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SECURITY REQUIREMENTS IN NORTHEAST ASIA

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SECURITY REQUIREMENTS IN NORTHEAST ASIA

A thesis submitted to the Graduate School of the University of Wisconsin-Madison in partial fulfillment of the requirements for the degree of Doctor of Philosophy

by

John On-fat Wong

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SECURITY REQUIREMENTS IN NORTHEAST ASIA

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A thesis submitted in partial fulfillment of the

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CHAPTER ONE

INTRODUCTION

The subject of this dissertation is nuclear deterrence in Northeast Asia. This study is meaningful for a number of reasons. First, there is today an unmistakable trend of small and developing nations moving towards the acquisition of nuclear weapons. Both Taiwan and South Korea have been identified as most critical Nth powers. Secondly, Northeast Asia is a region of great tensions where the likelihood of open conflicts is very high. Thirdly, deterrence theory has been traditionally concerned about the bilateral relationship between two superpowers. Little attention has been paid to multilateral deterrence situations. Fourthly, the study of lesser nuclear powers has been a relatively recent phenomenon. There is a need to learn more about them as it now appears that before the century is over, the size of the nuclear club may well be doubled, with some developing nations as the most likely additions. Lastly, of the little written about lesser nuclear powers, most are concerned with individual countries exercising the nuclear option. There has yet to be an attempt to extend the analysis of strategic interaction between the superpowers to the regional situations of several unequal powers.

Perhaps the single most important event in the recent history of mankind was the use of atomic bombs over Hiroshima and Nagasaki in 1945. The destructive power of this new weapon appeared total and instantaneous. Some believed that it meant the beginning of the end of the human race. Others found in it the ultimate weapon which would put an end to all wars. Thirty-five years have elapsed since then. While war has not been halted as a result of the advent of the atomic bomb, none has been fought between nuclear powers so far.

Today, six countries have exploded at least one nuclear device. Two others are suspected to have secretly acquired nuclear weapons. About a dozen more are believed to be striving towards acquiring such capabilities in some future time. At least as many highly industrialized countries are in or moving towards the so-called "over-hang" or "near-nuclear" category such that they could swiftly enter into the actual manufacturing of nuclear warheads should the need arise. All in all, there are well over forty countries which will have acquired sufficient fissile material to manufacture three bombs or more by 1985.[1] Despite repeated efforts to arrest the spread of nuclear weapons, the trend of proliferation today appears both irresistable and irreversible. War did not begin with nuclear weapons, and has not and probably will not end because of them. As more and more countries acquire the capability to go nuclear, many will find it necessary at some point to take the final step. It may be just a matter of time before international conflicts feature the devastating exchange of nuclear arms.

Recent literature has noted a trend towards the acquisition of nuclear arms by small developing countries. Pakistan, Taiwan and South Korea are often cited on the list of the most critical Nth countries. Of the high tension areas today, many lie along the immediate border of Soviet Asia. Turkey, the Middle East, the Persian Gulf, the Indian subcontinent, and last but not the least, Northeast Asia. Indeed, northwestern Pacific is the area where the power and interests of the Soviet Union, the U.S., China and Japan meet. It was in Korea that the first major postwar fighting broke out. Shortly after the successful test flight of Sputnik, the Soviet Union and the U.S. were again brought into potential military confrontation over the Taiwan Strait crisis. If it were not for the formidable American military presence in Korea, Japan, Okinawa, and Taiwan, war might have broken out a few times in the area. Since the Vietnam war, American combat troops have gradually been withdrawn from most of the area. Their continued presence in Korea is dictated perhaps in part by the fear that the small regimes, as well as Japan, may be stampeded into a scramble for nuclear arms.

Since the promulgation of the Nixon doctrine on 25 July 1969 as a belated response to the changing international realities, the U.S. has sought to move away from a direct presence in Asia and to encourage its Asian allies to become increasingly independent and self-reliant militarily. Through the combined effects of grant-in-aids, sales, and licensed productions, advanced military equipments have been transferred to Taiwan and South Korea to facilitate the rapid buildup of local arms industries. This process has culminated in the sale of nuclear reactors, presumably for peaceful use, while simultaneously, indigenous scientists are being trained in advanced missile technologies.[3] Today, there is an increasing recognition that these two small powers in Northeast Asia, if not restrained, will soon acquire the ability to produce their own nuclear arms.[4] The possibility that North Korea and Japan will feel pressured to move towards nuclear armament as a result is very real.

Most of the problems responsible for the instabilities in Northeast Asia really has not been solved over the past thirty years. The Soviet Union and China have yet to engage in serious negotiations to demarcate their border. Solution to the question of the Northern Territories is now more remote than ever, as the Soviet Union has proceeded in install military fortifications on three of the four islands in dispute. North Korea is growing increasingly impatient with the prospect that South Korea may eventually evolve into a viable independent regime. China, while preoccupied domestically and cosntantly fearful of Soviet expansionism and designs, is still very concerned about the possible emergence of an independent Taiwan, the eventuality of which almost certainly will increase the prospects of war. Looking into the future, China is a potential competitor with Japan for influence and trade in Southeast Asia. The controversial issue of right to subterraneous ocean resources will remain a focal point for conflicts among China, Japan, Korea, and even the Soviet Union.[4] Underlying the criss-cross of conflicts is the global competition between the U.S. and the Soviet Union. Northeast Asia is one spot along an arc where Soviet power ends and American influence begins.

Like many other developing countries, leadership changes in Northeast Asia tend to be a rather haphazard process, and could lead to drastic changes in a country's foreign policy. Indeed, leadership changes can be potentially explosive, and conceivably could lead to the disintegration of a regime. All three small powers in this area are susceptible to violent social upheavals as a result. Underneath the surface of remarkable social and economical progress, and the relative stability of the societies in Northeast Asia lie in waiting to erupt a volcano of domestic and regional conflicts. Both war and nuclear proliferation are real possibilities in this region. It is precisely for this reason that the study of nuclear weapons in Northeast Asia is cogent and necessary.

Deterrence theory so far has evolved primarily from the experience of two nuclear powers, each possessing the capability to manufacture virtually an unlimited number of nuclear weapons. Outside the U.S. and the Soviet Union, of the four countries (Britain, France, China and India) which have exploded a nuclear device or the two (Israel and South Africa) suspected to have acquired nuclear arms, none could field a very large nuclear force--say, of more than a few hundred bombs. Nor is there any power on the horizon which could come close to matching the efforts of the two superpowers. Deterrence theory, i.e. with respect to nuclear weapons, has been largely a study in bilateral interactions between two very large nuclear powers.

Since the 1970s, several studies on nuclear forces for medium powers have appeared.[7] These are primarily extensions of superpower bilateral deterrence to that between a medium power and a superpower. The basic motivation of these studies is to explore the force requirements of a medium power in Europe, with the Soviet Union as the hypothetical enemy, or with the requirements of Japan, with respect to China or the Soviet Union as the object of deterrence.

After the Indian detonation in 1974, the concern about nuclear proliferation to less developing countries suddenly intensified. Today, there is greater awareness of the possibility of converting atoms for peace to atoms for war. The nuclear statuses of the potential Nth powers are closely scrutinized and monitored. Studies have been conducted on the international political effects of the spread of nuclear arms. There are also renewed efforts to explore effective measures to control horizontal proliferation. So far, few have attempted to explore the probable force postures of several nuclear powers and their interactive effects on a regional basis. Nor has been any serious attempt to examine the idea of unacceptable damage and finite deterrence under multilateral situations. Also, the perenial question of "How much is enough?" for small powers has yet to be raised.

Many deterrence theorists share the view that rough strategic parity under mutual assured destruction is a stable form of mutual deterrence.[8] This view has its origin in the vast destructive power of nuclear weapons which have created the unprecedented historical possibility of the total annihilation of a nation. Since no nation wishes to be annihilated, it follows that some enemy threshold of unacceptable damage exists. The doctrine of finite deterrence calls for the deployment of strategic forces to meet such an enemy threshold. Any additonal forces beyond this (minimum) requirement is considered to be strategically meaningless.[9]

Dissenters to this view have strongly argued that numerical superiority, even under mutual assured destruction, still has significant meaning in non-strategic conflicts.[10] Cumulative numerical advantages can be translated at some point into strategic superiority by posing the threat of a credible first strike. It is therefore necessary to maintain essential equivalence, or perhaps even superiroity in strategic forces. This is all the more important, as the argument continues, when the opposing strategic doctrines are asymmetrical, with one emphasizing restrained options, and the other superior war-fighting capabilities.[11]

Robert McNamara first identified the idea of assured destruction in rough quantitative terms.[12] The destruction of up to one quarter of the Soviet population and up to two-thirds of its industrial capacity was judged to be amply sufficient to eliminate the Soviet Union as a modern society for many years, and therefore should be unacceptable to the Soviet Union under any circumstances. This idea was clarified further by Enthoven and Smith.[13] Although the operational definition of assured destruction has undergone some modifications since then, it is still considered to be the bedrock of a credible American deterrence policy today.[4]

Despite the fact that the concept of a minimum deterrent has been the fundamental element to the theory of a finite deterrence, only Geoffrey Kemp and John Endicott have attempted serious explorations on the implications of assured destruction on the strategic nuclear weapons and force postures of lesser powers.[15] The thrust of the two studies has been on the design of medium nuclear forces against a single hypothetical enemy. The lack of interest in the empirical requirements of strategic nuclear deterrence is hardly surprising.

First, the theory of finite deterrence came forth at a time when the U.S. was already in possession of a huge strategic arsenal many times above what is understood today as the "minimum requirement" called for by McNamara. The U.S. was in no danger in this respect. Secondly, the danger of a potentially explosive process of nuclear proliferation leading to many nuclear powers was not as obvious then. The concern was more with pariah nuclear powers such as China, and the enigmatic nuclear power, France. The intellectual environment at that time was such that whenever nuclear forces of the lesser powers were studied, they had to be viewed as either irrelevant to global deterrence relationships or as potential crazy powers to be restrained from such a dangerous undertaking. As a result, the study of lesser nuclear powers has been extremely underdeveloped.

This study assumes that by the year 1990, all nations within Northeast Asia will have acquired nuclear weapons, or will be in a position to produce them on short notice. It explores the strategic requirements of the Soviet Union, China, North Korea, South Korea, Taiwan, Japan, and the U.S. within this time frame. It proceeds on an intitial assumption that the McNamara type of operational definition of assured destruction approximate the perceived requirements of minimum deterrence in Northeast Asia, and then explores the more probable deterrence requirements in a multilateral, segmented strategic environment of several nuclear powers.

Deterrence, in the final analysis, is a psychological phenomenon. As such, it is event and situation specific. Although the precise requirements for deterrence are not easily quantifiable and must be judged in the last resort on a subjective scale of values, the present study proceeds on the following basis: (1) a subjective scale of values is not an insurmountable barrier to useful inquiry in the discipline of political science; (2) at any given point in time sets of objective strategic requirements do exists; (3) the empircal contents of the fundamental elements of nuclear strategy need to be explored and not avoided; and (4) enough is known to warrant a general analysis of target structures and force postures and their interactive effects on the configuration of strategic forces among several nuclear powers.

Because of the immense destructive power of nuclear weapons, studies of their use must, by necessity, have important policy implications. Inevitably, deterrence theorists are simultaneously to some extent advocates. Few, if any, cherish the idea of a nuclear holocaust. The tendency has been for most analysts to assume that the mere thought of the possibility of a nuclear war in itself is reason enough for deterrence to succeed. As a result, there is a general reluctance to look beyond some commonly accepted beliefs. Many wished that nuclear weapons had never existed, much less that they proliferate. Hence, the argument that small nuclear forces, because of their obvious vulnerability to pre-emption, would be inconsequential and (therefore should be) unattractive to small powers, found wide acceptance. While the moral stand of the analyst as advocate in this case is most noble, the resulting paucity of understanding with respect to lesser-power deterrence needs has not helped non-proliferation. The belief expressed here is that good policy analysis can only come from a willingness to accept facts as they are, and not from what one wishes that they should be. This study on the empirical contents of the fundamental elements of nuclear strategy in Northeast Asia is undertaken in the hope that it might provide a better understanding of the deterrence requirements of lesser nuclear powers.

The Scenarios

To approach the discussion of possible variations on defense alternatives realistically, four scenarios on the political situation in Northeast Asia have been developed:

1. General detente among the U.S., the Soviet Union, and China.
2. Bilateral detente between the Soviet Union and the U.S., and between the U.S. and China.
3. A cold war atmosphere with two likely permutations:
   (a) limited Sino-Soviet detente, or
   (b) Sino-American rapprochement.
4. General cold war among the U.S., the Soviet Union, China, and Japan.

Throughout the first three scenarios, it is assumed that the basic alignment of the small powers to the major powers in the region remains unchanged. Japan, in its gradual emergence as an Asian superpower maintains its close relationship with the U.S., and tries its best to steer a balancing course between the Soviet Union and China under the guise of an equidistant policy.[16] Taiwan defines its security interests largely in terms of an independent and viable military force in close co-operation with American Pacific forces to resist attempts at unification, or if and when the situation arises, to seek unification on KMT terms. Both North and South Korea are primarily concerned with the question of unification in a similar manner. Barring revolutionary upheavals and catastrophic wars, both South Korea and Taiwan stays closely allied to the U.S. and Japan. North Korea, on the other hand, depends on the Soviet Union and China for support. Only in the last scenario do we find a general loosening of this basic alignment, in which neither China nor Japan is militarily allied to either superpower. At its extreme, even the small powers do not trust major power security guarantees.

There is no question that wherever the two superpowers—the U.S. and the Soviet Union—are concerned, regional security guarantees will always be less than complete. Also, the security concsiderations of China and Japan are intricately related to the situations on the Indian sub-continent and in Southeast Asia.[17] Despite these qualifications, the entire Northeast Asia region does constitute a distinct subset of the international strategic system within which the lesser powers define their fundamental security interests.

The Methodology

Firstly, strategic countervalue targets are compiled for each nation. These targets are primarily (1) population centers, and (2) industrial structures and facilities in general.[18] Since industrial centers are usually urban centers, most important targets tend to embrace both elements. Information on target size, population size, and industrial significance are compiled from primary sources and estimated from secondary sources. The data are then re-arranged by geographic-economic regions, and by proximity to various firing points. The overall target structures are then analysed for each nation, and the warhead requirements computed corresponding to the different levels of destruction in terms of population and industrial capacity. Along any given curve of target acquisition based on the above data there are poiunts of increasing efficiency in terms of the destruction of population and industry, and points of diminishing returns. A nation's deterrence requirements are primarily shaped by its perceived needs. But the choice of a particular defense posture in terms of strategic deterrence may also be a function of what the nation can do with some manner of efficiency.

Two different damage levels have been drawn up to represent the varying degrees of destruction as approximations to McNamara's operational definition of assured destruction. Analyses are performed by nation under the four scenarios. Deterrence requirements, initially calculated in terms of designated ground zeros (DGZs) are translated into actual warhead requirements under certain assumptions about blast effects and degradation factors. These, in turn, form the basis for the construction of available options in weapons systems and force structures given the constraints of existing and projected military technology and the related infrastructures.

It is quite conceivable that within the next ten to fifteen years, nuclear weapons may no longer be the most important strategic factor in military security. However, it is assumed in this study that the extensive production and deployment of new types of strategic weapons systems will take time, and therefore they will be unlikely to supercede totally the existing and improved nuclear forces. Furthermore, it is unlikely, even if new offensive or defensive technology does come about in some dramatic manner, that the diffusion of such technology would be fast enough to render obsolete analyses based primarily on strategic nuclear forces. In time, for political or practical reasons, extremely precise long-range weapons armed with non-nuclear warheads may become an attractive alternative to lesser powers. Yet, such a possibility is seriously mitigated by the limited durability and extreme vulnerability of space satellites. Also, immediate breakthroughs in defensive technolgy are possible, but require a long time lag before they could become available for practical use. Experimental devices such as charged particle beams and lasers could have offensive implications as well.

The Objective

The objective of this study is to explore the implications of assured destruction if adopted for security policies across several nations in Northeast Asia. More specifically, it attempts to examine, through a hypothetical seven unequal powers, if (1) assured destruction is synonymous with minimum deterrence for the lesser nuclear powers, such that it can serve as the yardstick for strategic sufficiency, and if (2) it is possible to speak of multilateral assured destruction as a stable form of deterrence situation analogous to bilateral mutual assured destruction. Would all nations, large or small, pursue implicitly assured destruction policies? Is there an optimal solution to finite deterrence across several nations? Would security policies short of assured destruction constitute a crietrion for strategic sufficiency. How many nuclear weapons does a small power need in order to deter a larger power? What effect would a military entente have on the requirement structures? In what ways do small and medium powers differ, if they do, from superpowers in their respective force requirements?

This is a study on an area of high international conflicts where the likelihood of nuclear proliferation is also very high. Unlike other studies on nulear proliferation or on multilateral deterrence, it views several lesser power deterrence requirements from each of their individual perspectives. It recognizes that the intensity of interest on issues of conflict may be very asymmetrical among different countries. In conjunction with the examination of the empirical elements of deterrence requirements, they provide a more realistic picture of the deterrence needs of the different unequal powers in Northeast Asia. A study of lesser-power deterrence needs not predicated on wishful thinking will also contribute to our underataning of the incentives, strategic logic, and potential consequences of horizontal nuclear proliferation.

CHAPTER ONE NOTES

1. Albert Wohlstetter et. al., Swords from Plowshares: The Military Potential of Civilian Nuclear Energy (Chicago: University of Chicago Press, 1979), pp. 126ff. A more conservative estimate is given by William Epstein, "A Ban on the Fissionable Material for Weapons," Scientific American, Vol. 243, No. 1 (July 1980), pp. 43-51, map. Epstein's estimates, excluding South Africa and Israel, include 13 countries which could explode a nuclear device within a year or two, another 13 within two to six years, and 14 more within six to 10 years.

2. For example, Japan, Taiwan and South Korea are on the list of eleven most critical potential Nth powers in a study prepared by the Hudson Institute for the U.S. Arms Control and Disarmament Agency. Lewis Dunn and Herman Kahn, Trends in Nuclear Proliferation, 1975-1995: Projections, Problems and Policy Options (Croton-on-Hudson, NY: Hudson Institute, 1976).

3. One of the "ten basic construction projects" called for a total of no less than 8 nuclear reactors (Far Eastern Economic Review, 18 July 1975). By 1980, Taiwan should possess 4 nuclear reactors over 20 MWe (Onkar Marwah and Ann Schulz, ed., Nulcear Proliferation and the Near-Nulcear Powers, Cambridge, MA: Ballinger, 1975, p. 99). In the late 70s, a group of scientists from Taiwan underwent training in inertial guidance system at MIT, a program which later continued in Taiwan (United Daily News, April 30, 1976, p. 2). Also reported was that Taiwan had followed the Israeli example to test run computer-simulated explosions (Ming Pao Monthly, Vol. 12, No. 1, January 1977, p. 5).

4. Japan has had numerous conflicts with the Soviet Union and China over fishing rights. China and Japan has yet to settle the dispute of the Tiaoyutai (Senkaku) Islands. South Korea, Taiwan and Japan had conflicting claims over the right to petroleum exploration on the continental shelf. China insisted that all negotiations on this subject are null and void without its participation.

5. According to a CIA report, Taiwan had begun reprocessing spent uranium to acquire a stockpile of plutonium which could be used to make nuclear weapons within a short period of time (Washington Post, 29 August 1976, p.1). South Korea was in a position to do the same should it so desire. Also refer to notes 1 and 2.

6. Some notable exceptions are Donald G. Brenan, "Some Remarks on Multipolar Strategy," and George H. Quester, "The Politics of Twenty Nulcear Powers," in Richard Rosecrance ed. The Future of the International Strategic System (San Francisco: Chandler, 1972), pp. 13-28 and pp. 56-80.

7. Geoffrey Kemp, "Nuclear Forces for Medium Powers: Part I: Targets and Weapon Systems," Adelphi Papers, No. 106 (London: IISS,

Autumn 1974); "Nuclear Forces for Medium Powers: Parts II and III: Strategic Requirements and Options," Adelphi Papers, No. 107 (London: IISS, Autumn 1974); John E. Endicott, Japan's Nuclear Options: Political, Tcehnical, and Strategic Factors (New York: Praeger, 1975); Faud Jabber, Israel and Nuclear Weapons: Present Option and Future Strategies (London: Chatto & Windus, 1971).

8. For example: Henry A. Kissinger, Nuclear Weapons and Foreign Policy (New York: Council on Foreign Relations, Inc., 1957); Bernard Brodie, Strategy in the Missile Age (Princeton, NJ: Princeton University Press, 1965); Robert S. McNamara, The Essence of Security (New York: Harper & Row, 1968); Alain C. Enthoven and K. Wayne Smith, How Much is Enough? (New York: Harper & Row, 1971); Wolfgang Panofsky, "The Mutual Hostage Relationship Between America and Russia," Foreign Affairs, (October 1973), pp. 109-181.

9. John Herz, International Politics in the Atomic Age (New York: Columbia Press, 1959); also see note 3.

10. Walter Slocombe, "The Political Implications of Strategic Parity," Adelphi Papers, No. 77 (London: IISS, 1971).

11. Fred Charles Ikle, "Can Nuclear Deterrence Last Out the Century?" Foreign Affairs (January 1973), pp. 267-295; Leon Goure, Foy D. Kohler & Mose L. Harvey, The Role of Nuclear Weapons in Current Soviet Strategy (Miami: University of Miami Press, 1974); Paul Nitze, "Assuring Strategic Stability in an Era of Detente," Foreign Affairs (January 1976), pp. 207-232.

12. McNamara, pp. 51-86.

13. Enthoven and Smith, pp. 197-242.

14. Report of the Secretray of Defense Harold Brown to the Congress on the FY 1981 Budget, FY 1982 Authorization Request and FY 1981-1985 Defense Programs. January 29, 1980.

15. Endicott, Japan's Nuclear Options, op. cit.; Kemp, "Nuclear Forces for Medium Powers," op. cit..

16. John K. Emmerson and Leonard Humphreys, Will Japan Rearm? (Washington, D.C.: AEIPPR, 1972); Masataka Kosaka, "Options for Japan's Foreign Policy," Adelphi Papaers, No. 97 (London: IISS, Summer 1973); Ralph N. Clough, East Asia and U.S. Security (Washington, D.C.: Brookings Institution, 1975).

17. The Indian quest for a strong defense featuring (albeit unofficially) its own nuclear weapons is justified largely on the ground of a nuclear China. Japan is highly dependent on the Malacca Strait for its energy supplies and world-wide trade. ASEAN also happens to be a high import area.

18. Demographic information have been drawn primarily from statistical yearbooks. For example: Department of Civil Affairs, Taiwan Provincial Geovernment, Taiwan Demographic Fact Book (Nantou: 1971). Industrial information have been compiled from primary sources whwerever possible. Otherwise, they are constructed from secondary sources such as Yano-Tsuneta Kinekai ed., Nippon: A Charted Survey 1975-76 (Tokyo: Kokusei-sha, 1975).

CHAPTER TWO

DETERRENCE THEORY AND DETERRENCE POLICY

The security of a nation takes on many facets, of which military considerations are one. Military security itself covers a wide range of concerns. Depending on the country, national defense calls for the maintenance of forces to respond to various contingencies, ranging from intelligence gathering and counter-insurgency to theater warfare and strategic defense. This study is primarily interested in one aspect of military security, namely, the role of nuclear weapons in strategic deterrence.

Admittedly, the designs for survival are intricately linked to the foreign policy of a nation. It is not always possible to define sufficiency of the strategic nuclear deterrent strictly in military terms. Neither should military considerations be examined in isolation from the political, economic, or even social matters. Yet, the scope of a study encompassing all relevant factors of national security is necessarily huge, particularly so when several nuclear powers are involved. This study intends to focus on one aspect of deterrence in terms of strategic nuclear weapons. More specifically, it examines assured destruction as a policy guideline to the structuring of strategic nuclear forces, and the implication of its interactive effects among several unequal nuclear powers.

Deterrence as we understand it today has existed largely as a result of the atomic revolution in weapons technology. Despite its relatively short history, the body of literature on the topic is considerable. Because of its tremendous policy implications, the theory of nuclear deterrence has always been controversial, and has necessarily been undergoing constant revisions. By the early 1960s, a core of theoretical constructs emerged from extensive discussions about nuclear strategy and nuclear war to constitute the basic framework of what has come to be known as "deterrence theory." Deterrence, defined as "discouraging the enemy from taking military action by posing for him a prospect of cost and risk out-weighing his prospective gain,"[1] is a process to influence intentions through dissuasion rather than coercion or compellence. It has been conceptually distinguished from defense which is primarily concerned with reducing the enemy's capability to inflict damage or to promise denial.[2] Deterrence really embraces two basic elements; one psychological, the other intellectual. Psychologically, an individual or organization is persuaded to desist from certain action because of the fear generated by the punishment or loss of reward promised. Intellectually, it involves a process of rational calculation, performed on the basis of the credibility of the enemy's threat that the prospective cost would out-weigh the gain should the enemy's threat be carried out. The "theory" of nuclear deterrence is founded on the belief that given the vast destructive power of nuclear weapons, the threat of their use alone creates a strong deterrence situation. Few question the general fear of nuclear war. In fact, it may well be the chief reason why one has yet to be fought. But the psychological aspect of deterrence is highly subjective and cannot be ascertained easily. Consequently, deterrence theorists have tended to focus on the rational aspect of cost and gain calculations, and to suppress the emotional aspect of irrational responses. It has been pointed out that "fear" and "rational calculation" are very different responses, and that "the assumption of rationality may distort our perception of what deterrence is and how it works."[3] However, it is extraordinarily difficult to tell where (and when) rational calculation ends and fear begins (and vice versa). Nor is the dichotomy rational vs. psychological an ideal description of the two behavioral responses. Since even the so-called "rational" calculations of cost and gain are ultimately a question of values, and since values are by nature psychological quantities, it remains to be established if the two responses are unrelated, and that the difference between them are qualitative and not a matter of degrees.

Under the assumption of rationality, nuclear deterrence involves at least two parties: one which makes the threat to use nuclear weapons (hereafter referred to as the deterrer), and the other for which the threat is meant (the deterree). The threat (explicit or implicit) must be communicated by action, by words, or by some combination of both directly or indirectly from the deterrer to the deterree. For deterrence to be successful, the threat must be credible. The deterrer also assumes that the deterree is capable of comprehending the significance of the threat and will perform rational calculations of cost and gain. If the credibility of the threat is high, and the cost outweighs the gain should deterrence fail, the deterree would presumably desist from certain previously intended actions. As a result, deterrence is said to have succeeded.

This formulation of deterrence theory is of course not new. It is basically an extension of the classical notion of strategy into the age of nuclear weapons. However, nuclear weapons do represent a tremendous jump in the magnitude of destructive capability over weapons of the WWII vintage. In this respect, national viability[4] is now subject to historically unprecedented jeopardy. There is no single nation today which can claim categorically or confidently that it cannot be destroyed by another.[5] Only the superpowers--the U.S. and the Soviet Union--can claim unconditional viability via-a-vis the hundred-fifty or so lessor powers. As the number of nuclear powers increases, more nations will become conditionally viable as best vis-a-vis the lesser nuclear powers.

The new technological condition of instantaneous destruction is almost a perfect case of the total domination of the defense by the offense. Today, the best defense is nothing more than a surprise attack (pre-emption) against the enemy's (potentially offensive) nuclear weapons, in which case the uncertainty factor is high and the consequences of the lack of total success extremely severe. To highlight this pronounced vulnerability of both the nation and its military forces, a new vocabulary has been developed to aid the concise presentation of the theory of the balance of terror.

Broadly speaking, nuclear weapons may be aimed at two types of targets. The first are population and industrial centers or targets of value. The second are concentrations of military forces and facilities such as airfields, ammunition depots, missile silos, command and communication centers. A "countervalue" attack is an attack on the first type of targets (hence referred to as countervalue targets); a "counterforce" attack is an attack on those of the second type (hence counterforce targets). There is no inherent distinction except in use between nuclear weapons for a first strike and those for a retaliatory strike, and between those targetted against civilians and those targetted against military forces. Like offensive weapons of the past, they also can be used in the battlefield under certain conditions. Nuclear weapons per se are not distinguishable as tactical or strategic. Range and yield by themselves do not serve as adequate criteria for this purpose.

As a result of the widespread moral aversion to violence, the use of force in international diplomacy is usually presented as a means of the last resort and justifiable only for a good cause such as self-defense. During the Cold War era, the just war principle obviated much of the need to stress the non-use of nuclear arms. Nevertheless, there had been a general reluctance to advocate first use openly. The development of the theory of nuclear deterrence has been affected by this consideration to some extent. In the West, nuclear weapons are generally regarded as a means for deterrence and not for actually fighting and winning a war. This orientation becomes particularly attractive when the enemy is also in possession of nuclear weapons.[6] As a deterrent, nuclear weapons must be shielded from potential enemy pre-emption. In other words, a sufficient number of nuclear weapons must survive any conceivable enemy attack in order to carry out their function credibly. The capability to maintain a large enough residual nuclear force (after an all-out enemy surprise attack) to retaliate and inflict unacceptable damage (usually countervalue) to the attacker is called the "second-strike" capability. It is also known as the capability of "assured destruction." The derivative concept--"first-strike" capability--stands for the capability to disarm the enemy by attacking first. It is possible, and indeed desirable to deprive the enemy of a first strike capability by maintaining a relatively invulnerable strategic nuclear force. When the enemy is also in possession of a comparable capability, the state of the balance of terror is called mutual assured destruction (MAD).

There was never one school of thought which monopolized the evolution of nuclear deterrence theory. The process was more like a continuous running debate. There were perhaps as many different formulations of nuclear deterrence theory as there were judgments about the nature of the Soviet threat, the arms race, and how best to deal with them. These different formulations can be grouped under two broad categories: those which favored the minimalist approach, and those which favored the maximalist approach.[7] Deterrence theory in the 1960s was largely shaped by the former.

Regardless of their differences, both approaches are predicated on a number of common assumptions concerning the future of weapons technology and the emergent state of the military balance. First, the number of nuclear weapons is large and continuously growing by any standard. Second, mobile ballistic missile systems such as the nuclear submarine and the MX are expected to remain relatively invulnerable for some time, provided a reasonable number of them are deployed.[8] A mix of bombers, missiles and submarines presumably guarantees, through variety and redundancy, the survivability of a credible retaliatory force. Third, an effective defense against missiles, which would not also have ominous offensive implications, is not expected to come about in the near future.[9] In any case, weapons technology still appears to favor the offense over the defense. Four, deterrence is considered to be relatively stable (albeit potentially dangerous) under MAD since neither side needs to fear enemy attempts at pre-emption given the very low probability of success and dire consequences of failure.

The maximalists tend to see the enemy as motivated primarily by aggressive intent and bent on seeking military superiority. The arms race is largely considered to be a consequence of responses to such unilateral moves for advantage. Consequently, there is much less faith in arms control measures and more concern about the possibility that deterrence might fail. The maximalists argue that despite the apparent stability of deterrence under MAD, the conditions are at best transitory since the military balance is inherently dynamic and unstable, and that surprises are always possible. Unilateral moves to relax the arms race therefore are not only fortuitous but also very dangerous since the arms race itself is the major factor contributing to stability by restoring the military balance. Because deterrence might fail, it may be important to be able to conduct delayed, controlled, and deliberate retaliations to maintain intra-war deterrence in order to avoid mutual destruction. Based on the above analysis, maximalists argue that a counterforce strategy appears to be more effective. Indeed, superiority in every category of military forces is regarded as the most reliable guarantee.

The minimalists, on the other hand, tend to hold a less sinister view of the enemy, and regard both parties as prisoners of the security dilemma, forced to participate in the arms race by the situation. A certain symmetry of values is assumed here. The enemy can be induced to co-operate on arms control for motives similar to our own. Deterrence under MAD is therefore not only stable but also reliable since the alternative (which neither side wants and both fear) is massive and spasmodic nuclear war from which no victor will emerge. The greatest danger to national security lies not in the enemy, but from the spiralling arms race itself. The arms race creates numerical imbalances and the illusion of superiority (regarded to be never decisive under conditions of MAD) which may lead to miscalculations and consequently nuclear war. For the minimalists, the conditions of MAD appears to support the contention that the requirements of deterrence are finite, such that any improvement of strategic forces above and beyond those required to maintained MAD is unwarranted and may even enhance insecurity by under-cutting MAD. In sum, strategic superiority is undesirable because it is impossible, meaningless, and-- worst of all—dangerous in the long run. These are considered to be objective facts of life under MAD such that regardless of ideological orientation, the enemy can be counted upon to reason likewise.

The minimalist theory of MAD is simple, elegant, as well as psychologically gratifying. It guarantees security and simultaneously supports arms control. It is abstract and even-handed such that it need not be context-dependent or event-specific. It could be applied to any pair of independent nuclear powers. In contrast, the maximalist approach to deterrence is highly relativistic and open-ended. It does not provide any clear answer and appears to be out of step with peace time intellectual concerns. There is every reason for MAD to have captivated deterrence theory since the 1960s, and for the minimalist approach to have dictated the declaratory policy of the U.S. up to 1974.

Criticisms of Deterrence Theory

The problems confronting deterrence theory, according to today's critics, are varied. Patrick Morgan and Robert Jervis have aptly summarized them as follows.[10] First, it is overly simplistic and is incapable of differentiating between immediate deterrence situations (i.e. impedning attacks) and general deterrence situations. Secondly, it is based on the unrealistic assumption of the full rationality of state behavior, which presumably has led to dangerous theoretical conclusions. Thirdly, deterrence theory featuring mutual assured destruction has failed to come to grips with the complexities of the decision-making process and its different levels of analysis. Fourthly, deterrence theory has conveniently ignored the psychological aspects of decision-making under crisis situations. Fifthly, deterrence theory tends to characterize situations of high conflict only.

Apart from these five short-comings, deterrence theory also suffers from three major epistemological pitfalls. The first is its deductiveness. Deterrence theory has been expanded and accepted without much reference to and does not actively seek empirical support. The second is its ethnocentrism. Being largely an American product, deterrence theory takes for granted the symmetry of American and Soviet strategic thinking, despite evidences to the contrary. The third epistemological pitfall is related to the second. Because of its pre-occupation with the strategic relationship between the U.S. and the Soviet Union, the theory of nuclear deterrence has not been able to accomodate for the existing and emerging lesser nuclear powers, except perhaps in terms of the danger related to horizontal proliferation, which again is necessarily self-centered if not status quo biased. Consequently, the deterrence relationship between the nuclear superpowers and the lesser nuclear powers, or for that matter between two lesser nuclear powers, has not been adequately explored.

Despite this barrage of criticisms, deterrence theory today is still largely based on the concept of assured destruction. The idea of a credible nuclear deterrent is still very much grounded on the concept of some threshold of unacceptable damage, although exactly what is meant by "unacceptable" remains very much a subject for investigation and debate. Neither Secretary Schlesinger, who is widely credited with swinging the American strategic debate away from its pre-occupation with "assured destruction" through his open and forceful advocacy of "limited nuclear options" (LNOs), nor Secretary Brown, during whose tenure the famous Presidential Directive Number Fifty-Nine (P.D. 59) calling for the targetting of the Soviet political leadership was issued, in any way repudiated "assured destruction." On the contrary, both emphasized that assured destruction remained the "cornerstone" and the "bedrock" of American deterrence policy. The changes they advocated, as both argued, were meant to refine rather than to revolutionize American strategic doctrine.

In the footsteps of Colin Gray, Robert Jervis recently organized and analysed American deterrence theory in terms of three waves. The first wave came immediately after the appearance of the atomic bomb. Analysts of this wave were amazingly quick to point out, albeit haphazardly, the uses and the limits of nuclear weapons as well as their implications for defense decision-making. The contributions of Bernard Brodie, for example, have proved to be lasting.

The second wave of deterrence theory came largely as a critique of the controversial official doctrine of "massive retaliation." The basic idea emerged during the 1950s and evolved by the mid-60s into a body of reasoning which, as the Soviet Union steadily amassed her strategic nuclear forces, served both to explain the stabilizing strategic relationship between the U.S. and the Soviet Union, and to provide justification for the imposition of a limit on defense spending by "yardsticking" sufficiency.[11] The concept of a reliable retaliatory capability to inflict unacceptable damage laid the ground-work for the promotion of MAD as the most stable form of deterrence relationship. Under conditions of rough strategic parity, the acceptance of MAD as conventional wisdom made Strategic Arms Limitation Talks (SALT) and other American defense decisions on strategic weapons possible and even appealing to a large section of the strategic community. However, the very same reasoning is considered by others to be responsible for the immobilism of American defesne policy in the face of mounting Soviet challenges.[12] The basic tenets of deterrence theory in the second wave have been intellectually most satisfying and have enjoyed, albeit implicitly and with occasional reservations, wide acceptance by the strategic community despite their apparent simple-mindedness and the host of criticisms against them. Indeed, they have been so successful that the doctrine of assured destruction has continued to exert a dominant influence on American strategic policy throughout the 1970s.

Deterrence theory in the third wave has arrived in a time of increasing momentum towards Soviet superiority by the early 1980s. The third wave scholars attempt to correct the short-comings of deterrence theory in three major areas. First, they look into the recent past for empirical support and attempt to amend the appropriate propositions in deterrence theory wherever such support is lacking.[13] Secondly, they try to reduce the emphasis placed upon the idea of commitment by the second wave theorists, and re-assert the more lasting influence of intrinsic interests in deterrence relationships.[14] Thirdly, they try to move deterrence theory away from its apparent apolitical (objective) orientation and place it in concrete political contexts, and by doing so encourage the consideration of human factors in a theory which had been unduly fascinated with the technologically possible and its concurrent capabilities for bargaining and intimidation.

More recently, scholars have tended to view deterrence theory as a kind of decision-making theory rather than a theory of military strategy and bargaining.[15] Accordingly, the emphasis on the stability and the reliability of a strategic relationship can no longer be considered in isolation from the dialectical relationship between the structural configurations, on the one hand, of the opposing nuclear forces and the nature of military technology, and on the other hand, political processes and the structure of command and communications.[16] It is no longer sufficient to look at the force postures, per se, to judge the viability of a particular deterrence policy, nor is it acceptable by the same token to design a strategic deterrent purely on the basis of first strike and second strike calculations. For mutual assured destruction to work in the way third wave theorists would like it to work, we must now also perform an assessment of the goals, the motivations, and the intricate decision-making processes of the opponent as well as the various ways of influencing his behavior.

Second wave theorists were attracted by the intellectual simplicity of deterrence theory which appeared to have direct and useful policy implications. Critics of the second wave have vigorously pointed out the ethnocentric conception of deterrence and the unrealism of the rationality principle and its dangerous implications which presumably would subvert deterrence theory as a whole. Thus, third wave theorists are particularly disturbed by the intellectual successes of a theory which has failed to explain, if it is not at least in part responsible for, the failure of American deterrence in various parts of the world. They ask for a deterrence theory which is sensitive to the political realities of decision-making.

All these criticisms and challenges, in so far as they have succeeded to circumscribe and modify deterrence theory, have worked to put deterrence theory on a sounder footing. For example, the terms "first" and "second strike" may not inspire the same finality as they once did, but they remain important and viable concepts in deterrence theory today. Even the most fierce critics of MAD have not repudiated assured destruction as such, although they regard arms control concessions as dangerous.[18] In a way, most critics of second wave deterrence theory themselves are indebted to the theory and, by accepting the language and the basic concepts of deterrence, in effect have sought to restore deterrence theory by radical means.

Despite the many new (and sometimes exotic) ways to analyse deterrence since the arrival of the third wave, deterrence theory for policy in the U.S. has hardly experienced comparable changes. The reason for this is obvious. It is one thing to detail the non-rational elements in decision-making and quite another to deny the purposiveness of policy. Normatively, deterrence policy is by necessity a conscious undertaking. While it is permissible to admit the possibility of procedural non-rationality, policy itself must, by definition, be goal-oriented. Inasmuch as faith in the policy-making process is concerned, third wave theorists have corrected for the naivete of their predecessors. They have not, by any means, created real alternatives to existing U.S. deterrence policy.

Evolution of U.S. Strategic Doctrine

Strategic posture, as Colin Gray once noted, is not the undiluted product of rational strategic planning.[19] It is too long in the making, and at best serves to reflect and to justify particular international technological, military and political relationships. As the embodiment of strategic doctrine, it holds the uniquely heroic and unenviable responsibility of appearing invincible whatever the means available and under any circumstances. Some have even gone so far as to contend that historically, strategic policy has very little to do with the actual development and production of nuclear weapons. Others believed differently, and point to the doctrine of assured destruction as the culprit for the American failure to maintain its lead over the Soviet Union in the strategic arms competition.[20]

The truth, one suspects, lies somewhere between these two poles. We learn from hindsight, as the McNamara era has taught us so well, that technological developments and weapons procurements are largely contingent upon budgetary processes. Strategic beliefs reflect the different perceptions about the enemy and its capabilities and intentions, as well as the best way to guarantee national security on the basis of these varying judgments about reality. In this respect, strategic doctrine does exert an indirect and delayed, but nevertheless very significant influence on strategic posture. The evolution of American nuclear strategy also reflects the changing power relationship between the U.S. and the Soviet Union, in terms of what has become feasible with the technological revolution in military affairs and what has been made available as a result of political, economic, doctrinal, and to some extent even moral considerations.

Historically, the U.S. was the first to possess nuclear weapons. The first Soviet detonation came later in 1949. Until 1954, the U.S. also enjoyed a virtual monopoly of long-range heavy bombers, which meant that for almost an entire decade, the U.S. had been the only effective nuclear power with a global reach.[21] This was a period of unquestioned American strategic dominance. In 1957, the perception of this strategic relationship underwent an aboutface when the Soviet Union succeeded in putting the first man-made satellite into earth-orbit, which gave the Soviet Union an operational inter-continental ballistic missile (ICBM) capability. The Soviet leadership was euphoric about this technological breakthrough. The U.S., on the other hand, was suddenly overwhelmed by a concern for the "missile gap." Towards the end of 1961, intelligence sources revised downwards their earlier alarmist estimates on the strength of the Soviet ICBM program. At the same time, American strategic forces reached their peak in 1967 when the U.S. unilaterally decided to cap her numerical build-up to allow the Soviet Union to achieve some sort rough parity with the U.S., which it did by 1969. Since then, the U.S. and the Soviet Union have negotiated two SALT treaties which supposedly would regulate the overall balance between between two opposing strategic arsenals. Under these agreements, Soviet advantages in total launch strength and throw-weight were built in to compensate for the American lead in missile accuracy and MIRV technology. By the end of the 1970s, there were signs that Soviet ICBM improvements had exceeded American expectations, such that its strategic weapons program had gathered sufficient momentum to swing the balance in favor of the Soviet Union under the guidelines of SALT II some time in the early 1980s. In response to this projected Soviet gain, the U.S. initiated an across the board modernization of her strategic forces (including the go-ahead of the MX-missile program and the procurement of the B-1 bomber), the effect of which may not be felt till the end of the decade.

The changing balance of (military) power between the U.S. and the Soviet Union can be highlighted by the concept of "strategic ratio."[22] From 1945 to 1967, the U.S. enjoyed various degrees of strategic superiority over the Soviet Union, with the exception perhaps of the years 1957-1960 when the perceived balance was in favor of the Soviet Union. During the brief period of 1967-1969 of rough numerical parity, the U.S. still commanded certain advantages vis-a-vis the Soviet Union in guidance, reliability, MIRV, as well as readiness. Some time thereafter, the Soviet Union began to move beyond the U.S. in the total number of launchers and gross throw-weight, although not in the number of deliverable warheads. The 1970s can be characterized as a period of off-setting advantages, with the Soviet Union in possession of bigger and more ICBMs and the U.S. more warheads with greater accuracy.

Corresponding to these changes in power ratios, various American strategic doctrines had been advanced by different administrations to guarantee the continued credibility of American nuclear deterrence. Sometimes, a change in declaratory policy did included essential differences over past policies. There were also occasions in which the "new" strategic doctrines were more nominal than substantive. Over the three phases of Soviet-American strategic balance—American superiority, American advantage, and off-setting advantages—no less than six American doctrines have been declared. They were "massive retaliation" of the Eisenhower-Dulles era; "flexible response" or "graduated deterrence" with "no-city" emphasis under Kennedy-McNamara; "assured destruction" and "damage limitation" under Johnson-McNamara; "realistic deterrence" and "strategic sufficiency" under Nixon-Laird; "essential equivalence" and "limited nuclear options" under Nixon-Schlesinger"; "assured retaliation" under Ford-Rumsfeld, and the "countervailing strategy" of Carter-Brown. Chronologically, massive retaliation, flexible response, and no-city emphasis fall into the period of American superiority; assured destruction under American advantage; strategic sufficiency, essential equivalence, and countervailing strategy (up to the 1980 defense posture statement) under off-setting advantages and rough parity. Schlesinger's attempt to improve the credibility of American deterrence policy by shifting American strategic thinking towards a more counterforce oriented posture began a process of down-playing the omnipotence of assured destruction. His attempt to move beyond assured destruction has some interesting historical parallels to the rise of flexible response over massive retaliation during the Kennedy-McNamara era.

The U.S., being the first nuclear power notwithstanding, is by far the most articulate on the utility (or non-utility) of nuclear weapons in international affairs. By virtue of the fact that it has permitted civilian strategists to theorize on nuclear strategy without inhibitions, deterrence theory as we know it is largely an American intellectual product. British and French contributions to the body of literature are most valuable, but they are really based on the language and concepts of American deterrence theory. It is interesting to note that contributions by the civilian strategic community have been taken seriously by policy-makers in the U.S. In fact, there is no sharp distinction between "civilian strategists" and "policy-makers" as such since many individuals have played both roles at different times. Inevitably, emerging nuclear countries will draw on (but not copy) American experience and wisdom on the development of their strategic nuclear doctrines.

There are a number of lessons to be learned from the evolution of American strategic doctrine concerning the relationship between nuclear deterrence as theory and as policy. First, the most salient feature underlying American strategic doctrines from the time of massive retaliation to the countervailing strategy is the idea of the capability to inflict unaccepatble damage to the enemy. From this perspective, American nuclear doctrine has been remarkably stable over time. Great destruction is really a function of nuclear weapons. This fact will not be lost to any country aspiring to join the nuclear club. Secondly, although the promise of unacceptable damage has been constant, there has been considerable variations on how refined this promise should be. Flexible response and limited nuclear options are designed to improve credibility by doctrinally requiring the capability to respond to a wider spectrum of contingencies. The idea, of course, is that a more discriminant capability increases the deterrent value of nuclear weapons. Furthermore, an enhanced capability is believed to be inherently more credible. Countervailing strategy, for example, calls for the targetting of the Soviet political leadership, a prospect considered to be clearly unacceptable to the Soviet regime. Thirdly, a doctrine of flexible options is credible only when the capabilities are there. Hence, such a doctrine comes only with the growing sophistication of nuclear weaponry. Again, nuclear doctrine is at least in part conditioned by what is technologically possible. Without vast improvements in missile accuracy and warhead miniaturization, LNOs could not have existed. Indeed, before the advent of atomic weapons, it was not at all easy for roughly equal powers to promise mutual massive destruction. Fourthly, as it has been outlined earlier, variations on strategic doctrine are in part responses to the changing strategic environment. During the time of undisputed American superiority, the threat to use nuclear weapons was the strongest as witnessed by the doctrine of massive retaliation. As the strategic ratio changed, and with the growth of Soviet nuclear capabilities to strike directly at the U.S., the doctrinal emphasis has shifted away from heavy reliance on a massive U.S. nuclear response. Fifthly, particular variations on nuclear doctrine can be used not only as a response to, but also to shape the strategic environment. Given the conditions of mutual capability to destroy each other, the nuclear doctrine "assured destruction" (with SALT as its procedural derivative) had been advanced to foster and justify a particular strategic relationship (MAD) with the Soviet Union. This represented a conscious effort to contain a potential runaway arms race by rationalizing strategic competition. Lastly, the open exposition of the methodology on how the doctrine of assured destruction was operationalized has provided a ready blue-print for the design of an optimal nuclear retaliatory force. There is no reason to believe that other nuclear states would not have arrived at the same sensible considerations with or without this open exposition. But the handiness of this knowledge would have certainly helped and not hurt.

Presumably, strategic doctrine is a summary statement on perceptions about the enemy and how best to deal with it through the use or the threat of use of force. It directs and shapes strategic posture, and attempts to influence enemy behavior through the promise of cooperation or punitive action. Intuitively, there are certain inherently "good" properties of a strategic posture. Greater control is always better than less. Strength is always preferred over weakness. Non-offensive orientation is always less dangerous than offensive orientation. Greater control implies a wider spectrum of options. Miniaturization of warheads, improved accuracy of missiles, and minimization of blast effect all lead to the reduction of collateral damages rendering greater flexibility by providing more rungs to the ladder of escalation. More and better weapons project a formidable defense which by itself should be unmistakably deterring. Weapons which are non-offensive in appearance are less likely to induce great fear in the enemy such that it would feel compelled to engage in an all-out arms race.[23] Limited range and very limited yield are some indicators of the intention to eschew full pre-emptive first strikes.

These properties of a "good" strategic posture are believed to reduce the incentive for pre-emption, provide for greater crisis stability should deterrence fail, and are conducive to arms control. In the real world, there are limits to how many of these properties a country could purchase. A country often has to make do with less than what it would like to acquire. Strategic weapons programs are usually developmental and not stationery. This is particularly true of the emergent nuclear powers. As a result, strategic doctrines, instead of directing the development of strategic weapons programs, more often than not are means to make the best of what is available. On the international level, the power ratio, itself a consequence of dynamic interactions, also constrains the sensible choice of strategic doctrines. Given the lessons from the evolution of American strategic nuclear doctrine, one can expect the emergent nuclear powers to advance doctrines best suited to their existing and expected capabilities. A further complication, however, is that ideas sometimes die hard. Strategic doctrines initially intended to maximize credibility or to check bureaucratic momentum (e.g. to prevent over-spending on military programs, or conversely to vigorously catch up with the enemy) may assume virtues which were originally the products of necessity. As it has been discussed earlier, strategic doctrines may promote or restrict change in strategic postures depending on whether they are forward looking, or whether they have out-lived their usefulness.

Characteristics of Superpower Deterrence

By the very magnitude of their resources and capabilities and their consistent interest in the full range of international affairs, superpowers exercise predominant influence in their conduct of international relations and define rules under which the lesser states must operate.[24] Since WWII, the structure of the international system of states has often been described in terms of loose or tight bipolarity, and in terms of the two camps and the three worlds.[25] Such descriptions owe largely to the changing relative strength between the two superpowers on the one hand, and between the superpowers and the bulk of the lesser states on the other.[26] Between the two superpowers, confrontation is global. There can be no neutral zone. The prominant characteristics of superpower relations today are the primacy of one single enemy on a global basis, and the irrelevance of many of the lesser powers. World politics for the superpowers is still very much a series of zero-sum games with occasional opportunities for limited co-operation. Instead of rendering traditional power relations irrelevant, the advent of nuclear weapons has brought them into sharp focus and intense contrast. The vast destructiveness of nuclear weapons has clearly reminded the lesser states of their extreme vulnerability and of their conditional viability which is very much dependent on the goodwill of the superpowers.[27] While the superpowers are unconditionally viable via-a-vis the lesser powers (regardless of whether any of them possess nuclear weapons), their viability remains conditional towards each other. The theory of mutual assured destruction (however objectionable the term has become) offers a good shorthand for their bilateral strategic relationship.

MAD means the reciprocal possession of secure second-strike capabilities. There are two conceivable ways in which this could come about. First, it could be the result of both superpowers possessing offensive strategic weapon systems which are practically invulnerable to enemy pre-emption. Examples of such brief moments of "secure" or "invulnerable" strategic forces were the early days when ICBMs were less accurate (i.e. relatively low hard-target kill capability) and the period during which the relatively quiet nuclear powered-submarines defied existing ASW measures. Under these situations, it was not necessary to acquire very large numbers of strategic weapons in order to guarantee a secure second-destruction capability.

Second, a combination of measures could be taken to improve the survivability of weapons in the event that they could otherwise become vulnerable to pre-emption. For example, missile silos could be hardened, aircraft could be parked underground and runways hidden inside caves, and more effective still, missiles could be mounted on mobile platforms which are either difficult to detect (such as the nuclear submarines), or if detectable, difficult to counteract (such as the MX garage system with multiple launch points).[28] These are some of the means by which the probability of a successful pre-emption by the enemy is greatly reduced and the requirements of pre-emption significantly increased. Since vulnerability to a first strike is seen as a relative condition, a sufficiently large strategic force deployed unde improved survivability is needed in order to yield a reliable second-strike capability.

As has been discussed earlier, MAD is a condition largely defined by rough strategic parity between the Soviet Union and the U.S., with dominance of offense over the defense in weapons technology. However, MAD could not have been possible without the active pursuit of an assured detruction policy or a strategic policy embracing assured destruction implicitly by both superpowers. If one of the two believed that a few weapons placed under a rigid launch-on-warning (LOW) posture capable of destroying several major urban and industrial centers would be a sufficient deterrent for all practical purposes, while the other believed nothing short of a first strike and superior war-fighting capability was required to deter, then there would be immense disparity in the strategic strength and a dangerous divergence in strategic beliefs. The size of the minimum deterrent could be misconstrued as an indicator of weakness. As a result, the likelihood of deterrence failure might be very high.

Analysts disagree on whether the Soviet Union and the U.S. share some basic beliefs on MAD.[29] The maximalists believe that the Soviet Union is more interested in strategic superiority than in the perpetuation of MAD. The minimalists, on the other hand, argue that the Soviet Union recognizes the need to avoid a nuclear war with the U.S. by acting prudently within the framework of MAD. Besides, MAD is a technologically given condition which cannot be subverted easily by unilateral actions when very large quantities of strategic nuclear weapons have been stockpiled by both adversary powers. The maximalists tend to view deterrence requirements as highly relative to enemy capabilities. As a result, there is no easy way to define how much is enough. It follows that as a rule of thumb, more is always better than less.[30] In contrast, the minimalists are more susceptible to the notion that there are objective limits to the destruction of any society, which leads to the logical conclusion that deterrence is finite. It is really not too meaningful to go beyond the requirements of assured destruction. In fact, it may well be dangerous to seek greater than necessary forces.

In the 1970s, debates on arms control rearely distinguish between finite deterrence and minimum deterrence.[31] Most adherents to assured destruction were identified as peopled who wanted only the bare minimum of nuclear weapons in total disregard of the needs to ensure against uncertainties and other kinds of contingencies. This is hardly a fair characterization of a doctrine which was originally promulgated on the basis of conservative planning by taking the maximum position possible at that time, namely, the worst case analysis based on a greater than expected threat, i.e. an all-out enemy attempt at pre-emption. Retaliation under the doctrine of assured destruction was neither total nor automatic by necessity, although in maximizing the deterrence value of strategic nuclear weapons, assured destruction may well have raised the cost of carrying out the threat of retaliation to an unacceptable level, and is so doing, have undercut the credibility of the deterrent and paralyzed the will to respond when deterrence fails.[32]

Assured Destruction

The underlying conception of assured destruction is the threat to retaliate by inflicting unacceptable damage. As such, it is not easily distinguishable from minimum deterrence. This process of deterrence by promising great harm involves the deterrer's estimation of what constitutes "unacceptable damage" to the deterree. Assured destruction stipulates that a second-strike capability to destroy the enemy as a modern society is needed for the damage to be "unacceptable." Minimum deterrence, on the other hand, would settle for as few as a handful of nuclear weapons as long as they could be, or the deterree perceives that they could be employed to destroy (despite enemy attempts at pre-emption) a few important cities, should this be considered unacceptable damage. In a way, the term "minimum deterrent" is somewhat misleading. As is in the case of "minimalist" versus "maximalist" approaches to nuclear strategy, "minimum deterrent" is used to indicate the lowest of requirements deemed efficacious to deterrence relative to those prescribed by other doctrines. Every doctrine of nuclear deterrence makes the claim to advocating the "minimum" in accordance with the economy of force principle. None ever admits that it is asking for more than is necessary. In this sense, every nuclear doctrine is some variation of "minimum deterrence." Yet, the objective differences in requirements for deterrence resulting from the various positions taken by these doctrines cover very wide ranges. At the lowest extreme, one may argue that a deterrent either is, or is not. If twenty nuclear weapons amount to a credible deterrent, then there is not much difference between twenty and twenty thousand nuclear weapons. At the other extreme, one may argue that because of the asymmetry of values, suspicions about enemy willingness to use nuclear weapons in defiance of rational calculus of cost and gain could lead to self-deterrence (i.e. the paralysis of will) of the deterrer itself. Hence, the deterrent is inadequate unless a comprehensive damage limitation capability (full counterforce included) exists. What is usually referred to as "minimum deterrence" tend to bias towards the first extreme, but assured destruction is about mid-way between minimum deterrent and full counterforce.

There are also discrepancies between assured destruction as theory and assured destruction as policy. First, the theory calls for the elimination of the enemy as a modern society by detroying industrial facilities and killing people. It is not always possible to meet this requirement, particularly when the enemy has a large and dispersed economy and population. Second, the companion concept of damage limitation is a lofty goal given existing weapons technologies and an enemy with a considerable amount of nuclear weapons. The policy of assured destruction is therefore pursued under the constraints of enemy target structure and enemy force levels. Furthermore, assured destruction as declaratory policy does not necessarily represent the true interpretation of the strategic posture. Since policy is a product of the decision-making process, its formulation cannot but reflect to some extent the various bureaucratic inputs and political considerations extraneous to strategic needs. In theory, assured destruction capability is arrived at through a series of procedures. First, the enemy threshold of unacceptable damage is identified; the enemy capabilities are ascertained. On the basis of the above information, a force level designed to survive enemy pre-emptive attempts and still meet the threshold of unacceptable damage would be the requirement of assured destruction. In reality, however, the problem of how much is enough for assured destruction was never approached in such a manner.

Assured destruction under McNamara was pursued in what is more appropriately termed the "limited economy approach" than the so-called "requirements approach."[33] Instead of treating security as an all-or-nothing concept by identifying specific strategic objectives and striving to meet all of them, the "limited economy approach" believes that there could be more or less security, and uses the marginal utitlity criterion to minimize cost. McNamara's public enunciations of the operational definition of assured destruction are a clear and unmistakable reflection of the influence of marginal return on the range of cut-off points delimiting enoughness.[34]

Since the introduction of the "new concepts and new tools" by McNamara to manage national security affairs, assured destruction as defined operationally in terms of fixed percentages of population and industrial capacity has emerged as the pillar of American deterrence policy. Originally, the requirement calculation for an assured destruction capability was deliberately based on extremely conservative assumptions, leading to the actual maintenance of force levels considerably higher than those used for planning purposes evaluated against a greater-than-expected threat. However, the structures of population and industrial targets are such that they rarely exhibit significant changes over several years. Since the U.S. had already reached an assured destruction capability vis-a-vis the Soviet Union by the mid-60s, it follows that only incremental changes in American strategic forces would be needed as long as the survivability factors are not seriously degraded by Soviet weapons. While this logic might have appeared impeccable during the 1960s, it has since become increasingly difficult to justify the seemingly perpetual stagnation of American strategic weapons program over time in the face of steadily growing Soviet capabilities. On the other hand, assured destruction, now part of conventional wisdom, has become more entrenched as a result of strong support by constituencies generated by arms control policies. It is therefore extremely difficult to operate outside the framework of assured destruction. The only "acceptable" responses to the grwoing Soviet challenges within constraints are (1) to manipulate the operational definition of assured destruction, and (2) to re-interpret its role in deterrence and defense.

The operational definition of assured destruction has undergone two major modifications since McNamara first revealed his formulation to the public in 1967. In his report to the Congress, McNamara defined the destruction of one-fifth to one-fourth of Soviet population and a half to two-thirds of Soviet industrial capacity as the "assured destruction" of the Soviet Union.[35] The total force required was estimated roughly to be 400 MTE (Megaton Equivalent, sometimes referred to as EMT, as by Wohlstetter). This absolute criterion of enoughness was derived on grounds that (1) such an extent of distruction appeared vast by any imaginable standard, and that (2) the marginal returns for further destruction rapidly deteriorated beyond these percentage points. This formulation represented the high point of emphasizing management over reuqirements in American defense policy, and the farthest drift away from McNamara's intial focus on flexible options.

The return to a more balanced view between flexbile retaliatory options and assured destruction actually began under the first Nixon administration.[36] As the Soviet Union gained "approximate strategic parity" with the U.S., the defined threshold of assured destruction against the Soviet Union was again raised to the level wherein the Soviet Union would suffer greater damage than the U.S. in the event of an all-out nuclear war.[37] This new threshold, now termed "assured retaliation," was further redefined to ensure that the Soviet Union would under no circumstances recover from a nuclear war faster than the U.S.[38] Since knowledge about the workings of the Soviet economy are scarce and unreliable, it was not clear how assured destruction could be operationally defined in terms of targetting relative recovery rates.

These upward revisions of the definition of assured destruction were accompanied simulataneously by increasing emphasis on deterrence against high probability actions such as limited aggression.[39] Secretary Schlesinger made a very strong case for LNOs in his 1974 annual Department of Defense report. Subsequent administrations have by and large openly embraced the declaratory policy of a limited counterforce posture. Some analysts viewed the Schlesinger shift as a radical departure from previous policies, and a triumph of those who favored defense over those who preferred a strictly deterrence posture. However, as Schlesinger himself stressed, the change in fact was largely declaratory and mental. It did not affect the actual composition of the American deterrent which had always included counterforce options as an integral part of its missions. Indeed, Secretary Harold Brown went so far as to re-emphasize the consistency and continuity of limited counterforce options with American deterrence policy since the 1950s.[40]

Presumably, deterrence differs from defense in that the former is a peacetime objective, while the latter is a wartime value.[41] The defense value of the military forces exists only after deterrence has failed. Under this conceptual distinction, maximizing the deterrent value of military forces may actually erode their defense value. In other words, weapons geared towards punishing the enemy may not bode well for mitigating damage to oneself. This partial separation of pre-attack deterrence and post-attack defense is a new possibility created by the advent of nuclear weapons. But it is by no means a necessary relationship that the maximization of deterrence invariably leads to a paralysis of defense. Conversely, the maximization of defense capabilities does not always mean a corresponding loss in the efficacy of deterrence. It was recognized even at the time when nuclear weapons were much less sophisticated "that a capacity to deny territory to the enemy, or otherwise to block his aims, may be a very efficient deterrent," and that "such denial may be accomplished by strategic nuclear means, though at high cost to the defender."[42] Nevertheless, the clear conceptual separation of deterrence from defense in American strategic thought is largely a function of the geographical non-contiguity of the U.S. and her chief adversary, the Soviet Union. In fact, the possibility of a direct Soviet invasion of the U.S. with the support of tactical nuclear weapons really has never been in the consciousness of of the American strategic community. Soviet attack on the U.S. is considered unlikely to begin with, and is generally conceived to come in the form of a surprise first strike if it ever did occur. Strategic deterrence appears to be a direct and appropriate answer to this problem. Since the U.S. is not seeking the conquest of the Soviet Union, nuclear "war-fighting" does not seem to have any immediate or direct relevance to American security concerns. The problem arises only in the case of extending deterrence to the European theater.[43] Assured destruction, therefore, appears to be a most appropriate strategic doctrine under these circumstances.

Assured Destruction Reasoning

By the early 1970s, the policies of simultaneously eschewing assured destruction against and pursuing arms limitation talks with the Soviet Union had become part of the conventional wisdom. On the basis of the idea of "unacceptable damage," strategists had constructed a body of deductions called assured destruction reasoning. Some even argued that through the active pursuit of SALT, the U.S. had in fact succeeded in bringing the Soviet Union to accept the realities of MAD. This reasoning runs as follows:

A. DEDUCTIONS:

1. For every nation, there exists a threshold of unbearable pain, or in other words, a level of unacceptable damage. The ability to inflict such a level of damage on the enemy (even after absorbing an all-out enemy surprise attack) is called assured destruction capability.

2. The destruction of any nation as a modern society must be considered as unacceptable by that nation under any circumstances, and at all times, since no conceivable gain could outweigh this loss.

3. There is a meaningful limit to the physical destruction of a nation's industries and population (i.e. cities) beyond which the marginal returns of additional destruction deteriorate

rapidly. This limit usually coincides with the modern sector of the society.

4. Operationally, therefore, an assured destruction capability means the possession of relatively secure or invulnerable retaliatory forces to approach the limit described in 3.

CORROLLARIES:

5. As a consequence of the above reasoning, the guaranteed vulnerability of the enemy's cities (or, in a more general sense, its key values) means effective deterrence.

6. Conversely, the guaranteed self-vulnerability of key values simultaneously by one-self and by the enemy (i.e., MAD) is the most stable deterrence relationship imaginable, since both sides are effectively deterred.

7. As an extension of 3 and 6, there exist an upper limit to the size of an efficient deterrent, beyond which "overkill" begins and "numerical superiority" becomes strategically meaningless.

8. However, since the deterrent is not easily distinguishable and never absolutely invulnerable from offensive weapon systems, uninhibited increases in the deployment of strategic arms over and above the requirements of MAD by one side may incite the opponent's fear for numerical (which at some point may become real) inferiority, thereby inducing enemy reaction to seek rough parity. This in turn may set in motion the gears of an unnecessary (in the sense that it will not increase security) arms race. In short, attempts at numerical superiority endangers the stability of the deterrence system.

9. The sum total of this reasoning is that in the name of security and the stability of the deterrence system, a nation must ensure the relative invulnerability of its strategic forces and the vulnerability of its people and industries. Absurd as these priorities may seem, any attempt to protect one's population or endanger the strategic forces of the enemy works, as the reasoning goes, to subvert the security of the nation. The ideal strategic posture must, therefore, unequivocably reflect the priorities governed by MAD.

Contrary to what many analysts have argued, assured destruction *per se* does not depend entirely on the so-called "rationality principle." It merely posits some threshold of unbearable pain which is a behavioral phenomenon, and as such, implies non-rational factors as well as rational calculations of cost and gain. However, the theory of MAD as it unfolded was built upon two conditions which from hindsight were exceptions rather than the rule. First, it was based on a scenario of a potential vertical arms race between the U.S. and the Soviet Union relatively free from numerical constraints. Second, it revolved around speculations which were remarkably emphatic on the separation of the "strategic" as opposed to the "tactical" role of nuclear weapons. The strategic use of nuclear weapons were usually discussed in terms of retaliation which, in general, were assumed to be massive and spasmodic, so much so that functionally, "strategic" nuclear weapons were identified with ICBMs, long-range heavy bombers, and missile-carrying, nuclear-powered submarines. These two implicit conditions: a potentially numericallly unlimited arms race and obvious geographical non-contiguity by and large conformed to the realities of the superpower arms race. Understandably, a theory of assured destruction built upon this basis can have only limited relevance to the many nuclear and would-be nuclear powers in the world today.

To begin with, there is no conceivable power on the horizon that could rival the U.S. and the Soviet Union in terms of military might, industrial capacity, and natural resources. The highly industrialized nations today are resource-dependent in general, while the resource-rich nations of considerable size are industrially backward. Largely as a consequence of such limitations, the security concerns of most nations by necessity are regional and local rather than global in character. This means that (1) there are very real and severe limitations on the size (and/or quality) of the nuclear forces of the medium and small powers, and (2) the distinction between "strategic" and "tactical" nuclear weapons may not be as conceptually clear or useful as is the case between the U.S. and the Soviet Union. In fact, virtually all the conceivable nuclear-capable adversary pairs are territorially contiguous. Most weapon systems considered "tactical" in the superpower equation by virtue of their limited range have obvious strategic implications under such circumstances. While every nation large or small is ultimately concerned about its national security, the strategic environment under which the lesser powers must operate is so different from that between the superpowers that it becomes questionable if the policy of assured destruction and the theory of MAD are still applicable to lesser power nuclear deterrence relationships.

Nuclear Deterrence and the Lesser Powers

In contra-distinction to the superpowers (or in David Vital's terminology, great or primary powers), the lesser powers by virtue of their limited resources and capabilities cannot hope to participate in a full range of international politics.[44] In terms of their national security, they are all conditionally viable vis-a-vis the superpowers while the reciprocal relationship is one of unconditional viability. This basic fact suggests that the deterrence relationship between a superpower and a lessor power (primary-secondary or primary-tertiary interaction) is fundamentally differrent from the bilateral deterrence relationship between two superpowers.[45] The pattern of bilateral interactions between a superpower and a lesser power, when considered by itself, is vastly asymmetrical and appears to be overwhelmingly unfavorable to the lesser powers. The deterrence relationship between the Soviet Union and China, for example, should be very different from, say, that between the Soviet Union and a nuclear Albania.

Among the lesser powers, there are three major subdivisions. Vital identified them as the "middle" or "secondary powers," the "small" or "tertiary powers," and the "micropowers." Of these three subgroups, only the first two are considered possible candidates to nuclear power status.[46] The critieria upon which the small powers are differentiated from the medium powers are admittedly haphazard, and are based on predominantly intuitive (but by no means totally subjective) judgments about the relative "size," "weight," or "importance" of the power concern. Nevertheless, such a classification does correlate to the degree to which a given power will attempt to influence events beyond its borders, the corresponding willingness of its leaders to take risks in so doing, and the extent to which it will be successful.[47]

Let us adopt a functional definition of the small (or minor or tertiary) power as one

> which in the long term, in itself and as a satellite or client or close ally—i.e., as a non-autonomous participant in international politics—can consitute no more than a dispensable and non-decisive increment to a primary state's total array of political and military resources[48]

It follows that the deterrence relationship between a small nuclear power and a nuclear superpower is one in which the nuclear forces of the former cannot significantly degrade the nuclear forces of the latter. It also follows that a medium power can affect, in ways a small power cannot, the deterrence relationship between two or more superpowers to a considerable extent.

Empirically, the small power as defined earlier means a weak power. It is usually characterized by some combination of the following attributes: (1) small territory, (2) small population, (3) small productive capacity, and (4) low level of military capabilities.[49] It is useful to distiguish between industrialized (developed) as opposed to developing countries. Switzerland, Denmark, the Netherlands, and New Zealand are examples of industrialized small powers. Chad, Niger, Sudan, Burma, and Costa Rica, which have either (not both) a large population or large territory but low industrial capacity and military capabilities are also considered as small powers. While this approach does not provide us with an unambiguous guideline to identify any given state as a small or a medium power, it does offer a useful conceptual typology which could be operationalized for further empirical research.[50] On the basis of this typology, some obvious medium powers are West Germany, France, Japan, China, India, Brazil, Indonesia, Mexico, Nigeria, South Africa.

As has been discussed earlier, there are two basic differences between the deterrence relationship involving the two superpowers, and deterrence relationships of which at least one party is not a superpower. First, there are severe limitations on the size of the lesser power deterrent. Second, there is also the proximity of the adversary to be deterred by the nuclear weapons of the lesser power.

Generally speaking, as a function of the immense disparity in numbers, any independent deterrent of a lesser power is vulnerable strictly on a bilateral basis to a first strike by either of the two superpowers. Conversely, none of the lesser nuclear forces can pose anywhere close to a similar threat to the superpowers. However, their fewness in numbers also has significant implications on lesser power deterrence relationships. A smaller deterrent does mean that it is easier to be overcome by modest changes in enemy strategic posture. It follows that smaller deterrents tend to be more vulnerable.

Geographical proximity adds to the problem of relative vulnerability. Nearness of targets means that more weapons systems are available for the delivery of nuclear weapons. It also means that warning time will be short. As a result, a mutual second-strike capability between two lesser powers (if at all possible) may be difficult to attain and maintain. The corresponding pressure to pre-empt (including the first use of nuclear weapons) in time of crisis may be very high.

Furthermore, the physical target structures of the lesser powers tend to enhance rather than reduce their vulnerability to punitive strikes. The industrialized medium powers are generally limited in geographical size, which leaves them with little room for the dispersion of key values. The developing countries of considerable geographical size, on the other hand, have the modern sector of their economy and infra-structure concentrated in a handful of urban centers. This leaves the nation as well as its land-based deterrent quite vulnerable to external threats. This fact has an interesting effect on deterrence requirements among lesser powers. While it is relatively easy to threaten unacceptable damage, it is much more difficult to guarantee that this capability is relatively secure. Since the term "lesser powers" embraces a large group of diversified countries, the extent to which the above observation is true varies considerably depending on which countries are actually being analysed.

In addition to the differences in the physical characteristics between superpower deterrence and deterrence among lesser powers, there is also a psychological difference. The extent to which a nation feels secure depends very much on it ability (perceived or actual) to control or influence events which it deems pertinent to its well-being. All else being equal, stronger powers usually feel less threatened than weaker ones in a confrontation. Because of this feeling of a lack of control over events, weaker powers tend to have more intense and exaggerated fears for adverse consequences in a crisis. The inclination is to seek extreme solutions. The urge for first use is therefore stronger for weaker powers. However, this heightened sense of insecurity should not be mistaken as "irrationality." On the contrary, it is a very realistic appraisal of their relative vulnerability and powerlessness.

Characteristics of Medium Power Nuclear Deterrence

The limiting factor of the medium power is its inability to define, or to alter, as the superpower can, the rules of international relations. Given the available resources, the medium power can at best make its influence felt in its immediate environment or in selected places beyond a limited range of concerns.[51] Let us generalize by saying that the medium power is essentially a regional power, and as such, the design for national survival, while taking the global political context into consideration, is necessarily regional in perspective. The nuclear weapons program of a medium power, being part of the overall defense, is no exception to the rule. The independent nuclear forces in Western Europe today, for example, have as their hypothetical enemy the military forces of the Warsaw Treaty Organization. They were not intended primarily for deterring potential adversaries from interfering with their spheres of influence in Africa, although this may well change under certain unforeseen future conditions. Clearly, the British or the French nuclear forces have not been designed to target China or perhaps the Soviet Far East. Conversely, the Chinese nuclear program has painstickingly emphasized the development of delivery vehicles of limited ranges until recently.

Unlike the small power, the medium power can affect and sometimes even radically alter the distribution of actual or potential resources between the superpowers. West Germany, Japan, China, and India are contemporary examples. Their intrinsic and contingent values can drastically alter the balance of power between the U.S. and the Soviet Union today. However, by themselves alone, none can, in the foreseeable future, constitute a serious threat to the viability of the Soviet Union as a nation. The same can be said of the medium nuclear forces.

A distinction must be made here between medium powers with "small" nuclear forces, and those with "medium" nuclear forces.[52] A small nuclear force is one which has few deliverable weapons and is extremely vulnerable to a first strike attempt even by another small power. A medium nuclear force is relatively more sizable and less vulnerable except to the very large nuclear forces of the superpowers.

We can also discuss the characteristics of the medium nuclear force in terms of its survivability and assured destruction capability. However, discussions along these traditional themes of deterrence theory are necessarily highly dependent on the existing state of weapons technology. One notable example is anti-submarine warfare (ASW). A fleet of quiet, long-range nuclear submarines has been regarded as the most survivable form of mobile launch pads for two decades. Should ASW technology permit the systematic and effective hunting of such submarines, the offense-defense relationship would be drastically revised.[53] More recently, laser and particle beam technology have been developed to advance new ABM systems. Should they prove to be effective, MAD as we know it may no longer be a stable condition. The possession of offensive nuclear weapons alone will not be sufficient. An effective ABM system may nullify attempts to deter. The military security of a nation must then depend much more critically on a certain offense-defense mix. Despite the fact that large-scale research has been initiated in the U.S. recently, and has been going on for some time in the Soviet Union, the effectiveness of particle beams and laser is still subject to debate. These new weapon systems still require tremendous engineering if not basic scientific research.[54]

It has been argued that even if beam weapons prove to be feasible for BMD purposes, the technology also has offensive implications, and will likely reside only with the superpowers for a considerable period of time, and that lead time for widespread deployment may take up to several years.

Proceeding on the basis that the sea-based deterrent will remain relatively survivable for the next several years, a medium nuclear force based entirely on nuclear submarines can be quite effective within the time frame. Realistically, hardly any medium power can afford the luxury of such an enterprise. Submarines are one of the most expensive weapon systems to build, to operate, as well as to maintain.[55] Both the manpower requirements and base facilities pose a severe recurrent demand for limited resources. Given the existing strategic environment, it has been estimated that a country like Japan, with the U.S. as its close ally and the Soviet Union as the primary deterree, would need a fleet of about ten boats of the Polaris vintage in order to maintain a modicum of constancy and perhaps anonymity for the system to survive.[56] Yet, for the same cost of construction, operation, and maintenance of these ballistic missile submarines, a much larger force based on fighter-bombers and land-based missiles can be procured. The technological requirements for a sea-based deterrent are also much greater. This fact has been borne out by the histories of all known nuclear weapons programs. Indeed, only the U.S. and the Soviet Union have any sizable ballistic missile submarine fleet. As of this date, Britain and France have only four and five respectively, while China has yet to come up with one.[57]

Nor can any other power outside the U.S. and the Soviet Union boast of a long-range bomber program. So far, fighter-bombers and land-based missiles have remain the back-bone of the medium power nuclear deterrents.

When pitted against the vastly superior forces of a superpower, the nuclear forces of the medium power have little chance to survive. Even a triad of a modest fleet of ballistic missile submarines, several squadrons of fighter-bombers, and a respectable number of land-based missiles, cannot hope to meet a superpower first strike attempt when their bilateral strategic relationship is considered by itself. Given such a situation, the medium power must always contemplate responding on warning so as to vitiate the demands for survivability. Fortunately for the medium forces, the real world has two competing superpowers. It is not possible for one to ignore the other, and in fact, their bilateral relationship must take precedence over any primary-secondary interaction. The medium power, in so far as it is not a likely candidate for immediate superpower status, is therefore considered by one superpower largely as a factor affecting the balance of power vis-a-vis its opponent in the strategic equation. In the light of this more realistic assessment of the situation, the "survivability" of the medium power nuclear deterrent takes on a very different meaning.

If we define rough strategic parity as the overall balance conceived of as a dyadic relationship between the combined factors of quantity and quality of one nuclear power to those of the other, and the marginal nuclear force as the variation in the quantity of such weapons which does not in any way affect the essential equivalence of the two opposing strategic forces, we may then arrive at the relative concept of a medium nuclear power by stipulating that the strategic forces of the medium nuclear power, while extremely vulnerable to a first strike by the overall nuclear forces of a superpower, are not susceptible to such threats by the marginal nuclear forces of the superpower.[58] The medium nuclear power is significant precisely because its entrance into an alliance with a superpower will cause a significant incremental change in the equation of strategic parity between the two opposing forces. In other words, it will require a superpower to divert more forces than it can afford to marginally in order to avoid an unfavorable state of the balance. Its effect can vary tremendously depending on the relative size, location, and quality of the nuclear force concerned.[59]

By definition, the upper limit of a medium nuclear force is numerical parity with a nuclear superpower. It is, of course, theoretically possible for a medium power to acquire a "large" nuclear force. Realistically, there is no such candidate in sight. Highly industrialized countries such as Sweden, Japan, France, and West Germany are limited by their relatively small territories, and must rely on external sources either for their energy needs or for the raw materials required for a large scale nuclear program, or more likely for both. It is questionable even for South Africa, which is highly industrialized and richly endowed, to sustain a nuclear weapons program on a large scale.[60] (Perhaps the only exception is Australia.) For those countries with large areas and abundant natural resources such as

Brazil, China, and India, their economies are unlikely as yet to allow such a luxury, which will most certainly compete with immediate needs in conventional defense capabilities, and divert a considerable amount of their valuable resources and skilled manpower. Also, the technological requirements involved in a large scale nuclear weapons program can only be met by an advanced industrial base and infrastructure in many areas, and in which these countries are lacking.[61] Therefore, the nuclear weapons programs of the medium powers are likely to remain modest, and will not possess "assured destruction" capabilities in the sense a superpower does against another.

The French have persuasively argued that deterrence is actually "proportionate."[62] In order for the lesser power to succeed in deterring against a superpower, it is not necessary to acquire the theoretical destructive capability of an assured second-strike. If a medium nuclear power possessed the ability to make the cost of a superpower attack higher than the expected gain for the superpower, then a threshold of adequacy has in fact been attained. We may conceive of a military alliance between a medium nuclear power and a superpower as a gain to one superpower, and simultaneously as a loss to the rival one.[63] The medium power is a regional power. It is by virtue of its effect on the regional balance of power that it participates in global superpower politics, and to this extent determine if indeed a particular superpower is to concede or to acquire a preponderance of power in the region concerned. Just as the meaning of "survivability" is circumscribed, "assured destruction" takes on the corresponding modifications.

In short, the optimal strategy of the medium nuclear power vis-a-vis a superpower is one of proportional deterrence. This is in fact analogous to MAD between a medium power and a part of a superpower. For example, the French strategic nuclear forces programmed against the Soviet Union are probably primarily concerned with the areas west of the Urals. Soviet Asia, apart from their relative insignificance vis-a-vis the industrial west, are too far for practical purposes. In fact, even the destruction of part of European Russia, such as the Donets-Dnieper region or the Moscow area, could provide unacceptable damage to the Soviet Union. It is quite likely that as the medium power continues to build up its nuclear forces above and beyond what is perceived to be necessary for proportional deterrence, i.e. deploying strategic forces capable of covering many more important targets, the superpower concerned will be compelled to re-evaluate the credibility of its own marginal forces and the role the medium power plays in the global strategic balance.

While in most cases of the recent past, medium powers have acquired nuclear weapons with one superpower and/or the other as the primary deterree, some future Nth countries may embark on their nuclear weapons program with a secondary adversary power in mind. India vs. China, Argentina vs. Brazil, Iraq vs. Iran, Nigeria vs. South Africa, Pakistan vs. India, etc., are some hypothetical examples. For reasons we have discussed earlier, the nuclear deterrents of the medium powers are likely to be less secure from pre-emptive attempts even by comparable powers. However, this is not to say that MAD as we understand it in the case of two superpowers is totally impossible between two medium powers. On the contrary, MAD, too, is possible though less likely in secondary-secondary interactions, and probably much less stable than MAD between superpowers. In a hypothetical nuclear conflict between two medium powers, chances are better that a significant portion of their nuclear weapons would survive the initial exchange (first volley). The remaining weapons would permit "assured heavy damage" but not "assured destruction" to take place. If "unacceptable damage" is operationalized to mean "the total destruction of the modern society," then assured heavy damage would mean close to, but not quite complete a level of destruction. Depending on the structure of the countervalue targets, MAD may well be quite feasible albeit less reliable in some cases among medium nuclear powers.[64] It may be useful to consider "assured heavy damage" as a lesser power version of the "assured destruction" doctrine.

In sum, the survivability of the medium nuclear force is largely a function of existing superpower competition and rivalry. It is "invulnerable" only in the sense that the marginal nuclear forces of the enemy superpower is not large enough to eliminate it by a first strike. Conversely, according to the principle of proportionality, the assured destruction requirements for a medium power vis-a-vis a superpower is considerably lower than the absolute invulnerability of its retaliatory force. With respect to strategic interaction among medium powers, assured destruction is possible but unlikely and less reliable since it is much more difficult for medium powers to protect their nuclear forces from pre-emptive strikes or to eliminate the opponent's nuclear forces with a first strike.

Characteristics of Small Power Nuclear Deterrence

As has been indicated earlier, the small power is one which, by virtue of its very limited physical size, can at best contribute marginally to the total array of political and military resources of a superpower.[65] The same can be said for small nuclear powers. Geographical smallness implies limited natural resources, both in terms of quantity and variety. Even for a highly industrialized small state, its economy is severely contrained by the inherent lack of scale and the absence of a large domestic market to sustain it. Self-sufficiency is a lofty goal, and its national survival depends higly on a successful relationship with its immediate neighbors as well as with one or both superpowers. Yet, despite all these limitations, it is still possible for some small powers to embark on a limited nuclear weapons program. For example, according to some well-informed speculations, Israel may have acquired a small arsenal of nuclear weapons as early as 1975.[66]

While in the ultimate sense all nuclear weapons programs are meant for national survival, only the small power can indubitably claim the primacy and singularity of this basic motive. Ironically, the nuclear forces of the small power are the most vulnerable since they are few in number and must be highly concentrated by necessity. This basic fact holds both for fighter-bombers and land-based missiles.[67] Small powers with access to the sea may acquire a few ballistic missile submarines to obviate this handicap. But the small power is most unlikely to come up with the resources to sustain a sufficiently large fleet to guarantee its relative invulnerability. For those that are landlocked, the lack of ports means that the option of a sea-based deterrent does not even exist.

As a target, small geographical size usually means a small and higly concentrated population. There may not be more than a few cities with population over 100,000 under contemporary conditions. Industrial installations are correspondingly concentrated in the few relatively large urban centers. Hence, a small nuclear force is sufficient to meet the few important counter-value targets, and threaten a very high percentage of the population and industrial capacity of the small power. While the small nuclear power is only of marginal consequences to the superpower, it is could be quite threatening to states of the same class. Conversely, its own nuclear force is vulnerable to any other small nuclear force. In this sense, "assured destruction" could still be meaningful between small powers, but becomes meaningless when interaction with a superpower is involved.

One interesting question is whether the small nuclear power can deter a medium power the same way a medium nuclear power can deter a superpower and define the concept of assured destruction accordingly. This is equivalent to asking if the nuclear forces of a medium power can be significantly degraded by a small nuclear power. Again, the small power nuclear deterrent affects the medium power in two ways: first along the axis of primary-secondary interactions, and secondly along the axis of secondary-secondary interactions.

The effects of the nuclear deterrent of a tertiary power on the primary power is, as discussed earlier, marginal at best. Medium nuclear forces, on the other hand, can affect the strategic balance between the superpowers considerably. Conceptually, it is quite possible in a continuum of nuclear powers for a small nuclear force to degrade medium nuclear forces which border on being small nuclear forces. Perhaps this lack of sensitivity in discrimination of borderline cases is indicative of one theoretical weakness of this "small/medium" classification scheme, or at least of the inadequacies of the criteria chosen. At the present, however, such a paradigmatic approach does highlight the very basic difference between a small nuclear force which has only some nuisance value, and one which can disturb the balance of power in the international system. In the real world, many medium powers are still struggling to come up with nuclear forces capable of meeting their needs. Another hypothetical situation is that a number of small nuclear forces may rally to form an alliance such that the next additional small nuclear force could propel this military entente into the equivalence of a medium nuclear force. In this sense, the small nuclear power can be a significant factor in the international strategic balance. It may take less than such an alliance for the small powers to affect the interaction between medium nuclear powers.

In general, we may say that the small power has little to no effect on primary-secondary interactions, but may affect secondary-secondary interactions in ways analogous to the role the medium power plays in superpower rivalry. The one significant difference between the medium power and the small power is that while the former can theoretically field a credible nuclear deterrent which has a good chance for some part of it to survive (in the absence of a widely deployed effective ABM system, nuclear or non-nuclear), the latter cannot hope to boast of the same. In this sense, it is not possible for the small power to speak of a credible second-strike or assured destruction capability against any other nuclear power. The nuclear deterrent of the small power is vulnerable to enemy attempts at pre-emption at all times.

The strategic relationship between two antagonistic small nuclear powers is best characterized as "mutual (or reciprocal) vulnerability." Where the condition of MAD exists, pre-emptive instability is also very high.[68] However, this vulnerability of the nation and its nuclear forces does not necessarily mean the end of the utility of nuclear weapons to small powers. First, the presence of nuclear weapons, however few in number, forces the potential aggressor to ponder any attack as a crossing of the firebreak. This would invariably raise the threshold of decision-making since pre-emption must now be part of the undertaking. Second, while delivery systems are vulnerable, nuclear warheads themselves are much less so. A number of warheads could be hidden for clandestine delivery. Furthermore, no matter how well planned a pre-emptive strike may be, there is also the probability that a few may escape the attempt. These two considerations contribute to the ever-present uncertainty factor. In order to vitiate the obvious vulnerability of small nuclear forces, part or all of them may be rigidly pre-programmed to be launched on warning. In this sense, even the most vulnerable of nuclear weapons still commands some credibility, and indeed may even be effective when used.

In sum, when a small power is interacting with a large power, the principle of proportionality can be applied. Relative to the stakes involved, in a tertiary-secondary strategic interaction, the medium power may entertain a considerably lower threshold of unacceptable damage than it would, say, in a secondary-secondary interaction. With a strong incentive for first use when confronted by a major power nuclear attack, there is some finite possibility that the small power in a suicidal launch can also inflict considerable damage on the larger power even if the larger power were well on its way to a pre-emptive strike.

Colin Gray once depicted assured destruction as an automobile with numerous options.[69] When defined simply as maintaining a reliable ability to inflict unacceptable damage, this would certainly be true. In concrete terms, however, the question should be "Unacceptable to the enemy under what circumstances?" and "What is really at stake?" The enemy threshold to unacceptable damage is likely to vary as the circumstances and the stakes change. This, in reality, is what makes the principle of proportionality plausible. If assured destruction were defined more narrowly to mean the promised destruction of the modern society or bombing a country back to the stone age, then the meaning becomes much more befitting to the term. There is no longer the need to ask "How much destruction?" or "Destruction of what?"

In all fairness to McNamara and the assured destruction resaoning which subsequently evolved in his name, the context in which the theory and the policy resided has not always been remembered correctly by their critics. Implicit in the doctrine of assured destruction was not so much that it would deter <u>all</u> hostile Soviet behavior, but only the most serious kind which would lead to a full scale war between the U.S. and the Soviet Union. In this sense and this sense only that the guaranteed physical destruction of the Soviet Union as a modern society should be unmistakingly deterring--whatever the circumstances and for the highest of stakes. The question of extended deterrence was important only in so far as the declared American interests were perceived to be obviously vital. For example, if the U.S. could successfully demonstrate (communicate) to the Soviet Union that Soviet military support for a Bulgarian invasion of Yugoslavia would surely bring about a massive (even if only conventional intitially) American military response, it is quite possible that the much derided strategic doctrine of assured destruction would still hold. Unfortunately, it is never easy to associate the absence of serious military conflicts with the efficacy of a given military doctrine. However, the human mind is much readier to establish a causal relationship between the two once hostilities has broken out.

Relative Criteria of Unacceptable Damage

General Pierre Gallois once proposed that as long as the harm threatened by the nuclear strike capability of a small state is proportionate to the prize implied by its conquest or defeat, then the advantages of attacking it would be cancelled out.[70] This argument of proportionality in deterrence formed the conceptual foundation for the French "force de frappe."[71] On a similar basis, Geoffrey Kemp has argued that for the medium power to design a credible deterrent against the Soviet Union, it is not necessary to meet literally the McNamara requirements.

Few if any deterrence theorists today would adhere to the McNamara criteria literally. Yet, it would appear equally simplistic to advocate strict proportionality in deterence. To push either to their logical extremes would be doing a great injustice to the original theoretical intent. Judging from hindsight, the concept of mutual assured destruction seems to be a powerful description of bilateral deterrence for the superpowers. While the type of deterrence relationship General Gallois was concerned with in which the hypothetical enemy of the medium power, being a superpower, did not consider the medium power its chief adversay (i.e. what has been called a primary-secondary interaction), the deterrence requirements of the medium power in this case against the superpower need not, and indeed should not, be considered solely on a bilateral basis, particularly when the superpower is simultaneously confronted by the adversary more or less its equal.

The principle of proportionality in deterrence has been accepted generally by the community of strategists. Its implication on the design of medium and lower level deterrents are considerable. Yet, just as the superpower has an adversary more or less its equal to contend with, the medium power may also have to confront a number of adversaries of its own class. The specific requirement towards any such adversary is therefore related to the combined effects of the set of adversaries involved. The burden of this requirement of one against many is offset to some extent by the fact that each one of the adversaries must also take into consideration its own set of potential opponents. Accordingly, the local criteria of unacceptable damage is largely a function of the strategic environment at hand.

It has also been suggested that a few leaders of some countries enjoy supreme control over decisions concerning war and peace.[72] Presumably, their perceptions of strategic needs will have a decisive influence over the design of the strategic deterrent. While acknowledging the importance of such a possibility, this study does not consider it likely that such leaders are totally immune from the influence of objective strategic constraints. Where the role of individual leaders are dominant, the bias is more likely (though by no means guaranteed) towards more security and hence a larger deterrent. However, it is difficult to ascertain with any precision to what extent, if at all, particular leaders "distort" the design of the nuclear deterrent.[74]

To minimize unmanageable complications, it will be assumed here that within the given time frame and in the absence of evidence to the contrary, the seven powers in Northwestern Pacific will remain naturally inclined towards the maintainence of an efficient deterrent, while the superpowers may, for a variety of reasons, wish to improve their ability to meet an extended range of contingencies. This assumption is not as unrealistic as it might appear for two reasons. First, with the exception of the U.S. and the Soviet Union, none of the five remaining powers is likely to possess the resources to seek, much less to maintain a larger than minimum strategic deterrent. North Korea, South Korea and Taiwan are severely handicapped by their limited sizes. While China has the raw materials, she lacks the industrial infrastructure to pursue a technologically sophisticated deterrent. On the other hand, Japan, while capable industrially and economically, must rely on external uranium supply. Moreover, Japan's success as a viable economic power and her chances of remaining so depends highly on the maintenance at least in appearance of an extremely low military profile and a good neighborly foreign policy. Secondly, as of today, only the U.S. and the Soviet Union possess adequate strategic deterrents, while the rest have yet to acquire such forces. Therefore, at least for the immediate future, the preoccupation of the five lesser powers will likely remain that of achieving a relatively credible deterrent.

Because nuclear weapons are awesome instruments of destruction, we usually associate them only when vital national interests are at stake, and when all other means have failed. Since strategic interaction is a process involving at least two players, it is quite likely that sometimes the players possess different capabilities and value the stakes at issue very differently.[75] The Soviet Union , for example, is militarily superior in every respect to Japan. At the same time, the Soviet occupied Northern Territory means a lot more both strategically and emotionally to Japan than to the Soviet Union. As a result, in a Soviet-Japanese confrontation over the Northern Territory, the Japanese threshold of pain may be much higher than that of the Soviets. A similar case can be made with respect to the U.S. and China over Taiwan, or for that matter, between China and Taiwan over the question of unification.

There is therefore some sort of relativity of key values between unequal powers. When a large power is at odds with a lesser power, the stake at issue is usually much more central to the vital interests of the lesser power. This relative difference in the centrality of concern, and therefore, in the intensity of interest, is the smallest when it comes to the question of national unification, as in the case of mainland China and Taiwan. Even here, the asymmetry of values is transparent. The future of Taiwan has been, is, and will be clearly one of the very few most important concerns with China. But for the leadership on Taiwan, it is the ultimate concern. This relativity of key values has direct implications on what constitutes "unacceptable damage" in the event that the use of force were considered. From the perspectives of the lesser power, the principle of proportional deterrence offers a most useful policy guideline. Some form of assured retaliation may suffice as a credible deterrent. From the perspective of the large power, however, the utility of nuclear deterrence may be very limited. Indeed, there may not be any threshold of unacceptable damage to the lesser power if the stake involved were its very existence. In other words, even assured destruction may not be sufficient to deter the first (and perhaps suicidal) use of nuclear weapons by the lesser power if it were forced to make such a choice.

It appears that assured destruction, when broadly defined, is really a misnomer. It fails to differentiate even in very rough terms the disparate levels of destruction, say, between 1 city and 200 cities when deterrence holds. While the assured destruction of one Soviet city may be unmistakably deterring under the right circumstances, it could hardly be called the destruction of the Soviet Union as such. Nor could it be called "assured heavy damage." More appropriately, it is some form of "assured retaliation"[76] (not equating it with the specific way Donald Rumsfeld used this term) commensurate with the need under those circumstances. The narrower definition provided by the so-called assured destruction reasoning, though more controversial, is in fact more discriminating and more befitting to its name. Instead of using "assured destruction" broadly as an umbrella concept, we could differentiate among (1) assured destruction, (2) assured heavy damage, and (3) assured retaliation. Assured destruction here means as it reads, and is equivalent to the definition propounded by the assured destruction reasoning. Assured heavy damage refers to the destruction of at least several major population and industrial centers, and not just one or two. Assured retaliation is a residual category, and refers to any level of destruction short of being "heavy." While the requirements of "assured destruction" are quite independent of the strategic context, those of "assured heavy damage" and "assured retaliation" are more relative.

This categorization of strategic doctrines is, of course, not ideal. Conceptually, the terms employed are not mutually exclusive. "Assured retaliation," for example, embraces all levels of damage, from the most minor to toal destruction. We may also say that the destruction of the modern society (whatever the operational meaning of this may be in terms of the number of cities) is one extreme form of "heavy damage." But the increasing specificity from retaliation to destruction is clear and unmistakable, which also serves to emphasize the gradation in the seriousness of threat being communicated and revenge being sought in the event deterrence fails. In this sense, this categorization is an advance over the option-laden "assured destruction" ridiculed by Gray. Focus on the punitive aspect here does not exclude the other elements which characterize particular strategic doctrines, such as deterrence by uncertainty, or with defensive emphasis. Table 2.1 provides a quick overview of the likely doctrinal preferences by the different powers in order to achieve the baseline requirements to threaten "unacceptable damage."

Table 2.1 Probable Doctrinal Preferences

Deterree: / Deterrer	Superpower	Medium Power	Small Power
Superpower	AD	AD	AD
Medium Power	AR	AHD	AD
Small Power	AR	AR	MD/PD

AD Assured Destruction
AHD Assured Heavy damage
AR Assured Retaliation
MD/PD Mutual (or Probable) Destruction[77]

It is useful to distinguish between preference for the doctrine of assured destruction and preference for the strategic condition of MAD. The latter is not a necessary consequence of the former. MAD becomes an optimal choice if and only if the powers involved in the strategic equation possess the capabilities to pursue a virtually numerically unlimited arms race, but share the view that controlled competition is far better than an explosive race to oblivion. Preference for assured destruction, therefore, need not mean a rejection of defense emphasis. In fact, it is more logical for a country unilaterally pursuing a policy of assured destruction to place particular premium on defense emphasis. Preference for MAD, on the other hand, must exclude defense emphasis as part of the overall strategic posture. The same logic can be extended to the lesser powers.

However, there is in general a qualitative difference between the ability of a superpower to pursue and maintain a given strategic condition such as MAD, and that of a lesser power. This is due to the fact that: (1) a large power can exercise greater influence and control over its environment while a small power must operate under conditions dictated to it by larger powers;[78] (2) a large power has greater resources to fine tune its deterrent (e.g. for intra-war deterrence) while a small power does not; (3) a large power has a more reliable deterrent (by virtue of its numbers and dispersed deployment) while a small power has a very vulnerable one; (4) a large power has a more credible deterrent in the sense that it has a wider spectrum of non-nuclear options at its disposal to minimize early failure of deterrence, a capability which a small power usually does not have; and (5) as a consequence of the above, a large power usually does not experience the same psychological pressure and paranoia as a small power in having to choose early between strategic surrender and armageddon.

It is also helpful to distinguish between a policy of assured destruction pursued by a small power as opposed to that pursued by a superpower. Given the vulnerability of the small power and its nuclear forces, enemy destruction is more "probable" than "assured." This condition of pre-emptive instability suggests that among the small powers, "mutual vulnerability" or "mutual probable destruction" is a much more appropriate description of their strategic relationship than "mutual assured destruction." Once they have acquired some quantity of nuclear weapons, the condition of "mutual vulnerability" has been created. It is possible to imagine asymmetry of doctrines among small nuclear powers (e.g. one pursuing assured destruction while the other superiority). However, the differences in their nuclear arsenals will not alter their vulnerability. This is not surprising since (1) regardless of their doctrinal preference, there are real limits to their nuclear arsenals, and (2) the effectiveness of pre-emption by conventional means is enhanced by relatively small and dense target structures and geographical proximity.[79]

Deterrence: Credibility and Stability

A number of general theoretical considerations have been raised with respect to nuclear deterrence among unequal powers. There is a sort of relativity in the intensity of interest in the stake under contention. Because of the way nations tend to define their vital interests, the small power usually attaches greater value to the prize than the large power. Consequently, there is a greater willingness on the part of the small power to sustain pain (thereby raising the threshold of unacceptable damage) and a greater propensity to resort to violence when all other means have, or appear to have failed. The ultimate effect is an enhancement of the credibility of the small power nuclear deterrent. However, the paucity of means usually forces the small power to adopt a relatively rigid strategic doctrine and force posture vis-a-vis the large power. This rigidity of posture has a paradoxical effect on the credibility of the small power nuclear deterrent and the stability of the nuclear deterrence system. In a sense, the relative enhancement of the small power deterrent contributes to greater overall stability of the deterrence system. However, due to the severe limitations on its capabilities, the real choice of the small power in time of crisis is between strategic surrender and suicidal war. There is a built-in instability in this type of situations. Overall crisis stability has been eroded, in fact, by the possession of nuclear weapons by small powers.

Rigidity in doctrine and posture in general has a similarly composite effect on credibility and stability. This is characteristic of the minimalist approach to nuclear deterrence. The deliberate deprivation of choices enhances the uncertainty, if not the likelihood of a nuclear response. It either compounds the calculations or raises the stakes. The result is an enhancement of the credibility of the strategic deterrent in times of conflict at or above a certain threshold. In practice, the posture has great attractiveness since it means defense with fewer men, and perhaps also fewer dollars.

On the other hand, rigidity of doctrine and posture means a lack of options. This means a sharp decrease in credibility with respect to conflicts below the threshold of a spasmodic response. This increase in the likelihood of non-strategic military conflicts which in turn raises the probability that one of such might escalate into an all out nuclear exchange. Furthermore, the stark choice between strategic surrender and suicidal war may effectively lead to "self-deterrence"--a paralysis of will when the moment of choice is up. It cannot be assumed that the adversary is totally oblivious of this fact. The stability of the deterrence system therefore hangs in the balance between the uncertainty of choice, the gravity of its consequences, and the extent to which the deterree has, or feels that it has, reduced the uncertainty of the deterrer's intentions.

While the minimalist argument that the rigidity of choice enhances the credibility of the nuclear deterrent is valid, it need not necessarily mean a corresponding enhancement of the stability of the strategic system. It could be argued that self-deterrence is a more serious problem in the minimalist position. Conversely, the abundance of options could mean an earlier use of nuclear weapons though (initially) on a smaller scale. This constitutes an earlier crossing of the firebreak. Greater flexibility could also lead to false confidence in escalation dominance--a miscalculation in one's ability to control escalation. The implications of more options, therefore, need not always mean greater stability to the deterrence system. The consequences of over-confidence could be as catastrophic as self-deterrence. The difficulty here lies not so much with the lack of a "best" strategy, but on the inability of men to make sensible judgments at all times and under all circumstances, regardless of whether they are weapons rich or weapons poor.

CHAPTER TWO NOTES

1. Glenn Snyder, Deterrence and Defense (Princeton University Press, 1961), p. 3.

2. Ibid., p. 4. Snyder also acknowledged that the two concepts are not totally independent of each other since effective defense also enhances deterrence. Defense is dinstinguished from denial in that the latter is a much narrower concept unsually identified with "holding territory."

3. Patrick Morgan, Deterrence: A Conceptual Analysis (Beverly Hills, CA: Sage, 1977), pp. 21ff.

4. According to Kenneth E. Boulding, "A party that cannot be absorbed or destroyed as an independent source of decisions is said to be unconditionally viable. A party that can be absorbed or destroyed by another is conditionally viable if the party that has the power to destroy it refrains from exercising this power." Conflict and Defense: A General Theory (New York: Harper, 1962), p. 58.

5. Implausibility is not at issue here.

6. David Tarr, American Strategy in the Nuclear Age (London: Macmillan, 1966), p. 44.

7. The terms "minimalist" and "maximalist" are only relative in the sense that a maximalist approach would favor a much higher level of weapons requirement to ensure "adequacy" or "sufficiency" over and above the so-called "assured destruction" requirement. It would be incorrect to say that the minimalists want "minimum" security. On the contrary, the minimalist approach argues that maximum security actually arises from minimum deterrence. Over-buying of strategic nuclear weapons undermines rather than strengthens straegic stability, and therefore reduces and not increases security.

8. The relative invulnerability of the SSBN may be on the verge of being degraded by U.S. advances in ASW technologies. See for example, SIPRI Yearbook, 1979 (London: Taylor & Francis Ltd., 1979), pp. 389-452; Joel S. Wit, "Advances in Antisubmarine Warfare," Scientific American, Vol. 244, No. 2 (February 1981), pp. 31-41. It has also been observed that "Soviet navigation, guidance and command systems are on the whole less redundant and less survivable than those of the USA. Navigation guidance for Soviet SLBMs are not yet accurate enough to confer any significant counterforce capability." SIPRI Yearbook 1979, p. 417.

9. The most prominent ABM technologies of the near future might be charged particle beams and lasers. These are also likely to be developed as space-based weapons which could conceivably be deployed offensively as well as defensively. There is no known defense against

such offensive systems outside pre-emption. An intermediate alternative is spaced-based ballistic missles, which again cuts both ways on offense and defense.

10. Morgan, Deterrence, op. cit.; Robert Jervis, "Deterrence Theory Revisited," World Politics, Vol. 31, No. 2 (January 1979), pp. 289-324.

11. Alain C. Enthoven and K. Wayne Smith, How Much is Enough? (New York: Harper & Row, 1971); Robert McNamara, The Essence of Security (New York: Harper & Row, 196);

12. Since James Schlesinger's attempt to revive the debate on selective targetting and limited nuclear options (LNOs), the trend of strategic thinking has gradually shifted away from an exclusive focus on spasmodic strategic exchanges (featuring assured destruction considerations) and the mechanics of SALT as a means to forestall such an eventuality. This shift of emphasis finally crystalized in the much publicized (and mis-interpreted) Presidential Directive No. 59 (P.D. 59) signed by Carter in 1980. However, it is debatable as to whether P.D. 59 represented an actual revolution in U.S. strategic policy, or whether it was a mere shift in declaratory emphasis with no real impact on the actual strategic force posture and the SIOP. Even if this new codification, the countervailing strategy, were not a revolutionary departure from past U.S. strategic policies, the public call for the targetting of Soviet political leadership appears one step closer to a war-fighting war-winning strategy.

13. Alexander George and Richard Smoke, Deterrence in American Foreign Policy: Theory and Practice (New York: Columbia University Press, 1974).

14. Glenn Snyder and Paul Diesing, Conflict Among Nations (Princeton: Princeton University Press, 1977), Ch. 3; Jervis, "Deterrence Theory Revisited," pp. 314-5.

15. John Steinbruner, "Beyond Rational Deterrence: The Struggle for New Conceptions," World Politics, Vol. 28, No. 2 (January 1976), pp. 223-245.

16. Ibid., pp. 237ff.

17. Such as the argument that concessions do demonstrate sincerity and goodwill (unilateral decisions which do not require reciprocity: the 1967 decision to self-impose a ceiling of 1,054 ICBMs, the mothballing of the only operational ABM site at Grand Forks, ND, the shelving of the B-1, etc.), and are necessary to induce co-operation on the part of the Soviet Union. Opponents of assured destruction reasoning are alarmed by this policy of appeasement, self-deception, and capitulation.

18. The major objection against the theory of MAD was that it has monopolized the attention of strategists on pre-attack deterrence in total exclusion of an equally if not more important concern about what to do when deterrence fails. Critics of the second wave theorists contend that psychological inhibitions against thinking about the latter effectively leads to self-deterrence or paralysis of will once war has broken out. From this perspective, MAD is less of a technological condition and more of a self-fulfilling hypothesis. In order for pre-attack deterrence to function successfully, the U.S. must therefore be prepared doctrinally for post-attack defense which necessarily calls for selective nuclear options. This line of thinking does not argue for the fall but the strengthening of assured destruction as the cornerstone of U.S. strategic policy. See, for example, Benjamin S. Lambeth, Selective Nuclear Options in American and Soviet Strategic Policy, R-2043-DDRE (Santa Monica, CA: Rand, December 1976); Paul H. Nitze, "Deterring Our Deterrent," Foreign Policy, No. 25 (Winter 1976-1977), pp. 195-210.

19. Gray, The Soviet-American Arms Race, pp. 75-87.

20. See, for example, the strategic debate sparked off by Albert Wohlstter's series of two articles in Foreign Policy, "Is There a Strategic Arms Race?" No. 15 (Summer 1974), pp. 3-20, and "Rivals, But No Race." No. 16 (Fall 1974), pp. 48-81. The ensuing debate featured articles and comments by many analysts including Michael Nacht, Johan Holst, Paul Nitze, Paul Warnke, David Aaron and Alva Myrdal, which carried on until the summer of 1975.

21. Soviet long-range bombers Tu-20 and Mya-4 were first deployed in 1956. The Soviet medium range bomber Tu-16 which had a range of 4,000 statue miles and could theoretically reach the U.S. on one way missions entered service in 1955. Military Balance 1970 (London: IISS, 1970), p. 108.

22. David Tarr, "SALT II and the Soviet-American Relationship," 1979, unpublished manuscript.

23. This is a statement of likelihood only, and is largely a matter of judgment. There are always two sides to this problem. A non-offensive posture could be misconstrued as a sign of weakness (or paralysis of will) and therefore could invite aggression. Logically, such a posture need not necsarily mean that the Soviet Union would not seek a maximum posture regardless of what the U.S. posture might be.

24. David Vital, The Survival of Small States: Studies in Small Power Great Power Conflict (London: Oxford University Press, 1971).

25. The two camps are the socialist camp (or the free world) and the socialist camp (or the communist world). The three worlds have at least two classifications. The conventional classification refers

to the first world as those advanced industrial democracies of the West and a few others such as Japan and Australia, the second world as the Soviet Union and Eastern Europe, and the rest of the countries as the third world. More recently, a fourth world has been delineated, comprising the extremely poor countries with a marginally surviving population. Since 1974, China came out with a theory of the three worlds, identifying the two superpowers--the U.S. and the Soviet Union--as the first world, the rest of the industrial countries as the second world, and the developing countries (China included) as the third world. This theory, now shelved, originally envisaged the necessity of a united front between the second and the third worlds to resist domination by the superpowers.

26. Scholars in the west are primarily interested in the structural characteristics of bipolarity and multipolarity. Scholars in the east have been more interested in the struggle between the socialist and the capitalist (by definition imperialist) camps. The loosening of bloc politics has been particularly prominant since the Sino-Soviet split and the arrival of rough strategic parity between the U.S. and the Soviet Union.

27. Viability as defined by Boulding. See note 2.

28. Colin S. Gray, "The Future of Land-Based Missiles," Adelphi Papers, No. 134 (Winter 1977); "A New Debate on Ballistic Missile Defense," Survival, Vol. XXIII, No.2 (March/April 1981), pp. 60-71.

29. One prominant exception is Raymond Garthoff (writing while as U.S. Ambassador to Bulgaria), "Mutual Deterrence and Strategic Arms Limitation in Soviet Policy," International Security, Vol. 3, No. 1 (Summer 1978), pp. 112-147. Garthoff argues that in actual policy, the Soviet Union in the 1970s did accept MAD as the cornerstone of Soviet-U.S. strategic relationship. This is an interesting view especially coming from Garthoff since he was one of the first to explicate, in the late 50s and early 60s, the war-fighting bias of Soviet military thinking even in the age of nuclear weapons.

30. For example, see Francis Hoeber, "How Little is Enough?" International Security, Vol. 3, No. 3 (Winter 1978/79), pp. 53-73.

31. As early as 1960, Herman Kahn differentiated finite deterrence from minimum deterrence in that the former "wants enough forces to cover all contingencies" and tend to insist on an objective capability as opposed to one that is only "psychological." Kahn pointed out that originally, minimum deterrence and finite deterrence meant the same thing. The two notions differ only in degree, and not so much in substance. On Thermonuclear War (Princeton, NJ: Princeton University Press, 1970), pp. 13-18. However, the conditions of the 1970s were so different (by then, the number of deliverable warheads had outgrown the requirements of assured destruction several times

over) that in terms of policy implications, finite deterrence was synonymous with minimum deterrence since both argued for a restraint on further improvement and expansion of strategic nuclear forces.

32. For a concise discussion of "self-deterrence", see Gray, "Victory is Possible," op. cit., and Tarr, "SALT II".

33. Snyder, Deterrence and Defense, pp. 260-276.

34. See, for example, McNamara's responses to questions posed by Wiiliam Bates in House Armed Services Commitee's Hearings on Military Posture and H.R. 13456, March 8, 1966, p. 7330. "The point I would emphasize from this table and the only point I need to draw your attention to is as you increase the number of warheads detonated on the Soviet Union above [deleted] you don't get comparable increases in the number of fatalities and the amount of damage as you would expect. Instead you begin to reach a point of diminishing returns. [Deleted.]"

35. The same definitions recurred in the various testimonies and reports to the Congress, such as the DoD Annual Report, FY 1965 (Washington: USGPO, 1967), p. 12, and the Hearings on Military Posture and H.R. 13456 before the full House Committee on Armed Services beginning March 8, 1966 (Washington, USGPO, 1966), p. 7236.

36. Secretary of Defense Elliot Richardson, Department of Defense Annual Report, FY 1974. March 29, 1973.

37. Report of the Secretary of Defense Donald H. Rumsfeld to the Congress on the 1977 Budget and Its Implications for the FY 1978 Authorization Request and the FY 1977-1981 Defense Programs, June 27, 1976.

38. Report of the Secretary of Defense Donald H. Rumsfeld to the Congress on FY 1978 Budget, FY 1979 Authorization Request and FY 1978-82 Defense Program, January 17, 1977.

39. The term "limited aggresssion" usually refers to attack or the threat of such on U.S. allies, and not directly on the U.S. itself. In this sense, the concern is primarily on the efficacy of extended deterrence.

40. Report of Secretary of Defense Harold Brown to the Congress on the FY 1981 Budget, FY 1982 Authorization Request and FY 1981-1985 Defense Programs (January 29, 1980), p. 66; Some analysts think that even this is not enough. See NYT, 6, 21 August 1980; Colin S. Gray and Keith Payne, "Victory is Possible," Foreign Policy, No. 39 (Summer 1980), p. 21; also Gray, "Nuclear Strategy: A Case for a Theory of Victory," International Security, Vol. 4, No. 1 (Summer 1979), pp. 54-87.

41. Snyder, Deterrence and Defense, pp. 4ff.

42. See note 2.

43. Edward N. Luttwak, "The Operational Level of War," International Security, Vol. 5, No. 3 (Winter 1980/81), pp. 61-79.

44. Vital, The Survival of Small States, op. cit., pp. 5-6.

45. Donald G. Brenan, "Some Remarks on Multipolar Strategy," in The Future of the International Strategic System ed. by Richard Rosecrance (San Francisco: Chandler, 1972), pp. 13-28.

46. Although it is theoretically possible for micro-states such as Barbados, Sycheles, Fiji, or the Comoro Islands to possess (not manufacture) nuclear weapons, such a likelihood is practically non-existent under present circumstances.

47. Vital, op. cit., p. 6.

48. Ibid., p. 9

49. This is really a conventional model of the small state. See, for example, Robert L. Rothstein, Alliance and the Small Powers (New York: Columbia University Press, 1968); David Vital, The Inequality of States (London: Oxford University Press, 1967). Interesting reviews include Robert O. Keohane, "Lilliputians Dilemma: Small States in International Politics," International Organization, Vol. XXIII, No. 2 (1969), pp. 291-310; Donald E. Milsten, "Small Powers—A Struggle for Survival," Journal of Conflict Resolution, Vol. VIII, No. 3 (Summer 1969). While generally applicable, this characterization is by no means universal. It cannot accomodate states such as Portugal and England during their imperial hey-days, and perhaps also their contemporary counterpart or would-be counterpart, Japan.

50. Ray Cline attempted a sequence of two world power assessments in 1975 and 1977, in which he identified some "concrete elements" of power and assigned scores to the "national strategy and national will" to arrive at final scores of power. Wayne H. Ferris compiled similar capability scores on the historical power capabilities of nations between 1850 and 1965 in The Power Capabilities of Nation-States (Lexington: Lexington Books, 1973). In a broader study, R. J. Rummel also used empirical indicators to classify the different nations, Dimension of Nations (Sage: Beverly Hills, 19). In most cases, the findings are comparable. Also refer to Maurice A. East, "Size and Foreign Policy Behavior: A Test of Two Models," World Politics, Vol. XXV, No. 4 (July 1973), pp. 556-576.

51. Medium powers are usually significant as regional powers, and as such do wield considerable influence near their borders. Some may even project their influence to some selected places far beyond

their borders. This is particularly true of the ex-colonial powers (Japan included) and China.

52. The primary concern of the study carried out by Geoffrey Kemp ("Nuclear Forces for Medium Powers," op. cit.), for example, was with medium nuclear forces of medium powers.

53. Clarence A. Robinson, Jr., "Soviet Push for Beam Weapon," Aviation Week and Space Technology (May 2, 1977), pp. 16-23; Phillip J. Klass, "Laser Destroys Missile in Test," Aviation Week (August 7, 1978), pp. 14-16; Robinson, "U.S. Pushes Development of Beam Weapons," Aviation Week (October 2, 1978), pp. 15-22; "Key Beam Weapons Tests Slated," Aviation Week (October 9, 1978). pp. 42-53; "Army Pushes New Weapons Effort," Aviation Week (October 16, 1978), pp. 42-52; "Air Forces Emphasizes Laser Weapons," Aviation Week (October 30, 1978), pp. 51-55; "Power Generation Key to Beam Weapons Development," Aviation Week (November 6, 1978), pp. 50-57; "Soviet Test Beam Technologies in Space," Aviation Week (November 13, 1978), pp. 14-20.

54. John Parmentola and Kosta Tsipis, "Particle Beam Weapons," Scientific American, Vol. 240, No. 4 (April 1979), pp. 38-49.

55. According to one estimate, the (1977) unit price for the French Le Redoubtable strategic submarine armed with 16 SLBMs was approximately US$230 million, while that of one U.S. 24-tube Trident submarine was US$730 million. In both cases, the acquisition of one ship in terms of hardware alone would cost as much as 12-17 aircrafts armed with nuclear weapons (SIPRI Yearbook, 1977, pp. 262-266). There is also a significant difference in manpower requirements and maintainence facilities. American SSBNs usually require a compliment of about 100 men. Most Soviet SSBNs require a compliment of close to 100 men. In addition, there are demands on berthing, transit (overseas bases important), and supplies.

56. For example, see Endicott, pp. 206-213.

57. As of 1980, China is constructing at least one nuclear powered submarine, designated the "Han" class. China also has one diesel powered submarine of the Soviet Golf class with three missile tubes, but probably stilled not armed. China reportedly had lost a 320-foot submarine with a complement of 100 men in the North China Sea while test-firing a SLBM underwater. The suspected reason was the submarine's inability to withstand the shock and vibration generated by the missile launch. The Associated Press news story was carried by the Wisconsin State Journal, 15 October 1981.

58. The upper limit is therefore invulnerability from the strategic forces of a superpower, which would then propel the medium power to the rank a superpower, provided that the assumptions about existing weapons technology hold.

59. Such as China against the Soviet Union, or perhaps in the future, Brazil against the U.S.

60. South Africa is heavily dependent on external supply for its energy needs.

61. The two exceptions are Canada and Australia.

62. General Pierre Gallois, The Balance of Terror: Strategy in the Nuclear Age, transl. Richard Howard (Boston: Houghton Mifflin, 1961).

63. Pursuing the same logic, it is possible for the micro-power to achieve credible deterrence against a superpower by acquiring the capability to create a significant enough nuisance against the giant opponent.

64. Morton Kaplan's "unit-veto" system is one example of such ideal-types. See Kaplan, Systems and Process in International Politics (New York: Wiley, 1957); "Variants on Six Models of the International System" in James N. Rosenau ed. International Politics and Foreign Policy (New York: The Free Press, 1969), pp. 291-303; and "The Unit-Veto System Recosnidered," in Rosecrance ed., The Future of the International Strategic System, op. cit., PP. 49-55.

65. See note 27.

66. U.S. intelligence community repeatedly assumed that Israel either was already in possession of nuclear arms, or at least the means to assemble them quickly should the need arise. NYT, April 7, 1975. Robert J. Pranger and Dale R. Tahtinen, heads of the foreign and defense sections of the American Enterprise Institute believed that it was almost a certainty that Israel was nuclear-armed. NYT, July 13, 1975.

67. Small powers are unlikely to develop single purpose long range strategic bombers since the cost of such a weapon system would be probibitive, and the strategic needs for it extremely dubious. Fighter bombers capable of carrying nuclear weapons and up to a range of 1,000 miles will meet most, if not all, defense needs both in terms of defense and deterrence for the small powers. SRBMs of up to 100 miles in range are also very sttractive.

68. See Donald Brenan in Richard Rosecrance, pp. 24ff.

69. Gray, Soviet-American Arms Race, p. 156.

70. See note 62.

71. See Wilfred L. Kohl, French Nulcear Diplomacy (Princeton, NJ: Princeton University Press, 1971).

72. Richard K. Betts, "Nuclear Proliferation and Regional Rivalry: Speculations on South Asia," Orbis, Vol. 23, No. 1 (Spring 1979), pp. 167-184. Betts refers to leadership sobriety as one of the major variables influencing the effects of nuclear proliferation. One such candidate, who is eminently qualified, is Kim Il-sung.

73. The view here is that few countries in the world have a genuine mass base for their foreign policy. Public opinion, while they do provide some very broad constraints, is usually mobilized and manipulated to support or justify certain foreign policy decisions . Great leaders are usually very nationalistic, and in this sense always tend to favor independent policies which must be backed up by strong military capabilities. Apart from the prestige factor, nuclear weapons, however few in numbers, do offer a new dimension to the ultimate struggle for national survival.

74. It is not possible to "control" for, or to isolate the leadership factor.

75. For an interesting discussion on lesser power deterrence needs, see Peter Neilor and Jonathan Alford, "The Future of Britain's Deterrence Force," Adelphi Papers, No. 156 (Spring 1980), pp. 4-8, and the essay by Yehezkel Dror in "The Future of Strategic Deterrence, Part II," Adelphi Papers, No. 161 (Autumn 1980), pp. 45-52.

76. Cf. note 20.

77. This concept of probable mutual destruction was first advanced in the Hudson Institute study compiled by Lewis Dunn and Herman Kahn et. al. for the U.S. Arms Control and Disarmament Agency, Trends in Nulcear Proliferation, 1975-1995 (Croton-on-Hudson, NY: Hudson Institute, 1976).

78. Israel is one clear exception to this rule.

79. This thought can be extended to the conventional capabilities of the superpowers as a potential means for pre-emption against small or medium nuclear forces. Geographical proximity in this case is a very significant factor.

CHAPTER THREE

REGIONAL RELATIONS IN NORTHEAST ASIA

As Clauswitz had so aptly observed, war is merely the continuation of policy by other means. Militray security is therefore an integral part of overall national security. Since need is relative to the circumstances, it is impossible to analyse deterrence policies and deterrence requirements of the Northeast Asian countries without reference to the existing and future-probable political environments of the region. Given the present state of U.S.-Japanese alliance relations, for example, there is little reason to believe that Japan's current security policy entails the deterring of, say, a U.S. invasion or occupation of Japan. Under a different set of political alignments, however, a Japanese nuclear deterrent against the U.S. is quite thinkable and perhaps within the realm of possibilities. The question is how probable this change in alignment would be within our time frame.

Four political scenarios have been developed in this chapter to provide a set of contexts within which the deterrence requirements of each of the seven powers in Northeast Asia are analysed. These scenarios cover considerable changes in the international environemnt. They serve both to highlight how extreme changes in the political environment (e.g. from detente to cold war) can affect deterrence requirements, and to exclude what are considered to be highly improbable political developments (e.g. unification of Korea) within this decade.

Since relations among nations during the atomic age have been dominated by the bilateral relationship between the two superpowers--the U.S. and the Soviet Union--the four scenarios must also be be understood in terms of this changing bipolarity in international affairs. The following discussions present in broad brushes how bipolarity has affected and will continue to affect the major issues of war and peace in Northeast Asia. These are then followed by the development of four scenarios of probable regional relations in the area, each of which is constrained by the bipolarity in international politics.

The Bipolar International Environment

International politics since World War II have witnessed the emergence of nuclear weapons as an important factor in international diplomacy.[1] There was a time when territorial defense allowed some degree of relative security, which, given the appropriate geographical setting, could approach the absolute. England and Japan were two favorite examples.

However, with the advent of long-range bombers, ballistic missiles, and nuclear warheads, this type of relative security has all but vanished. The possibility of total annihilation of a nation-state has ushered in new realities in warfare where the clear distinction between combatants and non-combatants can no longer be taken for granted. The significance of this fact has permanently altered our conception of military security and its respective counterparts in diplomacy, and resulted in the birth of a new vocabulary to deal with the salient features of contemporary international politics.

Nevertheless, traditional forms of international relations have survived this sudden onslaught of the ultimate offense. First, only a handful of nations possess nuclear weapons, of which only two embrace them in overwhelming quantitites. Secondly, it is still possible for small states to gain some degree of security by adhering to neutrality or by allying with big nuclear powers. Thirdly, the new weapons, being close to ultimate, are increasingly perceived to be unlikely tools for low level conflicts.[2] Yet, the process of horizontal proliferation though much slower than predicted, by now appears to be irresistable, and has signalled a short life to this optimism. What are considered by big powers to be "low level" conflicts among small powers in non-contested areas may indeed be issues of vital national interests as far as the lesser powers are concerned. This is especially the case for frustrated nationalisms tied to divided peoples. Despite strenous efforts by the Soviet Union on the one hand, and by the U.S. on the other to stem the tide of proliferation, lesser powers have become increasingly emboldened by the availability of technological know-how to press ahead for the development of what they hope may prove to be the equalizer in international politics. As this trend now appears persistent and irreversible, many international conflicts previously considered to be "low level" will take on increasing importance, particularly when vital national interests of the lesser powers appear at stake.[3]

Whereas the North Korea attack to the South in 1950 and the

Chinese shelling of Jinmen-Mazu (Quemoy-Matsu) in 1954 and 1958, were understood primarily in terms of Soviet instigation, Chinese intervention, and as tests of American will and resolve, similar "international crises" today are less likely to be understood solely in terms of big power politics. What goes on among the divided powers of Asia, in Taiwan or Korea today, has taken on new and greater significance, if not because of the apparent change in the global correlation of forces featuring a decline in American power, then at least because of the acquisition by such lesser partners in regional politics of the ability and readiness to acquire the ultimate equalizer in strategic capability.[4] In Northeast Asia today, Korean attitudes toward when and how unification should come about, and the Kuomintang leadership's blueprint on the future of Taiwan may run afoul of great power expectations.[5] Governments must prepare against being left alone and vulnerable. The persistent attempts by Taiwan and South Korea to acquire independent nuclear weapons despite strong American discouragement is one obvious case in point. Yet, this is not to imply the demise of great power influence in Northeast Asian politics today. On the contrary, big powers still define a good number of issues, choices and constraints within which the lesser powers must operate. Soviet-American global relations are still the most prominant feature of international politics and a most critical factor in Northeast Asia by virtue of their presence in the area. Sino-Soviet confrontations, sharpest along the Soviet Far East and the Manchurian frontiers, and the Soviet occupation of the Japanese Northern Territories are two of the several issues of decisive importance to the peace and security of the entire Northeast Asia. These are highly emotional issues soaked with variagated experiences and conflicting images atop competing interests perceived vital to each of the superpowers. An analysis of security relations in Northeast Asia must necessarily retain a perspective on the important roles played by the two global rivals, the Soviet Union, the U.S., the two regional powers, China and Japan, and yet still remain sensitive to the increasingly significant lesser power perceptions and aspirations. The focus on the consequences of the lesser nations going nuclear allows us in this work to join these perspectives in a way denied the optimistic approaches which too readily assume the ability of the superpowers to keep weaker allies unarmed in the nuclear realm.

Soviet-American Rivalry

To impose a comprehensive order on the complex realities of international politics is inherently a precarious enterprise. More may be missed than gained. Yet, it is impossible to begin without some sense of direction, and an image even if somewhat distorted will provide at least a starting point for a systematic understanding of what is at stake.

It is indeed very tempting to see the world in strictly bipolar terms and explain international politics as a struggle between the Soviet Union and the U.S. through the manipulation of surrogates. Equally fascinating is the tendency to view the world in a state of anarchy without law or morality and defying systematic generalizations. The view here is that might does mean right in many instances in international politics. The fundamental military factor underlying international relations today is still Soviet-American rivalry. However, the increasing proliferation of force in the world has weakened their control over events to the extent that they no longer can define most of the issues all the time when vital national interests of the lesser powers are at stake.

Global relations since World War II have been more or less described by what has come to be known as the bipolar system. The global setting changes with the Soviet-American relationship. In the thirty-four months between January 1947 and October 1949, American foreign policy underwent an about-face. The Truman administration gave up reliance on the United Nations and the expectation of cooperation with the Soviet Union, and began (in response) to conduct a bipolar power struggle with the Russians.[6] The emergence of a Soviet-backed China and subsequent events in Korea helped to crystalize a global politics of confrontation. Henceforth, Soviet-American rivalry has been a major factor on the politics of Northeast Asia.

The history of the Cold War has left behind a structure of alliance relationships which has been greatly affected since the 1960s by the Soviet-American dispute. A bitterly divided Korea, a dynamic capitalist and expansionist Japan, a successful Taiwan autonomous from China--all are, to some extent, a function of Soviet-American competition for advantage.[7] The progress of detente since the Kissinger years has introduced elements of flexibility in a hitherto extremely rigid alliance structure. North Korea began to exploit the new found freedom to seek direct negotiations with the U.S. without fearing Soviet or Chinese reprisals. South Korea found it possible to maintain good will contacts with China in the hope that it constituted semi-recognition and to avert if possible a one-sided Chinese policy towards North Korea. Japan has apparently gained sufficient flexibility to conduct a more rational policy towards its communist mainland neighbors. While Nixon's trip to Beijing upgraded Sino-American relations, it has never been more than a move to adjust to the new global balance of power.[8] Existing views serve well to highlight the controversy over Taiwan. Now that de-recognition has become a reality, Taiwan has sought to assert its autonomy through a process of restructuring priorities and positions, and thereby creating unprecedented possibilities for the future of Taiwan.[9] What is happening in Taiwan today may well be the first step towards new alliance relationships throughout Northeast Asia.[10] In sum, while politics in Northeast Asia are still broadly defined and constrained by Soviet-American rivalry, issues pertaining to the vital national interests of the small powers have become increasingly significant.

The Sino-Soviet Dispute

With hindsight, it is easy to discover how early the CPC and the CPSU relationship began to disintegrate. Nevertheless, the alarming reality in the Fifties was not so much their bickering with each other, but rather their apparent solidarity creating a seemingly unbreakable and awesome alliance over vast Eurasian masses. The geopolitical potential was both real and psychological. Power is in part a state of the mind. Yet this exaggerated imagery in turn dramatized subsequent Sino-Soviet contradictions. The result was an equally traumatic exhilaration over the Moscow-Beijing rift when the facts became too overwhelming to be conveniently dismissed. Perceptions about enemies have been a critical factor in international politics. Allies and enemies alike gauge their foreign policies on their perception of what the American position and reactions might be. The same can be said with respect to the Soviet Union. Hence, images--whether they are of an indivisible communist alliance or weaker allies forever without nuclear weapons--can provide a mythic basis for policy.

The causes of the Sino-Soviet rift were manifold. It has been argued that the open rift was never quite a forgone conclusion. Possibilities had been more fluid than our subsequent analyses suggested.[11] The Soviet decision to confront the realities of an open break with China by withdrawing technical assistance was regarded by many to be the last straw. This dramatic change created new possibilities for international alliance structures, which India for one exploited. In terms of Northeast Asia, the main features of bipolar cold war confrontation gave way to more complicated calculations. The prospects of Korean unification certainly did not gain from the Sino-Soviet rift, yet it created conditions favorable for North Korea to solicit competitive aid from its two major allies.[12] Japan experienced little immediate gain from the Sino-Soviet rift. But as Sino-American detente came about, intense competition between China and the Soviet Union gave Japan ample room to maneuver for advantage. It has also been suggested that a Japanese posture of equidistance may no longer be a viable policy choice.[13] Recent arguments have been made to show how the Shanghai Communique has aided Taiwan domestically and internationally to free it from its previous complacency and rigidity. The international political context of Soviet-American detente and Sino-Soviet dispute has allowed Taiwan to feign possible cooperation with the Soviet Union, an eventuality neither Beijing nor Washington can accept.

Divided Korea and Efforts for Unification

On August 9, 1945, one day after it declared war on Japan, the Soviet Union went into action in Manchuria and landed on the northern tip of Korea. Two days later, the U.S. drafted General Order Number One which created what proved to be the de facto partition of Korea.[14] At that time, the industrial north were superior militarily as well as politically more stable than the rural south. Subsequent East-West relations sealed the fate of the Korean people. Two drastically different political and social systems emerged over the years. The prospects for a peaceful unification of Korea grew more and more remote with time. Several developments over the past twenty years have affected the situation fundamentally. First, about the time a strong South Korean state began to emerge shortly after Park Chung-hee seized power in the early 1960s, the Sino-Soviet dispute broke into the open. While the threat of an invasion from the north appeared to have diminished considerably, it has also been observed that North Korea had received more generous aid from its allies than before. Secondly, Japan re-established its close relationship with South Korea and openly declared a coupling of their security concerns. The fact that a number of influential American scholars acceded to this as a legitimate Japanese concern today is suggestive of the Japanese factor in Korean politics.[15] Thirdly, the dramatic decline of hostility between China and the U.S. which finally led to a limited friendship further complicated North Korea's strategy towards unification. While detente appeared to have eroded North Korea's position on unification, it has also created favorable conditions for the eventual withdrawal of American troops in the South.[16] This serves the intermediate goal both of a reduced American presence and greater pressure on the South to participate in negotiations. A popular view among observers is that the North and South Korean Red Cross talks dealing with family reunification which began in 1971 were the direct result of this new political atmosphere. The rationale of peaceful reunification is first to bring the North and South relationship from mutual hostility to mutual acceptance.

Along the socialist front, there has always been a divergence of interests among North Korea, China, and the Soviet Union on the issue of Korean unification. National unification has always been and will remain the top priority in North Korea. For China, a united, socialist Korea strikes a sympathetic chord, but cannot be pursued at the expense of its other important national interests. Surely, China cannot approve of two separate Koreas while fighting for one China itself. Observers concur that for the Soviet Union, Korean unification is a preferred outcome only when tied to overall Soviet objectives in the Far East.[17] It is therefore a necessarily subordinate part to its policy towards China and Japan.

As historians have noted, Korea had been a cultural corridor between China and Japan. It had been the lips of China's teeth as well as a bridge for Japan to the mainland. Culturally, China, Korea, and Japan share a deep Confucian tradition, such that they understand each other in ways the Soviet Union cannot realistically hope to approximate. Historically, Korea has never been a threat to any of its neighbors. Neither is it a rival for influence like Vietnam is to China, or China is to the Soviet Union. The competition for friendship in Korea means much more to China and to Japan, than to the Soviet Union or to the U.S.[18]

The Northern Territories and Japan

The legacy of World War II has left the Soviet Union in occupation of four islands immediately north of Hokkaido, two of which form part of the rangy Kurile Archaepelago.[19] These islands--Etorofu, Kunashiri, Shikotan and Habomai together form what Japan considers to be its Northern Territories. Several attempts had been made shortly after the San Francisco Conference (1951) by both parties to end the state of hostilities and to normalize their relationship.[20] The Soviet Union was interested in using Shikotan and Habomai, the two smaller islands, to solicit and hopefully also to cement a favorable relationship with the strongly pro-American Japan. Tying the islands to the peace treaty had always been part of Soviet foreign policy towards the U.S. in the Far East. Japan, on the other hand, insisted that the return of the four islands should be a pre-condition to any peace settlement. A shift in the Japanese position took place when Ichiro Hatoyama became prime minister in December 1954, as a result of which intensive informal negotiations with the Soviet Union yielded a draft peace agreement promising Japan the return of the two islands adjacent to Hokkaido after the treaty had been signed. Japan, however, was unable to go through with the agreement and meet the tough Soviet demands which effectively called for its Finlandization and alienation from the U.S. The situation became even more complex after the Sino-Soviet rift. By 1964, the Soviet Union adopted a strictly legalistic position that all territorial questions have been settled and none could be re-opened.

Although the islands are strategically important to Japan, they are not vital to Soviet national interest as such. The Japanese understand well that the Soviet Union has been making full use of them as carrots and sticks. By such maneuvers as military fortifications or troop deployments on one or several of these islands, the Soviet Union can place severe constraints to Japanese foreign policy deemed distasteful to its northern neighbor. Apart from the potential implications on subterranean resources and economic rights, the Northern Territories are, and will remain a symbol of impaired national sovereignty and territorial integrity. It would be impossible for any Japanese government to accept anything less than the whole.[21] Today, the Northern Territories serve as hostage, for which the ransom price is tantamount to the Finlandization of Japan. Realistically, neither the U.S. nor China could ever help in this regard. The continued occupation of the Northern Territories and the impotence of diplomacy for their recovery argues well ultimately for a strong, steady program of rearmament in Japan.

Taiwan and the Unification of China

Since December 1949, the top leaders of the Koumintang (KMT) have maintained effective control over Taiwan, the Penghu Island groups, and a few off-shore islands. The security of Taiwan was first guarded by the 100-mile Taiwan Strait in the absence of a navy by which the Central People's Government could bring its popular forces to bear. Its security from a possible mainland assault apparently enjoyed a more effective and lasting guarantee from the U.S. after the Korean War broke out.[22] Taiwan has since become economically viable and by and large politically stable in the absence of any link with the mainland.

The KMT at first sought the ultimate recovery of the mainland. This posture both befitted the feelings of the KMT as well as provided the KMT a legitimate claim to stand as the de jure government of China. Since the death of Chiang Kai-shek and the shift in American foreign policy towards China, the never-too-credible policy of returning to the mainland completely lost its appeal at home. In spite of rhetoric to the contrary, recent diplomatic activities attempt to suggest an image of a helpless Taiwan trying no more than to safeguard the rights of its people to a decent, autonomous existence.[23]

From the vantage point of Beijing, the tough conditions for successful unification have not been met. Although Taiwan has been effectively deprived of international recognition with the important exceptions of Saudi Arabia and South Africa, economic links between Taiwan and its traditional backers have been strengthened rather than weakened. While the people in Taiwan in general share the identity of being Chinese, strong underground organizations have emerged ready to capture most, if not all of the anit-Chiang, anti-KMT (and by implication anti-Chinese, as the independence movement would like to see) forces.[25]

The viability of choices the U.S. and Japan still enjoy with respect to the future of Taiwan shoud not be underestimated. First, progressive forces within the KMT can be encouraged to assume an important role to foster reforms. Secondly, the self-determination movement, which presumably has a broader mass base because it does not pre-judge the issue of "independence," could be nurtured, emboldened, and supported. Thirdly, the Taiwan independence movement remains a strong and forceful, albeit violent, alternative. And if all should fail, there is always the possibility of a coup d'etat by the 600,000 strong armed forces. In any event, the question of the status of Taiwan can be defaulted to the international community if and when the need arises.[26] Existing analyses suggest no reason why Japan will not be sympathetic to any of these arrangements as long as the gains appear to outweigh the costs in the long run. As in the case of most if not all divided nations, Taiwan and the mainland alone are the ones seeking reunification. It is quite possible that as the stalemate continues, the weaker side may wonder if a German solution to the problem is not a wiser choice after all.

Detente is an idea, a catchword, a continuing process, and a state of affairs. Since the Sixties, the salient feature of international politics has been detente. It implies the releasing or loosening up of tensions, or softening and mellowing of difficult relationships. But as a means to an end, or as an intermediate goal at best, detente has meant different things to different people. It is a search for peaceful coexistence and a constructive relationship.[27] Yet, it also means appeasement, superpower collusion, competition, and rivalry.[28] Supposedly, in the Kissingerian scheme of the world, differences in political ideology cannot be resolved within the lifespan of a generation, but disastrous consequences from differences can be minimized by emphasizing the pursuit of common interests. There can be no better first step than to seek understanding from the major centers of power to create a semblance of consensus albeit just on procedural matters, and hopefully by the skillful practice of give and take, thereafter to transform a condominium of power into a community of power. Towards this historic purpose, the Cold War must be constrained, and detente was meant to do just that. However, there is no guarantee that detente will work, or that it will last. Reconciliation of conflicting national interests is necessarily trying and not always possible. The interaction of the foregoing issues may well determine the state of regional relations in Northeast Asia. In fact, judging by the events of the past few years, the process of detente appears to have halted, while the politics of the Cold War have made a steady comeback.

Scenarios of Political Alignments in Northeast Asia

In general, military alliances are positive indicators, and indeed usually consequences of close political alliances. It therefore follows that military security must be analysed in the context of given international poltical alignments. As it has been discussed in the previous section, the major conditioning factor of politics in Northeast Asia is relations between the U.S. and the Soviet Union and their attitude towards and management of their respective alliance relationships. In other words, whether there will be cold war or detente in Northeast Asia is largely conditioned by the cooling or warming of relationship between Washington and Moscow. Detente between the U.S. and the Soviet Union in the 1960s, for example, made it possible for Japan to expand its relationship with the Soviet Union. Detente between the U.S. and China in the early 1970s, on the other hand, permitted South Korea to take initiatives on its relations with China, and North Korea to seek direct talks with the U.S. Conversely, the resurgence of confrontation politics between the U.S. and the Soviet Union in the late 1970s has made it difficult for Japan to collaborate with the Soviet Union in joint economic ventures in the Soviet Far East.

However, superpower detente (though necessary) by itself is not sufficient to dictate general detente in Northeast Asia. U.S. policy towards Taiwan, Soviet policy towards the Northern Territories, and Sino-Soviet relations are some important factors whereby superpower attitudes towards regional powers and regional issues do make a significant difference in the political alignment of the region. Consequently, these changes affect the military requirements for national security, of which nuclear deterrence is an important aspect.

In order to analayse strategic deterrence requirements in terms of nuclear weapons in Northeast Asia, four political scenarios will be developed to approximate the most likely outcomes of the interactions among the critical issues outlined above. The scenarios range from the most relaxed to the most tense of relationships. The expectation here is that the likelihood of overt conflicts is the least when international relations are the most relaxed, and the greatest when relations are the most tense. The implication is that any power must be better prepared militarily when the likelihood of war is high. the requirements for deterrence will also rise corresponding to the rise in international tension. However, international tension does not affect all nations the same way or to the same extent. It is quite possible for a nation to feel more secure in times of conflict rather than in times of peace. Generally speaking, such enhanced sense of security is also a consequence of increased military preparedness and more credible security guarantees. Deterrence requirements in terms of nuclear weapons, being part of military preparedness, will also undergo corresponding adjustments commensurate with the needs of the changing circumstances.

Scenario I: General Detente

General detente depicts, among what are considered probable, the most relaxed overall relations among the four major powers in Northeast Asia. The relaxed relations among major powers, while lowering their deterrence requirements, may have the paradoxic effect of threatening the viability of the small regimes--namely, Taiwan, North and South Korea. This may serve to accelerate rather than decelerate horizontal nuclear proliferation. The features of this scenario are:

(1) Relatively relaxed but still competive relations among the U.S., the Soviet Union and China.

(2) A partially remilitarized Japan characterized by its pursuit of good neighborly relations while maintaining a close relationship with the U.S.

(3) Progress on border, navigation, and trade negotiations between the Soviet Union and China.

General detente is expected to evolve as a logical next step from a successful fabrication of a global condominium of powers. Evolution into this state of affairs is neither necessary nor inevitable. Indeed, trilateralism (the close cooperation of the U.S., Western Europe and Japan) championed by analysts like Robert L. Pfaltzgraff, Jr., and later put into practice by the Carter team of foreign affairs experts, was precisely meant to steer the U.S. clear of the unprincipled and damaging Kissingerian scheme of things. To the extent that this new trilateralism succeeded, so much less likely would general detente come about. Foreign policy decisions tend to assume greater moral overtones. In effect, alliance structures would most likely be reinforced, and thereby lose much of their flexibility acquired previously under the Kissinger era. As national interests converge with the moral visions of the nation, ideological differences among different social systems would be exposed and amplified. Under such circumstances, "Cold War" may well become a more accurate depiction of the situation. Although judging by today's events detente may not be the most probable state of international affairs, it is nevertheless a very interesting and possible alternative.

Today, both the Soviet Union and the U.S. are superpowers and global powers. It appears certain that the two will remain unparalleled for the next decade to come. The Soviet Union views itself as a strong communist power and the leader of the world socialist revolution. The U.S., on the other hand, cherishes the self-image of a powerful leader and protector of the diminishing free world. The clash between self-images and enemy images of self is a source of constant conflicts. Such conflicts may be regulated by the recognition that foreign policy involves relationships among sovereign nations, and that just or unjust, their respective strengths determine to a large extent what each can do. Detente comes about when power and legitimacy are recognized as different but not entirely separable, and thereby the enemy can be respected. For a system of general detente to work, there needs to be a willingness to recognize and accomodate "legitimate interests," a readiness to negotiate conflicting claims, a spirit of coexistence, of give and take, however temporary and tactical they may be.[30]

Several obstacles stand in the way of a general detente in Northeast Asia. The first is Sino-Soviet confrontation. As noted earlier, the rift had a long and bitter history, and is unlikely to be forgotten easily. But the same can be said of U.S.-China relations in the Fifties and Sixties. It is therefore not inconceivable to envisage a swift transition to improved state-to-state relations should realpolitik so dictate. Even limited rapprochement between the CPSU and the CPC is within the realm of possible politics. However, dramatic improvement in Sino-Soviet relations will probably be predicated on two important conditions: First, the Soviet Union must be prepared to thin out its troops stationed along the Sino-Soviet border and inside Mongolia. Preferably, Soviet troop strength would be reduced to pre-1960 levels. Secondly, the Soviet Union must be willing to liberate Mao Zedong thought from the category of heresy and recognize it as socialism in China according to its concrete, historical conditions. In return, China must abandon all overt anti-Soviet activities and recognize the Soviet Union as a leading socialist country. The second condition is fundamental to any improvement in party-to-party relationships and the corresponding move from detente to rapprochement. Also, China will insist on Soviet guarantees that it will not interfere in the internal affairs of the CPC and, by implication, of the state.[32]

In the long run, the long standing and highly visible territorial dispute between the Soviet Union and China will remain a difficult problem. Concessions from either party in matters of principle are unlikely. The Soviet Union is likely to insist that the Sino-Soviet boundary has been clearly delimited historically, since to do otherwise would open a pandora's box all along her borders.[33] China, on the other hand, is unlikely to settle only for minor adjustments due to problems of surveying. China's willingness to shelve difficult territorial issues temporarily does not imply that it opts for the issues to fade away.[34] On the contrary, it is a tactic to keep the issues in animated suspension, to revive them from time to time if necessary to keep them alive, and ultimately to force a decision if and when the balance of forces become favorable to China in some future time.

Despite all the recriminations, good reasons exist for a Sino-Soviet accommodation. The U.S. is likely to remain the chief competitor and adversary of the Soviet Union. In terms of the threat to its national security and the corresponding burden in defense, the Soviet Union has much to gain from a lessening of tension in the Far East. Logistic problems aside, supplying one million non-productive soldiers in the Soviet Far East puts a tremendous burden on the Trans-Siberian railway system and the few eastern ports. Substantial savings can be realised by a partial demobilisation, or redeployment to the Southern and Western fronts, or re-assigning the Far East army to pioneering work. Similar savings in valuable resources may be far more meaningful to China.

The second important obstacle is the question of Taiwan. There is today a strong opinion among some China scholars that the top issue in China is the Soviet threat, and will probably remain so if the U.S. makes the appropriate moves.[35] Based on the same facts, and even more popular judgment is to take advantage of the powerlessness of China, and table the issue of Taiwan indefinitely.[36] In the meantime, change could be brought about on Taiwan. Like Euclidean geometry and Newtonian physics, such a policy is good only for a short distance and a small time scale.

If China's pursuit of detente with the U.S. is meant to check Soviet expansionism, it also serves to placate American concern over the future of Taiwan. There could be no easy solution to the question of unification should the U.S. decide to support the evolution of an independent Taiwan. Since it is not possible to maintain the status quo forever, and time appears to be running out quickly, the U.S. must either facilitate a reversion of Taiwan to the mainland, or actively pursue a covert policy of encouraging if not creating an independent island republic. From the Chinese point of view, detente with the U.S. is meant to create conditions under which the U.S. finds it possible to facilitate the unification of China, and not the independence of Taiwan. There are reasons to believe that since the advent of the Carter administration, the tendency has been towards a deliberate non-decision if not retreat from the former American commitments and positions.[37] The China policy of the Reagan administration is even more overtly a two-China policy. Under such circumstances, China can hardly be expected to confront Soviet hostility and at the same time watch helplessly what could be rightly construed as an American betrayal. There is a point beyond which detente with the U.S. becomes unfruitful and perhaps even damaging. Conceivably, China will try its best to dissuade the U.S. from crossing the point of no return. As some analysts have speculated, one method would be to relegate the Sino-Soviet confrontation to a secondary priority provided that the Soviet Union makes the necessary accomodation too.[38] A limited Sino-Soviet detente may create the image of a China with more flexibility and greater bargaining power.

Japan's interests in Taiwan are formidable, but still must be regarded as secondary compared to its overall foreign policy objectives. The basic foreign policy objective of Japan as a world trading power is to maintain the best possible relationship with all nations provided that this does not jeopardize its special relationship with the U.S. Stable, friendly relations between Japan and its mainland neighbors are conducive to long term stable economic ties, which in turn will form the basis for continued and diversified economic expansion, and therefore further insurance against possible deterioration of any single bilateral trade relationship.[40] However, the policy of friend to all and enemy to none may not always be feasible. The diminishing credibility of the American nuclear umbrella, and in fact its overall security guarantees, renders Japan exposed to social systems which are by and large hostile. This emerging feeling of vulnerability provides good reasons for Japan to pursue a low key but nevertheless serious program of an independent nuclear deterrent.[41] Other reasons may also come into play. A more self-confident and nationalistic Japan may desire the full range of military options to protect its life lines and to guarantee its unquestioned survival as a major regional if not global power. However, a major rearmament on the part of Japan is not without considerable costs. Indeed, rapid rearmament by Japan may be itself change the entire political atmosphere of Northeast Asia. Unless events such as the invasion of Taiwan or South Korea or the physical occupation of Japanese territory by the Soviet Union errupt, general detente will remain the preferred state of affairs by Japan.

In sum, general detente, however unlikely, is ostensibly a possible state of affairs for a number of good reasons. For the U.S., it means a justifiable policy of reduced physical presence in the area. With the help of a stronger Japan, a system of checks and balances may work towards a containment of expansionism by any single power.[42] For the Soviet Union, "peaceful coexistence" is still the best means in its pursuit of competitive dominance. After-all, a lessening of tension in the Far East alleviates the drain of resources, and enhances its position in Europe and in the near east. For China, choices are limited. It cannot at the present solve its problems by the existing arrangement of global and regional relationships. It is necessary for China to create and exploit contradictions between the superpowers and their allies, to maneuver for a greater degree of security and independence, and perhaps the eventual return of Taiwan. Japan stands to gain most by an overall improvement in relations in the region. It will mean greater stability and lesser tension, and therefore less strain on the government, which must confront the impossible task of having to cope with the otherwise irreconcilable demands by antagonistic powers. It will also give Japan the time it needs, should it so decide, to become militarily strong.[43]

While the small powers always prefer that the elephants of the region do not fight, they also fear that too cozy a relationship among them spells big power collusion. Under the conditions of general detente, the need for military preparedness may not be as urgent on the one hand, but security guarantees may be much less reliable on the other. Indeed, the steadfastness of guarantees under the strict and rigid alliance system immediately after World War II can no longer be found since the U.S.-Soviet detente.

If detente means a lessening of tensions, it also means a threat to the existence of small powers whose identities thrive under conditions of direct confrontation. This is particularly true of divided nations. Taiwan is a prime example in Northeast Asia. The fear is that both the U.S. and Japan would abandon Taiwan as France and Great Britian had done to Czechoslovakia in Munich, 1938. South Korea, like Taiwan, depends almost entirely on American security guarantees. It is therefore quite understandable that both countries have embarked on nuclear programs with covert military implications since the late Sixties. While North Korea does not share the same fear for its identity and existence, it would certainly feel vulnerable to South Korean nuclear capabilities. This process of lesser powers seeking independent deterrents was initiated at a time when the Soviet Union had reached a rough strategic parity with the U.S. and as the U.S. sought to adjust to this new relationship. By now, the trend appears to be irreversible even if the process itself may still be retarded. General detente does not in any way preclude nuclear proliferation.

Under this scenario of general detente, the probability that any single nation must face more than one major war at a time in Northeast Asia is judged to be the lowest. For the Soviet Union, the U.S., China and Japan, the maximum requirement of a minimum posture will be that of being able to meet the most formidable enemy under the worst possible situation in a two-way strategic confrontation. Irrespective of the international situation, the Korean nuclear forces would strive towards strictly limited postures of deterring for survival at the minimum, and, along with Taiwan, they might each opt for a credible strategic force which also has strong tactical implications against concentrated military forces. Approximations of these force structures will be developed according to the above assumptions in Chapter Five.

Scenario II: Limited Bilateral Detente

Limited bilateral detente depicts a political situation similar to the one existing today. This scenario features limited detente between the U.S. and the Soviet Union, and between the U.S. and China. Sino-Soviet confrontation persists, with Japan playing a delicate role of balancing the two powers under the guise of an equidistant foreign policy. Several factors will be assumed in this scenario:

(1) Sufficient progress is being made on the question of Taiwan between the U.S. and China to keep the dialogue going, yet American military and economic ties to Taiwan are still intact.

(2) China is still not in a position to command an overwhelming local air and naval superiority over the Taiwan Strait vis-a-vis the combined forces of the American regional presence and Taiwan.

(3) The Sino-Soviet dispute persists with no sign of abatement.

(4) Little or no progress has been made concerning the return of the Northern Territories to Japan, and therefore no peace treaty between Japan and the Soviet Union.

To say that Scenario II is analogous to the present situation is not to suggest that the status quo will somehow persist. On the contrary, the interesting features of this scenario, as with the existing situation, are its inherent dynamism and open possibilities. Although the fundamental readjustments were made after Nixon's trip to Beijing, the re-ordering of American security objectives and defense priorities is still going on.

Precisely because the Kissingerian search for a condomium of powers had been beset by problems of conflicting interests abroad and ideological resistance at home, the U.S. once again is looking for a new formula to deal with the burgeoning Soviet power.[44] The resulting emphasis on a new trilateralism has been warmly embraced by the NATO allies. However, the fate of this new trilateralism is still hanging in the balance since it is founded on a resurgence of American nationalism and moral righteousness, a basis which must confront the unequal economic relationship between the U.S. and Japan that has its roots way back in the cold war years. Similarly, America's relationship with Europe is still undergoing a process of redefinition. Because of Europe's nearness to Soviet military might, it is questionable if trilateralism is possible without Soviet-American detente. This is all the more ironical since trilateralism under the Reagan administration is meant to check the growth of communist influence in general, and Soviet power in particular.

As the emphasis on strengthening an alliance of the free world continues, the American position on the future of Taiwan will become increasingly untenable. The ideal solution would be a relatively tranquil transition of power to more liberal elements on the island, such that a credible bid may be made to rally the forces of self-determination. It is also attractive to believe that a successful program of liberalization (thereby increasing the legitimacy and popularity of the regime) will reduce the incentive for the mainland to intervene militarily. Time is required for this process to have a fair chance, during which the U.S. must also maintain the momentum of rapprochement with China.[45] This double task is necessarily trying. There is no inherent reason why short term mortgaging of American credibility to buy time for a revitalization of the free world must fail. Yet, rising American nationalism may also be matched by a resurgence of Korean, Japanese, and perhaps even "Taiwanese" nationalism.[46] Detente with the communists means American retreat from its previous commitments in South Korea and Taiwan. Dissatisfaction with American flirtation with their enemies can be and has been translated into rising tides of anti-Americanism. This in turn will curtail American influence and credibility in the area.

On the other hand, the Soviet Union may decide to match American flexibility with its own version by reaching a settlement on the Northern Territories with Japan, in which case one major obstacel against the improvement of economic relations (which is largely complementary and mutually beneficial) between the two countries would be lifted. The likelihood of such a turn of events is influenced to some degree by the development of Sino-Soviet relations, which in turn is tied to U.S. policy towards China. Scenario II is not a picture of stalement, but one of potentially great changes.

The dominant issue in the global system today is Soviet-American rivalry. This is expected to be true in this scenario as well. Being the only superpowers, a set of common concerns exists between the two.[47] The first and foremost concern is the mutual ability to conduct a war of global destruction. A direct military confrontation between the two must therefore be avoided. Rising military might of the Soviet Union towards the late Sixties served both as a demonstration to the U.S. and a self-reinforcement on the necessity or desirability of "peaceful coexistence." Secondly, the reality of American power has had a sobering effect on the otherwise uninhibited exercise of Soviet power.[48] The end result has been a mutual feeling that the two should seek an understanding on, or perhaps even settle major world problems between themselves. This has meant, in effect, the constant neglect of the interests of their allies, resulting in hurt feelings. Thirdly, both superpowers are concerned about their leadership roles in their respective bloc politics. The status quo has by and large served the interests of the superpowers, although the Soviet Union appeared to have gained consistently considerably more. The management of a stable world has therefore become synonymous with progress towards peace. Since nuclear war is so unthinkable in a world armed to the teeth with nuclear weapons, peace must be maintained even if it should come at the inconvenience or expense of the lesser powers. Fourthly, as a consequence of superpower interests in maintaining the status quo, disaffected powers have sought to form peripheral challenges within their respective spheres of influence. This development has in turn reinforced the need for mutual understandings between the superpowers to handle such challenges.[49]

For the U.S., detente with the Soviet Union is "progress towards peace" by increasingly drawing the Soviet Union not only into "constraints and disciplines but also the advantages of the international system" via certain devised "rules of conduct" for the restrained use of power.[50] For the Soviet Union, detente is inseparable from peaceful coexistence, which means "determined resistance to imperialism's aggressive actions" combined with "a constructive approach to international problems, and an uncompromising stand in the ideological struggle with a readiness to promote mutually beneficial relations with countries belonging to opposing social systems."[51] Both believe that mutually beneficial cooperation serves to strengthen world peace and national security.

Some analysts contend that the relative decline of American pre-eminence which brought about detente with the Soviet Union was also responsible for detente, and perhaps ulitmately rapprochement with China.[52] Given a state of rough strategic parity with the Soviet

Union and a momentum of change unfavorable to the U.S., improved Sino-American relations will, as the argument goes, have a restraining effect on Soviet behavior as long as Sino-Soviet confrontation persists.[53] The same argument has also suggested that because of China's relatively weak position vis-a-vis the Soviet Union, it has few options but to lean on one side. Indeed, leaning towards the U.S. serves a number of purposes. It is good politics to align with a less dangerous power (weaker in terms of resolve) which is on the defensive. China's security will be strengthened through an alliance (formal or informal) with the U.S. to restrain the expansionist power. The U.S. as the weaker superpower also happens to be technologically more sophisticated, which may potentially contribute to some extent to the modernization programs on China's domestic front.[54] Furthermore, a negotiated settlement on the question of Taiwan cannot be effected without American acquiesence. Lastly, there is no reason why China's experience of the Soviet Union as the number one hegemone should not be taken seriously.[55] This explains why despite all the apparent benefits flexibility may bring, a Sino-Soviet accomodation lacks overwhelming appeal.

However, the potential benefits of a Sino-Soviet rapprochement both to China and to the Soviet Union has not been overlooked by American analysts who argue for a strengthening of Sino-American relations through indirect aid to China such as selective sales of defensive military hardware and intelligence gathering devices.[56] Based on the observation that U.S. policy towards China does have some effects on China's internal politics, the idea is to set in motion the evolution of long term expectations and behavior patterns (basically friendly to the U.S.) which will in time be difficult to reverse.[57]

While Soviet-American detente by no means implies military cooperation, such is not ruled out in the case of Sino-American rapprochement. The U.S. Department of State at one time explicitly stated that the U.S. would not stand idly by should the Soviet Union attack China.[58] It is therefore a realistic assessment that Sino-American rapprochement may amount to a limited, albeit implicit, military entente vis-a-vis the Soviet Union.

Under the conditions of bilateral detente between the U.S. and the Soviet Union, and between the U.S. and China, a remilitarized Japan is expected to enjoy greater flexibility than it does today.[59] Yet, being primarily a trading nation with limited natural resources, the immediate Japanese foreign policy objectives are expected to be as follows:

1. Maintenance of general international stability.
2. A close defense relationship with the U.S.
3. Avoidance of conflict with the Soviet Union or China.
4. Secure sea routes, stable sources of raw materials, and markets.
5. Highly integrated economic relations with Southeast Asia, Taiwan and South Korea.

Although the Soviet Union is likely to remain the most disliked nation by the Japanese people, its might and immediate presence will continue to be a major consideration in Japan's security policy.[60]

Given its limited geographical expression, Japan is expected to pursue a balancer's role in Northeast Asian politics without siding decisively with the Soviet Union or China. In practice, this may mean implicit support for China on most issues. Continued Sino-American detente may also act as a reinforcing factor. As with the case of general detente, American pursuit of detente with Japan's communist neighbors means a de facto weakening of American security guarantees. This is particularly true of the nuclear umbrella as China will most likely have deployed a good number of tested full range ICBMs within our time frame.[61]

For the lesser powers whose survival depends on big power guarantees, detente brings mixed blessings. Ultimately, the aspirations of the lesser powers are less likely to be fulfilled under big power detente. The same reasoning which argues for an independent deterrent for South Korea or Taiwan, for example, applies in Scenario II as in Scenario I. In fact, the process of horizontal proliferation of nuclear weapons has already started as early as a decade back, and, regardless of what the mutation of international politics may be, the process will not be easily reversed.[62]

Under the scenario of limited bilateral detente, the likelihood of hostilities between the East and the West are assumed to be low. The basic alliance structures evolved from the 1950s are largely intact. Japan will stay in alliance with the U.S. Both South Korea and Taiwan will look to the U.S. and Japan for assistance, although their faith in their backers may have been weakened. The most likely sources of direct conflict will come as a result of troubles between the Soviet Union and China, between North Korea and South Korea, and between Taiwan and the mainland. The issue of the Northern Territories may also affect the position taken by Japan. This will depend on the rise of Japanese nationalism, and to what extent it is a function of alienation from the U.S. The Korean situation remains potentially explosive. However, as long as the Soviet Union and China do not have a working relationship, and conflict in the Korean peninsula will likely to be limited.[63] Also, a strategic exchange between Taiwan and the mainland is considered extremely unlikely.[64] It is possible that Taiwan may, when confronted by an invasion force, use nuclear weapons against concentrated military targets. But the probability of this occurring under this scenario is very low. In sum, limited bilateral detente has many similarities with general detente. Regional conflicts are even less likely with the major exception of a Sino-Soviet war.

Scenario III: The New Cold War

The scenario of a new cold war is constructed on the basis of renewed confrontation between the U.S. and the Soviet Union. This state of affairs can come about in two ways. First, the U.S. amy decide that its pursuit of detente since Camp David with the Soviet Union has been largely a policy of wishful thinking and self-deception. The Soviet Union can be seen as having taken advantage of the situation in the meantime, contributing to the continued deterioration of the American position all over the world. In order to reverse this trend, America would have to get tough. Secondly, the

Soviet Union may find that the U.S. has become weak, and lacks both the will and the resolve to stand up against encroachments. Detente with the U.S. would no longer be necessary and indeed would become a nuisance. This Soviet perception might become all the more possible when changes within China make it possible for a Sino-Soviet rapprochement to come about. After fifteen years of seething prejudices and scathing polemics, it is difficult for an observer to believe nowadays that a Sino-Soviet rapprochement is possible, let alone likely. Such a turnabout appears to call for too many sacrifices from the forces which have thrived on a persistent Sino-Soviet confrontation.[65] This would be as unthinkable (but nevertheless possible) as the Sino-Soviet split some two decades ago.

This scenario makes one of the following sets of assumptions:

A. (1) Deterioration of Soviet American relations over SALT, MBFR, spheres of influence, human rights, and other issues.

(2) Close alignment of China with the U.S., Western Europe and Japan. Western military aid to China.

(3) Persistence of Sino-Soviet conflict; border incidents.

(4) Soviet refusal to negotiate with Japan on the Northern Territories. Military fortification on the islands.

B. (1) Deterioration of Soviet-American relations over SALT, MBFR, spheres of influence, human rights, and other issues.

(2) Deterioration of U.S.-China relations, and Sino-Japanese relations over the issue of Taiwanese independence.

(3) Dramatic improvement in Sino-Soviet relations.

(4) Increased military involvement of Japan on the Korean peninsula.

(5) Trilateralism as a new form of imperialism; increasing polarization of the international economy; the Soviet Union and China siding with the third world.

The closer one looks at the problem of Sino-Soviet relations, the less likely one finds the second set of assumptions a probable prospect. The Russians are convinced of Chinese ingratitude and irrationality.[66] Massive Soviet aid to put China back on her feet at a time the Soviet Union needed every bit of the resources itself had been dismissed by China in retrospect as neo-colonial plundering of the Chinese economy. Vicious attacks had been and are still being launched against the Soviet Union, resulting in great setbacks in the world socialist movement. China's claim that Mao Zedong thought is an original contribution to Marxism-Leninism can only be perceived by the Soviet Union as shameless and heretical. For the Soviet Union, China is an instance of petty-bourgeois fanaticism and narrow-minded nationalism displacing dialetical materialism and proletarian internationalism. All facts point to unprincipled Chinese behavior, allying with world reactionary forces to oppose the Soviet Union and hence opposing the world socialist revolution. Although a distinction is still being made between the reactionary CPC leadership and the Chinese people, China as a whole is experienced as the epitomy of xenophobism under the hypnotism of great Han chauvinism and the most likely cause of the next world war. The only saving grace is that China, thank Marx, is still weak.

Chinese disillusionment with Soviet revisionism and social imperialism has been no less a traumatic experience. Soviet aid to

China did not come free and could hardly be called selfless. The fact that China had to pay back for every bullet fired during the Korean War for the next fifteen years is unlikely to be remembered as one of the most fraternal experiences. Soviet trade with China had been a blatant version of neo-colonialism, taking advantage of China's lack of alternatives to dump low quality goods at higher than world market prices.[67] Khrushchev's attitude towards the Chinese leaders had been at best condescending.[68] Worse still, the Soviet Union has betrayed its socialist brothers and revived its Czarist ambitions. China had been first dominated, and later betrayed to the U.S. imperialists behind its back.[69] Indeed, attempt to encircle China by courting India and supporting the regional hegemone Vietnam will be remembered as part of the unrelenting efforts to bring China to its knees.

An accomodating U.S. certainly had not helped the two sides to mend their fences. Afterall, it is always in America's interest to be the only one talking to both sides. Yet, continued Soviet successes in the third world have forced the U.S. to talk more to the Chinese (or at least to pretend talking more to the Chinese). The idea, however, is not to alienate the Soviet Union, but to bring it back to the fold of detente. This flirtation with the second love is based on the observation that the odds against a Sino-Soviet rapprochement are sufficiently formidable without reference to historical and geopolitical reasons. The ungrateful, irrational, petty-borugeois fanatical and xenophobic Chinese appear locked into permanent hostility with the selfish, hegemonic, imperialistic Russians. But an image powerful and persuasive as such must not be accepted as part of the perpetual mythology. One needs no reminder that only thirty years ago, France was at war with Germany, and twenty years ago, Russia and China were unshakable allies. But a willingness to accept the myth of permanent Sino-Soviet hostility makes good political sense at home in the U.S.[70] Nothing could be more telling on communist proletarian internationalism than the Sino-Soviet dispute.[71] Furthermore, it allows the U.S. to enjoy more leverage over the Soviet Union, the U.S. feels that it could therefore delay a decision on Taiwan to make peace with its strong parochial interests and avoid the potentially prohibitive domestic political costs. It is also comforting to learn that even the Chinese agree how dangerous and untrustworthy the Russians are, particularly on Soviet expansionist designs.

But to see China and the Soviet Union in conflict as a result of which both are losing flexibility vis-a-vis the U.S. is also to see powerful reasons for Sino-Soviet detente or rapprochement. It would be foolhardy to overlook the fact that not so long ago, Sino-Soviet relations had been a very divisive issue in Soviet politics.[72] It is still an extremely controversial issue among the leadership of the CPC today. Both sides have advanced initiatives at various times. In the recent years, the return of two Soviet pilots with unprecedented official apology underscores the potential for change.[73] The Soviet Union also took up a conspicuously conciliatory posture towards China immediately after Mao's death. Foreign Minister Huang Hua's visit to the Soviet delegation in Beijing to celebrate the sixtieth anniversary of the Bolshevik Revolution was another indicator of what might be possible. Brezhnev's Tashkent speech in the spring of 1982 is another recent case in point. These facts suggest that although anti-Soviet and anti-Chinese forces may still be strong in the respective countries, there are also powerful forces yearning for a more rational approach to Sino-Soviet politics.

However unlikely it may seem, the Soviet Union and China are quite capable of reaching a procedural understanding towards resolving their long standing dispute. The 1975 agreement on navigation rights along the Ussuri River is one good example.[74] Whether the Sino-Soviet dispute is a lasting feature in international politics depends at least in part on U.S. policy towards the two powers.

The logic of a new trilateralism with a more solid moral basis to favor friends over enemies and to encourage peaceful transitions of third world dictatorship into liberal democracies had triumphed briefly during the Carter administration over the Kissingerian scheme of Machiavellian politics. The rationale of this policy has the same root as the anti-Communist stand of the 1950s, and the 1960s, and of the Reagan administration's cold war politics today. But to call China and the Soviet Union to understand the facts of life in the democratic process of foreign-policy decision-making in the U.S. simultaneously serves to erode the need for sensitivity on the internal political dynamics of these countries. For a Chinese leadership seeking accomodation with the U.S., it must deliver among other things on a solution to Taiwan. No group in China can afford anything less. Neither can a Soviet administration maintain detente when confronted by assertive U.S. policies which seek to strengthen the anti-communist alliance on the one hand, and labor to undermine the legitimacy of the

Soviet domination of Eastern Europe on the other. With each and every success in American foreign policy, the closer will the Soviet Union and China move towards each other. But the moral basis for the cold war is beyond reproach and principles must somehow be upheld. There are ample reasons to believe that just as communist expansionism is again experienced for what it is supposed to be, American imperialism will also be placed in its proper perspective in the Soviet Union and China.

As the cold war atmosphere resumes, there is every reason for the U.S. and Japan to strengthen their ties to South Korea and Taiwan. While the U.S. may well remain the dominant partner in any such alliance, the emergent regional power Japan will seek to enlarge its share of friendship through expanded joint exploration of offshore natural resources, and perhaps even licensed production of Japanese designed weapons, warship, missiles, and so on. Japanese cooperation with South Korean and Taiwanese nuclear scientists on the peaceful use of nuclear energy cannot be excluded in due course. Such developments will not be conducive to a solution to the question of Korean or Chinese unification.

Although the approaches are very different, both Reagan and Carter call for closer cooperation among the industrial democracies of the West and the East (i.e. Japan and Australia). It is no coincidence that they are also export-oriented trading nations. Traditionally, many of them had colonial holdings. They are collectively viewed as imperialist powers by the newly independent third world nations. Through aid and trade, networks of "interdependence" have evolved to create as well as to perpetuate a system of structural dependence of the third world on the industrially advanced.[75] The international economy has become increasingly unstable as energy and other cartels compete for advantage. Resource poor and industrially backward countries have become increasingly indebted to the centers of capital, energy, and manufacturing, sometimes even of food. Waves and waves of default may well lead to the formation of a class of desperate nations. This structural weakness of the international capitalist system can be exploited by those who want a new world order. For ideological and political reasons, the Soviet Union and China may side with the "desperadoes" in the wake of the new cold war.[76]

The evolution of new satellite systems in Northeast Asia may mean the emergence of Japan as the regional metropolis, with South Korea, Taiwan and Southeast Asia as its hinterland. This is possible as a result of American withdrawal from Asia and the general decline in American power. A more assertive and nationalistic Japan may view these satellites as within its rightful sphere of influence. There may well be an increasing reluctance to accede to the reversion of Taiwan to the mainland, or to South Korean appeasement to the north.

The tightening of alliance systems in the new cold war does not necessarily mean the foregoing of the nuclear option by the lesser powers. As it has been discussed with some detail earlier, the process of horizontal proliferation had started as early as a decade ago, and that the trend appears to be irreversible today. But in a state of confrontation politics, there is less room for ambiguity in alliances. Security guarantees are therefore more reliable. Also, the increased dependence of lesser powers on their bigger allies in the cold war makies it easier for the superpowers to restrain the process of nuclear proliferation. Nevertheless, it is argued here that by now the technology of reprocessing nuclear fuel is known to all in Northeast Asia perhaps with the exception of North Korea. It is most probably that by 1990, all of the powers concerned will have acquired the ability to produce the bomb.

Two probable alliance systems may come about as a consequence of the two sets of assumptions made earlier. The new cold war may feature a close alignment between China and the West, or alternatively, it may feature a Sino-Soviet rapprochement. The strategic implications of the two are very different. In fact, the impact of the swing of China from one camp to the other would make a tremendous change in the requirements for deterrence for Japan, the Soviet Union, and the U.S. This is particularly the case when alliances are reinforced by mutual defense agreements.

The effect on the small powers is less dramatic. First, their objective of deterring for survival is relatively limited by virtual of the principle of proportionality. Secondly, security guarantees are more reliable as well as stronger under cold war conditions. Thirdly, the existence of South Korea and Taiwan came at a time of direct Communist-non-Communist confrontation. Their identity and indeed their regime legitimacy was built on this very basis. It is therefore only natural that they thrive under such conditions. Similarly, North Korean aspirations are better served by the cold war. But a continued Sino-Soviet split may thwart any attempt at Korean unification by the use of force. Since none of the three small powers are under the direct control of foreign powers as Japan once was or Laos and Afghanistan are today, the likelihood that they will pursue, persistently and perhaps surreptitiously, independent nuclear capabilities remains very high.

Scenario IV: General Cold War

In this scenario, superpower control over the lesser powers have declined considerably, resulting in the proliferation of power centers. At the same time, the process of rationalization and polarization of national interests and ideologies have set in, resulting in increased international confrontations. The scenario features the rise of the ideological factor in international realtions, making it difficult if not impossible for governments to wheel and deal and still retain the trust of or a consensus among the various power groups on the domestic front. The emergence of the ideological factor may have been a function of a deteriorating international economic order (rise in economic nationalism) in which the traditional rules and agreements have ceased to operate. The state of the world is analogous to the Hobbesian state of nature. Only the small powers need to have some form of alliance relationship with one or two of the major powers. Several factors will be assumed in the scenario:

(1) International economic disorder as a consequence of world recession. Protectionism practiced by all major powers.

(2) Resurgence of ultra-nationalism in Japan. Rapid re-militarization. Aggressive posture to seek economic domination in the region and to protect its life lines.

(3) De facto independence of Taiwan strongly supported by Japan and/or the U.S.

(4) Increased tension along the 38th parallel. Massive military buildup on both sides.

(5) Increased Japanese military presence in Hokkaido. Japanese naval patrol around the Northern Territories. Japanese preparedness to seek reversion of the islands to Japan.

(6) Transformation of the theory of the three worlds into anti-hegemonism within China. Abandonment of the second world in its united front policy.

While there are good reasons for detente to come about, the foundation of detente among the major powers has never been solid. It has been repeatedly argued within the U.S. that it takes more than military might and the will to use force to safeguard the freedom and democracy of the peoples in the west. Strong socialist and communist showings in the elections in Western Europe and their prospective sharing of power at the center are indicative of the pending crisis of capitalism. A way has yet to be found to rescue liberal democracy from the brink of moral bankruptcy. This problem is compounded by the lack of an alternative ideology to ward off the intellectual offensive from the left.[77] The paradox of an economically prosperous and militarily capable west succumbing to what are perceived to be the forces of totalitarianism is a most frustrating experience, particularly when all the facts in recent history point to the superiority of western democracies, moral or otherwise. The explanation lies in the unwary and naive politicians of the West, who persistently make unilateral concessions in the process of detente hoping that somehow, Moscow could be induced by American generosity and goodwill to reciprocate in mutually beneficial ways. An asymmetry in the perceptions and objectives of detente, as this explanation argues, is a danger in itself. This willingness to deal squarely with the Soviet Union reflects either an inability on the part of the U.S. to see the Soviet Union for what is, or worse still, an implied acceptance of the legitimacy of totalitarian politics.[78] In the final analysis, detente cannot last if it means Soviet gains and American retreat. Furthermore, there can be no moral justification for that is tentamount to ideological surrender.

It is one thing for the Soviet Union to justify detente as a peaceful means to struggle against U.S. imperialism, and quite another to advocate self-restraint on the development of its military might. The latter means voluntarily foregoing viable options in a savagely competitive world. The Soviet view holds that while detente has found its concrete expression in the "liquidation of military conflicts" and in the reversion of the cold war into limited cooperation between the Soviet Union and the U.S., these have been possible only because of the growth of the economic and military might of the Soviet Union and its fraternal countries.[79] Forces obstructing the processs of detente are strong. American military circles propose negotiations from a position of strength to justify arms buildups. Constant provocations in various high tension areas of the world have been instigated under the pretext of preserving peace and stability. New theories and doctrines of limited war have been drummend up to meet the supposedly growing danger from the defensive minded, peace-loving Soviet people. Hardly a single opportunity has been wasted by the American militarists using arms control negotiations to their advantage.

There can be no question from the Soviet Union's point of view that it has always been the champion of world peace and the initiator of disarmament negotiations, and that the U.S. always looks for military adventures and intrigues and has been forced to participate in arms control negotiations only because of Soviet strength. Exactly how negotiations of this sort can produce agreements of consequence is always a complex question. Leaders identified with detente must continually extract concessions from the West in order to demonstrate the validity of the process. Yet for reasons beyond the control of the Soviet Union, such concessions may become increasingly difficult to obtain without appropriate reciprocations. These reciprocations will necessarily be difficult to justify under the existing moral basis of peaceful coexistence.[80]

Peaceful coexistence, a virtual Soviet synonym for detente in practice, was experienced by China in the late Fifties and early Sixties as capitulationism and betrayal. It meant the bartering away of fraternal interests and the docile acceptance of humiliating imperialist demands.[81] Although a necessary condition, peaceful coexistence according to China should never be allowed to precede or to pre-empt proletarian internationalism.[82] Soviet-American detente marked the beginning of superpower collusion and the subsequent emergence of social imperialism. This new development called for a new strategy of international relations based on the theory of the three worlds.[83] The task today is to forge a broad, united front between the second and the third worlds (Europe, Japan, and the developing nations) to oppose war and to wage relentless struggle against the superpowers.[84]

If China were to seek friendship with the U.S., it would be for reasons of national security and economic development. The U.S. will remain the only counter-weight against the Soviet giant in the north. American friendship also fits in well with the modernization drive. These reasons, however, are necessarily tactical and transitory. The legitimacy of the policy of friendship with the U.S. depends to a large extent on the goods it can deliver. America may be forced by unforeseen circumstances to choose between the Soviet Union and China, and opt for the former. It may not wish to foster a strong communist China. It may actively seek the evolution of independent liberal democracies in South Korea and Taiwan. The reasons against the development of full-fledged friendly relationship between the two are many and are lasting. Yet, Chinese disillusionment with Sino-American rapprochement is not by itself a sufficient cause for Sino-Soviet rapprochement.

Although it is quite conceivable for Sino-Soviet rapprochement to come about as a result of immediate nominal Soviet concessions on the border disputes and promises to assist China technologically and economically, such concessions and promises would not come by easily. More importantly, it would be virtually impossible to disavow the Brezhnev Doctrine specifically for China's sake. Apart from traditional acquisitive mentalities, for the Soviet Union to acknowledge that a territorial "problem" exists is tantamount to opening a pandora's box of similar difficulties with most of its neighboring states, notably in Eastern Europe and with Japan. The very unwillingness to make even a symbolic gesture could be taken to imply a lack of real Soviet interest in detente with China. In lieu of a fundamental change in Soviet attitude, it is extremely difficult for any Chinese leadership to make a good case for Sino-Soviet rapprochement.

The same logic which works against a Sino-Soviet dialogue on territorial disputes also works against a return of the Northern Territories to Japan by the Soviet Union. The case might be different if Japan opted for its own Findlandization, and cooperated closely with the Soviet Union on a collective security arrangement to contain China and to keep the U.S. away from Northeast Asia.[85] From all appearances, Japan is unlikely to repeat its unhappy experiences with the Soviet Union. A more probable scenario is an assertive and nationalistic Japan becoming increasingly independent of the U.S. A more independent Japan makes it easier for China to confront both superpowers at the same time. This expectation arises from two observations. First, if allowed to pursue a foreign policy according to its national interests, Japan may seek ties closer to China than today's. Secondly, both the Soviet Union and the U.S. do not wish to see a Sino-Japanese entente. But continued deterioration of economic relations with the U.S. could bring about a rising tide of nationalism in Japan with strong anti-American overtones, in which case even right-wing nationalists would acquiesce in closer ties with China for mutually beneficial cooperation.[86] But it is also possible to see a very strong Japan coming into conflict with China over Korea, Taiwan, Southeast Asia, the Tiaoyutai Islands, Okinawa, and the rights over fishing and subterranean resources. It is not impossible for Japan to risk another non-aggression pact with the Soviet Union if the stakes were high enough. Again, the likelihood of such taking place within our time frame is not very high.

In sum, there are reasons for a possible general cold war among the U.S., the Soviet Union, and China in Northeast Asia, with reduced cooperation and increased competition between the U.S. and Japan. Tension is likely to be hgih. The major powers may find it necessary to be able to deter more than one enemy at the same time. The lesser powers could find greater realiability on major power security guarantees. This advantage alone, however, is unlikely to obviate the need for an independent deterrent. In fact, nothing short of the direct transfer of nuclear weapons can be a meaningful substitute for an indigenous nuclear weapons program. First, nuclear weapons are believed to be the ultimate equalizer in international politics. Unless nuclear weapons can be rendered obsolete (e.g. by extremely effective BMD systems), they are likely to be regarded as the best deterrent for national survival. Secondly, they have important battlefield implications. They are excellent single-shot weapons against large scale concentration of forces. Thirdly, the program is indigenous, and the weapons are directly controlled by the country's leaders. There is no need to seek approval from any external authority for their deployment or employment. Lastly, the technology is available, and the economic cost not as high as it is made to appear. The fact that many countries must be restrained from going nuclear is precisely because the attractiveness of nuclear weapons far out-weighs the economic price.[87] National security as well as national prestige are believed to be greatly enhanced by the possession of nuclear arms. The return of the cold war, however reliable the security guarantees as a result, may retard, but probably would not reverse the process of horizontal nuclear proliferation in Northeast Asia.

The four scenarios represent discrete typological expressions along a spectrum of possible relationships. They range from the most harmonious possible (general detente) to the most hostile possible (general cold war). Their implications on deterrence requirements for the seven powers in the region and the corresponding force structures are also different. These implications will be explored in Chapters Five and Six.

CHAPTER THREE NOTES

1. George Quester, Nuclear Diplomacy: The First Twenty-Five Years (2nd ed.; New York: Dunellen, 1973); Wilfrd Kohl, French Nuclear Diplomacy (Princeton, NJ: Princeton University Press, 1971); John Herz, International Politics in the Atomic Age (New York: Columbia Press, 1959).

2. Henry A. Kissinger, Nuclear Weapons and Foreign Policy (New York: Harper & Bros., 1957); Morton H. Halperin, Limited War in the Nuclear Age (1st Princeton Paperback ed., 5th printing; Princeton: Princeton University Press, 1971).

3. Fuad Jabber, Israel and Nuclear Weapons: Present Options and Furute Strategies (London: Cahtto & Windus, 1971); David Gompart et. al., "The Diffusion of Power: I. Proliferation of Force," Adelphi Papers, No. 133 (London: IISS, Spring 1977); George H. Quester, "Taiwan and Nuclear Proliferation," Orbis, Vol. VIII, No. 1 (Spring 1974), 140-150.

4. P. K. Minn, "Calls for Own N-Arms in Seoul," Korean Times, 13 August 1977. Also a report by Ranan R. Lurie, "Tawian has Nuclear Capacity," Wisconsin State Journal, 27 October 1977, is highly suggestive of the governments' desire to acquire nuclear arms if it were not already in possession of them.

5. Young C. Kim, ed., Major Powers and Korea (Springfield, MD: Research Institute on Korean Affairs, 1973); John F. Copper, "Taiwan's Strategy and America's China Policy," Orbis, Vol. XXI, No. 2 (Summer 1977), pp. 261-276; Rhee Sung-Hon, "The Peace System in Northeast Asia and the Role of Korea," Korea Observer, Vol. VII, No. 1 (Winter 1976), pp. 80-97.

6. Paul Y. Hammond, The Cold War Years: American Foreign Policy Since 1945 (New York: Harcourt, Brace & World, 1969); pp. 5-31.

7. Yonosuke Nagai and Akira Iriye, eds., The Origins of the Cold War in Asia (Tokyo: Tokyo University Press, 1977), pp. 43-320.

8. For example, Yuan-li Wu, U.S. Policy and Strategic Interests in the Western Pacific (New York: Crane, Russak & Co., 1975), pp. 1-55.

9. Copper, "Taiwan's Strategy".

10. According to the testimony given by

11. Donald S. Zagoria, for one, believed that there are real ideological limits to the Sino-Soviet conflict. also, an open schism would not be to the advantage of either, such that a possibility existed for a search for a more equal and stable relationship.

"Introduction," The Sino-Soviet Conflict 1956-1961 (New York: Antheneum, 1969).

12. Chong-Sik Lee, "The Detente and Korea," Ch. 3, The World and the Great Power Triangles, ed. William E. Griffith (Cambridge, MA: MIT Press, 1975), pp. 321-396. Morton Abramowitz, "Moving the Glacier: The Two Korea and the Powers," Adelphi Papers, No. 80 (London: IISS, august 1971).

13. For example, Matasaka Kosaka, "Options for Japan's Foreign Policy," Adelphi Papers, No. 97 (London: IISS, Summer 1973), pp. 27ff; Ralph N. Clough, East Asia and U.S. Security (Washington, D.C.: Brookings Insitution, 1975), pp. 80ff.

14. For a brief account of the partition, see B. C. Koh, "Dilemmas of Korea Unification," Asian Survey, Vol. XI, No. 5 (May 1971), pp. 476ff.

15. Leslie H. Brown, "American Security Policy in Asia," Adelphi Papers, No. 132 (London: IISS, Spring 1977), pp. 19-21; Ralph N. Clough, Deterrence and Defense in Korea (Washington, D.C.: Brookings Institution, 1976), pp. 44-48; Donald H. Rumsfeld, Annual Defense Department Report FY1977, 27 January 1976, p. 9.

16. This may have taken place already when the UN General Assembly adopted a resolution co-sponsored by 43 countries calling for the dissolution of the "United Nations command" and the withdrawal of "all foreign troops stationed in South Korea under the flag of the United Nations." UN Resoltution 3390 B (XXX), 18 November 1975.

17. For example, Charles McLane, "Korea in Russia's East Asian Policy," Major Powers and Korea, pp. 3-14; "The Detente and Korea," pp. 344-349.

18. Chun-tu Hsueh, "Korea in China's Foreign Policy," Dimension of China's Foreign Policy (New York: Praeger, 1977), pp. 126-155; Young C. Kim, "Japanese Policy Towards Korea," Major Powers and Korea, pp. 53-84.

19. The two islands which are part of the southern Kuriles are Etorofu and Kunashiri. Under the San Francisco Treaty, Japan had renounced all right to Sakhalin and its adjacent islands acquired as a result of the Treaty of Portsmouth. Although the Soviet Union was not named as the country to whom these islands had to be renounced, it would still have a formal claim to the Northern Territories had it signed the treaty. The current stand of the Japanese government is that the islands should be returned to Japan before a peace treaty between the two countries can be negotiated. See Bhabani Sen Gupta, Soviet-Asian Relations in the 1970s and Beyond: An Interperceptional Study (New York: Praeger, 1976), pp. 276-280.

20. Ibid., Ch. 7, "Japan: Where Perceptions Diverge," pp. 273-337.

21. It is conceivable that at some point, the Hayatoma formula of concluding a peace treaty with the Soviet Union first for the return of Habomai and Shikotan, and then negotiate for the reversion of Etorofu and Kunashiri could be revived as a solution to the impasse, even though the present policy of demanding a peace package reversion for all four islands remains officially unshakable. See Sonada interview in Tokyo Shimbun (DSJP), 5 January 1978, p. 2.

22. The Seventh Fleet started patrolling the Taiwan Strait on 28 June 1950 under orders of President Truman, and openly committed the U.S. to the continued existence of the Nationalists.

23. For example, Copper, "Taiwan's strategy."

24. China has neither a large submarine contingent, nor a large paratrooper force to sustain a military takeover operation. Air superiority over the Taiwan Strait is by no means certain, and the navy is not equipped for amphibious landings on a large scale. The Military Balance: 1977-78 (London: IISS, 1977), pp. 52-58.

25. Groups across the entire political spectrum have been in existence for a number of years, and have become very active lately. The Taiwanese Independence Movement enjoys by far the largest share of overseas support, and particularly from sympathetic foreign sources. Liberal forces on the island have grown rapidly since 1972, enjoying some support from within the KMT itself as well as encouragements from abroad.

26. A good summary description is given by Copper, "Taiwan's Strategy," p. 266.

27. Richard Nixon, U.S. Foreign Policy for the 1970s: A New Strategy for Peace, A Report to the Congress by the President of the U.S. , 18 February 1970; Henry A. Kissinger, Statement before the Senate Foreign Relations Committee, 19 September 1974, see note 10; I. D. Ovsyany et. al., A Study of Soviet Foreign Policy, trans. David Skvirsky (Moscow: Progress Publishers, 1975); V. Komlev, "Along the Path of Detente," Pravda, 29 October 1973, excerpts by Strategic Review (Winter 1974), pp. 112-113.

28. For example, Chen Chu, "What do Moscow-Vaunted 'Detente' and 'Disarmament' add up to?" Excerpts from a speech at the First Committee of the UN General Assembly, Peking Review, Vol. 20, No. 50 (9 December 1977), pp. 22-24.

29. Richard H. Ullman, "Trilateralism: 'Partnership' for What?" Foreign Affairs, Vol. 55, No. 1 (October 1976), pp. 1-19.

30. One incident which exemplifies the willingness to accommodate "legitimate interests" is the drafting of the "Sonnefeldt Papers."

31. China has repeatedly called for the withdrawal of Soviet troops from the Sino-Soviet border, and the reduction of their strength down to pre-1960 levels before it could negotiate with the Soviet Union. See, for example, Kenneth Lieberthal, Sino-Soviet Conflict in the 1970s: The Evolution and Implication for the Strategic Triangle, Rand Report R-2342-NA (Santa Monica, CA: Rand, 1978). In fact, China has been prepared to accept the de facto boundary on the condition that the Soviet Union accede to the hisotrically "unequal" nature of the 12 treaties by which Tsarist Russia acquired the vast territories in the far east.

32. The one fear China has is no longer an American sponsored invasion from the KMT forces, but rather the internal political struggles during which one faction may invite Soviet intervention.

33. Private communications with Professor Edward Friedman.

34. This is a technique to tackle the major contradiction first by bypassing the difficult issue between China and a potential member of the united front. China shelved the Tiaoyutai (Senkaku) issue with Japan in concluding the Sino-Japanese Peace Treaty (to upstage Moscow), and agreed with the U.S. to disagree on Taiwan. The major contradiction here is Soviet hegemonism.

35. Leslie Brown, "American Security Policy in Asia," op. cit., PP. 28-30; Edward Friedman, "China-America Normalization: What Do We Win? What Do We Lose? Abnormal Normalization versus Genuine Normalization," unpublished manuscript, May 1977; Roger Glenn Brown, "Chinese Politics and American Policy," Foreign Policy, No. 23 (Summer 1976), pp. 3-23; Richard Solomon, "Thinking Through the China Problem," Foreign Affairs, Vol. 56, No. 2 (January 1978), pp. 324-356.

36. During the Carter adminsitration, mass media coverage has focused on the dark side of Chinese society, and played on Taiwan's movement towards greater freedom to induce a judgment as to the desirability of retarding the process of strengthening relations with Beijing. Susan Shirk, "Human Rights: What About China," Foreign Policy, No. 29 (Winter 1977-78), p. 125; Barry Goldwater, "Abrogating Treaties," NYT, 11 October 1977; George W. Ball, "Against "Cravenly Yielding' to Peking," NYT, 24 August 1977; various articles by Fox Butterfield such as "China Nationalists to Give High Post to Taiwan Native," NYT, 16 February 1978.

37. Harrison E. Salisbury, "China 'Quite Unhappy' with Carter over Taiwan, a Top Leader Says," NYT, 30 August 1977; "Teng Says Vance Upset U.S. Relations," Wisconsin State Journal, 7 September 1977; Fox Butterfield, "Vance-Teng Meeting Seems to Bring Ties No Closer," NYT,

25 August 1977. Three years after normalization has taken place, the issue of (arms sales to) Taiwan not only has not faded away, instead, it has become the top issue and the potential reason for the retrogression in Sino-U.S. relations.

38. Roger Brown, "Chinese Politics and American Policy," p. 20.

39. "Foreign Minister Sonoda Talks with Soviet Ambassador; Seeks Understanding about 'Opposition to Hegemony'; Stress Concept of Constitution; To Handle Japan-China Treaty from Japan's Own Position; Foreign Minsiter Expresses Hope to See General Secretary Brezhnev in His Visit to USSR; Ambassador Replies, 'He Has Cold.'" Mainichi (DSJP), Eve., 26 December 1977; "Gist of Japan-China Problem Discussion at Joint Meeting of LDP Organs," Ashahi (DSJP), 28 December 1977; "Government Thinks Sino-Soviet Treaty Will Pose No Obstacle to Conclusion of Japan-China Treaty; Confirms It 'Has Name But Not Substance'; Will Deal with It at 'End' of Negotiations," Nihon Keizai (DSJP), 26 December 1977; also refer to note 21.

40. Japan has been energetically seeking ways to diversify its trade to avoid over-reliance on any country for market and resources. Andrew H. Malcolm, "Japan and China Sign 8-Year Pact for $20 Billion Industrial Deal," NYT, 17 February 1978.

41. The existing consensus among Japanese defense analysts is that Japan should, first and foremost, strengthen its special relationship with the U.S., and work towards a lowering of tension between the Soviet Union and China. There is, however, a strong undertone that if all else should fail, Japan ought to be in a position to look out for its own security interests--i.e. retain the option of a defensive nuclear capability.

42. Wu, Western Pacific, op. cit., pp. 50-51.

43. Popular attitude in Japan has been strongly against the revival of militarism, which, as a corollary has also affected efforts towards remilitarization. One example is the Fourth Defense Buildup Plan engineered by Nakasone (1970 Defense White Paper) designed to move Japan from the 11th ranked military power to the 7th, just behind China, in terms of military spending and manpower. The Plan touched off a coalition of opposition forces which paralysed the Diet for seventeen days. The difficulties Japan has been facing with Europe and the U.S. (over trade) could strengthen the hands of the Government towards the purchase of more and better American military equipment as one way to solve the imbalanced trade problem. John K. Emmerson and Leonard A Humphreys, Will Japan Rearm? A Study in Attitudes (Washington, D.C.: AEIPPR, 1973).

44. Numerous studies, research reports and news stories have appeared, charging the administration and its predecessors with deliberate understatements of Soviet military strength, or "discovering" that the Soviet intentions are not really "defensive," but "expansionist." For example, Bernard Weintraub, "Report on U.S. Arms Stirring Heated Debate," NYT, 2 September 1977; Drew Middleton, "C.I.A. Says Soviet Steps Up Arms Aid to Third World," NYT, 17 January 1978; " B. Weintraub, "U.S. Is Reassessing Its Strategy for Meeting Soviet Nuclear Strike," NYT, 15 May 1977; David Binder, "Military edge on U.S. may be Soviet's Goal," Wisconsin State Journal (NYT News Service), 26 December 1976.

45. It is still too early to speculate on the future of Taiwan in terms of how an "independent Taiwan" would look like. for all we know, it could even be a "socialist Taiwan," depending on which faction within the Taiwan Independence Movement should become dominant.

46. Marshall D. Shulman, "Soviet-Amercian Relations and World-Order: The Two and the Many," Adepli Papers, No. 66 (March 1970).

47. Marshall D. Shulman, "SALT and the Soviet Union," in SALT: The Moscow Agreements and Beyond, ed. Mason Willrich and John B. Rhinelander (New York: The Free Press, 1974), pp. 101-121.

48. William E. Griffith, Peking, Moscow and Beyond, The Wshington Papers, No. 6 (Washington, D.C.: Center for strategic and International Studies, 1973), pp. 1-17.

49. J. D. B. Miller, "Unlimited Competition of Spheres of Responsibility," Shulman et al., pp. 32-41.

50. Helmut Sonnefeldt, "Russia, America, and Detente," Foreign Affairs, Vol. 56, No. 2 (January 1978), pp. 275-294.

51. Ovsyany et al., p. 168.

52. Wu, Western Pacific, op. cit., pp. 19-55.

53. Ibid., xv.; Solomon, "Thinking Through," pp. 333-337.

54. The four modernizations are: industry, agriculture, science, and technology and defense. U.S. influence over Japan and the EEC is formidable; such meaningful sales are usually cleared by consultation.

55. See note 33. Also, Jen Ku-ping, "The Munich Tragedy and Contemporary Appeasement," Peking Review, Vol. 20, No. 50 (9 December 1977), pp. 6-11.

56. Michael Pillsbury, "U.S. Military Ties?" Foreign Policy, No. 20 (Fall 1975), pp. 50-64; Roger Brown, "Chinese Politics and American Policy," op. cit.

57. Walter C. Clemens, Jr., "The Impact of Detente on Chinese and Soviet Communism," Journal of International Affairs, Vol. 28, No. 2 (1974), pp. 133-157. Also, see note 56.

58. See, for example, "U.S. would treat Soviet China assaults seriously," Wisconsin State Journal, 20 October 1976.

59. Kuino Muraoka, "Japanese Security and the U.S.," Adelphi Papers, No. 95 (London: IISS, February 1973), pp. 10ff.

60. This depends in some ways on the rise of Japanese nationalism, which could rise with the growth of Japanese economic and military might and its perception of an increasingly hostile Western world (over trade, for example).

61. The series of tests of the ICBM Long March III began 18 May 1980. Far Eastern Economic Review, Vol. 108, No. 21, (16-22 May 1980), pp. 24-26.

62. Albert Wohlstetter et al., Swords from Plowshares: The Military Potential of Civilian Nuclear Energy (Chicago: University of Chicago Press, 1979); Ernest W. Lefever, Nuclear Arms in the Third World: U.S. Policy Dilemma (Washington, D.C.: Brookings Institution, 1979). The only likely restraint of horizontal nuclear proliferation would probably come from the revolutionary development of effective, non-nuclear, ABM capabilities. This is unlikely to come about within this decade.

63. Clough, Deterrence and Defense in Korea, op. cit.; William J. Brands, ed., The Two Koreas in East-Asian Affairs (New York: New York University Press, 1976); Ilpyong J. Kim, "North Korea between Moscow and Peking," Ch. 6, Communist Politics in North Korea (New York: Praeger, 1975), pp. 93-115; Roger Brown, "American Security Policy in Asia," op. cit., pp. 30-32; Franklin B. Weinstein, "The United states, Japan and the Security of Korea," International Security, Vol. 2, No. 2 (Fall 1977), pp. 68-95; William V. Kennedy, "Korea: The Problem of Superpower Withdrawal," Ch. 11, Foreign Policy and the U.S. National Security: Major Post-Election Issues (New York: Praeger, 1976), pp. 154-165.

64. George H. Quester took the exceptional view and speculated on the possible use of nuclear weapons by Taiwan. See Quester, "Taiwan and Nuclear Proliferation," op. cit.; The official view of the KMT is that it will not produce nuclear weapons because such a program is too prohibitive in terms of costs, and must face American pressures, thus rendering the effort not worthwhile.

Besides, nuclear weapons will not distinguish the good people from the communists; refer to "Taiwan has nulcear Capacity," supra., note 4.

65. Friedman, "China-America Normalization," op. cit.

66. O. B. Borisov and B. T. Koloskov, Sino-Soviet Relations, 1945-1973, trans. Yuri Shirokov (Moscow: Progress Publishers, 1975); M.I. Sladovsky et al., Present-Day China: Socio-Economic Problems, trans. Galina Sdobnikova (Moscow: Progress Publishers, 1974); M. Altaisky and V. Georgiyev, The Philosophical Views of Mao Tse-tung: A Critical Analysis, trans. Brian Bean (Moscow: Progress Publishers, 1971).

67. Zhong su lun zhan wen xian (Hong Kong: Wen hua zi liao gong ying she, 1977). This is a collection of exchanges between the CPC and the CPSU beginning 14 June 1963).

68. Strobe Talbott, ed., Khrushchev Remembers, Vol. I (New York: Bantam Books, 1971), pp. 511-530; Khrushchev Remembers, Vol. II (New York, Bantam Books, 1976), pp. 268-332. Although the authenticity of the "autobiographies" is suspect, they are generally considered to represent the spirit of Khrushchev's attitude towards Mao and the Chinese.

69. Soviet-American detente in the early 1960s was Munich again for China. It is impossible not to notice the same fear today, only that sincere advises are now being given to the U.S. See note 55. Also, Donald S. Zagoria, The Sino-Soviet Dispute: 1956-61 (New York: Atheneun, 1969).

70. Friedman, "China-America Normalization," op. cit.

71. Cuba, for example, is adamantly furious about China's betrayal of internationalism, and claims that China's foreign policy is reactionary. "From the Cutting Room Floor: The Complete Text of Barbara Walter's Interview with Fidel," Seven Days, Vol. 1, No. 2 (December 1977), pp. 10-38.

72. Michel Tatu, Power in the Kremlin: From Khrushchev to Kosygin, trans. Helen Katel (New York: The Viking Press, 1970), pp. 364-369. There is also a speculation that this is also a divisive issue between the CPC. V. Zorza, "Reading between the lines in People's Daily: A Peking faction that wants peace with Moscow?" The Christian Science Monitor, 9 October 1975.

73. The Soviet helicopter, reported to be an MI-4 type intruded deep into Xinjiang (Sinkiang) in March 1974, and was announced by the Soviet Union on March 15. the crew members were released on 27 December 1975, with an unprecedented apology from Peking.

74. China and the Soviet Union began talks on navigation problems on the Ussuri frontier on 10 August 1975. An agreement was reached on 7 October the same year. China signed a big increase in trade in the annual trade agreement with the Soviet Union on 16 April 1982. NYT, 17 April 1982.

75. Geoffrey Kay, Development and Underdevelopment: A Marxist Analysis (London: Macmillan, 1975); James D. cockroft et al., Dependence and Underdevelopment (New York: Doubleday, 1972); Cheryl Payer, "Third World Debt Problems," Monthly Review, Vol. 28, No. 4 (September 1976), pp. 1-18.

76. Sh. P. Sanakoyev and N. I. Kapchenko, Socialism: foreign Policy in Theory and Practice (Moscow: Progress Publishers, 1976); "Zhong Hua Renmin Gonghegio dai biao tuan tuan zhang Deng Xiaoping zai Luanda te bie hui yi shang di fa yan," (The People's Republic of China's delegation chairman Deng Xiaoping's speech in a special meeting of the United Nations (General Assembly)) 10 April 1974, reported in Hongqi, No. 431 (May 1974), pp. 45-52.

77. Henry A. Kissinger, "On the Record," NBC Special, interviewed by David Brinkley, 8 pm., 13 January 1978. Willy Brandt was also given a brief moment to support this view.

78. Richard Pipes, "Detente and Reciprocity," Detente, op. cit., pp. 174-197.

79. Col. A. Mogilatyev, "International Detente and the Intrigues of the Militarists," Red Star, 11 July 1975, excerpts and trans. by Strategic Review (Winter 1976), pp. 117-120.

80. Ovsyany et al., op. cit.; S. Vladimirov and L. Teplov, NATO: A Black Picture (Moscow: Progress Publishers, 1977).

81. John Gittings, The World and China, 1922-1972 (New York: Harper & Row, 1974), pp. 217-220; A Proposal Concerning the General Line of the International communist Movement: The Letter of the Central Committee of the Communist Party of China in Reply to the Letter of the Central Committee of the Communist Party of the Soviet Union of March 30, 1963 (Peking: Foreign Language Press, 1963).

82. Editorial departments of Remin ribao (People's Daily) and Hongqi (Red Flag), "Peaceful Co-existence--Two Diametrically Opposed Policies: Comment on the Open Letter of the Central Committee of the CPSU (VI)," 12 December 1963 (Peking: Foreign Language Press, 1963).

83. "The Middle Kingdom," China News Analysis, No. 963 (14 June 1974). See also notes 33 and 76. The first world refers to the U.S. and the Soviet Union. The second world includes the industrial powers in Europe, Japan, and Australia, and the third world embraces the bulk of the developing countries, China being one among them. The

idea of such an alaysis is to seek a united front between the second and the third world to oppose the domination of the world by the first world (superpower collusion). This "three world" theory appeared only briefly in the early 1970s. Since then, China's foreign policy has been preoccupied with the possible world domination by the league of global hegemone and regional hegemones (i.e. Soviet Union supporting Cuba, Vietnam, etc. to control the world). It is entirely possible that the souring of relationship between China and the U.S. could reincarnate the "three world" theory.

84. The most lucid exposition of this argument to date is still Deng Xiaoping's speech at the UN. See note 76.

85. Bhabani Sen Gupta, op. cit., Ch. 3, "The Soviet Security Model for Asia," pp. 205-272; Joseph M. Ha, "Moscow's Policy Towards Japan," Problems of Communism, Vol. XXVI, No. 5 (September-October, 1977), pp. 61-72.

86. Kurio Muraoka, "Japanese Security and the U.S.," op. cit.; Matasaka Kosaka, "Japanese and Americans in a Competitive Alliance," in The Silent Power: Japan's Identity and World Role, ed. Japan Center for International Exchange (Tokyo: Simul Press, 1976), pp. 178ff. There are still people in Japan who would like to seek a EEC in Asia with China as an important member.

87. While the total cost of a comprhensive weapons program including a delivery system of reasonable size remains high, the cost for acquiring a demonstrative capability is not. According to a 1968 UN study, the capital cost of a complete plutonium-239 production complex (with plants to concentrate uranium ore, refining uranium to high purity and reducing it to metal ingot, and for fabricating reactor fuel, a nuclear reactor, a chemical plant for plutonium extraction and one for reducing plutonium to metal, together with the necessary service facilities) with a capacity of 8-160 kg. of weapons-grade plutonium per year would be around US $22-27 million (1968), and an annual operating cost of same US$5-10 million (1968). The same UN report cited a Polish study which envisaged a 2-stage 10-year program which, by the end of the first stage (1968-72), a nuclear force of 10-15 bombers and 15-20 nuclear weapons would be established, and during the second stage (1973-1977), the force would grow to 20-30 thermonuclear weapons, 100 IRBMs and 2 SSBNs. The total cost for this small, high quality force was put at US $5,600 million (1968). spread over 10 years. Similar cost estimates have been carried out by various authors during the last ten years. UN Department of Political and Security Council Affairs, Effects of the Possible Use of Nuclear Weapons and the Security and Economic Implications for States of the Acquisition and Further Development of These Weapons, UN Document A/6858 (1968). See also, Levefer, Nuclear Arms in the Third World, op. cit., pp. 14-22; Wohlstetter, Swords from Plowshares, op. cit., pp. 71-110. Assuming a 200% inflation rate since 1968, a plutonium complex of US $44-174 million spread over

several years is not prohibitive to a good number of developing countries. In fact, even a 300% inflation in cost will not deter the highly motivated ones. In 1981, the defense expenditures of South Korea was estimated to be US $4.4 billion; Taiwan, US $1.75 billion (the unofficial estimate is about US $4 billion); North Korea, US $1.47 billion. The Military Balance, 1981-1982 (London: IISS, 1981).

CHAPTER FOUR

TARGET STRUCTURES

Nuclear weapons, because of their vast destructiveness, provide a most efficient punitive capability qualitatively superior to WWII's strategic bombing. As a result, they are logical instruments for strategic targetting. Strategic targets have two major components: targets of military significance, known as counterforce targets, and targets such as population and industrial concentrations, known as countervalue targets. On the basis of public use sources, accurate or comprehensive information on military targets are hard to come by. For theoretical as well as practical reasons, this study is restricted to analyses based on countervalue targets. Although an exclusively countervalue analysis is necessarily limited in perspective, considering the extraordinary emphasis placed on the "retaliatory" or "punitive" function of nuclear weapons in strategic literature, this restriction is not as crippling as it may appear.

Intutitvely, the size as well as the distribution of cities have a direct impact on the design of nuclear warheads and the quantity of delivery vehicles required for their destruction. The larger the size and the number of enemy cities, the greater will be the weapons requirements to effect a specific level of their destruction. The closer the cities are located to each other, the easier they are to target against. Also, the higher the proportion of population and industrial capacity located in large urban areas, the more vulnerable the country is to a strategic nuclear attack. The distances these targets are located from potential enemy launch points may also affect the mode of weapons delivery. The physical structure of countervalue targets, therefore, has a direct bearing on weapons requirements. To the extent available information permits, this chapter compiles a composite list of major urban targets for each of the seven powers in Northeast Asia in terms of their population size, industrial significance and geographical area. The purpose is to provide a basis for the calculation of weapons requirements, the task of the next Chapter. This exercise serves to illustrate how disparities in target structures may result in disparities in weapons requirements and that, contrary to the common belief that small powers cannot hope to achieve an "adequate" nuclear deterrent against their adversaries, the reuqirements for small powers are not very high.

Population figures for cities of 100,000 or more of the U.S., the Soviet Union, Japan, China, and cities of 50,000 or more of Taiwan, North and South Korea have been collected from official sources or estimated from secondary sources.[1] An index of industrial significance has been constructed for these cities on a common denominator making it possible for cross-national comparison. The geographical location of these cities have been carefully identified from gazetteers and various maps and atlases, official and unofficial.

We know approximately how much immediate destruction a single nuclear warhead, if detonated on target, may cause. We also have good estimates on the areas of the targets. On the basis of the above information, one can calculate roughly (after making a number of assumptions) the number of weapons required to achieve a specific level of destruction (economic and population-wise) on a given country.

As it has been discussed earlier, the operational definition of assured destruction against the Soviet Union as espoused by Robert McNamara is the destruction of one-fifth to one-fourth of its population and one-half to two-thirds of its industrial capacity. These "levels" of destruction were said to constitute "unacceptable damage" to the Soviet Union. Incidentally, the McNamara operational definitions of assured destruction against the Soviet Union embraced the regions of rapidly decreasing marginal returns in terms of placing its population as well as its industrial centers under the threat of additional targetting by U.S. strategic nuclear weapons. The idea of "assured destruction," while presumably meeting requirements of "unacceptable damage," was also conveniently a criterion of efficiency based not so much on changes in the marginal cost of additional weapons deployed but on the rapidly diminishing marginal returns as a result of the structure of Soviet (strategic, counter-value) targets itself. This point, while seemingly lost in the heat of subsequent debates among deterrence theorists, has been emphasized time and again by a small number of analysts.

Assured destruction, therefore, has two important aspects. First and foremost is the threshold of unacceptable damage, which by itself is far from being an unambiguous concept. Secondly, because of the great uncertainty associated with the operational identification of the level of unacceptable damage, there is always a need to go for a wider margin of safety. It is in this respect that targetting efficiency becomes a critical consideration. The optimal assured destruction posture, therefore, is one which could, if necessary, inflict "unacceptable damage" on the enemy and at the same time without having to resort to weapons deployments which would incur a rapid deterioration of marginal returns. It is of course possible to have declining rates of marginal return without achieving any semblance of assured destruction capability. A small nuclear power with a big and powerful enemy is one good case in point. Conversely, an assured destruction capability may even be attained while marginal return is on the increase. However, in the real world of politics, extremely lopsided power relationships make assured destruction a trivial consideration if not an entirely meaningless one. Indeed, the principle of proportionality as discussed in Chapter Two offers a much better explanation of such power relationships.

Assured destruction is both a condition of stabilized strategic relationship in terms of nuclear weapons and a policy guideline to attaining such stability in an efficient manner. Whereas the idea of mutually assured destruction can be conceptualized with relative clarity, the situation is much more complex when several unequal nuclear powers are involved. First, the condition of multilateral assured destruction as a result of the simultaneous pursuit of assured destruction capability against multilateral adversaries may not exist in reality, given the specific set of environmental conditions.[2] There may be too many players constantly juggling for advantage such that a dynamic equilibrium is never possible. Secondly, even if the condition of multilateral assured destruction is objectively feasible, it may be extremely difficult if not impossible to attain or to maintain. This is analogous to the 2-person game-theoretic situation of the prisonner's dilemma in which the ideal solution is neither a likely nor a stable outcome.[3] Thirdly, nations are seldom equally endowed in resources, human and otherwise. Nor do they necessarily realize their full power potential at the same time. Nations with vast areas enjoy distinct advantages over small ones. More industrially advanced and decentralized economies are more likely to survive and recover from nuclear exchanges than small industrial economies which tend to be concentrated in a few areas. Fourthly, key values are unlikely to be symmetrical when the interplay of several unequal powers are involved.

For these and other reasons discussed earlier, even a purely military analysis of security requirements solely on the basis of strategic nuclear forces is already a complicated undertaking. Furthermore, considerable uncertainties concerning the battlefield performance of strategic nuclear weapons and command and communications systems, the real effects of a large scale strategic nuclear exchange, the interplay of the decision-making processes of several unequal nuclear powers, and the psychological disposition of the respective leadership during crisis situations render such an analysis illustrative at best. However, to note these difficulties is not to deny the usefulness of this type of analysis, however uncertain and tentative it may be. On the contrary, it is only through the study of small, isolated component parts that large and complex analyses are constructed and improved, provided, of course, that the larger perspective has not been lost in the process. Whether we like it or not, the development of American strategic thinking (just as the developemnt of nuclear weapons) has provided a basis for strategic theory and policy among the emergent nuclear powers. This attempt to study the extension of assured destruction to the strategic interaction of several unequal nuclear powers has been initiated and conducted with the belief that, however crude and primitive this analysis may be, it is a thinking through of the possible-to-probable strategic postures of the different states in a Northeast Asia which may not be so distant in the future. It also serves to illustrate how lesser nuclear powers may evolve strategic doctrines which appear to be so different from, and yet may have the very same root as American strategic theory.

Overall Structure

The overall structure of the counter-value strategic targets in Northeast Asia reflects the vast differences in geography and in the state of the industrial economy. The Soviet Union, the U.S. and China have the largest areas under urban occupation. This is not surprising given their large (in absolute numbers) urban populations. Japan, with a highly urbanized population, has more than one quarter of her territory under municipal administration, yet only 5% of that is comprised of "Densely Inhabited Districts (DIDs)."[4] Taiwan, North and South Korea all have much smaller urban areas.

TABLE 4.1 URBAN POPULATION AND AREA, 1970

	Urban Population (millions)	% National Population	Urban Area (mi.^{2})	# Major Urban Centers	# DGZ at 1mt Optimal SHOB 5 psi	# DGZ at 1mt Optimal SHOB 10 psi
USSR	136.0	56.3	14,622.773	232[1]	244[2]	617
USA	149.3	69.9	40,237.982	154	671	1,698
China	160.0	20.0	12,799.986	135	214	540
Taiwan	8.9	69.3	1,312.263	50	25	57
S.Korea	12.9	48.5	1,346.670	33	22	56
N.Korea	6.6	38.1	629.033	19	11	27
Japan	78.2	75.9	3,654.088	175	61	155
DIDs[3]	74.9	70.0	1,632.645	125	28	69

NOTES:

[1]For North Korea, South Korea and Taiwan, all urban places of 50,000 and above are included. For the rest, places of 100,000 and above are included.

[2]Roughly estimated by dividing the total urban area by the area destroyed under 5 psi and 10 psi overpressures respectively, assuming air burst at optimal scaled height of burst (SHOB).

[3]DIDs are Japanese census units refering to Densely Inhabited Districts, with population density of 4,000 or more per square kilometer, and a total of no less than 5,000 (in 1970).

A first approximation of the total warhead requirements in terms of Designated Ground Zeros (DGZs)[5] against the total urban areas of each of the seven powers indicates that those countries with vast and numerous urban areas enjoy distinct advantages. A survey of the seven powers in the region (Table 4.2) clearly illustrates this point. A composite index is formed first by collecting the number of different industrial installations in twenty-six different industry-groups belonging to six broad categories (Appendix B.1), namely: metallurgy, machine-building, transportation equipments, light industries, electricity (all forms), and petro-chemical industries. This index is then transformed into an IDX score such that the industrial significance of a city is expressed in terms relative to the total of individual IDX scores of all the major urban centers using the latter as the base. In lieu of reliable indices from official sources (e.g., census of manufacturing industries) such as value added, industrial employment or industrial floor spaces in some countries, this transformation makes it possible for illustrative purposes to approximate the relative industrial capacities of different urban centers on a comparable basis across different nations. As in the case of major population centers, large nations simply have numerically more important industrial centers than small ones.

Population Centers

Two interacting factors affect targetting requirements. The first is the number of significant urban centers in each nation. We have seen from Table 4.1 that although the U.S., Japan and Taiwan have the highest percentages of urbanized population, it is the Soviet Union, U.S. and China which have the largest urban population in absolute terms, followed immediately by Japan. This fact is clearly reflected by the very large number of major cities in each of these four nations. While China has more cities over one million (all in 1970 figures) than the Soviet Union and U.S. combined, the Soviet Union actually has the largest number of cities over 100,000. The relative distribution of cities as categorized in Table 4. shows that the initial targetting of the top 20-50 cities would threaten China most in absolute terms. As the target list grows, the differentials among the Soviet Union, U.S., China and Japan decreases. As a group, the smaller nations never come close in this respect except in the first couple of targets. This is one clear indication of the objective constraints on the targetting of large nations by small nuclear powers.

The second factor is the geographical size of these major population centers, which in reality is a function of population size and density. In this respect, the degree of urbanization also becomes critical. The higher the degree of concentrated urbanization, the more vulnerable the population become at earlier stages of an incremental target list. Table 4.5 illustrates this point. Again, the picture is obvious. For example, targetting one-fifth or one-fourth of the

TABLE 4.2 NUMBER OF CITIES AT 20%, 25% AND 50% OF URBAN AND NATIONAL POPULATION, 1970

	Urban			National		
	20%	25%	50%	20%	25%	50%
Soviet Union	18	27	152	60	108	
U.S.A.	23	40	-	50	105	-
China	11	17	-	-	-	-
Japan	3	5	43	6	12	115
Taiwan	1	2	9	3	5	45
N. Korea	1	2	6	6	8	19[1]
S. Korea	1	1	2	2	3	33[2]

NOTES:

[1]North Korea had a total of 19 cities with an estimated population of 50,000 or more in 1970. The percentage of the population in these 19 urban centers accounted for 42.7% of the national total.

[2]South Korea officially defines all SIs (Cities) as urban places of 50,000 or over. There were a total of 33 such places in 1970, accounting for 41.1% of the total population.

population of North Korea, South Korea, Taiwan, or even Japan does not call for large requirements in terms of Designated Ground Zeros (DGZs). Putting aside for the time being the problems of survivability and reliability of the strategic forces, any small nuclear force can be a significant threat to any of these four. The same can be said for the group of four plus China if one-fifth to one-fourth of their urban populations were targetted. The same task becomes formidable with the U.S. and the Soviet Union. Indeed, as far as China is concerned, there are no quotable target figures to speak of--reliable or not--to account for one-fifth to one-fourth of its total population. Even if all of China's urban dwellers were put into one contiguous zone (as is in the case of our first approximation to the total DGZ requirements on entire urban populations in Table 4.1), hundreds of 1-MT warheads would be required to inflict a 5-10 psi level of damage. The U.S. and the Soviet Union are not too different from China in this respect. However, if the considerations of Endicott and Kemp[6] on the design of medium nuclear forces as deterrents against big powers were adopted, then the damage requirements in terms of population would be reduced considerably. This is particularly the case with China.

TABLE 4.3 CUMULATIVE PERCENTAGE DISTRIBUTION

OF THE LARGEST URBAN CENTERS, 1970*

	USSR		USA		China		Japan		Taiwan		S.Korea		N.Korea	
#C	Urban	Total	Urban	Total	Urban	Total	Urban	Total	Urban	Total	Urban	Total	Urban	Total
1	5.3	3.0	5.3	3.9	4.4	0.9	14.9	10.8	19.5	12.0	42.7	17.6	23.9	10.2
5	11.5	6.5	11.7	8.6	13.1	2.8	26.5	19.1	42.2	26.0	74.5	30.6	38.3	16.2
10	15.7	8.8	14.8	10.8	19.3	4.1	33.4	24.1	53.1	32.7	83.9	34.5	47.1	20.1
15	19.0	10.7	17.1	12.6	23.7	5.1	37.0	26.7	59.0	36.4	89.0	36.6	52.6	22.4
20	22.1	12.4	19.2	14.1	27.1	5.8	40.0	28.9	63.8	39.3	92.9	38.3		
25	25.0	14.0	21.0	15.4	30.3	6.5	42.6	30.8						
30	27.3	15.4	22.5	16.6	33.0	7.0	45.1	32.6						
35	29.2	16.5	23.9	17.5	35.2	7.5	47.3	34.1						

NOTE: *Included are cities of 100,000 or more for the Soviet Union, the U.S., China and Japan, and 50,000 or more for Taiwan, South and North Korea. Only the first 20 cities are displayed for the small powers.

Industrial Centers

Industrial centers are usually also major urban centers. The same factors of distribution affecting weapons requirements in population centers also apply to industrial centers. The number of significant industrial is one, while the industrial capacity each center embraces is another. It is, of course much easier to identify the number of major industrial centers. Information on their respective industrial capacity on the other hand is difficult to obtain, and for the few that are available, the data are often unsystematic.[7] Composite indices to quantify "industrial capacity" simply cannot be constructed on such an inadequate basis. Instead, as a rough approximation to the relative significance of different industrial centers, an index is derived from the number of different industrial installations and types of industries. The index is then re-expressed in percentage terms using the cumulative total as 100 (Appendices A.1 and A.2). The higher the score, the more important is the city. The rationale behind this approach is first dictated by necessity, as this constitutes the closest approximation possible on a comparable cross-national basis with available information, and secondly, rehional industrial centers do perform a variety of economic functions for their immediate hinterlands. This is particularly true for the geographically vast nations.[8] Cities with a rich variety of industries are usually cities of regional if not national significance.

It appears obvious from the distribution of major industrial cities that the more populous and geographically vast countries should be considered as a group quite different from the lesser powers. Among the group of the big three -- namely, the Soviet Union, U.S., and China -- the Soviet Union appears to have the largest number of industrial cities of major importance. It is closely followed by the U.S. in this respect. The distribution of industrial capacity as reflected by the IDX index (supra) shows that the top few Soviet cities seem to carry more wieght than their American counterparts. Table 4.3 shows

TABLE 4.4 DISTRIBUTION OF MAJOR INDUSTRIAL CITIES BY STANDARD DEVIATION OF THE IDX SCORE

	USSR	USA	China	Japan	Taiwan	S.Korea	N.Korea
Over 2 S_x	9	5	4	8	3	3	1
1.5-2 S_x	5	10	7	7	2	2	0
1-1.5 S_x	17	13	13	8	4	1	2
0.5-1 S_x	22	18	16	19	5	0	3
Total:	53	46	40	42	14	6	6

that while the Soviet Union boasts 10 cities with scores of 2 S_x, only 5 U.S. cities carry similar scores. A total of 31 Soviet cities score above 1 S_x, accounting for 13.6% of the toal number of cities above 100,000 in 1970. On the other hand, 28 U.S. cities fall in the same class. China has 4 cities scoring between 1 S_x and 2 S_x, giving a total of 24 cities or 18.6% of all cities over 100,000. In terms of absolute numbers, the three large countries, together with the highly industrialized and quite populous Japan, are rather similar at the 0.5 S_x or greater range, in which the Soviet Union has 54, the U.S. has 45, Japan has 42, and China has 40. In terms of percentages of of cities with 100,000 or more in 1970, however, they represent approximately 24%, 29%, 24%, and 31% for the Soviet Union, the U.S., Japan, and China respectively. this overall distribution suggests that the Soviet Union has the smallest percentage of her major cities carrying a larger proportion of her industrial capacity among the three geographically vast countries.

In a second group, South Korea appears to have the highest concentration of industrial capacity. Despite the fact that Taiwan and South Korea each has 5 cities scoring over 1.5 S_x, 14 cities in Taiwan score 0.5 S_x or more compared to 6 for South and North Korea. When these numbers are expressed in terms of the percentages of the total number of major population centers, the contrast is even more striking, with South Korea standing at a low of approximately 19% as opposed to 28% for Taiwan and 32% for North Korea.

Thus far, we have been concerned with the number of significant industrial and population targets. While indeed they affect total requirements significantly, their geographical distribution has not been taken into consideration. Since range has a direct bearing on delivery systems, it is also important to consider the location of these important industrial, population centers.

TABLE 4.5 CUMULATIVE DISTRIBUTION OF INDUSTRIAL CAPACITY*

	USSR	USA	China	Japan	Taiwan	S.Korea	N.Korea
1	2.00	1.62	2.13	1.82	10.05	18.36	11.66
5	7.55	4.47	7.94	8.55	37.38	63.22	44.47
10	13.09	15.30	17.43	15.47	61.01	87.66	76.68
15	17.64	22.28	24.66	21.74	77.58	97.94	95.41
20	21.80	28.58	31.45	27.00			
25	25.75	34.47	37.71	31.88			
30	29.50	39.94	43.45	36.31			
35	32.99	44.98	48.97	40.62			

NOTE: *As measured by the % of the cumulative IDX score. Cf. text and Appendix B.

Economic Regions

The Soviet Union

On the basis of the nineteen official economic regions, Geoffrey Kemp identified eleven "remarkably concentrated" industrial areas.[9] Kemp admitted that the groups were somewhat arbitrary and were not precisely demarcated. This arbitrariness becomes clear if we take a look at cities like Kuybyshev and Kazan which had been included in the Chelyabinsk-Sverdlovsk Industrial Area. Yet these two cities are just as near, and probably more closely tied to Gorky and Volgograd. Also, some industrial areas extended much further than others. Alma Ata, a memebr of the Tashkent Industrial Area, is as far away as Omsk is from Chelyabinsk. Some of this arbitrariness was due to Kemp's desire to include all the major industrial cities his economic areas, some of which should be considered by themselves instead. To improve upon Kemp's target list, this study has identified central industrial and urban cities from each of the eleven areas. Sincere attempts have been made to adhere to officially designated economic regions (which can be very different in size and not always rationally delineated geographically) as far as possible. A range criterion of approximately 200 miles has been derived from the empirical distribution and thus set to define the outer limits of the industrial areas.[10] Depending upon the economic and geographical structure within each area, an inner boundary is defined somewhere between 60 miles and 100 miles from the central cities, wherever the drop-off is most pronounced. Implementing the above changes have provided us with an improved list which is less exhaustive (when only major industrial areas are considered), but much more sensitive to locational clusters. This improvement has eliminated much of the arbitrariness in the studies of Kemp and Endicott as there is no attempt to include unjustifiably significant targets which do not meet the prosimity criterion. Instead, they are considered independently of any industrial area.

TABLE 4.6 SOVIET INDUSTRIAL AREAS

		Indsutry		Population	
Area	#Cities	IDX	%IDX	%Urban	%Nation
Moscow	21	4.17	8.29	8.48	4.76
Donetsk-Dnieper	33	5.86	11.63	6.99	3.93
Chelyabinsk	13	3.40	6.75	3.22	1.81
Tbilsi-Baku	15	4.26	8.46	3.69	2.10
Kuybyshev-Kazan	14	2.77	5.08	3.31	1.78
Novosibirsk	13	2.52	5.00	3.07	1.72
Tashkent	12	2.45	4.86	2.54	1.42
Total:	121	25.43	50.07	31.30	17.52

1. The Moscow Industrial Area

Moscow is the metroplois of the Soviet Union. It had about 7 million inhabitants in 1970. It is also the heart of the Central Economic Region which in 1970 contained 21 cities of 100,000 people or more, ranking second behind the Donets-Dniepper Economic Region. The inner boundary of 60 miles in this case included 10 satellite cities of the 100,000 class (none of which was larger than 200,000). The outer limit of 200 miles embraced important textile centers such as Yarolavi, Ivanovo, and Kalinin, petroleum refinery center Ryazan, and heavy industrial city Tula. The area had a total of 21 of the 24 urban industrial centers within the official boundaries of Economic Region. The bulk of the Soviet ABM defenses permitted by SALT I have been deployed to protect this area.

TABLE 4.7 MOSCOW INDUSTRIAL AREA

City	Industry IDX	%IDX	Population %Urban	%Total
1. Moscow	.97	.97	5.21	2.97
2. Perovo	-	-	.11	.06
3. Babushkin	-	-	.11	.06
4. Mytishchii	.06	.11	.09	.05
5. Lyubertsy	.06	.11	.09	.05
6. Podol'sk	.13	.26	.13	.07
7. Elecktrostal'	.13	.25	.09	.05
8. Noginsk	.32	.63	.08	.05
9. Orekhovo-Zuyevo	.19	.37	.09	.05
10. Serpukhov	.27	.54	.10	.06
11. Kolomna	.24	.47	.10	.06
12. Kaluga	.19	.37	.14	.08
13. Kalinin	.21	.41	.25	.14
14. Tula	.27	.53	.30	.17
15. Vladimir	.20	.40	.17	.09
16. Razan	.29	.57	.25	.14
*115 miles:	3.50	6.95	7.35	4.13
17. Kovrov	.09	.18	.09	.05
18. Yaroslavl	.06	.11	.39	.22
19. Ivanovo	.22	.46	.32	.18
20. Rybinsk	.14	.28	.17	.09
21. Kostroma	.17	.34	.16	.09
*200 miles:	4.17	8.29	8.48	4.76

NOTE: *Subtotals and totals for IDX and %IDX in all the following tables have been calculated to the third significant digit and rounded to two significant digits. Column entry sums are therefore slightly different from the table entries.

2. The Donets-Kharkov-Dnepropetrovsk Industrial Area

The Donets-Dnieper Economic Region consists administratively of eight oblasts, all in the eastern part of the Ukraine S. S. R. Although the region is territorially larger than the Central Economic Region and has about three-quarters as many people, population distribution is less even and much denser in some areas. Industries tend to be more concentrated between Kharkov and the Sea of Azov. The D-K-D Industrial Area constitutes not only most of the Donets-Dnieper Economic Region, but also inlcudes part of the North Caucasus Region.

The immediate vicinities of Donetsk had 10 cities over 100,000 in 1970, second only to Moscow. Kharkov, Dnepropetrovsk, and Donetsk are all within 200 miles of each other. (Rostov-na-Donu, just west of Donetsk Oblast, is only about 100 miles southeast of Donetsk.) The triangle formed by these three great Ukrainian cities probably had the highest industrial and population concentration in the entire Soviet Union. Indeed, using any of the three cities as center, circles of 200-mile radius can be drawn to embrace 29-32 cities which had over 100,000 people in 1970.

No other area of comparable size is more richly endowed with mineral resources. In 1974, the Ukraine produced close to 50% of the total national iron ore output. The expanded basin of Krivoy Rog alone accounted for 96% of the Ukrainian total. The entire Donets Basin produced one-third of the national coal output. Potash, manganese, mercury, uranium, titanium and sulphur are also mined in this area. Petroleum and natural gas are also extracted in major quantities to meet the demands of a proliferation of industrial activities.

TABLE 4.8 DONETSK-DNEPROPETROVSK INDUSTRIAL AREA

	City	Industry IDX	Industry %IDX	Population %Urban	Population %Total
1.	Dnepropetrovsk	.45	.89	.64	.36
2.	Novomoskovsk	.09	.18	.10	.06
3.	Dneprodzershinsk	.45	.89	.18	.10
4.	Zaprozhye	.03	.07	.47	.26
5.	Nikopol	.14	.28	.09	.05
6.	Kuntsevo	-	-	.10	.06
7.	Poltava	.28	.56	.14	.08
8.	Kremenchug	.27	.53	.11	.06
9.	Krivoy Rog	.21	.43	.41	.23
10.	Melitopol	.14	.29	.09	.05
11.	Kramatorsk	.03	.07	.11	.06
12.	Kharkov	.43	.84	.92	.52
13.	Kirovograd	.16	.31	.13	.07
14.	Slavyansk	.15	.30	.09	.05
15.	Konstantinovka	.24	.48	.08	.05
16.	Donetsk	.30	.60	.66	.37
17.	Makeyevka	.14	.28	.33	.18
18.	Gorlovka	.38	.76	.27	.15
19.	Berdyansk	.10	.19	.07	.04
20.	Khartsyzsk	-	-	.04	.02
21.	Cherkassy	.18	.35	.10	.06
22.	Zhdanov	.27	.53	.30	.17
23.	Lisichansk	.06	.11	.08	.05
24.	Severodonetsk	-	-	.07	.04
25.	Belgorod	.09	.18	.10	.06
26.	Kadiyevka	-	-	.11	.06
27.	Sumy	.18	.35	.11	.06
28.	Nikolayev	.21	.41	.24	.13
29.	Kommunarsk	.06	.11	.10	.06
30.	Kherson	.25	.49	.19	.11
31.	Krasnyy Luch	-	-	.19	.11
32.	Voroshilovgrad	.25	.50	.28	.16
33.	Taganrog	.33	.66	.19	.11
	203 miles:	5.86	11.63	6.99	3.93

The Donets-Dnieper Region itself had 25 cities over 100,000 in 1970, which was more than any other economic region. The D-K-D Industrial Area, taking its outer limit, goes beyond the Donets-Dnieper Economic Region, and embraces up to 33 cities which had more than 100,000 then. Like the Moscow Industrial Area, it is far from Northeast Asia, yet within reach of any sea based system deployed in the Mediterranian Sea or the Arabian Sea.

3. The Sverdlovsk-Chelyabinsk Industrial Area

The Sverdlovsk-Chelyabinsk Industrial Area coincides with a large part of the Urals Economic Region. Chelyabinsk is about 120 miles south of Sverdlovsk, which is the largest city of the region. Another large urban center Perm and the highly publicized Tyumen are just under 200 miles from Sverdlovsk. The Urals Econmic Region is very strong in mining and metallurgical industries, and with 13 cities of more than 100,000 population in 1970, ties for fourth place with the North Caucasus and Kazakhstan. Four cities of 100,000 or more are within the 100-mile radius of Sverdlovsk, with 7 more falling between 100-200 miles. Using Chelyabinsk as the center, the counts are 6 and 6 respectively. This area is just within range of Chinese IRBMs stationed in Xinjiang and Ziqang (Tibet).

TABLE 4.9 SVERDLOVSK-CHELYABINSK INDUSTRIAL AREA

	Industry		Population	
City	IDX	%IDX	%Urban	%Total
1. Chelyabinsk	.56	1.12	.66	.37
2. Kopeysk	.14	.28	.13	.07
3. Miass	.13	.25	.10	.05
4. Zlatoust	.29	.58	.14	.08
5. Orsk	.40	.80	.17	.10
6. Kamensk-Ural'sk	.26	.52	.13	.07
90 miles:	1.78	3.54	1.33	.74
7. Sverdlovsk	.50	1.00	.77	.43
8. Pervoulral'sk	.18	.36	.09	.05
9. Magnitogorsk	.27	.53	.28	.16
10. Kurgan	-	-	.17	.10
11. Kustanay	.13	.26	.09	.05
12. Nizhniy-Tagi	.31	.62	.30	.17
13. Tyumen	.22	.44	.19	.11
210 miles:	3.40	6.75	3.22	1.81

4. The Tbilsi Industrial Area

The Tbilsi Industrial Area lies within the Transcaucasus Economic Region, excluding 3 towns north of the Bolshoy Kavkaz. The Tanscaucasus Economic Region has 3 large cities. Tbilsi and Yerevan are within 100 miles of each other while the important petroleum city Baku is some 300 miles to the east. A total of 6 cities over 100,000 in 1970 are within 100 miles of Tbilsi, and 12 are within a 200-mile radius. Petroleum extraction and refinery around Baku dominates the economy of this region. Copper is important near Tbilsi. Molybdenum mining is located southeast of Yerevan near the Turkish border. Aluminum ore is alos extracted near Kirovabad.

TABLE 4.10 TBILSI-BAKU INDUSTRIAL AREA

City	Industry IDX	%IDX	Population %Urban	%Total
1. Tbilsi	.41	.81	.67	.38
2. Rustavi	.56	1.12	.08	.05
3. Kirovakan	-	-	.08	.05
4. Leninakan	.16	.33	.12	.07
5. Yerevan	.45	.90	.58	.33
6. Kirovabad	.27	.53	.14	.08
100 miles:	1.86	3.69	1.67	.96
7. Ordzhonikidz	.28	.55	.17	.10
8. Kutaisi	.23	.45	.13	.07
9. Groznyy	.30	.59	.26	.15
10. Nal'chik	.21	.41	.09	.05
11. Batumi	.28	.56	.08	.05
12. Makhachkala	.28	.55	.13	.07
13. Sukhumi	.11	.22	.13	.07
205 miles:	3.53	7.02	2.66	1.52
14. Baku	.41	.81	.95	.53
15. Sumgait	.32	.63	.08	.05
Area Total:	4.26	8.46	3.69	2.10

5. The Kyubyshev-Kazan Industrial Area

The Kyubyshev-Kazan Industrial Area covers the upper and middle parts of the Volga Valley. It has 3 cities of 100,000 or more within 100 miles of Kazan, and a total of 12 cities of such sizes within a radius of approximately 200 miles.

While the Volga Valley is a relatively late-comer into industrialization, it occupies an intermediate position in between three major industrial nodes of the Central Region (Moscow), the Urals (Sverdlovsk-Chelyabinsk), and Eastern Ukraine (Donets-Dniepper). Petroleum extraction and refinery expanded rapidly around Ufa and Kuybyshev. Related petrochemical industries grew simultaneously along the entire area. Ulyanovsk serves as a major light truck production center for the nation, while Togliatti (named after the late chairman of the Italian Communist Party) acquired its Fiat plant in 1970 to become an important automobile production center. A huge integrated truck plant has been built at Zhnyye Chelny in 1975. It is expected that the middle Volga Valley will remain one of the most rapidly grwoing industrialized regions in the country.

Towards the lower Volga Valley lie important cities such as Volgograd, Volzhkiy and Astrakhan. Volgograd is an important caterpillar tractor production center and Astrakhan is a major port to the Caspian Sea. The Volga River contains many hydroelectric facilities and is an important artery of domestic transportation. In fact, the Volga Valley has more cities over 500,000 in 1970 than the Central Region, and ties with Eastern Ukraine in this respect to co-rank first in the nation.

TABLE 4.11 KUYBYSHEV-KAZAN INDUSTRIAL AREA

	City	Industry IDX	%IDX	Population %Urban	%Total
1.	Kazan	.35	.70	.65	.36
2.	Cheboksary	.13	.26	.14	.08
3.	Yoshkar-Ola	.14	.29	.11	.06
4.	Ul'yanovsk	.24	.48	.23	.13
	102 miles:	.86	1.72	1.13	.53
5.	Togliatti	.22	.44	.11	.06
6.	Izhevsk	.17	.34	.30	.17
7.	Syzran	-	-	.13	.07
8.	Kyubyshev	.29	.57	.79	.44
9.	Novokyubyshev	-	-	.08	.05
10.	Saransk	.20	.40	.12	.07
11.	Kirov	.25	.50	.24	.14
12.	Gorkiy	.44	.87	.23	.15
	202 miles:	2.43	4.83	3.13	1.68
13.	Balakovo	.22	.44	.08	.05
14.	Ural'sk	.12	.24	.08	.05
	Area Total:	2.77	5.51	3.31	1.78

6. The Greater Novosibirsk Industrial Area

The Greater Novosibirsk Area lies in the southern part of the western Siberia Economic Region which is believed to hold the largest mineral and fuel reserve of the entire nation. Because of its harsh environmental conditions (and consequently the lack of population), the area is not developed industrially until the late 1950s, and not on a large scale until the mid-1960s when the need for oil and natural gas became real. The area remains undeveloped in surface transportation with the single important exception of the Trans-Siberian Railway along which most of the cities were founded. This area, though not yet a major industrial center, serves the critical function of linking European Russia with the Soviet Far East. The Western Siberia Economic Region has 14 cities over 100,000, 12 of which lie in the industrial area. A total of 11 cities of 100,000 or more are within the 200-mile radius of Novosibirsk (none inside 100 miles), and one city is within 200 miles of Omsk.

TABLE 4.12 GREATER NOVOSIBIRSK INDUSTRIAL AREA

City	Industry IDX	Industry %IDX	Population %Urban	Population %Total
1. Novosibirsk	.52	1.03	.87	.49
2. Barnaul	.35	.70	.32	.18
3. Kemerovo	.28	.55	.29	.16
4. Tomsk	.22	.44	.26	.14
5. Leninsk-Kuznetsk	.09	.18	.11	.06
6. Belovo	.14	.28	.09	.05
7. Anzhero-Sudzhens	.19	.37	.07	.04
8. Kiselevsk	.10	.19	.11	.06
9. Prokopyevsk	.11	.22	.23	.13
10. Novokuznetsk	.19	.39	.39	.22
11. Biysk	.19	.37	.14	.08
12. Belaya-Tserk	-	-	.08	.05
13. Rubtsovsk	.15	.30	.11	.06
255 miles:	2.52	5.00	3.07	1.72

7. <u>The Tashkent Industrial Area</u>

The Taskhent Industrial Area lies in the southernmost part of the Kazakhstan Economic Region and the eastern part of the Central Asia Economic Region (which is a conglomerate of very diversified peoples and physical landscapes), Kazakhstan is one of the most higly mineralized regions in the Soviet Union. The Karaganda area was responsible for 6.6% of the national output in 1974. A new coal field in Ekibastuz basic has started production. Natural gas and petroleum are also abundant. The Gazli gas field rivals the productions in Ukraine and North Caucasus.

The Tashkent Industrial Area includes a total of 6 cities which had over 100,000 people in 1970 astride the Kazakhstan and the Central Asia Economic Regions. Four of them are within 100 miles of Tashkent, and 12 fall within 200 miles. Alma Ata (not considered part of the Tashkent Industrial Area) is about 400 miles to the east.

TABLE 4.13 TASHKENT INDUSTRIAL AREA

	Industry		Population	
City	IDX	%IDX	%Urban	%Total
1. Tashkent	.26	.52	1.05	.59
2. Chirchik	.61	1.22	.08	.04
3. Chimkent	.30	.60	.17	.09
4. Leninabad	.08	.15	.16	.09
80 miles:	1.25	2.49	1.46	.82
5. Kokand	.18	.36	.10	.06
6. Namagan	.03	.07	.13	.07
7. Fergana	.23	.46	.08	.05
8. Dzambul	.12	.24	.13	.07
9. Andizhan	.12	.24	.13	.07
10. Samakard	.12	.24	.13	.07
11. Osh	.07	.13	.09	.05
12. Dushaube	.31	.62	.29	.16
200 miles:	2.45	4.86	2.54	1.42

U.S.A.

Just as the Soviet industries are located laregly west of the Urals, a large proportion of American industries, both heavy and light, are located in northeast and northcentral U.S., with Milwaukee and Chicago to the west, Cincinnati to the south, and all the way up to the coast towards the east. This pattern coincides with the distribution of population as well as communication infrastructures. The location of important national business centers clearly reflects the importance of the northeast. The dominance of the northeast is much more dramatic when regional and local business centers are taken into consideration. As a result of the growth in the petroleum and related industries, some important industrial centers have emerged in the coastal areas of Texas and Louisiana. Unlike the northeast, these centers are still relatively un-integrated. Although there has been a marked migration of industrial activities toward the south and the west during the last decade, the overall pattern has not been altered fundamentally as yet. On the whole, seven major industrial areas can be identified. They are:

<u>Coastal Northeast Region</u>

1. The New York-Northeastern New Jersey Industrial Area
2. The Boston Industrial Area

<u>Northcentral Region</u>

3. The Detroit-Cleveland-Pittsburg Industrial Area
4. The Cincinnati Industrial Area
5. The Chicago Industrial Area

<u>Pacific Coast Region</u>

6. The Los angeles-San Diego Industrial Area
7. The San Francisco Industrial Area

TABLE 4.14 U.S. IMPORTANT BUSINESS CENTERS, 1967[1]

Rating	#Cities	NC-NE Belt
Class I	2	2
Class II	10	6
Class III	15	6
Total:	27	14

NOTE:
[1]Department of Interior Geological Survey, National Atlas (Washington, D.C.: USGPO, 1970). Class I cities are: New York, Chicago. Class II cities are: Philadelphia, Pittsburg, Cleveland, Minneapolis-St. Paul, St. Louis, Detroit, Los Angeles, San Francisco. Class III cities are: Milwaukee, Miami, Cicinnati, Indianapolis, Kansas City (MO), Baltimore, Buffalo, Denver, Dallas, Houston, Atlanta, Seattle, Portland, New Orleans, Newark.

The Coastal Northeast Region

This region stretches some 400 miles along the northeast coastal areas from Boston to the north down to Washington, D.C. in the south. At the center is New York-Northeastern New Jersey area. The entire region covers a total of 24 cities upwards of 100,000 population in 1970. These 24 cities contributed to nearly one-tenth of the total urban population in the U.S. This region taken as a whole is also the most developed, and has led the nation in virtually every aspect of industrial production and manufacturing. It also has the best communications network. New York city alone has more people and a larger economy than many states. It easily outranks all others as the largest business center of the nation. However, it is not the most industrially diversified city.

The Coastal Northeast Region, while more or less a continuous belt running north and south, can be sub-divided to give two sub-regions. Boston is the center for the northern sub-region. New York is the hub for the rest. (Baltimore and Washington, D.C. formed the outlying southern cluster.)

TABLE 4.15 U.S. INDUSTRIAL AREAS BY REGION

	Industrial Area	#C	Industry VA	%IDX	Population %Urban	%Total
	Coastal Northeast	25	9.3	19.07	10.20	7.27
1.	New York-N.E. NJ	12	6.9	9.41	7.63	5.38
2.	Boston	10	1.2	6.86	1.38	1.02
	Northcentral	31	9.7	22.80	8.76	6.43
3.	Detroit-Pittsburg	16	4.0	10.43	3.30	2.41
4.	Cincinnati	6	2.1	5.54	1.66	1.22
5.	Chicago	9	3.6	6.83	3.80	2.80
	Pacific Coast	20	3.7	13.26	4.88	3.59
7.	Los Angeles	13	2.6	7.51	3.47	2.56
8	San Francisco	7	1.1	5.75	1.41	1.03

[1]Value added in manufacturing industry, in hundreds of millions of dollars, current prices. Source: U.S. Department of Commerce, Bureau of Census, 1970 Census of Manufacturing Industry (Washington, D.C.: USGPO, 1972). The geographical regions in the table are not the same as the convention used by the Census Bureau.

1. <u>The New York-Northeastern New Jersey Industrial Area</u>

The sub-region of New York-Northeastern New Jersey alone outranks all other industrial areas in the nation both in industrial aignificance and in total urban population. It is in fact the most densely populated area with the highest concentration of industry and business. New York is by far the largest city of the nation. It is both the business and the financial headquarter. Philadelphia is the fourth largest city with both heavy and light industries. Like New York, it has been a major seaport and business center traditionally. The NY-NENJ Industrial Area had a total of 12 cities with more than 100,000 in 1970, accounting for 7.6 of the urban or 5.4% of the national population. It ranks first in industrial significance.

TABLE 4.16 NEW YORK-NENJ INDUSTRIAL AREA

City	Industry VA	Industry %IDX	Population %Urban	Population %Total
1. New York	3.27	1.27	5.29	3.89
2. Newark	0.23	1.11	0.26	0.19
3. Yonkers	0.06	0.49	0.07	0.05
4. Elizabeth	0.09	0.51	0.08	0.06
5. Jersey City	0.16	0.97	0.17	0.13
6. Paterson	0.11	0.43	0.77	0.10
7. Allentown	0.14	0.46	0.07	0.05
8. Trenton	0.07	0.68	0.07	0.05
9. Philadelphia	2.61	1.62	1.31	0.79
10. Camden	0.07	0.32	0.57	0.07
11. Waterbury	0.09	0.48	0.07	0.05
12. Scranton	0.04	0.46	0.07	0.05
Area	6.93	9.41	7.63	5.38

2. The Boston Industrial Area

The Boston sub-region embraces 7 other relatively smaller cities, representing only 1% of the national population in 1970. Nevertheless, it still ranked fifth among the various industrial regions. The Boston Industrial Area had a total of 10 cities over 100,00 in 1970. Boston, Portsmouth and New Bedford are ports witrh major shipyards. New Bedford and Providence are important textile centers. There are also some metallurgical and machine-building industries.

TABLE 4.17 BOSTON INDUSTRIAL AREA

	Industry		Population	
City	VA	%IDX	%Urban	%Total
1. Boston	0.32	1.19	0.43	0.32
2. New Bedford	0.08	0.66	0.07	0.05
3. Cambridge	0.08	0.54	0.07	0.05
4. Brdigeport	0.13	1.05	0.11	0.08
5. Portsmouth	0.04	0.15	0.07	0.06
6. Springfield	0.09	0.72	0.11	0.08
7. Worcester	0.13	0.87	0.12	0.09
8. Providence	0.15	0.54	0.12	0.09
9. Hartford	0.06	0.37	0.11	0.08
10. Albany	0.04	0.06	0.08	0.06
11. New Haven	0.06	0.71	0.09	0.07
Area	1.19	6.86	1.38	1.02

The Northcentral Region

The importance of northern U.S. from the Midwest to the Atlantic coast can hardly be over-estimated. Many cities in Michigan, Ohio and Indiana are industrially important. The area is vast and does not yield to very clear-cut delineation of "industrial areas." Detroit, Cleveland, Pittsburgh, and Cincinnati are all major centers. Geographically, Detroit and Pittsburgh are not too distant from Cleveland. It may be convenient to identify two areas in this region, with seaway ports Detroit and Cleveland to the north, and the river port Cincinnati to the south.

3. The Detroit-Cleveland-Pittsburgh Industrial Area

This is a belt of over 200 miles running across the southern side of lake Ontario from Detroit in the northwest to Pittsburg in the southeast. The Detroit area has always been the heartland of Amercican automobile production and is extremely important for the manufacturing of transportation equipments in general. Both Cleveland and Detroit have important shipyards. Pittsburgh is traditonally known for heavy industries and mining.

The D-C-P Industrial Area contains 16 cities (more than any other area) of more than 100,000 in 1970, accounting for approximately 3.5% of the urban population. It ranks second in industrial significance, just behind the NY-NENJ Industrial Area.

TABLE 4.18 DETROIT-CLEVELAND-PITTSBURG

INDUSTRIAL AREA

City	Industry VA	Industry %IDX	Population %Urban	Population %Total
1. Detroit	1.14	1.07	1.01	0.74
2. AnnArbor[1]	0.26	0.10	0,07	0.05
3. Grand Rapids	0.16	0.78	0.07	0.05
4. Lansing	0.22	0.47	0.09	0.06
5. Toledo	0.32	1.39	0.26	0.19
6. Cleveland	0.69	1.56	0.50	0.37
7. Akron	0.26	0.71	0.18	0.13
8. Canton	0.14	0.21	0.07	0.05
9. Pittsburg	0.19	1.48	0.35	0.26
10. Parma	-	-	-	-
11. Youngstown	0.11	0.50	0.09	0.07
12. Erie	0.09	1.01	0.09	0.06
13. Flint	-	0.38	0.13	0.09
14. Warren	0.28	0.51	0.12	0.09
15. Dearborn	-	-	0.07	0.05
16. Lvonia	0.14	0.31	0.07	0.05
Area	4.00	10.43	3.30	2.41

4. The Cincinnati Industrial Area

The Cincinnati Industrial Area, or more accurately, the Indiannapolis-Cincinnati-Louisville Industrial Area has 6 cities over 100,000 in 1970, of which Indiannapolis is the largest. Indiannapolisy is industrially diversified with heavy emphasis on transportation equipments. Cincinnati is a river port. Dayton is primarily a heavy industrial town. Louisville, apart from heavy industries, also serves as a wholesale center.

The Cincinnati Industrial Area, covered by a 100 mile-radius centering at Cincinnati, had less than 1.7% of the nation's urban population in 1970. It ranked sixth among the seven major industrial areas in industrial significance.

TABLE 4.19 CINCINNATI INDUSTRIAL AREA

City	Industry VA	Industry %IDX	Population %Urban	Population %Total
1. Cincinnati	0.30	1.00	0.30	0.22
2. Dayton	0.41	1.02	0.16	0.12
3. Indianapolis	0.56	1.26	0.50	0.37
4. Columbus	0.33	1.16	0.36	0.27
5. Lexington	0.11	0.37	0.07	0.05
6. Louisville	0.41	0.73	0.26	0.19
Area	2.11	5.54	1.65	1.22

5. The Chicago Industrial Area

In terms of individual cities, Chicago is as dominant in the Midwest as New York is in the Northeast. Chicago has a collection of almost all the industries, heavy and light. It is not only the second most important business center of the nation, but is also th focal point in the Midwest of railroads, interstate highways, and air routes. Like other super-cities, Chicago is a huge, sprawling metropolitan area. It has 6 cities within 100 miles which were over 100,000 in 1970. Three additonal centers of the same class are located in the immediate periphery. The 9 cities accounted for 3.8% of the urban, or 2.8% of the national population.

TABLE 4.20 CHICAGO INDUSTRIAL AREA

City	Industry VA	Industry %IDX	Population %Urban	Population %Total
1. Chicago	2.27	1.53	2.25	1.66
2. Gary	0.14	0.41	0.50	0.37
3. South Bend	0.09	0.50	0.08	0.06
4. Milwaukee	0.54	1.47	0.48	0.35
5. Hammond	0.80	0.36	0.07	0.05
6. Rockford	0.19	1.49	0.10	0.07
Basic Area	3.30	5.75	3.48	2.56
7. Madison	0.06	0.46	0.12	0.09
8. Peoria	0.06	0.06	0.09	0.06
9. Fort Wayne	0.14	0.56	0.12	0.09
Area	3.56	6.83	3.81	2.80

The Pacific Coast Region

Compare with the Northeast and Northcentral U.S., the Pacific Coast is not nearly as extensively industrialized. Only the Los Angeles area and the San Francisco area have enough major cities to match the eastern and the midwestern counterparts. However, this is not a fair indication of the trend. New industries, notably electronics, seem to favor the West and the deep south.

6. The Los Angeles Industrial Area

Los Angeles, the thrid largest city, is a major business center liek Chicago, and embraces almost every heavy and light industry. It is also a major port with shipbuilding facilities. The manufacturing of transportation equipments is very important.

The Los angeles Industrial Area extends 100 miles south to San Diego. This belt covers some 13 cities with more than 100,000 people in 1970, which accounted for 3.5% of the urban, or a little over 2.5% of the national population. While the manufacturing industries appear to compare less favorably in terms of value-added and total shipments in 1972 figures, the industrial significance score is at a par with the chicago area.

TABLE 4.21 LOS ANAGELES INDUSTRIAL AREA

City	Industry VA	%IDX	Population %Urban	%Total
1. Los Angeles	1.33	1.47	1.89	1.39
2. Los Angeles Beach	0.35	0.66	0.24	0.18
3. Glendale	0.50	0.63	0.09	0.07
4. Pasadena	0.06	0.33	0.08	0.06
5. Torrence	0.18	0.53	0.09	0.07
6. Huntington Beach	-	-	0.08	0.06
7. Hileah	0.09	0.90	0.07	0.05
8. Riverside	0.04	0.28	0.09	0.07
9. Anaheim	0.19	0.95	0.11	0.08
10. Garden Grove	0.01	-	0.08	0.06
11. San Diego	0.23	0.90	0.47	0.34
12. Santa Ana	0.03	0.71	0.11	0.08
13. San Bernardino	0.01	0.06	0.07	0.05
Area	2.57	7.51	3.47	2.56

7. <u>The San Francisco Indistrial Area</u>

San Francisco is basically a trading center first and a manufacturing center second. The San Francisco Industrial Area had a total of 7 cities with 100,000 or more people in 1970. Oakland and San Jose are two important cities with heavy industries. San Francisco itself is a seaport, a banking center, and a famous tourist attraction. Oakland is a major industrial port and terminal on the west coast in land transportation.

The 7 major cities in the San Francisco Industrial Area represented only 1% of the national population in 1970, and less than 1.5% of the total urban population.

TABLE 4.22 SAN FRANCISCO INDUSTRIAL AREA

City	Industry VA	Industry %IDX	Population %Urban	Population %Total
1. San Francisco	0.53	1.47	0.48	0.35
2. Oakland	0.14	1.19	0.24	0.18
3. Sacramento	0.09	0.38	0.17	0.12
4. Berkeley	0.06	0.65	0.08	0.06
5. Stockton	0.39	0.67	0.07	0.05
6. San Jose	0.16	0.41	0.30	0.22
7. Fremont	0.07	0.98	0.07	0.05
Area	1.08	5.75	1.41	1.03

Aside from the 7 major industrial areas described above, there are 18 smaller clusters or individual cities scattered across the U.S. Only 5 out of the 18 did not qualify as a major business center in 1970. Six scored higher than 1 S_x in the industrial significance score.

China

According to a ranking scheme designed by Yuan-li Wu, a group of four major metropolitan centers in China (Shanghai, Tianjin, Wuhan, Anshan) contributed up to 44.3% of the annual value-added in industrial production among the 328 industrial cities and production sites towards the end of the 1950s. Shanghai itself accounted for 30% of the toal value-added. Together with the next five ranking industrial cities, they accounted for 60% of the total value-added.

TABLE 4.23 ANNUAL INDUSTRIAL CAPACITY IN VALUE-ADDED[1]

	City	% of Total Value-Added
1.	Shanghai	30.02
2.	Tianjin	5.58
3.	Wuhan	4.71
4.	Anshan	3.97
	Top Four	44.28
5.	Chongqing	3.42
6.	Nanjing	3.35
7.	Beijing	3.25
8.	Baotou	2.81
9.	Guangzhou	2.64
	Top Nine	59.75

SOURCE: Yuan-li Wu, The Spatial Economy of Communist China, op. cit., pp. 235ff. The ranking was based on information collected for the late 1950s and early to mid-1960s. Names of cities have been translated into modern romanized form for consistency.

Although Wu's analysis was based on data some 20 years ago and much have occurred during the past two decades, the basic pattern of relative contributions to China's industrial economy has remained very much the same. Despite persistent efforts to decentralize China's economy, only mild successes have been scored. Coastal cities and big urban centers in the Northeast still dominate the national picture as China moved into the 1980s. Judging by the economic policies of the past few years, this pattern of unevenness is likely to remain (or perhaps become even more accentuated) for some time to come.

TABLE 4.24 GROSS VALUE OF INDUSTRIAL OUTPUT BY REGION, 1952-73 (PERCENT OF NATIONAL TOTAL)

	Beijing, Tianjin and Shanghai	Other Coastal Areas	Total	Inland
1952	26.9	41.4	68.3	31.7
1957	25.2	39.2	64.4	35.6
1965	27.4	38.5	65.9	34.1
1970	28.1	37.6	65.7	34.3
1973	27.0	37.1	64.1	35.9

SOURCE: R. M. Field, N. R. Lardy, and J. P. Emerson, "A Recosntruction of the Gross Value of Industrial Output by Province in the People's Republic of China: 1949-1973," U.S. Department of Commerce, Washington D.C., 1975, p. 6, as quoted by Charles Robert Roll, Jr. and Kung-Chia Yeh, "Balance in Coastal and Inland Industrial Development," <u>China: A Reassessment of the Economy</u>, op. cit., p. 88.

While it is not possible to replicate Wu's calculations due to the paucity of consistent official statistics since the 1960s, a less precise but nevertheless credible index can be constructed to rank the relative industrial significance of the urban centers in terms of the diversity of major industries and whenever applicable the number of major installations within each industry. As it has been discussed in the beginning of this chapter, this index suffers from the overtall lack of information on the capacities of the different industrial installation which renders it impossible to take the little we know about a number of plants into consideration for comparative purposes. Reallistically, this indewx comes closest to serve the purpose of cross-national comparisons.

According to CIA estimates, the Northeastern provinces in 1970 ranked first in the ouput of crude oil, crude steel, electric power, coal, trucks, freight cars, aluminum and machine-made paper. Northeast China was the foremost in heavy industries. It had the largest production oilfield (Daqing or Taching) near Anda, and the largest steel mill in Anshan. In short, the Northeast ranked first in industrial output, followed by the Eastern provinces which produced the most machine tools and textile products. The Northern provinces came in third, while Central-South China came in fourth. By far the least industrialized areas are the Northwest and the Southwest.

Major industrial areas in China do not fall neatly within provincial administrative boundaries. But they seldom cross major regional divisions. In accordance with their spatial charcateristics, four major and six lesser industrial areas can be identified (Table 4.29). In addition, there are 16 relatively minor clusters or individual cities of some industrial significance.

TABLE 4.25 CHINA: INDUSTRIAL AREAS

	Area	#C	%IDX	1970 Population Lower Est. %Urban	%Total	Upper Est. %Urban	%Total
	Group I						
1.	Shanghai	15	12.49	8.28	1.76	9.08	1.93
2.	Shenyang	12	9.93	4.25	0.88	5.03	1.06
3.	Beijing	9	8.84	7.59	1.62	7.72	1.65
4.	Harbin	11	8.71	3.57	0.76	4.53	0.93
	Four Areas	47	39.96	23.69	5.02	26.26	5.57
	Group II						
5.	Zhengzhou	11	6.10	1.95	0.40	2.84	0.60
6.	Chongqing	8	4.77	3.22	0.69	3.85	0.82
7.	Changsha	9	3.94	1.39	0.30	1.92	0.41
8.	Jinan	5	3.67	1.47	0.31	1.72	0.36
9.	Guangzhou	5	3.23	2.00	0.43	2.25	0.48
10.	Wuhan	7	3.21	1.98	0.42	2.73	0.58
	Ten Areas	92	64.89	35.7	7.57	41.67	8.82

Major Industrial Areas

The four major industrial areas are:

1. The Shanghai-Nanjing-Hangzhou Industrial Area
2. The Shenyang Industrial Area
3. The Beijing-Tianjin-Tangshan Industrial Area
4. The Changchun-Harbin-Qiqihar Industrial Area

1. The Shanghai-Nanjing-Hangzhou Industrial Area

The S-N-H Industrial Area includes 15 cities with populations of 100,000 or more in 1970. Shanghai is the largest city of China, the largest port today, a major shipbuilding and aircraft construction center, and has the second largest modern steel mill in the nation. Anothern large modern integrated steel mill is located in the neighboring city Ma'anshan. Traditionally, the Kiangsu province has the best textile industry in the nation.

An arc of roughly 100 miles centered at Shanghai includes a total of 8 cities with estimated populations upwards of 100,000 in 1970. A total of 13 cities of the same class would be included by extending the radius to 200 miles. The S-N-H Industrial Area ranked first among the four major industrial areas in importance.

TABLE 4.26 SHANGHAI-NANJING-HANGZHOU

INDUSTRIAL AREA

City[1]	%IDX	1970 Population[2] Lower Est. %Urban	%Total	Upper Est. %Urban	%Total
1. Shanghai	2.13	4.37	0.93	4.37	0.93
2. Wuxi	1.14	0.41	0.09	0.41	0.09
3. Hangzhou	1.11	0.60	0.13	0.60	0.13
4. Ma'anshan	0.37	0.12	0.03	0.12	0.03
5. Wuhu	0.40	0.19	0.04	0.62	0.13
6. Huainan	0.34	0.37	0.08	0.37	0.08
7. Hefei	1.14	0.39	0.08	0.39	0.08
8. Nanjing	1.45	1.09	0.23	1.09	0.23
9. Suzhou	0.98	0.08	0.02	0.08	0.02
10. Shaoxing	0.29	0.06	0.01	0.19	0.04
11. Nantong	0.63	0.06	0.01	0.19	0.04
12. Yangzhou	0.50	0.14	0.03	0.14	0.03
13. Changzhou	0.76	0.18	0.04	0.18	0.04
14. Taizhou	0.37	0.06	0.01	0.19	0.04
15. Ningbo	0.90	0.16	0.03	0.16	0.03
Area	12.49	8.28	1.76	9.10	1.94

[1]The list is based on the tri-center of Shanghai, Nanjing, and Hangzhou, extending up to 100 miles or roughly 160 kilometers from any of the three.

[2]For estimates derived from density measures, a lower and an upper estimates are also given.

2. The Shenyang Industrial Area

The Shenyang Industrial Area has the largest modern integrated steel mill in Anshan. Iron ore is abundant around Anshan, Benxi, Yingkou and Tonghua. Molybedinum and manganese are mined near Jinzhou. Both Shenyang and Fushun are major centers of heavy industries. Fushun leads the nation in aluminium metallurgy. Shenyang is extremely important in the production of automobiles, and is by far the largest producer of aircrafts (both military and civilian) in the nation.

TABLE 4.27 SHENYANG INDUSTRIAL AREA

City	%IDX	1970 Population			
		Lower Est.		Upper Est.	
		%Urban	%Total	%Urban	%Total
1. Shenyang	1.92	1.75	0.37	1.75	0.37
2. Fushun	1.42	0.67	0.14	0.67	0.14
3. Benxi	1.13	0.37	0.08	0.37	0.08
4. Liaoyang	0.58	0.06	0.01	0.19	0.04
5. Anshan	1.19	0.66	0.14	0.66	0.14
6. Fuxin	0.45	0.19	0.04	0.19	0.04
100 miles	6.69	3.70	0.78	3.83	0.81
7. Yingkou	-	0.06	0.01	0.19	0.04
8. Jinzhou	1.01	0.25	0.05	0.25	0.05
9. Beipiao	0.16	0.06	0.01	0.19	0.04
10. Chaoyang	0.13	0.06	0.01	0.19	0.04
11. Dandong	0.95	0.06	0.01	0.19	0.04
12. Tonghua	0.94	0.06	0.01	0.19	0.04
Area	9.93	4.25	0.88	5.03	1.06

A total of 12 cities with estimated populations of 100,000 or more in 1970 are located in this area, 6 of which fall within the inner limit of 100 miles. The Shenyang Area ranked second only to the S-N-H Area in industrial significance.

3. The Beijing-Tianjin-Tangshan Industrial Area

Beijing is the national capital and has, since 1949, become one of the largest integrated industrial cities in China today. It scores second in the industrial index, ranking second only to the traditional phenomenon Shanghai. Beijing is the national capitol, and one of the major communications centers in Northern China. It is also the gateway connecting China with the important Northeastern provinces.

TABLE 4.28 BEIJING-TIANJIN-TANGSHAN INDUSTRIAL AREA

		1970 Population			
		Lower Est.		Upper Est.	
City	%IDX	%Urban	%Total	%Urban	%Total
1. Beijing	1.97	3.13	0.67	3.13	0.67
2. Tianjin	1.66	2.25	0.48	2.25	0.48
3. Tangshan	1.08	0.59	0.13	0.59	0.13
4. Shijiazhuang	0.95	0.50	0.11	0.50	0.11
5. Qinhuandao	0.58	0.19	0.04	0.19	0.04
6. Cangzhou	0.16	0.06	0.01	0.19	0.04
7. Baoding	0.82	0.19	0.04	0.19	0.04
8. Zhangiakou	0.76	0.62	0.13	0.62	0.13
9. Xuanhua	0.87	0.06	0.01	0.06	0.01
Total	8.84	7.59	1.62	7.72	1.65

Tianjin scores sixth on the industrial index. It is about 100 miles southeast of Beijing, and has been transfromed from a city of commerce and light industries into a modern industrial city with emphasis on metallurgy, machine-building, petrochemicals, electronics, as well as textiles, food-processing and paper-making. Tangshan, the city which was wipe out by an earthquake in 1977, is primarily a coal-mining city with machine-building and cement production. The B-T-T Industrial Area includes 9 cities (within 100 miles of the tri-center) with populations of 100,000 or more in 1970. It is ranked third in industrial importance.

4. The Changchun-Harbin-Qiqihar Industrial Area

Immediately to the north of the Shenyang Industrial Area lies the upper Heilong Jiang river basin with Harbin at its center. Changchun, a city of 1,200,000 in 1970, is located 150 miles to the south. Qiqihar, a city of 760,000, is located 170 miles to the northwest edge of the river basin. A radius of 200 miles centered at Harbin gives 9 cities of 100,000 or more by 1970 estimate. The C-H-Q Industrial Area has a total of 11 such sites.

Harbin is one of the nation's most important industrial cities with a wide spectrum of heavy and light industries including shipbuilding, aircraft manufacturing and petroleum refinery. Its scale is almost comparable to Shenyang. Changchun is another city of the same class. Daqing, the largest oilfield in China, is located near Anda, mideway between Qiqihar and Harbin. Coal is mined near the peripheral cities Heganag and Shuangyashan. Hydroelectricity is near

Jilin, another important industrial city of over 700,000. The C-H-Q Industrial Area ranks fourth in industrial importance, just behind the Beijing-Tianjin-Tangshan Industrial Area.

TABLE 4.29 CHANGCHUN-HARBIN-QIQIHAR INDUSTRIAL AREA

		1970 Population			
		Lower Est.		Upper Est.	
City	%IDX	%Urban	%Total	%Urban	%Total
1. Changchun	1.03	0.75	0.16	0.75	0.16
2. Xiping	0.68	0.06	0.01	0.19	0.04
3. Jilin	1.27	0.45	0.10	0.45	0.10
4. Liaoyuan	0.37	0.06	0.01	0.19	0.04
5. Harbin	1.82	1.04	0.22	1.04	0.22
6. Anda	0.26	0.06	0.01	0.19	0.04
7. Qiqihar	0.53	0.47	0.10	0.47	0.10
8. Mudanjiang	1.11	0.19	0.04	0.63	0.13
9. Baicheng	0.32	0.12	0.03	0.12	0.03
10. Jiamusi	1.26	0.06	0.01	0.19	0.04
11. Hegang	0.08	0.31	0.07	0.31	0.07
Total	8.71	3.57	0.76	4.53	0.93

[1]Changchun, Jilin, Harbin, Qiqihar form part of an industrial axis which extends southwards, joining with the Shenyang Industrial Area, making the Northeast the most important industrial region of the country. Mudanjiang, Baicheng, Jiamusi and Hegang are important outlying cities.

Lesser Industrial Areas

Aside from the four major industrial areas, six other less impressive, but still relatively importance industrial areas can also be identified. They are:

North China
5. The Zhengzhou Industrial Area
6. The Jinan Industrial Area

South China
7. The Chengdu-Chongqing Industrial Area
8. The Changsha Industrial Area
9. The Guanzhou Industrial Area
10. The Wuhan Industrial Area

5. The Zhengzhou Industrial Area

The Zhengzhou Industrial Area embraces 9 cities which had estimated populations of 100,000 or more within 100 miles of Zhengzhou. Two additional cities belonging to the same economic system are located at distances of not more than 140 miles from Zhengzhou.

Zhengzhou is the meeting place of the major north-south and eats-west railway systems in China and a major textile center. Kaifeng is famous for its silk products. Luoyang is one of the two most important cities in tractor production. The area accounted for close to 3% of China's urban population in 1970. It ranks first among the six lesser industrial areas.

TABLE 4.30 ZHENGZHOU INDUSTRIAL AREA

City	%IDX	1970 Population Lower Est. %Urban	%Total	Upper Est. %Urban	%Total
1. Zhengzhou	1.10	0.66	0.14	0.66	0.14
2. Kaifeng	1.02	0.25	0.05	0.25	0.05
3. Xinxiang	0.47	0.06	0.01	0.19	0.04
4. Jiaozuo	0.58	0.06	0.01	0.19	0.04
5. Xuchang	0.50	0.06	0.01	0.19	0.04
6. Luoyang	0.66	0.36	0.08	0.36	0.08
7. Pingdingshan	0.24	0.06	0.01	0.19	0.04
8. Hebi	0.06	0.06	0.01	0.19	0.04
9. Anyang	0.66	0.06	0.01	0.19	0.04
100 miles:	5.28	1.63	0.33	2.41	1.51
10. Handan	0.64	0.24	0.05	0.24	0.05
11. Nanyang	1.16	0.06	0.01	0.19	0.04
140 miles:	7.08	1.93	0.39	2.84	1.60

6. <u>The Jinan Industrial Area</u>

Centered at Jinan, the administrative capitol of Shandong, this industrial area has 5 cities within 100 miles. Wefeng, the transportation and commercial center, is 115 miles to the east of Jinan. Other important cities such as Yengtai and Qindao are much further east on the Pacific coast.

The Jinan Industrial Area serves primarily as a transportation center connecting the inland railways with the coastal seaports. In the past 10 years, the Shengli oilfield, located just north of Zibo, has boosted the area's importance considerably. The 5 cities in 1970 accounted for approximately 1.5% of the urban population, and ranked fourth among the six in industrial significance.

TABLE 4.31 JINAN INDUSTRIAL AREA

		1970 Population			
		Lower Est.		Upper Est.	
City	%IDX	%Urban	%Total	%Urban	%Total
1. Jinan	1.42	0.69	0.15	0.69	0.15
2. Zibo	0.93	0.53	0.11	0.53	0.11
3. Xingtai	0.35	0.06	0.01	0.19	0.04
4. Jining	0.39	0.06	0.01	0.19	0.04
5. Wefeng	0.58	0.13	0.03	0.13	0.03
120 miles:	3.67	1.47	0.31	1.73	0.37

7. The Chengdu-Chongqing Industrial Area

Besides being the most populous province in China with over 70 million people (65 million in 1970), Sichuan is also known as the food basket of China. Chengdu and Chonqing are the two major cities in Sichuan. Because of its strategic locations along the Chang Jiang (Yangtze River), Chongqing (Chungking) has been the traditional economic and cultural center of this region.

TABLE 4.32 CHENGDU-CHONGQING INDUSTRIAL AREA

		1970 Population			
		Lower Est.		Upper Est.	
City	%IDX	%Urban	%Total	%Urban	%Total
1. Chongqing	1.50	1.50	0.32	1.50	0.32
2. Luzhou	0.42	0.06	0.01	0.19	0.04
3. Nanchong	0.26	0.06	0.01	0.19	0.04
4. Neijiang	0.21	0.06	0.01	0.19	0.04
5. Zigong	0.50	0.63	0.13	0.63	0.13
6. Wanxian	-	0.06	0.01	0.19	0.04
7. Yibin	0.37	0.06	0.01	0.19	0.17
8 Chengdu	1.53	0.78	0.17	0.79	0.17
Area:	4.79	3.21	0.67	3.87	0.82

The Sichuan River Basin is endowed with fertile soil and rich mineral resources. Oil is extracted from shales in the center of the Basin, while natural gas is abundant in most palces. Chengdu is the political and military center. Chongqing is a major river port, a center of railway networks, and one of the few integrated industrial cities in Southwest China. A total of 7 cities of 100,000 and more are located within 150 miles of Chongqing Together with Chengdu, which is about 180 miles to the northwest, the area accounted for 3.2% of China's urban population in 1970.

8. The Changsha Industrial Area

The Changsha Industrial Area includes up to 8 cities around the Donting Hu (Tungting Lake) basin which had 100,000 or more people in 1970. The area is rich in rare minerals and is important for non-ferrous metallurgy. Changsha is the nervous center for Hunan province, and is primarily a city of machine-building, textiles and food-processing industries. Zhuzhou is a new heavy industrial city important for its non-ferrous metallurgy.

TABLE 4.33 CHANSHA INDUSTRIAL AREA

		1970 Population			
		Lower Est.		Upper Est.	
Dongting Hu Basin	%IDX	%Urban	%Total	%Urban	%Total
1. Changsha	1.31	0.52	0.11	0.52	0.11
2. Zhuzhou	1.18	0.16	0.03	0.16	0.03
3. Yiyang	0.60	0.06	0.01	0.19	0.04
4. Hengyang	0.79	0.19	0.04	0.63	0.13
5. Xiangtan	0.74	0.09	0.02	0.11	0.02
6. Changde	0.26	0.11	0.02	0.12	0.02
7. Pingxiang	0.24	0.11	0.02	0.11	0.02
8. Shaoyang	-	0.06	0.01	0.19	0.04
Area:	5.12	1.30	0.26	2.00	0.41

The 8 cities of the Changsha Industrial Area accounted for about 1.3% of China's urban population in 1970, and ranked third among the six lesser industrial areas.

9. <u>The Guangzhou Industrial Area</u>

Guangzhou (Canton), the largest city in South China, is located on the rich delta area of a major river system. It is the political, economic, cultural, and communications center for Guangdong Province. It has also been China's single most important port to the west until recently. Hsitorical reasons aside, Guangzhou's proximity to Hong Kong and Macau made it an indispensable link to the outside world.

Guangdong Province is rich in minerals, and has the largest known deposit of tungsten in the world. The Guangzhou Industrial Area incldues 5 cities (not counting Hong Kong and Macau) which had populations of 100,000 or more in 1970. It accounted for 2% of China's urban population, and edged the Wuhan Industrial Area to rank fifth in Industrial significance.

TABLE 4.34 GUANGZHOU INDUSTRIAL AREA

		1970 Population			
		Lower Est.		Upper Est.	
City	%IDX	%Urban	%Total	%Urban	%Total
1. Guanzhou	1.31	0.52	0.11	0.52	0.11
2. Foshan	0.37	0.19	0.04	0.19	0.04
3. Jiangmen	0.55	0.06	0.01	0.19	0.04
4. Shaoguan	1.00	0.13	0.03	0.13	0.03
5. Maoming	0.32	0.06	0.01	0.19	0.04
Area:	3.78	2.00	0.42	2.26	0.48

10. The Wuhan Industrial Area

Wuhan is a an important river port on the Chang Jiang and a major center for land and water transportation. It is the largest industrial and commercial center in Central-South China, and was the first city to have a modern bridge to allow trains to cross the mighty Chang Jiang. It is also well known for the production of military materials. The area is rich in coal, iron ore, copper, phosphrous, lime, and salt.

The Wuhan Industrial Area includes 5 cities which had 100,000 or more people in 1970. Two additional river ports about 180 miles upstream are also associated with the Wuhan economic system. Together, the 7 cities accounted for approximately 2% of China's urban population. It ranks last among the six lesser areas in industrial significance.

TABLE 4.35 WUHAN INDUSTRIAL AREA

		1970 Population			
		Lower Est.		Upper Est.	
City	%IDX	%Urban	%Total	%Urban	%Total
1. Wuhan	1.66	1.60	0.34	1.60	0.34
2. Huangshi	0.39	0.06	0.01	0.19	0.04
3. Xingyang	0.24	0.06	0.01	0.19	0.04
4. Jiujiang	0.13	0.06	0.01	0.19	0.04
5. Shashi	0.18	0.06	0.01	0.19	0.04
Basic Area:	2.60	1.84	0.38	2.36	0.50
6. Xiangfan	0.26	0.06	0.01	0.19	0.04
7. Yichang	0.35	0.06	0.01	0.19	0.04
Area:	3.21	1.96	0.40	2.74	0.58

Japan

While Japan's industrial sector is large by any standard, and the number of Japanese industrial cities easily match those of the U.S. and the Soviet Union, the industries are higly concentrated in three major areas along the coastal regions in southern Honshu. As expected, Japan's industrial activities take place in the most urbanized areas, which means a 100-mile belt running south of the 36th parallel, with Fukuoka (Hukuoda) and Kitakyushu to the west and Yokohoma and Tokyo to the east.

All the major and secondary industrial areas of Japan have practically a full spectrum of heavy and light industries. Nearly all the industrially important cities are sea ports. Petroleum refineries can be found in virtually in every one of them. Japan is by far the world's largest shipbuilder, and has overtaken the U.S. as world leader in steel production. Principal shipyards are located in all the industrial areas. Japan's three major industrial areas are:

1. The Tokyo-Kawasaki-Yokohoma or Keihin Industrial Area
2. The Osaka-Kobe-Kyoto or Hanshin Industrial Area
3. The Nagoya or Chukyo Industrial Area

TABLE 4.36 JAPAN'S INDUSTRIAL AREAS

Area	#C	%IDX	1970 Population %Urban	%Total
Group I				
1. Keihin	46		29.71	21.42
2. Hanshn	27		14.56	10.49
3. Chukyo	16		6.57	4.73
Total	89		50.84	36.64
Group II				
4. Kitakyushu-Fuk	12		4.67	3.37
5. Okayama-Kurasi	6		2.10	1.52
6. Shimizu	5		1.47	1.06
7. Kanazawa	5		1.45	1.05
8. Hiroshima-Kure	4		1.32	0.96
Total	121		61.85	44.60

A second group of important, but relatively much smaller industrial areas are found mostly along the coast of Seto Nakai (Inner Sea) and a few other locations over the rest of Japan. They are:

4. The Kitakyushu-Fukuoka Industrial Area
5. The Kanazawa Industrial Area
6. The Okayama-Kurasiki Industrial Area
7. The Hiroshima-Kure Industrial Area
8. The Shimizu Industrial Area

Major Industrial Areas

1. The Keihin Industrial Area

The Keihin Industrial Area is located on the Kanto Plain. Within 60 miles of Tokyo are 48 major cities with more than 100,000 people in 1970. Extending the radius up to 100 miles will capture no less than 59 such cities, which accounted for as high as 32% of the urban population or 23% of the national population.

The greater Keihin Industrial Area includes a group of 5 major cities in the Surugu-wan. These 5 cities, while linked to Tokyo communication-wise, actually form a small industrial cluster closely tied to Shimizu (Simizu). The Keihin Industrial Area therefore actually has up to 54 cities which together had about 30% of Japan's population (or 20% of the national total) and close to 25% of Japan's industrial capacity expressed in terms of the IDX score.

TABLE 4.37 KEIHIN INDUSTRIAL AREA

	City	%IDX	1970 Population %Urban	%Total
1.	Tokyo	1.76	14.91	10.76
2.	Sagamihara	0.97	0.37	0.27
3.	Kawaguchi	1.19	0.41	0.29
4.	Kawasaki	1.46	1.30	0.94
5.	Musashino	0.10	0.18	0.13
6.	Mitaka	0.32	0.21	0.15
7.	Ichigawa	0.06	0.35	0.25
8.	Chofu (Tyohu)	0.25	0.21	0.15
9.	Soka	0.53	0.16	0.12
10.	Matsudo	0.59	0.34	0.24
11.	Funabashi	0.61	0.43	0.31
12.	Niiza	0.15	1.04	0.75
13.	Kashiwa	0.38	0.20	0.15
14.	Kodaira	0.25	0.18	0.13
15.	Urawa	0.50	0.36	0.26
16.	Hino	0.43	0.13	0.10
17.	Koshigaya	0.25	0.19	0.13
18.	Yokohama	1.82	2.99	2.16
19.	Narashino	0.32	0.14	0.11
20.	Koganei	0.10	0.13	0.09
21.	Higashimuraya	0.07	0.13	0.09
22.	Higashikurume	0.06	0.10	0.08
23.	Omiya	0.86	0.36	0.26
24.	Tokorozawa	0.25	0.18	0.13
25.	Fuchu (Hutu)	0.39	0.22	0.16
26.	Yamato	0.44	0.14	0.10
27.	Tachikawa	0.10	0.16	0.11
28.	Ichihara	0.58	0.21	0.15
29.	Chiba (Tiba)	1.12	0.64	0.15
30.	Kasugabe	0.06	0.11	0.08
31.	Kawagoe	0.04	0.23	0.16
32.	Ageo	0.53	0.15	0.11
33.	Hachioji	0.59	0.34	0.24
34.	Fujisawa	0.59	0.31	0.22
35.	Atsugi	0.44	0.11	0.08
36.	Yokosuka	0.57	0.46	0.34
37.	Kamakura	0.24	0.19	0.13
38.	Chigasaki	0.70	0.17	0.12
39.	Hiratsuka	0.74	0.22	0.16
40.	Hadano	0.28	0.10	0.07
41.	Tsuchiura	0.38	0.12	0.09
42.	Kumagaya	0.49	0.16	0.12
43.	Oyama	0.69	0.14	0.10
44.	Odawara	0.52	0.21	0.15
45.	Kawanishi	0.10	0.12	0.08
46.	Ashikaya	0.50	0.21	0.15
	Area:	24.31	29.71	21.42

2. The Hanshin Industrial Area

Kobe is the largest port and Osaka is the second largest city in Japan. Much as Yokohama is to Tokyo, Kobe serves as the deep water port for Osaka (which also has its own port facilities) and its hinterland--the Kiuki Lowland. The Hanshin Industrial Area is territorially smaller than the Keihin Industrial Area. The three, however, embrace as many as 34 cities within a 60-mile radius and 50 within a 100-mile radius. Because of the proximity of the Chukyo Industrial Area (which is approximately 80 miles away), cities over 40 miles to the east of Osaka should be more appropriately considered as part of the Chukyo Industrial Area. The boundary of the Seto Nakai areas is about 60 miles to the west of Osaka. In between is the Hanshin Industrial Area which had a total of 27 cities with population over 100,000 in 1970, which formed approximately 16% of the urban population or more than 11% of the national total.

While Tokyo is by far the premier Japanese population-wise, Osaka is just as dominant an industrial center to the Hanshin Area as Tokyo is to the Keihin Area. The Hanshin area with its 27 major cities is responsible for 18% of the nation's industrial capacity.

TABLE 4.38 HANSHIN INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	%Total
1. Osaka	1.76	3.98	2.87
2. Higashiosaka	1.33	0.67	0.48
3. Yao	0.59	0.35	0.25
4. Kodama	0.46	0.19	0.14
5. Neyagawa	0.44	0.28	0.20
6. Moriguchi	0.46	0.25	0.18
7. Hirakada	0.90	0.29	0.21
8. Nara	-	0.28	0.20
9. Suita	0.20	0.35	0.25
10. Ibaraki	0.52	0.22	0.16
11. Sakai	1.32	0.79	0.57
12. Takatsuki	0.67	0.31	0.22
13. Toyonada	0.39	0.49	0.36
14. Amagasaki	0.85	0.74	0.53
15. Nichinimiya	0.49	0.50	0.36
16. Itami	0.76	0.21	0.15
17. Uji	0.42	0.14	0.10
18. Takarazuka	0.19	0.17	0.12
19. Ikeda	0.13	0.13	0.09
20. Matsubara	0.18	0.15	0.11
21. Kishiwada	0.60	0.22	0.16
22. Otsu	0.80	0.23	0.17
23. Kobe	1.28	1.72	1.24
24. Kyoto	1.04	1.90	1.37
25. Akashi	0.86	0.28	0.20
26. Wakayama	0.86	0.49	0.35
27. Kagogawa	0.17	0.17	0.12
Area:	17.67	15.50	11.16

3. The Chukyo Industrial Area

By far the smallest of the three major industrial areas is the Chukyo Area, which had 16 cities of 100,000 or more in 1970. This represented some 6% of the nation's urban population or a little less than 5% of the national total. Industrially, it is dwarfed by both the Kaihin and the Hanshin Industrial Areas, but still contributes cosniderably more both industrially and population-wise than the lesser industrially areas.

TABLE 4.39 CHUKYO INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	%Total
1. Nagoya	1.76	2.72	1.96
2. Kasugai	0.73	0.22	0.16
3. Ichinomiya	0.33	0.29	0.21
4. Seto	1.01	0.12	0.09
5. Toyota	0.88	0.26	0.19
6. Anjo (Anzyo)	0.67	0.13	0.09
7. Yokkaichi	0.86	0.31	0.22
8. Okazaki	-	0.28	0.20
9. Ogaki	0.71	0.18	0.13
10. Gifu	0.71	0.52	0.37
11. Suzuka	0.71	0.16	0.12
12. Toyohashi	0.58	0.35	0.25
13. Tsu (Tu)	0.63	0.17	0.12
14. Matsusaka	0.44	0.14	0.10
15. Ise	0.60	0.14	0.10
16. Hamamatsu	1.26	0.58	0.42
Area:	11.90	6.57	4.73

Traditionally famous for its fine textile products, the Chukyo Industrial Area today is very diversified, and are important for iron and steel, heavy machinery, as well as various kinds of transportation equipments. The famous Toyota (Toyoda) city is found in this area. The Chukyo cities are responsible for about 12% of Japan's industrial capacity.

Lesser Industrial Areas

4. The Kitakyushu-Fukuoka Industrial Area

The Kitakyushu-Fukuoka Industrial Area is a relatively belt of about 125 miles running from Nagasaki and Sasebo in the extreme southwest, funnelling through Kitakyushu and Shimonoseki (Simonoseki) to Tokuyama (southern Honshu) in the northeast. This belt has a total

TABLE 4.40 KITAKYUSHU-FUKUOKA INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	%Total
1. Kitakyushu	1.40	1.39	1.00
2. Shimonoseki	0.71	1.74	1.35
3. Ube	0.58	0.20	0.15
4. Fukuoka	0.39	1.14	0.82
5. Kurume	0.44	0.26	0.19
6. Yamaguchi	0.06	0.13	0.10
7. Hofu	0.34	0.13	0.09
8. Saga	0.15	0.19	0.14
9. Beppu	-	0.13	0.09
10. Tokuyama	0.20	0.13	0.09
11. Omuta	0.53	0.23	0.17
12. Oita	0.69	0.35	0.25
Area:	5.49	6.02	4.44

of 14 cities over 100,000 in 1970. They accounted for about 5.4% of Japan's urban population and 5.5% of its indutrial capacity.

5. The Kanazawa Industrial Area

The Kanazawa Industrial Area is a coastal strip of about 60 miles stretching along the northern part of central Honshu. This area is not as densely populated. It had 5 cities of 100,000 or more in 1970, accounting for 1.5% of Japan's urban population. It is responsible for approximately 5.5% of Japan's industrial capacity.

TABLE 4.41 KANAZAWA INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	%Total
1. Fukui	0.36	0.27	0.19
2. Komatsu	0.30	0.13	0.09
3. Kanazawa	0.84	0.48	0.35
4. Takaoko	1.04	0.21	0.15
5. Toyama	1.44	0.36	0.26
Area:	3.98	1.96	1.42

6. The Okayama-Kurasiki Industrial Area

The Okayama-Kurasiki Industrial Area lies towards the east end of the Seto Nakai belt covering a 50-mile stretch, and in 1970 included 5 major cities of over 100,000, accounting for 2.1% of the urban population It is responsible for 4.75% of the nation's industrial capacity.

TABLE 4.42 OKAYAMA-KURASIKI INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	%Total
1. Fukuyama	0.90	0.34	0.25
2. Okayama	1.29	0.62	0.44
3. Kurasiki	0.93	0.47	0.34
4. Niihama	0.62	0.17	0.12
5. Takamatsu	1.02	0.36	0.27
Area:	4.76	1.96	1.42

7. The Hiroshima-Kure Industrial Area

The shores of Seto Nakai are highly industrialized. Two areas can be identified from the more or less contiguous zone of ports. The Hiroshima-Kure Industrial Area is located towards the west end of this belt. Four major urban and industrial cities are found in the neighborhood of some 45 miles. They accounted for a little over 1% of the urban population or close to 3% of its industrial capacity.

TABLE 4.43 HIROSHIMA-KURE INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	1970 Population %Total
1. Hiroshima	1.20	0.72	0.52
2. Kure	0.71	0.31	0.23
3. Iwakuni	0.74	0.14	0.10
4. Imbari	0.27	0.15	0.11
Area	2.92	1.32	0.96

8. The Shimizu Industrial Area

The Shimizu Industrial Area is located at the periphery of the Keihin area. It has a principal shipyard and a number of petroleum refineries. Some oil is extracted nearby. Aluminum smelting is also performed. The area is small, with some 5 cities of 100,000 or more in 1970, accounting for 1.23% of the urban population. Its contribution to Japan's industrial capacity is estimated at close to 4%.

TABLE 4.44 SHIMIZU INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	1970 Population %Total
1. Fuji (Huzi)	0.69	0.23	0.17
2. Fujinomiya	0.65	0.13	0.10
3. Shimizu	1.01	0.31	0.22
4. Shizuoka	0.88	0.56	0.40
5. Numatsu	0.74	0.24	0.17
6. Area:	3.97	1.47	1.06

North Korea

North Korea has a relatively small population and limited arable land on its 46,740 square miles. Yet the country is rich in mineral resources and hydro-electric potentials. One estimate puts the contribution made by the industrial sector in 1970 at generating 60% of the national income in that year. In the 1960s, planned investment in industry roughly accounted for 57% of total investment, 80% of which went to heavy industries.

Similar to Japan, the population tend to concentrate in the valleys and the lowlands, particularly around Pyongyang. Industries tend to cluster around the few major urban centers along the coasts. There is no industrial area comparable in size to any of those found in the Soviet Union, the U.S., China, or Japan. The Pyongyang area comes closest to being one. Individual cities of some industrial significance are Hamhung-Hungnam, Chongjin, Sinuiju, Haeju-Kaesong, Songjin, Wongsan, and Unggi.

1. The Pyongyang-Nampo Industrial Area

Pyongyong, the capitol with an estimated population of 1.5 million in 1970, is by far the largest city of North Korea. It is a center of chemical, electronics, machine-building and textile industries. iron foundaries are located nearby at Kangso, Nampo, and Songnim. Coal is also mined in the area. Nampo serves as an important port for the entire hinterland, and is one of the four sites with a shipbuilding capcity.

TABLE 4.45 PYONGYANG-NAMPO INDUSTRIAL AREA

	City	%IDX	1970 Population %Urban	%Total
1.	Pyongyang	7.35	23.92	10.02
2.	Songnim	6.76	5.85	2.49
3.	Nampo	8.90	5.85	2.49
4.	Sariwon	6.14	1.86	0.79
	Area:	29.15	37.48	15.79
	<u>Others</u>			
5.	Hamhung-Hungnam	15.63	12.53	5.35
6.	Haeju-Kaesong	12.56	9.68	4.13
7.	Chongjin	11.66	4.78	2.04
8.	Sinuiju	6.76	5.85	2.49
9.	Kimchaek	5.52	5.85	2.49
10.	Wonson	4.00	5.85	2.49
11.	Hoering-Najin	3.07	7.71	3.28
	Area:	88.34	89.73	38.06

South Korea

Under Japanese occupation, the southern part of Korea had been developed to specialize in agricultural and consumer goods production while the northern part in heavy industries, mining and electricity generation. South Korea has abundant arable land but lacks mineral resources and hydro-electricity potential. For historical reasons, it was not as industrialized as North Korea immediately after World War II.

On the other hand, South Korea has more than twice the population of North Korea. Also, there are nearly twice as many cities over 50,000. Since the 1960s, the growth of the South Korean economy as a whole has been phenomenal. The industrial sector experienced the fastest growth. Manufactruing industries mushroomed in the early 1970s. By mid-1970s, heavy industries began to play an important role in the economy. South Korea has been putting a third of its investments in the industrial sector. In 1972, heavy industries contributed about a

TABLE 4.46 SOUTH KOREA'S INDUSTRIAL AREAS

			1970 Population	
Area	#C	%IDX	%Urban	%Total
1. Kyongsong	7	26.54	52.18	21.47
2. Busan-Masan	9	42.85	28.78	11.84
Total:	16	69.39	80.96	33.31

quarter of the entire manufacturing sector. By 1974, the manufacturing industry provided close to 30% of the GNP, and for the first time surpassed the agricultural sector in this respect. In the recent years, considerable effort has been put in off-shore petroleum exploration. even modest discoveries will boost the South Korean economy (and thereby its military potential) considerably.

Despite its relatively small territory (comparable to North Korea's), three clusters of cities over 50,000 can be identified, two of which are of some industrial significance.

1. The Seoul-Inchon or Kyongsong Industrial Area
2. The Busan-Masan or Pusan-Masan Industrial Area

1. The Seoul-Inchon Industrial Area

The immediate neighborhood of the Seoul-Inchon Industrial Area (within 21 miles of Seoul) had four cities over 50,000 in 1970. The population of these four cities accounted for nearly half of South Korea's urban (si) population or a little over one-fifth of the total population. Extending the radius to 60 miles with Seoul as the center, three additional cities of the same class are included. Inchon is the principal port serving Seoul and the neighboring cities. Both Seoul and Inchon have iron ore and steel industries. They are also major textile centers.

TABLE 4.47 KYONGSONG INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	%Total
1. Seoul	12.24	42.74	17.58
2. Eujeongbu	-	0.73	0.54
3. Suweon	-	1.32	0.30
4. Inchon	12.24	4.98	2.05
21 miles:	24.49	49.77	20.47
5. Chuncheon	2.06	0.95	0.39
6. Cheonan	-	0.50	0.25
7. Weonju	-	0.87	0.36
55 miles:	26.54	52.19	21.47

2. The Busan-Masan Industrial Area

Using Busan as the center, an arc with a radius of 60 miles can be drawn over the Korean peninsula covering some 9 cities with populations of 50,000 or more in 1970. Busan does not dominate its immediate vicinity as Seoul does. The total population in the Busan-Masan Industrial Area is less than the city of Seoul by itself. Nevertheless, they accounted for close to 30% of the urban population and over 10% of the national total in 1970. However, this area surpasses the Kyongsang area in industrial importance in many respects. The reasons may have been partly historical (the last U.S. stand in the Korean War) and partly geographical (being a seaport and very near Japan). Busan is the cradle of South Korean heavy industry. Being the

TABLE 4.48 BUSAN-MASAN INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	1970 Population %Total
1. Busan	18.36	14.51	5.97
2. Jinhae	2.06	0.71	0.29
3. Masan	10.19	1.48	0.61
28 miles:	30.61	16.70	6.87
4. Ulsan	8.18	1.23	0.51
5. Chungmu	-	0.43	0.17
6. Gyeongju	-	0.71	0.29
7. Jinju	-	0.94	0.39
8. Samcheongpo	-	0.43	0.17
9. Daegu	4.06	8.36	3.44
58 miles:	42.79	28.78	11.84

second largest city and a principal port, Busan has more industries than any other city in South Korea. It is important for its iron and steel industries. Petroleum refinery is a rapidly expanding industry in Ulsan. Masan is another major industrial city nearby. The electronics industry is highly developed in Jinhae, a smaller city between Busan and Masan.

Taiwan

Taiwan, officially regarded as a province of China on both sides of the Taiwan Strait, had a population of 14.5 million in 1970, and 16 million in 1975. About a quarter of the island is under cultivation. Taiwan has few mineral resources and potential discoveries are unlikely on land. Coal is mined at a (miniscule, compared to local demand) rate of 3 million tons annually, depleting current reserves within 50 years. Crude oil import had consistently accounted for more than 13% of its total import in the 1970s. There has been some modest successes in off-shore explorations in recent years. However, no major oil field has been discovered thus far.

TABLE 4.49 TAIWAN'S INDUSTRIAL AREAS

			1970 Population	
Area	#C	%IDX	%Urban	%Total
1. Taipei-Keelung	16	43.62	38.49	23.71
2. Tainan-Kaohsiung	10	20.71	21.05	12.97
3. Taichung	16	21.94	16.65	10.25
Total:	42	86.27	76.19	46.93

As in the case of Japan, the lack of fuel and natural resources has not prevented Taiwan from being a highly industrialized island. By the mid-1970s, the industrial sector employed as large a labor force as the agricultural sector. Rapid grwoth of major cities have accompnaied the fast industrial growth. Like Korea and Japan, the major urban centers are located along the coastal lowlands. This means a concentration of population along the western part of the island, and particularly around Taipei and Tainan. Three clusters of major population and industrial centers can be identified. They are:

1. The Taipei-Keelung Industrial Area
2. The Tainan-Kaohsiung Industrial Area
3. The Taichung Industrial Area

1. <u>The Taipei-Keelung Industrial Area</u>

Taipei is the capital of Taiwan, and, with a population of 1.74 million in 1975, is also by far the largest city. Keelung had a population of 321,000 in 1970 and 343,000 in 1975, ranking fifth. Light industries are extremely important in the Taipei area, which is served by Keelung, the deep sea port which is also one of the three shipbuilding towns in Taiwan. Textiles, chemical products, construction materials as well as metals and machinery are also concentrated in this area. A special export zone has been created in the late 1970s to attract overseas investment. The area also sits on Taiwan's major coal reserve.

TABLE 4.50 TAIPEI INDUSTRIAL AREA

	City	%IDX	1970 Population %Urban	%Total
1.	Taipei	7.97	19.47	12.00
2.	Yungho	-	0.97	0.60
3.	Sanchung	4.78	2.56	1.58
4.	Hsintien	6.26	1.03	0.63
5.	Taoyuan	4.78	1.15	0.71
6.	Panchiu	2.20	1.21	0.74
7.	Taichi	-	0.60	0.37
8.	Keelung	3.44	3.59	2.21
9.	Chungli	3.44	1.42	0.88
10.	Juifan	-	0.82	0.50
11.	Ilan	1.71	0.80	0.49
12.	Yangmei	-	0.78	0.48
13.	Lotung	1.83	0.56	0.34
14.	Chutung	0.99	0.66	0.41
15.	Suao	1.34	0.58	0.36
16.	Hsinchu	4.90	2.29	1.41
	36 miles:	43.62	38.49	23.71

2. The Tainan-Kaohsiung Industrial Area

Kaohsiung is the largest port in the south, and was the first (as early as 1965) to have a government designated special export zone. Apart from the light and electronics industries which have mushroomed in the past fifteen years, the Kaohsiung area is also the site of many basic industries. Shipbuilding, petroleum refinery, machine-building, and construction materials industries are centered here. With a population of over 800,000 in 1970 and over 1 million in 1976, Kaohsiung ranks behind Taipei as the second largest city in Taiwan. Tainan came in third in population size with a total of 468,000 in 1970, but has since been surpassed by Taichung which had a population of over half a million in 1976. In 1970, the Kaohsiung-Tainan Industrial Area accounted for about 21% of the urban or 13% of the total population.

TABLE 4.51 TAINAN-KAOHSIUNG INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	%Total
1. Tainan	5.76	5.24	3.23
2. Matou	-	0.57	0.35
3. Kangshan	-	0.73	0.45
4. Chisan	-	0.60	0.37
5. Hsinyang	2.70	0.74	0.45
6. Meinung	-	0.65	0.40
7. Kaohsiung	10.05	9.02	5.56
8. Potzu	-	0.56	0.35
9. Fengshan	-	1.11	0.68
10. Pingtung	2.20	1.83	1.13
Area:	20.71	21.05	12.97

3. The Taichung Industrial Area

The importance of the Taichung Area increased considerably in the 1970s. This is clearly indicated by the accelerated urbanization process brought about by deliberate industrial planning. It has been a center for chemicals and metallurgy. Lumber industry is also important nearby. A new deep sea port has been built as one of the ten large government construction projects to serve the Taichung area. A total of 16 cities with populations of 500,000 or more were located within 40 miles of Taichung. In 1970, the area accounted for approximate 17% of the urban or slightly over 10% of the total population.

TABLE 4.52 TAICHUNG INDUSTRIAL AREA

City	%IDX	1970 Population %Urban	1970 Population %Total
1. Tainan	5.76	5.24	3.23
2. Changhwa	3.56	1.51	0.93
3. Chingshui	3.44	0.75	0.46
4. Tsaotun	1.71	0.79	0.49
5. Homei	-	0.61	0.37
6. Taichia	-	0.62	0.38
7. Yuanlin	-	0.89	0.55
8. Nantou	0.49	0.85	0.52
9. Lukang	-	0.74	0.46
10. Puli	0.99	0.85	0.53
11. Erhlin	-	0.64	0.39
12. Chusan	-	0.64	0.39
13. Hsilo	-	0.57	0.35
14. Miaoli	1.71	0.76	0.47
15. Touliu	0.49	0.83	0.51
16. Huwei	0.49	0.70	0.43
34 miles:	21.93	16.65	10.25

Target Structures and Damage Requirements

The lists of countervalue targets by area in Northeast Asia developed above have been compiled to provide a basis for the calculation of nuclear weapons requirements in the next chapter. As the data compiled above suggest, the distribution of targets in terms of their relative population and industrial significance may have a considerable effect on the number of weapons required to inflict a given level of damage. Small countries tend to have an extremely high concentration of industry and population in the top few major cities. Large countries, on the other hand, are more diversified. The disparities in target numbers between large and small countries are also considerable. Japan stands out as an interesting anomaly in that it has both a large population and a large industrial economy concentrated in a very limited area. As a result, it is comparable to large countries in its many large urban and industrial centers, but more similar to small countries with its high concentration of its population industrial capacity in a few major metropolitan areas. Measured in percentage terms, the requirements to threaten a McNamara type of assured destruction against Japan come closer to the small countries than to the large ones. One obvious implication of the target structures compiled above is that the number of weapons required to achieve a given level of dstruction against the enemy in terms of the percentage of population and industrial capacity are likely to be much higher if the target countries is large than if it is small.

CHAPTER FOUR NOTES

1. See Appendix A for data sources.

2. Donald Brennan does not believe that nuclear "balance-of-power" calculations in a multipolar world is likely to happen often, but the possibility should not be excluded. Brennan, "Some Remarks on Multipolar Nuclear Strategy," in Richard Rosecrance ed., The Future of the Internation Strategic System (San Francisco: Chandler, 1972), pp. 25-26. Morton Kaplan suggests that the only condition which makes a "unit-veto system" possible is a multipolar nuclear world. Ibid., pp. 49ff. Richard Rosecrance goes further with the analysis, which leads him to conclude that "multipolar stability cannot technically be attained unless each state or bloc is able to deter others from attacking. At the extreme this means that each should be able to retaliate against any or even all of the remaining powers in the system. More realistically, it requires that a state have the capacity to destroy or severely hurt any possible combination of its likely enemies. Whether this is feasible, however, in turn depends upon the sizes and technical characteristics of deterent forces. If ten nuclear powers possess 100 invulnerable SLBM, and there were no more than five crucial urban targets within each power, there could be mutual multipolar deterrence. If, on the other hand, some nuclear forces were much larger than others, some more vulnerable than others, andd if target systems were larger, it would be much more difficult to get mutual deterrent stability." Rosecrance, Strategic Deterrence Reconsidered, Adelphi Papers No. 116 (London: IISS, Spring 1975), pp. 28-29.

3. Since no nuclear weapon system is absolutely invulnerable to pre-emption and the pressure to pre-empt is the best available "defense" given today's weapons technology, the possibility of nuclear alliances in a world of many nuclear powers suggests that instability rather than stability is the norm in the multipolar nuclear world.

4. The concept of Densely Inhabited Districts, or DIDs, developed by the Bureau of Statistics, has been applied in the censuses of 1960 and after. A DID is defined as "an area within a shi, ku, machi, or mura that is composed of a group of contiguous enumeration districts each of whcih has a population density of about 4,000 inhabitants or more per square kilometer, and whose total population exceeds 5,000 as of 1 October, 1975." Bureau of Statistics, Office of the Prime Minister, 1975 Population Census of Japan, Vol. 1, Total Population, p.xxiii.

5. As defined by Samuel Gladstone and Phillip Dolan in The Effects of Nuclear Weapons, 2nd ed. published under the auspices of the Department of Defense and the Department of Energy (Washington, D.C.: USGPO, 1977), p. 39, the term "ground zero" refers to the point on earth's surface immediately below (or above) the point of detonation. For a burst over (or under) water, the corresponding point is generally

called "surface zero." Designated Ground Zero refers to the intended point of detonation. Sometimes, a target may be too large for a single bomb to destroy, in which case more than one DGZs are required. Large metropolitan areas such as Tokyo, Shanghai, Moscow, New York are some examples which require more than 1 DGZ to produce a 5 psi level of destruction as long as the warhead yield is short of 20 megatons.

6. Endicott, Japan's Nuclear Option, op. cit., pp. 170-171; Kemp, Nuclear Forces for Medium Powers, Part I, op. cit., pp. 25-31.

7. The U.S. and Japan, for example, have periodically conducted censuses on population and manufactures. China and North Korea, on the other hand, do not even have reliable estimates, which are publicly available, on their urban population sizes, let alone information on the industrial capacities of their cities. A common denominator must therefore be derived to permit cross-national comparisons. This means that the quality of data on the U.S. and Japan will have to be brought down to a level which is comparable to the data on China and North Korea, and yet remain meaningful at least in a crude manner. Both South Korea and Taiwan also have population censuses, but their census on manufactures are not detail enough to provide information at the city level outside a few areas such as Seoul and Taipei.

8. An industrial significance score conducted primarily on the basis of industrial diversity rather than capacity inevitably embraces distortions. However, in lieu of any usable information on the latter, such a score is remarkably reflective of the relative industrial significance of the cities. Also, it does provide a common denominator on which cross-national comparisons becomes feasible.

9. Kemp, "Nuclear Forces for Medium Powers, Part I," op. cit.

10. The 200-mile outer limit is empirically applicable also to the U.S. and China. Most areas are within the 100-mile range. This is perhaps a function of the interaction among modern social, economic, and geographical structures. A 60-mile range is more applicable to Japan and the lesser states.

CHAPTER FIVE

REQUIREMENT STRUCTURES

Time Frame: Circa 1990

For the purpose of this analysis, it is assumed that by 1990, all military powers of the Northeast Asia region will have acquired nuclear weapons. The U.S., the Soviet Union and China are already in possession of such capabilities. Japan has both the delivery system and the ability to produce the warheads on short notice.[1] It is as close to an effective nuclear power as one can be. It has also been reported that South Korea had embarked on an ambitious covert operation to acquire the essential components for the production of nuclear weapons.[2] As is true of Taiwan and Japn, South Korea is already in possession of SAM batteries of which some are Nike-Hercules missiles. The Korean air forces of 1980 have three squadrons of F-4D/E Phantom fighters capable of delivering nuclear weapons. By now, it has become obvious that Taiwan has been engaging in a low-keyed but very serious effort to acquire all the necessary technology and industrial infrastructure for a nuclear capability. Its attempts to acquire the nuclear capable jet fighters such as the F-4E, F5-G, and the F-16 have not been successful so far.[3] However, this is likely to be a temporary situation, since both South Korea and Japan have already been so equipped. Also, Taiwan has been rigorously training scientists in missile guidance technology. Like South Korea, its army is armed with the dual-capability Nike-Hercules missiles. There is little information on North Korea's nuclear program. It is nevertheless quite reasonable to assume that North Korea will try to stay competitive militarily vis-a-vis South Korea even though South Korea may well acquire nuclear capabilities ahead of the north. In sum, all seven powers of the region will have become nuclear powers within our time frame.

Strategic Goals

It is assumed by this study that the primary purpose of a nuclear weapons program is to deter enemy aggression against key values, the most basic one being national survival. This is particularly true of small powers such as the two Koreas and Taiwan. Indeed, the very same motivation has been the driving force behind China's nuclear weapons program. It is conceivable (though unlikely) that the U.S.-Japaneses relationship may sour to the point of becoming antagonistic, in which case the insular, resource-dependent industrial giant may opt for a crash program to re-arm. In fact, the increasing Soivet military build-up in the north and the rapidly decreasing American ability to project power all over the globe have already ushered in an era of serious rethinking on re-armament.[4] Under such circumstances, it would be surprising indeed if the strategic and tactical implications of nuclear weapons are not seriously considered.

As it has been discussed earlier, three tiers of nuclear powers can be identified. In this case, the Soviet Union and the U.S. are the superpowers whose nuclear weapons program have gone well beyond the necessities for national survival. Consequently, on top of the fundamental concern for deterrence, complex theories have been articulated to anticipate the different circumstances under which nuclear weapons may be employed to advantage. While the superpowers view each other as the primary adversary in a war involving nuclear weapons, the battlefield implications for such weapons have not been lost to the medium powers. Given their vastly superior forces, it would be most surprising if Washington and Moscow do not have contigency plans of a pre-emptive and preventive nature to eliminate the strategic nuclear forces of China on the one hand, and those of France and England on the other. The same logic may be extended to embrace the other Northeast Asian powers.

Accordingly, while the strategic goals of the powers are primarily countervalue, they do have obvious counterforce requirements. This does not mean that a medium power would and could realistically strive for a comprehensive counterforce capability against a superpower, or even against another medium power for that matter. Given existing technologies, the offense is still favored to dominate any strategic exchange, such that within our time frame the capability to inflict severe damage is much easier to acquire.[5]

Along the guidelines developed by Kemp and Endicott, two categories of tagets will be considered: major population centers and their corresponding or adjacent industrial facilities. Industrial areas have been delineated on the basis of their obvious importance. The structure of these targets largely determine the relative efficiency and inefficiency of enemy targetting options. For example, when major urban centers are ranked (in terms of population size) in descending order of priority for target assignment, it is natural for the marginal return per target assigned to decrease dramatically beyond a certain point. According to the calculations of Enthoven and Smith, a level of 400 EMT is sufficient to destroy 30% of the population and 76% of the industrial capacity of the Soviet Union. This has already exceeded the upper limit of the McNamara criteria for assured destruction. The delivery of an additional 400 EMT would only destroy an additional 9% of the population, and 1% of the industrial capacity. Theoretically, it is possible to reach a marginal return of close to zero before the McNamara criteria can be met. This is quite likely with a country like China or India, where the population is predominantly rural. Similarly, a country which is non-industrial and nomadic can rapidly give zero marginal returns.

Required Damage Levels

As it has been discussed earlier, assured destruction means no more than the capacity to inflict unacceptable damage on an adversary under all circumstances. McNamara and others have stretched the definition to connote specific requirements of one fifth to one-fourth of the Soviet population, and one-half of the Soviet industrial capacity, as the yardstick for strategic sufficiency (for the U.S.), requirements beyond which are supposedly meaningless, and by which a minimum deterrent has been attained. An added incentive to stay with the minimum (and finite) deterrent is that it rationalizes force sizing and avoids a weapons-matching strategic arms race. Colin Gray, on the other hand, argued that the famous McNamara cut-offs are no more than operational conveniences in terms of demographic and economic data, and by themselves have little to do with political considerations.

Theoretically, there can be an infinite number of levels of damage that could be inflicted upon an enemy provided that the capability is there. This study identifies two typical required damage levels for each power, moderate and severe. The moderate damage levels (D_1 and D_2) calls for the destruction of one-fifth to one quarter of the urban population, while the severe damage levels (D_3 and D_4) approximates the lower bound of McNamara's operational definition by calling for the destruction of one-fifth of the national population.[7] (See Tables 5.3 and 5.4). In practical terms, this means the destruction of up to one-half of the industrial capacity for some powers.

Weapons Requirements

It is assumed that nuclear warheads when detonated produce more or less the same effects regardless of their origin of production.[8] Also, this analysis is primarily concerned with the physical destruction of industrial structures and inflicting casualities on the population. The immediate contributing factors in these respects are thermal radiation (heat) and blast (shock wave).[9] Since the effects of thermal radiation depend high on the nature of the burst (surface or air) and the prevailing metecrological conditions, blast will be used as the measure of expected damage.[10] The effects of blast in terms of peak overpressure are summarized as follows:[11]

TABLE 5.1 THE EFFECTS OF ATOMIC BLAST

Type of Targets	Level of Damage	Peak Overpressure (PSI)
Wood-frame building,	Moderate	2 to 3
residential, 1-2 stories	Severe	3 to 4
Parked aircraft,	Moderate	1 to 2
including helicopters	Severe	2 to 3
Masonry building,	Moderate	3 to 4
multi-story, unreinforced	Severe	5 to 6
Exposed population	Moderate	5 to 6
	Severe	7 to 10
Railroad equipment	Moderate	4 to 6
	Severe	7 to 9
Multi-story building	Moderate	6 to 7
monumental, up to 4 stories	Severe	8 to 11
Multi-story (3-8) building	Moderate	8 to 11
reinforced concrete	Severe	11 to 15
Shallowly buried corrugated	Moderate	40 to 45
steel arch	Severe	45 to 60
Shallowly buried	Moderate	100 to 220
concrete arch	Severe	220 to 280
Missile shelters	Severe	300+ to 600+
Missile silos	Severe	500+ to 3,000+

On the basis of the above information, a blast effect of 5 psi overpressure would cause moderate to severe damage on unprotected population and residential structures. A blast effect of 10 psi overpressure would cause moderate damage to industrial structures (reinforced concrete) and severe damage to exposed population.[12] Indeed, if effects other than blast are also taken into consideration, a 5 psi blast would serve as a reasonable level of destruction.[13] In fact, many light industries are not housed in strucures of reinforced concrete. Besides, even if such structures survive the effect of blast, the delay effects of radiation could render the site useless for years to come. The choice of 5 psi over, say, 10 psi is based on relative efficiency. While a 1 mt warhead will cover close to 60 square miles (at 900 ft. Scaled Height of Burst, or SHOB) at 5 psi, it will only cover an optimal of 24 square miles (at 600 ft. SHOB). When all the effects have been taken into consideration, 5 psi appears to be a satisfactory minimum for all practical purposes.[14] Only countries with a vast surplus of nuclear weapons can afford the luxury of going for additional insurance at 10 psi or more. It is possible that counterforce considerations may influence force planning to take account of the need for hard target kills. Therefore, in our analysis which is primarily based on retributive countervalue considerations, a 5 psi peak overpressure appears to be suffice. Furthermore, the pursuit of minimum countervalue force posture does not preclude counterforce use of the weapons concerned in some limited way.

TABLE 5.2: BLAST EFFECT OF 5 PSI AT OPTIMAL SCALED HEIGHT OF BURST

Warhead Yield (mt)	Area (sq.mi.)	Lethal Radius (mi)*
.02	4.37	1.18
.04	6.97	1.49
.05	8.04	1.60
.10	12.57	2.00
.15	16.62	2.30
.17	18.10	2.40
.20	19.95	2.52
.30	26.42	2.90
.34	28.27	3.00
.50	36.32	3.40
.55	39.59	3.55
.60	40.72	3.60
.90	55.42	4.20
1.00	59.45	4.35
2.00	91.61	5.40
4.00	145.27	6.80
5.00	174.37	7.45
9.00	254.50	9.00
10.00	274.65	9.35
15.00	366.46	10.80
18.00	401.15	11.30
20.00	437.44	11.80

SOURCE: Nuclear Bomb Effects Computer, dveloped by E. Royce Fletcher of the Lovelace Biomedical and Environmental Reserch Institute, Inc., Albuquerque, New Mexico for the Division of Biomedical and Environmental Research, Energy Research and Development Administration, based on data from The Effects of Nuclear Weapons, revised ed., 1977.

NOTE: *Lethal Radius measures the destructive power of a warhead in terms of blast on a given target, and is defined as the distance from the point of the explosion within which the warhead will be able to destroy the target (in this case, at 5 psi overpressure).

As with Endicott, the 1 mt warhead has been chosen as the basic weapon for analysis. The choice is largely a result of two considerations. First, a 1 mt warhead detonated at optimal SHOB will cover some 60 square miles at 5 psi, assuming that the effects of blast will be roughly circular. This would mean a radius of about 2 miles from the point of burst and is far enough to embrace the city limits of most, and the city centers of nearly all large urban places. Secondly, the 1 mt warhead is well within the throw-weight allowance of most strategic missiles, and indeed is the specific design for most single-warhead second generation strategic missiles both for the U.S. and the Soviet Union. These two factors make it a good choice on the basis of efficient use of delivery vehicles and warheads in a non-MIRV situation. However, it is not as optimal a choice for some counterforce targets (particularly non-hardened ones). For a deterrent which is primarily retributive in design, the dual purpose of the threat and the use of nuclear weapons is not unduly compormised by this simplifying assumption. Whenever delivery systems require that the warhead be in the kt range, the 1 mt simplifying assumption will be relaxed. This is more likely the case with small nuclear powers whose delivery systems are basically purchased rather than indigenously designed. Even so, adaptations and modifications may still be possible.

Weapons requirements will be considered in terms of the options in delivery systems available at the two levels of destruction. Degradation factors such as survivability, operational and penetration will also be considered.[15] Survivability factors reflect the likelihood of a delivery system surviving a pre-emptive strike to carry out its retaliatory mission. Operational effectiveness is reflected by in-commission rates for aircrafts and boats, launch rates and in-flight factors for missiles, pilot target acquisition rates, and warhead reliability rates.[16] Penetration factors are largely a function of enemy defense posture (such as AA, ABM, ASW systems) and the ability of the offense to counter the defensive measures.[17] Since precise information on such factors are not readily available, rough approximations will be used to reflect the overall effects of these factors on weapons requirements.

Overall Target structures

The overall target structures of the seven powers concerned are determined by the numbers, the size, and the geographical distribution of the targets. Intuitively, the larger the number and the size of the targets, the more sparsely located and the better protected they are, the greater the requirements for their destruction. Countries with a large population and expansive territory are usually at an advantage. Conversely, small countries do not impose as stringent a requirement for credible deterrence. This relationship is amplified by the fact that most small countries tend to have a high percentage of their population in urban areas regardless of the size of the population.[18]

Table 5.3 DISTRIBUTION OF POPULATION, INDUSTRIAL CAPACITY, AND WARHEAD REQUIREMENTS (1 mt/5 psi)

	20% Urban			25% Urban			20% National			25% National		
	Cities	Warheads	% IDX	Cities	Warheads	% IDX	Cities	Warheads	% IDX	Cities	Warheads	% IDX
USSR	17	48	16.50	25	64	22.98	56	99	39.40	107	150	64.35
USA	22	83	28.13	40	148	45.02	50	165	51.26	105	239	81.26
CHINA	11	46	18.60	17	58	21.52	370*					
JAPAN	3	13	23.58+	5	20	28.50	6	24	29.99	12	40	36.84
S.KOREA	1	6	12.74	1	6	12.74	2	11	30.61	3	15	34.67
N.KOREA	1	8	7.35	2	10	19.01	6	19	41.40	8	23	56.75
TAIWAN	1	5	7.97	2	7	18.01	3	10	23.78	5	16	34.56

NOTES:

*Including towns of 50,000-100,000. Chen. op. cit., p. 70.

+On the basis of value added in manufacturing industries, National Association of Mayors, ed., Municipal Year Book of Japan, (Tokyo, 1968). The actual % IDX score is 5.38 for 3 cities, and 8.60 for 5 cities.

In a way analogous to the discussion on nuclear deterrence among the superpowers, the medium powers and the small powers target structures can be more conveniently analysed under two categories. The first category is comprised of the Soviet Union, the U.S., China, and Japan, and the second, Taiwan, South and North Korea. The rational behind this classification is obvious given the large numbers of important cities (population 100,000 and over in 1970) in the countries of the first category. While Japan does have a large number of industrial cities, they are highly clustered to three big areas, and have a relatively high percentage of its population concentrated on the few top cities. This suggests that in some ways, Japan is more vulnerable to small nuclear forces than any of the three in the first group. Table 5.3 illustrates this point clearly.

According to the data in 1970, the requirements in terms of 1 mt warheads actually delivered on target are the highest for the U.S. in terms of the proportion of its urban population under attack. When expressed in terms of the proportion of the total national population, however, the numbers of cities concerned become quite comparable between the U.S. and the Soviet Union. In this case, American cities tend to be larger area-wise.[19] The corresponding warhead requirements are also higher.

While China probably has the largest absolute number of urban dwellers in the world, only one in five of its population are urbanites. This would mean that a maximum of 20% of its population are located in meaningful point targets. An estimated total of 370 towns and cities of 50,000 and over accounted for this subtotal in 1970.

Table 5.4 AVERAGE % IDX PER CITY AND PER WARHEAD (1 mt 5 psi).

	D_1 20% Urban		D_2 25% Urban		D_3 20% National		D_4 25% National	
	Per City	Per Warhead	Per City	Per Warhead	Per City	Per Warhead	Per City	Per Warhead
USSR	0.97	0.34	0.92	0.36	0.70	0.40	0.60	0.43
USA	1.28	0.34	1.13	0.30	1.03	0.31	0.77	0.34
CHINA	1.69	0.40	1.27	0.37				
JAPAN	7.86	1.81*	5.70	1.43*	5.00	1.25*	3.07	0.92*
S. KOREA	12.74	2.12	12.74	2.12	15.31	2.78	11.56	2.31
N. KOREA	7.35	0.92	9.50	1.90	6.90	2.18	7.09	2.47
TAIWAN	7.97	7.97	9.00	2.57	7.93	2.38	6.91	2.16

NOTE:
*See notes in Table 5.3.

Assured destruction in McNamara's sense is not very realistic given such a population distribution. On the other hand, a small number of the largest cities in China contain a very high percentage of its total urban population. Furthermore, China appears to have the highest concentration of industrial installations in its large urban centers. Table 5.4 shows that the average industrial score per city for its top 20% and 25% of its urban population were 1.69 and 1.27 respectively. These are much higher than the corresponding scores of the U.S. and the Soviet Union.

With respect to the second group of powers, By far the most vulnerable on the list is South Korea. Its top three cities accounted for one quarter of its total population and one third of its industrial capacity in 1970. Taiwan is comparable to South Korea in that the distribution of its top five cities covers the same proportion of population and industry and requires roughly the same number of warheads.

Actual warhead requirements are not directly affected by the location of the cities. But geographical expanse does have an impact on the delivery system itself. According to the study by Endicott, for example, a distance of 500 nautical miles from Japan (Okinawa included) would cover 7 cities on the mainland of China with 200,000 or more. With a range of 800 nautical miles, 51 additional cities of the same class would be covered. The list would increase by 32 if the range were raised to 1,500 nautical miles. With 4,000 nautical miles, all 92 cities of 200,000 or more in China (1970) would be covered. Therefore, delivery systems with a range of 4,000 nautical miles can reach practically any target in China.[20] The same, however, cannot be said of the Soviet Union. Japanese land-based missiles would have to have an all-azimuth capability in order to threaten European Russia where most of the major urban and industrial centers are located. The optimal solution, as it has been suggested, is to operate a viable fleet of ballistic missile submarines which could then patrol the Sea of Japan, the Bay of Bengal, and the Arabian Sea. if conditions permit, a few may even enter the Mediterranean Sea. A 2,500 nautical mile SLBM system with launch points from the Arabian Sea would cover the top 25 Soviet cities of 600,000 or more in 1970. A 4,000 nautical mile SLBM system can reach any target within the Soviet Eurasian masses.

With respect to the U.S., an SLBM system operating off the coast of the Pacific states would have high survivability given the vastness of the Pacific Ocean. Any SLBM system which presents a credible second strike capability against the Soviet Union should be equally if not more applicable to the U.S.

Whereas the three countries with large land masses require that Japan or any other nuclear power in the area develop long range delivery systems, the reverse is true for Taiwan, South and North Korea. Their proximity to each other means that fighter bombers and MRBMs are adequate for all practical purposes. This is also true for Japan, and in some respects to China as well.[21] It is therefore quite obvious that geographical configurations do have very significant impacts on force postures.

Methodological Assumptions

Probability factors will be assigned to approximate as close as possible the possible combined effects of offensive, defensive, and operational measures. The probability factors are derived from a composite of educated guesstimates by a number of authors, and are assumed to be basically true within the 1990 time frame.[22] As such, they are necessarily illustrative at best. Three different levels of defense postures have been developed--low, medium, and high--to accomodate the different levels of military preparedness in each of the four scenarios.

In order to carry out its mission successfully, an offensive weapon system must survive a pre-emptive attack first. Different offensive systems have different survivability factors gauged according to their vulnerability to pre-emptive strike. Missiles in general are less vulnerable than parked aircraft. Submarines are subject to degredation by ASW measures. Given the shortness of warning time in a missile attack, weapon systems with greater mobility and better protection will have higher survivability factors than those which are less mobile and more exposed. The survivability factors are summarized in Table 5.5.

Offensive systems also have different levels of preparedness. Submarines usually have low in-commission rates because of their high demands for maintenance and re-supply. Servicing time for submarines are also respectively long. Aircrafts and missiles enjoy better in-commission rates and launch rates. In this study, it will be

TABLE 5.5

SURVIVABILITY FACTORS

Weapon System		
1. Strike aircraft/fighter-bombers		
Offensive military posture:	low	.15
	medium	.10
	high	.05
2. Medium/Long range bombers		
On air alert		.90
3. Mobile ICBMs, SLBMs, ICBMs with Launch-on-warning posture*		.90
4. SSBNs		
Existing ASW capabilities:		
missile range 2,500 nm	1-10 boats	.80
	11-20 boats	.85
missile range 4,000 nm	1-10 boats	.90
	11-20 boats	.95
Improved ASW capabilities		
missile range 2,500 nm	1-10 boats	.60
	11-20 boats	.70
missile range 4,000 nm	1-10 boats	.70
	11-20 boats	.80

NOTE: *ICBMs, even if silo-based, have a much lower survivability factor of 0.2 under non-multiple attack (i.e. one shot) and 0.04 after two shots.

TABLE 5.6

OPERATIONAL FACTORS

Aircraft In-commission Rate:		
Fighter-bombers		.80
Medium/Long range bombers		.75
Missile Launch Rate		
ICBM		.90
SLBM		.90
Target Acquisition		
Warhead Reliability	all systems	1.00
In-flilght Reliability		
ABM Single-Shot Kill Probability		.80

SOURCE: See note 22.

assumed that neither target acquisition nor warhead reliability contribute significantly to the degradation of the overall reliability of the weapon systems. Rapid advances in guidance systems and the near-perfect record of warhead tests support this simplifying and yet realistic assumption. Table 5.6 gives a summary of these operational factors.

The success of offensive weapon systems also depends in part on the defensive measures taken by the enemy. ABM systems deployed at specific points can raise considerably the requirements for successful penetration of these protected points. ASW measures, on the other hand, can prevent to some extent, the offensive SSBNs from reaching their launch points. Anti-aircraft (AA) measures are perhaps the most effective among the three. As a result, the penetration rate of aircrafts remain the lowest. Table 5.7 gives a summary of the penetration factors of aircrafts.

The overall reliability of the offensive weapon system is therefore a function of its ability to survive an enemy pre-emptive strike, its operational efficiencty, and its ability to penetrate enemy defensive measures. The CEP values of nearly alll known missiles are so small that at 5-10 psi, the Single-Shot Kill Probabilities (SSKPs) of all the missiles are practically 1.0, with the exception of the outdated Soviet SS-N-5 (which is estimated to be 0.898642 at 5 psi).[23] For this reason, the SSKPs for the different missiles has not been included as part of the operational factors as it would have been otherwise in a study of hard target (e.g. silo) kills.

TABLE 5.7

PENETRATION FACTORS

Defensive Posture		Fighter-Bombers G1	Fighter-Bombers G2	Fighter-Bombers G3	Medium/Long Range Bombers G1	Medium/Long Range Bombers G2	Medium/Long Range Bombers G3
Low	G1*	-	.30	.20	.50	.40	.10
	G2	.50	.40	.30	.60	.50	.40
	G3	.60	.50	.40	.70	.60	.50
Medium	G1	-	.25	.20	.45	.30	.20
	G2	.45	.35	.25	.55	.45	.30
	G3	.60	.45	.40	.65	.55	.45
High	G1	-	.20	.10	.30	.20	.10
	G2	.45	.30	.15	.45	.30	.15
	G3	.60	.45	.30	.60	.45	.30

SOURCE: See note 22.

NOTE: *G1, G2, G3 represent Superpower, Medium Power, and Small Power respectively. The column entries represent the offensive weapons system, while the row entries represent the defensive postures. For example, the penetration rate for the medium bombers of a superpower (G1) versus the AA measures of a medium power (G2) at a high defensive posture is 0.45.

As the different countries have different levels of technical proficiency and industrial capability, their abilities to protect their offensive weapon systems and to counter enemy defensive measures also differ. It is quite likely that the Soviet Union, the U.S. and Japan could improve their ASW capabilities considerably within our 1990 time frame. On the other hand, China may not. Also, it is questionable if ASW is a priority concern for the three small powers. Effective AA systems are more meaningful for them. Again, China probably will not emphasize existing ABM technologies in order to develop and deploy ABM missile systems. All indications point to a more future-oriented high energy option such as laser and/or charged particle beams. Such a system may not, if at all, be deployed on an extensive scale even for the Soviet Union and the U.S. given our time frame. While the U.S. has mothballed the only ABM system it had ever built, the Soviet Union is likely to push towards the upper limit of the number of ABM launchers allowed under Salt I. This will be reflected by the penetration factors.

Geographical configuration indirectly affects the survivability of offensive weapon systems in that small geographical size and proximity to enemy forces do not leave much room for advance warning or deployment dispersal. Japan, Taiwan, North and South Korea are distinctly disadvantaged in this respect. The U.S., on the other hand, is most privileged. However, strategies do exist to obviate some of these shortcomings. Launch on warning, launch under attack, airborne alert and other measures can be taken to circumvent these limitations due to size. Survivability rates can be maintained at reasonable levels by such means.

The Soviet Union

As far as the Soviet Union is concerned, the U.S. will likely remain the chief competitor and adversary for the foreseeable future. This is borne out not only by the fact that the U.S. has by far the most impressive strategic arsenal, it is also the only global power for a long time to come. In terms of the number of countervalue targets, the U.S. has more cities for either one fifth or one quarter of its population. In the national population were used as the base, China with its low urban to rural population ratio will appear to possess an extremely high tolerance level. While the Soviet Union undoubtedly has the capability today to wipe out in a second strike mode the 400 or so Chinese cities and towns, it can be reasonably argued that in order to deter China from attempting an all-out assualt on the Soviet Far East, much less should be sufficient.

Traditionally, Japan has been the chief rival for Soviet expansion in the Far East. Today, Soviet military might dwarfs Japan in nearly every respect. Japan is potentially capable of posing some threat to Soviet security. It is conceivable that Japan will possess a strong navy within a decade, by which time the Soviet heartland may no longer be immune from Japanese strategic strikes. However, under all circumstances, and by any standard, Japan will be much more vulnerable to Soviet forces that the other way around.

The nuclearization of the small powers in Northeast Asia will not negate the strategic superiority of the Soviet Union to any significant extent. It is extremely unlikely that North or South Korea for example will embark on an ICBM program or a fleet of ocean going SSBNs. At least in the next few years the smaller powers do not consider the Soviet Union as a direct threat to their very existence. Their perception in this respect will remain basically the same across the four scenarios of international relations in Northeast Asia.

The minimum deterrence requirements for the Soviet Union discussed below are summarized in Table 5.8 and Table 5.9.

TABLE 5.8

USSR: WARHEAD REQUIREMENTS

Scenario	#Cities	Before Degradation 1-2mt	Before Degradation 550-600kt	After Degradation 1-2mt	After Degradation 550-600kt
1	50	165	372	204	460
2	67	227	456	281	563
3a	56	189	406	234	502
3b,4	73	251	490	310	605

Scenario I: General Detente

Detente does not imply alliances or comradeship. It signifies the easing of tensions and willingness to accomodate conflicting views and interests. In this respect, enemies still exist but the likelihood of war is relatively low. The basic element of international relations within the context of detente is still superpower competition and rivalry. However, as it has been explored in some detail earlier, the objective reasons for Sino-Soviet accomodation and Soviet-American detente are both powerful and persuasive. There is every reason for Japan to seek good relations with its continental neighbors. Improved economic relations will not only be beneficial to Japan, but to China and the Soviet Union as well.

For this scenario to be possible, the Soviet Union and the U.S. must have come to some form of mutual understanding on restrained international behavior. The Soviet Union must have pulled back its troops from advanced positions along the 4,000 mile Sino-Soviet border. Neither the U.S. nor Japan overtly seeks to promote the independence of Taiwan. And, in principle, the Soviet Union agrees to negotiate with Japan on the status of the Northern Territories while leaving the occupied islands demilitarized. In the meantime, China and Japan have carefully avoided potentially explosive issues such as rights and sovereignty to subterranean resources and islands in the East China Sea (Tiaoyutai Islands included), and evolved mutually acceptable trade and aid relationship with Southeast Asian countries.

In the relatively relaxed atmosphere of general detente, the immediate strategic needs would be very much that of a one war policy for the major powers in the area. Assuming that waht McNamara considered to be unacceptable damage to the Soviet Union was really "ethnocentric" as some of its critics later claimed, the level of destruction set at one-fifth to one quarter of population and one half of industrial capacity was then actually a reflection of what might have been considered unaccpetable to the U.S. As Table 5.3 has shown, the top 50 American cities (D_3) in 1970 accounted for 20% of the nation's population, and approximately one half of the industrial capacity as measured by the IDX score. The actual DGZ requirement for D_3 is 165 for 1 mt warheads, and 372 for 550-600 kt warheads.

Like the U.S., the Soviet Union is in possession of a full range of delivery systems any one of which could meet the requirements alone. At damage level D_3, a total of 204 SS-11 mod 1 ICBMs are needed after allowing for degradation. As of July 1979, the Soviet has deployed up to 638. In terms of the MIRVed SS-19, 77 launchers are needed while 144 have already been deployed. Similarly, more vehicles than required are available in each of the ICBM as well as the SLBM categories even if damage level D_4 is called for.

Assuming a 0.8 system reliability for its SSBN forces (to account for imporved ASW capabilities) and an on patrol coefficient of 0.5, the number of submarines required at D_3 is 37 for the 16-tube Yankee class, 43 for the 12-tube Delta I class, or 32 for the 16-tube Delta II class. Two new nuclear powered submarines, the Delta III and the Typhoon have just entered service. They will cut down the fleet

TABLE 5.9

USSR: WEAPONS REQUIREMENTS

Weapons	Load	#VEHICLES REQUIRED PER CATEGORY[3] S1	S2	S3a	S3b	S4	July, 1979[1] #Deployed
ICBM Options							
SS-11 mod 1	1x1-2mt	204	281	234	310	310	638
SS-13/16							60
SS-17	4x900kt	51	71	59	78	78	100
SS-18 mod 2	8x600kt	58	71	63	76	76	200
SS-19 mod 1	6x550kt	77	94	84	101	101	300
SLBM Options							
SS-N-6 mod 1&2							528
SS-N-8	1x1-2mt	204	281	234	310	310	266
SS-NX-17							12
SS-NX-18	2x1-2mt	68	94	78	104	104	144
SSBN Options[2]							
Yankee	16 tubes SS-N-6/SS-NX-17	37	51	42	56	56	34
Delta I	12 tubes SS-N-8	43	59	49	65	65	15
Delta II	16 tubes SS-N-8	32	44	37	49	49	5
Delta III	16 tubes SS-NX-18	11	15	13	17	17	-
Typhoon	24 tubes SS-NX-18	7	10	9	11	11	-
Bombers							
Tu-95	42,000 lbs.						113
Mya-4	20,000 lbs						43
Tu-16	20,000 lbs.						613
Tu-22	17,500 lbs.						80

NOTES:

[1]Deployment figures based on The Military Balance, 1979-1980 (London: IISS, 1979).

[2]Configuration of Delta III and Typhoon based on John Moore,ed., Jane's Fighting Ships, 1979-1980 (New York: Franklin Watts, 1979).

[3]For each delivery system, as if they were stand-alone systems, and assuming that land-based ICBMs can operate under launch-on-warning conditions.

size required to 11 and 7 respectively. At the present, the Soviet SSBN force combined can meet any of the four levels of damage. This is on top of a considerable SSB force which may be phased out in the future but is still in operation today.

Despite its traditional preference for big bang missiles and general neglect for long range bombers, the Soviet Union still has a fleet of some 156 such planes. Assuming an in-commission rate of 0.75, penetration rate of 0.5, and survivability of 0.9 (on air alert), this fleet can be expected to meet the requirements of D_3 by itself. There are some 700 additional medium range bombers which can render support.

In sum, the Soviet Union does possess a certain triad which is roughly symmetrical to the American strategic forces. There is heavy redundancy to ensure that a substantial number of them will survive. The sizes of these strategic forces are clearly much larger than the minimum. As of today, the Soviet strategic forces as a whole are not vulnerable to a first strike even theoretically. They are invulnerable in the sense that the second strike retaliatory capability has been emphatically assured.

It is possible that under the atmosphere of general detente, the Soviet Union may, either in agreement with the U.S. or perhaps even unilaterally decide not to replace part of its obsolete bomber fleet, diesel powered submarine fleet, or phase out some of the out-moded missile forces to reduce numerically the sum total of its strategic delivery vehicles. Such reduction is likely to match American moves of a similar nature such that at no time the U.S. could conceivable succeed in a first strike against the Soviet strategic forces. From the American point of view, the processes of SALT are meant precisely for the evolution of such a gradual and careful mutual reduction of excessive strategic weapons.

Scenario II: Limited Detente

This scenario depicts the development in the 1970s in which the U.S. maintained a working relationship with both the Soviet Union and with China, when China and the Soviet Union remained bitter enemies to each other. Deterrence requirements for the U.S., China and Japan are not so different in this scenario from the previous scenario. This, however, is not the case with the Soviet Union. Continued confrontation with China calls for the maintenance of some deterrence capability directed specifically against China at all times. Simultaneously, the U.S. remains the number one adversary and competitor. Since the Soviet invasion of Afghanistan, it appears that the U.S. has significantly shifted away from the position of even-handedness to commit the U.S. to the evolution of some sort of North Pacific entente with China and Japan.[24] Such a development is still embryonic. Significant Soviet gestures could induce the U.S. to particpate once again in some limited form of collaboration with the Soviet Union in areas of mutual interest. Limited detente therefore remains a real possibility within our time frame.

The Soviet Union could threaten China in a number of ways. First, the 17 or so top cities in China could be directly targetted.

These cities would account for one quarter of China's urban population, and roughly one fifth of its industrial capacity measured by the IDX score. As Table 5.4 has shown, China has the highest industrial concentration per city among the three countries with large territories. Most of these cities can be reached by IRBMs. Secondly, the Soviet Union could deploy a number of its MRBMs close to the border. This would place the industrial areas and cities in the North, Northwest and Northeast China within range. The advantages of MRBMs are (1) their relative proximity to target, thus reducing warning time available to the defense, and (2) it serves to free up more ICBMs (the deployment of which is restrained by SALT) for use against targets in the U.S. Indeed, only three of the seventeen top Chinese cities are not within the reach of advance-based Soviet IRBMs.

Another characteristic of China's target structure is the importance of coastal cities. Shenyang, Luda, Tianjin, Tangshan, Qingdao, Shanghai, Guangzhou are all major coastal industrial, political and population centers. Soviet SSBN fleet coming from the warm water port Vladivostok can easily reach any of these targets as well as many more important cities 100-200 miles from the coast. Indeed, a combination of MRBM and SSBN forces would cover all the ten major industrial areas of China, and nearly all of the small clusters of industrial and commercial cities. As we can see from Table 5.9, the Soviet Union has the capability to meet the requirements under this scenario in every category of ICBMs. There are also more than enough bombers to carry out the same task. Again, the biggest development would probably come from the Soviet SSBN force, in that the fleet will be continously modernized as submarines of the Delta III and the Typhoon class enter into service. As of today, the combined force of SSBNs (not including SSBs) can comfortably meet the needs of a limited bilateral detente between the U.S. and China.

Scenario III: The New Cold War

Renewed confrontation between the Soviet Union and the U.S. is always likely if either or both decide that it is no longer in their interest to maintain the process of dentente. Since the Vietnam War, the change in world balance of power has become increasingly unfavorable to the U.S. Soviet foreign policy has demonstrated time and again this growing Soviet power. It is all too easy to understand why Soviet assertiveness could arouse negative feelings about detente. The natural reaction in the U.S. is to put a stop to the politics of appeasement. However, anti-Sovietism (or anti-Soviet expansionism) has fundamentally the same root as anti-communism in the U.S. The tendency in a new spirit of confrontation is to identify friends from enemies. This could have tremendous implications on American policy towards Taiwan. In this respect, the swing factor in the new cold war is China. One possibility is that China remains a friend (Taiwan is still part of China) and an indispensable part of the North Pacific entente. Another possibility (which is looming in the horizon under the Reagan administration) is that renewed anti-communism in the U.S. leads to a retreat of American policy towards China from the Nixon-Ford-Carter position, and actively and overtly campaign for two China's or perhaps even an independent

Taiwan. The latter possibility could erode whatever support the Chinese leadership had for Sino-American rapprochement. This would create new conditions for the Soviet Union and China to work out their previously irreconcilable differences. Japan remains allied to the U.S. regardless of the China swing. Indeed, Japan has an inherent interest in the de facto and/or de jure independence of Taiwan. The international alignment in the rest of Northeast Asia will stay the same way as it has been since the end of WWII.

The first possibility of Scenario 3 (S.3a) is hostility between the Soviet Union and the U.S. and Japan, with China allying with the Soviet Union. The second possibility (S.3b) is hostilities between the Soviet Union and the evolving entente among the U.S., China and a remilitarized Japan. Clearly, the security requirements in the latter case is more than that of the first case. Indeed, the latter case of Scenario 3 is equivalent to a worst case analysis for the Soviet Union on the minimum requirements for a viable deterrent.

Under S.3a, the requirement is a total of 234 DGZs in terms of 1 mt warheads at 5 psi. This would increas to 502 DGZs if 550/600 kt warheads are used instead. A total of 234 SS-11s, or 84 SS-19s must be deployed. Alternatively, 42 Yankee class or 13 Delta III class SSBNs must be deployed. Currently, the Soviet Union has about 34 Yankee class SSBNs. An additional 7 of the 15 Delta I SSBNs can complement the Yankee force to meet the 234 DGZ requirement after degradation.

Under S.3b, the DGZ requirements rise to 310 for 1 mt warheads and 605 550/600 kt warheads. Either the existing SS-11 or the SS-19 (or for that matter the SS-17 and SS-18) ICBMs can meet these requirements even after considering the factors of degradation. Also, the Yankee and Delta I classes of SSBNs currently deployed are sufficient to meet such a demand. There is no question that the Soviet strategic forces are sufficiently overwhelming to meet any such contingencies in Northeast Asia.

Scenario IV: General Cold War

As it has been discussed earlier, a general world economic disorder could lead to rapid deterioration of relations between the U.S. and its allies, and could cause a high tide of nationalism everywhere. In the competition for trade advantages, Japan could come to experience the U.S. as a big bully. Anti-Americanism would become synonymous with nationalism. Under such circumstances, self-preservation becomes the first priority. The world in general would be tense, unfriendly, suspicious.

The conditions of a general cold war do not affect the deterrence requirements of the Soviet Union as much as they do to the other powers in Northeast Asia. Under most circumstances, only China is the likely candidate of consequence for alliance relationships. (It is possible to conceive in longer term that Japan may ally with the Soviet Union should the U.S. persistently favor China over Japan in Sino-Japanese disputes and in bilateral economic relations). The Soviet Union must be prepared to confront the U.S. and Japan nearly all of the time. The only major difference (outside a Sino-Soviet entente in Scenario III) lies in the probability of open conflict.

The deterrence requirement of the Soviet Union under this scenario is not so different from that under S.3b. In fact, it may be argued that assuming everything else being constant, the security position of the Soviet Union is really stronger when China and/or Japan are not in alliance with the U.S.

Studies on the vulnerability of land-based missiles by and large agree that a first strike capability, even if it exists, is not a firm one either against the Soviet Union, or against the U.S.[25] Despite recent advances in ASW technology, the sea-based deterrent (provided it is of reasonable size) still remains relatively invulnerable. Given the huge and steadily improving strategic arsenal of the Soviet Union, the changes in the international environment does not place any undue strain on its strategic weapons program, outside the on-going technological arms race with the U.S. The Soviet long-range bomber force may soon become obsolete but Soviet missiles are rapidly being modernized. The greatest room for improvement among the existing weapons systems lies in its SSBN force. Table 5.9 shows that is the only area in which a single category of weapons system does not meet the basic deterrence requirements calculated on the operationalized definition of assured destruction. The trend points to continued Soviet superiority in Northeast Asia under any possible international alignment.

U.S.A

The U.S. was the first country in the world to possess atomic weapons, and is the only country that has ever used such weapons in a war. Although the U.S. no longer emjoys undisputed superiority over the Soviet Union, it still commands an impressive arsenal of nuclear weapons the bulk of which are technologically more advanced than their Soviet counterparts. As the leader of the free world, the U.S. feels obliged not only to guarantee its own security, but also to extend such security to its friends and allies. The number one threat comes from the big and powerful Soviet Union which has by now achieved numerical superiority in nearly all categories of strategic nuclear weapons.

Until recently, China had been considered a potentially powerful and dangerous enemy which had to be contained. The rapid change in the world balance of forces have brought together China and the U.S. today. Yet this relationship is built on a covergence of strategic interests. Outside anti-Soviet expansionism, neither can justify this new found friendship on ideological grounds. In this sense, it is reasonable to expect that China and the U.S. can easily become enemies once again. The continued development of China's ICBM and SLBM programs will eventually have a significant impact on the security requirements of the U.S.

Barring a sudden shift in American economic policy towards Japan, the latter will remain a firm ally of the U.S. Yet it is unrealistic to expect that the U.S. can maintain its present economic policy if the U.S., and probably the world, experiences an economic depression once again.

While the alliance structure evolved from the post-war realities is likely to remain by and large intact, the so-called loosening of the alliance system may take on serious proportions as Japan grows stronger and more nationalistic. Japan is and will remain a major competitor with the U.S. in world trade (markets and natural resources). Support for American foreign policy sometimes are detrimental to Japanese national interest. Growing trade and aid relationship also means the evolution of new blocs of interdependence, sometimes cutting across ideological divides and to the exclusion of the U.S. Issues such as world fishing, ocean resources, policy towards OPEC, the nuclear fuel cycle, the export of military equipments, the scale and the timing of remilitarization, and trade relationship with the Soviet Union can become extremely divisive. It is therefore not unrealistic to be prepared for the emergence of antagonistic relationships between the U.S. and Japan.

The small powers, once again, are subject to the competition for influence by the major powers. Regardless of the international atmosphere, the question of national unification and identity will remain the determinant of their security policy. As small powers, they are unlikely to have any major effect on strategic posture of the major regional powers.

TABLE 5.10

USA: WARHEAD REQUIREMENTS

Scenario	#Cities	50kt	100kt	150kt	170-200kt	340kt	1-2mt
A. Before Degradation:							
1,2	56	534	400	297	254	186	99
3a	63	939	663	496	421	307	161
3b,4	79	1,101	767	576	498	355	185
B. After Degradation:							
1,2	56	659	494	367	314	230	122
3a	63	1,160	819	612	520	379	199
3b,4	79	1,432	1,011	711	615	438	228
C. Moscow ABM:							
1,2	56	781	587	449	391	297	177
3a	63	1,282	912	694	597	446	254
3b,4	79	1,554	1,104	793	692	505	283

Scenario I: General Detente

General detente is a state of affairs American foreign policy makers in the 1970s had hoped to achieve. Today, it is generally believed that unilateral moves at self-restraint intended to induce Soviet co-operation and participation in such a process have resulted in a steady decline in American power vis-a-vis the Soviet Union. The fear is that the Soviet Union had never intended to, and will never reciprocrate to bring about genuine detente. The momentum of change definitely favors the emergence of Soviet superiority in the early 1980s. While this view has gained ascendence in the last few years, the official position of the U.S. still supports detente, and hopes to salvage whatever remains of past efforts, wishing to rebuild on this basis a constructive relationship with the Soviet Union. This scenario will reflect the international relations resulting from the successful fabrication of such a world as envisaged by Nixon and Kissinger towards the end of the 1960s.

The Soviet Union has emerged since the end of WWII as the chief adversary and competitor of the U.S. No other power in the same class is in sight before the end of this century. There is little doubt as to whom the bulk of the American deterrent is directed against at any time and under any circumstances. The probability that the U.S. must confront the combined strategic forces of the Soviet Union and China is relatively low under this scenario. Although Japan enjoys improved relationships with its mainland neighbors, it remains a friend and an ally. Also, Japanese military posture is likely to be low.

As is the case with the Soviet Union, the U.S. is in possession of a vast stockpile of strategic weapons which are more than adequate to meet any requirements of retribution. Under this scenario, the U.S. already has more Minuteman I, Minuteman II, Polaris A3 and Poseidon C3 missiles than are required in each category. The number of SSBNs in the Ohio class alone is suffice. There are more than twice the number of SSBNs required in the Benjamin Franklin class. In addition, the U.S. still enjoys a commanding lead in the number of strategic bombers deployed. Although there is a growing fear today that American strategic forces (just as its conventional capabilities) have become inferior to their Soviet counterpart, the concern is not that the U.S. no longer possesses an adequate retaliatory capability. There is indeed no debate as to whether the U.S. has the means to assured destruction. The question is whether the U.S. has the ability to assured survival.[26] Redudancy in retaliatory capacity is not necessarily a satisfactory answer to this problem.

At Damage Level D_3, which is the literal lower limit of McNamara's criterion for assured destruction in terms of population, a total of 56 Soviet cities are involved to yield a 39.4% IDX score. The requirements of deterrence at this level are 203 1-mt warheads. The U.S. can easily meet these requirements with existing weapon systems, even allowing for a Soviet attempt to strike first. As of July 1979, the U.S. enjoyed the services of some 46 nuclear powered SSBNs. Even in the event that the Soviet first strike should wipe out the entire land-based missile forces and incapacitated the bombers, the five Ohio class SSBNs or 14 of the 31 Benjamin Franklin class SSBNs would fulfill the task of retaliation at this level of damage. As it can be seen from Table 5.10, existing U.S. strategic forces can deliver retaliatory damages at the severest level with ample firepower to spare, despite the fact that the U.S. has drastically decelerated its deployment of strategic nuclear forces over the past 15 years.

Scenario II: Limited Bilateral Detente

This scenario is a reflection of the kind of international relations which existed for the most part of the last decade. It is conceivable that the present trend of deteriorating Soviet-American relations can be reversed. First, the U.S. could quietly embark on a program to ensure regional parity or superiority as well as preparedness. Simultaneously, the U.S. could maintain a low profile in foreign policy but with greater consistency, unambiguity, and firmness in its foreign policy positions. The combined effects of these measures could contain Soviet expansion in a way which direct confrontation with the Soviet Union might be kept at a minimum. Such a policy need not jeopardize its on-going relationship with China as long as explicit Sino-American collaborations directed against Soviet interests are carefully avoided. Also, there would be considerable support from Europe and Japan for these policies.

Although it is important for the U.S. to seek a more harmonious relationship with the Soviet Union in order to reduce the probability of direct conflict this does not in any way imply the elimination of competition and rivalry between the two for world leadership and

TABLE 5.11

USA: WEAPONS REQUIREMENTS

Weapons	Load	# Vehicles Required S1	S2	S3a	S3b	S4	#Deployed[1] July, 1979
ICBM Options:							
Minuteman II	1x1-2mt	177	177	254	283	283	450
Minuteman III	3x170kt	131	131	199	231	231	
	3x340kt	99	99	149	169	169	
SLBM Options:							
Polaris A3	3x200kt	131	131	199	231	231	160
Poseidon C3	10x50kt	78	78	129	156	156	496
Trident I C4	10x100kt	59	59	92	111	111	-
Trident II D5.1	14x150kt	32	32	50	57	57	-
Trident II D5.2	7x340kt	43	43	64	73	73	-
SSBN Options:							
Benjamin	16 tubes						
Franklin	Poseidon C3	14	14	23	28	28	31
Ethan Allen &							
George	16 tubes						5
Washington	Polaris A3	24	24	36	42	42	5
Ohio	24 tubes						
	Trident I C4	6	6	10	12	12	-
	Trident II D5.1	4	4	6	6	6	-
	Trident II D5.2	5	5	7	8	8	-
Bombers:							
B-52 D/G/H	60,000 lbs.						365
FB-111A	37,500 lbs.						66

NOTE: [1]Deployment figures based on Military Balance, 1979-1980 (London: IISS, 1980).

dominance. The U.S. would strive to maintain an adequate strategic posture vis-a-vis the Soviet Union under all circumstances.

There is, therefore, little difference in the requirements for assured destruction under Scenario I and Scenario II. The minimum strategic posture of the U.S. remains by and large the same. Since the U.S. already has an overwhelming redundancy in meeting this level of requirement for two decades, it is only natural that the current debates in the strategic community should center around American capabilities not to deter for survival, but to project power and to win wars.

Scenario III: The New Cold War

The basic feature of this scenario is the renewed confrontation between the Soviet Union and the U.S. Two variations are possible: First, the U.S., in its rapid decline in relative strength vis-a-vis the Soviet Union, could hasten the evolution of a mini Pacific entente among the U.S., Japan and China. Alternatively, politics within the U.S. at a time of fading American influence abroad and economic difficulties at home may dictate a more ideological and moralistic foreign policy. This may well mean open and perhaps active support for "Free China" or "Free Taiwan," leading to the emergence of Sino-Soviet rapprochement. In either case, tension is likely to be high in Northeast Asia, and probability of conflict would also be high.

The requirements for deterrence would be very different under the two variations. In the first case, the U.S. need not consider a drastic revision of its security requirements from those of Scenarios 1 and 2. A friendly China in fact helps to alleviate some of the burden of targetting the Soviet Far East. On the other hand, the domestic political imperative to stress anti-Communism in general in order to amplify anti-Sovietism could force the U.S. to prepare for both the Soviet Union and China at the same time. Table 5.11 shows the differences in launcher strength required under the two variations. While the differences in most categories are substantial, they do not affect the force posture of the U.S. in any significant manner as minimum requirements in terms of assured destruction since the U.S. is already in possession of a much larger strategic nuclear force.

Scenario IV: General Cold War

This scenario becomes possible when the U.S. and Japan fail to resolve their growing conflict over economic interests. The U.S. may perceive Japan as an ungrateful ally selfishly promoting a beggar-the-U.S. trade policy all over the world. On the other hand, Japan may come to fear the sense of desperateness in American foreign policy, which could drag Japan into unwanted conflicts with its mainland neighbors, or worse still experience the U.S. as the major obstacle to its realization of the later day version of the Great Asian Co-Prosperity Sphere. A general deterioration in world relations may help to breed mutual distrust. Nations may frantically seek alliances for various contingencies which are fleeting and unstable. Naturally, the security requirements for each country would be the highest under such circumstances.

For the U.S., Scenario 4 differs from Scenario 3b in that Japan now is an enemy, albiet the enmity may be somewhat less intense than that between the U.S. and the Soviet Union.

Under this scenario, the U.S. must meet the requirements at damage level D_3 for the Soviet Union and Japan, and damage level D_2 for China. This means only an addition of 6 more cities with 24 DGZs at 5 psi and 1 mt. However, enemy military postures are likely to be higher than Scenarios 1 and 2. The survivability factors of some weapon systems may be lower.

Again, the U.S. is already fully equipped to meet all these needs in terms of possessing an assured destruction capability. In spite of the higher factors of degradation under this scenario, the U.S. can inflict unacceptable damage in a second strike mode on all of its potential enemies with any single leg, or some combination of the triad.

As the Soviet Union continues to improve the accuracy of its strategic missiles, the U.S. feels more and more uneasy about the eventuality of Soviet capabilities to threaten American silo-based ICBMs with a first strike. While the vulnerability of two (bombers and ICBMs) of the three legs of the triad need not threaten the stability of MAD itself, the fear that such incrementally significant improvements in Soviet forces may one day catch the U.S. unprepared, say, with an effective ASW and/or ABM capability before the U.S. can respond with the same in time. One immediate answer to this Soviet challenge is to move for symmetry so as to maintain balance. The U.S. can develop missiles with higher throw-weight and warheads with bigger yield. Another is to develop mobile ICBMs which are not as vulnerable to a pre-emptive first strike. The expensive MX missile system combines both elements of yield and survivability. It is also potentially capable of a first strike against Soviet land-based ICBMs. Under the atmosphere of confrontation politics, the U.S. is more likely to retool its strategic thinking to match the Soviet preference for war winning and damage limitation.

China

Since the Soviet intervention in Czechoslovakia in 1968, the U.S. has been replaced by the Soviet Union as the number one enemy of China. This development has been reinforced by a number of factors. First, the possibility of an American sponsored invasion by the KMT forces on Taiwan became very remote by the 1960s, all the more so as China acquired nuclear weapons. Secondly, American defeat in Vietnam and the subsequent decline in American power led China to conclude that Soviet expansionism is a greater danger than American imperialism. Thirdly, the Soviet Union for a variety of reasons (one of which is ideological) is the only country which has a domestic constituency in China which is a potential Trojan horse to the genuine independence and sovereignty of the Chinese state.[27] Consequently, some sort of convergence in strategic interests occurred by the 1970s between the

TABLE 5.12

CHINA: WARHEAD REQUIREMENTS BY AREA BEFORE DEGRADATION

AREA	20 kt	200 kt	1-2 mt	3-4 mt
A. Soviet Far East (15)	262	63	25	16
B. U.S. Pacific (10)	376	86	32	16
C. Japan (6)	297	77	24	12
D. Soviet European (18)	735	173	68	37

NOTE: Area (A) includes: Tashkent, Novosibirsk, Sverdlovsk, Chelyabinsk, Omsk, Alma Ata, Krasnoyarsk, Karanganda, Novokunznetsk, Irkutsk, Vladivostok, Barnaul, Khabarovsk, Frunze, Dushaube; Area (B) includes: Seattle, Portland, Sacramento, San Francisco, Oakland, San Jose, Los Angeles, San Diego, Phoenix, Honolulu; Area (C) includes: Tokyo, Osaka, Yokohama, Nagoya, Kyoto, Kobe; Area (D) includes: Leningrad, Kiev, Baku, Kharkov, Gorkiy, Kuybyshev, Minsk, Tbilsi, Odessa, Dnepropetrovsk, Donetsk, Kazan, Perm, Volgograd, Ufa, Yerevan, Rostov, Saratov.

U.S. and China to contain the rapid expansion of Soviet influences in the East. However, this concurrence of strategic interests could be short-lived. Much depends on Soviet policy towards China, China's politics of modernization, and more importantly U.S. policy towards China and Taiwan.

Precisely because China perceives the Soviet Union as the major threat to its national security and independence, its strategic deterrent will be designed primarily to counter this threat. As it has been discussed earlier, compared with the U.S., the Soviet Union has a higher concentration of its urban population in the top 50 cities (Tables 4.5 and 5.3 illustrate this fact). Geographically, American cities are much farther away from China. A minimum deterrent directed against the Soviet Union is not likely to serve the same purpose against the U.S. Also, while Soviet missiles stationed along the eastern section of the Sino-Soviet and Sino-Mongolian frontier can easily reach many important targets in China (such as Harbin, Shenyang, Beijing, Baotou, Sian, etc.), the opposite is true of Chinese forces against Soviet targets. Only a handful of significant urban and industrial centers lie within the reach of Chinese MRBMs. The bulk of Soviet population are located west of the Urals, and are not within the reach of IRBMs stationed in Xizang (Tibet) or Qinghai. In time, it is possible for China to send a fleet of ballistic missile submarines (SSBs) to patrol the Indian Ocean and the Arabian Sea. The proximity of Xizang to the Indian Ocean should facilitate command and communication. Conceivably, China may be able to deploy a number of missile carrying diesel powered submarines within our time frame. It is doubtful if they could patrol much beyond Chinese coasts in the absence of base facilities on foreign soil. China has recently completed a solid propellant factory and is constructing at least one modern submarine.[28] Given the long lead time to build a nuclear-powered submarine fleet, it appears unlikely that the SLBM options are open to China within our time frame.

The history of Chinese nuclear tests reveals that that largest device ever exploded was 4 mt, and the lowest in the sub-20 kt range. Most of its recent tests were of the low yield category. The only delivery vehicle available now that can reach European Russia is the CSS-X-4 (called Long March II during its test flight). It is entirely possible that before 1990, China will have a modest fleet of long range bombers to complement its ICBM and IRBM forces. Bombers, however, are expensive to build and to maintain. Given the vast number of Soviet interceptors and the relative backwardness of China's eletronic counter-measure (ECM) technology, the long range bomber is unlikely to be emphasized in the immediate future. As Table 5.13 has shown, an SSBN fleet of the Han class which by itself can meet the requirements for deterrence is not likely to emerge within our time frame. But this is not to rule out the possibility of a developing SSB and SSBN combined force to supplement China's other strategic forces within the next few years.

Given the embryonic nature of China's nuclear forces, it appears unlikely that a significant number of its missiles would survive a pre-emptive strike. Furthermore, the ICBM program has just completed its first series of full range tests in July 1980. Its accuracy is very low. It is unrealistic to expect the deployment of a large, highly accurate and MIRVed ICBM force by 1990 that could promise the destruction of the Moscow area which is under ABM protection. Currently, China has 40-50 MRBMs and more significantly 50-70 IRBMs. THe IRBMs, if stationed in the mountains of Xizang and Qinghai, can reach most of the important Soviet industrial centers immediately to the east of the Urals. A more sensible strategy for China is to bypass the ABM protected Moscow area, and instead seek to destroy the industrial areas of Sverdlovk, Tashkent, Novosibirsk, as well as individual cities such as Khabarovsk, Irkutsk, Omsk, Vladivostok, Semipalatinsk, etc., in Siberia and in the Far East. The utility of the limited number of ICBMs deployed could be maximized by targetting them against the relatively more vulnerable but highly industrialized and urbanized Donets-Dnieper region.

The Chinese deterrent designed primarily with the Soviet Union as the hypothetical enemy also has strategic implications for the rest of Northeast Asia. China's deployment of the early MRBM forces are known to have concentrated in Liaoning, Jilin, Harbin and the Beijing area. These missiles could certainly be re-programmed to target Japan and its neighbors. China has bout 90 Tu-16 medium range bombers and numerous strike aircrafts which are capable of carrying nuclear weapons, and can reach any target in Northeast Asia.[29] Given the high concentration of population and industry in Japan, Taiwan, North and South Korea, even the modest program China has acquired so far constitutes a formidable and credible force.

Scenario I: General Detente

It would be a dream world for China indeed if neither the Soviet Union nor the U.S. were seriously seeking to threaten China's security. This is particularly the case for the rest of this decade as China undergoes fundamental adjustments across the society. The official view is that while war is inevitable, it can and must be postponed. China can only develop itself in a peaceful international environment. There is every reason to believe that China perfers general detente if the Soviet Union could be persuaded to give up its expansionist designs (by a strong America, for example) on China's autonomous regions and frontier provinces, in Europe, and in the Middle East. By now, the major threat to China's security is no longer an American sponsored invasion by the Nationalist forces. Rather, it will come in the form of a massive intervention from the north under the pretext of fulfilling its international obligation to the proletarian revolution in China. Even in times of relaxed international relations, it is reasonable to expect China to direct the bulk of its limited strategic deterrent against major Soviet targets. Since Moscow is protected by about 100 ABM launchers, a substantial number of missiles--anywhere between 60 and 124 depending on whether the leakage method or the exhaustion method were used will be needed to destroy Moscow with 5 psi blasts.[30]

By-passing Moscow and concentrating on unprotected but important industrial centers would appear to be a much more optimal use of China's limited strategic deterrent, especially in a second strike mode.

China currently has about 200 nuclear weapons.[31] Assuming that China opts for a steady growth in its developmental ICBM program, and produces 2-4 CSS-4 annually between 1981 and 1982, 5-10 between 1983 and 1985, and 10-15 between 1986 and 1990, China will possess approximately 60-130 full range ICBMs within our time frame. Even allowing for low accuracy (which could be compensated by carrying a large warhead), this force is good enough to inflict damage level D_2 (excluding Moscow) on the Soviet Union. More realistically, China will improve its IRBM forces to guarantee the destruction of major targets in Soviet Central Asia and the Soviet Far East.

The top 15 cities in Soviet Central Asia and the Soviet Far East within 2,000 miles of China accounted for about 11 million people (approximately 8% of urban population) and 12% of its industrial capacity. A total of 61 major cities east of the Urals accounted for about 33 million people and 27% of the industrial capacity. They are well within the reach of China's IRBM CSS-2 and medium bomber Tu-16. Indeed, with the exception of Sverdlovsk and Chelyabinsk, all are within the range of Chinese fighter bombers and forward based MRBMs. In accordance with the relative criteria of unacceptable damage discussed earlier in Chapter Two, Chinese ability to retaliate against the 15 major Soviet targets east of the Urals can be considered a sufficient minimum deterrent against an all-out Soviet attack on China under this scenario. The fact that up to 61 industrial and population centers are

TABLE 5.13

CHINA: WARHEAD REQUIREMENTS

Scenario	#Cities	Before Degradation				After Degradation			
		20kt	200kt	1-2mt	3-4mt	20kt	200kt	1-2mt	3-4mt
1	15	262	63	25	16	324	78	31	20
2,3a	33	997	236	93	53	1231	292	115	66
3b	31	935	226	81	44	1155	279	100	55
4	49	1670	399	149	81	2062	493	184	100

Note: Scenario 1 = Area (A); Scenario 2 and Scenario 3a = Areas (A,D); Scenario 3b = Areas (A,B,C); Scenario 4 = Areas (A,B,C,D). Refer to Table 5.11 for specifics on the areas.

well within the reach of Chinese land-based IRBMs and bombers, and that China is in possession of a large (though primitive and aging but operational) bomber force means that China probably has a credible deterrent against the Soviet Union under general detente.

The same forces, however, cannot constitute a deterrent against the U.S. On the other hand, China does possess a few CSS-4 missiles that could threaten unprotected U.S. cities along the Pacific coast. Also the likelihood of an American strategic attack on China is extremely low under this scenario.

It is quite conceivable that both South Korea and Taiwan may deploy a few nuclear weapons against China. In the case of South Korea, the idea may well be to deter Chinese (and for that matter Soviet) support for a North Korean take-over of the South. In the case of Taiwan, the likely purpose is to deter an invasion, and in the event that deterrence fails, to prevent any concentration of forces to cross the Taiwan Strait. In either case, the survival of the Chinese state is not threatened. There is really no meaningful suppression of such limited objectives outside a pre-emptive strike against their strategic nuclear forces at their earliest stage of development.

Scenario II: Limited Detente

The deterrence requirements for China are higher in limited bilateral detente than in general detente. Continued Sino-Soviet dispute means that the threshold of "unacceptable damage" to the Soviet Union is higher as the Soviet Union is more inclined to teach China a leasson at some cost. Under these circumstances, China may have to acquire a survivable retaliatory capability which can reach the heartland of the Soviet Union. This may take the form of mobile ICBMs and pehaps a modest SSBN force which can operate off the coast of Bangladesh and Pakistan. Still, it is not cost-effective to target the ABM protected Moscow area. However, the next 24 cities on the damage level D_2 list are all within the range of an SSBN force armed with 2,000 nm SLBMs. This additional Chinese ability can place 18 more Soviet European cities (with 800,000 or more in 1970) under the threat of China's strategic nuclear weapons. This would require a minimum of 46 CSS-4 ICBMs in launch under attack mode or as many as 84 CSS-NX-1 missiles on station, or a combination of such in addition to the existing IRBM, MRBM, and bomber forces. The new target list includes a total of 33 cities embracing some 33 million people in 1970 and 27.5% of industrial capacity as measured by the IDX score.

As is the case with general detente, both the U.S. and Japan are not considered to be major threats to China's security under this scenario. Furthermore, the ICBM/SLBM combined force is also capable of targeting the Pacific Coast of the U.S.

Scenario III: The New Cold War

Two alliance systems are possible under the renewed confrontation between the U.S. and the Soviet Union. The first possibility is that the momentum of existing changes may carry forth the evolution of a

U.S.-China-Japan entente in East Asia. This would augur well with the convergence of Sino-American and Sino-Japanese strategic interests. Alternatively, a Sino-Soviet alliance may emerge once again as a result of the non-solution if not deterioration of the Taiwan problem combined with domestic political changes within China itself. The security requirements for China are different under the two possible alignments.

Under the first possibility, the Soviet Union remains the number one threat to the national security of China. It is therefore necessary to seek an alliance with the U.S. to compensate for the lack of an adequate strategic deterrent against possible Soviet attempts to strike deep from the air while sending a huge army to occupy the frontier areas of Xinjiang, Neimongul and Manchuria. In this respect, the deterrence requirements against the Soviet Union should be at least the same as those under Scenario II, namely that a 33 Soviet cities list should be considered. It is clear (Table 5.13) that China does not have such a capability at the present, but will be able to acquire it in a few years time.

Under the second possibility, the Soviet Union is once again an ally. However, this does not mean that China can risk putting aside part of its strategic forces for the contingency of a recurrence of Sino-Soviet conflict. On the contrary, precisely because of the past experiences, the new alliance will never be quite the same as the old one. Also, there is no going back. The Chinese IRBM/MRBM capabilities are there, part of which may be needed for targeting against future adversaries such as India, but the bulk of which would still be reserved for Soviet targets east of the Urals.

TABLE 5.14 CHINA: WEAPONS REQUIREMENTS

Weapons	Load	15 Soviet Far East	18 Soviet European	10 U.S. Pacific	6 Japan Top Cities	#Deployed[4] July 1979
A. MRBM/ IRBM						
CSS-1	1x20kt	324	-	-	297	50
CSS-2	1x1-2mt	25	-	-	24	70
CSS-MRV[1]	3x200kt	29	-	-	29	-
B. ICBM						
CSS-3						
CSS-4						
C. SLBM						
CSS-N-1[2]	1x1-2mt		46	20	20	-
D. SSBN's						
HAN	3 tubes CSS-N-1		16	7	7	1
E. Bombers[3]	(on ground)					
Il-28	4,850 lbs.	800	-	-	215	300
Tu-16	20,000 lbs.	667	1,200	-	178	90

NOTES:

[1]Possible within our time frame. First deployment likely with solid fuel IRBM.

[2]Likely within out time frame. Probably of 2,000 nm range armed with a single 1-2 mt warhead.

[3]Assuming medium defense posture for the 6 Japanese cities and the 15 Soviet Eastern cities, high defense posture for 18 Soviet European cities, and survivability of .10. See Tables 5.4, 5.5 and 5.6 for degradation factors. None of the planes can reach the U.S.

[4]Deployment figures based on Military Balance 1979-1980 (London: IISS, 1980).

However, the reduced tension with the Soviet Union does relieve China from its greatest source of anxiety and its corresponding need to acquire a large long range deterrent. Although the U.S. is an equally awesome superpower, it is nevertheless far away and not directly significant as an invasion and occupation force. It may well be the case that the U.S. is not perceived to have anywhere near the stakes in China as does the Soviet Union. With these considerations in mind, Chinese ability to destroy the major Pacific coastal cities of the U.S. may constitute a significant deterrent against any direct serious American action against China. It is, of course, not possible to exclude a nuclear Japan from the strategic equation. Both the U.S. and Japan, (the latter even more so) have an inherent interest in the long term independence (even if only de facto) and viability of Taiwan. Under the circumstances of a new Sino-Soviet alliance, it is only natural that Taiwan would receive increase support from the two.

Based on the above analysis, China would have to maintain strategic forces in a second strike mode to meet the requirements of the 10 Pacific coastal cities of the U.S., the 6 major cities of Japan, and perhaps also the 15 major Soviet cities east of the Urals. As it can be seen from Table 5.13, this is somewhat less than what China would have to maintain under the first possibility of this scenario, as well as under Scenario II. In this case, however, a viable SSBN force is indispensable against the U.S.

Scenario IV: General Cold War

Perhaps next to Soviet-American collaboration, the general breakdown in international alliance systems is the worst possible case for China. One historical parallel would be the pre-WWI colonial struggles. In the absence of effective ABM capabilities, the relative invulnerability of offensive nuclear weapons imposes real constraints to an all-out war of victory and conquest. While such may still be possible, the price for victory would be very high.[32] In the case of a general cold war, the Soviet Union, the U.S., and Japan are all potential enemies which could, if the circumstances were right, join forces to defeat China, or for that matter any single country.

In this sense, China would be hard pressed to maintain some form of deterrent which should be perceived as credible against all the major powers of the region at the same time.

At the minimum, China must strive for the capability to inflict a variant of damage level D_2 on the Soviet Union, which includes the top 18 European cities (excluding Moscow) and the top 15 Asiatic cities, inflict damage level D_3 on Japan (top 6 cities), and to destroy the Pacific coastal cities of the U.S. as well as a few targets of strategic significance in the Pacific (e.g., Guam, Marshall Islands). Realistically, a survivable SSBN fleet armed with 4,000 nm SLBMs would be required in order to cover any target on continental U.S. in a longer time frame, since an Atlantic SSBN fleet is not feasible due to the long transit time.[33]

A total of 49 cities need to be covered simultaneously under this scenario—33 in the Soviet Union, 6 in Japan and 10 in the U.S. A combination of long range and intermediate range delivery systems will be required since China is unlikely to meet this requirement with any single leg of its strategic forces. The 15 Soviet cities east of the Urals and the Japanese cities are within the range of IRBMs while the European Soviet targets and the American targets must be covered by ICBMs and in the near future SLBMs. As of July 1979, China is already in possession of a barely sufficient number of IRBMs to meet the requirements against the Soviet Central Asia and Soviet Far East cities and the Japanese cities as long as they are placed on a launch on warning or launch under attack mode. The margin of sufficiency will increase steadily over time. Its bomber force, while technologically out-dated, is still formidable numerically. As projected, China should have a 60-130 full range ICBMs. The upper limit of this estimate should just meet the requirements against the 28 distant targets in the U.S. and the Soviet Union. In addition, there may well be a few armed SSBNs deployed by 1985.

It is quite possible that by the second half of the 1980s, both the U.S. and the Soviet Union will have deployed laser and/or charged particle beam weapons with extremely effective ABM applications. In a decade's time, space-based laser weapons can be used to destroy both enemy military satelllites as well as in-coming exo-atmospheric ICBMs during their post-boost phase. They could also be directed against other space-based weapon systems or, if the source of energy were large enough, threaten specific targets on earth. Given the advanced technological requirements for such developments, many lesser powers will find themselves losing the "equalizer" effect of their hard-earned nuclear weapons against the superpowers, and will only be able to gamble on perfecting the clandestine modes of delivery to salvage some deterrence value for their nuclear forces. Indeed, the Soviet Union has already built at least one particle beam complex in Central Asia near Xinjiang.[34]

Japan

Japan is undoubtedly one of the two most eligible candidates for the nuclear club among the long list of near nuclear states. For almost a decade, Japan has the second largest capacity for nuclear power, after the U.S., and is porjected to have roughly the same net capacity as West Germany by the year 1984.[35] Much has been said about the special Japanese "nuclear allergy" and pacific sentiments against rearmament in general and nuclear weapons in particular. The constitution was regarded as one obstacle but has been re-interpreted since to allow for self-defense. Domestic opposition has been widely cited to buttress the argument that it is extremely difficult for any Japanese government to rearm, let alone to embark on a nuclear weapons program.

On the technical side, Japan as of 1978 had 19 nuclear reactors of more than 20 MWe each in operation, fewer than only the U.S., Britian and the Soviet Union, and will stay within the top five both in terms of the number of larg reactors as well as total capacity by 1985. As a result of more than 15 years of commercial reactor operation, Japan may have acquired up to 10,000 kg (a 20 kt weapon requires 10-25 kg) of plutonium.[36] Since 1979, Japan has completed its fuel cycle as its first reprocessing plant went into operation. Also, this means that Japan can repossess spent fuel for warhead production, and build additional facilities for this purpose should the need arise.

Japan has been producing the nuclear capable F-4 fighter jet for some years, and has succeeded in launching the Ionosphere Sounding Satellite-B (February 1978) and the Experimental Communications Satellite (February 1979) into robit, using the three-stage N-1 missile. Another three-stage launch vehicle H-1 is currently under development, designed to launch heavy satellites (500 kg) in the mid-1980s.[37] In addition, Japan has been the leader in shipbuilding for decades, is currently building 2-4 patrol submarines, and can build aircraft carriers if they are needed. All evidences suggest that while the existing political atmosphere may not permit an overt weapons program, Japan has quietly acquired the capability to do so on short notice. Indeed, since the Nixon trip to China, and in particular the collapse of the American effort in Vietnam, public opinion polls have recorded more favorable attitudes towards a stronger self-defense. As the international security environment changes, so will the Japanese perception of the need for a self-reliant defense capability.[38]

TABLE 5.15

JAPAN: REQUIREMENTS BY AREA BEFORE DEGRADATION

AREA	200 kt	340 kt	1 mt
A. Soviet Major (10)	76	54	29
B. Soviet Far East (15)	63	46	25
C. China D_2 (17)	62	121	167
D. U.S. Pacific (10)	86	61	32

NOTE: Area (A) includes: Leningrad, Kiev, Tashkent, Baku, Kharkov, Novosibirsk, Kuybyshev, Sverdlovsk, Minsk, Tbilsi; Area (C) includes: Shanghai, Beijing, Tianjin, Shengyang, Wuhan, Guangzhou, Chongqing, Nanjing, Harbin, Luda; Areas (B) and (D) are the same as Areas (A) and (B) in Table 5.12.

Irrespective of the thirty-five years of post-war history, Japan cannot be taken for granted as the "natural" ally of the U.S.[39] Indeed, experiences since the Nixon shock should have revealed that clashes between American and Japanese national interests have always existed, and will continue to grow as the U.S. becomes weaker and Japan stronger. The convergence of interest on issues such as Korean unification and the future of Taiwan may dissolve as Japan seeks to re-establish its "traditional" sphere of influence. It is only reasonable to expect Japan to acquire, however unassumingly, the capability not only for self-defense, but also to project power abroad to protect its life lines over the oceans.

Analysts have unanimously remarked upon the limited geography of Japan, and therefore the vulnerability of a land-based deterrent should one be considered. Its highly concentrated population and industry renders Japan easy prey to retaliation. Some advise Japan to stay unarmed and rely on American security guarantees. Others believe that the Japanese government can no longer count on such guarantees. The only sensible alternative is to develop a credible SSBN force which can patrol in the Indian Ocean.

Traditionally, all the major powers in this region had been Japan's adversary at one time or another over the past two hundred years. Today, the most likely candidate is the Soviet Union which is still in occupation of the Northern Territories claimed by Japan. In longer terms, China is a potential competitor for influence and economic advantage in Southeast Asia. Militarily, China is no direct threat to Japan within our time frame.

TABLE 5.16

JAPAN: WARHEAD REQUIREMENTS

Scenario	#Cities	Before Degradation 200kt	Before Degradation 340kt	Before Degradation 1mt	After Degradation 200kt	After Degradation 340kt	After Degradation 1mt
1,2	10	76	54	29	94	67	36
3a	15	63	46	25	78	57	31
3b	27	243	175	98	300	216	121
4	37	329	236	123	407	292	152

NOTE: Scenarios 1 and 2 = Area (A); Scenario 3a = Area (B); Scenario 3b = Areas (A,C); Scenario 4 = Areas (A,C,D). Refer to Table 5.14 for specifics on the areas.

While the probability of a direct attack on Japan itself does not appear to be very high, the Japanese are wary about their security and interests should a catalytic conflict break out between the two Koreas, over Taiwan, or between China and the Soviet Union in the Far East and over Mongolia.

Japan shares the same strategic disadvantage with China vis-a-vis the Soviet Union. Japan is exposed to Soviet medium range delivery systems, but cannot easily reach beyond Soviet Siberian targets. Japanese ICBMs are vulnerable unless placed on launch-on-warning, and if heading for Moscow, can be detected very early. Bombers must travel over Soviet land for many hours in order to reach meaningful targets outside Vladivostok and Khaborvsk.[40] In this sense, the argument for a fleet of quiet, long range SSBNs appears to be irrefutable as Japan positions itself in the all but warhead situation. This not only would pose as a deterrent against the Soviet Union, but also has strategic implications against the U.S., and obviously against China as well.

Scenario I: General Detente

In the 1978 issue of white paper on defense, Japan openly recognized that the Soviet Union has caught up with the U.S. in nuclear weapons, and might have surpassed it in conventional military power in East Asia as well.[41] One year later, the same source feared that as a result of increased naval and air power, the Soviet Union had made it difficult for the U.S. to secure sea lines of communication between the

U.S. forward deployment areas and the U.S. mainland.[42] While the probability of a direct Soviet attack on Japan was estimated to be low, Japan felt that the danger of a surprise attack could not be ruled out, and that one best way not to invite such an attack was to gradually build up an efficient defense capability.

The Soviet union has been identified as the major threat to Japanese security. The increase in Soviet combat troops in the Soviet Far East, and particularly in Sakhalin, above and beyond what are needed for the defense of the Soviet Union is interpreted by the Japanese to be a sign of Soviet intention to influence and control events in the area, by force if necessary. The design of the Japanese nuclear forces is therefore basically geared towards deterring Soviet aggression.

It can be reasonably argued that a Japanese capability to retaliate against the 15 major Soviet cities east of the Urals would be sufficient to deter a massive Soviet assault on Japan. For a land-based system, this would call for maximum range IRBMs. Such a capability would also serve to deter China, but would have no effect on the U.S. Given Japan's lack of geographical size and the increasing vulnerability of land-based missiles, a more attractive option is for Japan to acquire a survivable fleet of SSBNs.[43] This would permit easy access to Soviet targets in Europe when the boats are on station in the Arabian Sea. While the boats are in transit through the East China Sea, the whole of China would be within range. An additional advantage is that in the unlikely event of a need to target the U.S., the same system, armed with Polaris type missiles can pose as a credible deterrent. Technologically, Japan has a continuing program in nuclear ship propulsion and is building its own submarines.[44] All things considered, an SSBN force appears to be the most attractive option as the backbone of a Japanese deterrent.[45]

Since all Soviet European targets are within the range of 2,500 nm SLBMs stationed somewhere in the Arabian Sea, it would be more efficient to select the most valuable targets, many of which are located in the Ukraine. As in the case of China versus the Soviet Union, it may be more realistic for Japan to by-pass the ABM protected Moscow area. Consider the top 10 Soviet cities excluding Moscow and Gorky, as Kemp has suggested, to be the basic level of damage requirement: A total of approximately 11% of urban population in 1970 and 9% of industrial capacity as measured by the IDX score will be threatened.[46] This means that at least 7 SSBNs of 16 tubes each, armed with Polaris A3 type of missiles (3 x 200 kt) or 8 such SSBNs armed with non-MIRV 1 mt warheads.[47] This same capability is close to what would be required to threaten the 10 Pacific coastal cities of the U.S. on the other side of the ocean. The shortcoming is that this force level can only threaten the top five cities in China. Nevertheless, this already means 13% of China's urban population and more than 9% of its industrial capacity. Furthermore, the Shenyang Industrial Area, the Harbin Industrial Area and the Beijing Industrial Area are all within the range of the F-4 fighter-bombers.[48] Together, they account for 32 major cities with 15% of the total urban population and 27.5% of the industrial capacity. It appears that such a force should be adequate in meeting the deterrence requirements of

TABLE 5.17

JAPAN: WEAPONS REQUIREMENTS

Weapons	Load	# Vehicles Required S1	S2	S3a	S3b	S4
A. IRBM/ICBM[1]	1x1mt	36	36	31	121	152
B. SLBM options[2]	1x1mt	36	36	31	121	152
	3x200kt	32	32	26	100	136
C. SSBN options[3]	16x1x1mt	8	8	6	20	22
	16x3x200kt	7	7	5	16	19

NOTES:
[1]N and H 3-stage, solid-fuel launchers.
[2]Polaris A3 type of missiles.
[3]Ethan Allen and George Washington class submarines.

Japan under the conditions of general detente.

Scenario II: Limited Detente

There is little difference in Japan's deterrence requirements between the previous scenario and this one. In fact, Sino-Soviet confrontation affects Japan in two ways. First, it is largely responsible for the military buildup in the Far East which has a direct effect on Japan's defense planning. On the other hand, the Sino-Soviet dispute eliminates the fear of collusion between the two powers. The level of Soviet military might which could be directed against Japan is therefore lower as well. Realistically, China does not possess the conventional capability to invade Japan, and the Soviet Union does. There is every reason to see the Soviet Union as the number one enemy of Japan. In the respect, the deterrence requirements of Japan under limited detente should not exceed those under general detente.

Many have argued that given the protection of the American nuclear umbrella, there is no real need for Japan to go nuclear. In fact, it may even be in Japan's interest not to do so since the possession of nuclear weapons automatically invites the possibility of being attacked (e.g., under pre-emption) by the same. This line of argument will remain valid before the occurrence of any trigger event which leads to the Japanese exercise of the nuclear option. As long as the conditions of this scenario and those of the next hold, it may still be possible for Japan to maintain its near-nuclear status, while edging ever closer to but stopping short of the actual production of nuclear warheads.[49]

In a world where nearly one third of the countries have the ability to accumulate seperable fissile material for the production of the bomb, the pressure to keep up is immense. Even without being directly alienated by the U.S., Japan could feel compelled to declare its nuclear status if Taiwan and/or South and North Korea go nuclear. There is also a sort of internal technological imperative generated by the all-but-warhead policy which pressures for the actual production of nuclear weapon proto-types. Once the psychological threshold has been crossed, there is little chance for the process to be reversed. An analysis of Japan's nuclear deterrent and probable force posture is therefore not at all far-fetched under existing conditions.

Scenario III: The New Cold War

Renewed confrontation between the U.S. and the Soviet Union under the conditions of a U.S.-China-Japan entente in East Asia will not affect the deterrence requirements of Japan significantly from those of the previous scenarios. Japan can threaten specific strategic targets directly related to a possible Soviet invasion, such as Vladivostok, Khabarovsk, Irkutsk, Sakhalinsk, etc., and come to an understanding with China on the sharing of responsibilities under certain contingencies.[50] An IRBM force may be adequate to meet the requirements in this case.[51] In order to retaliate against the 15 major Soviet cities east of the Urals, for example, the number of DGZs is 25 for 1 mt warheads at 5 psi peak overpressure. This calls for at least 31 single-warhead IRBMs which can be launched on very short warning time. Alternatively, a fleet of 6 SSBNs each carrying 16 1-mt non-MIRV missiles will meet the same requirements with greater overall reliability over time.

However, if the renewed confrontation between the Soviet Union and the U.S. features a new Sino-Soviet alliance, Japan (still firmly in alliance with the U.S.) will become a forward base for potential military conflicts. Japan must be prepared to face China and the Soviet Union simultaneously. Japan may have to maintain the ability to retaliate against the top 17 Chinese targets, as well as the 10 targets on Kemp's list of the minimum level of damage required.[52] In addition, many Chinese cities in the North and the Northeast are within easy reach of jet fighters. The same can be said of Vladivostok and Khabarovsk. A moderate fleet of medium bombers therefore can be a very powerful supplement to the SLBM and/or IRBM force. The total DGZ requirements in this case (at 5 psi) are 98 for 1 mt warheads or 243 for 200 kt warheads. The SSBN requirements are 20 and 16 respectively.[53] As it has been discussed in Scenario I, there are 32 major cities among the three major industrial areas in the North and Northeast Chian, only 7 of which are on the top 17 (damage level D_2) list. Together with the 10 Soviet cities east of Lake Baikal 35 cities can be reach by fighter-bombers, and of course by civilian carriers converted to deliver the bomb.

Scenario IV: General Cold War

This is a condition in which Japan finds itself in direct confrontation with a long time ally and benefactor. Although the evolution of such an antagonistic relationship between Japan and the U.S. may not be too likely within our time frame, it is nevertheless possible, and indeed may be highly probably in ten to fifteen years' time. It is natural to expect a strong Japan to grow more nationalistic and more assertive. It is also possible to envisage Japanese collaboration with the Soviet Union on the development of Siberia in the event that the Japanese are not welcome or have been excluded from similar ventures in China. Furthermore, Soviet-American competition may take the form of increasing American support for and assistance to China, sometimes at the expense of Japanese national interests. Japanese and American trade policies are another source of major conflict. The undoing of the hitherto unbreakable U.S.-Japanese alliance makes it possible for this scenario to emerge.

Under the conditions of a general deterioration of international trust, Japan can only count on its own defense efforts. It must maintain the ability to threaten simultaneously in a second strike mode unacceptable damage on the Soviet Union, the U.S., and China. This means a total of 10-15 major Soviet cities, 17 Chinese cities, and at least 10 American cities. The total DGZ requirements at 5 psi are 123 for 1 mt warheads and 329 for 200 kt warheads respectively. The SSBN requirements for a system of 2,500 nm SLBMs are 25 and 22 respectively. The survivability of the SSBN can improve considerably if a 4,000 nm SLBM is used instead. This would allow the Japanese submarines to patrol far off the coast of the U.S, and increase the station time considerably against the Soviet Union. Also, this would permit Japanese missiles to target American cities on the Atlantic coast while patrolling in the Pacific Ocean. SSBN requirements for a 4,000 nm SLBM would be 22 and 19 respectively. This is indeed a large strategic force for a medium power to maintain. It is also unlikely that such a large SSBN force can be acquired within half a decade. A more realistis approach would be to build a 10-15 boat SSBN fleet, acquire a number of IRBMs and MRBMs and rely on medium bombers and fighters for some of the targets nearby. Considering the fact that many major Chinese cities are within a thousand miles of Japan, and half of the DGZ requirements are really for Chinese targets, there is no question that it is well within Japan's capability to meet these requirements if it so chooses.

In sum, Japan is in an excellent position to opt for the development of nuclear weapons and may well do so when the need arises. Japan will most likely build up a "defensive" SSBN force gradually, to be supplemented in part by MRBM and IRBM forces. Apart from the role of deterring nuclear rivals and being weapons of the last resort, Japanese nuclear forces will be deployed to defend against possible invasions. For this reason, a large part of these weapons will most likely be of high accuracy and low yield.

South Korea

South Korea received its first nuclear research reactor as early as 1962 from the U.S., and acquired a 2 MWe reactor in 1971, about the same time the U.S. and China began to normalize their relations. In 1970, the Korean Electric Company signed what was to be the first of a series of contracts with Westinghouse to construct atomic power plants.[54] Another contract has also been signed with the Atomic Energy of Canada, Ltd., for the construction of a 629 MWe pressured heavy water reactor scheduled to being operation in 1981.[55] By 1985, South Korea may have up to five nuclear reactors in commercial operation, with a total capacity of 2,698 MWe, higher than the projected capacity of Brazil or India in the same time frame. The amount of fissile plutonium accumulated through the operation of the first three reactors will be over 1,000 kg. by 1985. At the same time, South Korea emphasized the development of the local arms industry, and was extremely proud of the indegenous long and medium-range ground-to-ground missiles successfully test-fired on September 26, 1978.[56]

Although the U.S. had succeeded in pressuring the cancellation of the sale of a pilot nuclear reprocessing plany by Framatome to South Korea, there is every reason to believe that South Korea will attempt to assemble one as soon as it is in a position to do so, possibly with clandestine help from abroad.

South Korea's motivation to acquire an independent deterrent is clearly for national defense. The nation's defense industry (and, incidentally, planning for the nuclear power industry) was launched shortly after the Nixon Doctrine had been promulgated, with the full realization that the U.S. will eventually withdraw from the region. Nuclear weapons have direct and immediate battlefield implications in the Korean peninsula as they do in Europe. South Korea strives to maintain its battle field superiority over North Korea, and thereby to deter (and should deterrence fail, to prevail in) an invasion. The usual conceptual distinction between tactical and strategic nuclear weapons is not particularly helpful in this case. Given the short distances between the two parts of Korea, even the Hornest John and the 105 mm dual capability howitzer can have strategic implications.

Also, the smallness of the territories relative to the vast ranges modern weapons can cover makes it virtually impossible for North or South Korea to acquire an invulnerable deterrent outside a fleet of ballistic missile submarines, something neither can afford or build within our time frame. There is, therefore, no assured survival of any sizable strategic weapon systems in a second strike mode. Rather, there is reciprocal vulnerability.

Some analysts have suggested that because of their extremely limited destructive potential, small nuclear powers may not have the capacity to threaten assured destruction. Instead, a doctrinal variation called assured heavy damage may be advanced.[57] However, this does not appear to be a conceptual improvement in deterrence theory either. Deterrence between small powers does not call for a large number of weapons since only a handful of cities will constitute a major portion of the countries' population (and usually industrial capacity as well). Residual forces surviving an enemy first strike, by and large, will therefore suffice. Secondly, interaction between small nuclear powers and bigger powers involves the principle of proportional deterrence. Assured heavy damage therefore means that although the level of threatened destruction may not be as high as it would be among big powers, it is nevertheless "unacceptable" to the big power on the other side of the equation. This is but a variation of "assured destruction" specifically relevant to strategic deterrence among unequal powers.

As is the case with most small powers, South Korea's basic strategic concern is singular and local. The overriding objective is to guarantee the security and independence of the south from the north. While it is conceivable that some time in the future, South Korea may consider reuniting the two parts of the country under certain favorable circumstances, and possibly on its own terms (such as an uprising in the north, disintegration of the northern economy, etc.), its immediate goal is to foreclose the military option of the north to take over the south.[58] This preoccupation will remain unchanged regardless of the international environment at hand.

Given the realities of a small power nuclear deterrent, South Korea cannot be overly concerned about the vulnerability of its strategic forces to the major regional powers. However, regional powers are always involved in the politics of Korean unification. It is important that South Korea should maintain some demonstrative capability to threaten heavy damage on some selected targets in the territories of those which inclined to sponsor an invasion by the north. The selection of these targets are usually determined by their availability.

Probable Destruction

Although the preponderant of the South Korean military forces is geared towards war-fighting and war-winning, an integral part of the planning must still consider the ultimate option of retaliating against strategic countervalue targets such as big industrial cities to destroy the local potential of the north to sustain war efforts. In this sense, it is still possible to design a small force which could survive a first strike (by the north) to perform this task. A list of these targets is given in Table 5.18.

TABLE 5.18

SOUTH KOREA: DGZ REQUIREMENTS FOR PROBABLE DESTRUCTION

AREA	200 kt	1-2 mt
Pyongyang	42	15
Hamhung-Hungnam	16	6
Haeju-Kaesong	12	5
Chongjing	5	2
Total:	75	28

Assured Retaliation

In order to deter foreign sponsorship of a North Korean invasion, a few hypothetical targets are selected, some of which are of only limited significance. All four major regional powers are potential factors in the future of South Korea. The U.S. is the least likely to support military action against the south, and is also beyond the reach of any foreseeable South Korean delivery systems. Most important Soviet targets cannot be reached by MRBMs or the advanced F-4 fighters. Realistically, only Vladivostok and Khabarovsk are significant feasible targets. Like the U.S., Japan is a major backer of a viable South Korea. In the unlikely event that Japan participates in military operations against Seoul, many Japanese industrial and urban centers are within easy reach of South Korean fighters, boats, and the next generation of surface to surface missiles. China, the country which poured a million volunteers to check the American sponsored counter-offensive during the last war, is nearby. All four of its major industrial areas are within the reach of Korean fighter planes. Table 5.19 is a list of potential targets subject to assured heavy damage. It is assumed that South Korean ability to destroy 2-3 of these targets will generally be sufficient to deter major efforts to support the north in military actions against the South.

Deterrence Requirements

North Korean targets are the constant factor in South Korean strategic calculations. The Soviet Union is the most likely supported of North Korean military efforts since it has the least to lose on the one hand, and that North Korea must look to Moscow for arms supply on the other. The significant swing factor is China once again, which serves as a major hihterland for North Korea, but is vulnerable to South Korean retaliations. The U.S. will not be considered to be an antagonist. Besides, there is little South Korea can do to the U.S. While South Korea is suspicious of Japanese motives, Japan will remain essential to the viability of any South Korean regime. Japan, like China, is also vulnerable to South Korean retaliations.

Consider the top six cities of North Korea, which carry a fifth of the nation's population and up to 40% of industrial capacity. A total of 19 DGZs are required at 1 mt and 5 psi, yielding damage level D_3. This is the lower cut-off point for assured destruction. In order to assure that the South Korean deterrent is serious, the damage threshold can be increased to include the Pyongyang industrial area and three other major industrial centers all over the country. A total of 9 major cities will be involved, embracing close to 30% of the nation's population, and three quarters of industrial capacity. Even so, the total DGZ requirement at 1 mt and 5 psi does not go beyond 28. Assuming that a mobile MRBM force is deployed, on high alert and launch under attack, no more than 35 single 1 mt warheads will be required. Alternatively, part of the burden can be shared by F-4 jets which are not too susceptible to North Korean interceptors on a one-to-one basis. As of July 1979, the South Korea Air Force has some 37 F-4D/E fighter-bombers in service, and is seeking to obtain more advanced superiority fighters from the U.S.[59]

The requirements are not going to vary too much since only North Korea is considered to be the adversary. As Table 5.19 shows,

TABLE 5.19

SOUTH KOREA: DGZ REQUIREMENTS FOR ASSURED RETALIATION

	DGZ Requirements	
	200 kt	1-2 mt
Soviet Union		
Vladivostok	3	1
Kharbarovsk	3	1
Japan		
Tokyo	20	8
Osaka	4	2
Nagoya	7	3
China		
Beijing	20	7
Shanghai	28	10
Shenyang	18	4
Tianjin	15	5

selective targetting of the two Soviet cities only amounts to a marginal increase of a few delivery vehicles. As few as 2 warheads are required to destroy the second largest city in Japan. Only Chinese cities post some problems. However, it can be argued that less than total destruction of a couple of these cities is needed to qualilfy for "heavy damage." Indeed, only under the scenario of general cold war will these marginal requirements add up to about 10 warheads in the 1-2 mt range. The survival of no more than 20-30 weapons, therefore, will enable South Korea to a credible retaliation against its enemies.

North Korea

North Korea is the only country in this study which is not known to have a nuclear power industry or a program in nuclear energy research. Most literature on nuclear proliferation have failed to mention North Korea as a potential Nth power.[60] However, despite the fact that in recent years, North Korea has experienced tremendous problems in servicing its external debts, and has defaulted on several countries, it is nevertheless an industrially advanced country by Asian standards, and has an abundance of energy resources, the major ones being hydroelectricity and coal. Furthermore, there are strong reasons for North Korea to seek nuclear weapons.

To begin with, North Korea has an extremely nationalistic leadership. An independent North Korean deterrent would certainly demonstrate the superiority of the self-reliant independent north over the colonial south. It would be unacceptable to let South Korea acquire nuclear weapons first, much less alone. Secondly, a nuclear South Korea would render much of past North Korean efforts in military buildup meaningless. Only by neutralizing this capability can North Korea hope to regain the balance. Thirdly, nuclear capability can significantly bolster the bargaining position of the north. In the event that the on-going negotiation process becomes a meaningful tool for national unification, North Korea cannot afford to let South Korea go nuclear alone. Fourthly, nuclear weapons is the best answer to the growing superiority of South Korea military forces both in manpower and in hardware. Militarily, a North Korean nuclear deterrent is the best guarantee possible to discourage direct American involvement in future conflicts.

However, there are several limiting factors as well. Despite its extent of industrialization, North Korea lacks the technological base in nuclear energy. Compared with South Korea, it has few sources to draw from, as well as much less likely to obtain the technology and hardware necessary to embark on a crash program in weapons production. Only China and the Soviet Union are plausible suppliers of the technology.[61] Both would be willing to train North Korean physicists and engineers. China has not known to have supplied any country with nuclear plants or uranium. (There is no evidence that China has assisted Pakistan materially on its nuclear program. China has just begun its civilian nuclear power program, and was reported to have negotiated with Framatome for two such reactors recently.) The only possibility is for North Korea to begin its program with Soviet assistance and Soviet reactors.[62] This would certainly require a major improvement of Soviet-North Korean realtions. However, this is not as unlikely as it might appear. Should a nuclear South Korea appear as China maintains a cozy relationship with the U.S., the possibility of close North Korean ties to the Soviet Union is high.

Alternatively, Sino-Soviet alliance also amplifies Soviet confidence in North Korea as a loyal friend and ally--a necessary condition for the infusion of high technology.

All things considered, North Korea is the least likely candidate among the lesser powers for nuclear status within our time frame. However, it cannot be ruled out that North Korea may have been working very hard to acquire the technological base, particularly in the past five yearsz, and could accumulate sufficient fissile material to produce a few bombs by 1990.[63] It is with this in mind that a discussion of the probable deterrence requirements for North Korea is considered relevant.

The same observations concerning South Korea's probable nuclear posture applies to that of North Korea. The security requirements of the small powers are not directly affected to a great extent by superpower politics. There is no real way, for example, in which North Korea can fend off an all-out effort by the Soviet Union to take over the country. Nor can North Korea realistically "retaliate" against the U.S. in a joint invasion attempt by South Korean and American forces, unless North Korea deploys a large ICBM and SLBM force, somthing almost no small power is in a position to attain. In this sense, even the acquisition of nuclear weapons by small powers will not "equalize" the asymmetrical relationship in international conflicts. It is only in terms of rough proportionality in deterrence that the small powers hope to raise the price for their conquest to unacceptable levels.

Probable Destruction

Apart from the emphasis on small yield weapons for war-fighting purposes, North Korea will most certainly allow for strategic bombing of large urban and industrial centers, as well as major seaports to prevent large scale external supply of war materials to the south. Although theoretically, it is possible for South Korea to achieve a successful first strike against the north, a small portion of its strategic forces are likely to survive a pre-emptive strike by South Korean forces alone. A list of South Korean targets is given in Table 5.19.

Although the U.S. is the chief backer of the Seoul regime, North Korea has no way of retaliating against any major American targets, and can do little more than deter American troops from participating in another war in Korea. Japan and China are nearby. The Soviet Union is only peripherally contigous to North Korea. The same situation facing the south applies to the north.

Deterrence Requirements

While South Korea has more than twice the population of the north, and has many more cities over 50,000 it is also much more concentrated around two centers, Seoul and Busan (Pusan), that the requirements for the north will be actually somewhat less than the

TABLE 5.20

NORTH KOREA: DGZ REQUIREMENTS

Level of Destruction	# Cities	DGZ Requirements 200 kt	1 mt
D_3	2	30	11
D_4	3	42	15
Kyongsong[1]			
Inner	4	32	12
Outer	7	42	17
Busan[2]			
Inner	3	24	9
Outer	9	52	21

NOTES:
[1]Refer to Table 4.51 for details.
[2]Refer to Table 4.52 for details.

south. In addition, China and the Soviet Union are not considered to be likely antagonists, which leaves Japan to be the only probable candidate for assured heavy damage. This should put North Korea in a much more advantageous position strategically vis-a-vis the south. It is possible to achieve damage level D_4 against South Korea, for example, by destroying the top three urban centers, which has only a 15-DGZ requirement at 1 mt and 5 psi (Table 5.4). Indeed, the very destruction of Seoul alone is good enought to reach damage level D_2. The Kyongsong Industrial Area is comprised of seven cities, all close to the 38th parallel. The Busan-Masan Industrial Area at the southern-most tip of the Korean peninsula is actually the heart of South Korean heavy industries. The destruction of these two areas would come close to the absolute destruction of South Korea.

In terms of war-fighting, nothing short of absolute destruction can be credible. Until hostilities have been actually initiated, the ability to retaliate against a selected number of targets does constitute a credible deterrent. However, there is no guarantee to the survivability of the small power second strike capability.

Although North Korea lags behind South Korea in nuclear technology, it is ahead in offensive delivery systems. With 85 Il-28 light bombers and 120 MIG-21 fighters, North Korea can easily achieve damage level D_3 even if only half of the MIGs were configured for the delivery of atomic bombs.[64] North Korea also has three battalions of FROG missiles, its counterpart of the Hornest John. It is quite conceivable that North Korea may develop its own version of a surface-to-surface short-range ballistic missile (SRBM) capable of delivering a kt-range warhead. From this perspective, it appears that North Korea can come up with a formidable deterrent as soon as it embarks on a nuclear program geared towards weapons production.

Taiwan

Taiwan began research on nuclear arms as early as the late 1950s and acquired its first 1 MWe research reactor in 1961. In 1970, it ratified the nonproliferation treaty (NPT). Two years' later, it acquired a 40 MWe research reactor from Canada which started operation in 1973. This reactor, safeguarded by a bilateral agreement between Taiwan and the International Atomic Energy Agency (IAEA) of which Taiwan is no longer a member, is virtually identical to the Trombay reactor in India which was responsible for the first Indian nuclear test. A maximum of 10 kg weapon grade plutonium can be produced annually from its operation.[65]

Today, Taiwan has a total of five research reactors, two 604 MWe reactors in commercial operation, and four more 900+ MWe commercial reactors shceduled to begin operation before 1985.[66] The total amount of separable fissile plutonium accumulated by 1985 is estimated to be 2,762 kg, more than double that of South Korea. After more than two decades of research and training, Taiwan has a relatively advanced nuclear technology and infrastructure. One indication of Taiwan's sophistication in the state of the art is the discovery by U.S. inspectors of a nuclear reprocessing laboratory assembled in the early

1970s. This plant was later dismantled under U.S. pressure.[67]

Taiwan has openly acknowledged that it had carefully considered the nuclear option, but had rejected it on the groun that it could never use it against its countrymen.[68] Despite such a disavowal, it sent a group of scientists from the Chung Shan Research Institute to MIT for training in missile guidance technology. In 1977, Taiwan is belived to have purhcased the Gabriel missile from Israel, and attempted unsuccessfully to acquire the F-5G, the F-4E and the F-16 (all nuclear capable) from the U.S.[69] As a compensation, the Carter administration authorized the proposed Israeli sale of 50-60 Kfir Fighters which Taiwan later decided not to buy.[70] Since 1973, Taiwan has been joint producing the F-5E fighter (which, if upgraded to F5-G, can carry nuclear weapons) with Northrop, and should be able to produce short range surface-to-surface missiles (shipborn and land-based) in the very near future. The Kaohsiung shipyard with an annual capacity of 1.5 milliion tons which began production in 1976 has excess capacity for non-civilian shipbuilding. In sum, Taiwan has both the advanced nuclear technology and the industrial base to sustain a modest weapons program if it so chooses. Indeed, many European countries also possess such capabilities. The question remains if there are compelling reasons for Taiwan to go nuclear.

One obvious incentive for Taiwan to go nuclear is that its major, and possibly only adversary--China--is a nuclear power.[71] It is also confronted by a numerically overwhelmming conventional capability from across the starit. Militarily, the possession of nuclear weapons will make it extremely difficult for China to amass troops along the coast and to convey them across the Taiwan Strait, thus barring the kind of large scale amphibious landing necessary for an invasion.[72] There is also the argument that the home-made bomb will strengthen domestic morale. However, the morale of the KMT leadership has never been higher as the older generation are being blamed for Taiwan's diplomatic setbacks and eased from power, and the young, dynamic, and forward-looking technocrats have since taken over. Nevertheless, an independent deterrent will certainly demonstrate Taiwan's viability, and could be an extremely powerful tool for bargaining, both with the U.S. and with China. While the "external" threat does not appear to be as immediate here as in Korea, the reasons for going nuclear are strong and lasting. Despite ally pressure and dependence on foreign nuclear inputs, Taiwan can still count on the U.S. for nuclear fuel supply if it conducts a covert weapons development program (undetected), or on South Africa (as long as the present regime holds up) if the weapons program becomes an overt one. In any event, Taiwan does possess a spectrum of delivery systems as well as the ability to produce the warheads in good numbers if necessary.

Probable Destruction

Unlike the case of South Korea, where the primary interaction is between two small powers, Taiwan is confronted by a medium nuclear power (which, as is the case of Korea) both emotionally and legally part of the country. Apart from the fact that it may be technically impossible to achieve assured destruction against the mainland, there is also an inherent unwillingness to theorize about the killing of tens of millions of Chinese, and the destruction of major cities where thousands of years of civilization reside.[74] Also, the likelihood of the mainland using nuclear weapons against Taiwan when there is no immediate threat of an invasion of the mainland is considered to be very low. These considerations, however, do not rule out the contingency to destroy a few ports of a few cities which could be instrumental to an imminent invasion.

Assured Heavy Damage

There are many cases where the small power is primarily interacting with a big power although the big power is only interacting marginally with the small power. Some examples outside Northeast Asia are Finland with the Soviet Union, Cuba with the U.S., Nepal with India, Albania with Yugoslavia and the Soviet Union. Assured heavy damage as a variation of the "assured destruction" doctrine can be applied without too many complicating factors. It may be argued that the case between Taiwan and China is somewhat unique in the sense that it is more than just an interaction between two unequal powers. While it is true that the primary strategic concern of China today is with the superpowers and that Taiwan's nuclear deterrent will most certainly be directed principally towards the mainland, much more are involved than the calculations of the amount of damage Taiwan can do to China's population and industry.

First, any military conflict between the two would concern the question of unification. Therefore, the tendency to employ nuclear weapons (outside a pre-emptive strike) is weak. Secondly, in the event that nuclear weapons are required, say, to prevent the transfer of troops across the strait, they are primarily used for war-fighting purposes and not for retaliation. Thirdly, only when defensive efforts fail will they be used as weapons of the last resort. It is in this final phase that assured heavy damage may have some limited meaning. Fourthly, because it is a war for unification, China may be willing to suffer heavier damages than expected in order to achieve its goal.

However, this argument of uniqueness about China and Taiwan is exaggerated. The situation in Korea is also concerned with national unification. The primary purpose of nuclear arms is also for war-fighting and denial. It is perhaps true that the 38th parallel, unlike the Taiwan Strait, is an imaginery divide, which makes any military conflict that much more explosive. But the threshold of pain will also be high as there can be no alternative to surrender. In fact, the mutual reluctance to employ nuclear weapons is not atypical. Most strategists prefer to employ other means unless they have no real choice. Even so, they want to have as many rungs to the ladder of escalation as possible so as to keep the nuclear exchange to a minimum.

Although the nuclear force posture of Taiwan is predominantly oriented towards war-fighting and denial, any residual capability which can reach a few major cities like Shanghai, Nanjing, Chengdu, Kunming, Beijing, Guangzhou, must be taken seriously. As long as a pre-emptive strike by China (which virtually can be ruled out by Taiwan) cannot confidently eliminate such a residual capability, it is questionable if China would initiate an attempt to take over Taiwan by force. In this respect, deterrence still holds by virtue of the capability to assured heavy damage. The threshold of unacceptable damage is low before war breaks out, but once war has started, the threshold of unacceptable damage may become very high.

Deterrence Requirements

The most effective deterrent Taiwan could possibly maintain in the absence of any reliable security guarantee is the capability to deny any attempt to invade Taiwan to begin with, and to manage a survivable force to retaliate against a few major countervalue targets in China as the last resort. This means a contingent of nuclear-capable strike aircrafts with a minimum range of a few hundred miles (preferably up to 1,200 miles), and some missiles shipborne or land-based which can reach the coastal stretch between Hainan and Qingdao. This would place the South, East, and part of North China within range. Since many of China's major population and industrial centers are located along the coastal provinces, the threat of ultimate retaliation is therefore quite formidable. With a range of 500 miles, for example, Guangzhou, Nanjing, Shanghai, Wuhan, are within reach. A range of 1,200 miles will place the entire China proper under the threat of retaliation, including all the cities with more than 1 million people in 1970 except Harbin, or 38 of the 43 cities on Endicott's 500,000+ list.[75] From the perspective of assured heavy damage, the destruction of Shanghai alone should be sufficiently severe punitive measure. It is difficult to imagine any Chinese government willing to risk the destruction of Shanghai and one of the other major cities like Wuhan, Guangzhou or Nanjing in a military campaign against Taiwan.

TABLE 5.21
TAIWAN: DGZ REQUIREMENTS

	200 kt	1 mt
Shanghai	28	10
Wuhan	11	4
Guangzhou	10	4
Nanjing	7	3

It is quite possible that Taiwan will have acquired the capability to produce a SRBM comparable to the Lance missile in range as soon as the mid-1980s.[76] Assuming that it carries a 200 kt warhead, and can be launched on warning, the requirements for targetting Shanghai and Wuhan would be 35 and 14 respectively.[77] The number of launchers would drop drastically if 1 mt warheads were used instead. However, this would certainly increase the probability of being identified and destroyed under enemy pre-emption. As of July 1979, Taiwan's airforce has 200 F-5 fighters, some of which can probably be configured to deliver nuclear weapons.[78] This is a sufficiently large short range bombing force to meet the assured heavy damage requirements even under the most conservative assumptions on survivability and penetration. If Taiwan succeeds in acquiring the F-4, which has a longer range, a heavier weapons load, and in general a superior fighter even by contemporary standards, it will give it the ability to bomb any part of China from Kunming, Chengdu, Lanzhou, to Huhhot, Changchun Jilin.

Militarily, the security of Taiwan depends on the ability to deny any external attempt to seize control of the island. This may be guaranteed by a third power, such as the U.S., or by the maintenance of an independent capability to deny and to punish. In the absence of reliable security guarantees, such as the presence of combat personnel from the guarantor, the only genuine alternative is utlimately to strive towards an independent deterrent. Regardless of what the international environment may be, the predominant security concern of Taiwan remains an invasion by the communists (coordinated by subversion from within). It is quite likely that Taiwan will maintain basically the same force posture in a cold war, and under general detente.

CHAPTER FIVE NOTES

1. Japan has accumulated a significant amount of separable fissile plutonium, and is operating a large scale space program which has succeeded in sending two satellites into orbit.

2. Immediately after India's nuclear test, the U.S. compiled information on the importation of critical components for the manufacture of nuclear devices by friendly nations, and discovered that both South Korea and Pakistan were actively engaged in such purchases. It was reported that the U.S. succeeded in pursuading South Korea to abort the weapons program. NYT, February 1, 1976, p. 11.

3. The U.S. maintains that the nuclear capable F-4 is too offensive oriented for the defense of Taiwan. NYT, July 1, 1978, p. 2.

4. See, for example, Hideaki Kase, "Northeast Asian Security: A View of Japan," Comparative Strategy, Vol. 1, Nos. 1 and 2 (1978), pp. 95-101.

5. Up to now, the only effective way to counter an in-coming missile is to fire one at it. Such as system can be saturated easily at a cost considerably lower than building the defense.

6. Alain C. Enthoven and K. Wayne Smith, How Much is Enough? (New York: Harper & Row, 1971), p. 207.

7. Robert S. McNamara, The Essence of Security (New York: Harper & Row, 1968), p. 76.

8. Although peculiarity in design (such as Enhanced Radiation Weapon or the neutron bomb) may make a difference in the relative composite effects of blast, radiation, shock and heat, it is assumed here that such weapons are primarily meant for battles fought at close ranges, and that the technology will not filter down to the lesser powers within our time frame.

9. Samuel Glasstone and Phillip J. Dolan, ed., The Effects of Nuclear Weapons (Washington, D. C.: GPO, 1977).

10. By using blast effect alone, the calculations are necessarily conservative. Effects of dynamic pressure and various types of radiation have been ignored.

11. Adapted from the summary given by Geoffrey Kemp, "Nuclear Forces for Medium Powers, Part I: Targets and Weapon Systems," Adelphi Papers, No. 106 (London: IISS, Autumn 1974), p. 16 with additional information from Glasstone and Dolan, The Effects of Nuclear Weapons, pp. 154-230.

12. Direct blast effect on the human body at 10 psi is not significant since it can withstand up to 48 psi peak overpressure with 1% probability of fatality. However, indirect blast injuries can be substantial even at 2 psi. Kemp, "Medium Powers: Part I," p. 16.

13. Thermal radiation can inflict severe burnes at great distances. Other radiation effects are even more horrifying in the long run.

14. The choice of 5 psi peak overpressure is consistent with the study by Kemp, and higher than the choice of 3 psi by John Endicott, Japan's Nuclear Option (New York: Praeger, 1975).

15. These considerations are discussed in some detail by Endicott in Japan's Nuclear Option, pp. 172-178, as well as in Col. Gen. N.A. Lomov, ed., Scientific-Technical Progress and the Revolution in Military Affairs (Moscow, 1973), transl. and published under the auspices of the USAF.

16. Kemp takes a more simplified approach by assuming that both target acquisition and warhead reliability are practically equal to 1.

17. The relationship between the offense and the defense is highly dialectical. It is somewhat dangerous to assign probability values for penetration factors for all bombers regardless of their make or design. Bombers like the B-1 may incorporate highly sophisticated ECM capability which enhances its ability to survive ordinary AA measures.

18. The population sizes of modern cities tend to fall within the range of 100,000 to several million.

19. This comparison is based on Kemp's estimate of an average population density of 9,500 per square mile for the Soviet Union.

20. Endicott, Japan's Nuclear Option, p. 182.

21. Practically all major Japanese cities and China's coastal cities are within the reach of fighter bombers based in Korea or Taiwan.

22. These guesstimates are pooled from the following sources: Endicott, Japan's Nuclear Option, op. cit., pp. 185-212; Kemp, Nuclear Forces and Medium Powers, Part II, op. cit., pp. 1-22; L.E. Davis and W.R. Schilling, "All You Ever Wanted to Know about MIRV and ICBM Calculations, But Were Not Cleared to Ask," JCR, Vol. 17, No. 2 (June 1973), pp. 207-242; Report by the Subcommittee on National Security and International Operations of the Committee on Government Operations, U.S. Senate, 91st Congress, 1st Session, September 10, 1969; "Treatment of Operations-Research Questions in the 1969 Safeguard Debate," Operations Research, Vol. 19, No. 5 (September 1971), pp. 1175-1237;

Lomov, Scientific-Technical Progress, op. cit, pp. 68-72.

23. It is quite possible that Chinese strategic missiles may have greater CEPs.

24. Byung-Joon Ahn, "The U.S.-Japan-PRC Triangle and the Balance of Power in Northeast Asia." Korea & World Affairs, Vol. 3, No. 2 (Summer 1979), pp. 163-182; Robert G. Sutter, "The Evolution of China's Approach to the Soviet Union and the United States," Korea & World Affairs, Vol. 3, No. 1 (Spring 1979), pp. 27-45.

25. Lynn Etheridge Davis and Warner R. Schilling, "All You Ever Wanted to Know About MIRV and ICBM Calculations But Were not Cleared to Ask," Journal of Conflict Resolution, Vol, 1, No. 1 (Summer 1976), pp. 138-181; R.J. Rummel, "Will the Soviet Union Soon Have a First Strike Capability?" Orbis, Vol. 20, No. 3 (Fall 1976), pp. 579-594; Bernard S. Albert, "The Strategic Competition with the USSR--What is It and How are We Doing?" Comparative Strategy, Vol. 1, No. 3 (1979), pp. 139-168; Les Aspin, "How to Look at the Soviet-American Balance," Foreign Policy, No. 22 (Spring 1976), pp. 96-106. Rummel is convinced that the Soviet Union will have an effective first strike capability against the U.S. by 1981 at the latest.

26. Richard B. Foster, "From Assured Destruction to Assured Survival," Comparative Strategy, Vol. 2, No. 1 (1980), pp. 53-74.

27. Over time, this could change as China opens up to the West. It is entirely conceivable that apart from ultra-left terrorists, clandestine, anti-communist and pro-West groups might emerge, challenging the very legitimacy of the Chinese Communist Party.

28. John Moore, ed., Jane's Fighting Ships (New York: Franklin Watts, 1980), p. 104.

29. Tu-16 has a maximum range of 4,000 miles, Mach 0.8, and maximum weapons load of 20,000 lbs. It was first deployed in the Soviet Union in 1955.

30. The exhaustion method refers to calculating requirements in terms of the sum of missiles needed to exhaust the ABM system and the additional ones to destroy the targets. The leakage method makes use of probability assumptions that the most likely outcome would be that some 20% in this case would "leak through" the ABM system and arrive on target. The first method is more conservative (safer) than the second one. For an example of such calculations, see Kemp, "Nuclear Forces for Medium Powers, Part II," op. cit., PP. 10-11.

31. The Military Balance 1980-1981 (London: IISS, 1981), pp. 62-64.

32. This may not be true by the end of the decade.

33. SLBMs of the 2,000 nm range would require the SSBNs to patrol close to the U.S. coast in order to reach the Eastern continental targets. This would render them more vulnerable to ASW measures.

34. See Robinson article "Soviet Push for Beam Weapon" in Aviation Week and Space Technology, Chapter Two, note 53.

35. SIPRI Year Book, 1979. By 1984, the U.S. will possess a capacity for 129,155 MWE; West Germany, 24,107 MWe; Japan 22,179 MWe; USSR 21,316 MWe; France 35,308 MWe.

36. According to another estimate, Japan has accumulated 1,160 kg of plutonium by 1975, and is expected to raise it to 7,435 kg by 1980, 19,887 kg by 1985 and 33,960 kg by 1990. Swords from Plowshares, Table A-7, op. cit., p. 183.

37. John W.R. Taylor, ed., Jane's All the World's Aircraft 1979-80 (New York: Franklin Watts, 1979), p. 666.

38. See, for example, James E. Dornan, Jr.; "The Prospects of Nuclear Proliferation in Northeast Asia," Comparative Strategy, Vol. 1, Nos. 1 & 2 (1978), pp. 71-93; Swords from Plowshares, op. cit., pp. 111-150; Asia's Nuclear Future, op. cit., pp. 67-132. For the opposite view, see, Soong-Hoom Kil, "Japanese Defense Posture in the 1980's," Korea & World Affairs, Vol. 3, No. 4 (Winter 1979), pp. 495-515.

39. During the past hundred years, Japan had been at war with Russia, China and the U.S. at one time or another.

40. The rationale for a bomber force is therefore much weaker. However, bombers would still be very useful against targets within the region itself, most targets in China included.

41. "Summary of White Paper on the Defense of Japan (Excerpts)", Survival, Vol. XX, No. 6 (November/December 1978), pp. 264-7.

42. "Japanese White Paper on Defense," as tranl. by Mainichi Daily News by Survival, Vol. XXI, No. 2 (January/February 1980), pp. 31-36.

43. This is not to argue that Japan will not seek to deploy land-based missiles at all. In all likelihood, some land-based missiles will be deployed if and when Japan goes nuclear.

44. Currently, Japan is building 2-4 patrol submarines. Jane's Fighting Ships, 1979-80, pp. 289-290.

45. Japan's success in sending satellites in orbit suggests that Japan may well have the ability to deploy ICBMs.

46. Kemp's calculations are 11% of urban population and 15% of industrial capacity at risk respectively. See Kemp, "Nuclear Forces for Medium Powers, Part II & III," pp. 4-5.

47. The calculations are a little more conservative than Kemp's in general because Kemp performed his rounding to the nearest integer instead of to the next integer (as it should be). For example, he rounded off 16.4 SSBNs to 16 SSBNs (p. 11), which leaves a difference of up to 0.4 x 16 = 6.4 or 6 tubes with a possible total of 60 50 kt warheads.

48. If stationed in Okinawa, the F-4 can reach the Shanghai industrial area, which is also exposed to the sea based offensive systems with very short range.

49. The Japanese intention to retain the nuclear option is clear and unmistakable. One recent example can be found in the American effort to force Japan to forgo the ability to reprocess spent fuel in the first instance, and, failing that, to impose changes on the design on the Tokai-mura reprocessing plant to impede weapons development. The Japanese were furious.

50. This is absolutely necessary if a Japanese SSBN has been programmed to fire a missile over any part of China in order to reach a Soviet target while still in transit in the Indian Ocean.

51. It is, however, not wise to base too many missiles on the quake-prone Japanese islands.

52. The DGZ requirement for the 10 Soviet cities is 29, 4 more than the DGZ requirement for the 15 major Soviet targets east of the Urals. The ability to perform the first task in fact implies the ability to perform the second, since all targets are within the reach of 2,500 nm SLBMs.

53. These estimates are somewhat conservative since the ASW degradation factor for the Soviet Union (0.7) for SLBMs with a 2,500 nm range has been applied to China as well.

54. Altogether, four pressurized light water reactors are scheduled to be completed by 1985, the first of which (Kori-I) has already gone into commercial operation in July 1978, with a rating of 587 MWe. (The net capacity of Kori_I according to SIPRI Year Book 1979 should be 564 MWe.)

55. There may be two reactors to be constructed by the Atomic Energy of Canada, Ltd.. NYT, February 9, 1975.

56. South Korea also prides itself over the production of the nuclear-capable 155 mm howitzer and multiple-loaded rockets. See, "Missile Development & Defense Industry," in Korea Annual 1979 (Seoul:

Hapdong News Agency, 1979), pp. 33-35.

57. Lewis Dunn and Herman Kahn, Trends in Nuclear Proliferation, 1975-1995; Projections, Problems, and Policy Options (Croton-on-Hudson, NY: Hudson Institute, May 1976), pp. 100-101.

58. Taking for granted that the citizens of the south reject the regime of the north, such that the North Korean regime never had the political option.

59. South Korea is acutely aware that the north is numerically superior to the south in terms of air control, and is actively seeking to redress this situation. One of the planes South Korea wants to acquire is the F-16.

60. This is not surprising since neither Taiwan nor South Korea was ever mentioned in proliferation literature before 1975. Even today, most analysts by-pass the most eligible candidate South Africa. The only source which picked North Korea as a potential Nth power is Dunn and Kahn, Trends in Nuclear Proliferation.

61. Now that France has been pressured to renege on her sale of a pilot reprocessing plant to South Korea, the prospect of dealing with the north is dim.

62. The Soviet Union has built 8 reactors for East European allies (currently in operation), with 15 under construction, and 18 more planned to commence operation latest 1986. The GDR and Czechoslovakia are the chief beneficiaries. Cuba and Romania will have one each.

63. It is possible to envisage the stationing of Soviet rocket troops in North Korea, the primary purpose of which would not be for the defense of North Korea, but to target China.

64. This is true only compared to the relative lack of South Korean offensive systems to pre-empt the North. Deployment figures as of July 1979 are based on IISS, MB 1979-80, p. 68.

65. China had not interfered with IAEA inspection of the Canadian built facility after Taiwan was expelled from the IAEA. For a detailed discussion see William H. Overholt, "Nuclear Proliferation in Eastern Asia," in Overholt, ed., Asia's Nuclear Future, p. 140-141.

66. All six power reactors are American supplied, and are safeguarded by a trilateral U.S.-Taiwan bilateral agreement allowing American inspection of the facilities should IAEA for any reason lose its jurisdiction to inspect the facilities.

67. NYT, August 30, 1976; NYT, September 23, 1976. This also serves to indicate that it is possible even for a small country to assemble a small scale reprocessing plant surreptitiously.

68. Public statement by Chiang Ching-kuo in September 1975. Lefever, Nuclear Arms in the Third World, p. 88.

69. NYT, April 6, 1977; NYT, July 1, 1978.

70. NYT, September 6, 1978; NYT, October 25, 1978; NYT, November 2, 1978.

71. Despite speculations concerning the possible use of nuclear weapons on Taiwan, most KMT leaders do not believe that such us is likely or meaningful in an invasion, and at most only demonstrative and not punitive.

72. This would restrict China's option to paratroopers.

73. There is always the danger of losing American support, which may be more valuable in itself than an independent deterrent. However, the case of India has served as an encouragement to those who believe that the U.S has little leverage and must acquiesce in the fait accompli.

74. Compare with Overholt, Asia's Nuclear Future, p. 142.

75. Endicott, Japan's Nuclear Option, p. 183.

76. Taiwan is ahead of South Korea in missile technology. Apart from the deployed Hornest John SSM, the Nike Hercules, HAWK, and Chaparral SAMs, the shipborne Gabriel SSM, she is manufacturing the indigenous Hsuing Feng SSM.

77. It is possible to calculate the probability of a successful first strike by China against Taiwan's nuclear forces by making a few assumptions about the accuracy of Chinese missiles and hardness of silos or probability of identifying mobile launchers. This possibility is ruled out as most improbable under all conceivable circumstances since China's strategic forces are know to be deployed for very different purposes.

78. The Aero Industry Development Center of the Chinese (ROC) Air Force is license producing the F-5E, first rolled out in 1974, and is named Chung Cheng, after the second name of the late president Chiang Kai-shek.

CHAPTER SIX

NUCLEAR WEAPONS IN NORTHEAST ASIA

If the foregoing analyses on the probable nuclear force postures of each of the individual powers in Northeast Asia appear crude and simplistic, it is because of the artificiality imparted to it by a narrow and intense focus upon the strategic use of nuclear weapons in our attempt to isolate one factor from the many affecting national security. While our knowledge of the subject may have been sharpened by such an undertaking, our grasp on reality might have been unduly compromised unless the analyses themselves are understood in their proper contexts.

First, there are many uses to nuclear weapons. Strategic deterrence is only one of them. As our ability to control their modes of delivery and detonation grows, so will their potential uses. There is no inherent necessity that nuclear weapons be used only to deter an attack on vital interests. Besides, the definition of vital interests can also change with the quality and quantity of nuclear weapons in possession. Nuclear deterrence is but one specific aspect of general deterrence.

Secondly, several kinds of weapon systems have important strategic implications. Nuclear weapons are one of them. In fact, certain types of chemical and biological weapons are more economical and no less dreadful than nuclear weapons. Potentially, environmental weapons could be many times more destructive and space-based weapons more deadly. Analyses of military security requirements strictly in terms of nuclear weapons alone are therefore partial and illustrative at best. They do not always give us a comprehensive picture of strategic deterrence in general.

Thirdly, as critics of international relations theories constantly remind us, this kind of theory takes for granted that the baisc unit of analysis (i.e. the actor) is the nation-state, and as such, it is indivisibly purposive at least in some quasi-rational manner. Black-boxing the complexities of governmental and individual decision-making is, of course, a serious compromise of reality. Nevertheless, the old-fashioned "state as the primary actor" approach remains a powerful taxonomy for strategic analysis. It does provide some clarity of thought at a higher level of generality which would otherwise be unmanageable.

Lastly, contemporary analyses of nculear deterrence have been constructed on the basis of a remarkably stable relationship between the offense and the defense since the advent of strategic bombing. So far, there is no effective defense, active or passive, against the nuclear-armed missile except pre-emption (the result of which is by no means guaranteed). Nor is there any weapons technology which could constitute an effective defense against ICBMs that does not have in itslef ominous offensive implications. Deterrence theory as we know it remains meaningful only in so far as the offense continues to dominate the defense. However, the dominance of the offense is likely to be finite. It would be most interesting to see how nuclear deterrence theory will have to change should defense ascend once again above the offense.

A more realistic appraisal of nuclear weapons programs, doctrines, and force postures of the different powers in Northeast Asia would have to take into consideration the above limitations. Each of these four factors are serious enough to deserve a study by itself. It would not be possible to take proper account of them within the scope of this research. Because nuclear deterrence theory is largely deductive, it does not generate propositions that are readily falsifiable. As a result, two kinds of epistemological problems cannot be avoided: First, while we tend to identify the outbreak of armed hositilities with the failure of deterrence, we are generally more hestitant in claiming success of deterrence with the absence of war. For example, the absence of war between the U.S. and the Soviet Union during the 1950s has been rarely cited to demonstrate the efficacy of the doctrine of "massive retaliation." Analysing a "non-event" or "non-happening" is an inherently less interesting undertaking. Secondly, the distinction between the non-challenge of key values by the deterree and the success of the strategic nuclear doctrine of the deterrer is never very clear. It is possible to have a formidable territorial defense posture where the presence or absence of a few nuclear weapons may not have made any difference either way. At the present time, the most likely new members to the nuclear club are small and insecure powers. Their immediate concerns are the viability of their regimes and security from enemy subjugation. As a result, they maintain large and ready conventional military forces. If they succeed in acquiring nuclear weapons, their arsenals are likely to remain modest. It would be difficult to ascribe the total absence of enemy military challenge to the success of nuclear deterrence alone. On the other hand, it would be equally difficult to ignore completely the role nuclear weapons might have played, however few they may be.

The technology of nuclear weapons has been widely known for many years. By now, it has also become clear that small industrial economies are quite capable of sustaining modest nuclear weapons programs. Taiwan, South Korea, and North Korea are all possible candidates to the nuclear club withion our time frame. However, feasibility of the nuclear option does not always mean that it will be exercised. even if a small power wants to and is capable of acquiring its own nuclear deterrent, external forces may successfully seek to retrain it from so doing and perhaps for good reasons. On the other hand, many small and medium powers have voluntarily refrained from exercising the option even though they are quite capable of so doing technologically and economically. Sweden, Switzerland, Italy, Japan, and Australia are some obvious examples.[1]

The motives for a country to opt for nuclear status are many. Some arise as a result of external stimuli, others are self-sustaining and independent of the so-called arms race dynamics. The most obvious reason cited is national security. Nuclear weapons may be desired to deter a nuclear rival, to defend against invasion, as weapons of the last resort, to buttress a bargaining position, or to intimidate or to blackmail a non-nuclear rival. They may also be desired to enhance national prestige or to demonstrate national viability. At some point in time, nuclear proliferation may become an international fad such that it is simply chic to be a nuclear power irrespective of security needs. Domestically, the public disclosure of a nuclear weapons program may strengthen morale and perhaps also serves to divert the people's attention from divisive issues or discouraging realities. The decision to go nuclear could have been designed to restore or boost the morale of the military or the bureaucratic elites, or it could have been a result of bureaucratic politics. For the all-but-warhead near-nuclear powers, the scientific-technological momentum alone constitutes a tremendous pressure to take the next logical step. Inevitably, there is the so-called military-industrial complex which always clamours for more and better weapons. Usually, a combination of these factors for the underlying reasons for a nuclear weapons policy.

However, the actual decision to go nuclear itself may be triggered by an international crisis or by some unusual events. Taiwan started researching on nuclear weapons just about the time China was nearly ready for first nuclear test. Both Taiwan and South Korea embarked on their civilian nuclear energy programs shortly after the promulgation of the Nixon Doctrine. Taiwan secretly assembled a reprocessing laboratory during the early 1970s, while South Korea actively sought to acquire everything from solid propellant factories to reprocessing facilities immediately after the American disengagement from Vietnam. Also in the early 1970s, Japan debated if its constitution permitted the possession of "defensive" nuclear weapons. Between the promulgation of the Nixon Doctrine in 1969 and the fall of Saigon in 1975, a series of events took place, the most spectacular of which were Nixon's trip to China and the Sino-Japanese Peace Treaty.

It had become quite clear that the U.S. could no longer fulfill its commitments to its allies in Asia as it once could. It was during this period that both Taiwan and South Korea decided to accelerate their nuclear programs with the full knowledge of strong American opposition to nuclear proliferation. The reduction of alliance reliability was directly responsible for the decision to go nuclear surreptitiously at full speed. But their efforts have fallen short largely because they are dependent on foreign supply of key components and fuel, and in many ways extremely vulnerable to pressures from the U.S..

Theoretically, it would still be possible for South Korea and Taiwan to pursue the nuclear option if they considered nuclear weapons to be more vital to their continued existence than American aid and security guarantees. Today, there is a sufficiently large nuclear grey market in Europe and an abundance of nuclear fuel in South Africa and Australia to permit any determined state to develop its own weapons program. Furthermore, there is no lack of arms merchants to supply the necessary delivery systems. Besides, both South Korea and Taiwan can manufacture missiles and assemble fighter-bombers. In return for promises not to acquire nuclear arms, the U.S. has to upgrade the local arms industry and supply modern conventional weapons most of which have dual capability. While from all appearances the process of horizontal proliferation has been halted, these states are edging ever closer to become more formidable nuclear powers in some future time. It is in this respect that conjectures concerning their nuclear force postures are still relevant.

Proportional Deterrence

One obvious fact of life within a nuclear crowd is that the inequality of power remains unchanged. Small states are still confronted by limitations in size, in population, in resources, as well as in their relative inability to control and influence events even in their immediate surrounding environment. The nuclear forces of the lesser powers are, stricly speaking, vulnerable to either one of the superpowers on a bilateral basis. There are also some doubts as to the "credibility" of small nuclear forces. It has been argued that apart from being susceptible to pre-emptive strikes, they are too small to meet the requirements of "assured destruction."

It is only natural in any discussion of multilateral deterrence to borrow the concepts and assumptions developed from the experience of bilateral deterrence between the U.S. and the Soviet Union. However, it must also be remembered that the original definition of the concept means no more than "a highly reliable ability to inflict unacceptable damage" upon the enemy "after absorbing a surprise first strike."[2] This was later operationalized, for the American defense posture, to entail one fifth to one quarter of the Soviet population, and one-half to two-thirds of Societ industrial capacity, claiming that this would eliminate the Soviet Union as a major power for many years to come, and would therefore be totally unacceptable to the Soviet Union. Along came the French force de frappe. General Gallois argued that deterrence, in fact, is proportional to the value represented by the deterrer as perceived by the deterree. It therefore follows that in order for

France to deter Soviet aggression, it need not actually acquire the same second strike capability as the U.S. France, afterall, was not competing with the Soviet Union for world leadership. Nor does the bilateral deterrence relationship between France and the Soviet Union exist in isolation from the larger strategic context. Indeed, insofar as deterrence refers to the attempt to influence decision-making by posing a threat to key values, there is necessarily a subjective aspect to the process.[3]

Some analysts suggest that proportional deterrence is an antithesis to assured destruction.[4] This is largely based on the erroneous identification of the requirement to destroy a large portion of Soviet population and industrial capacity in a second strike mode with Soviet perception of what constitutes "unacceptable damage" without reference to specificc contexts. However, the term "assured destruction" itslef does suggest an extremely high level of damage. It need not completely preclude proportional deterrence, and it should not be restricted to the operational definition as applied to deterring the Soviet Union from an all-out attack on the U.S.. If assured destruction refers to the devastation of the industry and population of the enemy, then the damage of a fraction of such (e.g. a few industrial cities out of many) could be termed differently to distinguish between the seperate levels of physical destruction. It is hoped that this might eliminate some of the confusion arising from the use of the concept "assured destruction" in different situations by different powers.

The phrase "assured heavy damage" has been coined to designate the Nth country's version of assured destruction.[5] Examples of Iran versus India, Israel versus Egypt, and Argentina versus Brazil have been cited to indicate the relatively less destructive potential of many future Nth country forces. Presumably, none of them possesses the ability for assured destruction in the sense McNamara operationalized it. However, this observation is apporpriate perhaps only for medium size (or larger) countries with small nuclear forces. In the case of Korea, even small nuclear forces are potentially capable of assured destruction. It is only in the case of South Korea versus China, or North Korea versus Japan that the doctrine of assured heavy damage applies. An assured heavy damage psoture is therefore a proportional deterrence posture.

Problems of Vulnerability

It has been argued earlier that medium nuclear forces are vulnerable to superpower first strike at all times, and small nuclear forces are vulnerable even to each other. How, then, could it be possible to speak of "assured destruction" and "assured heavy damage" with respect to the future Nth countries? Medium nuclear forces can, by definition, survive an attack by the marginal strategic forces of the superpowers. They are therefore in a position to threaten assured heavy damage. However, there are also other ways to ensure the survival of some nuclear weapons regardless of the size of the enemy first strike. A crude fission bomb, for example, would probably weigh about 500 kg and measure one meter in diameter. A number of these could be packed away for clandestine delivery.[6] However, it is unlikely that a sufficient number of bombs could be delivered clandestinely so as to ensure an assured destruction capability. But there is an uncertainty factor involved, and, given the small number of major urban and industrial centers in small countries, even a few crude bombs of the Hiroshima and Nagasaki vintage could cause severe damage. In this sense, the pressure for small nuclear powers to pre-empt each other's nuclear forces may be somewhat alleviated.

The problem of survivability also exists in medium nuclear forces when confronted by the nuclear might of a superpower. Again, this pairwise analysis of bilateral deterrence as a direct extentsion of the relationship between the two superpowers makes the assumption that the pair exists, in isolation from other powers, when in fact most countries are allied to one or the other of the superpowers. Chinese strategic forces are clearly vulnerable to a Soviet pre-emptive strike. Yet the Soviet Union did not attempt to wipe out China's embryonic nuclear forces when the Soviets failed to obtain what was judged to be the necessary co-operation from the U.S. in the late 1960s. A first strike attempt on China today is even less likely considering repeated American warning that the U.S. would not stand idle while China is being attacked—a strong indication that the U.S. would like to preserve China as a counter-wieight to growing Soviet power in the Far East. Similarly, the nuclear forces of Japan may not be as vulnerable as the technical analysis of bilateral strategic relationship suggests. This brings up the question of alliance and the nature of the nuclear "umbrella" in a world of many nuclear powers.

Extended Deterrence

Commitment to defend an ally against a nuclear foe implies the provision of a nuclear umbrella to shield the ally from nuclear balckmail. This extension of the deterrent power of a state to include allies as well as troops stationed abroad is termed extended deterrence.[7] The original idea was to provide security guarantees to allies which (for a variety of reasons) do not possess nuclear weapons. The interesting question is whether extended deterrence is still meaningful in a world of nuclear powers.

There is no doubt that nuclear weapons, because of their unprecedented destructive power, are qualitatively different from all previous means of mass destruction. However, nuclear bombs are far from constituting so-called doomsday weapons. First, as it has been noted earlier, proliferation of nuclear weapons has not altered the reality of the inequality of power among the different states. Neither Britain nore France have become equals of the U.S. and the Soviet Union. China remains vulnerable to the modern military machine poised along its northern borders. The nuclearization of the Korean peninsula and Taiwan will not alter the fact that they are relatively weak pwers vis-a-vis the neighboring states. Secondly, alliances will not disintegrate because some or all of the members have acquired nuclear weapons. NATO has not been disbanded because both Britain and France have their own independent deterrents. It is extremely questionable that the U.S. would denounce Japan for going nuclear after the fact. The same can be said of South Korea and Taiwan. Unless the emergence of an independent deterrent undermines these objectives, proliferation alone is not a sufficient reason for the alliance to end. Given these facts, the weak states will remain dependent on the superpowers for security guarantees. Otherwise, small nuclear forces are vulnerable perhaps even to conventional military strikes. Extended deterrence therefore is still very much a meaningful concept in a nuclear crowd. We can expect that under the scenario of an evolving Sino-U.S. entente, China will benefit from American military might.

It has also been argued that superpowers may be reluctant to extend security guarantees to countries with nuclear weapons on the ground that they no longer need them, or that such guarantees are too dangeorus for the superpowers since they have no control over independent deterrents.[8] However, history has not supported this line of thought. The U.S. actually supplies Britain with its delivery system while France has not been expelled from NATO. The U.S. has also furnished South Korea and Taiwan with aircraft and missiles which could be converted to deliver nuclear bombs, with the full knowledge but certainly not with the expectation that together with Japan, they could go nuclear some time in the future.

There is one area in which nuclear weapons may make a difference in alliance politics. Just as in the bilateral case, nuclear weapons compel the attacker to think twice before committing the act. An alliance of nuclear powers may not easily take offensive action since there are several powers pondering the consequences of a nuclear counter-attack. In an age in which there is no effective defense against nuclear weapons, alliances may function stronger as means to collective security, and less reliable as vehicles for military conquest.[9] Indeed, the consequences of a strategic exchange hardly enhances the meaning and the attractiveness of military conquest.

Nuclear Weapons and the Small Powers

We have seen that while nuclear weapons are not a panacea to small and medium power security problems, they are still perceived to be essential to national survival in lieu of reliable security guarantees. Inspite of the many limitations of a small nuclear force, its extreme vulnerability to pre-emptive strikes, and high economic cost, both South Korea and Taiwan were willing to risk their alliance relationship with the U.S. and surreptitiously embarked on their nuclear weapons program. Yet, from our earlier analysis, none of the medium and small powers can threaten extensive physical destruction of either the Soviet Union or the U.S. even if they strike first. The most medium powers could hope for is a reliable retaliatory capacity to tear a leg or an arm off the superpower, and for the small powers, a couple of its major cities in interactions only peripheral to the superpower's strategic interests. Indeed, it has been persuasively argued that it is perhaps better not to have any nuclear weapons at all if they cannot survive a pre-emptive strike, since in time of crisis, they invite rather than deter an enemy attack. Why, then are so many of these countries tempted to acquire nuclear arms, and in so doing subject themselves to the danger of a nuclear holocaust?

The answer to this question is deceptively simple. If we move away from the highly stylized arguments of mutual deterrence and credible assured destruction capability, and return instead to the common sense approach to nuclear weapons, the reason becomes immediately apparent. Nuclear weapons are clearly still the most visible and most feared weapons in the world today. The great importance the two superpowers attach to their restrained development and the great care they have exhibited in controlling their deployment and potential use (or non-use) testify to this fact. The countries which have acquired nuclear arms have all gained rather than lost international prestige. It may still be true that countries with small or embryonic nuclear forces are in greater danger today than they were before they went nuclear, since events have not disproved this thesis. However, the alternative interpretation is at least as valid. None of the lesser powers which have detonated one nuclear device or more has suffered from a conventional invasion since the first detonation.[10] The superpowers themselves have painstickingly avoided situations of direct military confrontation, and have attempted time and again to regulate their conflicts. While this really does not mean that nuclear weapons deter conventional aggression, it does suggest that conventional aggression against nuclear powers is not lightly contemplated, and perhaps unlikely to be considered at all by non-nuclear foes.

There is also the objective battlefield capability of low yield atomic warheads. From the military point of view in South Korea, and more so perhaps in Taiwan, weapons of a few kilotons are extremely effective against troop concentrations. Shipborne cruise missiles and torpedoes can destroy major seaports. The utility of these weapons may be academic when American security guarantees are unmistakbly reliable. This is no longer true for Taiwan. Indeed, given the inability of American conventional forces to guarantee the viability of its forward-based systems, the credibility of a couple of American divisions in Korea would be suspect if they had not been equipped with nuclear weapons. It would be surprising indeed if powerful groups in Japan do not have some doubts about American capabilities in Northeast Asia. Given the realities of the relative declining of American power, it is only natural that there are strong opinions within these governments in favor of developing nuclear weapons. During such moments the problems associated with the vulnerability of their embryonic programs, the possibility of enemy attempts at pre-emption, the hazards of pre-mature disclosure, the technological constraints, and the political and economic costs are obstacles which must be overcome since there is really no (perceived) alternative to the independent deterrent.

Part of the answer to the question can be found in the evolution of American deterrence theory itself. It is probably correct to conjecture that deterrence, or the threat of great harm to disuade certain behavior, goes way back into the very beginning of human existence. It may also be true that the belief that the creation of some form of doomsday weapon could deter (or to prevail in) war was responsible in part for the perpetual search for ever more destructive weapons by mankind, which resulted in the atomic bomb. However, the doctrines of massive retaliation, graduated deterrence, assured destruction, and assured retaliation came only afterwards. These were attempts to theorize about the use (or non-use) of nuclear weapons rather than efforts to explain or rationalize the development and acqusition of the atomic bomb. Historically, the two strongest powers after the war were the first to develop these weapons, and have since acquired them in large numbers and with refined precision. For thirty-five years, the U.S. provided sufficient information on and openly permitted (if not encouraged) civilian scholars to theorize about the role of nuclear weapons in world affairs. Public discussions and debates on national security and nuclear weapons have actually influenced the declaratory policy of American defense postures.[11] Corresponding developments in the Soviet Union came only a decade ago, and on a much more limited scale.[12] It is therefore only natural that the theory of nuclear deterrence, particularly in the areas of coercive diplomacy and arms control, is largely an American intellectual product. By necessity, it is highly focused on the strategic relationship between the U.S. and the Soviet Union. The tendency is to restrict the possession of nuclear arms by as few states as possible. Understandably, the 1963 Test-Ban Treaty and the 1968 Non-Proliferation Treaty are by-products of a staunch anti-proliferation stand. There is a general intellectual unwillingness to see nuclear weapons from the perspective of the lesser powers seeking independent security guarantees. If assured destruction stands for a reliable capability to destroy physically a society by modern standards, then few small powers could or would aspire to it. On the other hand, if assured destruction means the capability to inflict unacceptable damage in retaliation to aggression, then it would appear as an attractive doctrine for finite deterrence. However, neither serves as a basic reason for the acquisition or non-acquisition of nuclear weapons to begin with. Indeed, nations embark on their nuclear weapons programs for a variety of reasons, some of which are practical, others political, and often some combination of both. It is only after the program has been well on track that some sort of coherent theory is advanced for the role nuclear weapons play in the array of foreign and defense policies. It was some fifteen years after China's first detonation that it expressed concern about the credibility of big nuclear missiles should the Soviet Union advance through Chinese defenses with the occassional use of low yield tactical nuclear weapons.[13] Taiwan, which is dependent on American support, may adopt the Israeli example of manufacturing a number of bombs without openly declaring its nuclear status or testing a sample device. This deliberate policy of ambiguity avoids embarrssing the U.S. but does project an element of deterrence by uncertainty at the same time. The evolution of nuclear deterrence doctrines need not stop here. In fact, it is quite likely that as more countries acquire nuclear arms, new theories will be advanced to accomodate the new realities of multilateral, but segmented and unequal deterrence relationships.

Multilateral Deterrence and Assured Destruction

Strictly speaking, small nuclear powers do not, and cannot really hope to achieve "assured destruction" (McNamara style) against a major power on a one-to-one basis. They may be able to threaten each other with this capability provided that appropriate steps are taken to enhance the role of uncertainty. Similarly, medium nuclear powers are vulnerable to the superpowers, but not vice versa. It is possible for one medium power to achieve assured destruction against another. Small powers are vulnerable to all powers nearly all of the time. However, general deductions of this kind are at best useful as a conceptual guidelines. This is even more so when the doctrine of assured destruction itself is the product of superpower bilateral deterrence. Theoretically, even countries like China and India, with literally thousands of cities, towns and villages, could be blanketted by the 11,000 or so warheads of deployed by the U.S., or by roughly half of that number deployed bv the Soviet Union.[14] In the real world, however, the situation in which either China or India would be subjected to threats of such a scale rarely, it at all, exists. The theory of finite deterrence claims that there exists an enemy threshold of unacceptable damage which, if threatened by a second strike, constitutes the ceiling of meaningful destruction. The deployment of adequate retaliatory forces to meet this threshold is therefore "sufficient." Any additional deployment above and beyond this level is considered strategically meaningless. A credible secodn-strike capability stands for the "minimum" (by implication the most efficient) deterrent. Mathematically, no medium nuclear force can survive a first-strike by one of the superpowers. Does it follow, then, that there is no such thing as a minimum deterrent against the superpowers by the lesser powers?

Consider the first variation of Scenario 3, the resumption of Cold War. China is allied with the Soviet Union, while Japan is allied with the U.S.. Obviously, Japanese strategic forces are vulnerable (on a bilateral basis) to a Soviet pre-emptive strike. Conversely, Chinese strategic forces will not survive an American first strike attempt. Does this mean that neither China, nor Japan, can speak of a minimum deterrent against each other? In the same scenario, Taiwan draws support from both the U.S. and Japan. Its nuclear forces are vulnerable to a first-strike by the mainland, and yet, China is no longer sure that its nuclear forces will always be there when the fateful moment comes. does this mean that China cannot reliably retaliate against Taiwan? where, then, is minimum deterrent for China, Japan, and Taiwan? How useful is assured destruction as a yardstick for strategic sufficiency? If, by definition, the lesser powers are not entitled to a minimum (i.e., sufficient) deterrent, does it mean that it makes no difference if they acquire nuclear arms or not? Or that they would be worse off with them than without them?

One analyst followed through the extension of the deductive logic of mutial assured destruction (the reciprocal possession of assured second-strike capabilities) to a multipolar world, and observed that for multipolar stability to be technically feasible, the world had to resemble Morton Kaplan's unit-veto system.[15] The more the number of nuclear states, the higher the military requirement, and the harder to achieve stable deterrence.

Imagine that South Korea has achieved an assured second-strike capability against all six other powers in Scenario 4. This means targetting a total of some 600 cities all over the northern hemisphere, covering some 300 million people.[16] A rough approximation of the DGZ requirements on a second strike at 1 mt and 5 psi yields a total of 820. The warhead requirements after degradation will be considerably higher. This is a huge force by any standard. Consider also the offensive weapons weapons which can theoretically be directed at South Korea. Just existing warhead inventories in the Soviet Union and the U.S. alone amount to some 18,000. To illustrate the actual size of the South korean strategic force which must survive an attack by the combined forces of all six other powers, let us go through the improbable calculations, making the most optimistic assumptions concerning the survivability factors of the South Korean forces. Suppose the average SSKP (hard-target kill) per offensive warhead coming through one time window is equal to 0.4 (overall reliability of the weapon in silo is therefore 0.6), it will require 6 consecutive attacks to achieve a 0.95 kill probability, or 9 consecutive attacks to achieve a 0.99 kill probability.[17] Let us take the most conservative 9:1 ratio in favor of the defense, South Korea must possess in excess of 2,000 delivery vehicles just to survive the potential first strike by the U.S. and the Soviet Union.

Let us make one further arbitrary restriction on the force size of China, Japan, North Korea and Taiwan to 500, 300, 100 and 100 individually targettable warheads, yielding an addition of 1,000 offensive weapons. this will raise the number of vulnerable delivery vehicles (at 0.99 kill probability) to a little over 2,110. Even if South Korean missiles (or any other delivery syetem) enjoy perfect launch, penetration, and other relibaility factors (which is never possible), it will still call for 2,110 + 820 = 2,930 high yield weapons to meet the second-strike requirement. Superpower forces notwithstanding, the restrictions concerning the force sizes of the lesser powers are totally unrealistic in a unit veto-system. Indeed, one would expect the nuclear forces of North Korea and Taiwan to be compatible to that of South Korea. Once we relax this restriction on force sizes, the corresponding requirement for South Korea will shoot up dramatically. For every 9 additional enemy weapons, South Korea must increase its strength by 1. If we multiply the previous force assumptions on the four lesser powers by a factor of 30, thus bringing North Korea on a par with the 3,000 or so high yield South Korean weapons calculated earlier, the new total requirements of South Korea will be 6,000 rather than 2,930. This doubling of requirement takes place when no change in the inventories of the superpowers has been instituted as yet in the calculations. If responses by the superpowers to such an alarming growth of nuclear weapons of the lesser powers are also taken into consideration, the numbers will be too fantastic for our imagination.

According to the logic of pre-emptive strikes against enemy strategic weapons, the force level of each individual nuclear power affects those of the rest. Responses by the rest of the powers to adjust their force levels upwards will in turn induce changes in the one which originally aroused the responses. The interactive effects of changes and responses, and responses to changes can quickly cause an explosion in the sizes of the nuclear forces of all powers concerned. This model of an explosive arms race due to minimum deterrence considerations is of course extremely simplistic.[19] We have yet to find a case of unlimited arms race in history. In the real world, there are many constraints on what countries can or cannot do with their defenses.

Alliance and the Minimum Deterrent

If mutual assured destruction is not possible across several nuclear powers in the Hobbesian state of nature type of situation, will it be any different if alliances are formed such that there is some sort of balance among the two or three blocs, and that within each bloc, each nuclear power maintains its own minimum deterrent? This question implies that nuclear weapons can be studied in ways similar to the traditional balance of power by alliance. What this amounts to is to reduce the amount of players to two, or three. If the number is two, then the logic of mutual assured destruction can be conveniently extended to analyse the strategic equation of a bipolar world. However, this approach has two problems. First, independent deterrents exist usually because they are needed in lieu of reliable guarantees. They cannot really be subjected to some external unified command such that they form parts to the whole of one big nuclear force. Secondly, as a result of this, it is still possible to have vulnerable independent deterrents which are neither controlled nor protected by a superpower.

Again, let us consider one case in the first variation of scenario 3. Internal unrest on Taiwan led to the emergence of a group attempting (with ally support) to declare the island an independent republic. In order to arrest the irreversible process of secession from developing fully, China promptly pre-empts (by whatever means) the small nuclear forces as well as other obstacles which could block the massive movement of troops from the mainland to Taiwan by air and across the Taiwan Strait. Assuming that the pre-emption is successful, and a military takeover is under way, how would Japan and the U.S. respond? Would this trigger a nuclear exchange between the two blocs? Or would the conflict be locally contained, such as a limited exchange of nuclear weapons around the area?

There is another possibility. Suppose the U.S. received advanced intelligence that a pre-emptive strike is about to be launched against Taiwan, say, a couple hours before time zero. Will the U.S. attempt to pre-rempt the mainland Chinese forces first? Will Japan be a participant to this act? What kind of support does China expect from the Soviet Union? What kind of supoort do Japan and the U.S. believe the Soviet Union will give to China?

It is obviously difficult to have clear-cut answers to these hypothetical questions. A lot depends on the international situation at that particular moment, the interplay of domestic political forces, the readiness and the regional balance of military power, and other factors. Even so, there are good reasons to believe that odds against an all-out nuclear exchange are high. At most, partial retaliation or partial pre-emption of China would be contemplated. It is also extremely unlikely that the Soviet Union would be committed to guarantee China because of Taiwan, as long as China is not about to be eliminated as a viable ally. Chinese actions against Taiwan do not directly affect the national security of the U.S., and have only indirect and long term implications on the position of Japan in East Asia. Afterall, Taiwan is only of peripheral interest to the Soviet Union. To follow through this line of rational conjecture, one may ask if China is not fully aware of the consequences, the great uncertainties involved, and the very possibility of suffering a large scale nuclear attack? And if so, why take the enormous risk for a small island? This scenario, although extremely hypothetical, amy appear much less so in a few years' time. The situation raises a fundamental issue concerning nuclear weapons and national interest.

Lesser powers may seek nuclear arms despite apparently insurmountable obstacles and difficulties of all kinds usually because they have a strong need to safeguard their national survival and their national interest. In Northeast Asia, as in many parts of the world today, threats of subjugation, invasion, occupation, problems of national unification and secession, territorial encroachment or even outright annexation are potentially explosive issues, which are strictly related to big power politics, but seldom receive the same intensity of concern or support the parties directly involved feel they should. The status of Taiwan is one obvious case in point. There are strong forces within Japan and the U.S. to work towards an independent Taiwan. Yet, when compared with the concern for Soviet preponderance in the western Pacific region, the issue of Taiwan takes a back seat. These same forces (particularly in the U.S.) also are either unwilling or unable to appreciate the emotion and importance China attaches to the issue of Taiwan. Rational calculations of gains and losses are useful guidelines to predict general patterns of behavior, but are hardly reliable tools to predict specific events and outcomes. The lack of understanding and empathy with the situation and the actors involved can and do lead to unexpected and unwanted confrontations. Confrontations of this sort, and between nuclear powers, really cannot be understood by the logic of mutual assured destruction. Considerations such as the feasibility and likelihood of a successfult pre-emptive strike, the probability of American retaliation to honor its commitments, the possibility of triggering a world war and perhaps of a global nuclear holocaust may not have mattered much anyway in the decision-making process. The choice between taking action or facing the permanent secession of Taiwan may be a very straight forward one indeed. Under these circumstances, it would be most surprising if China at all strives for a "minimum deterrent" such that it can efficiently balance the combined strategic forces of the East with those of the West.

Let us make one further alteration to our scenario. Assuming that the U.S. is in possession of advance intelligence that China is about to launch a pre-emptive strike against Taiwan, would the U.S. pass on this information to the (rebel) authorities on Taiwan such which are in control of the military capabilities? If the answer were yes, or the (rebel) authorities received similar information about the same time, how could the U.S. infleunce Taiwan's decision to launch or not to launch its nuclear weapons in anticipation of the coming attack? While we have no satisfactory answers to these hypothetical (but plausible) situations, we can state with some confidence that the minimum deterrent (defined in terms of assured destruction, or some variation of the same theme) in the context of an alliance among a number of nuclear powers has little relevance to the deterrence policy and the force posture of Taiwan. In fact, multilateral deterrence is neither conducive to nor responsible for the success or failure of deterrence in similar kinds of situations in Northeast Asia. It is quite possible that the lesser nuclear powers, to the extent that they want nuclear weapons badly, are acutely aware of the likelihood and more concerned with the consequences of deterrence failure. As a result, they may emphasize at an earlier stage (say, than the superpowers) in the evolution of their strategic doctrine the utility of nuclear weapons in battlefield applications, and may pronounce (as Glenn Snyder did) that credible deterrence lies in an effective defense.

Bilateral Deterrence in Korea

Let us take Korea as another example. Here is a case of two small powers, both receiving external support. Since the Korean War, the basic objective of North Korea has been to impress upon the South the superiority of the North economically, socially, politically, and militarily. South Korea, on the other hand, has struggled to and gradually succeeded in demonstrating its viability and hence legitimacy to exist as an individual political unit, representing at least the south part, if not all, of Korea. For a greater part of the past thirty years, North Korea has enjoyed overall superiority in military strength, confident leadership, and greater flexibility in diplomatic efforts to seek Korean unification. The single most important obstacle to the unification of Korea as seen by the North is the American military presence in South Korea. In recent years, South Korea has been rapidly building up its defense to match, and perhaps to surpass that of the north. Apparently, it is now ahead in nuclear technology, and could conceivably acquire nuclear arms before the north. Assuming that South Korea has just begun producing nuclear weapons, how would it design its nuclear force? How much would South Korea consider to be enough for its defense?

Let us further assume that South Korea by now has a limited array of nuclear weapons, deliverable by fighters, field guns, and missiles. North Korea is at its early stages of nuclear weapons production. How would North Korea, then, design its nuclear forces? What would be the immediate and the long term goals of the North Korean nuclear forces?

Consider the three different sets of circumstances in which the outbreak of hostilities between the north and the south is most likely:

[1] North Korea has some, though numerically fewer, nuclear weapons. A token American garrison is present in the south, but not forwardly deployed. A political crisis emerges in South Korea. No group is in clear control as a spontaneous uprising leads to a general rebellion and takeover of cities. North Korea decides to seize this opportunity to unite Korea by force. South Korean authorities have been paralyzed.

[2] South Korea has numerical superiority in nuclear weapons and conventional capabilities comparable to those of the north. The collapse of the North Korean economy has led to open discontent within the arm forces and general uprising across the country. South Korea decides to seize this opportunity to remove the antagonistic personal dictatorship in the north, and attempts to install a moderate and compliant regime which may eventually lead to peaceful unification with the south through a series of controlled plesbicites.

[3] War has broken out between China and the Soviet Union along the Mongolian and the Manchurian sectors along the Sino-Soviet border. Japan engages the Soviet Union over Sakhalin, Kamchatka, and Khabarovsk. Both South and North Korea fear a pre-emptive strike by the other side, and declared war on each other simultaneously. This is a situation beyond the control of either Korean government, and, because of their relative weak positions, for which they cannot adequately prepare themselves.

While the government and the military of both North and South Korea probably do not entertain such enventualities on a daily basis, there are good reasons to believe that occasionally, these scenarios are played out to aid long term planning on defense. Historically, North Korea has taken most of the initiatives in its relations with the South. Therefore, it is also quite likely that North Korean planning is more concerned about the utility of nuclear weapons in offensive action (and to deter local American involvement) while that of South Korea emphasizes retaliatory as well as interdictive functions.[20]

Initially, however, there may be brief transitions of symmetry between the two. With only a few bombs in stockpile, the strategy is likely to emphasize punitive strikes at key value locations such as Pyongyang and Seoul. However, as the stockpile grows to 20-30 weapons, some divergence of doctrine is likely to emerge. Given the assumption of a slight South Korean numerical advantage in the number of deliverable weapons, the North Korean strategy may amplify the rigid, massive retaliatory function of nuclear weapons in order to forestall their possible employment by South Korea, thereby limiting conflicts to the conventional level. On the other hand, South Korea may choose to play up the effectiveness of nuclear weapons for interdiction and battlefield support to discourage the amassing of troops (necessary for an invasion, for instance). Furthermore, threats of selective, retaliatory countervalue strikes can also be raised to reduce the incentive to initiate an attack by North Korea. In either case, the idea of assured destruction as the baseline for strategic sufficiency is unlikely to play a dominant role in the design of the respective nuclear forces. South Korea cannot really advance a credible threat by promising the assured destruction of Korean cities and millions of Korea people in the North. On the other hand, North Korea is attempting to catch up, and cannot afford to lag further behind. In fact, the declaratory doctrine of an all-out retaliation in this case may also be restricted to the military-industrial potential of the war-machine in the south. It threatens mutual destruction with weapons of the last resort, and reflects a position of weakness rather than strength. In no way does strategic inferiority aid North Korean attempts at unification.

The South Korean perspective here is that credible deterrence lies in an effective defense. The North Korean perspective is that rough parity is necessary to prevent the South Koreans from active use of nuclear weapons in a North-South military conflict. If possible, a first-strike capability is preferred since it would permit the north the option to a counter-force pre-emptive strike--perhaps the best way there is to guarantee the non-use of nuclear weapons by the south. Once again, we fail to see assured destruction at work in shaping or limiting the design, development, and deployment of small nuclear forces. Korea appears to have presented another case in which the definition of the minimum deterrent is perhaps relative to enemy strength at all times.

Nuclear weapons, like other kinds of force, can be used in different ways: for offense, for coercion, for defense, and for deterrence. These conceptual categories represent convenient indexing for different modes of the use of force, and are not by themselves mutually exclusive. Rather, they often complement each other for greater effectiveness. Deterrence, for instance, can be accomplished either by threatening punishment, or by promising denial, and most effectively by both. Massive retaliation, assured destruction, selective and limited strategic reprisals are doctrines for deterrence by punishment. Preventive strike, pre-emptive strike, controlled counter-force strike are doctrines for war-fighting and deterrence by denial. In the case of Taiwan versus the mainland, apart from the fact that massive destruction of China is most unlikely to be contemplated, assured destruction in the sense of eliminating China as a modern society for many years to come may not even be feasible for a small nuclear force. In the case of Korea, mutual assured destruction may be feasible, but remains inherently unstable and uncertain because of the smallness of forces and the lack of warning time. To be more exact, their strategic relationship is perhaps better described as "mutual probable destruction." For both North and South Korea, the primary concern is not with the ability to bomb a few cities, but to deter, and to prevent if deterrence should fail an invasion by the opponent. Strategic retaliation is considered only as a desperate response of the last resort, and perhaps only demonstrative by design.[21]

Yardsticking Sufficiency

We have seen that in our hypothetical world, the small powers are primarily concerned with capabilities of denial, such that assured destruction is not a basic guideline for and has hardly any influence on the design for an efficient deterrent. In the case of Korea, the adversaries are of comparable size and capabilities. In the case of Taiwan, geographical configurations compensate for the considerable disparities in capabilities. Similarly, the medium powers also desire nuclear weapons for effective denial. Realistically, however, both Japan and China can only hope to acquire very limited capabilities to do so with the Soviet Union as the hypothetical enemy. Relatively more weight therefore must be placed on the retaliatory function of the deterrent. The superpowers enjoy vast superiority in every respect, and can eliminate any independent deterrent of the lesser powers, or all of them, in a first strike. Strictly speaking, only the superpower deterrence relationship between each other can be called "mutual assured destruction" relationship. Even so, there are questions as to the wisdom of a unilateral subscription to this doctrine. Nor is "assured destruction" itself a clear and unambiguous concept. In fact, "assured destruction" as a criterion for strategic sufficiency has shifted over the years in the official defense posture of the U.S. It has meant 50 cities at one time, and 200 today.[22] It embraced large percentages of population and industrial capacity before but now also calls for more severe damages to the Soviet Union and the destruction of their political leadership. These changes reflect differences in the perception of what constitutes unacceptable damage to the Soviet Union. Perhaps they reveal a lot more about the domestic politics of the U.S. and the relative strength between the U.S. and the Soviet Union than the intellectual developments in the concept itself. But as our investigation of the target structures has indicated, for every nuclear power, there exists a point beyond which the marginal returns per increase in weapon becomes negligible. There are obvious structural as well as technical, economical and political limits to the size of an optimal deterrent. Optimality is also relative to purpose, and is therefore subject to a set of values which cannot be quantified easily. As the pioneering study by Enthoven and Smith has frankly stated, the 400 EMT criterion for assured destruction had been derived also in part from effiency consideration.[23] Difficult as it may be to quantify the "industrial capacity" of a nation, it is already a relatively easy task since objective indicators can be utilized, and refined to greater precision over time.

Even if we put aside the question of the relevance and the feasibility of assured destruction as a guideline to the design of medium and small nuclear forces, there is also the problem of multilateral interactions of strategic force postures. We have seen that the strategic relationship between North and South Korea under Scenario 4 defies the calculations of mutual assured destruction. Although the example is a limiting case, it does clearly illustrate the dynamic interactive effect of several nuclear forces, each juggling for the minimum requirement of assured destruction against all other powers. There is no such equilibrium point as "multilateral assured destruction" which can be a conceptual parallel to the bilateral "mutual assured destruction." Since nuclear weapons can be used both for the pre-emption and retaliation, it will require phenomenal numbers of these weapons in order for a reasonable number of them to survive the first-strike exchanges to meet the reuqirements of assured destruction. Realistically, even the medium powers China and Japan are unlikely to go beyond a few hundred weapons within our time frame. The small powers have absolutely no chance to achieve assured destruction in a multilateral deterrence situation.

Given the structural characteristics of great inequlaities, it appears that "assured destruction" is not a feasible guideline for security policies across several nations. Nor do all the nations in Northeast Asia implicitly adopt assured destruction designs for their nuclear weapons program. In many cases, the primary action between the small powers are basically dyadic, and are predominantly concerned with deterrence by effective denial. doctrinal variations usually refelct maneuvers for greater security. China emphasizes no first use in its declaratory stand. In the initial stages with a small arsenal of nuclear weapons, their deployment are likely to be for retaliatory purposes. As the program acquires greater sophistication, deployment will reflect both counter-force and counter-value strategic bombings as well as limited battlefield applications. Japan, on the other hand, is already in possession of a full spectrum of delivery systems, and will be in a better position than China to articulate defensive nuclear doctrines if it goes nuclear. However, under no circumstances can either espouse the doctrine of assured destruction, since the capability simply will not be there within the forseeable future with the superpower as the primary antagonist. There are very real limitations to the number of weapons any of the lesser powers can acquire. Consequently, the idea of finite deterrence and assured destruction has little relevance to the needs and capabilities of small, and even medium nuclear forces. An efficient deterrent therefore is not one that will meet the requirements of assured destruction. It is one that requires the least number of weapons to sustain a credible deterrence policy--credible in the sense that as a result the enemy will refrain from initiating an attack, or that the enemy will desist from the employment of nuclear arms in a conflict. Sufficiency, however, is largely relative, and may be a very lofty goal.

Indeed, deterrence theory and deterrence policy outside those of the superpowers have not shown much sophistication and complexity precisely beause of the primitiveness of lesser power nuclear capabilities and the lack of concern for the full range of international affairs which the superpowers must confront. The most eloquent attempt so far had been made by the French, who succeeded in advancing the principle of proportionality.

However, the fact that nuclear weapons are very destructive remains unchanged. The consequences of their employment, however low the yield the weapon may be, are still formidable and do shatter the psychological barrier called the firebreak. Despite their small numbers, low accuracy, low reliability, vulnerable launch sites, and crude doctrines, there is still a healthy margin to cushion them against possible pre-emption by superior forces. In this respect, the theoretical vulnerability of lesser power nuclear forces may have been a somewhat exaggerated version of the real world. Today, no less than four or five lesser powers have detonated at least one nuclear device, and at least one known country (Pakistan) is engaging in an overt weapons program.[25] None of these programs have yet to be pre-empted although the Chinese program has been rumoured to have survived two contemplated pre-emptions.[26] In the real world, therefore, the lack of a sophisticated strategic doctrine so far does not appear to have hurt the lesser nuclear powers in any significant way.

To the extent that small powers are technologically and economically capable of sustaining a nuclear weapons program, and in so doing do not fragment valuable ties with allies, there are clear advantages for them to become nuclear powers even if weak and vulnerable as long as it does not invite pre-emptive action from major powers. This view, however, is not shared by the U.S. and the Soviet Union.[27]

Nuclear Weapons and Nuclear War in Northeast Asia

The nastiness of nuclear weapons itself is sufficent justification to believe that nuclear proliferation is inherently an unpleasant sort of business. Argument have been deployed to highlight some of the dangers in a world of many nuclear powers. Among them are the following: First, by virtue of the sheer increase in numbers, the likelihood of a nuclear war occurring will be higher. Second, the process of proliferation causes uneven and drastic changes in the international status of the new nuclear states, thus disturbing the stability of the international system. This may result in more conflicts in the form of attempts to subjugate or to pre-empt. Third, nuclear proliferation increases uncertainty in the internationsl system by eroding security guarantees extended to non-nuclear states. Fourth, the likelihood of accidental launch is higher. Fifth, the advantages of an anonymous launch are enhanced. Sixth, the number of nuclear crazy states will increase. Seventh, there will be increased terrorist access to nuclear materials and weapons. Eighth, more nuclear weapons means the weakening of the nuclear taboo. All these arguments suggest readier and likelier use of nuclear weapons resulting in an eventual global holocaust.

On the other hand, it has also been argued that nuclear weapons, while infinitely more powerful than conventional weapons, really have not changed the international system to any alarming extent.[28] One extreme suggestion likens the completely proliferated world to one of Kaplan's ideal-types--the unit veto system--in which the likelihood of war is very low and the stability of the system very high. Another reason that the increase in the number of nuclear states makes it difficult to calculate for clear advantages, which in turn makes war less likely.[29] Thirdly, historical reasons seem to support the notion that conflict between nuclear powers, or intiated against nuclear powers tend to be lower. Fourthly, there is no justifiable reason to believe that new nuclear states will not behave responsibly and intelligently. In fact, small nuclear states have more to lose, and have tended to act more cautiously in the past.[30] Lastly, the best help is self-help. Nulcear weapons seem to offer those lesser powers which need help most precisely what they want. The inherent uncertainty concerning the effects of a nuclear war and the vast destructive power of nuclear weapons are good insurances of caution and restraint.

Given the above observations, will war be more or less likely in Northeast Asia as a result of nuclear proliferation? The fundamental resaon for war and peace is Northeast Asia, as in elsewhere, are political and not military. But military forces, as instruments in self-defense and foreign policy, do affect perceptions of strategic situations and shape considerations on their deployment and employment. To the extent that the use of nuclear weapons could invite reprisals in kind, and bring disastrous consequences on a large scale, it is likely to be avoided as much as possible by sensible decision-makers. The thirty years of the nuclear age have not contradicted this view.[31] Nuclear weapons have not been used since the world has had more than one nuclear power. Conventional war fought between two nuclear powers, outside border conflicts, has yet to occur. Nearly all of the wars fought since the 1950s have been between non-nuclear states. These have taken place inspite of the dangerous reliance on nuclear deterrence in the absence of adequate defensive capabilities, and in some cases, such as China and India, the inadequqcies of both.[32]

On the other hand, few weapons developed and deployed in our history have not been used at some point in time. It is therefore really dangerous to place too much faith in the uniqueness of the supposed doomsday effects of a nuclear exchange to believe that such will never come. Increasing miniaturization of warheads, improving accuracy with precision guidance, minimizing blast effects by enhancing radiation, deploying nuclear weapons in field guns, howitzers, torpedoes, drones, etc., all contribute to their "usefulness" in battle, and perhaps greater "acceptability" because of the relatively limited damage they would incur. These technologies will filter down to the lesser nuclear powers in time.

As long as political solutions are not forthcoming, overt conflicts remain a very real possibility in Northeast Asia. While the presence of nuclear weapons may inhibit the general use of force, the availability of nuclear weapons in conflict areas make them logical weapons of the last resort or perhaps the only weapons of any consequence. The danger of conflicts leading to nuclear wars are very real indeed. How else could South Korea and Taiwan safeguard their independent existence in lieu of external assistance except with their own nuclear weapons? How else could North Korea suppress the fire-power of the south without a first-strike capability, and even then, the results are far from guaranteed? Could China resist a large-scale Soviet invasion without using its nuclear forces? Could Japan exert any real influence in world events and protect its territorial integrity and interests without a credibly strong military force equipped with the most modern weapons? The momentum of declining American power and increasing Soviet preponderance in the Far East must have impressed upon the Japanese deceision-makers the self-help is perhaps the best help. The dictates of realpolitik forging a tripartite entente among the U.S., China and Japan will not ally the fears of the regimes in South Korea and Taiwan. Yet, as long as Sino-Soviet confrontation continues, and the question of Taiwan does not emerge as an issue in U.S.-China and Sino-Japanese relations, it is still possible to forestall Taiwan and South Korea, and perhaps even Japan from exercising the nuclear option as a policy of last resort. Under these circumstances, there is still sufficient American leverage to influence decisions within South Korea and Taiwan.[33]

But the greatest danger in Northeast Asia does not lie so much with Korea and Taiwan as with China itself. The fact that domestic politics is extremely polarized, that the country has a vast as well as poor and frustrated population, that recent changes may not bring tangible results for the country for some time, that China still have border problems with the Soviet Union and India, and that the Chinese minorities could, as a result of the recent liberalization of policy, experience rapidly rising expectations could mean possible upheavals in China in the autonomous regions as well as at the center. The possibilities of Soviet intervention is both real and formidable. The danger of the disintegration of China and the ensuing scramble for what were once parts of China could easily lead to the participation of the Soviet Union, Japan, India, the U.S., and perhaps the return of the KMT to the mainland. Under these circumstances, the pressure and the uncertainty may be too much for either South or North Korea not to seize the initiative by taking pre-emptive action in order to avoid possible defeat. Under this scenario, the use of nuclear weapons cannot be precluded. Indeed, a war on such a scale has yet to take place since 1945, and may well lead to the unthinkable--the next world war.

The problem of nuclear weapons is their awesome destructive power. Effective counter-measures against their use has yet to be found. As long as this offense dominates the defense, there is no persuasive alternative to nuclear weapons for the lesser powers. Yet, while the likelihood of war may be reduced by the possession of nuclear weapons, the consequences of war have also become more ominous. As Professor Tarr has once commented, we have but one planet.[34] It is perhaps mankind's last chance to seize the short remaining moments while assured destruction still provides a sense of awe and fragile military balance to create constructive political environments to retard the dangerous process of galloping proliferation, and in the meantime work toward the kind of technology which will render nuclear weapons much less attractive as tools of coercion and weapons of the last resort. There is indeed no substitue for political solutions. The will and the goodwill to seek a lasting solution to this common threat to human existence must first exist. But the outlook for such is not promising at all. In all probability, new and more destructive weapon systems may appear as means to enhance the national security of individual nations, the end result of which may well be greater insecurity for all.

Traditional nuclear deterrence theory which has so neatly depicted the fundamental strategic relationship between the U.S. and the Soviet Union is not adequate to cope with the probable nuclear doctrines and force postures of the future Nth countires. This inadequacy is likely to increase rather than decrease for two reasons.

1. It now appears that horizontal proliferation while not as rapid as it was once feared is nevertheless persistent and irreversible. The need for a better analysis, perhaps with new premises, new concepts, and greater empathy with individual national perspectives on the role of nuclear weapons is more cogent than ever.
2. Recent developments in weapons technology nuclear and non-nuclear suggest an impending revolution perhaps within this decade in military affairs. While the eventual configuration and the combined effect of these new developments are still unclear, it is quite possible that nuclear weapons would no longer occupy the same centrality of concern with respect to the national security of some, if not all, countries before the century is over.

The process of continued horizontal proliferation coupled with improvements in the miniaturization and precision of nuclear weapons may well mean the increased applicability of nuclear weapons in the battlefield. The combined effects of horizontal and verticle proliferation would probably lead to a lowering of the nuclear threshold. As a result, the probability of war involving nuclear weapons would increase correspondingly. We know that lesser powers, because of limitations in size and in resources, are unlikely to field a large nuclear force. The implication of this is that the nuclear forces of the lesser powers, unlike those of the superpowers, cannot be overly specialized to serve specific purposes. Lesser powers are forced by necessity to develop and deploy multi-role nuclear forces. This creates a problem of simultaneity of functions. It is much more difficult to identify retaliatory forces from war-fighting ones. However, the lesser powers usually have proximate adversaries. Their security concerns vis-a-vis their primary adversary is an effective territorial defense capability. Nuclear forces are deployed first to support this capability, and second as a weapon of the last resort. The conceptual distinction between deterrence and defense becomes progressively more difficult to operationalize the smaller the nuclear power.[35]

We have discussed earlier the psychological disposition of the small power in time of crisis. The small powers in general experience a lack of control over their immediate environment and an inability to influence events. Consequently, they have an exaggerated sense of urgency and tend to seek extreme solutions. The combined effect of better nuclear weapons and more insecure nuclear powers is a greater likelihood of nuclear wars. If the first few localized nuclear conflicts proved that they need not mean the end of humanity, we might witness among other things an era of the (bounded) conventionalization of nuclear warfare. This would have provided incontrovertible evidence that nuclear wars, like other wars, could be fought and won. Such happenings would also have the side effect of accelerated horizontal as well as verticle nuclear proliferation.

This change in thinking about and attitude towards the "conventional" aspects of nuclear weapons need not be a consequence of actual limited nuclear engagements in the battlefield. The successful development of portable high energy weapons such as laser and charged particle beams could lead to extremely effective BMD systems. While such weapon systems potentially share the offensive invincibility of ICBMs, their restricted availability to a very select group of major powers could usher in an era (perhaps not as brief as we might imagine) in which a few countries could treat limited numbers of nuclear weapons as if they were other large conventional weapon systems. It would be interesting to see then if the "conventionalization" of nuclear weapons indeed meant the resurgence of conventional military thinking. Nuclear deterrence theory as we know it most likely would have to be drastically revised. The early deployment of effective high-energy BMD-oriented weapon systems is likely to dampen small power incentives to pursue a vigorous nuclear weapons program. In reality, this is perhaps the most likely happening to have a substantial decelerating effect on the horizontal proliferation of nuclear weapons.

There is another possible scenario in which nuclear weapons would become less prominant a security concern. If the research and development of environmental weapons by the most advanced industrial powers could reach a stage whereby their use could be fine-tuned to yield the desired effects and yet remain relatively undetectable and anonymous to the target nation, then a very different kind of international influence and warfare had come into existence. Natural environmental processes such as earthquakes, hurricanes, tidal waves, volcanic activities, abnormal abundance or scarcity of precipitation leading to floods or droughts, sustained alteration in temperature or humidity leading to disruptions in agricultural activities, etc., could be simulated to trigger certain immediate or long term political changes. Major "natural" disasters, for example, could direct domestic attention from internal political and civil strifes. The resulting economic disaster could, at crititical moments, strengthen the hands of some ruling factions or weaken those of the others. Wherever geophysical conditions permit, simulated earthquakes at the right time could discourage the location of weapons deployment. Similarly, tidal waves could retard if not discourage the development of particular port facilities or shipyards. Generated economic hardships could also lead to greater external dependence. These are some of the results which could not be gained through the naked use of force.[35]

The key to the successful employment of environmental weapons as a strategic deterrent is the combined effect of the knowledge, or at least suspicion, of their existence by the deterree, and yet their very use is not easily verifiable. Environmental weapons permit covert warfare on a scale hitherto unheard of. In order to preserve their usefulness, their employment must remain extremely occasional and highly ambiguous. In this manner, the deterree could not easily threaten retaliation unless it could do so in kind. To the extent that this were true, the utility of the nuclear deterrent would be somewhat depreciated.

By itself, the dawning of environmental weapons would not vitiate small power demand for nuclear arms. On the contrary, it might even dramatize their urgent need for such. The effect is likely to be mixed. Some discouraged by their diminished utility; others goaded to accelerate their efforts. However, the simultaneous emergence of effective BMD systems and environmental modification measures could lead to the effective nullification of nuclear weapons. In the long run, however, all weapons technolgies will proliferate. The sad fact is that because of the increasing ability of human beings to control nature on an ever larger scale, it appears that the periodic triumphs of defensive technologies will grow shorter with time. Unless the international political system undergoes very fundamental changes, the future is likely to be an era of potentially ever more massive destruction.

CHAPTER SIX NOTES

1. Stockholm International Peace Research Institute (SIPRI), The Near-Nuclear Countries and the NPT (Stockholm: SIPRI, 1972); Robert M. Lawrence and Joel Larus, ed., Nuclear Proliferation: Phase II (Lawrence, KS: University Press of Kansas, 1974); George Quester, The Politics of Nuclear Proliferation (Baltimore: Johns Hopkins University Press, 1973).

2. See Chapter Two, note 14.

3. Patrick Morgan, Deterrence: A Conceptual Analysis (Beverly Hills, CA: Sage, 1977), pp. 32ff.

4. Richard Rosecrance, "Strategic Deterrence Reconsidered," Adelphi Papers, No. 116 (London: IISS, Spring 1975). McNamara never really (had to) ventured beyond the Soviet-American strategic relationship in his discussion of assured destruction.

5. Refer to Chapter Five, note 57.

6. They could be shipped to their destination disguised as freight cargo, for example, and detonate upon inspection. Some could be delivered by small remotely piloted vehicles (RPVs) stationed close to the border and flying at tree-top level. Parts could be smuggled into the target country and re-assembled for detonation.

7. Wolfram F. Hanreider and Larry V. Buel, Words and Arms: A Dictionary of Security and Defense Terms (Boulder, CO: Westview Press, 1979).

8. See "Life in a Nuclear Armed Crowd," in Albert Wohlstetteret. al., Swords from Plowshares: The Military Potential of Civilian Nuclear Energy (Chicago: University of Chicago Press, 1979), pp. 126-150.

9. Unless, of course, that the leader of the alliance enjoys near absolute control over its satellites. Not even the Soviet Union has ever enjoyed this privilege.

10. Border incidents not included.

11. One such public forum in the late 1950s was the quarterly journal Foreign Affairs, in which the doctrine of massive retaliation was roundly rejected by critics as lacking in credibility.

12. One major exception is Marshall V. D. Sokolovkiy's Military Strategy which first appeared in 1962, and subsequently underwent two more editions in 1963 and 1968 respectively.

13. Cheah Cheng Hye, "Bridging the Strategic Gap," Far Eastern Economic Review (25 April 1980), pp. 30-32; The author discussed an essay which appeared in the Liberation Army Daily, titled "Research into the Initial Stage of Future War," written by Xu Baoxi.

14. The Soviet Union is expected to increase its inventory to approximately 7,200 warheads by the early 1980s. The Military Balance 1979-80 (London: IISS, 1979). U.S. Defense Secretary Harold Brown gave the figure 9,200 instead of the mid-year IISS estimate of 11,000. See Report of Secretary of Defense Harold Brown to the Congress on the FY 1981 Budget, FY 1982 Authorization Request and FY 1981-1985 Defense Programs, p.72.

15. See Chapter Four, note 2.

16. According to our data, this includes some 200 cities each from the U.S. and the Soviet Union, 110 from China, 50 from Japan, 19 from North Korea, 8 from South Korea and 11 from Taiwan.

17. The cumulative kill probability (KP) is equal to $1-(1-SSKP)^n$, where n=number of consecutive offensive warheads coming through n time windows. In this case,

$$KP = 1-(1-0.4)^n$$

$$0.99 = 1-(0.6)^n$$

$$(0.6)^n=1-0.99$$

$$n \log 0.6 = \log 0.01$$

$$n=\frac{\log 0.01}{\log 0.60}=\frac{-2}{-.222} = 9$$

18. If the lower KP value of 0.95 were accepted, the ratio will be 6:1 instead of 9:1, and the total DGZ requirement will be 3,000 instead of 2,000. See note 17.

19. Rosecrance claims that mutual deterrent stability is possible when the nuclear forces are more or less equal in size, and that there are relatively few crucial targets to destroy. even so, he has to make the restricting assumption that SLBM forces are invulnerable. Otherwise, in a world of unequal forces and some extent of vulnerability, deterrent alliances are necessary for the maintenance of stability. "Strategic Deterrence Reconsidered," p. 29.

20. This does not mean that North Korea is not concerned about a possible joint invasion by American and South Korean forces under the pretext of a counter-attack.

21. This view is shared by Robert E. Harkavy, "The Pariah State Syndrome," Orbis, Vol. XXI, No. 3 (Fall 1977), pp. 623-649; Indeed, most small powers which seek to acquire nuclear weapons are confronted by what Patrick Morgan called "immediate deterrence" or "pure deterrence" situations (Deterrence: A Conceptual Analysis, op. cit.). Small states tend to be concerned primarily with possible invasion which threaten their very existence. Nuclear weapons are to deter such invasions by effective denial. See also, Fuad Jabber, Israel and Nuclear Weapons: Present Option and Future Strategies (London: Cahtto & Windus, 1971); Harkavy, on the other hand, stresses the "last resort" as the dominant scenario in Spectre of a Middle Eastern Holocaust, Monograph Series in World Affairs, Vol. 14, No. 4 (Denver, Co: University of Denver GSIS, 1976-1977).

22. See discussion in Kemp, "Nuclear Forces for Medium Powers: Part I," op. cit., pp. 25-29, and Harold Brown, DoD Annual Report FY 1979, p. 55. What was once considered by McNamara to be the maximum level of assured destruction is considered by Brown to be essential but not adequate.

23. Enthoven and Smith, op. cit., p. 207.

24. Multilateral deterrence situation understood as the conceptual extension of the superpower bilateral deterrence situation.

25. Depending on whether South Africa is counted. Pakistan is overtly pursuing a nuclear weapons program.

26. One by the U.S. in the early 1960s, and the other by the Soviet Union towards the end of the 1960s.

27. With the important exception of Britain, which is the only example of wholesale transfer of delivery systems (purchased from the U.S.) minus the warheads. See, for example, Lefever, Nuclear Arms in the Third World: U.S. Policy Dilemma, op. cit., pp. 2-9.

28. Robert L. Rothstein, Alliances and Small Powers (New York: Columbia University Press, 1968); Vital, Inequality of State, op. cit.; Kenneth Waltz, "What Will the Spread of Nuclear Weapons Do to the World?" in John Kerry King ed., International Political Effects of the Spread of Nuclear Weapons (Washington, D.C.: USGPO, 1977), pp. 165-197; Francois Duchene, "The Proliferation of Arms: Motives, Magnitude and Consequences," in D. C. Gompart et. al., "The diffusion of Power: I. Proliferation of Force," Adelphi Papers, No. 133 (London: IISS, Spring 1977), pp. 14-23.

29. Rosecrance argues that the unit-veto system can have multilateral stability only if the nuclear powers are of more or less equal strength. Waltz, on the other hand, believes that nuclear deterrence has enhanced the stability of the international system not because of the emergence of multipolarity, but because of strengthened bipolarity. See notes 15, 19, and 28.

30. This view is shared by Vital, Rothstein and Waltz.

31. One major exception is the Cuban Missile Crisis, in which both the Soviet Union and the U.S. backed down from the actual use of force. This could be used to argue that the Game of Chicken becomes dominant when such rare instances of nuclear power direct confrontation should come about.

32. It is quite possible that a whole array of factors are responsible for these phenomena, and nuclear weapons are but one common characteristic among these powerful nations.

33. One interesting speculation is that China supports the re-militarization of Japan as long as it does not go nuclear. China believes that only a re-militarized Japan can stand up to Soviet pressures in the Far East.

34. Private communications with Professor David Tarr, 21 August 1980.

35. To a certain extent, covert bacteriological warfare may be able to produce similar political effects. Given the long histroy of the development of bactriological weapons and techniques in "rain-making," it would not be surprising if some such techniques had already been tried on a modest scale in unconventional warfare.

APPENDICES

APPENDIX A

DATABASE SOURCES

I. CHINA (Mainland)

"An Illustrative Map of Some of Last Year's Completed Construction Projects," Ta Kung Pao. (Hong Kong, Chinese ed.) 15 January 1979.

Central Intelligence Agency, PRC Atlas (Washiongton, D.C.: USGPO, 1971).

Cheng-siang Chen, "Population Growth and Urbanization in China, 1953-70," Geographical Review, Vol. , No. (1970), pp. 55-72.

Chinese Economy Post-Mao: A Compednium of Papers, Vol.1: Policy and Performance, Joint Economic Committee of the 95th Congress of the U.S., 2nd Session, 1978.

Chung-kuo hsin-wan (China News), Vol. 7096, 1 May 1974 and 1 October 1974 (Beijing).

Eiichi Koshimura, Chungoku sangyo daichizu (An Economic Atlas of China) (Tokyo: May 1973.

Fuji Janaru Sha, Chugoku Keizai Zenkyubu, ed., Saishin Chugoku kokogyo bumpu zu (Modern Atlas on China's Mining Industries (Tokyo: Fuji Janaru Sha, 1974).

_______, Chugoku keizai no gengo to yembo (Chinese Economy: Present and Future) (Tokyo: Fuji Janaru Sha, 1974).

Hsieh Chiao-min, Atlas of China (Los Angeles: McGraw-Hill, 1973).

Hsu Tak-ming, Communist Chinese Economy During the Cultural Revolution (Hong Kong: Union Research Institute, 1968).

_______, Communist Chinese Economy After the Cultural Revolution (Hong Kong: Union Research Institute, 1974).

Lu yun et. al., Chung kung kung yeh kai kuang tiao ch'a (Survey of Communist Chinese Industries) (Hong Kong: Institute of Research on Chinese Economy and Politics, 1972).

Muskowitz, H. and J. Roberts, Department of the Army Headquarters, China: An Analytical Survey of Literature. DA Pamphlet 550-9-1 (Washington, D.C.: DOA, 1978).

State Statistical Bureau, ed., The Ten Great Years: Statistics

on Economic and Cultural Constructions of the Peoples' Republic of China (Beijing: Peoples' Publications, 1959).

Strategic Survey 1968. London: IISS, 1969.

Strategic Survey 1970. London: IISS, 1971, pp. 38, 49-51.

Donald P. Whitaker and Rinn-Sup Shinn, Area Handbook for the PRC, 2nd ed., (Washington, D.C.: USGPO, 1972).

Yuan-li Wu, China: A Handbook (New York: Praeger, 1973).

_______, China's Spatial Economy (Standford:

Yearbook on Chinese Communism, Taipei: Institute for the Study of Chinese Communist problems, August 1973.

Zhonghua Renmin Kunghoguo Funsheng Ditu Xi (Provincial Atlas of the Peoples' Republic of China) (Beijing: Atlas Publications, October 1974).

II. CHINA (Taiwan):

Chang Chi-yun, ed., National Atlas of China, Vol. I: Taiwan (Yang Ming Shan, Taiwan: The National War College, May 1963).

Chen Cheng-siang, Atlas of Taiwan (Taipei: Fu-min Geographical Institute of Economic Development, 1959).

The Bank of Taiwan Quaterly, Volume 26, No. 1 (1975).

The Bank of Taiwan Quaterly, Volume 26, No. 2 (1975).

China Yearbook 1979. (Taipei: China Publishing Co., 1979).

Committee on the Ten Great Contructions and the Future of the Nation, The Ten Great Constructions and the Future of the Nation. Taipei: August 1974.

Directorate-General of Budget, Accounting and Statistics, Statistical Yearbook of the Republic of China, 1979 (Taipei: Executive Yuan, 1979).

Li Kuang-ming, Why Must We Complete the Nine Big Construction Projects ? (Taipei: Li-ming Cultural Affairs, 1974).

Taiwan (Formosa): Scale 1:500,000, Lambert Orthomorphic Projection, Edition 4-CMS, Sheet 1-1, Series L491, China Map Service Survey Department, CCSF, September 1956, 6-64, Army Map Service, Corps of Engineers, U. S. Army.

Taiwan Demographic Fact Book, 1970. Taipei: Department of Civil Affairs, Taiwan Provincial Government, Nantou, Tawain, 1971.

Republic of China (Taiwan): Administrative Divisions, U. S. Army Topographic Command, n. d.

III. JAPAN:

Asahi Shimbun, Asahi Yearbook 1976, Tokyo: 1976.

Major Metropolitan Areas, 1970 Population Census of Japan Reference Report Series No. 5, Bureau of Statistics, Office of the Prime Minister, 1973.

1975 Population Census of Japan: Volume 1: Total Population, Bureau of Statistics, Office of the Prime Minister, 1977.

1975 Population Census of Japan: Densely Inhabited Districts, Bureau of Statistics, office of the Prime Minister, 1977.

Census of Manufacturers 1975: Report by Cities, Towns, and Villages, Research and Statistics Department, Minister's Secretariat, Ministry of International Trade and Statistics, 1977.

Geographical Survey Institute, The National Atlas of Japan (Tokyo: Ministry of Construction, 1977).

International Society for Educational Information, Atlas of Japan: Physical, Economic and Social (Tokyo: ISEI, 1974).

Japan. Scale 1:3,540,000, 4-72, U. S. Army Topographic Command, n. d.

Japan: 1:2,000,000. (Azimuthal Equidistant Projection Based on Latitutde 40°N, Longitude 141°E) No. 5204, Edition 2-AMS, Army Map Service (GD), Corps of Engineers, U. S. Army, 1953.

Japan and Korea, Scale 1:3,801,600 (60 miles to the inch), Polyconic Projection, Cartographic Division, National Geographic Society, Washington, D.C.: 1970.

National Association of Mayors, ed. Municipal Year Book of Japan '67-'68,

Nippon: A Charted Survey of Japan, 1975/76, ed. Yano-Tsuneta Kinenkai, Tokyo: Kokusei-sha, August 1975).

Shigen chosajo (Natural Resources Survey Bureau), ed., Nihon no shigen zusetsu (An Illustration of Japan's Natural Resources), January

1971.

Strategic Survey 1970, (London: IISS, 1970), p. 38.

IV. KOREA:

Basic Industries, Korea Series No. 9, Ministry of Information, ROK (n. d.).

Business Research in South Korea: An Experiment in Foreign Aid (New York: United Christian Board for Higher Education in Asia, 1976).

Gene and Clare Gurney, North and South Korea (New York: Frankling Watts, 1973).

C. I. Eugene Kim, ed., Korean Unification: Problems and Prospects (Kalamazoo: Korean Research Publications, 1971).

Korean Annual 1977 (Seoul: Hapdong News Agency, May 1977).

Korean Annual 1978 (Seoul: Hapdong News Agency, May 1978).

Korean Annual 1979 (Seoul: Hapdong News Agency, May 1979).

Korean Overseas Information Service, Ministry of Culture and Information, A Handbook of Korea: 1978, 3rd ed. (Seoul: December 1979).

Korean Road Map: North Korea, South Korea, Series L351, Chief of Engineer, Headquarters, ROK Army, ROK Army Map Service, compiled in 1963 from Korea 1:250,000 AMS series 522(1962).

Korean Statistical Yearbook, 1973, Bureau of Statistics Economic Planning Board, Repulbic of Korea (Seoul: 1973).

Southern Korea: Korea Road Map 1:700,000, edition 2-TPC (29 ETB), Sheet 2, Series L351, Transverse Mercator Projection, Mapping and Geodesy Division, Office of the Engineer USARPAC, 1970.

South Korea Administrative Divisions, U. S. Army Topographic Command, n.d.

South Korea, Scale 1:1,220,000, U. S. Army Topographic Command, n. d.

North Korea Railroads, April 1969, Scale 1:1,220,000, n. a., n. d.

Oegunmun Ch'ulp'ansa (Foreign Language Press), Ch'ao-hsien jai k'uang (A Survey of Korea) (Pyongyang: 1961).

The Year Books on North Korea, 1945-1968 (Seoul: Research Institute on Communist Bloc, June 1968).

Nena Vreeland and Rinn-Sup Shinn et. al., Area Handbook for North Korea (Washington, D.C.: USGPO, 1976).

V. USA:

Bureau of the Census, U.S. Department of Commerce, 1972 Census of Manufacturs, Vol. 3: Area Statistics, Parts 1 and 2 (washington, D.C.: USGPO, August 1976).

_______, 1970 Census of Population (Washington, D.C.: USGPO, 1972).

_______, Statistical Abstract of the U.S., 1977 (Washington, D.C.: USGPO, 1977).

Federal Power Commission, 1976 Annual Report (Washington, D.C.: USGPO, 1976).

Geological Survey, U.S. Department of Interior, The National Atlas of the United States of America (Washington, D.C.: 1970).

The Fourth Estate, Editor and Publisher Market Guide (New York: E & P Co., 1977).

1981 Commercial Atlas and Marketing Guide, 112th ed. (New York: Rand McNally & Co., 1981).

VI. USSR:

John C. Dewdney, A Geography of the Soviet Union, 3rd ed. (Oxford: Pergamon Press, 1979).

Chauncy D. Harris, "Urbanization and Population Growth in the Soviet Union, 1959-1970," The Geographical Review, Vol. 21, No. 1 (January 1971), pp. 102-124.

Headquarters, Department of the Army, USSR: An Analytical Survey of Literature, DA Pamphlet 550-6-1, 1976 ed. (Washington, D.C., USGPO, 1976).

S. V. Lalesnik and V. F. Pavlenko, Soviet Union: A Geographical Survey (Moscow: Progress Publishers, 1976).

Eugene E. Keefe, Area Handbook of the Soviet Union (Washington, D.C.: USGPO, 1971).

George Kish, Economic Atlas of the Soviet Union, 2nd ed. (Ann Arbor: University of Michigan Press, 1971).

Borys Lewytzkyi, The Soviet Union: Figures-Facts-Data (Munchen: K. G. Saur, 1979).

Paul Lydolph, Geography of the USSR, 3rd ed. (New York: John Wiley & Sons, 1977).

________, Geography of the USSR, 4th ed. (New York: John Wiley & Sons, 1979).

Abraham Melezim, "Soviet Regionalization: An Attempt at the Delineation of Socioeconomic Integrated Regions," The Geographical Review, Vol. 18, No. 4 (October 1968), pp. 593-621.

Soviet Economy in a New Perspective, Joint Economic Committee of the 94th Congress, 2nd Session, October 14, 1976.

VII. GAZETTEERS:

Mainland China, Vol. I, A-L, Gazetteer No. 22, 2nd ed. (Washington, D.C.: Geographical Names Division, Army Map Service, September 1968).

Mainland China, Vol. II, M-Z, Gazetteer No. 22, 2nd ed. (Washington, D.C.: Geographical Names Division, Army Map Service, September 1968).

Gazetteer of the PRC (Washington, D.C.: Defense Mapping Agency, July 1979).

Republic of China: Official Standard Names Gazetteer (Washington, D.C.: U.S. Board on Geographical Names, Defense Mapping Agency Topographical Center, May 1974).

Gazetteer to Maps of Japan: Map Series AMS L561, L571, L591, W511, 1:250,000, 2nd ed., Army Map Service, War Department, Washington, D.C.: 1945.

North Korea, Gazetteer No. 75 (Washington, D.C.: Office of Geography, Department of Interior, June 1963).

South Korea, Gazetteer No. 95 (Washington, D.C.: Office of Geography, Department fo Interior, December 1965).

The National Atlas of the United States of American (Washington, D.C.: U.S. Department of Interior Geological Survey, 1970).

USSR, Official Standard Names Gazetteer No. 42, Vol. 1, A-B, 2nd ed. (Washington, D.C.: Geographical Names Division, Army Topographic Command, June 1970).

USSR, Official Standard Names Gazetteer No. 42, Vol. I, A-B, 2nd ed. (Washington, D.C.: Geographical Names Division, Army Topographic Command, June 1970).

USSR, Official Standard Names Gazetteer No. 42, Vol. II, C-J, 2nd ed. (Washington, D.C.: Geographical Names Division, Army Topographic Command, June 1970).

USSR, Official Standard Names Gazetteer No. 42, Vol. III, K, 2nd ed. (Washington, D.C.: Geographical Names Division, Army Topographic Command, June 1970).

USSR, Official Standard Names Gazetteer No. 42, Vol. IV, L-N, 2nd ed. (Washington, D.C.: Geographical Names Division, Army Topographic Command, June 1970).

USSR, Official Standard Names Gazetteer No. 42, Vol. V, O-R, 2nd ed. (Washington, D.C.: Geographical Names Division, Army Topographic Command, June 1970).

USSR, Official Standard Names Gazetteer No. 42, Vol. VI, S-T, 2nd ed. (Washington, D.C.: Geographical Names Division, Army Topographic Command, June 1970).

USSR, Official Standard Names Gazetteer No. 42, Vol. VII, U-Z, 2nd ed. (Washington, D.C.: Geographical Names Division, Army Topographic Command, June 1970).

The Times Atlas of the World: Comprehensive Edition (London: Times Publishing Co., 1975).

The Times Index-Gazetteer of the World (London: Times Publishing Co., 1965).

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C   PROGRAM READS FROM CARDS, WRITES ON UNIT 20
      PARAMETER N1=16,N2=38
      DIMENSION CITY(2,N1),    W(6),SEQ(N1),HEAD(54,2),U(N1,N1),XSUM(3)
      INTEGER BLK,V(N2,N1)
      DATA KS/0/,FAC/.75/,W/6*0./
      READ(5,110)KSET,PRNT
      IF(PRNT.NE.'PRINT')GO TO 3
      DO 1 I=1,54
    1 READ(5,102)(HEAD(I,J),J=1,2)
    3 KS=KS+1
      K=0
      READ(5,-)W
      DO 4 I=1,N1
    4 SEQ(I)=0.
      DO 5 I=1,3
    5 XSUM(I)=0.
    7 MX=0
      DO 10 J=1,N1
      DO 9 I=1,N1
    9 U(I,J)=0.
      DO 10 I=1,N2
   10 V(I,J)=0.
      DO 40 J=1,N1
      READ(5,100,ERR=99,END=87)(CITY(I,J),I=1,2),(V(I,J),I=1,12),
     1  (V(I,J),I=22,24),(V(I,J),I=13,21),(V(I,J),I=36,38),
     2  (V(I,J),I=28,35),(V(I,J),I=25,27),ID
   11 MX=MX+1
      K=K+1
      SEQ(J)=K
      DO 15 I=1,38
   15 IF(V(I,J).GE.9)V(I,J)=9
      U( 1,J)=(V(1,J)+V(2,J)+V(3,J)/FAC)/W(1)
      U( 2,J)=(V(4,J)+V(5,J)+V(6,J)+V(7,J)*FAC)/W(2)
      U( 3,J)=(V(8,J)+V(9,J)+V(10,J)+V(11,J)+V(12,J)*(1+FAC))/W(3)
      U( 4,J)=(V(23,J)+V(24,J)+V(25,J)+V(26,J)+V(27,J)+V(22,J)+V(13,J))/
     $ W(4)
      U( 5,J)=(V(14,J)+V(15,J)+V(16,J)+V(17,J))/W(5)
      U( 6,J)=(V(18,J)+V(19,J)+V(20,J)+V(21,J))/W(6)
      U( 9,J)=(V(28,J)+V(29,J)*FAC+V(30,J))/2.
      U(10,J)=(V(36,J)+V(37,J)+V(38,J))/3.
      U(11,J)=(V(31,J)+V(32,J)+V(33,J)+V(34,J)+V(35,J))/5.
C------CONVERSION------
      DO 25 I=1,38
      U(15,J)=U(15,J)+V(I,J)
      IF(PRNT.NE.'PRINT')GO TO 25
      IF(V(I,J)-1)23,22,21
   21 ENCODE(BLK,103)(V(I,J))
      V(I,J)=BLK
      GO TO 25
   22 V(I,J)='X'
      GO TO 25
   23 V(I,J)=' '
   25 CONTINUE
```

```
      DO 30 I=1,6
      IF(U(I,J))30,30,28
   28 U(14,J)=U(14,J)+1
      U(7,J)=U(7,J)+U(I,J)
   30 CONTINUE
      U(12,J)=U(12,J)+U(7,J)
      DO 33 I=9,11
      IF(U(I,J))33,33,31
   31 U(14,J)=U(14,J)+1
      U(12,J)=U(12,J)+U(I,J)
   33 CONTINUE
      U(7,J)=U(7,J)/6.
      U(12,J)=U(12,J)/9.
      XSUM(1)=XSUM(1)+U(7,J)
      XSUM(2)=XSUM(2)+U(12,J)
      XSUM(3)=XSUM(3)+U(15,J)
      U(8,J)=XSUM(1)/K
      U(13,J)=XSUM(2)/K
      U(16,J)=XSUM(3)
      WRITE(20,120)(CITY(I,J),I=1,2),U(7,J),U(12,J),U(14,J),U(15,J),ID
   40 CONTINUE
   87 IF(PRNT.NE.'PRINT')GO TO 72
      PRINT 104,(SEQ(J),J=1,MX)
      PRINT 105,(CITY(1,J),J=1,MX)
      PRINT 105,(CITY(2,J),J=1,MX)
      DO 50 I=1,38
      F=I
      PRINT 106,F,(HEAD(I,J),J=1,2),(V(I,J),J=1,MX)
   50 CONTINUE
      DO 60 I=1,13
      F=I
      L=I+38
      PRINT 107,F,(HEAD(L,J),J=1,2),(U(I,J),J=1,MX)
   60 CONTINUE
      DO 70 I=14,N1
      F=I
      L=I+38
      PRINT 108,F,(HEAD(L,J),J=1,2),(U(I,J),J=1,MX)
   70 CONTINUE
   72 IF(MX.LT.N1)GO TO 88
      GO TO 7
   88 END FILE 20
      IF(KS.LT.KSET)GO TO 3
2     REWIND 20
      PRINT 101
      STOP ENDJOB
   99 STOP RDERR
  100 FORMAT(2A6,3X,2I1,2X,4I1,1X,10I1,2(1X,4I1),I2,2(I1,1X),3I1,2X,8I1,
     $ T79,I2)
  101 FORMAT(1H1)
  102 FORMAT(2A6)
  103 FORMAT(I1)
  104 FORMAT(1H1,18X,16(2X,F4,1X))
  105 FORMAT(19X,16(1X,A6))
  106 FORMAT(1X,F3,1X,2A6,2X,16(4X,A1,2X))
  107 FORMAT(1X,F3,1X,2A6,1X,16(2X,F5.3))
  108 FORMAT(1X,F3,1X,2A6,1X,16(1X,F6))
  110 FORMAT(I2,A6)
  120 FORMAT(2A6,2F5.3,2F3,I2)
      END
```

	1. ABAKAN	2. ACHINSK	3. AKTYURINSK	4. ALMA ATA	5. ANDIZHAN	6. ANGARSK	7. ANZHERO-SUDZ	8. ARKANGELSK	9. ARMAVIR	10. ASHKHABAD	11. ASTRAKHAN	12. BABUSHKIN	13. BAKU	14. BALAKOVO	15. BARANOVICHI	16. BARNAUL
1. IRON & STEEL			X													
2. NONFERROUS M		X														
3. ALL METAL.																
4. MACHINE BLDG			X	X	X	X	X	X	X	X	X		X	X	X	X
5. ELEC.MACHINE																
6. AGRI.MACHINE									X							X
7. PREC.INSTRUM																
8. SHIPBUILDING								X			X		X			X
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER	X			X	X		X			X					X	
14. THERMOELECTR	X		X	X			X	X	X	X	X		X	X	X	
15. HYDROELECTR.				X												X
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD													X			
19. PETRO REFINE						X							X			
20. CHEMICAL IND			X			X	X						X	X		X
21. FERTILIZERS																
22. LIGHT INDUS				X						X			X	X	X	X
23. TEXTILE IND				X				X		X			X			X
24. PAPER MILLS											X			X		
25. FOOD INDUS				X	X	X		X		X	X		X			X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT								X			X		X			
29. SECOND PORT																
30. AIRFIELD				X									X			
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.500	.500	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2. MACHINERIES	.000	.000	.333	.333	.333	.333	.333	.333	.667	.333	.333	.000	.333	.333	.333	.667
3. TRANSP.EQPMS	.000	.000	.000	.000	.000	.000	.000	.250	.000	.000	.250	.000	.250	.000	.000	.250
4. LIGHT INDUS.	.200	.000	.000	.800	.400	.200	.200	.400	.000	.800	.400	.000	.600	.400	.400	.600
5. ELECTRICITY	.250	.000	.250	.500	.000	.000	.250	.250	.250	.250	.250	.000	.250	.250	.250	.250
6. PETRO-CHEM.	.000	.000	.333	.000	.000	.667	.333	.000	.000	.000	.000	.000	1.000	.333	.000	.333
7. IND IDX 1	.075	.083	.236	.272	.122	.200	.186	.206	.153	.231	.206	.000	.406	.219	.164	.350
8. AVG IDX 1	.075	.079	.131	.167	.158	.165	.168	.173	.170	.176	.179	.164	.183	.185	.184	.194
9. PORT&AIRFILD	.000	.000	.000	.500	.000	.000	.000	.500	.000	.000	.500	.000	1.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.050	.056	.157	.237	.081	.133	.124	.193	.102	.154	.193	.000	.381	.146	.109	.233
13. AVG IDX 2	.050	.053	.088	.125	.116	.119	.120	.129	.126	.129	.135	.123	.143	.143	.141	.147
14. # DIF INDUS	2.	1.	4.	4.	2.	3.	4.	5.	2.	3.	5.	0.	6.	4.	3.	5.
15. # DIF INSTAL	2.	1.	4.	8.	3.	4.	4.	6.	3.	6.	6.	0.	11.	5.	4.	8.
16. CUM INSTAL	2.	3.	7.	15.	18.	22.	26.	32.	35.	41.	47.	47.	58.	63.	67.	75.

	17. RATUMI	18. BELAYA -TSERK	19. BELGOR OD	20. BELOVO	21. BEL'TS Y	22. BERDYA NSK	23. BEREZN IKI	24. BIYSK	25. BLAGOV ESHCHE	26. BOBRUY SK	27. BRATSK	28. BREST	29. BRYANS K	30. BUKHAR A	31. CHEBOK SARY	32. CHELYA BINSK
1. IRON & STEEL																X
2. NONFERROUS M				X							X					X
3. ALL METAL.																
4. MACHINE BLDG	X		X	X	X	X		X	X	X	X		X	X	X	X
5. ELEC.MACHINE																
6. AGRI.MACHINE									X							X
7. PREC.INSTRUM																
8. SHIPBUILDING						X			X							
9. AUTOBUILDING																
10. LOCOMOTIVE													X			
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER					X			X					X			X
14. THERMOELECTR	X									X		X			X	X
15. HYDROELECTR.	X										X					
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																X
19. PETRO REFINE	X															
20. CHEMICAL IND	X									X			X			X
21. FERTILIZERS																
22. LIGHT INDUS			X		X			X		X		X				X
23. TEXTILE IND								X							X	X
24. PAPER MILLS																
25. FOOD INDUS	X								X			X	X	X		X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT	X					X										
29. SECOND PORT									X							
30. AIRFIELD																X
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.000	.500	.000	.000	.000	.000	.000	.000	.500	.000	.000	.000	.000	1.000
2. MACHINERIES	.333	.000	.333	.333	.333	.333	.000	.333	.667	.333	.333	.000	.333	.333	.333	.667
3. TRANSP.EQPHS	.000	.000	.000	.000	.000	.250	.000	.000	.250	.000	.000	.000	.250	.000	.000	.000
4. LIGHT INDUS.	.200	.000	.200	.000	.400	.000	.000	.600	.200	.200	.000	.400	.400	.200	.200	.800
5. ELECTRICITY	.500	.000	.000	.000	.000	.000	.000	.000	.000	.250	.250	.250	.000	.000	.250	.250
6. PETRO-CHEM.	.667	.000	.000	.000	.000	.000	.000	.000	.000	.333	.000	.000	.333	.000	.000	.667
7. IND IDX 1	.283	.000	.089	.139	.122	.097	.000	.156	.186	.186	.181	.108	.219	.089	.131	.564
8. AVG IDX 1	.200	.188	.183	.181	.178	.174	.167	.166	.167	.168	.168	.166	.168	.165	.164	.177
9. PORT&AIRFILD	.500	.000	.000	.000	.000	.500	.000	.000	.375	.000	.000	.000	.000	.000	.000	.500
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.244	.000	.059	.093	.081	.120	.000	.104	.166	.124	.120	.072	.146	.059	.087	.431
13. AVG IDX 2	.153	.144	.140	.137	.135	.134	.128	.127	.129	.129	.128	.126	.127	.125	.123	.133
14. # DIF INDUS	5.	0.	2.	2.	2.	3.	0.	2.	4.	4.	3.	2.	4.	2.	3.	6.
15. # DIF INSTAL	7.	0.	2.	2.	3.	3.	0.	4.	5.	4.	3.	3.	5.	2.	3.	12.
16. CUM INSTAL	82.	82.	84.	86.	89.	92.	92.	96.	101.	105.	108.	111.	116.	118.	121.	133.

	33. CHEREP OVETS	34. CHERKA SSY	35. CHERNI GOV	36. CHERNO VTSY	37. CHIMKE NT	38. CHIRCH IK	39. CHITA	40. DAUGAV PILS	41. DNEPRO DZERZH	42. DNEPRO PETROV	43. DONETS K	44. DUSHAU BE	45. DZAMBU L	46. DZERZH INSK	47. ELEKTR OSTAL'	48. ENGELS
1. IRON & STEEL	X					X			X	X	X				X	
2. NONFERROUS M					X											
3. ALL METAL.																
4. MACHINE BLDG	X	X		X	X		X	X		X	X	X				X
5. ELEC.MACHINE																
6. AGRI.MACHINE								X		X						
7. PREC.INSTRUM															X	
8. SHIPBUILDING	X									X						
9. AUTOBUILDING										X						X
10. LOCOMOTIVE									X	X						X
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER					X	X		X	X		X	X	X	X		
14. THERMOELECTR					X		X		X	X	X	X				
15. HYDROELECTR.						9			X			2				
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE																
20. CHEMICAL IND		X	X		X	X			X	X	X		X	X		X
21. FERTILIZERS																
22. LIGHT INDUS		X	X			X		X				X				
23. TEXTILE IND			X	X	X		X	X				X				X
24. PAPER MILLS																
25. FOOD INDUS		X	X	X		X	X			X	X	X	X			
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD										X	X					
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.500	.000	.000	.000	.500	.500	.000	.000	.500	.500	.500	.000	.000	.000	.500	.000
2. MACHINERIES	.333	.333	.000	.333	.333	.000	.333	.667	.000	.667	.333	.333	.000	.000	.250	.333
3. TRANSP.EQPMS	.250	.000	.000	.000	.000	.000	.000	.000	.250	.750	.000	.000	.000	.000	.000	.500
4. LIGHT INDUS.	.000	.400	.600	.400	.400	.600	.400	.600	.200	.200	.400	.800	.400	.200	.000	.200
5. ELECTRICITY	.000	.000	.000	.000	.250	2.250	.250	.000	.500	.250	.250	.750	.000	.000	.000	.000
6. PETRO-CHEM.	.000	.333	.333	.000	.333	.333	.000	.000	.333	.333	.333	.000	.333	.333	.000	.333
7. IND IDX 1	.181	.178	.156	.122	.303	.614	.164	.211	.297	.450	.303	.314	.122	.089	.125	.228
8. AVG IDX 1	.177	.177	.176	.175	.178	.190	.189	.190	.192	.198	.201	.203	.202	.199	.198	.198
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500	.500	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.120	.119	.104	.081	.202	.409	.109	.141	.198	.356	.257	.209	.081	.059	.083	.152
13. AVG IDX 2	.133	.132	.131	.130	.132	.139	.139	.139	.140	.145	.148	.149	.148	.146	.144	.145
14. # DIF INDUS	3.	3.	2.	2.	5.	4.	3.	2.	5.	7.	6.	3.	2.	2.	2.	4.
15. # DIF INSTAL	3.	4.	4.	3.	6.	14.	4.	5.	6.	10.	7.	8.	3.	2.	2.	5.
16. CUM INSTAL	136.	140.	144.	147.	153.	167.	171.	176.	182.	192.	199.	207.	210.	212.	214.	219.

	49. FEODOSIYA	50. FERGANA	51. FRUNZE	52. GOMEL	53. GORKY	54. GORLOVKA	55. GRODNO	56. GROZNYY	57. GURYEV	58. IRKUTSK	59. IVANOVO	60. IVANO-FRANKO	61. IZHERSK	62. KADIYEVKA	63. KALININ	64. KALININGRAD
1. IRON & STEEL					X	X				X						
2. NONFERROUS M					X	X				X			X			
3. ALL METAL.																
4. MACHINE BLDG			X	X		X		X		X	X	X	X		X	X
5. ELEC.MACHINE																
6. AGRI.MACHINE			X	X												
7. PREC.INSTRUM																
8. SHIPBUILDING					X					X						X
9. AUTOBUILDING					X		X			X						
10. LOCOMOTIVE					X										X	X
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER				X		X	X			X	X		X			
14. THERMOELECTR			X			3	X	X	X	X	X				X	X
15. HYDROELECTR.			X							X						
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD		X						X								
19. PETRO REFINE		X			X			X	X	X						
20. CHEMICAL IND		X		X	X			X		X	X					
21. FERTILIZERS																
22. LIGHT INDUS												X				
23. TEXTILE IND		X	X	X			X				X	X			X	
24. PAPER MILLS				X	X											X
25. FOOD INDUS		X	X	X			X	X	X	X		X			X	X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT	X								X							
29. SECOND PORT					X					X						
30. AIRFIELD					X					X						
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.000	.000	1.000	1.000	.000	.000	.000	1.000	.000	.000	.500	.000	.000	.000
2. MACHINERIES	.000	.000	.667	.667	.000	.333	.000	.333	.000	.333	.333	.333	.333	.000	.333	.333
3. TRANSP.EQPMS	.000	.000	.000	.000	.750	.000	.250	.000	.000	.500	.000	.000	.000	.000	.250	.500
4. LIGHT INDUS.	.000	.400	.400	.800	.200	.200	.600	.200	.200	.400	.400	.600	.200	.000	.400	.400
5. ELECTRICITY	.000	.000	.500	.000	.000	.750	.250	.250	.250	.500	.250	.000	.000	.000	.250	.250
6. PETRO-CHEM.	.000	1.000	.000	.333	.667	.000	.000	1.000	.333	.667	.333	.000	.000	.000	.000	.000
7. IND IDX 1	.000	.233	.261	.300	.436	.381	.183	.297	.131	.567	.219	.156	.172	.000	.206	.247
8. AVG IDX 1	.194	.195	.196	.198	.203	.206	.206	.207	.206	.212	.212	.211	.211	.207	.207	.208
9. PORT&AIRFILD	.500	.000	.000	.000	.875	.000	.000	.000	.500	.875	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.056	.156	.174	.200	.388	.254	.122	.198	.143	.475	.146	.104	.115	.000	.137	.165
13. AVG IDX 2	.143	.143	.144	.145	.149	.151	.151	.152	.151	.157	.157	.156	.155	.153	.152	.153
14. # DIF INDUS	1.	2.	3.	3.	5.	4.	3.	4.	4.	7.	4.	2.	3.	0.	4.	4.
15. # DIF INSTAL	1.	5.	6.	7.	10.	7.	5.	6.	4.	13.	5.	4.	3.	0.	5.	6.
16. CUM INSTAL	220.	225.	231.	238.	248.	255.	260.	266.	270.	283.	288.	292.	295.	295.	300.	306.

	65. KALUGA	66. KAMENS K-URAL	67. KARAGA NDA	68. KAUNAS	69. KAZAN	70. KEMERO VO	71. KERCH	72. KHABAR OVSK	73. KHARKO V	74. KHARTS YZSK	75. KHERSO N	76. KIEV	77. KIROV	78. KIROVA BAD	79. KIROVA KAN	80. KIROVO GRAD
1. IRON & STEEL		X	X				X			X	X					
2. NONFERROUS M		X												X		
3. ALL METAL.																
4. MACHINE BLDG	X	X	X	X	X	X		X	X			X	X		X	
5. ELEC.MACHINE																
6. AGRI.MACHINE				X	X	X		X	X				X	X		X
7. PREC.INSTRUM																
8. SHIPBUILDING							X	X			X	X				
9. AUTOBUILDING																
10. LOCOMOTIVE	X				X				X							
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER			X	X	X	X			X			X				X
14. THERMOELECTR		X	X	X	X	X	X	X	2			X	X	X	X	
15. HYDROELECTR.				X								X				
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE								X			X					
20. CHEMICAL IND	X			X	X	X	X		X			X		X	X	
21. FERTILIZERS																
22. LIGHT INDUS			X	X	X				X		X	X	X			
23. TEXTILE IND			X	X	X				X			X		X	X	X
24. PAPER MILLS													X			
25. FOOD INDUS	X		X			X		X	X		X	X	X			X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT				X			X									
29. SECOND PORT					X			X				X				
30. AIRFIELD					X			X	X			X				
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	1.000	.500	.000	.000	.000	.500	.000	.000	.500	.500	.000	.000	.500	.000	.000
2. MACHINERIES	.333	.333	.333	.667	.667	.667	.000	.667	.667	.000	.000	.333	.667	.333	.333	.333
3. TRANSP.EQPMS	.250	.000	.000	.000	.250	.000	.250	.250	.250	.000	.250	.250	.000	.000	.000	.000
4. LIGHT INDUS.	.200	.000	.800	.600	.600	.400	.000	.200	.800	.000	.400	.800	.600	.200	.200	.600
5. ELECTRICITY	.000	.250	.250	.500	.250	.250	.250	.250	.500	.000	.000	.500	.250	.250	.250	.000
6. PETRO-CHEM.	.333	.000	.000	.333	.333	.333	.333	.333	.333	.000	.333	.333	.000	.333	.333	.000
7. IND IDX 1	.186	.264	.314	.350	.350	.275	.222	.283	.425	.083	.247	.369	.253	.269	.186	.156
8. AVG IDX 1	.208	.208	.210	.212	.214	.215	.215	.216	.219	.217	.217	.219	.220	.220	.220	.219
9. PORT&AIRFILD	.000	.000	.000	.500	.875	.000	.500	.875	.500	.000	.000	.875	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.124	.176	.209	.289	.331	.183	.204	.286	.339	.056	.165	.344	.169	.180	.124	.104
13. AVG IDX 2	.152	.153	.153	.155	.158	.158	.159	.161	.163	.162	.162	.164	.164	.164	.164	.163
14. # DIF INDUS	4.	3.	4.	5.	6.	4.	5.	6.	6.	1.	4.	6.	3.	5.	4.	2.
15. # DIF INSTAL	4.	4.	7.	9.	10.	6.	5.	8.	11.	1.	5.	11.	6.	5.	4.	4.
16. CUM INSTAL	310.	314.	321.	330.	340.	346.	351.	359.	370.	371.	376.	387.	393.	398.	402.	406.

	81. KISELEVSK	82. KISHINEV	83. KLAJPEDA	84. KOKAND	85. KOLOMNA	86. KOMMUNARSK	87. KOMSOMOLSK-N	88. KONSTANTINOV	89. KOPEYSK	90. KOSTROMA	91. KOVROV	92. KRAMATORSK	93. KRASNODAR	94. KRASNOYARSK	95. KRASNY LUCH	96. KREMENCHUG
1. IRON & STEEL								X						X		
2. NONFERROUS M									X					X		
3. ALL METAL.																
4. MACHINE BLDG	X	X	X	X	X		X	X	X	X	X		X	X		X
5. ELEC.MACHINE																
6. AGRI.MACHINE													X	X		X
7. PREC.INSTRUM					X											
8. SHIPBUILDING			X		X		X			X				X		
9. AUTOBUILDING																X
10. LOCOMOTIVE					X									X		X
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER		X					X					X	X			
14. THERMOELECTR	X	X	X	X			X	X		X			X	X		
15. HYDROELECTR.														X		X
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE							X						X	X		
20. CHEMICAL IND			X	X	X	X		X						X		
21. FERTILIZERS																
22. LIGHT INDUS		X	X													X
23. TEXTILE IND		X	X	X						X	X		X	X		
24. PAPER MILLS			X													
25. FOOD INDUS		X											X	X		
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT														X		
30. AIRFIELD							X						X	X		
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.000	.000	.000	.000	.000	.500	.500	.000	.000	.000	.000	1.000	.000	.000
2. MACHINERIES	.333	.333	.333	.333	.583	.000	.333	.333	.333	.333	.333	.000	.667	.667	.000	.667
3. TRANSP.EQPMS	.000	.000	.250	.000	.500	.000	.250	.000	.000	.250	.000	.000	.000	.500	.000	.500
4. LIGHT INDUS.	.000	.800	.600	.200	.000	.000	.200	.000	.000	.200	.200	.200	.600	.400	.000	.200
5. ELECTRICITY	.250	.250	.250	.250	.000	.000	.250	.250	.000	.250	.000	.000	.250	.500	.000	.250
6. PETRO-CHEM.	.000	.000	.333	.333	.333	.333	.333	.333	.000	.000	.000	.000	.333	.667	.000	.000
7. IND IDX 1	.097	.231	.294	.186	.236	.056	.228	.236	.139	.172	.089	.033	.308	.622	.000	.269
8. AVG IDX 1	.218	.218	.219	.218	.219	.217	.217	.217	.216	.216	.214	.212	.213	.218	.215	.216
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.500	.000	.000	.000	.000	.000	.500	.875	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.065	.154	.196	.124	.157	.037	.207	.157	.093	.115	.059	.022	.261	.512	.000	.180
13. AVG IDX 2	.162	.162	.162	.162	.162	.160	.161	.161	.160	.160	.158	.157	.158	.162	.160	.160
14. # DIF INDUS	2.	3.	5.	4.	3.	1.	6.	4.	2.	4.	2.	1.	5.	7.	0.	4.
15. # DIF INSTAL	2.	6.	7.	4.	5.	1.	6.	4.	2.	4.	2.	1.	8.	14.	0.	6.
16. CUM INSTAL	408.	414.	421.	425.	430.	431.	437.	441.	443.	447.	449.	450.	458.	472.	472.	478.

	97. KRIVOY ROG	98. KURYSH EV	99. KUNTSE VO	100. KURGAN	101. KURSK	102. KUSTAN AY	103. KUTAIS I	104. KZYL-O RDA	105. LENINA BAD	106. LENINA KAN	107. LENING RAD	108. LENINS K-KUZN	109. LIPETS K	110. LISICH ANSK	111. LUTSK	112. LVOV
1. IRON & STEEL	X										X		X			
2. NONFERROUS M											X					
3. ALL METAL.																
4. MACHINE BLDG		X			X		X			X	X	X	X			X
5. ELEC.MACHINE																
6. AGRI.MACHINE		X											X		X	X
7. PREC.INSTRUM																
8. SHIPBUILDING											X					
9. AUTOBUILDING							X									X
10. LOCOMOTIVE											X					
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER		X			X	X						X	X		X	
14. THERMOELECTR	X				X						9					X
15. HYDROELECTR.							X		X	X						
16. OTHER ELECTR																
17. NUCLEAR ENER					2						2					
18. OILFIELD																
19. PETRO REFINE		X									X					X
20. CHEMICAL IND	X	X			X		X				X		X	X		X
21. FERTILIZERS																
22. LIGHT INDUS		X			X	X		X	X	X	X				X	
23. TEXTILE IND					X	X	X			X	X					X
24. PAPER MILLS	X										X					
25. FOOD INDUS					X	X		X			X		X		X	X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT											X					
29. SECOND PORT		X														
30. AIRFIELD		X									X		X			
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.500	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.000	.500	.000	.000	.000
2. MACHINERIES	.000	.667	.000	.000	.333	.000	.333	.000	.000	.333	.333	.333	.667	.000	.333	.667
3. TRANSP.EQPMS	.000	.000	.000	.000	.000	.000	.250	.000	.000	.000	.500	.000	.000	.000	.000	.250
4. LIGHT INDUS.	.200	.400	.000	.000	.800	.800	.200	.400	.200	.400	.800	.200	.400	.000	.600	.400
5. ELECTRICITY	.250	.000	.000	.000	.750	.000	.250	.000	.250	.250	2.750	.000	.000	.000	.000	.250
6. PETRO-CHEM.	.333	.667	.000	.000	.333	.000	.333	.000	.000	.000	.667	.000	.333	.333	.000	.667
7. IND IDX 1	.214	.289	.000	.000	.369	.133	.228	.067	.075	.164	1.008	.089	.317	.056	.156	.372
8. AVG IDX 1	.216	.217	.215	.212	.214	.213	.213	.212	.211	.210	.218	.216	.217	.216	.215	.217
9. PORT&AIRFILD	.000	.875	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.000	.500	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.143	.290	.000	.000	.246	.089	.152	.044	.050	.109	.783	.059	.267	.037	.104	.248
13. AVG IDX 2	.160	.161	.160	.1[illegible]8	.159	.158	.158	.157	.156	.156	.162	.161	.162	.161	.160	.161
14. # DIF INDUS	4.	4.	0.	0.	4.	1.	5.	1.	2.	3.	7.	2.	5.	1.	2.	5.
15. # DIF INSTAL	4.	8.	0.	0.	9.	4.	5.	2.	2.	4.	24.	2.	7.	1.	4.	8.
16. CUM INSTAL	482.	490.	490.	490.	499.	503.	508.	510.	512.	516.	540.	542.	549.	550.	554.	562.

	113. LYURER TSY	114. MAGADA N	115. MAGNIT OGORSK	116. MAKEYE VKA	117. MAKHAC HKALA	118. MAYKOP	119. MELITO POL	120. MIASS	121. MINSK	122. MOGILE V	123. MOSCOW	124. MURMAN SK	125. MYSTIS HCHII	126. NAKHOD KA	127. NAL'CH IK	128. NAMANG AN
1. IRON & STEEL			X	X							X					
2. NONFERROUS M								X			X				X	
3. ALL METAL.																
4. MACHINE BLDG		X	X		X	X	X		X	X		X			X	
5. ELEC.MACHINE																
6. AGRI.MACHINE							X		X		X					
7. PREC.INSTRUM																
8. SHIPBUILDING					X							X		X		
9. AUTOBUILDING								X	X		X					
10. LOCOMOTIVE											X					
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER		X							X	X	X	X			X	
14. THERMOELECTR			X						X		o	X				
15. HYDROELECTR.						X						X				
16. OTHER ELECTR																
17. NUCLEAR ENER											X	4				
18. OILFIELD																
19. PETRO REFINE					X						X					
20. CHEMICAL IND	X		X	X	X	X			X	X	X		X			
21. FERTILIZERS																
22. LIGHT INDUS									X		X					
23. TEXTILE IND					X		X		X		X					
24. PAPER MILLS																
25. FOOD INDUS		X	X		X				X		X	X			X	X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT					X							X		X		
29. SECOND PORT											X					
30. AIRFIELD									X		X					
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.500	.500	.000	.000	.000	.500	.000	.000	1.000	.000	.000	.000	.500	.000
2. MACHINERIES	.000	.333	.333	.000	.333	.333	.667	.000	.667	.333	.333	.333	.000	.000	.333	.000
3. TRANSP.EQPMS	.000	.000	.000	.000	.250	.000	.000	.250	.250	.000	.500	.250	.000	.250	.000	.000
4. LIGHT INDUS.	.000	.400	.200	.000	.400	.000	.200	.000	.800	.200	.800	.400	.000	.000	.400	.200
5. ELECTRICITY	.000	.000	.250	.000	.000	.250	.000	.000	.250	.000	2.500	1.500	.000	.000	.000	.000
6. PETRO-CHEM.	.333	.000	.333	.333	.667	.333	.000	.000	.333	.333	.667	.000	.333	.000	.000	.000
7. IND IDX 1	.056	.122	.269	.139	.275	.153	.144	.125	.383	.144	.967	.414	.056	.042	.206	.033
8. AVG IDX 1	.215	.214	.215	.214	.215	.214	.214	.213	.214	.214	.220	.221	.220	.219	.219	.217
9. PORT&AIRFILD	.000	.000	.000	.000	.500	.000	.000	.000	.500	.000	.875	.500	.000	.500	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.037	.081	.180	.093	.239	.102	.096	.083	.311	.096	.742	.331	.037	.083	.137	.022
13. AVG IDX 2	.160	.159	.159	.159	.159	.159	.158	.158	.159	.158	.163	.165	.164	.163	.163	.162
14. # DIF INDUS	1.	2.	5.	2.	5.	3.	2.	2.	6.	3.	7.	5.	1.	2.	3.	1.
15. # DIF INSTAL	1.	3.	5.	2.	7.	3.	3.	2.	10.	3.	23.	11.	1.	2.	4.	1.
16. CUM INSTAL	563.	566.	571.	573.	580.	583.	586.	588.	598.	601.	624.	635.	636.	638.	642.	643.

	129. NIKOLAYEV	130. NIKOPOL	131. NIZHNIY-TAGI	132. NOGINSK	133. NORILSK	134. NOROCHERKASK	135. NOVGOROD	136. NOVOKUBYSHEV	137. NOVOKUZNETSK	138. NOVOMOSKOVSK	139. NOVOROSSIYSK	140. NOVOSHAKHTI(	141. NOVOSIBIRSK	142. ODESSA	143. OMSK	144. ORDZHONIKIDZ
1. IRON & STEEL		X	X		X				X				X		X	
2. NONFERROUS M					X				X				X		X	X
3. ALL METAL.																
4. MACHINE BLDG		X	X	X	X		X		X		X		X	X	X	X
5. ELEC.MACHINE																
6. AGRI.MACHINE	X			X							X		X	X	X	
7. PREC.INSTRUM																
8. SHIPBUILDING	X													X		
9. AUTOBUILDING														X		
10. LOCOMOTIVE			X			X			X							X
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER			X	X					X	X	X	X		X		
14. THERMOELECTR	X		X	X	X	X			X		X	X	X	X	X	
15. HYDROELECTR.													X		X	X
16. OTHER ELECTR																
17. NUCLEAR ENER				X												
18. OILFIELD																
19. PETRO REFINE														X	X	
20. CHEMICAL IND			X	X		X			X	X	X	X	X	X	X	X
21. FERTILIZERS																
22. LIGHT INDUS													X		X	
23. TEXTILE IND	X										X		X	X	X	
24. PAPER MILLS																
25. FOOD INDUS	X			X	X								X	X	X	
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT	X										X		X	X		
29. SECOND PORT					X										X	
30. AIRFIELD													X		X	
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.500	.500	.000	1.000	.000	.000	.000	1.000	.000	.000	.000	1.000	.000	1.000	.500
2. MACHINERIES	.333	.333	.333	.667	.333	.000	.333	.000	.333	.000	.667	.000	.667	.667	.667	.333
3. TRANSP.EQPMS	.250	.000	.250	.000	.000	.250	.000	.000	.250	.000	.000	.000	.000	.500	.000	.250
4. LIGHT INDUS.	.400	.000	.200	.400	.200	.000	.000	.000	.200	.200	.400	.200	.600	.600	.600	.000
5. ELECTRICITY	.250	.000	.250	.500	.250	.250	.000	.000	.250	.000	.250	.250	.500	.250	.500	.250
6. PETRO-CHEM.	.000	.000	.333	.333	.000	.333	.000	.000	.333	.333	.333	.333	.333	.667	.667	.333
7. IND IDX 1	.206	.139	.311	.317	.297	.139	.056	.000	.394	.089	.275	.131	.517	.447	.572	.278
8. AVG IDX 1	.217	.216	.217	.218	.219	.218	.217	.215	.216	.216	.216	.215	.217	.219	.222	.222
9. PORT&AIRFILD	.500	.000	.000	.000	.375	.000	.000	.000	.000	.000	.500	.000	1.000	.500	.875	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.193	.093	.207	.211	.240	.093	.037	.000	.263	.059	.239	.087	.456	.354	.479	.185
13. AVG IDX 2	.162	.161	.162	.162	.163	.162	.161	.160	.161	.160	.161	.160	.162	.163	.166	.166
14. # DIF INDUS	5.	2.	6.	4.	5.	3.	1.	0.	6.	2.	5.	3.	6.	6.	6.	5.
15. # DIF INSTAL	6.	2.	6.	7.	6.	3.	1.	0.	7.	2.	7.	3.	12.	11.	13.	5.
16. CUM INSTAL	649.	651.	657.	664.	670.	673.	674.	674.	681.	683.	690.	693.	705.	716.	729.	734.

	145. OREKHO VO-ZUY	146. OREL	147. ORENBU RG	148. ORSHA	149. ORSK	150. OSH	151. PAVLOD AR	152. PENZA	153. PERM	154. PEROVO	155. PERVOU RAL'SK	156. PETROP AVLOVS	157. PETROP AVLOVS	158. PETROZ AVODSK	159. PODOL' SK	160. POLTAV A
1. IRON & STEEL											X					
2. NONFERROUS M					X		X									
3. ALL METAL.																
4. MACHINE BLDG	X	X	X	X	X			X	X			X		X	X	X
5. ELEC.MACHINE																
6. AGRI.MACHINE		X			X		X		X				X	X		
7. PREC.INSTRUM																
8. SHIPBUILDING									X			X		X		
9. AUTOBUILDING	X															
10. LOCOMOTIVE					X										X	
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER					X		X		X				X	X	X	X
14. THERMOELECTR		X	X	X	X			X	X		X	X	X			X
15. HYDROELECTR.									X							
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD									X							
19. PETRO REFINE			X		X		X									
20. CHEMICAL IND	X						X				X					X
21. FERTILIZERS																
22. LIGHT INDUS			X		X									X		X
23. TEXTILE IND	X		X	X		X			X							X
24. PAPER MILLS								X								
25. FOOD INDUS		X	X			X	X		X				X			
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT									X							
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.000	.000	.500	.000	.500	.000	.000	.000	.500	.000	.000	.000	.000	.000
2. MACHINERIES	.333	.667	.333	.333	.667	.000	.333	.333	.667	.000	.000	.333	.333	.667	.333	.333
3. TRANSP.EQPMS	.250	.000	.000	.000	.250	.000	.000	.000	.250	.000	.000	.250	.000	.250	.250	.000
4. LIGHT INDUS.	.200	.200	.600	.200	.400	.400	.400	.200	.600	.000	.000	.000	.400	.400	.200	.600
5. ELECTRICITY	.000	.250	.250	.250	.250	.000	.000	.250	.500	.000	.250	.250	.250	.000	.000	.250
6. PETRO-CHEM.	.333	.000	.333	.000	.333	.000	.667	.000	.333	.000	.333	.000	.000	.000	.000	.333
7. IND IDX 1	.186	.186	.253	.131	.400	.067	.317	.131	.392	.000	.181	.139	.164	.219	.131	.253
8. AVG IDX 1	.222	.221	.222	.221	.222	.221	.222	.221	.222	.221	.221	.220	.220	.220	.219	.219
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.375	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.124	.124	.169	.087	.267	.044	.211	.087	.303	.000	.120	.093	.109	.146	.087	.169
13. AVG IDX 2	.166	.165	.165	.165	.165	.165	.165	.164	.165	.164	.164	.164	.163	.163	.163	.163
14. # DIF INDUS	4.	3.	4.	3.	6.	1.	4.	3.	6.	0.	3.	3.	3.	3.	3.	4.
15. # DIF INSTAL	4.	4.	6.	3.	8.	2.	6.	3.	10.	0.	3.	3.	4.	5.	3.	6.
16. CUM INSTAL	738.	742.	748.	751.	759.	761.	767.	770.	780.	780.	783.	786.	790.	795.	798.	804.

	161. PROKOP YEVSK	162. PSKOV	163. RAZAN	164. RIGA	165. ROSTOV -NA-DO	166. ROVNO	167. RURTSO VSK	168. RUSTAV I	169. RYBINS K	170. SALAVA T	171. SAMAKA RND	172. SARANS K	173. SARATO V	174. SEMIPA LATINS	175. SEROV	176. SERPUH OV
1. IRON & STEEL								X							X	
2. NONFERROUS M																
3. ALL METAL.																
4. MACHINE BLDG	X	X	X	X	X		X	X	X		X	X	X	X		X
5. ELEC.MACHINE																X
6. AGRI.MACHINE			X	X	X		X						X			
7. PREC.INSTRUM																
8. SHIPBUILDING				X	X				X							
9. AUTOBUILDING												X				
10. LOCOMOTIVE				X												
11. AIRCRAFT																
12. ALL TRANSP.																X
13. CONSTR.MATER				X	X								X	X		
14. THERMOELECTR				X	X		X					X	X	X	X	
15. HYDROELECTR.								9	X							
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE			X										X			
20. CHEMICAL IND	X		X	X	X			X		X			X			X
21. FERTILIZERS																
22. LIGHT INDUS			X		X							X	X	X		
23. TEXTILE IND		X		X							X		X	X		X
24. PAPER MILLS				X	X											
25. FOOD INDUS			X	X	X						X	X	X	X		
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT					X											
30. AIRFIELD					X											
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.000	.000	.000	.000	.000	.500	.000	.000	.000	.000	.000	.000	.500	.000
2. MACHINERIES	.333	.333	.667	.667	.667	.000	.667	.333	.333	.000	.333	.333	.667	.333	.000	.667
3. TRANSP.EQPMS	.000	.000	.000	.500	.250	.000	.000	.000	.250	.000	.000	.250	.000	.000	.000	.438
4. LIGHT INDUS.	.000	.200	.400	.800	.800	.000	.000	.000	.000	.000	.400	.400	.800	.800	.000	.200
5. ELECTRICITY	.000	.000	.000	.250	.250	.000	.250	2.250	.250	.000	.000	.250	.250	.250	.250	.000
6. PETRO-CHEM.	.333	.000	.667	.333	.333	.000	.000	.333	.000	.333	.000	.000	.667	.000	.000	.333
7. IND IDX 1	.111	.089	.289	.425	.383	.000	.153	.569	.139	.056	.122	.206	.397	.231	.125	.273
8. AVG IDX 1	.219	.218	.218	.220	.221	.219	.219	.221	.221	.220	.219	.219	.220	.220	.219	.220
9. PORT&AIRFILD	.000	.000	.000	.000	.875	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.074	.059	.193	.283	.353	.000	.102	.380	.093	.037	.081	.137	.265	.154	.083	.182
13. AVG IDX 2	.162	.161	.162	.162	.164	.163	.162	.163	.163	.162	.162	.162	.162	.162	.162	.162
14. # DIF INDUS	2.	2.	3.	5.	6.	0.	2.	4.	3.	1.	2.	4.	4.	3.	2.	4.
15. # DIF INSTAL	2.	2.	6.	10.	11.	0.	3.	12.	3.	1.	3.	5.	9.	6.	2.	5.
16. CUM INSTAL	806.	808.	814.	824.	835.	835.	838.	850.	853.	854.	857.	862.	871.	877.	879.	884.

	177. SEVAST OPOL'	178. SEVERO DONETS	179. SEVERO DVINS	180. SHAKHT Y	181. SIMFER OPOL'	182. SLAVYA NSK	183. SMOLEN SK	184. SOCHI	185. STARVR OPOL	186. STERLI TAMAK	187. SUKHUM I	188. SUMGAI T	189. SUMY	190. SVERDL OVSK	191. SYKTYV KAR	192. SYZRAN
1. IRON & STEEL												X		X		
2. NONFERROUS M												X		X		
3. ALL METAL.																
4. MACHINE BLDG	X		X		X	X	X		X	X			X	X	X	X
5. ELEC.MACHINE																
6. AGRI.MACHINE																X
7. PREC.INSTRUM																
8. SHIPBUILDING			X												X	
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER				X						X				X		
14. THERMOELECTR	X			X	X	X	X		X			X		X		
15. HYDROELECTR.											X					
16. OTHER ELECTR																
17. NUCLEAR ENER				X			2							2		
18. OILFIELD												X				
19. PETRO REFINE																X
20. CHEMICAL IND						X			X	X		X	X	X		
21. FERTILIZERS																
22. LIGHT INDUS	X			X	X						X			X		X
23. TEXTILE IND							X						X		X	
24. PAPER MILLS															X	
25. FOOD INDUS					X		X		X		X		X	X		
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD					X			X								
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.000	1.000	.000	.000
2. MACHINERIES	.333	.000	.333	.000	.333	.333	.333	.000	.333	.333	.000	.000	.333	.333	.333	.667
3. TRANSP.EQPMS	.000	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000
4. LIGHT INDUS.	.200	.000	.000	.400	.400	.000	.400	.000	.200	.200	.400	.000	.400	.600	.400	.200
5. ELECTRICITY	.250	.000	.000	.500	.250	.250	.750	.000	.250	.000	.250	.250	.000	.750	.000	.000
6. PETRO-CHEM.	.000	.000	.000	.000	.000	.333	.000	.000	.333	.333	.000	.667	.333	.333	.000	.333
7. IND IDX 1	.131	.000	.097	.150	.164	.153	.247	.000	.186	.144	.108	.319	.178	.503	.164	.200
8. AVG IDX 1	.219	.218	.217	.217	.217	.216	.217	.215	.215	.215	.214	.215	.215	.216	.216	.216
9. PORT&AIRFILD	.000	.000	.000	.000	.500	.000	.000	.500	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.087	.000	.065	.100	.165	.102	.165	.056	.124	.096	.072	.213	.119	.335	.109	.133
13. AVG IDX 2	.161	.161	.160	.160	.160	.159	.159	.159	.159	.158	.158	.158	.158	.159	.159	.159
14. # DIF INDUS	3.	0.	2.	2.	4.	3.	3.	1.	4.	3.	2.	3.	3.	5.	3.	3.
15. # DIF INSTAL	3.	0.	2.	4.	5.	3.	6.	1.	4.	3.	3.	5.	4.	10.	4.	4.
16. CUM INSTAL	887.	887.	889.	893.	898.	901.	907.	908.	912.	915.	918.	923.	927.	937.	941.	945.

	193. YAGANR OG	194. TALLIN N	195. TAMBOV	196. TASHKE NT	197. TBILIS I	198. TEMIRT AU	199. TERNOP OL	200. TIRASP OL'	201. TOGLIA TTI	202. TOMSK	203. TSELIN OGRAD	204. TULA	205. TYUMEN	206. UFA	207. ULAN-U DE	208. UL'YAN OVSK
1. IRON & STEEL	X					X						X				
2. NONFERROUS M																
3. ALL METAL.																
4. MACHINE BLDG	X	X	X	X	X			X	X	X	X	X	X	X	X	X
5. ELEC.MACHINE																
6. AGRI.MACHINE	X			X	X						X	X				
7. PREC.INSTRUM																
8. SHIPBUILDING	X	X						X					X	X		
9. AUTOBUILDING									X							X
10. LOCOMOTIVE														X	X	
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER		X				X	X				X	X		X	X	
14. THERMOELECTR	X	X	X	X	X	X		X		X		X		X	X	X
15. HYDROELECTR.				X	X											
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD					X											
19. PETRO REFINE					X									X		
20. CHEMICAL IND	X	X	X						X	X	X		X	X		
21. FERTILIZERS																
22. LIGHT INDUS		X		X	X		X	X	X	X			X			X
23. TEXTILE IND		X	X		X			X	X					X	X	X
24. PAPER MILLS														X		
25. FOOD INDUS		X	X	X	X					X	X		X	X	X	X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT		X														
29. SECOND PORT											X		X	X		
30. AIRFIELD				X	X											
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.500	.000	.000	.000	.000	.500	.000	.000	.000	.000	.000	.500	.000	.000	.000	.000
2. MACHINERIES	.667	.333	.333	.667	.667	.000	.000	.333	.333	.333	.667	.667	.333	.333	.333	.333
3. TRANSP.EQPMS	.250	.250	.000	.000	.000	.000	.000	.250	.250	.000	.000	.000	.250	.500	.250	.250
4. LIGHT INDUS.	.000	.800	.400	.400	.600	.200	.400	.400	.400	.400	.400	.200	.400	.800	.600	.600
5. ELECTRICITY	.250	.250	.250	.500	.500	.250	.000	.250	.000	.250	.000	.250	.000	.250	.250	.250
6. PETRO-CHEM.	.333	.333	.333	.000	.667	.000	.000	.000	.333	.333	.333	.000	.333	.667	.000	.000
7. IND IDX 1	.333	.328	.219	.261	.406	.158	.067	.206	.219	.219	.233	.269	.219	.425	.239	.239
8. AVG IDX 1	.216	.217	.217	.217	.218	.218	.217	.217	.217	.217	.217	.217	.217	.218	.218	.219
9. PORT&AIRFILD	.000	.500	.000	.500	.500	.000	.000	.000	.000	.000	.375	.000	.375	.375	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.222	.274	.146	.230	.326	.106	.044	.137	.146	.146	.197	.180	.188	.325	.159	.159
13. AVG IDX 2	.159	.159	.159	.160	.161	.160	.160	.160	.160	.159	.160	.160	.160	.161	.161	.161
14. # DIF INDUS	5.	6.	4.	4.	5.	3.	1.	4.	4.	4.	4.	4.	5.	6.	4.	4.
15. # DIF INSTAL	6.	9.	5.	7.	10.	3.	2.	5.	5.	5.	6.	5.	6.	11.	6.	6.
16. CUM INSTAL	951.	960.	965.	972.	982.	985.	987.	992.	997.	1002.	1008.	1013.	1019.	1030.	1036.	1042.

	209. URAL'S K	210. USSURI YSK	211. UST-KA MENOGO	212. VILNA	213. VINNIT SA	214. VITEBS K	215. VLADIM IR	216. VLADIV OSTOK	217. VOLGOG RAD	218. VOLOGD A	219. VOLZHS KIY	220. VORONE ZH	221. VOROSH ILOVGR	222. YAKUTS K	223. YALTA	224. YAROSL AVL
1. IRON & STEEL									X							
2. NONFERROUS M			X						X							
3. ALL METAL.																
4. MACHINE BLDG	X	X	X	X	X	X	X	X	X	X	X	X	X			X
5. ELEC.MACHINE																
6. AGRI.MACHINE				X		X	X		X	X		X				
7. PREC.INSTRUM																
8. SHIPBUILDING								X	X	X						
9. AUTOBUILDING																
10. LOCOMOTIVE													X			
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER			X	X		X		X	X			X	X			
14. THERMOELECTR		X		X		X		X	X			X		X		
15. HYDROELECTR.			2						X							
16. OTHER ELECTR																
17. NUCLEAR ENER												X				
18. OILFIELD																
19. PETRO REFINE								X								
20. CHEMICAL IND			X		X		X		X		X	X	X			
21. FERTILIZERS																
22. LIGHT INDUS	X			X				X	X					X		
23. TEXTILE IND				X		X	X		X				X			
24. PAPER MILLS						X										
25. FOOD INDUS	X			X	X	X		X	X			X	X			
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT								X								
29. SECOND PORT									X					X		X
30. AIRFIELD									X							
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.500	.000	.000	.000	.000	.000	1.000	.000	.000	.000	.000	.000	.000	.000
2. MACHINERIES	.333	.333	.333	.667	.333	.667	.667	.333	.667	.667	.333	.667	.333	.000	.000	.333
3. TRANSP.EQPMS	.000	.000	.000	.000	.000	.000	.000	.250	.250	.250	.000	.000	.250	.000	.000	.000
4. LIGHT INDUS.	.400	.000	.200	.800	.200	.800	.200	.600	.800	.000	.000	.400	.600	.200	.000	.000
5. ELECTRICITY	.000	.250	.500	.250	.000	.250	.000	.250	.500	.000	.000	.500	.000	.250	.000	.000
6. PETRO-CHEM.	.000	.000	.333	.000	.333	.000	.333	.333	.333	.000	.333	.333	.333	.000	.000	.000
7. IND IDX 1	.122	.097	.311	.286	.144	.286	.200	.294	.592	.153	.111	.317	.253	.075	.000	.056
8. AVG IDX 1	.218	.218	.218	.218	.218	.218	.218	.219	.220	.220	.219	.220	.220	.219	.218	.218
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.500	.875	.000	.000	.000	.000	.375	.000	.375
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.081	.065	.207	.191	.096	.191	.133	.252	.492	.102	.074	.211	.169	.092	.000	.079
13. AVG IDX 2	.160	.160	.160	.160	.160	.160	.160	.160	.162	.162	.161	.161	.161	.161	.160	.160
14. # DIF INDUS	2.	2.	5.	3.	3.	3.	3.	6.	7.	2.	2.	4.	4.	3.	0.	2.
15. # DIF INSTAL	3.	2.	6.	7.	3.	7.	4.	8.	14.	3.	2.	7.	6.	3.	0.	2.
16. CUM INSTAL	1045.	1047.	1053.	1060.	1063.	1070.	1074.	1082.	1096.	1099.	1101.	1108.	1114.	1117.	1117.	1119.

	225. YELETS	226. YEREVAN	227. YOSHKAR-OLA	228. YUZHNO-SAKHA	229. ZAPOROZHYE	230. ZHDANOV	231. ZHITOMIR	232. ZLATOUST
1. IRON & STEEL						X		X
2. NONFERROUS M		X						
3. ALL METAL.								
4. MACHINE BLDG	X	X	X	X		X	X	X
5. ELEC.MACHINE								
6. AGRI.MACHINE			X					X
7. PREC.INSTRUM								
8. SHIPBUILDING								
9. AUTOBUILDING								
10. LOCOMOTIVE								
11. AIRCRAFT								
12. ALL TRANSP.								
13. CONSTR.MATER		X				X		
14. THERMOELECTR		X				X		X
15. HYDROELECTR.		X						
16. OTHER ELECTR								
17. NUCLEAR ENER		X						
18. OILFIELD								
19. PETRO REFINE								
20. CHEMICAL IND		X				X	X	X
21. FERTILIZERS								
22. LIGHT INDUS	X	X						
23. TEXTILE IND		X					X	
24. PAPER MILLS				X			X	
25. FOOD INDUS		X	X	X	X		X	
26. GLASS MFG								
27. SUGAR REFINE								
28. MAJOR PORT						X		
29. SECOND PORT								
30. AIRFIELD								
31. MILITARY C C								
32. NAVAL BASE								
33. ARMY BASE								
34. AIRFORCE B								
35. MUNITION DEP								
36. WEAPONS PROD								
37. MISSILES								
38. NUCLEAR WPNS								
1. METALLURGY	.000	.500	.000	.000	.000	.500	.000	.500
2. MACHINERIES	.333	.333	.667	.333	.000	.333	.333	.667
3. TRANSP.EQPMS	.000	.000	.000	.000	.000	.000	.000	.000
4. LIGHT INDUS.	.200	.800	.200	.400	.200	.200	.600	.000
5. ELECTRICITY	.000	.750	.000	.000	.000	.250	.000	.250
6. PETRO-CHEM.	.000	.333	.000	.000	.000	.333	.333	.333
7. IND IDX 1	.089	.453	.144	.122	.033	.269	.211	.292
8. AVG IDX 1	.217	.218	.218	.217	.217	.217	.217	.217
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.500	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.059	.302	.096	.081	.022	.235	.141	.194
13. AVG IDX 2	.160	.160	.160	.160	.159	.159	.159	.159
14. # DIF INDUS	2.	5.	2.	2.	1.	6.	3.	4.
15. # DIF INSTAL	2.	10.	3.	3.	1.	6.	5.	5.
16. CUM INSTAL	1121.	1131.	1134.	1137.	1138.	1144.	1149.	1154.

	1. AKRON	2. ALBANY	3. ALBUQU ERQUE	4. ALEXAN DRIA	5. ALLENT OWN	6. AMARIL LO	7. ANAHEI M	8. ANCHOR AGE	9. ANN AR BOR	10. ATLANT A	11. BALTIM ORE	12. BATON ROUGE	13. BEAUMO NT	14. BERKEL EY	15. BIRMIN GHAM	16. BOSTON
1. IRON & STEEL	X						X			X	X	X	X	X	X	X
2. NONFERROUS M																
3. ALL METAL.	X									X	X		X	X	X	X
4. MACHINE BLDG	X		X		X		X			X	X			X	X	X
5. ELEC.MACHINE					X		X		X	X	X					
6. AGRI.MACHINE																
7. PREC.INSTRUM							X									X
8. SHIPBUILDING											X	X			X	X
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.							X				X				X	X
13. CONSTR.MATER			X							X						
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE																
20. CHEMICAL IND	X				X		X			X	X	X	X	X		X
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND					X					X	X					X
24. PAPER MILLS							X			X	X					
25. FOOD INDUS	X	X		X	X	X	X	X		X	X	X	X	X	X	X
26. GLASS MFG	X							X		X					X	
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE								X		X						
34. AIRFORCE B								X								
35. MUNITION DEP											X					
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	1.167	.000	.000	.000	.000	.000	.500	.000	.000	1.167	1.167	.500	1.167	1.167	1.167	1.167
2. MACHINERIES	.333	.000	.333	.000	.667	.000	.917	.000	.333	.667	.667	.000	.000	.333	.333	.583
3. TRANSP.EQPMS	.000	.000	.000	.000	.000	.000	.875	.000	.000	.000	1.375	.500	.000	.000	1.375	1.375
4. LIGHT INDUS.	.400	.200	.200	.200	.400	.200	.400	.400	.000	1.000	.600	.200	.200	.200	.400	.400
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.500	.000	.000	.000	.500	.000	.500	.000	.000	.500	.500	.500	.500	.500	.000	.500
7. IND IDX 1	.400	.033	.089	.033	.261	.033	.532	.067	.056	.556	.718	.283	.311	.367	.546	.671
8. AVG IDX 1	.400	.217	.174	.139	.163	.142	.197	.181	.167	.206	.253	.255	.259	.267	.286	.310
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.400	.000	.200	.200	.000	.000	.000	.000	.000
12. IND IDX 2	.267	.022	.059	.022	.174	.022	.355	.089	.037	.393	.501	.189	.207	.244	.364	.447
13. AVG IDX 2	.267	.144	.116	.093	.109	.094	.132	.126	.116	.144	.176	.177	.180	.184	.196	.212
14. # DIF INDUS	4.	1.	2.	1.	3.	1.	5.	2.	1.	5.	6.	4.	3.	4.	4.	5.
15. # DIF INSTAL	6.	1.	2.	1.	5.	1.	8.	4.	1.	11.	11.	4.	4.	5.	7.	9.
16. CUM INSTAL	6.	7.	9.	10.	15.	16.	24.	28.	29.	40.	51.	55.	59.	64.	71.	80.

	17. BRIDGE PORT	18. BUFFAL O	19. CAMBRI DGE	20. CAMDEN	21. CANTON	22. CEDAR RAPIDS	23. CHARLO TTE	24. CHATAN OOGA	25. CHICAG O	26. CINCIN NATI	27. CLEVEL AND	28. COLO.S PRINGS	29. COLUMB IA	30. COLUMB US	31. COLUMB US	32. CORPUS CHRIS
1. IRON & STEEL	X	X	X	X	X		X	X	X	X	X		X	X	X	
2. NONFERROUS M																
3. ALL METAL.	X	X					X	X	X	X	X				X	
4. MACHINE BLDG	X	X	X	X			X	X	X	X	X	X		X	X	
5. ELEC.MACHINE	X	X	X				X	X	X	X	X	X				
6. AGRI.MACHINE																
7. PREC.INSTRUM	X		X						X	X	X				X	
8. SHIPBUILDING											X					X
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.	X							X	X		X				X	
13. CONSTR.MATER								X	X					X		
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD									X							
19. PETRO REFINE											X					
20. CHEMICAL IND		X		X				X	X	X	X				X	
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND	X	X	X	X			X	X	X	X	X			X	X	
24. PAPER MILLS	X	X				X	X	X	X	X	X				X	
25. FOOD INDUS	X	X	X	X	X		X	X	X	X	X		X	X	X	X
26. GLASS MFG		X		X			X	X	X	X	X			X	X	X
27. SUGAR REFINE									X							
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C														X		
32. NAVAL BASE		X														
33. ARMY BASE												X		X		
34. AIRFORCE B												X			X	X
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	1.167	1.167	.500	.500	.500	.000	1.167	1.167	1.167	1.167	1.167	.000	.500	.500	1.167	.000
2. MACHINERIES	.917	.667	.917	.333	.000	.000	.667	.667	.917	.917	.917	.667	.000	.333	.583	.000
3. TRANSP.EQPMS	.875	.000	.000	.000	.000	.000	.000	.875	.875	.000	1.375	.000	.000	.000	.875	.500
4. LIGHT INDUS.	.600	.800	.400	.600	.200	.200	.800	1.000	1.200	.800	.800	.000	.200	.800	.800	.400
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.000	.500	.000	.500	.000	.000	.000	.500	1.000	.500	1.000	.000	.000	.000	.500	.000
7. IND IDX 1	.593	.522	.303	.322	.117	.033	.439	.701	.860	.564	.876	.111	.117	.272	.654	.150
8. AVG IDX 1	.326	.337	.335	.335	.324	.311	.317	.333	.354	.362	.381	.371	.363	.360	.369	.362
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.200	.000	.000	.000	.000	.000	.000	.000	.000	.000	.400	.000	.400	.200	.200
12. IND IDX 2	.395	.370	.202	.215	.078	.022	.293	.468	.573	.376	.584	.119	.078	.226	.458	.122
13. AVG IDX 2	.223	.231	.229	.229	.222	.212	.216	.226	.240	.246	.258	.253	.247	.246	.253	.249
14. # DIF INDUS	4.	5.	3.	4.	2.	1	3.	5.	5.	4.	5.	2.	2.	4.	6.	3.
15. # DIF INSTAL	9.	10.	6.	6.	2.	1.	8.	11.	14.	10.	13.	4.	2.	8.	11.	4.
16. CUM INSTAL	89.	99.	105.	111.	113.	114.	122.	133.	147.	157.	170.	174.	176.	184.	195.	199.

	33. DALLAS	34. DAYTON	35. DEARBORN	36. DENVER	37. DES MOINES	38. DETROIT	39. DULUTH	40. EL PASO	41. ELIZABETH	42. ERIE	43. EVANSVILLE	44. FLINT	45. FREMONT	46. FRESNO	47. FT.LAUDERDAL	48. FT.WAYNE
1. IRON & STEEL	X	X		X	X	X	X	X	X	X	X	X				X
2. NONFERROUS M																
3. ALL METAL.	X	X								X			X			X
4. MACHINE BLDG	X	X		X		X	X		X	X	X	X	X		X	X
5. ELEC.MACHINE	X	X				X				X			X			
6. AGRI.MACHINE																
7. PREC.INSTRUM	X					X						X				
8. SHIPBUILDING		X		X						X						
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.						X				X			X	X	X	
13. CONSTR.MATER	X					X		X						X		
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE	X															
20. CHEMICAL IND	X	X				X			X				X			
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND	X			X				X	X		X		X			
24. PAPER MILLS	X	X			X	X							X			X
25. FOOD INDUS	X	X		X	X	X	X	X	X	X	X	X	X	X		X
26. GLASS MFG	X	X				X		X								
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE								X								
34. AIRFORCE B	X	X		X												
35. MUNITION DEP				X												
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	1.167	1.167	.000	.500	.500	.500	.500	.500	.500	1.167	.500	.500	.667	.000	.000	1.167
2. MACHINERIES	.917	.667	.000	.333	.000	.917	.333	.000	.333	.667	.333	.583	.667	.000	.333	.333
3. TRANSP.EQPMS	.000	.500	.000	.500	.000	.875	.000	.000	.000	1.375	.000	.000	.875	.875	.875	.000
4. LIGHT INDUS.	1.000	.600	.000	.400	.400	.800	.200	.800	.400	.200	.400	.200	.600	.400	.000	.400
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	1.000	.500	.000	.000	.000	.500	.000	.000	.500	.000	.000	.000	.500	.000	.000	.000
7. IND IDX 1	.681	.572	.000	.289	.150	.599	.172	.217	.289	.568	.206	.214	.551	.212	.201	.317
8. AVG IDX 1	.372	.378	.367	.365	.359	.365	.360	.357	.355	.360	.357	.353	.358	.355	.351	.351
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.200	.200	.000	.400	.000	.000	.000	.200	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.476	.404	.000	.237	.100	.399	.115	.167	.193	.379	.137	.143	.368	.142	.134	.211
13. AVG IDX 2	.256	.260	.253	.252	.248	.252	.249	.247	.245	.249	.246	.244	.246	.244	.242	.241
14. # DIF INDUS	5.	6.	0.	5.	2.	5.	3.	3.	4.	4.	3.	3.	5.	2.	2.	3.
15. # DIF INSTAL	13.	10.	0.	7.	3.	10.	3.	6.	5.	7.	4.	4.	8.	3.	2.	5.
16. CUM INSTAL	212.	222.	222.	229.	232.	242.	245.	251.	256.	263.	267.	271.	279.	282.	284.	289.

	49. FT.WORTH	50. GARDEN GROVE	51. GARY	52. GLENDALE	53. GRAND RAPIDS	54. GREENSBORO	55. HAMMOND	56. HAMPTON	57. HARTFORD	58. HIALEAH	59. HOLLYWOOD	60. HONOLULU	61. HOUSTON	62. HUNTSVILLE	63. INDEPENDENCE	64. INDIANAPOLIS
1. IRON & STEEL	X		X	X	X	X			X	X			X		X	X
2. NONFERROUS M																
3. ALL METAL.	X		X				X						X			X
4. MACHINE BLDG	X			X	X	X	X		X	X			X	X	X	X
5. ELEC.MACHINE				X	X	X				X			X		X	X
6. AGRI.MACHINE																
7. PREC.INSTRUM	X			X									X			X
8. SHIPBUILDING												X	X			
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.					X					X			X	X	X	X
13. CONSTR.MATER	X				X					X			X		X	X
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE	X												X		X	
20. CHEMICAL IND	X			X		X							X			X
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND	X					X			X	X			X			
24. PAPER MILLS	X									X		X	X			X
25. FOOD INDUS	X		X	X	X	X	X	X	X	X	X	X	X	X		X
26. GLASS MFG	X				X	X						X	X	X		X
27. SUGAR REFINE										X						
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C													X			
32. NAVAL BASE												X				
33. ARMY BASE												X				X
34. AIRFORCE B	X											X	X			
35. MUNITION DEP														X		
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	1.167	.000	1.167	.500	.500	.500	.667	.000	.500	.500	.000	.000	1.167	.000	.500	1.167
2. MACHINERIES	.583	.000	.000	.917	.667	.667	.333	.000	.333	.667	.000	.000	.917	.333	.667	.917
3. TRANSP.EQPMS	.000	.000	.000	.000	.875	.000	.000	.000	.000	.875	.000	.500	1.375	.875	.875	.875
4. LIGHT INDUS.	1.000	.000	.200	.200	.600	.600	.200	.200	.400	1.000	.200	.600	1.000	.400	.200	.800
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	1.000	.000	.000	.500	.000	.500	.000	.000	.000	.000	.000	.000	1.000	.000	.500	.500
7. IND IDX 1	.625	.000	.228	.353	.440	.378	.200	.033	.206	.507	.033	.183	.910	.268	.457	.710
8. AVG IDX 1	.356	.349	.347	.347	.349	.349	.346	.341	.338	.341	.336	.334	.343	.342	.344	.349
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.200	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.600	.400	.200	.000	.200
12. IND IDX 2	.439	.000	.152	.235	.294	.252	.133	.022	.137	.338	.022	.189	.651	.201	.305	.495
13. AVG IDX 2	.245	.240	.239	.238	.240	.240	.238	.234	.232	.234	.230	.230	.237	.236	.237	.241
14. # DIF INDUS	5.	0.	2.	4.	4.	4.	3.	1.	3.	4.	1.	3.	6.	4.	5.	6.
15. # DIF INSTAL	12.	0.	3.	6.	7.	7.	3.	1.	4.	9.	1.	7.	16.	5.	6.	12.
16. CUM INSTAL	301.	301.	304.	310.	317.	324.	327.	328.	332.	341.	342.	349.	365.	370.	376.	388.

	65. JACKSON	66. JACKSONVILLE	67. JERSEY CITY	68. KANSAS CITY	69. KANSAS CITY	70. KNOXVILLE	71. LANSING	72. LAS VEGAS	73. LEXINGTON	74. LINCOLN	75. LITTLE ROCK	76. LIVIONIA	77. LONG BEACH	78. LOS ANGELES	79. LOUISVILLE	80. LUBBOCK
1. IRON & STEEL	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
2. NONFERROUS M																
3. ALL METAL.		X												X		
4. MACHINE BLDG		X	X		X	X			X			X	X	X	X	X
5. ELEC.MACHINE		X	X		X						X			X	X	
6. AGRI.MACHINE																
7. PREC.INSTRUM	X				X					X				X		
8. SHIPBUILDING		X	X										X			
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.		X					X							X		X
13. CONSTR.MATER		X									X			X	X	X
14. THERMOELECTR								X								
15. HYDROELECTR.	X															
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE			X											X		
20. CHEMICAL IND		X	X	X	X								X	X	X	
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND		X			X				X					X		
24. PAPER MILLS		X	X	X	X	X					X			X	X	
25. FOOD INDUS	X	X	X	X	X	X		X	X		X	X	X	X	X	X
26. GLASS MFG	X	X	X	X	X	X	X						X	X	X	
27. SUGAR REFINE																
28. MAJOR PORT														X		
29. SECOND PORT																
30. AIRFIELD														X		
31. MILITARY C C																
32. NAVAL BASE		X											X			
33. ARMY BASE																
34. AIRFORCE B		X						X								X
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.500	1.167	.500	.500	.500	.500	.500	.000	.500	.500	.500	.500	.500	1.167	.500	.500
2. MACHINERIES	.250	.667	.667	.000	.917	.333	.000	.000	.333	.250	.333	.333	.333	.917	.667	.333
3. TRANSP.EQPMS	.000	1.375	.500	.000	.000	.000	.875	.000	.000	.000	.000	.000	.500	.875	.000	.875
4. LIGHT INDUS.	.400	1.000	.600	.600	.800	.600	.200	.200	.400	.000	.600	.200	.400	1.000	.800	.400
5. ELECTRICITY	.250	.000	.000	.000	.000	.000	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.000	.500	1.000	.500	.500	.000	.000	.000	.000	.000	.000	.000	.500	1.000	.500	.000
7. IND IDX 1	.233	.785	.544	.267	.453	.239	.262	.075	.206	.125	.239	.172	.372	.826	.411	.351
8. AVG IDX 1	.348	.354	.357	.356	.357	.355	.354	.350	.348	.345	.344	.342	.342	.348	.349	.349
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.400	.000	.000	.000	.000	.000	.200	.000	.000	.000	.000	.200	.000	.000	.200
12. IND IDX 2	.156	.568	.363	.178	.302	.159	.175	.072	.137	.083	.159	.115	.270	.662	.274	.256
13. AVG IDX 2	.240	.245	.247	.246	.246	.245	.244	.242	.240	.238	.237	.236	.236	.242	.242	.242
14. # DIF INDUS	4.	6.	5.	3.	4.	3.	3.	3.	3.	2.	3.	3.	6.	6.	4.	5.
15. # DIF INSTAL	5.	14.	9.	5.	9.	5.	3.	3.	4.	2.	5.	3.	7.	15.	8.	6.
16. CUM INSTAL	393.	407.	416.	421.	430.	435.	438.	441.	445.	447.	452.	455.	462.	477.	485.	491.

	81. MACON	82. MADISON	83. MEMPHIS	84. MIAMI	85. MILWAUKEE	86. MINEAPOLIS	87. MOBILE	88. MONTGOMERY	89. NASHVILLE-DA	90. NEW BEDFORD	91. NEW HAVEN	92. NEW ORLEANS	93. NEW YORK	94. NEWARK	95. NEWPORT NEWS	96. NORFOLK
1. IRON & STEEL			X		X	X				X	X	X	X	X		
2. NONFERROUS M																
3. ALL METAL.		X	X		X	X				X	X			X		
4. MACHINE BLDG		X	X		X	X		X		X	X	X	X	X		
5. ELEC.MACHINE	X	X	X	X	X	X				X		X	X	X		
6. AGRI.MACHINE																
7. PREC.INSTRUM					X								X	X		
8. SHIPBUILDING				X	X		X				X	X			X	X
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.	X		X	X	X	X	X		X			X	X	X		
13. CONSTR.MATER			X		X			X				X	X			X
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE			X									X	X			
20. CHEMICAL IND			X	X	X	X	X						X			X
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND	X		X	X	X	X		X		X	X	X	X	X		
24. PAPER MILLS			X		X	X			X			X	X	X		
25. FOOD INDUS		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
26. GLASS MFG	X		X	X	X		X	X					X	X		X
27. SUGAR REFINE																
28. MAJOR PORT													X			
29. SECOND PORT																
30. AIRFIELD													X			
31. MILITARY C C																
32. NAVAL BASE							X					X				
33. ARMY BASE													X			
34. AIRFORCE B								X				X				
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.667	1.167	.000	1.167	1.167	.000	.000	.000	1.167	1.167	.500	.500	1.167	.000	.000
2. MACHINERIES	.333	.667	.667	.333	.917	.667	.000	.333	.000	.667	.333	.667	.917	.917	.000	.000
3. TRANSP.EQPMS	.875	.000	.875	1.375	1.375	.875	1.375	.000	.875	.000	.500	1.375	.875	.875	.500	.500
4. LIGHT INDUS.	.400	.200	1.000	.600	1.000	.600	.400	.800	.400	.400	.400	.800	1.000	.800	.200	.600
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.000	.000	1.000	.500	.500	.500	.500	.000	.000	.000	.000	.500	1.000	.000	.000	.500
7. IND IDX 1	.268	.256	.785	.468	.826	.635	.379	.189	.212	.372	.400	.640	.715	.626	.117	.267
8. AVG IDX 1	.348	.347	.352	.354	.359	.362	.362	.361	.359	.359	.359	.362	.366	.369	.366	.365
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.200	.200	.000	.000	.000	.400	.200	.000	.000	.000
12. IND IDX 2	.179	.170	.523	.312	.551	.423	.275	.148	.142	.248	.267	.471	.610	.418	.078	.178
13. AVG IDX 2	.241	.240	.244	.245	.248	.250	.251	.249	.248	.248	.248	.251	.255	.256	.255	.254
14. # DIF INDUS	3.	3.	5.	4.	5.	5.	4.	3.	2.	3.	4.	6.	7.	4.	2.	3.
15. # DIF INSTAL	4.	4.	12.	7.	13.	9.	6.	6.	3.	6.	6.	12.	15.	10.	2.	5.
16. CUM INSTAL	495.	499.	511.	518.	531.	540.	546.	552.	555.	561.	567.	579.	594.	604.	606.	611.

	97. OAKLAND	98. OKLAHOMA CIT	99. OMAHA	100. ORLANDO	101. PARMA	102. PASADENA	103. PATERSON	104. PEORIA	105. PHILADELPHIA	106. PHOENIX	107. PITTSBURG	108. PORTLAND	109. PORTSHOUTH	110. PROVIDENCE	111. RALEIGH	112. RICHMOND
1. IRON & STEEL	X	X	X	X			X		X	X	X	X		X	X	X
2. NONFERROUS M																
3. ALL METAL.	X						X		X		X	X				X
4. MACHINE BLDG	X	X	X			X	X		X	X	X	X		X	X	X
5. ELEC.MACHINE	X					X			X		X	X		X	X	
6. AGRI.MACHINE																
7. PREC.INSTRUM						X			X					X		
8. SHIPBUILDING									X		X	X	X			
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.	X	X							X		X	X				
13. CONSTR.MATER		X							X	X		X				X
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE									X		X					
20. CHEMICAL IND	X						X		X		X	X				
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND	X	X				X	X		X	X	X	X		X		X
24. PAPER MILLS	X								X		X	X				X
25. FOOD INDUS	X	X		X			X	X	X	X	X	X		X	X	X
26. GLASS MFG	X	X	X				X		X	X	X	X				X
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C				X												
32. NAVAL BASE									X							
33. ARMY BASE	X															
34. AIRFORCE B			X	X												
35. MUNITION DEP									X							
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	1.167	.500	.500	.500	.000	.000	1.167	.000	1.167	.500	1.167	1.167	.000	.500	.500	1.167
2. MACHINERIES	.667	.333	.333	.000	.000	.917	.333	.000	.917	.333	.667	.667	.000	.917	.667	.333
3. TRANSP.EQPMS	.875	.875	.000	.000	.000	.000	.000	.000	1.375	.000	1.375	1.375	.500	.000	.000	.000
4. LIGHT INDUS.	.800	.800	.200	.200	.000	.200	.600	.200	1.000	.800	.800	1.000	.000	.400	.200	1.000
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.500	.000	.000	.000	.000	.000	.500	.000	1.000	.000	1.000	.500	.000	.000	.000	.000
7. IND IDX 1	.668	.418	.172	.117	.000	.186	.433	.033	.910	.272	.835	.785	.083	.303	.228	.417
8. AVG IDX 1	.368	.369	.367	.364	.361	.359	.360	.357	.362	.361	.366	.369	.367	.366	.365	.365
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.200	.000	.200	.400	.000	.000	.000	.000	.400	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.468	.279	.137	.122	.000	.124	.289	.022	.651	.181	.556	.523	.056	.202	.152	.278
13. AVG IDX 2	.256	.256	.255	.254	.251	.250	.250	.248	.252	.251	.254	.257	.255	.254	.253	.254
14. # DIF INDUS	6.	4.	4.	3.	0.	2.	4.	1.	6.	3.	5.	5.	1.	3.	3.	3.
15. # DIF INSTAL	11.	7.	4.	4.	0.	4.	7.	1.	16.	6.	12.	12.	1.	6.	4.	8.
16. CUM INSTAL	622.	629.	633.	637.	637.	641.	648.	649.	665.	671.	683.	695.	696.	702.	706.	714.

	113. RIVERSIDE	114. ROCHESTER	115. ROCKFORD	116. SACRAMENTO	117. SALT LAKE CI	118. SAN ANTONIO	119. SAN BERNADIN	120. SAN DIEGO	121. SAN FRANCISC	122. SAN JOSE	123. SANTA ANA	124. SAVANNAH	125. SCRATON	126. SEATTLE	127. SHREVEPORT	128. SOUTH BEND
1. IRON & STEEL		X	X	X	X	X			X	X			X	X	X	X
2. NONFERROUS M																
3. ALL METAL.			X						X					X		X
4. MACHINE BLDG	X	X	X	X	X			X	X	X	X		X	X	X	X
5. ELEC.MACHINE		X	X		X			X	X	X	X		X	X		
6. AGRI.MACHINE																
7. PREC.INSTRUM								X	X		X			X		
8. SHIPBUILDING					X			X				X		X		
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.			X		X			X	X		X			X		
13. CONSTR.MATER	X			X	X	X			X		X			X		
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER				X												
18. OILFIELD																
19. PETRO REFINE									X							
20. CHEMICAL IND			X			X		X	X					X		
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND		X			X	X		X	X				X	X	X	
24. PAPER MILLS									X							
25. FOOD INDUS	X	X	X		X	X	X	X	X	X	X		X	X	X	X
26. GLASS MFG	X				X			X	X		X	X		X		
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C							X		X							
32. NAVAL BASE								X	X							
33. ARMY BASE				X												
34. AIRFORCE B	X					X		X	X		X				X	
35. MUNITION DEP				X												
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.500	1.167	.500	.500	.500	.000	.000	1.167	.500	.000	.000	.500	1.167	.500	1.167
2. MACHINERIES	.333	.667	.667	.333	.667	.000	.000	.917	.917	.667	.917	.000	.667	.917	.333	.333
3. TRANSP.EQPMS	.000	.000	.875	.000	1.375	.000	.000	1.375	.875	.000	.875	.500	.000	1.375	.000	.000
4. LIGHT INDUS.	.600	.400	.200	.200	.800	.600	.200	.600	1.000	.200	.600	.200	.400	.800	.400	.200
5. ELECTRICITY	.000	.000	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.000	.000	.500	.000	.000	.500	.000	.500	1.000	.000	.000	.000	.000	.500	.000	.000
7. IND IDX 1	.156	.261	.568	.214	.557	.267	.033	.565	.826	.228	.399	.117	.261	.793	.206	.283
8. AVG IDX 1	.364	.363	.365	.363	.365	.364	.361	.363	.367	.366	.366	.364	.363	.367	.365	.365
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.200	.000	.000	.400	.000	.200	.200	.400	.600	.000	.200	.000	.000	.000	.200	.000
12. IND IDX 2	.126	.174	.379	.187	.371	.200	.044	.421	.618	.152	.288	.078	.174	.529	.159	.189
13. AVG IDX 2	.252	.252	.253	.252	.253	.253	.251	.253	.256	.255	.255	.254	.253	.255	.254	.254
14. # DIF INDUS	3.	3.	5.	5.	4.	4.	2.	5.	6.	3.	4.	2.	3.	5.	4.	3.
15. # DIF INSTAL	5.	5.	7.	6.	9.	6.	2.	11.	16.	4.	8.	2.	5.	12.	5.	4.
16. CUM INSTAL	719.	724.	731.	737.	746.	752.	754.	765.	781.	785.	793.	795.	800.	812.	817.	821.

	129. SPOKAN E	130. SPRING FIELD	131. SPRING FIELD	132. STOCKT ON	133. ST.LOU IS	134. ST.PAU L	135. ST.PET ERSBUR	136. SYRACU SE	137. TACOMA	138. TAMPA	139. TOLEDO	140. TOPEKA A	141. TORRAN CE	142. TRENTO N	143. TUCSON	144. TULSA
1. IRON & STEEL		X		X	X	X		X		X	X		X	X		X
2. NONFERROUS M																
3. ALL METAL.		X			X	X				X	X			X		X
4. MACHINE BLDG		X	X		X	X	X	X	X	X	X					X
5. ELEC.MACHINE		X			X	X		X		X				X		X
6. AGRI.MACHINE													X			
7. PREC.INSTRUM					X								X			X
8. SHIPBUILDING				X	X				X		X					
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.			X	X	X		X		X	X	X	X				X
13. CONSTR.MATER	X			X	X				X	X	X					
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE					X						X					
20. CHEMICAL IND					X	X			X	X	X	X	X			
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND		X	X		X	X		X	X	X				X		
24. PAPER MILLS		X	X		X				X	X	X			X		
25. FOOD INDUS	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
26. GLASS MFG					X					X	X		X	X		X
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE					X											
33. ARMY BASE														X		
34. AIRFORCE B							X			X				X	X	
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	1.167	.000	.500	1.167	1.167	.000	.500	.000	1.167	1.167	.000	.500	1.167	.000	1.167
2. MACHINERIES	.000	.667	.333	.000	.917	.667	.333	.667	.333	.667	.333	.000	.583	.333	.000	.917
3. TRANSP.EQPMS	.000	.000	.875	1.375	1.375	.000	.875	.000	1.375	.875	1.375	.875	.000	.000	.000	.875
4. LIGHT INDUS.	.400	.600	.600	.400	1.000	.400	.200	.400	.800	1.000	.800	.200	.200	.800	.200	.400
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.000	.000	.000	.000	1.000	.500	.000	.000	.500	.500	1.000	.500	.500	.000	.000	.000
7. IND IDX 1	.067	.406	.301	.379	.910	.456	.235	.261	.501	.701	.779	.262	.297	.383	.033	.560
8. AVG IDX 1	.362	.363	.362	.362	.366	.367	.366	.365	.366	.369	.372	.371	.370	.370	.368	.369
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.200	.000	.200	.000	.000	.200	.000	.000	.000	.400	.200	.000
12. IND IDX 2	.044	.270	.201	.253	.629	.304	.179	.174	.334	.490	.519	.175	.198	.300	.044	.373
13. AVG IDX 2	.252	.252	.252	.252	.255	.255	.255	.254	.255	.256	.258	.258	.257	.257	.256	.257
14. # DIF INDUS	1.	3.	3.	3.	6.	4.	4.	3.	4.	6.	5.	3.	4.	4.	2.	4.
15. # DIF INSTAL	2.	7.	5.	5.	15.	7.	4.	5.	8.	12.	11.	3.	5.	9.	2.	8.
16. CUM INSTAL	823.	830.	835.	840.	855.	862.	866.	871.	879.	891.	902.	905.	910.	919.	921.	929.

	145. VIRGIN IA BEA	146. WARREN	147. WASHIN GTON,D	148. WATERB URY	149. WICHIT A	150. WINSTO N-SALE	151. WORCES TER	152. YONKER S	153. YOUNGS TOWN
1. IRON & STEEL		X	X	X	X	X	X	X	X
2. NONFERROUS M									
3. ALL METAL.			X		X		X		X
4. MACHINE BLDG		X	X	X	X	X	X	X	X
5. ELEC.MACHINE			X	X			X	X	
6. AGRI.MACHINE									
7. PREC.INSTRUM			X	X	X				
8. SHIPBUILDING									
9. AUTOBUILDING									
10. LOCOMOTIVE									
11. AIRCRAFT									
12. ALL TRANSP.		X	X						
13. CONSTR.MATER			X		X				
14. THERMOELECTR									
15. HYDROELECTR.									
16. OTHER ELECTR									
17. NUCLEAR ENER									
18. OILFIELD									
19. PETRO REFINE			X						
20. CHEMICAL IND			X				X	X	
21. FERTILIZERS									
22. LIGHT INDUS									
23. TEXTILE IND			X	X		X	X		
24. PAPER MILLS			X			X	X		
25. FOOD INDUS			X		X	X	X		X
26. GLASS MFG			X		X				
27. SUGAR REFINE									
28. MAJOR PORT									
29. SECOND PORT									
30. AIRFIELD									
31. MILITARY C C									
32. NAVAL BASE			X						
33. ARMY BASE			X						
34. AIRFORCE B					X				
35. MUNITION DEP									
36. WEAPONS PROD									
37. MISSILES									
38. NUCLEAR WPNS									
1. METALLURGY	.000	.500	1.167	.500	1.167	.500	1.167	.500	1.167
2. MACHINERIES	.000	.333	.917	.917	.583	.333	.667	.667	.333
3. TRANSP.EQPMS	.000	.875	.875	.000	.000	.000	.000	.000	.000
4. LIGHT INDUS.	.000	.000	1.000	.200	.600	.600	.600	.000	.200
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.000	.000	1.000	.000	.000	.000	.500	.500	.000
7. IND IDX 1	.000	.285	.826	.269	.392	.239	.489	.278	.283
8. AVG IDX 1	.367	.366	.369	.369	.369	.368	.369	.368	.368
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.400	.000	.200	.000	.000	.000	.000
12. IND IDX 2	.000	.190	.595	.180	.283	.159	.326	.185	.189
13. AVG IDX 2	.255	.255	.257	.256	.257	.256	.256	.256	.255
14. # DIF INDUS	0.	3.	6.	3.	4.	3.	4.	3.	3.
15. # DIF INSTAL	0.	3.	15.	5.	8.	5.	8.	4.	4.
16. CUM INSTAL	929.	932.	947.	952.	960.	965.	973.	977.	981.

	1. AGEO	2. AIZUWA KAMATS	3. AKASHI	4. AKITA	5. AMAGAS AKI	6. ANJO	7. AOMORI	8. ASAHIK AWA	9. ASHIKA GA	10. ATSUGI	11. BEPPU	12. CHIBA	13. CHIGAS AKI	14. CHOFU	15. DAITO	16. FUCHU
1. IRON & STEEL					X							X				
2. NONFERROUS M				X	X		X					X				
3. ALL METAL.			X	X	X	X		X	X	X		X	X		X	
4. MACHINE BLDG	X	X	X		X	X			X	X		X	X	X	X	X
5. ELEC.MACHINE	X		X		X	X				X		X	X	X	X	X
6. AGRI.MACHINE																
7. PREC.INSTRUM	X		X										X			
8. SHIPBUILDING												X				
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT		X														
12. ALL TRANSP.	X		X			X			X	X			X			
13. CONSTR.MATER				X								X				
14. THERMOELECTR	X		X		X							X				
15. HYDROELECTR.																
16. OTHER ELECTR		X														
17. NUCLEAR ENER			X			X			X							
18. OILFIELD				X			X	X								
19. PETRO REFINE				X	X			X				X	X			X
20. CHEMICAL IND												X				
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS																
25. FOOD INDUS		X	X	X	X	X	X	X				X	X	X		X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT					X		X					X				
30. AIRFIELD					X											
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.CCC	.444	.778	1.111	.444	.333	.444	.444	.444	.C00	1.111	.444	.COC	.444	.CCC
2. MACHINERIES	.917	.333	.917	.000	.667	.667	.000	.000	.333	.667	.000	.667	.917	.667	.667	.667
3. TRANSP.EQPMS	.438	.250	.438	.000	.000	.438	.000	.000	.438	.438	.000	.250	.438	.000	.0C0	.000
4. LIGHT INDUS.	.C00	.200	.2C0	.40C	.200	.200	.2C0	.200	.000	.C00	.000	.400	.200	.200	.0C0	.20C
5. ELECTRICITY	.500	.500	1.000	.CC0	.500	.500	.000	.000	.500	.000	.000	.500	.000	.000	.0C0	.000
6. PETRO-CHEM.	.000	.000	.000	1.000	.500	.000	.5C0	1.0C0	.000	.000	.000	1.000	.500	.C00	.000	.500
7. IND IDX 1	.309	.214	.500	.363	.496	.375	.172	.274	.286	.258	.000	.655	.416	.144	.185	.228
8. AVG IDX 1	.309	.261	.341	.346	.376	.376	.347	.338	.332	.325	.295	.325	.332	.319	.310	.305
9. PORT&AIRFILD	.000	.CC0	.CC0	.CC0	.875	.00C	.375	.0CC	.0CC	.C00	.000	.375	.000	.C0C	.CCC	.CCC
10. WEAPONS	.000	.000	.C00	.000	.000	.000	.0C0	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.206	.143	.333	.242	.428	.250	.156	.183	.191	.172	.CCC	.478	.278	.C96	.123	.152
13. AVG IDX 2	.206	.174	.227	.231	.270	.267	.251	.243	.237	.230	.209	.232	.235	.225	.219	.214
14. # DIF INDUS	3.	4.	5.	3.	6.	5.	4.	3.	4.	3.	0.	7.	5.	2.	2.	3.
15. # DIF INSTAL	5.	4.	8.	6.	10.	6.	4.	4.	4.	4.	0.	12.	7.	3.	3.	4.
16. CUM INSTAL	5.	9.	17.	23.	33.	39.	43.	47.	51.	55.	55.	67.	74.	77.	8C.	84.

	17. FUJI	18. FUJINO MIYA	19. FUJISA WA	2C. FUKUI	21. FUKUOK A	22. FUKUSH IMA	23. FUKUYA MA	24. FUNABA SHI	25. GIFU	26. HACHIN OE	27. HACHIO JI	28. HADANO	29. HAKODA TE	30. HAMAMA TSU	31. HIGASH IKURUM	32. HIGASH IMURAY
1. IRON & STEEL			X			X	X	X		X				X		
2. NONFERROUS M								X						X		
3. ALL METAL.	X		X	X		X	X	X	X					X		
4. MACHINE BLDG	X	X	X	X	X	X	X	X	X		X		X	X		
5. ELEC.MACHINE			X		X	X	X				X	X		X		
6. AGRI.MACHINE																
7. PREC.INSTRUM											X					X
8. SHIPBUILDING													X			
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.	X	X	X			X					X	X	X	X		
13. CONSTR.MATER													X			
14. THERMOELECTR	X	X					X									
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER		X		X		X	X		X		X			X		
18. OILFIELD	X	X							X	X				X		
19. PETRO REFINE					X	X	X	X	X	X				X		
20. CHEMICAL IND																
21. FERTILIZERS														X		
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS																
25. FOOD INDUS	X		X		X	X	X	X	X	X	X	X	X	X	X	
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT					X								X			
30. AIRFIELD					X						X					
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.444	.000	.778	.444	.000	.778	.778	1.111	.444	.333	.000	.000	.000	1.111	.000	.000
2. MACHINERIES	.333	.333	.667	.333	.667	.667	.667	.333	.333	.000	.917	.333	.333	.667	.CC0	.250
3. TRANSP.EQPMS	.438	.438	.438	.C00	.000	.438	.0C0	.000	.000	.C00	.438	.438	.688	.438	.CCC	.CCC
4. LIGHT INDUS.	.200	.000	.200	.0CC	.200	.200	.2C0	.200	.200	.200	.200	.200	.400	.200	.2C0	.000
5. ELECTRICITY	.500	1.000	.C00	.500	.000	.500	1.0C0	.000	.500	.000	.500	.000	.000	.500	.000	.000
6. PETRO-CHEM.	.500	.5L0	.CC0	.CCC	.500	.500	.5C0	.5C0	1.C00	1.C00	.0CC	.00C	.000	1.50C	.CC0	.0CC
7. IND IDX 1	.403	.378	.347	.213	.228	.514	.524	.357	.413	.256	.342	.162	.237	.736	.033	.042
8. AVG IDX 1	.310	.314	.316	.311	.307	.316	.325	.327	.330	.327	.328	.322	.319	.333	.323	.314
9. PORT&AIRFILD	.000	.CC0	.CC0	.CCC	.875	.000	.0C0	.000	.000	.000	.500	.000	.375	.CCC	.CCC	.CCC
10. WEAPONS	.000	.000	.C00	.000	.000	.000	.0C0	.000	.000	.000	.000	.000	.000	.C0C	.CC0	.00C
11. MILITARY INS	.000	.000	.000	.C00	.000	.000	.000	.000	.C00	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.268	.252	.231	.142	.249	.342	.349	.238	.275	.170	.284	.108	.200	.491	.022	.028
13. AVG IDX 2	.218	.220	.220	.216	.218	.223	.229	.229	.231	.229	.231	.226	.226	.234	.228	.221
14. # DIF INDUS	6.	4.	4.	3.	4.	6.	5.	4.	5.	3.	5.	3.	4.	6.	1.	1.
15. # DIF INSTAL	6.	5.	6.	3.	6.	8.	8.	6.	6.	4.	7.	3.	6.	11.	1.	1.
16. CUM INSTAL	90.	95.	1C1.	1C4.	110.	118.	126.	132.	138.	142.	149.	152.	158.	169.	17C.	171.

	33. HIGASH IOSAKA	34. HIMEJI	35. HINO	36. HIRAKA DA	37. HIRATS UKA	38. HIROSA KI	39. HIROSH IMA	40. HITACH I	41. HOFU	42. IBARAK I	43. ICHIHA RA	44. ICHIKA WA	45. ICHINO MIYA	46. IKEDA	47. IMBARI	48. ISE
1. IRON & STEEL	X	X		X			X									
2. NONFERROUS M	X				X		X	X			X					
3. ALL METAL.	X	X		X	X		X	X		X	X					
4. MACHINE BLDG	X	X		X	X		X	X		X			X			X
5. ELEC.MACHINE	X	X	X	X	X		X	X		X	X		X			
6. AGRI.MACHINE																
7. PREC.INSTRUM	X		X													
8. SHIPBUILDING							X									
9. AUTOBUILDING							X									
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.	X		X		X		X	X			X			X	X	X
13. CONSTR.MATER		X														
14. THERMOELECTR	X	X	X	X	X		X		X	X	X					
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER	X	X		X			X						X		X	
18. OILFIELD	X															
19. PETRO REFINE	X	X		X			X		X							
20. CHEMICAL IND																
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS																
25. FOOD INDUS	X	X		X	X	X	X		X	X		X				X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT							X									
30. AIRFIELD					X											
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD	9															
37. MISSILES	X															
38. NUCLEAR WPNS																
1. METALLURGY	1.111	.778	.000	.778	.778	.000	1.111	.778	.000	.444	.778	.000	.000	.000	.000	.000
2. MACHINERIES	.917	.667	.583	.667	.667	.000	.667	.667	.000	.667	.333	.000	.667	.000	.000	.333
3. TRANSP.EQPMS	.438	.000	.438	.000	.438	.000	.938	.438	.000	.000	.438	.000	.000	.438	.438	.438
4. LIGHT INDUS.	.200	.400	.000	.200	.200	.200	.200	.000	.200	.200	.000	.200	.000	.000	.000	.200
5. ELECTRICITY	1.000	1.000	.500	1.000	.500	.000	1.000	.000	.500	.500	.500	.000	.500	.000	.500	.000
6. PETRO-CHEM.	1.000	.500	.000	.500	.000	.000	.500	.000	.500	.000	.000	.000	.000	.000	.000	.000
7. IND IDX 1	.778	.557	.253	.524	.430	.033	.736	.314	.200	.302	.341	.033	.194	.073	.156	.162
8. AVG IDX 1	.328	.335	.333	.338	.341	.333	.343	.342	.339	.338	.338	.331	.328	.322	.319	.316
9. PORT&AIRFILD	.000	.000	.000	.000	.500	.000	.375	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	3.333	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.889	.372	.169	.349	.342	.022	.532	.209	.133	.201	.228	.022	.130	.049	.104	.108
13. AVG IDX 2	.242	.245	.243	.246	.249	.243	.250	.249	.246	.245	.245	.240	.237	.233	.230	.228
14. # DIF INDUS	7.	5.	3.	5.	6.	1.	7.	3.	3.	4.	4.	1.	2.	1.	2.	3.
15. # DIF INSTAL	22.	9.	4.	8.	8.	1.	13.	5.	3.	5.	5.	1.	3.	1.	2.	3.
16. CUM INSTAL	193.	202.	206.	214.	222.	223.	236.	241.	244.	249.	254.	255.	258.	259.	261.	264.

	49. ISHINO MAKI	50. ITAMI	51. IWAKI	52. IWAKUN I	53. IZUMI	54. JOETSU	55. KAGCGA WA	56. KAGCSH IMA	57. KAMAKU RA	58. KANAZA WA	59. KASHIW A	60. KASUGA I	61. KASUKA BE	62. KAWAGU CHI	63. KAWAKO E	64. KAWANI SHI
1. IRON & STEEL		X				X	X							X		
2. NONFERROUS M			X			X								X		
3. ALL METAL.		X		X			X	X		X	X	X		X	X	
4. MACHINE BLDG		X	X			X	X			X	X	X		X	X	X
5. ELEC.MACHINE		X	X						X	X	X	X		X	X	
6. AGRI.MACHINE			X													
7. PREC.INSTRUM														X		
8. SHIPBUILDING																
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.	X			X				X				X		X	X	
13. CONSTR.MATER				X												
14. THERMOELECTR		X		X					X					X	X	
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER		X		X	X		X	X		X				X		
18. OILFIELD	X			X						X		X		X		
19. PETRO REFINE	X							X		X		X				
20. CHEMICAL IND			X													
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS																
25. FOOD INDUS	X	X	X			X	X	X		X	X		X	X	X	
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT								X								
30. AIRFIELD				X												
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.778	.333	.444	.000	.667	.778	.444	.000	.444	.444	.444	.000	1.111	.444	.000
2. MACHINERIES	.000	.667	1.000	.000	.000	.333	.333	.000	.333	.667	.667	.667	.000	.917	.667	.333
3. TRANSP.EQPMS	.438	.000	.000	.438	.000	.000	.000	.438	.000	.000	.000	.438	.000	.438	.438	.000
4. LIGHT INDUS.	.200	.200	.200	.200	.000	.200	.200	.200	.000	.200	.200	.000	.200	.200	.200	.000
5. ELECTRICITY	.000	1.000	.000	1.000	.500	.000	.500	.500	.500	.500	.000	.000	.000	1.000	.500	.000
6. PETRO-CHEM.	1.000	.000	.500	.500	.000	.000	.000	.500	.000	1.000	.000	1.000	.000	.500	.000	.000
7. IND IDX 1	.273	.441	.339	.430	.083	.200	.302	.347	.139	.469	.219	.425	.033	.694	.375	.056
8. AVG IDX 1	.315	.317	.316	.320	.315	.313	.313	.314	.311	.313	.312	.314	.309	.315	.316	.312
9. PORT&AIRFILD	.000	.000	.000	.500	.000	.000	.000	.375	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.182	.294	.226	.342	.056	.133	.201	.273	.093	.312	.146	.283	.022	.463	.250	.037
13. AVG IDX 2	.227	.228	.228	.230	.227	.225	.225	.226	.224	.225	.224	.225	.221	.225	.226	.223
14. # DIF INDUS	3.	4.	4.	6.	1.	3.	4.	6.	2.	5.	3.	4.	1.	6.	5.	1.
15. # DIF INSTAL	4.	7.	6.	7.	1.	4.	5.	6.	2.	7.	4.	6.	1.	11.	6.	1.
16. CUM INSTAL	268.	275.	281.	286.	289.	293.	298.	304.	306.	313.	317.	323.	324.	335.	341.	342.

	65. KAWASAKI	66. KISHIWADA	67. KITAKYUSHU	68. KOBE	69. KOCHI	70. KODAIRA	71. KODAMA	72. KOFU	73. KOGANEI	74. KOMATSU	75. KORIYAMA	76. KOSHIGAYA	77. KUMAGAYA	78. KUMAMOTO	79. KURASHIKI	80. KURE
1. IRON & STEEL	X	X	X	X	X								X		X	X
2. NONFERROUS M	X		X	X									X	X		
3. ALL METAL.	X	X	X				X				X			X	X	X
4. MACHINE BLDG	X	X	X	X	X	X	X		X	X		X		X	X	X
5. ELEC.MACHINE	X		X	X		X	X	X			X	X	X	X		
6. AGRI.MACHINE																
7. PREC.INSTRUM	X															
8. SHIPBUILDING	X			X												X
9. AUTOBUILDING				X												
10. LOCOMOTIVE				X												
11. AIRCRAFT				X												
12. ALL TRANSP.	X		X	X	X						X				X	X
13. CONSTR.MATER	X															
14. THERMOELECTR	X		X	X							X				X	
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER	X	X	X	X				X		X	X			X	X	
18. OILFIELD	X		X				X									
19. PETRO REFINE	X	X	X		X						X		X		X	X
20. CHEMICAL IND			X	X												
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS																
25. FOOD INDUS	X		X	X	X	X		X		X	X	X	X	X	X	X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT			X	X												
29. SECOND PORT	X															X
30. AIRFIELD	X															
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	1.111	.778	1.111	.667	.333	.000	.444	.000	.000	.000	.444	.000	.667	.778	.778	.778
2. MACHINERIES	.917	.333	.667	.667	.333	.667	.667	.333	.333	.333	.333	.667	.333	.667	.333	.333
3. TRANSP.EQPMS	.688	.000	.438	1.437	.438	.000	.000	.000	.000	.000	.438	.000	.000	.000	.438	.688
4. LIGHT INDUS.	.400	.000	.200	.200	.200	.200	.000	.200	.000	.200	.200	.200	.200	.200	.200	.200
5. ELECTRICITY	1.000	.500	1.000	1.000	.000	.000	.000	.500	.000	.500	1.000	.000	.000	.500	1.000	.000
6. PETRO-CHEM.	1.000	.500	1.500	.500	.500	.000	.500	.000	.000	.000	.500	.000	.500	.000	.500	.500
7. IND IDX 1	.853	.352	.619	.745	.301	.144	.269	.172	.056	.172	.486	.144	.283	.357	.541	.416
8. AVG IDX 1	.320	.321	.328	.334	.334	.331	.330	.328	.324	.322	.325	.322	.322	.322	.325	.326
9. PORT&AIRFILD	.875	.000	.500	.500	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.375
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.666	.235	.602	.552	.200	.096	.179	.115	.037	.115	.324	.096	.189	.238	.361	.319
13. AVG IDX 2	.230	.230	.235	.240	.239	.237	.236	.235	.232	.230	.232	.230	.229	.229	.231	.232
14. # DIF INDUS	7.	4.	7.	7.	5.	2.	3.	3.	1.	3.	6.	2.	4.	4.	6.	6.
15. # DIF INSTAL	16.	5.	13.	14.	5.	3.	4.	3.	1.	3.	7.	3.	5.	6.	8.	8.
16. CUM INSTAL	358.	363.	376.	390.	395.	398.	402.	405.	406.	409.	416.	419.	424.	430.	438.	446.

	81. KURUME	82. KUSHIRO	83. KYCTO	84. KYRIU	85. MACHIDA	86. MAEBASHI	87. MATSUBARA	88. MATSUDO	89. MATSUE	90. MATSUMOTO	91. MATSUSAKA	92. MATSUYAMA	93. MITAKA	94. MITO	95. MIYAKONOJO	96. MIYASAKI
1. IRON & STEEL																
2. NONFERROUS M			X	X		X						X				
3. ALL METAL.				X			X	X		X						
4. MACHINE BLDG	X		X	X		X		X		X		X	X			
5. ELEC.MACHINE			X	X	X	X		X		X	X		X			
6. AGRI.MACHINE																
7. PREC.INSTRUM			X					X		X						
8. SHIPBUILDING																
9. AUTOBUILDING																
10. LOCOMOTIVE			X													
11. AIRCRAFT																
12. ALL TRANSP.			X	X		X							X			
13. CONSTR.MATER												X				
14. THERMOELECTR	X		X									X				
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER	X		X	X		X		X		X	X	X				
18. OILFIELD																
19. PETRO REFINE			X								X	X			X	
20. CHEMICAL IND																
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS																
25. FOOD INDUS	X	X	X			X	X	X	X	X	X	X		X	X	X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																X
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.333	.778	.000	.333	.444	.444	.000	.444	.000	.333	.000	.COO	.OCO	.COO
2. MACHINERIES	.333	.COO	.917	.667	.333	.667	.000	.917	.000	.917	.333	.333	.667	.COC	.CCO	.OCC
3. TRANSP.EQPMS	.000	.OCO	.688	.438	.OOO	.438	.000	.000	.000	.COO	.000	.000	.438	.000	.000	.000
4. LIGHT INDUS.	.200	.200	.200	.OCO	.000	.200	.200	.200	.200	.200	.200	.400	.000	.200	.2CO	.200
5. ELECTRICITY	1.000	.000	1.COO	.500	.000	.500	.000	.500	.000	.500	.500	1.000	.000	.000	.OCO	.000
6. PETRO-CHEM.	.COO	.COO	.5CO	.COO	.000	.000	.OCO	.000	.000	.COO	.5CO	.5OC	.COO	.COC	.5CC	.OOC
7. IND IDX 1	.256	.033	.606	.397	.056	.356	.107	.344	.033	.344	.256	.428	.184	.033	.117	.033
8. AVG IDX 1	.325	.322	.325	.326	.323	.323	.321	.321	.318	.318	.317	.318	.317	.314	.312	.309
9. PORT&AIRFILD	.000	.000	.COO	.COO	.000	.000	.OCO	.000	.000	.COO	.000	.000	.000	.COC	.CCO	.5CC
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.COO	.CCO	.COO	.000	.000	.OCO	.000	.000	.000	.000	.000	.000	.COC	.CCO	.000
12. IND IDX 2	.170	.022	.4C4	.265	.037	.237	.072	.229	.022	.229	.170	.285	.123	.022	.078	.078
13. AVG IDX 2	.231	.229	.231	.231	.229	.229	.227	.227	.225	.225	.225	.225	.224	.222	.22C	.219
14. # DIF INDUS	3.	1.	6.	4.	1.	5.	2.	4.	1.	4.	4.	5.	2.	1.	2.	2.
15. # DIF INSTAL	4.	1.	10.	6.	1.	6.	2.	6.	1.	6.	4.	7.	3.	1.	2.	2.
16. CUM INSTAL	450.	451.	461.	467.	468.	474.	476.	482.	483.	489.	493.	500.	503.	5C4.	5C6.	5C8.

	97. MORIGU CHI	98. MORIOK A	99. MURORA N	100. MUSASH INO	101. NAGANO	102. NAGACK A	103. NAGASA KI	104. NAGOYA	105. NAHA	106. NARA	107. NARASH INO	108. NEYAGA WA	109. NIIGAT A	110. NIIHAM A	111. NIIZA	112. NISHIN OMIYA
1. IRON & STEEL			X					X					X			X
2. NONFERROUS M							X	X					X	X		
3. ALL METAL.	X		X		X	X	X	X			X	X	X			
4. MACHINE BLDG	X		X		X	X		X			X	X	X	X		X
5. ELEC.MACHINE	X			X	X		X	X			X	X			X	X
6. AGRI.MACHINE																
7. PREC.INSTRUM								X								
8. SHIPBUILDING			X				X	X								
9. AUTOBUILDING								X								
10. LOCOMOTIVE								X					X			
11. AIRCRAFT								X								
12. ALL TRANSP.			X				X	X				X	X			
13. CONSTR.MATER			X										X			
14. THERMOELECTR								X					X	X		
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER	X				X	X		X					X	X		
18. OILFIELD								X					X			
19. PETRO REFINE					X			X					X			X
20. CHEMICAL IND								X						X		
21. FERTILIZERS													X			
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS																
25. FOOD INDUS		X	X		X	X	X	X	X				X		X	X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT								X								
29. SECOND PORT			X				X						X			
30. AIRFIELD								X	X							
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.444	.000	.778	.000	.444	.444	.778	1.111	.000	.000	.444	.444	1.111	.333	.000	.333
2. MACHINERIES	.667	.000	.333	.333	.667	.333	.333	.917	.000	.000	.667	.667	.333	.333	.333	.667
3. TRANSP.EQPMS	.000	.000	.688	.000	.000	.000	.688	1.437	.000	.000	.000	.438	.688	.000	.000	.000
4. LIGHT INDUS.	.000	.200	.400	.000	.200	.200	.200	.200	.200	.000	.000	.000	.400	.000	.200	.200
5. ELECTRICITY	.500	.000	.000	.000	.500	.500	.000	1.000	.000	.000	.000	.000	1.000	1.000	.000	.000
6. PETRO-CHEM.	.000	.000	.000	.000	.500	.000	.000	1.500	.000	.000	.000	.000	1.500	.500	.000	.500
7. IND IDX 1	.269	.033	.366	.056	.385	.246	.333	1.028	.033	.000	.185	.258	.839	.361	.089	.283
8. AVG IDX 1	.309	.306	.306	.304	.305	.304	.304	.311	.309	.306	.305	.304	.309	.310	.308	.307
9. PORT&AIRFILD	.000	.000	.375	.000	.000	.000	.375	1.000	.500	.000	.000	.000	.375	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.179	.022	.286	.037	.257	.164	.264	.796	.078	.000	.123	.172	.601	.241	.059	.189
13. AVG IDX 2	.219	.217	.217	.215	.216	.215	.216	.221	.220	.218	.217	.217	.220	.220	.219	.219
14. # DIF INDUS	3.	1.	5.	1.	5.	4.	5.	7.	2.	0.	2.	3.	7.	4.	2.	4.
15. # DIF INSTAL	4.	1.	8.	1.	6.	4.	7.	19.	2.	0.	3.	4.	14.	5.	2.	5.
16. CUM INSTAL	512.	513.	521.	522.	528.	532.	539.	558.	560.	560.	563.	567.	581.	586.	588.	593.

	113. NOBEOKA	114. NUMATSU	115. OBIHIRO	116. ODAWARA	117. OGAKI	118. OITA	119. OKAYAMA	120. OKAZAKI	121. OMIYA	122. OMUTA	123. ONOMICHI	124. OSAKA	125. OTA	126. OTARU	127. OTSU	128. OYAMA
1. IRON & STEEL						X	X					X				X
2. NONFERROUS M	X	X				X	X			X		X				X
3. ALL METAL.		X					X		X			X	X	X		X
4. MACHINE BLDG	X	X		X	X		X		X	X		X	X		X	X
5. ELEC.MACHINE		X		X		X			X			X	X		X	X
6. AGRI.MACHINE																
7. PREC.INSTRUM									X			X	X			
8. SHIPBUILDING												X				
9. AUTOBUILDING							X					X				
10. LOCOMOTIVE												X				
11. AIRCRAFT												X				
12. ALL TRANSP.		X		X	X		X		X		X	X	X		X	X
13. CONSTR.MATER	X					X	X									
14. THERMOELECTR	X			X	X	X	X		X	X		X	X	X	X	
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER					X		X		X			X	X	X	X	
18. OILFIELD		X					X					X				
19. PETRO REFINE					X	X	X					X		X	X	
20. CHEMICAL IND										X		X				
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS																
25. FOOD INDUS	X	X	X	X	X	X	X		X	X	X	X		X	X	X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT												X				
29. SECOND PORT														X		
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.333	.778	.000	.000	.000	.667	1.111	.000	.444	.333	.000	1.111	.444	.444	.000	1.111
2. MACHINERIES	.333	.667	.000	.667	.333	.333	.333	.000	.917	.333	.000	.917	.917	.000	.667	.667
3. TRANSP.EQPMS	.000	.438	.000	.438	.438	.000	.688	.000	.438	.000	.438	1.437	.438	.000	.438	.438
4. LIGHT INDUS.	.400	.200	.200	.200	.200	.400	.400	.000	.200	.200	.200	.200	.000	.200	.200	.200
5. ELECTRICITY	.500	.000	.000	.500	1.000	.500	1.000	.000	1.000	.500	.000	1.000	1.000	1.000	1.000	.000
6. PETRO-CHEM.	.000	.500	.000	.000	.500	.500	1.000	.000	.000	.500	.000	1.500	.000	.500	.500	.000
7. IND IDX 1	.261	.430	.033	.301	.412	.400	.755	.000	.500	.311	.106	1.028	.466	.357	.467	.403
8. AVG IDX 1	.307	.308	.306	.306	.307	.307	.311	.309	.310	.310	.308	.314	.315	.316	.317	.318
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500	.000	.375	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.174	.287	.022	.200	.275	.267	.504	.000	.333	.207	.071	.741	.311	.280	.312	.268
13. AVG IDX 2	.218	.219	.217	.217	.218	.218	.220	.218	.219	.219	.218	.222	.223	.224	.224	.225
14. # DIF INDUS	4.	5.	1.	4.	5.	5.	6.	0.	5.	5.	2.	7.	4.	5.	5.	4.
15. # DIF INSTAL	5.	7.	1.	5.	6.	7.	12.	0.	8.	5.	2.	18.	7.	6.	7.	7.
16. CUM INSTAL	598.	605.	606.	611.	617.	624.	636.	636.	644.	649.	651.	669.	676.	682.	689.	696.

	129. SAGA	130. SAGAMIHARA	131. SAKAI	132. SAPPORO	133. SASEBO	134. SENDAI	135. SETO	136. SHIMIZU	137. SHIMONOSEKI	138. SHIZUOKA	139. SOKA	140. SUITA	141. SUZUKA	142. TACHIGAWA	143. TAKAMATSU	144. TAKAOKA
1. IRON & STEEL		X	X	X		X									X	X
2. NONFERROUS M		X	X	X		X		X	X	X						X
3. ALL METAL.		X	X	X	X	X		X	X	X					X	X
4. MACHINE BLDG		X	X	X		X		X	X	X	X			X	X	X
5. ELEC.MACHINE	X	X	X			X	X	X		X	X		X		X	
6. AGRI.MACHINE																
7. PREC.INSTRUM			X													
8. SHIPBUILDING			X		X			X	X							
9. AUTOBUILDING																
10. LOCOMOTIVE				X												
11. AIRCRAFT																
12. ALL TRANSP.		X	X		X			X	X	X			X		X	
13. CONSTR.MATER			X			X		X								
14. THERMOELECTR			X	X		X				X	X	X	X			X
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER			X										X		X	X
18. OILFIELD		X				X		X			X				X	X
19. PETRO REFINE		X	X		X		X	X	X	X			X		X	X
20. CHEMICAL IND				X		X										
21. FERTILIZERS																
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS																
25. FOOD INDUS	X	X	X	X	X	X		X	X	X	X	X	X		X	X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT					X											
29. SECOND PORT								X					X			
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES										X						
38. NUCLEAR WPNS																
1. METALLURGY	.000	1.111	1.111	1.111	.444	1.111	.000	.778	.778	.778	.000	.000	.000	.000	.778	1.111
2. MACHINERIES	.333	.667	.917	.333	.000	.667	.333	.667	.333	.667	.667	.000	.333	.333	.667	.333
3. TRANSP.EQPMS	.000	.438	.688	.250	.688	.000	.000	.688	.683	.438	.000	.000	.438	.000	.438	.000
4. LIGHT INDUS.	.200	.200	.400	.200	.200	.400	.000	.400	.200	.200	.200	.200	.200	.000	.200	.200
5. ELECTRICITY	.000	.000	1.000	.500	.000	.500	.000	.000	.000	.500	.500	.500	1.000	.000	.500	1.000
6. PETRO-CHEM.	.000	1.000	.500	.500	.500	1.000	.500	1.000	.500	.500	.500	.000	.500	.000	1.000	1.000
7. IND IDX 1	.089	.569	.769	.482	.305	.613	.139	.589	.416	.514	.311	.117	.412	.056	.597	.607
8. AVG IDX 1	.316	.318	.321	.323	.322	.325	.323	.325	.326	.327	.327	.326	.326	.324	.326	.328
9. PORT&AIRFILD	.000	.000	.000	.000	.500	.000	.000	.375	.000	.000	.000	.000	.375	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.333	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.059	.379	.513	.322	.259	.409	.093	.434	.278	.379	.207	.078	.316	.037	.398	.405
13. AVG IDX 2	.223	.224	.227	.227	.228	.229	.228	.229	.230	.231	.231	.230	.230	.229	.230	.231
14. # DIF INDUS	2.	5.	6.	6.	5.	5.	2.	6.	5.	7.	4.	2.	6.	1.	6.	5.
15. # DIF INSTAL	2.	9.	13.	6.	6.	10.	2.	11.	7.	9.	5.	2.	7.	1.	9.	9.
16. CUM INSTAL	698.	707.	720.	726.	734.	744.	746.	757.	764.	773.	778.	780.	787.	788.	797.	806.

	145. TAKARA ZUKA	146. TAKASA KI	147. TAKASU KI	148. TOKORO ZAWA	149. TOKUSH IMA	150. TOKUYA MA	151. TOKYO	152. TOMAKO MAI	153. TOTTOR I	154. TOYAHA SHI	155. TOYAMA	156. TOYONA KA	157. TOYOTA	158. TSU	159. TSUCHI URA	160. UBE
1. IRON & STEEL		X					X			X	X		X			
2. NONFERROUS M							X								X	
3. ALL METAL.		X	X		X		X		X	X	X	X	X		X	
4. MACHINE BLDG	X	X	X	X			X		X	X	X	X	X		X	X
5. ELEC.MACHINE	X	X		X			X		X	X	X	X	X	X		
6. AGRI.MACHINE																
7. PREC.INSTRUM							X									
8. SHIPBUILDING							X				X	X		X		
9. AUTOBUILDING							X									
10. LOCOMOTIVE							X									
11. AIRCRAFT							X									
12. ALL TRANSP.		X	X				X			X	X		X	X		
13. CONSTR.MATER						X		X			X					
14. THERMOELECTR		X	X		X	X	X			X	X		X	X		X
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER		X			X		X		X	X	X			X		
18. OILFIELD			X				X	X			X					
19. PETRO REFINE					X		X			X	X		X			X
20. CHEMICAL IND							X									X
21. FERTILIZERS											X					
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS																
25. FOOD INDUS		X	X	X	X		X		X	X	X		X	X	X	X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT					X											
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.778	.444	.000	.444	.000	1.111	.000	.444	.778	.778	.444	.778	.000	.778	.000
2. MACHINERIES	.667	.667	.333	.667	.000	.000	.917	.000	.667	.667	.667	.667	.667	.333	.333	.333
3. TRANSP.EQPMS	.000	.438	.438	.000	.000	.000	1.437	.000	.000	.438	.688	.250	.438	.688	.000	.000
4. LIGHT INDUS.	.000	.200	.200	.200	.200	.200	.200	.200	.200	.200	.400	.000	.200	.200	.200	.200
5. ELECTRICITY	.000	1.000	.500	.000	1.000	.500	1.000	.000	.500	1.000	1.000	.000	.500	1.000	.000	.500
6. PETRO-CHEM.	.000	.000	.500	.000	.500	.000	1.500	.500	.000	.500	1.500	.000	.500	.000	.000	1.000
7. IND IDX 1	.111	.514	.403	.144	.357	.117	1.028	.117	.302	.597	.839	.227	.514	.370	.219	.339
8. AVG IDX 1	.327	.328	.328	.327	.327	.326	.331	.329	.329	.331	.334	.333	.334	.335	.334	.334
9. PORT&AIRFILD	.000	.000	.000	.000	.500	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.074	.342	.268	.096	.294	.078	.685	.078	.201	.398	.559	.151	.342	.247	.146	.226
13. AVG IDX 2	.230	.231	.231	.230	.231	.230	.233	.232	.232	.233	.235	.234	.235	.235	.234	.234
14. # DIF INDUS	1.	5.	6.	2.	5.	2.	6.	2.	4.	6.	6.	3.	6.	4.	3.	4.
15. # DIF INSTAL	2.	8.	6.	3.	6.	2.	17.	2.	5.	9.	13.	4.	8.	6.	4.	5.
16. CUM INSTAL	808.	816.	822.	825.	831.	833.	850.	852.	857.	866.	879.	883.	891.	897.	901.	906.

	161. UEDA	162. UJI	163. URAWA	164. UTSUNO MIYA	165. WAKAYA MA	166. YACHIY O	167. YAMAGA TA	168. YAMAGU CHI	169. YAMATO	170. YAO	171. YATSUS HIRO	172. YOKKAI CHI	173. YOKOHA MA	174. YOKOSU KA	175. YONAGO
1. IRON & STEEL					X					X			X		
2. NONFERROUS M													X		
3. ALL METAL.			X	X	X	X	X		X	X		X	X	X	
4. MACHINE BLDG	X		X	X	X	X	X		X	X		X	X	X	
5. ELEC.MACHINE	X	X	X	X			X		X			X	X	X	
6. AGRI.MACHINE															
7. PREC.INSTRUM													X		
8. SHIPBUILDING													X	X	
9. AUTOBUILDING													X		
10. LOCOMOTIVE													X		
11. AIRCRAFT										X			X		
12. ALL TRANSP.	X	X	X	X					X				X	X	
13. CONSTR.MATER					X							X	X		
14. THERMOELECTR		X			X							X	X		
15. HYDROELECTR.															
16. OTHER ELECTR										X					
17. NUCLEAR ENER				X	X		X					X	X		
18. OILFIELD				X							X		X		X
19. PETRO REFINE					X		X					X	X		
20. CHEMICAL IND													X		
21. FERTILIZERS															
22. LIGHT INDUS															
23. TEXTILE IND															
24. PAPER MILLS															
25. FOOD INDUS	X	X	X	X	X		X	X		X	X	X	X	X	X
26. GLASS MFG															
27. SUGAR REFINE															
28. MAJOR PORT													X	X	
29. SECOND PORT															
30. AIRFIELD															
31. MILITARY C C															
32. NAVAL BASE															
33. ARMY BASE.															
34. AIRFORCE B															
35. MUNITION DEP															
36. WEAPONS PROD															
37. MISSILES															
38. NUCLEAR WPNS															
1. METALLURGY	.000	.000	.444	.444	.778	.444	.444	.000	.444	.778	.000	.444	1.111	.444	.CCC
2. MACHINERIES	.667	.333	.667	.667	.333	.333	.667	.000	.667	.333	.000	.667	.917	.667	.000
3. TRANSP.EQPMS	.438	.438	.438	.438	.000	.000	.000	.000	.438	.250	.000	.000	1.437	.688	.0C0
4. LIGHT INDUS.	.200	.200	.200	.2C0	.400	.000	.200	.200	.000	.200	.200	.400	.400	.200	.2C0
5. ELECTRICITY	.C00	.500	.CCC	.5CC	1.0C0	.000	.5C0	.000	.000	.5C0	.CCC	1.000	1.CCC	.COC	.CCC
6. PETRO-CHEM.	.000	.000	.000	.500	.500	.000	.500	.000	.000	.000	.500	.500	1.500	.000	.500
7. IND IDX 1	.217	.245	.291	.458	.502	.130	.385	.033	.258	.344	.117	.502	1.C61	.333	.117
8. AVG IDX 1	.333	.333	.332	.333	.334	.333	.333	.332	.331	.331	.330	.331	.335	.335	.334
9. PORT&AIRFILD	.000	.C00	.C00	.C00	.000	.000	.0C0	.0C0	.000	.000	.000	.000	.500	.500	.0C0
10. WEAPONS	.000	.000	.000	.000	.000	.000	.0C0	.000	.000	.000	.000	.000	.000	.COC	.000
11. MILITARY INS	.000	.C00	.C00	.000	.000	.000	.0C0	.000	.000	.000	.000	.000	.000	.C00	.C00
12. IND IDX 2	.145	.163	.194	.305	.335	.086	.257	.022	.172	.229	.078	.335	.763	.278	.078
13. AVG IDX 2	.234	.233	.233	.234	.234	.233	.233	.232	.232	.232	.231	.231	.235	.235	.234
14. # DIF INDUS	3.	4.	4.	6.	5.	2.	5.	1.	3.	5.	2.	5.	7.	5.	2.
15. # DIF INSTAL	4.	4.	5.	7.	8.	2.	6.	1.	4.	6.	2.	8.	19.	7.	2.
16. CUM INSTAL	910.	914.	919.	926.	934.	936.	942.	943.	947.	953.	955.	963.	982.	989.	991.

	1. ANDA	2. ANQING	3. ANSHAN	4. ANYANG	5. BAICHENG	6. BAODING	7. BAOJI	8. BAUTOU	9. BEIJING	10. BEIPIAO	11. BENGBU	12. BENXI	13. CANGZHOU	14. CHANGCHUN	15. CHANGDE	16. CHANGSHA
1. IRON & STEEL		X	X	X		X	X	X	X			X				X
2. NONFERROUS M			X					X	X					X		X
3. ALL METAL.																
4. MACHINE BLDG		X	X	X		X	X	X	X	X	X	X	X	X		X
5. ELEC.MACHINE	X		X	X				X	X		X				X	X
6. AGRI.MACHINE			X	X	X	X	X		X		X	X	X		X	X
7. PREC.INSTRUM			X			X			X					X		
8. SHIPBUILDING																X
9. AUTOBUILDING			X				X	X	X		X			X		X
10. LOCOMOTIVE			X						X					X		
11. AIRCRAFT									5							
12. ALL TRANSP.																
13. CONSTR.MATER						X		X	X			X		X		X
14. THERMOELECTR			X		X	X	X	2	3	X	2	7		3		2
15. HYDROELECTR.									X							
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE	X		X					X	X							X
20. CHEMICAL IND			X	X		X		X	X			X		X		X
21. FERTILIZERS		X	X	X		X	X		X		X	X				X
22. LIGHT INDUS				X	X			X	X		X			X	X	
23. TEXTILE IND	X	X	X		X	X	X	X	X		X	X		X	X	X
24. PAPER MILLS		X	X	X	X	X			X					X		X
25. FOOD INDUS	X					X	X	X	X		X			X		X
26. GLASS MFG																
27. SUGAR REFINE		X						X			X					
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD								9	3					2		2
37. MISSILES									X							
38. NUCLEAR WPNS								X								
1. METALLURGY	.000	.500	1.000	.500	.000	.500	.500	1.000	1.000	.000	.000	.500	.000	.500	.000	1.000
2. MACHINERIES	.250	.250	.938	.750	.250	.688	.500	.500	.938	.250	.750	.500	.500	.438	.500	.750
3. TRANSP.EQPMS	.000	.000	.500	.000	.000	.000	.250	.250	1.750	.000	.250	.000	.000	.500	.000	.500
4. LIGHT INDUS.	.333	.500	.333	.333	.500	.667	.333	.833	.833	.000	.667	.333	.000	.833	.333	.667
5. ELECTRICITY	.000	.000	.250	.000	.250	.250	.250	.500	1.000	.250	.500	1.750	.000	.750	.000	.500
6. PETRO-CHEM.	.250	.250	.750	.500	.000	.500	.250	.500	.750	.000	.250	.500	.000	.250	.000	.750
7. IND IDX 1	.139	.250	.628	.347	.167	.434	.347	.597	1.045	.083	.403	.597	.083	.545	.139	.694
8. AVG IDX 1	.139	.194	.339	.341	.306	.328	.330	.364	.439	.404	.404	.420	.394	.405	.387	.406
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	3.333	1.333	.000	.000	.000	.000	.667	.000	.667
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.093	.167	.419	.231	.111	.289	.231	.769	.845	.056	.269	.398	.056	.437	.093	.537
13. AVG IDX 2	.093	.130	.226	.227	.204	.218	.220	.289	.351	.321	.316	.323	.303	.312	.298	.312
14. # DIF INDUS	3.	4.	6.	4.	3.	5.	6.	7.	7.	2.	5.	5.	1.	7.	2.	7.
15. # DIF INSTAL	4.	6.	14.	8.	5.	11.	8.	24.	29.	2.	11.	14.	2.	16.	4.	18.
16. CUM INSTAL	4.	10.	24.	32.	37.	48.	56.	80.	109.	111.	122.	136.	138.	154.	158.	176.

	17. CHANGZHOU	18. CHAOYANG	19. CHENGDU	20. CHONGQING	21. DANDONG	22. DATUNG	23. DUKOU	24. FOSHAN	25. FUSHUN	26. FUXIN	27. FUZHOU	28. GANZHOU	29. GEJIU	30. GUANGZHOU	31. GUILIN	32. GUIYANG
1. IRON & STEEL	X		X	X					X		X	X		X		X
2. NONFERROUS M			X	X					X				X	X	X	X
3. ALL METAL.																
4. MACHINE BLDG	X		X	X	X	X		X	X	X	X		X	X	X	X
5. ELEC.MACHINE	X		X	X	X				X	X	X			X		X
6. AGRI.MACHINE			X	X	X									X	X	X
7. PREC.INSTRUM	X		X	X	X					X	X			X		X
8. SHIPBUILDING				X							X			X		
9. AUTOBUILDING	X		X	X	X	X	X		X		X	X	X	X	X	X
10. LOCOMOTIVE	X		X			X			X					X		X
11. AIRCRAFT			3	X										2		
12. ALL TRANSP.																
13. CONSTR.MATER				X	X	X			X					X		X
14. THERMOELECTR			2	2	X	X			X	2	X		X	X		2
15. HYDROELECTR.		X			X				X							
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE	X			X		X			4							X
20. CHEMICAL IND	X		X	X	X			X	X		X	X		X	X	X
21. FERTILIZERS			X	X	X				X	X	X	X		X	X	X
22. LIGHT INDUS	X		X	X	X	X		X	X		X			X	X	
23. TEXTILE IND	X		X	X	X			X			X			X	X	X
24. PAPER MILLS			X	X	X			X	X		X			X		X
25. FOOD INDUS		X	X	X	X			X			X			X		X
26. GLASS MFG																
27. SUGAR REFINE						X						X	X	X		X
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD			5	9	3	2	X				X			9	X	
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.500	.000	1.000	1.000	.000	.000	.000	.000	1.000	.000	.500	.500	.500	1.000	.500	1.000
2. MACHINERIES	.688	.000	.938	.938	.938	.250	.000	.250	.500	.688	.688	.000	.250	.938	.500	.938
3. TRANSP.EQPMS	.500	.000	1.250	.750	.250	.500	.250	.000	.500	.000	.500	.250	.250	1.250	.250	.500
4. LIGHT INDUS.	.333	.167	.667	.833	.833	.500	.000	.667	.500	.000	.667	.167	.167	1.000	.333	.833
5. ELECTRICITY	.000	.250	.500	.500	.500	.250	.000	.000	.500	.500	.250	.000	.250	.250	.000	.500
6. PETRO-CHEM.	.500	.000	.500	.750	.500	.250	.000	.250	1.500	.250	.500	.500	.000	.500	.500	.750
7. IND IDX 1	.420	.069	.809	.795	.503	.292	.042	.194	.750	.240	.517	.236	.236	.823	.347	.753
8. AVG IDX 1	.407	.388	.410	.430	.433	.427	.410	.401	.415	.408	.412	.406	.400	.414	.412	.423
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	1.667	3.000	1.000	.667	.333	.000	.000	.000	.333	.000	.000	3.000	.333	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.280	.046	.725	.863	.447	.269	.065	.130	.500	.160	.382	.157	.157	.882	.269	.502
13. AVG IDX 2	.311	.296	.318	.346	.351	.347	.335	.326	.333	.326	.328	.322	.317	.335	.333	.339
14. # DIF INDUS	5.	2.	7.	7.	6.	6.	2.	3.	6.	3.	7.	4.	5.	7.	6.	6.
15. # DIF INSTAL	10.	2.	24.	28.	17.	10.	2.	6.	17.	6.	14.	5.	5.	29.	9.	18.
16. CUM INSTAL	186.	188.	212.	240.	257.	267.	269.	275.	292.	298.	312.	317.	322.	351.	360.	378.

	33. HAIKOU	34. HANDAN	35. HANGZH OU	36. HARBIN	37. HEBI	38. HEFEI	39. HEGANG	40. HENGYA NG	41. HUAINA N	42. HUANGS HI	43. HUHHOT	44. JIAMUS I	45. JIAN	46. JIANGM EN	47. JIAOZU O	48. JILIN
1. IRON & STEEL	X	X	X	X		X		X		X	X				X	X
2. NONFERROUS M		X		X		X						X			X	
3. ALL METAL.																
4. MACHINE BLDG	X	X	X	X		X		X			X	X		X	X	X
5. ELEC.MACHINE			X	X		X		X			X	X		X		X
6. AGRI.MACHINE			X	X		X					X	X				
7. PREC.INSTRUM		X	X	X	X	X		X								X
8. SHIPBUILDING	X			X				X				X		X		
9. AUTOBUILDING	X		X	X		X					X	X				X
10. LOCOMOTIVE			X	X												
11. AIRCRAFT				5												X
12. ALL TRANSP.																
13. CONSTR.MATER	X	X	X	X		X		X		X		X			X	X
14. THERMOELECTR	X	X	X	2		X	X	X	X	X	X	3			X	X
15. HYDROELECTR.																X
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE			X	X					X							2
20. CHEMICAL IND			X	X		X		X	X		X	X		X		X
21. FERTILIZERS	X					X		X				X		X		X
22. LIGHT INDUS			X	X		X				X		X				X
23. TEXTILE IND		X	X	X		X		X		X	X	X				X
24. PAPER MILLS			X			X			X		X	X		X	X	X
25. FOOD INDUS	X		X	X					X			X		X		
26. GLASS MFG																
27. SUGAR REFINE				X							X	X		X		X
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD								4								
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.500	1.000	.500	1.000	.000	1.000	.000	.500	.000	.500	.500	.500	.000	.000	1.000	.500
2. MACHINERIES	.250	.438	.938	.938	.188	.938	.000	.688	.000	.000	.750	.750	.000	.500	.250	.688
3. TRANSP.EQPMS	.500	.000	.500	2.000	.000	.250	.000	.250	.000	.000	.250	.500	.000	.250	.000	.500
4. LIGHT INDUS.	.333	.333	.833	.833	.000	.667	.000	.333	.333	.500	.500	1.000	.000	.500	.333	.833
5. ELECTRICITY	.250	.250	.250	.500	.000	.250	.250	.250	.250	.250	.250	.750	.000	.000	.250	.500
6. PETRO-CHEM.	.250	.000	.500	.500	.000	.500	.000	.500	.500	.000	.250	.500	.000	.500	.000	1.000
7. IND IDX 1	.347	.337	.587	.962	.031	.601	.042	.420	.181	.208	.417	.667	.000	.292	.306	.670
8. AVG IDX 1	.420	.418	.423	.438	.427	.431	.421	.421	.415	.411	.411	.417	.407	.405	.403	.408
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	1.333	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.231	.225	.391	.641	.021	.400	.028	.428	.120	.139	.278	.444	.000	.194	.204	.447
13. AVG IDX 2	.335	.332	.334	.342	.334	.335	.327	.330	.325	.320	.319	.322	.315	.312	.310	.313
14. # DIF INDUS	6.	4.	6.	6.	1.	6.	1.	7.	3.	3.	6.	6.	0.	4.	4.	6.
15. # DIF INSTAL	8.	7.	15.	23.	1.	14.	1.	14.	5.	5.	10.	17.	0.	8.	6.	17.
16. CUM INSTAL	386.	393.	408.	431.	432.	446.	447.	461.	466.	471.	481.	498.	498.	506.	512.	529.

	49. JINAN	50. JINGDE ZHEN	51. JINING	52. JINZHO U	53. JIUJIA NG	54. JIXI	55. KAIFEN G	56. KASHI	57. KUNMIN G	58. LANZHO U	59. LASA	60. LIANGY UNGANG	61. LIAOYA NG	62. LIAOYU AN	63. LIUZHO U	64. LUDA
1. IRON & STEEL	X			X					X					X	X	X
2. NONFERROUS M				X			X		X	X					X	
3. ALL METAL.																
4. MACHINE BLDG	X			X		X	X		X	X	X				X	X
5. ELEC.MACHINE		X		X			X		X	X	X	X		X	X	X
6. AGRI.MACHINE	X		X				X	X		X	X				X	
7. PREC.INSTRUM	X			X					X	X			X			X
8. SHIPBUILDING			X													X
9. AUTOBUILDING	X		X	X			X	X	X	X	X				X	X
10. LOCOMOTIVE	X						X	X		X						X
11. AIRCRAFT	X							X	X							
12. ALL TRANSP.								X								
13. CONSTR.MATER	X	X							X	X	X		X		X	X
14. THERMOELECTR	3		X	X		X	X		3	2			X		X	3
15. HYDROELECTR.	2	X					X			X			2			
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE				X				X		X						X
20. CHEMICAL IND	X		X	X	X		X	X	X	X				X		X
21. FERTILIZERS	X						X		X	X			X		X	X
22. LIGHT INDUS	X	X		X			X		X	X	X	X	X		X	X
23. TEXTILE IND	X			X	X		X		X	X			X	X	X	X
24. PAPER MILLS	X			X				X	X	X			X		X	X
25. FOOD INDUS	X			X			X			X	X					X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD	X								9	3	X		X		X	2
37. MISSILES									5							
38. NUCLEAR WPNS																
1. METALLURGY	.500	.000	.000	1.000	.000	.000	.500	.000	1.000	.500	.000	.000	.000	.500	1.000	.500
2. MACHINERIES	.688	.250	.250	.688	.000	.250	.750	.250	.688	.938	.750	.250	.188	.250	.750	.688
3. TRANSP.EQPMS	.750	.000	.500	.250	.000	.000	.500	1.187	.500	.500	.250	.000	.000	.000	.250	.750
4. LIGHT INDUS.	.833	.333	.000	.667	.167	.000	.500	.167	.667	.833	.500	.167	.667	.167	.667	.833
5. ELECTRICITY	1.250	.250	.250	.250	.000	.250	.500	.000	.750	.750	.000	.000	.750	.000	.250	.750
6. PETRO-CHEM.	.500	.000	.250	.500	.250	.000	.500	.500	.500	.750	.000	.000	.250	.250	.250	.750
7. IND IDX 1	.753	.139	.208	.559	.069	.083	.542	.351	.684	.712	.250	.069	.309	.194	.528	.712
8. AVG IDX 1	.415	.410	.406	.409	.402	.396	.399	.398	.403	.409	.406	.400	.399	.395	.398	.402
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.333	.000	.000	.000	.000	.000	.000	.000	4.667	1.000	.333	.000	.333	.000	.333	.667
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.539	.093	.139	.373	.046	.056	.361	.234	.975	.586	.204	.046	.243	.130	.389	.549
13. AVG IDX 2	.318	.313	.310	.311	.306	.301	.302	.301	.313	.318	.316	.311	.310	.307	.309	.312
14. # DIF INDUS	7.	3.	4.	6.	2.	2.	6.	4.	7.	7.	4.	2.	5.	4.	7.	7.
15. # DIF INSTAL	20.	4.	5.	13.	2.	2.	13.	8.	30.	21.	8.	2.	10.	4.	13.	20.
16. CUM INSTAL	549.	553.	558.	571.	573.	575.	588.	596.	626.	647.	655.	657.	667.	671.	684.	704.

	65. LUOYAN G	66. LUZHOU	67. MAOMIN G	68. MA'ANS HAN	69. MUDANG JIANG	70. NANCHA NG	71. NANCHO NG	72. NANJIN G
1. IRON & STEEL				X	X	X		X
2. NONFERROUS M					X			
3. ALL METAL.								
4. MACHINE BLDG		X			X	X	X	X
5. ELEC.MACHINE	X				X	X		X
6. AGRI.MACHINE	X				X	X		X
7. PREC.INSTRUM					X	X		X
8. SHIPBUILDING								X
9. AUTOBUILDING	X		X		X	X		X
10. LOCOMOTIVE	X				X			X
11. AIRCRAFT						2		2
12. ALL TRANSP.								
13. CONSTR.MATER	X			X	X			
14. THERMOELECTR	X	X	X	X	X	2		2
15. HYDROELECTR.					X			
16. OTHER ELECTR								
17. NUCLEAR ENER								
18. OILFIELD								
19. PETRO REFINE			X				X	X
20. CHEMICAL IND	X	X			X	X		X
21. FERTILIZERS	X	X	X	X		X		X
22. LIGHT INDUS		X				X		X
23. TEXTILE IND	X	X			X	X	X	X
24. PAPER MILLS								X
25. FOOD INDUS						X	X	X
26. GLASS MFG								
27. SUGAR REFINE								
28. MAJOR PORT								
29. SECOND PORT								
30. AIRFIELD								
31. MILITARY C C								
32. NAVAL BASE								
33. ARMY BASE								
34. AIRFORCE B								
35. MUNITION DEP								
36. WEAPONS PROD	2		X		X	X		4
37. MISSILES								
38. NUCLEAR WPNS								
1. METALLURGY	.000	.000	.000	.500	1.000	.500	.000	.500
2. MACHINERIES	.500	.250	.000	.000	.938	.938	.250	.938
3. TRANSP.EQPMS	.500	.000	.250	.000	.500	.750	.000	1.250
4. LIGHT INDUS.	.333	.333	.000	.167	.333	.500	.333	.667
5. ELECTRICITY	.250	.250	.250	.250	.500	.500	.000	.500
6. PETRO-CHEM.	.500	.500	.500	.250	.250	.500	.250	.750
7. IND IDX 1	.347	.222	.167	.194	.587	.615	.139	.767
8. AVG IDX 1	.402	.399	.395	.392	.395	.398	.395	.400
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.667	.000	.333	.000	.333	.333	.000	1.333
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.306	.148	.148	.130	.428	.447	.093	.660
13. AVG IDX 2	.312	.310	.307	.305	.306	.308	.305	.310
14. # DIF INDUS	6.	4.	4.	4.	7.	7.	3.	7.
15. # DIF INSTAL	11.	6.	5.	4.	14.	16.	4.	23.
16. CUM INSTAL	715.	721.	726.	730.	744.	760.	764.	787.

	73. NANNIN G	74. NANTON G	75. NANYAN G	76. NEIJIA NG	77. NINGBO	78. PINGDI NGSHAN	79. PINGXI ANG	80. QINGDA O
1. IRON & STEEL	X						X	X
2. NONFERROUS M	X				X			X
3. ALL METAL.								
4. MACHINE BLDG	X	X			X	X		X
5. ELEC.MACHINE		X					X	X
6. AGRI.MACHINE	X	X			X			
7. PREC.INSTRUM					X			
8. SHIPBUILDING					X			X
9. AUTOBUILDING	X		X	X	X			X
10. LOCOMOTIVE								X
11. AIRCRAFT								
12. ALL TRANSP.								
13. CONSTR.MATER								X
14. THERMOELECTR		X		X	X	X		3
15. HYDROELECTR.								
16. OTHER ELECTR								
17. NUCLEAR ENER								
18. OILFIELD								
19. PETRO REFINE								X
20. CHEMICAL IND	X	X			X			X
21. FERTILIZERS	X	X	X					X
22. LIGHT INDUS		X	X		X			X
23. TEXTILE IND	X	X			X			X
24. PAPER MILLS	X	X			X			X
25. FOOD INDUS	X		X		X			X
26. GLASS MFG								
27. SUGAR REFINE	X			X				
28. MAJOR PORT								
29. SECOND PORT								
30. AIRFIELD								
31. MILITARY C C								
32. NAVAL BASE								
33. ARMY BASE								
34. AIRFORCE B								
35. MUNITION DEP								
36. WEAPONS PROD	2				X			2
37. MISSILES								
38. NUCLEAR WPNS								
1. METALLURGY	1.000	.000	.000	.000	.500	.000	.500	1.000
2. MACHINERIES	.500	.750	.000	.000	.688	.250	.250	.500
3. TRANSP.EQPMS	.250	.000	.250	.250	.500	.000	.000	.750
4. LIGHT INDUS.	.667	.500	.333	.167	.667	.000	.000	.833
5. ELECTRICITY	.000	.250	.000	.250	.250	.250	.000	.750
6. PETRO-CHEM.	.500	.500	.250	.000	.250	.000	.000	.750
7. IND IDX 1	.486	.333	.139	.111	.476	.083	.125	.764
8. AVG IDX 1	.401	.400	.397	.393	.394	.390	.387	.391
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.667	.000	.000	.000	.333	.000	.000	.667
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.398	.222	.093	.074	.354	.056	.083	.583
13. AVG IDX 2	.312	.310	.307	.304	.305	.302	.299	.303
14. # DIF INDUS	6.	4.	3.	3.	7.	2.	2.	7.
15. # DIF INSTAL	13.	9.	4.	3.	13.	2.	2.	20.
16. CUM INSTAL	800.	809.	813.	816.	829.	831.	833.	853.

	81. QINGHUANDAO	82. QINGJIANG	83. QIQIHAR	84. QUANZHOU	85. SANTOU	86. SHANGHAI	87. SHAOGUAN	88. SHAOXING	89. SHAOYANG	90. SHASI	91. SHENYANG	92. SHIJIAZHUANG	93. SHUANYASHAN	94. SUZHOU	95. TAIYUAN	96. TAIZHOU
1. IRON & STEEL						X	X				X	X		X	X	
2. NONFERROUS M						X	X				X	X			X	
3. ALL METAL.																
4. MACHINE BLDG	X		X			X	X				X	X		X	X	X
5. ELEC.MACHINE			X	X	X	X	X				X			X	X	X
6. AGRI.MACHINE				X	X	X		X			X			X	X	X
7. PREC.INSTRUM		X			X	X					X	X		X	X	
8. SHIPBUILDING	X				X	X		X						X		
9. AUTOBUILDING	X		X		X	X	X				X	X			X	
10. LOCOMOTIVE			X								X	X		X	X	
11. AIRCRAFT						6					6					
12. ALL TRANSP.																
13. CONSTR.MATER	X					X	X								X	
14. THERMOELECTR			X			5	X				3	X		X	2	
15. HYDROELECTR.															3	
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE					X	X					X				X	
20. CHEMICAL IND	X		X		X	X	X				X	X		X	X	X
21. FERTILIZERS		X		X	X	X	X	X		X	X	X			X	
22. LIGHT INDUS	X	X				X	X			X	X			X	X	
23. TEXTILE IND	X	X		X		X	X	X		X	X	X		X	X	X
24. PAPER MILLS	X				X	X					X	X		X	X	
25. FOOD INDUS	X	X		X	X	X	X				X			X	X	
26. GLASS MFG																
27. SUGAR REFINE			X	X	X											
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD	X		2			9					9	X			8	
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.000	.000	.000	1.000	1.000	.000	.000	.000	1.000	1.000	.000	.500	1.000	.000
2. MACHINERIES	.250	.188	.500	.500	.688	.938	.500	.250	.000	.000	.938	.438	.000	.938	.938	.750
3. TRANSP.EQPMS	.500	.000	.500	.000	.500	2.000	.250	.250	.000	.000	2.000	.500	.000	.500	.500	.000
4. LIGHT INDUS.	.833	.500	.167	.500	.500	.833	.667	.167	.000	.333	.667	.333	.000	.667	.833	.167
5. ELECTRICITY	.000	.000	.250	.000	.000	1.250	.250	.000	.000	.000	.750	.250	.000	.250	1.250	.000
6. PETRO-CHEM.	.250	.250	.250	.250	.750	.750	.500	.250	.000	.250	.750	.500	.000	.250	.750	.250
7. IND IDX 1	.306	.156	.278	.208	.406	1.128	.528	.153	.000	.097	1.017	.503	.000	.517	.878	.194
8. AVG IDX 1	.390	.387	.386	.384	.384	.393	.395	.392	.387	.384	.391	.392	.388	.389	.395	.393
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.333	.000	.667	.000	.000	3.000	.000	.000	.000	.000	3.000	.333	.000	.000	2.667	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.241	.104	.259	.139	.271	1.086	.352	.102	.000	.065	1.012	.373	.000	.345	.882	.130
13. AVG IDX 2	.302	.299	.299	.297	.297	.306	.306	.304	.301	.298	.306	.307	.303	.304	.310	.308
14. # DIF INDUS	5.	3.	6.	3.	4.	7.	6.	4.	0.	2.	7.	7.	0.	6.	7.	3.
15. # DIF INSTAL	10.	5.	9.	6.	11.	36.	12.	4.	0.	3.	33.	12.	0.	13.	29.	5.
16. CUM INSTAL	863.	868.	877.	883.	894.	930.	942.	946.	946.	949.	982.	994.	994.	1007.	1036.	1041.

	97. TANGSHAN	98. TIANJIN	99. TONGHUA	100. URUMQI	101. WANXIAN	102. WEFENG	103. WENZHOU	104. WUHAN	105. WUHU	106. WUXI	107. WUZHOU	108. XIAMEN	109. XIANGFAN	110. XIANGTAN	111. XINGTAI	112. XINGYANG
1. IRON & STEEL	X	X	X	X		X		X	X	X	X			X	X	X
2. NONFERROUS M	X	X	X	X				X								
3. ALL METAL.																
4. MACHINE BLDG		X	X	X		X		X		X	X	X		X		
5. ELEC.MACHINE	X	X	X	X			X	X		X	X	X		X		
6. AGRI.MACHINE	X	X	X	X		X	X	X		X				X	X	
7. PREC.INSTRUM		X						X	X	X					X	
8. SHIPBUILDING		X					X	X	X	X	X	X				
9. AUTOBUILDING	X	X		X		X	X	X		X		X				
10. LOCOMOTIVE	X	X		X				X				X		X		
11. AIRCRAFT				X				X								
12. ALL TRANSP.																
13. CONSTR.MATER	X	X		X				X	X					X		
14. THERMOELECTR	X	4	X	X		X	X	4		X	2	X	X	X		
15. HYDROELECTR.	X		X	X												
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE	X	X		X				X		X	X					
20. CHEMICAL IND		X					X			X	X	X				
21. FERTILIZERS		X	X	X				X		X		X		X		X
22. LIGHT INDUS	X	X	X	X			X	X		X		X				
23. TEXTILE IND	X	X	X	X		X	X	X	X	X	X	X		X	X	
24. PAPER MILLS	X	X	X	X		X	X	X		X	X	X				
25. FOOD INDUS		X					X	X		X		X				
26. GLASS MFG																
27. SUGAR REFINE				X							X	X				
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD		2		5			X	6				X		X	X	
37. MISSILES								X								
38. NUCLEAR WPNS																
1. METALLURGY	1.000	1.000	1.000	1.000	.000	.500	.000	1.000	.500	.500	.500	.000	.000	.500	.500	.500
2. MACHINERIES	.500	.938	.750	.750	.000	.500	.500	.938	.188	.938	.500	.500	.000	.750	.438	.000
3. TRANSP.EQPMS	.500	.750	.000	.750	.000	.250	.500	1.000	.250	.500	.250	.750	.000	.250	.000	.000
4. LIGHT INDUS.	.667	.833	.500	.833	.000	.333	.667	.833	.333	.667	.500	.833	.000	.333	.167	.000
5. ELECTRICITY	.500	1.000	.500	.500	.000	.250	.250	1.000	.000	.250	.500	.250	.250	.250	.000	.000
6. PETRO-CHEM.	.250	.750	.250	.500	.000	.000	.250	.500	.000	.750	.500	.500	.000	.250	.000	.250
7. IND IDX 1	.569	.878	.500	.722	.000	.306	.361	.878	.212	.601	.458	.472	.042	.389	.184	.125
8. AVG IDX 1	.394	.399	.400	.404	.400	.399	.398	.403	.401	.403	.403	.404	.401	.401	.399	.396
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.667	.000	.667	.000	.000	.333	2.333	.000	.000	.000	.333	.000	.333	.333	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.380	.660	.333	.556	.000	.204	.278	.845	.141	.400	.306	.352	.028	.296	.160	.083
13. AVG IDX 2	.309	.312	.313	.315	.312	.311	.310	.316	.314	.315	.315	.315	.312	.312	.311	.309
14. # DIF INDUS	6.	7.	5.	7.	0.	5.	6.	7.	4.	6.	6.	6.	1.	7.	4.	2.
15. # DIF INSTAL	13.	23.	11.	19.	0.	7.	11.	28.	5.	15.	11.	14.	1.	10.	5.	2.
16. CUM INSTAL	1054.	1077.	1088.	1107.	1107.	1114.	1125.	1153.	1158.	1173.	1184.	1198.	1199.	1209.	1214.	1216.

	113. XINING	114. XINXIANG	115. XIPING	116. XI'AN	117. XUANHUA	118. XUCHANG	119. XUZHOU	120. YANGQUAN	121. YANGZHOU	122. YANTAI	123. YIBIN	124. YICHANG	125. YINCHUAN	126. YIYANG	127. ZHANGJIAKOU	128. ZHANGJIANG
1. IRON & STEEL	X			X	X		X	X						X	X	
2. NONFERROUS M			X	X	X											
3. ALL METAL.																
4. MACHINE BLDG	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
5. ELEC.MACHINE	X	X	X	X			X			X	X		X		X	
6. AGRI.MACHINE	X		X	X		X	X		X			X		X	X	
7. PREC.INSTRUM				X						X		X				
8. SHIPBUILDING												X				X
9. AUTOBUILDING	X			X	X	X	X		X				X		X	
10. LOCOMOTIVE				X	X	X										
11. AIRCRAFT				X			X		X							
12. ALL TRANSP.																
13. CONSTR.MATER	X			X	X							X				X
14. THERMOELECTR	2	X		4			X				X			X		
15. HYDROELECTR.	2		X										3			
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE			X								X					
20. CHEMICAL IND	X	X	X	X	X	X	X							X	X	X
21. FERTILIZERS	X			X	X		X		X	X			X	X		X
22. LIGHT INDUS	X	X		X		X	X		X				X		X	
23. TEXTILE IND	X			X			X		X	X			X	X	X	X
24. PAPER MILLS	X	X			X					X	X		X		X	
25. FOOD INDUS	X	X	X	X		X				X			X		X	
26. GLASS MFG																
27. SUGAR REFINE	X				X											X
28. MAJOR PORT																
29. SECOND PORT																
30. AIRFIELD																
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD				3									2			
37. MISSILES				2												
38. NUCLEAR WPNS																
1. METALLURGY	.500	.000	.500	1.000	1.000	.000	.500	.500	.000	.000	.000	.000	.000	.500	.500	.000
2. MACHINERIES	.750	.500	.750	.938	.250	.500	.500	.250	.500	.688	.500	.688	.500	.500	.750	.250
3. TRANSP.EQPMS	.250	.000	.000	.750	.500	.500	.500	.000	.500	.000	.000	.250	.250	.000	.250	.250
4. LIGHT INDUS.	1.000	.500	.167	.667	.500	.333	.333	.000	.333	.500	.167	.167	.667	.167	.667	.500
5. ELECTRICITY	1.000	.250	.250	1.000	.000	.000	.250	.000	.000	.000	.250	.000	.750	.250	.000	.000
6. PETRO-CHEM.	.500	.250	.500	.500	.500	.250	.500	.000	.250	.250	.250	.000	.250	.500	.250	.500
7. IND IDX 1	.667	.250	.361	.809	.458	.264	.431	.125	.264	.240	.194	.184	.403	.319	.403	.250
8. AVG IDX 1	.399	.397	.397	.401	.401	.400	.400	.398	.397	.395	.394	.392	.392	.392	.392	.391
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	1.667	.000	.000	.000	.000	.000	.000	.000	.000	.667	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.444	.167	.241	.725	.306	.176	.287	.083	.176	.160	.130	.123	.343	.213	.269	.167
13. AVG IDX 2	.310	.309	.308	.312	.312	.311	.310	.308	.307	.306	.305	.303	.304	.303	.303	.302
14. # DIF INDUS	6.	4.	5.	7.	5.	4.	6.	2.	4.	3.	4.	3.	6.	5.	5.	4.
15. # DIF INSTAL	17.	7.	8.	24.	10.	7.	10.	2.	7.	7.	5.	5.	13.	7.	10.	7.
16. CUM INSTAL	1233.	1240.	1248.	1272.	1282.	1289.	1299.	1301.	1308.	1315.	1320.	1325.	1338.	1345.	1355.	1362.

	129. ZHANGZHOU	130. ZHENGZHOU	131. ZHENJIANG	132. ZHUZHOU	133. ZIBO	134. ZIGONG	135. ZUNYI
1. IRON & STEEL		X		X			X
2. NONFERROUS M		X		X	X		
3. ALL METAL.							
4. MACHINE BLDG	X	X	X	X	X	X	
5. ELEC.MACHINE	X	X	X	X		X	X
6. AGRI.MACHINE			X	X		X	X
7. PREC.INSTRUM					X		
8. SHIPBUILDING					X		
9. AUTOBUILDING	X	X		X	X		X
10. LOCOMOTIVE		X		X			
11. AIRCRAFT			X	X			
12. ALL TRANSP.							
13. CONSTR.MATER					X	X	
14. THERMOELECTR	X	X		X	2		
15. HYDROELECTR.		X					
16. OTHER ELECTR							
17. NUCLEAR ENER							
18. OILFIELD							
19. PETRO REFINE		X			X		
20. CHEMICAL IND	X			X	X	X	X
21. FERTILIZERS	X	X		X		X	X
22. LIGHT INDUS	X	X	X	X	X		
23. TEXTILE IND	X	X	X	X	X		X
24. PAPER MILLS	X		X	X			
25. FOOD INDUS	X	X	X			X	
26. GLASS MFG							
27. SUGAR REFINE	X						
28. MAJOR PORT							
29. SECOND PORT							
30. AIRFIELD							
31. MILITARY C C							
32. NAVAL BASE							
33. ARMY BASE							
34. AIRFORCE B							
35. MUNITION DEP							
36. WEAPONS PROD		X		2	X		
37. MISSILES		X					
38. NUCLEAR WPNS							
1. METALLURGY	.000	1.000	.000	1.000	.500	.000	.500
2. MACHINERIES	.500	.500	.750	.750	.438	.750	.500
3. TRANSP.EQPMS	.250	.500	.250	.750	.500	.000	.250
4. LIGHT INDUS.	.833	.500	.667	.500	.500	.333	.167
5. ELECTRICITY	.250	.500	.000	.250	.500	.000	.000
6. PETRO-CHEM.	.500	.500	.000	.500	.500	.500	.500
7. IND IDX 1	.389	.583	.278	.625	.490	.264	.319
8. AVG IDX 1	.391	.392	.391	.393	.394	.393	.392
9. PORT&AIRFILD	.000	.000	.000	.000	.000	.000	.000
10. WEAPONS	.000	.667	.000	.667	.333	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.259	.463	.185	.491	.363	.176	.213
13. AVG IDX 2	.301	.302	.302	.303	.303	.302	.302
14. # DIF INDUS	5.	7.	3.	7.	7.	3.	5.
15. # DIF INSTAL	11.	15.	8.	16.	13.	7.	7.
16. CUM INSTAL	1373.	1388.	1396.	1412.	1425.	1432.	1439.

	1. CHANGHWA	2. CHIAYI	3. CHINGSHUI	4. CHISAN AN	5. CHUNGLI	6. CHUSAN	7. CHUTUNG	8. ERHLIN	9. FENGSHAN	10. FENGYUAN	11. HOMEI	12. HSILO	13. HSINCHU	14. HSINTIEN	15. HSINYING	16. HUALIEN
1. IRON & STEEL	X	X	X		X					X			X	X	X	X
2. NONFERROUS M																
3. ALL METAL.																
4. MACHINE BLDG		X												X		
5. ELEC.MACHINE			X													
6. AGRI.MACHINE																
7. PREC.INSTRUM																
8. SHIPBUILDING																
9. AUTOBUILDING					X									X		
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER							X						X	X		X
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE																
20. CHEMICAL IND	X	X			X					X			X			X
21. FERTILIZERS													X			X
22. LIGHT INDUS																
23. TEXTILE IND	X												X	X		
24. PAPER MILLS																
25. FOOD INDUS														X		
26. GLASS MFG							X							X	X	
27. SUGAR REFINE	X	X											X		X	X
28. MAJOR PORT																
29. SECOND PORT																X
30. AIRFIELD		X							X				X			X
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.500	.500	.500	.000	.500	.000	.000	.000	.000	.500	.000	.000	.500	.500	.500	.500
2. MACHINERIES	.000	.500	.500	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500	.000	.000
3. TRANSP.EQPMS	.000	.000	.000	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000	.000
4. LIGHT INDUS.	.286	.143	.000	.000	.000	.000	.286	.000	.000	.000	.000	.000	.429	.571	.286	.286
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.250	.250	.000	.000	.250	.000	.000	.000	.000	.250	.000	.000	.500	.000	.000	.500
7. IND IDX 1	.173	.232	.167	.000	.167	.000	.048	.000	.000	.125	.000	.000	.238	.304	.131	.214
8. AVG IDX 1	.173	.202	.190	.143	.148	.123	.112	.098	.087	.091	.083	.076	.088	.104	.106	.112
9. PORT&AIRFILD	.000	.500	.000	.000	.000	.000	.000	.000	.500	.000	.000	.000	.500	.000	.000	.875
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.115	.210	.111	.000	.111	.000	.032	.000	.056	.083	.000	.000	.214	.202	.087	.240
13. AVG IDX 2	.115	.163	.146	.109	.110	.091	.083	.072	.071	.072	.065	.060	.072	.081	.081	.091
14. # DIF INDUS	3.	5.	2.	0.	3.	0.	1.	0.	1.	2.	0.	0.	4.	4.	2.	4.
15. # DIF INSTAL	4.	5.	2.	0.	3.	0.	2.	0.	1.	2.	0.	0.	7.	7.	3.	7.
16. CUM INSTAL	4.	9.	11.	11.	14.	14.	16.	16.	17.	19.	19.	19.	26.	33.	36.	43.

	17. HUWEI	18. ILAN	19. JUIFAN	20. KANGSHAN	21. KAOHSIUNG	22. KEELUNG	23. LOTUNG	24. LUKANG	25. MAKUNG	26. MATOU	27. MEINUNGN	28. MIAULI	29. NANTOU	30. PANCHIU	31. PEIKANG	32. PINGTUNG
1. IRON & STEEL		X			X	X								X		X
2. NONFERROUS M																
3. ALL METAL.																
4. MACHINE BLDG					X											
5. ELEC.MACHINE					X											
6. AGRI.MACHINE																
7. PREC.INSTRUM																
8. SHIPBUILDING					X	X										
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER					X		X									
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE					X											
20. CHEMICAL IND					X		X					X				
21. FERTILIZERS					X	X						X				
22. LIGHT INDUS																
23. TEXTILE IND																
24. PAPER MILLS					X		X									
25. FOOD INDUS.																
26. GLASS MFG														X		
27. SUGAR REFINE	X				X								X		X	X
28. MAJOR PORT					X	X										
29. SECOND PORT									X							
30. AIRFIELD																X
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.500	.000	.000	.500	.500	.000	.000	.000	.000	.000	.000	.000	.500	.000	.500
2. MACHINERIES	.000	.000	.000	.000	1.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
3. TRANSP.EQPMS	.000	.000	.000	.000	.250	.250	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
4. LIGHT INDUS.	.143	.000	.000	.000	.429	.000	.286	.000	.000	.000	.000	.000	.143	.143	.143	.143
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.000	.000	.000	.000	.750	.250	.250	.000	.000	.000	.000	.500	.000	.000	.000	.000
7. IND IDX 1	.024	.083	.000	.000	.488	.167	.089	.000	.000	.000	.000	.083	.024	.107	.024	.107
8. AVG IDX 1	.107	.106	.100	.095	.114	.116	.115	.110	.106	.102	.098	.098	.095	.095	.093	.094
9. PORT&AIRFILD	.000	.000	.000	.000	.500	.500	.000	.000	.375	.000	.000	.000	.000	.000	.000	.500
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.016	.056	.000	.000	.381	.167	.060	.000	.042	.000	.000	.056	.016	.071	.016	.127
13. AVG IDX 2	.087	.085	.081	.077	.091	.095	.093	.089	.087	.084	.081	.080	.078	.078	.076	.077
14. # DIF INDUS	1.	1.	0.	0.	6.	4.	2.	0.	1.	0.	0.	1.	1.	2.	1.	3.
15. # DIF INSTAL	1.	1.	0.	0.	11.	4.	3.	0.	1.	0.	0.	2.	1.	2.	1.	3.
16. CUM INSTAL	44.	45.	45.	45.	56.	60.	63.	63.	64.	64.	64.	66.	67.	69.	70.	73.

	33. POTEZ	34. PULI	35. SANCHUNG	36. SUAO	37. TACHI	38. TACHIA	39. TAICHUNG	40. TAINAN	41. TAIPEI	42. TAITUNG	43. TAOYUAN	44. TOULIV	45. TOVFEN	46. TSAOTUN	47. TUNGSHIH	48. YANGMEI
1. IRON & STEEL			X				X	X	X		X			X		
2. NONFERROUS M																
3. ALL METAL.																
4. MACHINE BLDG			X				X		X							
5. ELEC.MACHINE							X	X	X							
6. AGRI.MACHINE																
7. PREC.INSTRUM																
8. SHIPBUILDING				X												
9. AUTOBUILDING							X				X					
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER		X	X							X						
14. THERMOELECTR																
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE																
20. CHEMICAL IND			X				X	X	X		X		X			
21. FERTILIZERS											X		X			
22. LIGHT INDUS																
23. TEXTILE IND								X	X		X		X			
24. PAPER MILLS								X	X							
25. FOOD INDUS									X							
26. GLASS MFG									X							
27. SUGAR REFINE		X		X			X	X		X		X				
28. MAJOR PORT				X												
29. SECOND PORT																
30. AIRFIELD								X	X		X					
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.500	.000	.000	.000	.500	.500	.500	.000	.500	.000	.000	.500	.000	.000
2. MACHINERIES	.000	.000	.500	.000	.000	.000	1.000	.500	1.000	.000	.000	.000	.000	.000	.000	.000
3. TRANSP.EQPMS	.000	.000	.000	.250	.000	.000	.250	.000	.000	.000	.250	.000	.000	.000	.000	.000
4. LIGHT INDUS.	.000	.286	.143	.143	.000	.000	.143	.429	.571	.286	.143	.143	.143	.000	.000	.000
5. ELECTRICITY	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
6. PETRO-CHEM.	.000	.000	.250	.000	.000	.000	.250	.250	.250	.000	.500	.000	.500	.000	.000	.000
7. IND IDX 1	.000	.048	.232	.065	.000	.000	.357	.280	.387	.048	.232	.024	.107	.083	.000	.000
8. AVG IDX 1	.091	.089	.094	.093	.090	.088	.095	.099	.106	.105	.108	.106	.106	.106	.103	.101
9. PORT&AIRFILD	.000	.000	.000	.500	.000	.000	.000	.500	.500	.000	.500	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.000	.032	.155	.099	.000	.000	.238	.242	.313	.032	.210	.016	.071	.056	.000	.000
13. AVG IDX 2	.075	.074	.076	.076	.074	.072	.077	.081	.087	.085	.088	.086	.086	.085	.084	.082
14. # DIF INDUS	0.	1.	4.	3.	0.	0.	5.	5.	5.	1.	5.	1.	2.	1.	0.	0.
15. # DIF INSTAL	0.	2.	4.	3.	0.	0.	6.	7.	9.	2.	6.	1.	3.	1.	0.	0.
16. CUM INSTAL	73.	75.	79.	82.	82.	82.	88.	95.	104.	106.	112.	113.	116.	117.	117.	117.

	49. YUANLIN	50. YUNGHO
1. IRON & STEEL		
2. NONFERROUS M		
3. ALL METAL.		
4. MACHINE BLDG		
5. ELEC.MACHINE		
6. AGRI.MACHINE		
7. PREC.INSTRUM		
8. SHIPBUILDING		
9. AUTOBUILDING		
10. LOCOMOTIVE		
11. AIRCRAFT		
12. ALL TRANSP.		
13. CONSTR.MATER		
14. THERMOELECTR		
15. HYDROELECTR.		
16. OTHER ELECTR		
17. NUCLEAR ENER		
18. OILFIELD		
19. PETRO REFINE		
20. CHEMICAL IND		
21. FERTILIZERS		
22. LIGHT INDUS		
23. TEXTILE IND		
24. PAPER MILLS		
25. FOOD INDUS		
26. GLASS MFG		
27. SUGAR REFINE		
28. MAJOR PORT		
29. SECOND PORT		
30. AIRFIELD		
31. MILITARY C C		
32. NAVAL BASE		
33. ARMY BASE		
34. AIRFORCE B		
35. MUNITION DEP		
36. WEAPONS PROD		
37. MISSILES		
38. NUCLEAR WPNS		
1. METALLURGY	.000	.000
2. MACHINERIES	.000	.000
3. TRANSP.EQPMS	.000	.000
4. LIGHT INDUS.	.000	.000
5. ELECTRICITY	.000	.000
6. PETRO-CHEM.	.000	.000
7. IND IDX 1	.000	.000
8. AVG IDX 1	.099	.097
9. PORT&AIRFILD	.000	.000
10. WEAPONS	.000	.000
11. MILITARY INS	.000	.000
12. IND IDX 2	.000	.000
13. AVG IDX 2	.080	.079
14. # DIF INDUS	0.	0.
15. # DIF INSTAL	0.	0.
16. CUM INSTAL	117.	117.

	1. ANDONG	2. BUSAN	3. CHEONAN	4. CHEONGJU	5. CHUNCHEON	6. CHUNGJU	7. CHUNGHU	8. DAEGU	9. DAEJON	10. EUIJEONGBU	11. GANGREUNG	12. GIMCHEON	13. GUNSAN	14. GWANGJU	15. GYEONGJU	16. INCHEON
1. IRON & STEEL		X														X
2. NONFERROUS M																
3. ALL METAL.																
4. MACHINE BLDG																
5. ELEC.MACHINE																
6. AGRI.MACHINE																
7. PREC.INSTRUM																
8. SHIPBUILDING		X														
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER		X						X								X
14. THERMOELECTR		X			X								X	X		X
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER		X														
18. OILFIELD																
19. PETRO REFINE																
20. CHEMICAL IND		X														
21. FERTILIZERS						X										
22. LIGHT INDUS																
23. TEXTILE IND		X						X						X		X
24. PAPER MILLS																
25. FOOD INDUS		X														X
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT		X														X
29. SECOND PORT													X			
30. AIRFIELD								X					X			
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.500	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500
2. MACHINERIES	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
3. TRANSP.EQPMS	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
4. LIGHT INDUS.	.000	.750	.000	.000	.000	.000	.000	.500	.000	.000	.000	.000	.000	.250	.000	.750
5. ELECTRICITY	.000	.500	.000	.000	.250	.000	.000	.000	.000	.000	.000	.000	.250	.250	.000	.250
6. PETRO-CHEM.	.000	.250	.000	.000	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
7. IND IDX 1	.000	.375	.000	.000	.042	.042	.000	.083	.000	.000	.000	.000	.042	.083	.000	.250
8. AVG IDX 1	.000	.188	.125	.094	.083	.076	.065	.068	.060	.054	.049	.045	.045	.048	.044	.057
9. PORT&AIRFILD	.000	.500	.000	.000	.000	.000	.000	.500	.000	.000	.000	.000	.875	.000	.000	.500
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.000	.306	.000	.000	.028	.028	.000	.111	.000	.000	.000	.000	.125	.056	.000	.222
13. AVG IDX 2	.000	.153	.102	.076	.067	.060	.052	.059	.052	.047	.043	.039	.046	.047	.044	.055
14. # DIF INDUS	0.	6.	0.	0.	1.	1.	0.	2.	0.	0.	0.	0.	2.	2.	0.	4.
15. # DIF INSTAL	0.	9.	0.	0.	1.	1.	0.	3.	0.	0.	0.	0.	3.	2.	0.	6.
16. CUM INSTAL	0.	9.	9.	9.	10.	11.	11.	14.	14.	14.	14.	14.	17.	19.	19.	25.

	17. IRI	18. JEJU	19. JEONJU	20. JINHAE	21. JINJU	22. MASAN	23. MOGPO	24. POHANG	25. SAMCHE ONGPO	26. SEONGN AM	27. SEOUL	28. SOGCHO	29. SUNCHE ON	30. SUWEON	31. ULSAN	32. WEONJU
1. IRON & STEEL						X		X			X	X				
2. NONFERROUS M																
3. ALL METAL.																
4. MACHINE BLDG																
5. ELEC.MACHINE																
6. AGRI.MACHINE																
7. PREC.INSTRUM															X	
8. SHIPBUILDING																
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER												X				
14. THERMOELECTR		X				X	X				X	X			X	
15. HYDROELECTR.																
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE															X	
20. CHEMICAL IND											X	X				
21. FERTILIZERS				X											X	
22. LIGHT INDUS																
23. TEXTILE IND						X					X					
24. PAPER MILLS																
25. FOOD INDUS						X					X					
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT																
29. SECOND PORT				X		X	X									
30. AIRFIELD		X		X							X					
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	.000	.000	.000	.000	.000	.500	.000	.500	.000	.000	.500	.500	.000	.000	.000	.000
2. MACHINERIES	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000
3. TRANSP.EQPMS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
4. LIGHT INDUS.	.000	.000	.000	.000	.000	.500	.000	.000	.000	.000	.500	.250	.000	.000	.000	.000
5. ELECTRICITY	.000	.250	.000	.000	.000	.250	.250	.000	.000	.000	.250	.250	.000	.000	.250	.000
6. PETRO-CHEM.	.000	.000	.000	.250	.000	.000	.000	.000	.000	.000	.250	.250	.000	.000	.500	.000
7. IND IDX 1	.000	.042	.000	.042	.000	.208	.042	.083	.000	.000	.250	.208	.000	.000	.167	.000
8. AVG IDX 1	.054	.053	.050	.050	.048	.055	.054	.056	.053	.051	.059	.064	.062	.060	.063	.061
9. PORT&AIRFILD	.000	.500	.000	.875	.000	.375	.375	.000	.000	.000	.500	.000	.000	.000	.000	.000
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.000	.083	.000	.125	.000	.181	.069	.056	.000	.000	.222	.139	.000	.000	.111	.000
13. AVG IDX 2	.051	.053	.050	.054	.052	.057	.058	.058	.056	.053	.060	.062	.060	.058	.060	.058
14. # DIF INDUS	0.	2.	0.	2.	0.	4.	2.	1.	0.	0.	5.	4.	0.	0.	3.	0.
15. # DIF INSTAL	0.	2.	0.	3.	0.	5.	2.	1.	0.	0.	6.	4.	0.	0.	4.	0.
16. CUM INSTAL	25.	27.	27.	30.	30.	35.	37.	38.	38.	38.	44.	48.	48.	48.	52.	52.

	33. YEOSU
1. IRON & STEEL	
2. NONFERROUS M	
3. ALL METAL.	
4. MACHINE BLDG	
5. ELEC.MACHINE	
6. AGRI.MACHINE	
7. PREC.INSTRUM	
8. SHIPBUILDING	
9. AUTOBUILDING	
10. LOCOMOTIVE	
11. AIRCRAFT	
12. ALL TRANSP.	
13. CONSTR.MATER	
14. THERMOELECTR	
15. HYDROELECTR.	
16. OTHER ELECTR	
17. NUCLEAR ENER	
18. OILFIELD	
19. PETRO REFINE	X
20. CHEMICAL IND	X
21. FERTILIZERS	
22. LIGHT INDUS	
23. TEXTILE IND	
24. PAPER MILLS	
25. FOOD INDUS	
26. GLASS MFG	
27. SUGAR REFINE	
28. MAJOR PORT	
29. SECOND PORT	X
30. AIRFIELD	
31. MILITARY C C	
32. NAVAL BASE	
33. ARMY BASE	
34. AIRFORCE B	
35. MUNITION DEP	
36. WEAPONS PROD	
37. MISSILES	
38. NUCLEAR WPNS	
1. METALLURGY	.000
2. MACHINERIES	.000
3. TRANSP.EQPMS	.000
4. LIGHT INDUS.	.000
5. ELECTRICITY	.000
6. PETRO-CHEM.	.500
7. IND IDX 1	.083
8. AVG IDX 1	.062
9. PORT&AIRFILD	.375
10. WEAPONS	.000
11. MILITARY INS	.000
12. IND IDX 2	.097
13. AVG IDX 2	.059
14. # DIF INDUS	2.
15. # DIF INSTAL	3.
16. CUM INSTAL	55.

	1. CHONGJIN	2. CHONGJU	3. HAEJU	4. HAMHUNG	5. HOERYING	6. HUNGNAM	7. HYESAN	8. KAESONG	9. KANGGYE	10. NAJIN	11. NAMPO	12. PYONGYANG	13. SARIWON	14. SINP'O	15. SINVIJU	16. SONGJIN
1. IRON & STEEL	X										X					X
2. NONFERROUS M	X		X	X		X										X
3. ALL METAL.																
4. MACHINE BLDG	X		X	X	X	X	X		X		X	X	X		X	
5. ELEC.MACHINE											X	X				
6. AGRI.MACHINE	X		X	X								X	X			
7. PREC.INSTRUM																
8. SHIPBUILDING	X		X							X	X			X	X	X
9. AUTOBUILDING																
10. LOCOMOTIVE																
11. AIRCRAFT																
12. ALL TRANSP.																
13. CONSTR.MATER	X		X	X	X	X	X	X	X		X		X		X	X
14. THERMOELECTR	X							X			X	X	X			
15. HYDROELECTR.									X							
16. OTHER ELECTR																
17. NUCLEAR ENER																
18. OILFIELD																
19. PETRO REFINE																
20. CHEMICAL IND	X		X	X		X	X				X	X			X	
21. FERTILIZERS						X					X					
22. LIGHT INDUS	X		X			X		X	X				X		X	
23. TEXTILE IND	X			X		X	X	X				X	X		X	
24. PAPER MILLS																
25. FOOD INDUS						X		X				X		X	X	
26. GLASS MFG																
27. SUGAR REFINE																
28. MAJOR PORT	X										X		X			
29. SECOND PORT										X						X
30. AIRFIELD	X						X					X			X	
31. MILITARY C C																
32. NAVAL BASE																
33. ARMY BASE																
34. AIRFORCE B																
35. MUNITION DEP																
36. WEAPONS PROD																
37. MISSILES																
38. NUCLEAR WPNS																
1. METALLURGY	1.000	.000	.500	.500	.000	.500	.000	.000	.000	.000	.500	.000	.000	.000	.000	1.000
2. MACHINERIES	.667	.000	.667	.667	.333	.333	.333	.000	.333	.000	.667	1.000	.667	.000	.333	.000
3. TRANSP.EQPMS	.250	.000	.250	.000	.000	.000	.000	.000	.000	.250	.250	.000	.000	.250	.250	.250
4. LIGHT INDUS.	.750	.000	.500	.500	.250	1.000	.500	1.000	.500	.000	.250	.500	.750	.250	1.000	.250
5. ELECTRICITY	.250	.000	.000	.000	.000	.000	.000	.250	.250	.000	.250	.250	.250	.000	.000	.000
6. PETRO-CHEM.	.250	.000	.250	.250	.000	.500	.250	.000	.000	.000	.500	.250	.000	.000	.250	.000
7. IND IDX 1	.528	.000	.361	.319	.097	.389	.181	.208	.181	.042	.403	.333	.278	.083	.306	.250
8. AVG IDX 1	.528	.264	.296	.302	.261	.282	.268	.260	.252	.231	.246	.253	.255	.243	.247	.247
9. PORT&AIRFILD	1.000	.000	.000	.000	.000	.000	.500	.000	.000	.375	.500	.500	.500	.000	.500	.375
10. WEAPONS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
11. MILITARY INS	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
12. IND IDX 2	.463	.000	.241	.213	.065	.259	.176	.139	.120	.069	.324	.278	.241	.056	.259	.208
13. AVG IDX 2	.463	.231	.235	.229	.196	.207	.202	.194	.186	.175	.188	.196	.199	.189	.194	.194
14. # DIF INDUS	7.	0.	5.	4.	2.	4.	4.	2.	3.	2.	7.	5.	4.	2.	5.	4.
15. # DIF INSTAL	12.	0.	7.	6.	2.	8.	5.	5.	4.	2.	9.	8.	7.	2.	8.	5.
16. CUM INSTAL	12.	12.	19.	25.	27.	35.	40.	45.	49.	51.	60.	68.	75.	77.	85.	90.

	17. SONGNI M	18. SUNCHO N	19. WONSAN
1. IRON & STEEL	X		
2. NONFERROUS M	X		
3. ALL METAL.			
4. MACHINE BLDG	X		X
5. ELEC.MACHINE			
6. AGRI.MACHINE			
7. PREC.INSTRUM			
8. SHIPBUILDING			X
9. AUTOBUILDING			
10. LOCOMOTIVE			
11. AIRCRAFT			
12. ALL TRANSP.			
13. CONSTR.MATER		X	
14. THERMOELECTR			
15. HYDROELECTR.	X		
16. OTHER ELECTR			
17. NUCLEAR ENER			
18. OILFIELD			
19. PETRO REFINE			
20. CHEMICAL IND		X	
21. FERTILIZERS			
22. LIGHT INDUS			X
23. TEXTILE IND	X		
24. PAPER MILLS			
25. FOOD INDUS			X
26. GLASS MFG			
27. SUGAR REFINE			
28. MAJOR PORT			
29. SECOND PORT			X
30. AIRFIELD		X	X
31. MILITARY C C			
32. NAVAL BASE			
33. ARMY BASE			
34. AIRFORCE B			
35. MUNITION DEP			
36. WEAPONS PROD			
37. MISSILES			
38. NUCLEAR WPNS			
1. METALLURGY	1.000	.000	.000
2. MACHINERIES	.333	.000	.333
3. TRANSP.EQPMS	.000	.000	.250
4. LIGHT INDUS.	.250	.250	.500
5. ELECTRICITY	.250	.000	.000
6. PETRO-CHEM.	.000	.250	.000
7. IND IDX 1	.306	.083	.181
8. AVG IDX 1	.251	.242	.238
9. PORT&AIRFILD	.000	.500	.875
10. WEAPONS	.000	.000	.000
11. MILITARY INS	.000	.000	.000
12. IND IDX 2	.204	.111	.218
13. AVG IDX 2	.195	.190	.192
14. # DIF INDUS	4.	3.	4.
15. # DIF INSTAL	5.	3.	6.
16. CUM INSTAL	95.	98.	104.

```
      DIMENSION FMT(13),R(8,5),CITY(2),NWH(8),ITEM(5)
      INTEGER PSI(5)
      DATA R/4.3,8.,13.6,20.5,36.4,60.,189.,447.,1.8,3.3,5.4,8.1,16.2,
     $  23.7,70.4,180.,.76,1.5,2.3,3.4,6.3,10.,28.8,76.,.33,.55,.88,
     2  1.5,2.7,4.2,13.6,31.,.04,.07,.11,.19,.33,.55,1.62,4.1/
      DATA        PSI/5,10,20,30,300/
      DATA UNIT/'MI'/
      CNVERT=1.6093*1.6093
    5 C=0.
      J1=0
      READ(5,102)LIMIT,FMT
      KJ=LIMIT
      READ(5,104,ERR=98,END=99)UNIT,(ITEM(I),I=1,KJ)
      PRINT 101,FMT
   15 PRINT 105
      PRINT 106
   20 READ(5,FMT,END=99)CITY,AREA
      IF(CITY(1).EQ.'REPEAT')GO TO 5
      IF(UNIT.NE.'MI')AREA=AREA/CNVERT
      C=C+1
      DO 50 I=1,KJ
      J1=J1+1
      IF(J1.LE.50)GO TO 35
      PRINT 105
      PRINT 106
      J1=1
   35 II=ITEM(I)
      DO 40 J=1,8
   40 NWH(J)=AREA/R(J,II)+.9
      PRINT 200,C,CITY,AREA,PSI(II),(NWH(J),J=1,8)
   50 CONTINUE
      GO TO 20
   98 STOP READXX
   99 PRINT 202
      STOP REQ
  101 FORMAT(///,1X,80('='),/' PROGRAM <REQUIRE> CALCULATES #WAPHEADS RE
     SQUIRED TO DESTROY TARGETS OF GIVEN PSI'//
     2 ' ITEM SET TO:  1=5PSI; 2=10PSI; 3=20PSI; 4=30PSI; 5=300PSI'//  '
     3 THE INPUT FORMAT FOR THIS DATA SET IS: ',13A6/1X,81('='))
  102 FORMAT(I2,13A6)
  103 FORMAT(/)
  104 FORMAT(A2,10I1)
  105 FORMAT(1H1)
  106 FORMAT(8X, 'CITY', 10X, 'AREA', 4X, 'PSI', 2X, '  20KT  50KT 100KT
     2 200KT 500KT    1MT    5MT   20MT'/
     3 8X,'====', 10X, '====', 4X, '===', 2X, 2('  ===='), 3(' ====='),
     4 2('   ==='), '  ===='/)
  200 FORMAT(1X,F5.0,2X,2A6,F6.1,2X,I5,  3X,8(I5,1X))
  202 FORMAT(1H1,//'    PROGRAM [REQUIRE] NORMALLY TERMINATED  '//)
      END
```

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
1.	ABAKAN	108.0	5	26	14	8	6	3	2	1	1
1.	ABAKAN	108.0	10	60	33	20	14	7	5	2	1
1.	ABAKAN	108.0	20	143	72	47	32	18	11	4	2
1.	ABAKAN	108.0	30	328	197	123	72	40	26	8	4
1.	ABAKAN	108.0	300	2700	1543	982	569	328	197	67	27
2.	ACHINSK	105.0	5	25	14	8	6	3	2	1	1
2.	ACHINSK	105.0	10	59	32	20	13	7	5	2	1
2.	ACHINSK	105.0	20	139	70	46	31	17	11	4	2
2.	ACHINSK	105.0	30	319	191	120	70	39	25	8	4
2.	ACHINSK	105.0	300	2625	1500	955	553	319	191	65	26
3.	AKTYUBINSK	154.0	5	36	20	12	8	5	3	1	1
3.	AKTYUBINSK	154.0	10	86	47	29	19	10	7	3	1
3.	AKTYUBINSK	154.0	20	203	103	67	46	25	16	6	2
3.	AKTYUBINSK	154.0	30	467	280	175	103	57	37	12	5
3.	AKTYUBINSK	154.0	300	3850	2200	1400	811	467	280	95	38
4.	ALMA ATA	63.3	5	15	8	5	3	2	1	1	1
4.	ALMA ATA	63.3	10	36	20	12	8	4	3	1	1
4.	ALMA ATA	63.3	20	84	43	28	19	10	7	3	1
4.	ALMA ATA	63.3	30	192	115	72	43	24	15	5	2
4.	ALMA ATA	63.3	300	1583	905	576	334	192	115	39	16
5.	ANDIZHAN	194.0	5	46	25	15	10	6	4	1	1
5.	ANDIZHAN	194.0	10	108	59	36	24	12	9	3	1
5.	ANDIZHAN	194.0	20	256	130	85	57	31	20	7	3
5.	ANDIZHAN	194.0	30	588	353	221	130	72	47	15	7
5.	ANDIZHAN	194.0	300	4850	2772	1764	1021	588	353	120	48
6.	ANGARSK	210.0	5	49	27	16	11	6	4	2	1
6.	ANGARSK	210.0	10	117	64	39	26	13	9	3	2
6.	ANGARSK	210.0	20	277	140	92	62	34	21	8	3
6.	ANGARSK	210.0	30	637	382	239	140	78	50	16	7
6.	ANGARSK	210.0	300	5250	3000	1909	1106	637	382	130	52
7.	ANZHERO-SUDZ	99.0	5	23	13	8	5	3	2	1	1
7.	ANZHERO-SUDZ	99.0	10	55	30	19	13	7	5	2	1
7.	ANZHERO-SUDZ	99.0	20	131	66	43	30	16	10	4	2
7.	ANZHERO-SUDZ	99.0	30	300	180	113	66	37	24	8	4
7.	ANZHERO-SUDZ	99.0	300	2475	1415	900	521	300	180	62	25
8.	ARKANGELSK	346.0	5	81	44	26	17	10	6	2	1
8.	ARKANGELSK	346.0	10	193	105	64	43	22	15	5	2
8.	ARKANGELSK	346.0	20	456	231	151	102	55	35	12	5
8.	ARKANGELSK	346.0	30	1049	629	394	231	129	83	26	12
8.	ARKANGELSK	346.0	300	8650	4943	3146	1821	1049	629	214	85
9.	ARMAVIR	160.0	5	38	20	12	8	5	3	1	1
9.	ARMAVIR	160.0	10	89	49	30	20	10	7	3	1
9.	ARMAVIR	160.0	20	211	107	70	47	26	16	6	3
9.	ARMAVIR	160.0	30	485	291	182	107	60	38	12	6
9.	ARMAVIR	160.0	300	4000	2286	1455	843	485	291	99	39
10.	ASHKHABAD	278.0	5	65	35	21	14	8	5	2	1
10.	ASHKHABAD	278.0	10	155	85	52	35	18	12	4	2
10.	ASHKHABAD	278.0	20	366	186	121	82	45	28	10	4
10.	ASHKHABAD	278.0	30	843	506	316	186	103	67	21	9
10.	ASHKHABAD	278.0	300	6950	3972	2528	1464	843	506	172	68

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
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11.	ASTRAKHAN	424.0	5	99	53	32	21	12	7	3	1
11.	ASTRAKHAN	424.0	10	236	129	79	53	27	18	6	3
11.	ASTRAKHAN	424.0	20	558	283	185	125	68	43	15	6
11.	ASTRAKHAN	424.0	30	1285	771	482	283	157	101	32	14
11.	ASTRAKHAN	424.0	300	10600	6058	3855	2232	1285	771	262	104
12.	BABUSHKIN	12.9	5	3	2	1	1	1	1	0	0
12.	BABUSHKIN	12.9	10	8	4	3	2	1	1	1	0
12.	BABUSHKIN	12.9	20	17	9	6	4	2	2	1	1
12.	BABUSHKIN	12.9	30	39	24	15	9	5	3	1	1
12.	BABUSHKIN	12.9	300	323	185	118	68	39	24	8	4
13.	BAKU	76.9	5	18	10	6	4	3	2	1	1
13.	BAKU	76.9	10	43	24	15	10	5	4	1	1
13.	BAKU	76.9	20	102	52	34	23	13	8	3	1
13.	BAKU	76.9	30	233	140	88	52	29	19	6	3
13.	BAKU	76.9	300	1923	1099	699	405	233	140	48	19
14.	BALAKOVO	118.0	5	28	15	9	6	4	2	1	1
14.	BALAKOVO	118.0	10	66	36	22	15	8	5	2	1
14.	BALAKOVO	118.0	20	156	79	52	35	19	12	4	2
14.	BALAKOVO	118.0	30	358	215	134	79	44	28	9	4
14.	BALAKOVO	118.0	300	2950	1686	1073	621	358	215	73	29
15.	BARANOVICHI	110.0	5	26	14	8	6	3	2	1	1
15.	BARANOVICHI	110.0	10	62	34	21	14	7	5	2	1
15.	BARANOVICHI	110.0	20	145	74	48	33	18	11	4	2
15.	BARANOVICHI	110.0	30	334	200	125	74	41	27	8	4
15.	BARANOVICHI	110.0	300	2750	1572	1000	579	334	200	68	27
16.	BARNAUL	469.0	5	109	59	35	23	13	8	3	1
16.	BARNAUL	469.0	10	261	143	87	58	29	20	7	3
16.	BARNAUL	469.0	20	618	313	204	138	75	47	17	7
16.	BARNAUL	469.0	30	1422	853	533	313	174	112	35	16
16.	BARNAUL	469.0	300	11725	6700	4264	2469	1422	853	290	115
17.	BATUMI	115.0	5	27	15	9	6	4	2	1	1
17.	BATUMI	115.0	10	64	35	22	15	7	5	2	1
17.	BATUMI	115.0	20	152	77	50	34	19	12	4	2
17.	BATUMI	115.0	30	349	209	131	77	43	28	9	4
17.	BATUMI	115.0	300	2875	1643	1046	606	349	209	71	28
18.	BELAYA-TSERK	123.0	5	29	16	9	6	4	2	1	1
18.	BELAYA-TSERK	123.0	10	69	38	23	16	8	6	2	1
18.	BELAYA-TSERK	123.0	20	162	82	54	37	20	13	5	2
18.	BELAYA-TSERK	123.0	30	373	224	140	82	46	30	9	4
18.	BELAYA-TSERK	123.0	300	3075	1758	1119	648	373	224	76	30
19.	BELGOROD	14.8	5	4	2	1	1	1	1	0	0
19.	BELGOROD	14.8	10	9	5	3	2	1	1	1	0
19.	BELGOROD	14.8	20	20	10	7	5	3	2	1	1
19.	BELGOROD	14.8	30	45	27	17	10	6	4	1	1
19.	BELGOROD	14.8	300	370	212	135	78	45	27	10	4
20.	BELOVO	133.0	5	31	17	10	7	4	3	1	1
20.	BELOVO	133.0	10	74	41	25	17	9	6	2	1
20.	BELOVO	133.0	20	175	89	58	40	22	14	5	2
20.	BELOVO	133.0	30	403	242	152	89	50	32	10	5
20.	BELOVO	133.0	300	3325	1900	1209	700	403	242	82	33

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
21.	BEL'TSY	110.0	5	26	14	8	6	3	2	1	1
21.	BEL'TSY	110.0	10	62	34	21	14	7	5	2	1
21.	BEL'TSY	110.0	20	145	74	48	33	18	11	4	2
21.	BEL'TSY	110.0	30	334	200	125	74	41	27	8	4
21.	BEL'TSY	110.0	300	2750	1572	1000	579	334	200	68	27
22.	BERDYANSK	109.0	5	26	14	8	6	3	2	1	1
22.	BERDYANSK	109.0	10	61	33	21	14	7	5	2	1
22.	BERDYANSK	109.0	20	144	73	48	32	18	11	4	2
22.	BERDYANSK	109.0	30	331	199	124	73	41	26	8	4
22.	BERDYANSK	109.0	300	2725	1558	991	574	331	199	68	27
23.	BEREZNIKI	154.0	5	36	20	12	8	5	3	1	1
23.	BEREZNIKI	154.0	10	86	47	29	19	10	7	3	1
23.	BEREZNIKI	154.0	20	203	103	67	46	25	16	6	2
23.	BEREZNIKI	154.0	30	467	280	175	103	57	37	12	5
23.	BEREZNIKI	154.0	300	3850	2200	1400	811	467	280	95	38
24.	BIYSK	208.0	5	49	26	16	11	6	4	2	1
24.	BIYSK	208.0	10	116	63	39	26	13	9	3	2
24.	BIYSK	208.0	20	274	139	91	62	33	21	8	3
24.	BIYSK	208.0	30	631	379	237	139	77	50	16	7
24.	BIYSK	208.0	300	5200	2972	1891	1095	631	379	129	51
25.	BLAGOVESHCHE	139.0	5	33	18	11	7	4	3	1	1
25.	BLAGOVESHCHE	139.0	10	78	43	26	18	9	6	2	1
25.	BLAGOVESHCHE	139.0	20	183	93	61	41	22	14	5	2
25.	BLAGOVESHCHE	139.0	30	422	253	158	93	52	33	11	5
25.	BLAGOVESHCHE	139.0	300	3475	1986	1264	732	422	253	86	34
26.	BOBRUYSK	138.0	5	32	18	11	7	4	3	1	1
26.	BOBRUYSK	138.0	10	77	42	26	17	9	6	2	1
26.	BOBRUYSK	138.0	20	182	92	60	41	22	14	5	2
26.	BOBRUYSK	138.0	30	419	251	157	92	52	33	11	5
26.	BOBRUYSK	138.0	300	3450	1972	1255	727	419	251	86	34
27.	BRATSK	140.0	5	33	18	11	7	4	3	1	1
27.	BRATSK	140.0	10	78	43	26	18	9	6	2	1
27.	BRATSK	140.0	20	185	94	61	42	23	14	5	2
27.	BRATSK	140.0	30	425	255	159	94	52	34	11	5
27.	BRATSK	140.0	300	3500	2000	1273	737	425	255	87	35
28.	BREST	144.0	5	34	18	11	7	4	3	1	1
28.	BREST	144.0	10	80	44	27	18	9	6	2	1
28.	BREST	144.0	20	190	96	63	43	23	15	5	2
28.	BREST	144.0	30	437	262	164	96	54	35	11	5
28.	BREST	144.0	300	3600	2058	1309	758	437	262	89	36
29.	BRYANSK	332.0	5	78	42	25	17	10	6	2	1
29.	BRYANSK	332.0	10	185	101	62	41	21	14	5	2
29.	BRYANSK	332.0	20	437	222	145	98	53	34	12	5
29.	BRYANSK	332.0	30	1006	604	378	222	123	79	25	11
29.	BRYANSK	332.0	300	8300	4743	3019	1748	1006	604	205	81
30.	BUKHARA	117.0	5	28	15	9	6	4	2	1	1
30.	BUKHARA	117.0	10	65	36	22	15	8	5	2	1
30.	BUKHARA	117.0	20	154	78	51	35	19	12	4	2
30.	BUKHARA	117.0	30	355	213	133	78	44	28	9	4
30.	BUKHARA	117.0	300	2925	1672	1064	616	355	213	73	29

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
31.	CHEBOKSARY	205.0	5	48	26	15	10	6	4	1	1
31.	CHEBOKSARY	205.0	10	114	63	38	26	13	9	3	2
31.	CHEBOKSARY	205.0	20	270	137	90	61	33	21	8	3
31.	CHEBOKSARY	205.0	30	622	373	233	137	76	49	15	7
31.	CHEBOKSARY	205.0	300	5125	2929	1864	1079	622	373	127	50
32.	CHELYABINSK	964.0	5	225	121	71	47	27	16	6	3
32.	CHELYABINSK	964.0	10	536	293	179	119	60	41	14	6
32.	CHELYABINSK	964.0	20	1269	643	420	284	153	97	34	13
32.	CHELYABINSK	964.0	30	2922	1753	1096	643	357	230	71	31
32.	CHELYABINSK	964.0	300	24100	13772	8764	5074	2922	1753	595	236
33.	CHEREPOVETS	125.0	5	29	16	10	6	4	2	1	1
33.	CHEREPOVETS	125.0	10	70	38	24	16	8	6	2	1
33.	CHEREPOVETS	125.0	20	165	84	55	37	20	13	5	2
33.	CHEREPOVETS	125.0	30	379	228	142	84	47	30	10	4
33.	CHEREPOVETS	125.0	300	3125	1786	1137	658	379	228	78	31
34.	CHERKASSY	147.0	5	35	19	11	8	4	3	1	1
34.	CHERKASSY	147.0	10	82	45	28	19	9	7	2	1
34.	CHERKASSY	147.0	20	194	98	64	44	24	15	6	2
34.	CHERKASSY	147.0	30	446	268	167	98	55	35	11	5
34.	CHERKASSY	147.0	300	3675	2100	1337	774	446	268	91	36
35.	CHERNIGOV	160.0	5	38	20	12	8	5	3	1	1
35.	CHERNIGOV	160.0	10	89	49	30	20	10	7	3	1
35.	CHERNIGOV	160.0	20	211	107	70	47	26	16	6	3
35.	CHERNIGOV	160.0	30	485	291	182	107	60	38	12	6
35.	CHERNIGOV	160.0	300	4000	2286	1455	843	485	291	99	39
36.	CHERNOVTSY	205.0	5	48	26	15	10	6	4	1	1
36.	CHERNOVTSY	205.0	10	114	63	38	26	13	9	3	2
36.	CHERNOVTSY	205.0	20	270	137	90	61	33	21	8	3
36.	CHERNOVTSY	205.0	30	622	373	233	137	76	49	15	7
36.	CHERNOVTSY	205.0	300	5125	2929	1864	1079	622	373	127	50
37.	CHIMKENT	252.0	5	59	32	19	13	7	5	2	1
37.	CHIMKENT	252.0	10	140	77	47	32	16	11	4	2
37.	CHIMKENT	252.0	20	332	168	110	75	40	26	9	4
37.	CHIMKENT	252.0	30	764	459	287	168	94	60	19	9
37.	CHIMKENT	252.0	300	6300	3600	2291	1327	764	459	156	62
38.	CHIRCHIK	115.0	5	27	15	9	6	4	2	1	1
38.	CHIRCHIK	115.0	10	64	35	22	15	7	5	2	1
38.	CHIRCHIK	115.0	20	152	77	50	34	19	12	4	2
38.	CHIRCHIK	115.0	30	349	209	131	77	43	28	9	4
38.	CHIRCHIK	115.0	300	2875	1643	1046	606	349	209	71	28
39.	CHITA	234.0	5	55	30	18	12	7	4	2	1
39.	CHITA	234.0	10	130	71	44	29	15	10	4	2
39.	CHITA	234.0	20	308	156	102	69	38	24	9	3
39.	CHITA	234.0	30	709	426	266	156	87	56	18	8
39.	CHITA	234.0	300	5850	3343	2128	1232	709	426	145	57
40.	DAUGAVPILS	105.0	5	25	14	8	6	3	2	1	1
40.	DAUGAVPILS	105.0	10	59	32	20	13	7	5	2	1
40.	DAUGAVPILS	105.0	20	139	70	46	31	17	11	4	2
40.	DAUGAVPILS	105.0	30	319	191	120	70	39	25	8	4
40.	DAUGAVPILS	105.0	300	2625	1500	955	553	319	191	65	26

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
41.	DNEPRODZERZH	258.0	5	60	33	19	13	7	5	2	1
41.	DNEPRODZERZH	258.0	10	144	79	48	32	16	11	4	2
41.	DNEPRODZERZH	258.0	20	340	172	113	76	41	26	9	4
41.	DNEPRODZERZH	258.0	30	782	469	294	172	96	62	19	9
41.	DNEPRODZERZH	258.0	300	6450	3686	2346	1358	782	469	160	63
42.	DNEPROPETROV	940.0	5	219	118	70	46	26	16	5	3
42.	DNEPROPETROV	940.0	10	523	285	174	116	58	40	14	6
42.	DNEPROPETROV	940.0	20	1237	627	409	277	150	94	33	13
42.	DNEPROPETROV	940.0	30	2849	1709	1069	627	349	224	70	31
42.	DNEPROPETROV	940.0	300	23500	13429	8546	4948	2849	1709	581	230
43.	DONETSK	968.0	5	226	121	72	48	27	17	6	3
43.	DONETSK	968.0	10	538	294	180	120	60	41	14	6
43.	DONETSK	968.0	20	1274	646	421	285	154	97	34	13
43.	DONETSK	968.0	30	2934	1760	1100	646	359	231	72	32
43.	DONETSK	968.0	300	24200	13829	8800	5095	2934	1760	598	236
44.	DUSHAUBE	417.0	5	97	53	31	21	12	7	3	1
44.	DUSHAUBE	417.0	10	232	127	78	52	26	18	6	3
44.	DUSHAUBE	417.0	20	549	278	182	123	67	42	15	6
44.	DUSHAUBE	417.0	30	1264	759	474	278	155	100	31	14
44.	DUSHAUBE	417.0	300	10425	5958	3791	2195	1264	759	258	102
45.	DZAMBUL	182.0	5	43	23	14	9	5	3	1	1
45.	DZAMBUL	182.0	10	102	56	34	23	12	8	3	1
45.	DZAMBUL	182.0	20	240	122	80	54	29	19	7	3
45.	DZAMBUL	182.0	30	552	331	207	122	68	44	14	6
45.	DZAMBUL	182.0	300	4550	2600	1655	958	552	331	113	45
46.	DZERZHINSK	232.0	5	54	29	17	12	7	4	2	1
46.	DZERZHINSK	232.0	10	129	71	43	29	15	10	4	2
46.	DZERZHINSK	232.0	20	306	155	101	69	37	24	8	3
46.	DZERZHINSK	232.0	30	703	422	264	155	86	56	17	8
46.	DZERZHINSK	232.0	300	5800	3315	2109	1221	703	422	144	57
47.	ELEKTROSTAL'	13.5	5	4	2	1	1	1	1	0	0
47.	ELEKTROSTAL'	13.5	10	8	4	3	2	1	1	1	0
47.	ELEKTROSTAL'	13.5	20	18	9	6	4	3	2	1	1
47.	ELEKTROSTAL'	13.5	30	41	25	16	9	5	4	1	1
47.	ELEKTROSTAL'	13.5	300	338	193	123	71	41	25	9	4
48.	ENGELS	830.0	5	193	104	61	41	23	14	5	2
48.	ENGELS	830.0	10	462	252	154	103	52	35	12	5
48.	ENGELS	830.0	20	1093	554	361	245	132	83	29	11
48.	ENGELS	830.0	30	2516	1509	944	554	308	198	61	27
48.	ENGELS	830.0	300	20750	11858	7546	4369	2516	1509	513	203
49.	FEODOSIYA	68.0	5	16	9	5	4	2	2	1	1
49.	FEODOSIYA	68.0	10	38	21	13	9	5	3	1	1
49.	FEODOSIYA	68.0	20	90	46	30	20	11	7	3	1
49.	FEODOSIYA	68.0	30	206	124	78	46	26	17	5	3
49.	FEODOSIYA	68.0	300	1700	972	619	358	206	124	42	17
50.	FERGANA	120.0	5	28	15	9	6	4	2	1	1
50.	FERGANA	120.0	10	67	37	23	15	8	5	2	1
50.	FERGANA	120.0	20	158	80	53	36	19	12	5	2
50.	FERGANA	120.0	30	364	219	137	80	45	29	9	4
50.	FERGANA	120.0	300	3000	1715	1091	632	364	219	74	30

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
51.	FRUNZE	475.0	5	111	60	35	24	13	8	3	1
51.	FRUNZE	475.0	10	264	144	88	59	30	20	7	3
51.	FRUNZE	475.0	20	625	317	207	140	76	48	17	7
51.	FRUNZE	475.0	30	1440	864	540	317	176	113	35	16
51.	FRUNZE	475.0	300	11875	6786	4319	2500	1440	864	294	116
52.	GOMEL'	273.0	5	64	35	20	14	8	5	2	1
52.	GOMEL'	273.0	10	152	83	51	34	17	12	4	2
52.	GOMEL'	273.0	20	360	182	119	81	44	28	10	4
52.	GOMEL'	273.0	30	828	497	311	182	102	65	20	9
52.	GOMEL'	273.0	300	6825	3900	2482	1437	828	497	169	67
53.	GORKY	127.9	5	30	16	10	7	4	3	1	1
53.	GORKY	127.9	10	71	39	24	16	8	6	2	1
53.	GORKY	127.9	20	169	86	56	38	21	13	5	2
53.	GORKY	127.9	30	388	233	146	86	48	31	10	5
53.	GORKY	127.9	300	3198	1828	1163	674	388	233	79	32
54.	GORLOVKA	395.0	5	92	50	29	20	11	7	2	1
54.	GORLOVKA	395.0	10	220	120	74	49	25	17	6	3
54.	GORLOVKA	395.0	20	520	264	172	117	63	40	14	6
54.	GORLOVKA	395.0	30	1197	719	449	264	147	94	29	13
54.	GORLOVKA	395.0	300	9875	5643	3591	2079	1197	719	244	97
55.	GRODNO	127.0	5	30	16	10	7	4	3	1	1
55.	GRODNO	127.0	10	71	39	24	16	8	6	2	1
55.	GRODNO	127.0	20	168	85	56	38	21	13	5	2
55.	GRODNO	127.0	30	385	231	145	85	47	31	10	4
55.	GRODNO	127.0	300	3175	1815	1155	669	385	231	79	31
56.	GROZNYY	381.0	5	89	48	28	19	11	7	2	1
56.	GROZNYY	381.0	10	212	116	71	47	24	16	6	3
56.	GROZNYY	381.0	20	502	254	166	112	61	38	14	5
56.	GROZNYY	381.0	30	1155	693	433	254	142	91	28	13
56.	GROZNYY	381.0	300	9525	5443	3464	2006	1155	693	236	93
57.	GURYEV	116.0	5	27	15	9	6	4	2	1	1
57.	GURYEV	116.0	10	65	36	22	15	8	5	2	1
57.	GURYEV	116.0	20	153	78	51	35	19	12	4	2
57.	GURYEV	116.0	30	352	211	132	78	43	28	9	4
57.	GURYEV	116.0	300	2900	1658	1055	611	352	211	72	29
58.	IRKUTSK	483.0	5	113	61	36	24	14	8	3	1
58.	IRKUTSK	483.0	10	269	147	90	60	30	21	7	3
58.	IRKUTSK	483.0	20	636	322	210	142	77	49	17	7
58.	IRKUTSK	483.0	30	1464	879	549	322	179	115	36	16
58.	IRKUTSK	483.0	300	12075	6900	4391	2543	1464	879	299	118
59.	IVANOVO	469.0	5	109	59	35	23	13	8	3	1
59.	IVANOVO	469.0	10	261	143	87	58	29	20	7	3
59.	IVANOVO	469.0	20	618	313	204	138	75	47	17	7
59.	IVANOVO	469.0	30	1422	853	533	313	174	112	35	16
59.	IVANOVO	469.0	300	11725	6700	4264	2469	1422	853	290	115
60.	IVANO-FRANKO	123.0	5	29	16	9	6	4	2	1	1
60.	IVANO-FRANKO	123.0	10	69	38	23	16	8	6	2	1
60.	IVANO-FRANKO	123.0	20	162	82	54	37	20	13	5	2
60.	IVANO-FRANKO	123.0	30	373	224	140	82	46	30	9	4
60.	IVANO-FRANKO	123.0	300	3075	1758	1119	648	373	224	76	30

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
61.	IZHEVSK	433.0	5	101	55	32	22	12	8	3	1
61.	IZHEVSK	433.0	10	241	132	81	54	27	19	7	3
61.	IZHEVSK	433.0	20	570	289	189	128	69	44	15	6
61.	IZHEVSK	433.0	30	1313	788	492	289	161	103	32	14
61.	IZHEVSK	433.0	300	10825	6186	3937	2279	1313	788	268	106
62.	KADIYEVKA	160.0	5	38	20	12	8	5	3	1	1
62.	KADIYEVKA	160.0	10	89	49	30	20	10	7	3	1
62.	KADIYEVKA	160.0	20	211	107	70	47	26	16	6	3
62.	KADIYEVKA	160.0	30	485	291	182	107	60	38	12	6
62.	KADIYEVKA	160.0	300	4000	2286	1455	843	485	291	99	39
63.	KALININ	366.0	5	86	46	27	18	10	6	2	1
63.	KALININ	366.0	10	204	111	68	46	23	16	6	2
63.	KALININ	366.0	20	482	244	160	108	58	37	13	5
63.	KALININ	366.0	30	1109	666	416	244	136	88	27	12
63.	KALININ	366.0	300	9150	5229	3328	1927	1109	666	226	90
64.	KALININGRAD	311.0	5	73	39	23	16	9	6	2	1
64.	KALININGRAD	311.0	10	173	95	58	39	20	14	5	2
64.	KALININGRAD	311.0	20	410	208	136	92	50	31	11	4
64.	KALININGRAD	311.0	30	943	566	354	208	116	74	23	10
64.	KALININGRAD	311.0	300	7775	4443	2828	1637	943	566	192	76
65.	KALUGA	206.0	5	48	26	16	10	6	4	1	1
65.	KALUGA	206.0	10	115	63	39	26	13	9	3	2
65.	KALUGA	206.0	20	271	138	90	61	33	21	8	3
65.	KALUGA	206.0	30	625	375	234	138	77	49	16	7
65.	KALUGA	206.0	300	5150	2943	1873	1085	625	375	128	51
66.	KAMENSK-URAL	186.0	5	44	24	14	9	6	3	1	1
66.	KAMENSK-URAL	186.0	10	104	57	35	23	12	8	3	1
66.	KAMENSK-URAL	186.0	20	245	124	81	55	30	19	7	3
66.	KAMENSK-URAL	186.0	30	564	339	212	124	69	45	14	6
66.	KAMENSK-URAL	186.0	300	4650	2658	1691	979	564	339	115	46
67.	KARAGANDA	574.0	5	134	72	43	28	16	10	3	2
67.	KARAGANDA	574.0	10	319	174	107	71	36	25	9	4
67.	KARAGANDA	574.0	20	756	383	250	169	92	58	20	8
67.	KARAGANDA	574.0	30	1740	1044	653	383	213	137	43	19
67.	KARAGANDA	574.0	300	14350	8200	5219	3021	1740	1044	355	140
68.	KAUNAS	327.0	5	76	41	24	16	9	6	2	1
68.	KAUNAS	327.0	10	182	99	61	41	21	14	5	2
68.	KAUNAS	327.0	20	431	218	143	97	52	33	12	5
68.	KAUNAS	327.0	30	991	595	372	218	122	78	24	11
68.	KAUNAS	327.0	300	8175	4672	2973	1721	991	595	202	80
69.	KAZAN	947.0	5	221	119	70	47	26	16	5	3
69.	KAZAN	947.0	10	527	287	176	117	59	40	14	6
69.	KAZAN	947.0	20	1246	632	412	279	151	95	33	13
69.	KAZAN	947.0	30	2870	1722	1077	632	351	226	70	31
69.	KAZAN	947.0	300	23675	13529	8609	4985	2870	1722	585	231
70.	KEMEROVO	419.0	5	98	53	31	21	12	7	3	1
70.	KEMEROVO	419.0	10	233	127	78	52	26	18	6	3
70.	KEMEROVO	419.0	20	552	280	183	124	67	42	15	6
70.	KEMEROVO	419.0	30	1270	762	477	280	156	100	31	14
70.	KEMEROVO	419.0	300	10475	5986	3809	2206	1270	762	259	103

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
71.	KERCH	136.0	5	32	17	10	7	4	3	1	1
71.	KERCH	136.0	10	76	42	26	17	9	6	2	1
71.	KERCH	136.0	20	179	91	60	40	22	14	5	2
71.	KERCH	136.0	30	413	248	155	91	51	33	10	5
71.	KERCH	136.0	300	3400	1943	1237	716	413	248	84	34
72.	KHABAROVSK	502.0	5	117	63	37	25	14	9	3	2
72.	KHABAROVSK	502.0	10	279	153	93	62	31	22	8	3
72.	KHABAROVSK	502.0	20	661	335	219	148	80	51	18	7
72.	KHABAROVSK	502.0	30	1522	913	571	335	186	120	37	17
72.	KHABAROVSK	502.0	300	12550	7172	4564	2643	1522	913	310	123
73.	KHARKOV	104.9	5	25	14	8	6	3	2	1	1
73.	KHARKOV	104.9	10	59	32	20	13	7	5	2	1
73.	KHARKOV	104.9	20	138	70	46	31	17	11	4	2
73.	KHARKOV	104.9	30	318	191	120	70	39	25	8	4
73.	KHARKOV	104.9	300	2623	1499	954	553	318	191	65	26
74.	KHARTSYZSK	53.0	5	13	7	4	3	2	1	1	1
74.	KHARTSYZSK	53.0	10	30	16	10	7	4	3	1	1
74.	KHARTSYZSK	53.0	20	70	36	23	16	9	6	2	1
74.	KHARTSYZSK	53.0	30	161	97	61	36	20	13	4	2
74.	KHARTSYZSK	53.0	300	1325	758	482	279	161	97	33	13
75.	KHERSON	270.0	5	63	34	20	14	8	5	2	1
75.	KHERSON	270.0	10	150	82	50	34	17	12	4	2
75.	KHERSON	270.0	20	356	180	118	80	43	27	10	4
75.	KHERSON	270.0	30	819	491	307	180	100	65	20	9
75.	KHERSON	270.0	300	6750	3858	2455	1421	819	491	167	66
76.	KIEV	297.0	5	69	38	22	15	9	5	2	1
76.	KIEV	297.0	10	165	90	55	37	19	13	5	2
76.	KIEV	297.0	20	391	198	130	88	48	30	11	4
76.	KIEV	297.0	30	900	540	338	198	110	71	22	10
76.	KIEV	297.0	300	7425	4243	2700	1564	900	540	184	73
77.	KIROV	355.0	5	83	45	27	18	10	6	2	1
77.	KIROV	355.0	10	198	108	66	44	22	15	5	2
77.	KIROV	355.0	20	468	237	155	105	57	36	13	5
77.	KIROV	355.0	30	1076	646	404	237	132	85	27	12
77.	KIROV	355.0	300	8875	5072	3228	1869	1076	646	220	87
78.	KIROVABAD	201.0	5	47	26	15	10	6	4	1	1
78.	KIROVABAD	201.0	10	112	61	38	25	13	9	3	2
78.	KIROVABAD	201.0	20	265	134	88	60	32	20	7	3
78.	KIROVABAD	201.0	30	609	366	229	134	75	48	15	7
78.	KIROVABAD	201.0	300	5025	2872	1828	1058	609	366	124	49
79.	KIROVAKAN	.0	5	0	0	0	0	0	0	0	0
79.	KIROVAKAN	.0	10	0	0	0	0	0	0	0	0
79.	KIROVAKAN	.0	20	0	0	0	0	0	0	0	0
79.	KIROVAKAN	.0	30	0	0	0	0	0	0	0	0
79.	KIROVAKAN	.0	300	0	0	0	0	0	0	0	0
80.	KIROVOGRAD	193.0	5	45	25	15	10	6	4	1	1
80.	KIROVOGRAD	193.0	10	108	59	36	24	12	9	3	1
80.	KIROVOGRAD	193.0	20	254	129	84	57	31	20	7	3
80.	KIROVOGRAD	193.0	30	585	351	220	129	72	46	15	7
80.	KIROVOGRAD	193.0	300	4825	2758	1755	1016	585	351	120	47

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
81.	KISELEVSK	159.0	5	37	20	12	8	5	3	1	1
81.	KISELEVSK	159.0	10	89	49	30	20	10	7	3	1
81.	KISELEVSK	159.0	20	210	106	70	47	26	16	6	2
81.	KISELEVSK	159.0	30	482	289	181	106	59	38	12	6
81.	KISELEVSK	159.0	300	3975	2272	1446	837	482	289	99	39
82.	KISHINEV	402.0	5	94	51	30	20	11	7	3	1
82.	KISHINEV	402.0	10	224	122	75	50	25	17	6	3
82.	KISHINEV	402.0	20	529	268	175	119	64	41	14	6
82.	KISHINEV	402.0	30	1219	731	457	268	149	96	30	13
82.	KISHINEV	402.0	300	10050	5743	3655	2116	1219	731	249	98
83.	KLAJPEDA	150.0	5	35	19	11	8	5	3	1	1
83.	KLAJPEDA	150.0	10	84	46	28	19	10	7	3	1
83.	KLAJPEDA	150.0	20	198	100	66	45	24	15	6	2
83.	KLAJPEDA	150.0	30	455	273	171	100	56	36	11	5
83.	KLAJPEDA	150.0	300	3750	2143	1364	790	455	273	93	37
84.	KOKAND	151.0	5	36	19	12	8	5	3	1	1
84.	KOKAND	151.0	10	84	46	28	19	10	7	3	1
84.	KOKAND	151.0	20	199	101	66	45	24	15	6	2
84.	KOKAND	151.0	30	458	275	172	101	56	36	12	5
84.	KOKAND	151.0	300	3775	2158	1373	795	458	275	94	37
85.	KOLOMNA	15.1	5	4	2	2	1	1	1	0	0
85.	KOLOMNA	15.1	10	9	5	3	2	1	1	1	0
85.	KOLOMNA	15.1	20	20	10	7	5	3	2	1	1
85.	KOLOMNA	15.1	30	46	28	18	10	6	4	2	1
85.	KOLOMNA	15.1	300	378	216	138	80	46	28	10	4
86.	KOMMUNARSK	143.0	5	34	18	11	7	4	3	1	1
86.	KOMMUNARSK	143.0	10	80	44	27	18	9	6	2	1
86.	KOMMUNARSK	143.0	20	189	96	63	42	23	15	5	2
86.	KOMMUNARSK	143.0	30	434	260	163	96	53	34	11	5
86.	KOMMUNARSK	143.0	300	3575	2043	1300	753	434	260	89	35
87.	KOMSOMOLSK-N	240.0	5	56	30	18	12	7	4	2	1
87.	KOMSOMOLSK-N	240.0	10	134	73	45	30	15	11	4	2
87.	KOMSOMOLSK-N	240.0	20	316	160	105	71	38	24	9	4
87.	KOMSOMOLSK-N	240.0	30	728	437	273	160	89	58	18	8
87.	KOMSOMOLSK-N	240.0	300	6000	3429	2182	1264	728	437	149	59
88.	KONSTANTINOV	119.0	5	28	15	9	6	4	2	1	1
88.	KONSTANTINOV	119.0	10	67	36	22	15	8	5	2	1
88.	KONSTANTINOV	119.0	20	157	80	52	35	19	12	5	2
88.	KONSTANTINOV	119.0	30	361	217	136	80	44	29	9	4
88.	KONSTANTINOV	119.0	300	2975	1700	1082	627	361	217	74	29
89.	KOPEYSK	191.0	5	45	24	14	10	6	4	1	1
89.	KOPEYSK	191.0	10	107	58	36	24	12	8	3	1
89.	KOPEYSK	191.0	20	252	128	83	57	31	19	7	3
89.	KOPEYSK	191.0	30	579	348	217	128	71	46	14	7
89.	KOPEYSK	191.0	300	4775	2729	1737	1006	579	348	118	47
90.	KOSTROMA	240.0	5	56	30	18	12	7	4	2	1
90.	KOSTROMA	240.0	10	134	73	45	30	15	11	4	2
90.	KOSTROMA	240.0	20	316	160	105	71	38	24	9	4
90.	KOSTROMA	240.0	30	728	437	273	160	89	58	18	8
90.	KOSTROMA	240.0	300	6000	3429	2182	1264	728	437	149	59

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
91.	KOVROV	13.3	5	3	2	1	1	1	1	0	0
91.	KOVROV	13.3	10	8	4	3	2	1	1	1	0
91.	KOVROV	13.3	20	18	9	6	4	3	2	1	1
91.	KOVROV	13.3	30	41	25	16	9	5	4	1	1
91.	KOVROV	13.3	300	333	190	121	70	41	25	9	4
92.	KRAMATORSK	162.0	5	38	21	12	8	5	3	1	1
92.	KRAMATORSK	162.0	10	90	49	30	20	10	7	3	1
92.	KRAMATORSK	162.0	20	214	108	71	48	26	17	6	3
92.	KRAMATORSK	162.0	30	491	295	184	108	60	39	12	6
92.	KRAMATORSK	162.0	300	4050	2315	1473	853	491	295	100	40
93.	KRASNODAR	469.0	5	109	59	35	23	13	8	3	1
93.	KRASNODAR	469.0	10	261	143	87	58	29	20	7	3
93.	KRASNODAR	469.0	20	618	313	204	138	75	47	17	7
93.	KRASNODAR	469.0	30	1422	853	533	313	174	112	35	16
93.	KRASNODAR	469.0	300	11725	6700	4264	2469	1422	853	290	115
94.	KRASNOYARSK	664.0	5	155	83	49	33	19	11	4	2
94.	KRASNOYARSK	664.0	10	369	202	123	82	41	28	10	4
94.	KRASNOYARSK	664.0	20	874	443	289	196	106	67	23	9
94.	KRASNOYARSK	664.0	30	2013	1208	755	443	246	158	49	22
94.	KRASNOYARSK	664.0	300	16600	9486	6037	3495	2013	1208	410	162
95.	KRASNYY LUCH	117.0	5	28	15	9	6	4	2	1	1
95.	KRASNYY LUCH	117.0	10	65	36	22	15	8	5	2	1
95.	KRASNYY LUCH	117.0	20	154	78	51	35	19	12	4	2
95.	KRASNYY LUCH	117.0	30	355	213	133	78	44	28	9	4
95.	KRASNYY LUCH	117.0	300	2925	1672	1064	616	355	213	73	29
96.	KREMENCHUG	156.0	5	37	20	12	8	5	3	1	1
96.	KREMENCHUG	156.0	10	87	48	29	20	10	7	3	1
96.	KREMENCHUG	156.0	20	206	104	68	46	25	16	6	2
96.	KREMENCHUG	156.0	30	473	284	178	104	58	38	12	5
96.	KREMENCHUG	156.0	300	3900	2229	1419	821	473	284	97	38
97.	KRIVOY ROG	594.0	5	139	75	44	29	17	10	4	2
97.	KRIVOY ROG	594.0	10	330	180	110	74	37	25	9	4
97.	KRIVOY ROG	594.0	20	782	396	259	175	95	60	21	8
97.	KRIVOY ROG	594.0	30	1800	1080	675	396	220	142	44	20
97.	KRIVOY ROG	594.0	300	14850	8486	5400	3127	1800	1080	367	145
98.	KUNTSEVO	14.8	5	4	2	1	1	1	1	0	0
98.	KUNTSEVO	14.8	10	9	5	3	2	1	1	1	0
98.	KUNTSEVO	14.8	20	20	10	7	5	3	2	1	1
98.	KUNTSEVO	14.8	30	45	27	17	10	6	4	1	1
98.	KUNTSEVO	14.8	300	370	212	135	78	45	27	10	4
99.	KURGAN	248.0	5	58	31	19	12	7	5	2	1
99.	KURGAN	248.0	10	138	76	46	31	16	11	4	2
99.	KURGAN	248.0	20	327	166	108	73	40	25	9	4
99.	KURGAN	248.0	30	752	451	282	166	92	59	19	8
99.	KURGAN	248.0	300	6200	3543	2255	1306	752	451	153	61
100.	KURSK	29.5	5	7	4	3	2	1	1	1	0
100.	KURSK	29.5	10	17	9	6	4	2	2	1	1
100.	KURSK	29.5	20	39	20	13	9	5	3	1	1
100.	KURSK	29.5	30	90	54	34	20	11	7	3	1
100.	KURSK	29.5	300	738	422	269	156	90	54	19	8

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
101.	KUSTANAY	136.0	5	32	17	10	7	4	3	1	1
101.	KUSTANAY	136.0	10	76	42	26	17	9	6	2	1
101.	KUSTANAY	136.0	20	179	91	60	40	22	14	5	2
101.	KUSTANAY	136.0	30	413	248	155	91	51	33	10	5
101.	KUSTANAY	136.0	300	3400	1943	1237	716	413	248	84	34
102.	KUTAISI	183.0	5	43	23	14	9	5	3	1	1
102.	KUTAISI	183.0	10	102	56	34	23	12	8	3	1
102.	KUTAISI	183.0	20	241	122	80	54	29	19	7	3
102.	KUTAISI	183.0	30	555	333	208	122	68	44	14	6
102.	KUTAISI	183.0	300	4575	2615	1664	964	555	333	113	45
103.	KUYBYSHEV	133.6	5	31	17	10	7	4	3	1	1
103.	KUYBYSHEV	133.6	10	75	41	25	17	9	6	2	1
103.	KUYBYSHEV	133.6	20	176	89	58	40	22	14	5	2
103.	KUYBYSHEV	133.6	30	405	243	152	89	50	32	10	5
103.	KUYBYSHEV	133.6	300	3340	1909	1215	704	405	243	83	33
104.	KZYL-ORDA	130.0	5	31	17	10	7	4	3	1	1
104.	KZYL-ORDA	130.0	10	73	40	24	16	8	6	2	1
104.	KZYL-ORDA	130.0	20	171	87	57	39	21	13	5	2
104.	KZYL-ORDA	130.0	30	394	237	148	87	49	31	10	5
104.	KZYL-ORDA	130.0	300	3250	1858	1182	685	394	237	81	32
105.	LENINABAD	231.0	5	54	29	17	12	7	4	2	1
105.	LENINABAD	231.0	10	129	70	43	29	15	10	4	2
105.	LENINABAD	231.0	20	304	154	101	68	37	23	8	3
105.	LENINABAD	231.0	30	700	420	263	154	86	55	17	8
105.	LENINABAD	231.0	300	5775	3300	2100	1216	700	420	143	57
106.	LENINAKAN	177.0	5	42	23	13	9	5	3	1	1
106.	LENINAKAN	177.0	10	99	54	33	22	11	8	3	1
106.	LENINAKAN	177.0	20	233	118	77	52	28	18	7	3
106.	LENINAKAN	177.0	30	537	322	202	118	66	43	13	6
106.	LENINAKAN	177.0	300	4425	2529	1609	932	537	322	110	44
107.	LENINGRAD	250.1	5	59	32	19	13	7	5	2	1
107.	LENINGRAD	250.1	10	139	76	47	31	16	11	4	2
107.	LENINGRAD	250.1	20	329	167	109	74	40	25	9	4
107.	LENINGRAD	250.1	30	758	455	285	167	93	60	19	8
107.	LENINGRAD	250.1	300	6253	3573	2274	1317	758	455	155	61
108.	LENINSK-KUZN	159.0	5	37	20	12	8	5	3	1	1
108.	LENINSK-KUZN	159.0	10	89	49	30	20	10	7	3	1
108.	LENINSK-KUZN	159.0	20	210	106	70	47	26	16	6	2
108.	LENINSK-KUZN	159.0	30	482	289	181	106	59	38	12	6
108.	LENINSK-KUZN	159.0	300	3975	2272	1446	837	482	289	99	39
109.	LIPETSK	29.1	5	7	4	3	2	1	1	1	0
109.	LIPETSK	29.1	10	17	9	6	4	2	2	1	1
109.	LIPETSK	29.1	20	39	20	13	9	5	3	1	1
109.	LIPETSK	29.1	30	89	53	33	20	11	7	3	1
109.	LIPETSK	29.1	300	728	416	265	154	89	53	18	7
110.	LISICHANSK	138.0	5	32	18	11	7	4	3	1	1
110.	LISICHANSK	138.0	10	77	42	26	17	9	6	2	1
110.	LISICHANSK	138.0	20	182	92	60	41	22	14	5	2
110.	LISICHANSK	138.0	30	419	251	157	92	52	33	11	5
110.	LISICHANSK	138.0	300	3450	1972	1255	727	419	251	86	34

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
111.	LUTSK	110.0	5	26	14	8	6	3	2	1	1
111.	LUTSK	110.0	10	62	34	21	14	7	5	2	1
111.	LUTSK	110.0	20	145	74	48	33	18	11	4	2
111.	LUTSK	110.0	30	334	200	125	74	41	27	8	4
111.	LUTSK	110.0	300	2750	1572	1000	579	334	200	68	27
112.	LVOV	590.0	5	138	74	44	29	17	10	4	2
112.	LVOV	590.0	10	328	179	110	73	37	25	9	4
112.	LVOV	590.0	20	777	394	257	174	94	59	21	8
112.	LVOV	590.0	30	1788	1073	671	394	219	141	44	19
112.	LVOV	590.0	300	14750	8429	5364	3106	1788	1073	365	144
113.	LYUBERTSY	13.9	5	4	2	1	1	1	1	0	0
113.	LYUBERTSY	13.9	10	8	5	3	2	1	1	1	0
113.	LYUBERTSY	13.9	20	19	10	6	4	3	2	1	1
113.	LYUBERTSY	13.9	30	43	26	16	10	6	4	1	1
113.	LYUBERTSY	13.9	300	348	199	127	74	43	26	9	4
114.	MAGADAN	102.0	5	24	13	8	5	3	2	1	1
114.	MAGADAN	102.0	10	57	31	19	13	7	5	2	1
114.	MAGADAN	102.0	20	135	68	45	30	17	11	4	2
114.	MAGADAN	102.0	30	309	186	116	68	38	25	8	4
114.	MAGADAN	102.0	300	2550	1458	928	537	309	186	63	25
115.	MAGNITOGORSK	412.0	5	96	52	31	20	12	7	3	1
115.	MAGNITOGORSK	412.0	10	229	125	77	51	26	18	6	3
115.	MAGNITOGORSK	412.0	20	543	275	180	122	66	42	15	6
115.	MAGNITOGORSK	412.0	30	1249	749	469	275	153	98	31	14
115.	MAGNITOGORSK	412.0	300	10300	5886	3746	2169	1249	749	255	101
116.	MAKEYEVKA	477.0	5	111	60	35	24	14	8	3	1
116.	MAKEYEVKA	477.0	10	265	145	89	59	30	21	7	3
116.	MAKEYEVKA	477.0	20	628	318	208	141	76	48	17	7
116.	MAKEYEVKA	477.0	30	1446	868	542	318	177	114	35	16
116.	MAKEYEVKA	477.0	300	11925	6815	4337	2511	1446	868	295	117
117.	MAKHACHKALA	190.0	5	45	24	14	10	6	4	1	1
117.	MAKHACHKALA	190.0	10	106	58	36	24	12	8	3	1
117.	MAKHACHKALA	190.0	20	250	127	83	56	31	19	7	3
117.	MAKHACHKALA	190.0	30	576	346	216	127	71	46	14	7
117.	MAKHACHKALA	190.0	300	4750	2715	1728	1000	576	346	118	47
118.	MAYKOP	122.0	5	29	16	9	6	4	2	1	1
118.	MAYKOP	122.0	10	68	37	23	15	8	6	2	1
118.	MAYKOP	122.0	20	161	82	53	36	20	13	5	2
118.	MAYKOP	122.0	30	370	222	139	82	46	29	9	4
118.	MAYKOP	122.0	300	3050	1743	1109	643	370	222	76	30
119.	MELITOPOL	137.0	5	32	18	10	7	4	3	1	1
119.	MELITOPOL	137.0	10	77	42	26	17	9	6	2	1
119.	MELITOPOL	137.0	20	181	92	60	41	22	14	5	2
119.	MELITOPOL	137.0	30	416	249	156	92	51	33	10	5
119.	MELITOPOL	137.0	300	3425	1958	1246	721	416	249	85	34
120.	MIASS	140.0	5	33	18	11	7	4	3	1	1
120.	MIASS	140.0	10	78	43	26	18	9	6	2	1
120.	MIASS	140.0	20	185	94	61	42	23	14	5	2
120.	MIASS	140.0	30	425	255	159	94	52	34	11	5
120.	MIASS	140.0	300	3500	2000	1273	737	425	255	87	35

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
121.	MINSK	54.9	5	13	7	4	3	2	1	1	1
121.	MINSK	54.9	10	31	17	11	7	4	3	1	1
121.	MINSK	54.9	20	73	37	24	17	9	6	2	1
121.	MINSK	54.9	30	167	100	63	37	21	13	4	2
121.	MINSK	54.9	300	1373	785	499	289	167	100	34	14
122.	MOGILEV	203.0	5	48	26	15	10	6	4	1	1
122.	MOGILEV	203.0	10	113	62	38	25	13	9	3	2
122.	MOGILEV	203.0	20	268	136	89	60	33	21	7	3
122.	MOGILEV	203.0	30	616	369	231	136	76	49	15	7
122.	MOGILEV	203.0	300	5075	2900	1846	1069	616	369	126	50
123.	MOSCOW	346.5	5	81	44	26	17	10	6	2	1
123.	MOSCOW	346.5	10	193	105	65	43	22	15	5	2
123.	MOSCOW	346.5	20	456	231	151	102	55	35	12	5
123.	MOSCOW	346.5	30	1050	630	394	231	129	83	26	12
123.	MOSCOW	346.5	300	8663	4950	3150	1824	1050	630	214	85
124.	MURMANSK	331.0	5	77	42	25	17	9	6	2	1
124.	MURMANSK	331.0	10	184	101	62	41	21	14	5	2
124.	MURMANSK	331.0	20	436	221	144	98	53	33	12	5
124.	MURMANSK	331.0	30	1003	602	377	221	123	79	25	11
124.	MURMANSK	331.0	300	8275	4729	3009	1743	1003	602	205	81
125.	MYTISHCHII	12.9	5	3	2	1	1	1	1	0	0
125.	MYTISHCHII	12.9	10	8	4	3	2	1	1	1	0
125.	MYTISHCHII	12.9	20	17	9	6	4	2	2	1	1
125.	MYTISHCHII	12.9	30	39	24	15	9	5	3	1	1
125.	MYTISHCHII	12.9	300	323	185	118	68	39	24	8	4
126.	NAKHODKA	117.0	5	28	15	9	6	4	2	1	1
126.	NAKHODKA	117.0	10	65	36	22	15	8	5	2	1
126.	NAKHODKA	117.0	20	154	78	51	35	19	12	4	2
126.	NAKHODKA	117.0	30	355	213	133	78	44	28	9	4
126.	NAKHODKA	117.0	300	2925	1672	1064	616	355	213	73	29
127.	NAL'CHIK	137.0	5	32	18	10	7	4	3	1	1
127.	NAL'CHIK	137.0	10	77	42	26	17	9	6	2	1
127.	NAL'CHIK	137.0	20	181	92	60	41	22	14	5	2
127.	NAL'CHIK	137.0	30	416	249	156	92	51	33	10	5
127.	NAL'CHIK	137.0	300	3425	1958	1246	721	416	249	85	34
128.	NAMANGAN	182.0	5	43	23	14	9	5	3	1	1
128.	NAMANGAN	182.0	10	102	56	34	23	12	8	3	1
128.	NAMANGAN	182.0	20	240	122	80	54	29	19	7	3
128.	NAMANGAN	182.0	30	552	331	207	122	68	44	14	6
128.	NAMANGAN	182.0	300	4550	2600	1655	958	552	331	113	45
129.	NIKOLAYEV	346.0	5	81	44	26	17	10	6	2	1
129.	NIKOLAYEV	346.0	10	193	105	64	43	22	15	5	2
129.	NIKOLAYEV	346.0	20	456	231	151	102	55	35	12	5
129.	NIKOLAYEV	346.0	30	1049	629	394	231	129	83	26	12
129.	NIKOLAYEV	346.0	300	8650	4943	3146	1821	1049	629	214	85
130.	NIKOPOL	126.0	5	30	16	10	7	4	2	1	1
130.	NIKOPOL	126.0	10	70	39	24	16	8	6	2	1
130.	NIKOPOL	126.0	20	166	84	55	37	20	13	5	2
130.	NIKOPOL	126.0	30	382	229	144	84	47	30	10	4
130.	NIKOPOL	126.0	300	3150	1800	1146	664	382	229	78	31

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
131.	NIZHNIY-TAGI	434.0	5	101	55	32	22	12	8	3	1
131.	NIZHNIY-TAGI	434.0	10	242	132	81	54	27	19	7	3
131.	NIZHNIY-TAGI	434.0	20	571	290	189	128	69	44	15	6
131.	NIZHNIY-TAGI	434.0	30	1316	789	494	290	161	104	32	14
131.	NIZHNIY-TAGI	434.0	300	10850	6200	3946	2285	1316	789	263	106
132.	NOGINSK	11.7	5	3	2	1	1	1	1	0	0
132.	NOGINSK	11.7	10	7	4	3	2	1	1	1	0
132.	NOGINSK	11.7	20	16	8	5	4	2	2	1	1
132.	NOGINSK	11.7	30	36	22	14	8	5	3	1	1
132.	NOGINSK	11.7	300	293	168	107	62	36	22	8	3
133.	NORILSK	148.0	5	35	19	11	8	4	3	1	1
133.	NORILSK	148.0	10	83	45	28	19	10	7	3	1
133.	NORILSK	148.0	20	195	99	65	44	24	15	6	2
133.	NORILSK	148.0	30	449	269	169	99	55	36	11	5
133.	NORILSK	148.0	300	3700	2115	1346	779	449	269	92	36
134.	NOROCHERKASK	186.0	5	44	24	14	9	6	3	1	1
134.	NOROCHERKASK	186.0	10	104	57	35	23	12	8	3	1
134.	NOROCHERKASK	186.0	20	245	124	81	55	30	19	7	3
134.	NOROCHERKASK	186.0	30	564	339	212	124	69	45	14	6
134.	NOROCHERKASK	186.0	300	4650	2658	1691	979	564	339	115	46
135.	NOVGOROD	125.0	5	29	16	10	6	4	2	1	1
135.	NOVGOROD	125.0	10	70	38	24	16	8	6	2	1
135.	NOVGOROD	125.0	20	165	84	55	37	20	13	5	2
135.	NOVGOROD	125.0	30	379	228	142	84	47	30	10	4
135.	NOVGOROD	125.0	300	3125	1786	1137	658	379	228	78	31
136.	NOVOKUBYSHEV	123.0	5	29	16	9	6	4	2	1	1
136.	NOVOKUBYSHEV	123.0	10	69	38	23	16	8	6	2	1
136.	NOVOKUBYSHEV	123.0	20	162	82	54	37	20	13	5	2
136.	NOVOKUBYSHEV	123.0	30	373	224	140	82	46	30	9	4
136.	NOVOKUBYSHEV	123.0	300	3075	1758	1119	648	373	224	76	30
137.	NOVOKUZNETSK	568.0	5	132	71	42	28	16	10	3	2
137.	NOVOKUZNETSK	568.0	10	316	173	106	71	35	24	8	4
137.	NOVOKUZNETSK	568.0	20	748	379	247	167	91	57	20	8
137.	NOVOKUZNETSK	568.0	30	1722	1033	646	379	211	136	42	19
137.	NOVOKUZNETSK	568.0	300	14200	8115	5164	2990	1722	1033	351	139
138.	NOVOMOSKOVSK	14.5	5	4	2	1	1	1	1	0	0
138.	NOVOMOSKOVSK	14.5	10	8	5	3	2	1	1	1	0
138.	NOVOMOSKOVSK	14.5	20	19	10	7	5	3	2	1	1
138.	NOVOMOSKOVSK	14.5	30	44	27	17	10	6	4	1	1
138.	NOVOMOSKOVSK	14.5	300	363	208	132	77	44	27	9	4
139.	NOVOROSSIYSK	141.0	5	33	18	11	7	4	3	1	1
139.	NOVOROSSIYSK	141.0	10	79	43	27	18	9	6	2	1
139.	NOVOROSSIYSK	141.0	20	186	94	62	42	23	14	5	2
139.	NOVOROSSIYSK	141.0	30	428	257	161	94	53	34	11	5
139.	NOVOROSSIYSK	141.0	300	3525	2015	1282	743	428	257	87	35
140.	NOVOSHAKHTIN	123.0	5	29	16	9	6	4	2	1	1
140.	NOVOSHAKHTIN	123.0	10	69	38	23	16	8	6	2	1
140.	NOVOSHAKHTIN	123.0	20	162	82	54	37	20	13	5	2
140.	NOVOSHAKHTIN	123.0	30	373	224	140	82	46	30	9	4
140.	NOVOSHAKHTIN	123.0	300	3075	1758	1119	648	373	224	76	30

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
141.	NOVOSIBIRSK	181.5	5	43	23	14	9	5	3	1	1
141.	NOVOSIBIRSK	181.5	10	101	55	34	23	12	8	3	1
141.	NOVOSIBIRSK	181.5	20	239	121	79	54	29	19	7	3
141.	NOVOSIBIRSK	181.5	30	550	330	207	121	68	44	14	6
141.	NOVOSIBIRSK	181.5	300	4538	2593	1650	956	550	330	112	45
142.	ODESSA	894.0	5	208	112	66	44	25	15	5	2
142.	ODESSA	894.0	10	497	271	166	111	56	38	13	5
142.	ODESSA	894.0	20	1177	596	389	263	142	90	31	12
142.	ODESSA	894.0	30	2709	1626	1016	596	332	213	66	29
142.	ODESSA	894.0	300	22350	12772	8128	4706	2709	1626	552	218
143.	OMSK	892.0	5	208	112	66	44	25	15	5	2
143.	OMSK	892.0	10	496	271	166	111	55	38	13	5
143.	OMSK	892.0	20	1174	595	388	263	142	90	31	12
143.	OMSK	892.0	30	2703	1622	1014	595	331	213	66	29
143.	OMSK	892.0	300	22300	12743	8109	4695	2703	1622	551	218
144.	ORDZHONIKIDZ	252.0	5	59	32	19	13	7	5	2	1
144.	ORDZHONIKIDZ	252.0	10	140	77	47	32	16	11	4	2
144.	ORDZHONIKIDZ	252.0	20	332	168	110	75	[illegible]0	26	9	4
144.	ORDZHONIKIDZ	252.0	30	764	459	287	168	94	60	19	9
144.	ORDZHONIKIDZ	252.0	300	6300	3600	2291	1327	764	459	156	62
145.	OREKHOVO-ZUY	13.5	5	4	2	1	1	1	1	0	0
145.	OREKHOVO-ZUY	13.5	10	8	4	3	2	1	1	1	0
145.	OREKHOVO-ZUY	13.5	20	18	9	6	4	3	2	1	1
145.	OREKHOVO-ZUY	13.5	30	41	25	16	9	5	4	1	1
145.	OREKHOVO-ZUY	13.5	300	338	193	123	71	41	25	9	4
146.	OREL	240.0	5	56	30	18	12	7	4	2	1
146.	OREL	240.0	10	134	73	45	30	15	11	4	2
146.	OREL	240.0	20	316	160	105	71	38	24	9	4
146.	OREL	240.0	30	728	437	273	160	89	58	18	8
146.	OREL	240.0	300	6000	3429	2182	1264	728	437	149	59
147.	ORENBURG	376.0	5	88	47	28	19	11	7	2	1
147.	ORENBURG	376.0	10	209	114	70	47	24	16	6	2
147.	ORENBURG	376.0	20	495	251	164	111	60	38	13	5
147.	ORENBURG	376.0	30	1140	684	428	251	140	90	28	13
147.	ORENBURG	376.0	300	9400	5372	3419	1979	1140	684	232	92
148.	ORSHA	107.0	5	25	14	8	6	3	2	1	1
148.	ORSHA	107.0	10	60	33	20	14	7	5	2	1
148.	ORSHA	107.0	20	141	72	47	32	17	11	4	2
148.	ORSHA	107.0	30	325	195	122	72	40	26	8	4
148.	ORSHA	107.0	300	2675	1529	973	564	325	195	66	26
149.	ORSK	248.0	5	58	31	19	12	7	5	2	1
149.	ORSK	248.0	10	138	76	46	31	16	11	4	2
149.	ORSK	248.0	20	327	166	108	73	40	25	9	4
149.	ORSK	248.0	30	752	451	282	166	92	59	19	8
149.	ORSK	248.0	300	6200	3543	2255	1306	752	451	153	61
150.	OSH	137.0	5	32	18	10	7	4	3	1	1
150.	OSH	137.0	10	77	42	26	17	9	6	2	1
150.	OSH	137.0	20	181	92	60	41	22	14	5	2
150.	OSH	137.0	30	416	249	156	92	51	33	10	5
150.	OSH	137.0	300	3425	1958	1246	721	416	249	85	34

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
151.	PAVLODAR	177.0	5	42	23	13	9	5	3	1	1
151.	PAVLODAR	177.0	10	99	54	33	22	11	8	3	1
151.	PAVLODAR	177.0	20	233	118	77	52	28	18	7	3
151.	PAVLODAR	177.0	30	537	322	202	118	66	43	13	6
151.	PAVLODAR	177.0	300	4425	2529	1609	932	537	322	110	44
152.	PENZA	383.0	5	89	48	29	19	11	7	2	1
152.	PENZA	383.0	10	213	116	71	48	24	17	6	3
152.	PENZA	383.0	20	504	256	167	113	61	39	14	5
152.	PENZA	383.0	30	1161	697	436	256	142	92	29	13
152.	PENZA	383.0	300	9575	5472	3482	2016	1161	697	237	94
153.	PERM	918.0	5	214	115	68	45	26	16	5	2
153.	PERM	918.0	10	510	279	170	114	57	39	13	5
153.	PERM	918.0	20	1208	612	400	270	146	92	32	12
153.	PERM	918.0	30	2782	1669	1044	612	340	219	68	30
153.	PERM	918.0	300	22950	13115	8346	4832	2782	1669	567	224
154.	PEROVO	16.5	5	4	2	2	1	1	1	0	0
154.	PEROVO	16.5	10	10	5	3	2	1	1	1	0
154.	PEROVO	16.5	20	22	11	8	5	3	2	1	1
154.	PEROVO	16.5	30	50	30	19	11	7	4	2	1
154.	PEROVO	16.5	300	413	236	150	87	50	30	11	4
155.	PERVOURAL'SK	126.0	5	30	16	10	7	4	2	1	1
155.	PERVOURAL'SK	126.0	10	70	39	24	16	8	6	2	1
155.	PERVOURAL'SK	126.0	20	166	84	55	37	20	13	5	2
155.	PERVOURAL'SK	126.0	30	382	229	144	84	47	30	10	4
155.	PERVOURAL'SK	126.0	300	3150	1800	1146	664	382	229	78	31
156.	PETROPAVLOVS	141.0	5	33	18	11	7	4	3	1	1
156.	PETROPAVLOVS	141.0	10	79	43	27	18	9	6	2	1
156.	PETROPAVLOVS	141.0	20	186	94	62	42	23	14	5	2
156.	PETROPAVLOVS	141.0	30	428	257	161	94	53	34	11	5
156.	PETROPAVLOVS	141.0	300	3525	2015	1282	743	428	257	87	35
157.	PETROPAVLOVS	191.0	5	45	24	14	10	6	4	1	1
157.	PETROPAVLOVS	191.0	10	107	58	36	24	12	8	3	1
157.	PETROPAVLOVS	191.0	20	252	128	83	57	31	19	7	3
157.	PETROPAVLOVS	191.0	30	579	348	217	128	71	46	14	7
157.	PETROPAVLOVS	191.0	300	4775	2729	1737	1006	579	348	118	47
158.	PETROZAVODSK	196.0	5	46	25	15	10	6	4	1	1
158.	PETROZAVODSK	196.0	10	109	60	37	25	12	9	3	1
158.	PETROZAVODSK	196.0	20	258	131	86	58	32	20	7	3
158.	PETROZAVODSK	196.0	30	594	357	223	131	73	47	15	7
158.	PETROZAVODSK	196.0	300	4900	2800	1782	1032	594	357	121	48
159.	PODOL'SK	18.8	5	5	3	2	1	1	1	0	0
159.	PODOL'SK	18.8	10	11	6	4	3	2	1	1	1
159.	PODOL'SK	18.8	20	25	13	9	6	3	2	1	1
159.	PODOL'SK	18.8	30	57	35	22	13	7	5	2	1
159.	PODOL'SK	18.8	300	470	269	171	99	57	35	12	5
160.	POLTAVA	211.0	5	49	27	16	11	6	4	2	1
160.	POLTAVA	211.0	10	118	64	39	26	13	9	3	2
160.	POLTAVA	211.0	20	278	141	92	62	34	21	8	3
160.	POLTAVA	211.0	30	640	384	240	141	79	51	16	7
160.	POLTAVA	211.0	300	5275	3015	1919	1111	640	384	131	52

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
161.	PROKOPYEVSK	334.0	5	78	42	25	17	10	6	2	1
161.	PROKOPYEVSK	334.0	10	186	102	62	42	21	14	5	2
161.	PROKOPYEVSK	334.0	20	440	223	146	99	53	34	12	5
161.	PROKOPYEVSK	334.0	30	1013	608	380	223	124	80	25	11
161.	PROKOPYEVSK	334.0	300	8350	4772	3037	1758	1013	608	207	82
162.	PSKOV	129.0	5	30	17	10	7	4	3	1	1
162.	PSKOV	129.0	10	72	39	24	16	8	6	2	1
162.	PSKOV	129.0	20	170	86	56	38	21	13	5	2
162.	PSKOV	129.0	30	391	235	147	86	48	31	10	5
162.	PSKOV	129.0	300	3225	1843	1173	679	391	235	80	32
163.	RAZAN	359.0	5	84	45	27	18	10	6	2	1
163.	RAZAN	359.0	10	200	109	67	45	23	16	5	2
163.	RAZAN	359.0	20	473	240	156	106	57	36	13	5
163.	RAZAN	359.0	30	1088	653	408	240	133	86	27	12
163.	RAZAN	359.0	300	8975	5129	3264	1890	1088	653	222	88
164.	RIGA	99.1	5	23	13	8	5	3	2	1	1
164.	RIGA	99.1	10	55	30	19	13	7	5	2	1
164.	RIGA	99.1	20	131	66	43	30	16	10	4	2
164.	RIGA	99.1	30	301	181	113	66	37	24	8	4
164.	RIGA	99.1	300	2478	1416	901	522	301	181	62	25
165.	ROSTOV-NA-DO	873.0	5	203	110	65	43	24	15	5	2
165.	ROSTOV-NA-DO	873.0	10	485	265	162	108	54	37	13	5
165.	ROSTOV-NA-DO	873.0	20	1149	592	380	257	139	88	31	12
165.	ROSTOV-NA-DO	873.0	30	2646	1588	992	582	324	208	65	29
165.	ROSTOV-NA-DO	873.0	300	21825	12472	7937	4595	2646	1588	539	213
166.	ROVNO	115.0	5	27	15	9	6	4	2	1	1
166.	ROVNO	115.0	10	64	35	22	15	7	5	2	1
166.	ROVNO	115.0	20	152	77	50	34	19	12	4	2
166.	ROVNO	115.0	30	349	209	131	77	43	28	9	4
166.	ROVNO	115.0	300	2875	1643	1046	606	349	209	71	28
167.	RUBTSOVSK	163.0	5	38	21	12	8	5	3	1	1
167.	RUBTSOVSK	163.0	10	91	50	31	21	10	7	3	1
167.	RUBTSOVSK	163.0	20	215	109	71	48	26	17	6	3
167.	RUBTSOVSK	163.0	30	494	297	186	109	61	39	12	6
167.	RUBTSOVSK	163.0	300	4075	2329	1482	858	494	297	101	40
168.	RUSTAVI	112.0	5	26	14	9	6	3	2	1	1
168.	RUSTAVI	112.0	10	63	34	21	14	7	5	2	1
168.	RUSTAVI	112.0	20	148	75	49	33	18	12	4	2
168.	RUSTAVI	112.0	30	340	204	128	75	42	27	9	4
168.	RUSTAVI	112.0	300	2800	1600	1019	590	340	204	70	28
169.	RYBINSK	244.0	5	57	31	18	12	7	4	2	1
169.	RYBINSK	244.0	10	136	74	46	31	15	11	4	2
169.	RYBINSK	244.0	20	321	163	106	72	39	25	9	4
169.	RYBINSK	244.0	30	740	444	278	163	91	58	18	8
169.	RYBINSK	244.0	300	6100	3486	2219	1285	740	444	151	60
170.	SALAVAT	121.0	5	29	16	9	6	4	2	1	1
170.	SALAVAT	121.0	10	68	37	23	15	8	6	2	1
170.	SALAVAT	121.0	20	160	81	53	36	20	12	5	2
170.	SALAVAT	121.0	30	367	220	138	81	45	29	9	4
170.	SALAVAT	121.0	300	3025	1729	1100	637	367	220	75	30

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
171.	SAMAKARND	286.0	5	67	36	21	14	8	5	2	1
171.	SAMAKARND	286.0	10	159	87	53	36	18	12	4	2
171.	SAMAKARND	286.0	20	377	191	125	85	46	29	10	4
171.	SAMAKARND	286.0	30	867	520	325	191	106	68	21	10
171.	SAMAKARND	286.0	300	7150	4086	2600	1506	867	520	177	70
172.	SARANSK	177.0	5	42	23	13	9	5	3	1	1
172.	SARANSK	177.0	10	99	54	33	22	11	8	3	1
172.	SARANSK	177.0	20	233	118	77	52	28	18	7	3
172.	SARANSK	177.0	30	537	322	202	118	66	43	13	6
172.	SARANSK	177.0	300.	4425	2529	1609	932	537	322	110	44
173.	SARATOV	830.0	5	193	104	61	41	23	14	5	2
173.	SARATOV	830.0	10	462	252	154	103	52	35	12	5
173.	SARATOV	830.0	20	1093	554	361	245	132	83	29	11
173.	SARATOV	830.0	30	2516	1509	944	554	308	198	61	27
173.	SARATOV	830.0	300	20750	11858	7546	4369	2516	1509	513	203
174.	SEMIPALATINS	235.0	5	55	30	18	12	7	4	2	1
174.	SEMIPALATINS	235.0	10	131	72	44	29	15	10	4	2
174.	SEMIPALATINS	235.0	20	310	157	103	70	38	24	9	3
174.	SEMIPALATINS	235.0	30	713	428	267	157	87	56	18	8
174.	SEMIPALATINS	235.0	300	5875	3358	2137	1237	713	428	145	58
175.	SEROV	120.0	5	28	15	9	6	4	2	1	1
175.	SEROV	120.0	10	67	37	23	15	8	5	2	1
175.	SEROV	120.0	20	158	80	53	36	19	12	5	2
175.	SEROV	120.0	30	364	219	137	80	45	29	9	4
175.	SEROV	120.0	300	3000	1715	1091	632	364	219	74	30
176.	SERPUKHOV	14.0	5	4	2	1	1	1	1	0	0
176.	SERPUKHOV	14.0	10	8	5	3	2	1	1	1	0
176.	SERPUKHOV	14.0	20	19	10	6	5	3	2	1	1
176.	SERPUKHOV	14.0	30	43	26	16	10	6	4	1	1
176.	SERPUKHOV	14.0	300	350	200	128	74	43	26	9	4
177.	SEVASTOPOL'	240.0	5	56	30	18	12	7	4	2	1
177.	SEVASTOPOL'	240.0	10	134	73	45	30	15	11	4	2
177.	SEVASTOPOL'	240.0	20	316	160	105	71	38	24	9	4
177.	SEVASTOPOL'	240.0	30	728	437	273	160	89	58	18	8
177.	SEVASTOPOL'	240.0	300	6000	3429	2182	1264	728	437	149	59
178.	SEVERODONETS	100.0	5	24	13	8	5	3	2	1	1
178.	SEVERODONETS	100.0	10	56	31	19	13	7	5	2	1
178.	SEVERODONETS	100.0	20	132	67	44	30	16	10	4	2
178.	SEVERODONETS	100.0	30	303	182	114	67	37	24	8	4
178.	SEVERODONETS	100.0	300	2500	1429	909	527	303	182	62	25
179.	SEVERODVINS	138.0	5	32	18	11	7	4	3	1	1
179.	SEVERODVINS	138.0	10	77	42	26	17	9	6	2	1
179.	SEVERODVINS	138.0	20	182	92	60	41	22	14	5	2
179.	SEVERODVINS	138.0	30	419	251	157	92	52	33	11	5
179.	SEVERODVINS	138.0	300	3450	1972	1255	727	419	251	86	34
180.	SHAKHTY	240.0	5	56	30	18	12	7	4	2	1
180.	SHAKHTY	240.0	10	134	73	45	30	15	11	4	2
180.	SHAKHTY	240.0	20	316	160	105	71	38	24	9	4
180.	SHAKHTY	240.0	30	728	437	273	160	89	58	18	8
180.	SHAKHTY	240.0	300	6000	3429	2182	1264	728	437	149	59

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
181.	SIMFEROPOL'	256.0	5	60	32	19	13	7	5	2	1
181.	SIMFEROPOL'	256.0	10	143	78	48	32	16	11	4	2
181.	SIMFEROPOL'	256.0	20	337	171	112	76	41	26	9	4
181.	SIMFEROPOL'	256.0	30	776	466	291	171	95	61	19	9
181.	SIMFEROPOL'	256.0	300	6400	3658	2328	1348	776	466	158	63
182.	SLAVYANSK	130.0	5	31	17	10	7	4	3	1	1
182.	SLAVYANSK	130.0	10	73	40	24	16	8	6	2	1
182.	SLAVYANSK	130.0	20	171	87	57	39	21	13	5	2
182.	SLAVYANSK	130.0	30	304	237	148	87	49	31	10	5
182.	SLAVYANSK	130.0	300	3250	1858	1182	685	394	237	81	32
183.	SMOLENSK	225.0	5	53	29	17	11	7	4	2	1
183.	SMOLENSK	225.0	10	125	69	42	28	14	10	4	2
183.	SMOLENSK	225.0	20	296	150	98	67	36	23	8	3
183.	SMOLENSK	225.0	30	682	409	256	150	84	54	17	8
183.	SMOLENSK	225.0	300	5625	3215	2046	1185	682	409	139	55
184.	SOCHI	217.0	5	51	28	16	11	6	4	2	1
184.	SOCHI	217.0	10	121	66	41	27	14	10	3	2
184.	SOCHI	217.0	20	286	145	95	64	35	22	8	3
184.	SOCHI	217.0	30	658	395	247	145	81	52	16	7
184.	SOCHI	217.0	300	5425	3100	1973	1143	658	395	134	53
185.	STARVROPOL	204.0	5	48	26	15	10	6	4	1	1
185.	STARVROPOL	204.0	10	114	62	38	26	13	9	3	2
185.	STARVROPOL	204.0	20	269	136	89	60	33	21	7	3
185.	STARVROPOL	204.0	30	619	371	232	136	76	49	15	7
185.	STARVROPOL	204.0	300	5100	2915	1855	1074	619	371	126	50
186.	STERLITAMAK	187.0	5	44	24	14	10	6	4	1	1
186.	STERLITAMAK	187.0	10	104	57	35	23	12	8	3	1
186.	STERLITAMAK	187.0	20	246	125	82	55	30	19	7	3
186.	STERLITAMAK	187.0	30	567	340	213	125	70	45	14	6
186.	STERLITAMAK	187.0	300	4675	2672	1700	985	567	340	116	46
187.	SUKHUMI	108.0	5	26	14	8	6	3	2	1	1
187.	SUKHUMI	108.0	10	60	33	20	14	7	5	2	1
187.	SUKHUMI	108.0	20	143	72	47	32	18	11	4	2
187.	SUKHUMI	108.0	30	328	197	123	72	40	26	8	4
187.	SUKHUMI	108.0	300	2700	1543	982	569	328	197	67	27
188.	SUMGAIT	120.0	5	28	15	9	6	4	2	1	1
188.	SUMGAIT	120.0	10	67	37	23	15	8	5	2	1
188.	SUMGAIT	120.0	20	158	80	53	36	19	12	5	2
188.	SUMGAIT	120.0	30	364	219	137	80	45	29	9	4
188.	SUMGAIT	120.0	300	3000	1715	1091	632	364	219	74	30
189.	SUMY	161.0	5	38	21	12	8	5	3	1	1
189.	SUMY	161.0	10	90	49	30	20	10	7	3	1
189.	SUMY	161.0	20	212	108	70	48	26	16	6	3
189.	SUMY	161.0	30	488	293	183	108	60	39	12	6
189.	SUMY	161.0	300	4025	2300	1464	843	488	293	100	40
190.	SVERDLOVSK	149.7	5	35	19	11	8	5	3	1	1
190.	SVERDLOVSK	149.7	10	84	46	28	19	10	7	3	1
190.	SVERDLOVSK	149.7	20	197	100	65	44	24	15	6	2
190.	SVERDLOVSK	149.7	30	454	273	171	100	56	36	11	5
190.	SVERDLOVSK	149.7	300	3743	2139	1361	788	454	273	93	37

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
191.	SYKTYVKAR	117.0	5	28	15	9	6	4	2	1	1
191.	SYKTYVKAR	117.0	10	65	36	22	15	8	5	2	1
191.	SYKTYVKAR	117.0	20	154	78	51	35	19	12	4	2
191.	SYKTYVKAR	117.0	30	355	213	133	78	44	28	9	4
191.	SYKTYVKAR	117.0	300	2925	1672	1064	616	355	213	73	29
192.	SYZRAN	194.0	5	46	25	15	10	6	4	1	1
192.	SYZRAN	194.0	10	108	59	36	24	12	9	3	1
192.	SYZRAN	194.0	20	256	130	85	57	31	20	7	3
192.	SYZRAN	194.0	30	588	353	221	130	72	47	15	7
192.	SYZRAN	194.0	300	4850	2772	1764	1021	588	353	120	48
193.	TAGANROG	282.0	5	66	36	21	14	8	5	2	1
193.	TAGANROG	282.0	10	157	86	53	35	18	12	4	2
193.	TAGANROG	282.0	20	371	188	123	63	45	29	10	4
193.	TAGANROG	282.0	30	855	513	321	188	105	68	21	9
193.	TAGANROG	282.0	300	7050	4029	2564	1485	855	513	174	69
194.	TALLINN	365.0	5	85	46	27	18	10	6	2	1
194.	TALLINN	365.0	10	203	111	68	45	23	16	6	2
194.	TALLINN	365.0	20	481	244	159	108	58	37	13	5
194.	TALLINN	365.0	30	1106	664	415	244	136	87	27	12
194.	TALLINN	365.0	300	9125	5215	3319	1921	1106	664	226	89
195.	TAMBOV	24.3	5	6	3	2	2	1	1	1	0
195.	TAMBOV	24.3	10	14	8	5	3	2	1	1	1
195.	TAMBOV	24.3	20	32	17	11	8	4	3	1	1
195.	TAMBOV	24.3	30	74	45	28	17	9	6	2	1
195.	TAMBOV	24.3	300	608	346	221	128	74	45	15	6
196.	TASHKENT	87.4	5	21	11	7	5	3	2	1	1
196.	TASHKENT	87.4	10	49	27	17	11	6	4	2	1
196.	TASHKENT	87.4	20	115	59	38	26	14	9	3	2
196.	TASHKENT	87.4	30	265	159	100	59	33	21	7	3
196.	TASHKENT	87.4	300	2125	1249	795	460	265	159	54	22
197.	TBILISI	103.1	5	24	13	8	5	3	2	1	1
197.	TBILISI	103.1	10	58	32	19	13	7	5	2	1
197.	TBILISI	103.1	20	136	69	45	31	17	11	4	2
197.	TBILISI	103.1	30	313	188	118	69	39	25	8	4
197.	TBILISI	103.1	300	2578	1473	938	543	313	188	64	26
198.	TEMIRTAU	173.0	5	41	22	13	9	5	3	1	1
198.	TEMIRTAU	173.0	10	97	53	32	22	11	8	3	1
198.	TEMIRTAU	173.0	20	228	116	76	51	28	18	6	3
198.	TEMIRTAU	173.0	30	525	315	197	116	64	42	13	6
198.	TEMIRTAU	173.0	300	4325	2472	1573	911	525	315	107	43
199.	TERNOPOL	108.0	5	26	14	8	6	3	2	1	1
199.	TERNOPOL	108.0	10	60	33	20	14	7	5	2	1
199.	TERNOPOL	108.0	20	143	72	47	32	18	11	4	2
199.	TERNOPOL	108.0	30	328	197	123	72	40	26	8	4
199.	TERNOPOL	108.0	300	2700	1543	982	569	328	197	67	27
200.	TIRASPOL'	121.0	5	29	16	9	6	4	2	1	1
200.	TIRASPOL'	121.0	10	68	37	23	15	8	6	2	1
200.	TIRASPOL'	121.0	20	160	81	53	36	20	12	5	2
200.	TIRASPOL'	121.0	30	367	220	138	81	45	29	9	4
200.	TIRASPOL'	121.0	300	3025	1729	1100	637	367	220	75	30

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
201.	TOGLIATTI	164.0	5	39	21	12	8	5	3	1	1
201.	TOGLIATTI	164.0	10	92	50	31	21	11	7	3	1
201.	TOGLIATTI	164.0	20	216	110	72	49	26	17	6	3
201.	TOGLIATTI	164.0	30	497	299	187	110	61	39	12	6
201.	TOGLIATTI	164.0	300	4100	2243	1491	864	497	299	102	40
202.	TOMSK	374.0	5	87	47	28	19	11	7	2	1
202.	TOMSK	374.0	10	208	114	70	47	23	16	6	2
202.	TOMSK	374.0	20	403	250	163	110	60	38	13	5
202.	TOMSK	374.0	30	1134	680	425	250	139	89	28	12
202.	TOMSK	374.0	300	9350	5343	3400	1969	1134	680	231	92
203.	TSELINOGRAD	203.0	5	48	26	15	10	6	4	1	1
203.	TSELINOGRAD	203.0	10	113	62	38	25	13	9	3	2
203.	TSELINOGRAD	203.0	20	268	136	89	60	33	21	7	3
203.	TSELINOGRAD	203.0	30	616	369	231	136	76	49	15	7
203.	TSELINOGRAD	203.0	300	5075	2900	1846	1069	616	369	126	50
204.	TULA	434.0	5	101	55	32	22	12	8	3	1
204.	TULA	434.0	10	242	132	81	54	27	19	7	3
204.	TULA	434.0	20	571	290	189	128	69	44	15	6
204.	TULA	434.0	30	1316	789	494	290	161	104	32	14
204.	TULA	434.0	300	10850	6200	3946	2285	1316	789	268	106
205.	TYUMEN	276.0	5	65	35	21	14	8	5	2	1
205.	TYUMEN	276.0	10	154	84	52	34	17	12	4	2
205.	TYUMEN	276.0	20	364	184	120	82	44	28	10	4
205.	TYUMEN	276.0	30	837	502	314	184	103	66	21	9
205.	TYUMEN	276.0	300	6900	3943	2509	1453	837	502	171	68
206.	UFA	811.0	5	189	102	60	40	23	14	5	2
206.	UFA	811.0	10	451	246	151	101	50	35	12	5
206.	UFA	811.0	20	1068	541	353	239	129	81	29	11
206.	UFA	811.0	30	2458	1475	922	541	301	193	60	27
206.	UFA	811.0	300	20275	11586	7373	4269	2458	1475	501	198
207.	ULAN-UDE	262.0	5	61	33	20	13	8	5	2	1
207.	ULAN-UDE	262.0	10	146	80	49	33	17	11	4	2
207.	ULAN-UDE	262.0	20	345	175	114	77	42	27	9	4
207.	ULAN-UDE	262.0	30	794	477	298	175	97	63	20	9
207.	ULAN-UDE	262.0	300	6550	3743	2382	1379	794	477	162	64
208.	UL'YANOVSK	338.0	5	79	43	25	17	10	6	2	1
208.	UL'YANOVSK	338.0	10	188	103	63	42	21	15	5	2
208.	UL'YANOVSK	338.0	20	445	226	147	100	54	34	12	5
208.	UL'YANOVSK	338.0	30	1025	615	384	226	126	81	25	11
208.	UL'YANOVSK	338.0	300	8450	4829	3073	1779	1025	615	209	83
209.	URAL'SK	141.0	5	33	18	11	7	4	3	1	1
209.	URAL'SK	141.0	10	79	43	27	18	9	6	2	1
209.	URAL'SK	141.0	20	186	94	62	42	23	14	5	2
209.	URAL'SK	141.0	30	428	257	161	94	53	34	11	5
209.	URAL'SK	141.0	300	3525	2015	1282	743	428	257	87	35
210.	USSURIYSK	143.0	5	34	18	11	7	4	3	1	1
210.	USSURIYSK	143.0	10	80	44	27	18	9	6	2	1
210.	USSURIYSK	143.0	20	189	96	63	42	23	15	5	2
210.	USSURIYSK	143.0	30	434	260	163	96	53	34	11	5
210.	USSURIYSK	143.0	300	3575	2043	1300	753	434	260	89	35

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
211.	UST-KAMENOGO	244.0	5	57	31	18	12	7	4	2	1
211.	UST-KAMENOGO	244.0	10	136	74	46	31	15	11	4	2
211.	UST-KAMENOGO	244.0	20	321	163	106	72	39	25	9	4
211.	UST-KAMENOGO	244.0	30	740	444	278	163	91	58	18	8
211.	UST-KAMENOGO	244.0	300	6100	3486	2219	1285	740	444	151	60
212.	VILNA	415.0	5	97	52	31	21	12	7	3	1
212.	VILNA	415.0	10	231	126	77	52	26	18	6	3
212.	VILNA	415.0	20	546	277	181	122	66	42	15	6
212.	VILNA	415.0	30	1258	755	472	277	154	99	31	14
212.	VILNA	415.0	300	10375	5929	3773	2185	1258	755	257	102
213.	VINNITSA	193.0	5	45	25	15	10	6	4	1	1
213.	VINNITSA	193.0	10	108	59	36	24	12	9	3	1
213.	VINNITSA	193.0	20	254	129	84	57	31	20	7	3
213.	VINNITSA	193.0	30	585	351	220	129	72	46	15	7
213.	VINNITSA	193.0	300	4825	2758	1755	1016	585	351	120	47
214.	VITEBSK	234.0	5	55	30	18	12	7	4	2	1
214.	VITEBSK	234.0	10	130	71	44	29	15	10	4	2
214.	VITEBSK	234.0	20	308	156	102	69	38	24	9	3
214.	VITEBSK	234.0	30	709	426	266	156	87	56	18	8
214.	VITEBSK	234.0	300	5850	3343	2128	1232	709	426	145	57
215.	VLADIMIR	243.0	5	57	31	18	12	7	4	2	1
215.	VLADIMIR	243.0	10	135	74	45	30	15	11	4	2
215.	VLADIMIR	243.0	20	320	162	106	72	39	25	9	4
215.	VLADIMIR	243.0	30	737	442	277	162	90	58	18	8
215.	VLADIMIR	243.0	300	6075	3472	2209	1279	737	442	150	60
216.	VLADIVOSTOK	458.0	5	107	58	34	23	13	8	3	1
216.	VLADIVOSTOK	458.0	10	255	139	85	57	29	20	7	3
216.	VLADIVOSTOK	458.0	20	603	306	200	135	73	46	16	6
216.	VLADIVOSTOK	458.0	30	1388	933	521	306	170	109	34	15
216.	VLADIVOSTOK	458.0	300	11450	6543	4164	2411	1388	833	283	112
217.	VOLGOGRAD	856.0	5	199	107	63	42	24	15	5	2
217.	VOLGOGRAD	856.0	10	476	260	159	106	53	37	13	5
217.	VOLGOGRAD	856.0	20	1127	571	373	252	136	86	30	12
217.	VOLGOGRAD	856.0	30	2594	1557	973	571	317	204	63	28
217.	VOLGOGRAD	856.0	300	21400	12229	7782	4506	2594	1557	529	209
218.	VOLOGDA	195.0	5	46	25	15	10	6	4	1	1
218.	VOLOGDA	195.0	10	109	59	37	24	12	9	3	1
218.	VOLOGDA	195.0	20	257	130	85	58	31	20	7	3
218.	VOLOGDA	195.0	30	591	355	222	130	73	47	15	7
218.	VOLOGDA	195.0	300	4875	2786	1773	1027	591	355	121	48
219.	VOLZHSKIY	131.0	5	31	17	10	7	4	3	1	1
219.	VOLZHSKIY	131.0	10	73	40	25	17	8	6	2	1
219.	VOLZHSKIY	131.0	20	173	88	57	39	21	13	5	2
219.	VOLZHSKIY	131.0	30	397	239	149	88	49	32	10	5
219.	VOLZHSKIY	131.0	300	3275	1872	1191	690	397	239	81	32
220.	VORONEZH	70.4	5	17	9	6	4	2	2	1	1
220.	VORONEZH	70.4	10	40	22	13	9	5	3	1	1
220.	VORONEZH	70.4	20	93	47	31	21	12	7	3	1
220.	VORONEZH	70.4	30	214	128	80	47	26	17	6	3
220.	VORONEZH	70.4	300	1760	1006	640	371	214	128	44	18

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
221.	VOROSHILOVGR	408.0	5	95	51	30	20	12	7	3	1
221.	VOROSHILOVGR	408.0	10	227	124	76	51	26	18	6	3
221.	VOROSHILOVGR	408.0	20	537	272	178	120	65	41	15	6
221.	VOROSHILOVGR	408.0	30	1237	742	464	272	152	98	30	14
221.	VOROSHILOVGR	408.0	300	10200	5829	3709	2148	1237	742	252	100
222.	YAKUTSK	129.0	5	30	17	10	7	4	3	1	1
222.	YAKUTSK	129.0	10	72	39	24	16	8	6	2	1
222.	YAKUTSK	129.0	20	170	86	56	38	21	13	5	2
222.	YAKUTSK	129.0	30	391	235	147	86	48	31	10	5
222.	YAKUTSK	129.0	300	3225	1843	1173	679	391	235	80	32
223.	YALTA	70.0	5	17	9	6	4	2	2	1	1
223.	YALTA	70.0	10	39	22	13	9	5	3	1	1
223.	YALTA	70.0	20	93	47	31	21	12	7	3	1
223.	YALTA	70.0	30	213	128	80	47	26	17	6	3
223.	YALTA	70.0	300	1750	1000	637	369	213	128	44	17
224.	YAROSLAVL	574.0	5	134	72	43	28	16	10	3	2
224.	YAROSLAVL	574.0	10	319	174	107	71	36	25	9	4
224.	YAROSLAVL	574.0	20	756	383	250	169	92	58	20	8
224.	YAROSLAVL	574.0	30	1740	1044	653	383	213	137	43	19
224.	YAROSLAVL	574.0	300	14350	8200	5219	3021	1740	1044	355	140
225.	YELETS	10.4	5	3	2	1	1	1	1	0	0
225.	YELETS	10.4	10	6	4	2	2	1	1	1	0
225.	YELETS	10.4	20	14	7	5	3	2	1	1	1
225.	YELETS	10.4	30	32	19	12	7	4	3	1	1
225.	YELETS	10.4	300	260	149	95	55	32	19	7	3
226.	YEREVAN	89.9	5	21	12	7	5	3	2	1	1
226.	YEREVAN	89.9	10	50	28	17	11	6	4	2	1
226.	YEREVAN	89.9	20	119	60	39	27	15	9	4	2
226.	YEREVAN	89.9	30	273	164	103	60	34	22	7	3
226.	YEREVAN	89.9	300	2248	1285	818	474	273	164	56	22
227.	YOSHKAR-OLA	158.0	5	37	20	12	8	5	3	1	1
227.	YOSHKAR-OLA	158.0	10	86	48	30	20	10	7	3	1
227.	YOSHKAR-OLA	158.0	20	208	106	69	47	25	16	6	2
227.	YOSHKAR-OLA	158.0	30	479	288	180	106	59	38	12	5
227.	YOSHKAR-OLA	158.0	300	3950	2258	1437	832	479	288	98	39
228.	YUZHNO-SAKHA	120.0	5	28	15	9	6	4	2	1	1
228.	YUZHNO-SAKHA	120.0	10	67	37	23	15	8	5	2	1
228.	YUZHNO-SAKHA	120.0	20	158	80	53	36	19	12	5	2
228.	YUZHNO-SAKHA	120.0	30	364	219	137	80	45	29	9	4
228.	YUZHNO-SAKHA	120.0	300	3000	1715	1091	632	364	219	74	30
229.	ZAPOROZHYE	6860.0	5	1596	858	505	335	189	115	37	16
229.	ZAPOROZHYE	6860.0	10	3812	2079	1271	847	424	290	98	39
229.	ZAPOROZHYE	6860.0	20	9027	4574	2983	2018	1089	686	239	91
229.	ZAPOROZHYE	6860.0	30	20788	12473	7796	4574	2541	1634	505	222
229.	ZAPOROZHYE	6860.0	300	*****	98000	62364	36106	20788	12473	4235	1674
230.	ZHDANOV	443.0	5	103	56	33	22	13	8	3	1
230.	ZHDANOV	443.0	10	247	135	82	55	28	19	7	3
230.	ZHDANOV	443.0	20	583	296	193	131	71	45	16	6
230.	ZHDANOV	443.0	30	1343	806	504	296	164	106	33	15
230.	ZHDANOV	443.0	300	11075	6329	4028	2332	1343	806	274	108

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
231.	ZHITOMIR	162.0	5	38	21	12	8	5	3	1	1
231.	7HITOMIR	162.0	10	90	49	30	20	10	7	3	1
231.	ZHITOMIR	162.0	20	214	108	71	48	26	17	6	3
231.	ZHITOMIR	162.0	30	491	295	184	108	60	39	12	6
231.	ZHITOMIR	162.0	300	4050	2315	1473	853	491	295	100	40
232.	ZLATOUST	205.0	5	48	26	15	10	6	4	1	1
232.	ZLATOUST	205.0	10	114	63	38	26	13	9	3	2
232.	ZLATOUST	205.0	20	270	137	90	61	33	21	8	3
232.	ZLATOUST	205.0	30	622	373	233	137	76	49	15	7
232.	ZLATOUST	205.0	300	5125	2929	1864	1079	622	373	127	50

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
1.	AKRON	54.2	5	13	7	4	3	2	1	1	1
1.	AKRON	54.2	10	31	17	10	7	4	3	1	1
1.	AKRON	54.2	20	72	37	24	16	9	6	2	1
1.	AKRON	54.2	30	165	99	62	37	20	13	4	2
1.	AKRON	54.2	300	1355	775	493	286	165	99	34	14
2.	ALBANY	20.9	5	5	3	2	1	1	1	1	0
2.	ALBANY	20.9	10	12	7	4	3	2	1	1	1
2.	ALBANY	20.9	20	28	14	9	7	4	2	1	1
2.	ALBANY	20.9	30	64	38	24	14	8	5	2	1
2.	ALBANY	20.9	300	523	299	190	110	64	38	13	5
3.	ALBUQUERQUE	82.2	5	20	11	6	4	3	2	1	1
3.	ALBUQUERQUE	82.2	10	46	25	16	11	5	4	2	1
3.	ALBUQUERQUE	82.2	20	109	55	36	25	13	9	3	1
3.	ALBUQUERQUE	82.2	30	249	150	94	55	31	20	6	3
3.	ALBUQUERQUE	82.2	300	2055	1175	748	433	249	150	51	20
4.	ALEXANDRIA	14.7	5	4	2	1	1	1	1	0	0
4.	ALEXANDRIA	14.7	10	9	5	3	2	1	1	1	0
4.	ALEXANDRIA	14.7	20	20	10	7	5	3	2	1	1
4.	ALEXANDRIA	14.7	30	45	27	17	10	6	4	1	1
4.	ALEXANDRIA	14.7	300	368	210	134	78	45	27	9	4
5.	ALLENTOWN	17.8	5	5	3	2	1	1	1	0	0
5.	ALLENTOWN	17.8	10	10	6	4	3	1	1	1	0
5.	ALLENTOWN	17.8	20	24	12	8	6	3	2	1	1
5.	ALLENTOWN	17.8	30	54	33	21	12	7	5	2	1
5.	ALLENTOWN	17.8	300	445	255	162	94	54	33	11	5
6.	AMARILLO	60.7	5	15	8	5	3	2	1	1	1
6.	AMARILLO	60.7	10	34	19	12	8	4	3	1	1
6.	AMARILLO	60.7	20	80	41	27	18	10	6	3	1
6.	AMARILLO	60.7	30	184	111	69	41	23	15	5	2
6.	AMARILLO	60.7	300	1518	868	552	320	184	111	38	15
7.	ANAHEIM	33.3	5	8	5	3	2	1	1	1	0
7.	ANAHEIM	33.3	10	19	10	7	5	2	2	1	1
7.	ANAHEIM	33.3	20	44	23	15	10	6	4	2	1
7.	ANAHEIM	33.3	30	101	61	38	23	13	8	3	1
7.	ANAHEIM	33.3	300	833	476	303	176	101	61	21	9
8.	ATLANTA	131.5	5	31	17	10	7	4	3	1	1
8.	ATLANTA	131.5	10	73	40	25	17	9	6	2	1
8.	ATLANTA	131.5	20	173	88	58	39	21	14	5	2
8.	ATLANTA	131.5	30	399	239	150	88	49	32	10	5
8.	ATLANTA	131.5	300	3288	1879	1196	693	399	239	82	32
9.	AUSTIN	72.1	5	17	9	6	4	2	2	1	1
9.	AUSTIN	72.1	10	40	22	14	9	5	3	1	1
9.	AUSTIN	72.1	20	95	48	32	22	12	8	3	1
9.	AUSTIN	72.1	30	219	131	82	48	27	18	6	3
9.	AUSTIN	72.1	300	1803	1030	656	380	219	131	45	18
10.	BALTIMORE	78.3	5	19	10	6	4	3	2	1	1
10.	BALTIMORE	78.3	10	44	24	15	10	5	4	2	1
10.	BALTIMORE	78.3	20	103	53	34	23	13	8	3	1
10.	BALTIMORE	78.3	30	238	143	89	53	29	19	6	3
10.	BALTIMORE	78.3	300	1958	1119	712	413	238	143	49	19

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
11.	BATON ROUGE	40.4	5	10	5	3	2	2	1	1	0
11.	BATON ROUGE	40.4	10	23	13	8	5	3	2	1	1
11.	BATON ROUGE	40.4	20	54	27	18	12	7	4	2	1
11.	BATON ROUGE	40.4	30	123	74	46	27	15	10	3	2
11.	BATON ROUGE	40.4	300	1010	578	368	213	123	74	25	10
12.	BEAUMONT	71.6	5	17	9	6	4	2	2	1	1
12.	BEAUMONT	71.6	10	40	22	14	9	5	3	1	1
12.	BEAUMONT	71.6	20	95	48	32	21	12	8	3	1
12.	BEAUMONT	71.6	30	217	131	82	48	27	17	6	3
12.	BEAUMONT	71.6	300	1700	1023	651	377	217	131	45	18
13.	BERKELEY	10.6	5	3	2	1	1	1	1	0	0
13.	BERKELEY	10.6	10	6	4	2	2	1	1	1	0
13.	BERKELEY	10.6	20	14	7	5	4	2	1	1	1
13.	BERKELEY	10.6	30	33	20	12	7	4	3	1	1
13.	BERKELEY	10.6	300	265	152	97	56	33	20	7	3
14.	BIRMINGHAM	79.5	5	19	10	6	4	3	2	1	1
14.	BIRMINGHAM	79.5	10	45	24	15	10	5	4	2	1
14.	BIRMINGHAM	79.5	20	105	53	35	24	13	8	3	1
14.	BIRMINGHAM	79.5	30	241	145	91	53	30	19	6	3
14.	BIRMINGHAM	79.5	300	1988	1136	723	419	241	145	49	20
15.	BOSTON	46.0	5	11	6	4	3	2	1	1	1
15.	BOSTON	46.0	10	26	14	9	6	3	2	1	1
15.	BOSTON	46.0	20	61	31	20	14	8	5	2	1
15.	BOSTON	46.0	30	140	84	53	31	17	11	4	2
15.	BOSTON	46.0	300	1150	658	419	243	140	84	29	12
16.	BRIDGEPORT	16.1	5	4	2	2	1	1	1	0	0
16.	BRIDGEPORT	16.1	10	9	5	3	2	1	1	1	0
16.	BRIDGEPORT	16.1	20	22	11	7	5	3	2	1	1
16.	BRIDGEPORT	16.1	30	49	30	19	11	6	4	2	1
16.	BRIDGEPORT	16.1	300	403	230	147	85	49	30	10	4
17.	BUFFALO	41.3	5	10	6	3	2	2	1	1	0
17.	BUFFALO	41.3	10	23	13	8	5	3	2	1	1
17.	BUFFALO	41.3	20	55	28	18	13	7	5	2	1
17.	BUFFALO	41.3	30	126	75	47	28	16	10	3	2
17.	BUFFALO	41.3	300	1033	590	376	218	126	75	26	10
18.	CAMBRIDGE	6.2	5	2	1	1	1	1	1	0	0
18.	CAMBRIDGE	6.2	10	4	2	2	1	1	1	0	0
18.	CAMBRIDGE	6.2	20	9	5	3	2	1	1	1	0
18.	CAMBRIDGE	6.2	30	19	12	7	5	3	2	1	1
18.	CAMBRIDGE	6.2	300	155	89	57	33	19	12	4	2
19.	CAMDEN	9.0	5	2	2	1	1	1	1	0	0
19.	CAMDEN	9.0	10	5	3	2	2	1	1	1	0
19.	CAMDEN	9.0	20	12	6	4	3	2	1	1	1
19.	CAMDEN	9.0	30	28	17	11	6	4	3	1	1
19.	CAMDEN	9.0	300	225	129	82	48	28	17	6	3
20.	CANTON	19.0	5	5	3	2	1	1	1	1	0
20.	CANTON	19.0	10	11	6	4	3	2	1	1	1
20.	CANTON	19.0	20	25	13	9	6	3	2	1	1
20.	CANTON	19.0	30	58	35	22	13	7	5	2	1
20.	CANTON	19.0	300	475	272	173	100	58	35	12	5

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
21.	CEDAR RAPIDS	50.7	5	12	7	4	3	2	1	1	1
21.	CEDAR RAPIDS	50.7	10	29	16	10	7	4	3	1	1
21.	CEDAR RAPIDS	50.7	20	67	34	22	15	8	5	2	1
21.	CEDAR RAPIDS	50.7	30	154	93	58	34	19	12	4	2
21.	CEDAR RAPIDS	50.7	300	1268	725	461	267	154	93	32	13
22.	CHARLOTTE	76.0	5	18	10	6	4	2	2	1	1
22.	CHARLOTTE	76.0	10	43	23	14	10	5	4	1	1
22.	CHARLOTTE	76.0	20	100	51	33	23	12	8	3	1
22.	CHARLOTTE	76.0	30	231	139	87	51	29	18	6	3
22.	CHARLOTTE	76.0	300	1900	1086	691	400	231	139	47	19
23.	CHATTANOOGA	52.5	5	13	7	4	3	2	1	1	1
23.	CHATTANOOGA	52.5	10	30	16	10	7	4	3	1	1
23.	CHATTANOOGA	52.5	20	69	35	23	16	9	6	2	1
23.	CHATTANOOGA	52.5	30	159	96	60	35	20	13	4	2
23.	CHATTANOOGA	52.5	300	1313	750	478	277	159	96	33	13
24.	CHICAGO	222.6	5	52	28	17	11	7	4	2	1
24.	CHICAGO	222.6	10	124	68	42	28	14	10	4	2
24.	CHICAGO	222.6	20	293	149	97	66	36	23	8	3
24.	CHICAGO	222.6	30	675	405	253	149	83	53	17	8
24.	CHICAGO	222.6	300	5565	3180	2024	1172	675	405	138	55
25.	CINCINNATI	78.1	5	19	10	6	4	3	2	1	1
25.	CINCINNATI	78.1	10	44	24	15	10	5	4	2	1
25.	CINCINNATI	78.1	20	103	52	34	23	13	8	3	1
25.	CINCINNATI	78.1	30	237	142	89	52	29	19	6	3
25.	CINCINNATI	78.1	300	1953	1116	710	411	237	142	49	19
26.	CLEVELAND	75.9	5	18	10	6	4	2	2	1	1
26.	CLEVELAND	75.9	10	43	23	14	10	5	4	1	1
26.	CLEVELAND	75.9	20	100	51	33	23	12	8	3	1
26.	CLEVELAND	75.9	30	230	138	87	51	29	18	6	3
26.	CLEVELAND	75.9	300	1898	1085	690	400	230	138	47	19
27.	COLO.SPRINGS	60.8	5	15	8	5	3	2	1	1	1
27.	COLO.SPRINGS	60.8	10	34	19	12	8	4	3	1	1
27.	COLO.SPRINGS	60.8	20	80	41	27	18	10	6	3	1
27.	COLO.SPRINGS	60.8	30	185	111	69	41	23	15	5	2
27.	COLO.SPRINGS	60.8	300	1520	869	553	320	185	111	38	15
28.	COLUMBIA	106.2	5	25	14	8	6	3	2	1	1
28.	COLUMBIA	106.2	10	59	33	20	14	7	5	2	1
28.	COLUMBIA	106.2	20	140	71	47	32	17	11	4	2
28.	COLUMBIA	106.2	30	322	193	121	71	40	26	8	4
28.	COLUMBIA	106.2	300	2655	1518	966	559	322	193	66	26
29.	COLUMBUS	69.5	5	17	9	6	4	2	2	1	1
29.	COLUMBUS	69.5	10	39	21	13	9	5	3	1	1
29.	COLUMBUS	69.5	20	92	47	31	21	11	7	3	1
29.	COLUMBUS	69.5	30	211	127	79	47	26	17	6	3
29.	COLUMBUS	69.5	300	1738	993	632	366	211	127	43	17
30.	COLUMBUS	134.6	5	32	17	10	7	4	3	1	1
30.	COLUMBUS	134.6	10	75	41	25	17	9	6	2	1
30.	COLUMBUS	134.6	20	178	90	59	40	22	14	5	2
30.	COLUMBUS	134.6	30	408	245	153	90	50	32	10	5
30.	COLUMBUS	134.6	300	3365	1923	1224	709	408	245	83	33

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
31.	CORPUS CHRIS	100.6	5	24	13	8	5	3	2	1	1
31.	CORPUS CHRIS	100.6	10	56	31	19	13	7	5	2	1
31.	CORPUS CHRIS	100.6	20	133	67	44	30	16	10	4	2
31.	CORPUS CHRIS	100.6	30	305	183	115	67	38	24	8	4
31.	CORPUS CHRIS	100.6	300	2515	1438	915	530	305	183	62	25
32.	DALLAS	265.6	5	62	34	20	13	8	5	2	1
32.	DALLAS	265.6	10	148	81	50	33	17	12	4	2
32.	DALLAS	265.6	20	350	177	116	79	43	27	10	4
32.	DALLAS	265.6	30	805	483	302	177	99	64	20	9
32.	DALLAS	265.6	300	6640	3795	2415	1398	805	483	164	65
33.	DAYTON	38.3	5	9	5	3	2	1	1	1	0
33.	DAYTON	38.3	10	22	12	7	5	3	2	1	1
33.	DAYTON	38.3	20	51	26	17	12	6	4	2	1
33.	DAYTON	38.3	30	116	70	44	26	15	10	3	2
33.	DAYTON	38.3	300	958	548	349	202	116	70	24	10
34.	DEARBORN	24.5	5	6	3	2	2	1	1	1	0
34.	DEARBORN	24.5	10	14	8	5	3	2	1	1	1
34.	DEARBORN	24.5	20	33	17	11	8	4	3	1	1
34.	DEARBORN	24.5	30	75	45	28	17	9	6	2	1
34.	DEARBORN	24.5	300	613	350	223	129	75	45	16	6
35.	DENVER	95.2	5	23	12	7	5	3	2	1	1
35.	DENVER	95.2	10	53	29	18	12	6	4	2	1
35.	DENVER	95.2	20	126	64	42	28	16	10	4	2
35.	DENVER	95.2	30	289	173	109	64	36	23	7	3
35.	DENVER	95.2	300	2380	1360	866	501	289	173	59	24
36.	DES MOINES	63.2	5	15	8	5	3	2	1	1	1
36.	DES MOINES	63.2	10	36	20	12	8	4	3	1	1
36.	DES MOINES	63.2	20	84	43	28	19	10	7	3	1
36.	DES MOINES	63.2	30	192	115	72	43	24	15	5	2
36.	DES MOINES	63.2	300	1580	903	575	333	192	115	39	16
37.	DETROIT	138.0	5	32	18	11	7	4	3	1	1
37.	DETROIT	138.0	10	77	42	26	17	9	6	2	1
37.	DETROIT	138.0	20	182	92	60	41	22	14	5	2
37.	DETROIT	138.0	30	419	251	157	92	52	33	11	5
37.	DETROIT	138.0	300	3450	1972	1255	727	419	251	86	34
38.	DULUTH	67.3	5	16	9	5	4	2	2	1	1
38.	DULUTH	67.3	10	38	21	13	9	5	3	1	1
38.	DULUTH	67.3	20	89	45	30	20	11	7	3	1
38.	DULUTH	67.3	30	204	123	77	45	25	16	5	3
38.	DULUTH	67.3	300	1683	962	612	355	204	123	42	17
39.	ELIZABETH	11.7	5	3	2	1	1	1	1	0	0
39.	ELIZABETH	11.7	10	7	4	3	2	1	1	1	0
39.	ELIZABETH	11.7	20	16	8	5	4	2	2	1	1
39.	ELIZABETH	11.7	30	36	22	14	8	5	3	1	1
39.	ELIZABETH	11.7	300	293	168	107	62	36	22	8	3
40.	EL PASO	118.3	5	28	15	9	6	4	2	1	1
40.	EL PASO	118.3	10	66	36	22	15	8	5	2	1
40.	EL PASO	118.3	20	156	79	52	35	19	12	5	2
40.	EL PASO	118.3	30	359	215	135	79	44	29	9	4
40.	EL PASO	118.3	300	2958	1690	1076	623	359	215	73	29

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
41.	ERIE	18.9	5	5	3	2	1	1	1	0	0
41.	ERIE	18.9	10	11	6	4	3	2	1	1	1
41.	ERIE	18.9	20	25	13	9	6	3	2	1	1
41.	ERIE	18.9	30	58	35	22	13	7	5	2	1
41.	ERIE	18.9	300	473	270	172	100	58	35	12	5
42.	EVANSVILLE	36.0	5	9	5	3	2	1	1	1	0
42.	EVANSVILLE	36.0	10	20	11	7	5	3	2	1	1
42.	EVANSVILLE	36.0	20	48	24	16	11	6	4	2	1
42.	EVANSVILLE	36.0	30	109	66	41	24	14	9	3	2
42.	EVANSVILLE	36.0	300	900	515	328	190	109	66	23	9
43.	FLINT	32.8	5	8	4	3	2	1	1	1	0
43.	FLINT	32.8	10	19	10	6	4	2	2	1	1
43.	FLINT	32.8	20	44	22	15	10	6	4	2	1
43.	FLINT	32.8	30	100	60	38	22	13	8	3	1
43.	FLINT	32.8	300	820	469	299	173	100	60	21	8
44.	FORT LAUDERD	29.6	5	7	4	3	2	1	1	1	0
44.	FORT LAUDERD	29.6	10	17	9	6	4	2	2	1	1
44.	FORT LAUDERD	29.6	20	39	20	13	9	5	3	1	1
44.	FORT LAUDERD	29.6	30	90	54	34	20	11	7	3	1
44.	FORT LAUDERD	29.6	300	740	423	269	156	90	54	19	8
45.	FORT WAYNE	51.5	5	12	7	4	3	2	1	1	1
45.	FORT WAYNE	51.5	10	29	16	10	7	4	3	1	1
45.	FORT WAYNE	51.5	20	68	35	23	16	9	6	2	1
45.	FORT WAYNE	51.5	30	156	94	59	35	19	13	4	2
45.	FORT WAYNE	51.5	300	1288	736	469	271	156	94	32	13
46.	FORT WORTH	205.0	5	48	26	15	10	6	4	1	1
46.	FORT WORTH	205.0	10	114	63	38	26	13	9	3	2
46.	FORT WORTH	205.0	20	270	137	90	61	33	21	8	3
46.	FORT WORTH	205.0	30	622	373	233	137	76	49	15	7
46.	FORT WORTH	205.0	300	5125	2929	1864	1079	622	373	127	50
47.	FREMONT	84.3	5	20	11	7	5	3	2	1	1
47.	FREMONT	84.3	10	47	26	16	11	6	4	2	1
47.	FREMONT	84.3	20	111	57	37	25	14	9	3	2
47.	FREMONT	84.3	30	256	154	96	57	32	20	7	3
47.	FREMONT	84.3	300	2108	1205	767	444	256	154	52	21
48.	FRESNO	41.8	5	10	6	3	2	2	1	1	0
48.	FRESNO	41.8	10	24	13	8	6	3	2	1	1
48.	FRESNO	41.8	20	55	28	19	13	7	5	2	1
48.	FRESNO	41.8	30	127	76	46	28	16	10	3	2
48.	FRESNO	41.8	300	1045	598	380	220	127	76	26	11
49.	GARDEN GROVE	17.4	5	4	3	2	1	1	1	0	0
49.	GARDEN GROVE	17.4	10	10	6	4	3	1	1	1	0
49.	GARDEN GROVE	17.4	20	23	12	8	6	3	2	1	1
49.	GARDEN GROVE	17.4	30	53	32	20	12	7	5	2	1
49.	GARDEN GROVE	17.4	300	435	249	159	92	53	32	11	5
50.	GARY	42.0	5	10	6	3	2	2	1	1	0
50.	GARY	42.0	10	24	13	8	6	3	2	1	1
50.	GARY	42.0	20	56	28	19	13	7	5	2	1
50.	GARY	42.0	30	128	77	48	28	16	10	3	2
50.	GARY	42.0	300	1050	600	382	221	128	77	26	11

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
51.	GLENDALE	29.4	5	7	4	3	2	1	1	1	0
51.	GLENDALE	29.4	10	17	9	6	4	2	2	1	1
51.	GLENDALE	29.4	20	39	20	13	9	5	3	1	1
51.	GLENDALE	29.4	30	89	54	34	20	11	7	3	1
51.	GLENDALE	29.4	300	735	420	268	155	89	54	19	8
52.	GRAND RAPIDS	44.9	5	11	6	4	3	2	1	1	1
52.	GRAND RAPIDS	44.9	10	25	14	9	6	3	2	1	1
52.	GRAND RAPIDS	44.9	20	59	30	20	14	8	5	2	1
52.	GRAND RAPIDS	44.9	30	136	82	51	30	17	11	4	2
52.	GRAND RAPIDS	44.9	300	1123	642	409	237	136	82	28	11
53.	GREENSBORO	54.4	5	13	7	4	3	2	1	1	1
53.	GREENSBORO	54.4	10	31	17	10	7	4	3	1	1
53.	GREENSBORO	54.4	20	72	37	24	16	9	6	2	1
53.	GREENSBORO	54.4	30	165	99	62	37	21	13	4	2
53.	GREENSBORO	54.4	300	1360	778	495	287	165	99	34	14
54.	HAMMOND	24.1	5	6	3	2	2	1	1	1	0
54.	HAMMOND	24.1	10	14	8	5	3	2	1	1	1
54.	HAMMOND	24.1	20	32	16	11	7	4	3	1	1
54.	HAMMOND	24.1	30	73	44	28	16	9	6	2	1
54.	HAMMOND	24.1	300	603	345	219	127	73	44	15	6
55.	HAMPTON	54.7	5	13	7	4	3	2	1	1	1
55.	HAMPTON	54.7	10	31	17	11	7	4	3	1	1
55.	HAMPTON	54.7	20	72	37	24	16	9	6	2	1
55.	HAMPTON	54.7	30	166	100	63	37	21	13	4	2
55.	HAMPTON	54.7	300	1368	782	498	288	166	100	34	14
56.	HARTFORD	17.4	5	4	3	2	1	1	1	0	0
56.	HARTFORD	17.4	10	10	6	4	3	1	1	1	0
56.	HARTFORD	17.4	20	23	12	8	6	3	2	1	1
56.	HARTFORD	17.4	30	53	32	20	12	7	5	2	1
56.	HARTFORD	17.4	300	435	249	159	92	53	32	11	5
57.	HIALEAH	20.0	5	5	3	2	1	1	1	1	0
57.	HIALEAH	20.0	10	12	6	4	3	2	1	1	1
57.	HIALEAH	20.0	20	27	14	9	6	4	2	1	1
57.	HIALEAH	20.0	30	61	37	23	14	8	5	2	1
57.	HIALEAH	20.0	300	500	286	182	106	61	37	13	5
58.	HOLLYWOOD	25.1	5	6	4	2	2	1	1	1	0
58.	HOLLYWOOD	25.1	10	14	8	5	3	2	1	1	1
58.	HOLLYWOOD	25.1	20	33	17	11	8	4	3	1	1
58.	HOLLYWOOD	25.1	30	76	46	29	17	10	6	2	1
58.	HOLLYWOOD	25.1	300	628	359	229	133	76	46	16	7
59.	HONOLULU	83.9	5	20	11	7	4	3	2	1	1
59.	HONOLULU	83.9	10	47	26	16	11	6	4	2	1
59.	HONOLULU	83.9	20	111	56	37	25	14	9	3	2
59.	HONOLULU	83.9	30	255	153	96	56	31	20	7	3
59.	HONOLULU	83.9	300	2098	1199	763	442	255	153	52	21
60.	HOUSTON	433.9	5	101	55	32	22	12	8	3	1
60.	HOUSTON	433.9	10	241	132	81	54	27	19	7	3
60.	HOUSTON	433.9	20	571	290	189	128	69	44	15	6
60.	HOUSTON	433.9	30	1315	789	493	290	161	104	32	14
60.	HOUSTON	433.9	300	10848	6199	3945	2284	1315	789	268	106

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
61.	HUNGTINTON B	26.6	5	7	4	2	2	1	1	1	0
61.	HUNGTINTON B	26.6	10	15	8	5	4	2	2	1	1
61.	HUNGTINTON B	26.6	20	35	18	12	8	5	3	1	1
61.	HUNGTINTON B	26.6	30	81	49	31	18	10	7	2	1
61.	HUNGTINTON B	26.6	300	665	380	242	140	81	49	17	7
62.	HUNTSVILLE	109.1	5	26	14	8	6	3	2	1	1
62.	HUNTSVILLE	109.1	10	61	33	21	14	7	5	2	1
62.	HUNTSVILLE	109.1	20	144	73	48	32	18	11	4	2
62.	HUNTSVILLE	109.1	30	331	199	124	73	41	26	8	4
62.	HUNTSVILLE	109.1	300	2728	1559	992	575	331	199	68	27
63.	INDEPENDENCE	47.8	5	12	6	4	3	2	1	1	1
63.	INDEPENDENCE	47.8	10	27	15	9	6	3	2	1	1
63.	INDEPENDENCE	47.8	20	63	32	21	14	8	5	2	1
63.	INDEPENDENCE	47.8	30	145	87	55	32	18	12	4	2
63.	INDEPENDENCE	47.8	300	1195	683	435	252	145	87	30	12
64.	INDIANAPOLIS	379.4	5	89	48	28	19	11	7	2	1
64.	INDIANAPOLIS	379.4	10	211	115	71	47	24	16	6	3
64.	INDIANAPOLIS	379.4	20	500	253	165	112	61	38	14	5
64.	INDIANAPOLIS	379.4	30	1150	690	432	253	141	91	28	13
64.	INDIANAPOLIS	379.4	300	9485	5420	3449	1997	1150	690	235	93
65.	JACKSON	50.2	5	12	7	4	3	2	1	1	1
65.	JACKSON	50.2	10	28	16	10	7	3	3	1	1
65.	JACKSON	50.2	20	66	34	22	15	8	5	2	1
65.	JACKSON	50.2	30	153	92	57	34	19	12	4	2
65.	JACKSON	50.2	300	1255	718	457	265	153	92	31	13
66.	JACKSONVILLE	766.0	5	179	96	57	38	21	13	4	2
66.	JACKSONVILLE	766.0	10	426	233	142	95	48	33	11	5
66.	JACKSONVILLE	766.0	20	1008	511	333	226	122	77	27	10
66.	JACKSONVILLE	766.0	30	2322	1393	871	511	284	183	57	25
66.	JACKSONVILLE	766.0	300	19150	10943	6964	4032	2322	1393	473	187
67.	JERSEY CITY	15.1	5	4	2	2	1	1	1	0	0
67.	JERSEY CITY	15.1	10	9	5	3	2	1	1	1	0
67.	JERSEY CITY	15.1	20	20	10	7	5	3	2	1	1
67.	JERSEY CITY	15.1	30	45	28	18	10	6	4	2	1
67.	JERSEY CITY	15.1	300	378	216	138	80	46	28	10	4
68.	KANSAS CITY	56.8	5	14	7	5	3	2	1	1	1
68.	KANSAS CITY	56.8	10	32	18	11	7	4	3	1	1
68.	KANSAS CITY	56.8	20	75	38	25	17	9	6	2	1
68.	KANSAS CITY	56.8	30	173	104	65	38	21	14	5	2
68.	KANSAS CITY	56.8	300	1420	812	517	299	173	104	35	14
69.	KANSAS CITY	316.3	5	74	40	24	16	9	6	2	1
69.	KANSAS CITY	316.3	10	176	96	59	39	20	14	5	2
69.	KANSAS CITY	316.3	20	417	211	138	93	51	32	11	5
69.	KANSAS CITY	316.3	30	959	575	360	211	118	76	24	11
69.	KANSAS CITY	316.3	300	7908	4519	2876	1665	959	575	196	78
70.	KNOXVILLE	77.0	5	18	10	6	4	3	2	1	1
70.	KNOXVILLE	77.0	10	43	24	15	10	5	4	1	1
70.	KNOXVILLE	77.0	20	102	52	34	23	13	8	3	1
70.	KNOXVILLE	77.0	30	234	140	88	52	29	19	6	3
70.	KNOXVILLE	77.0	300	1925	1100	700	406	234	140	48	19

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
71.	LANSING	33.4	5	8	5	3	2	1	1	1	0
71.	LANSING	33.4	10	19	11	7	5	2	2	1	1
71.	LANSING	33.4	20	44	23	15	10	6	4	2	1
71.	LANSING	33.4	30	102	61	38	23	13	8	3	1
71.	LANSING	33.4	300	835	478	304	176	102	61	21	9
72.	LAS VEGAS	51.6	5	12	7	4	3	2	1	1	1
72.	LAS VEGAS	51.6	10	29	16	10	7	4	3	1	1
72.	LAS VEGAS	51.6	20	68	35	23	16	9	6	2	1
72.	LAS VEGAS	51.6	30	157	94	59	35	20	13	4	2
72.	LAS VEGAS	51.6	300	1290	738	469	272	157	94	32	13
73.	LEXINGTON	23.0	5	6	3	2	2	1	1	1	0
73.	LEXINGTON	23.0	10	13	7	5	3	2	1	1	1
73.	LEXINGTON	23.0	20	31	16	10	7	4	3	1	1
73.	LEXINGTON	23.0	30	70	42	27	16	9	6	2	1
73.	LEXINGTON	23.0	300	575	329	209	121	70	42	15	6
74.	LINCOLN	49.3	5	12	7	4	3	2	1	1	1
74.	LINCOLN	49.3	10	28	15	10	6	3	2	1	1
74.	LINCOLN	49.3	20	65	33	22	15	8	5	2	1
74.	LINCOLN	49.3	30	150	90	56	33	19	12	4	2
74.	LINCOLN	49.3	300	1233	705	449	260	150	90	31	12
75.	LITTLE ROCK	52.8	5	13	7	4	3	2	1	1	1
75.	LITTLE ROCK	52.8	10	30	16	10	7	4	3	1	1
75.	LITTLE ROCK	52.8	20	70	36	23	16	9	6	2	1
75.	LITTLE ROCK	52.8	30	160	96	60	36	20	13	4	2
75.	LITTLE ROCK	52.8	300	1320	755	480	278	160	96	33	13
76.	LIVONIA	36.1	5	9	5	3	2	1	1	1	0
76.	LIVONIA	36.1	10	20	11	7	5	3	2	1	1
76.	LIVONIA	36.1	20	48	24	16	11	6	4	2	1
76.	LIVONIA	36.1	30	110	66	41	24	14	9	3	2
76.	LIVONIA	36.1	300	903	516	329	190	110	66	23	9
77.	LONG BEACH	48.7	5	12	6	4	3	2	1	1	1
77.	LONG BEACH	48.7	10	27	15	9	6	3	2	1	1
77.	LONG BEACH	48.7	20	64	33	22	15	8	5	2	1
77.	LONG BEACH	48.7	30	148	89	56	33	18	12	4	2
77.	LONG BEACH	48.7	300	1218	696	443	257	148	89	30	12
78.	LOS ANGELES	463.7	5	106	58	34	23	13	8	3	1
78.	LOS ANGELES	463.7	10	258	141	86	58	29	20	7	3
78.	LOS ANGELES	463.7	20	611	310	202	137	74	47	17	7
78.	LOS ANGELES	463.7	30	1406	843	527	310	172	111	34	15
78.	LOS ANGELES	463.7	300	11593	6625	4216	2441	1406	843	287	113
79.	LOUISVILLE	60.0	5	14	8	5	3	2	1	1	1
79.	LOUISVILLE	60.0	10	34	19	12	8	4	3	1	1
79.	LOUISVILLE	60.0	20	79	40	26	18	10	6	2	1
79.	LOUISVILLE	60.0	30	182	109	69	40	23	15	5	2
79.	LOUISVILLE	60.0	300	1500	858	546	316	182	109	37	15
80.	LUBBOCK	75.7	5	18	10	6	4	2	2	1	1
80.	LUBBOCK	75.7	10	42	23	14	10	5	4	1	1
80.	LUBBOCK	75.7	20	100	51	33	23	12	8	3	1
80.	LUBBOCK	75.7	30	230	138	86	51	28	18	6	3
80.	LUBBOCK	75.7	300	1893	1082	689	399	230	138	47	19

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
81.	MACON	49.0	5	12	7	4	3	2	1	1	1
81.	MACON	49.0	10	28	15	9	6	3	2	1	1
81.	MACON	49.0	20	65	33	22	15	8	5	2	1
81.	MACON	49.0	30	149	89	56	33	19	12	4	2
81.	MACON	49.0	300	1225	700	446	258	149	89	31	12
82.	MADISON	48.5	5	12	6	4	3	2	1	1	1
82.	MADISON	48.5	10	27	15	9	6	3	2	1	1
82.	MADISON	48.5	20	64	33	21	15	8	5	2	1
82.	MADISON	48.5	30	147	89	56	33	18	12	4	2
82.	MADISON	48.5	300	1213	693	441	256	147	89	30	12
83.	MEMPHIS	217.4	5	51	28	16	11	6	4	2	1
83.	MEMPHIS	217.4	10	121	66	41	27	14	10	3	2
83.	MEMPHIS	217.4	20	286	145	95	64	35	22	8	3
83.	MEMPHIS	217.4	30	659	396	247	145	81	52	16	7
83.	MEMPHIS	217.4	300	5435	3106	1977	1145	659	396	135	53
84.	MIAMI	34.3	5	8	5	3	2	1	1	1	0
84.	MIAMI	34.3	10	19	11	7	5	3	2	1	1
84.	MIAMI	34.3	20	46	23	15	10	6	4	2	1
84.	MIAMI	34.3	30	104	63	39	23	13	9	3	2
84.	MIAMI	34.3	300	858	490	312	181	104	63	22	9
85.	MILWAUKEEE	95.0	5	22	12	7	5	3	2	1	1
85.	MILWAUKEEE	95.0	10	53	29	18	12	6	4	2	1
85.	MILWAUKEEE	95.0	20	125	64	42	28	15	10	4	2
85.	MILWAUKEEE	95.0	30	288	173	108	64	36	23	7	3
85.	MILWAUKEEE	95.0	300	2375	1358	864	500	288	173	59	24
86.	MINNEAPOLIS	55.1	5	13	7	4	3	2	1	1	1
86.	MINNEAPOLIS	55.1	10	31	17	11	7	4	3	1	1
86.	MINNEAPOLIS	55.1	20	73	37	24	17	9	6	2	1
86.	MINNEAPOLIS	55.1	30	167	101	63	37	21	14	4	2
86.	MINNEAPOLIS	55.1	300	1378	788	501	290	167	101	34	14
87.	MOBILE	116.6	5	28	15	9	6	4	2	1	1
87.	MOBILE	116.6	10	65	36	22	15	8	5	2	1
87.	MOBILE	116.6	20	154	78	51	35	19	12	4	2
87.	MOBILE	116.6	30	354	212	133	78	44	28	9	4
87.	MOBILE	116.6	300	2915	1666	1060	614	354	212	72	29
88.	MONTGOMERY	46.4	5	11	6	4	3	2	1	1	1
88.	MONTGOMERY	46.4	10	26	14	9	6	3	2	1	1
88.	MONTGOMERY	46.4	20	61	31	21	14	8	5	2	1
88.	MONTGOMERY	46.4	30	141	85	53	31	18	11	4	2
88.	MONTGOMERY	46.4	300	1160	663	422	245	141	85	29	12
89.	NASHVILLE-DA	507.8	5	118	64	38	25	14	9	3	2
89.	NASHVILLE-DA	507.8	10	283	154	94	63	32	22	8	3
89.	NASHVILLE-DA	507.8	20	669	339	221	150	81	51	18	7
89.	NASHVILLE-DA	507.8	30	1539	924	577	339	188	121	38	17
89.	NASHVILLE-DA	507.8	300	12695	7255	4617	2673	1539	924	314	124
90.	NEW BEDFORD	19.5	5	5	3	2	1	1	1	1	0
90.	NEW BEDFORD	19.5	10	11	6	4	3	2	1	1	1
90.	NEW BEDFORD	19.5	20	26	13	9	6	3	2	1	1
90.	NEW BEDFORD	19.5	30	59	36	23	13	8	5	2	1
90.	NEW BEDFORD	19.5	300	488	279	178	103	59	36	12	5

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
91.	NEW HAVEN	18.4	5	5	3	2	1	1	1	0	0
91.	NEW HAVEN	18.4	10	11	6	4	3	2	1	1	1
91.	NEW HAVEN	18.4	20	25	13	8	6	3	2	1	1
91.	NEW HAVEN	18.4	30	56	34	21	13	7	5	2	1
91.	NEW HAVEN	18.4	300	460	263	168	97	56	34	12	5
92.	NEW ORLEANS	197.1	5	46	25	15	10	6	4	1	1
92.	NEW ORLEANS	197.1	10	110	60	37	25	13	9	3	1
92.	NEW ORLEANS	197.1	20	260	132	86	58	32	20	7	3
92.	NEW ORLEANS	197.1	30	598	359	224	132	73	47	15	7
92.	NEW ORLEANS	197.1	300	4928	2816	1792	1038	598	359	122	48
93.	NEW YORK	299.7	5	70	38	22	15	9	5	2	1
93.	NEW YORK	299.7	10	167	91	56	37	19	13	5	2
93.	NEW YORK	299.7	20	395	200	131	89	48	30	11	4
93.	NEW YORK	299.7	30	909	545	341	200	111	72	22	10
93.	NEW YORK	299.7	300	7493	4282	2725	1578	909	545	185	73
94.	NEWARK	23.5	5	6	3	2	2	1	1	1	0
94.	NEWARK	23.5	10	13	8	5	3	2	1	1	1
94.	NEWARK	23.5	20	31	16	11	7	4	3	1	1
94.	NEWARK	23.5	30	72	43	27	16	9	6	2	1
94.	NEWARK	23.5	300	588	336	214	124	72	43	15	6
95.	NEWPORT	69.1	5	16	9	5	4	2	2	1	1
95.	NEWPORT	69.1	10	39	21	13	9	5	3	1	1
95.	NEWPORT	69.1	20	91	46	30	21	11	7	3	1
95.	NEWPORT	69.1	30	210	126	79	46	26	17	5	3
95.	NEWPORT	69.1	300	1728	988	629	364	210	126	43	17
96.	NORFOLK	52.6	5	13	7	4	3	2	1	1	1
96.	NORFOLK	52.6	10	30	16	10	7	4	3	1	1
96.	NORFOLK	52.6	20	70	35	23	16	9	6	2	1
96.	NORFOLK	52.6	30	160	96	60	35	20	13	4	2
96.	NORFOLK	52.6	300	1315	752	479	277	160	96	33	13
97.	OAKLAND	53.4	5	13	7	4	3	2	1	1	1
97.	OAKLAND	53.4	10	30	17	10	7	4	3	1	1
97.	OAKLAND	53.4	20	71	36	24	16	9	6	2	1
97.	OAKLAND	53.4	30	162	97	61	36	20	13	4	2
97.	OAKLAND	53.4	300	1335	763	486	281	162	97	33	13
98.	OKLAHOMA CIT	635.7	5	148	80	47	31	18	11	4	2
98.	OKLAHOMA CIT	635.7	10	354	193	118	79	40	27	9	4
98.	OKLAHOMA CIT	635.7	20	837	424	277	187	101	64	22	9
98.	OKLAHOMA CIT	635.7	30	1927	1156	723	424	236	152	47	21
98.	OKLAHOMA CIT	635.7	300	15893	9082	5779	3346	1927	1156	393	155
99.	OMAHA	76.6	5	18	10	6	4	3	2	1	1
99.	OMAHA	76.6	10	43	24	15	10	5	4	1	1
99.	OMAHA	76.6	20	101	51	34	23	13	8	3	1
99.	OMAHA	76.6	30	233	140	87	51	29	19	6	3
99.	OMAHA	76.6	300	1915	1095	697	404	233	140	48	19
100.	PARMA	20.8	5	5	3	2	1	1	1	1	0
100.	PARMA	20.8	10	12	7	4	3	2	1	1	1
100.	PARMA	20.8	20	28	14	9	7	4	2	1	1
100.	PARMA	20.8	30	63	38	24	14	8	5	2	1
100.	PARMA	20.8	300	520	298	189	110	63	38	13	5

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
101.	PASADENA	22.7	5	6	3	2	2	1	1	1	0
101.	PASADENA	22.7	10	13	7	5	3	2	1	1	1
101.	PASADENA	22.7	20	30	16	10	7	4	3	1	1
101.	PASADENA	22.7	30	69	42	26	16	9	6	2	1
101.	PASADENA	22.7	300	568	325	207	120	69	42	14	6
102.	PATERSON	8.4	5	2	1	1	1	1	1	0	0
102.	PATERSON	8.4	10	5	3	2	1	1	1	1	0
102.	PATERSON	8.4	20	11	6	4	3	2	1	1	1
102.	PATERSON	8.4	30	26	16	10	6	4	2	1	1
102.	PATERSON	8.4	300	210	120	77	45	26	16	6	2
103.	PEORIA	37.4	5	9	5	3	2	1	1	1	0
103.	PEORIA	37.4	10	21	12	7	5	3	2	1	1
103.	PEORIA	37.4	20	50	25	17	11	6	4	2	1
103.	PEORIA	37.4	30	114	68	43	25	14	9	3	2
103.	PEORIA	37.4	300	935	535	340	197	114	68	23	10
104.	PHILADELPHIA	128.5	5	30	16	10	7	4	3	1	1
104.	PHILADELPHIA	128.5	10	72	39	24	16	8	6	2	1
104.	PHILADELPHIA	128.5	20	169	86	56	38	21	13	5	2
104.	PHILADELPHIA	128.5	30	390	234	146	86	48	31	10	5
104.	PHILADELPHIA	128.5	300	3213	1836	1169	677	390	234	80	32
105.	PHOENIX	247.9	5	58	31	19	12	7	5	2	1
105.	PHOENIX	247.9	10	138	76	46	31	16	11	4	2
105.	PHOENIX	247.9	20	327	166	108	73	40	25	9	4
105.	PHOENIX	247.9	30	752	451	282	166	92	59	19	8
105.	PHOENIX	247.9	300	6198	3542	2254	1305	752	451	153	61
106.	PITTSBURG	55.2	5	13	7	4	3	2	1	1	1
106.	PITTSBURG	55.2	10	31	17	11	7	4	3	1	1
106.	PITTSBURG	55.2	20	73	37	24	17	9	6	2	1
106.	PITTSBURG	55.2	30	168	101	63	37	21	14	4	2
106.	PITTSBURG	55.2	300	1380	789	502	291	168	101	34	14
107.	PORTLAND	89.1	5	21	12	7	5	3	2	1	1
107.	PORTLAND	89.1	10	50	27	17	11	6	4	2	1
107.	PORTLAND	89.1	20	118	60	39	27	15	9	3	2
107.	PORTLAND	89.1	30	270	162	102	60	33	22	7	3
107.	PORTLAND	89.1	300	2228	1273	810	469	270	162	55	22
108.	PORTSMOUTH	29.0	5	7	4	3	2	1	1	1	0
108.	PORTSMOUTH	29.0	10	17	9	6	4	2	2	1	1
108.	PORTSMOUTH	29.0	20	39	20	13	9	5	3	1	1
108.	PORTSMOUTH	29.0	30	88	53	33	20	11	7	3	1
108.	PORTSMOUTH	29.0	300	725	415	264	153	88	53	18	7
109.	PROVIDENCE	18.1	5	5	3	2	1	1	1	0	0
109.	PROVIDENCE	18.1	10	10	6	4	3	2	1	1	1
109.	PROVIDENCE	18.1	20	24	12	8	6	3	2	1	1
109.	PROVIDENCE	18.1	30	55	33	21	12	7	5	2	1
109.	PROVIDENCE	18.1	300	453	259	165	96	55	33	12	5
110.	RALEIGH	44.9	5	11	6	4	3	2	1	1	1
110.	RALEIGH	44.9	10	25	14	9	6	3	2	1	1
110.	RALEIGH	44.9	20	59	30	20	14	8	5	2	1
110.	RALEIGH	44.9	30	136	82	51	30	17	11	4	2
110.	RALEIGH	44.9	300	1123	642	409	237	136	82	28	11

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
111.	RICHMOND	60.3	5	14	8	5	3	2	1	1	1
111.	RICHMOND	60.3	10	34	19	12	8	4	3	1	1
111.	RICHMOND	60.3	20	80	41	27	18	10	6	2	1
111.	RICHMOND	60.3	30	183	110	69	41	23	15	5	2
111.	RICHMOND	60.3	300	1508	862	549	318	183	110	38	15
112.	RIVERSIDE	71.5	5	17	9	6	4	2	2	1	1
112.	RIVERSIDE	71.5	10	40	22	14	9	5	3	1	1
112.	RIVERSIDE	71.5	20	94	48	31	21	12	8	3	1
112.	RIVERSIDE	71.5	30	217	130	82	48	27	17	6	3
112.	RIVERSIDE	71.5	300	1788	1022	650	377	217	130	45	18
113.	ROCHESTER	36.7	5	9	5	3	2	1	1	1	0
113.	ROCHESTER	36.7	10	21	12	7	5	3	2	1	1
113.	ROCHESTER	36.7	20	49	25	16	11	6	4	2	1
113.	ROCHESTER	36.7	30	112	67	42	25	14	9	3	2
113.	ROCHESTER	36.7	300	918	525	334	194	112	67	23	9
114.	ROCKFORD	34.2	5	8	5	3	2	1	1	1	0
114.	ROCKFORD	34.2	10	19	11	7	5	3	2	1	1
114.	ROCKFORD	34.2	20	45	23	15	10	6	4	2	1
114.	ROCKFORD	34.2	30	104	63	39	23	13	9	3	2
114.	ROCKFORD	34.2	300	855	489	311	180	104	63	22	9
115.	SACRAMENTO	93.8	5	22	12	7	5	3	2	1	1
115.	SACRAMENTO	93.8	10	53	29	18	12	6	4	2	1
115.	SACRAMENTO	93.8	20	124	63	41	28	15	10	4	2
115.	SACRAMENTO	93.8	30	285	171	107	63	35	23	7	3
115.	SACRAMENTO	93.8	300	2345	1340	853	494	285	171	58	23
116.	ST.LOUIS	61.2	5	15	8	5	3	2	1	1	1
116.	ST.LOUIS	61.2	10	34	19	12	8	4	3	1	1
116.	ST.LOUIS	61.2	20	81	41	27	18	10	7	3	1
116.	ST.LOUIS	61.2	30	186	112	70	41	23	15	5	2
116.	ST.LOUIS	61.2	300	1530	875	557	323	186	112	38	15
117.	ST.PAUL	52.2	5	13	7	4	3	2	1	1	1
117.	ST.PAUL	52.2	10	29	16	10	7	4	3	1	1
117.	ST.PAUL	52.2	20	69	35	23	16	9	6	2	1
117.	ST.PAUL	52.2	30	159	95	60	35	20	13	4	2
117.	ST.PAUL	52.2	300	1305	746	475	275	159	95	33	13
118.	ST.PETERSBUR	55.4	5	13	7	4	3	2	1	1	1
118.	ST.PETERSBUR	55.4	10	31	17	11	7	4	3	1	1
118.	ST.PETERSBUR	55.4	20	73	37	24	17	9	6	2	1
118.	ST.PETERSBUR	55.4	30	168	101	63	37	21	14	4	2
118.	ST.PETERSBUR	55.4	300	1385	792	504	292	168	101	35	14
119.	SALT LAKE CI	59.3	5	14	8	5	3	2	1	1	1
119.	SALT LAKE CI	59.3	10	33	18	11	8	4	3	1	1
119.	SALT LAKE CI	59.3	20	78	40	26	18	10	6	2	1
119.	SALT LAKE CI	59.3	30	180	108	68	40	22	15	5	2
119.	SALT LAKE CI	59.3	300	1483	848	539	313	180	108	37	15
120.	SAN ANTONIO	184.0	5	43	23	14	9	5	3	1	1
120.	SAN ANTONIO	184.0	10	103	56	34	23	12	8	3	1
120.	SAN ANTONIO	184.0	20	243	123	80	55	30	19	7	3
120.	SAN ANTONIO	184.0	30	558	335	209	123	69	44	14	6
120.	SAN ANTONIO	184.0	300	4600	2629	1673	969	558	335	114	45

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
121.	SAN BERNARDI	44.4	5	11	6	4	3	2	1	1	0
121.	SAN BERNARDI	44.4	10	25	14	9	6	3	2	1	1
121.	SAN BERNARDI	44.4	20	59	30	20	13	7	5	2	1
121.	SAN BERNARDI	44.4	30	135	81	51	30	17	11	4	2
121.	SAN BERNARDI	44.4	300	1110	635	404	234	135	81	28	11
122.	SAN DIEGO	316.9	5	74	40	24	16	9	6	2	1
122.	SAN DIEGO	316.9	10	176	96	59	40	20	14	5	2
122.	SAN DIEGO	316.9	20	417	212	138	94	51	32	11	5
122.	SAN DIEGO	316.9	30	961	577	361	212	118	76	24	11
122.	SAN DIEGO	316.9	300	7923	4528	2881	1668	961	577	196	78
123.	SAN FRANCISC	45.4	5	11	6	4	3	2	1	1	1
123.	SAN FRANCISC	45.4	10	26	14	9	6	3	2	1	1
123.	SAN FRANCISC	45.4	20	60	31	20	14	8	5	2	1
123.	SAN FRANCISC	45.4	30	138	83	52	31	17	11	4	2
123.	SAN FRANCISC	45.4	300	1135	649	413	239	138	83	28	11
124.	SAN JOSE	136.2	5	32	17	10	7	4	3	1	1
124.	SAN JOSE	136.2	10	76	42	26	17	9	6	2	1
124.	SAN JOSE	136.2	20	180	91	60	40	22	14	5	2
124.	SAN JOSE	136.2	30	413	248	155	91	51	33	10	5
124.	SAN JOSE	136.2	300	3405	1946	1239	717	413	248	84	34
125.	SANTA ANA	27.0	5	7	4	2	2	1	1	1	0
125.	SANTA ANA	27.0	10	15	9	5	4	2	2	1	1
125.	SANTA ANA	27.0	20	36	18	12	8	5	3	1	1
125.	SANTA ANA	27.0	30	82	49	31	18	10	7	2	1
125.	SANTA ANA	27.0	300	675	386	246	143	82	49	17	7
126.	SAVANNAH	26.8	5	7	4	2	2	1	1	1	0
126.	SAVANNAH	26.8	10	15	9	5	4	2	2	1	1
126.	SAVANNAH	26.8	20	36	18	12	8	5	3	1	1
126.	SAVANNAH	26.8	30	82	49	31	18	10	7	2	1
126.	SAVANNAH	26.8	300	670	383	244	141	82	49	17	7
127.	SCRANTON	25.7	5	6	4	2	2	1	1	1	0
127.	SCRANTON	25.7	10	15	8	5	4	2	1	1	1
127.	SCRANTON	25.7	20	34	18	12	8	4	3	1	1
127.	SCRANTON	25.7	30	78	47	30	18	10	7	2	1
127.	SCRANTON	25.7	300	643	368	234	136	78	47	16	7
128.	SEATTLE	83.6	5	20	11	7	4	3	2	1	1
128.	SEATTLE	83.6	10	47	26	16	11	6	4	2	1
128.	SEATTLE	83.6	20	110	56	37	25	14	9	3	1
128.	SEATTLE	83.6	30	254	152	95	56	31	20	7	3
128.	SEATTLE	83.6	300	2090	1195	760	440	254	152	52	21
129.	SHREVEPORT	56.9	5	14	8	5	3	2	1	1	1
129.	SHREVEPORT	56.9	10	32	18	11	7	4	3	1	1
129.	SHREVEPORT	56.9	20	75	38	25	17	9	6	2	1
129.	SHREVEPORT	56.9	30	173	104	65	38	21	14	5	2
129.	SHREVEPORT	56.9	300	1423	813	518	300	173	104	36	14
130.	SOUTH BEND	29.2	5	7	4	3	2	1	1	1	0
130.	SOUTH BEND	29.2	10	17	9	6	4	2	2	1	1
130.	SOUTH BEND	29.2	20	39	20	13	9	5	3	1	1
130.	SOUTH BEND	29.2	30	89	53	34	20	11	7	3	1
130.	SOUTH BEND	29.2	300	730	418	266	154	89	53	18	8

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
131.	SPOKANE	50.8	5	12	7	4	3	2	1	1	1
131.	SPOKANE	50.8	10	29	16	10	7	4	3	1	1
131.	SPOKANE	50.8	20	67	34	22	15	8	5	2	1
131.	SPOKANE	50.8	30	154	93	58	34	19	12	4	2
131.	SPOKANE	50.8	300	1270	726	462	268	154	93	32	13
132.	SPRINGFIELD	31.7	5	8	4	3	2	1	1	1	0
132.	SPRINGFIELD	31.7	10	18	10	6	4	2	2	1	1
132.	SPRINGFIELD	31.7	20	42	22	14	10	5	4	2	1
132.	SPRINGFIELD	31.7	30	96	58	36	22	12	8	3	1
132.	SPRINGFIELD	31.7	300	793	453	289	167	96	58	20	8
133.	SPRINGFIELD	61.5	5	15	8	5	3	2	1	1	1
133.	SPRINGFIELD	61.5	10	35	19	12	8	4	3	1	1
133.	SPRINGFIELD	61.5	20	81	41	27	18	10	7	3	1
133.	SPRINGFIELD	61.5	30	187	112	70	41	23	15	5	2
133.	SPRINGFIELD	61.5	300	1538	879	559	324	187	112	38	15
134.	STAMFORD	38.1	5	9	5	3	2	1	1	1	0
134.	STAMFORD	38.1	10	22	12	7	5	3	2	1	1
134.	STAMFORD	38.1	20	51	26	17	12	6	4	2	1
134.	STAMFORD	38.1	30	116	70	44	26	15	9	3	2
134.	STAMFORD	38.1	300	953	545	347	201	116	70	24	10
135.	STOCKTON	29.9	5	7	4	3	2	1	1	1	0
135.	STOCKTON	29.9	10	17	9	6	4	2	2	1	1
135.	STOCKTON	29.9	20	40	20	13	9	5	3	1	1
135.	STOCKTON	29.9	30	91	55	34	20	11	8	3	1
135.	STOCKTON	29.9	300	748	428	272	158	91	55	19	8
136.	SYRACUSE	25.8	5	6	4	2	2	1	1	1	0
136.	SYRACUSE	25.8	10	15	8	5	4	2	1	1	1
136.	SYRACUSE	25.8	20	34	18	12	8	4	3	1	1
136.	SYRACUSE	25.8	30	79	47	30	18	10	7	2	1
136.	SYRACUSE	25.8	300	645	369	235	136	79	47	16	7
137.	TACOMA	47.7	5	11	6	4	3	2	1	1	1
137.	TACOMA	47.7	10	27	15	9	6	3	2	1	1
137.	TACOMA	47.7	20	63	32	21	14	8	5	2	1
137.	TACOMA	47.7	30	145	87	55	32	18	12	4	2
137.	TACOMA	47.7	300	1193	682	434	251	145	87	30	12
138.	TAMPA	84.5	5	20	11	7	5	3	2	1	1
138.	TAMPA	84.5	10	47	26	16	11	6	4	2	1
138.	TAMPA	84.5	20	112	57	37	25	14	9	3	2
138.	TAMPA	84.5	30	256	154	96	57	32	21	7	3
138.	TAMPA	84.5	300	2113	1208	769	445	256	154	53	21
139.	TOLEDO	81.2	5	19	11	6	4	3	2	1	1
139.	TOLEDO	81.2	10	46	25	15	10	5	4	2	1
139.	TOLEDO	81.2	20	107	55	36	24	13	9	3	1
139.	TOLEDO	81.2	30	246	148	93	55	30	20	6	3
139.	TOLEDO	81.2	300	2030	1160	739	428	246	148	51	20
140.	TOPEKA	47.5	5	11	6	4	3	2	1	1	1
140.	TOPEKA	47.5	10	27	15	9	6	3	2	1	1
140.	TOPEKA	47.5	20	63	32	21	14	8	5	2	1
140.	TOPEKA	47.5	30	144	87	54	32	18	12	4	2
140.	TOPEKA	47.5	300	1188	679	432	250	144	87	30	12

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
141.	TORRENCE	20.5	5	5	3	2	1	1	1	1	0
141.	TORRENCE	20.5	10	12	7	4	3	2	1	1	1
141.	TORRENCE	20.5	20	27	14	9	6	4	2	1	1
141.	TORRENCE	20.5	30	63	38	24	14	8	5	2	1
141.	TORRENCE	20.5	300	513	293	187	108	63	38	13	5
142.	TRENTON	7.5	5	2	1	1	1	1	1	0	0
142.	TRENTON	7.5	10	5	3	2	1	1	1	1	0
142.	TRENTON	7.5	20	10	5	4	3	2	1	1	0
142.	TRENTON	7.5	30	23	14	9	5	3	2	1	1
142.	TRENTON	7.5	300	188	108	69	40	23	14	5	2
143.	TUCSON	80.0	5	19	10	6	4	3	2	1	1
143.	TUCSON	80.0	10	45	25	15	10	5	4	2	1
143.	TUCSON	80.0	20	106	54	35	24	13	8	3	1
143.	TUCSON	80.0	30	243	146	91	54	30	19	6	3
143.	TUCSON	80.0	300	2000	1143	728	421	243	146	50	20
144.	TULSA	171.9	5	40	22	13	9	5	3	1	1
144.	TULSA	171.9	10	96	52	32	22	11	8	3	1
144.	TULSA	171.9	20	227	115	75	51	28	18	6	3
144.	TULSA	171.9	30	521	313	196	115	64	41	13	6
144.	TULSA	171.9	300	4298	2456	1563	905	521	313	107	42
145.	VIRGINIA BEA	220.0	5	52	28	17	11	6	4	2	1
145.	VIRGINIA BEA	220.0	10	123	67	41	28	14	10	4	2
145.	VIRGINIA BEA	220.0	20	240	147	96	65	35	22	8	3
145.	VIRGINIA BEA	220.0	30	667	400	250	147	82	53	17	7
145.	VIRGINIA BEA	220.0	300	5500	3143	2000	1158	667	400	136	54
146.	WARREN	34.2	5	8	5	3	2	1	1	1	0
146.	WARREN	34.2	10	19	11	7	5	3	2	1	1
146.	WARREN	34.2	20	45	23	15	10	6	4	2	1
146.	WARREN	34.2	30	104	63	39	23	13	9	3	2
146.	WARREN	34.2	300	855	489	311	180	104	63	22	9
147.	WASHINGTON	61.4	5	15	8	5	3	2	1	1	1
147.	WASHINGTON	61.4	10	35	19	12	8	4	3	1	1
147.	WASHINGTON	61.4	20	81	41	27	18	10	7	3	1
147.	WASHINGTON	61.4	30	186	112	70	41	23	15	5	2
147.	WASHINGTON	61.4	300	1535	878	559	324	186	112	38	15
148.	WATERBURY	27.6	5	7	4	2	2	1	1	1	0
148.	WATERBURY	27.6	10	16	9	6	4	2	2	1	1
148.	WATERBURY	27.6	20	37	19	12	9	5	3	1	1
148.	WATERBURY	27.6	30	84	51	32	19	11	7	2	1
148.	WATERBURY	27.6	300	690	395	251	146	84	51	17	7
149.	WICHITA	86.5	5	21	11	7	5	3	2	1	1
149.	WICHITA	86.5	10	48	27	16	11	6	4	2	1
149.	WICHITA	86.5	20	114	58	38	26	14	9	3	2
149.	WICHITA	86.5	30	263	158	99	58	32	21	7	3
149.	WICHITA	86.5	300	2163	1236	787	456	263	158	54	21
150.	WINSTON-SALE	56.5	5	14	7	5	3	2	1	1	1
150.	WINSTON-SALE	56.5	10	32	18	11	7	4	3	1	1
150.	WINSTON-SALE	56.5	20	75	38	25	17	9	6	2	1
150.	WINSTON-SALE	56.5	30	172	103	65	38	21	14	5	2
150.	WINSTON-SALE	56.5	300	1413	808	514	298	172	103	35	14

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
151.	WORCESTER	37.4	5	9	5	3	2	1	1	1	0
151.	WORCESTER	37.4	10	21	12	7	5	3	2	1	1
151.	WORCESTER	37.4	20	50	25	17	11	6	4	2	1
151.	WORCESTER	37.4	30	114	68	43	25	14	9	3	2
151.	WORCESTER	37.4	300	935	535	340	197	114	68	23	10
152.	YONKERS	17.7	5	5	3	2	1	1	1	0	0
152.	YONKERS	17.7	10	10	6	4	3	1	1	1	0
152.	YONKERS	17.7	20	24	12	8	6	3	2	1	1
152.	YONKERS	17.7	30	54	33	21	12	7	5	2	1
152.	YONKERS	17.7	300	443	253	161	94	54	33	11	5
153.	YOUNGSTOWN	33.6	5	8	5	3	2	1	1	1	0
153.	YOUNGSTOWN	33.6	10	19	11	7	5	2	2	1	1
153.	YOUNGSTOWN	33.6	20	45	23	15	10	6	4	2	1
153.	YOUNGSTOWN	33.6	30	102	61	39	23	13	8	3	1
153.	YOUNGSTOWN	33.6	300	840	480	306	177	102	61	21	9

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
1.	AGEO	45.6	5	11	6	4	3	2	1	1	1
1.	AGEO	45.6	10	26	14	9	6	3	2	1	1
1.	AGEO	45.6	20	61	31	20	14	8	5	2	1
1.	AGEO	45.6	30	139	83	52	31	17	11	4	2
1.	AGEO	45.6	300	1141	652	415	241	139	83	29	12
2.	AIZUWAKAMATU	286.3	5	67	36	22	14	8	5	2	1
2.	AIZUWAKAMATU	286.3	10	160	87	54	36	18	13	5	2
2.	AIZUWAKAMATU	286.3	20	377	191	125	85	46	29	10	4
2.	AIZUWAKAMATU	286.3	30	868	521	326	191	107	69	22	10
2.	AIZUWAKAMATU	286.3	300	7157	4090	2603	1507	868	521	177	70
3.	AKASI	47.3	5	11	6	4	3	2	1	1	1
3.	AKASI	47.3	10	27	15	9	6	3	2	1	1
3.	AKASI	47.3	20	63	32	21	14	8	5	2	1
3.	AKASI	47.3	30	144	87	54	32	18	12	4	2
3.	AKASI	47.3	300	1184	677	431	250	144	87	30	12
4.	AKITA	458.9	5	107	58	34	23	13	8	3	2
4.	AKITA	458.9	10	255	140	85	57	29	20	7	3
4.	AKITA	458.9	20	604	306	200	135	73	46	16	7
4.	AKITA	458.9	30	1391	835	522	306	170	110	34	15
4.	AKITA	458.9	300	11474	6557	4173	2416	1391	835	284	112
5.	AMAGASAKI	49.1	5	12	7	4	3	2	1	1	1
5.	AMAGASAKI	49.1	10	28	15	10	7	4	3	1	1
5.	AMAGASAKI	49.1	20	65	33	22	15	8	5	2	1
5.	AMAGASAKI	49.1	30	149	90	56	33	19	12	4	2
5.	AMAGASAKI	49.1	300	1228	702	447	259	149	90	31	12
6.	ANZYO	85.7	5	20	11	7	5	3	2	1	1
6.	ANZYO	85.7	10	48	26	16	11	6	4	2	1
6.	ANZYO	85.7	20	113	58	38	26	14	9	3	2
6.	ANZYO	85.7	30	260	156	98	58	32	21	7	3
6.	ANZYO	85.7	300	2142	1224	779	451	260	156	53	21
7.	AOMORI	693.5	5	162	87	51	34	20	12	4	2
7.	AOMORI	693.5	10	386	211	129	86	43	30	10	4
7.	AOMORI	693.5	20	913	463	302	204	111	70	25	10
7.	AOMORI	693.5	30	2102	1261	789	463	257	166	51	23
7.	AOMORI	693.5	300	17337	9907	6305	3650	2102	1261	429	170
8.	ASAHIKAWA	749.4	5	175	94	56	37	21	13	4	2
8.	ASAHIKAWA	749.4	10	417	228	139	93	47	32	11	5
8.	ASAHIKAWA	749.4	20	987	500	326	221	119	75	27	10
8.	ASAHIKAWA	749.4	30	2271	1363	852	500	278	179	56	25
8.	ASAHIKAWA	749.4	300	18736	10706	6813	3945	2271	1363	463	183
9.	ASIKAGA	177.7	5	42	23	14	9	5	3	1	1
9.	ASIKAGA	177.7	10	99	54	33	22	11	8	3	1
9.	ASIKAGA	177.7	20	234	119	78	53	29	18	7	3
9.	ASIKAGA	177.7	30	539	324	202	119	66	43	14	6
9.	ASIKAGA	177.7	300	4442	2539	1616	936	539	324	110	44
10.	ATUGI	117.3	5	25	15	9	6	4	2	1	1
10.	ATUGI	117.3	10	66	36	22	15	8	5	2	1
10.	ATUGI	117.3	20	155	79	52	35	19	12	5	2
10.	ATUGI	117.3	30	356	214	134	79	44	28	9	4
10.	ATUGI	117.3	300	2934	1677	1067	618	356	214	73	29

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
11.	BEPPU	124.8	5	30	16	10	7	4	3	1	1
11.	BEPPU	124.8	10	70	38	24	16	8	6	2	1
11.	BEPPU	124.8	20	165	84	55	37	20	13	5	2
11.	BEPPU	124.8	30	379	227	142	84	47	30	10	5
11.	BEPPU	124.8	300	3129	1783	1135	657	379	227	78	31
12.	DAITO	18.4	5	5	3	2	1	1	1	1	1
12.	DAITO	18.4	10	11	6	4	3	2	1	1	1
12.	DAITO	18.4	20	25	13	8	6	3	2	1	1
12.	DAITO	18.4	30	56	34	21	13	7	5	2	1
12.	DAITO	18.4	300	460	263	167	97	56	34	12	5
13.	GIHU	196.2	5	46	25	15	10	6	4	2	1
13.	GIHU	196.2	10	109	60	37	25	13	9	3	2
13.	GIHU	196.2	20	259	131	86	58	32	20	7	3
13.	GIHU	196.2	30	595	357	223	131	73	47	15	7
13.	GIHU	196.2	300	4905	2803	1784	1033	595	357	122	48
14.	HADANO	104.2	5	25	14	8	6	3	2	1	1
14.	HADANO	104.2	10	58	32	20	13	7	5	2	1
14.	HADANO	104.2	20	138	70	46	31	17	11	4	2
14.	HADANO	104.2	30	316	190	119	70	39	25	8	4
14.	HADANO	104.2	300	2604	1488	947	549	316	190	65	26
15.	HAKODATE	347.8	5	81	44	26	17	10	6	2	1
15.	HAKODATE	347.8	10	194	106	65	43	22	15	5	2
15.	HAKODATE	347.8	20	458	232	152	103	56	35	13	5
15.	HAKODATE	347.8	30	1054	633	396	232	129	83	26	12
15.	HAKODATE	347.8	300	8695	4969	3162	1831	1054	633	215	85
16.	HAMAMATU	250.3	5	59	32	19	13	7	5	2	1
16.	HAMAMATU	250.3	10	140	76	47	31	16	11	4	2
16.	HAMAMATU	250.3	20	330	167	109	74	40	26	9	4
16.	HAMAMATU	250.3	30	759	456	285	167	93	60	19	9
16.	HAMAMATU	250.3	300	6258	3576	2276	1318	759	456	155	62
17.	HATINOHE	213.4	5	50	27	16	11	6	4	2	1
17.	HATINOHE	213.4	10	119	65	40	27	14	9	4	2
17.	HATINOHE	213.4	20	281	143	93	63	34	22	8	3
17.	HATINOHE	213.4	30	647	388	243	143	80	51	16	7
17.	HATINOHE	213.4	300	5335	3049	1940	1123	647	388	132	53
18.	HATIOZI	187.8	5	44	24	14	10	6	4	1	1
18.	HATIOZI	187.8	10	105	57	35	24	12	8	3	2
18.	HATIOZI	187.8	20	248	126	82	56	30	19	7	3
18.	HATIOZI	187.8	30	570	342	214	126	70	45	14	7
18.	HATIOZI	187.8	300	4695	2683	1708	989	570	342	116	46
19.	HIGASIOSAKA	61.8	5	15	8	5	4	2	2	1	1
19.	HIGASIOSAKA	61.8	10	35	19	12	8	4	3	1	1
19.	HIGASIOSAKA	61.8	20	82	42	27	19	10	7	3	1
19.	HIGASIOSAKA	61.8	30	188	113	71	42	23	15	5	2
19.	HIGASIOSAKA	61.8	300	1545	883	562	326	188	113	39	16
20.	HIGASIMURAYA	16.6	5	4	3	2	1	1	1	1	1
20.	HIGASIMURAYA	16.6	10	10	6	4	3	2	1	1	1
20.	HIGASIMURAYA	16.6	20	22	12	8	5	3	2	1	1
20.	HIGASIMURAYA	16.6	30	51	31	19	12	7	4	2	1
20.	HIGASIMURAYA	16.6	300	415	237	151	88	51	31	11	5

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
21.	HIGASIKURUME	13.0	5	4	2	1	1	1	1	1	1
21.	HIGASIKURUME	13.0	10	8	4	3	2	1	1	1	1
21.	HIGASIKURUME	13.0	20	18	9	6	4	3	2	1	1
21.	HIGASIKURUME	13.0	30	40	24	15	9	5	4	1	1
21.	HIGASIKURUME	13.0	300	325	186	118	69	40	24	9	4
22.	HIMEJI	268.4	5	63	34	20	14	8	5	2	1
22.	HIMEJI	268.4	10	150	82	50	34	17	12	4	2
22.	HIMEJI	268.4	20	354	179	117	79	43	27	10	4
22.	HIMEJI	268.4	30	814	489	306	179	100	64	20	9
22.	HIMEJI	268.4	300	6711	3835	2441	1413	814	489	166	66
23.	HINO	27.1	5	7	4	2	2	1	1	1	1
23.	HINO	27.1	10	16	9	6	4	2	2	1	1
23.	HINO	27.1	20	36	19	12	8	5	3	1	1
23.	HINO	27.1	30	83	50	31	19	11	7	2	1
23.	HINO	27.1	300	678	388	247	143	83	50	17	7
24.	HIRAKADA	64.5	5	15	9	5	4	2	2	1	1
24.	HIRAKADA	64.5	10	36	20	12	8	4	3	1	1
24.	HIRAKADA	64.5	20	85	44	29	19	11	7	3	1
24.	HIRAKADA	64.5	30	196	118	74	44	24	16	5	3
24.	HIRAKADA	64.5	300	1613	922	587	340	196	118	40	16
25.	HIRATUKA	67.9	5	16	9	5	4	2	2	1	1
25.	HIRATUKA	67.9	10	38	21	13	9	5	3	1	1
25.	HIRATUKA	67.9	20	90	46	30	20	11	7	3	1
25.	HIRATUKA	67.9	30	206	124	78	46	26	17	5	3
25.	HIRATUKA	67.9	300	1697	970	618	358	206	124	42	17
26.	HIROSIMA	672.8	5	157	85	50	33	19	12	4	2
26.	HIROSIMA	672.8	10	374	204	125	84	42	29	10	4
26.	HIROSIMA	672.8	20	886	449	293	198	107	68	24	9
26.	HIROSIMA	672.8	30	2039	1224	765	449	250	161	50	22
26.	HIROSIMA	672.8	300	16821	9612	6117	3542	2039	1224	416	165
27.	HIROSAKI	273.4	5	64	35	21	14	8	5	2	1
27.	HIROSAKI	273.4	10	152	83	51	34	17	12	4	2
27.	HIROSAKI	273.4	20	360	183	119	81	44	28	10	4
27.	HIROSAKI	273.4	30	829	498	311	183	102	66	21	9
27.	HIROSAKI	273.4	300	6836	3906	2486	1439	829	498	169	67
28.	HITATI	152.6	5	36	20	12	8	5	3	1	1
28.	HITATI	152.6	10	85	47	29	19	10	7	3	1
28.	HITATI	152.6	20	201	102	67	45	25	16	6	2
28.	HITATI	152.6	30	463	278	174	102	57	37	12	5
28.	HITATI	152.6	300	3816	2181	1388	804	463	278	95	38
29.	HOHU	186.0	5	44	24	14	10	6	4	1	1
29.	HOHU	186.0	10	104	57	35	23	12	8	3	2
29.	HOHU	186.0	20	245	125	81	55	30	19	7	3
29.	HOHU	186.0	30	564	339	212	125	69	45	14	6
29.	HOHU	186.0	300	4652	2658	1692	980	564	339	115	46
30.	HUKUI	339.2	5	79	43	25	17	10	6	2	1
30.	HUKUI	339.2	10	189	103	63	42	21	15	5	2
30.	HUKUI	339.2	20	447	227	148	100	54	34	12	5
30.	HUKUI	339.2	30	1028	617	386	227	126	81	25	11
30.	HUKUI	339.2	300	8481	4846	3084	1786	1028	617	210	83

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
31.	HUKUOKA	334.8	5	78	42	25	17	10	6	2	1
31.	HUKUOKA	334.8	10	186	102	62	42	21	15	5	2
31.	HUKUOKA	334.8	20	441	224	146	99	54	34	12	5
31.	HUKUOKA	334.8	30	1015	609	381	224	124	80	25	11
31.	HUKUOKA	334.8	300	8370	4783	3044	1762	1015	609	207	82
32.	HUKUSIMA	745.9	5	174	94	55	37	21	13	4	2
32.	HUKUSIMA	745.9	10	415	227	139	93	47	32	11	5
32.	HUKUSIMA	745.9	20	982	498	325	220	119	75	26	10
32.	HUKUSIMA	745.9	30	2261	1357	848	498	277	178	55	25
32.	HUKUSIMA	745.9	300	18647	10656	6781	3926	2261	1357	461	182
33.	HUKUYAMA	362.3	5	85	46	27	18	10	7	2	1
33.	HUKUYAMA	362.3	10	202	110	68	45	23	16	6	3
33.	HUKUYAMA	362.3	20	477	242	158	107	58	37	13	5
33.	HUKUYAMA	362.3	30	1098	659	412	242	135	87	27	12
33.	HUKUYAMA	362.3	300	9059	5177	3294	1907	1098	659	224	89
34.	HUNABASI	84.4	5	20	11	7	5	3	2	1	1
34.	HUNABASI	84.4	10	47	26	16	11	6	4	2	1
34.	HUNABASI	84.4	20	112	57	37	25	14	9	3	2
34.	HUNABASI	84.4	30	256	154	96	57	32	21	7	3
34.	HUNABASI	84.4	300	2110	1206	767	445	256	154	53	21
35.	HUTYU	29.9	5	7	4	3	2	1	1	1	1
35.	HUTYU	29.9	10	17	10	6	4	3	2	1	1
35.	HUTYU	29.9	20	40	20	13	9	5	3	2	1
35.	HUTYU	29.9	30	91	55	34	20	12	8	3	1
35.	HUTYU	29.9	300	747	427	272	158	91	55	19	8
36.	HUZI	215.3	5	51	27	16	11	6	4	2	1
36.	HUZI	215.3	10	120	66	40	27	14	10	4	2
36.	HUZI	215.3	20	284	144	94	64	35	22	8	3
36.	HUZI	215.3	30	653	392	245	144	80	52	16	7
36.	HUZI	215.3	300	5384	3077	1958	1134	653	392	133	53
37.	HUZINOMIYA	314.2	5	74	40	24	16	9	6	2	1
37.	HUZINOMIYA	314.2	10	175	96	59	39	20	14	5	2
37.	HUZINOMIYA	314.2	20	414	210	137	93	50	32	11	5
37.	HUZINOMIYA	314.2	30	953	572	358	210	117	75	24	11
37.	HUZINOMIYA	314.2	300	7856	4489	2857	1654	953	572	194	77
38.	HUZISAWA	69.6	5	17	9	6	4	2	2	1	1
38.	HUZISAWA	69.6	10	39	22	13	9	5	3	1	1
38.	HUZISAWA	69.6	20	92	47	31	21	12	7	3	1
38.	HUZISAWA	69.6	30	211	127	80	47	26	17	6	3
38.	HUZISAWA	69.6	300	1741	995	633	367	211	127	43	17
39.	IBARAKI	75.1	5	18	10	6	4	3	2	1	1
39.	IBARAKI	75.1	10	42	23	14	10	5	4	2	1
39.	IBARAKI	75.1	20	99	51	33	23	12	8	3	1
39.	IBARAKI	75.1	30	228	137	86	51	28	18	6	3
39.	IBARAKI	75.1	300	1879	1074	684	396	228	137	47	19
40.	IIDA	176.5	5	42	23	13	9	5	3	1	1
40.	IIDA	176.5	10	99	54	33	22	11	8	3	1
40.	IIDA	176.5	20	233	118	77	52	29	18	7	3
40.	IIDA	176.5	30	535	321	201	118	66	43	13	6
40.	IIDA	176.5	300	4412	2522	1605	929	535	321	109	44

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
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41.	IKEDA	21.7	5	6	3	2	2	1	1	1	1
41.	IKEDA	21.7	10	13	7	5	3	2	1	1	1
41.	IKEDA	21.7	20	29	15	10	7	4	3	1	1
41.	IKEDA	21.7	30	66	40	25	15	9	6	2	1
41.	IKEDA	21.7	300	544	311	198	115	66	40	14	6
42.	IMBARI	74.5	5	18	10	6	4	3	2	1	1
42.	IMBARI	74.5	10	42	23	14	10	5	4	2	1
42.	IMBARI	74.5	20	99	50	33	22	12	8	3	1
42.	IMBARI	74.5	30	226	136	85	50	28	18	6	3
42.	IMBARI	74.5	300	1864	1065	678	393	226	136	47	19
43.	ISE	177.9	5	42	23	14	9	5	3	1	1
43.	ISE	177.9	10	99	54	33	22	11	8	3	1
43.	ISE	177.9	20	235	119	78	53	29	18	7	3
43.	ISE	177.9	30	540	324	203	117	66	43	14	6
43.	ISE	177.9	300	4449	2542	1618	937	540	324	110	44
44.	ISINOMAKI	138.4	5	33	18	11	7	4	3	1	1
44.	ISINOMAKI	138.4	10	77	42	26	18	9	6	2	1
44.	ISINOMAKI	138.4	20	183	93	61	41	22	14	5	2
44.	ISINOMAKI	138.4	30	420	252	158	93	52	33	11	5
44.	ISINOMAKI	138.4	300	3460	1977	1259	729	420	252	86	34
45.	ITAMI	25.1	5	6	4	2	2	1	1	1	1
45.	ITAMI	25.1	10	14	8	5	4	2	2	1	1
45.	ITAMI	25.1	20	34	17	11	8	4	3	1	1
45.	ITAMI	25.1	30	77	46	29	17	10	6	2	1
45.	ITAMI	25.1	300	628	359	229	133	77	46	16	7
46.	ITIGAWA	54.7	5	13	7	5	3	2	1	1	1
46.	ITIGAWA	54.7	10	31	17	11	7	4	3	1	1
46.	ITIGAWA	54.7	20	72	37	24	17	9	6	2	1
46.	ITIGAWA	54.7	30	166	100	63	37	21	14	5	2
46.	ITIGAWA	54.7	300	1368	782	498	288	166	100	34	14
47.	ITIHARA	366.7	5	86	46	27	18	11	7	2	1
47.	ITIHARA	366.7	10	204	112	68	46	23	16	6	3
47.	ITIHARA	366.7	20	483	245	160	108	59	37	13	5
47.	ITIHARA	366.7	30	1112	667	417	245	136	88	27	12
47.	ITIHARA	366.7	300	9167	5239	3334	1930	1112	667	227	90
48.	ITINOMIYA	79.0	5	19	10	6	4	3	2	1	1
48.	ITINOMIYA	79.0	10	44	24	15	10	5	4	2	1
48.	ITINOMIYA	79.0	20	104	53	35	24	13	8	3	2
48.	ITINOMIYA	79.0	30	240	144	90	53	30	19	6	3
48.	ITINOMIYA	79.0	300	1974	1128	718	416	240	144	49	20
49.	IWAKI	1229.0	5	286	154	91	60	34	21	7	3
49.	IWAKI	1229.0	10	683	373	228	152	76	52	18	7
49.	IWAKI	1229.0	20	1618	820	535	362	196	123	43	17
49.	IWAKI	1229.0	30	3725	2235	1397	820	456	293	91	40
49.	IWAKI	1229.0	300	30727	17558	11174	6469	3725	2235	759	300
50.	IWAKUNI	218.9	5	51	28	17	11	7	4	2	1
50.	IWAKUNI	218.9	10	122	67	41	28	14	10	4	2
50.	IWAKUNI	218.9	20	288	146	96	65	35	22	8	3
50.	IWAKUNI	218.9	30	664	398	249	146	82	53	17	8
50.	IWAKUNI	218.9	300	5472	3127	1990	1152	664	398	136	54

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
51.	IZUMI	85.4	5	20	11	7	5	3	2	1	1
51.	IZUMI	85.4	10	48	26	16	11	6	4	2	1
51.	IZUMI	85.4	20	113	57	38	26	14	9	3	2
51.	IZUMI	85.4	30	259	156	98	57	32	21	7	3
51.	IZUMI	85.4	300	2136	1221	777	450	259	156	53	21
52.	KADOMA	12.2	5	3	2	1	1	1	1	1	1
52.	KADOMA	12.2	10	7	4	3	2	1	1	1	1
52.	KADOMA	12.2	20	17	9	6	4	2	2	1	1
52.	KADOMA	12.2	30	37	23	14	9	5	3	1	1
52.	KADOMA	12.2	300	306	175	111	65	37	23	8	3
53.	KAGOSIMA	284.0	5	67	36	21	14	8	5	2	1
53.	KAGOSIMA	284.0	10	158	87	53	36	18	12	5	2
53.	KAGOSIMA	284.0	20	374	190	124	84	46	29	10	4
53.	KAGOSIMA	284.0	30	861	517	323	190	106	68	21	10
53.	KAGOSIMA	284.0	300	7101	4058	2583	1495	861	517	176	70
54.	KAKOGAWA	98.1	5	23	13	8	5	3	2	1	1
54.	KAKOGAWA	98.1	10	55	30	19	13	7	5	2	1
54.	KAKOGAWA	98.1	20	130	66	43	29	16	10	4	2
54.	KAKOGAWA	98.1	30	298	179	112	66	37	24	8	4
54.	KAKOGAWA	98.1	300	2452	1401	892	517	298	179	61	24
55.	KAMAKURA	39.5	5	10	5	3	2	2	1	1	1
55.	KAMAKURA	39.5	10	22	12	8	5	3	2	1	1
55.	KAMAKURA	39.5	20	53	27	18	12	7	4	2	1
55.	KAMAKURA	39.5	30	120	72	45	27	15	10	3	2
55.	KAMAKURA	39.5	300	989	565	360	209	120	72	25	10
56.	KANAZAWA	459.3	5	107	58	34	23	13	8	3	2
56.	KANAZAWA	459.3	10	256	140	86	57	29	20	7	3
56.	KANAZAWA	459.3	20	605	307	200	136	73	46	16	7
56.	KANAZAWA	459.3	30	1392	836	522	307	171	110	34	15
56.	KANAZAWA	459.3	300	11483	6562	4176	2418	1392	836	284	113
57.	KASIWADA	70.0	5	17	9	6	4	2	2	1	1
57.	KASIWADA	70.0	10	39	22	13	9	5	3	1	1
57.	KASIWADA	70.0	20	93	47	31	21	12	7	3	1
57.	KASIWADA	70.0	30	213	128	80	47	26	17	6	3
57.	KASIWADA	70.0	300	1750	1000	637	369	213	128	44	18
58.	KASIWA	73.0	5	17	10	6	4	2	2	1	1
58.	KASIWA	73.0	10	41	23	14	10	5	4	2	1
58.	KASIWA	73.0	20	97	49	32	22	12	8	3	1
58.	KASIWA	73.0	30	222	133	83	49	28	18	6	3
58.	KASIWA	73.0	300	1825	1043	664	385	222	133	46	18
59.	KASUKABE	38.0	5	9	5	3	2	2	1	1	1
59.	KASUKABE	38.0	10	22	12	8	5	3	2	1	1
59.	KASUKABE	38.0	20	50	26	17	12	7	4	2	1
59.	KASUKABE	38.0	30	116	70	44	26	15	10	3	2
59.	KASUKABE	38.0	300	949	543	346	200	116	70	24	10
60.	KAWAGUTI	55.7	5	13	7	5	3	2	1	1	1
60.	KAWAGUTI	55.7	10	31	17	11	7	4	3	1	1
60.	KAWAGUTI	55.7	20	74	38	25	17	9	6	2	1
60.	KAWAGUTI	55.7	30	169	102	64	38	21	14	5	2
60.	KAWAGUTI	55.7	300	1392	796	506	293	169	102	35	14

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
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61.	KAWAGOE	109.1	5	26	14	9	6	3	2	1	1
61.	KAWAGOE	109.1	10	61	34	21	14	7	5	2	1
61.	KAWAGOE	109.1	20	144	73	48	33	18	11	4	2
61.	KAWAGOE	109.1	30	331	199	124	73	41	26	9	4
61.	KAWAGOE	109.1	300	2728	1559	992	575	331	199	68	27
62.	KAWANISI	53.7	5	13	7	4	3	2	1	1	1
62.	KAWANISI	53.7	10	30	17	10	7	4	3	1	1
62.	KAWANISI	53.7	20	71	36	24	16	9	6	2	1
62.	KAWANISI	53.7	30	163	98	62	36	20	13	4	2
62.	KAWANISI	53.7	300	1344	768	489	283	163	98	34	14
63.	KAWASAKI	135.1	5	32	17	10	7	4	3	1	1
63.	KAWASAKI	135.1	10	76	41	26	17	9	6	2	1
63.	KAWASAKI	135.1	20	178	91	59	40	22	14	5	2
63.	KAWASAKI	135.1	30	410	246	154	91	51	33	10	5
63.	KAWASAKI	135.1	300	3377	1930	1228	711	410	246	84	33
64.	KIRYU	131.9	5	31	17	10	7	4	- 3	1	1
64.	KIRYU	131.9	10	74	40	25	17	9	6	2	1
64.	KIRYU	131.9	20	174	88	58	39	21	14	5	2
64.	KIRYU	131.9	30	400	240	150	88	49	32	10	5
64.	KIRYU	131.9	300	3299	1885	1200	695	400	240	82	33
65.	KITAKYUSHU	474.3	5	111	60	35	24	14	8	3	2
65.	KITAKYUSHU	474.3	10	264	144	88	59	30	21	7	3
65.	KITAKYUSHU	474.3	20	625	317	207	140	76	48	17	7
65.	KITAKYUSHU	474.3	30	1438	863	539	317	176	113	35	16
65.	KITAKYUSHU	474.3	300	11858	6776	4312	2497	1438	863	293	116
66.	KOBE	540.0	5	126	68	40	27	15	9	3	2
66.	KOBE	540.0	10	300	164	100	67	34	23	8	3
66.	KOBE	540.0	20	711	360	235	159	86	54	19	8
66.	KOBE	540.0	30	1637	982	614	360	200	129	40	18
66.	KOBE	540.0	300	13500	7714	4909	2842	1637	982	334	132
67.	KODAIRA	20.8	5	5	3	2	2	1	1	1	1
67.	KODAIRA	20.8	10	12	7	4	3	2	1	1	1
67.	KODAIRA	20.8	20	28	14	10	7	4	3	1	1
67.	KODAIRA	20.8	30	64	38	24	14	8	5	2	1
67.	KODAIRA	20.8	300	522	298	190	110	64	38	13	6
68.	KOGANEI	11.3	5	3	2	1	1	1	1	1	1
68.	KOGANEI	11.3	10	7	4	3	2	1	1	1	1
68.	KOGANEI	11.3	20	15	8	5	4	2	2	1	1
68.	KOGANEI	11.3	30	35	21	13	8	5	3	1	1
68.	KOGANEI	11.3	300	284	163	104	60	35	21	7	3
69.	KOHU	171.1	5	40	22	13	9	5	3	1	1
69.	KOHU	171.1	10	96	52	32	22	11	8	3	1
69.	KOHU	171.1	20	226	115	75	51	28	18	6	3
69.	KOHU	171.1	30	519	312	195	115	64	41	13	6
69.	KOHU	171.1	300	4278	2445	1556	901	519	312	106	42
70.	KOMATU	374.7	5	88	47	28	19	11	7	2	1
70.	KOMATU	374.7	10	209	114	70	47	24	16	6	3
70.	KOMATU	374.7	20	494	250	163	111	60	38	14	5
70.	KOMATU	374.7	30	1136	682	426	250	139	90	28	13
70.	KOMATU	374.7	300	9368	5354	3407	1973	1136	682	232	92

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
71.	KORIYAMA	729.4	5	170	92	54	36	21	13	4	2
71.	KORIYAMA	729.4	10	406	222	136	91	46	31	11	5
71.	KORIYAMA	729.4	20	960	487	318	215	116	73	26	10
71.	KORIYAMA	729.4	30	2211	1327	829	487	271	174	54	24
71.	KORIYAMA	729.4	300	18236	10421	6632	3840	2211	1327	451	178
72.	KOSIGAYA	59.7	5	14	8	5	3	2	1	1	1
72.	KOSIGAYA	59.7	10	34	19	12	8	4	3	1	1
72.	KOSIGAYA	59.7	20	79	40	26	18	10	6	3	1
72.	KOSIGAYA	59.7	30	181	109	68	40	23	15	5	2
72.	KOSIGAYA	59.7	300	1494	854	543	315	181	109	37	15
73.	KOTI	143.2	5	34	18	11	7	4	3	1	1
73.	KOTI	143.2	10	80	44	27	18	9	7	3	1
73.	KOTI	143.2	20	189	96	63	43	23	15	5	2
73.	KOTI	143.2	30	435	261	163	96	54	35	11	5
73.	KOTI	143.2	300	3581	2047	1303	754	435	261	89	35
74.	KUMAGAYA	86.0	5	20	11	7	5	3	2	1	1
74.	KUMAGAYA	86.0	10	48	27	16	11	6	4	2	1
74.	KUMAGAYA	86.0	20	114	58	38	26	14	9	3	2
74.	KUMAGAYA	86.0	30	261	157	98	58	32	21	7	3
74.	KUMAGAYA	86.0	300	2150	1229	782	453	261	157	54	21
75.	KUMAMOTO	171.7	5	40	22	13	9	5	3	1	1
75.	KUMAMOTO	171.7	10	96	53	32	22	11	8	3	1
75.	KUMAMOTO	171.7	20	226	115	75	51	28	18	6	3
75.	KUMAMOTO	171.7	30	521	313	196	115	64	41	13	6
75.	KUMAMOTO	171.7	300	4293	2454	1562	904	521	313	106	42
76.	KURASIKI	293.3	5	69	37	22	15	9	5	2	1
76.	KURASIKI	293.3	10	163	89	55	37	19	13	5	2
76.	KURASIKI	293.3	20	386	196	128	87	47	30	11	4
76.	KURASIKI	293.3	30	889	534	334	196	109	70	22	10
76.	KURASIKI	293.3	300	7334	4191	2667	1544	889	534	182	72
77.	KURE	144.7	5	34	19	11	8	4	3	1	1
77.	KURE	144.7	10	81	44	27	18	9	7	3	1
77.	KURE	144.7	20	191	97	63	43	23	15	6	2
77.	KURE	144.7	30	439	264	165	97	54	35	11	5
77.	KURE	144.7	300	3618	2068	1316	762	439	264	90	36
78.	KURUME	123.9	5	29	16	10	7	4	3	1	1
78.	KURUME	123.9	10	69	38	23	16	8	6	2	1
78.	KURUME	123.9	20	164	83	54	37	20	13	5	2
78.	KURUME	123.9	30	376	226	141	83	46	30	10	4
78.	KURUME	123.9	300	3099	1771	1127	653	376	226	77	31
79.	KUSIRO	218.0	5	51	28	17	11	6	4	2	1
79.	KUSIRO	218.0	10	122	67	41	27	14	10	4	2
79.	KUSIRO	218.0	20	287	146	95	65	35	22	8	3
79.	KUSIRO	218.0	30	661	397	248	146	81	52	17	8
79.	KUSIRO	218.0	300	5452	3115	1983	1148	661	397	135	54
80.	KYOTO	610.6	5	142	77	45	30	17	11	4	2
80.	KYOTO	610.6	10	340	186	114	76	38	26	9	4
80.	KYOTO	610.6	20	804	408	266	180	97	62	22	9
80.	KYOTO	610.6	30	1851	1111	694	408	227	146	45	20
80.	KYOTO	610.6	300	15266	8723	5551	3214	1851	1111	377	149

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
81.	MAEBASI	147.4	5	35	19	11	8	5	3	1	1
81.	MAEBASI	147.4	10	82	45	28	19	10	7	3	1
81.	MAEBASI	147.4	20	194	99	65	44	24	15	6	2
81.	MAEBASI	147.4	30	447	268	168	99	55	36	11	5
81.	MAEBASI	147.4	300	3685	2106	1340	776	447	268	91	36
82.	MATIDA	71.5	5	17	9	6	4	2	2	1	1
82.	MATIDA	71.5	10	40	22	14	9	5	4	2	1
82.	MATIDA	71.5	20	95	48	32	22	12	8	3	1
82.	MATIDA	71.5	30	217	131	82	48	27	18	6	3
82.	MATIDA	71.5	300	1789	1022	651	377	217	131	45	18
83.	MATUBARA	16.6	5	4	3	2	1	1	1	1	1
83.	MATUBARA	16.6	10	10	6	4	3	2	1	1	1
83.	MATUBARA	16.6	20	22	12	8	5	3	2	1	1
83.	MATUBARA	16.6	30	51	31	19	12	7	4	2	1
83.	MATUBARA	16.6	300	415	237	151	88	51	31	11	5
84.	MATUDO	61.2	5	15	8	5	3	2	2	1	1
84.	MATUDO	61.2	10	34	19	12	8	4	3	1	1
84.	MATUDO	61.2	20	81	41	27	18	10	7	3	1
84.	MATUDO	61.2	30	186	112	70	41	23	15	5	2
84.	MATUDO	61.2	300	1530	875	557	323	186	112	38	15
85.	MATUE	175.4	5	41	22	13	9	5	3	1	1
85.	MATUE	175.4	10	98	54	33	22	11	8	3	1
85.	MATUE	175.4	20	231	117	77	52	28	18	7	3
85.	MATUE	175.4	30	532	319	200	117	65	42	13	6
85.	MATUE	175.4	300	4386	2506	1595	924	532	319	109	43
86.	MATUMOTO	264.3	5	62	34	20	13	8	5	2	1
86.	MATUMOTO	264.3	10	147	81	49	33	17	12	4	2
86.	MATUMOTO	264.3	20	348	177	115	78	42	27	10	4
86.	MATUMOTO	264.3	30	801	481	301	177	98	63	20	9
86.	MATUMOTO	264.3	300	6608	3776	2403	1392	801	481	164	65
87.	MATUSAKA	208.1	5	49	26	16	11	6	4	2	1
87.	MATUSAKA	208.1	10	116	64	39	26	13	9	3	2
87.	MATUSAKA	208.1	20	274	139	91	62	34	21	8	3
87.	MATUSAKA	208.1	30	631	379	237	139	78	50	16	7
87.	MATUSAKA	208.1	300	5202	2973	1892	1096	631	379	129	51
88.	MATUYAMA	288.7	5	68	37	22	15	8	5	2	1
88.	MATUYAMA	288.7	10	161	88	54	36	18	13	5	2
88.	MATUYAMA	288.7	20	380	193	126	85	46	29	11	4
88.	MATUYAMA	288.7	30	875	525	329	193	107	69	22	10
88.	MATUYAMA	288.7	300	7218	4125	2625	1520	875	525	179	71
89.	MITAKA	16.8	5	4	3	2	1	1	1	1	1
89.	MITAKA	16.8	10	10	6	4	3	2	1	1	1
89.	MITAKA	16.8	20	23	12	8	5	3	2	1	1
89.	MITAKA	16.8	30	51	31	20	12	7	4	2	1
89.	MITAKA	16.8	300	421	241	153	89	51	31	11	5
90.	MITO	146.0	5	34	19	11	8	4	3	1	1
90.	MITO	146.0	10	82	45	28	19	9	7	3	1
90.	MITO	146.0	20	193	98	64	43	24	15	6	2
90.	MITO	146.0	30	443	266	166	98	55	35	11	5
90.	MITO	146.0	300	3649	2086	1327	769	443	266	91	36

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
91.	MIYAKONOZYO	306.7	5	72	39	23	15	9	6	2	1
91.	MIYAKONOZYO	306.7	10	171	93	57	38	19	13	5	2
91.	MIYAKONOZYO	306.7	20	404	205	134	91	49	31	11	5
91.	MIYAKONOZYO	306.7	30	930	558	349	205	114	74	23	10
91.	MIYAKONOZYO	306.7	300	7668	4382	2789	1615	930	558	190	75
92.	MIYAZAKI	286.0	5	67	36	22	14	8	5	2	1
92.	MIYAZAKI	286.0	10	159	87	53	36	18	13	5	2
92.	MIYAZAKI	286.0	20	377	191	125	85	46	29	10	4
92.	MIYAZAKI	286.0	30	867	520	325	191	106	69	22	10
92.	MIYAZAKI	286.0	300	7149	4086	2600	1506	867	520	177	70
93.	MORIGUTI	13.1	5	4	2	1	1	1	1	1	1
93.	MORIGUTI	13.1	10	8	4	3	2	1	1	1	1
93.	MORIGUTI	13.1	20	18	9	6	4	3	2	1	1
93.	MORIGUTI	13.1	30	40	24	15	9	5	4	1	1
93.	MORIGUTI	13.1	300	329	188	120	70	40	24	9	4
94.	MORIOKA	398.7	5	93	50	30	20	11	7	3	1
94.	MORIOKA	398.7	10	222	121	74	50	25	17	6	3
94.	MORIOKA	398.7	20	525	266	174	118	64	40	14	6
94.	MORIOKA	398.7	30	1209	725	454	266	148	95	30	13
94.	MORIOKA	398.7	300	9968	5696	3625	2099	1209	725	247	98
95.	MURORAN	79.7	5	19	10	6	4	3	2	1	1
95.	MURORAN	79.7	10	45	25	15	10	5	4	2	1
95.	MURORAN	79.7	20	105	54	35	24	13	8	3	2
95.	MURORAN	79.7	30	242	145	91	54	30	19	6	3
95.	MURORAN	79.7	300	1993	1139	725	420	242	145	50	20
96.	MUSASINO	11.0	5	3	2	1	1	1	1	1	1
96.	MUSASINO	11.0	10	7	4	3	2	1	1	1	1
96.	MUSASINO	11.0	20	15	8	5	4	2	2	1	1
96.	MUSASINO	11.0	30	34	21	13	8	5	3	1	1
96.	MUSASINO	11.0	300	276	158	101	59	34	21	7	3
97.	NAGANO	404.1	5	94	51	30	20	12	7	3	1
97.	NAGANO	404.1	10	225	123	75	50	25	18	6	3
97.	NAGANO	404.1	20	532	270	176	119	65	41	15	6
97.	NAGANO	404.1	30	1225	735	460	270	150	97	30	14
97.	NAGANO	404.1	300	10102	5773	3674	2127	1225	735	250	99
98.	NAGAOKA	259.9	5	61	33	20	13	8	5	2	1
98.	NAGAOKA	259.9	10	145	79	49	33	17	11	4	2
98.	NAGAOKA	259.9	20	342	174	113	77	42	26	10	4
98.	NAGAOKA	259.9	30	788	473	296	174	97	62	20	9
98.	NAGAOKA	259.9	300	6498	3714	2363	1368	788	473	161	64
99.	NAGASAKI	239.6	5	56	30	18	12	7	4	2	1
99.	NAGASAKI	239.6	10	134	73	45	30	15	11	4	2
99.	NAGASAKI	239.6	20	316	160	105	71	39	24	9	4
99.	NAGASAKI	239.6	30	727	436	273	160	89	58	18	8
99.	NAGASAKI	239.6	300	5992	3424	2179	1262	727	436	148	59
100.	NAGOYA	326.2	5	76	41	24	16	9	6	2	1
100.	NAGOYA	326.2	10	182	99	61	41	21	14	5	2
100.	NAGOYA	326.2	20	430	218	142	96	52	33	12	5
100.	NAGOYA	326.2	30	989	594	371	218	121	78	24	11
100.	NAGOYA	326.2	300	8155	4660	2966	1717	989	594	202	80

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
101.	NAHA	37.2	5	9	5	3	2	2	1	1	1
101.	NAHA	37.2	10	21	12	7	5	3	2	1	1
101.	NAHA	37.2	20	49	25	17	11	6	4	2	1
101.	NAHA	37.2	30	113	68	43	25	14	9	3	2
101.	NAHA	37.2	300	930	531	338	196	113	68	23	10
102.	NARA	211.9	5	50	27	16	11	6	4	2	1
102.	NARA	211.9	10	118	65	40	27	14	9	4	2
102.	NARA	211.9	20	279	142	93	63	34	22	8	3
102.	NARA	211.9	30	643	386	241	142	79	51	16	7
102.	NARA	211.9	300	5298	3028	1927	1116	643	386	131	52
103.	NARASINO	15.2	5	4	2	2	1	1	1	1	1
103.	NARASINO	15.2	10	9	5	3	2	1	1	1	1
103.	NARASINO	15.2	20	21	11	7	5	3	2	1	1
103.	NARASINO	15.2	30	47	28	18	11	6	4	2	1
103.	NARASINO	15.2	300	381	218	139	81	47	28	10	4
104.	NEYAGAWA	24.0	5	6	3	2	2	1	1	1	1
104.	NEYAGAWA	24.0	10	14	8	5	3	2	2	1	1
104.	NEYAGAWA	24.0	20	32	16	11	8	4	3	1	1
104.	NEYAGAWA	24.0	30	73	44	28	16	9	6	2	1
104.	NEYAGAWA	24.0	300	600	343	219	127	73	44	15	6
105.	NIIGATA	208.9	5	49	27	16	11	6	4	2	1
105.	NIIGATA	208.9	10	117	64	39	26	13	9	3	2
105.	NIIGATA	208.9	20	275	140	91	62	34	21	8	3
105.	NIIGATA	208.9	30	634	380	238	140	78	50	16	7
105.	NIIGATA	208.9	300	5223	2985	1900	1100	634	380	129	51
106.	NIIHAMA	158.6	5	37	20	12	8	5	3	1	1
106.	NIIHAMA	158.6	10	89	49	30	20	10	7	3	1
106.	NIIHAMA	158.6	20	209	106	69	47	26	16	6	3
106.	NIIHAMA	158.6	30	481	289	181	106	59	38	12	6
106.	NIIHAMA	158.6	300	3966	2266	1442	835	481	289	98	39
107.	NIIZA	22.9	5	6	3	2	2	1	1	1	1
107.	NIIZA	22.9	10	13	7	5	3	2	1	1	1
107.	NIIZA	22.9	20	31	16	10	7	4	3	1	1
107.	NIIZA	22.9	30	70	42	27	16	9	6	2	1
107.	NIIZA	22.9	300	573	327	209	121	70	42	15	6
108.	NISINOMIYA	97.5	5	23	13	8	5	3	2	1	1
108.	NISINOMIYA	97.5	10	55	30	19	13	7	5	2	1
108.	NISINOMIYA	97.5	20	129	66	43	29	16	10	4	2
108.	NISINOMIYA	97.5	30	296	178	111	66	37	24	8	4
108.	NISINOMIYA	97.5	300	2438	1394	887	514	296	178	61	24
109.	NOBEOKA	287.4	5	67	36	22	15	8	5	2	1
109.	NOBEOKA	287.4	10	160	88	54	36	18	13	5	2
109.	NOBEOKA	287.4	20	379	192	125	85	46	29	10	4
109.	NOBEOKA	287.4	30	871	523	327	192	107	69	22	10
109.	NOBEOKA	287.4	300	7185	4106	2613	1513	871	523	178	71
110.	NUMATU	151.1	5	36	19	12	8	5	3	1	1
110.	NUMATU	151.1	10	84	46	28	19	10	7	3	1
110.	NUMATU	151.1	20	199	101	66	45	24	16	6	2
110.	NUMATU	151.1	30	458	275	172	101	56	36	12	5
110.	NUMATU	151.1	300	3779	2160	1374	796	458	275	94	37

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
111.	OBIHIRO	617.9	5	144	78	46	31	17	11	4	2
111.	OBIHIRO	617.9	10	344	188	115	77	39	27	9	4
111.	OBIHIRO	617.9	20	814	412	269	182	99	62	22	9
111.	OBIHIRO	617.9	30	1873	1124	703	412	229	148	46	20
111.	OBIHIRO	617.9	300	15449	8828	5618	3253	1873	1124	382	151
112.	ODAWARA	114.2	5	27	15	9	6	4	2	1	1
112.	ODAWARA	114.2	10	64	35	22	15	8	5	2	1
112.	ODAWARA	114.2	20	151	77	50	34	19	12	4	2
112.	ODAWARA	114.2	30	347	208	130	77	43	28	9	4
112.	ODAWARA	114.2	300	2856	1632	1039	602	347	208	71	28
113.	OGAKI	80.3	5	19	11	6	4	3	2	1	1
113.	OGAKI	80.3	10	45	25	15	10	5	4	2	1
113.	OGAKI	80.3	20	106	54	35	24	13	9	3	2
113.	OGAKI	80.3	30	244	146	92	54	30	20	6	3
113.	OGAKI	80.3	300	2007	1147	730	423	244	146	50	20
114.	OITA	354.8	5	83	45	27	18	10	6	2	1
114.	OITA	354.8	10	198	108	66	44	22	15	6	2
114.	OITA	354.8	20	467	237	155	105	57	36	13	5
114.	OITA	354.8	30	1076	646	404	237	132	85	27	12
114.	OITA	354.8	300	8871	5069	3226	1868	1076	646	220	87
115.	OKAYAMA	510.5	5	119	64	38	25	15	9	3	2
115.	OKAYAMA	510.5	10	284	155	95	64	32	22	8	3
115.	OKAYAMA	510.5	20	672	341	222	151	82	52	18	7
115.	OKAYAMA	510.5	30	1547	929	581	341	190	122	38	17
115.	OKAYAMA	510.5	300	12762	7293	4641	2687	1547	929	316	125
116.	OKAZAKI	227.0	5	53	29	17	12	7	4	2	1
116.	OKAZAKI	227.0	10	127	69	43	29	15	10	4	2
116.	OKAZAKI	227.0	20	299	152	99	67	37	23	8	3
116.	OKAZAKI	227.0	30	689	413	259	152	85	55	17	8
116.	OKAZAKI	227.0	300	5677	3244	2065	1195	689	413	141	56
117.	OMIYA	88.9	5	21	12	7	5	3	2	1	1
117.	OMIYA	88.9	10	50	27	17	11	6	4	2	1
117.	OMIYA	88.9	20	117	60	39	27	15	9	4	2
117.	OMIYA	88.9	30	270	162	101	60	33	22	7	3
117.	OMIYA	88.9	300	2222	1270	808	468	270	162	55	22
118.	OMUTA	79.4	5	19	10	6	4	3	2	1	1
118.	OMUTA	79.4	10	45	25	15	10	5	4	2	1
118.	OMUTA	79.4	20	105	53	35	24	13	8	3	2
118.	OMUTA	79.4	30	241	145	91	53	30	19	6	3
118.	OMUTA	79.4	300	1986	1135	722	418	241	145	50	20
119.	ONOMITI	110.6	5	26	14	9	6	4	2	1	1
119.	ONOMITI	110.6	10	62	34	21	14	7	5	2	1
119.	ONOMITI	110.6	20	146	74	49	33	18	12	4	2
119.	ONOMITI	110.6	30	336	202	126	74	41	27	9	4
119.	ONOMITI	110.6	300	2766	1581	1006	583	336	202	69	27
120.	OSAKA	208.1	5	49	27	16	11	6	4	2	1
120.	OSAKA	208.1	10	116	64	39	26	13	9	3	2
120.	OSAKA	208.1	20	274	139	91	62	34	21	8	3
120.	OSAKA	208.1	30	631	379	237	139	78	50	16	7
120.	OSAKA	208.1	300	5203	2973	1892	1096	631	379	129	51

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
121.	OTA	97.5	5	23	13	8	5	3	2	1	1
121.	OTA	97.5	10	55	30	19	13	7	5	2	1
121.	OTA	97.5	20	129	66	43	29	16	10	4	2
121.	OTA	97.5	30	296	178	111	66	37	24	8	4
121.	OTA	97.5	300	2438	1394	887	514	296	178	61	24
122.	OTARU	244.2	5	57	31	18	12	7	5	2	1
122.	OTARU	244.2	10	136	74	46	31	16	11	4	2
122.	OTARU	244.2	20	322	163	107	72	39	25	9	4
122.	OTARU	244.2	30	741	445	278	163	91	59	18	8
122.	OTARU	244.2	300	6106	3489	2221	1286	741	445	151	60
123.	OTU	302.8	5	71	38	23	15	9	6	2	1
123.	OTU	302.8	10	169	92	57	38	19	13	5	2
123.	OTU	302.8	20	309	202	132	90	49	31	11	4
123.	OTU	302.8	30	918	551	345	202	113	73	23	10
123.	OTU	302.8	300	7570	4326	2753	1594	918	551	187	74
124.	OYAMA	173.8	5	41	22	13	9	5	3	1	1
124.	OYAMA	173.8	10	97	53	33	22	11	8	3	1
124.	OYAMA	173.8	20	229	116	76	52	28	18	7	3
124.	OYAMA	173.8	30	527	316	198	116	65	42	13	6
124.	OYAMA	173.8	300	4345	2483	1580	915	527	316	108	43
125.	SAGA	103.7	5	25	13	8	6	3	2	1	1
125.	SAGA	103.7	10	58	32	20	13	7	5	2	1
125.	SAGA	103.7	20	137	70	46	31	17	11	4	2
125.	SAGA	103.7	30	315	189	118	70	39	25	8	4
125.	SAGA	103.7	300	2592	1482	943	546	315	189	64	26
126.	SAGAMIHARA	90.8	5	22	12	7	5	3	2	1	1
126.	SAGAMIHARA	90.8	10	51	28	17	12	6	4	2	1
126.	SAGAMIHARA	90.8	20	120	61	40	27	15	10	4	2
126.	SAGAMIHARA	90.8	30	276	166	104	61	34	22	7	3
126.	SAGAMIHARA	90.8	300	2270	1297	826	478	276	166	57	23
127.	SAKAI	132.9	5	31	17	10	7	4	3	1	1
127.	SAKAI	132.9	10	74	41	25	17	9	6	2	1
127.	SAKAI	132.9	20	175	89	58	40	22	14	5	2
127.	SAKAI	132.9	30	403	242	152	89	50	32	10	5
127.	SAKAI	132.9	300	3323	1899	1209	700	403	242	83	33
128.	SAPPORO	1118.0	5	260	140	83	55	31	19	6	3
128.	SAPPORO	1118.0	10	622	339	208	139	70	48	16	7
128.	SAPPORO	1118.0	20	1472	746	487	329	178	112	39	15
128.	SAPPORO	1118.0	30	3388	2033	1271	746	415	267	83	37
128.	SAPPORO	1118.0	300	27951	15972	10164	5885	3388	2033	691	273
129.	SASEBO	249.8	5	59	32	19	13	7	5	2	1
129.	SASEBO	249.8	10	139	76	47	31	16	11	4	2
129.	SASEBO	249.8	20	329	167	109	74	40	25	9	4
129.	SASEBO	249.8	30	758	455	284	167	93	60	19	9
129.	SASEBO	249.8	300	6246	3570	2272	1315	758	455	155	61
130.	SENDAI	237.1	5	56	30	18	12	7	4	2	1
130.	SENDAI	237.1	10	132	72	44	30	15	10	4	2
130.	SENDAI	237.1	20	312	159	104	70	38	24	9	4
130.	SENDAI	237.1	30	719	432	270	159	88	57	18	8
130.	SENDAI	237.1	300	5928	3388	2156	1248	719	432	147	58

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
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131.	SETO	110.3	5	26	14	9	6	4	2	1	1
131.	SETO	110.3	10	62	34	21	14	7	5	2	1
131.	SETO	110.3	20	146	74	48	33	18	12	4	2
131.	SETO	110.3	30	335	201	126	74	41	27	9	4
131.	SETO	110.3	300	2759	1577	1004	581	335	201	69	27
132.	SIMIZU	227.7	5	53	29	17	12	7	4	2	1
132.	SIMIZU	227.7	10	127	70	43	29	15	10	4	2
132.	SIMIZU	227.7	20	300	152	100	67	37	23	8	3
132.	SIMIZU	227.7	30	691	415	259	152	85	55	17	8
132.	SIMIZU	227.7	300	5694	3254	2071	1199	691	415	141	56
133.	SIMONOSEKI	220.8	5	52	28	17	11	7	4	2	1
133.	SIMONOSEKI	220.8	10	123	67	41	28	14	10	4	2
133.	SIMONOSEKI	220.8	20	291	148	96	65	36	23	8	3
133.	SIMONOSEKI	220.8	30	670	402	251	148	82	53	17	8
133.	SIMONOSEKI	220.8	300	5521	3155	2008	1163	670	402	137	54
134.	SIZUOKA	1146.0	5	267	144	85	56	32	20	7	3
134.	SIZUOKA	1146.0	10	637	348	213	142	71	49	17	7
134.	SIZUOKA	1146.0	20	1508	764	499	338	182	115	40	16
134.	SIZUOKA	1146.0	30	3473	2084	1303	764	425	273	85	37
134.	SIZUOKA	1146.0	300	28649	16371	10418	6032	3473	2084	708	280
135.	SOKA	27.5	5	7	4	3	2	1	1	1	1
135.	SOKA	27.5	10	16	9	6	4	2	2	1	1
135.	SOKA	27.5	20	37	19	12	9	5	3	1	1
135.	SOKA	27.5	30	84	51	32	19	11	7	3	1
135.	SOKA	27.5	300	689	394	251	145	84	51	17	7
136.	SUITA	36.6	5	9	5	3	2	1	1	1	1
136.	SUITA	36.6	10	21	12	7	5	3	2	1	1
136.	SUITA	36.6	20	49	25	16	11	6	4	2	1
136.	SUITA	36.6	30	111	67	42	25	14	9	3	2
136.	SUITA	36.6	300	915	523	333	193	111	67	23	9
137.	SUZUKA	195.9	5	46	25	15	10	6	4	2	1
137.	SUZUKA	195.9	10	109	60	37	25	13	9	3	2
137.	SUZUKA	195.9	20	258	131	86	58	32	20	7	3
137.	SUZUKA	195.9	30	594	357	223	131	73	47	15	7
137.	SUZUKA	195.9	300	4898	2799	1781	1031	594	357	121	48
138.	TAKAMATU	194.5	5	46	25	15	10	6	4	2	1
138.	TAKAMATU	194.5	10	109	59	37	24	12	9	3	2
138.	TAKAMATU	194.5	20	256	130	85	58	31	20	7	3
138.	TAKAMATU	194.5	30	590	354	221	130	73	47	15	7
138.	TAKAMATU	194.5	300	4862	2778	1768	1024	590	354	121	48
139.	TAKAOKA	151.0	5	36	19	12	8	5	3	1	1
139.	TAKAOKA	151.0	10	84	46	28	19	10	7	3	1
139.	TAKAOKA	151.0	20	199	101	66	45	24	16	6	2
139.	TAKAOKA	151.0	30	458	275	172	101	56	36	12	5
139.	TAKAOKA	151.0	300	3777	2158	1374	795	458	275	94	37
140.	TAKARAZUKA	101.9	5	24	13	8	5	3	2	1	1
140.	TAKARAZUKA	101.9	10	57	31	19	13	7	5	2	1
140.	TAKARAZUKA	101.9	20	135	68	45	30	17	11	4	2
140.	TAKARAZUKA	101.9	30	309	186	116	68	38	25	8	4
140.	TAKARAZUKA	101.9	300	2548	1456	927	537	309	186	63	25

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
141.	TAKASAKI	110.5	5	26	14	9	6	4	2	1	1
141.	TAKASAKI	110.5	10	62	34	21	14	7	5	2	1
141.	TAKASAKI	110.5	20	146	74	49	33	18	12	4	2
141.	TAKASAKI	110.5	30	335	201	126	74	41	27	9	4
141.	TAKASAKI	110.5	300	2762	1579	1005	582	335	201	69	27
142.	TAKATUKI	104.9	5	25	14	8	6	3	2	1	1
142.	TAKATUKI	104.9	10	59	32	20	13	7	5	2	1
142.	TAKATUKI	104.9	20	139	70	46	31	17	11	4	2
142.	TAKATUKI	104.9	30	319	191	120	70	39	25	8	4
142.	TAKATUKI	104.9	300	2624	1500	955	553	319	191	65	26
143.	TATIKAWA	24.2	5	6	4	2	2	1	1	1	1
143.	TATIKAWA	24.2	10	14	8	5	3	2	2	1	1
143.	TATIKAWA	24.2	20	32	17	11	8	4	3	1	1
143.	TATIKAWA	24.2	30	74	45	28	17	9	6	2	1
143.	TATIKAWA	24.2	300	606	346	221	128	74	45	15	6
144.	TIBA	260.9	5	61	33	20	13	8	5	2	1
144.	TIBA	260.9	10	145	80	49	33	17	11	4	2
144.	TIBA	260.9	20	344	174	114	77	42	27	10	4
144.	TIBA	260.9	30	791	475	297	174	97	63	20	9
144.	TIBA	260.9	300	6522	3727	2372	1373	791	475	162	64
145.	TIGASAKI	35.8	5	9	5	3	2	1	1	1	1
145.	TIGASAKI	35.8	10	20	11	7	5	3	2	1	1
145.	TIGASAKI	35.8	20	48	24	16	11	6	4	2	1
145.	TIGASAKI	35.8	30	109	66	41	24	14	9	3	2
145.	TIGASAKI	35.8	300	894	511	326	189	109	66	23	9
146.	TOKOROZAWA	71.8	5	17	9	6	4	2	2	1	1
146.	TOKOROZAWA	71.8	10	40	22	14	9	5	4	2	1
146.	TOKOROZAWA	71.8	20	95	48	32	22	12	8	3	1
146.	TOKOROZAWA	71.8	30	218	131	82	48	27	18	6	3
146.	TOKOROZAWA	71.8	300	1796	1027	654	379	218	131	45	18
147.	TOKUSIMA	177.1	5	42	23	14	9	5	3	1	1
147.	TOKUSIMA	177.1	10	99	54	33	22	11	8	3	1
147.	TOKUSIMA	177.1	20	234	119	78	53	29	18	7	3
147.	TOKUSIMA	177.1	30	537	323	202	119	66	43	14	6
147.	TOKUSIMA	177.1	300	4429	2531	1611	933	537	323	110	44
148.	TOKUYAMA	338.0	5	79	43	25	17	10	6	2	1
148.	TOKUYAMA	338.0	10	188	103	63	42	21	15	5	2
148.	TOKUYAMA	338.0	20	445	226	147	100	54	34	12	5
148.	TOKUYAMA	338.0	30	1025	615	385	226	126	81	25	11
148.	TOKUYAMA	338.0	300	8451	4829	3073	1779	1025	615	209	83
149.	TOKYO	1305.2	5	304	164	96	64	36	22	7	3
149.	TOKYO	1305.2	10	726	396	242	162	81	56	19	8
149.	TOKYO	1305.2	20	1718	871	568	384	208	131	46	18
149.	TOKYO	1305.2	30	3956	2374	1484	871	484	311	96	43
149.	TOKYO	1305.2	300	32630	18646	11866	6870	3956	2374	806	319
150.	TOMAKOMAI	562.1	5	131	71	42	28	16	10	3	2
150.	TOMAKOMAI	562.1	10	313	171	105	70	35	24	8	4
150.	TOMAKOMAI	562.1	20	740	375	245	166	90	57	20	8
150.	TOMAKOMAI	562.1	30	1704	1022	639	375	209	134	42	19
150.	TOMAKOMAI	562.1	300	14053	8030	5110	2959	1704	1022	347	138

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
151.	TOTTORI	237.2	5	56	30	18	12	7	4	2	1
151.	TOTTORI	237.2	10	132	72	44	30	15	11	4	2
151.	TOTTORI	237.2	20	313	159	104	70	38	24	9	4
151.	TOTTORI	237.2	30	719	432	270	159	88	57	18	8
151.	TOTTORI	237.2	300	5932	3390	2157	1249	719	432	147	58
152.	TOYAMA	209.1	5	49	27	16	11	6	4	2	1
152.	TOYAMA	209.1	10	117	64	39	26	13	9	3	2
152.	TOYAMA	209.1	20	276	140	91	62	34	21	8	3
152.	TOYAMA	209.1	30	634	381	238	140	78	50	16	7
152.	TOYAMA	209.1	300	5227	2987	1901	1101	634	381	130	51
153.	TOYODA	289.1	5	68	37	22	15	8	5	2	1
153.	TOYODA	289.1	10	161	88	54	36	18	13	5	2
153.	TOYODA	289.1	20	381	193	126	86	46	29	11	4
153.	TOYODA	289.1	30	876	526	329	193	108	69	22	10
153.	TOYODA	289.1	300	7227	4130	2628	1522	876	526	179	71
154.	TOYOHASI	256.9	5	60	33	19	13	8	5	2	1
154.	TOYOHASI	256.9	10	143	78	48	32	16	11	4	2
154.	TOYOHASI	256.9	20	339	172	112	76	41	26	9	4
154.	TOYOHASI	256.9	30	779	468	292	172	96	62	19	9
154.	TOYOHASI	256.9	300	6423	3670	2336	1353	779	468	159	63
155.	TOYONAKA	36.6	5	9	5	3	2	1	1	1	1
155.	TOYONAKA	36.6	10	21	12	7	5	3	2	1	1
155.	TOYONAKA	36.6	20	49	25	16	11	6	4	2	1
155.	TOYONAKA	36.6	30	111	67	42	25	14	9	3	2
155.	TOYONAKA	36.6	300	915	523	333	193	111	67	23	9
156.	TU	101.6	5	24	13	8	5	3	2	1	1
156.	TU	101.6	10	57	31	19	13	7	5	2	1
156.	TU	101.6	20	134	68	45	30	17	11	4	2
156.	TU	101.6	30	308	185	116	68	38	25	8	4
156.	TU	101.6	300	2540	1452	924	535	308	185	63	25
157.	TUTIURA	91.5	5	22	12	7	5	3	2	1	1
157.	TUTIURA	91.5	10	51	28	17	12	6	4	2	1
157.	TUTIURA	91.5	20	121	61	40	27	15	10	4	2
157.	TUTIURA	91.5	30	278	167	104	61	34	22	7	3
157.	TUTIURA	91.5	300	2288	1308	832	482	278	167	57	23
158.	TYOHU	21.8	5	6	3	2	2	1	1	1	1
158.	TYOHU	21.8	10	13	7	5	3	2	1	1	1
158.	TYOHU	21.8	20	29	15	10	7	4	3	1	1
158.	TYOHU	21.8	30	67	40	25	15	9	6	2	1
158.	TYOHU	21.8	300	545	312	199	115	67	40	14	6
159.	UBE	205.5	5	48	26	16	11	6	4	2	1
159.	UBE	205.5	10	115	63	39	26	13	9	3	2
159.	UBE	205.5	20	271	137	90	61	33	21	8	3
159.	UBE	205.5	30	623	374	234	137	77	49	16	7
159.	UBE	205.5	300	5137	2936	1868	1082	623	374	127	51
160.	URAWA	71.0	5	17	9	6	4	2	2	1	1
160.	URAWA	71.0	10	40	22	14	9	5	3	1	1
160.	URAWA	71.0	20	94	48	31	21	12	8	3	1
160.	URAWA	71.0	30	216	130	81	48	27	17	6	3
160.	URAWA	71.0	300	1776	1015	646	374	216	130	44	18

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
161.	UTUNOMIYA	312.5	5	73	40	23	16	9	6	2	1
161.	UTUNOMIYA	312.5	10	174	95	58	39	20	14	5	2
161.	UTUNOMIYA	312.5	20	412	209	136	92	50	32	11	5
161.	UTUNOMIYA	312.5	30	948	369	356	209	116	75	23	11
161.	UTUNOMIYA	312.5	300	7814	4465	2842	1645	948	569	193	77
162.	UZI	67.3	5	16	9	5	4	2	2	1	1
162.	UZI	67.3	10	38	21	13	9	5	3	1	1
162.	UZI	67.3	20	89	45	30	20	11	7	3	1
162.	UZI	67.3	30	204	123	77	45	25	17	5	3
162.	UZI	67.3	300	1683	962	612	355	204	123	42	17
163.	WAKAYAMA	205.6	5	48	26	16	11	6	4	2	1
163.	WAKAYAMA	205.6	10	115	63	39	26	13	9	3	2
163.	WAKAYAMA	205.6	20	271	138	90	61	33	21	8	3
163.	WAKAYAMA	205.6	30	624	374	234	138	77	49	16	7
163.	WAKAYAMA	205.6	300	5140	2938	1870	1083	624	374	127	51
164.	YAKKAITI	195.0	5	46	25	15	10	6	4	2	1
164.	YAKKAITI	195.0	10	109	60	37	25	13	9	3	2
164.	YAKKAITI	195.0	20	257	130	85	58	31	20	7	3
164.	YAKKAITI	195.0	30	591	355	222	130	73	47	15	7
164.	YAKKAITI	195.0	300	4874	2786	1773	1027	591	355	121	48
165.	YAMAGATA	381.6	5	89	48	29	19	11	7	3	1
165.	YAMAGATA	381.6	10	212	116	71	48	24	17	6	3
165.	YAMAGATA	381.6	20	503	255	166	113	61	39	14	6
165.	YAMAGATA	381.6	30	1157	694	434	255	142	91	29	13
165.	YAMAGATA	381.6	300	9540	5452	3469	2009	1157	694	236	94
166.	YAMAGUTI	356.6	5	83	45	27	18	10	6	2	1
166.	YAMAGUTI	356.6	10	199	109	67	45	23	16	6	2
166.	YAMAGUTI	356.6	20	470	238	156	105	57	36	13	5
166.	YAMAGUTI	356.6	30	1081	649	406	238	133	85	27	12
166.	YAMAGUTI	356.6	300	8915	5095	3242	1877	1081	649	221	87
167.	YAMATO	28.6	5	7	4	3	2	1	1	1	1
167.	YAMATO	28.6	10	16	9	6	4	2	2	1	1
167.	YAMATO	28.6	20	38	20	13	9	5	3	1	1
167.	YAMATO	28.6	30	87	52	33	20	11	7	3	1
167.	YAMATO	28.6	300	715	409	260	151	87	52	18	7
168.	YAO	41.3	5	10	6	4	3	2	1	1	1
168.	YAO	41.3	10	23	13	8	6	3	2	1	1
168.	YAO	41.3	20	55	28	18	13	7	5	2	1
168.	YAO	41.3	30	126	76	47	28	16	10	4	2
168.	YAO	41.3	300	1032	590	376	218	126	76	26	11
169.	YATIYO	51.1	5	12	7	4	3	2	1	1	1
169.	YATIYO	51.1	10	29	16	10	7	4	3	1	1
169.	YATIYO	51.1	20	68	35	23	16	9	6	2	1
169.	YATIYO	51.1	30	155	93	59	35	19	13	4	2
169.	YATIYO	51.1	300	1277	730	465	269	155	93	32	13
170.	YATSUSIRO	146.1	5	34	19	11	8	5	3	1	1
170.	YATSUSIRO	146.1	10	82	45	28	19	10	7	3	1
170.	YATSUSIRO	146.1	20	193	98	64	43	24	15	6	2
170.	YATSUSIRO	146.1	30	443	266	167	98	55	35	11	5
170.	YATSUSIRO	146.1	300	3653	2087	1329	769	443	266	91	36

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
171.	YOKOHAMA	421.5	5	99	53	31	21	12	8	3	1
171.	YOKOHAMA	421.5	10	235	128	79	53	27	18	6	3
171.	YOKOHAMA	421.5	20	555	281	184	124	67	43	15	6
171.	YOKOHAMA	421.5	30	1278	767	479	281	157	101	31	14
171.	YOKOHAMA	421.5	300	10537	6021	3832	2219	1278	767	261	103
172.	YOKOSUKA	99.0	5	24	13	8	5	3	2	1	1
172.	YOKOSUKA	99.0	10	55	30	19	13	7	5	2	1
172.	YOKOSUKA	99.0	20	131	66	44	30	16	10	4	2
172.	YOKOSUKA	99.0	30	300	180	113	66	37	24	8	4
172.	YOKOSUKA	99.0	300	2475	1415	900	522	300	180	62	25
173.	YONAGO	97.5	5	23	13	8	5	3	2	1	1
173.	YONAGO	97.5	10	55	30	19	13	7	5	2	1
173.	YONAGO	97.5	20	129	65	43	29	16	10	4	2
173.	YONAGO	97.5	30	296	178	111	65	37	24	8	4
173.	YONAGO	97.5	300	2438	1393	887	514	296	178	61	24
174.	ZYOETU	251.5	5	59	32	19	13	7	5	2	1
174.	ZYOETU	251.5	10	140	77	47	32	16	11	4	2
174.	ZYOETU	251.5	20	331	168	110	74	40	26	9	4
174.	ZYOETU	251.5	30	763	458	286	168	94	60	19	9
174.	ZYOETU	251.5	300	6289	3594	2287	1324	763	458	156	62

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
1.	ANDA	8.0	5	2	1	1	1	1	1	0	0
1.	ANDA	8.0	10	5	3	2	1	1	1	1	0
1.	ANDA	8.0	20	11	6	4	3	2	1	1	1
1.	ANDA	8.0	30	25	15	9	6	3	2	1	1
1.	ANDA	8.0	300	200	115	73	43	25	15	5	2
2.	ANQING	8.0	5	2	1	1	1	1	1	0	0
2.	ANQING	8.0	10	5	3	2	1	1	1	1	0
2.	ANQING	8.0	20	11	6	4	3	2	1	1	1
2.	ANQING	8.0	30	25	15	9	6	3	2	1	1
2.	ANQING	8.0	300	200	115	73	43	25	15	5	2
3.	ANSHAN	84.0	5	20	11	7	4	3	2	1	1
3.	ANSHAN	84.0	10	47	26	16	11	6	4	2	1
3.	ANSHAN	84.0	20	111	56	37	25	14	9	3	2
3.	ANSHAN	84.0	30	255	153	96	56	32	20	7	3
3.	ANSHAN	84.0	300	2100	1200	764	443	255	153	52	21
4.	ANYANG	10.4	5	3	2	1	1	1	1	0	0
4.	ANYANG	10.4	10	6	4	2	2	1	1	1	0
4.	ANYANG	10.4	20	14	7	5	3	2	1	1	1
4.	ANYANG	10.4	30	32	19	12	7	4	3	1	1
4.	ANYANG	10.4	300	260	149	95	55	32	19	7	3
5.	BAICHENG	16.0	5	4	2	2	1	1	1	0	0
5.	BAICHENG	16.0	10	9	5	3	2	1	1	1	0
5.	BAICHENG	16.0	20	21	11	7	5	3	2	1	1
5.	BAICHENG	16.0	30	49	29	19	11	6	4	2	1
5.	BAICHENG	16.0	300	400	229	146	85	49	29	10	4
6.	BAODING	24.0	5	6	3	2	2	1	1	1	0
6.	BAODING	24.0	10	14	8	5	3	2	1	1	1
6.	BAODING	24.0	20	32	16	11	7	4	3	1	1
6.	BAODING	24.0	30	73	44	28	16	9	6	2	1
6.	BAODING	24.0	300	600	343	219	127	73	44	15	6
7.	BAOJI	16.0	5	4	2	2	1	1	1	0	0
7.	BAOJI	16.0	10	9	5	3	2	1	1	1	0
7.	BAOJI	16.0	20	21	11	7	5	3	2	1	1
7.	BAOJI	16.0	30	49	29	19	11	6	4	2	1
7.	BAOJI	16.0	300	400	229	146	85	49	29	10	4
8.	BAUTOU	73.6	5	18	10	6	4	2	2	1	1
8.	BAUTOU	73.6	10	41	23	14	9	5	4	1	1
8.	BAUTOU	73.6	20	97	49	32	22	12	8	3	1
8.	BAUTOU	73.6	30	223	134	84	49	28	18	6	3
8.	BAUTOU	73.6	300	1840	1052	669	388	223	134	46	18
9.	BEIJING	400.0	5	93	50	30	20	11	7	3	1
9.	BEIJING	400.0	10	223	122	74	50	25	17	6	3
9.	BEIJING	400.0	20	527	267	174	118	64	40	14	6
9.	BEIJING	400.0	30	1213	728	455	267	149	96	30	13
9.	BEIJING	400.0	300	10000	5715	3637	2106	1213	728	247	98
10.	BEIPIAO	8.0	5	2	1	1	1	1	1	0	0
10.	BEIPIAO	8.0	10	5	3	2	1	1	1	1	0
10.	BEIPIAO	8.0	20	11	6	4	3	2	1	1	1
10.	BEIPIAO	8.0	30	25	15	9	6	3	2	1	1
10.	BEIPIAO	8.0	300	200	115	73	43	25	15	5	2

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
11.	BENGBU	32.0	5	8	4	3	2	1	1	1	0
11.	BENGBU	32.0	10	18	10	6	4	2	2	1	1
11.	BENGBU	32.0	20	43	22	14	10	5	4	2	1
11.	BENGBU	32.0	30	97	59	37	22	12	8	3	1
11.	BENGBU	32.0	300	800	458	291	169	97	59	20	8
12.	BENXI	48.0	5	12	6	4	3	2	1	1	1
12.	BENXI	48.0	10	27	15	9	6	3	2	1	1
12.	BENXI	48.0	20	64	32	21	15	8	5	2	1
12.	BENXI	48.0	30	146	88	55	32	18	12	4	2
12.	BENXI	48.0	300	1200	686	437	253	146	88	30	12
13.	CANGZHOU	8.0	5	2	1	1	1	1	1	0	0
13.	CANGZHOU	8.0	10	5	3	2	1	1	1	1	0
13.	CANGZHOU	8.0	20	11	6	4	3	2	1	1	1
13.	CANGZHOU	8.0	30	25	15	9	6	3	2	1	1
13.	CANGZHOU	8.0	300	200	115	73	43	25	15	5	2
14.	CHANGCHUN	96.0	5	23	12	7	5	3	2	1	1
14.	CHANGCHUN	96.0	10	54	29	18	12	6	4	2	1
14.	CHANGCHUN	96.0	20	127	64	42	29	16	10	4	2
14.	CHANGCHUN	96.0	30	291	175	109	64	36	23	7	3
14.	CHANGCHUN	96.0	300	2400	1372	873	506	291	175	60	24
15.	CHANGDE	13.6	5	4	2	1	1	1	1	0	0
15.	CHANGDE	13.6	10	8	5	3	2	1	1	1	0
15.	CHANGDE	13.6	20	18	9	6	4	3	2	1	1
15.	CHANGDE	13.6	30	42	25	16	9	5	4	1	1
15.	CHANGDE	13.6	300	340	195	124	72	42	25	9	4
16.	CHANGSHA	66.0	5	16	9	5	4	2	1	1	1
16.	CHANGSHA	66.0	10	37	20	13	9	4	3	1	1
16.	CHANGSHA	66.0	20	87	44	29	20	11	7	3	1
16.	CHANGSHA	66.0	30	200	120	75	44	25	16	5	3
16.	CHANGSHA	66.0	300	1650	943	600	348	200	120	41	16
17.	CHANGZHOU	22.9	5	6	3	2	2	1	1	1	0
17.	CHANGZHOU	22.9	10	13	7	5	3	2	1	1	1
17.	CHANGZHOU	22.9	20	31	16	10	7	4	3	1	1
17.	CHANGZHOU	22.9	30	70	42	26	16	9	6	2	1
17.	CHANGZHOU	22.9	300	573	328	209	121	70	42	15	6
18.	CHAOYANG	.8	5	1	0	0	0	0	0	0	0
18.	CHAOYANG	.8	10	1	1	1	0	0	0	0	0
18.	CHAOYANG	.8	20	1	1	1	1	1	0	0	0
18.	CHAOYANG	.8	30	3	2	1	1	1	1	0	0
18.	CHAOYANG	.8	300	20	12	8	5	3	2	1	1
19.	CHENGDU	100.0	5	24	13	8	5	3	2	1	1
19.	CHENGDU	100.0	10	56	31	19	13	7	5	2	1
19.	CHENGDU	100.0	20	132	67	44	30	16	10	4	2
19.	CHENGDU	100.0	30	303	182	114	67	37	24	8	4
19.	CHENGDU	100.0	300	2500	1429	909	527	303	182	62	25
20.	CHONGQING	192.0	5	45	24	15	10	6	4	1	1
20.	CHONGQING	192.0	10	107	59	36	24	12	9	3	1
20.	CHONGQING	192.0	20	253	128	84	57	31	20	7	3
20.	CHONGQING	192.0	30	582	349	219	128	72	46	15	7
20.	CHONGQING	192.0	300	4800	2743	1746	1011	582	349	119	47

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
21.	DANDONG	8.0	5	2	1	1	1	1	1	0	0
21.	DANDONG	8.0	10	5	3	2	1	1	1	1	0
21.	DANDONG	8.0	20	11	6	4	3	2	1	1	1
21.	DANDONG	8.0	30	25	15	9	6	3	2	1	1
21.	DANDONG	8.0	300	200	115	73	43	25	15	5	2
22.	DATUNG	80.0	5	19	10	6	4	3	2	1	1
22.	DATUNG	80.0	10	45	25	15	10	5	4	2	1
22.	DATUNG	80.0	20	106	54	35	24	13	8	3	1
22.	DATUNG	80.0	30	243	146	91	54	30	19	6	3
22.	DATUNG	80.0	300	2000	1143	728	421	243	146	50	20
23.	DUKOU	40.0	5	10	5	3	2	1	1	1	0
23.	DUKOU	40.0	10	23	13	8	5	3	2	1	1
23.	DUKOU	40.0	20	53	27	18	12	7	4	2	1
23.	DUKOU	40.0	30	122	73	46	27	15	10	3	2
23.	DUKOU	40.0	300	1000	572	364	211	122	73	25	10
24.	FOSHAN	24.0	5	6	3	2	2	1	1	1	0
24.	FOSHAN	24.0	10	14	8	5	3	2	1	1	1
24.	FOSHAN	24.0	20	32	16	11	7	4	3	1	1
24.	FOSHAN	24.0	30	73	44	28	16	9	6	2	1
24.	FOSHAN	24.0	300	600	343	219	127	73	44	15	6
25.	FUSHUN	86.4	5	20	11	7	5	3	2	1	1
25.	FUSHUN	86.4	10	48	27	16	11	6	4	2	1
25.	FUSHUN	86.4	20	114	58	38	26	14	9	3	2
25.	FUSHUN	86.4	30	262	157	99	58	32	21	7	3
25.	FUSHUN	86.4	300	2160	1235	786	455	262	157	54	21
26.	FUXIN	24.0	5	6	3	2	2	1	1	1	0
26.	FUXIN	24.0	10	14	8	5	3	2	1	1	1
26.	FUXIN	24.0	20	32	16	11	7	4	3	1	1
26.	FUXIN	24.0	30	73	44	28	16	9	6	2	1
26.	FUXIN	24.0	300	600	343	219	127	73	44	15	6
27.	FUZHOU	54.4	5	13	7	4	3	2	1	1	1
27.	FUZHOU	54.4	10	31	17	10	7	4	3	1	1
27.	FUZHOU	54.4	20	72	37	24	16	9	6	2	1
27.	FUZHOU	54.4	30	165	99	62	37	21	13	4	2
27.	FUZHOU	54.4	300	1360	778	495	287	165	99	34	14
28.	GANZHOU	16.0	5	4	2	2	1	1	1	0	0
28.	GANZHOU	16.0	10	9	5	3	2	1	1	1	0
28.	GANZHOU	16.0	20	21	11	7	5	3	2	1	1
28.	GANZHOU	16.0	30	49	29	19	11	6	4	2	1
28.	GANZHOU	16.0	300	400	229	146	85	49	29	10	4
29.	GEJIU	16.0	5	4	2	2	1	1	1	0	0
29.	GEJIU	16.0	10	9	5	3	2	1	1	1	0
29.	GEJIU	16.0	20	21	11	7	5	3	2	1	1
29.	GEJIU	16.0	30	49	29	19	11	6	4	2	1
29.	GEJIU	16.0	300	400	229	146	85	49	29	10	4
30.	GUANGZHOU	200.0	5	47	25	15	10	6	4	1	1
30.	GUANGZHOU	200.0	10	112	61	37	25	13	9	3	2
30.	GUANGZHOU	200.0	20	264	134	87	59	32	20	7	3
30.	GUANGZHOU	200.0	30	606	364	228	134	74	48	15	7
30.	GUANGZHOU	200.0	300	5000	2858	1819	1053	606	364	124	49

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
31.	GUILIN	16.0	5	4	2	2	1	1	1	0	0
31.	GUILIN	16.0	10	9	5	3	2	1	1	1	0
31.	GUILIN	16.0	20	21	11	7	5	3	2	1	1
31.	GUILIN	16.0	30	49	29	19	11	6	4	2	1
31.	GUILIN	16.0	300	400	229	146	85	49	29	10	4
32.	GUIYANG	52.8	5	13	7	4	3	2	1	1	1
32.	GUIYANG	52.8	10	30	16	10	7	4	3	1	1
32.	GUIYANG	52.8	20	70	36	23	16	9	6	2	1
32.	GUIYANG	52.8	30	160	96	60	36	20	13	4	2
32.	GUIYANG	52.8	300	1320	755	480	278	160	96	33	13
33.	HAIKOU	16.0	5	4	2	2	1	1	1	0	0
33.	HAIKOU	16.0	10	9	5	3	2	1	1	1	0
33.	HAIKOU	16.0	20	21	11	7	5	3	2	1	1
33.	HAIKOU	16.0	30	49	29	19	11	6	4	2	1
33.	HAIKOU	16.0	300	400	229	146	85	49	29	10	4
34.	HANDAN	30.4	5	7	4	3	2	1	1	1	0
34.	HANDAN	30.4	10	17	10	6	4	2	2	1	1
34.	HANDAN	30.4	20	40	21	14	9	5	3	1	1
34.	HANDAN	30.4	30	93	56	35	21	12	8	3	1
34.	HANDAN	30.4	300	760	435	277	160	93	56	19	8
35.	HANGZHOU	76.8	5	18	10	6	4	3	2	1	1
35.	HANGZHOU	76.8	10	43	24	15	10	5	4	1	1
35.	HANGZHOU	76.8	20	101	52	34	23	13	8	3	1
35.	HANGZHOU	76.8	30	233	140	88	52	29	19	6	3
35.	HANGZHOU	76.8	300	1920	1098	699	405	233	140	48	19
36.	HARBIN	133.6	5	31	17	10	7	4	3	1	1
36.	HARBIN	133.6	10	75	41	25	17	9	6	2	1
36.	HARBIN	133.6	20	176	89	58	40	22	14	5	2
36.	HARBIN	133.6	30	405	243	152	89	50	32	10	5
36.	HARBIN	133.6	300	3340	1909	1215	704	405	243	83	33
37.	HEBI	8.0	5	2	1	1	1	1	1	0	0
37.	HEBI	8.0	10	5	3	2	1	1	1	1	0
37.	HEBI	8.0	20	11	6	4	3	2	1	1	1
37.	HEBI	8.0	30	25	15	9	6	3	2	1	1
37.	HEBI	8.0	300	200	115	73	43	25	15	5	2
38.	HEFEI	50.4	5	12	7	4	3	2	1	1	1
38.	HEFEI	50.4	10	28	16	10	7	4	3	1	1
38.	HEFEI	50.4	20	67	34	22	15	8	5	2	1
38.	HEFEI	50.4	30	153	92	58	34	19	12	4	2
38.	HEFEI	50.4	300	1260	720	459	266	153	92	32	13
39.	HEGANG	40.0	5	10	5	3	2	1	1	1	0
39.	HEGANG	40.0	10	23	13	8	5	3	2	1	1
39.	HEGANG	40.0	20	53	27	18	12	7	4	2	1
39.	HEGANG	40.0	30	122	73	46	27	15	10	3	2
39.	HEGANG	40.0	300	1000	572	364	211	122	73	25	10
40.	HENGYANG	24.0	5	6	3	2	2	1	1	1	0
40.	HENGYANG	24.0	10	14	8	5	3	2	1	1	1
40.	HENGYANG	24.0	20	32	16	11	7	4	3	1	1
40.	HENGYANG	24.0	30	73	44	28	16	9	6	2	1
40.	HENGYANG	24.0	300	600	343	219	127	73	44	15	6

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
41.	HUAINAN	48.0	5	12	6	4	3	2	1	1	1
41.	HUAINAN	48.0	10	27	15	9	6	3	2	1	1
41.	HUAINAN	48.0	20	64	32	21	15	8	5	2	1
41.	HUAINAN	48.0	30	146	88	55	32	18	12	4	2
41.	HUAINAN	48.0	300	1200	686	437	253	146	88	30	12
42.	HUANGSHI	8.0	5	2	1	1	1	1	1	0	0
42.	HUANGSHI	8.0	10	5	3	2	1	1	1	1	0
42.	HUANGSHI	8.0	20	11	6	4	3	2	1	1	1
42.	HUANGSHI	8.0	30	25	15	9	6	3	2	1	1
42.	HUANGSHI	8.0	300	200	115	73	43	25	15	5	2
43.	HUHHOT	42.4	5	10	6	4	2	2	1	1	0
43.	HUHHOT	42.4	10	24	13	8	6	3	2	1	1
43.	HUHHOT	42.4	20	56	29	19	13	7	5	2	1
43.	HUHHOT	42.4	30	129	77	49	29	16	10	4	2
43.	HUHHOT	42.4	300	1060	606	386	224	129	77	27	11
44.	JIAMUSI	8.0	5	2	1	1	1	1	1	0	0
44.	JIAMUSI	8.0	10	5	3	2	1	1	1	1	0
44.	JIAMUSI	8.0	20	11	6	4	3	2	1	1	1
44.	JIAMUSI	8.0	30	25	15	9	6	3	2	1	1
44.	JIAMUSI	8.0	300	200	115	73	43	25	15	5	2
45.	JIAN	12.0	5	3	2	1	1	1	1	0	0
45.	JIAN	12.0	10	7	4	3	2	1	1	1	0
45.	JIAN	12.0	20	16	8	6	4	2	2	1	1
45.	JIAN	12.0	30	37	22	14	8	5	3	1	1
45.	JIAN	12.0	300	300	172	109	64	37	22	8	3
46.	JIANGMEN	8.0	5	2	1	1	1	1	1	0	0
46.	JIANGMEN	8.0	10	5	3	2	1	1	1	1	0
46.	JIANGMEN	8.0	20	11	6	4	3	2	1	1	1
46.	JIANGMEN	8.0	30	25	15	9	6	3	2	1	1
46.	JIANGMEN	8.0	300	200	115	73	43	25	15	5	2
47.	JIAOZUO	8.0	5	2	1	1	1	1	1	0	0
47.	JIAOZUO	8.0	10	5	3	2	1	1	1	1	0
47.	JIAOZUO	8.0	20	11	6	4	3	2	1	1	1
47.	JIAOZUO	8.0	30	25	15	9	6	3	2	1	1
47.	JIAOZUO	8.0	300	200	115	73	43	25	15	5	2
48.	JILIN	57.6	5	14	8	5	3	2	1	1	1
48.	JILIN	57.6	10	32	18	11	8	4	3	1	1
48.	JILIN	57.6	20	76	39	25	17	10	6	2	1
48.	JILIN	57.6	30	175	105	66	39	22	14	5	2
48.	JILIN	57.6	300	1440	823	524	304	175	105	36	14
49.	JINAN	88.0	5	21	11	7	5	3	2	1	1
49.	JINAN	88.0	10	49	27	17	11	6	4	2	1
49.	JINAN	88.0	20	116	59	39	26	14	9	3	2
49.	JINAN	88.0	30	267	160	100	59	33	21	7	3
49.	JINAN	88.0	300	2200	1258	800	464	267	160	55	22
50.	JINGDEZHEN	16.0	5	4	2	2	1	1	1	0	0
50.	JINGDEZHEN	16.0	10	9	5	3	2	1	1	1	0
50.	JINGDEZHEN	16.0	20	21	11	7	5	3	2	1	1
50.	JINGDEZHEN	16.0	30	49	29	19	11	6	4	2	1
50.	JINGDEZHEN	16.0	300	400	229	146	85	49	29	10	4

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
51.	JINING	8.0	5	2	1	1	1	1	1	0	0
51.	JINING	8.0	10	5	3	2	1	1	1	1	0
51.	JINING	8.0	20	11	6	4	3	2	1	1	1
51.	JINING	8.0	30	25	15	9	6	3	2	1	1
51.	JINING	8.0	300	200	115	73	43	25	15	5	2
52.	JINZHOU	32.0	5	8	4	3	2	1	1	1	0
52.	JINZHOU	32.0	10	18	10	6	4	2	2	1	1
52.	JINZHOU	32.0	20	43	22	14	10	5	4	2	1
52.	JINZHOU	32.0	30	97	59	37	22	12	8	3	1
52.	JINZHOU	32.0	300	800	458	291	169	97	59	20	8
53.	JIUJIANG	8.0	5	2	1	1	1	1	1	0	0
53.	JIUJIANG	8.0	10	5	3	2	1	1	1	1	0
53.	JIUJIANG	8.0	20	11	6	4	3	2	1	1	1
53.	JIUJIANG	8.0	30	25	15	9	6	3	2	1	1
53.	JIUJIANG	8.0	300	200	115	73	43	25	15	5	2
54.	JIXI	24.0	5	6	3	2	2	1	1	1	0
54.	JIXI	24.0	10	14	8	5	3	2	1	1	1
54.	JIXI	24.0	20	32	16	11	7	4	3	1	1
54.	JIXI	24.0	30	73	44	28	16	9	6	2	1
54.	JIXI	24.0	300	600	343	219	127	73	44	15	6
55.	KAIFENG	32.0	5	8	4	3	2	1	1	1	0
55.	KAIFENG	32.0	10	18	10	6	4	2	2	1	1
55.	KAIFENG	32.0	20	43	22	14	10	5	4	2	1
55.	KAIFENG	32.0	30	97	59	37	22	12	8	3	1
55.	KAIFENG	32.0	300	800	458	291	169	97	59	20	8
56.	KASHI	16.0	5	4	2	2	1	1	1	0	0
56.	KASHI	16.0	10	9	5	3	2	1	1	1	0
56.	KASHI	16.0	20	21	11	7	5	3	2	1	1
56.	KASHI	16.0	30	49	29	19	11	6	4	2	1
56.	KASHI	16.0	300	400	229	146	85	49	29	10	4
57.	KUNMING	88.0	5	21	11	7	5	3	2	1	1
57.	KUNMING	88.0	10	49	27	17	11	6	4	2	1
57.	KUNMING	88.0	20	116	59	39	26	14	9	3	2
57.	KUNMING	88.0	30	267	160	100	59	33	21	7	3
57.	KUNMING	88.0	300	2200	1258	800	464	267	160	55	22
58.	LANZHOU	116.0	5	27	15	9	6	4	2	1	1
58.	LANZHOU	116.0	10	65	36	22	15	8	5	2	1
58.	LANZHOU	116.0	20	153	78	51	35	19	12	4	2
58.	LANZHOU	116.0	30	352	211	132	78	43	28	9	4
58.	LANZHOU	116.0	300	2900	1658	1055	611	352	211	72	29
59.	LASA	16.0	5	4	2	2	1	1	1	0	0
59.	LASA	16.0	10	9	5	3	2	1	1	1	0
59.	LASA	16.0	20	21	11	7	5	3	2	1	1
59.	LASA	16.0	30	49	29	19	11	6	4	2	1
59.	LASA	16.0	300	400	229	146	85	49	29	10	4
60.	LIANGYUNGANG	16.0	5	4	2	2	1	1	1	0	0
60.	LIANGYUNGANG	16.0	10	9	5	3	2	1	1	1	0
60.	LIANGYUNGANG	16.0	20	21	11	7	5	3	2	1	1
60.	LIANGYUNGANG	16.0	30	49	29	19	11	6	4	2	1
60.	LIANGYUNGANG	16.0	300	400	229	146	85	49	29	10	4

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
61.	LIAOYANG	8.0	5	2	1	1	1	1	1	0	0
61.	LIAOYANG	8.0	10	5	3	2	1	1	1	1	0
61.	LIAOYANG	8.0	20	11	6	4	3	2	1	1	1
61.	LIAOYANG	8.0	30	25	15	9	6	3	2	1	1
61.	LIAOYANG	8.0	300	200	115	73	43	25	15	5	2
62.	LIAOYUAN	8.0	5	2	1	1	1	1	1	0	0
62.	LIAOYUAN	8.0	10	5	3	2	1	1	1	1	0
62.	LIAOYUAN	8.0	20	11	6	4	3	2	1	1	1
62.	LIAOYUAN	8.0	30	25	15	9	6	3	2	1	1
62.	LIAOYUAN	8.0	300	200	115	73	43	25	15	5	2
63.	LIUZHOU	24.0	5	6	3	2	2	1	1	1	0
63.	LIUZHOU	24.0	10	14	8	5	3	2	1	1	1
63.	LIUZHOU	24.0	20	32	16	11	7	4	3	1	1
63.	LIUZHOU	24.0	30	73	44	28	16	9	6	2	1
63.	LIUZHOU	24.0	300	600	343	219	127	73	44	15	6
64.	LUDA	132.0	5	31	17	10	7	4	3	1	1
64.	LUDA	132.0	10	74	40	25	17	9	6	2	1
64.	LUDA	132.0	20	174	88	58	39	21	14	5	2
64.	LUDA	132.0	30	400	240	150	88	49	32	10	5
64.	LUDA	132.0	300	3300	1886	1200	695	400	240	82	33
65.	LUOYANG	46.4	5	11	6	4	3	2	1	1	1
65.	LUOYANG	46.4	10	26	14	9	6	3	2	1	1
65.	LUOYANG	46.4	20	61	31	21	14	8	5	2	1
65.	LUOYANG	46.4	30	141	85	53	31	18	11	4	2
65.	LUOYANG	46.4	300	1160	663	422	245	141	85	29	12
66.	LUZHOU	8.0	5	2	1	1	1	1	1	0	0
66.	LUZHOU	8.0	10	5	3	2	1	1	1	1	0
66.	LUZHOU	8.0	20	11	6	4	3	2	1	1	1
66.	LUZHOU	8.0	30	25	15	9	6	3	2	1	1
66.	LUZHOU	8.0	300	200	115	73	43	25	15	5	2
67.	MA'ANSHAN	16.0	5	4	2	2	1	1	1	0	0
67.	MA'ANSHAN	16.0	10	9	5	3	2	1	1	1	0
67.	MA'ANSHAN	16.0	20	21	11	7	5	3	2	1	1
67.	MA'ANSHAN	16.0	30	49	29	19	11	6	4	2	1
67.	MA'ANSHAN	16.0	300	400	229	146	85	49	29	10	4
68.	MAOMING	8.0	5	2	1	1	1	1	1	0	0
68.	MAOMING	8.0	10	5	3	2	1	1	1	1	0
68.	MAOMING	8.0	20	11	6	4	3	2	1	1	1
68.	MAOMING	8.0	30	25	15	9	6	3	2	1	1
68.	MAOMING	8.0	300	200	115	73	43	25	15	5	2
69.	MUDANGJIANG	24.0	5	6	3	2	2	1	1	1	0
69.	MUDANGJIANG	24.0	10	14	8	5	3	2	1	1	1
69.	MUDANGJIANG	24.0	20	32	16	11	7	4	3	1	1
69.	MUDANGJIANG	24.0	30	73	44	28	16	9	6	2	1
69.	MUDANGJIANG	24.0	300	600	343	219	127	73	44	15	6
70.	NANCHANG	54.0	5	13	7	4	3	2	1	1	1
70.	NANCHANG	54.0	10	30	17	10	7	4	3	1	1
70.	NANCHANG	54.0	20	71	36	24	16	9	6	2	1
70.	NANCHANG.	54.0	30	164	99	62	36	20	13	4	2
70.	NANCHANG	54.0	300	1350	772	491	285	164	99	34	14

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
71.	NANCHONG	8.0	5	2	1	1	1	1	1	0	0
71.	NANCHONG	8.0	10	5	3	2	1	1	1	1	0
71.	NANCHONG	8.0	20	11	6	[illegible]	3	2	1	1	1
71.	NANCHONG	8.0	30	25	15	9	6	3	2	1	1
71.	NANCHONG	8.0	300	200	115	73	43	25	15	5	2
72.	NANJING	140.0	5	33	18	11	7	4	3	1	1
72.	NANJING	140.0	10	78	43	26	18	9	6	2	1
72.	NANJING	140.0	20	185	94	61	42	23	14	5	2
72.	NANJING	140.0	30	425	255	159	94	52	34	11	5
72.	NANJING	140.0	300	3500	2000	1273	737	425	255	87	35
73.	NANNING	44.0	5	11	6	4	3	2	1	1	0
73.	NANNING	44.0	10	25	14	9	6	3	2	1	1
73.	NANNING	44.0	20	58	30	20	13	7	5	2	1
73.	NANNING	44.0	30	134	80	50	30	17	11	4	2
73.	NANNING	44.0	300	1100	629	400	232	134	80	28	11
74.	NANTONG	8.0	5	2	1	1	1	1	1	0	0
74.	NANTONG	8.0	10	5	3	2	1	1	1	1	0
74.	NANTONG	8.0	20	11	6	4	3	2	1	1	1
74.	NANTONG	8.0	30	25	15	9	6	3	2	1	1
74.	NANTONG	8.0	300	200	115	73	43	25	15	5	2
75.	NANYANG	8.0	5	2	1	1	1	1	1	0	0
75.	NANYANG	8.0	10	5	3	2	1	1	1	1	0
75.	NANYANG	8.0	20	11	6	4	3	2	1	1	1
75.	NANYANG	8.0	30	25	15	9	6	3	2	1	1
75.	NANYANG	8.0	300	200	115	73	43	25	15	5	2
76.	NEIJIANG	8.0	5	2	1	1	1	1	1	0	0
76.	NEIJIANG	8.0	10	5	3	2	1	1	1	1	0
76.	NEIJIANG	8.0	20	11	6	4	3	2	1	1	1
76.	NEIJIANG	8.0	30	25	15	9	6	3	2	1	1
76.	NEIJIANG	8.0	300	200	115	73	43	25	15	5	2
77.	NINGBO	20.0	5	5	3	2	1	1	1	1	0
77.	NINGBO	20.0	10	12	6	4	3	2	1	1	1
77.	NINGBO	20.0	20	27	14	9	6	4	2	1	1
77.	NINGBO	20.0	30	61	37	23	14	8	5	2	1
77.	NINGBO	20.0	300	500	286	182	106	61	37	13	5
78.	PINGDINGSHAN	8.0	5	2	1	1	1	1	1	0	0
78.	PINGDINGSHAN	8.0	10	5	3	2	1	1	1	1	0
78.	PINGDINGSHAN	8.0	20	11	6	4	3	2	1	1	1
78.	PINGDINGSHAN	8.0	30	25	15	9	6	3	2	1	1
78.	PINGDINGSHAN	8.0	300	200	115	73	43	25	15	5	2
79.	PINGXIANG	8.0	5	2	1	1	1	1	1	0	0
79.	PINGXIANG	8.0	10	5	3	2	1	1	1	1	0
79.	PINGXIANG	8.0	20	11	6	4	3	2	1	1	1
79.	PINGXIANG	8.0	30	25	15	9	6	3	2	1	1
79.	PINGXIANG	8.0	300	200	115	73	43	25	15	5	2
80.	QINGDAO	104.0	5	25	13	8	5	3	2	1	1
80.	QINGDAO	104.0	10	58	32	20	13	7	5	2	1
80.	QINGDAO	104.0	20	137	70	46	31	17	11	4	2
80.	QINGDAO	104.0	30	316	189	119	70	39	25	8	4
80.	QINGDAO	104.0	300	2600	1486	946	548	316	189	65	26

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
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81.	QINGJIANG	15.2	5	4	2	2	1	1	1	0	0
81.	QINGJIANG	15.2	10	9	5	3	2	1	1	1	0
81.	QINGJIANG	15.2	20	20	11	7	5	3	2	1	1
81.	QINGJIANG	15.2	30	46	28	18	11	6	4	2	1
81.	QINGJIANG	15.2	300	380	218	139	80	46	28	10	4
82.	QINGHUANDAO	24.0	5	6	3	2	2	1	1	1	0
82.	QINGHUANDAO	24.0	10	14	8	5	3	2	1	1	1
82.	QINGHUANDAO	24.0	20	32	16	11	7	4	3	1	1
82.	QINGHUANDAO	24.0	30	73	44	28	16	9	6	2	1
82.	QINGHUANDAO	24.0	300	600	343	219	127	73	44	15	6
83.	QIQIHAR	60.8	5	15	8	5	3	2	1	1	1
83.	QIQIHAR	60.8	10	34	19	12	8	4	3	1	1
83.	QIQIHAR	60.8	20	80	41	27	18	10	6	3	1
83.	QIQIHAR	60.8	30	185	111	69	41	23	15	5	2
83.	QIQIHAR	60.8	300	1520	869	553	320	185	111	38	15
84.	QUANZHOU	8.0	5	2	1	1	1	1	1	0	0
84.	QUANZHOU	8.0	10	5	3	2	1	1	1	1	0
84.	QUANZHOU	8.0	20	11	6	4	3	2	1	1	1
84.	QUANZHOU	8.0	30	25	15	9	6	3	2	1	1
84.	QUANZHOU	8.0	300	200	115	73	43	25	15	5	2
85.	SANTOU	24.0	5	6	3	2	2	1	1	1	0
85.	SANTOU	24.0	10	14	8	5	3	2	1	1	1
85.	SANTOU	24.0	20	32	16	11	7	4	3	1	1
85.	SANTOU	24.0	30	73	44	28	16	9	6	2	1
85.	SANTOU	24.0	300	600	343	219	127	73	44	15	6
86.	SHANGHAI	560.0	5	131	70	42	28	16	10	3	2
86.	SHANGHAI	560.0	10	312	170	104	70	35	24	8	4
86.	SHANGHAI	560.0	20	737	374	244	165	89	56	20	8
86.	SHANGHAI	560.0	30	1697	1019	637	374	208	134	42	18
86.	SHANGHAI	560.0	300	14000	8000	5091	2948	1697	1019	346	137
87.	SHAOYANG	13.6	5	4	2	1	1	1	1	0	0
87.	SHAOYANG	13.6	10	8	5	3	2	1	1	1	0
87.	SHAOYANG	13.6	20	18	9	6	4	3	2	1	1
87.	SHAOYANG	13.6	30	42	25	16	9	5	4	1	1
87.	SHAOYANG	13.6	300	340	195	124	72	42	25	9	4
88.	SHAOXING	8.0	5	2	1	1	1	1	1	0	0
88.	SHAOXING	8.0	10	5	3	2	1	1	1	1	0
88.	SHAOXING	8.0	20	11	6	4	3	2	1	1	1
88.	SHAOXING	8.0	30	25	15	9	6	3	2	1	1
88.	SHAOXING	8.0	300	200	115	73	43	25	15	5	2
89.	SHAOGUAN	16.0	5	4	2	2	1	1	1	0	0
89.	SHAOGUAN	16.0	10	9	5	3	2	1	1	1	0
89.	SHAOGUAN	16.0	20	21	11	7	5	3	2	1	1
89.	SHAOGUAN	16.0	30	49	29	19	11	6	4	2	1
89.	SHAOGUAN	16.0	300	400	229	146	85	49	29	10	4
90.	SHASI	8.0	5	2	1	1	1	1	1	0	0
90.	SHASI	8.0	10	5	3	2	1	1	1	1	0
90.	SHASI	8.0	20	11	6	4	3	2	1	1	1
90.	SHASI	8.0	30	25	15	9	6	3	2	1	1
90.	SHASI	8.0	300	200	115	73	43	25	15	5	2

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
91.	SHENYANG	224.0	5	52	28	17	11	7	4	2	1
91.	SHENYANG	224.0	10	125	68	42	28	14	10	4	2
91.	SHENYANG	224.0	20	295	150	98	66	36	23	8	3
91.	SHENYANG	224.0	30	679	408	255	150	83	54	17	8
91.	SHENYANG	224.0	300	5600	3200	2037	1179	679	408	139	55
92.	SHIJIAZHUANG	64.0	5	15	8	5	4	2	1	1	1
92.	SHIJIAZHUANG	64.0	10	36	20	12	8	4	3	1	1
92.	SHIJIAZHUANG	64.0	20	85	43	28	19	11	7	3	1
92.	SHIJIAZHUANG	64.0	30	194	117	73	43	24	16	5	2
92.	SHIJIAZHUANG	64.0	300	1600	915	582	337	194	117	40	16
93.	SHUANYASHAN	8.0	5	2	1	1	1	1	1	0	0
93.	SHUANYASHAN	8.0	10	5	3	2	1	1	1	1	0
93.	SHUANYASHAN	8.0	20	11	6	4	3	2	1	1	1
93.	SHUANYASHAN	8.0	30	25	15	9	6	3	2	1	1
93.	SHUANYASHAN	8.0	300	200	115	73	43	25	15	5	2
94.	SUZHOU	10.4	5	3	2	1	1	1	1	0	0
94.	SUZHOU	10.4	10	6	4	2	2	1	1	1	0
94.	SUZHOU	10.4	20	14	7	5	3	2	1	1	1
94.	SUZHOU	10.4	30	32	19	12	7	4	3	1	1
94.	SUZHOU	10.4	300	260	149	95	55	32	19	7	3
95.	TAIYUAN	108.0	5	26	14	8	6	3	2	1	1
95.	TAIYUAN	108.0	10	60	33	20	14	7	5	2	1
95.	TAIYUAN	108.0	20	143	72	47	32	18	11	4	2
95.	TAIYUAN	108.0	30	328	197	123	72	40	26	8	4
95.	TAIYUAN	108.0	300	2700	1543	982	569	328	197	67	27
96.	TAIZHOU	8.0	5	2	1	1	1	1	1	0	0
96.	TAIZHOU	8.0	10	5	3	2	1	1	1	1	0
96.	TAIZHOU	8.0	20	11	6	4	3	2	1	1	1
96.	TAIZHOU	8.0	30	25	15	9	6	3	2	1	1
96.	TAIZHOU	8.0	300	200	115	73	43	25	15	5	2
97.	TANGSHAN	76.0	5	18	10	6	4	2	2	1	1
97.	TANGSHAN	76.0	10	43	23	14	10	5	4	1	1
97.	TANGSHAN	76.0	20	100	51	33	23	12	8	3	1
97.	TANGSHAN	76.0	30	231	139	87	51	29	18	6	3
97.	TANGSHAN	76.0	300	1900	1086	691	400	231	139	47	19
98.	TIANJIN	288.0	5	67	36	22	14	8	5	2	1
98.	TIANJIN	288.0	10	160	88	54	36	18	13	4	2
98.	TIANJIN	288.0	20	379	192	126	85	46	29	10	4
98.	TIANJIN	288.0	30	873	524	328	192	107	69	22	10
98.	TIANJIN	288.0	300	7200	4115	2619	1516	873	524	178	71
99.	TONGHUA	8.0	5	2	1	1	1	1	1	0	0
99.	TONGHUA	8.0	10	5	3	2	1	1	1	1	0
99.	TONGHUA	8.0	20	11	6	4	3	2	1	1	1
99.	TONGHUA	8.0	30	25	15	9	6	3	2	1	1
99.	TONGHUA	8.0	300	200	115	73	43	25	15	5	2
100.	URUMQI	40.0	5	10	5	3	2	1	1	1	0
100.	URUMQI	40.0	10	23	13	8	5	3	2	1	1
100.	URUMQI	40.0	20	53	27	18	12	7	4	2	1
100.	URUMQI	40.0	30	122	73	46	27	15	10	3	2
100.	URUMQI	40.0	300	1000	572	364	211	122	73	25	10

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
101.	WANXIAN	8.0	5	2	1	1	1	1	1	0	0
101.	WANXIAN	8.0	10	5	3	2	1	1	1	1	0
101.	WANXIAN	8.0	20	11	6	4	3	2	1	1	1
101.	WANXIAN	8.0	30	25	15	9	6	3	2	1	1
101.	WANXIAN	8.0	300	200	115	73	43	25	15	5	2
102.	WEFENG	16.0	5	4	2	2	1	1	1	0	0
102.	WEFENG	16.0	10	9	5	3	2	1	1	1	0
102.	WEFENG	16.0	20	21	11	7	5	3	2	1	1
102.	WEFENG	16.0	30	49	29	19	11	6	4	2	1
102.	WEFENG	16.0	300	400	229	146	85	49	29	10	4
103.	WENZHOU	16.0	5	4	2	2	1	1	1	0	0
103.	WENZHOU	16.0	10	9	5	3	2	1	1	1	0
103.	WENZHOU	16.0	20	21	11	7	5	3	2	1	1
103.	WENZHOU	16.0	30	49	29	19	11	6	4	2	1
103.	WENZHOU	16.0	300	400	229	146	85	49	29	10	4
104.	WUHAN	204.8	5	48	26	15	10	6	4	1	1
104.	WUHAN	204.8	10	114	62	38	26	13	9	3	2
104.	WUHAN	204.6	20	270	137	89	61	33	21	8	3
104.	WUHAN	204.8	30	621	373	233	137	76	49	15	7
104.	WUHAN	203.9	300	5120	2926	1862	1078	621	373	127	50
105.	WUHU	24.0	5	6	3	2	2	1	1	1	0
105.	WUHU	24.0	10	14	8	5	3	2	1	1	1
105.	WUHU	24.0	20	32	16	11	7	4	3	1	1
105.	WUHU	24.0	30	73	44	28	16	9	6	2	1
105.	WUHU	24.0	300	600	343	219	127	73	44	15	6
106.	WUXI	52.0	5	12	7	4	3	2	1	1	1
106.	WUXI	52.0	10	29	16	10	7	4	3	1	1
106.	WUXI	52.0	20	69	35	23	16	9	6	2	1
106.	WUXI	52.0	30	158	95	59	35	20	13	4	2
106.	WUXI	52.0	300	1300	743	473	274	158	95	32	13
107.	WUZHOU	16.0	5	4	2	2	1	1	1	0	0
107.	WUZHOU	16.0	10	9	5	3	2	1	1	1	0
107.	WUZHOU	16.0	20	21	11	7	5	3	2	1	1
107.	WUZHOU	16.0	30	49	29	19	11	6	4	2	1
107.	WUZHOU	16.0	300	400	229	146	85	49	29	10	4
108.	XI'AN	128.0	5	30	16	10	7	4	3	1	1
108.	XI'AN	126.0	10	72	39	24	16	8	6	2	1
108.	XI'AN	125.0	20	169	86	56	38	21	13	5	2
108.	XI'AN	126.0	30	388	233	146	86	48	31	10	5
108.	XI'AN	128.0	300	3200	1829	1164	674	388	233	79	32
109.	XIAMEN	56.0	5	13	7	5	3	2	1	1	1
109.	XIAMEN	56.0	10	32	17	11	7	4	3	1	1
109.	XIAMEN	56.0	20	74	38	25	17	9	6	2	1
109.	XIAMEN	56.0	30	170	102	64	38	21	14	5	2
109.	XIAMEN	56.0	300	1400	800	509	295	170	102	35	14
110.	XIANGFAN	8.0	5	2	1	1	1	1	1	0	0
110.	XIANGFAN	8.0	10	5	3	2	1	1	1	1	0
110.	XIANGFAN	8.0	20	11	6	4	3	2	1	1	1
110.	XIANGFAN	8.0	30	25	15	9	6	3	2	1	1
110.	XIANGFAN	5.0	300	200	115	73	43	25	15	5	2

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
111.	XIANGTAN	12.0	5	3	2	1	1	1	1	0	0
111.	XIANGTAN	12.0	10	7	4	3	2	1	1	1	0
111.	XIANGTAN	12.0	20	16	8	6	4	2	2	1	1
111.	XIANGTAN	12.0	30	37	22	14	8	5	3	1	1
111.	XIANGTAN	12.0	300	300	172	109	64	37	22	8	3
112.	XINGTAI	8.0	5	2	1	1	1	1	1	0	0
112.	XINGTAI	8.0	10	5	3	2	1	1	1	1	0
112.	XINGTAI	8.0	20	11	6	4	3	2	1	1	1
112.	XINGTAI	8.0	30	25	15	9	6	3	2	1	1
112.	XINGTAI	8.0	300	200	115	73	43	25	15	5	2
113.	XINGYANG	8.0	5	2	1	1	1	1	1	0	0
113.	XINGYANG	8.0	10	5	3	2	1	1	1	1	0
113.	XINGYANG	8.0	20	11	6	4	3	2	1	1	1
113.	XINGYANG	8.0	30	25	15	9	6	3	2	1	1
113.	XINGYANG	8.0	300	200	115	73	43	25	15	5	2
114.	XINING	40.0	5	10	5	3	2	1	1	1	0
114.	XINING	40.0	10	23	13	8	5	3	2	1	1
114.	XINING	40.0	20	53	27	18	12	7	4	2	1
114.	XINING	40.0	30	122	73	46	27	15	10	3	2
114.	XINING	40.0	300	1000	572	364	211	122	73	25	10
115.	XINXIANG	8.0	5	2	1	1	1	1	1	0	0
115.	XINXIANG	8.0	10	5	3	2	1	1	1	1	0
115.	XINXIANG	8.0	20	11	6	4	3	2	1	1	1
115.	XINXIANG	8.0	30	25	15	9	6	3	2	1	1
115.	XINXIANG	8.0	300	200	115	73	43	25	15	5	2
116.	XIPING	11.2	5	3	2	1	1	1	1	0	0
116.	XIPING	11.2	10	7	4	2	2	1	1	1	0
116.	XIPING	11.2	20	15	8	5	4	2	2	1	1
116.	XIPING	11.2	30	34	21	13	8	5	3	1	1
116.	XIPING	11.2	300	280	160	102	59	34	21	7	3
117.	XUANHUA	8.0	5	2	1	1	1	1	1	0	0
117.	XUANHUA	8.0	10	5	3	2	1	1	1	1	0
117.	XUANHUA	8.0	20	11	6	4	3	2	1	1	1
117.	XUANHUA	8.0	30	25	15	9	6	3	2	1	1
117.	XUANHUA	8.0	300	200	115	73	43	25	15	5	2
118.	XUCHANG	8.0	5	2	1	1	1	1	1	0	0
118.	XUCHANG	8.0	10	5	3	2	1	1	1	1	0
118.	XUCHANG	8.0	20	11	6	4	3	2	1	1	1
118.	XUCHANG	8.0	30	25	15	9	6	3	2	1	1
118.	XUCHANG	8.0	300	200	115	73	43	25	15	5	2
119.	XUZHOU	56.0	5	13	7	5	3	2	1	1	1
119.	XUZHOU	56.0	10	32	17	11	7	4	3	1	1
119.	XUZHOU	56.0	20	74	38	25	17	9	6	2	1
119.	XUZHOU	56.0	30	170	102	64	38	21	14	5	2
119.	XUZHOU	56.0	300	1400	800	509	295	170	102	35	14
120.	YANGZHOU	17.6	5	4	3	2	1	1	1	0	0
120.	YANGZHOU	17.6	10	10	6	4	3	1	1	1	0
120.	YANGZHOU	17.6	20	24	12	8	6	3	2	1	1
120.	YANGZHOU	17.6	30	54	32	20	12	7	5	2	1
120.	YANGZHOU	17.6	300	440	252	160	93	54	32	11	5

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
121.	YANGQUAN	16.0	5	4	2	2	1	1	1	0	0
121.	YANGQUAN	16.0	10	9	5	3	2	1	1	1	0
121.	YANGQUAN	16.0	20	21	11	7	5	3	2	1	1
121.	YANGQUAN	16.0	30	49	29	19	11	6	4	2	1
121.	YANGQUAN	16.0	300	400	229	146	85	49	29	10	4
122.	YANTAI	20.0	5	5	3	2	1	1	1	1	0
122.	YANTAI	20.0	10	12	6	4	3	2	1	1	1
122.	YANTAI	20.0	20	27	14	9	6	4	2	1	1
122.	YANTAI	20.0	30	61	37	23	14	8	5	2	1
122.	YANTAI	20.0	300	500	286	182	106	61	37	13	5
123.	YIBIN	8.0	5	2	1	1	1	1	1	0	0
123.	YIBIN	8.0	10	5	3	2	1	1	1	1	0
123.	YIBIN	8.0	20	11	6	4	3	2	1	1	1
123.	YIBIN	8.0	30	25	15	9	6	3	2	1	1
123.	YIBIN	8.0	300	200	115	73	43	25	15	5	2
124.	YICHANG	8.0	5	2	1	1	1	1	1	0	0
124.	YICHANG	8.0	10	5	3	2	1	1	1	1	0
124.	YICHANG	8.0	20	11	6	4	3	2	1	1	1
124.	YICHANG	8.0	30	25	15	9	6	3	2	1	1
124.	YICHANG	8.0	300	200	115	73	43	25	15	5	2
125.	YINCHUAN	19.2	5	5	3	2	1	1	1	1	0
125.	YINCHUAN	19.2	10	11	6	4	3	2	1	1	1
125.	YINCHUAN	19.2	20	26	13	9	6	3	2	1	1
125.	YINCHUAN	19.2	30	59	35	22	13	8	5	2	1
125.	YINCHUAN	19.2	300	480	275	175	101	59	35	12	5
126.	YIYANG	8.0	5	2	1	1	1	1	1	0	0
126.	YIYANG	8.0	10	5	3	2	1	1	1	1	0
126.	YIYANG	8.0	20	11	6	4	3	2	1	1	1
126.	YIYANG	8.0	30	25	15	9	6	3	2	1	1
126.	YIYANG	8.0	300	200	115	73	43	25	15	5	2
127.	ZHANGZHOU	8.0	5	2	1	1	1	1	1	0	0
127.	ZHANGZHOU	8.0	10	5	3	2	1	1	1	1	0
127.	ZHANGZHOU	8.0	20	11	6	4	3	2	1	1	1
127.	ZHANGZHOU	8.0	30	25	15	9	6	3	2	1	1
127.	ZHANGZHOU	8.0	300	200	115	73	43	25	15	5	2
128.	ZHANGJIAKOU	80.0	5	19	10	6	4	3	2	1	1
128.	ZHANGJIAKOU	80.0	10	45	25	15	10	5	4	2	1
128.	ZHANGJIAKOU	80.0	20	106	54	35	24	13	8	3	1
128.	ZHANGJIAKOU	80.0	30	243	146	91	54	30	19	6	3
128.	ZHANGJIAKOU	80.0	300	2000	1143	728	421	243	146	50	20
129.	ZHANGJIANG	16.0	5	4	2	2	1	1	1	0	0
129.	ZHANGJIANG	16.0	10	9	5	3	2	1	1	1	0
129.	ZHANGJIANG	16.0	20	21	11	7	5	3	2	1	1
129.	ZHANGJIANG	16.0	30	49	29	19	11	6	4	2	1
129.	ZHANGJIANG	16.0	300	400	229	146	85	49	29	10	4
130.	ZHENJIANG	8.0	5	2	1	1	1	1	1	0	0
130.	ZHENJIANG	8.0	10	5	3	2	1	1	1	1	0
130.	ZHENJIANG	8.0	20	11	6	4	3	2	1	1	1
130.	ZHENJIANG	8.0	30	25	15	9	6	3	2	1	1
130.	ZHENJIANG	8.0	300	200	115	73	43	25	15	5	2

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
131.	ZHENGZHOU	84.0	5	20	11	7	4	3	2	1	1
131.	ZHENGZHOU	84.0	10	47	26	16	11	6	4	2	1
131.	ZHENGZHOU	84.0	20	111	56	37	25	14	9	3	2
131.	ZHENGZHOU	84.0	30	255	153	96	56	32	20	7	3
131.	ZHENGZHOU	84.0	300	2100	1200	764	443	255	153	52	21
132.	ZHUZHOU	20.0	5	5	3	2	1	1	1	1	0
132.	ZHUZHOU	20.0	10	12	6	4	3	2	1	1	1
132.	ZHUZHOU	20.0	20	27	14	9	6	4	2	1	1
132.	ZHUZHOU	20.0	30	61	37	23	14	8	5	2	1
132.	ZHUZHOU	20.0	300.	500	286	182	106	61	37	13	5
133.	ZIBO	68.0	5	16	9	5	4	2	2	1	1
133.	ZIBO	68.0	10	38	21	13	9	5	3	1	1
133.	ZIBO	68.0	20	90	46	30	20	11	7	3	1
133.	ZIBO	68.0	30	206	124	78	46	26	17	5	3
133.	ZIBO	68.0	300	1700	972	619	358	206	124	42	17
134.	ZIGONG	80.0	5	19	10	6	4	3	2	1	1
134.	ZIGONG	80.0	10	45	25	15	10	5	4	2	1
134.	ZIGONG	80.0	20	106	54	35	24	13	8	3	1
134.	ZIGONG	80.0	30	243	146	91	54	30	19	6	3
134.	ZIGONG	80.0	300	2000	1143	728	421	243	146	50	20
135.	ZUNYI	24.0	5	6	3	2	2	1	1	1	0
135.	ZUNYI	24.0	10	14	8	5	3	2	1	1	1
135.	ZUNYI	24.0	20	32	16	11	7	4	3	1	1
135.	ZUNYI	24.0	30	73	44	28	16	9	6	2	1
135.	ZUNYI	24.0	300	600	343	219	127	73	44	15	6

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
1.	CHANGHWA	51.4	5	12	7	4	3	2	1	1	1
1.	CHANGHWA	51.4	10	29	16	10	7	4	3	1	1
1.	CHANGHWA	51.4	20	68	35	23	16	9	6	2	1
1.	CHANGHWA	51.4	30	156	94	59	35	19	13	4	2
1.	CHANGHWA	51.4	300	1285	735	468	271	156	94	32	13
2.	CHIAYI	89.9	5	21	12	7	5	3	2	1	1
2.	CHIAYI	89.9	10	50	28	17	11	6	4	2	1
2.	CHIAYI	89.9	20	119	60	39	27	15	9	4	2
2.	CHIAYI	89.9	30	273	164	103	60	34	22	7	3
2.	CHIAYI	89.9	300	2248	1285	818	474	273	164	56	22
3.	CHINGSHUI	25.3	5	6	4	2	2	1	1	1	0
3.	CHINGSHUI	25.3	10	14	8	5	4	2	1	1	1
3.	CHINGSHUI	25.3	20	34	17	11	8	4	3	1	1
3.	CHINGSHUI	25.3	30	77	46	29	17	10	6	2	1
3.	CHINGSHUI	25.3	300	633	362	230	134	77	46	16	7
4.	CHISHAN	20.3	5	5	3	2	1	1	1	1	0
4.	CHISHAN	20.3	10	12	7	4	3	2	1	1	1
4.	CHISHAN	20.3	20	27	14	9	6	4	2	1	1
4.	CHISHAN	20.3	30	62	37	23	14	8	5	2	1
4.	CHISHAN	20.3	300	508	290	185	107	62	37	13	5
5.	CHUNGLI	48.3	5	12	6	4	3	2	1	1	1
5.	CHUNGLI	48.3	10	27	15	9	6	3	2	1	1
5.	CHUNGLI	48.3	20	64	33	21	15	8	5	2	1
5.	CHUNGLI	48.3	30	147	88	55	33	18	12	4	2
5.	CHUNGLI	48.3	300	1208	690	439	255	147	88	30	12
6.	CHUSAN	21.7	5	5	3	2	1	1	1	1	0
6.	CHUSAN	21.7	10	12	7	4	3	2	1	1	1
6.	CHUSAN	21.7	20	29	15	10	7	4	3	1	1
6.	CHUSAN	21.7	30	66	40	25	15	8	6	2	1
6.	CHUSAN	21.7	300	543	310	198	115	66	40	14	6
7.	CHUTUNG	22.5	5	6	3	2	1	1	1	1	0
7.	CHUTUNG	22.5	10	13	7	5	3	2	1	1	1
7.	CHUTUNG	22.5	20	30	15	10	7	4	3	1	1
7.	CHUTUNG	22.5	30	69	41	26	15	9	6	2	1
7.	CHUTUNG	22.5	300	563	322	205	119	69	41	14	6
8.	ERHLIN	21.7	5	5	3	2	1	1	1	1	0
8.	ERHLIN	21.7	10	12	7	4	3	2	1	1	1
8.	ERHLIN	21.7	20	29	15	10	7	4	3	1	1
8.	ERHLIN	21.7	30	66	40	25	15	8	6	2	1
8.	ERHLIN	21.7	300	543	310	198	115	66	40	14	6
9.	FENGSHAN	37.7	5	9	5	3	2	1	1	1	0
9.	FENGSHAN	37.7	10	21	12	7	5	3	2	1	1
9.	FENGSHAN	37.7	20	50	26	17	11	6	4	2	1
9.	FENGSHAN	37.7	30	115	69	43	26	14	9	3	2
9.	FENGSHAN	37.7	300	943	539	343	199	115	69	24	10
10.	FENGYUAN	37.1	5	9	5	3	2	1	1	1	0
10.	FENGYUAN	37.1	10	21	12	7	5	3	2	1	1
10.	FENGYUAN	37.1	20	49	25	17	11	6	4	2	1
10.	FENGYUAN	37.1	30	113	68	43	25	14	9	3	2
10.	FENGYUAN	37.1	300	928	530	338	196	113	68	23	9

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
11.	HOMEI	20.6	5	5	3	2	1	1	1	1	0
11.	HOMEI	20.6	10	12	7	4	3	2	1	1	1
11.	HOMEI	20.6	20	28	14	9	6	4	2	1	1
11.	HOMEI	20.6	30	63	38	24	14	8	5	2	1
11.	HOMEI	20.6	300	515	295	188	109	63	38	13	5
12.	HSILO	19.2	5	5	3	2	1	1	1	1	0
12.	HSILO	19.2	10	11	6	4	3	2	1	1	1
12.	HSILO	19.2	20	26	13	9	6	3	2	1	1
12.	HSILO	19.2	30	59	35	22	13	8	5	2	1
12.	HSILO	19.2	300	480	275	175	101	59	35	12	5
13.	HSINCHU	77.8	5	18	10	6	4	3	2	1	1
13.	HSINCHU	77.8	10	44	24	15	10	5	4	2	1
13.	HSINCHU	77.8	20	103	52	34	23	13	8	3	1
13.	HSINCHU	77.8	30	236	142	89	52	29	19	6	3
13.	HSINCHU	77.8	300	1945	1112	708	410	236	142	48	19
14.	HSINTIEN	34.9	5	9	5	3	2	1	1	1	0
14.	HSINTIEN	34.9	10	20	11	7	5	3	2	1	1
14.	HSINTIEN	34.9	20	46	24	16	11	6	4	2	1
14.	HSINTIEN	34.9	30	106	64	40	24	13	9	3	2
14.	HSINTIEN	34.9	300	873	499	318	184	106	64	22	9
15.	HSINYING	25.0	5	6	4	2	2	1	1	1	0
15.	HSINYING	25.0	10	14	8	5	3	2	1	1	1
15.	HSINYING	25.0	20	33	17	11	8	4	3	1	1
15.	HSINYING	25.0	30	76	46	29	17	10	6	2	1
15.	HSINYING	25.0	300	625	358	228	132	76	46	16	6
16.	HUALIEN	34.7	5	8	5	3	2	1	1	1	0
16.	HUALIEN	34.7	10	20	11	7	5	3	2	1	1
16.	HUALIEN	34.7	20	46	24	15	11	6	4	2	1
16.	HUALIEN	34.7	30	106	63	40	24	13	9	3	2
16.	HUALIEN	34.7	300	868	496	316	183	106	63	22	9
17.	HUWEI	23.8	5	6	3	2	2	1	1	1	0
17.	HUWEI	23.8	10	14	8	5	3	2	1	1	1
17.	HUWEI	23.8	20	32	16	11	7	4	3	1	1
17.	HUWEI	23.8	30	73	44	27	16	9	6	2	1
17.	HUWEI	23.8	300	595	340	217	126	73	44	15	6
18.	ILAN	27.0	5	7	4	2	2	1	1	1	0
18.	ILAN	27.0	10	15	9	5	4	2	2	1	1
18.	ILAN	27.0	20	36	18	12	8	5	3	1	1
18.	ILAN	27.0	30	82	49	31	18	10	7	2	1
18.	ILAN	27.0	300	675	386	246	143	82	49	17	7
19.	JUIFAN	27.8	5	7	4	2	2	1	1	1	0
19.	JUIFAN	27.8	10	16	9	6	4	2	2	1	1
19.	JUIFAN	27.8	20	37	19	12	9	5	3	1	1
19.	JUIFAN	27.8	30	85	51	32	19	11	7	2	1
19.	JUIFAN	27.8	300	695	398	253	147	85	51	18	7
20.	KANGSHAN	24.9	5	6	4	2	2	1	1	1	0
20.	KANGSHAN	24.9	10	14	8	5	3	2	1	1	1
20.	KANGSHAN	24.9	20	33	17	11	8	4	3	1	1
20.	KANGSHAN	24.9	30	76	46	29	17	10	6	2	1
20.	KANGSHAN	24.9	300	623	356	227	131	76	46	16	6

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
21.	KAOHSIUNG	113.8	5	27	15	9	6	4	2	1	1
21.	KAOHSIUNG	113.8	10	64	35	21	14	7	5	2	1
21.	KAOHSIUNG	113.8	20	150	76	50	34	18	12	4	2
21.	KAOHSIUNG	113.8	30	345	207	130	76	43	27	9	4
21.	KAOHSIUNG	113.8	300	2845	1626	1035	599	345	207	71	28
22.	KEELUNG	132.3	5	31	17	10	7	4	3	1	1
22.	KEELUNG	132.3	10	74	40	25	17	9	6	2	1
22.	KEELUNG	132.3	20	174	89	58	39	21	14	5	2
22.	KEELUNG	132.3	30	401	241	151	89	49	32	10	5
22.	KEELUNG	132.3	300	3308	1890	1203	697	401	241	82	33
23.	LOTUNG	19.0	5	5	3	2	1	1	1	1	0
23.	LOTUNG	19.0	10	11	6	4	3	2	1	1	1
23.	LOTUNG	19.0	20	25	13	9	6	3	2	1	1
23.	LOTUNG	19.0	30	58	35	22	13	7	5	2	1
23.	LOTUNG	19.0	300	475	272	173	100	58	35	12	5
24.	LUKANG	25.2	5	6	4	2	2	1	1	1	0
24.	LUKANG	25.2	10	14	8	5	4	2	1	1	1
24.	LUKANG	25.2	20	34	17	11	8	4	3	1	1
24.	LUKANG	25.2	30	77	46	29	17	10	6	2	1
24.	LUKANG	25.2	300	630	360	229	133	77	46	16	7
25.	MAKUNG	22.2	5	6	3	2	1	1	1	1	0
25.	MAKUNG	22.2	10	13	7	5	3	2	1	1	1
25.	MAKUNG	22.2	20	30	15	10	7	4	3	1	1
25.	MAKUNG	22.2	30	68	41	26	15	9	6	2	1
25.	MAKUNG	22.2	300	555	318	202	117	68	41	14	6
26.	MATOU	19.2	5	5	3	2	1	1	1	1	0
26.	MATOU	19.2	10	11	6	4	3	2	1	1	1
26.	MATOU	19.2	20	26	13	9	6	3	2	1	1
26.	MATOU	19.2	30	59	35	22	13	8	5	2	1
26.	MATOU	19.2	300	480	275	175	101	59	35	12	5
27.	MEINUNG	22.0	5	6	3	2	1	1	1	1	0
27.	MEINUNG	22.0	10	13	7	4	3	2	1	1	1
27.	MEINUNG	22.0	20	29	15	10	7	4	3	1	1
27.	MEINUNG	22.0	30	67	40	25	15	9	6	2	1
27.	MEINUNG	22.0	300	550	315	200	116	67	40	14	6
28.	MIALI	25.9	5	6	4	2	2	1	1	1	0
28.	MIALI	25.9	10	15	8	5	4	2	1	1	1
28.	MIALI	25.9	20	34	18	12	8	5	3	1	1
28.	MIALI	25.9	30	79	47	30	18	10	7	2	1
28.	MIALI	25.9	300	648	370	236	137	79	47	16	7
29.	NANTOU	28.8	5	7	4	3	2	1	1	1	0
29.	NANTOU	28.8	10	16	9	6	4	2	2	1	1
29.	NANTOU	28.8	20	38	20	13	9	5	3	1	1
29.	NANTOU	28.8	30	88	53	33	20	11	7	3	1
29.	NANTOU	28.8	300	720	412	262	152	88	53	18	7
30.	PANCHIAU	40.9	5	10	6	3	2	2	1	1	0
30.	PANCHIAU	40.9	10	23	13	8	5	3	2	1	1
30.	PANCHIAU	40.9	20	54	28	18	12	7	4	2	1
30.	PANCHIAU	40.9	30	124	75	47	28	16	10	3	2
30.	PANCHIAU	40.9	300	1023	585	372	216	124	75	26	10

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
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31.	PEIKANG	21.5	5	5	3	2	1	1	1	1	0
31.	PEIKANG	21.5	10	12	7	4	3	2	1	1	1
31.	PEIKANG	21.5	20	29	15	10	7	4	3	1	1
31.	PEIKANG	21.5	30	66	39	25	15	8	6	2	1
31.	PEIKANG	21.5	300	538	308	196	114	66	39	14	6
32.	PINGTUNG	62.1	5	15	8	5	3	2	1	1	1
32.	PINGTUNG	62.1	10	35	19	12	8	4	3	1	1
32.	PINGTUNG	62.1	20	82	42	27	19	10	7	3	1
32.	PINGTUNG	62.1	30	189	113	71	42	23	15	5	2
32.	PINGTUNG	62.1	300	1553	888	565	327	189	113	39	16
33.	POTZU	19.1	5	5	3	2	1	1	1	1	0
33.	POTZU	19.1	10	11	6	4	3	2	1	1	1
33.	POTZU	19.1	20	26	13	9	6	3	2	1	1
33.	POTZU	19.1	30	58	35	22	13	7	5	2	1
33.	POTZU	19.1	300	478	273	174	101	58	35	12	5
34.	PULI	28.9	5	7	4	3	2	1	1	1	0
34.	PULI	28.9	10	16	9	6	4	2	2	1	1
34.	PULI	28.9	20	38	20	13	9	5	3	1	1
34.	PULI	28.9	30	86	53	33	20	11	7	3	1
34.	PULI	28.9	300	723	413	263	153	88	53	18	7
35.	SANCHUNG	86.8	5	21	11	7	5	3	2	1	1
35.	SANCHUNG	86.8	10	49	27	16	11	6	4	2	1
35.	SANCHUNG	86.8	20	115	58	38	26	14	9	3	2
35.	SANCHUNG	86.8	30	263	158	99	58	33	21	7	3
35.	SANCHUNG	86.8	300	2170	1240	789	457	263	158	54	22
36.	SUAO	19.8	5	5	3	2	1	1	1	1	0
36.	SUAO	19.8	10	11	6	4	3	2	1	1	1
36.	SUAO	19.8	20	26	14	9	6	4	2	1	1
36.	SUAO	19.8	30	60	36	23	14	8	5	2	1
36.	SUAO	19.8	300	495	283	180	105	60	36	13	5
37.	TAICHI	20.2	5	5	3	2	1	1	1	1	0
37.	TAICHI	20.2	10	12	7	4	3	2	1	1	1
37.	TAICHI	20.2	20	27	14	9	6	4	2	1	1
37.	TAICHI	20.2	30	62	37	23	14	8	5	2	1
37.	TAICHI	20.2	300	505	289	184	107	62	37	13	5
38.	TAICHIA	21.1	5	5	3	2	1	1	1	1	0
38.	TAICHIA	21.1	10	12	7	4	3	2	1	1	1
38.	TAICHIA	21.1	20	28	14	10	7	4	3	1	1
38.	TAICHIA	21.1	30	64	39	24	14	8	5	2	1
38.	TAICHIA	21.1	300	528	302	192	111	64	39	13	6
39.	TAICHUNG	163.4	5	38	21	12	8	5	3	1	1
39.	TAICHUNG	163.4	10	91	50	31	21	10	7	3	1
39.	TAICHUNG	163.4	20	215	109	71	48	26	17	6	3
39.	TAICHUNG	163.4	30	496	297	186	109	61	39	12	6
39.	TAICHUNG	163.4	300	4085	2335	1486	860	496	297	101	40
40.	TAINAN	175.6	5	41	22	13	9	5	3	1	1
40.	TAINAN	175.6	10	98	54	33	22	11	8	3	1
40.	TAINAN	175.6	20	231	117	77	52	28	18	6	3
40.	TAINAN	175.6	30	533	320	200	117	65	42	13	6
40.	TAINAN	175.6	300	4390	2509	1597	925	533	320	109	43

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
41.	TAIPEI	272.1	5	64	34	20	14	8	5	2	1
41.	TAIPEI	272.1	10	152	83	51	34	17	12	4	2
41.	TAIPEI	272.1	20	358	182	119	80	44	28	10	4
41.	TAIPEI	272.1	30	825	495	310	182	101	65	20	9
41.	TAIPEI	272.1	300	6803	3888	2474	1433	825	495	168	67
42.	TAITUNG	29.0	5	7	4	3	2	1	1	1	0
42.	TAITUNG	29.0	10	17	9	6	4	2	2	1	1
42.	TAITUNG	29.0	20	39	20	13	9	5	3	1	1
42.	TAITUNG	29.0	30	88	53	33	20	11	7	3	1
42.	TAITUNG	29.0	300	725	415	264	153	88	53	18	7
43.	TAOYUAN	39.0	5	9	5	3	2	1	1	1	0
43.	TAOYUAN	39.0	10	22	12	8	5	3	2	1	1
43.	TAOYUAN	39.0	20	52	26	17	12	7	4	2	1
43.	TAOYUAN	39.0	30	119	71	45	26	15	10	3	2
43.	TAOYUAN	39.0	300	975	558	355	206	119	71	24	10
44.	TOUFEN	19.4	5	5	3	2	1	1	1	1	0
44.	TOUFEN	19.4	10	11	6	4	3	2	1	1	1
44.	TOUFEN	19.4	20	26	13	9	6	3	2	1	1
44.	TOUFEN	19.4	30	59	36	22	13	8	5	2	1
44.	TOUFEN	19.4	300	485	278	177	103	59	36	12	5
45.	TOULIU	28.3	5	7	4	2	2	1	1	1	0
45.	TOULIU	28.3	10	16	9	6	4	2	2	1	1
45.	TOULIU	28.3	20	38	19	13	9	5	3	1	1
45.	TOULIU	28.3	30	86	52	33	19	11	7	2	1
45.	TOULIU	28.3	300	708	405	258	149	86	52	18	7
46.	TSAOTUN	26.9	5	7	4	2	2	1	1	1	0
46.	TSAOTUN	26.9	10	15	9	5	4	2	2	1	1
46.	TSAOTUN	26.9	20	36	18	12	8	5	3	1	1
46.	TSAOTUN	26.9	30	82	49	31	18	10	7	2	1
46.	TSAOTUN	26.9	300	673	385	245	142	82	49	17	7
47.	TUNGSHIH	22.2	5	6	3	2	1	1	1	1	0
47.	TUNGSHIH	22.2	10	13	7	5	3	2	1	1	1
47.	TUNGSHIH	22.2	20	30	15	10	7	4	3	1	1
47.	TUNGSHIH	22.2	30	68	41	26	15	9	6	2	1
47.	TUNGSHIH	22.2	300	555	318	202	117	68	41	14	6
48.	YANGMEI	26.4	5	7	4	2	2	1	1	1	0
48.	YANGMEI	26.4	10	15	8	5	4	2	2	1	1
48.	YANGMEI	26.4	20	35	18	12	8	5	3	1	1
48.	YANGMEI	26.4	30	80	48	30	18	10	7	2	1
48.	YANGMEI	26.4	300	660	378	240	139	80	48	17	7
49.	YUANLIN	30.3	5	7	4	3	2	1	1	1	0
49.	YUANLIN	30.3	10	17	10	6	4	2	2	1	1
49.	YUANLIN	30.3	20	40	21	14	9	5	3	1	1
49.	YUANLIN	30.3	30	92	55	35	21	12	8	3	1
49.	YUANLIN	30.3	300	758	433	276	160	92	55	19	8
50.	YUNGHO	32.9	5	8	5	3	2	1	1	1	0
50.	YUNGHO	32.9	10	19	10	6	4	2	2	1	1
50.	YUNGHO	32.9	20	44	22	15	10	6	4	2	1
50.	YUNGHO	32.9	30	100	60	38	22	13	8	3	1
50.	YUNGHO	32.9	300	823	470	299	174	100	60	21	8

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
1.	ANDONG	23.2	5	6	3	2	2	1	1	1	0
1.	ANDONG	23.2	10	13	7	5	3	2	1	1	1
1.	ANDONG	23.2	20	31	16	10	7	4	3	1	1
1.	ANDONG	23.2	30	71	43	27	16	9	6	2	1
1.	ANDONG	23.2	300	580	332	211	123	71	43	15	6
2.	BUSAN	255.2	5	60	32	19	13	7	5	2	1
2.	BUSAN	255.2	10	142	78	48	32	16	11	4	2
2.	BUSAN	255.2	20	336	171	111	75	41	26	9	4
2.	BUSAN	255.2	30	774	464	290	171	95	61	19	9
2.	BUSAN	255.2	300	6380	3646	2320	1344	774	464	158	63
3.	CHEONAN	23.8	5	6	3	2	2	1	1	1	0
3.	CHEONAN	23.8	10	14	8	5	3	2	1	1	1
3.	CHEONAN	23.8	20	32	16	11	7	4	3	1	1
3.	CHEONAN	23.8	30	73	44	27	16	9	6	2	1
3.	CHEONAN	23.8	300	595	340	217	126	73	44	15	6
4.	CHEONGJU	43.8	5	11	6	4	3	2	1	1	0
4.	CHEONGJU	43.8	10	25	14	9	6	3	2	1	1
4.	CHEONGJU	43.8	20	58	30	19	13	7	5	2	1
4.	CHEONGJU	43.8	30	133	80	50	30	17	11	4	2
4.	CHEONGJU	43.8	300	1095	626	399	231	133	80	27	11
5.	CHEONGJU	81.3	5	19	11	6	4	3	2	1	1
5.	CHEONGJU	81.3	10	46	25	15	10	5	4	2	1
5.	CHEONGJU	81.3	20	107	55	36	24	13	9	3	1
5.	CHEONGJU	81.3	30	247	148	93	55	31	20	6	3
5.	CHEONGJU	81.3	300	2033	1162	739	428	247	148	51	20
6.	CHUNCHEON	126.2	5	30	16	10	7	4	3	1	1
6.	CHUNCHEON	126.2	10	71	39	24	16	8	6	2	1
6.	CHUNCHEON	126.2	20	166	85	55	38	20	13	5	2
6.	CHUNCHEON	126.2	30	383	230	144	85	47	30	10	4
6.	CHUNCHEON	126.2	300	3155	1803	1148	665	383	230	78	31
7.	CHUNGMU	13.7	5	4	2	1	1	1	1	0	0
7.	CHUNGMU	13.7	10	8	5	3	2	1	1	1	0
7.	CHUNGMU	13.7	20	18	10	6	4	3	2	1	1
7.	CHUNGMU	13.7	30	42	25	16	10	5	4	1	1
7.	CHUNGMU	13.7	300	343	196	125	73	42	25	9	4
8.	DAEGU	230.5	5	54	29	17	12	7	4	2	1
8.	DAEGU	230.5	10	128	70	43	29	15	10	4	2
8.	DAEGU	230.5	20	304	154	101	68	37	23	8	3
8.	DAEGU	230.5	30	699	419	262	154	86	55	17	8
8.	DAEGU	230.5	300	5763	3293	2096	1214	699	419	143	57
9.	DAEJEON	191.0	5	45	24	14	10	6	4	1	1
9.	DAEJEON	191.0	10	107	58	36	24	12	8	3	1
9.	DAEJEON	191.0	20	252	128	83	57	31	19	7	3
9.	DAEJEON	191.0	30	579	348	217	128	71	46	14	7
9.	DAEJEON	191.0	300	4775	2729	1737	1006	579	348	118	47
10.	EUIJEONGBU	28.7	5	7	4	3	2	1	1	1	0
10.	EUIJEONGBU	28.7	10	16	9	6	4	2	2	1	1
10.	EUIJEONGBU	28.7	20	38	20	13	9	5	3	1	1
10.	EUIJEONGBU	28.7	30	87	53	33	20	11	7	3	1
10.	EUIJEONGBU	28.7	300	718	410	261	151	87	53	18	7

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
11.	GANGREUNG	22.6	5	6	3	2	2	1	1	1	0
11.	GANGREUNG	22.6	10	13	7	5	3	2	1	1	1
11.	GANGREUNG	22.6	20	30	15	10	7	4	3	1	1
11.	GANGREUNG	22.6	30	69	41	26	15	9	6	2	1
11.	GANGREUNG	22.6	300	565	323	206	119	69	41	14	6
12.	GIMCHEON	18.9	5	5	3	2	1	1	1	0	0
12.	GIMCHEON	18.9	10	11	6	4	3	2	1	1	1
12.	GIMCHEON	18.9	20	25	13	9	6	3	2	1	1
12.	GIMCHEON	18.9	30	58	35	22	13	7	5	2	1
12.	GIMCHEON	18.9	300	473	270	172	100	58	35	12	5
13.	GUNSAN	34.1	5	8	5	3	2	1	1	1	0
13.	GUNSAN	34.1	10	19	11	7	5	3	2	1	1
13.	GUNSAN	34.1	20	45	23	15	10	6	4	2	1
13.	GUNSAN	34.1	30	104	62	39	23	13	9	3	1
13.	GUNSAN	34.1	300	853	488	310	180	104	62	21	9
14.	GWANGJU	153.0	5	36	20	12	8	5	3	1	1
14.	GWANGJU	153.0	10	85	47	29	19	10	7	3	1
14.	GWANGJU	153.0	20	202	102	67	45	25	16	6	2
14.	GWANGJU	153.0	30	464	279	174	102	57	37	12	5
14.	GWANGJU	153.0	300	3825	2186	1391	806	464	279	95	38
15.	GWANGJU	236.3	5	55	30	18	12	7	4	2	1
15.	GWANGJU	236.3	10	132	72	44	30	15	10	4	2
15.	GWANGJU	236.3	20	311	158	103	70	38	24	9	4
15.	GWANGJU	236.3	30	716	430	269	158	88	57	18	8
15.	GWANGJU	236.3	300	5908	3376	2149	1244	716	430	146	58
16.	GYEONGJU	28.0	5	7	4	2	2	1	1	1	0
16.	GYEONGJU	28.0	10	16	9	6	4	2	2	1	1
16.	GYEONGJU	28.0	20	37	19	13	9	5	3	1	1
16.	GYEONGJU	28.0	30	85	51	32	19	11	7	2	1
16.	GYEONGJU	28.0	300	700	400	255	148	85	51	18	7
17.	INCHEON	196.1	5	46	25	15	10	6	4	1	1
17.	INCHEON	196.1	10	109	60	37	25	13	9	3	1
17.	INCHEON	196.1	20	258	131	86	58	32	20	7	3
17.	INCHEON	196.1	30	595	357	223	131	73	47	15	7
17.	INCHEON	196.1	300	4903	2802	1783	1033	595	357	121	48
18.	IRI	26.4	5	7	4	2	2	1	1	1	0
18.	IRI	26.4	10	15	8	5	4	2	2	1	1
18.	IRI	26.4	20	35	18	12	8	5	3	1	1
18.	IRI	26.4	30	80	48	30	18	10	7	2	1
18.	IRI	26.4	300	660	378	240	139	80	48	17	7
19.	JEJU	35.8	5	9	5	3	2	1	1	1	0
19.	JEJU	35.8	10	20	11	7	5	3	2	1	1
19.	JEJU	35.8	20	48	24	16	11	6	4	2	1
19.	JEJU	35.8	30	109	65	41	24	14	9	3	2
19.	JEJU	35.8	300	895	512	326	189	109	65	22	9
20.	JEONJU	95.3	5	23	12	7	5	3	2	1	1
20.	JEONJU	95.3	10	53	29	18	12	6	4	2	1
20.	JEONJU	95.3	20	126	64	42	28	16	10	4	2
20.	JEONJU	95.3	30	289	174	109	64	36	23	7	3
20.	JEONJU	95.3	300	2383	1362	867	502	289	174	59	24

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
21.	JINJU	92.7	5	22	12	7	5	3	2	1	1
21.	JINJU	92.7	10	52	28	18	12	6	4	2	1
21.	JINJU	92.7	20	122	62	41	28	15	10	4	2
21.	JINJU	92.7	30	281	169	106	62	35	22	7	3
21.	JINJU	92.7	300	2318	1325	843	488	281	169	58	23
22.	MASAN-JINHAE	174.0	5	41	22	13	9	5	3	1	1
22.	MASAN-JINHAE	174.0	10	97	53	33	22	11	8	3	1
22.	MASAN-JINHAE	174.0	20	229	116	76	52	28	18	6	3
22.	MASAN-JINHAE	174.0	30	528	317	198	116	65	42	13	6
22.	MASAN-JINHAE	174.0	300	4350	2486	1582	916	528	317	108	43
23.	MOGPO	54.2	5	13	7	4	3	2	1	1	1
23.	MOGPO	54.2	10	31	17	10	7	4	3	1	1
23.	MOGPO	54.2	20	72	37	24	16	9	6	2	1
23.	MOGPO	54.2	30	165	99	62	37	20	13	4	2
23.	MOGPO	54.2	300	1355	775	493	286	165	99	34	14
24.	POHANG	24.2	5	6	3	2	2	1	1	1	0
24.	POHANG	24.2	10	14	8	5	3	2	1	1	1
24.	POHANG	24.2	20	32	17	11	8	4	3	1	1
24.	POHANG	24.2	30	74	44	28	17	9	6	2	1
24.	POHANG	24.2	300	605	346	220	128	74	44	15	6
25.	SAMCHEONPO	16.7	5	4	2	2	1	1	1	0	0
25.	SAMCHEONPO	16.7	10	10	5	3	2	1	1	1	0
25.	SAMCHEONPO	16.7	20	22	12	8	5	3	2	1	1
25.	SAMCHEONPO	16.7	30	51	31	19	12	7	4	2	1
25.	SAMCHEONPO	16.7	300	418	239	152	88	51	31	11	4
26.	SEOUL	338.4	5	79	43	25	17	10	6	2	1
26.	SEOUL	338.4	10	188	103	63	42	21	15	5	2
26.	SEOUL	338.4	20	446	226	148	100	54	34	12	5
26.	SEOUL	338.4	30	1026	616	385	226	126	81	25	11
26.	SEOUL	338.4	300	8460	4835	3077	1781	1026	616	209	83
27.	SOGCHO	22.3	5	6	3	2	1	1	1	1	0
27.	SOGCHO	22.3	10	13	7	5	3	2	1	1	1
27.	SOGCHO	22.3	20	30	15	10	7	4	3	1	1
27.	SOGCHO	22.3	30	68	41	26	15	9	6	2	1
27.	SOGCHO	22.3	300	558	319	203	118	68	41	14	6
28.	SUNCHEON	27.7	5	7	4	2	2	1	1	1	0
28.	SUNCHEON	27.7	10	16	9	6	4	2	2	1	1
28.	SUNCHEON	27.7	20	37	19	12	9	5	3	1	1
28.	SUNCHEON	27.7	30	84	51	32	19	11	7	2	1
28.	SUNCHEON	27.7	300	693	396	252	146	84	51	17	7
29.	SUWEON	51.8	5	12	7	4	3	2	1	1	1
29.	SUWEON	51.8	10	29	16	10	7	4	3	1	1
29.	SUWEON	51.8	20	69	35	23	16	9	6	2	1
29.	SUWEON	51.8	30	157	95	59	35	20	13	4	2
29.	SUWEON	51.8	300	1295	740	471	273	157	95	32	13
30.	ULSAN	128.9	5	30	17	10	7	4	3	1	1
30.	ULSAN	128.9	10	72	39	24	16	8	6	2	1
30.	ULSAN	128.9	20	170	86	56	38	21	13	5	2
30.	ULSAN	128.9	30	391	235	147	86	48	31	10	5
30.	ULSAN	128.9	300	3223	1842	1172	679	391	235	80	32

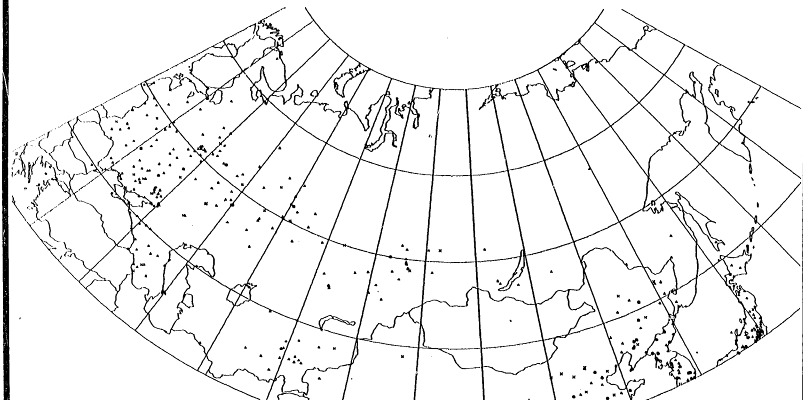
	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
31.	WEONJU	34.1	5	8	5	3	2	1	1	1	0
31.	WEONJU	34.1	10	19	11	7	5	3	2	1	1
31.	WEONJU	34.1	20	45	23	15	10	6	4	2	1
31.	WEONJU	34.1	30	104	62	39	23	13	9	3	1
31.	WEONJU	34.1	300	853	488	310	180	104	62	21	9
32.	YEOSU	34.6	5	8	5	3	2	1	1	1	0
32.	YEOSU	34.6	10	20	11	7	5	3	2	1	1
32.	YEOSU	34.6	20	46	23	15	11	6	4	2	1
32.	YEOSU	34.6	30	105	63	40	23	13	9	3	2
32.	YEOSU	34.6	300	865	495	315	183	105	63	22	9

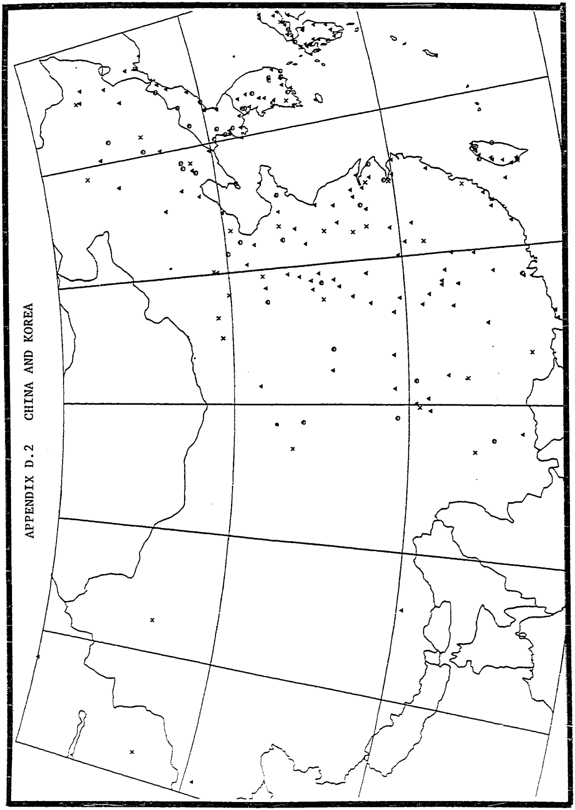
	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
1.	CHONGJIN	91.9	5	22	12	7	5	3	2	1	1
1.	CHONGJIN	91.9	10	51	28	17	12	6	4	2	1
1.	CHONGJIN	91.9	20	121	62	40	27	15	10	4	2
1.	CHONGJIN	91.9	30	279	167	105	62	34	22	7	3
1.	CHONGJIN	91.9	300	2298	1313	836	484	279	167	57	23
2.	CHONGJU	46.2	5	11	6	4	3	2	1	1	1
2.	CHONGJU	46.2	10	26	14	9	6	3	2	1	1
2.	CHONGJU	46.2	20	61	31	20	14	8	5	2	1
2.	CHONGJU	46.2	30	140	84	53	31	18	11	4	2
2.	CHONGJU	46.2	300	1155	660	420	244	140	84	29	12
3.	HAEJU	152.8	5	36	19	12	8	5	3	1	1
3.	HAEJU	152.8	10	85	47	29	19	10	7	3	1
3.	HAEJU	152.8	20	201	102	67	45	25	16	6	2
3.	HAEJU	152.8	30	463	278	174	102	57	37	12	5
3.	HAEJU	152.8	300	3820	2183	1389	805	463	278	95	38
4.	HAMHUNG	152.8	5	36	19	12	8	5	3	1	1
4.	HAMHUNG	152.8	10	85	47	29	19	10	7	3	1
4.	HAMHUNG	152.8	20	201	102	67	45	25	16	6	2
4.	HAMHUNG	152.8	30	463	278	174	102	57	37	12	5
4.	HAMHUNG	152.8	300	3820	2183	1389	805	463	278	95	38
5.	HOERYING	46.2	5	11	6	4	3	2	1	1	1
5.	HOERYING	46.2	10	26	14	9	6	3	2	1	1
5.	HOERYING	46.2	20	61	31	20	14	8	5	2	1
5.	HOERYING	46.2	30	140	84	53	31	18	11	4	2
5.	HOERYING	46.2	300	1155	660	420	244	140	84	29	12
6.	HUNGNAM	152.8	5	36	19	12	8	5	3	1	1
6.	HUNGNAM	152.8	10	85	47	29	19	10	7	3	1
6.	HUNGNAM	152.8	20	201	102	67	45	25	16	6	2
6.	HUNGNAM	152.8	30	463	278	174	102	57	37	12	5
6.	HUNGNAM	152.8	300	3820	2183	1389	805	463	278	95	38
7.	HYESAN	46.2	5	11	6	4	3	2	1	1	1
7.	HYESAN	46.2	10	26	14	9	6	3	2	1	1
7.	HYESAN	46.2	20	61	31	20	14	8	5	2	1
7.	HYESAN	46.2	30	140	84	53	31	18	11	4	2
7.	HYESAN	46.2	300	1155	660	420	244	140	84	29	12
8.	KANGGYE	46.2	5	11	6	4	3	2	1	1	1
8.	KANGGYE	46.2	10	26	14	9	6	3	2	1	1
8.	KANGGYE	46.2	20	61	31	20	14	8	5	2	1
8.	KANGGYE	46.2	30	140	84	53	31	18	11	4	2
8.	KANGGYE	46.2	300	1155	660	420	244	140	84	29	12
9.	KAESONG	73.6	5	18	10	6	4	2	2	1	1
9.	KAESONG	73.6	10	41	23	14	9	5	4	1	1
9.	KAESONG	73.6	20	97	49	32	22	12	8	3	1
9.	KAESONG	73.6	30	223	134	84	49	28	18	6	3
9.	KAESONG	73.6	300	1840	1052	669	388	223	134	46	18
10.	NAJIN	152.8	5	36	19	12	8	5	3	1	1
10.	NAJIN	152.8	10	85	47	29	19	10	7	3	1
10.	NAJIN	152.8	20	201	102	67	45	25	16	6	2
10.	NAJIN	152.8	30	463	278	174	102	57	37	12	5
10.	NAJIN	152.8	300	3820	2183	1389	805	463	278	95	38

	CITY	AREA	PSI	20KT	50KT	100KT	200KT	500KT	1MT	5MT	20MT
11.	NAMPO	152.8	5	36	19	12	8	5	3	1	1
11.	NAMPO	152.8	10	85	47	29	19	10	7	3	1
11.	NAMPO	152.8	20	201	102	67	45	25	16	6	2
11.	NAMPO	152.8	30	463	278	174	102	57	37	12	5
11.	NAMPO	152.8	300	3820	2183	1389	805	463	278	95	38
12.	PYONGYANG	457.6	5	107	58	34	23	13	8	3	1
12.	PYONGYANG	457.6	10	255	139	85	57	29	20	7	3
12.	PYONGYANG	457.6	20	603	305	199	135	73	46	16	6
12.	PYONGYANG	457.6	30	1387	832	520	305	170	109	34	15
12.	PYONGYANG	457.6	300	11440	6538	4160	2409	1387	832	283	112
13.	SARIWON	46.2	5	11	6	4	3	2	1	1	1
13.	SARIWON	46.2	10	26	14	9	6	3	2	1	1
13.	SARIWON	46.2	20	61	31	20	14	8	5	2	1
13.	SARIWON	46.2	30	140	84	53	31	18	11	4	2
13.	SARIWON	46.2	300	1155	660	420	244	140	84	29	12
14.	SINP'O	46.2	5	11	6	4	3	2	1	1	1
14.	SINP'O	46.2	10	26	14	9	6	3	2	1	1
14.	SINP'O	46.2	20	61	31	20	14	8	5	2	1
14.	SINP'O	46.2	30	140	84	53	31	18	11	4	2
14.	SINP'O	46.2	300	1155	660	420	244	140	84	29	12
15.	SINUIJIU	152.8	5	36	19	12	8	5	3	1	1
15.	SINUIJIU	152.8	10	85	47	29	19	10	7	3	1
15.	SINUIJIU	152.8	20	201	102	67	45	25	16	6	2
15.	SINUIJIU	152.8	30	463	278	174	102	57	37	12	5
15.	SINUIJIU	152.8	300	3820	2183	1389	805	463	278	95	38
16.	SONGJIN	152.8	5	36	19	12	8	5	3	1	1
16.	SONGJIN	152.8	10	85	47	29	19	10	7	3	1
16.	SONGJIN	152.8	20	201	102	67	45	25	16	6	2
16.	SONGJIN	152.8	30	463	278	174	102	57	37	12	5
16.	SONGJIN	152.8	300	3820	2183	1389	805	463	278	95	38
17.	SONGNIM	152.8	5	36	19	12	8	5	3	1	1
17.	SONGNIM	152.8	10	85	47	29	19	10	7	3	1
17.	SONGNIM	152.8	20	201	102	67	45	25	16	6	2
17.	SONGNIM	152.8	30	463	278	174	102	57	37	12	5
17.	SONGNIM	152.8	300	3820	2183	1389	805	463	278	95	38
18.	SUNCHON	46.2	5	11	6	4	3	2	1	1	1
18.	SUNCHON	46.2	10	26	14	9	6	3	2	1	1
18.	SUNCHON	46.2	20	61	31	20	14	8	5	2	1
18.	SUNCHON	46.2	30	140	84	53	31	18	11	4	2
18.	SUNCHON	46.2	300	1155	660	420	244	140	84	29	12
19.	WONSAN	152.8	5	36	19	12	8	5	3	1	1
19.	WONSAN	152.8	10	85	47	29	19	10	7	3	1
19.	WONSAN	152.8	20	201	102	67	45	25	16	6	2
19.	WONSAN	152.8	30	463	278	174	102	57	37	12	5
19.	WONSAN	152.8	300	3820	2183	1389	805	463	278	95	38

APPENDIX D.1

MAJOR SOVIET CITIES





APPENDIX D.2 CHINA AND KOREA

APPENDIX D.3

MAJOR JAPANESE CITIES

BIBLIOGRAPHY

Abdel-Aziz, Mahmoud. NUCLEAR PROLIFERATION AND NATIONAL SECURITY. New Dehli: Lancer Publishers, 1978.

Adams, Benson. BALLISTIC MISSILE DEFENSE. New York: American Elsevier, 1971.

Adie, W.A.C. CHINESE STRATEGIC THINKING UNDER MAO TSE-TUNG. Canberra: Australian National University Press, 1972.

Adomeit, Hannes. SOVIET RISK-TAKING AND CRISIS BEHAVIOR: FROM CONFRONTATION TO CO-EXISTENCE? Adelphi Papers 101. London: IISS, 1973.

Air Force Magazine. SPACE WEAPONS: A HANDBOOK OF MILITARY ASTONAUTICS. New York: Praeger, 1959.

Air Force ROTC, Air University. FUNDAMENTALS OF AEROSPACE WEAPON SYSTEMS. Washington, D.C.: USGPU, 1961.

Alexander, Archibald, et al. THE CONTROL OF CHEMICAL AND BIOLOGICAL WEAPONS. New York: Carnegie Endowment for International Peace, 1971.

American Security Council Committee of 31 Experts. USSR vs USA: THE ABM AND THE CHANGED STRATEGIC MILITARY BALANCE. Washington, D.C.: Acropolis Books, 1969.

Aron, Raymond. THE GREAT DEBATE: THEORIES OF NUCLEAR STRATEGY. Garden City, N.Y.: Doubleday Anchor, 1965.

Aron, Raymond et al. PROBLEMS OF MODERN STRATEGY: PART ONE. Adelphi Papers #54. London: IISS, February, 1969.

Aspatwaian, Vernon V. PROCESS AND POWER IN SOVIET FOREIGN POLICY. Boston: Little, Brown and Company, 1971.

Australian Institute of International Affairs. NUCLEAR DISPERSAL IN ASIA AND THE INDO-PACIFIC REGION. Canberra: Australian National University, 1965.

Ball, Desmond J. POLITICS AND FORCE LEVELS: THE STRATEGIC MISSILE PROGRAM OF THE KENNEDY ADMINISTRATION. Berkeley, CA: University of California Press, 1980.

Bennett, Bruce Wm. UNCERTAINTY IN ICBM SURVIVABILITY. Santa Monica, CA: Rand Corporation, 1979.

Beaton, Leonard and John Maddox. THE SPREAD OF NUCLEAR WEAPONS. London: Chatto and Windus, 1962.

Beaton, Leonard. THE WESTERN ALLIANCE AND THE MCNAMARA DOCTRINE. Adlephi Papers #11. London: IISS, August 1964.

Beaufre, Andre. STRATEGY FOR TOMORROW. New York: Crane, Russak and Company, 1972.

Beaufre, Andre. (General of the French Army) Transl. Major-General R.H. Barry (British Army). STRATEGY ACTION, 1976. London: Faber and Faber, 1977.

Belchman, Barry M. THE CHANGING SOVIET NAVY. Washington, D.C.: The Brooking Institution, 1973.

Bellany, Ian. AN AUSTRALIAN NUCLEAR FORCE. Canberra Papers on Strategy and Defense, No. 4. Canberra: Australian National University Press, 1969.

Bellany, Ian. AUSTRALIA IN THE NUCLEAR AGE: NATIONAL DEFENSE AND NATIONAL DEVELOPMENT. Sydney: Sydney University Press, 1972.

Bennet, Bruce. FATALITY UNCERTAINTIES IN LIMITED NUCLEAR WAR. Santa Monica, CA: Rand, November 1977.

Bennett, Bruce W. HOW TO ASSESS THE SURVIVABILITY OF U.S. ICBMs. Santa Monica, CA: Rand, 1980.

Bennett, Bruce W. HOW TO ASSESS THE SURVIVABILITY OF U.S. ICBMs: Appendixes (sic). Santa Monica, CA: Rand, 1980.

Bennett, Bruce M. ASSESSING THE CAPABILITIES OF STRATEGIC NUCLEAR FORCES: THE LIMITS OF CURRENT METHODS. Santa Monica, CA: Rand, June 1980.

Berman, Robert P. SOVIET AIR POWER IN TRANSITION. Washington, D.C.: Brookings Institution, 1978.

Betts, Richard ed. CRUISE MISSILES: TECHNOLOGY, STRATEGY, POLITICS. Washington, D.C.: Brookings Institution, 1981.

Bjorklund, Admiral Elis. Transl. Albert Read. INTERNATIONAL ATOMIC POLICY DURING A DECADE. London: George Allen and Unwin Ltd., 1956.

Bobrow, Daris B. ed. WEAPONS SYSTEM DECISIONS: POLITICAL AND PSYCHOLOGICAL PERSPECTIVES ON CONTINENTAL DEFENSE. New York: Praeger, 1969.

Booth, Ken. STRATEGY AND ETHNOCENTRISM. London: Croom Helm, 1979.

Bottome, Edgar M. THE BALANCE OF TERROR: A GUIDE TO THE ARMS RACE. Boston: Beacon Press, 1971.

Bottome, Edgar M. THE MISSILE GAP: A STUDY OF THE FORMULATION OF MILITARY AND POLITICAL POLICY. Cranbury, N.J.: Associated University Press, 1971.

Bowett, D.W. THE SEARCH FOR PEACE. London: Routledge and Kegan Paul, 1972. 236pp.

Brams, Steven J. GAME THEORY AND POLITICS. New York: The Free Press, 1975.

Brennan, D.G. and Johan J. Holst. BALLISTIC MISSILE DEFENSE: TWO VIEWS. Aldephi Papers #43. London: IISS, November 1967.

Bretnor, Reginald. DECISIVE WARFARE - A STUDY IN MILITARY THEORY. Harrisburg, PA: Stackpole Books, 1969.

Brewer, Garry D. and Martin Shubik. THE WAR GAME: A CRITIQUE OF MILITARY PROBLEM SOLVING. Cambridge, MA: Harvard University Press, 1979.

Brock, G.C. THE PHYSICAL ASPECTS OF AERIAL PHOTOGRAPHY. New York: Dover Publications, 1967.

Brodie, Bernard ed. THE ABSOLUTE WEAPON: ATOMIC POWER AND WORLD ORDER. New York: Harcourt, Brace & Company, 1946.

Brodie, Bernard. ESCALATION AND THE NUCLEAR OPTION. Princeton, N.J.: Princeton Unversity Press, 1966.

Brodie, Bernard. STRATEGY IN THE MIDDLE AGE. Princeton: Princeton University Press, 1965.

Brodie, Bernard. WAR AND POLITICS. London: Cassell and Company, 1973.

Brown, Neville. NUCLEAR WAR: THE IMPENDING STRATEGIC DEADLOCK. New York: Frederick Praeger, 1964.

Buchan, Alastair, ed. CHINA AND THE PEACE OF ASIA. New York: Praeger, 1965.

Buckley, James L. and Paul C. Warmke. STRATEGIC SUFFICIENCY: FACT OR FICTION? Washington, D.C. AEIPPR, 1972.

Builder, Carl H. WWHY NOT FIRST-STRIKE COUNTERFORCE CAPABILITIES? Santa Monica, CA: Rand, 1979.

Byley, Col. B. et al. MARXISM-LENINISM ON WAR AND ARMY. (Moscow: Progress Publishers, 1972).

Cahn, Anne Hessing, Joseph J. Kruzel, Peter M. Dawkins and Jacque Homtzinger. CONTROLLING FUTURE ARMS TRADE. New York: McGraw and Hill, 1977.

Carlton, David and Carlo Schaerf, ed. THE DYNAMICS OF THE ARMS RACE. New York: John Wiley and Sons, 1975.

Cladwell, Lawrence T. SOVIET ATTITUDES TO SALT. Aldephi Papers #75. London: IISS, February 1977.

Clough, Ralph N. DETERRENCE AND DEFENSE IN KOREA: THE ROLE OF U.S. FORCES. Washington, D.C.: Brookings Institution, 1976.

Collins, John M. GRAND STRATEGY: PRINCIPLES AND PRACTICES. Annapolis, Maryland: Naval Institute Press, 1973.

Conover, Johnston C. U.S. STRATEGIC NUCLEAR WEAPONS AND DETERRENCE. Santa Monica, CA: Rand, 1977.

Crosser, Paul K. THE DIALECTICS OF MILITARY TECHNOLOGY AND ITS CONSEQUENCE. Amsterdam: B.R. Guner, N.V., 1972.

Culver, John C. and John L. McLucas. PROSPECTS FOR THE STRATEGIC BOMBER: TWO VIEWS. AEI Defense Review, Volume II, No. 1. Washington, D.C.: AEI, 1978.

Dallin, Alexander and Thomas B. Larson, ed. SOVIET POLITICS SINCE KRUSCHEV. Englewood Cliffs, N.J.: Prentice-Hall, 1968.

Devkinandan, S. HOW CHINA MAY USE ATOM BOMB: MILITARY SCENARIOS. Delhi: New Century Books, 1974.

Dunn, Lewis A. CONTROLLING THE BOMB: NUCLEAR PROLIFERATION IN THE 1980s. New Haven: Yale University Press, 1982.

Eliot, George Fielding, et al. THE H BOMB. New York: Didier Publishers, 1950.

Epstein, William and Toshiyuki Toyoda. A NEW DESIGN FOR NUCLEAR DISARMAMENT. Pugwash Symposium, Kyoto, Japan: Spokesman, 1977.

Erickson, John. SOVIET MILITARY POWER. London: Royal United Services Institute for Defense Studies, 1971.

Feld, B. T. et al. IMPACT OF NEW TECHNOLOGIES ON THE ARMS RACE: PROCEEDINGS OF THE 10th PUGWASH SYMPOSIUM. Cambridge: The MIT Press, 1971.

Foster, Richard B. et al. STRATEGY FOR THE WEST: AMERICAN-ALLIED RELATIONS IN TRANSITION. New York: Crane, Russak & Company, 1974.

Fullbright, William J. and Maxwell D. Taylor. SALT II: AN OBLIGATION OR AN OPTION? AEI Defense Review, Vol. II, No. 4 Washington, D.C.: AEI, 1978.

Gallagher, Mathew P. and Karl F. Spielman, Jr. SOVIET DECISION-MAKING FOR DEFENSE: A CRITIQUE OF U.S. PERSPECTIVES ON THE ARMS RACE. New York: Praeger, 1972.

Garthoff, Raymond L. THE SOVIET IMAGE OF FUTURE WAR. Washington, D.C.: Public Affairs News, 1959.

Gelman, Harry. THE SOVIET UNION AND CHINA. Santa Monica, CA: Rand, 1980.

Gittings, John. THE ROLE OF THE CHINESE ARMY. London: Oxford University Press, 1967.

Gottlieb, Thomas M. CHINESE FOREIGN POLICY FACTIONALISM AND THE ORIGIN OF THE STRATEGIC TRIANGLE. Santa Monica, CA: Rand, November 1977.

Greenwood, Ted. RECOINNAISANCE, SURVEILLANCE AND ARMS CONTROL. Adelphi Papers No. 88. London: IISS, June, 1972.

Gurney, Gene and Clare. NORTH AND SOUTH KOREA. New York: Franklin Watts, 1973.

Ha, Joseph M. MOSCOW'S POLICY TOWARDS JAPAN. Problems of Communism. Vol. XXVI, September-October, 1977. pp. 61-72.

Halperin, Morton H. SINO-SOVIET RELATIONS AND ARMS CONTROL: AN ANALYSIS: VOL. I & II. Report to U.S. Arms Control and Disarmament Agency. Cambridge, MA: East Asian Research Center, Center for International Affairs, Harvard University, 1966.

Harkabi, Yehoshafat. NUCLEAR WAR AND NUCLEAR PEACE. transl. by Yigal Shendman. Jerusalem: Israel Program for Scientific Translations, 1966.

Harrison, Selig S. CHINA, OIL AND ASIA: CONFLICT AHEAD. New York: Columbia University Press, 1977.

Heymann, Hans Jr. CHINA'S APPROACH TO TECHNOLOGY ACQUISITION: PART I: THE AIRCRAFT INDUSTRY. R-1573-ARPA Santa Monica, CA: Rand, February 1975.

Hoffman, Stanley et al. FORCE IN MODERN SOCIETIES: ITS PLACE IN TERNATIONAL POLITICS. Aldephi Papers No. 102. London: IISS, 1973.

Holst, Johan Jorgen ed. SECURITY, ORDER AND THE BOMB. Oslo: Universitetsforlaget, 1972.

Hsieh, Alice Langley. COMMUNIST CHINA'S STRATEGY IN THE NUCLEAR ERA. Englewood Cliffs, N.J.: Prentice-Hall, 1962.

Hunt, Kenneth. THE ALLIANCE AND EUROPE: PART II, DEFENSE WITH FEWER MEN. Aldephi Paper No. 98. London: IISS, 1973.

Ikle;, Fred Charles. EVERY WAR MUST END. New York: Columbia University Press, 1971.

Imai, Ryukich and Henry S. Bowen. NUCLEAR ENERGY AND NUCLEAR PROLIFERATION: JAPANESE AND AMERICAN VIEWS. Boulder, CO: Westview Press, 1980.

Jabber, Faud. ISRAEL AND NUCLEAR WEAPONS: PRESENT OPTION AND FUTURE STRATEGIES. London: Chatto and Windus, 1971.

Johnson, Stuart E. and Joseph A. Yager. THE MILITARY EQUATION IN NORTHEAST ASIA. Washington, D.C.: Brookings Institution, 1979.

Jukes, Jeffrey. THE STRATEGIES SITUATION IN THE 1980s. Canberra: Australian National University Press, 1968.

Kahan, Jerome H. SECURITY IN THE NUCLEAR AGE: DEVELOPING U.S. STRATEGIC ARMS POLICY. Washington, D.C.: The Brookings Institution, 1975.

Kanzelberger, Michael W. AMERICAN NUCLEAR STRATEGY: A SELECTIVE ANALYTIC SURVEY OF THREAT CONCEPTS FOR DETERRENCE AND COMPELLENCE. Santa Monica, CA: Rand, September, 1979.

Kaufman, William W. THE MCNAMARA STRATEGY. New York: Harper and Row, 1964.

Kim, Young C. and Abraham M. Halperin ed. THE FUTURE OF THE KOREAN PENINSULA. New York: Praeger, 1977.

Kintner, William E. PEACE AND THE STRATEGY CONFLICT. New York: Frederick Praeger, 1967.

Kissinger, Henry A. NUCLEAR WEAPONS AND FOREIGN POLICY. New York: Harper and Row, 1957.

Kuenne, Robert E. THE ATTACK SUBMARINE: A STUDY IN STRATEGY. New Haven: Yale University Press, 1965.

Lambeth, Benjamin S. SELECTIVE NUCLEAR OPTIONS IN AMERICAN AND SOVIET STRATEGIC POLICY. Santa Monica, CA: Rand, 1976.

Lapp, Ralph. THE WEAPONS CULTURE. Baltimore: Pelican Books, 1960.

Licklider, Roy E. THE PRIVATE NUCLEAR STRATEGISTS. Canton, Ohio: Ohio State University Press, 1971.

Lowe, George E. THE AGE OF DETERRENCE. Boston: Little, Brown and Company, 1964.

Mandelbaum, Michael. THE NUCLEAR QUESTION: THE UNITED STATES AND NUCLEAR WEAPONS, 1946-1976. New York: Cambridge University Press, 1979.

Medershausen, Horst. OUTLOOK ON WESTERN SOLIDARITY: POLITICAL RELATIONS IN THE ATLANTIC ALLIANCES SYSTEM. Santa Monica, CA: Rand, June 1976.

Morgan, Patrick M. DETERRENCE: A CONCEPTUAL ANALYSIS. Sage Library of Social Research Vol. #40. Beverly Hills: Sage, 1977.

Murdock, Clark A. DEFENSE POLICY FORMATION. Albany: State University of New York Press, 1974.

McCormack, Garvin and John Gittings, ed. CRISES IN KOREA. London: Spokesman Books, 1977.

McNamara, Robert S. THE ESSENCE OF SECURITY. Reflecting in Office. New York: Harper & Row, 1968.

Naroll, Raoul, Vern L. Bullough and Frada Naroll. MILITARY DETERRENCE IN HISTORY: A PILOT CROSS-HISTORICAL SURVEY. Albany, N.Y.: Suny Press, 1974.

Nitze, Paul H. et al. SECURING THE SEAS: THE SOVIET NAVAL CHALLENGE AND WESTERN ALLIANCE OPTIONS. Boulder, CO: Westview Press, 1979.

O'Neill, Robert. SECURITY! THE SPREAD OF WEAPONS IN THE INDIAN AND PACIFIC OCEANS. Canberra: ANU Press, 1978.

Osgood, Robert. LIMITED WAR REVISITED. Boulder, CO: Westview Press, 1979.

Overholt, William H. ed. ASIA'S NUCLEAR FUTURE. Boulder, CO: Westview Press, 1977, pp. 290.

Palit, D.K., Major General. WAR IN THE DETERRENT AGE. London: McDonald, 1966.

Paskins, Barrie and Michael Dockrill. THE ETHICS OF WAR. Minneapolis: University of Minnesota Press, 1979.

Pillsbury, Michael. SOVIET APPREHENSIONS ABOUT SINO-AMERICAN RELATIONS: 1971-74. Rand, June 1975. P-5457. SALT ON THE DRAGON: CHINESE VIEWS OF THE SOVIET-AMERICAN BALANCE. Rand, April 1975, P-5457.

Power, Thomas S. and Albert A. Arnhym. DESIGN FOR SURVIVAL. New York: Coward-McCann, 1965.

Pranger, Robert J. and Roger P. Labrie ed. NUCLEAR STRATEGY AND NATIONAL SECURITY: POINTS OF VIEW. Washington, D.C.: American Enterprise Institute for Public Policy Research, 1977.

Quanbeck, Alton H. and Barry M. Belchman. STRATEGIC FORCES: ISSUES FOR MID-SEVENTIES. Washington, D.C.: The Brookings Institution, 1973.

Quester, George H. ed. SEA POWER IN THE 1970s. New York: Dunnellen, 1975.

Ramberg, Bennett. DESTRUCTION OF NUCLEAR ENERGY FACILITIES IN WAR: THE PROBLEM AND THE IMPLICATIONS. Lexington Books, Lexington, MA: 1980.

Reitzel, William et al. UNITED STATES FOREIGN POLICY 1945-1955. Washington, D.C.: The Brookings Institution, 1956.

Roherty, James M. DECISIONS OF ROBERT S MCNAMARA. Coral Gables, FLA: University of Miami Press, 1970.

Rummel, R.J. THE DIMENSION OF NATIONS. Beverly Hills, CA: Sage, 1972.

Russett, Bruce M. WHAT PRICE VIGILANCE? New Haven, CN: Yale University Press, 1970.

Sallager, Frederick M. AN OVERVIEW OF THE SOVIET THREAT. Santa Monica, CA: Rand, 1980.

Schelling, Thomas C. ARMS AND INFLUENCE. New Haven: Yale University Press, 1960.

Schlafly, Phyllis and Chester War. STRIKE FROM SPACE: HOW THE RUSSIANS MAY DESTROY US. New York: The Devin-Adair Co., 1966.

Scoville, Herbert Jr. MX: PRESCRIPTION FOR DISASTER. Cambridge, MA: MIT Press, 1981.

Shabad, B.A. et al. PROBLEMS OF WAR AND PEACE: A CRITICAL ANALYSIS OF BOURGEDIS THEORIES. Transl. by Bryan Bean. Moscow: Progress Publishers, 1972.

Sipri. NUCLEAR PROLIFERATION PROBLEMS. Cambridge, MA: MIT Press, 1974.

Sipri. NUCLEAR ENERGY AND NUCLEAR WEAPONS POLIFERATION. New York: Crane and Russak, 19??.

Smith, Myron J. Jr. THE SOVIET AIR AND STRATEGIC ROCKET FORCES, 1939-80 A GUIDE TO SOURCES IN ENGLISH. Santa Barbera, CA: ABC-CLIO, 1981.

Snyder, Jack L. RATIONALITY AT THE BRINK: THE ROLE OF COGNITIVE PROCESSES IN FAILURES OF DETERRENCE. Santa Monica, CA: Rand, October, 1976.

Sorenson, J. B. JAPANESE POLICY AND NUCLEAR ARMS. American-Asian Education Exchange, Inc., 1975. Monograph Series #12.

Stoiko,'Michael. SOVIET ROCKETRY: PAST, PRESENT AND FUTURE. New York: Holt, Rinehart and Winston, 1970.

Tarr, David W. AMERICAN STRATEGY IN THE NUCLEAR AGE. New York: Macmillan, 1966.

Taylor, Maxwell D. et al. NEW DYNAMICS IN NATIONAL STRATEGY. New York: Thomas Y. Crowell, 1975.

Tripathi, K.S. EVOLUTION OF NUCLEAR STRATEGY. Delhi: Vikas Publications, 1970.

United Nations. BASIC PROBLEMS OF DISARMAMENT: REPORTS OF THE SECRETARY-GENERAL. New York: United Nations, 1970.

Urban. G. R. ed. DETENTE. New York: Universe Books, 1976. 368 pp. c. Radio Free Europe.

Vasil'yev, B. A. (Major General of Aviation) LONG-RANGE MISSILE-EQUIPPED, C. 1972. Transl. DGIS Multilangual Section, Translation Bureau Secretary of State Department, Ottawa, Canada, Vol. 15, Soviet Military Thought Series, USAF. Washington, D.C.: USGPO, n.d., (1979).

Vohra, A. M. (Major General) CHINA'S STRATEGIC POSTURE IN THE 1980s. New Delhi: United Service Institution, 1972.

Walzer, Michael. JUST AND UNJUST WARS. New York: Basic Books, 1977.

Wegener, Edward. THE SOVIET NAVAL OFFENSIVE. Transl. Henning Wegener. Annapolis, MD: Naval Institute Press, 1972.

Weinstein, Martin E. JAPAN'S POST WAR DEFENSE POLICY, 1947-1968. New York: Columbia University Press, 1971.

Weizsacker, Carl-Frederick von et al. PROBLEMS OF MODERN STRATEGY: PART TWO. Aldephi Papers #55. London: IISS, March 1969.

Wentz, Walter B. NUCLEAR PROLIFERATION. Washington, D.C.: Public Affairs Press, 1968.

Whiting, Allen S. THE CHINESE CALCULUS OF DETERRENCE: INDIA AND INDOCHINA. Ann Arbor: The University of Michigan Press, 1975.

Whynes, David K. THE ECONOMICS OF THIRD WORLD MILITARY EXPENDITURE. Auston: University of Texas Press, 1979.

Williams, Phil. CRISIS MANAGEMENT: CONFRONTATION AND DIPLOMACY IN THE NUCLEAR AGE. London: Martin Robertson, 1976.

Willrich, Mason and John B. Rhinelander, ed. SALT: THE MOSCOW AGREEMENTS AND BEYOND. New York: The Free Press, 1974.

Wintringham, Tom. THE STORY OF WEAPONS AND TACTICS FROM TROY TO STALINGRAD. Boston: Houghton Mifflin Company, 1943.

Wohlstetter, Albert et al. THE IMPLICATIONS OF MILITARY TECHNOLOGY IN THE 1970s. Adelphi Press #46. London: IISS, March 1968.

Wohlstetter, Albert et al. SWORDS FROM PLOWSHARES: THE MILITARY POTENTIAL OF CIVILIAN NUCLEAR ENERGY. Chicago: University of Chicago Press, 1979.

Wohlstetter, Albert, Victor Gilinsky, Robert Gillette and Roberta Wohlstetter. NUCLEAR POLICIES: FUEL WITHOUT THE BOMB. Cambridge: Ballinger, 1978.

Wolfe, Thomas W. WORLDWIDE SOVIET MILITARY STRATEGY AND POLICY. Santa Monica, CA: Rand Corporation, 1973.

Wolfe, Thomas W. SOVIET STRATEGY AT CROSSROADS. Cambridge, MA: Harvard University Press, 1969.

Wolfe, Thomas W. SOVIET POWER AND EUROPE 1945-1970. Baltimore: The Johns Hopkins Press, 1970.

Wright, Quincy. A STUDY OF WAR. Chicago: University Chicago Press, 1965.

Yuan-li, WU, ed. U.S. POLICY AND STRATEGIC INTERESTS IN THE WESTERN PACIFIC. New York: Crane, Russak & Co., Inc., 1975. 215 pp.

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