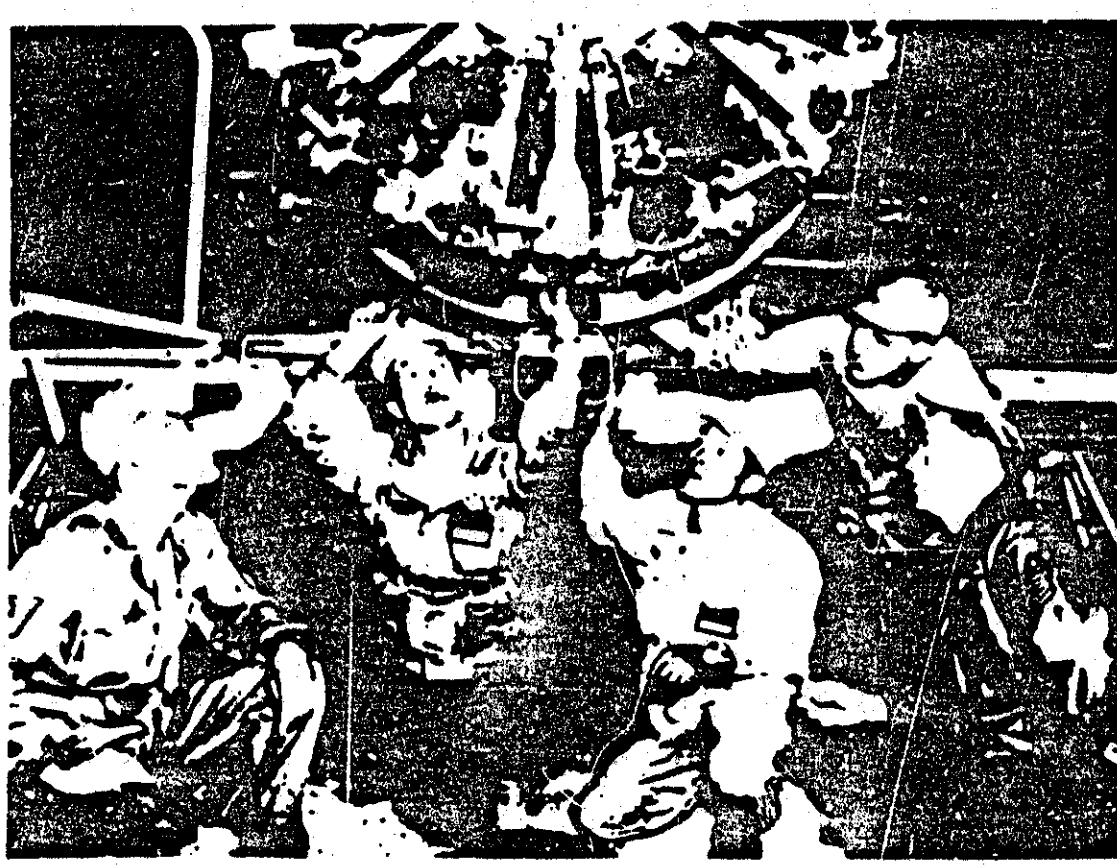
Frontispiece

MATSUSHIMA AIR BASE
(November 1955)



Military Transfer of Technology in Action

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ABSTRACT & SUMMARY

The objectives of this study have been as follows: First, to explore the hypothesis that there has been significant transfer of technology from the U.S. military forces to Japan's economy during the long presence of the U.S. in that country. Second, to make comparisons with other Pacific countries to determine if the propensity to borrow technology so characteristic of the Japanese is also found in neighboring countries, and if so, to what extent. Third, to identify the mechanism of military transfer, and determine something of the conditions under which it operates. Fourth, to make an initial analysis of the mechanism of transfer with a view to identifying and improving it as an effective instrument of potential U.S. policy. Fifth, to lay the foundations for further work with the concept of military transfer of technology, particularly in regard to quantifying and measuring its incidence, and estimating its value.

Findings

The data set forth in this book lead to the following findings:

First, the hypothesis that the U.S. military presence in a country has a techno-economic impact in upgrading technical potentials and supply capabilities is documented by the case materials presented. U.S. forces, bases, and military assistance groups overseas are established to support the U.S. military

security system. Their presence, however, generates a substantial technical impact in many diverse sectors of the civilian economy. Ranging from simple to very sophisticated technologies, these transfers have largely escaped identification and specification. The sample from Japan and the Pacific countries suggests that funds spent on overseas military activities, except for the immediate war zone, create additional returns in making largely unplanned technical benefits available to the economic capabilities and potentialities of the host country.

Each nation is, of course, a special case, requiring individual analysis, but the comparative country materials presented here suggest the following generalization for further testing: The U.S. military presence in a country provides that country with an opportunity for training in skills and modern orientation--an intellectual molding and reshaping of a substantial body of people, often outstanding leaders, within the recipient country.

Second, the data shows that Japan, a country with an unusual propensity to accept foreign technology, in humble imitation at first, has taken full advantage of opportunities presented by the U.S. military presence. It has built the knowledge and skills learned from its relationships with the U.S. military forces into its civilian economy, and, in many cases, added modest innovations of its own. Its pragmatic imitational activities, far from being ridiculed as is often done, should be studied with care by others seeking new technology. Japan is a model for those who would close the "technology gap".

Third, the materials from Japan's neighbors, Taiwan and Korea, suggest that they have accepted the Japanese model. They are using military channels to acquire new technologies and systems. The propensity to acquire new foreign technology is not as high as in Japan. Further, the linkages are weakened by the local military's retention of technologies in arsenals and depots, and the technology is not passed on to the private sector. However, the same general road is being travelled. There are even surprise accomplishments like the Taegu Jet Depot, which knowledgeable people thought impossible a few years ago.

Fourth, as a glance at Figure 4 will show, the research establishes that there are broadly four major sub-channels of military transfer of technology: demonstration, base training, procurements, and military assistance. Civic action and possibly other channels may be added to the list, but functionally, these may not be as important. All sub-channels overlap, to some degree, with one another, and with commercial, educational, and government channels of transfer. Feedback or reverse flow occurs everywhere. Basically, the mechanism of transfer starts with innovations developed in the donor country's economy, which are communicated to the donor's military, who, in turn, communicate them through the military channels of transfer to the donee's economy. This transfer is accomplished either directly to the donee's economy or indirectly through the donee's military forces. Sophisticated technology originates in the donor's R & D laboratories, and moves typically through commercial channels closely related to or identical with the military channels. In either case, long lags in time often are involved, and conversely, sudden unexpected, highly-productive spillovers occur such as the transfer of components from the F-104J to the high-speed train in Japan. In this way the foreign economy may benefit from the results of U.S. military R & D even before the American economy benefits.

The volume of flow through the military channels will be dependent on general conditions affecting any type of transfer of technology, as well as conditions specific to the military. The former involve such conditions as the donee's propensity to imitate technologies, and the donor's propensity to make the technologies available. Fundamental political and economic factors such as the cold war, the size of the market, the donee's prior technological and scientific base attained, and many others are involved. The latter, that is, the conditions specific to military, appear to depend on a threshold effect of cumulative quantitative and qualitative inputs such as those listed below, but further and broader study, particularly of a quantitative nature, will be required before definitive statements can be made.

Fifth, the mechanism of military transfer of technology can be improved, when and where desirable. Options include more effort with identification of transfers, informational and retrieval systems, more attention to "creative transferors", and more U.S. training in place of in-country training. Of special importance is the recognition of the need for in-country component repair systems, and self-sufficiency programs in alliance with defense contractors and local national governments. These have potential payoffs both in nailing down effective transfers of technology, and realizing cost savings to the U.S.

Sixth, the data set forth suggest the possibility of greater quantification. The materials have been uncovered with some difficulty, and constitute a first attempt to bulldoze through a new dimension in cost-benefit assessments of military activity overseas. Almost all military activity overseas probably has some benefit which transfers over into the civilian economy. A dollar spent on military assistance may produce as much benefit as, or more than, a dollar spent on economic assistance. Indeed, without the fillip of military assistance injections in such industries as aircraft in Japan, Korea, or Taiwan, it is fair to say, there would have been no such developments. In many cases, the civilian benefits could not have been predicted, as in the case of the F-104J spillovers. Perhaps most important, many military training schools impart skills, such as electronic, mechanical, and management, which are providing rising overseas industry with a supply of highly trained technical personnel when they leave the service. These schools themselves are the product of U.S. military training. No quantitative record of this critical civilian transfer, other than the few samples offered in this study, exists.

Thus, in some sense, this book is an interim report. If it calls attention to the great hiatus which exists in our knowledge on the subject of military transfer of technology, it may be said to have done an important service. More precise pinpointing of the contribution of military transfer of technology must await further investigations, and further refinements in methodology, particularly in establishing techniques for measuring the value of these transfers. However, the data thus far uncovered offer considerable evidence that future research in military transfer of technology will have distinct payoffs to both donee and donor countries.

ACKNOWLEDGEMENT

Many persons have contributed to the ideas in this book. A great number of members of the U.S. Military, and numerous civilians in the United States, Japan, Taiwan, and Korea have unstintingly given their time for interviews and assistance to me. In particular, without the generous cooperation of the officers and men of the U.S. Air Force, of the other U.S. Armed Services, and of their counterparts in the armed forces of the friendly countries concerned, this study could not have been made.

MILITARY TRANSFER OF TECHNOLOGY

INTRODUCTION

It is becoming increasingly clear that one of the most important problems of the late twentieth century is that of managing technological and related social change. We know that everywhere there has been a revolution of rising expectation, in which men even in the most backward areas feel there is something more to life than being Edwin Markham's Man With The Hoe. On the other side of the scale there is another revolution--a revolution of rising confidence in man's ability to effect planned change. Modern men of science and technology are increasingly confident that they can shape their destiny rather than be its slave. The problem seems to be how to bridge the gap between expectant men with hoes, and confident men with science. The transfer of technology and skills from the technicians to the unskilled is at the heart of the solution.

Military transfer of technology is one segment of this larger issue of our time which has become popularized under the term, "technological gap".[1] The United States, with its large resources devoted to research and development, has been, since World War II, the fountainhead of innovations in many

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[1]In late 1966, a Presidential Commission was appointed to study these problems, particularly the gap between U.S. and Western Europe and "brain-drain" from Western Europe. New York Times, Nov. 27, 1966, Section L, p. 41.

areas of economic life. Many of these new or improved products and processes have come from research and development in support of military activities. But whether civilian or military in origin, other nations are eager to obtain this technology because of the widely held belief in its beneficial effects on modernization and growth. The cost of inducting this technology in terms of "brain-drain", failure to do indigenous research, and possible social upheaval following in the wake of the new technology tends to be overlooked, and decried at a later date. For better or worse, the foreign nations want the modernizing impact of U.S. technology.

Technology may be defined in this context not only as relating to physical objects, but also to the accompanying labor and management skills. It may include an entire system of production such as mass production, quality control, or research and development methods. It ranges from the humble skills of the man who learns how to change a tire and do first echelon maintenance, to the high-level training of the aeronautical engineer who is already familiar with propeller planes, but has to acquire jet technology. On a still higher level, it means researchers in aeronautical stress analysis who acquire still more advanced methods in sophisticated research testing procedures.[1]

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[1]For further discussion of the definition of technology, see J.J. Murphy's paper, "Transfer of Technology: Retrospect and Prospect," in Daniel L. Spencer and Alexander Woroniak, editors: Transfer of Technology to Developing Nations. U.S. Air Force Office of Scientific Research, (Washington, D.C., December, 1966) Technical Report #2.

Whatever the definition of technology, the concern of this study is with its transfer, particularly under military auspices. Channels of transferring technology range from complex programs of exchanges of students, technicians, and productivity teams, or elaborate patent licensing, and know-how agreements in the commercial world, to simple copying of items from direct observation, or through reading literature from another country. One channel, less well known, and indeed usually overlooked, is the military channel.

It takes but little reflection to realize that the presence of a foreign military force in a country is bound to have some effect on that country's economy. In the past, there has been recognition of that fact, but it has usually been confined to the demand aspects, i.e., the military force adds to aggregate demand in a country and causes increased production, and/or, as is more likely under the inelastic supply conditions of underdeveloped countries, inflation. In fact, the latter is one basis for the negative value judgment about a military presence which is often made. Little attention is paid to the supply side of the equation, other than the usual comments about destruction, or the utilization of valuable farming lands and other productive facilities. In particular, the counter-proposition is neglected; namely, that the military presence of a higher technical civilization fosters technological change in various ways, and, in so doing, creates productive capabilities both actual and potential, within a host country.[1] It is to the elaboration of this proposition that the present book is dedicated.

Military transfer of technology should not be confused with much-publicized civic action programs of the U.S. and friendly foreign military forces. Civic action programs are aimed at using military forces to accomplish economic development tasks such as building roads, bridges, schools, etc., especially in rural areas where subversive infiltration might occur. While undoubtedly some technological transfer takes place in this manner, the aim of civic action is to accomplish some

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[1] The prevailing tone in literature about military economic activities in a nation was set long ago by Adam Smith's classic, The Wealth of Nations. His Part I of Book V is entitled "Expense of Defense", (i.e. cost) and is unrelieved by any recognition of positive economic benefits to the economies. To this day, economists have generally followed this pattern, treating of the "burden of the military forces" (e.g. recent report from Taiwan: Neil H. Jacoby, An Evaluation of U.S. Economic Aid to Free China, 1951-1965. (Bureau for the Far East, Agency for International Development, 1966) p. 88.

However, there has been an underworld of literature, usually scholarly or esoteric in nature, which has accorded recognition to the value of military activities in creating an important impact on the capabilities of industry. Historical literature is covered in Lewis Mumford's Technics and Civilization. (New York: Harcourt Brace, 1934) pp. 89-96. For recent studies of the favorable impact of military R and D on the civilian economy, see Richard S. Rosenbloom, Technology Transfer - Process and Policy. (Washington, D.C., National Planning Association, 1965) pamphlet, and Herbert E. Striner, Richard U. Sherman, Jr., and Leon N. Karadbil: Defense Spending and the U.S. Economy (Baltimore, Maryland: Johns Hopkins University, Operations Research Office, June, 1959), 2v. ORO-SP-57.

particular task, often as part of a counter-insurgency program. Military transfer of technology, in contrast, is a more comprehensive, less obvious, longer-run phenomenon. It is essentially a by-product or spillover of military activity on the civilian economy rather than a direct impact, and its effects are difficult to trace, recapture, and specify. Its incidence is dimensionally greater in industry than in agriculture. In this study, while recognizing military civic action as a sub-channel of transfer of technology, the attempt is made to examine other facets of technological transfers which may lead to industrial self-sufficiency in technically backward sectors of an economy.[1]

Framework of Military Transfers

Can the presence of the United States military forces in a foreign area provide a mechanism for the transmission of new technology and modern systems to developing civilian economies? Does such transfer result in the development of potential off-shore procurement capabilities with attendant cost-savings to the U.S. as well as industrialization in the area?

This book is based on U.S. experience in Japan and other Pacific countries which indicates that, given certain conditions, it is possible to achieve this mutually beneficial result. Although further research of a comparative nature must be made, the Far East provides an instructive record of past performance

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[1] For a good summary of civic action and its literature, see Harry F. Waterhouse, A Time To Build: Military Civic Action--Medium For Economic Development and Social Reform (Columbia, S.C.:

and a future guide. Japan has had distinct opportunities of access to U.S. technologies via diverse military contacts, and to a lesser extent other Pacific countries have had such access. When utilized, capabilities have sprung up, and industrial development has been furthered.

This study attempts to present details of this military transfer mechanism in Japan and in other Pacific countries.[1] It seeks to reveal in detail more specifically some of the channels of U.S. military technological transfers and their technical linkages with local economies. Further, it examines the mechanism critically with a view to improving it. To this end, the study is divided into chapters on the Demonstration Effect of External Military Presence, Linkages Through Formal Training, Linkages Through Procurements, Linkages Through Military Assistance Programs, Technological Transfers in Other Pacific Countries, and Improving Transfers of Technology. Illustrations are drawn largely from the automotive, aircraft, electronics, and related industries. In the light of this experience, some assessment is made of possible operational improvements in technological transfer, and of alternative

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University of South Carolina Press, 1964). The military technological spillover is given little recognition in this book which is concerned with the more immediate consideration of political and social problems in the countryside rather than industry.

[1] For a preliminary published report on this subject, see Daniel L. Spencer, "An External Military Presence, Technological Transfer, and Structural Change", Kyklos, XVIII (Fasc. 3, 1965), 451-474.

courses of action which may be pursued in capturing this phenomenon to the advantage of both the U.S. Military and the donee country.

The analytical framework of this study is composed of several concepts:

1) that each nation has a propensity to borrow technology which places it on a spectrum of willingness or reluctance to borrow technology from other nations.

2) that each nation has some propensity to supply technology. This propensity also varies in a similar scale from a liberal dispenser to a conserving position.

3) that a demonstration effect takes place at many levels when the external military forces of a higher technical civilization are present in a less developed country.

4) that a linkage effect relates certain activities of the military presence, such as procurements and military assistance, to the development of higher level technical capabilities in the civilian economy of the host country.

The first two concepts are derived from a generic study of the transfer of technology from country to country; the last two are terms adapted from the literature of economic development to apply to interaction between foreign military and the local people. The gist of the argument is an economic one, namely, that these propensities of nations interact like the forces of supply and demand in markets. Demonstration and linkage effects provide the mechanisms through which the propensities operate.

In particular, the presence of the military forces of a higher technical civilization in less developed countries provides opportunities for the transfer of technology. This military channel is not exclusive. It is often coincident with, or at least antecedent to, other channels of transfer, such as commercial licensing, informational exchange through journals, educational training opportunities, economic aid programs, productivity missions, etc. These channels are interrelated and it may be hard to disentangle them. But at least in some cases, like those set forth in this book, the military element is the significant and strategic component in the complex.

In any case, for significant and lasting effort, certain thresholds of contact must be reached. These thresholds are levels of time, quantity, and quality which must be attained before the transfers are productive. Thus, a large military force, operating over a long period, making sharp quantitative and qualitative demands of a local people with a strong emulative propensity, would trigger responses which would be less likely to occur where the conditions were less favorable. Japan meets these favorable conditions in the highest degree; other Pacific Command countries to a lesser extent.

Conditions for Transfer

Under what generalized[1] conditions does a donor military force equipped with a higher technical capability transfer technology to a donee country in which it is resident? First, the donee country must have some propensity to borrow technology. The propensity is a national characteristic of the people

[1] A forthcoming computer study of some specific conditions conducive to technological transfer in the case of Japan, which was made under this research program, will be published in the March, 1967, issue of *Kyklos*.

which makes them favorably disposed to try out innovations of foreign origin. Its elements are: 1) a receptivity to new and/or foreign traits, particularly technical traits, and a willingness to imitate them; 2) a passionate intellectual curiosity, expressed in avid study, careful and full note-taking, and a seeking out of further opportunities to learn; 3) a willingness to copy slavishly or imitate meticulously, even to the point of invoking ridicule, anticipating that, later, the mastered knowledge will be productive, and even extended by the learner.

There are, of course, numerous supporting conditions. For one, a mass market is probably a sine qua non for the utilization and introduction of modern technology. For another, a large mass-based educational system with an outturn of large numbers of engineers, technicians, managers, etc. is important. A high savings and investment ratio, clever fiscal and monetary policies, and above all the existence of that rare species, the much-prized entrepreneur, are some of the tangible bundle of requisites in the prior base of a country seeking to advance its technology. These conditions have been fairly well explored in the modern literature of development. Unstressed has been the humble matter of imitation, that national trait of a people which makes them willing to accept foreign ways of doing things which are more effective than their own. It is an admirable pragmatic trait which does not compel a people to feel that they must reinvent the wheel. It is this trait which makes possible a quick and effective transfer of technology, such as occurred in the military transfers in the Far East.

The Japanese are celebrated for such an emulative trait, and for the consequent speed with which they have brought Western innovations into their country both in the Meiji period, and more recently in the period since World War II. Their historic willingness to accept new cultural ideas was demonstrated in their formative period when they borrowed heavily from Tang China. In the 19th century, following the Restoration, there were wholesale importations of Western technology, and this transfer continued, though in abated form until World War II. The Japanese historical record is replete with eager missions and careful students in the American and European universities, as well as the importation of a host of foreign instructors to Japan. Technical tie-ups with Western companies (Siemens, General Electric, Westinghouse, Ford, General Motors, etc.) were quite usual and many Japanese engineers worked in industries such as aircraft in the pre-War period.[1] In the

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[1]Lockwood quotes the following rueful comment of the U. S. Strategic Bombing Survey: "For assistance other than financial, the Japanese aircraft industry owed more to the U.S. than it did to its own government. It is sad, but true, that United States fighter and bomber pilots fought against aircraft whose origins could be traced back to United States drafting boards. Many Japanese engines and propellers came from American designs which had been sold under license in prewar years. Many top Japanese aeronautical engineers could claim degrees from Massachusetts Institute of Technology, Stanford, and California Tech. Their best production men had served apprenticeships with Curtis, Douglas, Boeing, or Lockheed. Here and there, war-time German influence was evident, especially in the jet-and rocket-powered types that never became operational, but it can be fairly stated that the Japanese fought the war with aircraft on which the strongest influences in design were American." The Japanese Aircraft Industry, Washington, 1947, p. 4, quoted in W.W. Lockwood, The Economic Development of Japan (Princeton University Press, 1954), p. 331.

period following World War II, as will be shown in this monograph, the Japanese aircraft industry was rebuilt with very much the same sort of heavy borrowing from the U.S. under the accelerated impact of the military assistance program.

This point leads to the second generalized condition for a successful transfer of technology; namely that the donee country's propensity to borrow must be matched by a high propensity to lend or make available the technology on the part of the donor. The components of such a donor propensity break down into: 1) a willingness to demonstrate (show-how) to others; 2) a willingness to train people systematically, over long periods if necessary, and under their own managers; 3) a willingness to license and otherwise make available intricate and advanced technology through government and/or commercial channels. The first element is both national and individual. Thus, as a nation, some countries are clearly more open-handed than others. The U.S. has a long history of technological open-handedness. In contrast to German or Russian behavior in countries which they occupied, the U.S. national propensity to make available their technology is obviously much freer. But the willingness to make technology available is also a function of individual as well as national response. Some individuals are more willing to help foreign people than others. A foreign supervisor who is "simpatico" is more likely to be effective than an ethnocentric individual.

The second component of a propensity to make technology available involves willingness to employ local nationals, set up long run objectives and train the nationals systematically toward these prescribed goals over long periods, and, finally, allow them to function under their own supervisors. Such long-run wise policies are not easily instituted because they conflict with notions of national superiority, questions of security, and anxiety about making available valuable property which rightfully belongs to the donor country. Similarly, allowing local nationals to function under their own instructors, supervisors, and managers is also challenging to the donor group. In-group social and military distinctions conflict with the hierarchy of the donee group. Thus a private soldier in the donor armed force may feel he should give orders to an engineer in the donee structure simply because he is a member of the higher level technical group. U. S. engineers in Japan have cited many examples of G.I.'s who disturbed production with foolish orders to Japanese engineers or managers.

The third component of the technology supply propensity represents the highest level of transfer, government-sponsored license to transfer some complex system under commercial conditions. In the case of the United States, the donor government's motive is to secure an ally with some military capability. The donor commercial company's quid pro quo is the royalty and other payments it receives, plus some opportunity to establish a commercial tie-up, which in the intricate calculus of international or multi-national companies it regards as desirable. Thus donor companies may acquire new knowledge of a potential market, customer expectations, and possibilities for overseas manufacturing arrangements of specialized items with comparative advantage-based international specialization of affiliates. Of course, valuable technology is being provided, usually under some program regulation which limits royalties or profits to a nominal figure like five percent.

An adverse effect of technology may be the creation of potential competitors. Why, it is often asked, should the donor company do it? One answer is to please its own government for the sake of future goodwill in contracts and other government-business relationships. Cartel control systems are alleged to be another motivation. But a better economic reason is that technology becomes obsolete so rapidly that it pays to license it out while it is still current. Proceeds from such transfers, business feels, can be used to offset the mounting cost of research and development. Indeed, there are cases where the Japanese bought the R & D and one copy of the prototype for what the R & D cost. Naturally, the question of social versus private gain also enters into the calculation, because it may not be to the social interest of the donor country to allow commercial or even political considerations of short-run alliances to be the final arbiter of any disposition of the national store of technical knowledge. But such questions of policy, however important, are beyond the scope of this study, the purpose of which is simply to describe and analyze military transfer of technology.

In addition to the foregoing generalized propensity conditions necessary to effect a technology transfer under military auspices, a third condition must be added, namely, that the prevailing circumstances be favorable to the transfer. If the foreign military forces are hostile and/or in some way repressive, so that the local people fear and hate them, probably little technology will be transferred. But if there is a relatively benign military presence of a civilization which enjoys great world-wide respect, the local people are likely to study hard in the donor's school. The American Occupation of Japan, in contrast to other military occupations of history, qualifies on this score, and the after-treaty presence of American military bases was carried out in an inconspicuous and largely unprovocative manner.

Moreover, the technological gap between the U.S. and Japan was demonstrably wide, as the outcome of the war had made clear to the Japanese. With historic pragmacism, the Japanese set about emulating the victor. The Korean War was to become a fortunate circumstance for Japan, expediting technological transfer. Conversely, it was a restraining factor for Korea. But an exogenous factor such as a war is not a sufficient condition for exerting influence. The relative reluctance of the Japanese to meet the demands for U.S. procurement in the Viet Namese war in contrast to their earlier avidity is obviously related to the fact that the technological gap is now relatively smaller. While many other factors are involved, there is evidence that the Japanese feel they have little left to learn from military procurements, except in the most advanced systems.[1]

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[1] "Defense Industry of Peaceful Japan", Jitsugyo No Nippon, August 15, 1964, section 2 of this article. U.S. procurement officers also confirm this point.

These generalized conditions: the propensity to borrow, the propensity to lend, and the favorable circumstances factor interact to make possible transfer of technology from a foreign military donor to a local populace with varying degrees of success. Clearly, a native people with little propensity to borrow technology are not likely to be much affected even by the large-scale, long-term residence of a generous donor under the most suitable circumstances.[1] Conversely a military presence whose policy is to hoard national technique is unlikely to affect the local people much on a technical plane. While these determinants of technological transfer cannot be measured or even given systematic formulation, at this time they have conceptual and analytical value, and it may be assumed that policies can be designed to strengthen the propensities.

Side by side with the propensities and favorable circumstances, there are mechanisms of transfer, channels of contact, in which the phenomenon of transfer takes place. The famed demonstration effect is one such mechanism. People see others doing something more efficiently, or see a better way of coping with a problem, and copy them. In its simplest manifestation,

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[1] Speaking of the hill tribes of Burma, an anthropologist who had studied them says: "Even the massive intrusion of Japanese, British, and American troops into hill tribe areas during World War II had little visible impact. The Chin, for example, have little to show for this episode besides a few salvaged jeeps and a single track road that has to be rebuilt after every rainy season." H. Pendleton Banks, "Culture Change Among Hill Tribes in Burma", unpublished paper given at a Conference on South Asian Studies, Florida State University, pp. 28-30, January, 1965.

there is little formal context, but when the external military force employs the local nationals, all sorts of unintended or unplanned transfers are likely to take place. OJT - "on-the-job training" - is a descriptive term for what happens. Demonstration effect may take place over a long period of time. Where, as in the Japanese or Russian case, eventual upgrading of living levels are planned, the goal of attaining the level established by the U.S. provides a concrete demonstration of what the planners desire. In the short run, demonstration effect may include equipment which is torn down, examined carefully, and rebuilt, engineering drawings being derived in the process. In this respect, the Japanese are hailed as great "reverse engineers".

More specific than the concept of demonstration effect is that of linkage effect or linkages. As used here, this term depicts a tie-in between a foreign military activity and the civilian economy. It is more systematic and specific than "demonstration", though it may include the latter. The concept is similar to a "leading sector" in development literature, which means a pioneer industry requiring complementary investment in other industries. Thus, in Japan, formal training programs on American bases for local nationals could result in American practices being conveyed to individuals who later turned their knowledge to use in the civilian economy. Alternatively, a military procurement contract which insisted on high technical performance capability in a local company would make possible the later export of internationally competitive goods. In both cases, foreign military activity has a vital linkage effect in upgrading technical capability, shifting production functions or changing their share and altering the sectoral structure over time.

Military assistance linkages may well have the most important effects of all on the civilian economy. Operating as they do through the military forces of the host country, their impact is enormously multiplied. Thus, the man who is trained as an electronics technician in the United States returns to his country's armed forces, and communicates his learning to other men. If he is an instructor in a military service school, he may train hundreds, even thousands, of men in successive classes. The skills learned in the U.S. military training programs are reproduced, though perhaps with some leakage, in thousands of individuals. The linkage with civilian economy is accomplished when the man is discharged, or retires into civilian employment. Some of the data presented in this book documents the value of this military training for civilian economic linkages.

Lastly, demonstrations and linkages may accumulate over time until some threshold effect is visible. The interaction of propensities through channels of demonstration and linkages is likely to require time, and quantitative and qualitative infusions on a substantial scale, before results appear. In short, a threshold must be attained before results are discernible in the large. In the Japanese case, the Korean War procurements and later heavy military assistance programs surmounted this threshold. Foreign commercial licenses, know-how agreements, and joint venture investments were built on foundations and scaffolding provided by the military presence. In other countries this threshold for advance into a high technical capability on a wide front may not occur as it did in Japan, but it is likely that, at least in certain industries where the military impinges (e.g. trucks, autos, mechanical equipment, electronics, avionics, construction, etc.), the prospect for a specific threshold to emerge is quite likely. The evidence from Taiwan and Korea offered in this book suggests that these countries also have achieved such thresholds.

CHAPTER 1 THE DEMONSTRATION EFFECT OF EXTERNAL MILITARY PRESENCE

The presence of American military forces in a country nearly always provides an employment opportunity for the local nationals. The U.S. Forces need help to maintain motor pools, warehouses, base organization and other logistic activities, because of the rotation and turnover of military personnel. Like the civilian working with the military establishment in the U.S., the local national civilian is useful in maintaining continuity. The foreign employee provides interpreting and translating services, and generally knows his way around the country better than his American superiors.

But as an indigenous worker mediates his country to the U.S. Forces, the latter in turn reacts on him, indoctrinating him in American techniques and practice, putting him through an experience similar to training in the United States. As an overlay to the skill or profession in which he has been trained, he will be exposed to American techniques and practice. If employed for any length of time, he will acquire something of the high standards of the U.S. system in his field. Naturally, this opportunity is less meaningful at the lower levels of labor, but even here, the opportunity to become familiar with the U.S. system emphasizing speed, productivity, and standards has value, say, in turning the peasant youth into a modern industrial man. Labor is likely to become more habituated to organized effort, and ready for the next step in the country's development. But the impact in skilled work and professions is certain to be greater. On the individual level, depending on personal ability, the previous skill or profession is upgraded by the exposure to the advanced country's technology. For the nation as a whole, the impact will vary with the size of the military build-up and with the degree of utilization of the local nationals. With these general considerations, employment data from Japan may be examined.

Demonstration through Employment in Japan. From Japanese sources an annual total is available for the years 1949 to 1965 (see Appendix I). This table shows the build-up during the Korean War period to an annual high of 271,000 and the subsequent decline to about 50,000 persons at the present time, as missions have been curtailed, and the pressure of gold flow considerations have mounted. These figures do not show turnover of personnel, and it is not possible to know the exact number of persons who worked for the U.S. over the period. Turnover was important in skilled occupations as Japan recovered economic stability, but it is difficult to estimate it. Also there are the years 1945 to 1948 which are not covered by these data. Moreover, it does not cover persons working on contractor payrolls which were part of some on-base operations such as the World War II Vehicle Roll-up rebuild program. Yet on balance, as suggested by the Appendix total, a crude estimate of two million Japanese employed, for any length of time, by the U.S. over the twenty year period is probably reasonable.

American sources in Japan have estimated the following percentage composition of the skills used by the armed forces, and have given examples of types of occupations in each category:

TABLE 1

Skills Utilized by the U.S. Armed Forces in Japan

	PERCENT
HIGHLY SKILLED	1.3
Engineers	
Electronic Specialists	
Research Technicians	
Analysts & Inspectors	
Medical-Dental Officers	
Chemists	
SKILLED	34.3
Operating Engineers	
Heavy Equipment Operators	
Maritime Personnel	
Optical Parts Makers	
Electricians	
Machinists	
Welders	
Boiler Makers	
SEMI-SKILLED	36.0
Vehicle-Equipment Operators	
Automobile Repairman	
Machine Operators	
Engineer Equipment Servicers	
UNSKILLED - Laborers	10.0
CLERICAL	18.4
Accountants	
Interpreters	
Draftsmen	
Stenographers	
	100.0

Source: Headquarters, U.S. Forces, Japan.

Japanese sources have provided sample data for the years 1963 and 1964 of a selection of 158 highly skilled or skilled occupation classifications. Personnel employed in these classifications totaled 2,547 in 1963 and 2,305 in 1964. These data, which are given in full in Appendix II, constitute about 5% of the total U.S. Forces employment of Japanese professionals during each year. The list shows the great breadth of economic activity of a high level in which Japanese professionals were involved. If data were available for an earlier period when the U.S. forces were larger, there is no doubt that even more activities were involved, and the totals would be four or five times as large.

The significance of such employment does not lie in the total figures, which, relative to the total professional population of Japan, are quite small, and would have been small even when the U.S. Forces were larger in numbers and more active as during the Korean period.[1] It lies in the continuing demonstration effect which this employment provided for the managerial and professional classes. Naturally, the quantitative influence itself was greater in the earlier period when the Occupation Forces were a major employer in an economy already stagnant, halted by defeat in war. As the Japanese built back their economy, the U.S. Armed Forces employment became relatively less

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[1] The impact in other less-developed Pacific countries was greater quantitatively because of the smaller number of professionals in these countries.

important quantitatively, but their qualitative importance to the Japanese increased because the latter were entrusted with more and more complicated work. Post-World War II policies on reduction of U.S. effort and reduction of personnel caused greater reliance on Japanese professionals. The Korean War provided the stimulus to carry this trend further, and important training programs were instituted for higher personnel. But the big channel of learning was through the demonstration effect of working closely with American supervisory personnel, both military and civilian, including technical representatives from U.S. companies.

Typically, these Japanese were called upon to translate the technical manuals and related documents concerning repair, and maintenance, in their fields.[1] In turn, they communicated their knowledge to Japanese working under them in the American installations, and to their professional colleagues outside in professional meetings and seminars. When jobs became available in Japanese industry following the Korean War, these Japanese transferred out and were succeeded by their juniors who repeated the performance a few years later. In this way the demonstration effect of the work experience of a few key professionals was multiplied in its effects many times, and the

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[1] In many cases, American documents found their way into technical books in Japanese, sometimes English being reprinted verbatim. See for example, Japan Preservation Technique Institution, Bosei Gijutsu Binlan (Preservation Technique), (Tokyo: Nikkan Kogyo Shimbunsha, 1953) in Japanese.

technical practice was incorporated into Japanese general practice.

This sequence was, of course, not the only way the demonstration effect worked. There were many variants of the process. Demonstration could work directly on the civilian economy without the medium of employment. The tape recorder, for example, is said to have been introduced to the Japanese by an American G.I. who asked the Japanese to repair it for him, whereupon they immediately "reverse engineered" it, i.e., tore it down to see how it worked and prepared drawings and designs on the basis of what they found.[1] Or demonstration effect could occur through repair of U.S. equipment, and could trigger a trip to the United States to learn more of what had been seen. Thus the man who introduced automatic welding into the shipyard practice of Japan had seen something of the practice in repair and construction activities for the U.S. Navy. With the help of a SCAP consultant from a U.S. shipyard, he was able to get to the U.S. and buy the equipment from the Linde Products Company, where he was given a careful course in its use.[2] In other words, the demonstration effect resulting from the presence of American forces could occur either directly through employment on American bases or

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[1] This story has been repeated by several informants in interviews conducted in Japan.

[2] Interview with Mr. T. Kumose, Engineer, Mitsubishi Shipyard, Yokohama, August 28, 1965. This innovation borrowed from the U.S. when Japan was under SCAP's military occupation is fundamental to the modern preeminence of the Japanese shipyards.

more indirectly through some other military contact channel. Because the demonstration effect outside the employment channel is less a matter of record, the next sections will concentrate on employment training.

Demonstration through Informal Training. Training in connection with some sort of employment was one of the chief ways in which many modern innovations were communicated to Japan and to the friendly countries of the Pacific. The endogenous training program of the U.S. military forces could be informal communication of skills, or it could be performed under some formalized training programs such as a workshop, institute, or after-hours course. The informal training was usually on-the-job (OJT), but it could occur outside the regular work situation. The formal program (discussed in detail in the following chapter) could operate through some system of training set up by a U.S. base training officer, or it could be formalized by the local nationals in some directed or even voluntary way.

While the purpose of any training is usually to get an immediate job done, facilities have been made available to local nationals for longer-run purposes. Thus Japanese companies have sent personnel to be trained at an American base in order to upgrade personnel for fulfilling a U.S. procurement contract. Training programs have been conducted for people who have received reduction-in-force notices, and training offered merely to upgrade abilities as a service to personnel, possibly with an eye on future utility. Hence training of local nationals could occur for varying reasons, but it had in common the elements of transferring skills and techniques, and some purposive plan on the part of the donor country or the donee nationals.

Skills and techniques may also vary greatly in their character, ranging from humble but necessary trades to such complex technologies as the jet engine or the elaborate system of standardized management controls. The technical impact of the former may not be as far reaching as the latter, but in short run economic terms may insure the success of a military mission and/or provide a source of scarce specialties to the civilian economy and to U.S. business ventures investing in the country. In the more complicated technologies we have higher orders of innovations being transferred. But whatever level is conveyed, it is subject to a supply and demand balance, in which the propensity to borrow the technology operates in juxtaposition with the propensity to lend it. Examples of these types from the automotive industry will make the point clear.

The typical contact situation is in OJT training, a term widely used in industrial and military circles for describing the age-old apprentice system of learning by doing. Usually, it assumes some sort of background, if only cognate familiarity. Thus a jeep or truck driver, one of the first local national occupations utilized, is typically one who had some similar driving experience in his previous work in the civilian economy. Now the counterpart vehicle may be dissimilar in many respects, as, for example, a left hand drive, a charcoal burner engine, or derived from a separate automotive tradition such as a rear engine mount, but the family of automotive equipment is sufficiently similar throughout the world to give little trouble to one already familiar with one of the branches. However, even without prior familiarity of any kind, the operation of an automobile is sufficiently simple to be taught in an informal OJT program of instruction, to any person endowed with no prior training and little original aptitude. Experience in the PACOM countries suggests that the local national driver does the job well enough, though as in Japan, he may be dubbed "Kamikaze" for what appears to be recklessness.[1]

For repair and maintenance of vehicles, however, some background and aptitude for the work are more necessary as higher echelons of mechanical work are required. In other words, there is probably a direct relationship between the prior level of skills achieved, and the ease of acquisition of work with automotive machinery. But this correlation cannot be pressed too far. A bright young person with some aptitude may be more helpful than a trained older person "frozen" in some older practice. In Japan, in the early period, mechanics were available

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[1] The author heard a defense of the alleged recklessness of Japanese drivers from an American Nisei, somewhat proud of his racial origins, who held that the Japanese driver's sensitivities are honed to fine tolerances and narrow margins because of the cluttered conditions of city life in overcrowded Japan. In contrast, the American driver is attuned to an institutional system of roads, markers, lights, etc. which stress wide tolerances for safety purposes. In this sense, he held alleged "Kamikaze" drivers are better drivers than Americans.

in profusion in a war-stopped economy, and it was easy to obtain the services of very good men with considerable training. But the equipment with which they were familiar either belonged to a slightly different branch of the world automotive family or was previously-borrowed, out-of-date American equipment.[1] As in many other of her industries, Japan's automotive technology had been frozen at a mid-1930's level by the China war, and the American automotive industry had moved on to a still higher production level of technique or improvements.[2] In Korea, there was little prior level, but the Koreans have developed a tradition of "fix-on-the-spot" and "make-do" which wins the admiration of the U.S. forces personnel. Other PACOM countries, lacking the prior technical base of Japan, have nevertheless managed to provide support mechanics of varying capabilities.

In Japan, and all over the Pacific, a good deal of person-to-person instruction in America's premier industry has gone on and is still going on, with American mechanics passing on

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Such as the Nissan truck which was the product of the 1934 Graham-Paige truck factory bought by the Japanese and transported to Yokohama.

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Quoting the U.S. Strategic Bombing Survey, Lockwood op.cit., p. 108, noted that "because of its mountains, its poor road net and its good sea communications, Japan has never developed extensive motor transport. Domestic production of motor vehicles was also of little consequence until after 1935, when government protection and tax favors were increased for military reasons." Such a meager pre-War base is in contrast to the 1966 industry which stands as third in the world, and is invading markets in Europe and America. The experience in military mass production of the Roll-up period is an important foundation on which this quantum jump was based.

newer techniques to their counterparts. Its incidence is somewhat as follows. Typically, an American who has been trained in one or another automotive specialty in a standard American trade school, and perhaps had some experience in the U.S. industry (either at the manufacturing or repair level), is drafted and develops experience with military vehicles. Then he is sent overseas to Japan or another Pacific country, where he is found transferring his knowledge. Some of these men are now "old timers" who have made a career out of this down-to-earth technological transfer. Others, of course, have only their draft service to work out. The older man in Japan may have arrived as a member of a repair and maintenance unit after the surrender of Japan and later converted to civilian status, or he may have come later as a "DAC" (Department of Army Civilian). In either case, he has worked and is working with his Japanese or Pacific country counterparts at the machine-shop level, imparting American practice in the close rapport of mechanics everywhere.[1]

In the early period of U.S. troop presence in Japan, rebuilding of Sedan vehicles at the Nissan plant in Yokohama and at the Toyota plant near Nagoya were early examples of this

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[1] Younger men of the draft variety offered much less. In fact, there are cases of local nationals being given incorrect instruction by such juniors. Transfer of technology is likely to suffer also as older men are now being replaced under some well-meaning directives which require rotation after a specified number of years. This latter is a good example of the fact that there is no U.S. Government technology policy to offset other considerations.

kind of informal experience for local workers. These rebuilds occurred about 1946 or 1947 and were caused by the shortage of new cars in this period. They were largely "bay-type" operations in which cars were rebuilt as in the bay of a garage. Here Japanese mechanics could obtain much basic knowledge of late designs and improvements of U.S. vehicles and repair equipment. Even earlier, first and second echelon maintenance was being performed by Japanese in motor pools all over Japan, Korea and probably elsewhere in the Pacific areas where local mechanics took over in the wake of the departing World War II military. Thus, in a modern basic industry, much fundamental know-how was communicated.

Mass Production Technique. The Japanese, however, were more fortunate than other Pacific peoples in that they had an exposure to American assembly line manufacturing operations, because Japan was made the collection point for the World War II vehicles left behind in the Pacific. This Operation Roll-up included "rebuild" or, more properly, remanufacturing operations, which began well before the Korean War. BIG 5, the popular military term for "Base Industrial Group Fifth Echelon", was set up as a largely civilian directed and operated section of the U.S. Eighth Army Ordnance Section in Japan. It was in the planning stage as early as 1945, and it began to turn out engines and other units in 1946, and fully manufactured vehicles from 1948.[1]

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[1] U.S. Eighth Army Ordnance Section. Big 5 Base Industrial Group 5, unnumbered text.

There was, to be sure, an established automotive base in Japan. While tiny in American terms, Japanese automotive engineers have claimed that automobile "mass production" had been carried on before the War, asserting that a monthly output of 1,500 vehicles had been achieved in the late 1930's or early 1940's. But these production lines were limited to axles and engines. Many parts were still produced under hand industrial techniques by small industries or even cottage industries. Bodies for trucks, for example, were all "hammered out" and differed one from another. As noted above, the models themselves were "frozen" in the early or middle thirties. In contrast, U.S. industry, always a leader in automotive production, had made outstanding advances during the 1930's and 1940's. Thus the BIG 5 experience gave Japanese engineers, mechanics, and labor, an in-house experience with modern American production layout, methods and newly developed techniques, as well as with American creative ingenuity in improvisation to keep the line moving in the face of scarce parts.[1] Such on-the-job experience was less important for skilled mechanics whose skills were downgraded by the mass production lines, but many ex-soldiers and

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A note attached to a production planning schedule, given the author, speaks of Oppama in the phase-out stage of 1957-58, "Even with phase-out, note that 1300 vehicles were being turned out (RFI'd) monthly. Also note that the entire vehicle was rebuilt during the production run--there was no bank or reserve to draw from (i.e., engines; transmissions; transfer cases; axles; steering gears; bodies; frames; C&I; etc.)--quite a trick to make production when any one item could stop production." 1300 vehicles monthly is about the level of Japanese pre-war output.

farmers learned to work on automotive lines for the first time.

At the other end of the scale, engineers saw and worked on equipment and techniques which were unknown in Japan. Examples of such automotive techniques were modern enamel painting, infra-red-drying methods, electroplating, and safety-glass.[1] As years passed, and the Japanese engineers could go to the U.S. under various programs of productivity teams or inter-company licensing or know-how agreements, these engineers were alerted on what to look for by their informal OJT training in Roll-up remanufacturing factories. It was not necessary that the same engineer who had worked in the shops go to the United States later. Obviously, much sharing of knowledge went on, both from engineers who worked in the shops describing the new items at engineering meetings, and/or in journal articles. Furthermore, there were courtesy visits by management from automobile manufacturers who had nothing to do with the rebuilds. One American engineer recalls seeing such missions frequently in the plants, with the Japanese busily taking elaborate notes.

No doubt this U.S. military influence on Japanese engineers progressively diminished. Initially, it was very widespread when the gap between the two industries was very wide, but as Japanese engineers absorbed U.S. practice in many fields the impact lessened. The influence of military demonstration declined

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[1] Interview with U.S. and Japanese Engineers in Japan, July, 1965. Safety glass had been produced locally, but their work impaired vision with a greenish tint.

with the rise of the productivity team program and the commercial contract. But undoubtedly the American military presence had a profound demonstration effect--an idea-generating mechanism which laid foundations for later Japanese industrial development. As one Japanese engineer told the author, "they gave us the concept, but we developed it."

Another heavy OJT influence on Japanese engineers was what one Japanese engineer described as "controls". Basically, this means industrial engineering or production engineering, but its implication is broader, referring to any industrial control or program procedure, indeed a new way of life for a Japanese engineer.[1] Thus even as late as the Occupation period, it was well-known that the Japanese were less precise about appointments at a given time, whereas today they have become extremely punctual. However, with reference to industrial practice, some of the specific areas of U.S. influence on Japanese were detailed by the testimony of a Japanese industrial engineer who worked for the U.S. Army in one of the Roll-up Rebuild plants. Here are his comments:[2]

1) Standardization, of which interchangeability of parts is one important feature, and another is the SNL, Standard Nomenclature List.

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[1] The author is indebted to Dr. Umehara, vice-president, Toyota Company, for this concept. "We Japanese know our weakness--control".

[2] Interview with a top Japanese industrial engineer who worked for the U.S. during the Roll-up program, Tokyo, August, 1965.

2) Detailed procedural manuals, the elaborate character of the U.S. procedures, set down in manuals of operating and repairing was new to the Japanese.

3) Japanese production engineers, before adoption of the system, had no time for planning and organizing because they were always instructing foremen; whereas with detailed manuals, much better control of production was possible. Japanese engineers quickly translated these manuals and formed study groups to absorb them.

4) Industrial Engineering Division. In contrast to older Japanese practice which gave no stress to studying how to improve operations, U.S. practice was to set up a division which made many studies of how to improve production.

5) Time and Motion Study. This is a specific example of better practice. While not unknown in Japan, it was given no stress. In contrast, U.S. technical practice put much stress on it, giving it status as an independent branch of the Engineering Division.

6) Quality Control. Japanese manufacturers were required to learn quality control and use Japanese inspection for their companies' products before turning them over to the U.S. inspectors for further checks.

7) Inventory Control. This system was admired and learned by the Japanese engineers. As early as 1954 or 1955, one informant saw an electronic computer at work at Oppama.

These types of control engineering were transferred directly and indirectly to Japanese industry. Often, it was pointed out, the new practice was transferred within the same company from one plant working on a U.S. contract for rebuild to another division of the company in another part of Japan. This could be accomplished by the transfer of an engineer, or through company-wide seminars, in which a paper or report on the new method would be given. The transfer, or at least the idea or concept, would also occur through note-taking study teams of engineers from companies other than the contractor, who visited U.S. installations in Japan on some sort of invitational basis. Engineers in their society meetings, books, and journals described the new techniques.[1]

Lastly, though horizontal movement of personnel is relatively rare in Japan, individual engineers who had considerable experience in special aspects of U.S. techniques would be hired away to take charge of the development of this speciality in a new company. This practice was especially true if the engineer was employed by the U.S. installation directly and was not the employee of a U.S. contractor. A number of examples of this type of transfer of persons occurred in the care, preservation, and packaging fields. This technical area had received very little attention in Japan prior to the U.S. presence in that country. No doubt this came about because of the limited Japanese logistic concept which did not envision supply in depth. In any case, the U.S. Army had established such an installation after the Korean conflict to maintain the vehicles and parts of

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[1] As, for example, quality control. It is true that even before the F-86, T-33A contract, the Japanese had begun to take a great interest in quality control, because of the shoddy quality of Japanese goods in the early Occupation. The Japanese had set up a "Union of Japanese Scientists & Engineers" in March, 1948, which did pioneering work in introducing quality control, and to this day, they still give "The Deming Award" for best work in quality control. This is named for the American professor, W. Edwards Deming, who worked with the Japanese in this early period. The Deming Prize (Tokyo: The Union of Japanese Scientists and Engineers, 1960) 45 pp., pamphlet.

the Roll-up program which were still unutilized. This unit, a part of the U.S. Army Logistical Center at Tokorozawa (details of which appear in Chapter V), was responsible for training a number of people in this specialty who were later "bid away" to Japanese industry. One outstanding man from this activity is now the responsible man in care and preservation work for a large automotive manufacturer, Toyota.[1]

Visits. Under the category of informal training should also be listed the visits by persons or teams seeking information. Probably all U.S. installations had numerous visitors, but records were not kept. In the case of the Care and Preservation Division mentioned above, a list of visitors was compiled by a Japanese shop manager from name-cards left by those visiting. This list is reproduced in Appendix III. It is by no means comprehensive, and the period covered is vague--thought to be 4 to 5 years in the late 1950's or early 1960's, but it does illustrate the visitor principle, where important productivity ideas may be conveyed to the civilians merely on a visit to the installation. For example, on one of these visits, a man from a company with a U.S. procurement contract saw a piece of equipment and learned where he could buy an automatic heat sealing machine which at least quadrupled his productivity. He was

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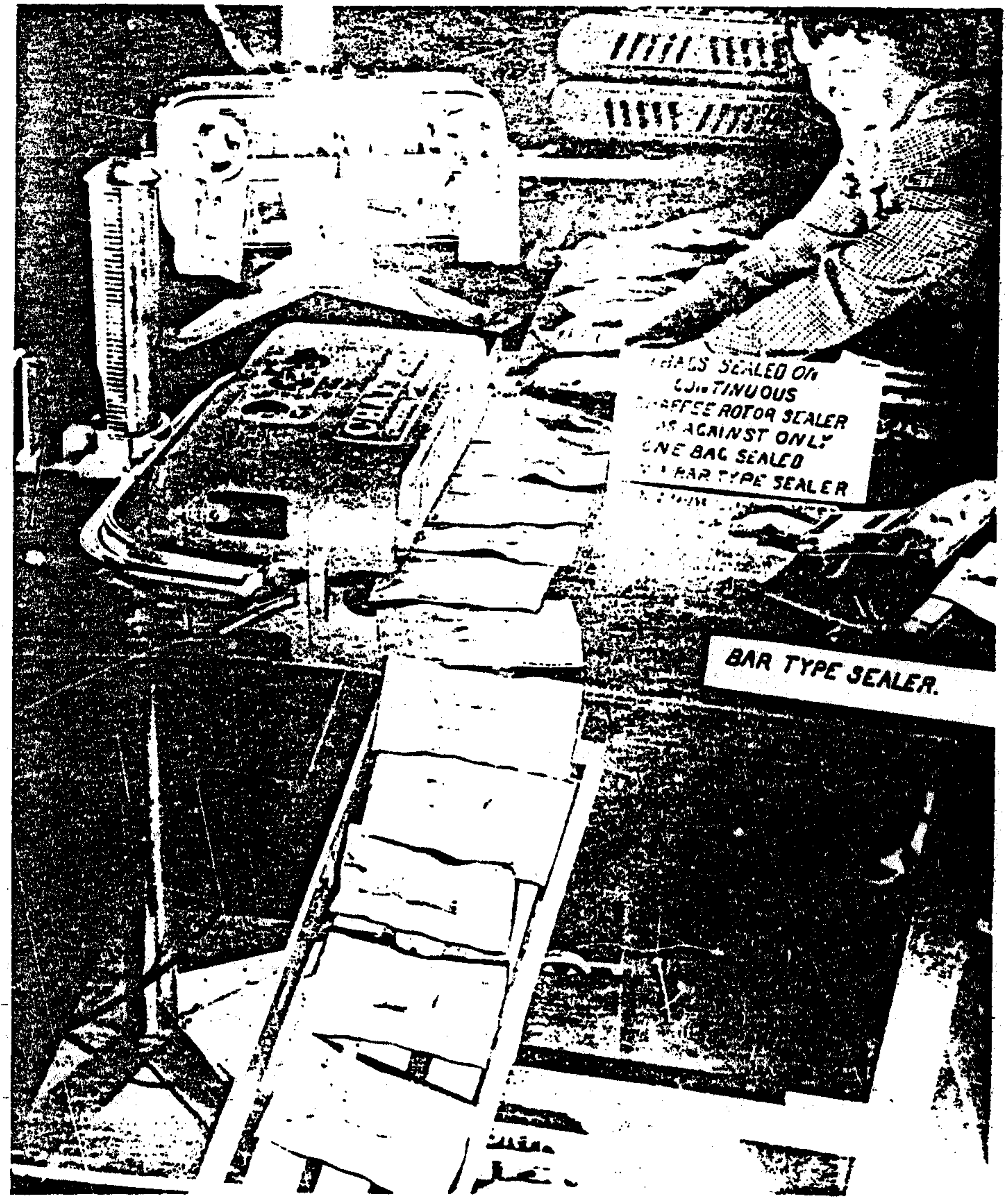
[1] However, at least one U.S. control system failed to "take". The U.S. system of job and wage classification was tried for a while, but seems to have come in conflict with the Japanese system of seniority through loyalty. Some companies are using it, but although there is a society in Tokyo to promote it, according to the secretary, little progress in the spread of the system has been made.



NO COLD SPOTS ARE POSSIBLE IN SEALS MADE ON THE CHAFFEE ROTOR SEALER.

Figure 2

given an advertisement from which he ordered the equipment, (see Figure 2).

Friendships. Finally, still another type of informal training-transfers came through the many person-to-person contacts between Japanese and Americans as personal friends. Thus an American engineer described a fishing trip with his Japanese friend, where the latter, the president of a large bakery with 465 trucks was worried about the scheduling of a maintenance system for his trucks as they were always out on the road. The American engineer thereupon devised a typical American system of records and maintenance based on peak-load usage. This system is alleged to have been widely circulated among all friendly bakery companies "when the boys in the trade got together".[1]

* * *

Summary

Thus, in many diverse and subtle ways, the American military forces played a fundamental role of transferring technology to the Japanese through the demonstration channel. It was largely unplanned, but it was fundamental. It gave the Japanese concepts of specific modern technologies, some of which were acquired immediately, and some of which were preparatory, permitting later exploration and development. Perhaps more important,

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[1] Interview, Tokyo, July 8, 1965.

a demonstration of modern managerial and technical methodologies permeated the consciousness of Japanese skilled labor. The foundations for building up later technical proficiency and productivity were laid in these demonstrations.

CHAPTER 2 LINKAGES THROUGH FORMAL TRAINING

Programs of formal training for local nationals were carried on by the U.S. military establishments from the early days. Thus an account of the BIG 5 industrial group, whose production dates from 1947, states in a caption below a picture of a formal classroom:[1]

> Training and indoctrination of Japanese workers in the American methods of mass production and standardization was a prime factor in the ultimate success of these first mass production lines in Japan. Farmers from the rice paddies and demilitarized Japanese soldiers were taught gainful occupations in the automotive trades, machine shop practice and automotive accessories field. The greatest stress being placed upon quality control, wherein manufacturing tolerances were held within American limits of standardization and replacement.
>
> Classes in precision measuring instruments were conducted to teach the workers the allowable wear limits and clearance of fit for bearing surfaces and internal working parts of engines. Visual aids and unserviceable engine samples were disassembled, and item replacement factors established for the Japanese to follow.

Japan Logistical Command, BIG 5's successor in the automotive rebuild program, also published an account of its activities which speaks of formal training activities of Japanese by Americans in several places.[2] It is a good presumption that

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[1] BIG 5 *ibid.*, p. 3.

[2] U.S. Army Japan Logistical Command. *Automotive Rebuilds*. 1951, pp. 2, 17, et passim.

every U.S. command had some such training program for its Japanese employees, but was less articulate about publishing accounts of its activities.

Formal training is basic to the American managerial-technical system and the transfer of the system itself is an important matter. Indeed on the national level, SCAP Headquarters, motivated by a desire to increase productivity, launched in 1948 a Point-four type technical assistance program before the U.S. Government programs of this type became popular. As part of this campaign, SCAP encouraged industry-wide training programs in management.

The Occupation program to improve Japanese management was called the "Training Within Industry" (TWI) program of the Labor Division of SCAP's Economic and Scientific Section (ESS/LAB). With the help of ESS/LAB, the Japanese Ministry of Labor and National Service drew up a job instruction manual for training foremen who were, in turn, to train Japanese workers. The manual contains the best U.S. training techniques of the day. It discusses methods to help trainees reach desired conclusions themselves instead of having to be told. The need to train by demonstration is also emphasized.[1] The American system of formal training in industry was widely promoted as part of SCAP policy. But, in addition to policy prescription,

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[1] See file labelled "Industrial Management" of SCAP, ESS, at World War II Records Division of the National Archives Service.

formal training on bases was provided for the Japanese wherever they worked with the U.S. Forces. Such training was an important channel of transfer of specific technique in many fields. An account of training activities on one of the bases will make clear something of its scope and incidence.

Tachikawa Air Base. The development of training at Tachikawa Air Base near Tokyo may be considered typical of changing training activities of the U.S. Air Force in that country. From the beginning of the American presence in Japan, this base was a major depot, and still is the most important of the Air Force bases in Japan. Its training program was a fountain-head of technique transferred to the Japanese in aircraft and related industries.

According to a memo from the files, three training projects were recorded as early as 1946 and 1947, the first being one to develop Japanese nationals as stock tracers in the Base Motor Shop.[1] The second enrolled 125 Japanese auto mechanics in a course to cover first and second echelon vehicle repair. The third project was on production methods and application of methods improvement, and was given in the base manufacturing shops. In 1948, courses in warehousing and stock record posting were developed and conducted by the supply division.

Beginning in October, 1949, a basic management training course was developed which was the foundation course of a syste-

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[1] Report of Employee and Career Development Activities, Memo in Files of Tachikawa Air Base, Japan.

matic training of higher type Japanese personnel for management positions. By this date it was realized that, with the decline of the Occupation Forces, greater reliance on Japanese management capability was necessary. The course was set up in the Training Section of the Civilian Personnel Office at the Base, and materials for the course came directly from the standard U.S. military course translated into Japanese.

In 1950, the first Japanese Management Instructor Institute was held at Waseda University in Tokyo, with leadership provided by the U.S. Air Force personnel. Thirty-one instructors were certificated in this course, of which only ten were Air Force Japanese employees, the others being from other U.S. commands, or ... Japanese industry. In the following year, 65 Japanese instructors were trained on the Base in a course conducted by Japanese instructors. In one pointed civilian linkage, it may be noted that thirteen of the trainees were from the newly-established and later formidable regulatory body, the Ministry of International Trade and Industry (MITI).

In subsequent years continuing down to mid-1965, nearly four thousand Japanese personnel were trained in this foundation management course or in the advanced management courses (see Table 2). This training is still going on. About 25 percent of those trained are still employed by the Base in managerial positions, while most of the remainder have gone into expanding Japanese industry as opportunities opened. Records of where they have gone in the Japanese economy either

Table 2

MANAGEMENT TRAINING FOR LOCAL NATIONALS
Kanto Base Command

Year	Basic Management Course Graduates
1949	239
1950	212
1951	383
1952	958
1953	366
1954	99
1955	258
1956	169
1957	186
1958	148
1959	85
1960	156
1961	223
1962	78
1963	189
1964	120
First 6 months of '65	57
TOTAL.	3925

Source: Tachikawa Air Force Base

were not kept, or have long since disappeared, but Appendixes V & VI offer a sample of such persons culled from the memories of old-timers, both U.S. and Japanese at the base. The fifty people in these samples have now assumed many important managerial positions. Naturally, activities connected with aircraft (aircraft manufacture, airlines, Japanese Air Force, electronics, etc.) tend to predominate. These lists evidence the comments by U.S. personnel that military training influence in the civilian economy has been very widespread. As one American put it, "there is hardly any corner of the aircraft industry which does not have our graduates in management positions."

Building on the foundation of the management course for supervisors and instructors, much wider training activities were held at Tachikawa Air Base. Some idea of the extent of training activities can be seen from Appendix IV, which is itself an abstract of the Tachikawa Training Activities, and covers only the years 1951 through 1956. In the year 1954, for example, 6,770 people received 141,000 training hours in a wide variety of subjects. For the period as a whole more than 50,000 people received more than 1.3 million hours of training. Naturally many skills were relatively simple, such as guard duties, driving, typing or English language training. But even in such simple skills, the people later entered the economy in jobs which often contributed to Japan's modernization, especially in the vital foreign exchange area, in such work as foreign trade, tourism, hotels, entertainment, etc.

However, from the technical standpoint, there were very important training activities in modern aircraft, jet engines and electronics which had profound effects on later industry in Japan.

How was the training undertaken? High level Japanese engineering graduates were selected and established as a "faculty" under a competent and creative American director of training. They trained under the supervision of Americans and received much assistance from the American Technical Representatives, but according to the U.S. Director of Training, who developed the program, in large measure they trained themselves by translating the American technical manuals into Japanese and setting up the training courses for the Japanese supervisors and technicians. These men were chiefly graduates of good engineering schools, and many had specialized in aircraft engineering. They usually started in relatively humble positions at the Base, but their intelligence and outstanding performance won quick recognition. The eleven asterisked names in Appendix V indicate the inner core of this training group. Under the leadership of their outstanding American director of training,[1] they developed a sense of responsibility, clear recognition of the importance of their work, and a strong group loyalty. They constituted a nucleus which radiated much influence in the formative stages of the Japanese aircraft industry and in other industries because of the proximity of the Base to the Tokyo area where most

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[1] See further comments on this man, Chapter V.

big companies have head offices.

A composite profile of these men show that they averaged about 30 years of age when they began to work as instructors in the early 1950's. Today, 10-15 years later, they all hold positions of management responsibility in Japanese industry. Generally, they averaged about 5 to 6 years work with the Tachikawa base, and each generation of instructors provided carefully for their own replacement. There were about 10 to 12 men in the initial cadre, and each took the management course and a technical course which qualified them in various specialities. Most of them were engineering graduates and some of them had some experience in pre-war or war production companies. Some of them returned to the companies they had started with, in the familiar Japanese pattern, but others joined new companies when they left the base.

Impact of the Economy

The impact of this nucleus instructor group was felt in a number of ways. First, the statistics of persons trained at Tachikawa show the significant role which a training program on a big American military base in a foreign country can play by utilizing local national instructors. Thousands of people learned skills of life-long value. Complicated skills connected with the aircraft and related industries made possible the repair of U.S. aircraft on the Base without heavy American manning. Secondly, when, at a later date, outside procurement contracts were given to Japanese companies for the repair and overhaul of aircraft, the established training program filled the need to train contract managers. Still later, when manufacturing contracts for aircraft were developed under the programs of MAP assistance to the Self-Defense Forces, the Tachikawa training program was a fundamental U.S. resource, providing the necessary skills to the contractors. Lastly, when the "rifs" (reduction in force) came with gradual closing down of installations, the training faculty, though itself attenuated, provided the program of retraining for skills in short supply to re-equip terminated workers.

All of the above are direct transfers of technology to the individual who worked for the U.S. Armed Forces. In turn, when he left the U.S. employ, his training influenced others with whom he came in contact in his civilian employment, which multiplied the impact. This multiplier effect was especially important when the individual was at a high level both with the Americans and outside. Former employees tended to set up institutionalized systems based on their American training wherever they went in their later employment.

What did they convey that was new? In some sense no single item was entirely new to the Japanese. Even in the most recondite technology, some Japanese, somewhere, had read about it or had some familiarity with some element of it. Thus in the aircraft engine field, the Japanese had built an experimental jet engine in August 1945, probably with German help. One plane had flown with it only to fall in the Bay. Again, in the field of electronics, a Japanese scientist, Dr. Yagi, is credited by the Japanese with inventing a remarkable radar antenna, if not the idea of radar itself, but according to the Director of Research of the former Imperial Japanese Navy, no radar was ever effectively working on naval vessels. Thus the Japanese could claim to be familiar with technological advances to a degree far beyond the other Pacific peoples, but the technological gap seemed to have loomed wide in effective performing systems. This application ability was strong in U.S. practice, and the U.S. Military Forces had this strength.

It is in conveying whole systems of know-how and practical procedures that the U.S. military establishment transmitted a higher technology to the Japanese through the Tachikawa and other military training programs. The Japanese high-level training cadres learned the latest American aircraft technology at Tachikawa, and learned it as a going system. The jet engine, for example, was a tried and working system which the Japanese training instructor mastered as a whole after long hours and hard work. He had rudimentary ideas from his schooling and experience during or before the war, but by translating technical manuals and specifications, and cornering technical representatives for the things he did not know, he mastered the intricacy of an advanced American technological system.

But perhaps even more important was the fact that simultaneously he was exposed to the elaborate, but highly rationalistic, American industrial system with emphasis on procedures, organization, work simplification, and mass output under efficient, cost-conscious conditions. The Japanese became familiar with the vast system of in-depth logistical maintenance and the supply system which are characteristic of the American method of scientific management.[1] They became familiar with rigorous U.S. standards and specifications, and learned the importance of inspection and quality control. Possibly many of these things had some sort of counterpart in previous Japanese industrial practice, but they were typically neglected or not emphasized. Japanese pre-war systems were simply not built in depth, but were dominated by a make-do, live-on-the-countryside philosophy. That this sort of ramshackle system can work to some degree is attested by such success as the Japanese enjoyed before and during the war. Similarly, homemade systems exist today in all the other countries, and enjoy some degree of success. But Japanese informants frequently emphasize their indebtedness to these organizational innovations, which they regard as being characteristically the contribution of the American military establishment in their country.

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[1] That the Japanese absorbed the scientific management system, a new concept to them, to the point of satiety is attested to by Dr. Hideo W. Toyoda, President, International Consultant Institute who declared: "Modern scientific management is an entirely new innovation to Japanese industry and business being introduced only since the end of World War II . . . As a result of formal management schooling and education a large group of "Management Consultants" has sprung up during the past 20 years; however, the effectiveness of these 5,000 or 6,000 management analysts has proven questionable, to say the least." 3rd Annual Joint Japanese-American Management Symposium, Papers, Tokyo, 1965, mimeographed.

CHAPTER 3 LINKAGES THROUGH PROCUREMENTS

In addition to, but related to, employment and training was the procurement channel of technological transfer. Procurements during the American presence in Japan were (1) in support of the American forces in the country, (2) in support of the Korean War, and recently, the Viet Nam War, (3) in support of the military assistance program in Japan, (4) off-shore procurements in Japan for grant or sale to third countries, usually but not always under military assistance programs. Procurements in other countries of the Pacific follow the same sort of breakdown, but in the past, overshadowed by Japan, the volume and variety has been very much less than in Japan.

In all cases, there is a broad distinction between planned and unplanned transfer. Technological transfer was unplanned in the first two types in the sense that it was a by-product of the objective of supporting the resident American forces or the War effort. The transfer in the third and fourth types may be thought of as planned transfer in that it is a conscious attempt to build up the capability of an American ally. Under both types of procurements, there are technical linkages which have long-range economic effects on the structural capability of the economy. Feedback from the strengthened civilian sector, in turn, builds further military capability. Their impact may be examined (1) by magnitude (2) by type and (3) by their effect in eliciting technical linkages.

PROCUREMENTS IN AGGREGATE

Detailed U.S. procurement statistics for Japan are not easily obtained for any lengthy period. In the past they have been generated by separate organizations in each service and it is only recently that even totals have been assembled. The Department of Defense provides the following data:

Table 3

Military Procurements in Japan
Contracts of $10,000 or more
(in thousands of U.S. dollars)
Fiscal years ending June 30

	Total	Army	Navy	Air Force	Defense Supply Agency
1956	256,871	219,531	11,710	25,630	---
1957	316,789	244,689	40,457	31,643	---
1958	200,453	153,679	24,351	22,423	---
1959	198,894	159,009	19,410	20,475	---
1960	171,534	117,498	26,408	27,628	---
1961	165,651	124,500	18,700	22,442	---
1962	222,441	172,700	25,643	23,553	545
1963	151,644	113,759	10,454	21,867	5,564
1964	144,971	117,922	7,125	13,177	6,747
1965	151,982	123,888	10,059	11,991	6,044
1966	206,459	171,147	11,466	16,228	7,618

Source: U.S. Department of Defense

These data do not cover earlier years, and they suffer from the exclusion of those contracts of less than $10,000, where a great deal of subsistence procurement took place in Japan. The data include some U.S. companies whose contract performance took place in Japan, but this amount would be more than offset by the omission of small Japanese contracts. That the series in Table 3 understates the totals by more than an average of 10 percent can be seen from the series for Army procurement alone in Table 4 which gives all contracts. Though the Army has "tri-service procurement responsibility for bulk purchases", and hence makes up over 80 percent of procurements by value, aircraft and ship procurements, whether for repairs, overhaul or new items, are important by individual technology.

Table 4

U.S. Army Procurements in Japan
(millions of U.S. dollars)

Year	Supplies	Per Cent	Services	Per Cent	Total	Index
1962	68.5	36.4	119.8	63.6	188.3	100
1963	27.4	18.7	119.3	81.3	146.7	77
1964	16.2	12.4	114.7	87.6	131.0	69
1965 (est.)	15.9	11.9	118.1	88.1	134.0	71.2
Average	-	-	-	-	150.0	-

Source: U.S. Army Headquarters, Zama, Japan.

It should be noted, however, that the Army total includes a large payment for "labor" for persons working on the U.S. bases, which has averaged over 80 million dollars in recent years. A detailed breakdown of U.S. military procurements in Japan for all military services and the Defense Supply Agency for fiscal 1965, is given in Appendix VII. These figures have been adjusted for procurements from American companies in Japan which the IBM system data included in the original data, and hence the totals are smaller than the totals in Table 3 by about $5 million. The breakdown shows that procurement activity in Japan at the present time is still very substantial at an average total of $150/$200 million in recent years, and covers a wide range of activities. These procurements range from simple foodstuffs to the repair and maintenance of complicated aircraft, electronic devices, and ships. In all fields, the high-standard American specifications are imposed on Japanese manufacturers and quality demanded at the level of U.S. procurements.

Comparative figures for other Western Pacific and Southeast Asian countries are given in Appendix VIII. The heavy preponderance of Japan with 74 percent of the total is to be expected, but the marked rise in the proportion of Southeast Asia and Okinawa may be of significance, indicating developing capabilities in the South Pacific.

In any case, the total figures have been falling in aggregate for recent years, primarily because of the gold flow restrictions designed to protect the U.S. balance of payments. The significant earlier figures of the Korean War period and after, when procurements were larger (both absolutely and relatively), are available in Japanese sources.

Korean Period. The following are some well-publicized data which combine procurements with troop expenditures for entertainment and recreation in Japan:

Table 5

Aid, Procurements and Troop Expenditures in Japan (unit: $1 million)

Year	Aid	Spec. Proc. & Troop Expenditures	Total
1947	192.8	---	192.8
1948	404.4	---	404.4
1949	461.0	---	461.0
1950	534.7	---	534.7
1951	361.3	149.0	510.3
1952	156.7	592.0	748.7
1953	0.5	824.0	824.5
1954	---	809.0	809.0
1955	---	596.0	596.0
1956	---	557.0	557.0
1957	---	595.0	595.0
1958	---	549.0	549.0

Source: For Aid and Procurements, Japan, Ministry of Finance quoted in G.C. Allen, Japan's Economic Recovery (New York: Oxford University Press, 1958) p. 203, and Jerome B. Cohen, Japan's Postwar Economy (Bloomington: Indiana University Press, 1958) Appendix.

Not so well publicized, in fact, buried in Japanese and American unpublished files, are the actual data on U.S. procurements during the Korean War period. A detailed table is provided in Appendix IX because the data are otherwise inaccessible, and because the great variety of technical impacts must be seen to be appreciated. Table 6 below gives the summary data:

Table 6

Special Procurements during Korean War period (thousands of U.S. dollars)

Year	Amount
1950	328,922
1951	331,520
1952	476,426
1953	158,614
Total................	1,295,482

Source: Ministry of International Trade and Industry.

Appendix IX gives a more detailed breakdown by commodity classes on a Japanese fiscal year basis.[1] From these sources, it may be seen that the Korean period (June 1950 to 1953) totalled $1.3 billion and the troop expenditures and/or aid about doubled this figure. These substantial financial injec-

[1] Japanese fiscal year ends in March 31, of the following year. Data on a calendar year basis have been provided by another Japanese source:

	($1000's)
1950	$191,356
1951	353,640
1952	306,623
1953	158,614
Total	$1,010,233

Source: Economic Deliberation Council, Research Bureau, Statistics Section, Statistics of Special Procurements Since the Outbreak of Korea to the Present Time, 1954 (in Japanese), p. 11.

tions multiplying themselves in the starved post-war Japan are acknowledged to have been a major factor in restoring a viable economic position through the increment of aggregate demand.[1]

Less attention has been paid to the effect on the supply side of the economic balance. Not only was access to raw materials gained by the Japanese, but also the opportunity to obtain technology by producing American products to American specifications. In addition, the severe test of American quality control inspections built capability and capacity into the previously shattered economy. In fact, it may be argued that the declining magnitude and proportion of procurements to national income on the demand side made the short-run stimulation effect much less important than these impressive technical results, which developed the capacity for the increased volume of quality exports that followed. What occurred in Japan has happened elsewhere in the Pacific, but not to the same degree, though the Viet Nam War may do for some other countries what the Korean War did for Japan (see Chapter V).

In any event, the Japanese case demonstrates a broad impact on a wide variety of industries. Detailed figures are given in Appendixes IX & XIII but it may be noted here that there is a broad distinction between procurements of goods amounting to

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[1] Leon Hollerman, "Some Doubts about the Overfulfillment of Japan's New Long-range Economic Plan", Kyklos XIV, 1961, Fasc. 1, p. 76.

$829 million, and services amounting to $467 million, over the four year Korean period, roughly a 2:1 ratio (1.78:1).

TYPES OF PROCUREMENTS AND THEIR EFFECT

In the early days of the Occupation, procurements were made for housing and numerous living items connected with troop support. These were indirect procurements, using the Japanese government as an intermediary, in contrast to the later direct procurements from Japanese manufacturers. These indirect procurements were made by requisition -- procurement demands on the Japanese Government, which, in turn, made contracts with suppliers to provide the necessary goods or services to the Occupation Forces. These early procurements were very decentralized, often being made by local commanders at quite low levels of authority. In practice, the Americans told the Japanese contractors what they wanted, often merely giving them a sample, or even a Sears Roebuck picture, rather than an engineering drawing. At first, there was some reluctance to turn over U.S. specifications and drawings to the Japanese. However, as time went on and procurements became more complicated, and centralized direct procurement was adopted, U.S. specifications, designs and drawings were made available freely. This was especially true after the policy of direct procurement for dollars was inaugurated. Yet the earlier period was quite significant, in that the Japanese with their low level of technique received their first exposure to U.S. standards.[1]

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[1] See account of the plywood industry where technique was estimated 20 years behind the U.S., in Daniel L. Spencer, "An External Military Presence, Technological Transfer, and Structural Change", Kyklos, XVIII (1965), pp. 458-59.

Companies on U.S. Bases. An intermediate form of procurement between the indirect and direct forms of contracting were service contracts, in which the labor was procured by a Japanese contractor and supplied to a base usually for some special purpose. While it appears in other sectors, there was an extensive use of this type of contracting in the "Roll-up" program of automotive rebuilds. As noted previously, the "Roll-up" refers to the program for recovery and rehabilitation of World War II equipment which had been abandoned throughout the Pacific by the hasty demobilization of the U.S. forces. This rebuild principle applied to other types of equipment, but since the automotive was by far the largest, and in many ways very typical of American technique and practice, it may be taken as representative of what happened.

The first of these automotive Roll-ups in which service contractors were used was BIG-5, or Base Industrial Group 5, so called to distinguish its operation from the regular Army ordnance depot which was part of the operating forces. The BIG-5 organization, which was manned largely by U.S. civilians, contracted with a number of Japanese companies, such as Japan Steel, Victor Auto, Fuji Motors, New Japan Aircraft, etc. to supply labor, both skilled and unskilled, on the production lines within the depots of the complex. The Japanese worked under their own company managers, but the whole operation was carried on under the supervision of U.S. engineers. As early as 1949, completely remanufactured vehicles were being turned out in quantity production.

With the Korean War, this roll-up operation assumed enormous proportions. By 1951, the Japan Logistical Command, as the complex was now called, was providing this kind of company-managed employment for more than 30,000 Japanese spread out in about 14 units of this industrial complex[1] (see Appendix X, table of organization chart). In the shop at Oppama, the most important of the plants, the production line turned out as many as 4,000 vehicles a month at the time of the Korean War, and over a ten-year period, 187,000 were remanufactured.[2] This figure of 4,000 vehicles is two or three times the high level of Japan's pre-War automotive output. It [redacted].

This rebuild operation and subsequent rebuilds at Fuchu and Tokorozawa bases used Japanese companies as contractors on each base. These companies procured the labor, provided Japanese managements, handled payrolls, and dealt with other administrative matters, but the work was performed under the direct surveillance of American engineers and inspectors. Some American observers have considered these intermediary companies unnecessary, but others have stressed their important role in

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[1] U.S. Army. Japan Logistical Command. Automotive Rebuilds, 1951.

[2] "Army Ordnance Marks 10 Years at Oppama", The Ordnance Press, August 20, 1958, p. 1-2; a newspaper published at Oppama printed by Muramatsu Printing Company, Kanazawa.

recruitment, training and interpretation through company channels which expedited the operation.

The companies which were under contract varied very much among themselves. Japan Steel (Nippon Seiko), which did engine rebuilds for the U.S., was a war-time munitions maker. It was an old established company, which prided itself on its high level of technique. When asked about what they learned from their ten-year contract, they acknowledged many things in the area of production engineering and efficiency, but felt that they learned very little in technique (narrowly construed) because their company had worked with far more "precise" engineering production in munitions making. Japan Steel even held they had no chance for creative development during their American contract. Since their work with the U.S., they have reverted to some munitions manufacturing and have diversified their activities in many lines of precision engineering, outside the automotive field.[1] In contrast, Victor Auto was, in the words of one American observer, a "suitcase company", born out of the genius of a Japanese entrepreneur with "personality and an Oxford accent, who could sell anything".[2] With little backing as a company in Japanese industrial circles after its American contract, it disappeared from the scene. Fuji Motors, on the

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[1] See Japan Steel Company, Tokyo, Catalogs.

[2] Interview with an American engineer, Tokyo, July 1965.

other hand, which had a contract for the complete rebuild of vehicles at Oppama from June 1949 through 1958 at least, is today one of the more important companies in the automobile industry. Hino Company, which fared rather badly with American procurement in a sudden contract cancellation, is today a major truck manufacturer. On a visit to the plant, the old production line laid out by the American engineer in charge of production under the contract was still visible in plant layout.

Thus there were direct carryovers, in some cases, by the company continuing in business in the same line. In other cases, different industries were involved because the company went into new lines, but still carried production techniques which it had learned from the U.S. In still other cases, companies disbanded and workers went elsewhere. Thus it was said that, when the last rebuild closed down, one large automotive company had a moveable personnel office in a van outside the gate.

Whatever the fate of the companies, the engineers and work force were diffused throughout the automotive and other industries, providing a core of personnel experienced in this kind of large-scale production operation. [redacted] claim that these on-base, American military-supervised production [redacted] the Japanese [redacted] This demonstration was clearly one of the factors laying foundations for future development of [redacted] and other large scale industrial operations. Some part of the spectacular success[1] of Japan's modern mass production industry is thus attributable to the on-the-base mass procurements of automotive rebuilds in the military Roll-up operation.

Types of procurements during the Korean War. The automotive roll-up operation continued throughout the Korean War period and was phased out in the late 1950's, with some cannibalizing of parts and supply function continuing down to the present time. At the time of the Korean War, procurement of a great variety of goods and services was added to the already existing SCAP procurements, in support of the Occupation and the special programs such as the rebuilds in the automotive and other industries. These earlier SCAP procurements were important in conveying technology to the Japanese, because of the American insistence on high standards in their living arrangements. This period (1945-1949) is overshadowed by the period following the outbreak in Korea, but many innovations were conveyed to the Japanese which either were adopted with a lag, when the policy of industrial rehabilitation was instituted, or were adopted at once.

Space does not permit details of this formative period, but mention should be made of the past SCAP policy of lending U.S.

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[1] The Japanese automobile industry in 1966, producing over 1 million vehicles per year, is planning export drives in European and U.S. markets according to newspaper accounts. Exports exceeded 100,000 vehicles in 1966. Mainichi Daily News (Japan), Jan. 29, 1966.

technicians to the Japanese during this period. Under this "Visiting Experts Program", American experts on such diverse matters as ammonia, sulfuric acid, solvay soda, oil, zinc, coal mining, coking, highway construction, industrial statistics, public finance, taxation, and, above all, steel-making, were brought to Japan for stays of three to six months. By far the greatest emphasis was placed on steel-making -- there are records of the visit of nine steel experts in the files of the Economic and Scientific Section of SCAP. While these experts were limited by the unavailability of investment funds in Japan, they could often achieve spectacular results with the help of slight changes in existing capital. Thus, Fred N. Hays and James T. MacLeod of the Carnegie-Illinois Steel Corporation achieved an average 20 percent reduction in fuel consumption in the open hearths of the plants they visited from January to July, 1949.[1]

These technical assistance activities in heavy industry and technical areas are matched by numerous procurements of many ordinary commodities which were upgraded by the American demands. Data are difficult to find on this period but the case of plywood, which has been described elsewhere, may be con-

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[1] See Fred N. Hays and James T. MacLeod, Report on Japanese Iron and Steel Industry (Tokyo: SCAP, Economic and Scientific Section, 1949), pp. 7-10. For further details on the visits of various American experts, see the Consolidated Weekly Operations Report of ESS/IND for October, 1948, through December, 1950. This material is to be found at the World War II Records Division, Archives.

sidered typical.[1] Further research is needed on the impact in this early period.

What were the important categories of direct procurements during the Korean War period which established significant technical linkages with the later civilian economy? It is probably fair to say that almost any Japanese industry which was affected by U.S. procurements experienced technical upgrading through new products, new methods or techniques of manufacture, and higher standards. Naturally, there were great differences in the character of the contracts and the consequent technical impact. Thus, the summary of procurements during the Korean War period (Appendix IX) shows that goods were 64 percent, while services were 36 percent, of the total expenditures. Generally one would expect to find the technical impact less in service industries. Transportation and warehousing, which together constitute 25 percent of all the service contracts, obviously would contain a large share of unskilled laborers, and it is doubtful that techniques of straight stevedoring vary much anywhere in the world. Yet even here, care must be exercised, for Japanese engineers and foremen were exposed to such American innovations as the fork lift, pallet techniques, bulk handling, piggy-backing, the elaborate system of packaging, care and preservation techniques, and the methods of stock

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[1] Daniel L. Spencer, "An External Military Presence, Technological Transfer, and Structural Change", Kyklos, op. cit.

control and inventory management, which are characteristically American. It is true that the fork lift, for example, did not come into general use in Japan until the 1960's, but this lag was a result of the unavailability of domestic supply, rather than an unwillingness to accept innovations.

"Repairs" constitute a third of all such service procurements, and although working on a truck, airplane engine, or ship could vary from the simple to complex, the Japanese were exposed to progressively more complicated technical activity with U.S. equipment. The Japanese companies' ability to take over more complicated manufacturing contracts such as the F-86 and F-104 airplanes is based on experience in repair and rebuilds during this period. Construction contractors (20 percent of all service procurements) also learned how to put up an American building or build a modern American road. In communications (16 percent of all services), the opportunity to work on the world-famous American telephone system, advanced radio, or electronic equipment was a boom to a people with a primitive communication system.

In any case, by value, the impact on goods production is twice as great as that classified as services by the Japanese. Metal products are the largest category, and not unexpectedly, this category is chiefly munitions. Textiles constitute another large category with 16 percent; while transportation equipment is 11 percent of the total. Mineral fuels are 10 percent, and raw materials add another 4 percent. Some of these industrial categories may be considered profitably in further detail.

Munitions. It has been estimated that the munitions industry received about $300 million worth of business from U.S. sources from the early days of Korean War procurement to the present time. For the Korean War period and somewhat later (1952 to 1957), the Japan Ordnance Association has published figures accounting for production valued at a total of 52 billion yen or $150 million. A breakdown of this figure can be found in Appendix XI which shows artillery, rocket launchers, cartridges, shells, explosives, bayonets and other types. In addition, over 10,000 military trucks were procured from Japanese contractors during the Korean War (Appendix XII).[1] Still more broadly construed, military procurements include contracts for repairs of ships, aircraft, and motor vehicles. Thus another source provides a total of all "arms and ammunition" procurements during the same period as given in Table 7 below.

Concerning munitions proper, or narrowly defined, although the Japanese certainly knew how to make guns and ammunition, their techniques were to some extent primitive or dated.[2]

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[1] Sources in Appendix. These new trucks should not be confused with rebuild program trucks, covered in the previous chapter.

[2] This may well be a vast understatement. U.S. engineers who were present in the early Occupation testify unanimously to the primitive techniques carried on by "squatting workers in pothole factories." Even in 1950, one old-timer, then a member of the Ordnance Section at GHQ, reports that napalm bombs were being hammered out by hand under an Air Force contract.

Table 7
Summarizing Procurement Orders For Arms And Ammunition
(By Military Service, by Supply and Service)
July 1950-December, 1957
(in U.S. dollars)

Military Service	Supply	Service	Total
Total	238,671,173	184,889,227	423,560,400
Army	185,123,110	148,865,130	333,988,240
Air Force	33,490,862	28,633,260	62,124,122
Navy	20,057,201	7,390,837	27,448,038

Source: Bank of Japan. Foreign Exchange Control Department. Procurement Orders for Arms and Ammunition, Addition #10, July 1957-Dec., 1957.

They now had the advantage of acquiring the latest American models, developed since World War II. They were able to conserve their capacity which had been previously dispersed, and to learn weaponry, which American military intelligence rated as having superior fire-power and other advantages over Japanese equivalents.[1] Along with the designs, specifications, and drawings, went American manufacturing methods, techniques of crating, storing, care and preservation, and other American logistic practices, geared to the in-depth system of mass-produced military support.

In a survey of Japan's defense industry prepared by the Japanese Ordnance Association, this American advanced weapon transfusion was acknowledged as a wonderful opportunity for

[1] Interview with a former U.S. weapons analyst.

the Japanese to learn techniques.[1] According to this source, the companies gathered together the technicians who had been dispersed, and reconstructed their hitherto forbidden industries in metal processing and explosive manufacture.

Writing in retrospect, the Japanese deprecated their excessive reliance on American technique during the Korean War period, but they praised the U.S. for sending many skilled technicians through military channels, who taught the Japanese. They acknowledged the "lesson of procurement", recognizing that the Americans were particularly good at management, inspection, contractual procedures, contract systems, standards, specifications, quality control, and other matters relating to procurement. They were impressed by the effort expended by American Forces in preparing for the reopening of defense industries before contracting, by their "earnest coaching" of Japanese in raising Japan's techniques, and American patience in solving problems which arose. They thought of the U.S. management as "very rational," and related that when, because of "different circumstances and characteristics of people," viewpoints or technical methods were offered that they could not accept, the Americans listened very carefully to the Japanese side. The Americans conferred among themselves or reported back to their country at great length in order to iron out the diffi-

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[1] Japanese Ordnance Association. <u>Nippon no Boei Sangyo (Japan's Defense Industry)</u>. (Tokyo: The Association, 1961), p. 5-7 in Japanese.

culties, "because they respect rationality." However, the Japanese expressed some degree of irritation that the Americans had contracted directly with Japanese companies, by-passing the Japanese government structure in doing so.

Another source complained that while the production of firearms was a paying proposition, very little could be gained which had application to other types of production.[1] It noted that in the pre-war period, the development of tank guns produced techniques applicable to other fields of production, but today, even the production of recoilless guns offers few techniques applicable to other industries. Indeed, technology already in Japan could be used for manufacturing such guns. Thus Japan Steel Works, once a world leader in gun manufacture, "seems to have little to learn from the recoilless gun born in the U.S.".[2] Some spill-over to civilian industries, however, was acknowledged. Japan Special Metals is supposed to be using techniques for jigs, which it learned in military rifle production, for the development of hunting rifles. It was not until jet, missile, and space technology began to be transferred under military assistance programs that the Japanese were able to learn fresh and different techniques from the arms

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[1] "Defense Industry in Japan", Jitsugyo no Nippon (Japan Heavy Industry), August 15, 1965, in Japanese .

[2] Ibid. The Author confirmed this view in interviews with company engineers.

industry. This story will be taken up in the next chapter, but the Japanese have acknowledged that the new 120-mile per hour train uses bearing technology derived from the military aircraft contracts.

Other Industries. While it is not possible to give an account of all the procurements which took place during the Korean period, Appendix XIII contains a U.S. sample of procurements for July 1, 1951 to February 17, 1952, a period in which the cumulative total for goods was $193,280,000 and for services, $72,969,000, a total of over $266 million, a more than 20 percent sample of the $1.3 billion four-year total perviously cited.[1]

Looking at the totals in each category we find nearly 2 million dollars in foodstuffs, beverages and cigarettes. At first glance such a simple area might suggest little technical transfer, but if the high-standard food practices of the American system are set against the crude and unsanitary Japanese practices of that day, it will be realized how many modern innovations and improvements were acquired by the Japanese at that time. Thus Americans insisted that vegetables be grown under specified conditions such as the absence of night soil, and shipped under refrigerated, carefully-packaged conditions. As procurement of imported materials was also

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[1] The $193 million total is based on U.S. data collected by SCAP, while the $1.3 billion total is from Japanese sources.

included, such externally produced and packaged foods as wheat or flour were also handled by Japanese firms, and American techniques noted by Japanese business.

The sample shows 12 million dollars of crude materials such as rubber, lumber, gravel, and crushed stone, $13 million of fuels such as coal. Specifications in each case were made available to the Japanese, and these usually required production to conform to higher standards of quality performance than had previously prevailed in the Japanese economy. U.S. technical assistance was often provided. In the case of coal, for example, even before the Korean War, there was a big SCAP program to streamline the coal mines with automatic coal digging machinery. Packaging was very poor. Cement, for example, was fairly good in quality, but so poorly packaged it could not stand in warehouses without hardening. As one American observer put it, "we opened the Japanese eyes to quality, always insisting on our standards."[1] High rejection rates of procured items

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[1] One packaging expert on the Staff of the U.S. Army Procurement Agency gave the author copies of lectures he had made before Japanese engineering and business groups at this time. Quoted herewith is an abstract from a lecture in 1951 which conveys the U.S. technician's role and effect:

> Improvements in packaging of Military items have been pronounced. As I mentioned at the packaging conference held in Yokohoma on 5 February, a year ago, post shipment rejections of contracts because of packaging deficiencies were approximately 60% of all rejections. Now post shipment rejections due to packaging are less than 5% of the rejections. Indications are that they will continue to drop. This is gratifying because it shows that the cooperation between JPA and the manufacturers is paying off. It shows the value of these meetings and seminars and this value can be measured in dollars and yen. -- U.S. Army. Japan Procurement Agency, Yokohoma.

backed up U.S. insistence. Rejection rates were as high as 80% in some cases.[1]

As for the chemical industry, here, too, the Japanese were content with pre-War substandard specifications. The sample in Appendix XIII shows 17 million dollars of procurements from the chemical industry listed. This category included sulphuric acid, phosphoric acid, ethyl alcohol, freon gas, calcium chloride, acetylene gas, paints, fertilizers, and drugs and pharmaceuticals. In the latter category, the procurements were an opportunity to secure many patent rights under license. A study of the pharmaceutical industry's technological licensing to Japanese industry shows that one-third of the licensing of miracle drugs occurred in the Korean War period (1950-1954).[2]

Textile yarns, fabrics and made-up articles constitute 40 millions or about 20 percent of the sample and are about the same proportion for the Japanese totals if clothing is added. Like the munitions category, textiles are an old industry in Japan, hence, barring special technical situations, it was largely through the insistence on higher specifications and the stress on quality control that the Japanese could profit through this procurement.

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[1] Interviews with Procurement men in Japan.

[2] Japan's Pharmaceutical Industry (Tokyo: Trade Bulletin Corporation, 1965), p. 1 and tables 1-3. English translation of a Government Report.

Metal products, both primary and manufactured, include a wide range which made them one of the largest categories by value. These ranged from very simple items like shovels and canteens to structural steel shapes. Munitions and armaments are not included. Again, it should be borne in mind that, though the Japanese had produced counterparts in most cases, the American equipment was usually sturdier, better designed and built to higher standard specifications. It is well known among Japanese and American procurement men that these American specifications formed the basis of the JIS or Japanese Industrial Standards which were developed after the War, and are today the Japanese equivalent of Federal Specifications and those of the ASTM (American Society for Testing Materials). In most cases, the Japanese specifications simply copy the American specifications with very little change.[1]

In more complicated items, such as steam-generating boilers, internal combustion engines and parts, electric generators, transformers, and transport equipment, valued in the sample in tens of millions, the level of foreign technology and industrial standards may well not have been as novel, because many of the large companies had long-standing, international, commercial relationships which gave them access to Western standards.

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[1] Thus in one sample Japanese Standard given the author, JIS Z 2911, Methods of Testing Fungal Resistance, rev. March 1, 1960, one finds the expression ATCC or the citation of USDA studies throughout (meaning American Type Cultural Center of Washington, D.C.).

In fact, in some areas such as railroad engineering, U.S. military orders may have been a complicating or even retarding factor.

Yet, for most industries, there was the long gap between pre-war and post-war contacts, and much research and development had taken place in the U.S. as compared with little or none in Japan. The evidence of this is the profusion of technical commercial contracts which took place during or soon after the Korean War from such firms as Westinghouse, General Electric, Babcock and Wilcox, etc. to Japanese industry.[1] As the balance of payments position has improved, these technical transfusions have continued to grow in volume and value each year to the present, and a recent Japanese White paper points out that those industries which have done the borrowing have been those industries with the highest growth rates. For total manufacturing industry, the share of goods manufactured by imported technology is shown as over fifty percent.[2]

<u>Post Korean War Period</u>. Procurements for the military fell

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[1] Daniel L. Spencer. "The New Technology in Japan." Unpublished study, Department of Economics, Howard University, no date (typewritten) Appendix. From 1950 to 1962, 1,998 technological contracts valued at $508 million brought foreign technology to Japan. Continuing to date, hundreds of new contracts annually are added to this total.

[2] Economic Planning Agency. <u>Economic Survey of Japan, 1963-1964</u> (Tokyo: Japan Times, 1964) p. 73-4. The foreign technology, in turn, improved the balance of payments position. This source shows that those industries which increased production through foreign-induced technology, also had a larger share of exports.

off after the Korean War, but not by as much as might be expected. The reason for this was the continued presence of the U.S. forces in Japan and Korea, as well as the program for procurements for third countries in the Pacific. However, in recent years, and until the American buildup in Viet Nam, the gold flow restrictions imposed on the military as a result of the balance of payments deficits have forced it to reduce offshore procurements. By 1965, totals had fallen off in Japan to about $150 million currently. The breakdown of U.S. procurements that year (Appendix VII) shows Army with $122, Navy with $7, Air Force with $11 and DSA with $6 millions. Eighty-five million dollars was spent on labor on the bases or in related activities, and utilities and post operations made up another 18 million more. The remainder is scattered among various types of procurements of which parts for OSP-J (Offshore Procurement Japan) vehicles are still around $4 million, representing the last phase of the automotive re-equipment program in the friendly countries of the Pacific under Military Assistance.

The beginning of a probable new wave of procurements appears in the rise of total procurements recently caused by the War in Viet Nam. The development of procurement capabilities in Southeast Asia, too, is discernible in the procurement pattern in the Western Pacific presented in Appendix VIII. In 1964, Japan was still averaging 70 percent of the total, but Korea and South East Asia have gained relatively over recent years. This trend will no doubt continue, for the Japanese have indicated considerable reluctance to accept procurements for support of the Southeast Asian War. Thus, when an attempt was made by the U.S. to exchange Nike-Hercules missiles for Japan-procured jeeps, trucks, and other equipment, the Japanese press reported reluctance to contract on grounds that it was not worth it, or that Japanese wanted to produce Nike and Hawk missiles themselves, or that it would have little impact in curing the current recession, or have no benefit to Japan's heavy and chemical industries.[1] While some Americans have held such expressed reluctance to be a screen to appease Socialist opinion in Japan, more realistic opinion is taking such comments seriously and considers a faster build-up of alternative sources in the other countries of the Pacific a logical carrying out of discernible trends.

Procurement Standards and Quality Control. Military procurement even in the home economy is likely to impose higher standards through specifications and rigorous inspection than manufacturers might normally produce for civilian consumption. This fact is particularly true of those items which involve a safety consideration or whose failure would result in further damage to a unit.[2] But even for less sensitive items, the U.S.

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[1] "American Offers of Missiles", The Weekly Asahi, August 2, 1965, translation from Japanese.

[2] Thus the automotive ordnance people distinguish between parts which will deadline a vehicle and those which will not. The former are those which involve the safety of the vehicle or parts which if neglected will result in greater damage. Examples of the deadline type might be the tires, the steering apparatus, or a knocking piston which might result in further engine damage if not corrected.

Government procurement standards and inspection system have been evolved to insure that the military products are highly durable. When specifications are imposed on firms overseas, they have a vital upgrading effect, particularly on smaller businesses. For one thing, they often force even smaller firms to buy machinery necessary to comply with the system. For another, the production technique must be improved to meet the specifications standard, or else the high rejection rate of the U. S. inspection system must be faced. The firm either learns by itself or persuades the U.S. to help. This often results in loan or purchase of U.S. machinery, or the assistance of a friendly military inspector, anxious to "get the firm through the inspection". However it is done, the end result is to force the firm to learn a more sophisticated way of producing to standard and to upgrade its production function to the point where it is capable of producing a more competitive product.[1] In turn, this spills over into the civilian economy, improving the domestic standard of living, and making possible import substitutes to a greater degree than previously. Export capability soon follows with possible bettering of the balance of payments position.

Quality control has been an exceedingly important component in this complex of procurement methodologies which are transferred to the contracting firm abroad. In Japan, the Japanese recognized

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[1] For details of typical examples from Japan and Korea, see Spencer, Kyklos article, op. cit., p. 461-64, 468-69.

that "in the past Japanese goods suffered ill-fame for inferior goods in the world market."[1] While there had been some isolated cases of statistical quality control before and during World War II, the Japanese say these efforts had no "systematic effect" and attribute the introduction of quality control to the U.S. military forces in Japan. They trace the origin of the system to the efforts of W.S. Magil and H.M. Sarasohn of SCAP headquarters in seeking to revive the communications of Japan, particularly in the manufacture of vacuum tubes. In 1948, the Union of Japanese Scientists and Engineers was founded to promote quality control in Japan, and soon afterwards it established the Deming prize, an award coveted by Japanese companies. American experts like Deming came initially under SCAP auspices and gave lectures, seminars and training programs to the Union. The Japanese state explicitly that they learned from U.S. War Standard Z1.2, and Z1.3, and the works of W.A. Shewhart, the importance of the quality production.[2]

In addition to this somewhat academic side of the instruction, the Japanese were receiving simultaneous practice in the use of American standards and quality control through the procurement activity of the Forces stationed in Japan. Specifica-

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[1] "Quality Control in Japan, January, 1958" Reports of Statistical Application Research, Union of Japanese Scientists and Engineers, vol. 6, Special Issue, 1959, p. 1.

[2] Quality Emphasis in Japan's Postwar Trade, A Report to the CIOS XIII International Management Congress, New York, September 16-20, 1963.

tions and designs were given to the Japanese whenever a procurement was made. The Japanese were required to produce to the same level of quality obtainable in the U.S. American inspectors, resident in factories, enforced the system with severe rejection when necessary, but also acted as advisors and furnishers of technical assistance and even procurers of equipment. Quality control was inherent in the American procurement system, and as it advanced in technique, the system was passed on to the Japanese, with a time lag.

Thus the system known as "verification inspection and verification testing" was transferred to the Japanese about 1961 after it had been in use in American procurements since 1954. Under this system, the contractor sets up a good quality control procedure as part of the contract, and the U.S. procurement people merely verify the contractor's system and make occasional spot checks of the output. As later practices have become available, the Japanese have been eager to borrow them.[1]

As far as quality control and assurance techniques were concerned, the procurement contract procedure had the effect of forcing the Japanese engineers to put in practice the techniques which they had been learning through American books and lecturers.[2] The overall consequence was a dimensional shift

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[1] The Zero defects program is such a later example.

[2] A Japanese source acknowledges this military role when it says: "there is even the view that quality control, which is widely called for in our country's industrial circles, has taken root in Japan, for the first time when such aircraft as the F104 and F86F were actually produced from the blueprints prepared in the U.S." "Dream and Reality of Defense Industries" <u>Asahi</u>, June 22, 1966, translation from Japanese version.

from the cheap goods of pre-war fame to quality products competitive with those of other advanced economies.

Procurement Summary. Summarizing U.S. procurement activity in Japan as a channel of technical transfer, it is probably not an overstatement to maintain that these procurements laid the technical groundwork for the modern growth miracle of Japan. At minimum, they opened Japan to contact with American companies with whom they served to initiate or renew commercial tieups. In magnitude, U.S. military procurements were on the level of Japan's total annual exports during the Korean War period. In composition, they covered an enormous range of techniques from the simplest operations to the most advanced technology. The U.S. standards, specifications, drawings, and designs of the best products of U.S. industry were made available to the Japanese at this time. Technical assistance and training, informal and formal, were made available freely by the U.S. Elaborate systems of management and control, particularly quality control, were transferred, and often required to be put in practice directly in the fulfillment of these contracts. As the economy advanced, U.S. procurements diminished in importance, both absolutely, and relatively to the growth in Japan's national income.

The Japanese, having mastered the techniques and procedures, now find little technical advantage in continuing procurement activity. American procurement trends indicate a modest shift away from Japan in favor of developing capabilities in other Pacific countries. No doubt these trends will be increased by the needs of the Viet Nam War, and the overall logic of the U.S. position. Procurement from other countries in the Pacific will be accelerated, particularly if Japan continues to be a reluctant ally and source of support. However, in spite of their well-publicized reluctance, the Japanese have profited from the Viet Nam War with some increase of procurements.[1]

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[1] Wall Street Journal, December 30, 1965, p. 12. Such American sources have been making gratuitous, flattering statements about valuable Japanese sources of supply, which will doubtless weaken the bargaining power of U.S. procurement officers.

CHAPTER 4 LINKAGES THROUGH MILITARY ASSISTANCE PROGRAMS

With the inception of the military assistance program, a new note was injected into the military transfer of technology to Japan, namely, the element of planning. Prior programs were unplanned in the sense that the objective of the American procurement was not aimed at upgrading Japanese technical potentials, but to supply the American armed forces or meet the need of a war emergency. Under the Military Assistance Program (MAP) there is a planned attempt to build up the technical capability of a military ally. In one sense, it is an extension of procurement activity, but the procurement agency is now the local government, and the products are used for the indigenous military forces. The technical assistance now extends far beyond the procurement activity, and relies primarily upon United States manufacturers working through commercial channels to impart technology to local manufacturers.

The rationale of the military assistance program is based on the broad objectives of U.S. foreign policy serving U.S. national self-interest which, though of vital importance, are beyond the scope of this study.[1] In passing, however, it may

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[1] For further analysis, see Military Assistance Data for Debate. (Washington, D.C.: Office of the Assistant Secretary of Defense for International Security Affairs, June 1, 1966) 15 pp. pamphlet.

be noted that the quid pro quo of making military technology available to foreign armed forces and industry was the provision of effective military assistance by friendly nations sharing U.S. determination to resist aggression, but not able to afford the high cost of their defense needs. Other substantial advantages have been detailed by the Defense Department, but the idea of technological transfer or technical spillover effects of the programs has not been explicitly noted.

The case of Japanese transfers provided herewith is believed to be typical of a worldwide pattern, which varied in detail, but involved the same principles. Thus the European Consortium which built military aircraft under similar circumstances in Europe, or the development of the remarkable jet aircraft capability in Taegu, Korea could have been chosen. The Japanese case, however, is of special interest because it is the story of a people who stood, at the time, half-way between the developed countries of Europe and the underdeveloped world, but whose historical propensity to imitate foreign technology was already world-famous.

There was a pattern of stages in military assistance as it occurred in Japan. At the beginning there were transfers of simple equipment, which the U.S. military personnel taught the Japanese how to operate, and make minor repairs. Next, a major overhaul capability was extended to the host military forces. This capability could be established in a military depot or arsenal, or it could be developed in a private foreign company. In Japan's case, the latter type was emphasized, while in the other Pacific countries, the former seems to predominate. In Japan, commercial arrangements between American and Japanese companies are established parallel to government-to-government agreements which permitted the Japanese to assemble and begin to manufacture parts. Little by little, the proportion of parts manufactured in the country rose to a large proportion of the whole, until the Japanese attained mastery of the final production and assembly. The first transfer in the aircraft industry involved the manufacture of the F-86 fighter aircraft. This weapon development project is a prototype of later contracts such as those for the P-2V and F-104.

AIRCRAFT REPAIR AND MANUFACTURE

Offshore procurements of military items and contracts for the repair and rehabilitation of U.S. aircraft began even before the Korean War in 1949, but in 1950 it assumed large-scale proportions.[1] On March 28, 1951, there was formal commitment to using Japan as a source of supply for such military requirements. The justification given for this use of Japan was that it would provide a logistical support to the United States

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[1] Other than newspapers, one of the few unclassified sources on this subject is L.M. Garrett, Industrial Planning with the Japanese Air Self Defense Force (Tokyo: Fifth Air Force Headquarters, 1957) p. 97.

and its allies in the PACOM countries, cut down the need of dollar aid to Japan, and conserve United States resources. Alternatively, the justification quoted Defense Department directives as seeking: a) to develop with Japan a program for Japanese assistance to defense and defense-supporting industries by U.S. offshore procurement with Defense and Mutual Security funds; b) to encourage Japan to expand and stabilize its economy; and c) to encourage the development of cooperative relations between Japan and other free nations. This directive is quoted as calling for:

> development and utilization of Japanese industrial capacity as a source of current and wartime requirements for the acquisition of supplies and equipment for the United States forces and in support of the United States Assistance program with contemplation of giving the Japanese a manufacturing capacity for the F-86 fighter.

The Defense Department directive was reissued in April, 1953 with the amplification that there was to be a "planned defense procurement program" for the U.S. Forces and the Japanese and by MDAP (Mutual Defense Assistance Program), implying that third countries would be involved. Provisions of licensing agreements and technical training for Japanese both in Japan and the U.S. were specifically ordered. An interim agreement between Lockheed and Kawasaki to provide the Japanese with technical assistance in the overhaul of jet engines and air frames preliminary to manufacture was concluded, and 10 Lockheed technicians arrived in Japan in early 1954. These men helped the company draw up its contract proposal, and set up facilities for the overhaul of U.S. Air Force and MDAP equipment with the understanding that they were preparing the way for the future production of Allison jet engines and Lockheed T-33A jet trainers for the Japanese Air Self Defense Forces. At the same time, North American and Mitsubishi were negotiating on licenses and contracts for the F-86 and T-28.

Training facilities were requested at Tachikawa Air Base which, as noted above, had already done a good deal in training Japanese technicians, but there were no appropriate funds from which training could be paid. As a result, the request was denied, and much valuable experience was lost. It is quite possible that the program could have been expedited at lower cost by using the facilities of the "FECOM University" (see above).[1] In any case, large numbers of American technicians went to Japan and some Japanese came to the U.S. The first contract for the overhaul of jet engines by Kawasaki Aircraft Company was made in July 1954, a contract which Kawasaki completed in 7 1/2 months.

With this overhaul capability established, negotiations began in March, 1955, on an assembly contract for 70 F-86F and 150 T-33A trainers to the amount of $60.0 million. The program was financed by MDAP, Wheat funds, and Japanese budget funds, with the U.S. assuming about two-thirds and the Japanese about one-third of the initial cost. MDAP funds paid for the

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[1] Interview with training officer, Tachikawa Air Base, dated July 30, 1965.

purchase of aircraft parts, tools, payment of license fees (the down payment), and technicians' salaries. MITI, the newly-established control agency, foreshadowed its future interventionary role by forcing down the royalty rate which North American sought to charge for its services.[1]

The whole program was formulated as a phased transfer. The initial establishment of preconditions was achieved by building an overhaul capacity into the Japanese firm, Kawasaki, which was to carry a large share of the business. Then the first manufacturing phase was essentially an assembly operation, in which parts for 100 T 33's and 70 F86's were shipped from the U.S. and assembled in Japan. In addition to parts, the transfer included all necessary technical data, 1,500 pounds of tools and master jigs for the aft to mid-fuselage sections, tooling and technical data. By the end of 1955 there were parts for eleven T-33 trainer aircraft in Japan, and the first assembly was achieved in January, 1956. It is of interest to note that the considerable delay over the original plan was caused by MITI's procrastination.[2]

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[1] North American sought a royalty charge of 12 1/2 percent, but finally agreed to 6 percent, Garrett, op. cit., p. 35.

[2] It may be noted that the original target was August, 1955, but delay in license approval by control unit, MITI, held up the program. Similarly, the F-86 projected delivery schedule was delayed from June to August, 1957. Garrett, op. cit., p. 36. The company says it began production of the T-33 in October, 1955. It also made the Bell licensed helicopter 47G-2. Kawasaki Company. Products of Kawasaki (Tokyo: The Company, no date) p. 5.

However, since the ultimate goal was to build the Japanese capability to make the planes, a follow-on agreement was soon under study. The first follow-on program, also known as the "second arrangement," was signed in April, 1956. Production plans called for one hundred and ten more F-86F's and eighty T-33A aircraft. Again the U.S. furnished parts, materials, components, and equipment, but the proportion of U.S.-supplied parts now began to fall as Japanese manufactured components rose. Plans were set on an airplane numbered basis. Thus the U.S. Air Material Command set up a schedule for furnishing all the materials needed for aircraft numbers 71-103, and certain long-lead items for numbers 104-180, including:[1]

> 11.2 percent of the detail parts and 33 percent of the equipment items for aircraft 104-130; 7.3 percent of the detail parts and 5.2 percent of the equipment items 131-147; 5.2 percent of the equipment for aircraft 148-180.

While the precise proportions actually achieved are not available, it may be seen from this U.S. estimate that the U.S. was confident of Japanese capability to build a very large proportion of the airplanes.

Interviews with U.S. procurement officers suggest that the proportion of locally-produced parts usually does not rise beyond some 85-90 percent or, in the case of the F-104, 70 percent. This is so for several reasons. Firstly, some of the latest processes are withheld because they are "classified."

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[1] *Ibid.*, p. 40-41.

Secondly, the recipients may lack the capability for certain essential items, such as, in the contracts in question, the jet engines, the armaments, and the pyrotechnics. These deficiencies however, may be progressively diminished as time goes on, as was case with these contracts. Thirdly, economic factors enter into the decision in that it may not be economical to tool up for only a few items, and it may be better cost-wise to continue to buy them from the licensor. The Japanese, however, pushed well beyond normal costing limits in their eagerness to be able to do it themselves. One rule of thumb used by the Japanese, American procurement officers thought, was that if the marginal cost exceeded two or three times the cost of the import, the Japanese felt they should import. Up to this point, experience value was considered worth the additional cost.[1] Fourthly, political factors were involved. The Socialist opposition fought the rebuilding of the Japanese Air Force, and "the charge that Japanese officials were truckling to the United States was political dynamite."[2] The Japanese conservative oligarchy, in turn, found this threat convenient to consolidate its own power position in the negotiations with the Americans.

In this last connection, it is instructive to note the assertion of power on the part of the resurgent Japanese Govern-

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[1] The Japanese, of course, calculated in the economic returns from the spillover effects on the civilian industry.

[2] Garrett, op. cit., p. 49.

ment. Par from accepting the new technology graciously, Government officials demanded that the U.S. companies contract directly with the Japanese Government, rather than on a compa to-company basis with the usual commercial and other Government approvals. The Americans went along with this idea, and found that the resulting tightened control over Japanese industry was used to favor some industries against others. Thus in the case of A-4 gunsight, Tokyo Keiki Company (Tokyo Instrument Company or TKS), a capable little producer of precision instru ments which had had a long-established tie-up with Sperry-Gyroscope, was to have had the contract. Garrett reports the stor as follows:[1]

> Seemingly Mitsubishi (under the name Electronics Manufacturing Association), while unable or unwilling to manufacture the products, by working through JDA (Japan Defense Agency), the Japanese Procurement Office and MITI's power to control a firm's dollar spending (needed for technical data, pilot parts, tools, etc.), was able to stop the smaller company from filling its A-4 gunsight contract. The Americans concerned, indignant at this dog-in-the-manger behavior, suggested the United States Embassy retaliate against Mitsubishi to enforce fair trade practices.

However, the U.S. side thought it inadvisable to intervene. Indeed there was little that could be done short of withdrawal or threat of withdrawal from the whole transfer, since the Japanese had quickly passed laws reasserting the traditional paternalistic government control over the aircraft and aircraft

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[1] Garrett, op. cit., p. 60.

supply company. The Aircraft Manufacturing Industry Law of June 3, 1954, gave MITI the power to grant and withhold licen and to distribute subsidies and control dollar allocations, which were necessary to companies involved in U.S. plans or using materials or services of U.S. technicians. All of this power-grab took place under the contention that MITI was preventing larger firms from putting the smaller ones out of business, and preventing cutthroat competition for the accomp ing exchange. Under later amendments, euphemistically called the Amended Anti-Monopoly Laws, a cartel of electrical suppli was set up which fixed prices and set production quotas for equipment.

Yet while the Japanese elites insisted in doing their business in the historic oyabun-kobun[1] (master-servant) relationship of government paternalism toward industry, newly revived from the underworlds of the SCAP period, they were clearly very anxious to restore their aircraft capability. The technological multiplier of 523 licenses and technical assistance contracts spreading through Japanese industry was understood by the leadership. They were particularly eager to learn jet engine technology which had replaced reciprocating engines during the period after World War II, and surprised the Americans by disregard of cost in obtaining jet

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[1] See John W. Bennett and Iwao Ishino, Paternalism in the Japanese Economy: Anthropological Studies in the Oyabun-Kobun Patterns (Minneapolis: University of Minnesota Press, 1963).

engine technology.[1] Moreover, they were cognizant that these F-86 and T-33 contracts would lay the foundation for obtaining the "century series aircraft", which was what in fact did occur.

P-2V Anti-Submarine Airplanes. The other services followed the lead of the Air Force in negotiating similar turnovers of advanced airplanes. Thus the Navy P-2V agreement in January, 1958 set up a joint cost-sharing program for the production and development in Japan of anti-submarine and sea-patrol type aircraft to augment the Japanese Maritime Self-Defense Forces. Under the government-to-government contract, reproduced in full in Appendix XIV, the U.S., as is typical of such contracts, agreed to furnish materials, parts, components, and equipment for forty-two P-2V airplanes. In addition, master and control tools, hand tools, tooling for model parts, plaster plugs, and major assembly jigs and plugs were turned over to the Japanese for production purposes. All technical data, such as handbooks, manuals, and operating instructions, were furnished, and the services of contract technicians were specifically provided for. The parallel company-to-company agreement between Lockheed and Kawasaki is specifically referenced as the medium of implementation. A production schedule is established, security provisions are specified, and the cost-sharing details are set forth in a table.

This airplane is of particular interest in its impact on

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[1] Garrett, op. cit., pp. 60-61.

the civilian aircraft industry because the Japanese have changed a few elements and called it a newly-derived airplane designed by the Japanese.[1] These changes include lengthening the fuselage, raising the tail, re-hanging the engines, and doubling the wheels. Some U.S. aeronautical engineers feel these changes would be called engineering changes in the U.S., hardly worthy of the name of a newly-designed airplane. However, it illustrates the impact of the military aircraft borrowing on the civilian industry. The widespread nature of these borrowings is shown in the accompanying diagram of Japanese-American aircraft tie-ups (Figure 3).

F-104J Program. Just as Japan moved from propellers to jets with the F-86, she took another dimensional jump when her aircraft industry received contracts for the F-104 fighter plane. Its speed, for example, is about twice as great as that of the F-86; it has very advanced aerodynamic characteristics, and it is accompanied by extremely advanced electronic equipment.[2] Originally, however, the U.S. gave the Japanese permission to build the F-104 under conditions similar to the pioneer F-86 contract, or to the P-2V contract. Mitsubishi Heavy Industries is the prime contractor for the F-104, obtaining

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[1] The Japanese named it P-2V7-Kai, which means "modification." Airview (Kokujoho), Tokyo, August, 1966. No. 211, p. 9-14, 120 in Japanese and in English.

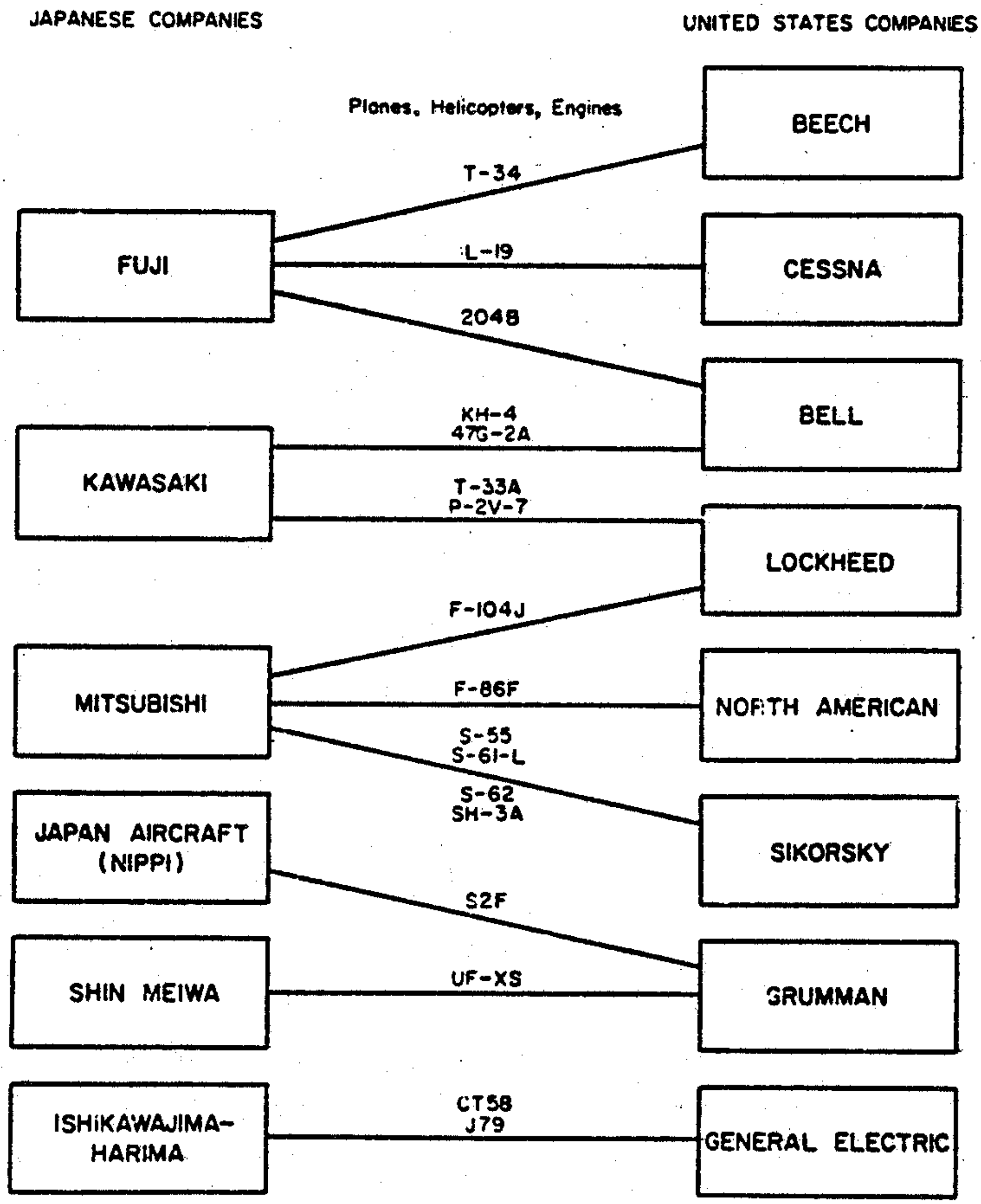
[2] A comparable European transfer has squeezed 16 years of know-how in advanced electronics into two years, Electronics, June 21, 1963, p. 17.

techniques from Lockheed, and in charge of final assembly. It produced nine F-104J's per month under a heavy schedule, which aimed at completing 200 of these aircraft by 1965. A total of $270 million is given as the value of the contract wit . the U.S. providing some $75 million. In add··ion to 550 subcontracts, the jet engine licenses between General Electric and Ishikawajima should be mentioned. Specialized equipment such as "stable platform" navigation and gunnery equipment also involved transfer of very advanced technology. Mitsubishi Precision Co., not, as noted above, Tokyo Instrument Co., has some of this type of business.

The same pattern of transfer as under the F-86 was followed. First, there were "IRAN" (inspection and repair as necessary) contracts let to Japanese companies on intermediate model F-102. The first twenty planes were built in the U.S., flown in the States, then disassembled, and shipped to Japan, where they were reassembled by Mitsubishi. The next twenty planes were shipped in "kit form" and assembled by Mitsubishi. Hence 160, not 200, were actually built in Japan. At the beginning of manufacturing, 35 percent of the parts were made in Japan. In August, 1963, 80 percent of the airplanes were made from locally produced parts. Quality control procedures from the U.S. were used, as with the F-86, and the resultant quality is very high, as evidenced by a high Lloyd's rating. But Japanese speed in turning out airplanes is not great, according to U.S. procurement men.

FIGURE 3

PRINCIPAL JAPANESE–UNITED STATES AIRCRAFT LICENSE RELATIONSHIPS



SOURCE: Rand Corporation and Interviews with Japanese and U.S. Aircraft Industry.

SOPHISTICATED EQUIPMENT

As the Japanese military build-up program progressed over time, the American contribution declined, and Japanese self-support rose. The problem of balance of payment deficits brought in a new era of military technical transfers, paid for by such countries as Japan which had attained some degree of capacity to pay for the transfusions. Known as MAS (Military Assistance Sales), this program is currently running at over $1.5 billion per year, and offsets 40 percent U.S. military costs abroad.[1] The program, however, gives rise to many Japanese comments to the effect that they are independent of U.S. military aid, both financial and technical. Reality, however, is slightly different. While it is true that the Japanese are now buying the bulk of their imported military technology, they are still heavily dependent techically on borrowing from the U.S. Yet, in this connection, the rise in the proportion of indigenous R & D is noteworthy; few companies a few years ago did any R & D, while today no company of stature is without it.[2]

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[1]U.S. Air Force Hqs., Directorate of Military Assistance, Information and Guidance on Military Assistance, 10th ed. (Washington, D.C.: 1966), p. 129; James L. Trainor, "Can U.S. Maintain the Momentum of its Military Export Sales?" Armed Forces Management, January, 1967, pp. 36-40. This article cites $11.1 billion total for fiscal years, 1962-1966.

[2]Research as a proportion of National income was 1.9 percent in 1962, as compared to a figure of 3.4 percent for the U.S., according to a Japanese source. Just what the Japanese mean by research is, however, a formidable question. Japan. Office of the Prime Minister, Kagaku Gijutsu Kenkyu Hokoku (Survey of Scientific and Technical Research), Tokyo, 1963 in Japanese.

The era of MAS sales may be illustrated with the case of the Systems Analyzer, an electronics maintenance gadget from the Autonetics Division of North American Aviation. Japan bought two for $270,000.00 each from them and obtained the rights to twelve more. They built the remaining twelve at a cost of $30,000.00 each. It was said that the Japanese bought the R & D in the first contract.[1]

Missile Systems. While the Japanese have sought systems from the other advanced countries (for example, from Oerlikons, in Switzerland), they have made heavy technological borrowings from U.S. systems. Nike-Ajax, Nike-Hawk, and Nike-Hercules have been programmed, and crews have been in the U.S. for training. The systems have been given on some sort of grant or sales basis, and some sort of rights are provided to build parts or components of the latter units, as in the Systems Analyzer case. The JSDF is now equipped with two kinds of missiles--Nike-Ajax (they plan to manufacture it locally, though it is 1.4 times more expensive than purchase from the U.S.) and Hawk--and two battalions each of these missiles were scheduled for establishment under the 2nd Defense Plan (1962-1966). Under the 3rd plan, the Japan Defense Agency (JDA) is formulating a policy for "giving importance to missiles" by adopting the Nike-Hercules (length 12.5 meters, range 150 km, speed Mach 3.3). Japanese ships have been provided with Tartar missiles.

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[1] Interview with the MAAG, Japan, July 6, 1964.

In an attempt to save dollars, the U.S. tried to exchange some American-built Nike missiles for procurements such as trucks and jeeps for use in Viet Nam. But the Japanese objected to such deals on the ground that "any unfair division of labor might hamper the domestic production of Nike and Hawk Missiles" in Japan.[1] Supporting their position on their own capability, it may be noted that the Japanese have even exported some small non-military rockets which were developed by Tokyo University's Industrial Science Institute.[2] However, their reluctance also reflects their lack of support for the U.S. position in Viet Nam.

BADGE System. This system of highly complex and sophisticated electronic know-how is designed to replace manual control of defense aircraft. As in many of the predecessor borrowings, the Japanese sent a technical mission to three U.S. companies, General Electric, Litton Industries, and Hughes Aircraft. With the mission's technical data, the Defense Agency specified the performance required of the system and asked for bids. Nippon Aviotronics, a joint venture of Hughes Aircraft (49 percent) and Nippon Electric (51 percent), the firm which built the Tropospheric Scatter System, won with a bid of ¥13 billion (less than $39 million) over joint bids of General Electric and Toshiba,

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[1] Asahi Shimbun (English edition), August 2, 1965, p. 11.

[2] This rocket the Kappa-8 went to Indonesia recently and three years ago went to Yugoslavia, Japan Times July 3, 1965, p. 2.

and Litton and Fuji. But other American and Japanese companies are involved as subcontractors. The U.S. is reported to have agreed to grant Japan 25 percent of the cost of the equipment.[1] Some idea of the time involved in these technical transfers can be seen from the fact that the agreement was signed in December of 1964, consummating planning during the early 1960's, and the system is scheduled to be completed by the end of Japan's fiscal 1967 (March, 1968). Japanese thinking on advantages of BADGE is given later, in the section dealing with industrial spillover effects.

Defense Development Exchange Program (DDEP). This program, which is also referred to as Defense Data Exchange, had antecedents in Europe under the name Mutual Weapons Development Program. Over the past 8 years, the Department of Defense has executed 860 Data Exchange Agreements for the transfer of information on specific subjects or particular technical areas. Of these, 600 are currently in force. The size of this effort is suggested by the fact that approximately 1000 people are involved yearly in the operation of the information exchange. Administration costs approximate $1 million per year.

In Japan, in the opinion of the American military, the Japanese capability had advanced so far since the original transfers that a joint program has been developed to take advantage of Japanese developments on an exchange basis. Thus U.S. and Japanese

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[1] Nippon Keizai Shimbun (International Edition), December 8, 1964, p. 1.

teams are set up to determine areas in which technical exchange may be effected with mutual profitability. Skeptics suggest that the ratio is about 9:1 in favor of data moving from the U.S. to Japan, and hold it is merely a convenient means of retaining U.S. influence in Japan after MAP was cut off. But proponents contend that Japanese R & D levels are rising, and that it will be of more value to the U.S. at some later date. As might be expected, the Maritime Force (Navy) with its base in Japan's highly competitive shipbuilding industry, has offered some cases of reverse flow. For example, a fast torpedo (50-60 knots) is said to be among the exchanges made from Japan to the U.S., or again, U.S. money is also said to have financed R & D of Japanese solid propellants. Even today, however, these cases tend to be exceptional, and the vast flow of advanced technology is still moving from the U.S. to Japan. A typical R & D example is given in the following section.

Fatigue Tests in Airplanes. The transfer of R and D technology from American industry to Japanese industry under military assistance auspices is well exemplified by the Navy's Fatigue Test Project. This concerns fatigue tests on S2F airplanes, and is somewhat unusual because it represents a transfer, not from U.S. industry, but from the U.S. Navy's research facilities to a Japanese military research organization--though with an aircraft company, Nippi (Japan Aircraft), doing the work under contract. Previously, the Japanese aircraft industries either had not made fatigue tests (not to be confused with analysis of failure in airplanes), or had done testing under such unsophisticated conditions that U.S. specialists privately regarded them as sophomoric, even primitive. The Japanese were anxious to acquire this research technique because their military airplanes are in service longer than U.S. counterparts, and such tests permit longer usage of civilian planes.

In early 1963, fatigue tests were first discussed with the Japanese by a visiting U.S. Naval Research Team. After 18 months or more of correspondence, an agreement to conduct the tests was reached in January, 1965. This was implemented by another American technical visit, and a second technical agreement in October, 1965. Under the latter, which specified conditions of the tests according to American military specifications, a Japanese team was invited to the U.S. to visit laboratories performing what in the U.S. itself is a relatively new R & D area which was developed in the 1950's.

The Japanese team's visit was arranged by the Navy MAAG in Japan, and jointly funded by the U.S. and Japan. The team visited such research installations as Naval Air Engineering Center (NAEC), Navy Air Laboratory, and private aircraft companies, such as Boeing and Lockheed. Project Officers observed Research and Fatigue testing practices, and worked in close cooperation with their American counterparts.

When the team returned to Japan, the tests were begun on an S2F airplane furnished by the U.S., and in the summer of 1966, the first test results were awaited. The total time is estimated at five years from the inspection to the completion state. As a sort of quid pro quo, the U.S. side requires that the tests be performed carefully in accordance with practice specified in U.S. military specifications, and reports be submitted periodically in English. The Japanese, with typical elan, already are agitating to be furnished a more advanced airplane than the S-2F to start a new set of tests.

Independent Japanese Design and Export. A less exalted form of proof of Japanese acquisition and mastery of technology than a reverse flow or mastery of modern R and D technique is the export of the product under some commercial or military procurement condition, especially involving some Japanese modification of design. In the early stages of borrowing, there is a pronounced tendency to stay close to the original U.S. designs. Even where full manufacturing of all parts is being attained, there is very little variation permitted, and the Japanese inspectors are reported as extremely critical, rejecting products even for "cosmetic defects" such as chipped paint. Later, as the Japanese feel at home with the technology, there is a clear attempt to experiment with additions, new designs, and generally to make the product more Japanese. Export validates their accomplishment. Thus the Kawasaki Company, having made helicopters under license from Bell from 1952, began to talk of its own design, and completed a mock-up for a helicopter of its own design. It evidently stayed close to the original, but permitted itself some variation as suggested by the following advertised account: "The helicopter has been built on the basis of a Bell 47 G-2 helicopter . . . The main rotor, larger than that of the Bell 47 G-2 is of metal." The P-2V modification described above also illustrates how the military borrowings evolve into "indigenous" Japanese designs.

Tropospheric Scatter System. An interesting combination of Japanese independent design elements with borrowed military technology is provided by this over-the-horizon system of long distance communications. The Japanese had and still have relatively inferior long-distance communications in most areas of the civilian economy. They had, however, access to developments in the electronics field in journal literature and at international meetings of engineers and scientists, and thus had become acquainted with U.S. developments in the field of over-the-horizon communications.[1] In addition they, or at least their leading companies, had built up confidence in their ability to overhaul and repair American equipment. In any case, about 1959 Nippon Electric Company, one of Japan's best electronics firms, had bid in open competition with other companies, and had secured a contract to build a system for the Air Force, known as the AC & W system. In U.S. procurement circles, there was considerable dubiety expressed on the wisdom of letting the Japanese have this contract, but the Japanese completed the contract, and the system has performed

[1] The history of the U.S. developments on which the Japanese system was based is depicted in brief in Spencer, Kyklos article, op. cit.

very well according to all technical reports. It has now been turned over to the Japanese Self-Defense Forces as part of the joint defenses of communications.

The Japanese were supposed to have lost money on this contract in an effort to establish their reputation as being capable of building the system. That they succeeded is attested by the fact that the U.S. procured a second set for their own use. This second set, known as the USARJ Tropospheric Scatter System, provides the American Forces with long distance communications in Japan. In contrast with the first set, the second set was more complicated. It involved more "long shots" and the true diffraction which characterises the tropospheric system, whereas the first set was close to micro-wave. It spanned nearly 2,000 air miles, cost 10 million dollars and was built to what the military calls 99.9 percent trouble-free communications. This set was also built under what is called a turn-key type contract. The specifications were performance specifications, and the designs were Japanese. However, it should be noted that the elements of the system were known. Some, in fact, had no substitutes, such as the U.S. Varian produced klystron. Moreover, there were standard designed sets in existence in the American supply line, though these would not have worked effectively in the mountainous terrain of Japan. Thus, the Japanese put together something slightly different from what anyone else had made, and to the high standard performance specifications of the U.S. Military.

RE-CREATION OF AIRCRAFT INDUSTRY AND INDUSTRIAL SPILL-OVER EFFECTS

It is obvious that the Japanese aircraft and related industries received a vast transfusion of technical knowledge from these military assistance contracts. Japanese pre-war industry had achieved some levels of competence as is witnessed by the famed Zero fighters,[1] but in the ensuing years, the state of the art in the U.S. had advanced very far with heavy research and development. Seven post-war years of prohibition of aircraft manufacture created a huge technological gap for Japan. The military assistance program made it possible to fill much of this gap, and recreate a viable, modern aircraft industry.[2] Moreover, 500 or more sub-contractors radiated the effects through other Japanese industries. As one Japanese source describes, all kinds of production techniques have been diffused through Japanese industry as a result of the military contracts.[3]

In addition to recreating an entire civilian industry and diffusing production techniques, this military transfer has induced numerous technical spillovers or by-products in other industries. It is impossible to trace more than a sample, but

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[1] As discussed in the Introduction, the pre-war industry also was borrowed largely from the U.S. Lockwood, op.cit., p. 331.

[2] For further details of Japanese aircraft, see Koyoshi Noda, "The Japanese Aircraft Industry," Oriental Economist, April, 1966, pp. 221-26.

[3] Jitsugyo No Nippon, August 15, 1964. Translation from Japanese.

a Japanese source gives some specific examples of obvious technical importance.[1] The famed Japanese 120-mile-per-hour train is supported by pivot bearings from the J-79 engine of the F-104J. Disc-brakes from the F-86 are also used on this "the world's fastest train," and brakes of similar design are being used in Japan-produced sports cars. Mitsubishi developed machines for X-ray treatment of cancer called "Leniac," manufactured by ultra-precision tools obtained in the F-104J contracts. A technique for treating epilepsy has been developed with automatic radar equipment from the F-104J communication equipment. This same source says that many Japanese companies depend on these "technical ripple effects" to support themselves, since the Japanese defense contracts yield very little profit. This comment accords with Japanese willingness to pay up to three times the cost of imported items to acquire new manufacturing technologies. The difference in cost must be made up in these civilian applications of the military technology.

Japanese thinking along these lines of staying abreast of developments in new advanced military technology by means of licensing is pinpointed by the following quotation which shows that they are perfectly willing to trade off present "pay-ability" for a longer range time horizon to insure that they

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[1] "Dream and Reality of Defense Industries," Asahi, June 22, 1966--translation from Japanese.

do not "miss the bus:"[1]

> The BADGE system represents the highest technical level of the electronics industry in the present age. It is by no means easy, therefore, to study and develop this system. Even if the foreign technics concerned are imported, it will certainly take a considerably long time for the Japanese to master such technics. Furthermore, it is difficult to have these "technics of tomorrow" utilized at once by private industries. Accordingly, it cannot be expected that these technics will yield a profit through their application to other industrial fields as in the case of aircraft and submarines, thus covering losses in the primary field.
>
> Nevertheless, this defense industry, which represents the highest level of modern technics, attracts attention. The reason lies in the desire not to "miss the bus." Technics of tomorrow cannot remain as such for long. In the present age of innovation technics become obsolete quickly. Japanese industries, therefore, cannot remain idle, even with up-to-date technics in their hands. Moreover, Japan relies on foreign countries for almost all such advanced technics. An enterprise which succeeded in importing excellent foreign technics, therefore, can readily defeat its rivals at home. For this reason, enterprises should lose no time in riding the bus once it begins moving.

Explicit in this quotation is the recognition of the fact that Japan borrows modern technology heavily through this military channel. It is in no sense derogatory to the Japanese to recognize this alert propensity to borrow and keep up in these advanced technologies Rather, it is ir refreshing contrast to plaints of a "technological gap" and "brain drain" which are heard from Europe. But, for the purpose of this study, it is important to underscore that these valuable technological transfers occur through the military channel. How valuable

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1 *Jitsugyo no Nippon*, *op. cit.*

these military transfers are will be realized when it is recalled that 60% of all research and development expenditures in the United States in 1964 was invested in two industrial areas: aircraft and missiles, and electrical equipment and communications. In prior years, going back to 1956, the proportion has been about the same, in any year, not less than 50 percent.[1]

Thus the alert Japanese have taken the most efficient and economical means to modernize their key industries; and the profound upgrading influence of the most modern industries of the civilian economy, via channels of U.S. military assistance, has gone largely unrecognized. On the contrary, military assistance is compared unfavorably with economic assistance, and indeed widely and arbitrarily condemned.

Summary of Military Assistance Transfers. The U.S. military transfer of technology to a foreign military force such as the Japanese has been an important factor in building or rebuilding the industry of a country. The pattern follows a step-by-step sequence from repair to full manufacturing. Some very high level technology in the aircraft, electronics, and related industries has been and still is being transferred. This has brought the Japanese close to the U.S. in procurement capability,

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[1] U.S. National Science Foundation. Basic Research, Applied Research, and Development in Industry, 1964 (Washington, D.C.: U.S. Government Printing Office, 1966), pp. 1-17.

and closed much of the gap which existed between their industries and that of the U.S. The programs began with much dollar aid, but in recent years, because of limitations of gold flow, the programs have become sales oriented. The Japanese emphasize developing their own capability in even the most advanced technology. They begin with operation and simple repairs of equipment, given or sold to them. A rebuild capability follows, and then a license to manufacture.

The Japanese copy the technology in precise imitation at first. Having mastered the prototype, they venture out with minor variations to develop slightly different variations, or even some combination of known elements. Such recombinations have been purchased back by the U.S. There are even some cases of technical data exchange, though the flow is insignificant in comparison with the outflow of U.S. technology. From the beginning of complex transfers dating from the landmark F-86 agreement, the transfer seems to have gone smoothly, except for some political problems. One of the more important obstacles to the effective transfer seems to have been reassertion by the Japanese government of its control over many facets of the economy in the post-SCAP period. Generally, through all the stages, the amazing Japanese propensity to borrow and absorb the foreign technology is matched only by the U.S. propensity to make the technology easily available, even though vast investments in American R & D are involved.

CHAPTER 5 TECHNOLOGICAL TRANSFERS IN OTHER PACIFIC COUNTRIES

Does the record show that Japan's Pacific neighbors have developed industrial capabilities through U.S. military presence or assistance programs in a manner similar to that of Japan? The remarkable development of the sophisticated automobile, aircraft, missiles, electronic communication, and other advanced systems in Japan dwarfs the achievements of the smaller countries. Yet the propensity to borrow technology is still clearly manifested in the more modest achievements of developing capabilities in simpler industrial undertakings. No doubt these capabilities can and will be increased over time, particularly if more attention is paid to them. However, Japan's neighbors, in a sense, suffer from their proximity to Japan. The easy way to get the job done is to procure in Japan, which is the country with the established base and reputation as a source of procurements, in both the post-World War II, and the Korean periods. Thus, the other countries are procurement alternatives with little base and experience, and are for these reasons likely to be high cost. American procurement authorities are always conscious of fostering competition, but the prime consideration is a job speedily accomplished at least cost. This is particularly true in a period of emergency. Yet with all the handicaps, development of considerable industrial capability through military linkages has taken place in other Pacific countries. The following sections are not meant to be comprehensive, but rather to illustrate how and in what way some of these linkages have taken place.

AGGREGATE PROCUREMENTS FOR OTHER PACIFIC COUNTRIES

The same difficulties in obtaining data on procurements occurs here as for Japan. There exist, however, some public data for Army procurements in the Western Pacific Command between 1962 to 1964 (Appendix VIII). These data show that there have been procurements in other countries during this period, and that these procurements have become relatively more important as Japanese procurement has decreased. As would be expected, Korea has the largest share with Ryukyus (Okinawa) in the second place. The share of all other South-Eastern Asian countries is quite small, though some increase has been recorded from $2.7 million in 1962 to more than double this figure in recent years.

As the Viet Nam build-up intensifies, it may be expected that the totals for South-East Asia will rise. Popular sources report that American construction companies were building airfields, air bases (including Da Nang and Bien Hoa), barracks, roads, and docks. Thus one company was said to be employing 12,000 Viet Namese under 500 American supervisors and was planning for expansion by recruiting another hundred supervisors.[1] However-

[1] Morrison, Knudsen and Raymond International Company, as reported in *Newsweek*, August 2, 1965, p. 45. In 1966, this company ranked ninth in volume of defense contracts. Koreans, too, are working in large numbers (see below).

ever, not all the expenditures carried by the military IBM system under the geographic breakdown mean that the area is affected. Thus expenditures for U.S. shipping service to carry personnel and equipment to the War zone will be listed as part of the total, but will have no impact other than possible stevedoring and other ship turn-around services. With this caveat, there is none the less some considerable quantitative impact of the American presence in these other countries.

Japan as a Center of Diffusion of Military Technology. -It is interesting to begin with the outreach from Japan. In the automotive field, the planned transfer of technology under the Military Assistance Program is based on the U.S. Army Logistical Center, an Army installation at Tokorozawa, Japan, one of whose principal missions is to provide supply and maintenance assistance to the MAAG (Military Assistance Groups) in the various countries.[1] The Logistical Center is the lineal descendant of the "Roll-up"operations of World War II vehicles, when a great deal of experience in rebuilding and cannibalizing old vehicles was acquired. The installation is still the main source in the world for spare parts of these World War II vehicles, because the U.S. manufacturers are no longer stocking them. While the center has other functions, the most important is that of providing logistical support (managing the inventory, and ordering new supplies) for the Military Assistance Program

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[1] In late 1966, the Center was being combined with the Army's troop supply depot at Sagami.

in the countries of the Pacific.[1] Specifically their mission reads:

> To provide advice and assistance to Military Assistance Advisory Groups in PACOM MAP countries with the objective of improving in-country logistics capabilities with emphasis on inventory management and material maintenance.

This mission requires the Center not only to support the logistic needs of the Military Assistance Groups, but also to supply technical training. Such training consists of sending technical teams to the country needing the assistance, as well as providing training for local teams coming to the Center. Under the first category many special teams are sent out for periods of two weeks or longer. These teams work through the local Military Assistance Group but provide direct advice and training to the local people.

Aside from the stocking of parts and components from which friendly countries "buy into" the logistical supply system, the heart of the operation is the engineering division. This group provides engineering services such as design, testing, and troubleshooting equipment made available under military assistance or sales. It serves as a kind of link with American industry, mediating the technology to local workshops throughout the Pacific. It solves problems of adjustment and adapta-

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[1] They also service other countries according to "Presidential determination," as for example, Burma. Also "State Department shipments" are made in response to countries being given access to buy special items of U.S. stocks. Moreover, they handle items of procurement for the other services (Air Force, Navy, Marines, etc.) if these other services have "Army peculiar equipment."

tion of machinery, and serves as a base for the technical missions which go out from the Depot, training and upgrading the local forces and supporting industry in the latest technical practices.

An example will make clear the work of these missions. A technician from the Logistical Center, designated Ordnance Liaison Representative, visited the Taiwan MAAG for three weeks in 1961 for the purpose of assisting and advising the rebuild facility on procedures used in tire rebuild. This assistance was requested by the Chief of the MAAG, at the instance of the Chinese, and a civilian technician with long experience in the employ of Army rebuilds was selected to go. This man is of interest because he was in an Ordnance Company which landed in Japan in the early Occupation, and from that time had been a part of the tire rebuild and, later, manufacture in Japan, and had watched the capability spread to other countries in the Pacific. Referring to the tire industry, he likened the development in Japan to a tree, and the later development capabilities in the other countries as branches. In his vision, which no doubt neglects commercial and other channels of technical transfer, he saw the Japanese tire industry develop from the seeds of the original tire rebuild shops of the U.S. military in Japan, and felt the industries in the other Pacific countries were going through the same evolution.

To return to the mission, this tire man made a typical visit, recommended certain technical and procedural changes, and as a result, the rejection rate of the Chinese Tire Rebuild Shop which had been averaging 17 percent fell to 1 1/2 percent. In the facility he visited, the Chinese Army's Tire Rebuild Shop at Taipei, Taiwan, equipment is American-made and the staff is Chinese army personnel. The American technical representative found them "energetic and conscientious in their work," but requiring "additional training in the proper application of tire rebuild methods and operation of equipment." As a representative example, details of his specific training instruction, which were acted upon in a very cooperative manner by the Chinese, are contained in Appendix XV: "Report of Special Ordnance Liaison Visit to MAAG - Republic of China." This visit is typical of the way hundreds of U.S. technicians upgrade local industrial capabilities under local military auspices.

The informant in Taiwan was liberal in acknowledging the cooperation and accomplishments of the Chinese. However, he felt that for the present it was desirable to maintain an American tire-rebuild specialist as a permanent staff member at this facility. In his opinion, it is difficult to assure compliance with rigorous standards of quality without having an American observer present. Conversations with other members of these technical missions indicated that they had reservations about the willingness or ability of some Pacific peoples to match the Japanese in the absorption of new technical and managerial skills. These comments, which apply to Korea, Taiwan, the Philippines, and other Pacific areas, should be understood in terms of their limited exposure to industrialization, and the recency of American tutelage in advanced technical matters.

Another American informant, who had been assigned to a Chinese marine radial engine rebuild facility, was critical of the in-country performance both because of the technical adequacy of the work and the bureaucratic processes that led to duplication of facilities.[1] One should note that the American members of the Tokorozawa visiting teams were prepared by their experience in Japan to criticize anything that was short of the Japanese propensity for improvement which in itself was little short of revolutionary. One observer noted that, in contrast to all other Pacific people, the Japanese operated with great avidity in learning techniques, taking elaborate notes and meeting together to compare these notes, operating "a little like industrial espionage." In contrast to other Pacific peoples, all agreed that the Japanese have a deep thirst for knowledge---even to the point that they had "academic minds and were deep thinkers," and thus sometimes a bit disadvantaged in practical matters. Koreans and Chinese also are thought to have an edge over others in the Pacific in their propensity to borrow and absorb technology.

In 1965, the Center began, as they called it, to "get into the AID business." That is, they took on missions in

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[1] Interview, Tokorozawa, July 20, 1965.

support of the Economic Aid missions rather than solely military assistance support. AID obtains a great deal of surplus equipment which requires maintenance. Since the AID missions are not familiar with supply and maintenance, they turned to the military for help, and agreements were worked out between AID and the Department of Defense in which the latter made technicians available. The U.S. Army Logistical Center in Japan was called upon to furnish such assistance in the Pacific areas, and, in doing so, again became a vehicle of instruction and technical transfer. Moreover, the activities of the Center in support of AID economic assistance became even more general, as when they set up some sort of techno-economic system. The installation of a supply and maintenance records system for the Bureau of Public Roads, Vientiane, Laos, is an illustration of this more generalized support of economic aid. This system was set up by teams working out of the Army Center in Japan.[1]

[1]The two missions were coordinated at the national level, according to Principles of Foreign Economic Assistance, Washington, Agency for International Development, 1965, pp. 43-44. "The Foreign Assistance Act of 1961 made the Secretary of State responsible for the supervision and general direction of the entire foreign assistance program, including military assistance. In those countries receiving substantial military assistance, the planning of U.S. aid takes into consideration the comparative costs and benefits of alternative combinations of the two types of assistance in order to maximize the program's total contribution toward both security and developmental goals. The two forms of assistance are often mutually supporting. Improved military security contributes indirectly to increased economic productivity and civilian investment; economic and social growth often increases the effectiveness of counterinsurgency and internal security programs. Military infrastructure or technical training programs contribute directly to increased civilian output, and civilian transportation investment directly assists military logistics. Coordination and the minimization of possible conflicts is particularly important at the country level, where it is accomplished by mutual examination of programs by AID missions and military assistance groups." However, under the "split and shift" concept of 1966, retrogression seems to have occurred, and the two forms are split apart again. U.S. Legislative Reference Service. What Should Be the Foreign Aid Policy of the U.S.? (Washington, D.C.: Government Printing Office, 1966), esp. pp. 81-87.

The reverse of this team outflow of Americans is a stream of visitors or visiting teams from the Pacific countries to the Center. This activity of training visiting teams usually under MAP assistance funds is not, of course, confined to the Tokorozawa facility, but is carried on by operational units of the Armed Forces throughout the Pacific. Thus an account of various training activities of military organizations in Korea describes a three months on-the-job training course for a ten-man Viet Namese supervisory team in automotive ordnance which was arranged by the MAAG unit in Viet Nam.[1] But the Tokorozawa organization is a prime source of expertise for the Military Assistance Missions. In fact, some people have referred to the installation as a MAAG's MAAG, because its primary mission is the control of inventories and the provision of backstopping training in support of the friendly countries of the Pacific. For this reason, it has built up much expertise and its personnel know much about the problem of transfer of technology under military auspices.

Care and Preservation. Within the Tokorozawa installation, one of the divisions is of special interest as a transferor of technique and practice. It has interest because care and preservation is an area in which the Japanese themselves had very little experience. The installation was set up to care for the stockpile of rebuilt vehicles after the Rebuild program was shut

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[1] Pipeline (Army Newspaper of the 7th Logistical Command, Korea), October 3, 1960, p. 3, 6. The same issue describes six medical officers from Viet Nam arriving for training in a military hospital in Korea, Ibid., p. 7.

down. These amounted to perhaps 100,000 vehicles at the beginning, and vast quantities of parts and components were involved. Deterioration would have occurred without care and preservation. Under the direction of an able American industrial engineer, with a dynamic leadership quality, a large staff of Japanese was employed to process the care and preservation of vehicles under efficient and sophisticated conditions of modern mass production. This American organized a key group of 10 to 12 interpreters and key men to whom he gave management responsibility for the carrying out of the program. He established clear lines of authority and backed up his Japanese managers in their decisions, thus eliciting a high degree of loyalty and an excellent productivity record. With hundreds of workers, his ratio of the use of American supervisors to local nationals was very low, averaging about 1:100.

While the unit has interest for its skillful handling of Japanese managers, and the consequent build-up of an efficient organization in Japan itself, also important is the conveyance of technology through a kit system given to visiting teams from the Pacific countries. This kit was given to a visiting team which received instruction in care and preservation techniques. Known to the unit as a "Fuller brush man kit," it contains types of materials necessary to care and preservation, information on where to get them, in what quantities, and how to use them. Instructions for the timing of the operations and for the procedures to be followed were also included, together with an estimate of how long specific treatments were likely to last. Workloads were related to cost figures for estimating purposes. Many pictures of the operations and steps to be taken were included. In 1965, 75 kits had been given away to Pacific country teams. This kit exemplifies American ingenuity in conveying technology efficiently under simplified conditions.

KOREA

There have been military-induced transfers in Korea. The presence of a large troop build-up has had the same demonstration effect type of impact as in Japan, but, in addition, there has evidently been some attempt to cultivate the technical transfer through planned cooperation programs with the American troops. Some illustrations, taken almost at random, may be given. Thus, an Army newspaper reports that the ROK Army, with the help of American units, was embarking on a 5-year program to build hard surfaced roads. Korea provides the troops; the U.S. Aid Mission, USOM, provides the funds; and units of the U.S. Eighth Army provide construction materials, machinery, asphalt, and technical assistance.[1] The same newspaper describes joint monthly meetings of a U.S. Dental Detachment with the Inchon Dental Society for the purpose of planned exchange of dental techniques and methods.

<u>AFAK Program</u>. Probably the programs cited were part of

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[1] <u>Pipeline</u>, <u>op. cit</u>., p. 5.

the Armed Forces Assistance to Korea (AFAK) program. Since 1954, there have been many other spontaneous activities of the U.S. troops which provide technology and know-how.[1] But the AFAK program constitutes a forerunner of modern civic action programs, which, though small in dollar value, have had technical transfer content. The program provides construction materials for schools, orphanages, hospitals, health centers, bridges, libraries, dams, waterworks, and other public facilities. It is jointly funded, with the U.S. providing about one third and the Koreans two thirds of the cost. The U.S. side donates construction materials, technical advice and assistance, surplus equipment, and makes loans of military equipment. Over 5,000 projects have been completed, at an estimated value of $79 million (see Table 8). The program is a planned attempt to provide good community relations, but the interaction of technically-trained men with Koreans in a people-to-people situation yields a direct demonstration effect, upgrading technology.

As in Japan, training, both informal and formal, for persons employed by the U.S. Forces is widespread in Korea. Thus, the 7th Logistical Command held a management seminar for 15 Korean employees in which instruction was given in management improvement, and organization analysis. Such seminars in Japan

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[1] One hears stories of G.I.s from farming areas who volunteered their weekends and spare time to teach Korean farmers modern farmers' techniques.

Table 8

AFAK Summary

FY	Projects Completed	Total Cost
1954-58	4,129	$65,665,300
1959	202	2,908,300
1960	196	2,069,800
1961	168	2,069,600
1962	273	1,965,200
1963	244	1,911,600
1964	279	1,310,700
1965	91	902,900
1966	3	280,500
TOTAL	5,585	$79,083,900

Source: Headquarters, Eighth Army, Korea.

had been held ten years earlier, but this seminar in 1960 was hailed as a first for Korea.[1] Quality control seminars have also been undertaken in Korea under AID (USOM) auspices, but there is good cooperation between AID and military activities.[2]

<u>Procurements in Korea</u>. U.S. procurements in Korea have been substantial. Reference to the table of Western Pacific

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[1] <u>Pipeline</u>, <u>op. cit</u>., p. 7.

[2] Proceedings of the First Quality Control Conferences in Seoul, Pusan, and Taegu (Seoul: Washington University Project, USOM-K, 1962) v.p. in Korean and English.

procurements (Appendix VIII) shows that procurements have averaged around $35 million per year, through 1965, and are about 17 or 18 percent of all Army procurements in the Pacific area. The following table gives the breakdown of these procurements in Korea since 1959:

Table 9

U.S. Army Procurements in Korea ($ millions)

Year	Total	Supplies	Services	Construction
1959	31.4	8.1	21.6	1.6
1960	36.0	11.0	20.7	4.3
1961	34.8	12.2	17.9	4.7
1962	37.8	14.0	20.1	3.7
1963	34.3	10.0	21.2	3.0
1964	34.9	11.7	20.1	3.1
1965	32.5	11.7	17.7	3.1
1966	49.2	24.6	20.4	4.2

Source: U.S. Army Korean Procurement Agency

The procurement activity in Korea began about 1956. At first there was procurement only for the MAP program and the ROK army, but today there are many procurements for U.S. use. Also at the beginning, contractors had to be urged to join, but in the summer of 1966, there were approximately 750 bidders of which 550 were "active", accounting for $49 million of procurements.[1]

[1] U.S. Army. Korean Procurement Agency.

Generally, today, the procurement authorities make every effort to procure in Korea, but this represents a relatively recent policy. The same sort of improvements through inspection, testing, and quality control found in the Japanese case are also evident in Korea. Cast iron pipe, for example, has been improved to the point where it is now acceptable to military procurement. Many simple procurements have been made in the automotive industry, where quality has improved consistently until, as in tires, for example, an export capability has been attained. This capability has been achieved frequently through the extra efforts made by American inspectors to improve the quality of the product.[1]

In 1965, a big contract for jungle shoes was awarded to Korean industry. It is reported that the U.S. commanding general in Korea made a strong representation that Korea rather than Japan be used as a source of these jungle shoes. Many people also feel that gold flow restriction, coinciding with the incipient build-up of these procurements, has hurt Korea's industry just as it was getting into stride. Yet Korean industry has been expanding in recent years, and the military procurement record has played some role in building it up. Thus, a New York Times account of a Korean electronics

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[1] Spencer, Kyklos, op. cit., pp. 468-470. The personality and the character of the U.S. personnel affects the outcome. Checking the cases of two technical sergeants with procurement personnel, it was pointed out that one gave the Koreans enormous help, while the other was usually drunk. Product excellence varied accordingly.

firm's success notes that it secured a U.S. contract in its formative stage, and today is a show-place firm.[1] While overshadowed by Japan, Korea has been following the same course of borrowing valuable technical know-how from the presence of the U.S. military forces in their country. Moreover, the good working relations between the AID people and the military there make the Korean picture more significant in some ways than the Japanese.

Impact of Viet Nam. The Viet Nam War is providing a boom to Korea similar to the impact on Japan of the Korean War in the early 1950's. The differences, however, are marked. For one, the magnitude of the impact is smaller, both because of the "buy American" policy (protection of the U.S. balance of payments policies), and because the business is distributed, with some calculation, to other Pacific countries. For another, the Korean economy has a less well-equipped industrial base than Japan of the 1950's, although, at that time, Japan's base was still partially destroyed. Furthermore, Korea's present economy is relatively prosperous and close to full utilization, thus offering Korean businessmen less incentive to bid on military contracts. Balancing these considerations, unemployment in Korea has made possible the export of workers to Viet Nam, the remittances from whom are currently estimated

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[1] The Gold Star Co. (Kim Sung) at Pusan. New York Times, December 5, 1965, Section 3, p. 11. The Koreans received training from the Japanese in this enterprise. Thus, they received technology at one remove from the U.S., it may be said, since the Japanese had acquired the technology themselves only a short time before, often under military auspices.

at $40 million annually.

Moreover, there are Korean procurements for Viet Nam. During the fiscal year 1966, a total of $12,689,000 was procured. Important items included uniforms, clothing, transformers, cast iron pipe, cement, crushed rock, plywood, tires, tubes, ponchos, beer, and other items. Yet an analysis made by the procurement authorities showed an even greater total for contracts "missed", or not awarded for one or another reason:[1]

Reason	Value of Contracts
Not low	$ 7,679,500
No bid	901,800
No response	2,443,200
Other reasons	2,981,400
Total	$14,005,900

Thus, while there are increasing efforts by Koreans to obtain more Viet Nam business, the industrial response appears to be lagging.

Part of the problem is lack of conformity to required standards. Failure to understand and appreciate the need for rigorous military specifications and high quality, in contrast to Japan or even Taiwan, is evident. Thus, the Korean Export

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[1] Korea. Ministry of Commerce and Industry. Status of Korean Economy and Military Supply (As delivered to Department of Defense Team on January 17, 1966). 37 pp. mimeographed. Section IV includes Proposals to the U.S. for obtaining more favorable procurement status for the Viet Nam War.

Inspection Observation Team reports that one Korean industrial leader insisted:[1]

> that visual inspection alone was entirely adequate for a product that was already in trouble in Viet Nam markets, and, anyway, who is going to notice during the war what is going on down there?

Yet at a comparable period of the Korean War, rejection rates of Japanese-supplied items ran very high for similar reasons. It is to be expected that the Koreans will learn fast under the pressure of military rejections and the encouragement of U.S. Government teams.

The Korean Armed Forces. The American military techno-economic impact in Korea is more explosive in the effect it has on the 600,000-man Armed Forces which, in turn, influences the Korean economy. The Korean Armed Forces have developed in the image of the U.S. Forces, and military upgrading of Korean civilian production takes place in a manner similar to that induced by the U.S. Military presence, but at one remove, and with, perhaps, some dilution of technical rigor. The Korean Armed Forces serve as a training ground, teaching peasants and youths from city slums the elements of modernization. Members of the Armed Forces often learn the most up-to-date technology in skills which have lifetime value. About 180,000 inductees annually are processed through training schools modeled on the U.S. pattern and staffed by some of the 14,315 men trained in

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[1] N. C. Beck, Report by Korean Export Inspection Observation Team (Seoul, Korea: USOM, 1966), mimeographed, p. 6.

the U.S. since 1950. The range of skills is virtually coincidental with that found in the economy as a whole, or as a Korean study observes:[1]

> Ranging from a design of a steel bridge to sewing a uniform, and accounting and bookkeeping, there is nothing that is not taught in military service.

The same source notes that, as of 1964, there were 1.96 million youths in Korea who had been trained in the military service. This figure is about one-third of the labor force and is being increased by 200,000 men who leave the services annually.

The activities of the ROK Air Force may be taken as representative of the conveyor belt of U.S. technology moving first from the U.S. military institution to the Korean military man, and from him to the Korean economy when he and/or those he has trained, leaves the service. The Korean Air Force was trained from its early days by the U.S. 6146th Air Force Advisory Group.[2] This American advisory group sent thousands of Korean officers and men to the United States to learn essential military skills (usually with a counterpart civilian skill). When these men returned to Korea, they became managers of key activities or

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[1] Hai-dong Kim and Kyong-dong Kim, Survey Report on Ex-Servicemen's Role in Social and Economic Development of Korea (Seoul: R.O.K. Office of Veterans Administration, 1965), manuscript, pp. 2-3. This report lists 10 pages of training schools, but is not sanguine about the impact of the Korean ex-serviceman as related to his post-military occupation. However, the authors blame this on the poor classification system and inadequate economic development (see p. 91).

[2] The unit was fathered by Major Dean Hess who wrote the book, Battle Hymn (New York: McGraw Hill, 195[illegible]), a description of those early days.

instructors in technical schools. In turn, these managers and instructors trained thousands of earnest students in the dedicated and disciplined ROK Air Force.[1] In addition, American instructors set up courses and taught them one or more times, until the Korean counterpart instructor felt sufficiently confident to do the teaching. In these ways, technical training was multiplied many times in the ROK Air Force. Little dilution of content has been experienced in the process, because the course contents have remained invariant, being taught with the same manuals, training aids, and equipment as used in the U.S. schools, and also because U.S. Air Force advisors have remained in residence, constantly checking, and even improving, the curricula with late changes from U.S. practice.

Some specific data will serve to illustrate these points. The principal training facility of the ROK Air Force is at Taejon, where the combined training schools give 164 courses and annually process over 17,000 students, of whom 6,500 are in technical trades. The following table gives a breakdown of courses, enumerating specialties and range of the duration of the courses in months.

It is estimated that 60% to 70% of the men trained in the Air Force return to the Korean economy immediately following their term of service, which is four years. For professional

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[1] American advisors refer to ROKAF as "gung-ho," an expression meaning all-out in cooperative effort and spirit.

Table 16

Courses in Taejon Center

Specialty	Number of Courses	Duration(Mos.)
A/C Maintenance	33	1-14
Armament	12	4-15
Mechanical Engineering	5	8-26
Power and Transportation	7	6-14
Installation	6	4-20
Utilities	10	4-19
Supply	6	4-10
Personnel and Administration	5	4-8
Air Traffic Control	6	8-18
Aircraft and Warning	3	8-9
Weather	5	14-24
Communications	7	18-20
Radar and Radio Maintenance	31	4-32
Wire	6	16-18
English Language	7	6-12
Basic Military	15	6-16
Total	164	

Source: Data provided by the Commanding General, Taejon Training School.

officers, to keep the Force young, strict observance of the twenty-year retirement rule is followed, making highly trained men available to the economy systematically at a relatively early age. A large proportion of officers were trained in the U.S. or in U.S. facilities in third countries, and, on retirement, are to be found in many managerial positions throughout industry, and in the universities. Not only is the Korean Airline dependent on this source of supply for pilots and all support technicians, but these ROK Air Force veterans are found holding strategic positions in every area of the economy. Even where they do not use the precise skill they have learned, there is an enormous transfer of the infra-structure of modern technology, such as the understanding of management, procedures, logistics, quality control, and the need for speed, accuracy, and cost minimization.[1]

<u>Taegu Aircraft Repair Depot</u>. The Korean military services themselves use trainees in depots, or in-house factories such as the Air Force Repair and Rebuild Depot at Taegu. A visit to this depot makes one feel as if one were going through a modern airplane factory in the U.S. It is overwhelming to find well-laid out hangars, production lines, and modern equipment for such advanced jet technology in a relatively underdeveloped country. Equally impressive are the production statistics of airplane and engine rebuild and repair, (See Table 11). Other untabulated support activities of the Taegu Depot include work on U.S. Eighth Army planes, civil police equipment, and some work for the Korean Airlines, and other minor customers.

The impressive nature of this activity is recognized when it is recalled that only a little more than ten years ago Japan was beginning to rebuild jet engines for the U.S., and was negotiating contracts for the assembly and manufacture of jet

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[1] The General in command at Taejon in 1966 had, in the interest of cost saving and cost consciousness, forced all his officers to go by bicycle, purchased at their own expense, rather than consume precious gasoline. Such cost savings were transferred to numerous important, but slightly supernumary, items such as a long delayed construction of an athletic field.

Table 11

Taegu Aircraft Engine Rebuild
(through July, 1966)

	Year Activated	Total Since Beginning	Yearly Average
Jets	1963	143	48
Reciprocating	1956	797	80
Total		940	128

Aircraft IRAN
(Inspection and Repair as Necessary)

Jets	1960	232	39
ROKAF Conventional	1955	156	14
ROK Army A/C	1956	463	46
Total		851	99

Source: ROK Air Force Taegu Depot.

aircraft by private Japanese companies. Yet it is precisely in this latter point that Korea lags. Its capability is in the military arsenal; there are no signs of the spread effects to the civilian aircraft industry as in Japan.

However, there are strong industrial spread effects through the training of personnel who go into the economy. The ROKAF Colonel in charge of the Taegu installation has had fifteen years in the Air Force, seven of which have been spent in training courses either in the U.S. or in U.S. installations in third countries (e.g.,Okinawa). He is very proud of his "factory," and boasts of future production plans for expansion, but on being questioned on his personal post-service plans, his orientation is away from jet technology. Fertilizer or textiles seem promising areas, but he has no interest in developing a civilian jet industrial capability of any kind. His case may not be typical, but it suggests that the military training spillover is more generalized than specific. It also points up the losses which occur when there is no private industry into which this highly-trained man might go.

TAIWAN

The spectacular growth of Taiwan's economy at an average annual rate of 7.6 percent over the period of 1951-1965 has attracted wide attention as a performance only slightly less than Japan's high growth rate.[1] There can be no doubt that the following factors played an important role in this growth: (1) the energy of the people; (2) the prior base laid by the Japanese: (3) the stability of the government; (4) wise policies freeing the private sector from excessive control, and (5) the role of intelligent U.S. economic aid. To this list, however, should be added the military sector, which played an important positive, though neglected and even derided, role in this growth.[2] The military contribution stems from both the presence of the U.S. Military organizations and the large indig-

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[1] Neil H. Jacoby, An Evaluation of U.S. Economic Aid to Free China, 1951-1965, Agency for International Development, 1966, p. 22.

[2] Ibid. As usual in such conventional wisdom, the military "burden" is featured prominently, with little or no attention to the kinds of positive military contributions set forth here. At minimum, the unemployment rate would have been much higher, and aggregate demand that much less had it not been for the big military force.

enous nationalist armed forces of about 600,000 men.

Under the first category, the American military presence was represented by the Military Assistance Group in Taiwan, which was for a long period the largest such U.S. group in the world, numbering as high as five thousand personnel. Its dispersed locations in the capital and throughout the relatively compact space of the island made possible a continuing demonstration of American practice. For example, hotels were placed off limits because of the lack of adequate fire escapes, and eating and drinking places were condemned because of failure to boil water for drinking and ice-cubes. Instant remedying of these faulty standards followed. In addition, American procurements had similar impact in raising standards as is found elsewhere. Thus, procurement of fresh fruit and vegetables for the 7th Fleet entailed the same sort of upgrading through military standards as happened in Japan.

But the big impact of the U.S. military assistance was indirect. Military assistance efforts operating on the Chinese Armed Forces had a big effect through the provision of equipment, standards, and training. The total military aid for 1950-1965 extended to Taiwan was $2,169,000,000, one of the largest amounts extended to any nation.[1] A large proportion of this amount went for military equipment for the Chinese military

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[1] U.S. Department of Defense, Military Assistance Facts (Washington, D.C.: May 1, 1966), pamphlet, p. 15.

forces, providing an immediate on-the-job training impact in the use and operation of the equipment, with notable after-effects. Thus, most drivers of Taiwan's burgeoning taxicab fleet are veterans who received their training in the service with American-furnished automotive equipment.

Arsenals and Procurements. More important from a technical standpoint was the continued maintenance and overhaul of this equipment, which offered a huge training ground for the Chinese military in modern technique. Huge arsenals were built rebuilt, and rebuilt again, also thousands upon thousands of tanks and other "shooting" vehicles. Similarly processed were trucks, jeeps, and all kinds of specialized support vehicles such as ambulances, cranes, derricks, fork lifts, and so forth. While these Chinese arsenals came from the Mainland, modern production lines were established in the 1950's by military assistance officers and American engineers attached to Military Assistance. As the Chinese became adept, American military and civil assistance gradually withdrew from operations, until today very few Americans are stationed in the plants.

Today, the vehicles are remanufactured or rebuilt in simple line or bay-type operations, unlike the large volume production lines of the World War II "Roll-ups" in Japan of the 1950's. However, a high level of skills was often involved, as for example, in foundry work, hydraulic mechanics, or electrical work. Hundreds of parts have been manufactured in these arsenals, and there is even a modest research and development program.

For example, in one arsenal visited by the author, an experimental land mine detector was being developed, probably copied from Fort Belvoir in the opinion of American engineers present.

The spillover effects on the civilian economy are readily apparent. Thus, though Chinese Government policy is aimed at self-sufficiency of its arsenals in view of its reiterated purpose to return to the Mainland, the arsenals have been procuring more and more from the local Taiwanese economy. This trend has been accelerated by the gradual attenuation of MAP assistance in buying parts in the United States, as well as the "nudging" of the American military personnel to let private enterprise take over more productive activity.

The impact of procurement activity on the civilian economy works through military specifications, inspection, testing, and rigorous rejection rates. The Chinese Army specifications are largely copies of U.S. specifications, and the U.S. military assistance officers follow the progress of procurements and render strategic assistance in providing American facilities to improve the quality. A quotation from an American military assistance officer's report on locally-procured battery cases for in-house production in one of the Chinese arsenals shows the concern for rejection rates and the U.S. Military's determination to do something about it:

> The rejection rate for leakage, the normal reason for rejection of battery cases, was 20.4% in 1964, 24.8% in 1965, and has been 24.6% in 1966. Locally procured cases are being tested in USALCJ to find out what improvements are required by the manufacturer to reduce the rejection rate. It is of interest

> to note that the local contractor is required to replace all rejected cases at no cost to the Chinese Army.

The USALCJ abbreviation refers to the U.S. Army's Logistical Center in Tokorozawa, Japan, discussed earlier in the chapter. The back-up function provides U.S. technical research of a high order in ascertaining the difficulty and "straightening it out." These rejection rates were said to have fallen from over 50%, but the persistence of the over 20% plateau evoked American action.

Chinese statistics are not readily available on such matters, and the calculation of percentages of dependence on local procurements by arsenals was not a popular pastime, in view of the Chinese military's desire for self-sufficiency. However, in one arsenal visited, officers estimated that about 11% of the components were locally procured. Again, in a large rebuild program of Chinese Navy LST ships the proportion of sub-contracting for a wide range of industrial items was given as 25%. This program was carried on by the Taiwan Shipbuilding Company, a state-owned enterprise closely associated with the Chinese Navy, though not an arsenal, and the extent of subcontracting was probably exceptional. The officials were attempting to introduce modern quality control methods and establish a "Qualified Products List" of manufacturers who had adequate quality control.

With the acceleration of the Korean War, there was an increase in procurements both on direct military account, and for private interests involved in the War. In 1966, a special

Army purchasing agency was set up on Taiwan, but representatives from Viet Nam (both U.S. and Viet Namese) also continue to buy directly in Taiwan. The impact of high military standards has occurred through what might be termed "learning by object lesson." A blow-up and U.S. Congressional investigation following the discovery of "defective, shoddy lathes" supplied to Viet Nam, served to give the Taiwan Chinese a stern lesson in the need to manufacture strictly to specifications.[1]

Construction. The work of the Chinese Military Construction Bureau is a good illustration of the effect of military procurement in an important field--that of construction of buildings, airports, and other public structures. Here, the effect of higher American design practices, standards, and specifications operated directly on those units in which American military assistance funds were involved in some way, but there was also an indirect impact of American practice in the general construction program. According to the responsible engineer of the U.S. advisory program, construction drawings during the early period of the American advisory presence (1952-1955) were incomplete, non-standard, confusing, and lacking in construction details. It was generally assumed that the contractor understood what was wanted and would provide the end-product somehow.

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[1] Senator Birch Bayh of Indiana and Congressman John E. Moss of California held hearings on this case in Taipei.

Beginning in 1956, improvement was made which has continued to be present. Drawing sizes, title blocks, and drafting symbols were standardized, and construction details worked out and included in the drawings. Basic specifications were initiated and have been continuously refined. The effect of the Military Advisory Group's training on the ability of the Chinese Military Construction Bureau to devise and execute a program of construction was appraised in the following terms. Comparing fiscal year 1963 program with that of the 1966 program, the Chinese design capability was estimated to have increased over 100%.[1]

If the effect on the obligating authority was impressive, the upgrading of the actual construction practices was even more so. In 1952, the construction contractor did his work with primitive equipment and primitive methods, and often ignored

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[1] Details of the estimate are as follows: The FY-63 program was NT* 220,000,000, of which almost fifty percent was contracted out to architect-engineer firms. MCB accomplished the balance of NT 121,000,000, but the design and obligation of funds took 18 months (down from 2-3 years in former years). The American engineer in charge, therefore, estimated the Chinese ability for work in FY-63 as established at NT 81,000,000 annually. The FY-65 program was accomplished in 14 months, while the FY-66 program was designed and obligated in the 12 months of the year. The personal strength between FY-63 and FY-66 was reduced from NT 20,000,000 to NT 8,000,000. The Military Construction Bureau designed work in the value of NT 100,000,000 during FY-66 with one-half the personnel required to design NT 81,000,000 in 1963. Thus, it may be concluded that the design capability had increased over 100% in three years -- Engineering Division, MAAG, China.

*NT means New Taiwan currency, NT40: $1.00.

sophisticated practices which meant the difference between usable and non-usable results under modern conditions. Thus, in the construction of airfield runways, ignoring the use of ungraded, unwashed aggregate resulted in small stones flying up into the intakes of jet engines under the impact of aircraft landings.

The Military Construction Bureau on Taiwan was furnished with a complete set of U.S. Corps of Engineers Guide Specifications and copies of practically all of U.S. standards such as ASTM and Federal Specifications. Better work methods followed these higher specifications; some of them are specifically footnoted below.[2]

Discussions with the U.S. Military Engineers' Office on Taiwan revealed that the upgrading of specifications calling

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[2] Methods as follows: 1) Mechanical vibrators instead of hand rods were specified. 2) Aggregates were required to be washed and properly graded. 3) Crushed aggregates became mandatory for certain type projects. 4) Membrane curing compounds were specified to improve curing of concrete (these compounds, used instead of earth or water, seal and retain water, guaranteeing a pure concrete and cutting costs an estimated 30%). 5) Sawed joints were specified for jet pavements. 6) Hand screeding operations were improved (simple change to a sliding method from a former "bouncing" type). 7) Excess handwork on concrete finishing was discouraged. Forms were requested to be properly aligned and keys accurately placed to prevent cracking. 8) Improvements were made in bonding, tieing and placing steel. 9) U.S. electrical, mechanical and electrical codes were introduced progressively; methods of installing sewers and water pipes were improved. 10) Improvements were made in plastering, setting blocks and bricks, and surface finishing. 11) Laying tiles, terrazzo work, suspended ceilings were improved (previously 20% of tiles on an average job had to be redone). 12) Soil investigation and control of job materials was initiated (MCB Soil Laboratories are now equipped with the latest books, equipment, and U.S. Standards and specifications).

for tighter practices in materials, work methods, and equipment, among others, produced two important effects: (1) higher quality products and (2) decreased maintenance. The higher quality product in the construction industry often comes about through increased project life, largely through changes in the type of construction (by shifting from wood to concrete), as well as through decreased maintenance costs. Thus, in 1952, the typical building was of timber construction. In 1956, it became apparent to the Americans that these wooden buildings were deteriorating because of lack of maintenance and failure to use preservatives prior to placement. Full concrete construction was therefore substituted. In 1963, a survey was conducted of 20 timber structures, about eight years old. Four were already not usable and the remaining sixteen would cost about 70% of the original value to restore. It was estimated that these buildings might last another two to four years without maintenance, to a maximum of twelve years of life.

Comparable concrete structures without maintenance would take about twenty years to arrive at the same point of deterioration. The engineers estimated conservatively that eight years were gained by substituting concrete, a 75% increase in building life or in its economic value.

Another increase in economic value through upgrading building specifications for higher quality results from decreased maintenance costs. On Taiwan it costs about 45% of the value of a concrete structure to maintain it for 20 years in contrast to a 100% value of maintenance for timber. Thus, it may be estimated that there has been 55% savings by eliminating timber, or put another way, the yield of the concrete building is more than double that of the timber. Timber construction financial costs were previously lower than concrete, but with the switch to concrete, have now become slightly higher. Use of concrete depended on the development of a concrete manufacturing capability, but the decision to demand concrete in military specifications was one of the deciding factors evoking that capability.

Training. Largely unrecognized by the authorities, the military impact on the Taiwan economy of the U.S. military assistance program, multiplied, in turn, through the Chinese Army's training program, created a massive input of technically-trained personnel to the civilian economy. It is not possible to describe the many occupations in which the Chinese military were trained in the U.S., or on some U.S. ship or base outside the U.S., but the following sample of electronics training given by the U.S. Navy will serve to typify technical transfer in a skilled area with obvious civilian spillover.

This is only one of twenty-six major subdivisions covering a thousand occupations, most of which were quite technical in nature. In the years from 1955 to the present, Navy MAAG records show that 2,286 Chinese were trained in these specialties in the U.S. or U.S. installations.[1]

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[1] The other services are not included in this sample.

Table 12

Electronics Training in U.S. (Navy)

		FY Period	No. of People	Avg. Length of Course (Mo.)
A.	Electronics Officer Course (Admin.)	57-59	5	4
B.	Electronics Officer (Maintenance)	54-63	18	1.5
C.	Electronics Technician (ET) Class "B"	56-63	45	7
D.	ET (Sonar)	55-57	5	11
E.	ET (Radar)	55-57	6	6
F.	ET (Communications)	55-60	9	8
G.	ET (Testing Equipment Repair)	61	1	2
H.	OJT Radar Maintenance and Repair	61	2	2
I.	OHF Course	56-57	4	6
J.	TOZ/RDZ Maintenance	56	12	2
K.	FT Class "A"	55-60	44	5
L.	FT Class "C" (MK10) (IFF Maintenance)	59-62	9	12
M.	FT Class "C" (MK 37)	54-57	9	25
N.	OJT Fire Control Shop	57-63	36	4
P.	AN/SQS-17A Maintenance	66	3	3
	Total	54-66	202	5 (Avg. of all courses)

Source: MAAG, China.

How did this U.S. training multiply itself in the Chinese context? To calculate a rough effect, the training of the Chinese Army may be used. Based on an Army sample of an ordnance school which shows 34 courses given with a 1965 output varying from 840 per year in the case of drivers to 20 to 30 in the more skilled occupations, a heuristic calculation may be made. If we assume that the Chinese Navy trains annually in only half of the 1000 naval occupations mentioned above and that they train an average of only 20 persons a year in each occupation, then based on the ordnance sample of the most skilled, the aggregative effect would be to train 10,000 a year (20 X 500) or 100,000 persons from

1956 to 1966. Obviously, the other military services played at least as important a role, and tripling this 100,000 figure, the resulting impact of, say, 300,000 trained men is clearly a substantial one. Of course, not all these men survived or will survive to enter the civilian economy, and not all had transferable occupations, but if we assume half of these men are alive and half of their skills were transferable, as a first rough approximation, it is fair to estimate that the small economy of Taiwan was or will be enriched by 75,000 men with skills derived from the U.S. military aid program and from the "burden" of the Chinese Army's training. This crude calculation is merely for illustrative purposes; extended research could specify the training impact more accurately.[1]

Quantity is not the only measure. Strategic and qualitative inputs are at least as important. Thus, the production manager of the Hue Loong Automobile Company, the only source of domestically-assembled cars, jeeps and trucks on Taiwan, is a former Air Force Colonel trained in the U.S. in line production methods at Curtis Wright. His staff of 10 former Air Force officers also were U.S.-trained. The number one and two (president and vice-president) of the China Airlines are both men who came through the Military Assistance programs,[2] and one

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[1] The author has research in progress designed to give more precise aggregative estimates of military training's influence on the civilian economy of the recipient country.

[2] Formerly a Major-General Chow and Colonel Ma respectively.

hears numerous stories of men in other critical positions of leadership being graduates of the military assistance training.

More statistically, in a sample from the controllers' field, of 123 controllers trained in the U.S. from 1949-1966, 101 are still on duty and 22 retired to civilian activities as shown in the accompanying Table 13. Thus 16% of the U.S.-trained controllers are retired and using their training in industry. The rest are either keeping books for the Chinese military or are instructors generating more controllers trained in U.S. methods at one remove. In a related area, 59 people have been trained in computer programming and maintenance, but the spillover is not known. These examples could be multiplied, but the Taiwan case clearly shows the military-conducted training has inserted a major technical thrust in many strategic areas of the Taiwan economy.

Other Pacific Countries in Summary. Throughout the Pacific, the military transfer of technology has proceeded in ways similar to Japan. We find the same channels--demonstration effect, on-base training, formal and informal, tie-ins with economic aid, use of procurements, military assistance impact, etc. In addition, Japan itself has acted as a secondary center of this diffusion. Military technologies in the automotive field have been developing in these countries, often, as in the case of tires, as an offshoot of the original Japanese developments. Secondly, Japan has continued to act as a focus

Table 13

Continental United States (CONUS) Trained
Republic of China (GRC) Military Finance
& Comptroller Personnel

1949-1960

Total Number CONUS Trained		123
Number in active duty	96	
Number retired	22	
Number transferred	5	

Distribution of Jobs for Retired Officers

Organization	No. of Persons
Accounting officer, Civil Aeronautics Adm.	1
Comptroller Office, China Air Line	2
CPA	2
Auditor, China Petroleum Corporation	1
Professor in Accounting, Cheng-chih University	1
Insurance company	1
Textile factory	1
Accountant, Grand Hotel	2
Statistical Officer, Taiwan Tourist Bureau	2
Financial Manager, Philco Corp.	1
Ministry of Foreign Affairs	1
Inspector, Ministry of Finance	1
Trading and Taxi companies	2
Unknown	4
Total	22

Five officers are transferred to VACRS* as the comptrollers and finance officers of various VACRS activities.

Source: Controller's Office, MAAG, China, August 9, 1966.

* Veteran's Activities Organization.

for training in military support infrastructure by providing training facilities. Thirdly, Japan, by and large, illustrates the case of a direct impact of the external military presence of the U.S. Forces, whereas the cases of Korea and Taiwan illustrate largely the mediation of indigenous military forces in the process of technological transfer. The U.S. presence in Japan was very large at the beginning and is still substantial. As is known, the Japanese armed forces are relatively small, and without much prestige. In contrast, the military forces of Korea and Taiwan are very large in relation to the respective populations, and the U.S. military presence, particularly in Taiwan, relatively small.

Fourthly, the smaller countries show aptitudes for working with the advanced technologies which are but a step behind Japan. Korea's jet rebuild facility, or Taiwan's military construction, illustrates impressive mastery of technologies via the military channel, which would have been thought incredible for these countries a few years ago. Fifthly, the smaller countries' tendency to concentrate logistic support in arsenals, combined with reluctance to utilize private contractors, is probably an inhibiting factor in gleaning maximum results from the spill-over effects of the military infusion.

Naturally, these conclusions are subject to many caveats. They are derived from the experience of only one part of the world, and, because of the basic cultural homogeneity of the region, reinforced by Japan's previous imperial domination over Korea and Taiwan, there is a presumption of similarity. The cases of more countries, progressively removed from Japan, must be examined in order to gain a sharper picture.

Japan's performance, in some measure, has inspired the other countries by example. This is particularly true for Taiwan where the friction between the Mainlanders and the indigenous Taiwanese give the latter a very nostalgic and friendly view of Japan's former over-lordship. In both smaller countries, the opinion is widely held that Japan's remarkable industrial recovery is based on her opportunity during the Korean War, and Koreans and Taiwanese feel it is a lesson they may apply today. Taiwan and Korea are both seeking economic stimulation from the Viet Namese War, and are again overshadowed considerably by the competent Japanese with their long lead. Yet, the procurements are more diversified today, and new factors enter, such as the large numbers of Koreans working in Viet Nam at American salary levels. These Koreans are sending home large remittances which assist the Korean balance of payments, as well as acquiring enormous know-how from on-the-job training and experience.

Perhaps the most important effect of the U.S. military presence, over the long run, seems to be the training activities of the U.S. MAAGs in the smaller countries. Examples make it clear that personnel of the local armed forces trained in the United States often used the skills acquired in civilian occupations after their tours of duty and discharge from the service. The cases of former officers serving as executives or critical middle managers in strategic industries, such as automobiles, airlines, electronics, and ship-building, exemplify the impact in managerial jobs.

When the U.S.-trained man returned to an instructorship in a service school, his U.S. training was multiplied many times, though probably some dilution occurred. While records are not available in detail, samples such as those from the Controller's office in Taiwan (Table 13) illustrate the importance of such service training for critical civilian positions. At the other end of the scale, the humble taxicab driver or auto mechanic who received his training in the service is the foundation for whole critical areas of a modern technical economy such as effective automobile transportation. In addition, the service-imparted training, whether in the United States or at one remove, in giving recipients a vision of modern organization, management, efficiency, and a host of other impressions, makes him a more decisive element in the emerging technological structure of his country than he was before his training.

Estimates of quantities and values involved must await further research, but it is clear that the U.S. military presence in training, and in other ways illustrated above, has already paid dividends in long-run effects. Three of the more important of these long-run effects have been: the strengthening of the host country's economy, making it more viable and self-sufficient; the development in the host country of a more effective actual or potential source of procurements or trained labor in a crisis such as the Viet Nam War; and effecting cost savings for the U.S.

CHAPTER 6 IMPROVING THE MECHANISM OF MILITARY TRANSFERS

How can the military transfer phenomenon be better captured and canalized? The caveat may be introduced that we need more data to form adequate judgments about such a complex phenomenon. We need more and better data from other countries in the Pacific, and from elsewhere in the world, before we can be certain of conclusions. Yet the data set forth above do yield some reasonably valid propositions which can form the basis for better utilization of the military channel of technology transfer.

It may be wise to begin with the value-judgment assumption that it is desirable to transfer technology from one country to another in an efficient manner via the military channel, or, for that matter, via any channel. This assumption is not as obvious or as popular as might be supposed; some take a negative view of transferring technology. There are people who believe that the developments in the advanced country are the property of that country, and, far from encouraging the spread of technology, think it should be inhibited. Such a technical conservation position in industry, similar to a protectionist position in trade, holds that short-run national interest is more important than any benefits which may accrue from a longsighted, liberal policy of encouragement of the movement of vital factors of production-like technology. This position has some validity--at least up to the point of serious injury to the donor country's capabilities.

But the prevailing American vision is that an open-handed outlay of our knowledge and know-how will be returned to the world's pool of technology and science, with dividends in the long run. We will be beneficiaries of the transferred technology through the future contributions of others as well as through more and better trade opportunities with these enriched foreign economies.[1] Of course, in the short run, we have stronger allies, enhancing the defensive capability of the free nations. Indeed, to the contrary, the national concern over the "technological gap" and the "brain drain" from other countries has promoted the establishment of a national committee, to concern itself with the injuries to other countries by giant U.S. companies and the lead in U.S. research and development.[2]

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1 For the U.S., which has been pursuing an open-handed policy of making technology available to its allies, it is legitimate to ask if a policy of national screening of these valuable national assets should not be established. There are restrictions on the movement of technology to Communist countries, but little has been done about friendly countries, although many of them have set careful screens on the import of U.S. technology (e.g. MITI). Having raised this question, however, it must be acknowledged that it is unlikely that the U.S. would let any screen interfere seriously with its historic concept of international welfare on the basis of free trade in goods, and in productive inputs which, in this case, means the factor of technology.

2 New York Times, November 13, 1966, p. 9. Much of the political argument is based on an O.E.C.D. study: C. Freeman and A. Young, The Research and Development Effort in Western Europe, North America and the Soviet Union (Paris: Organization for Economic Co-Operation and Development, 1965) 153 pp.

Therefore, in a world and in an age seeking mechanisms to improve the condition of technically less advanced countries by transferring technology to them, it behooves us to cast about for effective channels through which to do the job. One hitherto unstressed channel is ready to hand -- the presence of military units of the U.S. abroad. The military is certainly not the only channel available for transfer of technology, but the data from Japan and the Pacific countries suggest that a technical fallout to the local economy accompanies the presence of U.S. military forces abroad. This fallout should be better understood and capitalized upon.

THE CHANGING MILITARY FUNCTION AND JAPAN'S EXAMPLE

The word "military" is associated with negative images of violence and destruction, but, in a world of atomic stalemate and dynamically-changing technologies, the role of the military itself may be changing. At minimum, to use an industrial analogy, are there not by-products of its normal activities which may be made to yield profitable civilian uses? By-products from industrial processes have grown into whole new industries, as, for example, petrochemically-based plastics and fibers, which later became great industries in their own right. May it not be argued, by analogy, that whole new service functions may spring from a military presence in a foreign country? That is, the U.S. military abroad may carry the seeds of an incipient economic aid program in its transfer effect on the local economy.

In the domestic economy, the military institution has long been credited with a creative role in establishing new supply functions which sooner or later spilled over into the civilian economy, resulting in improved production functions. Thus, Mumford notes the impact historically of the standardization of rifle parts on the concept of interchangeability of parts, so basic to much modern industry.[1] There is a question that Eli Whitney actually succeeded in his attempt to make interchangeable parts. Although there is no doubt that he had this concept in mind, his attempt was not successful. More recently, studies have shown that there is a substantial transfer of technology from modern military electronics - for example, in solid state conductor research - to civilian industry. These transfers may range from basic scientific knowledge to specific and complex inventions like the jet aircraft engine.[2]

The data which have been set forth for Japan and a sample of Pacific countries establish that transfer of technology takes place in the international arena, with the operational military as an important channel. A foreign military presence with higher technology, like the U.S., at various points of contact -- demonstration effect, friendship, employment, training, procurements, enforced standards, and military assistance --

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[1] Lewis Mumford, Technics and Civilization. (New York: Harcourt Brace, 1934) p. [illegible]. Eli Whitney's role is described in: B.A. Battison, "Eli Whitney and the Milling Machine", Smithsonian Journal of History, Vol. 1, No. 2, (Summer, 1966) pp. 9-34.

[2] See the literature cited in the Introduction.

conveys technology in many subtle and ramified ways, which spills over into the civilian economy. Much of what transpires happens for some other reason than planned transfer of technology to the civilian economy. One substantial segment is entirely unplanned; and much of the remaining is virtually unplanned in relation to its long-range economic impact. Certainly, with the exception of certain incipient activities such as the economic aid support function at Tokorozawa, or scattered attempts at cooperation in the area, there is little marriage with economic assistance.

The volume for Japan is in contrast to the smaller operations of other countries. The Japanese procurement source is established and relied on by the U.S. Forces. There is much experience with the Japanese because huge numbers of them worked for U.S. installations. Americans know how they react and appreciate their "thirst for knowledge", claiming that they are a unique people with a high propensity to borrow technology. Certainly, they were to begin with, a more developed country than the others -- an "industrial people", military informants are wont to call them.

Yet this difference should not be overplayed. The Japanese economy at the close of World War II was so destroyed that Japan was, in effect, on the level of the least developed country in the Pacific. In the early years of the SCAP period, there was amazement by the U.S. that such a primitive country could have waged the long war which she did.[1] Much of this wonder was justified in the economic statistics. Thus, steel production in the "hot house industry" was a bare three to four million tons annually before World War II, and automobiles were represented by a truck, which was the product of the Graham Paige Truck Factory transported to Yokohama and assembled as it was originally. It is no wonder that Lockwood maintains the thesis of the midpoint country--half developed and half underdeveloped.[2]

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[1] A Japanese professor reports on the feeling of the time: "Six weeks prior to the surrender, I happened to visit the Yawata steel mill, where I found both its coal yard and iron ore depot were empty and the only activities I could see were the growing of weeds. Except for a few electric furnaces, the whole plant had almost ceased to function. Immediately after the end of the war, I made two return trips between Tokyo and Osaka in trains overcrowded with demobilized soldiers. Almost all major cities along the railway line had been reduced to the ground by air raids by U.S. military planes. Small wonder an American newspaper correspondent who accompanied Gen. Douglas MacArthur into Tokyo wrote it was unbelievable that it took nearly four years to defeat such an underdeveloped nation as he found here, which depended upon horses and oxcarts." Prof. Masamichi Inoki, in "Japan's Progress through Peace", Asahi Evening News Special Edition, August 14, 1965.

[2] "The position of pre-war Japan was still quite inferior to that of Western Europe and the United States. But equally it was far above that of most of Latin America, Africa, and the rest of Asia." W. W. Lockwood, The Economic Development of Japan (Princeton, 1954) pp. 79-80. Japan's middle position continues today in some measure and sometimes provides difficulties for her. Thus, referring to the U.N. Conference on Trade and Development, it was said that "Japan came to this Conference as one of the most popular members and now is leaving as one of the most unpopular", one of the reasons being that she sought to be a member of both blocs of developing, as well as developed nations. Saburo Okita, "Japan in the Developing Nations", Contemporary Japan XXVIII, No. 2, 1965, reprint by the Ministry of Foreign Affairs, p. 1-2.

But it is for this very reason that Japan's borrowing record is important and a model for other countries which seek to borrow. The latter have some exposure to the world of modern technology and they have propensities for borrowing technology -- at least on the level of the relatively simple techniques. These foundations may be built on and encouraged. It may be that the high propensity to borrow technology which characterizes Japan is not found in the other countries. If this is true, more care must be taken on the supplier's side, and the U.S. forces' propensity to provide technology, which, while generous in the past, must be intensified. Again, it would appear that what seems to happen as a natural fallout phenomenon of the military presence must be taken more seriously, and capitalized upon.

THE MECHANISM OF MILITARY - CIVILIAN TRANSFER

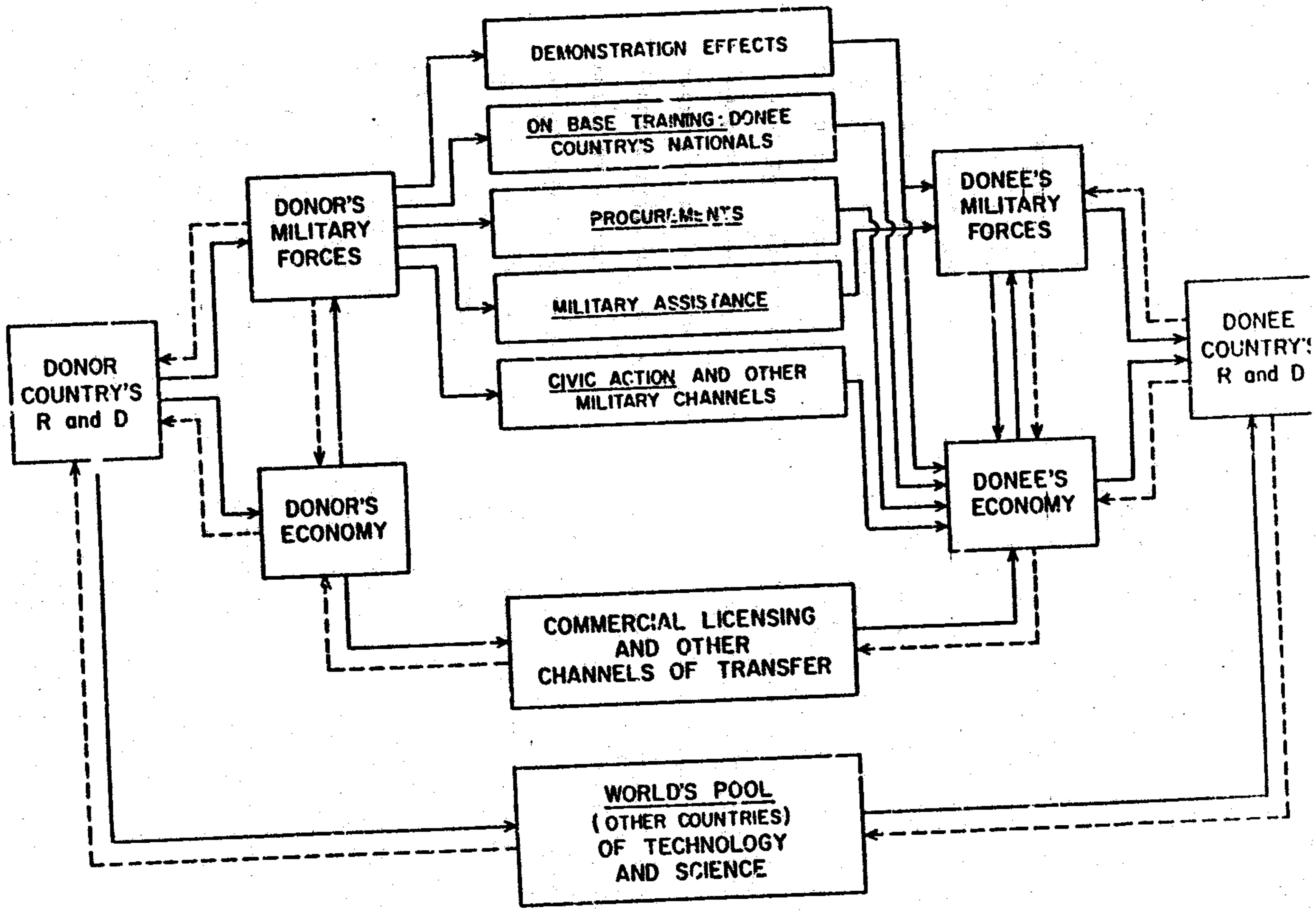
To improve the mechanism, it must first be visualized. How does this military transfer of technology work? What is its relation to the pool of world knowledge, and other channels of transfer? What is its essential structure and dynamic? The process may be understood with the aid of the chart in Figure 4 which shows a partially closed-loop, feedback system, the flow of which will cumulate upward or downward in accordance with favorable or unfavorable conditions for transfer.

The flow of technology under military auspices is derived originally from the donor's industrial system, which is the cumulation of generations of technical practice. For example, the automotive system which went to Japan under the roll-up and rebuilds had a long ancestry and big bulk lead over its Japanese counterparts. Incremental additions to the donor's inherited base are derived from the quantity and quality of an industry's R and D effort. Thus aerospace, electronics, and communications accounted for 60% of U.S. research expenditures in recent years, and these have been key industries in military transfer in Japan. One might say that the Japanese picked up the fruits of this effort under these military transfers.

As the flowchart shows, the flow of technology under military auspices is derived from current industrial practice, or, in the case of advanced technology, from R and D innovations which have come into practice shortly before the transfer. The donor's military forces field test and strengthen (through feedback) the technology. When they go to a friendly country, or provide military assistance to a country, technology is transferred to that country's economy. This transfer may be direct, as in the demonstration effect or in training provided to nationals working on bases, or it may be indirect, through the medium of the nation's armed forces via U.S. military assistance. The nation's economy grows, partially as a result of these technical transfusions, and permits resources to be devoted to indigenous R & D. The latter feeds back to the world pool of technical and scientific knowledge from which the donor may benefit, thus closing the circle. Or the products of technology may come back through international trade.

FIGURE 4

CHANNELS OF MILITARY TECHNOLOGY TRANSFER



KEY: —— FORWARD FLOW.

The size of the flow varies with certain conditions for effective transfer. These conditions may be thought of as general and military. The general conditions will include the propensities to borrow and supply technology discussed in the Introduction, as well as a host of more specific conditions. The size of the market, the number of engineers in the country, the level of R & D and the level of national income are among such general factors. Such general conditions will govern any channel of transfer of technology.[1] Military transfer also will be subject to them, but conditions particular to the military presence and role are of specific interest. Military conditions include such factors as size and duration of the troop build-up or commitment, the quantum and direction of the military assistance package, the size of the recipient's military training program, the latter's personnel retirement policies, the level of procurements, and many other matters peculiar to the military. To enhance the flow by means open to the military forces, each military sub-channel must be examined for appropriate levers.

Recapturing Fallouts. The first military channel is demonstration. When employed by the U.S. Forces, local nationals receive valuable technical experience through the

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[1] For further discussion of these general factors, see D.L. Spencer and A. Woroniak, Transfer of Technology to Developing Nations (Washington, D.C., Air Force Office of Scientific Research, 1966), Technical Report #2.

impact of the demonstration effect. This impact ranges from the most inadvertent happenstance, often outside working hours, to a work situation of largely unintended on-the-job training which is close to planned formal training. Such demonstration effects are pure by-products of U.S. military activities abroad, but are important to the U.S. both in the short and long run. For an area commander and his subordinates dealing on a day-to-day level with local officials, it is valuable to be aware of such beneficial effects and to be able to use them as the occasion warrants. For longer range policy data, and for scientific study, records of such fallouts are also important. It would be valuable, therefore, to better record, catalog, and retain such data. Perhaps some method of alerting our forces to be on the lookout for these transfers might be devised. Troop briefings, forms, and some officer, such as the Air Force's "FTO" (Foreign Technical Officer), might be assigned collateral duty to watch for and report these phenomena.

A positive attempt to recapture something of these fallouts is more likely to succeed as we go up the scale toward more planned and intended transfers for specific military purposes on a larger scale. Naturally, there may be conflicts with security objectives when greater publicity is desired, but a cost-benefit analysis might weigh the gain of a greater release of information on transfer of technology against possible losses in security. Certainly, non-sensitive data such as procurement information could be made publicly available on a larger scale, and sooner than is the practice at present. Cases can be cited where the U.S. military forces have obtained no benefit from their actions. Thus, for example, the U.S. military forces in the SCAP period can take credit for the wisdom of the visiting experts program to provide technical assistance to Japanese industry. This policy could well be hailed as a forerunner of Point-4 and all technical assistance programs since that time. Yet it is almost completely unknown in the U.S. and in Japan.[1]

Assuming that the secrecy handicap is progressively overcome, formal training programs for local nationals should be studied more carefully for positive transfer elements. For evaluation, it would be desirable that a more careful policy of keeping track of who gets trained and what the yield has been. As one option, the present IBM card system which keeps track of local nationals who receive valuable training from the U.S. forces should be refined and expanded. In addition to present data on such matters as where they come from and in what techniques they were trained, we might add the cost of the training and where they fitted into the civilian economy

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[1] The Acting Director of Japan's Productivity Center expressed pained surprise at a question on the role of U.S. military forces in providing technical assistance to Japan. He informed the author that the U.S. military had no role in Japan's productivity program. Interview, Japan Productivity Center, Tokyo, July 24, 1965. Fortunately, this particular hiatus now has been researched and will be made available in later research reports.

after leaving the local armed forces or American employment. Measurement of value added to the civilian economy might be estimated. The system could go back into the past and collect such data, as far as is possible, on all individuals who have been [illegible]ed under military assistance programs. Periodically, the information could be reexamined and recompiled.

Not only would precise summaries of data on technical training and its impact be of use to local area commanders, chiefs of MAAG missions, and other in-country Americans dealing with local people, but there would be longer-range uses. Thus, American businessmen and firms seeking to make sales and investments in the country could be offered lists of people trained in particular skills by U.S. military forces. Knowledge of the whereabouts of such graduates of U.S. training programs on a systematic basis would be useful in follow-up programs as such people grew older. Other things being equal, these people would be logical friends to invite to the U.S. from time to time under visiting team programs. Such later enrichment of their initial work with the U.S. forces would reinforce the investment. An alumni program of this type might build up a long-run source of key people in certain fields for tapping by the U.S. in various ways.

<u>Creative Transferors</u>. Perhaps more important in optimizing the transfer mechanism than a mechanistic formulation of keeping track of persons formally trained by the U.S. would be a more careful selection of inputs into the system. In particular, considerable care should be exercised in the selection of

American directors of training and other U.S. instructional or supervisory personnel. Very few Americans in such positions abroad perceive the long-run implications of "capability building" in the work they are doing.

The exceptions, however, are inspiring models of the importance of the human factor in the transfer of technology. The director of training at Tachikawa Air Base was this type of wise leader of men who saw it was necessary to build a core group of top Japanese engineers to train the Japanese in their own language, using translated U.S. technical manuals. He took over the position with a long-range horizon, and recruited the best men he could find. He instilled them with principles of good industrial management, and instituted a well-conceived system of training, advancement, and replacement among them. The resultant "faculty of FECOM University" trained thousands of Japanese, many of whom now hold top jobs in the present Japanese industrial structure. His training school made possible an efficient output of men for the newly-arising aircraft industry. The often American-admired industrial capability of the Japanese to repair, overhaul, and manufacture U.S. aircraft may be in no small measure traced to the work of this creative individual, who fortunately for the U.S. has now gone to Viet Nam to do the same job.[1]

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[1]This director, Mr. Morris Wilson, gave generously of his time and knowledge to the author in making possible understanding of the events in training Japanese. The author was struck by the similarity of the creative work carried on by Mr. Wilson to the thesis maintained by John Jewkes in his book, <u>Sources of Invention</u>. This book demonstrates clearly that a new invention is not the result of inputs of money in big expensive laboratory projects, but rather is still the result of the free creative activity of the single brain-endowed individual.

Another such creative American is found in the Chief of the Care and Preservation Division at Tokorozawa who has built a much-cited organization with Japanese managers. The Japanese managers were trained, trusted, and backed to turn out efficient work under conditions of considerable difficulty. These managers carried out the Chief's innovative ideas, often adding something to them, and together they have been responsible for real training innovations such as the "Fuller Brush" training kits described previously.[1]

Beyond these outstanding cases are men in all ranks of the U.S. Forces who warmly interested themselves in the affairs of the local nationals, who worked with them, and who extended themselves in countless ways to teach their foreign friends something of technical value. The technical sergeant who helped the Koreans through the U.S. inspection system by doing part of the work himself, and the industrial engineer who set up a truck maintenance system for his Japanese friend have been noted. Others may be cited, such as the procurement engineer who wrote to a U.S. company to get the technical nicety to correct a production flaw, yet who modestly depreciated his efforts, saying, "Oh, there was a big flap in tires -- otherwise I probably wouldn't have done it." Famed is the legend

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[1] The author wishes to thank Mr. John Holmes, Chief of Care and Preservation Division, Tokorozawa Logistical Center, for enabling him to see how an American military unit can utilize local nationals intelligently and efficiently with excellent results.

of the G.I. farmer who spent all his free time on the Korean farms increasing productivity by teaching irrigation methods. These men and countless others have demonstrated the importance of the individual in transfers of technology.

Therefore, one way to improve this free fall-out, is to conduct research on the personalities of people who work in these potential transfer situations. One qualification for a director of training should be an ability to reflect the essential trait of inspiring loyalty in subordinate local nationals. Such a job cannot be entrusted to a narrow, selfish person, but rather to a man capable of empathy with native aspirations and a capacity to marry them to U.S. objectives. Further, transfer men with suitable personality traits should be given strong official backing. For example, easier access to surplus disposal for such people would go a long way to encourage their natural affinities, which are somewhat akin to those of the missionary.[1]

IMPROVING PROCUREMENT TRANSFERS

Turning to procurement activity, transfer of technology is intended here, but its purpose is limited to some specific

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[1] Religious missionaries themselves often have not been given very much support. Thus, Paul Rusch, who developed the truly innovative upland farming and cattle raising industry at Kiyosato, Japan, states that he had almost no official support from the U.S. military forces, but that individuals in the service helped him very much. On the other hand, "Operation Pig Lift" to Father McGlinehey on Chedijo Island off Korea appears to have had much official U.S. organizational help.

objective: troop support, offshore procurement, etc. The long-run side-effect of capability building is usually overlooked, and soon forgotten. Here, as in demonstration and training transfers, a program of information retrieval is a means of achieving a higher payoff. Distillation of the historical record of technological transfer would seem to be very valuable as part of the briefing of area officers, before dealing with their local counterparts. Memories involving gratitude are notoriously short, and the U.S. policies of hoarding information in stale, classified files even in a relatively insensitive area like procurement may actually assist those hostile to U.S. interests.

With procurement, the linkage effect with the civilian economy involves clearer coupling than with base training activities. Because the foreign firm is forced to produce to higher U.S. military specification to meet the details of designs and drawings of high grade products, it must be ready to improve its capability. It may have to buy machinery to meet the contract; it may have to introduce quality control procedure and submit its products to laboratory tests; and its engineers may have to work very closely with U.S. engineers to perform as agreed. After completing a contract successfully, it has achieved a status as a reliable resource of the U.S. The Air Force, for example, finds it useful to maintain a Qualified Products List of approved manufacturers in Japan who can make items in a hurry. Concurrently, the country's industrial capability is built up, enabling it to make a better domestic product and compete in international export trade.

But for any one country like Japan, the coincidence of interest is not as great as may be thought; there is probably more coincidence for the Pacific area as a whole. While the U.S. interest is served by a reliable, capable supplier like Japan, U.S. interest is not served by excessive dependence on one source. During the Korean War, when Japan's economy was under-utilized, war-destroyed, and technically backward, Japan's interest in U.S. procurement contracts was great. However, in the economically flourishing late 1960's, a contract may hold little interest to a Japanese firm; it may even be regarded as a nuisance, an interruption of longer-range civilian production programs. Moreover, technical fallouts in many lines have already occurred, and Japanese see nothing more to be learned.

Thus, an optimizing of procurement policy as to transfers, and other considerations, appears to call for more diversification in placement of military procurements in the Pacific. The obvious reluctance of Japan to assist in the Viet Namese War effort could be countered by intensified U.S. efforts to diversify into friendly countries in the Pacific. Procurements there will help to build capabilities just as they were built in technically primitive Japan of the Korean War period. True, more effort and care must be exercised by the U.S. in cultivating such alternative sources. These alternatives may seem an obstacle to speed-minded procurement men, but to the extent permitted by time and other military considerations, much will be gained in working with Koreans, Taiwanese, Thai people, Greeks, Turks, etc. to supply offshore needs. Over-reliance on a single source is undesirable, and could even be dangerous to the U.S.; whereas much is to be gained in bargaining power for the U.S. by building alternative sources and, at the same time, making technological transfers to expedite local industrialization.

Moreover, in the dimension of military assistance activities, work with the local armed forces extends training and procurements (actual and potential) into modern and advanced industrial levels of the U.S. Many opportunities to develop industry with U.S. manufactures open as a result. Small countries without mass markets are unlikely candidates for developing whole industries, but they may be able to develop considerable component or part-making capabilities. Almost certainly, every country's operation can have some degree of overhaul and repair. Rebuild capability can be brought on gradually, and local assembly operations combined with overhaul of equipment is probably possible almost anywhere.

The astonishing development of the Taegu jet rebuild facility in Korea is a case in point.[1] Offshore procurement

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[1] In the words of one American officer, "Ten years ago, the Koreans couldn't use a can opener, but since 1962-3, they have been underbidding the Japanese in equal quality work on overhaul of U.S. aircraft."

activity of the U.S. tends to merge with the local military procurements, especially those with a military assistance component, and can be combined in many ingenious ways,[1] given the leverage of American money, influence and imagination. However, a more systematic approach to the role of military assistance is presented in the next section.

IMPROVING CIVILIAN IMPACT OF MILITARY ASSISTANCE*

Military assistance is a planned transfer of military skills to friendly, but less developed military forces. Included in this process is the task of making available the military infrastructure of logistics support and technology of the more advanced donor nation. Thus the Military Assistance Advisory Group in a country can be said to be in the business of transfer of technology, and it is in some sense presumptuous

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[1] Reports of such activities appear from all over the world. Thus an imaginative U.S. officer in Greece developed an "As is" program of procuring second-hand vehicles from U.S. forces in Europe, the repair and overhaul of which induced investment in a whole rebuild complex similar to Pacific rebuilds. The officer apparently had little knowledge of the Pacific precedents and developed the whole operation in Greece independently. Interview, Washington, D.C., with the officer who developed this program, Lt. Col. Walter J. Olzewski, March 1, 1965.

*The comments in this section represent the author's ideas of how to make explicit many of the values that are actually implicit in military assistance programs. He is convinced that the U.S. military forces should receive greater credit for the manner in which they have assisted allied military establishments, and improved supporting economies.

for an outside observer, even with the best intention, to tell these units how to run their business. Nevertheless, there is a short-run incidence of the work of the MAAGs which accent the immediate equipment and training of the armed forces of the donee country. While building civilian industrial capabilities is no doubt given some place on their scale of priorities, there is less emphasis on this somewhat long-run objective. In the Pacific countries, the presence of Japan with its long industrial lead also constrains the development of neighboring countries. The MAAGs action orientation dictates the easiest and quickest source of supply, which, in the Pacific, often means Japan.

As the MAAG framework is related to a greater consciousness of its economic impact under current directives, the importance of the by-product effects stressed in this monograph will be recognized. But the problem of economic structural change in a backward country goes deeper. Aside from the lack of capital and of effective social overhead, e.g., mails, telephones, telegraphs, water supply, sewerage, police, health and educational services, good civil servants, and a host of other such needs, the central economic problem of development was pin-pointed by Adam Smith long ago, namely, that the degree of specialization is indicated by the breadth and width of the market.[1] The typical

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[1] A 20th century restatement emphasizes the importance of external economies of scale. George Stigler, "The Division of Labor is Limited by the Extent of the Market," *Journal of Political Economy* LIX (June, 1951), p. 185-193.

underdeveloped country is hampered by the small scale of its home market, forcing it to enter the world economy to secure, if it is competitive, economies of scale of modern plants. Significant foreign military assistance provides a substitute for the commercial market because it (or the counterpart host government) buys in sufficiently large quantities to permit scale production functions. It is a kind of subsidy permitting modern scale operations to be developed in the absence of a market.

A military procurement order is, in fact, better than a subsidized market. It not only adds to demand, but also carries its own supply of techniques and technical renovation. It builds the new production functions in the country's economy to the rigor of its own specifications. Through the need to assure high quality military equipment and training in the assisted country, an indigenous military infrastructure of high quality maintenance and supply is fostered. The resultant service and supply are modeled after the best practice in the civilian economy of the high level donor country. Best practice comes pre-packaged and ready-made to the donee country, to be unwrapped layer by layer and examined through the rigorous testing and evaluation of the higher-level military maintenance and personnel system. Moreover, as Japanese informants stressed, the highly rationalistic and efficient production control system is infused into the borrower's economy. Small wonder that U.S. trained local personnel, or foreign factories which have maintained, rebuilt, or manufactured U.S.

equipment, became the nucleus of the new industry in the Pacific countries. The technological transfer is made under highly-favorable circumstances, and its potential fall-out, effecting long-run technical change in the civilian economy, is very likely to be realized.

However likely it may be, there still is no certainty that the transplant will "take" in foreign soil. What can be done to further assure that the seed planted sprouts and fructifies? As indicated above, the basic condition for the development of modern industry is the assurance of a market of adequate size for its product. Thus the technical linkage effect is likely to be lasting to the extent that the commercial market (either home or export) is able to pick up where the military stimulus ends, or, better, to integrate with that effort. The Japanese managed the transition skillfully without further encouragement; Taiwan and Korea are following Japan. Other countries may be likely to require further care and cultivation.

Now, the MAAG in a country cannot be expected to act as a permanent long-run economic planner, or even a commercial catalyst. Its role is to get an immediate job done as quickly as possible. But, in doing its job, it may be possible to give more attention to the longer-run implications of its activities. Could greater specialization of industry in each country within a region like the Pacific be encouraged? Thus, for the automobile industry, which is basic in its transport implications to any economy, could not each country in a region be assigned more specialized supplier roles, e.g., tires in Korea, rebuilt motors in Taiwan, bodies in the Philippines, and assembly in Thailand? Japan might supply specialty items, impractical to produce in volume in the developing countries. In any case, the idea would be to stimulate the market mechanism as much as possible by planning some regional dispersion of industrial and service activities. Each country would have some home market to begin with, and the addition of military demand might make the production run adequate. Details would have to be worked out precisely by procurement men familiar with market conditions in the area and with local government representatives. Despite many obstacles, the benefits of such a scheme almost certainly outweigh the time and trouble involved in getting it organized.[1]

Support for such ideas might be expected from world-wide, multi-national companies. While they have their own scale of evaluation for their interests and operations, it is quite conceivable that there would be sufficient identity of interest in transfer activities for these companies to make strategic commitments in support of the process. Faced with problems of

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[1] At this writing, the author has learned that a conference has been called for the PACOM area during February, 1967, in which the MAAGs are to submit five year plans for capability building in their countries. This is very gratifying, but, because many details of the story are classified, favorable image building effects are lost.

marketing their products on a world-wide basis, they are increasingly interested in specialized local production making possible sufficient exports to justify the economies of scale attendant on larger output. The "subsidy" of military purchases would make a prima facie case for interesting them. Even more pointed, in an ever-constricting flow of scarce MAP funds, is the need for companies to sell the whole product, not parts. The Norair case described next illustrates this intelligent business planning.

Cost Savings. The government and people of the United States have a stake in the gains from specific capability building, namely, cost savings. While the principle will be found in many contexts, the Northrop Norair company has developed specific data showing the desirability of cost-savings of in-country repair capability for the F-5 airplane.[1] Arguing that an objective of MAP programs is the development of maximum self-sufficiency in each participating nation, the company has presented a program which will establish component repair programs in participating countries. The company presents data to show that component assemblies manufactured locally can effect astonishing cost savings for the U.S. in certain cases. Also, combat readiness is increased because of the reduction in pipeline difficulties. In addition, Norair

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[1] Northrop Norair. Component Repair F-5 MAP (The Company: November, 1965) NB 65-367.

sees clearly the spillover idea; namely, that the recipient country will be able to build up its technological strength, and gain other benefits from local component repair. Norair presents a specific plan of action to establish an effective component repair program for the F-5, based on previous experience with the T-38 airplane.

National states, too, have a vested interest in getting industry started. Unfortunately, they usually have a grand scale approach to industrialization, which calls for total in-country manufacture of all components. There are signs that this unrealism has been changing recently, to favor more specialized production on the basis of comparative advantage in some countries. But the characteristically developing countries have preferred small-scale plants geared to the self-sufficiency of the small market within a single country. The latter will result in high-cost manufacture and should be discouraged as much as possible if high productivity is the goal. MAAG-inspired schemes of regional development would have an incentive effect which might well tip the scales in favor of a more sophisticated cost-wise approach to development.[1]

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[1] For examples of the great divergence in cost between the high cost, small scale plant geared to a small national market and the large scale plant, see Jack Baranson, "Transfer of Technical Knowledge by International Corporations to Developing Economies", American Economic Association, Papers and Proceedings, LVI (May, 1966) p. 262.

The economic assistance activity in the region is another possible ally in contemplating any extension of the military assistance role. Military and economic assistance are often taken to be somewhat mutually exclusive, and even competitive (at least for budgetary resources), but there are distinct complementarities, primarily the kind of long-run, military-induced spillover effect on the civilian economy discussed here. Already some precedent exists for this sort of joint undertaking. The civic action programs dating from 1961 have now become accepted as part of the U.S. national policies on the military overseas. Military forces are expected not merely to live in garrison, but to join in many types of community projects which support the military objectives of forestalling revolutions and Communist insurrections. More specific attempts to capture the natural technical and economic fall-outs of the presence of overseas activities can be viewed as an extension of civic action authority. But the two kinds of activity should not be confused: the civic action program aims at a short run, even battle-condition, kind of immediate assistance; transfer spillover effects have a long-run incidence which may take up to a generation or more to capture and consolidate into the free world economy.

What is proposed here is that strong linkage of military assistance with the civilian economy can be engendered by co-operation and interaction with the economic aid people. U.S. directives call for military and economic assistance to be interrelated, but coordination is difficult. True, there have been some examples of military and economic assistance units working together as in the USOM's use of military procurement in Korea, or the economic aid activities of the Tokorozawa installation in Japan. Also noteworthy is the provision in Thailand of heavy equipment for joint military-civilian mobile development units building roads, operating health centers, drilling wells, repairing schools, surveying for reservoirs, aiding agriculture, erecting radio and television towers, grading roads and playing fields, in addition to the primary military duties of constructing airfields, and military roads. Technical assistance teams are operating in Viet Nam, and these examples from the Pacific can be matched with civic action programs from many other parts of the world.[1] Yet these activities tend to be short-run specific jobs usually of a non-industrial nature. The longer range problem of changing the economic structure remains relatively untouched by such civic action activity. Hence, all of this leads to a final proposition: that MAAG activated military transfers of technology can be augmented not only by greater involvement with multi-national companies and local armed forces of recipient national states, but also with the U.S. economic assistance

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[1] Impressive is the work of the Air Commandos of the Special Air Warfare Center who are reported to have conducted civic action programs under in-action conditions.

program. By such outside mobilization of allies, MAAG activities would be in a better position to improve the military transfer of technology in terms of the long range linkage effects on the civilian industrial structure.

PROSPECT

This chapter has summarized and analyzed something of the nature of military transfer of technology which has been set forth in the cases in this book. Japan, as a celebrated borrower and adapter of technology, has, as it did before World War II, profited most from the U.S. military presence. But Japan was fortunately bulwarked by an accumulated scientific and technical base, an enterprising people, a long tradition of borrowing, and the large home market which has been manipulated skillfully by Japan's indicative planners.[1] Other countries can and do take advantage of the U.S. military presence, but the propensity to provide technology must be intensified to compensate for the weakness of the native borrowing propensity. The limitations of the home market must be overcome through greater long-range effort to retain and consolidate these beneficial military effects in the commercial world. To this end, mobilization of allies into multi-national business communities, involving profit-conscious defense contractors, will contribute to longer-run optimization of military transfers, and greater technological self-sufficiency in friendly countries, with consequent cost-savings to the United States.

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[1] The strategic moves of the Japanese oligarchy are well described in "Consider Japan", The Economist. (September 1 and 8, 1962)

Appendix I

Japanese Employees of U. S. Forces in Japan*

1949 - 1965

Year	Clerical	Technical	Others		Total Master Labor Classification (MLC)
1949	81047	89516	27663		198226
1950	70613	113126	28706		212445
1951	95713	146749	28948		271415
1952	84644	139168	3879		227691
1953	68949	119449	2879		191277
1954	66249	108376	2020		176645
1955	60294	95251	1540		157085
1956	59171	87001	1584		147756
1957	51929	76550	1462		129941
1958	43506	61251	1039		105896
1959	32101	43327	640		76068
1960	27911	34494	281		62686
1961	24805	32317	260		57382
1962	--	--	281		54169
					IHA 12349**
				Total	66518
1963	--	--	289		53119
					IHA 12436
				Total	65555
1964	--	--	277		49639
					IHA 11898
				Total	61537
1965	--	--	234		41818
					IHA 10608
				Total	52426
GRAND TOTAL*** 1949-1965					2,260,549

* Source: Defense Ministry of Japan (Boei Shiseitsu)

** Indirect Hire Agreement Act 15 Organizations Appropriated Non-appropriated Fund Organization (PX, BOQ, Theater, etc.)

*** This total does not mean that exactly this number of people worked for the U.S. Armed Forces during the period. Obviously, many people left to take other positions, retired, were laid off, or died. Many, of course, stayed on and are still employed. Data is not available for these categories, nor for the [illegible] period.

Appendix II

Sample of the Number of Skilled Personnel Employed by U. S. Forces in Japan - 1963, 1964

Job Classification Number	Job Description	Personnel 1963	Personnel 1964
1	Accountant	11	7
2	Accountant	17	17
3	Accountant	3	2
8	Accounting Technician	54	59
10	Administrative Specialist	281	288
11	Aircraft Quality Control Inspector	22	17
15	Athletic Instructor	0	1
16	Auditor	-	5
17	Auditor	33	22
18	Auditor	12	11
21	Budget Analyst	13	20
22	Budget Analyst	6	5
27	Cargo Superintendent	2	2
30	Cartographic Aid	108	88
31	Cartographic Aid	12	13
32	Cartographic Draftsman	25	20
38	Classification and Wage Technician	35	31
39	Classification and Wage Technician	9	9
46	Commercial Artist	31	32
50	Construction Inspector	71	52
53	Criminal Investigation Technician	1	1
56	Dairy Manufacturing Technologist	6	5
57	Document Examiner	0	0
61	EAM Project Planner	12	12
62	EAM Project Planner	3	3
64	Employee Development Officer	31	24
69	Engineering Draftsman	128	71
70	Engineering Technician	17	4
71	Entomology Technician	3	7
81	Geodetic Computer	8	4
82	Geodetic Technician	3	17
83	Hobbycraft Instructor	16	15
99	Interpreter	37	32
	Sub-total	1,032	896

Source: Unpublished data, Defense Ministry of Japan (Boei Shiseitsu) provided to the author.

Job Classification Number	Job Description	Personnel 1963	Personnel 1964
100	Interpreter	109	84
101	Interpreter	11	5
102	Interpreter Translator	161	149
103	Interpreter Translator	112	92
109	Legal Assistant	17	13
120	Management Analyst	7	1
125	Mechanical Trade Instructor	5	6
126	Medical Photographer	3	4
127	Medical Technologist	3	0
130	Meteorological Technician	30	7
131	Meteorological Technician	19	16
134	Milk Plant Superintendent	3	3
135	Milk Plant Superintendent	0	1
146	Personnel Specialist	20	21
150	Photographic Laboratory Technician	7	7
151	Photograph Instructor	2	2
155	Price Analyst	1	4
164	Production Control Specialist	6	6
165	Production Specialist	118	77
173	Quality Control Specialist	0	0
174	Quality Control Specialist	18	18
196	Sanitation Inspector	4	4
199	Security Specialist	22	24
212	Surveyor	7	7
214	Telecommunications Specialist	6	7
224	Training Technician	1	2
225	Training Technician	14	11
226	Training Technician	6	6
227	Translator	19	6
228	Translator	4	2
229	Translator	57	48
230	Transportation Auditor	0	0
	Sub-total	792	633

Job Classification Number	Job Description	Personnel 1963	Personnel 1964
237	Veterinarian	1	1
239	Veterinarian	5	3
242	Water Analyst	18	14
244	Woodworking Instructor	6	8
247	Teacher	4	1
248	Teacher	24	13
250	Administrative Management Officer	1	1
251	General Manager (Activity)	4	4
[illegible]	General Manager (Activity)	2	2
253	Personnel Officer (Activity)	2	2
261	Engineering Contract Manager	2	2
262	Engineering Manager	17	15
263	Engineering Manager	2	3
264	Engineering Technician (Appropriate Specialization)	285	262
265	Facility Planning Specialist	2	2
268	General Manager (Harbor Operation)	1	1
271	Hydrographer	2	1
274	Information Specialist	33	32
277	Maintenance Control Manager	2	2
280	Naval Architect Technician	0	0
284	Public Information Specialist	3	3
286	Safety Program Administrator	1	1
295	Telecommunications Inspector	2	1
296	Training Liaison Officer	1	1
297	Transportation Division Manager	1	1
298	Utilities Division Manager	1	1
303	Shop Foreman	9	9
304	Group Master	5	5
	Sub-total	436	391

Job Classification Number	Job Description	Personnel 1963	Personnel 1964
307	Meteorological Specialist	0	4
308	Printing Specialist	2	2
310	Engineering Technician (Appo. Spc.)	17	46
312	Facilities Repair Estimator	4	37
314	Marine Operation Specialist	0	2
316	Cartographic Draftsman	0	13
328	Employee Management Relations Technician	0	0
335	Test Development Technician	0	0
339	Industrial Relations Officer	0	0
345	Analytical Chemistry Technician	0	0
347	Animal Colony Veterinarian	0	0
348	Electron Microscope Operator	0	0
350	Medical Technologist	0	0
351	Veterinarian-Medical Research	0	0
352	Zoological Illustrator	0	0
353	Zoological Technologist	0	0
356	EDP Systems Operator	0	0
1000	Aeronautical Engineer	1	1
1001	Agronomist	0	0
1002	Architectural Engineer	18	17
1003	Attorney-Advisor	2	2
1004	Medical Researcher Micro-Organisms	3	3
1005	Business Economist	0	0
1006	Cartographer	3	2
1007	Cartographer	6	6
1008	Cartographer	5	6
1009	Chemist	2	6
1010	Chemist	0	0
1011	Civil Engineer	23	26
1012	Electrical Engineer	16	18
1013	Electronic Engineer	1	0
1014	Entomologist	1	1
	Sub-total	104	192

Job Classification Number	Job Description	Personnel 1963	Personnel 1964
1015	Entomologist	2	2
1016	General Engineer	15	14
1017	Geodegist	1	1
1018	Geodegist	0	0
1019	Geographer	4	2
1020	Research Aid	23	25
1021	Labor Economist	2	2
1022	Maintenance Engineer	4	5
1023	Marine Engineer	6	6
1024	Materials Engineer	1	1
1025	Materials Engineer	1	1
1026	Mechanical Engineer	16	17
1027	Mechanical Engineer	11	11
1028	Mechanical Engineer	0	0
1029	Metallurgist	0	0
1030	Meteorologist	0	1
1031	Naval Architect	0	2
1032	Physicist	1	2
1033	Safety Engineer	2	2
1034	Safety Engineer	2	2
1035	Ship Repair Designer	0	1
1036	Engineer (Appropriate Specialization)	87	90
1037	Naval Architect	5	5
1038	Legal Advisor	0	1
1039	Head Design Engineer	0	0
1040	Industrial Engineer	0	0
1041	Production Control Engineer	0	0
	Sub-total	183	193
	Totals	2,547	2,305

Appendix III

A LIST OF JAPANESE VISITORS
to the Care and Preservation Division

Name	Position	Name of Company
KUZUNO, Tsunejiro	Executive Director Chief, Inspection Division	Isuzu Motor Co. Ltd.
OGURA, Nobuo	Assistant Division Chief, Inspection Office	Isuzu Motor Co. Ltd.
KONO, Motoo	Executive Director	Nippon Packaging Co. Ltd.
UEMATSU, Hachiro	Chief, Storage Division	Toyota Motor Co. Ltd.
SHINOHARA, Kanjyu	Chief, Business Section	Japan Anti-Corrosive Engineering Association
FUJITANI, Eiichi	Lt. Col., Chief, Ordnance Branch	Japan Ground Self Defence Forces
KAWAHARA, Mitsuaki	Chief, Production Branch	Kurogane Small Car Co. Ltd.
NAKAYAMA, Sakae	Chief, Spare Parts Packaging Section Export Department	Toyota Motor Co. Ltd.
YORITOMI, RYutaro	Executive Director	Asahi Koki Co. Ltd.
SHIMURA, Ichirai	Chief, Inspection Section	Isuzu Motor Co. Ltd.
YOSHIMURA, Hiromi	Chief, No. 1 Section Sales Department	Kurita Industrial Co. Ltd.
YAMAGUCHI, Takuya	Assistant Chief, Engineering Section	Kurita Industrial Co. Ltd.
KATAYAMA, Fumizo	Main Stock Division	Japan Air Line Co. Ltd.
TAMIYA, Masanobu	Engineering Division	Nippon Parkerizing Co. Ltd.
HAYASHI, Noboru	Sales Department	Nippon Parkerizing Co. Ltd.
YUKI, Masatoshi	Supply & Stock Control Section	Komatsu Manufacturing Co. Ltd.
TERADA, Hiroji	Planning & Control Section	Komatsu Manufacturing Co. Ltd.
KARUBE, Yoshio	Unspecified	Japan Anti-Corrosive Association

Source: Compiled from visiting cards left at the Installation.

Name	Position	Name of Company
KINJYO, Hirosuke	Unspecified	Asahi Koki Co. Ltd.
MIZOGUCHI, Hiroshi	Unspecified	Tokyo Moisture-Proof Packaging Material Co.
SUDOH, Tetsuo	Unspecified	Sugawara Denki Co. (Packaging Material Co.)
MASUDA, Kazuo	Unspecified	Sugawara Denki Co. (Packaging Material Co.)
HIBINO, Yoshiaki	Export Division	Kanto, Chemical Co.
YOSHIHARA, Usaku	Unspecified	Kanto, Chemical Co.
HIRAMATSU, Umekichi	Products Management Section	Toyota Motor Co. Ltd.
SASAYA, Unaaki	Business Section Tokyo Office	Toyota Motor Co. Ltd.

Appendix IV

TRAINEES AND TRAINING HOURS

Tachikawa Air Base

1951-1956

Course	1951	1952	1953	1954	1955	1956	Total
Total							
Trainees	3,335	26,576	6,072	6,770	6,147	5,725	54,625
Training Hours	168,809	598,690	182,993	140,967	121,680	163,398	1,376,537
Auto Repair (Maint.)							
Trainees	73	44	-	-	-	-	117
Training Hours	-	14,159	-	-	-	-	14,159
C-22A							
Trainees	8	-	-	-	-	-	8
Training Hours	-	-	-	-	-	-	-
Drivers' Training							
Trainees	567	3,476	66	428	-	107	4,644
Training Hours	-	32,026	2,564	2,899	-	1,760	39,249
Electrical Account Machine Operation							
Trainees	17	-	-	-	-	-	17
Training Hours	-	-	-	-	-	-	-
Electric Terminal Soldering							
Trainees	39	-	-	-	-	-	39
Training Hours	-	-	-	-	-	-	-
English-Conversational							
Trainees	497	-	-	-	-	166	663
Training Hours	-	-	-	-	-	5,403	5,403

Source: Tachikawa Air Base Retired Files.

Course	1951	1952	1953	1954	1955	1956	Total
F80 Aircraft and J33 Engine Training							
Trainees	11	-	-	-	-	-	11
Training Hours	-	-	-	-	-	-	-
First Aid Training							
Trainees	24	-	-	-	-	-	24
Training Hours	-	-	-	-	-	-	-
GCA Training Repair							
Trainees	17	-	-	-	-	-	17
Training Hours	-	-	-	-	-	-	-
Guard Training (Civilian)							
Trainees	278	11,171	-	2,860	-	3,061	17,370
Training Hours	-	210,957	-	66,690	-	37,773	315,420
Hydraulic Machine Aircraft							
Trainees	3	-	-	-	-	-	3
Training Hours	-	-	-	-	-	-	-
Inventory Procedures							
Trainees	27	-	-	-	-	-	27
Training Hours	-	-	-	-	-	-	-
Job Instructor Training (Course)							
Trainees	58	-	61	46	-	19	184
Training Hours	-	-	2,992	1,532	-	629	5,153
Management Course							
Trainees	383	-	-	-	-	-	383
Training Hours	-	-	-	-	-	-	-
Pattern Development Aircraft Structures							
Trainees	135	-	-	-	-	-	135
Training Hours	-	-	-	-	-	-	-
Production Control Training							
Trainees	85	-	-	-	-	-	85
Training Hours	-	-	-	-	-	-	-

Course	1951	1952	1953	1954	1955	1956	Total
Radar Repair							
Trainees	27	-	-	-	-	-	27
Training Hours	-	-	-	-	-	-	-
Safety Training (Health)							
Trainees	80	1,946	-	-	-	-	2,026
Training Hours	-	18,572	-	-	-	-	18,572
Sheet Metal Repair							
Trainees	169	875	-	-	-	-	1,044
Training Hours	-	70,522	-	-	-	-	70,522
Supply-Stock Record							
Trainees	117	-	-	-	-	-	117
Training Hours	-	-	-	-	-	-	-
Technical Order Compliance							
Trainees	23	61	-	-	-	-	84
Training Hours	-	789	-	-	-	-	789
Technical Supervisors Training							
Trainees	4	-	-	-	-	-	4
Training Hours	-	-	-	-	-	-	-
Typing							
Trainees	174	159	49	35	25	35	477
Training Hours	-	21,546	8,410	1,032	2,360	880	34,22[illegible]
Voucher Control Procedures							
Trainees	108	-	-	-	-	-	108
Training Hours	-	-	-	-	-	-	-
Water Pump Maintenance							
Trainees	36	-	-	-	-	-	36
Training Hours	-	-	-	-	-	-	-
Warehousing							
Trainees	375	-	-	-	-	-	37[illegible]
Training Hours	-	-	-	-	-	-	-
Orientation--New Employees							
Trainees	-	4,183	272	1,185	-	390	6,[illegible]
Training Hours	-	8,998	486	2,370	-	580	[illegible]2,4[illegible]

Course	1951	1952	1953	1954	1955	1956	Total
Supervision & Management							
Trainees	-	958	366	99	258	169	1,850
Training Hours	-	24,096	13,341	4,082	7,836	7,465	56,820
Sales Clerk (P.X.)							
Trainees	-	39	-	-	-	-	39
Training Hours	-	751	-	-	-	-	751
Payroll Clerk							
Trainees	-	4	-	-	-	-	4
Training Hours	-	24	-	-	-	-	24
Office Clerk							
Trainees	-	19	-	-	-	-	19
Training Hours	-	416	-	-	-	-	416
Firefighter Training							
Trainees	-	86	-	40	44	181	351
Training Hours	-	10,216	-	3,428	6,952	30,141	56,747
Aircraft Mechanics							
Trainees	-	30	-	-	-	-	30
Training Hours	-	2,000	-	-	-	-	2,000
Meat Treating							
Trainees	-	1	-	-	-	-	1
Training Hours	-	128	-	-	-	-	[illegible]
Plating Training							
Trainees	-	1	-	-	-	-	1
Training Hours	-	232	-	-	-	-	232
Communications Equipment Repair							
Trainees	-	239	-	-	-	-	239
Training Hours	-	3,800	-	-	-	-	3,800
Aircraft Familiarization							
Trainees	-	346	-	-	-	-	346
Training Hours	-	12,738	-	-	-	-	12,738
Japanese CAA Inspector Course							
Trainees	-	45	-	-	-	-	45
Training Hours	-	10,351	-	-	-	-	10,351

Course	1951	1952	1953	1954	1955	1956	Total
Lathe Operators							
Trainees	-	35	-	-	-	-	35
Training Hours	-	205	-	-	-	-	205
AIO Sheet Metal Training							
Trainees	-	25	-	-	-	-	25
Training Hours	-	4,546	-	-	-	-	4,546
AIO Machinists							
Trainees	-	15	-	-	-	-	15
Training Hours	-	3,272	-	-	-	-	3,272
Stock Chaser Training							
Trainees	-	12	-	-	-	-	12
Training Hours	-	568	-	-	-	-	568
Magnaflux Operation							
Trainees	-	22	-	-	-	-	22
Training Hours	-	760	-	-	-	-	760
Boiler Engineering							
Trainees	-	141	-	-	-	-	141
Training Hours	-	676	-	-	-	-	676
Supply Records Procedures							
Trainees	-	347	-	-	-	-	347
Training Hours	-	7,050	-	-	-	-	7,050
Warehouse Procedures							
Trainees	-	985	-	-	-	-	985
Training Hours	-	45,960	-	-	-	-	45,960
Corrosion Control							
Trainees	-	77	-	-	89	-	166
Training Hours	-	7,290	-	-	2,604	-	9,894
Supply English (Supply Terms)							
Trainees	-	60	-	-	-	-	60
Training Hours	-	1,543	-	-	-	-	1,543
Other Training							
Trainees	-	1,274	-	-	-	-	1,274
Training Hours	-	84,499	-	-	-	-	84,499
Civilian Guard Training							
Trainees	-	-	3,324	-	-	-	3,324
Training Hours	-	-	42,343	-	-	-	42,343

Training Hours	-	-	[illegible]	-			
Propeller Shop OJT							
Trainees	-	-	14	-	15	-	29
Training Hours			1,383		423	-	1,806
Hydraulic Shop OJT							
Trainees	-	-	15	-	15	-	30
Training Hours	-	-	1,462	-	85	-	1,547
Structural Repair OJT							
Trainees	-	-	13	-	-	-	13
Training Hours	-	-	302	-	-	-	302
Kawasaki Co. OJT							
Trainees	-	-	8	-	-	-	8
Training Hours	-	-	1,376	-	-	-	1,376
Instrument Shop OJT							
Trainees	-	-	11	-	-	-	11
Training Hours	-	-	294	-	-	-	294
Motor Vehicle Shop OJT							
Trainees	-	-	74	-	-	-	74
Training Hours	-	-	4,533	-	-	-	4,533
Aircraft Sheet Metal OJT							
Trainees	-	-	244	-	-	-	244
Training Hours	-	-	9,716	-	-	-	9,716
Carpenter Shop OJT							
Trainees	-	-	70	-	-	-	70
Training Hours	-	-	6,628	-	-	-	6,628
Key Punch Operator							
Trainees	-	-	33	-	-	-	33
Training Hours	-	-	798	-	-	-	798
Electric Shop OJT							
Trainees	-	-	7	-	-	-	7
Training Hours	-	-	308	-	-	-	[illegible]
Mitsubishi Co. OJT							
Trainees	-	-	48	-	-	-	[illegible]
Training Hours	-	-	11,960	-	-	-	11,960

Course	1951	1952	1953	1954	1955	1956	Total
Boiler Engineering							
Trainees	-	-	57	-	-	-	57
Training Hours	-	-	336	-	-	-	336
Aircraft Sheet Metal Training							
Trainees	-	-	20	-	-	-	20
Training Hours	-	-	410	-	-	-	410
F-84E and G Familiarization Training							
Trainees	-	-	53	-	-	-	53
Training Hours	-	-	3,572	-	-	-	3,572
Aircraft Engine Preservation							
Trainees	-	-	15	-	-	-	15
Training Hours	-	-	356	-	-	-	356
Pattern Development							
Trainees	-	-	38	-	-	-	38
Training Hours	-	-	3,148	-	-	-	3,148
J-35 Aircraft Engine Maintenance							
Trainees	-	-	4	-	-	-	4
Training Hours	-	-	260	-	-	-	260
Aircraft Maintenance Administration Training							
Trainees	-	-	8	-	-	-	8
Training Hours	-	-	336	-	-	-	336
J-33 Aircraft Engine Training							
Trainees	-	-	17	9	-	-	26
Training Hours	-	-	1,767	1,209	-	-	2,976
F-86 Familiarization							
Trainees	-	-	208	-	-	-	208
Training Hours	-	-	10,308	-	-	-	10,308
Structural Repair							
Trainees	-	-	27	-	-	-	27
Training Hours	-	-	744	-	-	-	744

Course	1951	1952	1953	1954	1955	1956	Total
F-86 Training for Mitsubishi Co. Personnel							
Trainees	-	-	14	-	-	-	14
Training Hours	-	-	3,808	-	-	-	3,808
Aircraft Mechanic Orientation							
Trainees	-	-	47	-	-	-	47
Training Hours	-	-	3,964	-	-	-	3,964
Ground Radar Repair							
Trainees	-	-	24	-	-	-	24
Training Hours	-	-	144	-	-	-	144
Stock Records Basic Training							
Trainees	-	-	183	46	47	-	276
Training Hours	-	-	3,190	2,359	1,750	-	7,299
OJT for Stock Record Specialist							
Trainees	-	-	87	-	-	-	87
Training Hours	-	-	2,150	-	-	-	2,150
OJT for Warehouse Personnel							
Trainees	-	-	173	-	-	-	173
Training Hours	-	-	8,997	-	-	-	8,997
Supply Inspector Course							
Trainees	-	-	11	-	-	-	11
Training Hours	-	-	112	-	-	-	112
Warehouse OJT Instructors Course							
Trainees	-	-	20	-	-	-	20
Training Hours	-	-	552	-	-	-	552
Supply Procedures							
Trainees	-	-	29	-	-	-	29
Training Hours	-	-	258	-	-	-	258
Mechanized Service Stock Procedures							
Trainees	-	-	34	-	-	-	34
Training Hours	-	-	667	-	-	-	667

Course	1951	1952	1953	1954	1955	1956	Total
Aircraft Job Induction Courses							
Trainees	-	-	-	90	-	-	90
Training Hours	-	-	-	4,365	-	-	4,365
Architecture Basic Course							
Trainees	-	-	-	6	-	-	6
Training Hours	-	-	-	708	-	-	708
Key Punch Operators Orientation							
Trainees	-	-	-	17	-	-	17
Training Hours	-	-	-	500	-	-	500
Crew Chief Training							
Trainees	-	-	-	87	-	-	87
Training Hours	-	-	-	3,885	-	-	3,885
Work Simplification							
Trainees	-	-	-	24	-	-	24
Training Hours	-	-	-	806	-	-	806
JASDF-Depot Officers Course							
Trainees	-	-	-	52	-	-	52
Training Hours	-	-	-	3,868	-	-	3,868
Military Correspondence							
Trainees	-	-	-	189	66	70	325
Training Hours	-	-	-	3,779	1,476	791	6,046
Maintenance Shop OJT							
Trainees	-	-	-	235	-	46	281
Training Hours	-	-	-	7,723	-	24,519	32,242
Jet Engine Familiarization							
Trainees	-	-	-	11	-	-	11
Training Hours	-	-	-	136	-	-	136
Electrical Fundamentals							
Trainees	-	-	-	28	-	-	28
Training Hours	-	-	-	914	-	-	914
F-84G-IBAW Procedures							
Trainees	-	-	-	115	-	-	115
Training Hours	-	-	-	5,082	-	-	5,082

Course	1951	1952	1953	1954	1955	1956	Total
Boiler Water Analysis							
Trainees	-	-	-	8	-	-	8
Training Hours	-	-	-	20	-	-	20
Airborne Radar Familiarization							
Trainees	-	-	-	11	-	-	11
Training Hours	-	-	-	374	-	-	374
F86-D Maintenance Training							
Trainees	-	-	-	16	77	-	33
Training Hours	-	-	-	1,631	3,481	-	5,112
OJT Courses							
Trainees	-	-	-	49	-	-	49
Training Hours	-	-	-	2,005	-	-	2,005
Ammo Handling							
Trainees	-	-	-	147	-	-	147
Training Hours	-	-	-	4,566	-	-	4,566
Supply Introduction Course							
Trainees	-	-	-	36	14	-	50
Training Hours	-	-	-	613	2,292	-	2,905
Corrosion & Packaging							
Trainees	-	-	-	114	-	-	114
Training Hours	-	-	-	4,215	-	-	4,215
Holding Account Procedures							
Trainees	-	-	-	55	-	-	55
Training Hours	-	-	-	390	-	-	390
Stock Number Conversion							
Trainees	-	-	-	83	-	-	83
Training Hours	-	-	-	304	-	-	304
POL Supply Course							
Trainees	-	-	-	8	-	-	8
Training Hours	-	-	-	168	-	-	168
Basic Warehouse Course							
Trainees	-	-	-	130	-	-	130
Training Hours	-	-	-	3,620	-	-	3,620

Course	1951	1952	1953	1954	1955	1956	Total
Transportation Course							
Trainees	-	-	-	12	-	-	12
Training Hours	-	-	-	194	-	-	194
Base Support Procedures							
Trainees	-	-	-	61	7	-	68
Training Hours	-	-	-	828	90	-	918
Packing Specialist							
Trainees	-	-	-	74	-	-	74
Training Hours	-	-	-	1,425	-	-	1,425
Inventory Count Specialist							
Trainees	-	-	-	42	-	-	42
Training Hours	-	-	-	126	-	-	126
Safety Training							
Trainees	-	-	-	265	-	-	265
Training Hours	-	-	-	316	-	-	316
Spoken English							
Trainees	-	-	-	428	-	-	428
Training Hours	-	-	-	2,299	-	-	2,299
General Orientation							
Trainees	-	-	-	-	603	-	603
Training Hours	-	-	-	-	1,206	-	1,206
Wing Build-up Orientation							
Trainees	-	-	-	-	3	-	3
Training Hours	-	-	-	-	6	-	6
Stock Tracer Orientation							
Trainees	-	-	-	-	20	-	20
Training Hours	-	-	-	-	734	-	734
Program Stock Tracers							
Trainees	-	-	-	-	-	-	-
Training Hours	-	-	-	-	292		292
Familiarization of Federal Cataloging Program for Stock Tracers							
Trainees	-	-	-	-	42	-	42
Training Hours	-	-	-	-	-	-	-

Course	1951	1952	1953	1954	1955	1956	Total
OJT Instructor's Course							
Trainees	-	-	-	-	16	-	16
Training Hours	-	-	-	-	288	-	288
Technical Instructor's Course							
Trainees	-	-	-	-	21	-	21
Training Hours	-	-	-	-	3,520	-	3,520
Type 407 Accounting Machine Operators							
Trainees	-	-	-	-	30	-	30
Training Hours	-	-	-	-	1,065	-	1,065
English Training							
Trainees	-	-	-	-	24	-	24
Training Hours	-	-	-	-	601	-	601
Civilian Guard Training							
Trainees	-	-	-	-	3,033	-	3,033
Training Hours	-	-	-	-	36,498	-	36,498
Sanitary Dog Handler Course							
Trainees	-	-	-	-	108	118	226
Training Hours	-	-	-	-	13,140	13,844	26,984
Food Handlers Training							
Trainees	-	-	-	-	126	-	126
Training Hours	-	-	-	-	3,990	-	3,990
First Aid							
Trainees	-	-	-	-	18	-	18
Training Hours	-	-	-	-	267	-	267
Hydromatic Vehicles Familiarization Course							
Trainees	-	-	-	-	80	-	[illegible]
Training Hours	-	-	-	-	240	-	[illegible]
Aircraft Propeller Orientation							
Trainees	-	-	-	-	8	-	[illegible]
Training Hours	-	-	-	-	530	-	[illegible]
F-86D Familiarization							
Trainees	-	-	-	-	39	-	[illegible]
Training Hours	-	-	-	-	2,476	-	[illegible]

Course	1951	1952	1953	1954	1955	1956	Total
F-86 Line Hydraulic-OJT							
Trainees	-	-	-	-	4	-	4
Training Hours	-	-	-	-	112	-	112
J-47-173, 33 Build-up							
Trainees	-	-	-	-	12	-	12
Training hours	-	-	-	-	120	-	120
Air Conditioning Systems Operator Training							
Trainees	-	-	-	-	13	61	74
Training Hours	-	-	-	-	348	2,385	2,733
Electric Shop OJT							
Trainees	-	-	-	-	93	-	93
Training Hours	-	-	-	-	1,266	-	1,266
Fabric Shop OJT							
Trainees	-	-	-	-	77	-	77
Training Hours	-	-	-	-	686	-	686
Technical Publication HYD							
Trainees	-	-	-	-	37	-	37
Training Hours	-	-	-	-	780	-	780
Technical Order Filing							
Trainees	-	-	-	-	7	-	7
Training Hours	-	-	-	-	49	-	49
Paint and Dope Shop OJT							
Trainees	-	-	-	-	5	-	5
Training Hours	-	-	-	-	49	-	49
Rubber Shop							
Trainees	-	-	-	-	4	-	4
Training Hours	-	-	-	-	52	-	52
Aircraft Instrument Shop OJT							
Trainees	-	-	-	-	9	-	9
Training Hours	-	-	-	-	533	-	533
Electric Shop OJT							
Trainees	-	-	-	-	11	-	11
Training Hours	-	-	-	-	2,691	-	2,691
F-86 F Flight Control, Landing Gear S-C Maint.							
Trainees	-	-	-	-	26	-	26
Training Hours	-	-	-	-	492	-	492

Course	1951	1952	1953	1954	1955	1956	Total
Carburetor Shop OJT							
Trainees	-	-	-	-	11	-	11
Training Hours	-	-	-	-	33	-	33
J-65 Familiarization							
Trainees	-	-	-	-	68	-	68
Training Hours	-	-	-	-	18	-	18
Warehouse Location-Change Procedure							
Trainees	-	-	-	-	486	-	486
Training Hours	-	-	-	-	1,866	-	1,866
Error Correction Procedure							
Trainees	-	-	-	-	4	-	4
Training Hours	-	-	-	-	60	-	60
Depot Monetary Inventory-Accounting Procedure							
Trainees	-	-	-	-	81	-	81
Training Hours	-	-	-	-	1,431	-	1,431
Supply Orientation for Inventory Personnel							
Trainees	-	-	-	-	53	-	53
Training Hours	-	-	-	-	1,904	-	1,904
Warehousing Familiarization							
Trainees	-	-	-	-	23	-	23
Training Hours	-	-	-	-	547	-	547
Depot Monetary Inventory Accounting Procedure							
Trainees	-	-	-	-	73	-	73
Training Hours	-	-	-	-	837	-	837
Stock Record Refresher							
Trainees	-	-	-	-	32	-	32
Training Hours	-	-	-	-	226	-	226
MRS & MAP							
Trainees	-	-	-	-	96	-	96
Training Hours	-	-	-	-	1,257	-	1,257
EPA Mark-Sence Offset Procedures Familiarization							
Trainees	-	-	-	-	91	-	91
Training Hours	-	-	-	-	6,564	-	6,564

Course	1951	1952	1953	1954	1955	1956	Total
TYPE 407 & 514 Machine Operation Familiarization							
Trainees	-	-	-	-	18	-	18
Training Hours	-	-	-	-	690	-	690
TYP 604 Calculator							
Trainees	-	-	-	-	22	-	22
Training Hours	-	-	-	-	666	-	666
MPA & FSC Familiarization for Warehouse							
Trainees	-	-	-	-	19	-	19
Training Hours	-	-	-	-	236	-	236
MRS & MAP for Stock Tracers							
Trainees	-	-	-	-	48	-	48
Training Hours	-	-	-	-	869	-	869
Technical TRI Course							
Trainees	-	-	-	-	47	-	47
Training Hours	-	-	-	-	2,796	-	2,796
Japanese Labor Policies							
Trainees	-	-	-	-	-	390	390
Training Hours	-	-	-	-	-	913	913
Contractor Orientation (Japan A/C Co)							
Trainees	-	-	-	-	-	24	24
Training Hours	-	-	-	-	-	500	500
Typing & Military Correspondence							
Trainees	-	-	-	-	-	29	29
Training Hours	-	-	-	-	-	1,446	1,446
Inspection & Testing							
Trainees	-	-	-	-	-	26	26
Training Hours	-	-	-	-	-	2,009	2,009
Insect & Rodent Control							
Trainees	-	-	-	-	-	16	16
Training Hours	-	-	-	-	-	242	242
Leading C-119							
Trainees	-	-	-	-	-	81	81
Training Hours	-	-	-	-	-	467	467

Course	1951	1952	1953	1954	1955	1956	Total
J-65-3 A/C Engine Familiarization							
Trainees	-	-	-	-	-	18	18
Training Hours	-	-	-	-	-	220	220
Boiler Water Treatment							
Trainees	-	-	-	-	-	18	18
Training Hours	-	-	-	-	-	-	-
Electrical Measuring Instruments							
Trainees	-	-	-	-	-	42	42
Training Hours	-	-	-	-	-	2,436	2,436
Electrical Instrument Repair							
Trainees	-	-	-	-	-	20	20
Training Hours	-	-	-	-	-	516	516
Dry Cleaning Procedures							
Trainees	-	-	-	-	-	4	4
Training Hours	-	-	-	-	-	24	24
Theory of Boiler Operation							
Trainees	-	-	-	-	-	21	21
Training Hours	-	-	-	-	-	224	224
357 A/C Familiarization							
Trainees	-	-	-	-	-	58	58
Training Hours	-	-	-	-	-	4,561	4,561
T. C. Familiarization							
Trainees	-	-	-	-	-	58	58
Training Hours	-	-	-	-	-	1,160	1,160
Interrated Electronic Control							
Trainees	-	-	-	-	-	23	23
Training Hours	-	-	-	-	-	1,159	1,159
Carburetor Repair							
Trainees	-	-	-	-	-	15	15
Training Hours	-	-	-	-	-	160	160
Water Pump Operation							
Trainees	-	-	-	-	-	54	54
Training Hours	-	-	-	-	-	785	785

Course	1951	1952	1953	1954	1955	1956	Total
Hyp-System							
Trainees	-	-	-	-	-	28	28
Training Hours	-	-	-	-	-	977	977
Hydromatic Transmission							
Trainees	-	-	-	-	-	40	40
Training Hours	-	-	-	-	-	400	400
In-Checkers Training							
Trainees	-	-	-	-	-	56	56
Training Hours	-	-	-	-	-	1,038	1,038
Inspection Instructor's Course							
Trainees	-	-	-	-	-	13	13
Training Hours	-	-	-	-	-	2,426	2,426
Packing Refresher Training							
Trainees	-	-	-	-	-	54	54
Training Hours	-	-	-	-	-	409	409
Voucher Control							
Trainees	-	-	-	-	-	22	22
Training Hours	-	-	-	-	-	316	316
Depot Supply Record Specification							
Trainees	-	-	-	-	-	43	43
Training Hours	-	-	-	-	-	2,510	2,510
Mark-Sence Off-Set							
Trainees	-	-	-	-	-	126	126
Training Hours	-	-	-	-	-	2,724	2,724
Work Measurement Technician							
Trainees	-	-	-	-	-	40	40
Training Hours	-	-	-	-	-	8,570	8,570
Surveying							
Trainees	-	-	-	-	-	11	11
Training Hours	-	-	-	-	-	268	268
ISM - 407							
Trainees	-	-	-	-	-	166	166
Training Hours	-	-	-	-	-	21	21
ISM - 089, 402, 514							
Trainees	-	-	-	-	-	870	870
Training Hours	-	-	-	-	-	29	29

Appendix V

LIST OF THIRTY-THREE FORMER SUPERVISORY EMPLOYEES
OF TACHIKAWA AIR FORCE BASE
WITH PRESENT OCCUPATION

Name	First Job Title	When Hired	Title Departed As	When Left	Present Job
Shigeo Arai	Communications Equipment Repairer	1948	Training Instructor	1954	Chief, R&D Division Tokyo Instrument Company
Yoshio Arai	Production Control Specialist	1949	Training Admin.	1962	Chief, Electric Equipment Section Mitsubishi Denki
*Seishi Arisaka	Production Control Supervisor	1949	Training Admin.	1954	Vice President, Sumitomo.
*Takashi Asano	Dispatcher	1948	Training Instructor	1958	Business Manager Japan Industrial Training Association
*Ichikawa Fumihisa	Advisor	1953	Training Instructor	1960	Foreign Sales Representative, Price Auto Company
Ken Hasegawa	A/C Mechanic		A/C Mechanic		Assistant Chief Material Control Branch Japan Sales Promotion Bureau
*Teiji Horiguchi	Clerk	1948	Training Admin.	1959	Chief Nagoya Branch Japan Sales Promotion Bureau
Sukehiko Ito	Advisor	1948	Training Admin.	1961	Chief Liaison Section Mitsubishi Denki (Electronic Sales)
Tomio Iwasaki	Draftsman	1950	Information & Education Technician	1961	Plant Manager Yoshida Industries

Source: Personnel Departrent, Tachikawa Air Base.

Name	First Job Title	When Hired	Title Departed As	When Left	Present Job
Hamuro Kohsaku	Dispatcher	1953	Administrator	1960	Japan Concrete Block Company Personnel Technician
*Takaki Konno	St. Record Clerk	1948	Training Instructor	1955	Chief Sales Division Tokyo Instrument Company
Ichiro Maekawa	A/C Mechanic	1949	Training Instructor	1956	Chief Design Section Japan A/C Maintenance Company
Ichiro Miyauchi	Product Control Technician		Quality Control Inspector		Chief Inspector Branch Ishikawajima Haruma Heavy Industries
Ryojiro Nakagawa	A/C Mechanic		A/C Mechanic		Chief Administrative Section Japan Sales Promotion Bureau
Nami Nakajima	Driver	1947	Supervisor	1957	Major (JASDF) promoted Col.
Susumi Namiki	A/C Mechanic	1948	Training Instructor	1952	Chief Maintenance Branch Japan Aircraft Maintenance Company
*Chikanori Noda	Translator	1951	Training Admin.	1955	Chief Aircraft Design Branch Japan Air Lines
Hiroshi Naito	Draftsman	1950	Training Instructor	1959	Chief Design Section Ishikawajima Haruma Heavy Industries
*Shosaku Onshima	Auto Mechanic	1948	Training Instructor	1955	Deputy Manager Maintenance Engineer Branch Ishikawajima Haruma
Hiroshi Omigawa	Instructor	1949	Instructor	1952	Chief Personnel Division Shell Oil Company, Tokyo
Mamoru Ozeki	Instructor	1948	Instructor		Professor Waseda Univ.
Kiyotake Sakaki	Clerk, Product Control	1948	Training Admin.	1954	Assistant Chief Electronic Equipment Section Mitsubishi Denki

Name	First Job Title	When Hired	Title Departed As	When Left	Present Job
Hiroshi Shimamura	Instructor	1948		1952	President, Nippon Business Manager Consultant
Kenzo Shimazaki	A/C Mechanic	1948	Information & Education Technician	1954	Assistant Chief Engineer Branch Ito-chu A/C Maintenance Company
*Ben Suzuki	A/C Mechanic	1950	Training Instructor	1953	Col. Japan Air Self Defense Force
Tadao Suzuki	Clerk		Advisor		Chief Sales Branch A/C Spec. Packaging Company
*John Takarabe	Communications Equipment Repairer	1948	Training Admin.	1951	Chief Engineer Division Tokyo Instrument Company
*Shinichi Takezawa	Advisor	1949	Training Instructor	1951	Assistant Professor Industrial Relations St. Paul University Tokyo
Tsuneo Tamura	Advisor	1948	Training Admin.	1960	Manager Tokyo District Japan Sales Promotion Bureau
Shozo Tani	Draftsman	1951	Training Instructor	1959	Assistant Chief Sales Branch Mitsubishi Denki
Harumitsu Tomiyama	Translator	1951	Training Instructor	1958	Assistant Chief Engineer Branch Ishikawajima Haruma Heavy Industries
Watanabe	Safety Advisor	1953	Safety Advisor	1959	3M Company District Manager
*Yukuzo Yamazaki	Training Aids Man	1952	Training Instructor	1956	Lawyer, Harashima Law Office (now in Dallas, Texas)

Appendix VI

LIST OF EIGHTEEN LESS SKILLED EMPLOYEES OF TACHIKAWA AIR FORCE BASE WITH PRESENT OCCUPATION

Name	Date and Title Started Working at Tachikawa	Date and Title When He Left Tachikawa	Present Occupation
Adachi, Takaji	Dec. 1952 Waiter	Still Employed	Club Manager, Officers' Open Mess, Tachikawa AB
Azuma, Riichi	Apr. 1946 Admin. Clerk	May 1964 JN Manager Field Maintenance	President of Far East Manufacturing Company, Ltd. (fishing tackle, etc.)
Kishida, Fujio	Apr. 1949 Interpreter	Aug. 1962 Position Classifier	Chief Labor Branch Taito Phizer Company, Ltd.
Kokubo, Atsushi	Jan. 1948 Clerk	Apr. 1963 JN Manager Vehicle Maintenance	Chief, Shipping Section Concert Hall Society
Kuriyama, Reiji	Dec. 1947 Freight Handler		Local National Manager, Kanto-mura Commissary
Nara, Katsuyoshi	Apr. 1950 Clerk	1960 Special Technicalman	Chief, Technical Branch Japan Aviotronics Company, Ltd.
Okanda, Yoshio	Aug. 1952 Interpreter	Sept. 1957 Interpreter	Pres. Shiroyama Department Restaurant Pres. Chain Store (Grocery Birds and Fish)
Saito, Hayata	1947 Guard	1963 Guard Supervisor	Chief, Business Branch, New Japan Taxi Company, Ltd.
Shino, Iwao	Dec. 1945 Interpreter	Dec. 1953 Training Officer	Chief, Business Division Taito Phizer Company, Ltd.
Sugihara, Goro	1947 Guard	1963 Guard Supervisor	Chief, Guard Branch Guarding and Security Company, Ltd.
Sung, Kokuyu	1945 Cook	Still Employed	Local National Manager Food Services, Tachikawa AB

Source: Same as Appendix V.

Name	Date and Title Started Working at Tachikawa	Date and Title When He Left Tachikawa	Present Occupation
Tabuchi, Ryoan	Feb. 1952 Interpreter	Still employed	Housing Manager, Billeting Division
Takeuchi, Shigeo	1947 Clerk	May 1964 Position Classifier	Chief, Foreign Affairs Section, Tokyo Press and Die Company, Ltd.
Tanaka, Akira	Aug. 1949 Electrician	Dec. 1960 Electrician (Chairman, Tachikawa Chapter Zenchuro)	Assembly member of Akishima City (Candidate for Assembly member of Tokyo Met. Government now in election).
Tateno, Masayoshi	1950 Clerk	1962 Position Classifier	Personnel Officer, Japan Bulldozer and Civil Engineering Company, Ltd.
Tomochika, Kazuhiko	1950 Clerk	1960 Advisor	Chief, Planning Branch, Japan Aviotronics Company, Ltd.
Yokoyama, Takashi	July 1947 Clerk	Dec. 1958 Assistant Manager PX	Chief, General Affairs Division, Phizer Company, Ltd.
Yoshimoto, Hachiro	Apr. 1950 Interpreter	Mar. 1953 Interpreter Stationed in Arabia	Arab Petroleum Company, Ltd. (Headed by Yamashito, Taro) Liaison Officer.

Appendix VII

U. S. ARMED FORCES PROCUREMENTS IN JAPAN
FOR FISCAL YEAR 1965*
($000's)

Category	Army	Navy	Air Force	Defense Supply Agency	Total	Percentage Grand Total
Construction (Buildings and Facilities)	12,341	1,637	3,302		17,280	12
Maintenance, Operation, Repair of Facilities, Grounds, and Buildings	84,476		548		85,024	58
Housekeeping Utilities	11,011	360	4,720		16,091	11
Fuel (other than Housekeeping)				5,974**	5,974	4
Air and Space Industry	157	2,732	461		3,350	2
Automobile Industry	3,829				3,829	3
Electronics & Communications Industry	2,183	265			2,448	2
Shipbuilding Industry		935			935	1
Transportation Services	3,040	459	1,714		5,213	3
Miscellaneous Services	2,144	337	348		2,829	2
Miscellaneous Goods	3,255	324	128	70	3,777	2
Total	122,436	7,049	11,221	6,044	146,750	(Grand Total)
Per Cent of Grand Total	83	5	8	4	100	100

* Contracts below 10,000 are excluded by the IBM system of the Department of Defense. It has been estimated that this would exclude as much as 14 percent of total contracts. The data has been further adjusted to omit any contracts with U.S. companies in Japan. Such adjustment has resulted in the further deletion of about 6 millions on contracts, or another 4 percent.

** These contracts were placed largely with Japanese subsidies of international oil companies. In all probability, the fuel oils were refined in Japan, but it is hard to estimate what portion of these proceeds actually stayed in Japan.

Source: U. S. Department of Defense.

U. S. Army Procurement Contracts Over $10,000 with Japanese Firms (in $000's). For Year 1965

Category Item	Totals	Amount	Percentage
Buildings & Facilities Construction	12,341		10
Housing		514	
Other Buildings		9,846	
Other Construction		1,578	
Architect and Engineer Services		403	
Operation & Maintenance of Facilities	84,476		69
Air & Space Industry Contracts	157		
Tires & Tubes for Aircraft		133	
Aircraft Technical Representative Services		24	
Automobile Industry Contracts	3,829		3
Passenger Motor Vehicles Purchase		13	
Bodies and Frames		38	
Brakes		521	
Cooling System Components		314	
Diesel Engine Components		362	
Gasoline Engine Components		57	
Engine Electric System Components		367	
Engine Fuel System Components		279	
Drive and Fan Belts		17	
Vehicular Furniture & Accessories		103	
Miscellaneous Vehicular Components		1,697	
Miscellaneous Engine Accessories		61	
Electronics & Communication Industry Contracts	2,183		2
Tubes, Transistors, & Rectifiers		36	
Antennas		10	
Cable, Cord, & Wire		44	
Telephone & Telegraph Equipment		23	
Airborne Communication Equipment		13	
Tubes, Transistors, & Rectifiers		16	
Coils & Transformers		15	
Switches		61	
Miscellaneous Communication Equipment		14	

Category Item	Totals	Amount	Percentage
Miscellaneous Electronics Equipment		90	
Miscellaneous Electronics Equipment Components		83	
Operation & Maintenance of Electronic & Communication System		1,654	
Electronics & Communication Technical Representative Services		124	
Transportation Services	3,040		2
Vehicle Hire		807	
Stevedoring		507	
Other		1,726	
Miscellaneous Service Contracts	2,144		2
Maintenance & Repair of Miscellaneous Equipment		1,938	
Storage Services		101	
Miscellaneous Lease & Rental		14	
Packing & Crating		13	
Photographic, Printing, & Mapping Service		30	
ADP &/or EAM Equipment Rental		48	
Miscellaneous Procurement of Goods	3,255		3
Storage Tanks		11	
Metal Screening		86	
Fences, Fencing, & Gates		25	
Mineral Construction Materials		36	
Other Construction Materials		38	
Plywood & Veneer		14	
Lumber		190	
Heating Equipment		21	
Laboratory Equipment & Supplies		22	
Optical Instruments		10	
Fuses for Explosives		29	
Bags & Sacks		226	
Fruits & Vegetables		187	
Dairy Foods and Eggs		2,165	
Steel Shapes		16	
Non-Steel Metal Shapes		42	
Miscellaneous Items		137	
Housekeeping Utilities	11,011		9
Electricity		8,412	
Water		523	
Telephone		1,997	
Gas		79	
	122,436		100

U. S. Navy Procurement Contracts Over $10,000
with Japanese Firms (in $000's).
For Year 1965

Category Item	Totals	Amount	Percentage
Buildings & Facilities Construction	1,637		23
Buildings (other than housing)		122	
Other Construction		1,442	
Drafting Consultant Service		32	
Miscellaneous Construction Service		41	
Air & Space Contracts	2,732		39
Maintenance &/or Repair of Aircraft		2,713	
Guided Missile Components		19	
Shipyard Contracts	935		13
Maintenance & Repair of Vessels		935	
Electronics & Communication Contracts	265		4
Cable, Cord & Wire Assemblies		28	
Sound Recording Equipment		11	
Testing Instruments (for electronic equipment)		41	
Maintenance & Repair of Electronic Equipment		133	
Operation & Maintenance of Electronics & Communication System		52	
Transportation Services	459		6
Cargo Space, Vessel		80	
Vessel Charter		314	
Tug-Boat Service		65	
Miscellaneous Service Contracts	337		5
Garbage Collection		95	
Janitor Services		36	
Landscaping		18	
Maintenance &/or Operation of Utility System		28	
Installation of Equipment		137	
Miscellaneous Lease & Rental Facilities		23	
Miscellaneous Procurement of Goods	324		5
Beverages (non-alcoholic)		55	
Passenger Water Vehicles		53	

Category Item	Totals	Amount	Percentage
Hardware		11	
Geophysical & Astronomical Instruments		31	
Generators		127	
Transformers		21	
Special Purpose Clothing		12	
Iron & Steel, Plate, Sheet, & Strip		14	
Housekeeping Utilities Service	360		5
Housekeeping Electricity		344	
Fueling Service		16	
	7,049	7,049	100

U. S. Air Force Procurement Contracts Over $10,000
with Japanese Firms (in $000's).
For Year 1965

Category Item	Totals	Amount	Percentage
Buildings & Facilities Construction	3,302		29
Year 1917		1,474	
Year 1919		526	
Year 1916 (Painting)		609	
Housing		227	
Other Construction		354	
Architect & Engineer Service		112	
Maintenance & Repair of Grounds	548	548	5
Air & Space Industry Contracts	461		4
Maintenance &/or Repair of Aircraft		425	
Modification & Rebuild of Aircraft		36	
Transportation Services	1,714		15
Air Passenger Transportation		1,714	
Miscellaneous Services	348		3
Drafting & Engineering Consultant Services		70	
Laundry & Dry-Cleaning		15	
Custodial & Janitorial		80	
Miscellaneous Lease & Rental		183	
Miscellaneous Goods Procurement	128		1
Textiles		37	
Electric Lighting Fixtures		20	
Cameras Still Picture		21	
Metal Screens		18	
Floor Covering		32	
Housekeeping Utilities	4,720		43
Electricity		4,562	
Gas		123	
Other		35	
	11,221	11,221	100

Appendix VIII

TABLE OF WESTERN PACIFIC PROCUREMENTS OF U. S. ARMY

(in millions of dollars)

	1962	1963	1964	TOTAL	MEAN FOR 3 YEARS
JAPAN	188.3 (78.5%)	146.7 (73.4%)	130.0 (69.5%)	465.0 (74.2%)	155.0 (74.2%)
KOREA	37.7 (15.7%)	34.2 (17.1%)	34.9 (18.7%)	106.8 (17.0%)	35.6 (17.0%)
RYUKYU ISLAND	11.2 (4.7%)	10.3 (5.2%)	15.3 (8.2%)	36.8 (5.9%)	12.27(5.9%)
SOUTHEAST ASIA	2.7 (1.1%)	8.6 (4.3%)	6.8 (3.6%)	18.1 (2.9%)	6.03(2.9%)
TOTAL	239.9 (100%)	199.8 (100%)	187.0 (100%)	626.7 (100%)	208.90(100%)

Source: U. S. Army Headquarters, Zama, Japan.

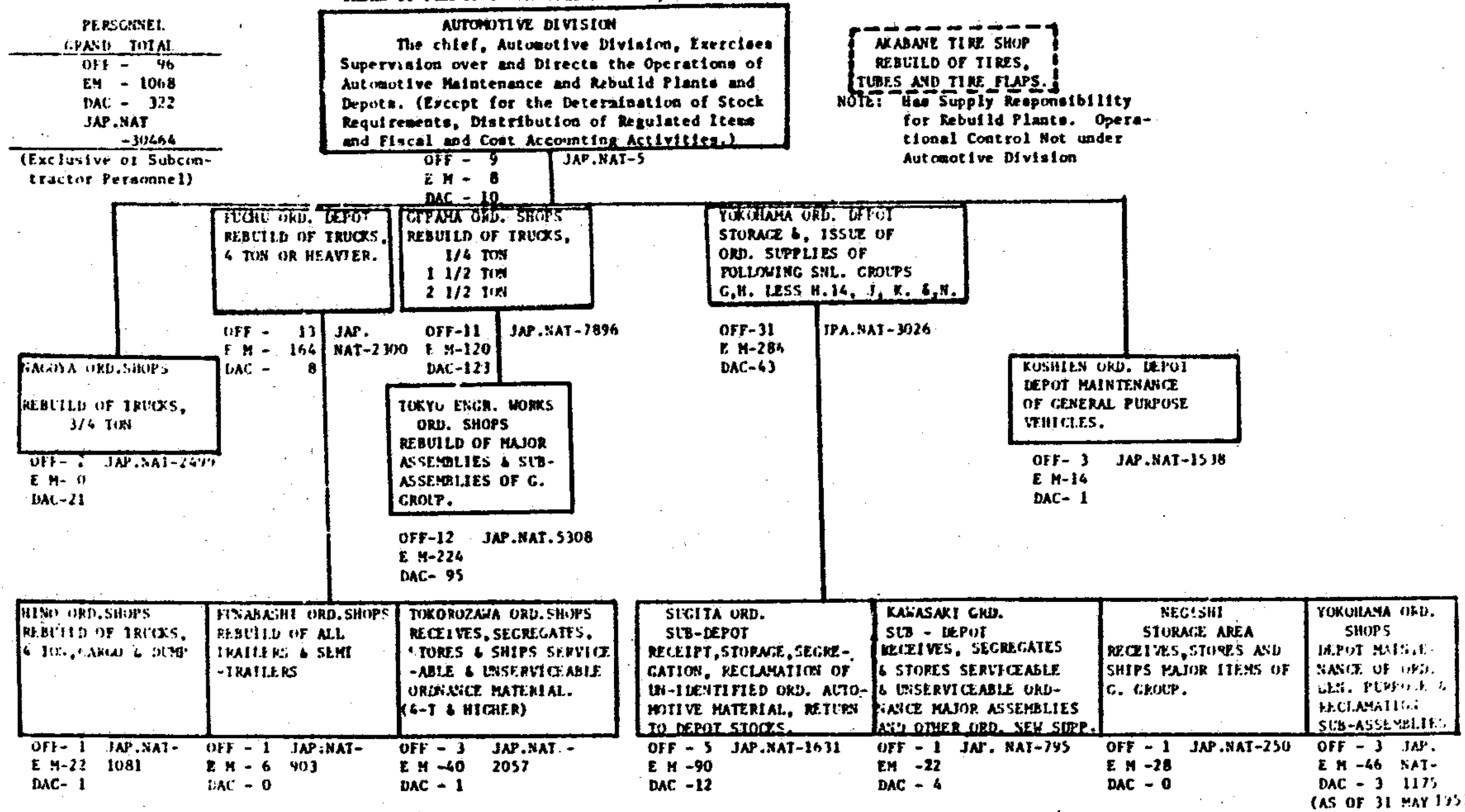
Appendix IX

PROCUREMENT BREAKDOWN DURING KOREAN WAR
JULY, 1950 - DECEMBER, 1953
(In millions U.S. dollars)

Item	1950	1951	1952	1953	Total 1950-53	Percentage of Product Total	Percentage Grand Total
Food	7.392	1.304	6.335	6.276	21.307	2.57	1.64
Beverage & Tobacco	.452	1.625	2.913	.482	5.472	.66	.42
Raw Material	7.991	13.033	15.202	1.059	37.285	4.50	2.88
Mineral Fuel	7.425	16.023	46.568	14.596	84.612	10.21	6.53
	11.616	24.185	19.980	5.038	60.819	7.34	4.69
Rubber Products	1.758	3.352	.503	.147	5.760	.70	.44
Wood Products	7.921	7.153	7.962	1.073	24.109	2.91	1.86
Pulp Paper	1.157	1.437	2.542	.609	5.743	.69	.44
Textile	62.531	44.740	27.386	1.330	135.987	16.41	10.50
Non-Metal Products	2.173	11.715	8.971	.456	23.315	2.81	1.8[illegible]
Primary Metal Products	11.167	17.717	24.654	1.951	55.489	6.70	4.28
Metal Products	36.651	45.191	90.593	14.303	185.120	22.342	14.29
Machines	3.526	3.956	4.886	.768	13.136	1.59	[illegible]

Item	1950	1951	1952	1953	Total 1950-53	Percentage of Product Total	Percentage Grand Total
Electric Machines	9.313	7.059	7.537	2.522	26.431	3.19	2.04
Transportation Equipment	43.990	30.309	11.474	3.455	89.228	10.768	6.89
	7.597	10.743	9.642	.527	28.509	3.44	2.20
Clothes & Shoes	4.938	4.638	4.356	.108	14.040	1.69	1.09
Other	2.399	1.984	3.726	2.481	10.590	1.28	.82
TOTAL	229.995	246.164	295.230	57.181	828.570	100.00	63.96
Services						Service Total	
Transportation Warehouse	39.324	26.622	28.841	22.689	117.476	25.16	9.068
Communication	4.747	5.077	40.797	26.372	76.993	16.49	5.94
Construction	11.146	16.719	46.849	20.117	94.831	20.31	7.3[illegible]
Repairs	39.600	32.455	54.985	30.553	157.593	33.75	12.1[illegible]
Manufactured Goods Using U. S. Army Materials	1.535	1.779	.312	.046	3.672	.79	.28
Professional Service	2.035	.703	3.565	1.244	7.547	1.62	.58
Other Service	.540	2.001	5.847	.412	8.800	1.88	.68
TOTAL	98.927	85.356	181.196	101.433	466.912	100.00	36.0[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	14[illegible]	[illegible]	[illegible]	[illegible]

Appendix Table X
TABLE OF PLANTS IN REBUILD PROGRAM, 1951



Source: Japan Logistical Command, Automotive Rebuilds in Japan, 1951, p. 111.

Appendix XI

ARMS MANUFACTURED IN JAPAN FOR AMERICAN PROCUREMENT 1952 - 1957 (Unit: ¥1,000)

U.S. Fiscal Years

1952

Classification	Types	Quantity	Amount of Money
Artillery	4.2 inch Mortar	528	78,424
Shell	81mm Mortar Shell	726,500	2,652,246
	4.2 inch Mortar Shell	363,300	2,743,932
Explosives	Hand Grenade	408,120	36,516
Shell and Parts of Explosives	Fuse	72,800	7,024
	Total................		5,518,142

1953

Classification	Types	Quantity	Amount of Money
Rifle	Rifle Stand	1,975	58,514
Artillery	57mm Recoilless Rifle	837	40,004
	60mm Mortar	514	11,149
Explosives' Launcher	Rocket Launcher	7,656	123,509
Cartridge	.50 Cal. Cartridge	10,362,000	1,122,494
Shell	57mm Recoilless Rifle Shell	111,000	257,746
	75mm Recoilless Rifle Shell	198,000	1,044,083
	60mm Mortar Shell	278,700	437,918
	81mm Mortar Shell	820,300	2,685,206
	4.2 inch Mortar Shell	270,000	2,032,676
	105mm Howitzer Shell	750,000	6,350,040
	155mm Howitzer Shell	260,000	2,424,816

Source: Japan Ordnance Association, Nippon no Boei Sangyo (Japan's Defense Industry) Tokyo, The Association, 1961, p. 110.

1953

Classification	Types	Quantity	Amount of Money
Explosives	2.36 inch Rocket	125,000	184,050
	3.5 inch Rocket	475,000	1,221,997
	Ground Mine	24,000	94,176
	Hand Grenade	1,767,500	335,083
Other	Bayonet	20,000	21,420
Gunpowder		260,000	2,326,176
	Total	....	20,771,057

1954

Classification	Types	Quantity	Amount of Money
Artillery	57mm Recoilless Rifle	286	51,731
	75mm Recoilless Rifle	16	4,607
	60mm Mortar	127	5,447
	81mm Mortar	24	3,276
	4.2 inch Mortar	117	77,498
Explosives' Launcher	Rocket Launcher	829	17,466
Cartridge	.30 Cal. Cartridge	122,540,000	3,161,493
Shell	57mm Recoilless Rifle Shell	137,100	373,576
	60mm Mortar Shell	260,600	553,880
	81mm Mortar Shell	542,000	1,879,652
	4.2 inch Mortar Shell	458,400	3,760,779
	105mm Howitzer Shell	952,000	8,981,611
	155mm Howitzer Shell	225,940	2,547,247
Explosives	3.5 inch Rocket	22,000	119,397
	Hand Grenade	316,500	117,271
Other	Bayonet	32,424	35,296
Gunpowder		1,068,940	1,166,760
	Total	....	22,856,987

1955

Classification	Types	Quantity	Amount of Money
Explosives' Launcher	Rocket Launcher	7,069	120,658
Cartridge	.30 Cal. Cartridge	8,983,000	229,605
	.45 Cal. Pistol Cartridge	3,741,000	112,608

1955

Classification	Types	Quantity	Amount of Money
Shell	75mm Howitzer Shell	44,000	254,264
	155mm Howitzer Shell	79,393	704,574
Shells and Parts of Explosives	Fuse	56,293	100,733
Gunpowder		87,293	569,467
	Total................		2,091,909

1956

Classification	Types	Quantity	Amount of Money
Shell	105mm Howitzer Shell	34,000	435,989
	155mm Howitzer Shell	10,900	214,721
Shell and Parts of Explosives	Fuse	784,000	124,565
Gunpowder		871,700	34,833
	Total................		810,108

1957

Classification	Types	Quantity	Amount of Money
Shells and Parts of Explosives		48,000	22,395
	Total................		22,395

TOTAL, 1952-1957

Classification	Types	Quantity	Amount of Money	Remarks
Rifle	Rifle Stand	1,975	58,514	100 cancelled from total
Artillery	57mm Recoil-less Rifle	1,123	91,735	All cancelled
	75mm Recoil-less Rifle	16	4,607	
	60mm Mortar	641	16,596	
	81mm Mortar	24	3,276	
	4.2 inch Mortar	645	155,922	
Explosives' Launcher	Rocket Launcher	15,554	261,633	6,548 during the fiscal year 1953 and 829 during the fiscal year 1954 were cancelled.
Cartridge	.30 Cal. Cartridge	131,523,000	3,891,098	
	.45 Cal. Pistol Cartridge	3,741,000	112,608	
	.50 Cal. Cartridge	10,362,000	1,122,494	
Shell	57mm Recoilless Rifle Shell	248,100	631,322	
	75mm Recoilless Rifle Shell	198,000	1,044,083	
	60mm Mortar Shell	537,300	991,798	
	81mm Mortar Shell	2,088,800	7,217,104	
	4.2 inch Mortar Shell	1,091,700	8,537,287	
	75mm Howitzer Shell	44,000	254,264	
	105mm Howitzer Shell	1,736,000	15,767,640	
	155mm Howitzer Shell	576,233	5,891,358	
Explosives	2.36 inch Rocket	125,000	184,050	16,774 were cancelled from total
	3.5 inch Rocket	497,000	1,341,394	
	Ground Mine	24,000	94,176	
	Hand Grenade	2,492,120	438,870	

Classification	Types	Quantity	Amount of Money	Remarks
Shell and Parts of Explosives	Fuse	961,093	254,717	
Other	Bayonet	52,424	56,716	
Gunpowder		2,287,933	4,097,236	
GRAND TOTAL			52,070,598	

Appendix XII

VEHICLES MANUFACTURED IN KOREAN WAR PERIOD
FOR U.S. SPECIAL PROCUREMENT

SORTS	1950	1951	1952	TOTAL
Ordinary Trucks	3,625	4,778	----	8,403
Special Equipped Cars	749	1,265	10	2,024
Bus	----	50	----	50
Midget Trucks	1	14	----	15
Automobiles	1	----	----	1
Total	4,376	6,107	10	10,493

Source: This table is based on a survey by the Association of Japan Car Industries.

Appendix XIII

Sample Of
CONTRACT AWARDS BY U. S. IN JAPAN
July 1, 1951-February 17, 1952
(Value in $000's)

Commodity Description	Unit	Quantity	Value
COMMODITIES TOTAL			193,280
Food			1,118
Wheat flour	m/t	5,100	665
Other foods	-	-	453
Beverages and tobacco			706
Ice	m/t	14,051	237
Cigarettes	th ea	418,666	469
Crude materials, inedible, except fuel			12,837
Crude rubber	l/t	1,901	1,988
Telegraph poles	ea	56,340	304
Railway sleepers	ea	408,750	1,247
Lumber, softwood	th bf	113,256	8,181
Lumber, hardwood	-	-	582
Gravel and crushed stone	cu yd	118,067	276
Other crude materials	-	-	309
Mineral fuels and lubricants			13,496
Coal, bituminous	m/t	844,433	13,049
Asphalt	-	-	363
Other mineral fuels and lubricants	-	-	84
Chemicals			16,903
Sulphuric acid	gal	182,000	58
Phosphoric acid	gal	440,690	1,158
Ethyl alcohol, denatured	drum	12,078	
	gal	10,000	710
Freon gas	lb	168,700	258
Calcium chloride	s/t	982	172
Acetylene gas	th cu ft	20,527	696
Enamel paint	gal	211,905	545
Paint, mixed	lb	494,850	
	gal	133,852	610

Source: SCAP Economic & Scientific Section files in World War II Records Center, Alexandria, Virginia.

Commodity Description	Unit	Quantity	Value
Other coatings and mastics	-	-	496
Serum and vaccines	-	-	523
Penicillin	bottle	139,000	135
Sulphamines	-	-	277
Gauze, bandage and absorbent cotton	-	-	410
Blood plasma	pkg*	15,000	138
Other pharmaceutical products	-	-	638
Ammonium sulphate	m/t	199,200	3,839
Calcium superphosphate	m/t	2,600	128
Prepared fertilizers	m/t	7,586	445
Dynamite	lb	1,031,359	198
Box flares	ea	413,300	498
Parachute flares	-	-	2,999
Other chemicals	-	-	1,912
Rubber manufactures			2,984
Truck tires	ea	47,700	2,441
Truck tire tubes	ea	41,250	133
Other rubber manufactures	-	-	410
Wood and cork manufactures			5,590
Plywood	sht	769,742	2,502
Fiberboard	sht	122,056	268
Bridge decks, laminated	set	2,000	420
Wood boxes	th ea	2,519	1,377
Pallets	ea	167,950	452
Other wood and cork manufactures	-	-	571
Paper and paper manufactures			1,378
Newsprint	roll	3,765	269
	ream	646	
Other printing and writing paper	-	-	612
Other paper and paper products	-	-	497
Textile yarns, fabrics & made-up articles			39,897
Cotton yarn and thread, unbleached	lb	725,460	588
Cotton yarn and thread, bleached	spool	456,710	
or dyed	lb	973,400	1,363
Other yarns & threads	lb	116,888	298
Cotton sheeting, unbleached	th yd	9,718	2,692
Duck, unbleached	yd	50,000	78
Cotton twill, bleached or dyed	th yd	21,236	9,894
Cotton sheeting, bleached or dyed	th yd	4,580	1,348
Duck, bleached or dyed	th yd	2,177	3,735
Other cotton fabric, bleached or dyed	th yd	905	304
Pile fabric, wool	yd	104,370	1,070
Other fabrics, ropes, etc.	-	-	1,192
Gunny bags, new	th ea	22,600	3,098
Gunny bags, used	th ea	36,955	4,510

Commodity Description	Unit	Quantity	Value
Tents	ea	8,251	1,693
Bags, duffel	ea	100,000	319
Tarpauline and other made-up canvas goods	-	-	447
Blankets	th ea	1,603	3,845
Sleeping pads	ea	258,000	1,878
Ponchoes	ea	238,650	1,176
Linoleum and similar products	-	-	242
Other made-up textile articles (except clothing)	-	-	127
Non-metallic mineral manufactures			6,945
Cement	m/t	297,576	
	th bag	89,509	5,056
Building materials, n.e.c., non-metallic mineral	-	-	360
Asbestos board	sht	70,400	436
Sheet glass	sht	767,754	432
Other non-metallic mineral manufactures	-	-	661
Primary metal products			13,783
Bars, iron & steel	-	-	1,004
Structural steel shapes	-	-	2,751
Piling	ft	224,040	911
Steel sheets & plates	sht	229,866	
	sq ft	129,700	1,352
Railway rails	ea	100,000	
	ft	771,500	1,529
Railway track accessories	-	-	496
Steel pipes, welded or drawn	th ft	1,355	
	ea	44,188	1,077
Cast iron pipes and fittings	-	-	2,968
Other iron and steel primary products	-	-	107
Copper wire	-	-	659
Lead ingots and sheets	-	-	485
Other nonferrous metal primary products	-	-	444
Metal manufactures			26,243
Barbed wire fence posts	th ea	5,632	3,522
Structural steel, fabricated	-	-	1,812
Wire cable and rope, steel	th ft	1,785	255
Barbed wire	coil	163,750	1,426
Wire nails	-	-	707
Nuts, bolts and washers, iron	-	-	1,053
Steel binding band	-	-	276
Shovels, picks and other hand tools	-	-	321
Drums, 55 gallon	th ea	1,338	10,550

Commodity Description	Unit	Quantity	Value
Other metal containers	-	-	2,975
Stoves and space heaters	ea	21,534	692
Stove parts & accessories	-	-	197
Fire extinguishers	ea	53,152	435
Canteens, aluminum	ea	582,405	293
Other metal manufactures	-	-	1,729
Machinery, other than electric			3,435
Steam generating boilers	ea	46	892
Internal combustion engines and parts	-	-	119
Construction machinery and parts	-	-	393
Gas compressors	ea	438	303
Valves and cocks	ea	135,920	808
Other machinery and parts	-	-	920
Electrical machinery and apparatus			5,882
Electric generators, transformers, etc.	-	-	781
Dry cells	-	-	239
Communication equipment	-	-	644
Insulated wire and cable	th ft	17,220	
	ea	4,500	2,003
Electric fan	ea	10,237	203
Storage batteries and parts	-	-	1,212
Insulators	ea	638,770	154
Other electrical machinery and apparatus	-	-	646
Transport equipment			25,599
Steam locomotives	ea	14	1,067
Freight cars	-	220	1,787
Parts of rolling stock	-	-	150
Buses	ea	45	266
Trucks	ea	128	298
Chains, automotive wheel	pair	33,100	409
Motor vehicle parts	-	-	15,515
Trailers	ea	14,452	4,319
Other road vehicles and aircraft parts	-	-	228
Wooden ships	ea	36	668
Pontoon barges	ea	50	252
Other ships and boats	ea	34	640
Prefabricated buildings, plumbing, heating and lighting fixtures			11,098
Prefabricated buildings	ea	13,281	7,633
Prefabricated tent kits	ea	20,000	2,008
Central heating apparatus and parts	-	-	354
Plumbing and bathroom fixtures	ea	85,319	392
Lamps and parts	-	-	561
Lighting fixtures n.e.s.	-	-	150

Commodity Description	Unit	Quantity	Value
Other manufactured articles			5,336
Furniture, wood	ea	45,993	435
Furniture, other than wood	ea	37,255	193
Socks, knitted cotton	th pair	1,210	187
Underwear, knitted	th ea	2,963	1,647
Coats and trousers of all materials	th ea	1,082	1,375
Other clothing	-	-	2[illegible]6
Footwear	pair	132,305	317
All other manufactured articles	-	-	916

* Pkg = 200cc

SERVICE CONTRACT AWARDS

By Armed Forces and Economic Cooperation Administration
(Value in $000's)
(July 1, 1951 - February 17, 1952)

	Received by ESS/PS
TOTAL	72,969
Transportation	7,968
Charterage	1,101
Other water transportation	5,910
Highway transportation	907
Other transportation	50
Communications	4,048
Handling and warehousing	4,875
Operation of facilities	7,641
Construction	15,936
Buildings	12,318
Other construction	3,618
Rehabilitation & processing of materials and equipment	31,350
Food products	210
Cotton products	537
Other textile products	470
Manufacture of clothing	351
Wood products	208
Rubber products	603
Iron & steel mill products	2,103
Electrical & communication equipment	588
Engines and boilers	148
Railway equipment	1,643
Motor vehicles	14,728
Water transportation equipment	1,454
Office appliances	79
Construction machinery	99
Ammunition loading and assembly	4,472
Bearing sets	750
Miscellaneous machinery	2,811
Miscellaneous products	96
Leases	28
Miscellaneous services	1,123
Printing	504
Other services	619

Appendix XIV

Arrangement for Production of P2V Airplanes between the Government of the United States of America and the Government of Japan

The Government of the United States of America and the Government of Japan, desiring to conclude an arrangement in accordance with the understandings reached in the Exchange of Notes, dated January 25, 1958, between the Ambassador Extraordinary and Plenipotentiary of the United States of America and the Minister for Foreign Affairs of Japan, relating to a joint cost sharing program for the production and development in Japan of anti-submarine and sea patrol type aircraft as a means of augmenting Japan's maritime self defense capabilities, have accordingly appointed their respective representatives for this purpose, who have agreed as follows:

Article I

For the purpose of this Arrangement, except where the text provides otherwise:

(1) The term "Government of Japan" means the Government of Japan or any officer duly authorized to act on behalf of such Government.

(2) The term "Government of the United States" means the Government of the United States of America or any officer duly authorized to act on behalf of such Government.

(3) The term "Contracting Officer" means any officer or civilian employee designated by the Government of the United States to administer this Arrangement on behalf of the said Government, including the authorized representative of a Contracting Officer acting within the limits of his authority.

(4) The term "Contract Technician" means a member of the civilian component of the United States Armed Forces under Article 1(b) of the Administrative Agreement under Article III of the Security Treaty between the United States of America and Japan, signed at Tokyo on February 28, 1952, so long as he meets all requirements for such status.

(5) The term "contract" means any agreement, contract, subcontract or purchase order made by the Government of Japan with any contractor in fulfillment of all or any part of this Arrangement, and any agreements, contracts, subcontracts or purchase orders thereunder.

(6) The term "United States Plant Representative" means the official stationed at the place of production and who has been assigned by the Government of the United States as the officer in charge of all United States Navy activities at such place.

Article II

The Government of the United States shall:

(1) Furnish, at no cost to the Government of Japan, loaded and stowed free on board Japanese vessels at United States ocean ports, the following:

a. the materials, parts, components and equipment required for performance of the "Supply Schedule for P2V Program" for forty-two (42) P2V airplanes, including such excess materials and parts as are determined by the Government of the United States to be necessary to cover losses in the production process. The said "Supply Schedule for P2V Program" shall be agreed upon between the competent authorities of the two Governments;

b. such spares as are determined necessary for support for the quantities of materials, parts, components and equipment furnished under subparagraph a above, not to exceed 20% of the cost of the said materials, parts, components and equipment;

c. such master and control tooling as will insure interchangeability at the significant mating point among the airplanes produced in the United States and those produced in Japan, including such U.S. masters, hand tools, tooling model parts, plaster plugs, glass cloths and such surplus major assembly jigs and plugs as may be available in the United States.

Title to such materials, parts, components and equipment shall pass to the Government of Japan upon delivery thereof loaded and stowed on board Japanese vessels at United States ocean ports. The Government of the United States shall bear transportation, handling, packaging and other charges accruing up to and including delivery thereof loaded and stowed on board Japanese vessels at United States ocean ports.

(2) As an exceptional case, and where the competent authorities of the two Governments agree, be permitted to furnish to the Government of Japan such materials, parts, components and equipment, as provided for in paragraph (1) above, for air shipment at United States airports. The Government of the United States shall bear only those transportation, handling, packaging and other charges accruing up to and including delivery of such materials, parts, components and equipment at United States airports.

Title to such materials, parts, components and equipment shall pass to the Government of Japan upon delivery thereof at United States airports.

(3) Furnish to the Government of Japan, at no cost, such technical data (as handbooks, manuals and operating instructions) necessary to provide adequate information concerning the airplanes or installed equipment.

(4) Inform the Government of Japan or its agent of the shipping schedules, with necessary particulars, within a reasonable period of time so as to enable the latter to provide vessels at the designated United States ocean ports.

(5) Take necessary steps to provide technical assistance to the Kawasaki Aircraft Company, Limited, in accordance with the technical assistance agreements entered into between the said

company and the Lockheed Aircraft Services-Overseas, Incorporated, as approved by the two Governments.

(6) Provide the services of Contract Technicians to assist in the execution of this Arrangement.

(7) Be permitted, instead of furnishing the materials, parts, components and equipment, as provided for in paragraph (1) of this Article at United States ocean ports, to procure directly or indirectly such materials, parts, components and equipment, from sources in Japan and furnish them to the Government of Japan; provided that the Government of the United States shall obtain the approval of the Government of Japan prior to such procurement.

Title to such materials, parts, components and equipment shall pass to the Government of Japan upon delivery thereof F.O.B. ex-factory at the inland point of shipment in Japan.

Article III

The Government of Japan shall:

(1) Accept formally from the Government of the United States the materials, parts, components, equipment and data furnished in accordance with Article II, paragraphs (1), (2), (3) and (7), take necessary steps from the time of acceptance for the protection and transportation to the production site in Japan of all such items, and bear all costs in connection therewith. Upon formal acceptance of the items a duly authorized representative of the Government of Japan shall issue a receipt therefor as evidence in writing of the full and complete delivery of each segment in itself.

(2) Through the medium of a contract with the Kawasaki Aircraft Company, Limited, take necessary steps to produce from the materials, parts, components and equipment furnished by the Government of the United States and from such materials, parts, components and equipment, manufactured in or supplied by Japan, a quantity of forty-two (42) P2V airplanes, including spares, and flight test the said airplanes, all in accordance with specifications cited in Lockheed Aircraft Corporation Report Number 12399, dated 19 July 1957 as amended, or as may further be amended, and bear the cost of such production and all costs related thereto.

(3) Render reports in connection with the flight testing of all P2V airplanes produced under this Arrangement, via the officer dispatched from the Japan Maritime Self Defense Force, to the United States Plant Representative who will make appropriate recommendations to the Government of Japan concerning the suitability of each airplane for acceptance.

(4) Upon acceptance, cause all completed airplanes to be used by the Japan Maritime Self Defense Force. Any other or subsequent disposition or use of the airplanes under the applicable laws and regulations of Japan will be made only after the prior consent of the Government of the United States.

(5) Recognizing that the approval by the Government of Japan of the technical assistance agreements between the Kawasaki Aircraft Company, Limited, and the Lockheed Aircraft Services-Overseas, Incorporated, for the production of the P2V airplanes under this Arrangement is a condition precedent to the performance

by the Government of the United States of any of the obligations assumed under this Arrangement, exert its best effort to approve, under the applicable laws and regulations of Japan, such technical assistance agreements, so that the work can be performed without delay.

It is understood that in case licenses and technical assistance agreements in connection with performance of this Arrangement are submitted to the Government of Japan for approval, the Government of Japan will, under the applicable laws and regulations of Japan, render a prompt decision in one way or another.

(6) Install in the P2V airplanes which have been completed and accepted by the Government of Japan such retrofit kits as may be furnished by the Government of the United States.

(7) In accordance with the laws and regulations of Japan, take appropriate steps, when necessary, to make the funds available from private or governmental sources to install the machine tools and production equipment required for the performance of this Arrangement and to otherwise permit the performance of this Arrangement by the Government of Japan.

(8) Furnish from time to time such progress reports relative to the work called for under this Arrangement as may be requested in writing by the United States Plant Representative.

Article IV

It is understood that the U.S.-Japan Cost Summary, attached hereto, is the broad scope within which each of the two Governments will take necessary steps to share the cost needed for the production of P2V aircraft.

Article V

The two Governments shall exert their best efforts to make available to the Japan Maritime Self Defense Force the airplanes and related spare parts produced under this Arrangement in accordance with the following cumulative schedule:

By March 31, 1960	6 Airplanes
By March 31, 1961	18 Airplanes
By March 31, 1962	30 Airplanes
By March 31, 1963	42 Airplanes

Article VI

All items preserved and packaged in Japan for the support of airplanes produced under this Arrangement will be processed in accordance with "Proposed Army Forces Far East Specification For Preservation, Packaging and Packing" except that specifications referred to therein shall be the latest revision in effect at the time this Arrangement is executed. The United States Plant Representative will be consulted upon the type of packaging as specified therein to be used for the various parts, units, components and materials involved.

Article VII

(1) All spare parts will be physically identified in accordance with specification MIL-M-7911. All Lockheed designed parts manufactured in Japan will be so part-numbered to conform to the

corresponding part numbers of the Lockheed Aircraft Corporation. All military parts and equipment manufactured in Japan will be so part-numbered as to conform to the Military Part or Type number (AN MS etc.). All Lockheed designed parts will have the Japanese Prime Contractor's letters (KAC as example) prefixed in front of the part numbers.

(2) Interior packages and shipping containers shall be marked in accordance with specification MIL STD 129.

Article VIII

(1) The Government of Japan shall make no changes in the airplanes being produced under this Arrangement without the written consent of the Contracting Officer. However, materials, parts, components and equipment furnished by the Government of the United States which are different from the airplane specifications cited under Article III, paragraph (2) shall be incorporated as so furnished into the airplanes to be assembled with only minimum changes as are required by such incorporation of the aforesaid materials, parts, components and equipment, all without specific written consent of the Contracting Officer. Furthermore, all production facility changes to Lockheed Aircraft Corporation drawings that do not affect specification changes as cited under Article III, paragraph (2) of this Arrangement, such as drawing errors and changes required for manufacturing equipment compatibility as exists in Japan, may be made under the Technical Assistance approval of Lockheed Aircraf Services-Overseas, Incorporated, without consent of the Con-

tracting Officer.

(2) For the purpose of revising the specifications referred to in Article III, paragraph (2) so that such specifications will accurately reflect the effect of any specification changes in the construction, design or configuration of the airplanes, components and equipment to be produced or furnished under this Arrangement, the Government of Japan will furnish the United States Plant Representative every 90 days - or as otherwise agreed to by the two Governments - with reports, in triplicate, on all deviations from the specifications affecting the airplanes, components and equipment to be produced or furnished under this Arrangement, which deviations have been made subsequent to the specification change last reported. All the specification changes reported in accordance with this paragraph shall constitute amendments to the model specifications cited in Article III, paragraph (2).

(3) The Government of Japan shall take necessary steps for such production engineering, tooling control and maintenance, and such tooling checks as will insure the greatest practicable interchangeability among the airplanes and spares being produced in the United States of America and Japan.

Article IX

All data and services in connection with the technical assistance to be provided to the Kawasaki Aircraft Company, Limited, by the Government of the United States for the performance of this Arrangement shall be delivered or furnished in accordance with the terms of such agreements as may be entered into between the Lockheed Aircraft Services-Overseas, Incorporated, and the Kawasaki Aircraft Company, Limited, and approved by the two Governments, and in accordance with the terms of such agreements as may be entered into between the Government of the United States and the Lockheed Aircraft Services-Overseas, Incorporated Such of the data as stated above as are classified by the Government of the United States as "Secret" or "Confidential" shall, however, be delivered or furnished by the Government of the United States through the Government of Japan, so that the Government of Japan may take the security measures as provided for in Article XIV, paragraph (1) hereof.

Article X

(1) The United States Plant Representative, Contracting Officer, Inspectors, Contract Technicians and miscellaneous administrative and clerical personnel may be stationed at the place of production of airplanes, and the accommodations necessary for the performance of their duties shall be provided without expense to the Government of the United States.

(2) The term "accommodations" means, for the purpose of the preceding paragraph, office space, utilities, telephones, furniture and equipment at the place of production.

Article XI

(1) In performance of this Arrangement the Government of the United States shall bear all the costs of:

a. all technical data and assistance called for in any technical assistance agreements entered into between the Kawasaki Aircraft Company, Limited, and the Lockheed Aircraft Services-Overseas, Incorporated, which have been approved by the two Governments; and

b. the Contract Technicians furnished in accordance with this Arrangement.

(2) Any other costs arising from the technical assistance agreements mentioned in this Article for the purpose of carrying out this Arrangement will be without expense to the Government of the United States.

Article XII

The Contracting Officer may at any time, by a written instruction through and with the consent of the Government of Japan, make changes, within the general scope of this Arrangement, in the specifications, provided that the Contracting Officer determines that such changes will facilitate production, improve parts interchangeability or operational characteristics, or are necessary to conform to changes in the manufacture of the parts furnished.

Article XIII

(1) The Government of the United States shall attach to the shipping documents a certificate issued by an authorized inspector of the Government of the United States for all supplies to be shipped to Japan.

(2) Adequate inspection and test of all supplies to insure conformity with drawings, designs and specifications of the contract shall be effected by the Government of Japan.

(3) The Government of Japan shall provide and maintain an inspection system acceptable to the two Governments covering the work called for under this Arrangement, and shall maintain such records of all inspection work for such period of time as is the normal practice of the Government of Japan.

(4) The Government of Japan will furnish to the United States Representative a certificate or certificates stating that the inspection has been made and that all supplies, services or materials covered by such certificates meet all requirements of the drawings, designs, specifications and quantities provided for in this Arrangement.

(5) The Government of the United States shall not, because of such inspection surveillance as is exercised by its personnel pursuant to this Article, assume any liability to any person or entity for any damage that may result from defects in the accepted articles.

(6) For the purpose of this Article, the term "supplies" includes, without limitation, materials, components, intermediate assemblies and end products.

Article XIV

(1) With respect to any materials, documents, drawings or specifications furnished under this Arrangement, security measures shall be taken in accordance with the Mutual Defense Assistance

Agreement between the United States of America and Japan, signed at Tokyo on March 8, 1954.

(2) The Government of Japan will incorporate in the contracts necessary provisions for such plant protection in all plants engaged in the performance of the work under this Arrangement as will insure the satisfactory completion of the said work.

(3) The furnishing of the materials, parts, components, equipment and data by the Government of the United States under this Arrangement does not constitute approval or permission for the Government of Japan or any of its contractors to reproduce such materials, parts, components, equipment or data. The Government of Japan agrees that it will not reproduce such materials, parts, components, equipment or data for any purpose not expressly authorized in writing by the owner of the property right to the product or data, and it further agrees that it will incorporate in the contracts under this Arrangement such provisions as may be necessary to prevent its contractors from reproducing such materials, parts, components, equipment or data for any purpose not expressly authorized in writing by the owner of the property right to the product or data.

(4) The restrictions contained in paragraph (3) above shall be applicable to all materials, parts, components, equipment and data whether or not Letters Patent or Copyright, as the case may be, have been applied for or issued.

Article XV

The Government of Japan agrees to furnish to the Contracting

Officer such information as may be requested regarding the placement or proposed placement by the Government of Japan of subcontracts and purchase orders, with a view to facilitating early consultation between the two Governments on any questions respecting the reliability, potential efficiency or productivity of any subcontractor concerned.

Article XVI

Any technical or administrative problems in connection with the performance of the production of airplanes under this Arrangement which cannot be resolved by the respective United States and Japanese Plant Representatives shall be referred to an Action Committee for settlement. Such Committee shall be composed of representatives of the two Governments and empowered to make decisions and secure the enforcement thereof. Major disputes arising out of this Arrangement will be referred to the Action Committee for recommendations to the respective Governments.

Article XVII

This Arrangement shall come into force on the date of signature and remain in force until:

(1) Terminated by mutual agreement between the two Governments.

(2) Termination of the Mutual Defense Assistance Agreement between the United States of America and Japan.

(3) Terminated by either Government in the event the other Government refuses or fails to comply with the terms of

this Arrangement to the extent that completion of the program under the Arrangement is jeopardized.

(4) War, active hostilities or other major calamity makes it impossible or impractical to continue with the performance of this Arrangement.

Article XVIII

(1) Each Government shall reserve its right of claim against the other Government in case this Arrangement is terminated pursuant to Article XVII, paragraph (3) hereof.

(2) In the event this Arrangement is terminated by the Government of the United States pursuant to Article XVII, paragraph (3) hereof, all materials - except those incorporated in completed airplanes - furnished by the Government of the United States under this Arrangement shall be regarded as "equipment and materials furnished under end item programs as are no longer required in the furtherance of the Mutual Defense Assistance Agreement" within the meaning of "Arrangements for Return of Equipment under Article I of the Mutual Defense Assistance Agreement between the United States of America and Japan", and shall be disposed of as prescribed by the said Arrangements.

(3) In the event this Arrangement is terminated for the reasons mentioned in Article XVII, paragraphs (1), (2) and (4) hereof, the disposition of all the materials set forth in Article II, paragraph (1) hereof - except those incorporated in the completed airplanes - will be made by mutual agreement pursuant to the provisions of the Mutual Defense Assistance Agreement between

the United States of America and Japan.

IN WITNESS WHEREOF the representatives of the two Governments, duly authorized for the purpose, have signed this Arrangement.

DONE in duplicate, in the English and Japanese languages, both equally authentic, at Tokyo, this twenty-fifth day of January, one thousand nine hundred and fifty-eight.

For the Government of the United States of America

For the Government of Japan

U.S. - JAPAN COST SUMMARY (P2V PRODUCTION IN JAPAN)

42 A/C: 1 A/C per month

	U. S. A.			JAPAN			TOTAL	
	ITEM	$	¥1,000	ITEM	$	¥1,000	$	¥1,000
FIXED COST	Mfg Data Tech Process For Foreign Prod	1,100,000	396,000	Tooling	5,791,886	2,085,079		
	Tech Ass't	5,000,000	1,800,000	Preplanning	61,539	22,154		
	U.S. Tooling	611,000	219,960					
	Crating Rebuilding	200,000	72,000					
	GC & A Fixed Fee	1,969,000	716,040					
	Total	8,900,000	3,204,000	Total	5,853,425	2,107,233	14,753,425	5,311,233
PRODUCTION COST	Material:			Material	23,392,736	8,421,385		
	U.S. Gov't	15,357,480	5,528,693	Flight Cost	208,000	74,592		
	L.A.C.	16,939,834	6,098,340	Labor Cost	4,436,761	1,597,234		
	LASO-Direct (Crating & Stateside Freight included)	2,020,078	727,228	Other Expenses	2,415,339	869,522		
				Royalty	1,470,000	529,200		
				GC & A Profit	3,825,347	1,377,125		
				Freight	478,000	172,080		
	Total	34,317,392	12,354,261	Total	36,226,183	13,041,138	70,543,575	25,395,399
	Grand Total	43,217,392	15,558,261	Grand Total	42,079,608	15,148,371	85,297,000	30,706,632
Unit Price	With 20% spares	1,028,986	370,435		1,001,895	360,676	2,030,881	731,111
	W/O spares	857,488	308,696		834,912	300,563	1,692,400	609,259
Ratio		50.67%		49.33%			100%	

Appendix XV

REPORT OF A SPECIAL ORDNANCE LIAISON VISIT TO
MAAG, REPUBLIC OF CHINA,
September - October 1961

1. Country Visited and Dates

Republic of China during period 14 September - 5 October 1961.

2. Purpose of Visit

a. To assist and advise rebuild facility on procedures used in tire rebuild.

b. Assistance was requested by Chief, MAAG-Republic of China.

c. Mr. Delbert J. Bundy, DAC, Rubber Products Inspector Foreman conducted the visit.

3. Observations

a. Installations and Activities Visited

(1) MAAG-Republic of China

Ordnance Section, MAAG-Republic of China.

(2) Chinese Army-Grand Republic China (CA-GRC)

(a) Automotive Base Depot.

(b) Tire Rebuild Shop.

b. Personnel Contacted

(1) MAAG-Republic of China

Col. W. P. Register	Chief, Ordnance Staff Advisor
Lt. Col. G. J. Harris	Ordnance Supply Advisor
Major W. W. Kinkaid	Ordnance Maintenance Advisor
Major J. M. Beale	Chief, Taipei Ordnance Sub-Office (Senior Advisor, Automotive Base Depot)
Major P. C. Ward	Supply & Maintenance Advisor (Taipei Ordnance Sub-Office)

Major C. E. Allen	Coordinator (Taipei Ordnance Sub-Office)
Capt. O. D. Parker	Maintenance Advisor (Taipei Ordnance Sub-Office)
CWO D. S. Black	Supply Advisor (Taipei Ordnance Sub-Office)
M/Sgt (E-7) J. S. Mersom	Supply Advisor (Taipei Ordnance Sub-Office)

(2) CA-GRC

Col. Y. Lay	CO, Automotive Base Depot
Col. L. Sun	Deputy CO, Automotive Base Depot
Lt. Col. C. Jung	Liaison Officer, Automotive Base Depot
Major H. L. Chang	CO, Tire Rebuild Shop

c. Definitions

Definitions and technical terms used in this report are contained in TM 9-1871 (Repair and Rebuild of Pneumatic Tires and Tubes) dated November, 1956.

d. General

The Tire Rebuild Shop is located at the Automotive Base Depot, Taipei, Formosa. Rebuild of tires and tubes by this facility is for direct support of vehicle rebuild and for depot stocks. This facility is located in two permanent concrete type buildings. Equipment used is American made and is in very good condition. Shop layout is adequate. Shop is staffed by Chinese Army personnel, who are very energetic and conscientious in their work. It is the opinion of the liaison representative that many of the personnel assigned to this facility were performing their duties in a commendable manner consistent with their knowledge of tire rebuild techniques, but require additional training in the proper application of tire rebuild methods and operation of equipment.

e. End Item Reject Rate

At beginning of visit reject rate of tires rebuilt was averaging approximately 17%, through advice, recommendation and assistance furnished, this rate was reduced to one and one half percent (1.5%) at end of visit. Recommendations and assistance furnished by liaison representative and the outstanding cooperation of the Chinese personnel in acting upon advice furnished towards improving the operations are contained in the succeeding portions of this report. These actions were wholly or in part responsible for reducing the reject rate. A two (2) percent rejection rate in a facility of this type is considered an acceptable quality level.

f. Tire Rebuild

In the course of advising and instructing in the proper methods of tire repair the following problem areas were reviewed.

(1) Standard Operating Procedure

No written SOP was available. During visit, liaison representative prepared a SOP outlining process, methods, techniques, standards and procedures to be followed. This SOP was approved and was in process of being translated into Chinese for use by operating personnel.

(2) Initial Inspection

Initial inspection performed did not provide for complete inspection to determine degree of repairs necessary to restore to servicable condition. Personnel were instructed in proper methods of inspection and marking. Marking codes provide for identification and segregation as regards full capping, retread, section repair, spot repair and nail hole repair. One set of gauges for measuring tread depth was locally fabricated upon recommendation and design of liaison representative and are primarily used in determining whether or not tire should be re-capped. Personnel were trained in use of these gauges.

(3) Buffing

Buffing equipment and method employed were improper. Buffing rasps were being used in operation other than what they were designed for. These practices contributed to faulty carcasses being processed. Personnel were instructed in the proper use of equipment and method application.

(4) Re-Inspection

After buffing operations tires should be re-inspected to determine whether or not initial inspection revealed all defects. This inspection was not being accomplished. Upon recommendation a re-inspection station was established.

(5) Drying Room

Tires were vertically stacked in the drying room after buffing operations. Drying room did not permit controlled heat circulation and exhaust of humidity. The two (2) drying rooms contained one (1) door each, this impaired controlled rotation of tires being dried. Personnel were advised to drill holes in the steel flooring in order to permit heat circulation from the steampipes that are located beneath the floor and to stack the tires horizontally to permit circulation throughout the tires and the room. To determine humidity, thermometers, wet and dry were installed to indicate when the exhaust blowers should be used to exhaust the humidity. To control rotation of tires being dried, it was suggested that an additional door be installed in each drying room to permit controlled flow of tires in and out of the room (first in-first out system), also tires should be kept in the drying room at least 72 hours under constant control temperature to insure proper and complete drying.

(6) Section Repair

Excessive cut down of tire injuries was being performed, resulting in good cords being removed along with damaged cords. Tires were cut from outside only. Wire wheel only was being used on flexible buffers causing tire cords to be burnt. Burr rasps which were available in supply but not used were obtained and put to use in conjunction with the wire wheels. These improper shop practices were pointed out to operating personnel followed-up by instruction and demonstration of proper methods to be employed.

(7) Cementing

Cement was applied to carcass in a brushing manner rather than by stippling. Application of cement was uneven. Naptha gasoline was being used for cleaning prior to cementing rather than by compressed air. Room temperature and cement drying time was not maintained causing improper adhesion of camelback (rubber) to tire carcass during molding operation. Wet and dry thermometers were installed and at completion of application of cement to the tire carcass, drying time was recorded on each tire.

(8) Recap Build-Up

Camelback (rubber) application was improper wherein it was not being centered on tire carcass and joining angle was not cut to prescribed 45° angle. Tire, build-up (thickness of rubber applied) and curing time required in molding operation not recorded on each tire. These malpractices were corrected.

(9) Mold Section

Improper use of spacers and curing rims in the molds was being practiced. Routine shop maintenance of molding equipment was not being accomplished. Proper use of spacer and curing rims was explained and malpractices corrected. Molding equipment requiring maintenance was serviced and shop maintenance schedules were established.

(10) Final Inspection

Only external inspection of tires was performed. Defective tires were not analyzed to determine cause of defect in order that responsible section be notified to affect corrective measures. Liaison representative thoroughly explained by demonstration final inspection procedures and causes for various defects and sections responsible for the cause.

4. Assistance Furnished by Team During Visit

Liaison representative instructed and advised tire rebuild personnel in all phases of tire repair and rebuild operations. Details of this are contained throughout the report.

5. Corrective Action on Recommendations and Problem Areas Reported on Previous Visit

Not previously reported, this report reflects results of special visit regarding assistance to tire rebuild facility requested by MAAG-Republic of China.

6. Conclusions

a. Tire rebuild reject rate was reduced from 17% to 1.5% during course of visit by liaison representative.

b. Tire rebuild personnel require additional training in rebuild methods and operation of equipment.

c. Tire rebuild personnel were very cooperative in immediately acting upon advice furnished by liaison representative towards improving their operation and standards of rebuild.

d. Rebuild quality of tires has been improved.

7. Recommendations - MAAG-Republic of China

a. That an American tire rebuild specialist be permanently assigned to the Tire Rebuild Facility to render necessary assistance as required.

b. That the tire rebuild SOP be followed by tire shop personnel and that the SOP be reviewed at least once a year by a qualified rubber product specialist to maintain current tire rebuild methods and practices.

8. Action by Team

a. During Visit

(1) Assisted tire rebuild personnel in improving tire rebuild quality and efficiency of operation.

(2) Advised and instructed by demonstration the proper methods and procedures applicable to tire rebuild.

b. After Return

Change to existing tire rebuild specifications as received by USALCJ will be made available to MAAG-Republic of China.

9. Exit Critiques

Matter contained in this report plus numerous minor items not included in this report was discussed with Senior Ordnance Advisor and staff, and Commanding Officer, Automotive Base Depot (CA-GRC) and staff. No discord was registered on items discussion during both critiques.

DELBERT J. BUNDY
Rubber Products Inspector Foreman

LIST OF ABBREVIATIONS

AFAK	(Armed Forces Assistance to Korea)
ASTM	(American Society for Testing Materials)
CONUS	(Continental United States)
DAC	(Department of Army Civilian)
DDEP	(Defense Development Exchange Program)
D.S.A.	(Defense Supply Agency)
ESS/LAB	(Labor Division of the Supreme Commander for the Allied Powers' Economic and Scientific Section)
FECOM	(Far Eastern Command)
FTO	(Foreign Technical Officer)
JDA	(Japanese Defense Agency)
JIS	(Japanese Industrial Standards)
JSDF	(Japanese Self Defense Forces)
MAAG	(Military Assistance Advisory Group)
MAP	(Military Assistance Program)
MAS	(Military Assistance Sales)
MCB	(Military Construction Bureau)
MDAP	(Mutual Defense Assistance Program)
MITI	(Ministry of International and Trade Industry)
NAEC	(Naval Air Engineering Center)
OJT	(On-the-job-training)
OSP-J	(Offshore Procurement-Japan)
PACOM	(Pacific Command)

R & D	(Research and Development)
ROK	(Republic of Korea)
SCAP	(Supreme Command for the Allied Powers)
TKS	(Tokyo Keiki Seisakusno or Tokyo Instrument Company)
USALCJ	(U.S. Army Logistic Center, Japan)
USARJ	(U.S. Army Japan)

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