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# Mind the Gap Between Rhetoric and Reality

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by Roger Cavazos

June 26, 2012



This report was originally presented at the [East Asia Nuclear Security workshop](#) held on November 11, 2011 in Tokyo, Japan. All of the papers and presentations given at the workshop are available [here](#), along with the full agenda, participant list and a workshop photo gallery.

Nautilus invites your contributions to this forum, including any responses to this report.

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### I. Introduction

In the following report Roger Cavazos considers two bounded cases of an artillery attack on Seoul. The question is pertinent since it bears on whether there is conventional stability on the Korean Peninsula. If there is a conventional military stability, that is neither South Korea nor North Korea have the military capacity to successfully invade, then both parties have an interest in cutting the Gordian knot of present relations. Legal frameworks such as a Korea Japan Nuclear Weapon Free Zone are far cheaper, less resource intensive yet still confrontational enough to relieve some

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pressure of an antagonistic relationship. The conclusion is that there is a conventional military stability which allows for the time and effort to seek alternative resolutions such as a Korea Japan Nuclear Weapon Free Zone which allows the DPRK to trade an almost no cost legal framework for a tangible security guarantee.

Roger Cavazos consults on Northeast Asia security. He is recently retired from a 22 year career in the United States Army with assignments at tactical, operational, and strategic levels.

The views expressed in this report do not necessarily reflect the official policy or position of the Nautilus Institute. Readers should note that Nautilus seeks a diversity of views and opinions on significant topics in order to identify common ground.

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## **II. Report by Roger Cavazos**

“Mind the gap between rhetoric and reality”  
by Roger Cavazos

North Korea occasionally threatens to “turn Seoul into a Sea of Fire”. The South Korean, U.S. and other international media often relay this statement, amplifying its effect. But can North Korea really do this? Does it matter if they can? The short answer is they can’t; but they can kill many tens of thousands of people, start a larger war and cause a tremendous amount of damage before ultimately losing their regime. Therefore, it doesn't matter whether they can do it directly since they have the capability to ignite a sequence of events leading to widespread destruction and likely regime change in Pyongyang. Previous Nuclear Weapon Free Zones have usually required about three decades to implement after discussions started during periods of stasis. Therefore, this is a period of stasis in which to explore confidence building measures and possibly something as radical as a Korea Japan Nuclear Weapon Free Zone.

If the North Korean Peoples Army (KPA) were to start a doctrinal, conventional artillery barrage focused on South Korean forces, we could expect to see around three thousand casualties in the first few minutes, but the casualty rate would quickly drop as the surprise wears off and counter-battery fires slow down the North Korean rates of fire. If the KPA were to engage Seoul in a primarily counter-value fashion by firing into Seoul instead of primarily aiming at military targets, there would likely be around thirty-thousand casualties in a short amount of time. Statistically speaking, almost eight-hundred of those casualties would be foreigners given Seoul’s international demographic. Chinese make up almost seventy percent of foreigners in Seoul and its northern environs which means KPA might also kill six-hundred Chinese diplomats, multi-national corporation leaders, and ranking cadre children who are students in Seoul. Horrible, but nothing approaching “millions”. Three primary factors and three secondary factors account for the huge discrepancy between rhetoric and reality:

### **Three Primary Factors**

1. Range - Only about 1/3 of Seoul is presently in range from artillery along a DMZ trace. The northern reaches of Seoul within artillery range have much lower population densities than Seoul proper;
2. Numbers - Even though KPA has a tremendous number of artillery pieces, only a certain number are emplaced to range Seoul. KPA can’t emplace every weapon near Seoul or the rest of North Korea’s expansive border would be unguarded and even more vulnerable. Moreover, an artillery tube immediately reveals its location as soon as it fires. Therefore only about two-thirds of

artillery will open fire at a time. The rest are trying to remain hidden;

3. Protection - Artillery shelters for twenty million people exist in the greater Seoul metropolitan area. After the initial surprise has worn off, there simply won't be large numbers of exposed people. Even during the initial attack the vast majority of people will either be at work, at home, or in transit. Few people will be standing in the middle of an open field with no protection whatsoever available anywhere nearby.

### **Three Secondary Factors**

1. Dud rate - the only numbers available—to the DPRK as well as the rest of the world—indicate a dud rate of twenty-five percent. It's like immediately taking every fourth artillery tube away.
2. Counter-battery fires - shortly after the KPA artillery begins firing, and the political decision has been made, South Korean artillery, Air Forces, and others will begin destroying artillery at a historical rate of 1% per hour. South Korea has had approximately 50 years to figure out where North Korean artillery tubes are emplaced using every sense available to man and machine.
3. Logistics - in order to move south from the DMZ trace and place the rest of Seoul at risk, KPA must expose approximately 2,500 thin-skinned vehicles each day along three well-defined transportation corridors. Otherwise, KPA grinds to an almost immediate halt without a way to transport fuel, ammunition and spare parts needed to continue moving south. Alternatively, KPA can scavenge from ROK fuel stores and depots if they have not been previously destroyed.

[Figure I](#) summarizes these results while Annexes A-C provide much greater detail about the process of arriving at these numbers and conclusions.

### **Methodology**

Some will disagree with these numbers and assessments - that is part of the point. Bringing the issues to light encourages informed and civil debate. This paper looked at two cases in quite a bit of detail using publicly available material: doctrinal counter force artillery barrages and an a-strategic, all out conventional artillery attack on Seoul.

### **Other cases not considered**

There are other possible ways to turn Seoul into a "Sea of Fire" as North Korea is believed to also have nuclear, chemical and biological weapons, several hundred missiles and around 200,000 "special forces".[\[1\]](#) Those cases are important but we will only briefly touch on them.

It is almost impossible to predict or model the psychological effects a North Korean artillery attack would have on Seoul. The artillery can only fire so deep into Seoul, meaning the majority of the roads leading south from Seoul, while extremely crowded, would fall under the Traffic Control Point and Main Supply Route management systems the South Korean military has been practicing and perfecting for decades, therefore this paper won't cover those effects.

A nuclear attack can be discounted since North Korea has yet to demonstrate the ability to detonate a nuclear weapon except under pristine, completely controlled conditions. Moreover, there are no truly viable methods at present to move something like a nuclear device to South Korea undetected. Peter Hayes and Scott Bruce tackle this subject in much greater detail in their work "Unprecedented Nuclear Strikes of the Invincible Army: A Realistic Assessment of North Korea's Operational Nuclear Capability".[\[2\]](#)

If North Korea were to use chemical and biological weapons, any conflict would rapidly escalate to one of regime change in Pyongyang and is hence an a-strategic move (there is no strategy other than to cause a great deal of damage) inconsistent with North Korea's goals of regime survival. Moreover, the vast majority of victims from any chemical and biological attacks would be civilians. Many of them, likely several thousands, of those third country nationals would be primarily Chinese since they represent approximately 70% of third country nationals in Seoul.[3] Moreover, the Chinese in Korea tend to be diplomats, multi-national corporation heads, and students of ranking cadres in China's Communist Party. The other foreigners in Seoul tend to be U.S. military forces, their families and other support elements. There are many other nationalities represented in the Seoul metropolitan area who are generally students (and children of relatively affluent parents), foreign language teachers, diplomats (Seoul has approximately 100 diplomatic facilities and relations with 170 countries), and those who work in large multi-national corporations. [4] The military forces are relatively well-protected and inoculated. Killing large numbers of Korean and international civilians is another a-strategic move indicative of a complete breakdown or desperation of leadership in Pyongyang.

North Korea likely has between 600-800 short range missiles and maybe 100 other longer-range missiles that it can repurpose from MRBM/ICBM to strike Seoul.[5] However, even if the DPRK launched every one of those missiles, they would total around a kiloton - thankfully without any of the radiation or fall out concerns. Again - destructive but hardly a "sea of fire" and thankfully not enough to militarily change the outcome. The effects of these missiles would primarily be political. After launching everything, the DPRK would be completely out of missiles and unable to hold anything hostage at that point and thus would have gained very little at the strategic and operational-levels of war. Such a move is not advantageous for North Korea. North Korea's primary goal in launching any missiles would likely be terroristic and psychological, extremely difficult to model, but in military terms, would not be terribly destructive and therefore not covered in this paper.

North Korea has an estimated 200,000 special forces, however, KPA only has the logistical capacity to move approximately 19,000 at any one time. They can move approximately 4,000 by air and about 15,000 by sea. [6] However, Seoul is covered by redundant systems and sensors. Small numbers can slip in undetected, but are so small as to not cause much damage. Large numbers of Special Forces may overwhelm the systems, but at least they'll trigger alerts - and a welcoming party. At any rate, it is unlikely KPA Special Forces can complete 10 cycles of insertion and exfiltration. Moreover, unless these Special Forces sneak in and assemble a nuclear device in Seoul, they can kill some people, cause mayhem, but can't create a "sea of fire". With such a tremendously large number of 200,000 Special Forces out of approximately 1,100,000 soldiers under arms in North Korea and almost no training budget it is easy to imagine that such a large number of these troops are well-disciplined, completely obedient, but likely not so special.

### **Condition Stable. For now...**

Why explore these concepts now? Miyamoto Musashi had a particularly apropos observation so long ago, and yet still relevant today, timing is everything, "All things entail rising and falling timing. You must be able to discern this. In strategy there are various timing considerations." [7] Many governments will likely be receptive to these topics between now and 2013 since there have been and will continue to be several major elections and governmental changes through 2012 which means large amounts of turnover in senior leadership. This turnover is a chance to start anew and a period of increased risk, as new actors sometimes miscalculate. Chronologically: [8]

- Taiwan, Presidential and entire legislature January 14

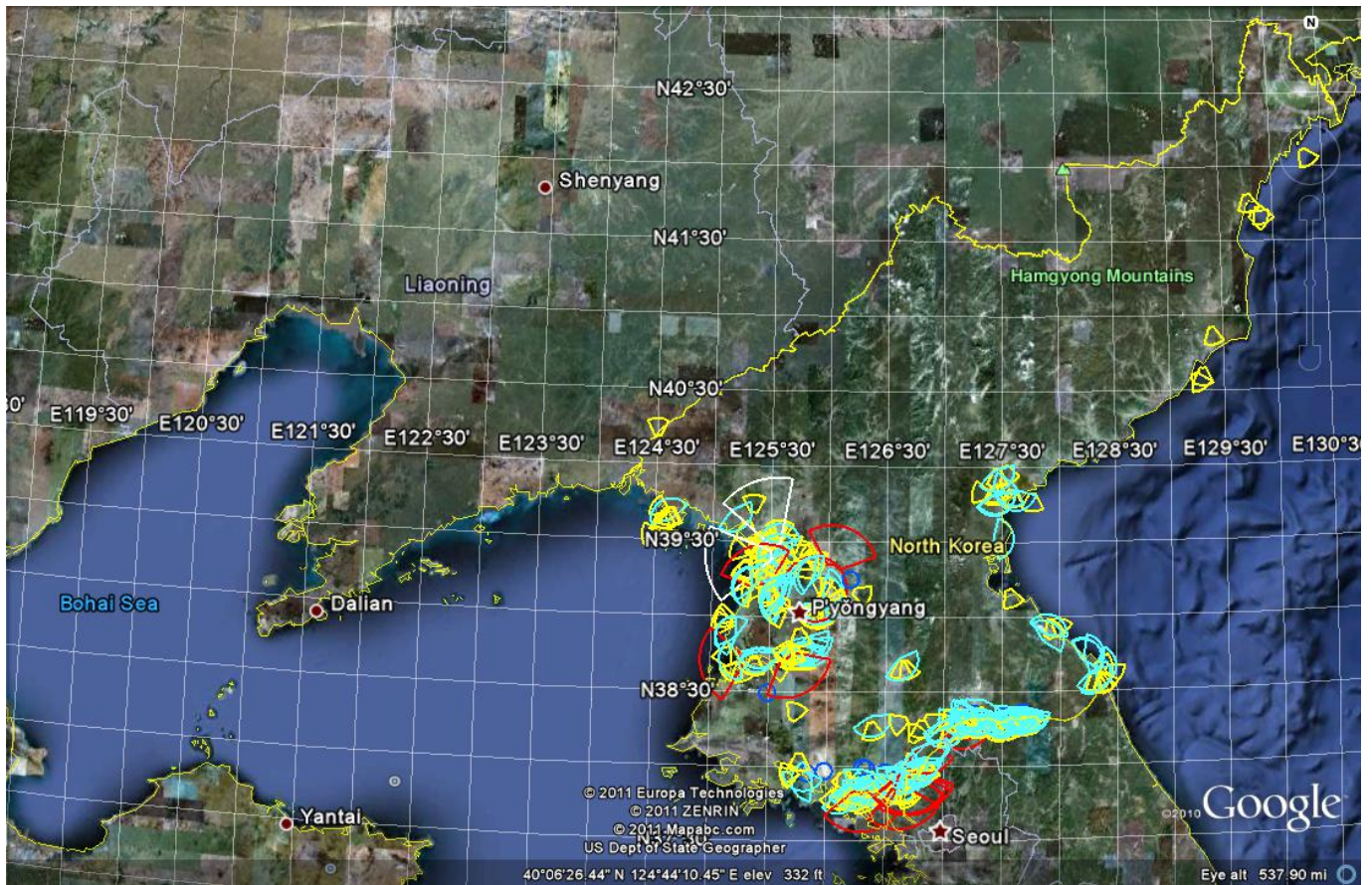
- Russia, Presidential March 4
- Republic of Korea, Parliamentary April
- Hong Kong, Legislative September 12 (has the potential to distract Beijing or reduce their flexibility)
- PRC 18<sup>th</sup> Party Congress (not an election in the normal sense, but a leadership transition and dynamics approaching that of an election and also decreases the amount of flexibility) October [9]
- United States of America, Presidential, legislative November 6
- Republic of Korea, Presidential, December

Now is when incumbents and prospective candidates are formulating ideas and possible policies. Add to this mix the U.S. Secretary of State's recent plan for American foreign policy in Asia. She stated U.S. diplomatic work to realize the "Pacific Century" "...will proceed along six key lines of action: strengthening bilateral security alliances; deepening our working relationships with emerging powers, including with China; engaging with regional multilateral institutions; expanding trade and investment; forging a broad-based military presence; and advancing democracy and human rights." [10] The U.S. Secretary of Defense also articulated a U.S. "pivot to Asia". In short, there will be some extremely complex domestic issues to complicate and likely dilute this particular issue and provide fertile ground for miscalculation. During and shortly after election/leadership transition season there is an increased possibility of miscalculation due to domestic concerns/processes and possibly due to a desire to test leadership or demonstrate leadership. DPRK changed leadership, but all signs indicate relative stability since Kim Jong il's death in December, 2011.

So what is it that South Korea is facing? And how much of it is near Seoul?

### **Figure 1: Selected DPRK Forces**

The DPRK has to move almost everything south of Pyongyang on this map to Busan in 30 days in order to succeed. Not depicted: ~4,000 tanks; ~2,500 armored personnel carriers; ~8,000 light and medium wheeled vehicles.



A war on the Korean peninsula would be an operational-level war with strategic consequences. Operational-level wars depend on battle campaigns and battle campaigns depend on logistics.

Korean peninsular geography is characterized by very defined north-south corridors between mountain ranges. Almost everything that is flat in Korea is a city, a village or agriculture. The KPA cannot simply bypass built up areas. Built up areas favor the defender by a great margin meaning an attacker would like to outnumber the defender by a ratio of 3:1. The ROK has had 50 years to prepare a labyrinthine series of bunkers, positions, weapons and ranges. The DPRK has also had as long. So as soon as either country moves from their own positions, they are exposed. In order for the KPA to achieve their objective, they would have to move from their positions to capture Seoul and surround Busan. Those two cities, combined, have a population equal to half of all of the DPRK's population. The DPRK will also have to move the world's second largest military in the world and move about 2/3 of the world's fourth largest military some 500 km in a month. [11] Moving that sheer volume of equipment through that distance takes an incredible amount of energy. In this case, the DPRK would have to devour about 8 months of their normal energy consumption in one month.[12] This a task which they have not performed in at least 50 years. And no historical records in the public domain indicate they have even practiced anything of a similar scale (e.g. moving 2/3 of Army within the DPRK in a month's time) in at least as long.

Delivering that energy and moving that many people and things along three defined geographic corridors seems ideal for a mass armed force with the majority of its forces positioned far forward. And it was until technology enabled others to immediately sense (see, hear, feel) enemy preparations and know when the military moves. Technology also enables detection and destruction on an unprecedented scale. Given a battlefield air interdiction rate approaching 0.5 [13] and that ROK has 467 aircraft, [14] the ROK alone can destroy approximately 230 targets per sortie. The ROK would likely get one to two sorties before the DPRK attempts to shut down ROK airfields by conventional means or by escalating to chemical or biological weapons.

However, the cost to the DPRK of resorting to chemicals or biological weapons is extremely high. Moreover, in the end, it will not significantly impact the military outcome, even though it would certainly impact the political outcome. The vast majority of U.S. aircraft are not on the Korean peninsula and are out of DPRK range. If the U.S. were to bring only half of the Air Force fighter and bomber fleet [15] to bear, the DPRK would likely lose another 500-700 targets per day in addition to those lost to direct, indirect and counter-battery-fire and various other reasons. And even assuming the forces are successful, they will likely run out of fuel and ammunition in one to two weeks unless the DPRK leaves ROK stores intact and scavenges ROK fuel supplies. These calculations exclude Naval and Marine aircraft as well as TLAMs. The DPRK would likely lose 20% of their tanks and artillery per day which is consistent with Operations DESERT SHIELD and DESERT STORM. In particular, the DPRK would suffer the majority of the damage in the first week, starting as soon as they leave their covered positions.

The following table summarizes the kind of military damage the DPRK can inflict upon their fellow Koreans in the short run. These numbers are not just numbers, but people: fathers, mothers, children, etc. However, in order to demonstrate a credible conventional deterrent exists, we will look at them as numerical abstractions. Appendices A-E contain all the details and methodologies. I realize everyone will find some part of the analyses they disagree with. I welcome your feedback and willingness to contribute to furthering this discussion. This is also one of the major recommendations: Increase the public analysis and amount of data available via scholarship on the subject. Based on in-depth, albeit not exhaustive, analysis of openly available material, it is likely that the ROK can absorb and defeat a full-fledged DPRK conventional attack at the strategic, operational and probably tactical levels - however, the ROK would be extremely weakened after such an attack and the DPRK would likely not have a capacity for self-defense after being defeated. There would be a large vacuum. Just before that vacuum reaches full strength is likely one of the biggest inflection points to escalate or not, to what degree and by what means, to achieve what goal?

**Table 1: Summary of Effects**

**IMPORTANT CAVEATS:**

- 1) No indications there are plans for these events;
- 2) Assumes most people are at home or in an office i.e. more protection than standing outside in an open field.

<b>Scenario</b>	<b>Possible Casualties</b>	<b>Weapons</b>
Surprise Volley (Primarily counter-force i.e. barracks, military bases)	~2,881 initial volley; mainly soldiers	240 MM MRL170 MM KOKSAN
Surprise Volley (Countervalue and a-strategic i.e. firing directly into population centers)	~29,661 Civilian; likely~790 Foreign nationals~605 Chinese	240 MM MRL170 MM KOKSAN

Counterbattery and counterforce missions. Very few 240 MM or 170 MM KOKSAN would exist after 1 week.	Expect DPRK to lose these weapons at 1%/hour based on historical rates.	467 ROK aircraft; Possibly 1,200 U.S. aircraft 2,660 Main Battle tanks 1,538 Multiple Rocket Launchers Note: These forces already exist on Korea, or come from Guam and from Carrier Strike Groups in international waters. No need to ask third country permission.
KPA would likely run out of fuel/ammunition within two weeks. NOTE: another study projects KPA can last up to two months. The point is, once started there is very finite amount of fuel and therefore time left.	DPRK needs to drive approximately 2,500 soft-skinned vehicles per day to supply a southward invasion in order to sustain themselves - or spare ROK fuel stores and scavenge from ROK	

Because a conventional conflict would likely end in DPRK defeat, DPRK and all those countries desiring stability on the peninsula, have strong incentives to seek alternative means of resolving or postponing resolution of DPRK's twin dialectic conflicts: a split peninsula and ensuring a third socialistic dynasty. Some likely unconventional means to move toward those goals short of full-fledged conflict include: limited strikes, cyber warfare [16] and Special Operations Forces. [17] A Korea Japan Nuclear Weapon Free Zone can be viewed as another form of legal warfare available to DPRK with little real cost and a tangible benefit of buying time. Establishing a KJNWFZ engages Northeast Asia in debate and provides the DPRK some much needed time to find or create a more advantageous set of international conditions which might be more favorable to finally resolving its conflicts. Finally, China would almost certainly become involved in any conflict on the peninsula. A KJNWFZ provides a means for shaping what will eventually happen when stasis on the peninsula changes. In fact, a KJNWFZ provides some opportunities to provide basic outlines or principles to address a future change in the status quo. As an example, a reunified peninsula would have to turn over any nuclear weapons to a nuclear power.

### Appendix A: Geographic Context

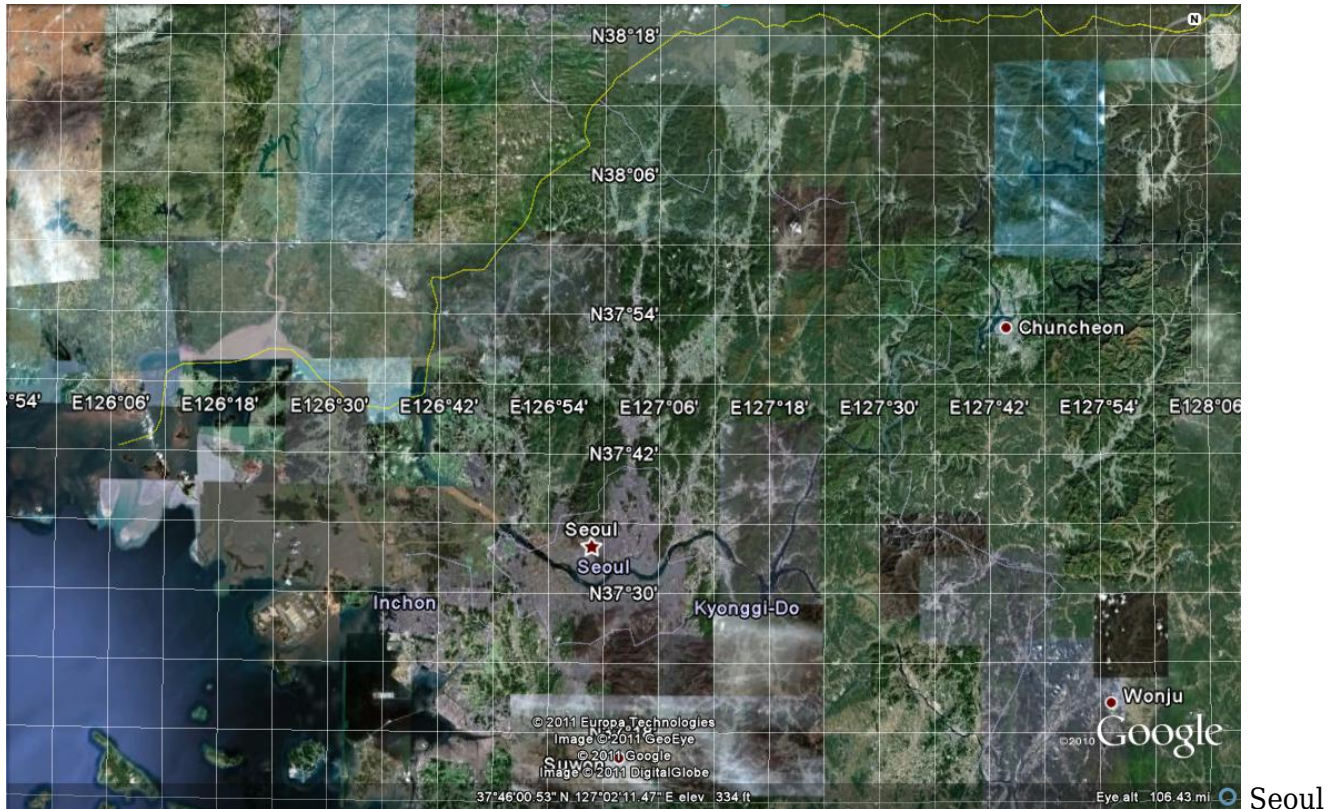
#### Figure A-1

#### Seoul Metropolitan Area and DMZ Trace

Seoul is famously and dangerously close to the DMZ. The city proper has about 10 million residents. However, approximately 24 million Koreans call Greater Seoul Metropolitan home.

There are plenty of detailed statistics in Annex B.

[caption id="attachment\_24994" align="alignnone" width="617"]



Seoul Metropolitan Area and DMZ Trace (all maps made on google earth)

All data on the following maps is from Planeman. Planeman is a pseudonym for an avid Google Earth user who also enjoys putting together his love of drawing and analysis to compile lists of equipment and places.

This particular dataset is available in two locations:

1. [http://bbs.keyhole.com/ubb/ubbthreads.php?ubb=download&Number=809291&filename=DPRK\\_file.kmz](http://bbs.keyhole.com/ubb/ubbthreads.php?ubb=download&Number=809291&filename=DPRK_file.kmz)
2. [https://gfc-military-a-googleproductfor-ms-com.googlegroups.com/attach/e0ad4dcb86fa344b/809291.kmz?gda=xQdwDkcAAAAtPODf7pi7c11\\_zm1OYTVZzC9IUzP5\\_1VoXytparREP9cjNfh3\\_TjZ9IvAlcA3yqEbQwFxFw55cVwemAxM-EWmeV4duv6pDMGhhhZdjQINAw&part=3](https://gfc-military-a-googleproductfor-ms-com.googlegroups.com/attach/e0ad4dcb86fa344b/809291.kmz?gda=xQdwDkcAAAAtPODf7pi7c11_zm1OYTVZzC9IUzP5_1VoXytparREP9cjNfh3_TjZ9IvAlcA3yqEbQwFxFw55cVwemAxM-EWmeV4duv6pDMGhhhZdjQINAw&part=3)

All the maps seem to show something when zoomed into the highest magnification. I personally am not an artist or scientist in these matters, but after studying them in great detail I do believe the dataset visually represents most of the data resident in the analytics of this paper. In the particular case of this appendix, one picture is worth approximately three thousand words.

### Figure A-2

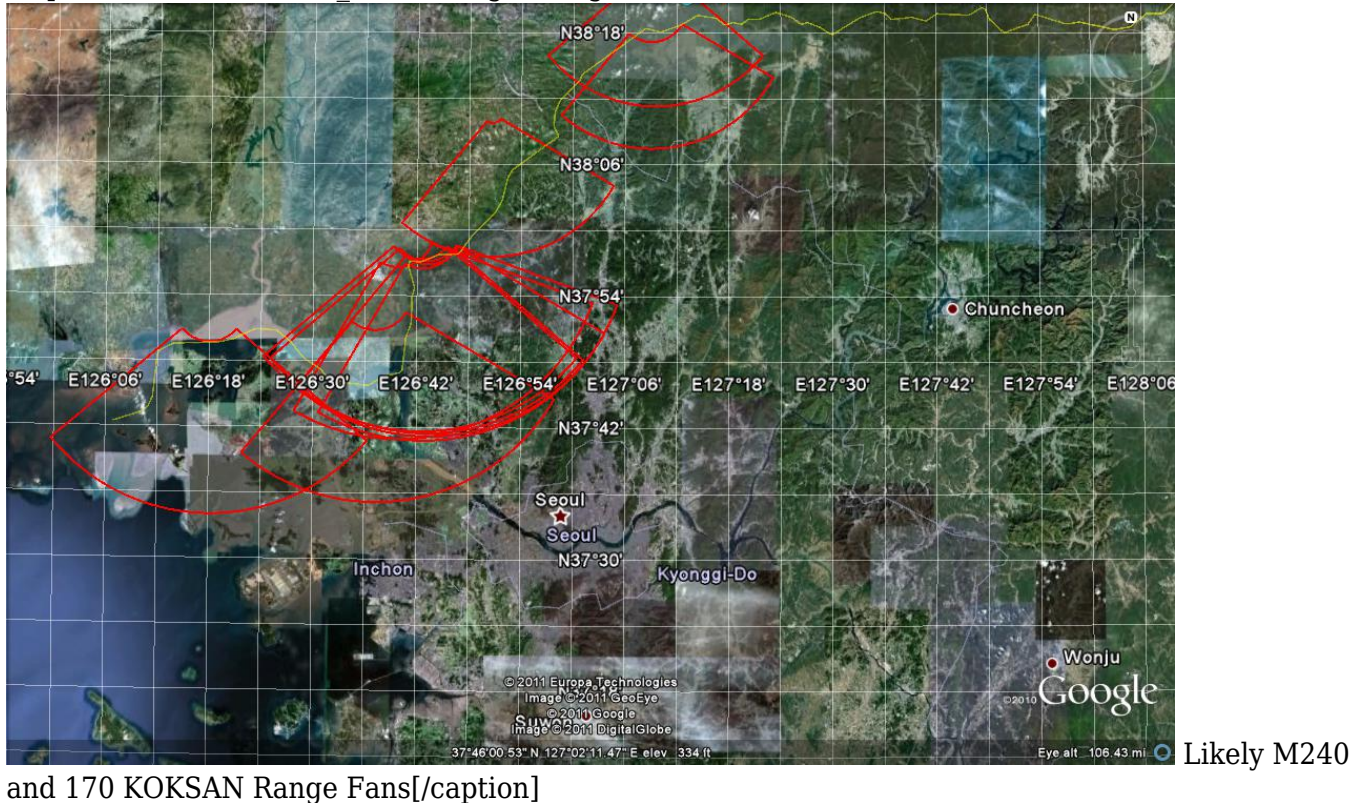
#### Likely M240 and 170 KOKSAN Range Fans

If one scours these areas looking for tell-tale signs of M240 and KOKSAN guns, these are likely positions for them. The range fans do not include artillery shadows and therefore encompass a larger area than can actually be struck based on physics. However, even given these range fans, it's clear the majority of Seoul is OUT of range. The parts of Seoul metropolitan which are in range are much less populated than Seoul proper.

Despite reports that North Korea was planning to deploy the “Juche 100” or a 240 MM MRL with an extended range of 200 km, as of 15 June, no publically available reports have confirmed the deployment.

Attack corridors are also fairly visible. They are the lighter fingers extending North through Uijeongbu and North-Northwest up the Cheorwon valley. I also highlight them in the next graph.

[caption id="attachment\_24995" align="alignnone" width="584"]



**Figure A-3**

### Likely Avenues of Approach to Seoul.

All roads in the area lead to Seoul. Even at their very widest, these corridors are only about 15 km [18] wide but narrow in many places to about 3km wide. There are even some places only 1 km wide. In a traditional defense, those narrow bottlenecks are extremely heavily defended. The kinds of defense are only limited by the imagination but usually include small arms fire, crew-served weapons, artillery, manmade obstacles such as roadblocks, chunks of concrete that are too large for a tank to bypass, and minefields. People and sensors will provide the information of who is coming, what they're bringing, where they're going, how fast, etc.

Panheuristics provides an excellent analysis of possible throughput of those corridors in terms of divisions per day. They assess that each corridor can hold about  $2 \frac{1}{4}$  DPRK divisions assuming the divisions maintain doctrinal distances and frontage. They would also clear out of the corridor and into Seoul at a rate of  $\frac{3}{4}$  of a division per day.[19] Those divisions are extremely vulnerable to direct, indirect and aerial fires while they are in the corridors. Even though the discussion of divisions occurs in an atomic context, given precision weapons and improved anti-personnel artillery, one can achieve similar effects today.

However, if the defender makes the area too impregnable, the defender will also find himself with limited mobility in that direction in the future. In effect, a defender can proscribe ground

counterattack mobility if not careful.

Both sides have had fifty years to think through these issues. They have also used every sense available to man and machine to map, model and study every aspect.

[caption id="attachment\_24996" align="alignnone" width="589"]



Avenues of Approach to Seoul[/caption]

**Figure A-4**

**Selected 240 MRL and 170 KOKSAN Hardened Artillery Sites (HARTs)**

There are several HARTs near the area. Because of the KOKSANS size, there are relatively few HARTs able to handle the gun. Here is a representative sample of the kinds of places from which and to which the guns can move.

HARTs can only be situated in certain areas to be effective. Generally they must provide protection, be oriented in the right direction, allow clearance for the artillery to come into and out of the location, cannot exceed certain gradient of slopes and other requirements. If the slope is too steep, the gun will not be able to depress or raise in order to fire at certain ranges. Also if the slope is too steep there is the very real possibility of sliding off the platform as anyone who has experienced a Korean winter knows. However, Korea has been blessed with numerous locations which meet all the criteria.

The 240 MRL needs a certain blast radius cleared behind it or can kill the operators and anyone else who happens to be in the way. The 240 is likely going to have to come out of the HARTs in order to fire, unlike other systems which can fire from an almost completely protected area with only the tube sticking out. The total exposure time for a 240 MRL is around 15 minutes from exiting the HART, stabilizing the platform, erecting the launcher, raising the pads, retracting the launcher, moving and reloading.

Even the HARTs which appear to be relatively close together usually involve descending a steep hill





All Likely HARTS in the Area.[/caption]

**Figure A-6**

### Selected Likely Observation Posts in the Area

The guns almost certainly have a dizzying array of pre-planned targets. The artilleryists will simply plug in all the information which they have had 50 years to pre-calculate: elevation, deflection, charge, shell-fuze combination, etc and then fire.

However, in order to adjust to current conditions or engage moving targets, the artilleryists need an Observation Post or place for someone to observe the effects of the fire and provide corrections to the artillery. KPA has set up a series of Observation Posts throughout the country and especially around the DMZ. These observation posts are extremely vulnerable to all kinds of fire. KPA observers generally have a more modest technical means of observation, relying on their eyes and binoculars. That means their effectiveness can be drastically cut by using simple smoke to obscure vision. And of course, any counterbattery fire landing nearby rattles one's nerves and has a local obscuring effect.

[caption id="attachment\_24999" align="alignleft" width="1112"]



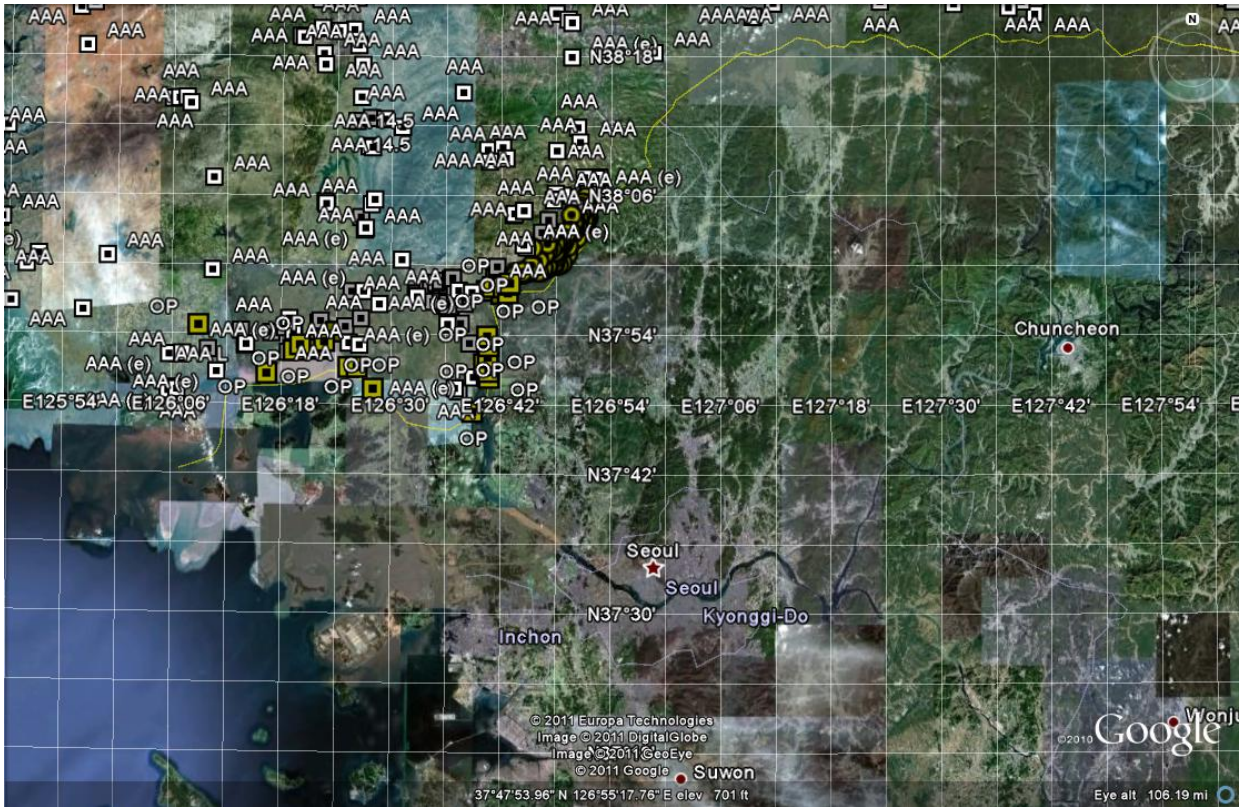
Selected Likely Observation Posts in the Area[/caption]

**Figure A-7**

**Selected Anti-Aircraft Artillery Sites and Range Rings**

Given that KPA has so much artillery on the ground, they would like to protect what they have by dissuading aircraft from flying toward DPRK. If an aircraft does fly toward the DPRK, the KPA wants to make sure they have some capability to shoot it down. Here is a representative sample of sites the KPA has developed to protect against air attack.

[caption id="attachment\_25000" align="aligncenter" width="617"]

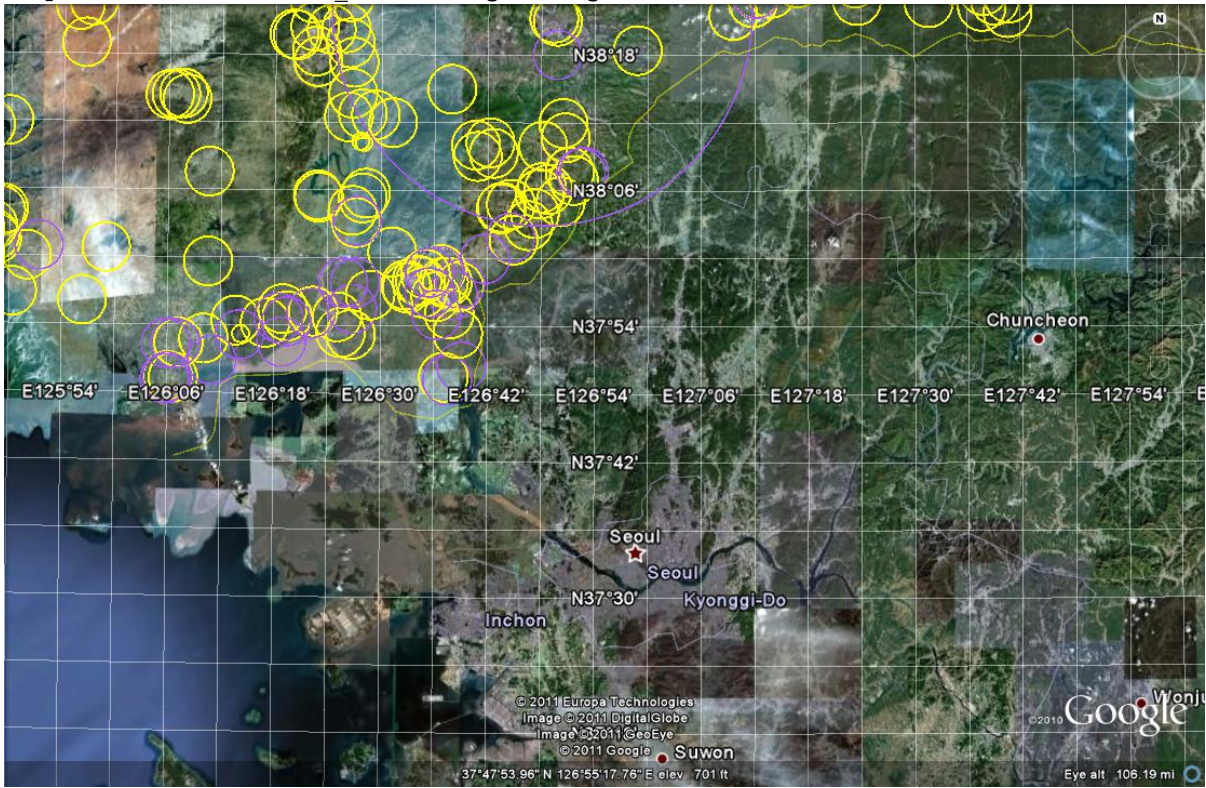


Selected

Anti-Aircraft Artillery Sites[/caption]

The figure below illustrates how the sites translate into air coverage rings.

[caption id="attachment\_25001" align="alignnone" width="600"]



Selected

Anti-Aircraft Artillery Sites and Range Rings[/caption]

**Figure A-8**

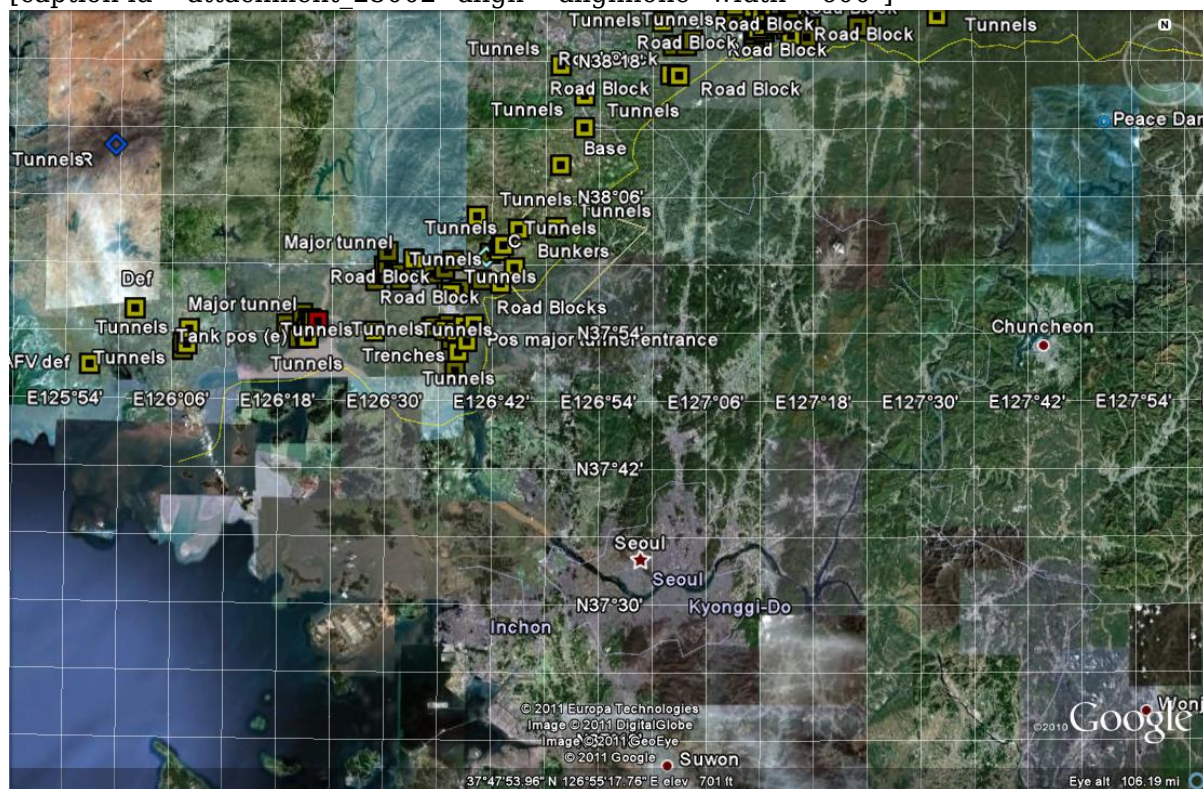
**Likely Tunnels, Bunkers and Road Blocks in the Area**

If a corridor is too constrictive, and one is too exposed to the air, go underground. Here are some known and suspected tunnels in the DMZ area.

However, there are also many smaller tunnels far away from the DMZ which may lead to barracks, equipment, fuel, ammunition, etc. There are also bunkers and trenches which may indicate a target KPA really wants to protect. Command and control facilities and communications areas normally require high levels of protection.

Just as there are numerous road blocks in the south, there are numerous road blocks in the north. Clearly, someone in the DPRK is worried about possible ground movement North. An alternative explanation is that as soon as KPA moves south, those who remain behind close off any possibility of those troops coming home. This is very similar to the Chinese saying “Breaking the clay pots and sinking the boats” in other words, the only way out is victory.

[caption id="attachment\_25002" align="alignnone" width="600"]



Tunnels, Bunkers and Road Blocks in the Area[/caption]

**Figure A - 9**

### **DPRK Forces Arrayed near the Area**

If we put all the information together, here is the picture which emerges: Seoul is under threat, but can't be turned into a “Sea of Fire” from artillery since most of the artillery will not reach into the heart of Seoul.

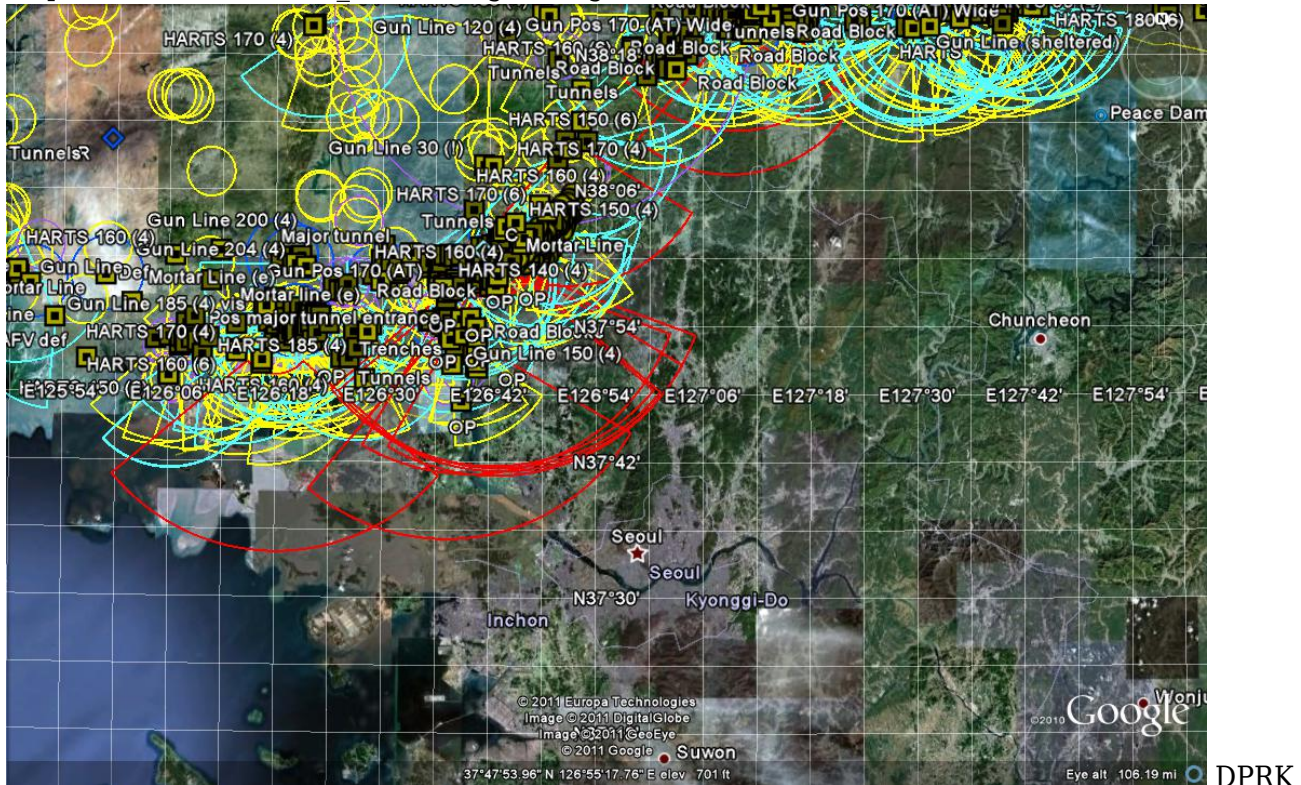
There are four distinct messages to draw from this picture:

1. DPRK is extremely concerned about movement north and set up an extremely impressive ground and air defense line. They understand the credible and overwhelming conventional forces arrayed against them in the south.
2. DPRK has forward stationed a very large portion of their forces and can switch from Defense to

Offense very rapidly, if suicidally ordered to do so.

3. Most of Seoul is beyond the range of DPRK direct fire weapons. The heart of Seoul will have between a couple and several hours to react to a conventional ground attack by going underground or moving further south. But they will have as little as three minutes warning from an air or missile attack.
4. DPRK has to move the majority of everything with a range fan seen here some 350 km to Busan in 30 days in order to succeed. There are also ~4,000 tanks, ~2,500 armored personnel carriers, ~8,000 light and medium wheeled vehicles and numerous other systems not pictured here which have to move.

[caption id="attachment 25003" align="alignnone" width="600"]



Forces Arrayed near the Area[/caption]

**Figure A - 10**

### **KPA Artillery Range Fans in the rest of DPRK**

Of course the DPRK must protect other areas of its country or those become weak points. What stands out is the relatively few artillery and anti-aircraft systems on the Chinese and Russian borders. There is one notable likely artillery range fan pointing into a Chinese Valley just north of Dandong. There are a few range rings for anti-aircraft and artillery (not shown) right along the borders with China and a few with Russia, but by and large, the DPRK displays a fair amount of trust in their neighbors here.

It is also noteworthy that the only other places we are likely to see 240 MRL and 170 KOKSAN is near Pyongyang. The KPA places high value upon its ability to threaten Seoul and protect Pyongyang. This dynamic is strategically asynchronous with DPRK stated desire to have better relations with ROK and U.S. It is difficult to have a positive relationship with someone pointing so many weapons at you.

As a positive gesture, the DPRK could remove at least some percentage or even some number of all those range fans directly across Seoul. Surely a few pieces won't determine the outcome and the rewards can be great. It is up to the Koreans to decide. Agreeing to the Kaesong Industrial Complex fits in with this confidence building theme. All sides recognized the value in turning the area into a manufacturing area thus generating some revenue and also moving weapons back from the border.

As a reminder of the significant logistical challenges, they have to move almost everything south of Pyongyang, even further south to Busan. That is a tough challenge for any military. It is made more challenging by acute fuel and food shortages and lack of practicing these types of maneuvers for at least fifty years.

**Figure A - 11**

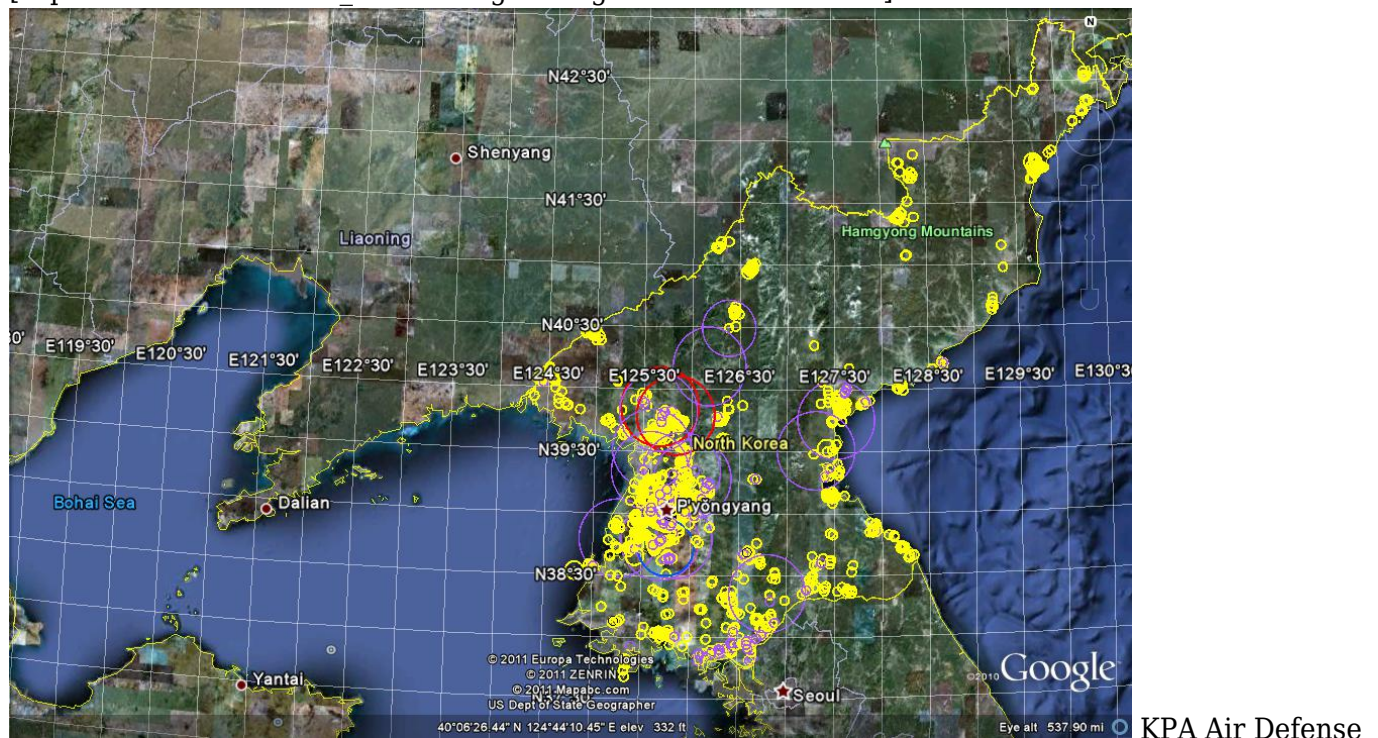
**KPA Air Defense Rings in the rest of DPRK**

An Air Defense Plan like this definitely emphasizes protecting Pyongyang.

Perhaps KPA assumes its troops in the south will be too close to the ROK for effective air support. Whatever the reason, KPA troops in the south have light air defense cover.

Presumably the air defense range rings next to China and Russia are a fence to ensure no KPA aircraft exit the country. However, they are immediately obvious and likely to be further explored since they may be protecting something else the DPRK holds dear.

[caption id="attachment\_25063" align="alignnone" width="561"]



Rings in the rest of DPRK[/caption]

**Figure A - 12**

**KPA Air Defense Rings in the rest of DPRK**

What stands out is the amount of preparation, work and effort which went into creating this national fortress.



KPA primarily counter-force	~ 2,811 fatalities initial volley.~ 64,000 first day (majority in first three hours)~ 80,000 one week. Very few KOKSAN and 240 MM MRL last more than one week	2/3 of batteries firing max rate for 5 minutes from likely positions between 5 and 10 km north of DMZ and then sustained rate for ½ of batteries for 24 hours. Batteries destroyed by direct, indirect and counter-battery fire at about 1%/hour. Unrealistic assumption of unlimited ammunition and 100% maintenance rate.
KPA counter-valueLikely indicates KPA desperation	~29,661 fatalities initial volley.Within the range of a previous study by Bennet, Bruce [20]	2/3 of batteries firing indiscriminately intoSeoulfrom DMZ trace. Most residents at home or office.

According to the Korea Statistics, Korea’s central government organization for statistics, Korea’s total population in 2010 was approximately 48,219,000. The city of Seoul officially counted 9,708,00 residents which was about a 1% decline from 2005. However, the Seoul Metropolitan area population was assessed as 23,616,000. The proportion of Seoul’s population relative to Korean population has grown from 46.3% to 49% in the past decade.[21] Some may consider this as common indicators that people do not believe there is an immediate existential threat from North Korea. Korea’s population overwhelmingly lives in cities with an urbanization rate of 82.1 %.[22] This simple fact has great military significance in that DPRK forces will have to engage in urban warfare almost the whole length of the Korean peninsula if they seek to unify the peninsula by force. There are simply almost no blank spaces where the KPA can bypass ROK forces. Also, when calculating fuel and ammunition consumption rates as well as equipment and personnel losses, North Korea (and South Korea and U.S. and any other forces which may join) must assume urban combat rates.

Every war is different, but given so much of it, there are some fairly consistent ratios of horrible events which allow us to create some morbid hypotheticals of various kinds of attacks. For example, we know typical weather patterns over South Korea and roughly how humans are negatively affected (i.e. die) when hit with certain chemical agents or conventional artillery in war. The numbers are ghastly since each number is not an abstraction but a person. However, for this paper, we will try to treat the numbers as only numbers in order to demonstrate methodology, promote conversation and provide the basis for exploring the value (or lack thereof) of nuclear weapons and eventually establishing a Korea Japan Nuclear Weapons Free Zone.

First, a conventional artillery attack on Seoul. It is often said that DPRK can hold Seoul hostage and “kill millions” in a sudden artillery barrage. The numbers just don’t support that assertion unless chemicals or multiple nuclear weapons are involved. Here’s an analytical look at the numbers in two scenarios:

- KPA relatively close to doctrine conventional artillery attack, mainly counter-force
- KPA conventional artillery attack mainly counter-force [23]

These numbers start out as ABSOLUTE WORST CASE. Everything works in DPRK favor and then we progress the sequence to what's more likely to happen.

I have not found another study which walks through a surprise volley even though all the numbers are publically available. The other numbers for a sustained barrage and a chemical barrage are within the ranges outlined in some previous studies. I did not find a previous analysis of a nuclear strike on Busan, and it wouldn't likely matter anyway since that is only a very specific scenario.

If the DPRK were to begin and sustain a conventional artillery barrage, they would begin with some 20,500 artillery pieces. Sounds overwhelming, but if we go down another level, it's believed the DPRK has 5,100 Multiple Rocket Launchers (MRL); 4,400 Self-propelled artillery and 7,500 mortars but not all 20,500 pieces can range Seoul [24]. Going down one more level of detail, initially, we need only be concerned with two systems: Multiple Rocket Launcher 240mm (MRL 240) rocket launchers with a range of 35 km and the KOKSAN 170mm with a 60km range if using Rocket Assisted Projectiles (RAP). Digging just a little deeper, some assess 500 KOKSAN pieces and 200 each 240 mm systems that can range parts of Seoul. The following paragraphs provide a brief overview of the systems.[25]

The MRL 240 rocket launcher has two main variants: M1985 and M1991. The M1985 fires 12 rockets in a single salvo while the M1991 can fire 22 rockets in a salvo. Both can fire their entire salvo within 45 seconds. They then need approximately two minutes to lower the firing pack and raise the stabilizing pads before they can move. Adding another minute to move back into a hardened artillery site (HARTS) [26] there is a total exposure time of roughly four minutes. It is unclear how long it takes to reload the firing pack, but we'll assume a 10 minute reload time - about the time it takes to reload a roughly similar BM-21 Multiple Rocket Launcher. MRL 240 rockets are basically unguided and are meant to destroy large areas with little regard for accuracy. DPRK use of these weapons against heavily populated areas might indicate the DPRK intends to cause a great deal of casualties. If DPRK only meant to harass or send a warning, they could use the more precise KOKSAN to fire into unpopulated areas such as a park.

There are also two different types of KOKSAN 170 mm: M1978 and M1989 each with the same range, 60 km with Rocket Assisted Projectile (RAP). The main difference is that the M1978 is usually mounted on some other chassis such as a T54, Chinese T59 or T62 and has no organic ammunition storage capability. That means in order to re-locate, it has to either move to a site where more ammunition has been pre-positioned or have vehicle transport ammunition for it and then both vehicles have to stop and cross-load the ammunition. The M1989 variant has a 12 round storage capacity or enough to fire an initial burst of 4 rounds in 1 minute and then shoot at a sustained rate of 1 round every 3 minutes giving it about 24 minutes of firing time, if firing constantly, until it has to re-load.

In a worst case scenario, there are 700 artillery pieces capable of ranging most of Seoul. Not all the rockets or shells will explode. The most recent dud rate available from any DPRK artillery piece comes from DPRK attack on Yeonpyong Do and yields a dud rate of 25% [27]. The source of such a large dud rate is unclear at this time, but again it is the only recent indicator available - to the North Koreans - as well as the rest of the world. If we see KPA suddenly testing all different types of Artillery tubes and shell-fuze combinations, it might indicate they lack confidence in their dud rates.

### **Figure B-1**

#### **Likely M240 and 170 KOKSAN Range Fans near Seoul**

[caption id="attachment\_25069" align="alignnone" width="1112"]



Likely M240 and 170 KOKSAN Range Fans near Seoul[/caption]

In all cases, standard practice would be to only fire about 2/3 of artillery at any time. Some artillery must be kept on standby as a reserve, some kept on standby since one would not want to give away every position immediately. And of course some must be ready to counter-counterfire in an artillery duel. Again, the latest incident at Yeonpyeong do indicates that KPA will likely receive counter-fire within 15 minutes of firing the first shot [28].

Even assuming a worst case with all DPRK artillery firing an opening burst, again this is not doctrinal and only about 2/3 would fire, but for calculation purposes, we'll assume every piece fires. This would be indicative of a completely countervalue tactic and does not make military sense at all.

We can represent it as:  $\sum$ Worst countervalue  $K+M+ M_2$

$$K = 500 * KOKSAN * 4 \text{ rds/min} = 2,000 \text{ rounds}$$

$$M = 100 * M1985 * 12 \text{ rds/min} = 1,200 \text{ rounds}$$

$$M_2 = 100 * M1991 * 22 \text{ rds/min} = 2,200 \text{ rounds}$$

Opening barrage Worst Countervalue =  $\sum$ Worst Countervalue  $K+M+ M_2 = 5,400$  rounds - 1350 rounds (representing dud rate of 25%) = 4,050 rounds with total projected fatalities in the range of 82,392 people assuming each round is evenly distributed across Seoul and the entire population of the Seoul metropolitan area is also evenly distributed across Seoul and standing outside in the open. Truly, a hardly likely scenario, but even with these worst case assumptions, there is nowhere near the "tens of thousands of shells turning Seoul into a sea of fire".

Here is how we derived projected casualties:

$\pi$  (lethal blast radius in meters)<sup>2</sup> \* (# rds) \* (pop density /km<sup>2</sup>) \* (convert km<sup>2</sup> to m<sup>2</sup> by 1 km<sup>2</sup>/1,000,000 m<sup>2</sup>).

Substituting in the scenario numbers and we have: 3.1416(12m\*12m)(4050 rds) (16,188.9 people/km<sup>2</sup>) (1 km<sup>2</sup>/1,000,000 m<sup>2</sup>) = 29,661 fatalities or just over one-tenth of one percent of Seoul Metropolitan's population.

However, if we make one assumption change, that most people are either at home or an office, in other words most people are NOT outside standing in the open, then the casualties, while still horrendous, change drastically to a projected 252,000 fatalities in an initial barrage. The major difference is the protection offered by being in a prone position, i.e. asleep and the protection offered by being in a covered position, a standard concrete apartment.

And even this is way more than would normally happen for three very important reasons: 1) DPRK would likely only open fire with no more than 2/3 of their artillery in order to keep some in reserve, not give away all their firing positions at once and in order to prepare for counter-counter battery. We can immediately reduce the numbers of systems firing by at least a third; 2) not all DPRK pieces are likely on a DMZ trace. Much of the terrain along a northern DMZ trace does not offer the right angle of fire and clearances needed. For example, the slopes may be too steep or face a direction which would leave them open to easy and direct strikes from the south. Also, a northern trace of the DMZ is generally within South Korean artillery range. Standard military doctrine would argue for DPRK using "stand off" or being out of range of ROK artillery, but still being able to use KPA artillery range to hit targets in the south. 3) MRLS can only fire 35 km which means they can only range the northern parts of Seoul and in particular Paju county, Yeoncheon, Dongducheon and Uijeongbu which have population densities ranging between 957.7 and 5,146 people /km<sup>2</sup>. However, there are also a fairly large number of foreign citizens living in Seoul. In 2010, there were 281,780 foreigners. Of those, 216,532 were Chinese or Korean-Chinese.[\[29\]](#) They are mainly concentrated in the Incheon and Goyang areas. There is another important factor here and that is these areas and the small cities in these areas are characterized by numerous mountains and hills meaning there will be significant artillery "shadows" which can only be struck by mortars and some howitzers since those are the only weapons with the trajectories to eliminate most of those "shadows". Howitzers and mortars can't range Seoul from a DMZ trace.

A blended average population around 3,000 people /km<sup>2</sup> is closer to representative of the northern areas. ROK forces and bases in the DMZ and north are relatively isolated from nearby populated areas meaning if KPA artillery hit civilian targets while aiming at a ROK base there would three likely reasons in what I think are descending order: 1) KPA is intentionally engaging in counter-value targeting; 2) KPA had faulty data on their aimpoints since 1953; or 3) they are extraordinarily incompetent due to lack of training or disintegrating infrastructure. [\[30\]](#)

In this case, a more realistic result would be represented by:  $\sum$ likely countervalue K+M+ M<sub>2</sub>

$$K = (2/3)500 * KOKSAN * 4 \text{ rds/min} * 25\% \text{ dud rate} = 1,001 \text{ rounds}$$

$$M = (2/3)100 * M1985 * 12 \text{ rds/min} * 25\% \text{ dud rate} = 600 \text{ rounds}$$

$$M_2 = (2/3)100 * M1991 * 22 \text{ rds/min} * 25\% \text{ dud rate} = 1,100 \text{ rounds}$$

Substituting back into the formula:  $\pi$  (lethal blast radius in meters)<sup>2</sup> \* (# rds) \* (pop density /km<sup>2</sup>) \* (convert km<sup>2</sup> to m<sup>2</sup> by 1 km<sup>2</sup>/1,000,000 m<sup>2</sup>) provides a still horrible, but eminently survivable figure since we have accounted for the much less densely populated area within range of artillery, a

likelihood that most people are either at home or in the office, that the majority of ROK bases are away from high population concentrations, only a certain percentage of KPA artillery will open fire immediately, the dud rate remains consistent with what was observed at Yeonpyong do, and that KPA uses a weapons stand off which is to their advantage.

$\pi (12)^2 * (2701\text{rds}) * (3,000 \text{ people /km}^2) * (1 \text{ km}^2/1,000,000 \text{ m}^2) = 2,811 \text{ fatalities}$ . I think this is a bit overstated and really depends on the degree to which KPA actually targets the ROK armed forces versus how much it targets the civilian population.

As a backward historical example, let's look at Yeonpyeong-do. Approximately 1,700 civilians and 1,000 military on 7 square kilometers using 170 rounds of a 120 mm shell (which has a smaller lethal blast radius). Using our standard formula yields:  $\pi (8)^2 * (170\text{rds}) * (2,700 \text{ people /7km}^2) * (1 \text{ km}^2/1,000,000 \text{ m}^2)$  which yields an expected 13 fatalities. As tragic as it was that 4 people died on Yeonpyeong do, we would have expected more. Perhaps it was a function of the numerous bunkers and people immediately diving for cover (which dramatically and quickly reduced the population density), or perhaps there was diminished effectiveness of the explosive charges. It is impossible at this stage to definitively explain the discrepancy.

However, after the initial barrage all the systems will have to move into a sustained firing rate which is much lower. Also, assuming that DPRK is actually going to invade after actively shelling Seoul, they are going to have to start displacing their systems south. Some systems will have to stay in place, some in reserve as stated above and some leap frogging south. This means only about half their systems are able to fire.

$$K_s = (1/2)500 * \text{KOKSAN} * 24 \text{ rds/hr} * 25\% \text{ dud rate} = 4,500 \text{ rds/hr} * 24 \text{ hrs}$$

$$M_s = (1/2)100 * \text{M1985} * 48 \text{ rds/hr} * 25\% \text{ dud rate} = 1,800 \text{ rds/hr} * 24 \text{ hrs}$$

$$M_{2S} = (1/2)100 * \text{M1991} * 88 \text{ rds/hr} * 25\% \text{ dud rate} = 3,300 \text{ rds/hr} * 24 \text{ hrs}$$

Sustained barrage =  $\sum_s K_s + M_s + M_{2S} = 24,064 \text{ rds/hr}$  for a 24 hour max rate of 230,400 + 5,076 or 233,101 rounds in a 24 hour period assuming DPRK has unlimited rounds, fires as rapidly as it can, moves south and suffers absolutely no losses, not even for maintenance, in short this is an artificial worst case.

$\pi (12)^2 * (233,101\text{rds}) * (3,000 \text{ people /km}^2) * (1 \text{ km}^2/1,000,000 \text{ m}^2) = 316,358 \text{ potential fatalities}$  in a 24 hour period.

Again, let's apply a little bit of reality in two specific areas: 1) percentage of equipment DPRK will likely lose to destruction from the effects of direct, indirect and counter-battery fire based on past statistics, as well as various other reasons; and 2) how rapidly Seoul and other areas can change their population densities. It is extremely understandable that most people will seek cover from fire in Seoul's shelters with space for 20 million.

A rough historical analog includes OPERATIONS DESERT STORM and DESERT SHIELD (ODS/S). I realize there are many flaws with this assumption, but it is the closest thing we have to the equipment match readily available. Present day KPA equipment is broadly based on former Soviet equipment.

During OPERATION DESERT SHIELD/STORM, coalition forces destroyed approximately 86% of Iraqi Main Battle Tanks (T-72s) over 83% of other armored vehicles and 83% of Iraq's 3,110 Artillery tubes. All that destruction took place over 42 days, but the statistics do not cover destruction per day. If the numbers were a consistent percentage every day, it would be right at 2% per day.

However, it was almost certainly a great deal at the beginning and then a smaller amount later. In particular, most fighting was done in four days which leads to a daily loss rate of about 20% [31]. This is also more consistent with 50 years of studying the terrain with every sense available. No one can be surprised that almost every square meter of the Korean peninsula has been studied. The basic assumption is that while the pieces are in the north, they have decent protection from airpower. However, as the pieces move from their HARTS toward the south, they move out from under their Air Defense Artillery cap and become extremely vulnerable as ROK, U.S. and other Air Forces have air superiority from roughly the DMZ south. Counterfire battery has historically taken another immediate 2% or so per day. There is also the matter any military would face and that is trying to keep every mission critical piece functioning. The gun systems are at least 33 years old gun system and the associated transport system upon which the gun rides is 57 year old. Altogether a daily loss rate at the outset of 20-25% is likely. It is entirely possible for the numbers of Precision Guided Munitions to become the limiting factor. Understandably, there are no reliable numbers of Precision Guided Munitions publicly available.

DPRK (and all militaries) will suffer a personnel casualty rate of between 2 and 6% under fluid modern warfare conditions due to non battle injuries. Militaries have a lot of cold, hard steel equipment which folds, spindles and mutilates any flesh and bone in the way of its normal functioning. And people still contract normal flu and other diseases in war.[32]

In a temperate climate, all armed forces suffer a normal amount of attrition due to heat or cold depending on the season. This will further decrement DPRK fighting strength by a small but consistent and persistent percentage depending on the time of year and ranging from a high of 0.3%/day in winter to 0.15% in early summer.[33] If DPRK is wearing chemical protective gear, despite training often in such gear, they will likely experience 2% or so heat casualties per day. That rate will only increase the longer they stay in chemical protective gear.

Very few DPRK weapons systems have modern night vision capability and even fewer personnel possess the equipment. The weapons systems which do have night vision usually have an older infrared (IR) system which require active illumination. Any active IR will be very quickly destroyed. Also, the older IR systems are blinded by many types of smoke, while most ROK night vision equipment has much greater resolution and is generally less degraded by smoke.

Another factor is that is extremely unlikely is that every person in Seoul will be outside in the open and remain that way for 24 hours. Major roads into and out of Seoul will almost immediately fall under military control, but there will be an inexorable flight of people and vehicles south. There will also be a large number of people moving into Seoul's 3,919 underground shelters designed to hold at least 20 million people [34]. It is very possible to reduce Seoul's exposed population density by about one half in a relatively short time. On any given business day 4 million people take the subway [35]. Many will be motivated to avoid the artillery so it is possible to double the number of people in subway stations to 8 million and within 12 hours to basically have everyone out of range or in a shelter, thus greatly reducing Seoul's surface population. It also unlikely that as KPA guns move toward Seoul they would engage in randomly targeting the ancient capital of Korea and its associated priceless Korean artifacts, history and palaces. The DPRK will likely not want to increase damage to its historical legacy and be forever known as the regime responsible for destroying a large part of Korea's historical artifacts.

Running the numbers one more time, but with reasonable decrements, we see a dramatic improvement in Seoulites' survivability. While still horrific, painful and extremely costly in terms of human lives, destroyed infrastructure, reduced and economic productivity such an attack is imminently survivable for Seoul, the Republic of Korea and almost certainly dooms any DPRK hope of achieving strategic or operational success since DPRK's bluff will have been called.

Here are the changes made to the calculations: First, we decrement the numbers of systems and rounds by 1% per hour to account for a 20-25% loss per day. After 3 hours over 1/2 of the surface population is in shelters which reduces the population density to ~ 1,000 people per square kilometer. A shell would need to land extremely close to and almost directly on a shelter in order to produce fatalities. Finally, after about 12 hours, even though the shells keep falling and the numbers of systems steadily decreases, virtually everyone has some sort of shelter thus reducing the surface population and the survivability of those who do come under fire. At that point, it is almost exclusively soldiers and those unfortunate civilians who happen to be at the wrong place at the wrong time who are susceptible to the effects of fire. This gives a daily fatality rate around 65,000 the first day. Assuming, the long range artillery continues decrementing, in a week the guns could claim up to 80,000 before themselves being decimated.

## APPENDIX C: Maps


### Map 1: Asia

[caption id="attachment\_25070" align="alignnone" width="1375"]



Map 1: Asia[caption]

### Map 2: South Korea

[caption id="attachment\_25071" align="alignnone" width="672"]  Map 2: South Korea[caption]

### Map 3: South Korea Topography

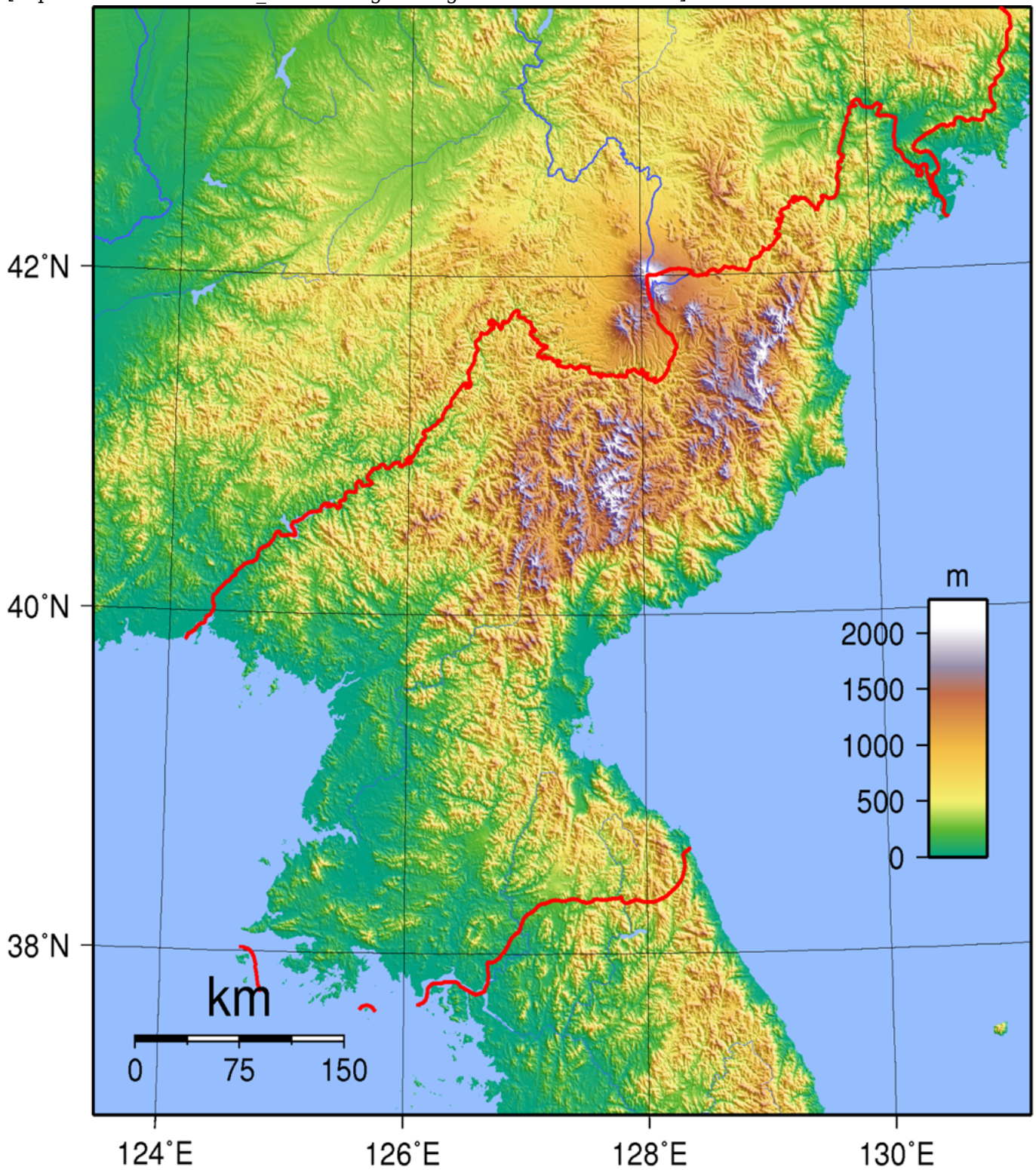
[caption id="attachment\_25072" align="alignnone" width="1432"] Map 3: South Korea Topography[/caption]

### Map 4: DPRK

[caption id="attachment\_25074" align="alignnone" width="660"]  
Map 4: DPRK[/caption]

### Map 5: DPRK Topography

[caption id="attachment\_25076" align="alignnone" width="1050"]



Map 5: DPRK Topography[/caption]

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Acknowledgement: The author thanks three external expert reviewers for the comments on earlier drafts of this paper. Naturally, all views expressed here remain the responsibility of the author.

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[20] Bennet, Bruce, "The Prospects for Conventional Conflict on the Korean Peninsula", Korean Journal of Defense Analyses, (Summer 1995, updated March 30, 2009), Table 5, pg 23 NOTE: differing assumptions of numbers of rounds and population densities. However, the methodologies are similar.

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[25] All information about 240mm and KOKSAN come from [www.globalsecurity.org](http://www.globalsecurity.org) (searched date: 17 June 2012)

[26] A Hardened Artillery Site (HARTS) provides cover and concealment of personnel and equipment

by basically being dug into a cave. Such sites usually have water, food, ammunition, communications equipment like a camp or small fort. However, these are exceptionally well hidden and protected by a mountain. However, in order to attack South Korea, a force must leave its HARTS. That is when a force is most vulnerable.

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[28] OP CIT, pg 6-7 for an excellent timeline on the specific details.

[29] Korea Times Online "Korean Chinese account for 70% of Foreigners in Seoul" Korea Times (September 11, 2011) at: [http://koreatimes.co.kr/www/news/nation/2011/09/117\\_94610.html](http://koreatimes.co.kr/www/news/nation/2011/09/117_94610.html) (searched date: 17 June 2012)

[30] Paju - si City Government website,  
[http://en.paju.go.kr/en/en\\_paju/en\\_info/en\\_paju\\_general/en\\_paju\\_general.cms](http://en.paju.go.kr/en/en_paju/en_info/en_paju_general/en_paju_general.cms) (searched date: 17 June 2012)

[31] Global Security website, Operation Desert Shield from the 1991 Defense Almanac,  
[http://www.globalsecurity.org/military/ops/desert\\_storm-stats.htm](http://www.globalsecurity.org/military/ops/desert_storm-stats.htm) (searched date: 17 June 2012)

[32] OP CIT table B

[33] OP CIT, pg 92

[34] Bae Ji-sook, "Seoul Not Safe from Artillery Attack," *Korea Times*, (November 26, 2010) at:  
[http://www.koreatimes.co.kr/www/news/nation/2010/11/177\\_77036.html](http://www.koreatimes.co.kr/www/news/nation/2010/11/177_77036.html) (searched date: 17 June 2012)

[35] Seoul Metro website <http://www.seoulmetro.co.kr/eng/page.jsp?code=A02000400000> (searched date: 17 June 2012)

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#### **IV. Nautilus invites your responses**

The Nautilus Peace and Security Network invites your responses to this report. Please leave a comment below or send your response to: [napsnet@nautilus.org](mailto:napsnet@nautilus.org). Comments will only be posted if they include the author's name and affiliation.

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