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Confidence Building on the Korean Peninsula: A Conceptual Development for the Cooperative Monitoring of Limited-Force Deployment Zones

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Abstract

Confidence building measures (CBMs), particularly military ones, that address the security needs of North and South Korea could decrease the risk of conflict on the Korean Peninsula and help create an environment in which to negotiate a peace regime. The Korea Institute for Defense Analyses (KIDA) and the Cooperative Monitoring Center (CMC) of Sandia National Laboratories collaborated to identify potential CBMs and define associated monitoring. The project is a conceptual analysis of political and technical options for confidence building that might be feasible in Korea at some future time. KIDA first analyzed current security conditions and options for CBMs. Their conclusions are presented as a hypothetical agreement to strengthen the Armistice Agreement by establishing Limited Force Deployment Zones along the Military Demarcation Line. The goal of the hypothetical agreement is to increase mutual security and build confidence. The CMC then used KIDA's scenario to develop a strategy for cooperatively monitoring the agreement.

Cooperative monitoring is the collecting, analyzing and sharing of agreed information among parties to an agreement and typically relies on the use of commercially available technology. A cooperative monitoring regime must be consistent with the agreement's terms; the geographic, logistic, military, and political factors in the Korean setting; and the capabilities of monitoring technologies. This report describes the security situation on the Korean peninsula, relevant precedents from other regions, the hypothetical agreement for reducing military tensions, a monitoring strategy for the hypothetical Korean agreement, examples of implementation, and a description of applicable monitoring technologies and procedures.

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Acronyms and Definitions

CBMs	confidence building measures
CFE	Conventional Armed Forces in Europe Treaty
CMC	The Cooperative Monitoring Center of Sandia National Laboratories
DMZ	demilitarized zone
DOE	U.S. Department of Energy
DPRK	Democratic People's Republic of Korea
GNP	gross national product
IAEA	International Atomic Energy Agency (United Nations)
IRLS	Infrared Line Scanner
JMC	Joint Military Commission
JSA	Joint Security Area
JVC	Joint Verification Committee
KEDO	Korean Peninsula Energy Development Organization
KIDA	Korea Institute for Defense Analyses
KPA	North Korean People's Army
LDZ	limited force deployment zones
MAC	Military Armistice Commission
MDL	military demarcation line
MIDS	Mini-Intrusion Detection System
MND	Ministry of National Defense of the Republic of Korea
NBD	northern boundary of the DMZ
NNSC	Neutral Nations Supervisory Commission
NTM	national technical means
ROK	Republic of Korea
ROKA	South Korean army
SAMs	surface-to-air missiles
SAR	synthetic aperture radar
SBD	southern Boundary of the DMZ
SFM	Sinai Field Mission
Sinai I	<i>1974 Sinai Disengagement Agreement</i>
Sinai II	<i>1975 Sinai Interim Agreement</i>
SOFs	special operations forces
SPOT	Système pour l'observation de la Terre (A French commercial satellite)
UNC	United Nations Command
UNDOF	United Nations Disengagement and Observer Force
WIM	weigh-in-motion sensor system
WMD	weapons of mass destruction

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1.0 Introduction

1.1 Project Description

This project is a conceptual analysis of political and technical options for military confidence building that might be feasible on the Korean peninsula at some future time. The analysis focuses on reducing the risk of surprise attack by conventional forces and is presented within the context of a hypothetical future agreement between South and North Korea. The hypothetical agreement is consistent with the 1991 South-North Korea “Agreement on Reconciliation, Nonaggression, and Exchange and Cooperation” as well as the 1996 Four-Party proposal by the Republic of Korea (ROK) and the United States (U.S.) to negotiate a permanent peace regime. None of the conceptual initiatives depend on a formal state of peace between South and North Korea.

The hypothetical agreement has both short-term and long-term goals:

Short-term Goals:

- Improve the current dangerous military situation
- Increase overall Korean security

Long-term Goals:

- Rejuvenate the peace process between the South and North
- Begin conventional arms reduction
- Begin arms control of weapons of mass destruction (WMD)

1.2 Origin of the Project

The U.S. Department of Energy (DOE) established the Cooperative Monitoring Center (CMC) at Sandia National Laboratories in 1994 to assist political and technical experts from around the world in acquiring the technical tools and expertise needed to assess, design, and implement cooperative monitoring agreements. The Korea Institute for Defense Analyses (KIDA) performs political analysis and security policy development to help the ROK government develop strategic options and solutions. Neither KIDA nor the CMC are representatives of the ROK or

U.S. governments. KIDA proposed that the two organizations collaborate to apply the principles of cooperative monitoring to the problem of security on the Korean peninsula.

1.3 Project Strategy

KIDA assessed the security situation on the Korean peninsula. KIDA then used this assessment to develop the hypothetical agreement to reduce military tension between the two Koreas. Relevant historical precedents from the Middle East and Europe were adapted and applied to the Korean setting in the hypothetical agreement. Based on the scenario KIDA generated, the CMC developed a strategy for cooperatively monitoring the hypothetical agreement.

1.4 Concept of Cooperative Monitoring

Cooperative monitoring is the collecting, analyzing, and sharing of agreed information among parties to an agreement. Cooperative monitoring typically relies on the use of commercially available sensor technology. When combined with techniques for data management and analysis, these technologies become powerful tools for implementing security-related agreements. Cooperative monitoring systems must have three features, as follows:

- Technologies that are sharable among all parties to the agreement
- The means to analyze and equally share information acquired by the system
- Procedures for dealing with anomalous data and false positives (“false alarms”)

2.0 Security Issues On The Korean Peninsula

2.1 Current Relations Between South and North Korea

The Korean peninsula is the site of the world's largest current military confrontation. Nearly 2 million North Korean, South Korean, and U.S. troops face each other along the 255-km-long military demarcation line (MDL). A demilitarized zone (DMZ) extends 2 km into each country from the MDL. Most troops are within 100 km of the DMZ. North Korea's efforts to acquire nuclear, chemical, and biological weapons of mass destruction contribute to the seriousness of the situation.

In testimony before the U.S. Congress on March 16, 1996, Gen. Gary Luck, commander of the ROK-U.S. Combined Forces Command, made several pessimistic assessments, as follows:¹

1. "As North Korea's economic situation worsens, their provocative actions and rhetoric become even more threatening toward South Korea."
2. "As we watch this economic situation and severe food shortage develop, the question is not will this country disintegrate, but rather how it will disintegrate: by implosion or explosion? And if an explosion, will it take the form of an attack on the South?"

2.1.1 Legacy of the 1953 Armistice Agreement

The framework for Korean security is provided by the 1953 Armistice Agreement. The Armistice was signed by the Supreme Commander of the United Nations forces (an American), the Supreme Commander of the Democratic People's Republic of Korea (DPRK) Korean People's Army, and the Commander of the Chinese People's Volunteers. (Figure 1 shows the signing of the Armistice.) Although the articles of the Armistice Agreement remain in effect until superseded either by mutually acceptable amendments or an agreement for a peaceful political settlement, the Armistice was not intended to be permanent.

¹ Reuters news wire service.



Figure 1. Signing of the Korean Armistice Agreement in 1953

The Armistice defined six major objectives, as follows:

1. Establishment of a 4-km-wide DMZ along the MDL
2. Withdrawal of all military forces and equipment from the DMZ, with the exception of a maximum force of 1,000 “civil police personnel” from each side
3. Replacement of combat personnel and equipment on the Korean peninsula on a piece-for-piece basis to prohibit either side from introducing reinforcements
4. Establishment of the Military Armistice Commission (MAC) and the Neutral Nations Supervisory Commission (NNSC) to administer the implementation, monitor the terms, and resolve disputes associated with the Armistice
5. Repatriation of prisoners of war and displaced persons
6. Convene future political conferences to achieve a permanent peace settlement

The MDL is marked by 1,292 yellow signs (Figure 2 shows an example) across the entire peninsula and is defined by the positions of the respective military forces when the Armistice was signed. As a result, it does not follow naturally occurring physical features such as rivers or ridge lines.



Figure 2. Marker for Military Demarcation Line Near Panmunjom

Verification of the terms of the Armistice Agreement was to have been performed by the NNSC and the MAC. NNSC carries out the functions of supervision, observation, inspection, and investigation of armistice violations in the DMZ and at specific ports of entry for both nations. The NNSC reports violations directly to the MAC for assessment and resolution. A formal MAC meeting is shown in Figure 3.

Neither the MAC nor the NNSC has been able to function effectively. Since the signing of the Armistice, hundreds of South Korean, North Korean, and U.S. troops have been killed and wounded in clashes along the MDL. Appendix A describes the structure and operation of the MAC and NNSC. The sections of the Armistice Agreement text defining the DMZ and verification functions of the MAC and NNSC are also presented in Appendix A.



Figure 3. A Formal Meeting of the Military Armistice Commission

2.1.2 South-North Perceptions of the Armistice Agreement

The two Koreas differ substantially on the role and relevance of the current Armistice mechanism. This section describes the differing views.

South Korea holds that, although the Armistice regime is an unfortunate legacy of the Korean War, it should remain in force until a final and peaceful settlement of the Korean War is achieved. The Armistice has played a constructive role in providing a reasonable degree of security on the Korean peninsula. For over four decades, the MAC has served as the only official channel of communication between the opposing commanders. Although intended to be a provisional military organization to supervise the implementation of the Armistice Agreement, it nevertheless plays an indispensable stabilizing role by defusing serious incidents, preventing misunderstandings, and avoiding the resumption of hostilities. South Korea states that it does not intend to maintain the Armistice forever. However, until an effective and enduring mechanism for peace is established through political dialogue between the two Koreas, the Armistice should be maintained.² Seoul points out that replacing the Armistice Agreement with a peace treaty might not, by itself, bring about peace. A peace treaty, in the absence of the political will to achieve peace, would create a false sense of security. South Korea believes that the first

² Paik Jin-Hyun, *Building a Peace Regime on the Korean Peninsula*, Korean and World Affairs, Vol. XIX, No. 3, Fall 1995, Research Center for Peace and Unification of Korea.

step to achieving peace is for the two Koreas to negotiate and carry out substantive steps to build political and military confidence. The next step should be arms reduction.³

North Korea holds a contrasting view on the role of the Armistice regime. In its view, the Armistice mechanism has become obsolete because of repeated violations on the part of the U.S., and remains the biggest obstacle to efforts to establish peace and stability on the Korean peninsula.⁴ North Korea believes the Armistice regime and the United Nations Command (UNC) constitute a wall that keeps the two Koreas apart. Dissolving the outdated, irrelevant Armistice mechanism and establishing a new peace arrangement are urgently required for securing peace and ultimately achieving unification. Since 1974, North Korea has consistently proposed direct negotiations with the U.S., excluding South Korea, to replace the Armistice Agreement. According to North Korea, since the Chinese People's Volunteers have withdrawn totally from North Korea and the so-called "UN forces" in South Korea are, in fact, U.S. troops, the "real parties" to the Armistice are the DPRK and the U.S. Since South Korea did not sign the Armistice, it cannot become a signatory to a peace treaty officially ending it.⁵

2.2 Risk of Conflict

2.2.1 Weapons of Mass Destruction

The potential for North Korea to produce nuclear weapons has been the focus of the Northeast Asia security debate since 1992. The October 1994 "Framework Agreement" between the U.S. and the DPRK, with the support of the International Atomic Energy Agency (IAEA), has stabilized this security problem, at least temporarily.

Nuclear proliferation, although significant, is not the only security problem in Korea. Richard Armitage, former U.S. Ambassador to the ROK, recently made several key points, as follows:⁶

³ Ibid.

⁴ Pae Sang-Hak, *Urgent Necessity for the Establishment of a New Peace Arrangement on the Korean Peninsula*, presented at the 8th Asia-Pacific Roundtable, Kuala Lumpur, Malaysia, June 5-8, 1994.

⁵ When General Clark, Supreme Commander of the UNC, signed the Armistice Agreement, he did so as the representative of the sixteen participating states and the ROK. Therefore the parties to the Armistice Agreement are not the UNC, but the sixteen states and the ROK, which were the belligerents as a consequence of committing troops to the UNC.

⁶ Armitage, Richard; *Playing the Winning Hand: The U.S.-ROK Alliance from Confrontation to Unification*, presented Oct. 27, 1995, 10th Annual Conference, The Council on U.S.-Korean Security Studies, Arlington, VA.

- "... it is a grave mistake to define Pyongyang's nuclear ambitions as the issue rather than part of the larger Korea problem."
- "This (conventional force threat) must be the center of U.S.-DPRK dialogue, and on a well-coordinated and parallel track, of North-South reconciliation."
- "If the nuclear deal was wildly successful, DPRK conventional, missile, and chemical weapon threats would not necessarily be diminished one iota."

2.2.2 Conventional Military Forces

North Korea has twice as many active-duty troops and major weapons as South Korea. Its numerical superiority in combat units and equipment is expected to continue. After Kim Il-Sung's death in July 1994, the Kim Jong-Il regime continued the military buildup. The superior quality of weapons, training, and command/control in South Korean forces partly offset the North's numerical advantage. Many North Korean heavy weapons are quite old and suffer from poor maintenance. This problem will increase as North Korea's defense burden grows while its economy stagnates. Table 1 shows a comparison of military forces of South and North Korea.⁷

The Ministry of National Defense of the Republic of Korea (MND) has concluded that North Korea will continue its policy of military superiority.⁸ In the event of a decision to go to war, North Korea would launch a surprise attack with simultaneous strikes on both the front and the rear lines. The goal would be to sweep the entire peninsula before reinforcement by U.S. troops.

Table 1. Military Forces of South and North Korea

Type of Force	N. Korea	S. Korea	U.S.
Active Duty Personnel	1,128,000	633,000	36,250
Army Divisions/Brigades	26/42	21/12	1/0
Tanks	3,940	2,050	150
Artillery	9,700	4,756	100
Combat Aircraft	589	461	84
Ballistic Missile Launchers	84	12	0

⁷ *The Military Balance: 1995-1996*, the International Institute of Strategic Studies, London, UK.

⁸ Defense White Paper 1995-1996, The Ministry of National Defense, The Republic of Korea, p. 50.

In June 1996, DPRK Air Force Capt. Li Chol-Su, who had defected the previous month in his MIG-19 aircraft, described his understanding of the war plan, as follows:⁹

In April 1994, Kim Jong-Il ordered the Ministry of the People's Armed Forces to map out a war plan to attack and occupy South Korea in a week. According to the North's war plan, North Korea has a three-stage strategy to attack and occupy all of South Korea in a week. Strategically, this means overtaking Seoul in 24 hours, Taejon in the next couple of days, and Pusan and all the rest of the country in seven days. In the initial stage, the North will employ four corps of the regular army to break through the truce line. The 2nd Corps will press Seoul through the main attack corridor of Kaesong-Munsan-Seoul and seize the capital within 24 hours after the start of the invasion.

Infiltration by special operations forces (SOFs) for harassment and attack preparations is also an important military threat to South Korea. Just before a surprise attack, SOFs may begin large-scale infiltration to perform surveillance, occupy chokepoints, and disrupt South Korean defense preparations. Capt. Li noted that, "From the early stage, North Korea will concurrently put 100,000-strong guerrilla units into South Korea, employing a combination of the regular operations with irregular warfare." Occasional infiltrators currently cross the DMZ and enter South Korea during peace-time to conduct intelligence collection and to disrupt the social system.

2.2.3 Recent Tensions

North Korea's attitude toward the Armistice regime is illustrated by recent events.¹⁰ On April 28, 1994, a DPRK Foreign Ministry statement proposed to hold talks with the U.S. to discuss replacing the 1953 Armistice Agreement with a new peace agreement. North Korea argued that the implementing bodies of the Armistice Agreement should be substituted by those of a "peace-guaranteeing system."¹¹ On the next day, the North withdrew its officers on resident duty at Panmunjom village after notifying the UNC of its decision to withdraw from the MAC. On

⁹ The Korea Herald newspaper (Seoul), a series in June 1996.

¹⁰ Paik Jin-Hyun, *Building a Peace Regime*.

¹¹ The DPRK news agency announced: "The U.S. violated the Korean Armistice Agreement by deploying Patriot missiles in South Korea, thereby rendering the agreement a mere paper sheet and the armistice bodies useless. The reason why political and military confrontation intensified over the North Korean nuclear issue is that the Armistice Agreement defines its parties, the DPRK and the U.S., as enemies. In order to reduce antagonism between the two countries and guarantee perpetual peace on the Korean peninsula, the Armistice Agreement should be replaced with a peace treaty, and the armistice regime with a new peace-guaranteeing regime. The DPRK government proposes negotiations with the United States in establishing a new peace-guaranteeing system that could consolidate peace on the peninsula."

May 25, 1994, North Korea announced that it had set up a new negotiation body called “Representative Office of the DPRK People's Army at Panmunjom” to replace its mission to the MAC. On September 2, 1994, at North Korea’s request, China announced its withdrawal from the MAC effective December 15, 1994. The Chinese Foreign Minister said that the Armistice Agreement would remain valid until a new system to secure peace on the Korean peninsula was established. On February 28, 1995, North Korea closed the NNSC on its side by forcing the Polish delegation to leave the country. (The Czech delegation had withdrawn on April 3, 1993 under North Korean pressure.) On May 3, 1995, the North Korean People’s Army (KPA) announced its decision to close its territory to any members of the NNSC and unilaterally declared an end to the Armistice supervisory function. In a MAC meeting on the same day, North Korea urged the UNC-appointed members of the NNSC to withdraw from the North Korean side of the NNSC building. Thus, the monitoring bodies of the Armistice Agreement ceased to officially function although a liaison role between the officers-of-the-day was retained.

Immediately after the April 28, 1994 statement, the DPRK initiated the first in a series of actions designed to challenge the Armistice Agreement by deploying 40 armed soldiers in the northern side of the Joint Security Area (JSA.) On May 6, 1994, KPA staff in the JSA stopped wearing the symbolic yellow arm bands, and even rejected using the term “Military Armistice Commission” in unofficial contacts among the secretarial officers of the MAC.¹² More recently, the ROK government ordered the second-highest military alert status on April 5, 1996 after over 100 KPA troops, armed with mortars and heavy machine guns, entered the JSA for exercises. About 200 troops returned for periods of several hours on April 6 and 7, 1996.

2.3 Opportunity for Peace

2.3.1 Confidence Building Measures for a Peaceful Transition

Over time, the United States, the European community, and the former Soviet Union recognized the vital role played by arms control and confidence building measures (CBMs) in enhancing security. Nevertheless, the concept that arms control and increased openness can actually enhance security can be difficult for countries and regions unfamiliar with the process to accept. Regional discussions can involve a wide range of issues, ranging from nuclear arms control to environmental

¹² Seong Ho-Jhe, *Replacing the Military Armistice Agreement on the Korean Peninsula?*, Korea and World Affairs, Vol. XIX, No. 1, Spring 1995, Research Center for Peace and Unification of Korea.

protection. In the initial stages of regional security discussions, it is important to identify issues in which progress is possible. The first series of discussions might need to focus on less volatile issues. In regions where tensions are high, limiting armaments may be possible only after considerable confidence building in other areas.

ROK and DPRK Prime Ministers began to meet at “mini-summits” in 1988. Progress was slow and tedious, but on December 13, 1991, the two Koreas signed the “Agreement on Reconciliation, Nonaggression, and Exchange and Cooperation” (known as the “Basic Agreement”) (Figure 4). Appendix B contains the text of the Basic Agreement. On January 20, 1992, South and North Korea signed the “Joint Declaration of the Denuclearization of the Korean Peninsula.” Both agreements were to go into effect on February 19, 1992.

Articles One to Four on “South-North Nonaggression” can be summarized as mutual recognition and respect of each other's system and recognition of the existing boundary. Article Five states: “The two sides shall endeavor together to transform the present state of armistice into a solid state of peace between them and shall abide by the Armistice Agreement until such a state of peace has been realized.” Under the Basic Agreement, three committees and five commissions are to be established.¹³



Figure 4. The Signing of the Basic Agreement by ROK Prime Minister Chung Won-Shik and DPRK Premier Yon Hyong-Muk

¹³ The committees and commissions are the: 1) Exchanges and Cooperation Committee, 2) Political Committee, 3) Military Committee, 4) Joint Commission for Economic Exchanges and Cooperation, 5) Joint Commission for Social and Cultural Exchanges and Cooperation, 6) Joint Military Commission, 7) Joint Nuclear Control Commission, and 8) Joint Reconciliation Commission.

After signing of the Basic Agreement, North Korea was still unwilling to recognize and deal directly with South Korea. North Korea interprets the Basic Agreement in the narrow sense of being only a simple reconciliation between the Koreans and not an acknowledgment that South Korea is its equal in signing a peace treaty. The terms have not been implemented to date, but they remain a framework for peaceful coexistence in the future.

Military CBMs were a very important topic in the process of improved relations between South and North Korea defined by the Basic Agreement. The Military Committee was to negotiate CBMs and arms reduction, to provide notification of large military exercises, to exchange information on military deployments, and to conduct mutual inspections. A hot-line telephone connection between the military authorities of both Koreas was to be established along with a mutual observation system of military exercises and maneuvers. Enhanced transparency was to be a key part of any future permanent peace mechanism.

2.3.2 Four-Party Talks for a Permanent Peace Agreement

On April 16, 1996, ROK President Kim and U.S. President Clinton proposed that “four-party talks” be held with North Korea and China with the goal of establishing a new permanent Korean peace regime.¹⁴ The statement said that the peace process should begin as soon as possible and be without preconditions. The two presidents agreed that the peace process should also address a wide range of tension-reduction measures. North Korea issued a statement saying it was examining the proposal to see “whether it is feasible.” South Korean officials expressed guarded optimism that North Korea will eventually accept the proposal, because the U.S. has pledged that it will not hold exclusive bilateral talks on a new peace regime with Pyongyang. The text of the ROK-U.S. joint statement, the official DPRK response, and regional assessments of the proposal are contained in Appendix C.

¹⁴ A “two plus two” formula means that South and North Korea, principal belligerents of the Korean War, work out a peace arrangement terminating the state of war in Korea, which will be endorsed by the United States and China, the other two belligerents. In contrast, a quadripartite formula means that two Koreas, the United States, and China work out a peace arrangement from the beginning as parties to negotiation.

3.0 Hypothetical Agreement For Military CBMs Between The Two Koreas

This section defines the hypothetical agreement developed as part of the analysis of the feasibility of monitoring a future system of military CBMs. The agreement is consistent with the CBMs defined by the South-North Basic Agreement as well as the current Four-Party proposal by the ROK and U.S. None of the initiatives depend on a formal state of peace between South and North Korea. There is no indication that the two Koreas would enter into any agreement resembling the hypothetical one presented at this time or in the near future. The security concerns of both South and North Korea need to be assessed in order to define the context in which the two countries might sign such an agreement. The analysis should be viewed as part of the process of defining options to reduce the risk of conflict on the Korean Peninsula.

3.1 South Korean Security Concerns

South Korea's primary security concern is the constant risk of a conventional attack by North Korea. KPA forces arrayed along the DMZ are capable of launching a short-notice attack at any time. North Korea completed its program to reorganize its mechanized corps, strengthen the special operations forces, and strengthen forces and emplace long-range artillery in hardened positions along the DMZ in the late 1980s. Another important security concern is the continual infiltration by SOFs from the North that occurs across the DMZ and along the coasts. Consequently, the ROK military maintains an elevated level of alert. The need for prompt response to threats is reinforced by the lack of strategic depth in South Korea. Seoul, the capital of the ROK, is only about 45 km from the DMZ.

Given the current lack of communication between North and South Korea, minor events run the risk of escalating into violations of the cease-fire

agreement. A crossing of the MDL by a few North Korean soldiers, such as occurred on May 17, 1996, near Yonchon might be caused by an unintentional error, the direction of a local commander, or the calculated decision to cause a provocation for political purposes by the national leaders. Given the severely curtailed function of the MAC, there is no way to easily assess and resolve such incidents.

South Korea has examined the issues associated with improving relations. On August 15, 1994, ROK President Kim Young-Sam defined the first step in future South-North relations as “reconciliation and cooperation.” The official ROK government goals are as follows:

- Reduce the possibility of war by decreasing military tensions
- Build confidence and enhance military stability
- Develop a basis for peaceful unification by establishing a system of peaceful coexistence

The ROK government has repeatedly stated its preference for a step-by-step process in improving relations with the North. The ROK government would thus be receptive to a bilateral agreement that would reduce the short-term threat of attack and increase the security of Seoul. The transparency and increased communication that could be achieved by the agreement would support the long-term goal of reunification. Future ROK government proposals for CBMs might take several forms, as follows:

- Activate the Joint Military Commission (JMC) specified by the Basic Agreement
- Exchange military training schedules
- Return the DMZ to its original function as a buffer zone
- Withdraw offensive weapons that exceed predetermined defensive limits near the DMZ toward a rear area
- Implement verification of agreed confidence-building actions by a monitoring team composed of U.S. and Chinese inspectors

The reduction of the North Korean military threat might permit South Korea to reduce the alert status of its armed forces. A stable structure for security might permit the ROK government to reduce the size of its military and associated expenses. Government funds might be redirected toward improving civilian infrastructure and support the economic boom initiated by its economic reforms.

3.2 North Korean Security Concerns

North Korea is controlled by a military-supported dictatorship and oligarchy whose authority is being eroded by economic difficulties and natural disasters. This small oligarchy, which has become largely

hereditary, is the decision-making group in North Korea. Members of the oligarchy may well make foreign policy decisions for their personal benefit rather than for the national interest. Any proposed future agreement for CBMs, such as the hypothetical one presented here, will need to address the motivations of this elite group in order to be accepted and implemented.

The North Korean elite considers the following factors in its decision process:¹⁵

- Political and personal survival
- Domestic politics
- Economic desperation

Political and Personal Survival

Given the economic and political environment, the North Korean elite will be very cautious about entering into agreements that endanger its political and personal well-being. An agreement to reduce military tensions that the elite believes will enable them to maintain their power might be accepted. Some analysts and ROK President Kim Young-Sam have offered the opinion that North Korea leaders might initiate a war, even if they know it would fail, in order to maintain their power.¹⁶

In the opinion of the authors, the Romanian revolution of 1989 probably made a significant impression on the North Korean oligarchy. Many members of the Romanian elite, including the President, were imprisoned or executed. The fear of a similar fate may deter the elite from constructive actions to reform North Korea and seek a peaceful settlement with the South. A supportive approach by South Korea, regional countries, and the U.S. might offer the North Korean oligarchy an alternative to war while retaining their privileges and power – at least in the short term. The Korean Peninsula Energy Development Organization (KEDO), an international consortium that includes South Korea, is a possible model for providing stabilizing support. KEDO's objective is to replace a North Korean graphite nuclear reactor that may have been used for nuclear weapon development with two safer light-water reactors. Fuel oil, in substitution for electric power lost by closing the graphite reactor, is even being provided to North Korea during construction of the new reactors.

Domestic Politics

Any objective observer of the Northern military structure and deployments would conclude that North Korea has an offensive orientation and South

¹⁵ Eberstadt, Nicholas, *Korea Approaches Reunification*; The National Bureau of Asian Research, published by M.E. Sharpe, 1995, pp 130-164.

¹⁶ *The Korea Times* newspaper (Seoul), October 4, 1996, "Kim: NK May Start War Knowing It Will Lose".

Korea a defensive one. The North Korean elite is unlikely to truly believe that South Korea poses a threat of military attack. Despite this, the creation and maintenance through propaganda of an impending South Korean threat has been the basis for political control of the North Korean population. The external threat has been both a unifying force and a basis for the acceptance of the regime's authoritarian control. An implication that this threat has declined might combine with deteriorating economic conditions to cause the DPRK regime to lose its influence over the population. Consequently, the elite may be reluctant to initiate constructive actions, even if it wants to, because of domestic political requirements.

Economic Desperation

Since 1992, an increasing number of North Koreans have left the country citing economic hardship. The DPRK government continues to spend approximately 25% of its gross national product (GNP) on the maintenance of 1.1 million troops. North Korea has a centrally planned socialist economy with a strong emphasis on self-sufficiency. Bad weather for harvests, natural disasters, mismanagement, and the diversion of resources to the military, are placing severe strains on the economy. Economic growth has stagnated since 1990. The average utilization of manufacturing capacity is currently only about 45% because of an energy shortage. Table 2 summarizes some key macroeconomic trends.^{17 18}

Table 2. Economic Structure: North Korea

Economic Indicators	1990	1991	1992	1993	1994
Real GNP growth (%)	-3.7	-5.2	-5.0	-3.5	-3.0
Rice production (1000t)	5,900	5,300	N/A	1,330	N/A
Population (mil)	21.4	21.8	22.2	22.6	23.0
Exports (\$ bn)	1.96	1.01	1.02	1.02	0.84
Imports (\$ bn)	2.76	1.71	1.64	1.62	1.27
External debt (\$ bn)	N/A	4.7	N/A	N/A	9.8
Exchange rate (W:\$)	0.94	0.96	2.16	2.17	2.17

Key:

bn billion

mil million

t tons

W:\$ Exchange rate of won (North Korean currency) to U.S. dollars

¹⁷ *The EIU Country report: North Korea*, 1st Quarter 1996.

¹⁸ South Korea has grown economically far faster than North Korea since 1976. In 1994, South Korea had a GNP about eighteen times greater and a per capita GNP about nine times greater (at the official North Korean exchange rate).

Nicholas Eberstadt summarized the economic options in North Korea as follows:¹⁹ “In a tightly controlled police state, neither declining standards of living nor food shortages should be presumed to presage a popular uprising against the DPRK government. Judged on its own terms, North Korea has proved expert in dealing with domestic discontent. Perhaps more unsettling to Pyongyang than the immediate impact of today’s economic woes may be the realization that there is simply no way out for them.”

China and the former Soviet Union have sharply cut their economic support and trade. Foreign economic resources from North Korea’s other international relationships might offer the regime some additional time for fundamental decisions, but are unlikely to be significant. Short-term prospects for North Korea to expand its exports are not favorable. With the exception of weapons, North Korea does not produce competitive products for the world market.

Scenarios for the Political Future of North Korea

Given favorable personal, political, and economic factors for the elite, there is the need for some measure of internal reform for significant initiatives in CBMs to occur. Many analysts have assessed the political future of North Korea. Robert Scalapino summarized the following three basic paths:²⁰

1. North Korea will be able to survive its current problems with minimal political and economic changes, counting upon its security and military apparatus to keep order. Some economic openness might be initiated but the bulk of its population will be isolated and the Leninist system will be preserved. This option is assessed to be unlikely in the middle- to long-term, given regional and global trends.
2. North Korea will collapse because of economic and political pressures and be absorbed by South Korea. The current economic stresses, combined with the ambiguity about the role and power of Kim Jong-Il, might combine to cause a sudden and rapid collapse as in several eastern European countries during 1989-90. A peaceful North Korean collapse and reunification, in the manner of East Germany by West Germany, is possible but not necessarily likely.
3. The third option is an evolution of North Korea into a system of “authoritarian pluralism.” With or without Kim Jong-Il, a military-technocratic coalition would retain authoritarian politics. The system would be modified only gradually and as circumstances

¹⁹ Eberstadt, pp 135 - 136.

²⁰ Scalapino, Robert; preface; Eberstadt, Nicholas; *Korea Approaches Reunification*, The National Bureau of Asian Research, published by M.E. Sharpe, 1995, pp. xv - xvii.

demanded, while permitting a small civil society to emerge apart from the state to alleviate tensions. Market mechanisms would be carefully introduced under state guidance and economic contacts with regional economies increased. China and Vietnam are precedents for this type of limited reform. Significant latitude for positive initiatives in North Korean foreign policy might be possible under these circumstances.

Likelihood of Future Progress

The DPRK government has yet to demonstrate a willingness to engage in anything more than a cautious tinkering at the margins of its economic and political problems. This does not mean that North Korea is incapable of initiatives that are in its self-interest. Eberstadt points out that however odd DPRK foreign and domestic policy may appear externally, some of its actions have been practical and effective.²¹ For example, North Korea skillfully extracted aid, without paying deference, for many years from China and the Soviet Union by playing them against each other. The initial collectivization of farms and development of heavy industry were successful by the precedents of the Soviet Union, China, and other communist nations.

Thus, a potential exists that sometime in the future, if favorable events occur in North Korea combined with supportive actions by South Korea and the international community, North Korea might take significant and credible actions to decrease the risk of military conflict on the Korean peninsula.

3.3 Objective of the Hypothetical Agreement

The objective of the hypothetical agreement is to thin the existing military forces along the DMZ by the creation of limited-force deployment zones (LDZs). A variety of CBMs can be applied, focusing on transparency and verification measures. In view of the short strategic depth in both countries, the scope and size of movements and training exercises need to be more limited than in Europe.

The hypothetical agreement would reduce the risk of a surprise attack and permit the military alert status along the MDL to be reduced. Successful implementation could provide momentum for subsequent initiatives dealing with reconciliation and cooperation between the two Koreas. With the absence of the constant threat of conflict, South and North Korea could

²¹ Eberstadt, pp. 132-133.

begin to pursue realistic options for arms reductions of all kinds and transform the Armistice Agreement into a permanent and formal peace agreement. Subsequent initiatives could include reducing the level of conventional weapons and troops, assuring that production or stockpiling of WMD is not occurring, and establishing a framework for reunification.

3.4 Strategy for Implementation and Monitoring

The conceptual system of military CBMs does not require arms reduction. Updating the Armistice system and activating the JMC (specified in the 1992 Basic Agreement) are assumed because those actions are closely related to implementation of the hypothetical agreement. The JMC should act as the negotiation and implementation organization for the hypothetical agreement. The authors propose that verification of the agreement and resolution of issues related to compliance be managed by a newly formed “Joint Verification Committee” (JVC) subordinate to the Joint Military Commission (JMC). The role of the JVC would be to evaluate reports from the monitoring organization, assess compliance, and resolve problems and ambiguities. The JVC would have the authority to order the monitoring organization to enact *special inspections* of sites or activities within the DMZ and LDZs if ambiguities reported during routine monitoring could not be readily resolved during meetings. Financial support for personnel and equipment to perform monitoring and verification activities for the JVC would be equally shared by the two Koreas.

Given the lack of confidence between the two Koreas, it is unlikely that South and North Korea could successfully operate the monitoring organization by themselves. Therefore, the authors propose that the monitoring of the hypothetical agreement be performed by a “third party.” There are precedents for a third-party monitoring strategy, most notably the Sinai disengagement between Egypt and Israel during the 1970s. It will be difficult to find an acceptable single neutral national party to perform monitoring on the Korean peninsula. The U.S. has a defense agreement with the ROK as well as troops in the country. Consequently, the U.S. would be unlikely to perform a neutral monitoring role as in the Sinai disengagement. Many nations participated in the conflict as part of the UNC, and North Korea might reject them on that basis. Monitoring of the DMZ and LDZs might be conducted by the UN as an organization (the ROK and DPRK are now both members). A regional group might also function as a monitoring organization. The U.S. could conceivably participate in multilateral organizations, particularly if China participated.

The hypothetical agreement defines the objectives and the details concerning the disengagement and monitoring regime. The issues are as follows:

- Definition of the LDZ area
- Definitions of the deployment, including limitations on the number and type of armaments and troops within the DMZ and the LDZs
- The schedule and plan for redeployment of forces
- The organization and procedures of the JVC and monitoring organization.

The agreement would be implemented in two phases:

1. The first phase would remove all personnel and facilities from the existing 4-km-wide DMZ area and make it a true demilitarized and clear zone. Both sides would remove all troops, armaments, and manned facilities from the DMZ within 6 months after signature of the agreement. An example of a manned bunker within the DMZ is shown in Figure 5. Passive defensive facilities such as tank barricades and fencing could remain. As an enhancement, heavy artillery and rockets (defined as greater than 150 mm) should be removed from hardened positions within 5 km of the DMZ.
2. The second phase, to be implemented as soon as possible after the first, would establish two limited force deployment zones in both South and North Korea. Forces would be redeployed from the LDZs to rearward areas. Redeployment should be completed within 12 months after the agreement is signed.



Figure 5. A Manned Bunker Within the DMZ

3.5 Options for Defining Limited Force Deployment Zones

There are several strategies for defining LDZs. Creation of LDZs of equal distance is impractical because of the geographical asymmetry between the two Koreas. Appendix E describes the geography of the DMZ area. Seoul is 45 km from the DMZ while Pyongyang is 150 km. The terrain between the MDL and Seoul contains plains that permit relatively easy movement by mechanized forces. If an invasion from North Korea occurred, South Korea would need time to deploy its active forces and prepare defensive positions, especially in the western forward area. Consequently, the ROK government is unlikely to accept equal LDZs because of South Korea's lack of strategic depth.

Options for asymmetrical zones must consequently be considered and evaluated for practicality. The distance ratio of Seoul and Pyongyang from the DMZ could be one option. A disadvantage with defining lines in terms of distance from the MDL is that some key terrain may be artificially divided. Complex urban areas and roadnets make it difficult to establish or mark boundaries smoothly. Alternatively, defining boundaries exclusively along major terrain features may cut across existing civilian and military logistic networks. For these and other reasons, the existing military defense lines in each country would provide a better rationale for defining LDZs. Such a system would have the following advantages:

- Current defense lines planned by each side can be assumed to provide the best defensive advantages and are connected along key terrain features.
- The proposal is more likely to be accepted by both the military and political establishments because each side still holds strong defensive positions. This could encourage a constructive attitude during negotiations.

3.6 Provisions of the Hypothetical Agreement

Basing the LDZ regime on existing defensive lines for each side would result in three limited force deployment zones, including the DMZ. The suggested DMZ and LDZ deployment lines in the hypothetical agreement are shown in Figure 6.

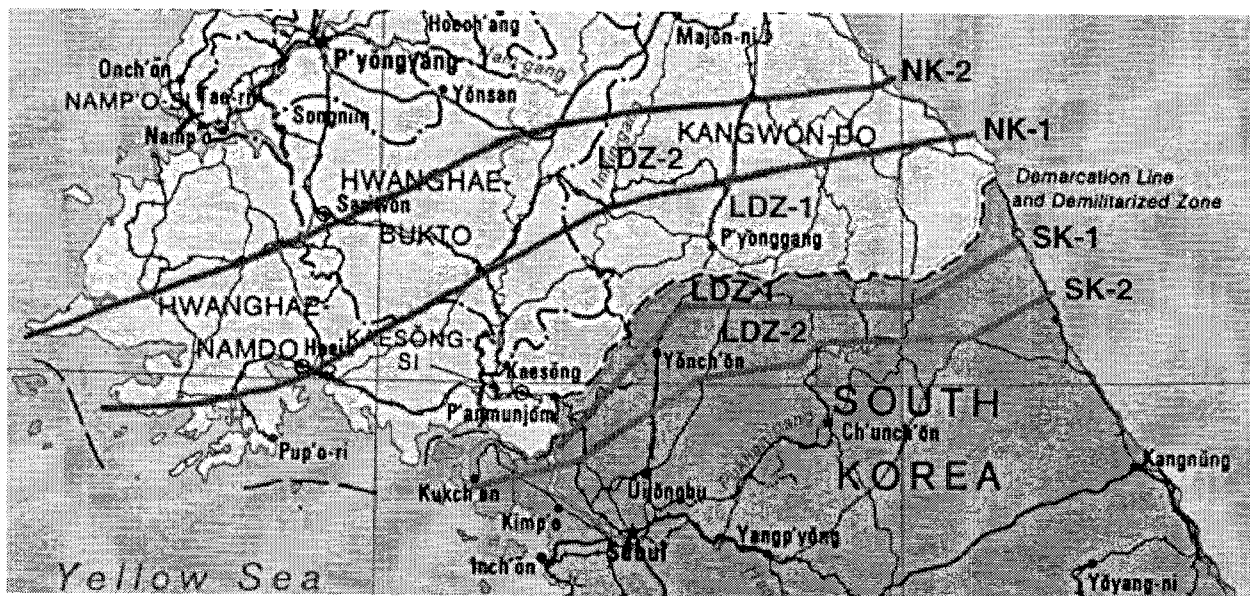


Figure 6. Map of the Conceptual LDZ Regime on the Korean Peninsula

General Provisions For Monitoring

The general provisions for monitoring are the following:

- The JMC negotiates and oversees the implementation of the agreement.
- The JMC funds and provides material support to the Joint Verification Committee.
- The Joint Verification Committee oversees the monitoring organization and places contracts for any necessary support.
- The Joint Verification Committee meets weekly to evaluate reports from the monitoring organization, evaluate compliance, and resolve problems and ambiguities.
- Both parties are permitted to call a special meeting of the Joint Verification Committee
- The JVC has the authority to order the monitoring organization to enact *special inspections* of sites or activities within the DMZ and LDZs if ambiguities reported during routine monitoring cannot be resolved during meetings. Special inspections could be performed by on-site inspection or aerial overflight.

Provisions of Military Disengagement:

The military forces of South and North Korea are to be deployed in three zones in accordance with the following terms:

Zone 1: The Existing Demilitarized Zone

- All ROK forces deploy south of the Southern Boundary of the DMZ (SBD).
- All DPRK forces deploy north of the Northern Boundary of the DMZ (NBD).
- Propaganda broadcasts within the DMZ stop.
- The Military Armistice Commission is reconvened.
- All military armaments and manned fortifications in the DMZ will be removed or dismantled. Passive defensive facilities, such as fencing, may remain.
- Resident civilian personnel are evacuated from the DMZ.²²

Zone 2: The Primary Limited Force Deployment Zone (LDZ-1)

The area between the northern boundary of the DMZ and line "NK-1" (shown on Figure 3-2) for North Korea and the area between the southern border of the DMZ and line "SK-1" for South Korea is defined as LDZ-1. The LDZ-1 runs from the edge of the DMZ to the existing first defensive line within each country. The width of this zone averages 8 km in the South and 40 km in the North. The limitations on military forces and movements in LDZ-1 are defined as follows:

Personnel:

- Armed personnel consist only of military police and/or light infantry.
- The maximum number of armed personnel is 2,500.

Facilities:

- Existing garrisons for troops in excess of the number permitted will be closed.
- Construction of new garrison facilities is permitted on a replacement basis.
- No permitted garrison may contain heavy weapons that can reach the other side of the DMZ.

²² Farming is practiced in the plains around Panmunjom. The South Korean village of Taesong with a population of about 150 is located slightly south of Panmunjom in the DMZ. The North Korean village of Kijong with an undetermined permanent population is located north of Panmunjom.

Activities:

- Each party will notify the other at JMC meetings two weeks in advance of military movements exceeding 200 personnel.
- No military training exercises are permitted.

Zone 3: The Secondary Limited Force Deployment Zone 2 (LDZ-2) LDZ-2 is defined to run from the edge of the existing first defensive line (NK-1, SK-1) to the second defensive line (NK-2, SK-2) within each country. The width of this zone averages 20 km in the South and 35 km in the North. The limitations on military forces and movements in LDZ-2 are defined as follows:

Personnel:

- Armed personnel are not restricted by type.
- The maximum number of troops is 75,000 (nominally five mechanized infantry divisions).

Facilities:

- No garrison may contain heavy weapons that are capable of striking territory across the DMZ.

Activities:

- Each party will notify the JMC two weeks in advance of military movements exceeding 1,000 personnel.
- No military exercises with over 500 personnel participating are permitted. Each party will notify the JMC of permitted exercises 30 days in advance of their planned start.

4.0 Cooperative Monitoring Strategy For The Hypothetical Korean Agreement

4.1 Elements of the Strategy

Cooperative monitoring is the collecting, analyzing, and sharing of agreed information among parties to an agreement. Cooperative monitoring typically relies on the use of commercially available technology.

Technologies include systems for:

- Detection and assessment, such as unattended ground sensor systems, aerial overflight systems, and commercial satellite systems
- Communications, such as telephone, direct connection by wire or fiber, radio, and satellite
- Data security, such as data authentication and archives, and tamper indication

Confidence in a monitoring system will never reach 100 percent. All systems are subject to some level of uncertainty. However, by incorporating redundancy, utilizing both different and complementary sensor detection phenomenologies, performing vulnerability analyses of the system, and having extensive coverage, high levels of confidence can be achieved. Confidence is as much a political issue as a technical one. The political tone set by national leaders, along with their willingness to provide needed openness, is critical to the effectiveness of the contribution made by cooperative monitoring systems.

The elements of the conceptual cooperative monitoring strategy for the Korean agreement are:

- Focus on the highest-risk areas and activities
- Balance cost with the contribution to overall confidence building
- Coordinate cooperative monitoring with existing security and national technical means (NTM) activities
- Blend technical and nontechnical types of monitoring

The monitoring system must operate reliably during conditions of extreme weather. The tense confrontation along the DMZ would not be reduced by a system that frequently reported events found to be nonexistent upon investigation. Neither party would gain confidence in either the monitoring system or each other's actions.

4.2 Phase 1: Strategy for Monitoring the Demilitarized Zone

Large military forces moving offensively would be forced by time and logistic support requirements to move through the major natural crossings of the DMZ. The terrain along the MDL is rugged, particularly in the eastern half. Figure 7 shows the ten primary land crossings of the DMZ. Infantry can still move through the intervening hills, but without significant logistic support from vehicles, their offensive capability (both in mobility and firepower) will be much lower than mechanized forces. Special operations forces moving through the DMZ would also constitute a threat.

The monitoring system would implement two levels of simultaneous monitoring for the DMZ in order to best adapt to the physical environment and security threat, as follows:

1. The ten strategic crossings are the most important locations and would be monitored intensively for the movement of vehicles and personnel.
2. The areas between the strategic crossings pose a lesser security threat because the terrain restricts movement to relatively small, non-mechanized forces. A less complex and expensive system would monitor primarily for small numbers of personnel and light vehicles.



Figure 7. Strategic Routes Across the DMZ

4.2.1 Strategic DMZ Crossing Points

The following sections describe the basic approach. Section 4.5 presents a detailed example, based on the Sami-Ch'on Valley crossing, to illustrate both the process of implementation and the applicable monitoring technologies.

Sensors

For maximum flexibility and reliability, the monitoring system for the DMZ crossing points would use a combination of unattended ground sensors and human observers. Ground sensors would be placed across the likely paths of movement to detect entrance into the DMZ. Different sensor detection phenomenologies would be used to gain synergies in overall performance. (Descriptions of representative sensors are in Appendix F.) According to the hypothetical agreement, the DMZ would be cleared of all human activity and thus present only natural background activity (e.g., birds and wind). The sensors would be selected and arranged to detect and report the entrance of people or vehicles with a high level of selectivity.

Observers

Watch stations, operated by the third-party monitoring organization, would be placed at strategic locations at each crossing point. The watch station personnel would assess all incidents. The sensors would greatly enhance the ability of the monitoring organization to make such assessments. South and North Korean liaison officers could also be present at the stations. To minimize background activity, the observers would not normally enter the DMZ except to perform maintenance or to resolve the cause of sensor activations that could not be confirmed from the watch stations.

4.2.2 Areas of the DMZ Between the Crossing Points

Ground Sensors

The rugged areas of the DMZ between the strategic crossing points are difficult for large numbers of vehicles and people to cross quickly, and would be monitored by unattended sensors placed across selected paths or valleys based on the likely threats. Given the 255-km length of the DMZ, it is not cost-effective to implement as high a level of monitoring as at the strategic crossings. The sensors used in this rugged country would communicate their findings to the nearest watch station for evaluation.

Aerial Overflight

The DMZ would also be monitored using aerial sensors. Overflight would permit the monitoring organization to survey broad areas of terrain and complement the more narrowly directed ground-based monitoring. The overflight would be performed by the cooperative use of an all-weather aircraft equipped with optical, radar, and infrared sensors. The sensors and their capabilities could be based on the 1992 Open Skies Treaty. (Appendix F summarizes the capabilities of the sensors.) A relatively simple aircraft (Figure 8) would be operated by the monitoring organization and could have South and North Korean liaison officers aboard. Flights could be performed on a weekly basis and would be restricted to the 4-km-wide DMZ. The aircraft could be guided by navigational radio beacons placed along the edges of the DMZ as an additional confidence building measure.

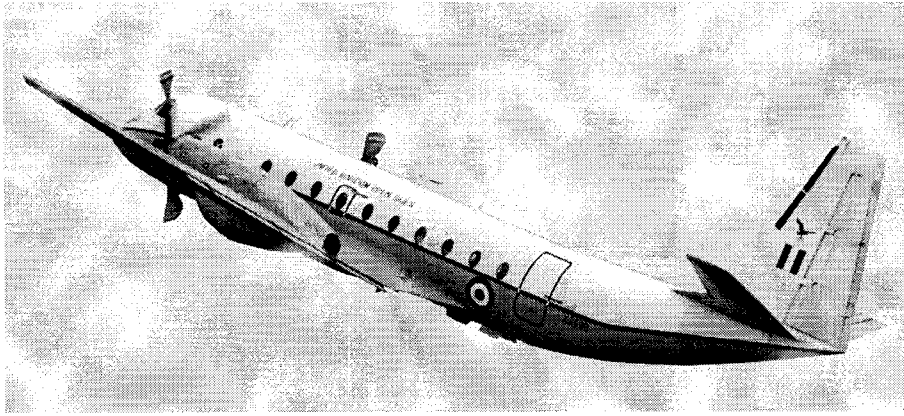


Figure 8. British Aircraft To Be Used for the Open Skies Treaty

Existing Security and NTM Functions

The cooperative monitoring regime assumes that supplemental information would be collected by North and South Korea using unilateral means. Military patrols along the DMZ boundaries using the permitted 2,500 light infantry based within the first LDZ would continue (Figure 9). Information collection by NTM conducted from the LDZs or from aircraft outside the DMZ would also continue.



Figure 9. South Korean Soldier Patrolling the Southern Edge of the DMZ

4.3 Phase 2: Strategy for Monitoring the Limited Force Deployment Zones

Cooperatively monitoring the LDZs is technically and procedurally more complicated than monitoring the DMZ. As envisioned in the agreement, the DMZ would be a zone with very little human background activity. The LDZs, in contrast, would have high levels of background activity caused by permitted military and civilian activities. Consequently, the system must distinguish relevant activities from background noise, and permitted activities from banned ones. The problem of reliable discrimination limits the application of unattended monitoring by sensors to points rather than zones. Likely applications in the LDZs are well-defined locations such as artillery positions, crossroads, and gates to military garrisons.

4.3.1. The Role of On-Site Inspection

The most widely applicable tool for monitoring the LDZs is on-site inspection. In the cooperative monitoring regime, on-site inspection would be performed by the third-party organization. (The 1992 Basic Agreement directed the JMC to develop protocols for inspections.) There would be host South or North Korean liaison officers present during inspections. As confidence increased, liaison officers from the other Korea might accompany the monitoring organization during inspections. The purpose of routine on-site inspections is to verify closure of facilities, observe troop movements and exercises, and verify removal of limited equipment from military bases. Special inspections could be initiated by the JVC to resolve anomalies arising from monitoring reports. The procedures for inspection could be adapted from those of the successful *Conventional Armed Forces in Europe (CFE) Treaty*. An inspection for the CFE Treaty is shown in Figure 10.

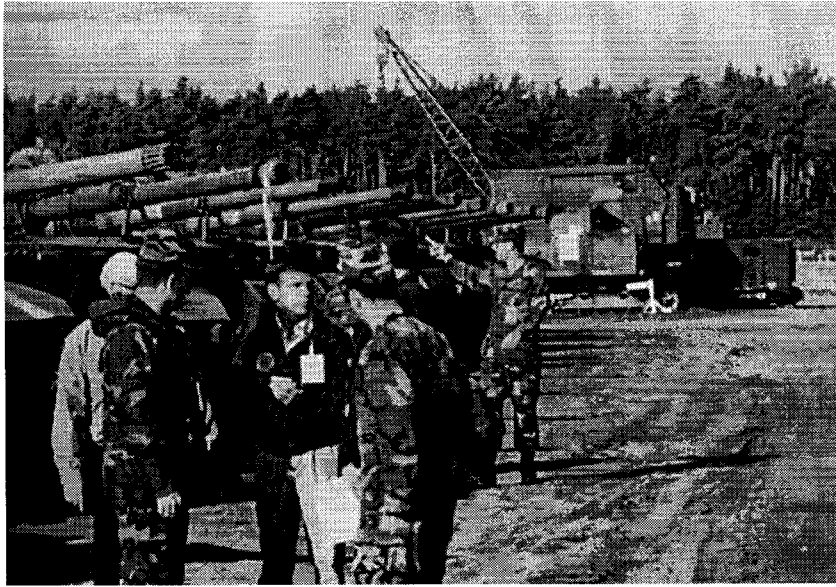


Figure 10. An Inspection of a U.S. Army Tank Storage Facility in Germany

4.3.2 Point and Military Facility Monitoring

Continuous remote monitoring of locations and facilities may be perceived as a significant encroachment on sovereignty and would require a political commitment by the parties.

Garrisons

Remote monitoring might be performed at the gates of a closed military facility. A more complex, but technically feasible, application would be to monitor the gate or perimeter of a permitted garrison in the LDZ-1 to detect if prohibited heavy weapons are reintroduced (Figure 11 shows an example). Monitoring of facilities could be accomplished by using a combination of sensors with detection and assessment functions.

Roads

Given the level of background activity, it is not feasible to selectively monitor a roadway with any acceptable level of confidence. An option would be to install a video system at a key point that continually collects and transmits images to a monitoring center. This is quite intrusive, and may not be acceptable politically.

Artillery Positions

A particularly important application of point monitoring by unattended ground sensors is the hardened firing positions for artillery and rockets all along the DMZ. North Korea has developed a large system of concrete bunkers and tunnels in hillsides to shelter its artillery. In addition to the heavy artillery positioned within 5 km of the DMZ that would be removed

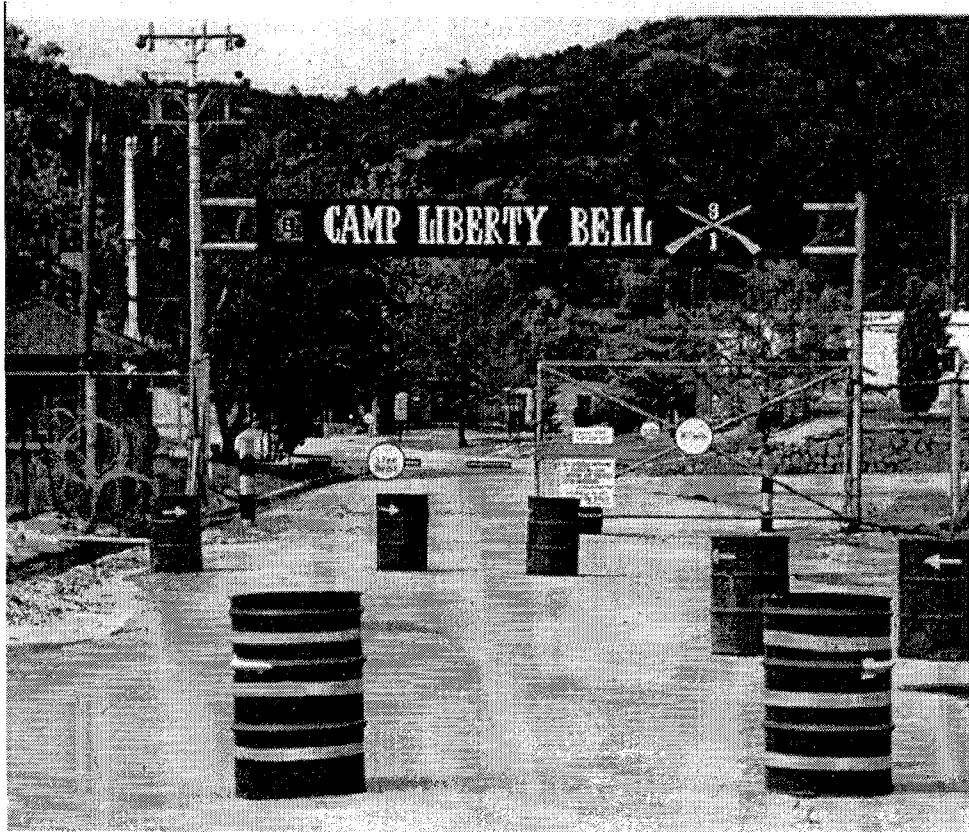


Figure 11. A UNC Military Facility Near the DMZ

during Phase 1, all heavy artillery would be removed within LDZ-1 during Phase 2. The conceptual monitoring regime would rely on on-site inspection by the monitoring organization to verify that removal has occurred on schedule. Continuous remote monitoring by ground sensors would then be used to detect if artillery is reintroduced.

The system of monitoring heavy artillery positions would use magnetic switches and/or loop seals attached to a radio transmitter that is placed on doors to detect movement, as shown in Figure 12. Magnetic switches would be placed where the door panels meet when closed. Loop seals would be threaded through holes in the door or gate. After installation during the initial on-site inspection, these sensors would detect the reactivation of an artillery position. For positions without doors, magnetic or induction loop sensors placed at the entrance or under the floor could be used to detect artillery repositioning. These battery-powered sensors would transmit radio signals to the nearest watch station. Periodic inspections could be combined with necessary battery changes. Passive seals such as a fiber-optic loop could also be used, but would require periodic visits by inspectors to verify their condition.

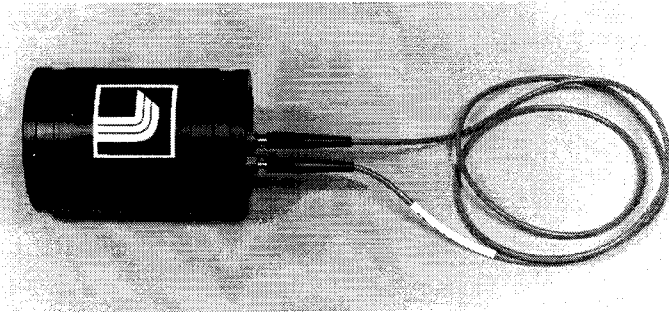


Figure 12. An Electronic Loop Seal

Periodic status reports (including indications of tampering) would be transmitted by these same sensors. Radio signal repeaters or direct satellite transmissions could be used if the distance to a watch station exceeds transmitter range. The sensors could also be linked to a video image system that transmits images. This option for enhanced performance would permit rapid assessment of alarms, but may be more intrusive than is currently acceptable.

4.3.3 Broad Area Monitoring

The aerial monitoring regime established during Phase 1 for monitoring the DMZ could be expanded to include the two LDZs in Phase 2. The purpose of aerial monitoring would be to detect facility construction, facility reactivation, and the re-entry of prohibited equipment into the LDZs. The sensors mounted on the aircraft would be the same as those used during Phase 1. Other analyses have assessed how a cooperative aerial monitoring regime might be implemented on the Korean peninsula.²³ Commercial satellite imagery may also be incorporated when planned future enhancements in image resolution and timeliness of availability are achieved. Appendix F summarizes current and future capability in satellite imagery.

4.3.4 Tunnels Under the DMZ

Four tunnels under the DMZ, dug by the North Koreans, have been discovered to date. The tunnel found in the Chorwon Valley in 1975 is shown in Figure 13. The ROK MND believes that up to twenty undiscovered tunnels may exist. The tunnels provide a means for special and regular forces to cross the DMZ in a covert manner and attack behind the current South Korean first defense line. Tunneling is a covert activity and the detection of North Korean tunnels has been an intelligence problem of great importance.

²³ Smithson, Amy; Cheon, Seong; "Open Skies" Over the Korean Peninsula: Breaking the Impasse, Korean and World Affairs, Spring 1993, pp 57-77.

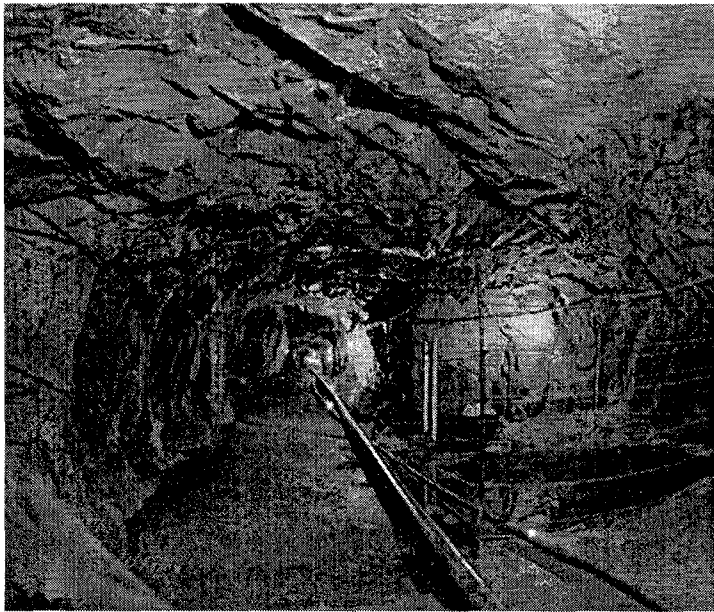


Figure 13. North Korean Tunnel Discovered in the Chorwan Valley

In contrast, cooperative monitoring is primarily applicable to known locations or facilities and declared activities. The conceptual monitoring regime would complement NTM activities with the broad area monitoring performed by aircraft of the LDZs. The aircraft sensors may detect indications of illicit tunneling such as new construction activity, dirt from excavation, and mining equipment. These findings would be classified as anomalies and entered into the routine monitoring report. The JVC, based on this and any other information the parties provided, might authorize a special inspection of the suspect site. If, as a confidence building measure, North Korea declared the locations of its covert tunnels, any future usage could be monitored using sensor technologies that have been described.

An objective in the design of the hypothetical agreement was to minimize the utility of any existing tunnels. Establishing the LDZs would move the first significant South Korean line of defense well south of the boundary of the DMZ. Under the hypothetical agreement, the permitted level of forces in the first LDZ would be much less than the number currently positioned in that area. Reintroduction of additional troops for invasion would likely be detected by both the cooperative monitoring system and NTM. If the North Koreans succeeded in a deception, they might acquire a strategic advantage. Therefore, NTM and military patrols must take the primary responsibility for detecting covert tunnels and their usage.

4.4 Role of a Korean Monitoring Center

The conceptual monitoring system would require the establishment of a “Korean Monitoring Center” to evaluate reports from the cooperative monitoring system. The monitoring center would provide centralized data collection, assessment, and communication, as shown in Figure 14. The JVC would use the Korean Monitoring Center as the site for its formal meetings. The location most likely to be acceptable for a Korean Monitoring Center is the existing JSA in Panmunjom. The JSA is a circular area, approximately 1 km in diameter, straddling the MDL at the site of the former village of Panmunjom. It was established in 1951 as the site for negotiation of the Military Armistice. After the Armistice was signed in 1953, the site was maintained for meetings of the MAC and other negotiations. Consequently, an infrastructure of buildings, roads, utilities, and communications already exists in the JSA, as shown in Figure 15.

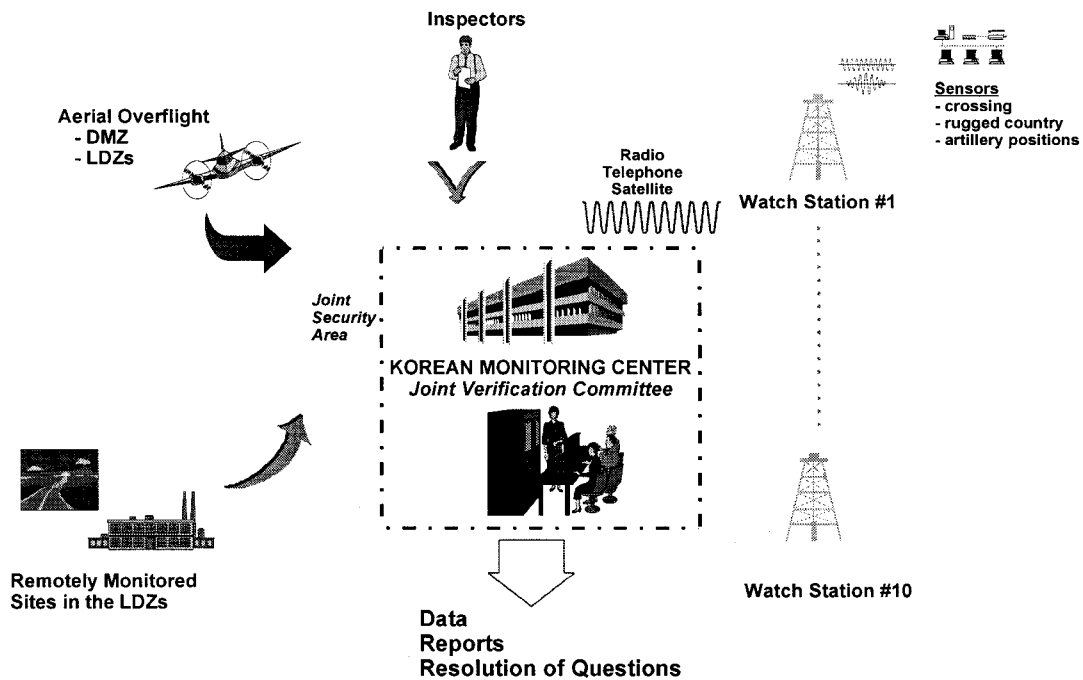


Figure 14. Schematic Representation of the Conceptual Korean Cooperative Monitoring System

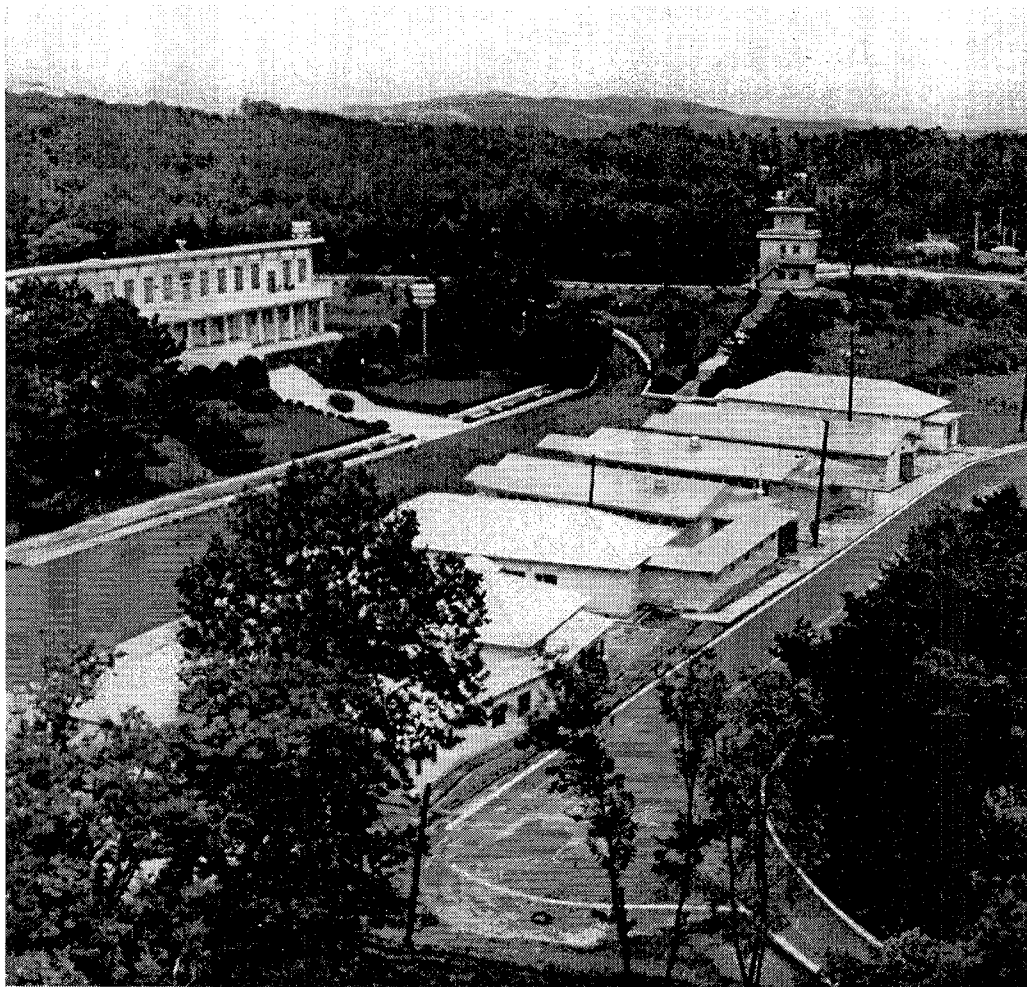
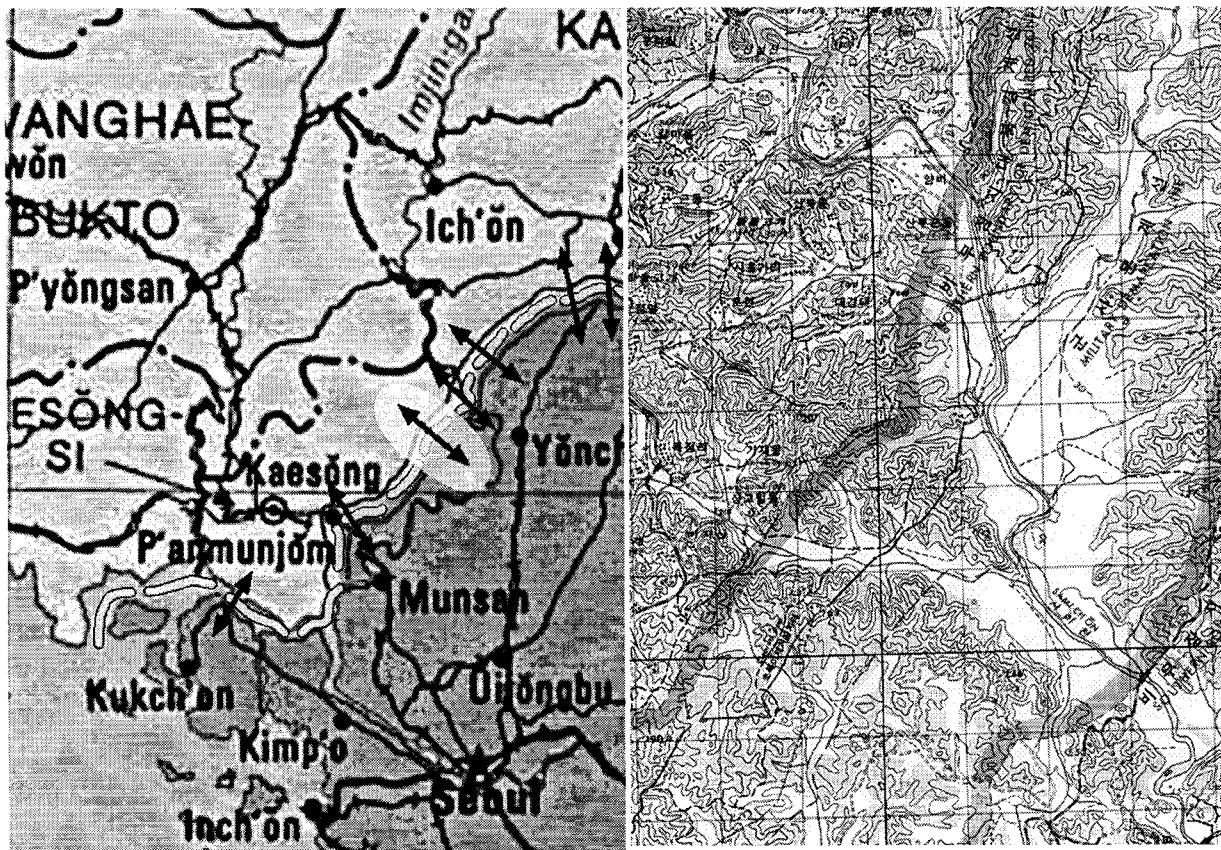


Figure 15. Facilities at the Joint Security Area in Panmunjom

4.5 Example of the Sami-Ch'on Valley DMZ Crossing

The analysts chose the Sami-Ch'on Valley crossing (Figure 16), located about 22 km northeast of Panmunjom, as an example to illustrate a design for a monitoring system. The valley surrounds the Sami-Ch'on River. The elevation of the river is about 25 m above sea level. The surrounding ridges typically rise to about 100 m elevation, with occasional peaks rising as high as 185 m. Siberian winds blow during the winter and the area has periodic fog. Snowfall normally occurs between December and February. Smoke from burning fields outside the DMZ, dust from China, and spring haze periodically limit visibility. Although the area is not what is traditionally considered as mountainous, there are several steep hills and ridges that serve as natural barriers to tracked and wheeled vehicles. There are no roads through the valley, but major roads are present within 5 km of the northern (North Korean Highway 1025) and southern entrances (South Korean Highway 322).



a: Location on peninsula

b: Topographic map of Sami-Ch'on Valley

Figure 16. The Sami-Ch'on Valley DMZ Crossing Point

The analysts used imagery from commercial satellites to characterize prospective locations for installing monitoring equipment. An image of the Sami-Ch'on Valley from the French SPOT (Systeme pour l'observation de la Terre) commercial satellite is shown in Figure 17. Roads, facilities, and vegetation are visible in the image. The sand bars located at the major turns of the Sami-Ch'on River indicate that it periodically floods during the summer rainy season.²⁴ The MDL and DMZ lines were placed on the image using computer software.

The conceptual monitoring strategy uses several layers of sensors. The layers vary in both detection phenomenologies as well as sensor placement. Sensors generally function in either a detection or assessment mode. Careful design of a monitoring system may permit some sensors to contribute to both goals. A summary of the sensor strategy in the Sami-Ch'on Valley is in Table 3.

²⁴ The image was taken on April 26, 1995. The resolution of the black and white image is 10 m. The dimensions of the image shown are 7 km by 6.3 km. The full SPOT image covers an area 60 km by 60 km.

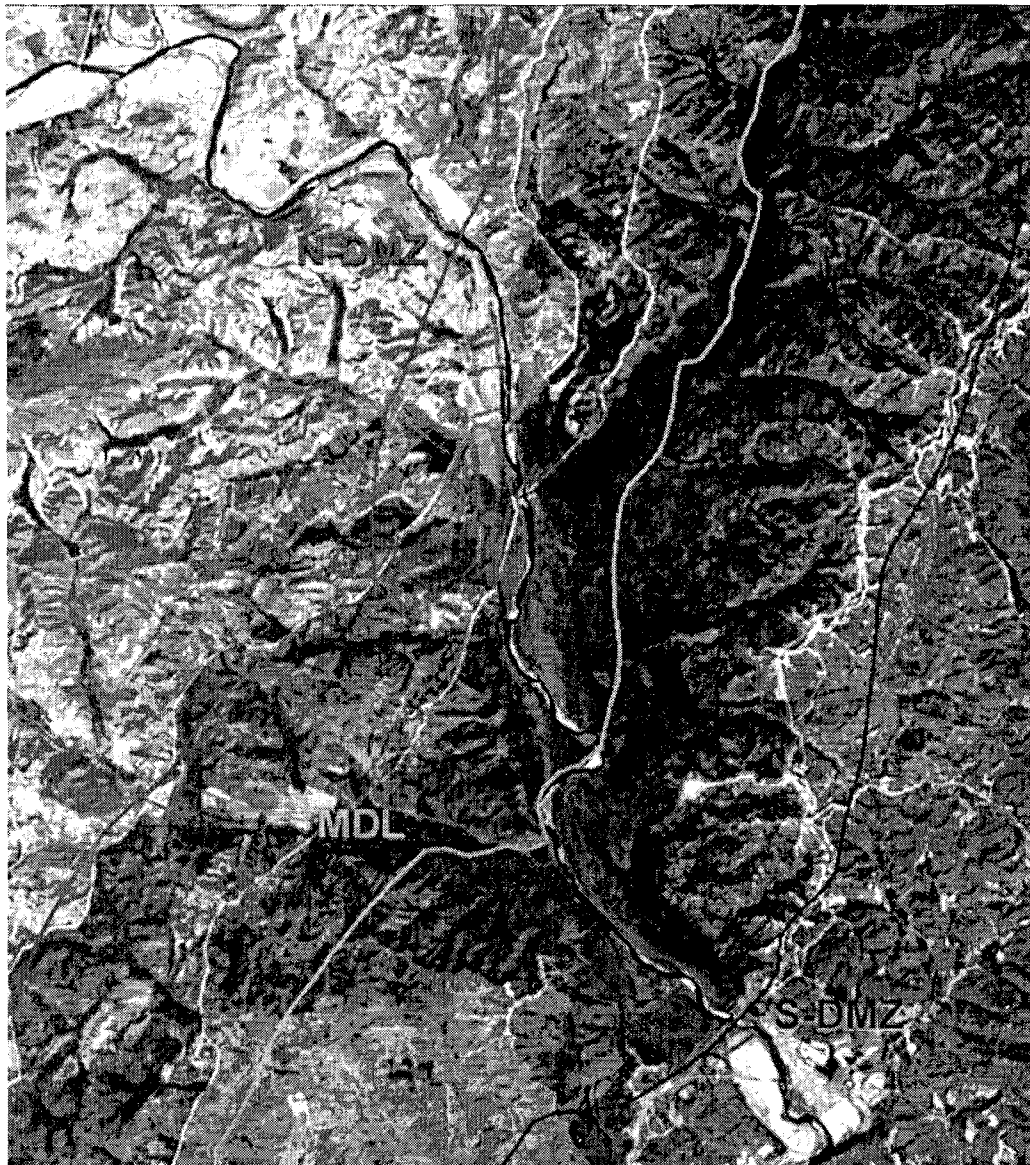


Figure 17. SPOT Satellite Image of the Sami-Ch'on Valley

Table 3. Sensor Strategy for the Sami-Ch'on Valley Crossing Point

Primary Detection Sensors	Secondary Detection Sensors	Assessment Sensors
Fence-type	Magnetic Video motion (future) Human observers	Magnetic Video camera Human observers

The conceptual system would rely primarily on radio communications from the magnetic and video sensors to the watch station, direct connections from the fence systems, and telephone (landline or satellite) communications between the watch station and the Korean Monitoring Center.

Artificial three-dimensional images were created by using computer software to combine terrain elevation data with the SPOT satellite image. A field of view can be specified and the resulting image provides an intuitive tool to help plan the monitoring system. Other geographic information, such as the DMZ lines, can be placed on the image. The analysts used this computer model to assist design and presentation of the monitoring system. The sensors for the Sami Ch'on Valley monitoring system are conceptually deployed in Figure 18.

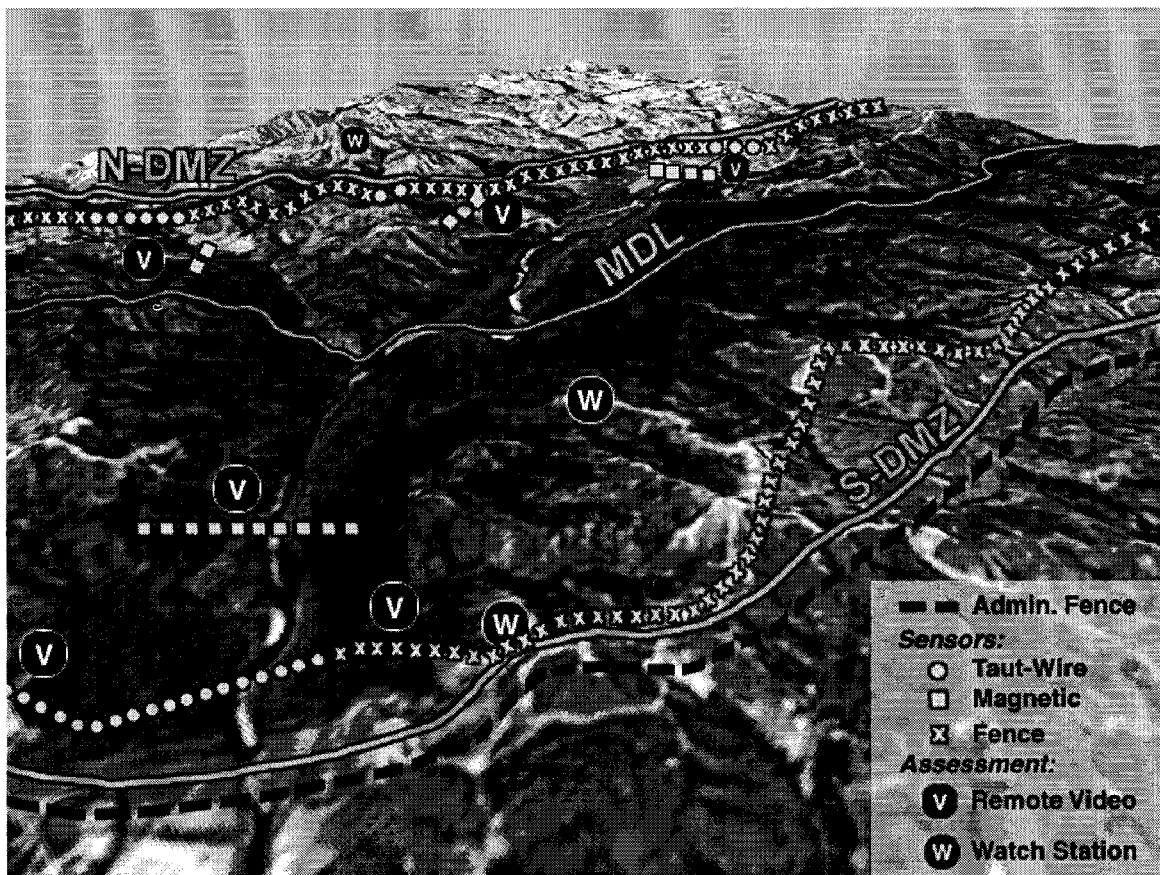


Figure 18. Conceptual Design of Sensor Locations in the Sami-Ch'on Valley Monitoring System

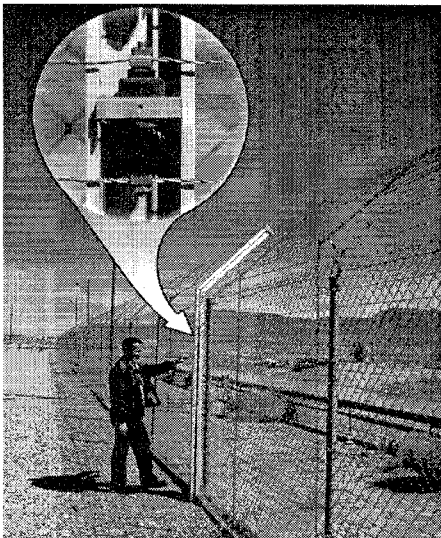
4.5.1 Primary Detection Sensors

Fence

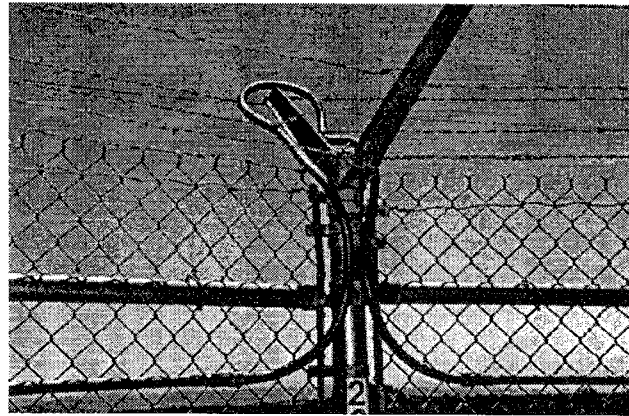
Fence-type sensors are suggested for primary detection of personnel and vehicles because there are designated boundaries along the DMZ. Such sensors can take advantage of existing fences and serve as a highly visible symbol of the agreement as well as a deterrent to violations. Fence sensors report the movement of both people and vehicles, but do not distinguish between them. Fence sensors only report which segment (not

the exact point) of the fence has experienced an intrusion. Consequently, the appropriate segment length is a design decision. Although the systems have low rates of false alarms, a conventional fence should also be placed a short distance away to prevent accidental alarms caused by civilians or animals.

To effectively define the DMZ, fence sensors (Figure 19) would be placed as close to the boundaries as possible given the terrain conditions. To reduce costs, the more capable, but more expensive, taut-wire fence system would only be placed across the most likely routes through the valley. Less expensive fiber-optic fence sensors would be used along the hilly terrain flanking these routes. Fiber-optic fence sensors would also be extended for some nominal distance east and west of the crossing to prevent intruders from easily bypassing the fence sensors and entering the valley.



a: Taut-Wire



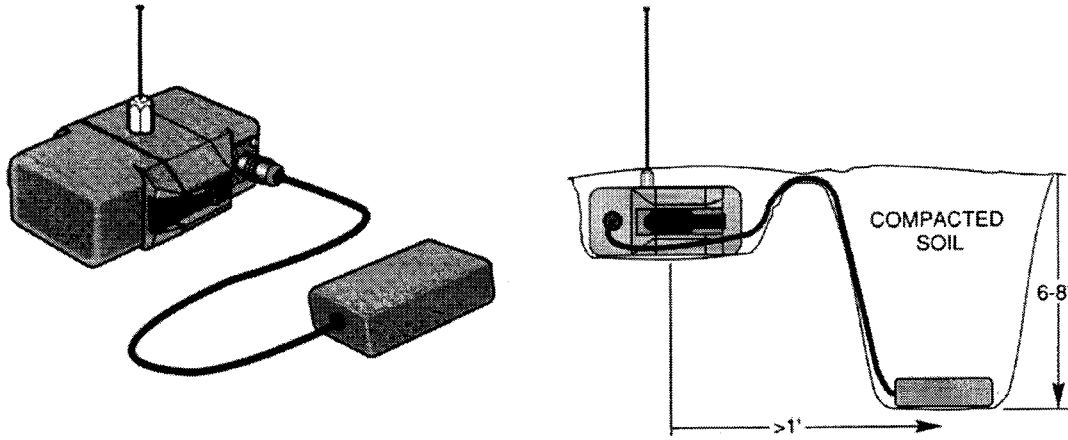
b: Fiber Optic

Figure 19. Fence Sensors

4.5.2 Secondary Detection Sensors

Magnetic

Magnetic sensors (Figure 20) detect the metallic mass associated with vehicles and weapons and would be placed within the DMZ to provide a redundant layer of sensors. Another role for these sensors is to provide confirmation of an intruder's movement given the activation of a primary fence sensor. Magnetic sensors are unaffected by background activity and weather (including snow) and are virtually undetectable visually. The presence of a magnetic signature is a relatively unambiguous indicator of a violation of the agreement.



a: Sensor

b: Buried in Soil

Figure 20. Magnetic Sensor

The strength of a magnetic field is a function of both the mass of the object and its range. Consequently, a single sensor cannot distinguish between an infiltrator at close range (3m) and a truck at long range (20m). Groups of magnetic sensors should be buried in a linear array across the north-south lines of movement through the valley.

Human Observers

Manned watch stations would be positioned so that primary routes of movement are within view. Each watch station would be used for collecting data from the monitoring sensors. In addition, observers at the watch stations would use optical and night-vision devices to supplement the detection sensors and confirm sensor activations. In effect, the observers function as visual sensors.

There are two options for placing watch stations at a crossing: a) a pair of stations along the DMZ placed such that one station overlooks each end of a crossing point, and b) a single station placed within the DMZ itself. Given that liaison officers may be present, the use of a single station would require a higher degree of cooperation between North and South Korea. Each of the watch stations would be linked to the Korean Monitoring Center.

As illustrated in Figure 18, terrain data and photographic imagery can be combined by computer software to generate simulated fields of view. This technique permits preliminary sites for watch stations to be identified without first performing extensive field surveys. However, an on-site assessment must still be conducted to verify that such candidate sites are free of obstacles. In the case of the Sami-Ch'on valley, it is possible to achieve full visual coverage with either a pair of watch stations along the northern and southern borders of the DMZ or a single station within the DMZ. These positions are noted on Figure 18. The best site for the single

station is currently a South Korean army (ROKA) observation post. Figure 21 shows a computer-generated picture combining an image from the SPOT satellite and digital terrain data. The picture simulates the view to the west from the ROKA observation post.

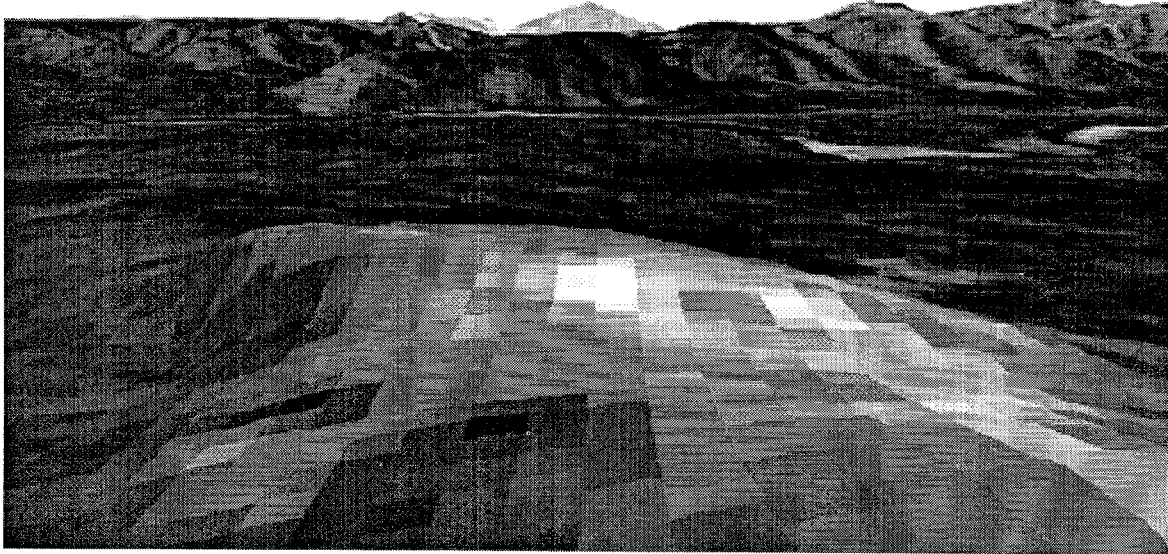


Figure 21. Computer-Generated View West from the ROKA Observation Post

4.5.3 Assessment Sensors

Magnetic

Although magnetic sensors have the limitation described previously, it is possible to configure a system of magnetic sensors to provide information about the size and direction of movement of the intrusion. The Sami-Ch'on monitoring system uses this technique. When a linear array of sensors is deployed, the mass of an object might be approximated by noting how many sensors register an activation. A large vehicle could activate several sensors simultaneously, while a person with a weapon would only activate one sensor. A moving object would activate sensors sequentially, so that the approximate direction and speed of movement through the sensor array could be estimated.

Video

Video cameras (Figure 22) are an unambiguous means of assessment. In the conceptual Sami-Ch'on monitoring system, an activation by a fence or magnetic sensor would command the secondary activation of a video camera positioned to view the area around the detecting sensor. Two images (one prealarm and one postalarm) would be transmitted to the watch station for interpretation by the observers. The video camera may also be directly activated by the observers.

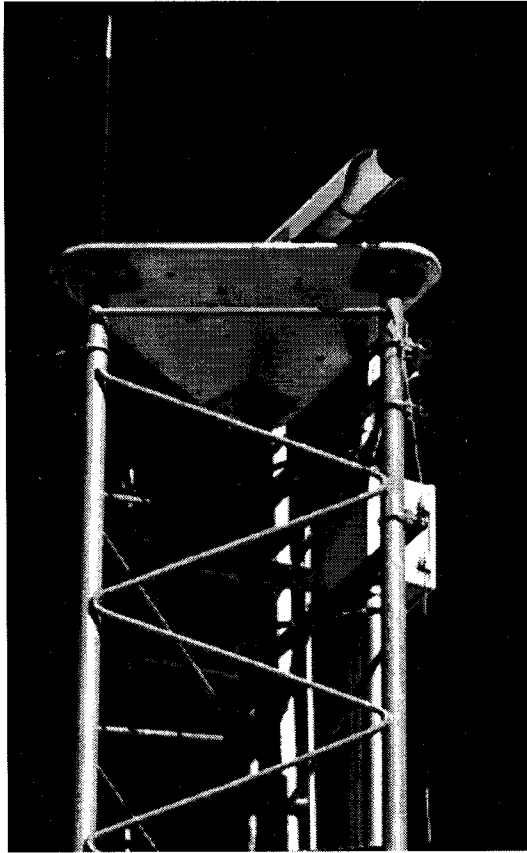


Figure 22. Video Camera in Environmental Housing Mounted on Tower

Video cameras require environmental housings for exterior applications. There are commercial cameras available that have visual capability under conditions of low light. Imaging infrared cameras that function in conditions of total darkness are commercially available, but are much more expensive. Even with careful positioning, there will likely be times when conditions such as darkness combined with heavy fog degrade the camera's ability to assess alarms.

Future improvements could permit the cameras to serve simultaneously as detection sensors. Movement is detected by a signal processing unit that detects changes in the stationary field of view. Current motion detection technology is not reliable because of the potential for background movement (e.g., trees moving in the wind) to cause an alarm.

Human Observers

The primary role of the observers at the watch stations would be to assess what caused the sensor activation, determine whether it is a reportable event, and transmit the report to the Korean Monitoring Center. This would be accomplished both by direct observation and interpretation of sensor reports. The observers would also initiate a patrol if they could not determine the cause of the activation from the watch station.

5.0 Cooperative Monitoring Process on the Korean Peninsula

This section describes the process of cooperative monitoring generally and links major points to the Korean application. Cooperative monitoring can strengthen existing agreements and set the stage for continued progress in improved relations. Cooperative monitoring is not limited to arms control or military applications, but also may be applied to a wide range of other regional concerns including natural resources, commerce and trade, the environment, and emergency response. An agreement on security between two or more countries may bring about a temporary equilibrium in their relations, but time and resources must be invested to make the equilibrium a lasting one. An investment in cooperative monitoring signals that the parties regard the agreement as important and are committed to its success. The availability of standardized monitoring systems (technologies and procedures) to all parties to an agreement can remove personal bias, minimize suspicion, and balance the ability to detect and analyze relevant information. This is particularly important when parties to an agreement have differing indigenous technical capabilities. Cooperative monitoring provides a method of openly documenting compliance with the terms of an agreement and makes any act of noncompliance difficult to ignore.

Cooperative monitoring can also support the process of confidence building. When two or more parties begin the process of confidence building, no permanent agreements are assumed. Specific actions to increase mutual confidence are defined and may be as simple as the exchange of military budgets or as complex as the unattended remote monitoring of a nuclear research facility. Such CBMs are intended to permit the parties to gain experience by working together. The experience hopefully leads to more substantive actions and formal agreements. The 1991 Quadripartite Agreement²⁵ for monitoring Argentine and Brazilian nuclear facilities was the culmination of over a decade of CBMs beginning with simple visits and evolving to a comprehensive, technically-based monitoring regime. The Egyptian-Israeli Peace Accord of 1979 occurred

²⁵ Brazil, Argentina, the Argentine-Brazilian Agency for Accounting and Control of Nuclear Materials (ABACC), and the IAEA were signatories.

after six years of increasingly complex and significant interim agreements for military disengagement.

Although cooperative monitoring is intended to provide information, it is not inherently a security system or another form of intelligence collection. Shared information collected by cooperative monitoring can have great utility in discussions of compliance, but additional information also may be important. Countries that participate in cooperative monitoring arrangements usually retain the sovereign right to make compliance decisions using all available information, including that collected from purely national means. Cooperative monitoring complements, but does not replace, a country's national technical means (NTM) and intelligence activities.

5.1 Framework for Cooperative Monitoring Regimes

Establishing a cooperative monitoring regime is a process. To evaluate monitoring options, it is first necessary to establish a framework (Figure 23). Every cooperative monitoring regime must define the following:

1. Context of the agreement
2. Agreement itself
3. Parameters affecting the monitoring function
4. Options for monitoring technologies

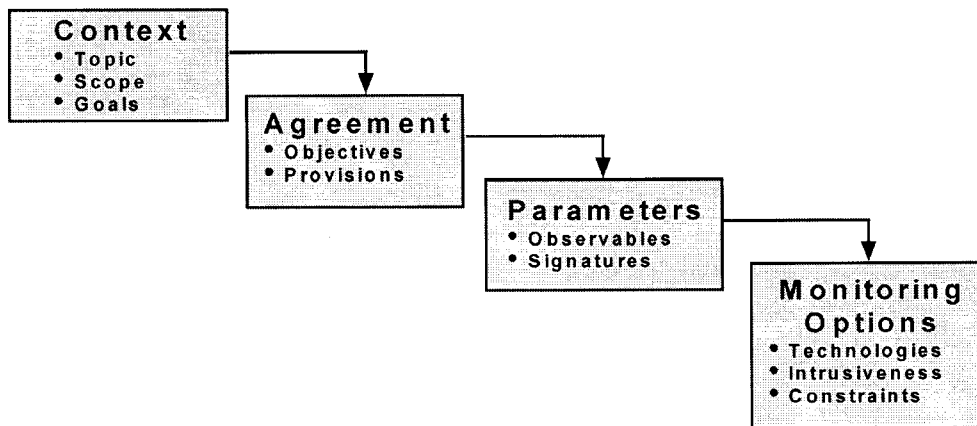


Figure 23. Framework for Cooperative Monitoring

5.1.1 Context

The context of the agreement includes the historical, political, geographic, and economic factors which affect the negotiation of the agreement.

Topic—This is the subject of interest. It may be an arms control agreement on missiles, conventional forces, or WMD. The agreement may also be on an environmental, resource, or commerce-related topic.

Relation to Korean Scenario—Within the hypothetical agreement, the topic is the separation and redeployment of conventional ground forces with offensive capability.

Scope—The scope of the agreement addresses the region, the number of parties involved, the time frame, and the extent to which the agreement will apply. The scope could be a bilateral agreement or a global regime with many signatories (e.g., the Treaty on the Non-Proliferation of Nuclear Weapons).

Relation to Korean Scenario—The geographic scope in the hypothetical agreement is the region of the Korean peninsula between Pyongyang and Seoul. The hypothetical agreement is intended to be bilateral between South and North Korea with the option for supporting participation from third parties. The agreement is to be valid until replaced by a permanent peace accord.

Goals—These are the high-level purposes for which an agreement is being considered. It may include eliminating weapons or initiating a regional dialogue on issues of concern. These goals will become more specific when incorporated into the agreement.

Relation to Korean Scenario—The overarching goal of South Korea in the hypothetical agreement is to improve relations with North Korea in order to create an environment where substantive negotiations can occur to solve security problems. Specific goals are to reduce the danger of surprise conventional attack and to create a more stable bilateral relationship.

5.1.2 Agreement

Agreements, whether formal treaties or less formal CBMs, have certain objectives and provisions intended to achieve the goals established in the previous Context phase. The agreement documents the specific objectives and contains the provisions of the monitoring regime. Agreements normally contain objectives and provisions, as follows:

Objectives—All agreements, treaties, and CBMs have a stated purpose or aim to enable the goal to be achieved. These objectives may:

- set limits or restrictions on objects or activities.
- provide mechanisms for transfer of information, thereby reducing uncertainties or perceived threats.
- promote or enhance relationships among the parties to the agreement.

Provisions—The provisions define the operational aspects of implementation, including the following:

- The types of control proposed
- The objects controlled by the agreement
- The condition, time, or location when the objects become subject to the agreement
- Type and frequency of monitoring to be performed

Agreements providing information exchange may also specify provisions for the following:

- Format and frequency of communications
- Quantity, location, and operational doctrine
- Characteristics such as performance and physical dimensions
- Confirmation of storage or destruction of specified items

Relation to Korean Scenario—The hypothetical agreement in the scenario, summarized in Section 3.6, defined the objectives and major provisions of the LDZ agreement.

5.1.3 Parameters for Monitoring

Measurable parameters define the function of the monitoring regime and must be identified before monitoring options can be assessed.

Observables—Observables are those items or activities in the agreement that lend themselves to being monitored and observed. They define what the monitoring system is intended to detect and characterize. These may include objects, activities, processes, or movements. For example, missile testing observables include launch equipment movement, launch vehicle deployment, fueling, closures of missile ranges or target areas, rocket ignition, rocket plume, radar track, vehicle telemetry, impact craters, and recovery operations.

Signatures—Signatures are the physical phenomena associated with the observables that can be measured. These signatures allow sensor systems to detect and classify differences between the items observed.

Relation to Korean Scenario—In the agreement, the parameters are associated with the monitoring of conventional troops, their weapons, and their facilities. Examples of what specifically will be monitored are troops or vehicles moving across the DMZ, the reintroduction of artillery to hardened positions, and placement of troops and weapons in the LDZs, and the reactivation or construction of facilities. Table 4 lists applicable observables and signatures.

Table 4. Parameters for Monitoring

Observables	Signatures
Vehicles	Weight
People	Magnetic characteristics
Buildings	Radar reflection
Facility construction	Seismic signal
Facility dismantlement	Infrared radiation
	Physical dimensions
	Physical deformation

Because an event may be considered a violation of the agreement, it is important to define the nature of observables that constitute a “reportable event.” Event definition, detection, characterization, and communication must be carefully structured to ensure that a timely diplomatic resolution is possible.

5.1.4 Monitoring Options

Once the objectives and provisions of an agreement have been defined and the parameters have been identified, technical options for the monitoring system must be evaluated. Monitoring options for an agreement range from no monitoring to extensive technical monitoring. The capability of available technology may constrain which activities or features can be monitored. Factors such as cost, personnel, redundancy, timeliness of reporting, data and hardware security, power requirements, utility and communications infrastructure, sensor function and display, environmental conditions of operation, and vulnerability need to be assessed. Also, the level of access or intrusiveness permitted under the terms of the agreement will affect the types of acceptable monitoring technology.

Relation to Korean Scenario—Table 5 lists technologies and constraints applicable to the scenario.

Table 5. Monitoring Options

Detection and Assessment Technologies	Constraints for Korean Application
Ground-based	High level of civilian activity
Unattended sensors	Wildlife in the DMZ
Operator-controlled sensors	Weather
Human observers	Topography
Aircraft sensors	Infrastructure in the DPRK
Commercial satellites	Communication over large area
	Permitted intrusiveness
	Cost

Distinguishing permitted background activity from activities banned by an agreement is a critical function. For example, wildlife and vegetation in

the monitored area can influence sensor performance. After 43 years, the unpopulated Korean DMZ has become the home for a large population of wildlife (Figure 24). Some sensors may have difficulty distinguishing large animals or birds from humans. Grass or bushes moving in the wind can also cause false alarms. Facilities must be surveyed with attention to the entrances and exits, the normal traffic patterns, and perimeters. Normal pedestrian and vehicular traffic patterns must be understood to determine if the relevant activities to be monitored can be reliably distinguished.



Figure 24. Sensors in the DMZ Must Distinguish Between Wildlife and Prohibited Activities

5.2 Design Considerations in a Cooperative Monitoring System

Individual components need to be integrated into an operational monitoring system. Factors in system design include communication between sensors, data transmission to a central monitoring site, and power for the system. Software to manage the sensors and data collection system is another element in system integration. A complete system design and evaluation also must include an assessment of system vulnerabilities. Many tools can assist in analyzing the weaknesses of monitoring system designs.

5.2.1 Intrusiveness

The intrusiveness of the system will be influenced by the level of transparency and reciprocity permitted by the agreement. For example, a determination must be made as to whether each side will permit monitoring systems to operate within their facilities or will require them to be deployed outside. The potential adverse effect of monitoring on normal facility operations is a significant factor in the acceptability of a system. For example, the continuous presence of on-site inspectors must be weighed against the value of periodic inspections. A determination must be made as to whether data from sensors should be collected on site or transmitted to a distant site.

Relation to Korean Scenario—Sovereignty is a key issue in any monitoring system implemented on the Korean peninsula. North Korea has historically rejected verification as an infringement on its sovereignty. South Korea accepts the concept of monitoring, but must incorporate it into its definition of national security.

5.2.2 Communications Systems

The communication of data from a site monitoring system to a monitoring station can be accomplished through several mechanisms, as follows:

- Direct connections by copper wire or fiber optic cable
- Radio frequency communications
- Landline or cellular telephone communications
- Satellite communications

Combinations of these mechanisms are possible. The choice of which mechanisms to use depends on whether on-site communications or remote access to the monitoring system are permitted. All of these mechanisms have advantages and disadvantages relating to cost, complexity, reliability, and availability.

Relation to Korean Scenario—The conceptual monitoring system for the Korean DMZ is quite flexible about the type of communication used. The system generally uses radio for short distances and telephone for long-range communications.

5.2.3 Data Integrity

There must be confidence that data sent from monitoring systems is only received by authorized organizations and is valid (i.e., no tampering). Limitations may be imposed in the agreement's provisions defining what type of data can be sent and under what circumstances. Data authentication confirms that the host country has not altered the sensor

reports. It adds a unique identifier to the transmitted data to assure that the information received is not false data. Sensitive information can be protected from non-parties to the agreement by means of encryption. Additionally, access controls on the data can be employed at the monitoring stations.

Relation to Korean Scenario—In the conceptual Sami-Ch'on Valley monitoring system example, the majority of sensor communications are performed using radio communications. The system could use a beacon to generate state-of-health messages to ensure that the communications are not being jammed. Access to the watch stations should be limited to liaison personnel and the third-party monitoring organization.

5.2.4 Local Infrastructure

The availability and reliability of local power and communications infrastructures may favor some system designs over others. If power is not readily accessible, some sensors can operate on battery power or solar power. Therefore, the maintenance program must plan for battery replacement or power backup during long periods of cloudy days. Countries operate on different electrical power standards, so equipment must be compatible with locally available power.

Relation to Korean Scenario—The monitoring plan for the scenario is constrained by North Korea's relatively poor telephone and electrical power systems. Telephone service is not generally available in rural areas, and there is a shortage of electrical power. A specialized cellular telephone system might be installed if needed. Battery-powered, direct satellite communications is another option. The conceptual monitoring system for the Sami-Ch'on Valley assumes that AC power is available to operate the fence sensors, video cameras, and watch station. An alternative would be to install small diesel generators to power the watch stations and associated sensors. It also may be possible to power all sensors except the fence sensors by batteries recharged by solar photoelectric panels.

5.2.5 Cost and Personnel

The cost of a monitoring regime can be significant and must be scaled to the available resources of the participating parties. The nature of constituent costs should be identified. For example, higher installation and capital costs may minimize later operation and maintenance costs. Conversely, systems with low installation costs may have higher operational and maintenance costs. The number of personnel and skill types needed to install, operate, and maintain the system must be defined.

Relation to Korean Scenario—Installation costs for the conceptual monitoring system for the Sami-Ch'on Valley are estimated at almost \$1.5 million and are described in Appendix G. Installation of monitoring equipment at other major crossings might cost more or less depending on the physical characteristics of the site. In the hypothetical agreement, the parties would determine whether military personnel, civilian contractors, or foreign third-party personnel will operate and manage the system.

6.0 *Precedents For Regional Cooperative Monitoring*

The Middle East may offer insights into the potential for reducing military threats in the absence of a formal peace. With appropriate modification for local conditions, elements of the Sinai and Golan Heights agreements and associated monitoring and verification can be applied to confidence building on the Korean peninsula.²⁶

6.1 Israel-Egypt: The 1974 and 1975 Sinai Peninsula Disengagement Agreements

The period from the 1973 Yom Kippur war to the signing of the 1979 Peace Accord between Egypt and Israel offers a useful precedent for implementing a regional peace process. The Sinai disengagement agreements contained the first example of an integrated monitoring system of hardware and personnel that collected and distributed information to the parties to the agreement.²⁷ From a technical perspective, the Sinai precedent still provides useful lessons in the implementation of sensor-based monitoring. Refinements have been made in sensor size, power consumption, and reliability, but performance and implementation are essentially unchanged. Modern computers permit data collected by sensors to be much more rapidly processed and interpreted than in the 1970s. Appendix D contains a comparison of the Sinai precedent to the contemporary Korean peninsula. The key compromise of the 1975 *Sinai Interim Agreement (Sinai II)* was Israeli withdrawal from the strategic Giddi (shown in Figure 25) and Mitla passes in exchange for monitoring by the U.S. The UN continued to provide peacekeeping troops to perform observation and on-site inspections of garrisons in the limited force zones. The U.S. operated the sensor fields at the passes and performed periodic overflights to monitor the disengagement zone. A “Joint Commission and

²⁶ Nam Man-Kwon, et al; *A Study on Potential Problems and Possibilities in Applying the Sinai Model to the Korean Peninsula*, Research Report of the Korea Institute for Defense Analyses, July 1995.

²⁷ Vannoni, Michael; *Sensors in the Sinai: A Precedent for Regional Cooperative Monitoring*, VST-074, Sandia National Laboratories, Albuquerque, NM, April 1996

Liaison System,” composed of representatives from all parties, supervised and coordinated implementation of the agreement. The organization of the Sinai Joint Commission might be a model for any future monitoring activities by the Korean JMC called for by the South-North Basic Agreement.



Figure 25. *The Giddi Pass in the Sinai Peninsula of Egypt*

The level of distrust between Israel and Egypt was quite high at the time and obtaining popular support for the Sinai I and II Agreements was not easy.²⁸ Mutual confidence was probably as low as on today’s Korean peninsula. The Sinai agreements successfully began and nurtured a process of constructive dialog and confidence building. Figure 26 shows a map of the 1975 Interim Agreement. The Peace Accord of 1979 brought a level of stability to the region that had not existed since the creation of the state of Israel.

²⁸ A political secretary to the Israeli Prime Minister was quoted in 1969: “The Arabs? They’ll always hate us. They will never recognize us. They’ll never sit with us, and we’re never going to have peace here.” (Krosney, Howard; *The Nation*, February 9, 1974).

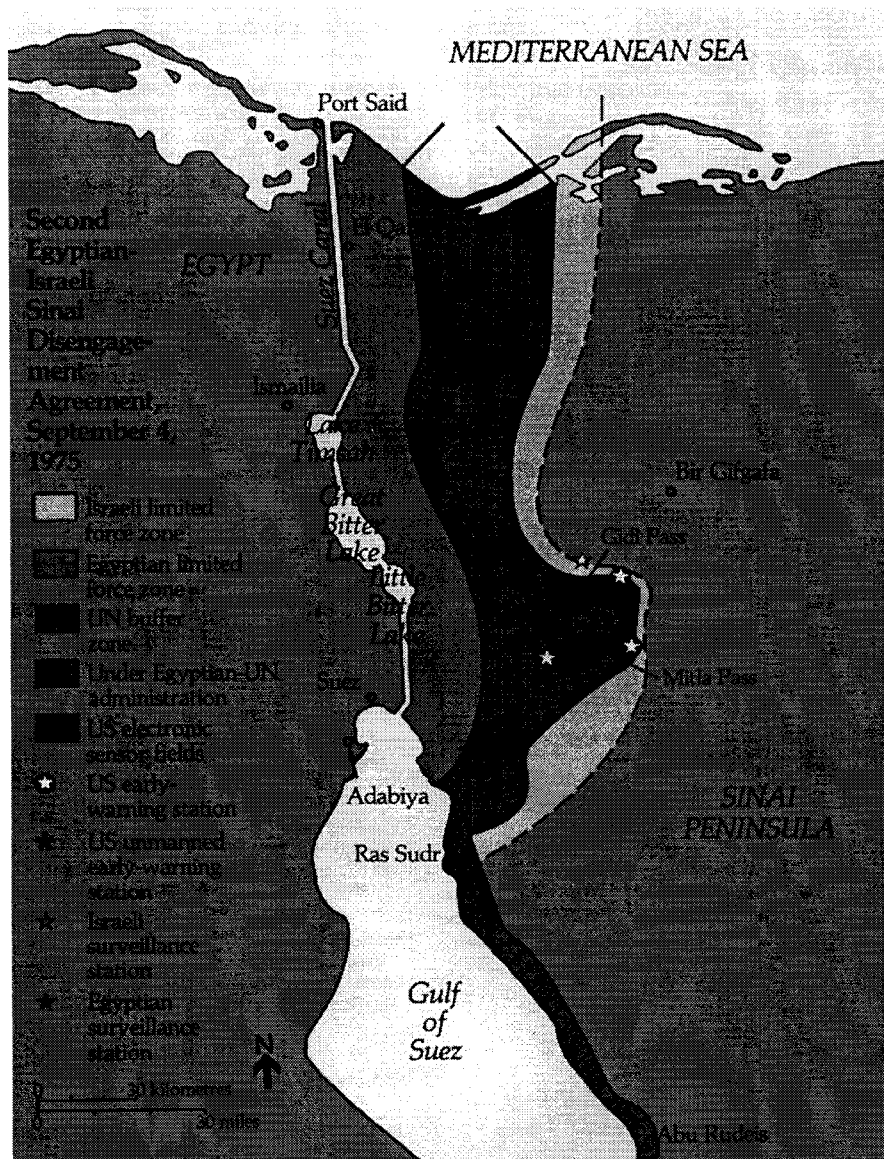
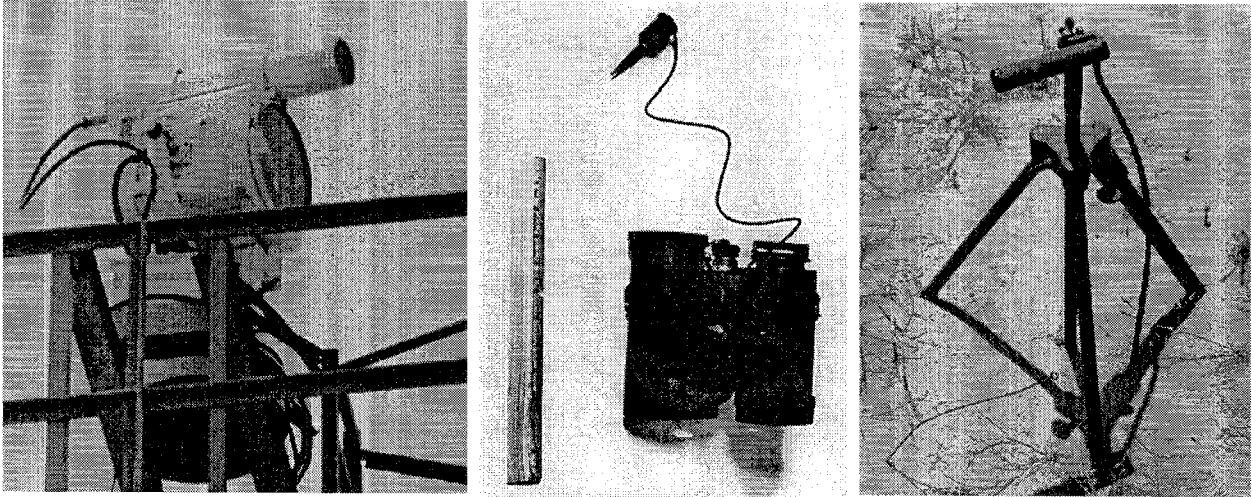


Figure 26. Map of the 1975 Sinai Interim Agreement

After a period of initial suspicion, the Sinai stabilized, and the monitoring activities became almost routine. Multiple types of sensors (seismic, acoustic, magnetic, pressure, infrared, and video) were used for redundancy (Figure 27). When a sensor was activated, it sent a radio signal to alert observers at a nearby watch station (Figure 28). If the observers concluded that the intrusion was improper, a report was sent to the Sinai Joint Commission. The monitoring system successfully distinguished between significant and inconsequential events, despite an average of 200 sensor activations per day due to permitted activity and natural disturbances. After the Peace Accord was signed, the Israelis withdrew eastward, and the monitoring system was shut down on January 25, 1980. The total cost of monitoring the passes was \$92.7 million.



a. Video

b. Seismic

c. Infrared

Figure 27. Sensors Used for Remote Monitoring in the Sinai

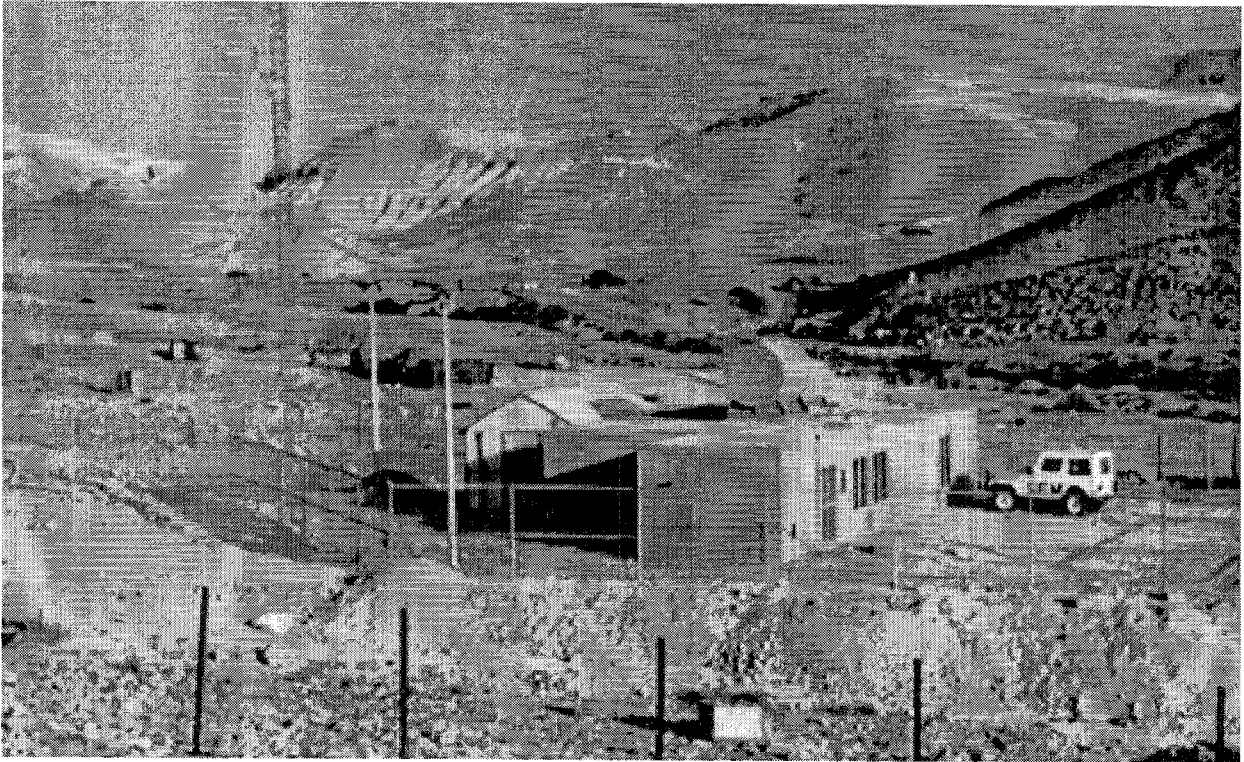


Figure 28. Watch Station at the Eastern Entrance to the Mitla Pass

Israeli Defense Force Lt. Col. Itshak Lederman analyzed the Sinai and Golan disengagement agreements and their associated monitoring in 1989.²⁹ He assessed the appropriate role of monitoring technology:

The prompt execution of the Interim Agreement and the successful operation of its complex verification regime created the atmosphere and confidence needed for completion of the Israeli-Egyptian Peace Agreement in 1979. The assorted verification measures provided both Israel and Egypt the assurances required to lessen the possibility of a surprise attack. It also proved that a complex verification regime can be operated successfully where there is a political will on the signatories' part in addition to an appropriate mechanism of coordination between all the parties. The right combination of technical measures and manned operations proved to be vital to the successful operation.

6.2 Israel-Syria: 1974 Golan Heights Disengagement Agreement

The Golan Heights between Israel and Syria has a number of strategic similarities to the Korean DMZ: a thin buffer zone, little strategic depth, a short distance to national capitals and population centers, and a high state of readiness by mobile armored forces. A general cease-fire agreement was negotiated on October 25, 1973, ending the Yom Kippur War. Egypt and Israel soon signed the first military disengagement agreement on January 15, 1974 (Sinai I) and officially acknowledged that it was the first step in a long-term peace process. Syria and Israel displayed far greater hostility. Periodic combat flared along the Golan Heights front after the cease-fire. A military disengagement agreement was finally signed on May 31, 1974. The negotiation required significant U.S. support. Even then, the text of the agreement contained the wary sentence, "This agreement is not a peace agreement."

The Golan agreement created a neutral and completely demilitarized buffer zone (80 km long and varying from 14 km wide in the north to less than 1 km wide in the south) supported by two limited-force zones (each 10 km wide). Surface-to-air missiles (SAMs) are banned from an additional 5-km-wide zone. Figure 29 shows the zones and associated limits on military forces. A joint committee was created to resolve disputes.

²⁹ Lederman, Itshak: *The Arab-Israeli Experience in Verification and Its Relevance to Conventional Arms Control in Europe*, Center for International Security Studies, University of Maryland, Occasional Paper Series, ISSN 1044-288X, (College Park, MD), 1989.

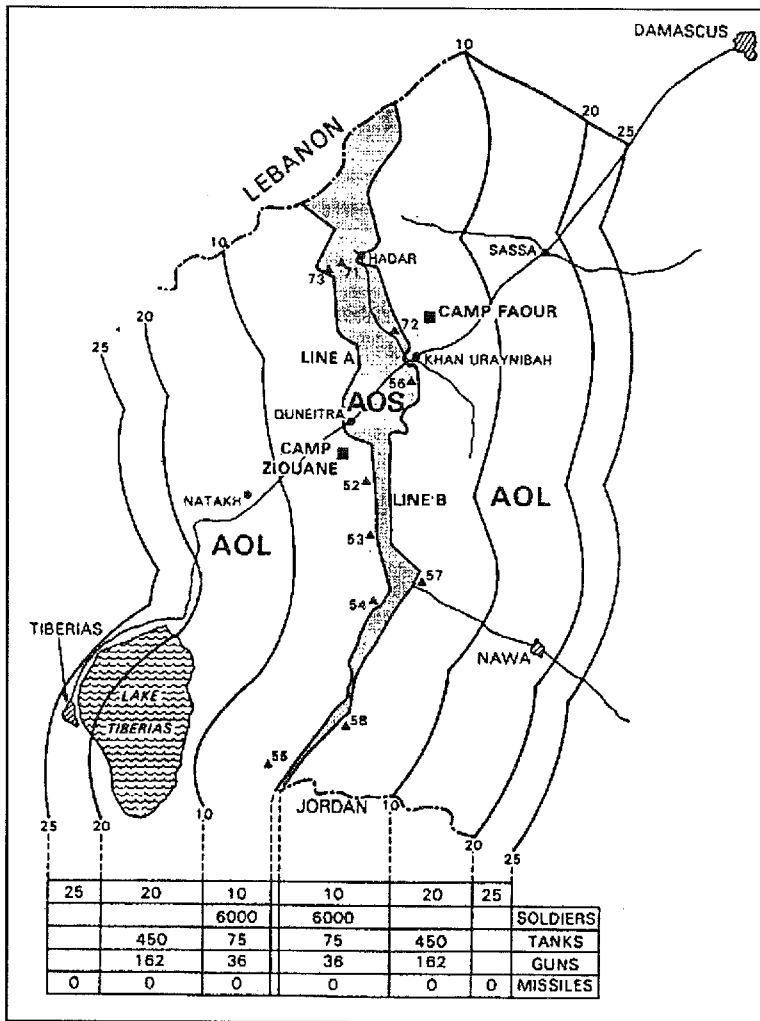


Figure 29. Limited Force Zones Defined by the Golan Disengagement Agreement

There are four primary routes for military movement in Golan. The United Nations Disengagement and Observer Force (UNDOF) of 1,200 men performs monitoring from 11 observation posts, conducts bi-weekly, on-site inspections (including challenge inspections), and acts as a liaison between Israel and Syria. Sensors are not used for monitoring (Figure 30). UNDOF's implementation of monitoring is less intrusive than in the Sinai and its reports are shared with both parties. At the same time, Israel and Syria continue to use their NTM (electronic signal collection and aerial reconnaissance) to monitor conditions.



Figure 30. United Nations Observer on the Golan Heights

In spite of mutual hostility and the lack of a formal peace agreement, the Golan Disengagement Agreement has worked well for 22 years. The overall system of monitoring provides sufficient early warning to both parties. There has been no conflict on the Golan Heights since the Agreement was signed. All violations have been minor and were resolved by the Joint Committee. The Golan Disengagement Agreement has indefinite duration.

7.0 *Conclusions*

Since 1953, the DMZ has become a heavily militarized, forward-defense area in violation of both the letter and the spirit of the Armistice Agreement. There have been frequent, minor, military clashes. Monitoring of the Armistice Agreement by the NNSC never functioned well and ceased in 1995 under North Korea pressure. At the present time, the DMZ functions more as a tense “no-man’s land” rather than a buffer zone. The risk of surprise attack is a constant threat to military and political stability on the Korean peninsula. The philosophy behind this analysis is that it is at least as important to prepare for peace as it is to prepare for war. The analysis is an example of how to think about a future South-North relationship that may not be as hostile as it is today.

7.1 Application to the Korean Peninsula

The current tense situation makes the search for options that might reduce the risk of conflict quite timely. The inter-Korea security situation is very serious but not hopeless. There have been encouraging precedents. Both Koreas have expressed a desire to use the DMZ as a mechanism for reducing tension and avoiding conflict. The 1992 South-North Basic Agreement defines measures to achieve this. In spite of hostile statements and aggressive acts, the DPRK government has shown occasionally that it can be quite pragmatic when it assesses an action to be in its interest. Many of its provocations in the DMZ appear to have been carefully calibrated for political effect. North Korea’s entry into the 1994 Framework Agreement avoided, for now, a direct confrontation with the U.S. and the international community. If the DPRK government thought enacting some provisions of the Basic Agreement would support its authority, it might do so in return for economic aid and a reduction in its military burden.

7.2 CBMs and Cooperative Monitoring

Historical experience from other regions (e.g., Europe, the Middle East, and South Asia) indicates that CBMs are easier to initiate than formal agreements for arms reduction. CBMs by their very nature can be quite flexible and adaptable to regional political and physical conditions. They can be implemented in a step-by-step manner if the parties prefer.

Cooperative monitoring technologies and techniques offer options for implementing more effective CBMs. Factors such as a party's perception of national sovereignty, the intrusiveness of monitoring, and a forum for communication are quite important and may, if inadequately addressed, doom an agreement. Cooperative monitoring can provide additional tools to the parties to overcome obstacles that might otherwise be insurmountable. For example, North Korea is unlikely to accept the continuous presence of South Korean inspectors within its territory, but might accept unattended sensors maintained by a neutral third-party organization. A CBM, such as the Sinai II Agreement, that the parties see as providing a useful function truly reduces tension and provides a foundation for a future agreement addressing the root causes of the dispute.

Establishing LDZs to reduce the number of offensive weapons and troops in the forward area is a practical option for confidence building that does not depend on overall arms reductions or a formal peace agreement. The analysis concludes that the existing military defense lines in each country provide the best rationale for defining LDZs. The two Koreas, lacking previous arms control experience, would probably be hesitant to begin general arms reduction. Confidence building by the phased establishment of monitored LDZs combines the advantage of easier verification with the long-term option for arms reduction. Continued success might provide the momentum to achieve a permanent Korean peace accord in the future.

7.3 Implementation of a Future Agreement

This analysis is not intended to be predictive. The hypothetical agreement and conceptual monitoring system do not assume a formal state of peace between North and South Korea and is only an attempt to assess what might be feasible in the future. Arms control agreements are generally adhered to when the political and security interests of the parties are served by complying with the terms. All the conceptual goals and

monitoring actions outlined here do not assume a level of cooperation beyond what is already agreed to, in principle, in the Basic Agreement.

Detailed procedures for monitoring are important for preventing future misunderstandings and misinterpretations when implementing agreements. Liaison teams, joint working committees, and direct lines of communication have been essential to monitoring agreements in other regions. All contribute to the process of confidence building. Increased confidence helps resolve alleged violations at the working level without the need to involve political leaders. Itsak Lederman summarized the potential problems in his analysis of the Middle East peace process, as follows:³⁰

It is a well-established tactic of negotiation to phrase difficult and controversial issues vaguely and later 'iron out' the obstacles. But mixing good intentions with vague terminology is sure to become counterproductive at a future time – during implementation or when governments change. When each side interprets an agreement – or even part of its monitoring regime – differently, there is always the potential of certain actions being pursued by one party which are then perceived as violations by the other signatory.

A recommendation of the analysis is that a “Korean Monitoring Center” be established to evaluate reports from the cooperative monitoring system. The mission of the Center would be to centralize data collection from all sensors, watch stations, aircraft, and inspectors for subsequent analysis, assessment, and distribution. The Center would report to and provide a facility for a “Joint Verification Committee.” The JVC should be established under the framework for the Joint Military Commission of the Basic Agreement.

7.4 Implementation of Cooperative Monitoring

The analysis concludes that a “third party” should be engaged to perform monitoring on the Korean peninsula, because there is insufficient confidence between the two Koreas to rely on indigenous monitoring. Furthermore, neither side has adequate expertise in arms control. UN peacekeepers are the most common third party, but regional peacekeeping and monitoring organizations have been created in Central America and sub-Saharan Africa. Individual countries have also performed the role of a

³⁰ *Ibid.*

neutral third party, most notably the U.S. in the Sinai. It is unlikely that the U.S. could perform a similar unilateral monitoring role in Korea because of its historic relationship with South Korea. The U.S. might, however, participate in a multinational monitoring organization which might result from the proposed Four-Party talks for a Korean peace accord.

A monitoring regime leading to verification becomes more efficient when the elements are integrated into a comprehensive system. Ground- and air-based monitoring technologies cannot perform the whole job; people are needed. A provision for special or challenge inspections can also be quite useful. Such inspections provide a means to assess anomalies reported by the monitoring system that might be violations. Such provisions can increase the public acceptance of the agreement. However, using special inspections too extensively may doom a prospective agreement.

Remote monitoring by unattended ground-based sensors is best implemented in relatively inactive environments such as the DMZ. The conceptual monitoring system for the strategic DMZ crossing points included human observers for redundancy and political confidence. Remote monitoring by unattended sensors in the LDZs has limitations because of the size of the monitored area and the high level of permitted background activity. Therefore, other forms of monitoring would be needed. Aerial monitoring by manned aircraft enables the monitoring of facilities and forces over broad areas. Commercial satellite imagery may supplement and partially replace aerial monitoring when planned enhancements in resolution and data distribution occur, but will probably never be able to monitor fast-moving situations. Nontechnical forms of cooperative monitoring, primarily on-site inspections in the LDZs, would also be needed.

An important conclusion of the analysis is that the conceptual monitoring system does not have to monitor all the security concerns associated with the hypothetical agreement in order to make a significant contribution to Korean security. Unilateral security and NTM activities are expected to continue and can support cooperative monitoring. The parties to an agreement reserve the right to make compliance decisions based on all available information. NTM can even be formally coordinated with the overall monitoring framework as was the case in the Sinai agreements. These agreements defined NTM activities that could be performed in restricted zones and coordinated them with the overall monitoring regime.

The cost of the conceptual monitoring system is likely to be within South and North Korea's ability to support. A detailed cost analysis for the full conceptual system is beyond the scope of this analysis. The conceptual monitoring system for the Sami-Ch'on Valley DMZ crossing was

estimated as \$1.5 million for sensor hardware and installation. Operating costs are impossible to estimate without certain assumptions. For example, if military or government employees were tasked to support the monitoring regime as part of their normal duties, there would be no additional costs to the parties. Many parts of the monitoring system already exist (e.g., observation posts in the DMZ) and could be used by the monitoring organization. Military aircraft could be loaned to the monitoring organization for the aerial monitoring function for no additional cost. The international community might also provide personnel and material support as well as financial support.

7.5 Relevance to the Future

The analysis concludes that military CBMs implemented with cooperative monitoring can play a key role in reducing tensions on the Korean peninsula. Furthermore, the analysis demonstrates that a cooperative monitoring system could be installed along the DMZ and conceptual LDZs. The conceptual system credibly addresses the military security problem, political concerns about sovereignty, the physical environment in Korea, and the limitations of monitoring technology. It cannot, of course, overcome fundamental intransigence by a party.

The current level of tension between South and North Korea may prevent the hypothetical agreement and monitoring system described in this analysis from being implemented in the near future. However, similar initiatives should be evaluated by the parties in preparation for future improvements in relations. Parts of the monitoring regime (e.g., a local monitoring system like the conceptual Sami-Ch'on Valley monitoring system) could be implemented as experiments between South and North Korea. Cooperative monitoring might provide a catalyst for easing tensions between South and North Korea. The recent proposal by Presidents Kim and Clinton for a Four-Party dialog between the U.S., China, South Korea, and North Korea indicates that the time may occur when such initiatives evolve from the conceptual to the practical.

Appendix A

Monitoring and Verification Provisions of the 1953 Armistice Agreement

The Neutral Nations Supervisory Commission (NNSC) and the Military Armistice Commission (MAC) were established by the Armistice Agreement to administer the implementation, monitor the terms, and resolve disputes associated with the Armistice. The NNSC is composed of four senior officers from nations that did not participate in the Korean War. The DPRK was represented by Czechoslovakia and Poland, while Switzerland and Sweden represented the United Nations Command (UNC). NNSC carries out the functions of supervision, observation, inspection, and investigation of armistice violations in the DMZ and at specific ports of entry for both nations. The NNSC conducts meetings weekly in the Joint Security Area (JSA) at Panmunjom village in the DMZ and reports violations directly to the MAC for assessment and resolution.

The MAC is composed of ten senior officers with five appointed by the Commander in Chief of the UNC and five by the Supreme Commander of the Korean People's Army and the Commander of the Chinese People's Volunteers. Ten Joint Observer teams are to work with the MAC to investigate violations of the Armistice. Each team is composed of four to six officers of field grade rank (half from the UNC and half from the DPRK).

The MAC meets in the JSA daily, and infractions of the Armistice Agreement are to be reported to both supreme commanders immediately. Both sides provide security at the JSA and are allowed 35 armed security personnel in addition to logistic support personnel. Four levels of meetings of the MAC are held in the JSA, as follows:

1. A formal MAC meeting is held to discuss major violations of the Armistice. The senior member of each delegation is the only speaker. The side calling the meeting makes the opening statement.
2. The next lower level is the Secretary's Meeting which is held to discuss lesser violations. It follows the same format as a formal meeting.
3. The third level is the Joint Duty Officer meeting which is held every day at noon except for Sundays and holidays. These meetings are

held to discuss pertinent administrative information relevant to the MAC. Each side is required to have an officer on duty 24 hours a day.

4. The fourth level of meetings is the Security Officer's Meeting. This meeting can be called by either side at any time deemed appropriate to ease tension between the two guard forces.

Text from the 1953 Armistice Agreement Defining the DMZ and Associated Monitoring¹

Article I: Military Demarcation Line and Demilitarized Zone

1. A military demarcation line shall be fixed and both sides shall withdraw two (2) kilometers from this line so as to establish a demilitarized zone between the opposing forces. A demilitarized zone shall be established as a buffer zone to prevent the occurrence of incidents which might lead to a resumption of hostilities.
2. The military demarcation line is located as indicated on the attached map.
3. This demilitarized zone is defined by a northern and southern boundary as indicated on the attached map.
4. The military demarcation line shall be plainly marked as directed by the Military Armistice Commission hereinafter established. The Commanders of the opposing sides shall have suitable markers erected along the boundary between the demilitarized zone and their respective areas. The Military Armistice Commission shall supervise the erection of all markers placed along the military demarcation line and along the boundaries of the demilitarized zone.
5. The waters of the Han River Estuary shall be open to civil shipping of both sides wherever one bank is controlled by one side and the other bank is controlled by the other side. The Military Armistice Commission shall prescribe rules for the shipping in that part of the Han River Estuary indicated on the attached map. Civil shipping of each side shall have unrestricted access to the land under the military control of that side.
6. Neither side shall execute any hostile act within, from, or against the demilitarized zone.
7. No person, military or civilian, shall be permitted to cross the military demarcation line unless specifically authorized to do so by the Military Armistice Commission.
8. No person, military or civilian, in the demilitarized zone shall be permitted to enter the territory under the military control of either side unless specifically authorized to do so by the Commander into whose territory entry is sought.
9. No person, military or civilian, shall be permitted to enter the demilitarized zone except persons concerned with the conduct of civil administration and relief and persons specifically authorized to enter by the Military Armistice Commission.
10. Civil administration and relief in that part of the demilitarized zone which is south of the military demarcation line shall be the responsibility of the Commander-in-Chief, United Nations Command; and civil administration and relief in that part of the

¹Note: The referenced map is not included.

demilitarized zone which is north of the military demarcation line shall be the joint responsibility of the Supreme Commander of the Korean People's Army and the Commander of the Chinese People's volunteers. The number of persons, military or civilian, from each side who are permitted to enter the demilitarized zone for the conduct of civil administration and relief shall be as determined by the respective Commanders, but in no case shall the total number authorized by either side exceed one thousand (1,000) persons at any one time. The number of civil police and the arms to be carried by them shall be as prescribed by the Military Armistice Commission. Other personnel shall not carry arms unless specifically authorized to do so by the Military Armistice Commission.

11. Nothing contained in this article shall be construed to prevent the complete freedom of movement to, from, and within the demilitarized zone by the Military Armistice Commission, its assistants, its Joint Observer Teams with their assistants, the Neutral Nations Supervisory Commission hereinafter established, its assistants, its Neutral Nations Inspection teams with their assistants, and of any other persons, materials, and equipment specifically authorized to enter the demilitarized zone by the Military Armistice Commission. Convenience of movement shall be permitted through the territory under the military control of either side over any route necessary to move between points within the demilitarized zone where such points are not connected by roads lying completely within the demilitarized zone.

Article II: Concrete Arrangements for Cease-Fire and Armistice

A. General

12. The Commanders of the opposing sides shall order and enforce a complete cessation of all hostilities in Korea by all armed forces under their control, including all units and personnel of the ground, naval, and air forces, effective twelve (12) hours after this armistice agreement is signed.

13. In order to insure the stability of the military armistice so as to facilitate the attainment of a peaceful settlement through the holding by both sides of a political conference of a higher level, the Commanders of the opposing sides shall:

(a) Within seventy-two (72) hours after this armistice agreement becomes effective, withdraw all of their military forces, supplies, and equipment from the demilitarized zone except as otherwise provided herein. All demolitions, minefields, wire entanglements, and other hazards to the safe movement of personnel of the Military Armistice Commission or its Joint Observer Teams, known to exist within the demilitarized zone after the withdrawal of military forces therefrom, together with lanes known to be free of all such hazards, shall be reported to the MAC by the Commander of the side whose forces emplaced such hazards.

(b) Within ten (10) days after this armistice agreement becomes effective, withdraw all of their military forces, supplies, and equipment from the rear and the coastal islands and waters of Korea of the other side.

(c) Cease the introduction into Korea of reinforcing military personnel; provided, however, that the rotation of units and personnel, the arrival in Korea of personnel on a temporary duty basis, and the return to Korea of personnel after short periods of leave or temporary duty outside of Korea shall be permitted within the scope prescribed below: "Rotation" is defined as the replacement of units or personnel by other units or personnel who are commencing a tour of duty in Korea. Rotation personnel shall be introduced into and evacuated from Korea only through the ports of entry enumerated in Paragraph 43 hereof. Rotation shall be conducted on a man-for-man basis; provided, however, that no

more than thirty-five thousand (35,000) persons in the military service shall be admitted into Korea by either side in any calendar month under the rotation policy. No military personnel of either side shall be introduced into Korea if the introduction of such personnel will cause the aggregate of the military personnel of that side admitted into Korea since the effective date of this Armistice Agreement to exceed the cumulative total of the military personnel of that side who have departed from Korea since that date. Reports concerning arrivals in and departures from Korea of military personnel shall be made daily to the Military Armistice Commission and the Neutral Nations Supervisory Commission; such reports shall include places of arrival and departure and the number of persons arriving at or departing from each such place. The Neutral Nations Supervisory Commission, through its Neutral Nations Inspection Teams, shall conduct supervision and inspection of the rotation of units and personnel authorized above, at the ports of entry enumerated in Paragraph 43 hereof.

(d) Cease the introduction into Korea of reinforcing combat aircraft, armored vehicles, weapons, and ammunition; provided however, that combat aircraft, armored vehicles, weapons, and ammunition which are destroyed, damaged, worn out, or used up during the period of the armistice may be replaced on the basis piece-for-piece of the same effectiveness and the same type. Such combat aircraft, armored vehicles, weapons, and ammunition shall be introduced into Korea only through the ports of entry enumerated in paragraph 43 hereof. In order to justify the requirements for combat aircraft, armored vehicles, weapons, and ammunition to be introduced into Korea for replacement purposes, reports concerning every incoming shipment of these items shall be made to the MAC and the NNSC; such reports shall include statements regarding the disposition of the items being replaced. Items to be replaced which are removed from Korea shall be removed only through the ports of entry enumerated in paragraph 43 hereof. The NNSC, through its Neutral Nations Inspection Teams, shall conduct supervision and inspection of the replacement of combat aircraft, armored vehicles, weapons, and ammunition authorized above, at the ports of entry enumerated in paragraph 43 hereof.

(e) Insure that personnel of their respective commands who violate any of the provisions of this armistice agreement are adequately punished.

(f) In those cases where places of burial are a matter of record and graves are actually found to exist, permit graves registration personnel of the other side to enter, within a definite time limit after this armistice agreement becomes effective, the territory of Korea under their military control, for the purpose of proceeding to such graves to recover and evacuate the bodies of the deceased military personnel of that side, including deceased prisoners of war. The specific procedures and the time limit for the performance of the above task shall be determined by the Military Armistice Commission. The Commanders of the opposing sides shall furnish to the other side all available information pertaining to the places of burial of the deceased military personnel of the other side.

(g) Afford full protection and all possible assistance and cooperation to the Military Armistice Commission, its Joint Observer Teams, the Neutral Nations Supervisory Commission, and its Neutral Nations Inspection Teams, in the carrying out of their functions and responsibilities hereinafter assigned; and accord to the Neutral Nations Inspection Teams, full convenience of movement between the headquarters of the Neutral Nations Supervisory Commission and the ports of entry enumerated in Paragraph 43 hereof over main lines of communication agreed upon by both sides (see Map 4), and between the headquarters of the Neutral Nations Supervisory Commission and the places where violations of this Armistice Agreement have been reported to have occurred.

(h) Provide such logistic support, including communications and transportation facilities, as may be required by the military Armistice Commission and the Neutral Nations Supervisory Commission and their Teams.

(i) Each construct, operate, and maintain a suitable airfield in their respective parts of the Demilitarized Zone in the vicinity of the headquarters of the Military Armistice Commission, for such uses as the Commission may determine.

(j) Insure that all members and other personnel of the Neutral Nations Supervisory Commission and of the Neutral Nations Repatriation Commission hereinafter established shall enjoy the freedom and facilities necessary for the proper exercise of their functions, including privileges, treatment, and immunities equivalent to those ordinarily enjoyed by accredited diplomatic personnel under international usage.

14. This Armistice Agreement shall apply to all opposing ground forces under the military control of either side, which ground forces shall respect the Demilitarized Zone and the area of Korea under the military control of the opposing side.

15. This Armistice Agreement shall apply to all opposing naval forces, which naval forces shall respect the water contiguous to the Demilitarized Zone and to the land area of Korea under the military control of the opposing side, and shall not engage in blockade of any kind of Korea.

16. This Armistice Agreement shall apply to all opposing air forces, which air forces shall respect the air space over the Demilitarized Zone and over the area of Korea under the military control of the opposing side, and over the waters contiguous to both.

17. Responsibility for compliance with and enforcement of the terms and provisions of this Armistice Agreement is that of the signatories hereto and their successors in command. The Commanders of the opposing sides shall establish within their respective commands all measures and procedures necessary to insure complete compliance with all of the provisions hereof by all elements of their commands. They shall actively co-operate with one another and with the Military Armistice Commission and the Neutral nations supervisory Commission in requiring observance of both letter and the spirit of all of the provisions of this Armistice Agreement.

18. The costs of the operations of the Military Armistice Commission and of the Neutral Nations supervisory Commission and of their Teams shall be shared equally by the two opposing sides.

B. Military Armistice Commission

I. Composition:

19. A Military Armistice Commission is hereby established.

20. The Military Armistice commission shall be composed of ten (10) senior officers, five (5) of whom shall be appointed by the Commander-in-Chief, United Nations Command, and five (5) of whom shall be appointed jointly by the Supreme Commander of the Korean People's Army and the Commander of the Chinese People's Volunteers. Of the ten members, three (3) from each side shall be of general of flag rank. The two (2) remaining members on each side may be major generals, brigadier generals, colonels, or their equivalents.

21. Members of the Military Armistice Commission shall be permitted to use staff assistants as required.

22. The Military Armistice Commission shall be provided with the necessary administrative personnel to establish a Secretariat charged with assisting the Commission by performing record-keeping, secretarial, interpreting, and such other functions as the Commission may assign to it. Each side shall appoint to the Secretariat a Secretary and an Assistant Secretary and such clerical and specialized personnel as required by the Secretariat. Records shall be kept in English, Korean, and Chinese, all of which shall be equally authentic.

23. (a) The Military Armistice Commission shall be initially provided with and assisted by ten (10) Joint Observer Teams, which number may be reduced by agreement of the senior members of both sides on the Military Armistice Commission.

(b) Each Joint Observer Team shall be composed of not less than four (4) nor more than six (6) officers of field grade, half of whom shall be appointed by the Commander-in-Chief, United Nations Command, and half of whom shall be appointed jointly by the Commander-in-Chief, United Nations Command, and half of whom shall be appointed jointly by the Supreme Commander of the Korean People's Army and the Commander of the Chinese People's Volunteers. Additional personnel such as drivers, clerks, and interpreters shall be furnished by each side as required for the functioning of the Joint Observer Teams.

24. The general mission of the Military Armistice Commission shall be to supervise the implementation of this Armistice Agreement and to settle through negotiations any violations of this Armistice Agreement.

25. The Military Armistice Commission shall:

(a) Locate its headquarters in the vicinity of PANMUNJOM (37 57'29" n, 126 40'00" e). The Military Armistice Commission may re-locate its headquarters at another point within the Demilitarized Zone by agreement of the senior members of both sides on the Commission.

(b) Operate as a joint organization without a chairman.

(c) Adopt such rules of procedure as it may, from time to time, deem necessary

(d) Supervise the carrying out of the provisions of this Armistice Agreement pertaining to the Demilitarized Zone and to the Han River Estuary.

(e) Direct the operations of the Joint Observer Teams.

(f) Settle through negotiations any violations of this Armistice Agreement.

(g) Transmit immediately to the Commanders of the opposing sides all reports of investigations of violations of this Armistice Agreement and all other reports and records of proceedings received from the Neutral nations supervisory Commission.

(h) Give general supervision and direction to the activities of the Committee for Repatriation of Prisoners of War and the Committee for Assisting the Return of Displaced Civilians, hereinafter established.

(i) Act as intermediary in transmitting communications between the Commanders of the opposing sides; provided, however, that the foregoing shall not be construed to preclude

the Commanders of both sides from Communicating with each other by any other means which they may desire to employ.

(j) Provide credentials and distinctive insignia for its staff and its Joint Observer Teams, and a distinctive marking for all vehicles, aircraft, and vessels, used in the performance of its mission.

26. The Mission of the Joint Observer Teams shall be to assist the Military Armistice Commission in supervising the carrying out of the provisions of this Armistice Agreement pertaining to the Demilitarized Zone and to the Han River Estuary.

27. The Military Armistice Commission, or the senior member of either side thereof, is authorized to dispatch Joint Observer Teams to investigate violations of this Armistice Agreement reported to have occurred in the Demilitarized Zone or in the Han River Estuary; provided, however, that not more than one half of the Joint Observer Teams which have not been dispatched by the Military Armistice Commission may be dispatched at any one time by the senior member of either side on the Commission.

28. The Military Armistice Commission, or the senior member of either side thereof, is authorized to request the Neutral Nations Supervisory Commission to conduct special observations and inspections at places outside the Demilitarized Zone where violations of this Armistice Agreement have been reported to have occurred.

29. When the Military Armistice Commission determines that a violation of this Armistice Agreement has occurred, it shall immediately report such violation to the Commanders of the opposing sides.

30. When the Military Armistice Commission determines that a violation of this Armistice Agreement has been corrected to its satisfaction, it shall so report to the Commanders of the opposing sides.

II. General

31. The Military Armistice Commission shall meet daily. Recesses of not to exceed seven (7) days may be agreed upon by the senior members of both sides; provided, that such recesses may be terminated on twenty-four (24) hour notice by the senior member of either side.

32. Copies of the record of the proceedings of all meetings of the Military Armistice Commission shall be forwarded to the Commanders of the opposing sides as soon as possible after each meeting.

33. The Joint Observer teams shall make periodic reports to the Military Armistice Commission as required by the Commission and, in addition, shall make such special reports as may be deemed necessary by them, or as may be required by the Commission.

34. The Military Armistice Commission shall maintain duplicate files of the reports and records of proceedings required by this Armistice Agreement. The Commission is authorized to maintain duplicate files of such other reports, records, etc., as may be necessary in the conduct of its business. Upon eventual dissolution of the Commission, one set of the above files shall be turned over to each side.

35. The Military Armistice Commission may make recommendations to the Commanders of the opposing sides with respect to amendments or additions to this Armistice

Agreement. Such recommended changes should generally be those designed to insure a more effective armistice.

C. Neutral Nations Supervisory Commission

I. Composition

36. A Neutral Nations Supervisory Commission is hereby established.

37. The Neutral Nations Supervisory Commission shall be composed of four (4) senior officers, two (2) of whom shall be appointed by neutral nations nominated by the Commander-in-Chief, United Nations Command, namely, SWEDEN and SWITZERLAND, and two (2) of whom shall be appointed by neutral nations nominated jointly by the Supreme Commander of the Korean People's Army and the Commander of the Chinese People's Volunteers, namely, POLAND and CZECHOSLOVAKIA. The term "neutral nations" as herein used is defined as those nations whose combatant forces have not participated in the hostilities in Korea. Members appointed to the Commission may be from the armed forces of the appointing nations. Each member shall designate an alternate member to attend those meetings which for any reason the principal member is unable to attend. Such alternate members shall be of the same nationality as their principals. The Neutral Nations Supervisory Commission may take action whenever the number of members present from the neutral nations nominated by one side is equal to the number of members present from the neutral nations nominated by the other side.

38. Members of the Neutral Nations Supervisory Commission shall be permitted to use staff assistants furnished by the neutral nations as required. These staff assistants may be appointed as alternate members of the Commission.

39. The neutral nations shall be requested to furnish the Neutral Nations Supervisory Commission with the necessary administrative personnel to establish a Secretariat charged with assisting the Commission by performing necessary record-keeping, secretarial, interpreting, and such other functions as the Commission may assign to it.

40. (a) The Neutral Nations supervisory Commission shall be initially provided with, and assisted by, twenty (20) Neutral Nations Inspection Teams, which number may be reduced by agreement of the senior members of both sides on the Military Armistice Commission. The Neutral Nations Inspection Teams shall be responsible to, shall report to, and shall be subject to the direction of, the Neutral Nations Supervisory Commission only.

(b) Each Neutral Nations Inspection Team shall be composed of not less than four (4) officers, preferably of field grade, half of whom shall be from the neutral nations nominated by the Commander-in-Chief, United Nations Command, and half of whom shall be from the neutral nations nominated jointly by the Supreme Commander of the Korean People's Army, and the Commander of the Chinese People's Volunteers. Members appointed to the Neutral Nations Inspection Teams may be from the armed forces of the appointed. In order to facilitate the functioning of the Teams, sub-teams composed of not less than two (2) members, one of whom shall be from a neutral nation nominated by the Commander-in-Chief, United Nations Command, and one of whom shall be from a neutral nation nominated jointly by the Supreme Commander of the Korean People's Army and the Commander of the Chinese People's Volunteers, may be formed as circumstances require. Additional personnel such as drivers, clerks, interpreters, and communications personnel, and such equipment as may be required by the Teams to perform their missions, shall be furnished by the Commander of each side, as required, in the Demilitarized Zone and in the territory under his military control. The Neutral Nations Supervisory Commission may provide itself and the Neutral Nations Inspection Teams with such of the above personnel

shall be personnel of the same neutral nations of which the Neutral Nations Supervisory Commission is composed.

II. Functions and Authority

41. The mission of the Neutral Nations Supervisory Commission shall be to carry out the functions of supervision, observation, inspection, and investigation, as stipulated in Sub-paragraphs 13(c) and 13(d) and Paragraph 28 hereof, and to report the results of such supervision, observation, inspection, and investigation to the Military Armistice Commission.

42. The Neutral Nations Supervisory Commission shall:

(a) Locate its headquarters in proximity to the headquarters of the Military Armistice Commission.

(b) Adopt such rules of procedure as it may, from time to time, deem necessary.

(c) Conduct, through its members and its Neutral Nations Inspection Teams, the supervision and inspection provided for in Sub-paragraphs 13(c) and 13(d) of this Armistice Agreement at the ports of entry enumerated in Paragraph 43 hereof, and the special observations and inspections provided for in paragraph 28 hereof at those places where violations of this Armistice Agreement have been reported to have occurred. The inspection of combat aircraft, armored vehicles, weapons, and ammunition by the Neutral Nations Inspection Teams shall be such as to enable them to properly insure that reinforcing combat aircraft, armored vehicles, weapons, and ammunition are not being introduced into Korea; but this shall not be construed as authorizing inspections or examinations of any secret designs of characteristics of any combat aircraft, armored vehicle, weapon, or ammunition.

(d) Direct and supervise the operations of the Neutral Nations Inspection Teams.

(e) Station five (5) Neutral Nations Inspection Teams at the ports of entry enumerated in Paragraph 43 hereof located in the territory under the military control of the Commander-in-Chief, United Nations Command; and five (5) Neutral Nations Inspection Teams at the ports of entry enumerated in Paragraph 43 hereof located in the territory under the military control of the Supreme Commander of the Korean People's Army and the Commander of the Chinese People's Volunteers; and establish initially ten (10) mobile Neutral Nations Inspection Teams in reserve, stationed in the general vicinity of the headquarters of the Neutral Nations Supervisory Commission, which number may be reduced by agreement of the senior members of both sides on the Military Armistice Commission. Not more than half of the mobile Neutral Nations Inspection Teams shall be dispatched at any one time in accordance with requests of the senior member of either side on the Military Armistice Commission.

(f) Subject to the provisions of the preceding Sub-paragraphs, conduct without delay investigations of reported violations of this Armistice Agreement, including such investigations of reported violations of this Armistice Agreement as may be requested by the Military Armistice Commission or by the senior member of either side on the Commission.

(g) Provide credentials and distinctive insignia for its staff and its Neutral Nations Inspection Teams, and a distinctive marking for all vehicles, aircraft, and vessels used in the Performance of this mission.

43. Neutral Nations Inspection Teams shall be stationed at the following ports of entry.

These Neutral Nations Inspection Teams shall be accorded full convenience of movement within the areas and over the routes of communication set forth on the attached map.

III. General

44. The Neutral Nations Supervisory Commission shall meet daily. Recesses of not to exceed seven (7) days may be agreed upon by the members of the Neutral Nations Supervisory Commission; provided, that such recesses may be terminated on twenty-four (24) hour notice by any member.

45. Copies of the record of the proceedings of all meetings of the Neutral Nations Supervisory commission shall be forwarded to the Military Armistice Commission as soon as possible after each meeting. Records shall be kept in English, Korean, and Chinese.

46. The Neutral Nations Inspection Teams shall make periodic reports concerning the results of their supervision observations, inspections, and investigations to the Neutral Nations Supervisory Commission as required by the Commission and, in addition, shall make such special reports as may be deemed necessary by them, or as may be required by the Commission. Reports shall be submitted by a Team as a whole, but may also be submitted by one or more individual members thereof; provided, that the reports submitted by one or more individual members thereof shall be considered as information only.

47. Copies of the reports made by the Neutral Nations Inspection teams shall be forwarded to the Military Armistice Commission by the Neutral Nations Supervisory Commission without delay and in the language in which received. They shall not be delayed by the process of translation or evaluation. The Neutral Nations Supervisory Commission shall evaluate such reports at the earliest practicable time and shall forward their findings to the Military Armistice Commission as a matter of priority. The Military Armistice Commission shall not take final action with regard to any such report until the evaluation thereof has been received from the Neutral Nations Supervisory Commission. Members of the Neutral Nations Supervisory Commission and of its Teams shall be subject to appearance before the Military Armistice Commission, at the request of the senior member of either side on the Military Armistice Commission, for clarification of any report submitted.

48. The Neutral Nations Supervisory Commission shall maintain duplicate files of the reports and records of proceedings required by this Armistice Agreement. The Commission is authorized to maintain duplicate files of such other reports, records, etc., as may be necessary in the conduct of its business. Upon eventual dissolution of the Commission, one set of the above files shall be turned over to each side.

49. The Neutral Nations Supervisory Commission may make recommendations to the Military Armistice Commission with respect to amendments or additions to this Armistice Agreement. Such recommended changes should generally be those designed to insure a more effective armistice.

50. The Neutral Nations Supervisory Commission, or any member thereof, shall be authorized to communicate with any member of the Military Armistice Commission.

Appendix B

Text of the Agreement on Reconciliation, Non-Aggression and Exchanges and Cooperation between the South and the North

(unofficial translation)

To enter into force as of February 19, 1992

The South and the North, in keeping with the yearning of the entire Korean people for the peaceful unification of the divided land:

Reaffirming the three principles of unification set forth in the July 4, 1972 South-North Joint Communiqué:

Determined to remove the state of political and military confrontation and achieve national reconciliation:

Also determined to avoid armed aggression and hostilities, reduce tension and ensure peace:

Expressing the desire to realize multi-faceted exchanges and cooperation to advance common national interests and prosperity:

Recognizing that their relations, not being a relationship between states, constitute a special interim relationship stemming from the process towards unification:

Pledging to exert joint efforts to achieve peaceful unification:

Hereby have agreed as follows:

CHAPTER I SOUTH-NORTH RECONCILIATION

- Article 1: The South and the North shall recognize and respect each other's system.
Article 2: The two sides shall not interfere in each other's internal affairs.
Article 3: The two sides shall not slander or vilify each other.
Article 4: The two sides shall not attempt any actions of sabotage or overthrow against each other.
Article 5: The two sides shall endeavor together to transform the present state of armistice into a solid state of peace between the South and the North and shall abide by the present Military Armistice Agreement (of July 27, 1953) until such a state of peace has been realized.
Article 6: The two sides shall cease to compete or confront each other and shall cooperate and endeavor together to promote national prestige and interests in the international arena.
Article 7: To ensure close consultations and liaison between the two sides, South-North Liaison Offices shall be established at Panmunjom within three (3) months after the coming into force of this Agreement.
Article 8: A South-North Political Committee shall be established within the framework of the South-North High-Level Talks within one (1) month of the coming into force of this

Agreement with a view to discussing concrete measures to ensure the implementation and observance of the accords on South-North reconciliation.

CHAPTER II SOUTH-NORTH NON-AGGRESSION

- Article 9: The two sides shall not use force against each other and shall not undertake armed aggression against each other.
- Article 10: Differences of views and disputes arising between the two sides shall be resolved peacefully through dialogue and negotiation.
- Article 11: The South-North demarcation line and areas for nonaggression shall be identical with the Military Demarcation Line specified in the Military Armistice Agreement of July 27, 1953 and the areas that have been under the jurisdiction of each sides until the present time.
- Article 12: To implement and guarantee non aggression, the two sides shall set up a South-North Joint Military Commission within three (3) months of the coming into force of this Agreement. In the said Commission, the two sides shall discuss and carry out steps to building military confidence and realize arms reduction, including the mutual notification and control of major movements of military units and major military exercises, the peaceful utilization of the Demilitarized Zone, exchanges of military personnel and information, phased reductions in armaments including the elimination of weapons of mass destruction and attack capabilities, and verifications thereof.
- Article 13: A telephone hotline shall be installed between the military authorities of the two sides to prevent accidental armed clashes and their escalation.
- Article 14: A South-North Military Committee shall be established within the framework of the South-North High-Level Talks within one (1) month of the coming into force of this Agreement in order to discuss concrete measures to ensure the implementation and observance of the accords on nonaggression and to remove military confrontation.

CHAPTER III SOUTH-NORTH EXCHANGES AND COOPERATION

- Article 15: To promote an integrated and balanced development of the national economy and the welfare of the entire people, the two sides shall engage in economic exchanges and cooperation, including the joint development of resources, the trade of goods as domestic commerce and joint ventures.
- Article 16: The two sides shall carry out exchanges and cooperation in various fields such as science and technology, education, literature and the arts, health, sports, environment, and publishing and journalism including newspapers, radio and television broadcasts, and publications.
- Article 17: The two sides shall promote free intra-Korean travel and contacts for the residents of their respective areas.
- Article 18: The two sides shall permit free correspondence, meetings and visits between dispersed family members and other relatives and shall promote the voluntary reunion of divided families and shall take measures to resolve other humanitarian issues.
- Article 19: The two sides shall reconnect railroads and roads that have been cut off and shall open South-North sea and air transport routes.
- Article 20: The two sides shall establish and link facilities needed for South-North postal and telecommunications services and shall guarantee the confidentiality of intra-Korean mail and telecommunications.
- Article 21: The two sides shall cooperate in the economic, cultural and various other fields in the international arena and carry out joint undertakings abroad.
- Article 22: To implement accords on exchanges and cooperation in the economic, cultural and

various other fields, the two sides shall establish joint commissions for specific sectors, including a Joint South-North Economic Exchanges and Cooperation Commission, within three (3) months of the coming into force of this Agreement.

Article 23: A South-North Exchanges and Cooperation Committee shall be established within the framework of the South-North High-Level Talks within one (1) month of the coming into force of this Agreement with a view to discussing concrete measures to ensure the implementation and observance of the accords on South-North exchanges and cooperation.

CHAPTER IV AMENDMENTS AND EFFECTUATION

Article 24: The Agreement may be amended or supplemented by concurrence between the two sides.

Article 25: This Agreement shall enter into force as of the day the two sides exchange appropriate instruments following the completion of their respective procedures for bringing it into effect.

Signed on December 13, 1991

Chung Won-shik

Prime Minister of the
Republic of Korea

Yon Hyong-muk

Premier of the
Administration Council of the
Democratic People's
Republic of Korea

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Appendix C

The Four-Party Proposal for a Permanent Peace on the Korean Peninsula

Transcript of the ROK-U.S. Joint Announcement

1. The President of the Republic of Korea, Kim Young-Sam, and the President of the United States of America, William J. Clinton, held a summit meeting at Cheju Island Korea, on April 16, 1996. They had an in-depth exchange of views regarding the situation on the Korean peninsula and on ways to promote dialogue and peace.
2. President Clinton pledged steadfast U.S. commitment to the security of the Republic of Korea and reaffirmed the strength of the U.S.-Korea security alliance. Both Presidents agreed that the present Armistice arrangement should be maintained until it is succeeded by a permanent peace agreement.
3. The two Presidents expressed their shared desire to foster a stable, permanent peace on the Korean peninsula, where tensions remain high. They agreed to work positively and with open minds to encourage a process for reconciliation and peace on the Korean peninsula.
4. The two Presidents confirmed the fundamental principle that establishment of a stable, permanent peace on the Korean peninsula is the task of the Korean people. Both Presidents agreed that South and North Korea should take the lead in a renewed search for a permanent peace arrangement, and that separate negotiations between the United States and North Korea on peace-related issues cannot be considered.
5. President Kim affirmed the Republic of Korea is willing to meet without preconditions at the governmental level with representatives of the DPRK. President Clinton affirmed that the U.S. is prepared to play an active and cooperative role in support of this effort. Both Presidents agreed that China's cooperation would be extremely helpful.
6. Accordingly, the two Presidents proposed to convene a Four-Party Meeting of representatives of the Republic of Korea, the Democratic People's Republic of Korea, the People's Republic of China, and the United States, as soon as possible and without preconditions. The

- purpose would be to initiate a process aimed at achieving a permanent peace agreement.
7. The two Presidents agreed that this peace process also should address a wide range of tension-reduction measures.
 8. President Clinton praised the Republic of Korea's initiative as a positive and important step in easing tensions on the Korea peninsula. President Kim acknowledged the importance of continued American support.

Transcript of the Official North Korean Response

U.S. President Clinton on April 16 'proposed' to hold 'quadrilateral talks' among the north and south of Korea, the U.S., and China in order to 'begin a peace process on the Korean peninsula.' His proposal has no more details. As for the matter of preserving peace on the Korean peninsula, it should be discussed and decided on by the DPRK and the United States, signatories to the Armistice Agreement.

We have no clear notion of why the U.S. side, which knows this fact better than anyone else, abruptly proposed 'quadrilateral talks.' Now that the Korean peninsula is in a situation strikingly similar to a state of war, it is urgently required that the outdated Armistice Agreement should be replaced by a peace proposal.

Proceeding from this stark reality, we have long since proposed it as a major issue to conclude a peace agreement between the DPRK and the U.S. We are not yet certain whether the 'proposal for quadrilateral talks' is aimed at concluding a genuine peace agreement between the signatories to the Korean Armistice Agreement. As is known to all, the north and south of Korea have already agreed on non-aggression, reconciliation, and cooperation and a document on the agreement has been published all over the world.

The point at issue is that the document has not been carried into practice. It is entirely because the North-South dialogue has been suspended due to the South Korean authorities. We are not certain, either, whether the 'proposal for quadrilateral talks' is related to this issue. We are now examining the proposal of the U.S. side to see whether it seeks another purpose and whether it is feasible.

Regional Perspectives on the Four Party Proposal

China

China indicated it would participate if North Korea accepts the proposal. On April 9, 1996, just after the North Korean provocations in the DMZ, China said that it hopes North Korea will reach a new peace agreement. Chinese Foreign Ministry spokesman Chen Jian told a news briefing:

We believe that there should be a new peace mechanism to replace the mechanism of the Armistice. But before this long-term new peace mechanism is established, we believe that the current Armistice Agreement must remain valid.

Japan

Japan said it would support the Four-Party proposal immediately after the ROK-U.S. joint announcement. If six-party talks (Japan and Russia plus the Four-Party proposal) were held, Japan might be able to formulate a good-faith response to North Korea's demand for a formal peace treaty. Regional security in Northeast Asia could thus be increased and a large reduction in U.S. forces in Okinawa, Japan, and South Korea would become possible.

Russia

The Russian response to the Four-Party proposal has been negative, proposing instead that an international conference of all parties concerned in order to resolve problems on the Korean peninsula. Russian Foreign Ministry spokesman Mikhail Demurin said: "The Russian position is that the problems of the Korean peninsula should be settled on a multilateral basis, taking account of the interests of all parties involved. ... Narrower options tended not to work."²

Short-Term Developments

Pyongyang gave every indication of initially rejecting the Four-Party plan. Pyongyang typically starts a dialog by saying "no" to any matter related to Seoul, a reflection of its inherent reluctance to deal directly with Seoul. On April 27, 1996, the U.S. Department of State acknowledged that U.S. and North Korean officials held secret working level talks in New York the previous day.

² The Korea Herald newspaper (Seoul), April 17, 1996.

North Korea's first response was to call for the reopening of the rice food aid talks in Beijing that halted in September 1995. Ri Jong-Hyok, a senior member of the Korean Workers' Party, said North Korea was waiting for a South Korean reply. He added that he expects overall inter-Korean relations to proceed smoothly. On May 29, 1996, the ROK Deputy Prime Minister for Unification said the Four-Party talks could discuss both the establishment of a peace regime and economic assistance to North Korea. He indicated that South Korea might consider establishing a Korean Peninsula Energy Development Organization (KEDO)-type program to provide economic assistance. KEDO is an international consortium, including South Korea, whose objective is to replace a North Korean graphite reactor with two light-water reactors.

In May 1996, senior foreign policymakers from the U.S., Japan and South Korea held bilateral and trilateral meetings to coordinate a common stance regarding how to bring North Korea to the Four-Party talks. During the ROK-U.S. talks, the officials agreed that, in constructing a new peace regime on the peninsula, military confidence building measures between ROK/U.S. forces and DPRK forces should be implemented first. The highest priority is "the reduction of military confrontation between South and North Korea."³

On July 25, 1996, North Korea renewed its call for direct negotiations with the U.S. The KPA proposed that "working contacts" be set up to foster a tentative agreement on securing peace on the Korean peninsula. Still, the North still did not reject the Four-Party proposal. On August 28, the ROK Foreign Minister reaffirmed that neither Seoul nor Washington will make concessions to induce Pyongyang to attend a joint briefing on the proposal which it originally requested. "We intend to be patient and stand firm on our basic principles," he said.

³ Seoul Sin-Mun newspaper, May 14, 1996

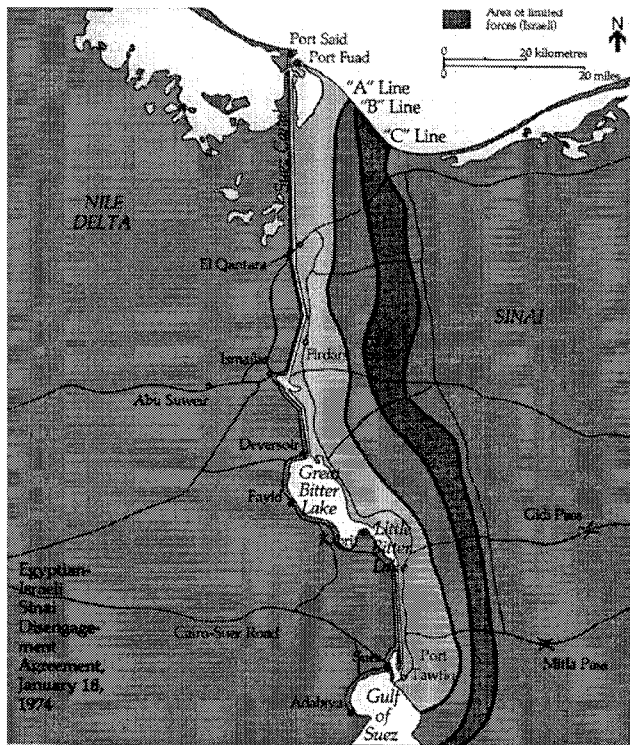
Appendix D

Comparison of the Sinai Precedent to the Contemporary Korean Peninsula

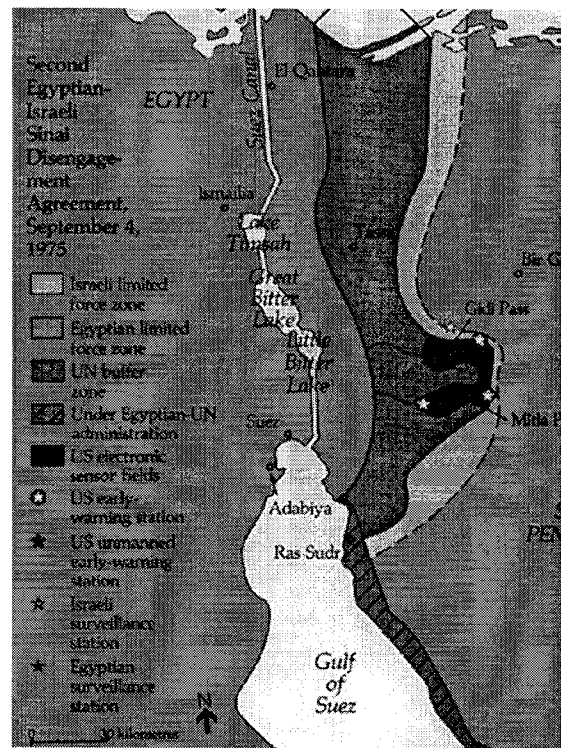
The *Sinai Disengagement Agreement* (Sinai I) was signed on January 18, 1974. The Israelis withdrew to defensive positions an average of 20 km from the Suez canal and a thin buffer zone with adjacent limited force zones was established. The acceptance by Israel and Egypt of third party monitoring performed by the UN and the U.S. was a significant breakthrough. The UN peacekeeping force performed on-site inspection and general observation, while the U.S. performed periodic aerial surveillance flights. As mutual confidence increased, the *Sinai Interim Agreement* (Sinai II) was signed on September 4, 1975. Sinai II moved Israeli lines eastward and increased the size of limited force zones. In addition, Egypt and Israel were each permitted to operate a signal collection station in the buffer zone as part of their national technical means. Figure D-1 illustrates the Sinai I and Sinai II disengagement agreements. The width of the buffer and limited force zones in the Sinai were much greater than the Korean DMZ. The Sinai strategy of using different and complimentary types of monitoring, third-party implementation, and monitoring at key locations is applicable to the Korean peninsula.

The United States established the Sinai Field Mission (SFM), composed of U.S. civilians, on November 14, 1975 to perform ground-based monitoring of the Giddi and Mitla passes for Sinai II. Sinai II entered into force on February 25, 1976 and the monitoring system became operational on Feb. 22, 1976. In addition to the passes, the SFM monitored the Israeli and Egyptian signal collection stations, some minor trails, and its own security perimeter for a total of 620 square km. The SFM shared its monitoring reports promptly and equally with all parties to the Agreement.

The Sinai Joint Commission had been established during Sinai I to administer implementation of the agreement. The Commission's role was expanded during Sinai II to receive and evaluate monitoring reports from the SFM and UN peacekeepers.



a. 1974



b. 1975

Figure D-1 Maps of the Sinai Disengagement Agreements

The Commission met monthly in the buffer zone and had the following goals:

1. Supervise implementation of the terms of the agreement
2. Evaluate reports from monitoring activities and resolve problems or violations
3. Coordinate military movements and supervise their implementation
4. Develop a schedule for on-site inspections

The SFM operated as an integrated system. The map in Figure D-2 shows the locations of SFM's monitoring activities. Multiple types of sensors (seismic, acoustic, magnetic, pressure, infrared, and video) were used for redundancy (Figure D-3). When a sensor was activated, it sent a radio signal to alert observers at a nearby watch station. The observers used optical and night vision devices to assess the intrusion. If the observers concluded that the intrusion was improper, a radio message was sent to the SFM monitoring center which then filed a report. The SFM made official reports to the Sinai Joint Commission by teletype because it produced a written record and minimized misinterpretation. Unencrypted messages were also simultaneously transmitted to the Israeli Government, the UN Peacekeeper headquarters, the Egyptian Ministry of Defense, and the U.S. embassies in Israel and Egypt. Reports of violations could reach the parties within five minutes.

During the system's operation between February 22, 1976 and January 25, 1980, only 90 violations were reported (67 assessed to Israel, 2 to Egypt, 19 unidentified aircraft, and 2 unidentified personnel). All the reported violations were minor and easily resolved.

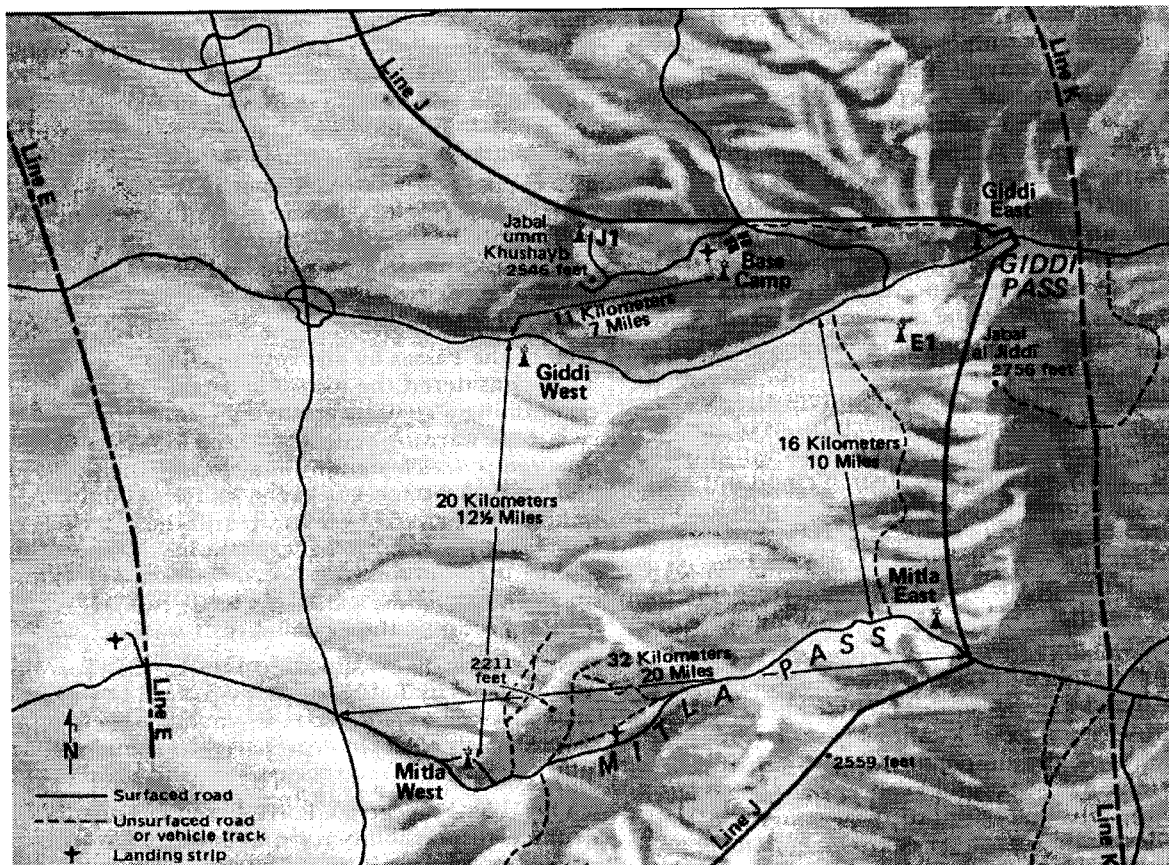
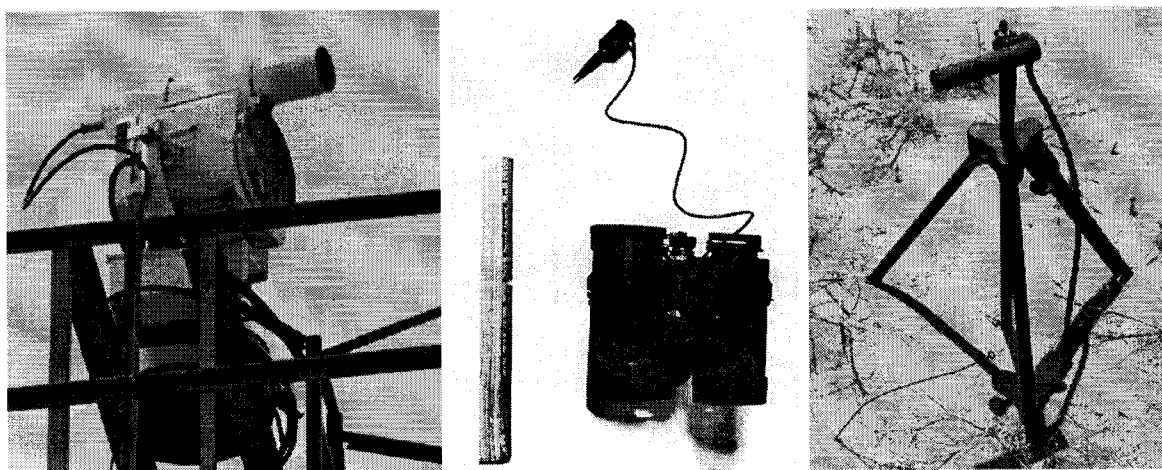


Figure D-2 Area Monitored by the Sinai Field Mission



a. Video

b. Seismic

c. Infrared

Figure D-3 Sensors Used for Remote Monitoring in the Sinai

Tabular Comparisons

The following tables compare the political, military, and verification considerations of the Sinai Precedent to the Korean Peninsula.

Table D-1 Political Considerations

Topic	Sinai Precedent	Korean Peninsula
Origin Of Conflict	Egypt rejected creation of Israel. Israel wanted Sinai for strategic depth. Egypt wanted to regain territory.	Artificial partition of peninsula. North and South seek to reunify on their own terms.
Level Of Distrust	High - 25 years of tension. Warfare had occurred very recently.	High - 45 years of tension. No recent warfare but periodic violent incidents occur. Intensive use of negative propaganda.
Existing Agreements	1973 cease-fire to Yom Kippur War was first ever direct negotiation.	1953 Armistice has been frequently violated. <i>South-North Coordinating Committee</i> created by 1972 Joint Communiqué is inactive. The 1992 Basic Agreement has not been implemented.
Context For Negotiations	Direct negotiations with U.S. and UN mediation.	North Korea rejects direct negotiation with South Korea. Seeks peace agreement with U.S.
Opportunity For "Third Party" To Support Peace Process	U.S. and UN could participate as neutral parties.	U.S. is involved militarily in the ROK. Cannot participate by itself as a neutral party. UN or regional organization might be possible.
Preconditions	Sinai I and II implemented without prior CBMs, formal peace agreement or arms reduction.	South Korea says that CBMs should precede arms reduction. North Korea says that large-scale arms reduction is a CBM.

Table D-2 Military Considerations

Topic	Sinai Precedent	Korean Peninsula
Function Of Buffer Zones	LDZs were combined with a DMZ. Adequate width and defense provided security.	Only a 4-km-wide DMZ exists and does not provide adequate separation.
Forces To Be Redeployed	Approximately 400,000 Israeli and Egyptian troops. Redeployment increased security.	Approximately 1 million ROK, DPRK, and U.S troops. Redeployment should be linked to future arms reduction.
Military Strategy	Both generally defensive. Both had used preemptive attacks if perceived threat existed.	North Korean: offensive, South Korean: defensive
Offensive Options	Two primary routes through the Giddi and Mitla Passes.	Ten major routes through the DMZ.
Effect Of Terrain	Military activities relatively visible due to generally clear weather and open desert terrain.	Military activities can be obscured due to poor weather, hilly terrain, and vegetation.

Table D-3 Verification Considerations

Topic	Sinai Precedent	Korean Peninsula
Consultative Organization	A <i>Joint Commission and Liaison System</i> was established between Israel, Egypt, the U.S., and UN	The 1992 Basic Agreement called for a <i>Joint Military Commission</i> . A <i>Joint Verification Committee</i> should be established.
Monitoring Implementation	U.S. performed sensor and aerial monitoring. UN managed LDZs and performed on-site inspection.	A neutral third party (country or organization) should perform monitoring. A suitable party needs to be identified.
Use Of NTM	Egypt and Israel operated signal collection station in DMZ and performed aerial reconnaissance.	South and North Korea can continue to operate NTM to supplement cooperative monitoring.
Uninvolved Participants	Bedouins in Sinai complicated monitoring.	No uninvolved parties.
Sensors Used	Sensors monitored both points and open areas. Seismic, magnetic, acoustic, pressure, video, and infrared types used.	Similar sensors could be used on the Korean peninsula. Climate and background activity increase the potential for false alarms.
Role Of Personnel	Sensors alerted observers who assessed intrusion and reported if it was a violation.	Human observers increase overall reliability. Similar strategy applicable on the Korean peninsula.
Aerial Reconnaissance	U.S. performed observation of the LDZ and DMZ by aircraft and satellite. Information selectively shared with parties.	The 1992 Open Skies Treaty in Europe may have application on the Korean peninsula. Commercial satellite imagery has limited application.

Appendix E

The Geography of the DMZ Area

Eastern Part

The geography of the eastern part of the DMZ adversely affects military operations. The natural ruggedness of the Kumkang mountain system limits observation and fields of fire. There are limited open areas in the Pyongkang and Kumsung plateaus in the northwest and the coastal lowland in the east.

The varying relief and thick forests of the Taebaek mountain range provide both the attacker and defender with considerable cover. The slopes, valleys, and canyons created by the Hantan river, the Pukhan river, and Kumsung stream limit troop movement. The Nam river, the Kwangkyo stream, and the Han stream, all of which flow to the east, are fordable, however crossing is limited during the rainy season.

Four routes (road numbers 5, 7, 31 and 43) are the likely avenues of approach and link key terrain in the area. Heavy rain in the summer may restrict cross-country movement.

The following factors affect monitoring devices in terms of geographic conditions in the eastern part of the peninsula:

- Temperature extremes in the hot, rainy summer and snowy winter may cause malfunctions in the monitoring sensors.
- The steep contour and heavy vegetation in the mountain area may restrict the employment of the optical devices.
- The background noise from wildlife and vegetation may cause sensors to generate false alarms.
- Monitoring of points in defiles that act as bottlenecks may be cost-effective.

Central Part

The southern plain in the downstream area of the Imjin river provides good line-of-sight for observation and fields of fire. The complex tributary systems of the Imjin and Yesung rivers provide partial cover and concealment, and forests mask 50-60% of the area in the summer. The Imjin river and its tributaries block troop movement in the rainy season (July and August), however they are fordable during the dry season.

There is sufficient enough open space for combined arms operations. Three routes (road numbers 1, 3 and 352) provide avenues of approach linking key terrain in the area. Heavy rain in the summer may restrict cross-country movement.

The following factors affect the monitoring devices in terms of geographic conditions in the central part of the peninsula:

- Temperature extremes between the hot and wet summer and snowy winter may cause malfunctions of the monitoring sensors
- Except for flat areas in the west, the contours and vegetation in the mountain area will restrict the employment of the optical devices.
- The background noise from civilian activities, wildlife, and vegetation may cause sensors to generate false alarms.
- Monitoring of points in defiles that act as bottlenecks in the eastern areas may be cost-effective.

Western Part

The Moelak mountain range, although its average height is relatively low, provides good observation and fields of fire because of the compartmented terrain in the western plain. Open ground in the Kimpo and Yeonbaek plains provides space to maneuver but little natural cover. However urban areas and farm buildings can provide partial cover for maneuvering units. The Yesung river is a natural obstacle with no fordable site.

Three routes (road numbers 1, 51, and 52) provide avenues of approach linking key terrain in the area and permit enough space for combined arms operations. Heavy rain in the summer may restrict cross-country movement.

The following factors affect the monitoring devices in terms of geographic conditions in the western part of the peninsula:

- Rolling grounds and lowlands provide good line-of-sight for optical sensors.
- The background noise from civilian activities and vegetation may cause sensors to generate false alarms.
- The mix of major roads, ridgelines, river valleys and plains encourages a monitoring strategy that combines point-control and line-control sensors.

Appendix F

Potential Technologies for a Cooperative Monitoring System

A number of sensor technologies can be used in cooperative monitoring systems. This appendix provides a brief functional description of sensors that were considered for monitoring the Korean LDZ scenario. There are multiple manufacturers for most types of sensors and this section is not intended to endorse a particular brand. Different models of the same type of sensor may have different features and capability.

Sensors of different types may be combined into a system that performs a specific function such as monitoring activity at a facility. For example, a gate might be monitored by various types of sensors to detect and characterize traffic entering and exiting the facility by size and quantity or other specifications such as a radioactive signature. Information associated with vehicles that do not meet the monitoring specification need not be transmitted. The system might also detect vehicles that try to bypass the system to avoid being monitored by exiting out of the sides of the system.

Fence Sensors

The taut-wire fence sensor uses the physical property that a steel wire will act as a spring. High-tensile strength wires, usually barbed, are strung horizontally between posts and placed under tension. Each wire is connected to a sensor located in a post mid-way along the wires. Attempting to climb over the fence or to spread the wires activates the sensors and causes an alarm. Cutting the wire also causes tension in the wire to activate the sensor. The taut-wire fence has a very low false-alarm rate and is not generally affected by weather.

There are several different manufacturers of taut-wire sensors. The principle of operation is the same for all systems although various models use mechanical switches, piezo-electric devices, and strain gauges. A taut-wire fence is relatively expensive (approximately \$154,000 per kilometer when installed) and is thus primarily applicable to zones or facilities that are to be monitored intensely.

An alternative type of fence sensor uses fiber optic cables to detect intrusions. The fiber optic cables are woven through a new or existing

chain-link fence. An optical communication unit continually transmits a coded signal through the cable. Disruptions to the signal caused by cutting or movement generate changes in the light pattern that are detected by a receiver. This system is somewhat more likely to generate false alarms than the taut-wire system but can be installed in more rugged terrain. The cost of this type of system, including the fence, is about \$60,000 per kilometer.

Microwave Sensors

Microwave sensor technology has been used for 20 years in a variety of security protection applications. Reflections of the microwave energy transmitted by the unit are monitored by the reception antenna to obtain a reference level against which new activity is compared. Intruders entering the zone cause a change in the strength of the reflected signal and generate an alarm. Microwave sensors are classified as either monostatic or bistatic, depending on the configuration of the antennas. Bistatic models have separate transmit and receive antennas located at opposite ends of the detection zone. Monostatic models have the transmit and receiver antennas located together in a single housing. Many systems are portable and can be powered by batteries.

Monostatic and bistatic microwave sensors both transmit in the X (10.525 Ghz) frequency band or K (24 Ghz) frequency band, but bistatic systems generally have longer range. The detection zone is adjustable by the operator. Monostatic systems have a cone shape and can be set from 20 m to 125 m in length with a width of 1 m to 8 m. Bistatic systems have an oval detection zone up to 500 m long and 6 to 12 m wide. When the microwave sensor unit is carefully positioned, the detection zone can follow moderate undulations in the local terrain. Special consideration must be given to screening false alarms resulting from wildlife and vegetation where these sensors are used. Many models are available and a unit costs in the range of \$3,000 to \$5,000.

Infrared Break Beams

Infrared break-beam sensors detect changes in the signal power of an infrared beam created between a transmitter and a receiver (referred to as an "active system"). When an intruder breaks the beam (not visible to the human eye), the signal strength at the receiver lens is reduced, generating an alarm. The technology has been used around buildings for security purposes for about 20 years. The typical separation of the transmitter and receiver is about 100 m but new systems can have a line-of-sight separation as far apart as 150 m. The simplest version of a break-beam system consists of a single pair of sensors mounted on tripods. Such a system can also be portable. Electric power may be 120 volt AC or from 12 volt DC sources. The operating temperature is -30°C to +60°C.

A more complex system of multiple transmitters and receivers can be installed on poles at each end of the detection zone. The detection zone thus becomes a vertical plane and can measure the profile of an object passing through it. If parallel sets of break beams are used, the system can determine if an object is greater than a specified length as well as its direction of travel. A single set of sensors costs approximately \$500 (not including the communication equipment).

Weight Sensors

In well-defined locations such as roads and paths, vehicles passing a point can be detected using a weigh-in-motion system (WIM). A WIM system consists of two magnetic sensors and a capacitance-type sensor. The system can be calibrated to only report vehicles weighing greater than a specified weight and thus screen extraneous information. WIM systems cost approximately \$25,000.

Unattended Ground Sensors

Several commercial sensors using infrared, magnetic, break-wire, and seismic detection phenomenologies are available. Sensor units are powered by batteries and are buried in the ground or placed near the surface. A system may be assembled using sensors with different detection phenomenologies. The detectors sense activity in an area, but cannot assess the nature of the activity. Each sensor is assigned an identification number. When activity occurs, the sensor transmits its identification code by radio as a short digital burst. An antenna is normally attached to the sensor for line-of-sight radio communication up to 800 m. Signal repeaters can be added for more range. An operator at the reception station notes the identification number and cross-references to a location. Receiving stations may vary from hand-held units to permanent monitoring stations. A large number of sensors will require a computer to display sensor status on a map. A beacon can be positioned among the sensors to indicate if the radio signal is being jammed.

The Mini Intrusion Detection System (MIDS) is representative of commercially available sensors. The sensors can operate for 2 to 3 months from a common 9-volt battery, depending on the level of activity in the area being monitored. An external weather-proof battery pack assembly can replace the internal battery and extend the operational life by a factor of 10. Radio communication occurs in the 138-MHz to 153-MHz band. The following summarizes the various MIDS sensor phenomenologies. The detection range varies with local conditions.

- **Seismic** – Nominal detection range: 10 to 30 m for people walking and 100m to 300 m for vehicles. The sensor can be tuned to reduce false alarms resulting from natural activity.

- **Magnetic** – Nominal detection range: 3 m for a person with a rifle and 20 m for a medium truck.
- **Passive Infrared Detector** – Nominal detection range: 30 m for people and 50 m for vehicles. The sensor can be tuned to reduce false alarms resulting from natural activity.
- **Infrared Break-Beam Detector** – An object must block the infrared beam to cause an alarm. There is a 30-m maximum range between the sensor's transmitter and receiver.
- **Break-Wire Detector** – A fine wire is stretched across a potential path for intruders. The length is selected to match local conditions. When the wire is broken, an alarm is transmitted.
- **State-of-Health Beacon** – A radio transmitter located among the sensors that broadcasts every 10 minutes to verify that the system is operating and is not being jammed by other radio activity.

MIDS sensors cost \$300 to \$500 each. Hand-held receivers cost \$550 to \$1300. A radio relay costs \$1200.

Video Cameras

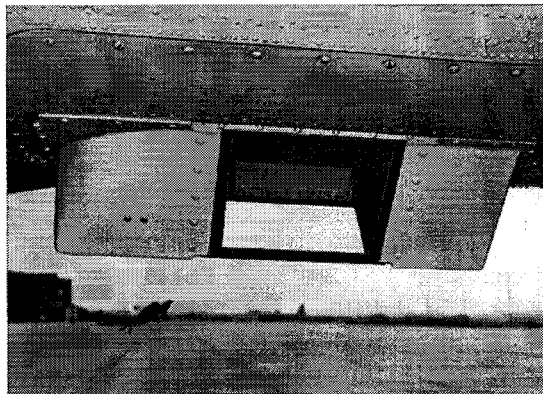
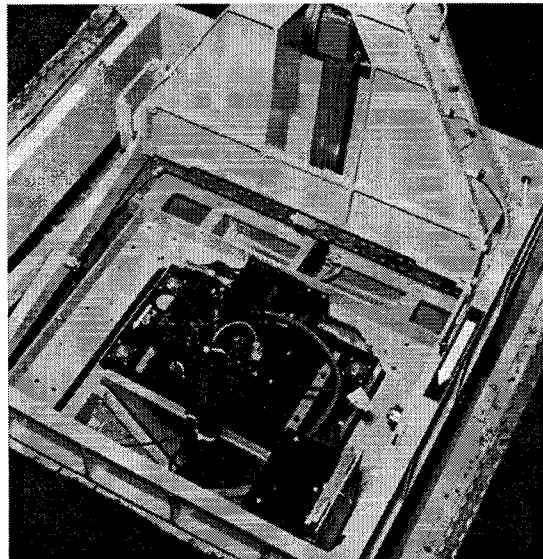
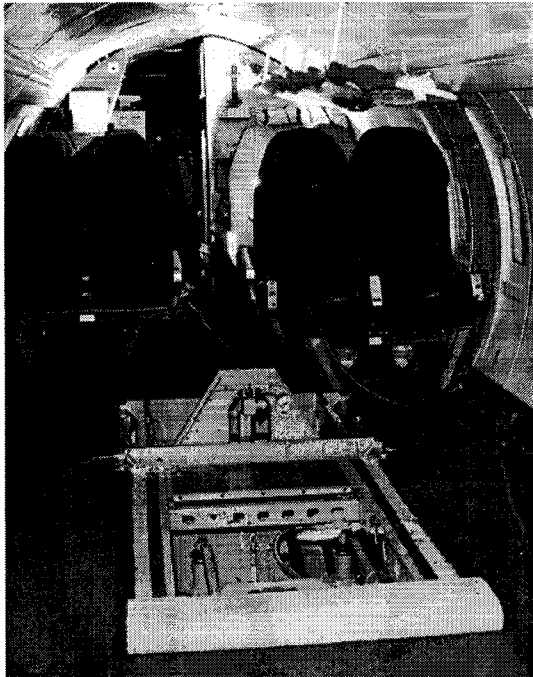
Video cameras are primarily used to determine the cause of alarms and document events. They may also be used as part of a video motion detection system that detects changes within the field of view. In the assessment mode, an alarm transmitter interprets sensor signals, determines if an alarm condition exists, and instructs the video camera to operate. The camera takes video snapshots that it transmits to a remote receiving station. The receiver station displays the alarm information and provides the operator interface to the system.

Many commercial models of cameras are available at a cost between \$100 and \$3000. A motion detection unit with adjustable sensitivity, if added, costs about \$500. A typical capability under low-light conditions is .07 lux (defined as the intensity of one candle at a distance of 1 meter). Most cameras have an automatic iris control to adjust to changing light conditions. Rugged containers permit operation in adverse climates. Extreme cold may require a heater and blower to warm circuitry and prevent condensation.

Aerial Sensors

Sensors mounted on aircraft can be quickly dispatched to monitor terms of an agreement and can achieve much higher resolution than is currently available from commercial satellites. Aerial monitoring, by definition, must be cooperative because aircraft need permission to fly over national territory. The Open Skies Treaty provides an excellent example of the type of monitoring system that could be used on the Korean peninsula. The treaty was originally intended to provide transparency in significant

military activities and build confidence between NATO and the Warsaw Pact. Negotiations continued after the Warsaw Pact disbanded, and the treaty was opened to the new republics and non-NATO members. The treaty is still in the ratification phase and has not yet entered into force. Complimentary bilateral agreements are permitted. Hungary and Rumania signed a separate agreement in 1991 to reduce bilateral tensions. The two countries use only optical sensors, and they continue to perform overflights. Figure F-1 shows some sensors and their installation on the British aircraft to be used for the Open Skies Treaty. The four types of permitted Open Skies sensors and their associated resolutions are listed in Table F-1.



a. Infrared line scanner (left) b. Camera port (top right) c. Installation on aircraft(bottom right)
Figure F-1: Sensors on the British Opens Skies Aircraft

Table F-1. Open Skies Treaty Aircraft-Mounted Sensors

Sensor Type	Spatial Resolution
Optical Camera	30 cm
Video Camera	30 cm
Infrared Line Scanner	50 cm
Synthetic Aperture Radar	3 m

Optical and Video Cameras

Large-format aerial cameras are commonly used for mapping purposes. A typical camera uses a film width of 24 cm with a film length of 120 m. A useful image area of 23 x 23 cm per frame results in 420 high-resolution images per roll. Images can be acquired at three-second intervals during flight, which permits overlapping coverage of the ground with aircraft speeds of 460 km/hr or slower at 300 m or greater altitude. Any color or black and white film can be used to fit specific mission requirements. High-resolution color video cameras are used in daylight recording operations. Cameras are capable of shutter speeds of up to 1/10,000 of a second. Shutter options enable the camera to produce clear images in still or slow-motion playback even when the objects are moving at very high speeds.

Infrared Line Scanner (IRLS)

IRLS is a passive thermal infrared sensor that is especially useful for nighttime reconnaissance of heat-generating targets. Operating much like a video camera, the imager is sensitive to only thermal infrared energy. Its lens usually permits the user to select one of several levels of magnification. Data acquired is recorded with a high-resolution video recorder using the 8mm format, which captures higher frequencies and bandwidths than the conventional VHS format.

Synthetic Aperture Radar (SAR)

SAR is an airborne imaging radar that forms images by transmitting electromagnetic energy and sensing echoes of the reflected energy from the ground target area. This system produces high-resolution, two-dimensional images, similar in some ways to a photograph. The SAR gathers target echoes at many points along the aircraft's flight path and stores them in a digital form. The system's digital signal processor performs range and azimuth processing to create an image. The SAR can produce images during day or night operation and under adverse weather conditions, including heavy cloud cover and precipitation. As a result, radar images can be acquired when conventional photographic and video systems cannot be used.

Sensor Resolution

The resolution of an imaging sensor defines the smallest items detectable and refers to the size of the picture elements that comprise the image. Figure F-2 illustrates the concept for the detection of tanks using grids representing resolutions of 15 m and 3 m. Table F-2 lists typical requirements for resolution to detect and classify various types of objects. Detection and characterization are different activities. In the example in Figure F-2, the tanks could be detected with 3 m resolution although their model could not be identified.

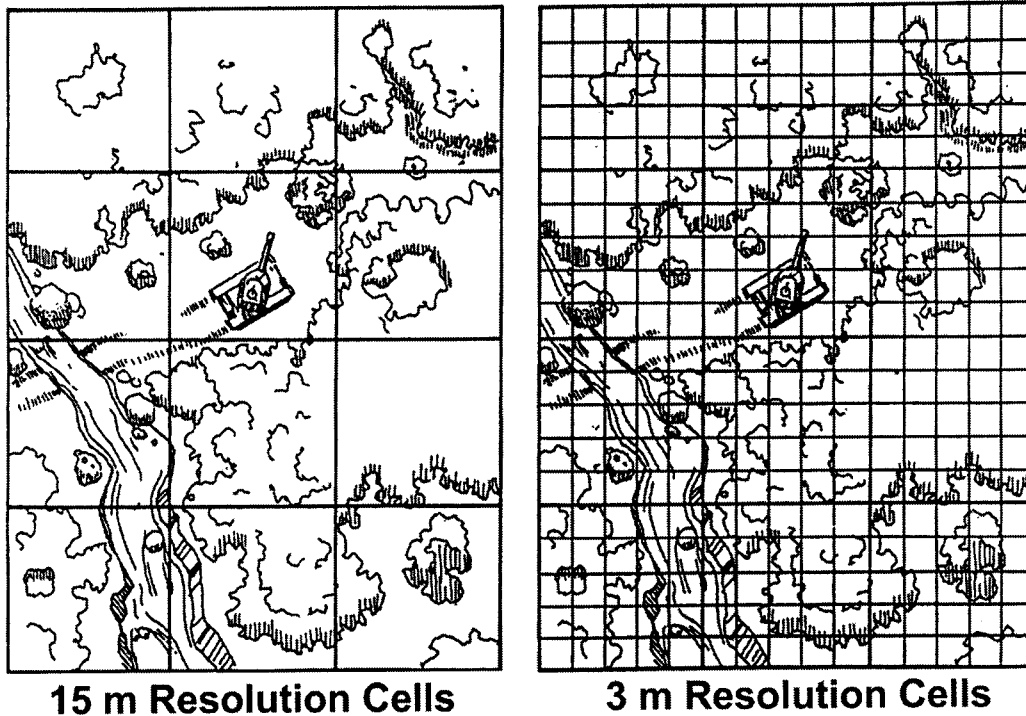


Figure F-2 Detectability of Tanks at Different Levels of Resolution

Table F-2: Typical Requirements for Resolution¹

Target ^a	Detection ^b	General ID ^c	Precise ID ^d	Description ^e	Tech Analysis ^f
Bridges	6	4.5	1.5	1	0.3
Supply Dumps	1.5-3	0.6	0.3	0.03	0.03
Troop Units (in bivouac or on road)	6	2	1.2	0.3	0.15
Airfield Facilities	6	4.5	3	0.3	0.15
Rockets and Artillery	1	0.6	0.15	0.05	0.045
Aircraft	4.5	1.5	1	0.15	0.045
Surface ships	7.5-15	4.5	0.6	0.3	0.045
Vehicles	1.5	0.6	0.3	0.06	0.045
Ports and Harbors	30	15	6	3	0.3
Coasts, Landing Beaches	15-30	4.5	3	1.5	0.15
Roads	6-9	6	1.8	0.6	0.4
Urban Areas	60	30	3	3	0.75
Terrain	—	90	4.5	1.5	0.75

a. Chart indicates minimum resolution in meters at which target can be detected, identified, described, or analyzed. No source specifies which definition of resolution (pixel-size or white dot) is used, but the chart is internally consistent.

b. Detection: Location of a class of units, object, or activity of military interest.

c. General Identification: Determination of general target type.

d. Precise identification: Discrimination within target type of known types.

e. Description: Size/dimension, configuration/layout, components construction, equipment count, etc.

f. Technical analysis: Detailed analysis of specific equipment.

Sources: Senate Committee on Commerce, Science, and Transportation, *NASA Authorization for Fiscal Year 1978*, pp. 1642-1643, and *Reconnaissance Hand Book* (McDonnell-Douglas Corporation, 1982), p.125

¹ Florini, Ann; *The Opening Skies: Third Party Imaging Satellites and U.S. Security*, International Security, Vol. 13, No. 2 (Fall 1988), p 98

Commercial Satellite Imagery

Commercial satellites provide wide-area monitoring and can detect construction or changes in roads, large buildings or facilities, and vegetation patterns caused by human activity. Images can be digitally processed by commercial software for analysis of features. Combining different spectral bands permits viewing of the image in false color. For example, the near-infrared spectrum shows healthy vegetation as red. Table F-3 summarizes currently available imagery. Cost per image varies from \$2,000 to \$5,000.

Table F-3. Commercial Satellite Characteristics

Satellite	Country	Resolution	Sensitivity	Revisit Time
LANDSAT	USA	30 m	Color (7 bands)	16 days
SPOT	France	20 m/10 m	Color (3 bands) or black and white	26 days
KVR-1000	Russia	2 m	Black and white	N/A
ERS-1	EEC	8-30 m	Synthetic aperture radar	35 days

Significant improvements are expected by the turn of the century in the coverage, timeliness, and variety of commercial satellite imagery. Digital images with resolution to 1 m will be available. Improved multispectral and radar images will also be available. Although useful for monitoring, commercial satellite images are not currently timely. Planned improvements may shorten the acquisition process to a few days. Commercial imagery could still not be used to track quickly changing events. In addition, all satellites are limited by the time required to repeat the image of the same location (revisit time).

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Appendix G

Table G-1. Cost Evaluation for the Conceptual Sami-Ch'on Valley Monitoring System

Equip- ment Zones	Chain Link Fence		Fiber Optic Sensor		Taut-Wire Fence		Magnetic Sensors		Video Assessment	
	Size	Cost \$	Zones	Cost \$	Zones	Cost \$	QTY	Cost \$	Cam- eras	Cost \$
South A*	4 km	40000	2	20000						
South 1**					9	150000	350	175000	19	47500
South B	8	80000	4	40000						
North A	5	50000	3	30000						
North 1					7	110000	175	87500	12	30000
North B	4.5	45000	3	30000						
North 2					4	75000	175	87500	9	22500
North C	1	10000	1	10000						
North 3					5	80000	150	75000	9	22500
North D	8	80000	4	40000						
Subtotal	30.5	305000	17	170000	25	415000	850	425000	49	122500

TOTAL

\$1,437,500

* Letter designations refer to the zones of less intensive monitoring.

** Number designations refer to the zones of more intensive monitoring.

The following assumptions were used in the cost estimate:

1. Equipment can tolerate terrain/weather conditions.
2. Radio frequency allocation for communication has been obtained.
3. AC power supplied to fence sensors.
4. Magnetic and video assessment sensors are battery powered.
5. Costs do not include labor for operation or maintenance.
6. An existing chain link fence is available to support the fiber optic sensor.

General note about cost estimation for monitoring systems:

A detailed cost analysis for the full conceptual system is beyond the scope of this analysis. Operating costs are impossible to estimate without making certain assumptions. The true cost of a monitoring system depends on the distinction between fixed and variable costs. For example, government-owned equipment that is redirected to monitoring activities does not cost the party any additional funds. The same logic applies to military or government personnel who are directed to support monitoring and verification. Many parts of the monitoring system already exist (e.g., observation posts in the DMZ) and could be used by the monitoring organization. Military aircraft could be loaned to the monitoring organization for the aerial monitoring function for no additional cost. The international community might also provide personnel and material support.

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