THE ROLE OF SATELLITES IN COOPERATIVE MONITORING

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The participants in the ACRS process have agreed on the importance of CSBMs, and the need to develop mechanisms to prevent accidental war, surprise attack, and crisis instability. The Sinai I and II disengagement agreements and the 1979 Israel-Egypt Peace Treaty established useful precedents.[1] The models provided by the CSCE and CFE systems have also been examined and discussed, and many of the elements, such as prenotification, conventional arms limitations, and limits on military exercises, are under consideration. CSBMs and measures to increase stability and mutual security are also incorporated in the Israel-Jordan peace treaty, and are important elements in the negotiations between Israel and Syria.

To insure compliance and provide assurance against the possibilities of breakout and sudden abrogation of these limitations, such measures require the development and long term implementation of verification and monitoring systems. In the CFSE and CFE context, verification mechanisms include the "Open Skies" Treaty for aerial monitoring, and a highly detailed regime for on-site inspection of military bases, production facilities, and related installations.[2] In addition, the space and aerial monitoring technologies have the additional benefit of providing data for environmental monitoring and regional economic coordination.

In order to implement many of these verification and monitoring systems, a high degree of openness and intrusiveness is generally required. In the early stages of the developing peace process in the Middle East, however, this type of openness is difficult (perhaps anathema) to many (perhaps all) of the states. In addition to a long tradition of military secrecy, the potential for conflict continues, particularly with respect to states that are not involved in the ACRS framework and other aspects of the Middle East peace process. For example, Israel and Jordan may be more open and willing to accept a cooperative monitoring system based on high degree of intrusiveness with respect to each other, but neither would be willing to risk the flow of sensitive military information to Syria or Iraq.

Indeed, in any region in which the probability of military conflict is high, and deterrence and defense are of primary importance, the trade-off between reassurance based on openness andmilitary secrecy is a critical issue. The conditions in the Middle East, with the inherent instabilities and continuing conflicts, are very different from Europe after the Cold War and the demise of the Soviet Union. As a result, the nature of CSBMs and monitoring regimes must be designed specifically to meet conditions in the region.

THE CONCEPT OF COOPERATIVE MONITORING

In a broad sense, two approaches to verification and the transfer of information in the context of CSBMs and arms limitation agreements can be identified. The first approach is based on unilateral "national technical means" of verification (NTM), in which non-intrusive remote technologies are used to monitor compliance. For example, remote seismic systems provide information on nuclear weapons tests, and, as will be discussed in greater detail below, satellite systems are used by the US and Russia to verify implementation with the SALT, ABM, and START strategic weapons limitation agreements. Such systems are non-intrusive; they are operated remotely without requiring the active cooperation of the state that is being monitored.

The second approach to the transfer of information in CSBMs and verification of arms limitation agreements is based on the concept of cooperative monitoring. This approach is more intrusive, requiring the states involved to cooperate in the operation of sensors and reporting systems on their territory or over their air space, and, in some cases, to agree to on-site inspections. Examples of cooperative monitoring regimes include the verification provisions of the Intermediate-range Nuclear Forces Treaty (INF), the systems of cameras, seals and other devices operated by the International Atomic Energy Agency (IAEA), the monitoring systems for the Sinai I and II disengagement agreements, and the CFE and CSCE verification regimes. Verification has been a central issue in the context of the ACRS discussions and workshops. In addition, the concept of regional Cooperative Monitoring Centers (CMC) has been examined in a number of recent conferences and meetings, including the July 1994 Middle East Cooperative Monitoring Workshop.[3] In October, the delegates to the ACRS conference in Paris made progress towards the establishment of a regional crisis-resolution center in the region, and this center could serve as the foundation for the establishment of a Middle East cooperative monitoring center.

In the context of regional (or bilateral) CSBMs and arms limitation agreements, the countries involved must establish a regime for verifying compliance and exchanging information. Limited force zones, for example, would specify ceilings on the types and numbers of large platforms (i.e., tanks, SP artillery, towed guns, combat aircraft, mobile air defense systems, attack helicopters, naval craft, ballistic missiles launchers, etc). To monitor compliance, the states involved could, at least in theory, agree on a system of electronic tags and tag scanners, video, weight sensors, motion sensors, etc. to monitor the movement and location of treaty-limited items. The various remote sensors would transmit their information to a regional CMC, where it would be available to the various participants. This system, however, is not based on NTM, but requires active cooperation and a high level of intrusiveness, and does not preserve a balance between military secrecy and reassurance.

COOPERATIVE SATELLITE TECHNOLOGY

In addition, or as a step towards the implementation of these ground and aircraft-based monitoring technologies, satellite-based systems can be considered. Satellites have the advantage of being non-intrusive means of verification. Indeed, during the Cold War, the first stages of confidence building and information exchange between the US and Soviet Union began unilaterally through the use of overhead satellites. Although these were initially developed in the early 1960s as reconnaissance platforms to replace the high-altitude aircraft (such as the U-2, that had become vulnerable to SAMs), within a few years, such systems had been transformed into national technical means of verification (NTM). Over a period of a few years, both the US and Soviet leadership acknowledged the important contribution of such systems to stability and confidence building,[4] and in the 1972 SALT and ABM agreements, the two sides formally agreed not to interfere with each other's NTM.[5]

In addition, the CSCE 1986 Stockholm Document and the 1990 Vienna Documents explicitly note that "the participating states recognize that National Technical Means can play a role in monitoring compliance...". In the context of the CFE agreement, the Western European Union (WEU) has established a regional satellite monitoring agency (RSMA) at Torrejon, Spain for the purpose of "monitoring

disarmament treaties, crisis-management and following problems connected with the environment." In the long term, this center is designed to form the foundation of a European space-based observation system for the "maintenance of international peace and security".[6] In the initial phase, this center uses images from the Spot, ERS, and Landsat satellites, and plans call for using the data from the Franco- Italian- Spanish HELIOS military observation satellite when this system is available.

The situation in the Middle East is, of course, quite different from the US-Soviet case of the CFE, but a carefully constructed regional cooperative monitoring system involving non-intrusive satellite observation can play an important role in CSBMs and verification of agreements. Such a system could overcome many of the traditional objections and obstacles to the direct exchange of sensitive data and on-site verification of closed military facilities.

A regional system would give all participating states equal access to the verification information specified under regional cooperation agreements, CSBMs and treaties. Depending on image resolution and orbital characteristics, such a facility could provide data necessary to verify agreed limits on deployments in the context of the ACRS process in the region. In particular, this would allow non-intrusive verification of treaty-limited items, such as the number of tanks and other platforms in specified zones, limits on the size of military exercises, construction restrictions (runway length, number of aircraft and tank bunkers in specified bases), etc.[7] If agreement is reached on the use of more intrusive sensors, video systems, and other technologies, these can be linked with the satellite data provide more detailed coverage, particularly where satellite images are insufficient to verify full compliance with agreements.

The technological basis of such a cooperative regional satellite monitoring center can be provided through civil commercial observation satellite systems. The individual states in the region already have access to images from the commercial systems operated by the US, France and Russia, and many operate ground receiving stations for SPOT and Landsat. In addition, images of specific sites can be ordered from the operators of these systems and the Russian Soyuzkarta. (Zimmerman notes that the Golan Heights and other "sensitive" areas are among the more popular targets for clients of SPOT imaging.[8]) Thus, a cooperative satellite center does not require the introduction of a new technology in the region.

The resolution necessary for a Middle East CSMC depends on the specific verification requirements. In general, high-resolution imagery is defined at 4 meters,[9] which is less that the capabilities of the existing commercial systems; Landsat (30m), Spot (10m panchromatic), and Soyuzkarta (5m).[10] (See Table 1.) Imaging systems with 15 to 30 meter resolutions might be sufficient to monitor the absence (or demonstrating the presence) of large scale tank concentrations in limited force zones. Five-meter resolution images are useful to monitor limits on tank and aircraft shelters within bases, as well as other limitations.

More detailed commercial satellite imaging will probably be available in the next few years, should this be required for CSBMs and verification of regional agreements. Soyuzkarta has announced plans for a satellite with up to 2m resolution,[11] and the next generation of Spot imagers is expected to provide 5m resolution. A number of American firms have announced plans to develop similar systems, including SIS (Space Imaging Satellite), and EYEGLASS, which is being

developed by a consortium of Orbital Sciences, Litton Itek, and GDE, and will have a resolution of one meter.[12] Japan is also planning to launch the ALOS remote- sensing satellite with 2.5m imaging and radar. (The French Helios military system to be used in the WEU satellite verification center will offer 1m resolution.)

Thus, existing and planned imaging systems can serve as the basis for the creation and operation of a regional cooperative satellite monitoring center. These satellites are owned and operated by the co-sponsors (the United States and Russia), and, in the case of France, under the European Union, which is also a participant in the ACRS process, as is Japan. The use of existing systems can reduce costs to a minimum, and allow for the rapid operationalization of such a center. (The production and launch costs for a new dedicated system can be estimated at $300 million, based on the published cost estimates for the EYEGLASS satellite.) No technical assets will transferred, and this center will not involve any of the problems associated with the transfer of dual-use technology.

TECHNICAL AND POLITICAL REQUIREMENTS

All forms of information on military deployments and the location of targets can be exploited to provide data for offensive military operations. It is therefore necessary to insure that a regional satellite verification center cannot become a source of instability or a basis for changing the balance of power in the region.[13]

In part, this can be accomplished through careful definition of the field of view and targets of satellite images. The coordinates and resolutions selected for transmission would have to be defined clearly and systematically in advance, to assure that the data that is relevant for treaty verification is provided, while unrelated information outside the agreed parameters is excluded. (This would not prevent the individual states from ordering images or purchasing data from satellite imaging services outside the framework of the regional center.)

As in the case of SALT, ABM, and CFE Treaties, the participants in the Middle East would also agree not to interfere with the satellite verification process, particularly by abstaining from measures that would make image interpretation and analysis with respect to treaty compliance ambiguous or impossible. Large scale underground construction, as well as the use of covers and horizontal screens under which treaty limited items may be transported or located, would have to be banned (or provisions made for on-site inspection in such cases).

It is also necessary to insure equal access to all the ACRS participants and to all the data specified under the agreed framework for operating the center. Any form of filtering by a third party (whether a single country or an international organization) will be seen as a potential source of discrimination. A number of policy makers and analysts have proposed the establishment of international satellite monitoring networks and systems, generally to be operated by the United Nations or a UN-affiliated agency similar to the IAEA, but these are not appropriate for the Middle East.[14] It is important that the data be provided in "raw" form, so that all the parties are able to analyze it independently and with assurance that key data has not been overlooked or removed. Each state will know precisely what information is available to the other states, thereby reducing (but not eliminating) the potential for offensive use of this information. In addition, the access to data should be restricted to the participants in the

ACRS process, although this is no guarantee that militarily sensitive information does not reach Iraq or Iran.

Orbital characteristics, targeting, resolution and type of sensors are also important factors that must be considered. The orbit of the satellites will determine the field of view and targets for imaging, the frequency of satellite passes (return time), and the sun angle. For example, a limitation agreement covering construction on military bases and in specific zones could require images of each base under the agreement once every two weeks, while limits on tank deployments in these zones might require daily imaging. Unless satellite coverage can be provided, such limits cannot be monitored. Imaging should also be symmetric with respect to resolution and frequency for all the states involved.

POTENTIAL PROBLEMS OF COOPERATIVE SATELLITE MONITORING

In examining and assessing the concept of a cooperative satellite monitoring center for the Middle East, it is also important to recognize potential limitations and problems. First, it should be noted that such a system is not designed to go beyond the terms of the multilateral agreements that define the operating characteristics and coordinates for imaging. This system would not be used to search for or identify ballistic missiles or chemical warfare facilities, unless these are explicitly included in the regional agreements, nor would it scan areas that are not defined in these agreements.

A regional center will not replace or eliminate the rights of the individual states to operate national space-based observation and intelligence systems. Thus, this proposal is very different from the proposed International Satellite Monitoring Agency, as proposed initially by France, and discussed in United Nations Pugwash forums in the 1980s.[15] The supporters of the ISMA concept expected this agency to search for signs of illegal development of non-conventional weapons, prevent the outbreak of war, provide broad threat assessments and support peacekeeping.[16] In contrast, the CSMC is strictly limited to verifying agreements among the countries participating in the Middle East ACRS negotiations, and is designed as part of or linked to other technologies used in cooperative monitoring in the ACRS context.

Nevertheless, some analysts have expressed the concern that a regional and cooperative center could ultimately lead to restrictions of the satellite activities of the individual states, outside the regional framework.[17] The concept of "open skies" for satellites was developed in the early 1960s, and has been accepted internationally. The operations of the regional center should not interfere with this in any way. Participants would not be restricted from using national technical means, including satellite technology, both for national security and for unilateral monitoring and verification.

In a broader sense, the uncertainty inherent in the interpretation of satellite data could provide a source of conflict, rather than cooperation.

In fact, the problem of uncertainly and the potential for conflict in the interpretation of data exists in all forms of cooperative monitoring, irrespective of technology and situation. In periods of tension during the Cold War, conflicts over interpretation of satellite images increased. For example, in the 1980s, the US claimed that these images showed that a radar installation near Kransnoyarsk constituted a violation of the 1972 Anti-Ballistic Missile (ABM) Treaty, while the Soviet Union denied this charge. The availability of high-resolution satellite images did not prevent conflict over this issue, but the conflict was a product of the broader tension that existed during

this period. The same is likely to be true in the Middle East; uncertainty in verification and monitoring, in any form, will reflect the broader state of political relations, and will not constitute an independent source of conflict.

Another potential problem with regional or international satellite observation is related to the inherent asymmetries between the states being observed. For example, Gupta notes that if equal areas are imaged in the different states, those states with smaller land areas will be covered in greater detail than the larger states. In this situation, the area under observation in the smaller states (Israel, Lebanon, Kuwait, Oman, and Qatar) would cover a greater percentage of the country than in the case of the larger states (Egypt, Syria, Iraq, etc.) This could be militarily disadvantageous for the small states, while affording the large states with the ability to hide treaty-prohibited items or activities in areas not under observation.

To prevent this imbalance, the areas under observation must be carefully considered by the states involved, and the small states in particular. If the agreements on limited force zones between states reflect the asymmetries in area, as is the case in the Egyptian-Israeli peace treaty, for example, then the area under observation for verification will also be structured to reflect the asymmetry. In this way, the small states can insure that the regional satellite observation will not have an uneven impact on security.

Finally, the development of a regional center might be seen as a potential source for the transfer of advanced photo-interpretation skills. As noted above, no hardware would be transferred, but it is possible that the states participating in this center might be able to learn more about satellite observation and technology, and to use this knowledge to develop deception and camouflage measures. The prospects of technology transfer in the area of image processing and interpretation are of particular importance and should be carefully monitored.

At the same time, the regional satellite center is unlikely to provide technology or knowledge that could not be obtained through direct links to the commercial satellite providers. The impact of a regional center is likely to be much lower than the consequences of the unilateral satellite observation capabilities being sought by many of the individual states. With Saudi Arabia's purchase of an equity stake in EYEGLASS, the UAE seeking to obtain its own high-resolution satellite, and reports of an Israeli program to develop similar technology, the additional impact of a regional center using commercial satellite systems is likely to be negligible.

SATELLITE OBSERVATION FOR REGIONAL ENVIRONMENTAL MONITORING AND ECONOMIC COOPERATION

Commercial and civil observation satellites have been used primarily for environmental monitoring and in support of economic activities. Oil spills, desertification, air pollution, water quality, and many other environmental changes are routinely observed and monitored using non-military satellites. From earth orbit, the large scale impacts caused by these environmental changes are readily detected and assessed. Many of these environmental changes have regional impacts, and effective responses also require a regional framework. For example, pollution of the Mediterranean is clearly a regional issue, and a regional cooperative satellite monitoring center could provide significant assistance in this process.

Similarly, satellites are used for mineral exploration, agricultural assessments, and other economic activities. While the cooperative aspects of satellites observation for economic purposes seem relatively limited, a regional system could be used in some specific areas. Space-based observation can assess the availability of water from winter snowfalls, and this data can be used in support of multilateral water sharing agreements.

It should be noted that the satellites and imaging systems that are useful for verification of arms limitations agreements and demilitarized zones are not necessarily the best systems for environmental monitoring and economic cooperation. While broad-spectrum low-resolution systems, such as Landsat, provide the optimal technology for environmental monitoring, verification of arms limitation agreements requires high-resolution imaging. A Middle East satellite monitoring center based on commercial systems would have access to both types of systems, matching the available services to each specific objective.

SUMMARY

The concept of a regional cooperative satellite monitoring center, designed to provide data for verification, as well as for environment or economic purposes, is not confined to the Middle East. In addition to the existing WEU center at Torrejon, Spain, other regional systems have been proposed in areas such as South Asia, the Korean Peninsula, etc. In a general article on the impact of commercial satellite imaging on international stability, Vipin Gupta notes, "In conjunction with multilateral agreements covering a particular geographic area, commercial satellites allow ... groups of states ... to verify compliance from space."[18]

In addition, a satellite monitoring center can also provide the foundation for cooperative space-based earth resources and environmental assessment projects in the region. The data provided from space is very useful for joint assessment of cross-boundary issues, such as oil spills, water and air pollution, and mineral exploitation. As the Middle East peace process continues, and opportunities for cooperation increase, satellite observation can provide a useful contribution, in conjunction with other technologies available through a regional cooperative monitoring center.

At the same time, the potential impact of a Middle East cooperative satellite monitoring center should not be exaggerated. Like other technologies, satellites can provide a useful tool in the implementation of regional agreements, but these agreements themselves are dependent on political factors. At most, the technology can support the political process, and enhance regional cooperation and confidence building, but it cannot substitute for political agreements.

Table 1: Ground resolution requirements for various targets -- reprinted from Vipin Gupta, New Satellite Images for Sale: The Opportunities and Risks Ahead, Center for Security and Technology Studies, Lawrence Livermore National Laboratory, 1994, p.20:

REFERENCES:

1.These issues were discussed during the Cooperative Monitoring Workshop, Sandia National Laboratories, July 1994.

2.See Verification of Disarmament or Limitation of Armaments: Instruments, Negotiations, Proposals, UNIDIR, Geneva, 1992; and Michael Krepon, Dominique M. McCoy, Matthew C.J. Rudolph; A Handbook of Confidence-Building Measures for Regional Security The Henry L. Stimson Center; Handbook No.1, September 1993

3.Arian L. Pregenzer, "Crisis Prevention Centers as Confidence Building Measures: Suggestions for Northeast Asia", Verification and Monitoring Analysis Department, Sandia National Laboratories, New Mexico, 1994

4.Following the Cuban Missile Crisis in October 1962, Washington and Moscow began to seek means of reducing the risk of accidental war, and preemptive strikes. In this context, the use of "observation satellites to promote international security" began to be discussed. US Deputy Assistant Secretary of State Richard Gardner stated that "Space photography can contribute to the reduction of risks of war ... And it is a use of space which may prove important someday in monitoring disarmament agreements." See Gerald M. Steinberg, Satellite Reconnaissance, Praeger, 1983

5.Article XII of the 1972 ABM Treaty, and Article V
of the SALT I agreement, signed in Moscow in May, 1972, state:

> "1.For the purpose of providing assurance of compliance with the provisions of this treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law.
> 2.Each Party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this article.
> 3.Each Party undertakes not to use deliberate concealment measures which impede verification by national technical means of compliance with the provisions of this treaty."

6.Henny J. van der Graaf, "Conventional Arms Control Verification", Verification of Disarmament or Limitation of Armaments: Instruments, Negotiations, Proposals, UNIDIR, Geneva, 1992, p.132; Western European Union, Document 1393, 8th November 1993, The development of a European space-based observation system - Part II, REPORT (1), Technological and Aerospace Committee (2)

7.These issues were discussed during the Cooperative Monitoring Workshop, Sandia National Laboratories, July 1994.

8.Peter Zimmerman, "From the SPOT Files: Evidence of Spying", Bulletin of Atomic Scientists, Vol. 45, No. 7. July 1989, pp.24-25

9.Vipin Gupta, New Satellite Images for Sale: The Opportunities and Risks Ahead, Center for Security and Technology Studies, Lawrence Livermore National Laboratory, 1994, p.2fn

10.According to reliable reports, US military satellites provide images with a resolution of 30 cm or less.

11.Gupta (1994) notes that in 1992, Russia began offering degraded intelligence-grade images from the KVR-1000 camera, with a resolution of 2 meters. However, the actual availability of these images has been limited by political and other factors. p.4

12.This consortium has sought to sell a large equity share to Saudi Arabia, in return for which Saudi Arabia will receive exclusive rights to images in the Middle East, (with the exception of Israel). See Gupta, 1994, p.15-16. However, there are now indications that this proposed sale will not be carried out.

13.For many years, the Soviet Union objected to US overhead reconnaissance on the grounds that these systems were being developed to acquire targeting information for a first-strike.

14.Gerald Steinberg, "Political Factors in the Development and Implementation of Technology-Based Confidence-Building Measures", Proceedings of the Conference on Technology-Based Confidence-Building Center for National Security Studies, University of California and the Los Alamos National Laboratory, July 1989 pp.413-426; John Tirman, "International Monitoring for Peace", Issues in Science and Technology, 4, No. 4, (Summer 1988): 53-58; B. Jasani and T. Sakata, editors, Satellites for Arms Control and Crisis Monitoring, SIPRI/Oxford University Press, 1987.

15.See B. Jasani and T. Sakata, editors, Satellites for Arms Control and Crisis Monitoring, SIPRI/Oxford University Press, 1987, and Michael Krepon, Peter Zimmerman, Leonard Spector, and Mary Umberger, eds., Commercial Observation Satellites and International Security (New York: St. Martin's Press, 1990)

16.A.S. Krass, "Arms control Verification", in Arms and Disarmament: Sipri Findings, edited by Marek Thee, New York, Oxford University Press, 1986 pp.371-378; and John Tirman, "International Monitoring for Peace", in Issues in Science and Technology, Vol. 4, No. 4, Summer 1988.

17.See, for example, Gupta, pp.26-30

18.Gupta, 1994, p.23