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## **Multilateral On-going Monitoring and Verification (OMV) of Compliance: Nurturing Cost-Effectiveness**

F.R. CLEMINSON

## Multilateral On-going Monitoring and Verification (MV) of Compliance: Nurturing Cost-Effectiveness

### INTRODUCTION

The 1990s will be remembered from an arms control perspective because of the extraordinary level of success achieved in multilateral negotiations; unprecedented in the previous five decades. The entry-into-force (EIF) of the Chemical Weapons Convention (CWC) which occurred in April 1997 and in 1998 the initiation of the process to define and establish an organization for the Comprehensive Test Ban Treaty (CTBTO) are but two of the activities which are illustrative of the flurry of activity which is taking place in terms of internationalizing the monitoring and verification processes.

Add to these, the achievement of an extension of the Non-Proliferation Treaty (NPT) in 1995 and the impressive success and evolution of the CFE Treaty. Taken all together, these achievements, plus others, provide a rich background of data and experience from which researchers might usefully draw. With the termination of the cold War, multilateral non-proliferation, arms control and disarmament (NACD) treaties and agreements have reached a plateau in terms of international security and stability rivalling -- but, at the same time, reinforcing -- those significant bilateral strategic arms agreements between the superpowers of the 1970s and 1980s.

As a result, by the year 2000, literally hundreds of millions of dollars will be expended annually on these various multilateral OMV processes mandated by this increasing number of significant NACD agreements and obligations. Regrettably, the development of these new treaty-specific verification mechanisms is not always accomplished in the most cost-effective manner. These agreements and obligations collectively are destined to play increasingly critical roles in the maintenance and enhancement of international peace and security, both globally and at a regional level. Inadequate attention has been paid up to now with the establishment of cost-effective OMV mechanisms within existing individual agreements. Practically none to the potential for OMV cost reductions through collective actions

One collective method of studying the potential for achieving cost-effectiveness in the overall multilateral NACD OMV process might be to initiate a simple three steps research approach:

- Step one: the review of existing treaties and on-going NACD negotiations to quantify OMV requirements,
- Step two: the identification of proven and effective methods of verification, and
- Step three: the development of a resultant packaging of these applicable technologies and techniques in a mutually supportive manner designed to meet the identified and specified verification requirements. This "packaging" or "layered" conceptual approach should take advantage of and exploit the synergistic effects which exist between complementary OMV methodologies.

OMV requirements can be quantified independently and objectively by reviewing existing and projected NACD agreements and obligations. Identification of commonalities in both technology and in application between specific OMV packages constitutes a simple and particularly useful initial step toward avoiding expensive duplication of effort. Combining past OMV experience, including OSI, with a judicious application of new and proven technologies including in particular remote sensing in all of its forms, can at one and the same time achieve (a) an increase in effectiveness, (b) a decrease in intrusiveness, and (c) a reduction in overall costs.

In the latter context of reduced costs, it seems prudent to study closely existing and projected OMV frameworks established in various forms as integral parts of existing multilateral NACD agreements. Others which may have been developed to meet a variety of obligations assessed in other types of agreement (such as those assumed through membership in supplier control regimes) should be assessed also as part of any comprehensive review.

## **MULTILATERAL NACD AGREEMENTS**

With the exception of the 1972 Non-Proliferation Treaty, it is fair to say that, prior to 1990, there were few NACD agreements which had a significant impact on the then-existing international security agenda. By the end of this decade and century, however, an increasing number of significant multilateral agreements will impinge directly upon contemporary international security and stability; and to an unprecedented degree. Even a cursory examination of the verification provisions of these treaties, reveals that almost all of them depend upon on-site inspection (OSI) as a central monitoring mechanism. By contrast, virtually none of them have incorporated, in any significant way, the use of remote sensing particularly involving overhead imagery (OHI), as a main or supporting method of monitoring.

The following major NACD agreements are included amongst those which collectively have the potential to significantly determine the role of arms control as a central factor in the international security equation.

### ***Non-Proliferation Treaty (NPT)***

- The safeguards provisions of the NPT constitute the International Community's oldest OSI program with more than 30 years of practical experience behind it. While not "cutting-edge" in terms of OMV, it does provide a solid base and supporting detail from which to examine the management and financial aspects of the OMV process. For example, in 1995, the IAEA employed approximately 200 field inspectors on a budget of approximately US\$88 millions. A further US\$14 millions of extra-budgetary support was contributed by 8 member states including Canada. During the year, 554 nuclear facilities and other nuclear material locations were inspected. This entailed a total of 2285 inspections requiring 10167 person-days of inspection effort.<sup>1</sup> On an average, one inspection required 4.5 person days. IAEA inspectors are accustomed to spending approximately 100 days per year in the field.
- The May 1995 NPT Review and Extension Conference examined the future of

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<sup>1</sup> IAEA Press Release 96/11, 21 June 1996: Implementation of IAEA Safeguards in 1995.

the Treaty and agreed upon an indefinite extension of the mandate. One important aspect for review was said to be the treaty verification process. Central to the effective monitoring and verification of NPT compliance is the IAEA's "safeguards". The safeguards regime remains essentially a material accounting process which depends heavily upon the use of on-site inspections (OSI) as a final verification tool. Only recently has overhead remote sensing been raised as a method of improving effectiveness and to date nothing of consequence has been achieved in this regard.

- Throughout this paper, boxes such as the following, will be used to recapitulate certain basic statistics though to be more relevant to the on-going monitoring and verification process. These will focus mainly on OMV cost-related factors (CRF).

**OMV CRF<sup>2</sup>**: In 1995, the IAEA expended 10157 person days (PD) in 2285 inspections at 554 sites. IAEA verification organization includes some 600 staff of which 200 are inspectors. Its budget was US\$88 millions + an additional US\$14 millions (possible increase of US\$4 millions)

### ***Bacteriological and Toxin Weapons Convention (BTWC)***

- From the verification perspective, the BTWC has sometimes been referred to as an NACD treaty with no verification provisions. The fact is that the treaty does provide for a number of "symbolic" verification procedures<sup>3</sup> in the guise of a "Complain/Consult" mechanism which includes the right to report to the UN Security Council (UNSC) if the event is unresolved.
- Prior to 1990, there had been two events, the "Yellow Rain" activities in South East Asia and the "Sverdlovsk Incident" in the USSR, which were relevant, if not particularly enlightening, in terms of illustrating the problem encountered in agreeing upon a monitoring and verification mechanism relating to bacteriological and toxin agents.
- Since 1990, it is the on-going experience accumulated as a result of UNSCR 687(1991) which has served to discriminate further on the problems associated with attempting to verify compliance in the BTW field particularly under non-cooperative conditions. One factor is clear that the development of selective intensive and probably intrusive OSI procedures will be essential to establish a reasonable level of confidence in compliance.
- Following from a two-year review process referred to as "VEREX" which attempted to identify and evaluate possible solutions to satisfy BTWC verification requirements, a number of review conferences were convened in Geneva from 1996 to 1998, but without great success in identifying verification mechanisms which might be applied to the BTWC as a means of strengthening its credibility.
- On the positive side for researchers, certain similarities exist between the BTWC and the Chemical Weapons Convention (CWC) approach as the

<sup>2</sup> CRF=Cost Related Factors.

<sup>3</sup> "A Conceptual Working Papers on Arms Control Verification", F.R. Cleminson and E. Gilman, Arms Control Verification Study No. 1, 1986 page 21.

negotiating records of both will attest. Additionally the contemporary experience of UNSCOM, as well as that now being gained by the OPCW as the CWC is being implemented, will increasingly identify and define significant contrasts and similarities between the two.

OMV CRF: Though process within the context of BTWC review procedures and ad-hoc group activities has been disappointing, increased practical experience is likely to indicate a need for a greater reliance on OSI and on intrusive access. UNSCOM experience is particularly relevant in the extrapolating of possible BTWC OMV costs estimates.

### ***Chemical Weapons Convention (CWC)***

- Within approximately the same timeframe, the Organization for the Prohibition of Chemical Weapons (OPCW), established under the Chemical Weapons Convention (CWC) of 1993, is developing putting into operation a new and precedent-setting OMV regime. It is based primarily upon OSI as well.
- With the signing of the CWC in 1993, the Preparatory Commission for the OPCW began to fabricate the required OMV architecture. Approximately 16,000 facilities and sites are expected to be declared and approximately 400 inspections are likely to be initiated in the first year.<sup>4</sup>
- The Organization for the Prohibition of Chemical Weapons (OPCW), based in the Hague, employs approximately 470 staff members including 211 inspectors. OPCW budget is still in flux due to the intensity of first time operations and these forecasts are difficult to make as yet with any precision. It is reckoned that rises of up to 25% could be expected in present funding estimates.<sup>5</sup>

SUMMARY OMV CRF: With a possible 16,000 sites, 400 inspections are expected in 1st year. OPCW staff approximates 470 including 211 inspectors with budget est. US\$90 millions± 25%/

### ***Comprehensive Test Ban Treaty (CTBT)***

- With the opening of the CTBT for signature in a special session of UNGA 50 in September 1996, initial steps have been taken to set up a CTBT Organization (CTBTO). Central to the treaty is an OMV regime so far based on four remote monitoring methods -- seismic, hydroacoustics, radionuclide and infrasound -- as well as the as yet undefined use of OSI as a verification tool. (The use of overhead imagery has been conspicuously absent during the 2\_ years of negotiations; even as a possible early warning mechanism.)
- Still in the building stage, the CTBTO's provisional technical secretariat is likely to employ ultimately between 250 to 400 personnel.<sup>6</sup> For a CTBTO located in Vienna and based on a 300 person staff, estimates suggest that the budgetary

<sup>4</sup> OPCW Chairman's Non-paper Methodology and Assumption on the First OPCW Budget paper 12/rev. 6, page 3.

<sup>5</sup> YWCW5747: OPCW PrepCom - Budgetary Blues, page 1.

<sup>6</sup> Draft Report of the Site-Visit Team on the visit to Vienna 8-11 July 1996, Conference on Disarmament, Geneva. Page 2.

cost would amount to approximately \$30,000,000.<sup>7</sup> Whether the inspection cadre is included in these figures is not clear.

- In addition to this central agency, specific costs associated with the infrastructure of the International Data Centre (IDC), the national/international cost sharing of a worldwide International Monitoring System (IMS) network, the operation and integration of seismic, hydro acoustic, infra-sound and radiological sensing systems as well as other specialized CTBTO costs would all have to be integrated into a central budget.
- Total capital costs are estimated variously at US\$91 millions and operating costs at approximately US\$72 millions.<sup>8</sup> Other estimates have ranged as high as US\$110-130 millions for start up and approximately US\$100 millions for annual operating costs.<sup>9</sup>

<p><b>SUMMARY OMV CRF:</b> CTBTO 300 persons — US\$30,000,000/initial cost 45 millions/operating costs 28 millions/for a total of 75 millions/(GSMS-16 millions + 9 millions operating)/capital cost US\$91 millions/operating costs US\$72 millions/<sup>10</sup></p>
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### ***Fissionable Material "Cutoff" Treaty (FMCT)***

- Although the CD has discussed the possibility of initiating a negotiation aimed at ending the production of fissionable materials for weapons purposes, its progress has been seriously delayed. Nevertheless, this treaty will require a verification regime likely based upon the safeguards program of the International Atomic Energy Agency (IAEA).
- Although the extent of the verification requirement is not known precisely, it has been estimated that it could cost 2 to 3 times more than the present safeguards regime associated with the NPT. The low side is estimated if the cut-off monitoring and verification mechanism was integrated into the IAEA as a separate department. The higher estimate is based on a stand-alone agency.

<p><b>OMV CRF:</b> 88 millions (IAEA costs) X 2 = 176 millions/→ 88 millions X 3 = 264 millions/If CWC is used as model/smaller staff/greater number of inspectors/</p>
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### ***Conventional Forces in Europe Treaty***

- Five years after implementation and with the experience of more than 3,000 OSIs, the CFE Treaty's adherents have shifted attention from the verification of inventories and the destruction of proscribed systems, to a future compliance regime intended to ensure that equipment levels remain below agreed limits and as notified.
- Although verification during the baseline and reduction phases was accomplished almost exclusively by OSI, the Treaty provides for the creation of a CFE aerial monitoring capability as part of an ongoing monitoring and

<sup>7</sup> Ibid. Page 9.

<sup>8</sup> IDA0471 29 July 1996 "CTBT-Budget in case of extended EIF". Page 2.

<sup>9</sup> IDA1008 6 February 1996 "Status of Negotiations on a CTBT". Page 3.

<sup>10</sup> CD/FOC Preliminary Cost Estimates for the PrepCom in 1997. Table 1.

verification process. (The Review Conference Final Document made no mention of activating the CFE aerial requirement.)

- The operation of the CFE OMV program provided useful information for future planning. It combines a unique degree of coordination and centralization through NATO and its Verification Implementation and Coordination Staff (VICS) framework. VICS provides a common data collection and coordinating function, but inspections remain as a national responsibility. Inspectors are normally military officers and numbers involved vary from nation to nation. This VICS database is now shared with all treaty participants.
- The USA which maintains an on-site inspection agency (OSIA) of over 900 persons (dedicated for other purposes in addition to CFE) is probably the largest. Germany, France and the United Kingdom operate regimes in the neighbourhood of 300-400 personnel. It is difficult to estimate accurately the full number of personnel employed collectively or the overall cost of the CFE OMV process since it can include both national and international commitments.

<p><b>OMV CRF:</b> USA OSIA 900 personnel/FR/FRG/UK: 300-400 persons/total inspectors 2000 +/(budgeting is national collective estimate) &gt; US\$75,000,000 to US\$300,000,000</p>
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### ***UNSCOM/IAEA OMV in Iraq***

- Under the mandate of the UN Security Council's Resolution (UNSCR) 687, 707, 715(1991) and 1051(1995), the United Nations Special Commission (UNSCOM) and the International Atomic Energy Agency (IAEA) are responsible to monitor and verify Iraq's compliance to terms related to WMD capabilities and proscribed missile delivery systems. In itself, the integrated activity collectively between UNSCOM and the IAEA is unique.
- The IAEA activities fall into a category similar to the OSI aspects of the NPT safeguards regime; but OSI access and no-notice inspection rights are more intrusive. UNSCOM operates with a smaller, ad-hoc headquarters component in New York City with field stations in Bahrain and Iraq. The latter, Baghdad Monitoring and Verification Center (BMVC), is a unique UN activity. Unlike the IAEA, UNSCOM does not possess a stable of "full time" inspectors but has devised a system whereby member nations provide specialists at no cost to UNSCOM other than the provision of travel expenses and in-country expenses while on UN duty. U-2 high altitude photographic surveillance and integrated air transport/helicopter support are also provided separately.

<p><b>OMV CRF:</b> 75 persons in NYC/10 persons in Bahrain/80 persons in Baghdad/Budget 28,000,000 per annum/air component est. US\$15,000,000 per year/high altitude imagery US\$16,000,000/ inspectors basic pay assumed by member states, travel and per diem covered by UNSCOM.</p>
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### ***Open Skies Treaty***

- The Open Skies Treaty is a unique multilateral venture to combine the use of proven and equally shared technology within a specific framework. When implemented, most likely mid-year 1997, this aerial observation regime will

enable Treaty signatories to overfly one another's territories to monitor military capabilities and activities. Designed mainly as a confidence-building measure, its primary purpose is to increase openness and transparency.

- The Open Skies Treaty hold a "spin-off" potential of proving both the utility of and at the same time the relative unintrusive nature of overhead imagery (OHI) for monitoring, verification and other arms control purposes as well as for confidence-building. With some initiative and insight, it has the potential to grow in utility and application. It could be extended, for example, to accomplish the objectives of aerial surveillance as outlined in the CFE treaty protocol. At an expanded, international level, it could be integrated with commercially-available space-based imagery to form a unique OHI capability to be made available to treaty participants on a global basis and in a cost-effective manner.

OMV CRE: USA 3 C-135 est. cost for refit US\$150,000,000/FRG TU 154 US\$10,000,000, NATO POD consortium US\$6,000,000
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### ***Overhead Imagery - A Missing Ingredient***

- A common thread through the first six treaties and discussions is that all of them have or are likely to focus on OSI as a central verification mechanism. A second common thread is that all of them have virtually ignored the use of overhead imaging. This is in spite of the fact that commercially-available overhead imagery constitutes a proven, effective, flexible -- and available -- means of acquiring masses of data on a global (or regional) basis. Experience gained from UNSCOM and the potential application of the Open Skies concept globally should combine to highlight the potential for increasing effectiveness and decreasing costs by applying proven and available technology.
- One of the major problems in this regard is the myth in the minds of negotiators that overhead remote sensing is too expensive to be used for NACD purposes. While a dedicated satellite system for each treaty would have been prohibitively expensive years ago, such dedicated systems are today simply not required. The use of commercially-available imagery provides a practical, affordable and virtual alternative.
- Nevertheless, negotiators continue to be "turned-off" when overhead imagery is considered. This despite the fact that by using commercially-available overhead imaging resources as part of a package of techniques designed to meet the specific verification requirements of each treaty, the OMV process would become increasingly cost-effective. The rapid changes which have occurred in the field of overhead imaging and sensing over the last five years, reinforced by the availability of value-added packaging, makes commercially-available imagery even more attractive for use as part of a verification package. Space-based and airborne remote sensing are not competitive but, in fact, they represent complementary approaches for monitoring purposes.

### ***Approaches to Cost-Effectiveness***

- As indicated above, arms control treaties tend to be negotiated sequentially. They emulate, to a significant degree, the pattern of previous negotiations. Thus it is not unusual to find an identical formulation of words in treaties. Innovation



and progressive thinking have not featured as hallmarks of multilateral negotiations. This is particularly so for those undertaken in the Conference on Disarmament (CD). Thus it is that the concept of OSI, initially formulated more than 30 years ago, still finds itself thrust forward as the core monitoring mechanisms in the CWC, the CFE, and the CTBT. This will undoubtedly be true for the FMCT negotiation as well. Although OSI is an effective OMV mechanism when used at a specific time and in a specific place, it is not an effective means of global gather of great masses of data. Nor is it an inexpensive method of verification as some negotiators appear to think!

- One significant approach to cost-effectiveness lies in the synergistic application of a number of different but supportive methods. The packaging of OMV methodologies must be tailored, however, to the specific agreement or obligation. It must be applied in a "layered" format. The objective of such a package should be to achieve a level of effectiveness which provides an adequate level of confidence in compliance. It should be achieved in the least intrusive way possible and at minimum cost.
- To achieve maximum cost-effectiveness, it is necessary to determine the capabilities of each method to be employed and to move from the gross collector to the most selective one. In terms of treaties with worldwide application, global systems such as overhead sensors, seismic systems and hydroacoustic arrays should be used first as gross collectors, taking advantage of their maximum ability to discriminate. In the layered concept, a second set of OMV technologies would be identified to provide improved discrimination. The final step would see OSI being applied in a surgical fashion as a final and selective determinant after all other less intrusive methods had been used to maximum effect.

### *Contemporary Cost-effectiveness*

- Comparative effectiveness between individual data collection systems is often difficult to gauge with accuracy. Much depends upon the specifics contained in the treaty's verification provision relating to (a) the type of data required to be collected, and (b) the level of confidence required. In many cases, the verification requirement pertains to a specific site. As a basic yardstick, it is necessary often to determine as much as possible about the facility's general layout and operation as an initial stage. Much can be accomplished in this regard by the use of remote sensing techniques.
- Effectiveness can be very much improved by the mutually applicable of cooperative measures. For example, in the CFE Treaty where the main verification function relates to the counting of aircraft, tanks and artillery, such treaty limited equipment (TLE) might be openly displayed in such a way as to facilitate the cost-effective use of overhead imagery (OHI). In this case, OHI could be used not only to verify compliance but to pinpoint anomalies as well. By making full use of such techniques for identification and preparatory purposes, OSIs could probably be reduced in numbers but also applied with greater effect, particularly in situations where anomalies were known to exist in advance. This would be a primary example of the cost-effective use of the synergistic effect of two major monitoring systems.
- In other cases, such as those which might arise in the CWC or CTBT contexts, overhead surveillance might be best used in a secondary role as a supporting

mechanism to update maps or other acquired material. Its main function might be to facilitate and making other OMV means such as OSI more effective by narrowing fields for investigation.

- In a review<sup>11</sup> of the CTBT negotiations in Geneva, Sir Michael Weston, British Ambassador at the Conference on Disarmament (CD) stated that satellite-based monitoring techniques had also been considered (during the negotiations) but the "high cost of these" had led many delegations to conclude that an integrated monitoring system based on the four technologies (seismic, radionuclide, hydro-acoustic and infrared) would provide the most cost-effective solution. It is difficult however to identify in the CD proceedings that any such "cost-benefit" analysis was ever undertaken. Indeed, it seems clear, that if such an independent and unbiased analysis of the use of commercially-available space-based imagery had been carried, that the opposite conclusion would have been reached.

**Multilateral Verification and Global Costs**

**CHART I: MULYILSYRTSL NACD OMV COST ESTIMATES FOR THE YEAR 2000**

TREATY	PERSONNEL	INSPECTORS	ANNUALCOST (USD)	OTHER CRF
NPT	600 <b>INCLUDING</b>	200	88,000,000 (1)	
CWC	470 INCLUDING	211	90,000,000 (2)	
CTBT	250 INCLUDING	50	120,000,000 (3)	
FMCT	? INCLUDING	?	176,000,000 (4)	
BTWC	100 INCLUDING	?	40,000,000 (5)	
TOTAL ESTIMATE AT YEAR 2000			514,000,000	
(1) Firm figures for 1995 (2) Estimate for first full year of extended operation (1998) (3) Estimate using Vienna as site and "stand beside" concept (4) Estimate based on rule of thumb (2X safeguards) if operated by IAEA (5) Estimate based on positive scenario of "VEREX" progress; interpolation from UNSCOM experience				

- By the year 2000, if the assumption is correct that five global NACD treaties (NPT, CWC, CTBT, FIZZ, BTWC) are all in effect, then, when taken collectively, the cost of existing and proposed systems will total more than half a billion dollars. It is likely to rise. Chart I, which derives information from the foregoing by extrapolation, provides a rough illustration of probable OMV costs. Other multilateral costs in treaties such as the CFE and Open Skies are not included. thus the "half-billion dollar" estimate is probably on the conservative side.

<sup>11</sup> NATO Review "The Comprehensive Test Ban Treaty Negotiations: A View from Geneva" Sir Michael Weston, September 1995, page 17.

## *Cost-Effectiveness Quantification*

- The contemporary "mind-set" necessary to negotiate NACD agreements, often shackled by national perceptions and political nuances, is not readily seen as being compatible with the development of effective OMV protocols nor of the identification and packaging of cost-effective systems. There is no guarantee that lessons learned in preceding negotiations will be passed on to the next set of negotiations. The practical results of contemporary field operations in terms of OMV are likely to be excluded from the rarefied atmosphere of on-going negotiations. Thus, it is that the 30-year old principle of OSI as practiced in the safeguards regime of the NPT, found its way into the OSI concept in the CWC which in turn led to the focus on the use of OSI under a CTBT mandate. In contrast, the practical experience gained in the field within the CFE context in Europe and the multi-sensor approach developed under IAEA/UNSCOM mandate in Iraq had little influence on negotiations in the Conference on Disarmament.
- How should cost-effectiveness be approached? Clearly, it should be both announced and practiced as a guiding principle in each negotiation. Beyond that, however, it should be seen as applying beyond any single treaty negotiation and in an overarching manner and applied to the collectivity of multilateral NACD agreements. In the latter case commonalities, such as the dominant use of OSIs in all five treaty contexts, should be examined both in terms of maximum effectiveness and as well as minimum cost. Could the purposes of both, for example, be served by centralizing common functions within a single agency? Could contracting out be seen as a significant factor? Perhaps a systems analysis approach to OMV might be in order. The development of a packaged or layered concept as exemplified in the UNSCOM/IAEA Baghdad Monitoring and Verification Centre in Iraq might be explored. Finally, the introduction and standard use of new technologies might lead to the goal of increased effectiveness while over all costs are reduced.
- While it is not the purview of this paper to deal in detail with the problems inherent in each individual treaty, there are a number of factors which might be considered in the abstract. Perhaps the negotiating table is too cluttered with legalistic and diplomatic jargon to deal with the technical mathematical aspects of cost effectiveness. Perhaps, technical qualifications should not be the purview of politics and diplomats. The concept of establishing other ad-hoc specialist working groups patterned along the line of the GSE in terms of seismic detection, might provide the necessary forum. What ever the manner decided upon, the following factors remain relevant:
  - Establish the level of confidence required and the type(s) of data necessary for collection.
  - Review the technologies available in terms of overall data collection characteristics and place them in descending order of capability for collecting from the most general to the most specific.
  - Recognize the synergistic effect(s) of systems. In other words, determine how one might support or improve the function of another.
  - Where existing methods are unable to meet the required parameters, identify other technologies from within existing resources. Do not enter into a research and development program; rather keep the package simple.
  - Where possible, use the least intrusive methods of collecting data first

commensurate with achieving the objectives identified.

- In circumstances (and there will be many) where a number of similar or common methods are employed, co-locate these functions.
  
- "Contracting out" to either governments, international agencies or private companies might prove useful in establishing a cost-effective regime.
- Recognize the advantages to be gained by the use of new collection and communication concepts to establish "virtual centres" when appropriate.
- Look to new, and as yet untried, concepts such as the potential to employ the Open Skies capability as a common-user function.
- Consider existing (and proven) concepts and frameworks such as the UNSCOM/IAEA architecture or the NATO VICS as a model for a central mechanism. The United Nations might play a useful role in the "third party" concept.
- Recognize the synergistic characteristics of global and regional OMV requirements.
- Understand that the human/technology interface is a mutually supportive and compatible one capable of providing maximum effectiveness at minimum cost.

## CONCLUSION

- For purposes of future planning, whether to meet these practical challenges in terms of either traditional or non-traditional security challenges, there will be a need to review and improve the "package concept" and to identify cost-effective synergies between the systems employed. As well, it is necessary to establish some sort of procedure to quantify the overall costs of present and projected OMV activities. The more difficult aspect of this task will be the attempt, at the same time, to establish some method of quantifying the comparative effectiveness of the various systems proposed and available.
- An additional task will be to take advantage of commercially-available overhead imagery plus value added products, as part of a package of technologies which, in a synergistic manner, will increase effectiveness while decreasing costs. In the latter case, practical demonstration of both of these aspects will be a useful tool with which to convince the sceptics. In this regard, overhead imagery is a technology which lends itself to the process quantification more readily than any other of the methods likely to be included in an OMV package.