



Document Title: Constraining Proliferation: The Role of Verification Synergies

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Date(s): 21 December 1992

Document Type/Physical Description: Type-written, 8pgs (includes 1 chart)

Fonds/Collection Name: George Lindsey Fonds

Series: NACD Verification

File/Box Number: 2/1

Original Archival Reference: N/A

Item Description: This document is a typed paper that Lindsey prepared for a Verification Research Unit Workshop on Non-Proliferation in all its Aspects: Verification of Compliance Effectiveness, which was held in Ottawa, Ontario.

Keywords: Limited Test Ban Agreement (LTBT); Nuclear Non-Proliferation Treaty (NPT); Strategic Arms Limitation Treaty (SALT I and II); Strategic Arms Reduction Treaty (START); Europe; USSR; USA; Cold War

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CONSTRAINING PROLIFERATION:
THE ROLE OF VERIFICATION SYNERGIES

by
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Verification Research Unit Workshop
on
NON-PROLIFERATION IN ALL ITS ASPECTS:
VERIFICATION OF
COMPLIANCE EFFECTIVENESS

Ottawa

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Of the arms control agreements achieved in the past, the seven most important have been:

1963	The Limited Test Ban Agreement (LTBT)	(multilateral)
1968	Nuclear Non-Proliferation Treaty (NPT)	(multilateral)
1972	Strategic Arms Limitation Treaty (SALT I)	(bilateral)
1979	SALT II	(bilateral)
1987	Intermediate Nuclear Forces (INF) Treaty	(bilateral)
1990	Conventional Forces in Europe (CFE) Treaty	(multilateral)
1991	Strategic Arms Reduction Treaty (START)	(bilateral)

Four of these were bilateral, between the USA and the USSR, and could only constrain vertical proliferation of nuclear weapons. Of the three multilateral treaties, the Nuclear Non-Proliferation Treaty and the Conventional Forces in Europe Treaty were very much oriented towards the containment of horizontal proliferation (in the case of CFE of conventional weapons), while the Test Ban Treaty was concerned with nuclear testing (and its consequences for human health) rather than deployment of weapons.

If we consider that in the 1990s "proliferation" will be primarily a problem of growth and spreading of armaments into many countries other than the two former Superpowers, then the major treaties relevant to the constraining of proliferation are the multilateral NPT and CFE, with the latter being confined to the members of NATO and the former Warsaw Pact.

For the NPT, verification was conducted by the International Atomic Energy Agency (IAEA), while for CFE (as for the bilateral INF and START, all signed since the general thaw which began in 1987) national technical means (NTM) were supplemented by data exchanges, notifications of military activities, and on-site inspections (OSIs).

Up to the end of the Cold War, and somewhat beyond, arms control has been dominated by treaties signed after long and tedious negotiations. In turn, verification has been directly associated with arms control treaties.

All of this could change in the post-Cold War 1990s. Arms control may be achieved by unilateral undertakings and confidence-building measures (CBMs), rather than negotiated treaties. Verification may be associated with unilateral undertakings, CBMs, and other arrangements less legally binding than treaties, and may be needed in circumstances in which some of the participants are uncooperative or even actively adversarial. Proliferation of armaments and other threats to international security are likely to be met by multilateral rather than unilateral countermeasures.

In a study of verification synergies conducted for the Arms Control and Disarmament Division of EAATC by Patricia McFate, Sidney Graybeal, George Lindsey, and Marc Kilgour, two general categories of synergy were considered. One was among the various modes of verification, all of which have been used in the implementation of some of the past arms control treaties, and are likely to be employed in future verification programs. The other category of synergy was among different organizations involved in verification.

The table displays a matrix showing the two-way interactions among eight modes of verification. The eight modes are:

- (1) on-site inspections (OSIs)
- (2) notifications of planned military activities
- (3) data exchanges
- (4) national, international, and multinational technical means (NTM, ITM, MTM)
- (5) national intelligence means (NIM)
(which cover means other than purely technical)
- (6) aerial inspections
- (7) open skies agreements
- (8) confidence-building measures (CBMs)

The eight modes are listed down the vertical column at the left of the matrix, in decreasing order of the degree to which they are able to contribute to the other modes in a synergistic interaction. The same eight modes are listed along the horizontal column across the top of the matrix, this time in decreasing order of the degree to which they are able to receive a synergistic interaction from the other modes. The symbol in each element of the matrix indicates whether the synergistic interaction is strong (heavy arrow), medium (right-angle), or weak (diagonal line).

Each of these modes has some interaction with each of the others, but these interactions are by no means reciprocal. For example, most of the modes have very little effect on notifications of planned activities (see weak interactions in right-hand column), whereas notifications are likely to have an important effect on OSIs, NTMs, aerial inspections, and open skies flights, (see second horizontal line in matrix), both for selection of locations to be observed and for interpretation of the resulting observations.

The most interactive mode is on-site inspection, which has a strong effect on NTM, NIM, aerial inspection, and data exchange, (see first horizontal line), and is strongly affected by notifications, data exchange, NTM, NIM, and aerial inspection (see first vertical line). The reason for the strong synergy available from OSIs is that the choice of sites to be inspected and the attention of the inspectors while on site, as well as their understanding of what they observe, will be strongly influenced by information as to what may be important, and, conversely, what the inspectors see will be a valuable source of information for assigning targets for other systems, for interpreting the data obtained, and for determining what data should be exchanged.

It may be productive to devote research to methodologies of exploiting synergy among different modes of verification. The theory of games has been used to analyze the optimum strategy for selecting targets for inspection, using whatever clues are available. Use can be made of Bayesian statistics, which allows subjective assessments to be combined with physical measurements. Modern techniques of data fusion can be used to collect large amounts of information from different sources, to be combined and displayed with a minimum of delay.

Synergy among different organizations conducting verification has great potential. In addition to having different facilities and equipment, they will bring different background knowledge, and concentrate on different aspects of the available evidence. However, cooperation is often inhibited by institutional problems. Inside a large country there are usually several agencies concerned with defence, foreign policy, security, and intelligence, whose mutual trust and cooperation is constrained by rivalry. The same can occur among navies, armies, air forces, and police forces of the same country. In the international sphere, nations wish to preserve a high level of secrecy from potential enemies, and to protect some of their methods and sources of information, both technical and human, from allies as well as from enemies.

Of the eight modes of verification mentioned above, three (data exchanges, notifications of military activities, and confidence building measures) are completely dependent on cooperation, and three others (on-site inspection, aerial inspection, and open skies procedures) can be impeded by non-cooperation or completely prevented by adversarial military action. Thus, while the advantages of synergy amongst modes of verification have great potential in circumstances of cooperation following a comprehensive agreement voluntarily entered by all participants, they are far less available without cooperation, and even less so in the face of outright opposition. In the worst circumstances, verification may become totally dependent on national, international, and multinational means (technical and

other), in which case synergies amongst organizations will become more important.

One means to improve institutional synergy may be to centralize national intelligence agencies and to create multilateral verification agencies.

Looking to the future, several changing aspects of proliferation and the associated problems of verification are likely to require the attention of alliances and major developed countries concerned with international stability and security.

During the Cold War, the control of nuclear arms centred on the agreements between two Superpowers. Verification became progressively more cooperative, and proliferation of the number of strategic nuclear weapon systems was effectively checked. Open proliferation among other countries extended only as far as the permanent members of the UN Security Council. A hundred states signed the NPT, and relied on the IAEA for verification.

With the disintegration of the Soviet Union and the end of bipolar confrontation, concern regarding control of nuclear weapons is going to be concentrated on disposal of the weapons and fissile material resulting from reductions on the part of the former USSR, and on horizontal proliferation among states not now possessing (or acknowledging their possession of) nuclear weapons. The greatest dangers will occur with non-signatories of the NPT. However, it is also unlikely that the IAEA safeguards are going to be considered adequate to provide effective verification of signatory states. The problems call for recourse to synergy, through combination of such national and multilateral means as can be employed.

In the 1990s the proliferation of conventional weapons is likely to constitute a worse threat to international stability than will nuclear weapons. Instabilities exist in many parts of the world, and are being and will continue to be exacerbated by acquisitions of ballistic and other guided missiles, combat aircraft, helicopters, warships, submarines, tanks, artillery, mortars, automatic infantry weapons, and mines. The most dangerous states are unlikely to enter into voluntary agreements to control, let alone divest themselves of such armaments. Assessment of their arsenals, and of steps taken to comply with agreements or instructions to disarm, may have to depend on NTM, supplemented by other modes of intelligence gathering not requiring cooperation. Satellite photography can detect and count large objects such as ships, aircraft, and tanks, although there are difficulties in distinguishing small naval vessels from civilian ships, military from commercial aircraft, and tanks from trucks. But overhead photography is less effective against smaller weapons, especially if steps are taken to conceal them.

Thus, if most of the modes of verification are prevented by

non-cooperation, and with NTM less effective against smaller weapons, it is going to be very difficult to control the proliferation of conventional armaments. It may be possible to detect transfers between countries by use of economic intelligence, or, depending on geography and multinational agreement, to control imports by economic blockade. Synergy between economic and military intelligence will be highly desirable.

In the past nearly all of the attention of arms control has been focused on numbers of weapons, rather than on their quality or performance characteristics. Several treaties have explicitly permitted modernization of the weapons deployed. Advancing technology can permit great increases to combat power without changing the number of weapons deployed. Verifying the performance characteristics of weapons already deployed is likely to prove very difficult. The best information is probably to be obtained from observation of the testing of weapons during the stages of development, demonstration, and evaluation. Much can be learned from NTM regarding the performance of long-range weapons during tests, but cooperation through invitations for observers to be present at test sites would add to the effectiveness of verification. Synergies are to be expected from analysis of the current state of technology in the world at large, and in the country concerned.

Another measure of offensive capability that is likely to receive more attention in the future is the numbers of military personnel, particularly in land forces. There are difficulties associated with the definition of "military personnel", the state of their training, and the ease with which a soldier can put on or take off his uniform. However, overhead imagery and on-site inspections of military bases will produce observations of many measurable objects that are associated with military personnel, such as sizes of barrack buildings, mess halls, and other facilities, numbers of vehicles, and large weapons. In cooperative situations, clues to the actual number of soldiers can be assembled from synergies among data exchanges, identification of units made during OSIs, overhead imagery, and other items of evidence. Important cooperative measures would be the issue of computer-readable individual identification cards to each soldier, correlated with comprehensive nominal rolls of personnel, and access to base personnel records. But verification of manpower in adversarial or coercive situations, or when dealing with inhomogeneous and loosely-organized guerrilla-type military forces will be extremely difficult.

In summary, it may be concluded that in situations of good cooperation, verification can be greatly improved by the use of synergy among both modes of verification and among the organizations conducting the verification. In adversarial or coercive situations, which must be anticipated in the 1990s,

lack of cooperation will render many of the modes of verification ineffective, and put more dependence on national and multilateral technical and other means of monitoring. Synergy among the different agencies would encounter obstacles, but has the potential to greatly improve the effectiveness of verification.

RECIPIENT MODE

OSIs NTM/ITM,MTM NIM AERIAL INSPECTIONS OPEN SKIES CBMs DATA EXCHANGE NOTIFICATIONS

O.S.I.s	•	↗	↗	↗	↗	↗	↗
NOTIFICATIONS	↗	↗	↗	↗	↗	↗	•
DATA EXCHANGE	↗	↗	↗	↗	↗	↗	↗
NTM/ITM/MTM	↗	•	↗	↗	↗	↗	↗
NIM	↗	↗	•	↗	↗	↗	↗
AERIAL INSPECTIONS	↗	↗	↗	•	↗	↗	↗
OPES SKIES	↗	↗	↗	↗	•	↗	↗
CBMs	↗	↗	↗	↗	↗	•	↗

CONTRIBUTING MODE

↗ WEAK CONTRIBUTION

↗ MEDIUM CONTRIBUTION

↗ STRONG CONTRIBUTION