CANADA

COMPENDIUM OF ARMS CONTROL VERIFICATION PROPOSALS

Third Edition

VOLUME
3

Chapters K - Q
Indexes

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CHAPTER K

SEISMIC SENSORS

Seismic monitoring as a verification technique is most frequently discussed in the context of a nuclear test ban. In this sense, seismic monitoring involves recording and analyzing ground shock waves at a considerable distance from the event. While such seismic devices could accurately be described as remote sensors and therefore included in Chapter J, because of the number of proposals abstracted and the restricted utility of the method, a separate chapter has been created. It should also be pointed out that short-range seismic detectors also exist which are discussed in Chapter I.

There are three main requirements for seismic monitoring. First, to detect a seismic event; second, to locate it; and third to identify whether it represents a natural event or a nuclear explosion. Because of limitations on equipment sensitivity there is a threshold magnitude of event which is detectable. Locating an event usually demands detection at two or more distantly separated locations (i.e. a detection network) and identification depends on the shock wave pattern or "signature" of the event.

The magnitude of the shock produced by a nuclear explosion varies according to its location and the type of earth or rock in which it is detonated. There is controversy over the minimum size of nuclear burst which can be detected and also over how far it is possible to disguise the "signature" of a burst to simulate a natural event.

There are two types of seismic detection networks relevant to monitoring a nuclear test ban: internal or "in-country" networks (identified in the Compendium as "intra-border stations") and external networks outside a nation's borders (identified in the Compendium as "extra-border stations"). The former type are more intrusive than the latter because they involve a state's granting foreign nationals access to its territory. It is possible, however, that internal seismic stations could be left unattended after they are established. Internal seismic detection networks appear able to provide better detection capabilities than external networks because they can be located nearer to the sources of potentially controversial seismic events.

Many countries possess seismic detection stations for earthquake monitoring and there are international data exchange networks. However, some countries notably the USSR have been reticent about contributing to such networks, leaving a significant gap in geographic coverage.

The Limited Test Ban Treaty of 1963 does not include specific provision for verification although it is written so as to ban only those explosions which it was believed could be detected. A very large proportion of the verification proposals in this chapter have been concerned with converting this limited test ban into a comprehensive test ban or at least extending the range of explosions banned, and with introducing adequate verification for such an extension. Whether an officially accepted and internationally operated verification network

would be a great improvement over the unofficial system now operating is a matter for debate, but undoubtedly it would be an advantage if all nations adhered to any comprehensive test ban treaty and accepted a uniform verification system.

It seems clear, however, that there is little likelihood of devising a system capable of detecting and identifying by remote sensors all nuclear explosions however small. It is therefore sometimes recommended that other methods of verification, on-site inspection for example, may be necessary to supplement the use of seismic sensors.

A list of technical working papers on seismic monitoring delivered in the ENDC, CCD and CD which have not been abstracted can be found at the end of this volume.

Proposal Abstract K1(A58)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   Seismic sensors - intra-border stations

3. **Source:**
   Orear, J. "The Detection of Nuclear Weapons Testing". In Inspection for Disarmament. Edited by Seymour Melman. New York: Columbia University Press, 1958.

4. **Summary:**

This proposal calls for the establishment of twenty-five seismic monitoring stations in the USSR and seven in the United States, each station to monitor a 300 mile range. This would mean that any test would be within 300 miles of at least one station and within 600 miles of twelve stations.

Alternatively, a range of 500 miles could be used, although there would be a need for additional stations in seismic belts. Stations should be located in non-restricted areas and the personnel operating the stations should be confined to them so that no charge could be raised that a state's security was being jeopardized.

Finally, all presently existing seismic stations should be required to submit copies of their records to the international inspectorate. This might allow for a reduction in the number of monitoring stations.

Proposal Abstract K2(G62)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors
   (b) On-site inspection - selective
   - non-obligatory
   (c) International control organization

3. **Source:**
   Brazil, Burma, Ethiopia, India, Mexico, Nigeria, Sweden, United Arab Republic. "Joint memorandum". ENDC/28, 16 April 1962.

4. **Summary:**

There exists the possibility of establishing a system for continuous observation and effective control on a purely scientific and non-political basis. Such a system might be based upon already existing national networks of observation posts and institutions together with new posts established by agreement.

An International Commission consisting of a limited number of highly qualified scientists with appropriate staff might be considered. This Commission would process data received from the system of observation posts. All parties would agree to furnish data to the Commission regarding the nature of any suspicious and significant event. Parties could invite the Commission to visit their territory and/or the site of a suspicious event. If the Commission remained uncertain as to the nature of the event, the party and the Commission would consult regarding further measures of clarification. After full examination of the facts the Commission would inform the parties to the treaty of its assessment of the event in question.

5. **Selected Comments of States:**

The US raised several questions regarding the details of the proposed system, see: ENDC/29, 17 April 1962. The USSR supported the position taken in this paper, see: ENDC/32, 19 April 1962.

Proposal Abstract K3(G62)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   Seismic sensors

3. **Source:**
   United States. "Report by the United States Department of Defense, dated 7 July, on Project Vela". ENDC/45, 16 July 1962.

4. **Summary:**
   This paper reviews the findings of an intensive research and development program directed at improving methods of detecting underground nuclear explosions. The topics reviewed include deep bore-hole seismographic instruments, surface arrays, ocean-bottom seismometers and seismographic techniques for locating and identifying tests.

Proposal Abstract K4(G65)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information
   (c) International control organization

3. **Source:**
   Sweden. "Memorandum on international cooperation for the detection of underground nuclear explosives". ENDC/154, 2 September 1965.
   See also: ENDC/PV.222, 10 August 1965.

4. **Summary:**

The paper proposes the creation of a "detection club" to extend international cooperation in seismology for the purpose of detecting underground blasts. The paper is concerned only with the detection aspect of seismic verification.

Despite improvements in seismic monitoring, few nations, if any, would have the capability to monitor signals over the entire globe. To enable all states to monitor a CTB treaty, data from several seismic stations widely distributed and suitably sited would have to be made available.

The "detection club" would be essentially an international data service, providing access to first class data for independent analysis. If such cooperation began before the test ban enters into force, research on remaining verification problems would be facilitated.

The data should preferably come from good instruments at well chosen, globally distributed sites. Such a network could, if necessary, be based on data from selected stations in a small number of countries. It might be desirable, in order to heighten a potential violator's uncertainty, to keep some stations outside the network.

The data exchanged should be in the form of short bulletin-like messages. Results of calculations on the data should also be included. Records would be exchanged on request.

Another important element of the system is the adoption of standards for instrumentation and data formats. It might be necessary to establish some international coordinating body to cope with the large amount of data generated by existing and projected seismic stations.

Given the existence of scientific data exchange networks, the specific needs of a "detection club" might in some cases require only adjustments of present national and international efforts. Use might be made of existing global telecommunications networks (e.g. the World Meteorological Organization's network). Coordination with existing global seismological cooperative efforts would also be desirable.

Proposal Abstract K5(A66)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors
   (b) On-site inspection - selective

3. **Source:**
   Bullard, Edward. "The Detection of Underground Explosions". Scientific American 215, no. 1 (July 1966): 19-29.

4. **Summary:**

This article discusses techniques for detecting underground nuclear explosions. Monitoring of tests involves detection, location and identification and must overcome problems with background "noise" in distinguishing explosions from earthquakes. Technological advances have made improvements in the ratio of seismic signal to noise which is caused by storms at sea, waves breaking on shore, the movement of trees and buildings, and traffic and machinery. The use of an array of seismographs instead of a single instrument has contributed to improvements in the ratio of signal to noise. A common arrangement for an array uses two lines of instruments on the arms of a cross each about 20 kilometres in length. A useful technique is to take the two records produced by summing the instruments on each arm of the cross array, to accentuate the similar parts of the records and to reduce the dissimilar parts. This can be accomplished by feeding the two records into a multiplier, multiplying them point by point and smoothing the results over time intervals of 1.5 or 2 seconds. The result is called a correlogram. In a test conducted in Yellowknife, Canada, it was possible to separate the signal of a .2 kiloton underground chemical explosion from the seismic effect produced by a preceding small earthquake with the use of correlograms and a seismic array 2,400 kilometres distant. This remarkable discovery shows that "an explosion of the size of significance for bomb-test detection will usually be detected" (p. 145), but identification of the event as an explosion is the main problem.

Earthquakes produce a seismic wave which is different from that yielded by explosions, so that seismic events can often be distinguished by wave characteristics. Seismic arrays have facilitated this identification. The determination of depth can also identify a large number of earthquakes. Any event occurring at a depth below eight kilometres is certainly an earthquake. A careful examination of records from arrays can permit an estimate of the depth of an explosion. An examination of worldwide samples of 161 earthquakes with depths of less than 50 kilometres published by the

United Kingdom Atomic Energy Authority found that there were seven earthquakes, or 4.5 percent, that could not be distinguished from explosions. This could mean an average of eight "suspicious events" (depending on the evaluation of "suspicious") per year in the USSR. It may not be possible to develop a system which never mistakes an earthquake for an explosion, but improvements can be expected with increased use of seismic arrays.

It may be possible to develop a method of concealing a nuclear explosion, but it would be very difficult and has apparently not been done. Setting off an explosion in a very large cavity is possible, but for explosions greater than one kiloton, the engineering difficulties of making a cavity several hundred feet in diameter and the possibility that the cavity will collapse and form a detectable crater inhibit such activity. Setting off several explosions in a short interval is not likely to be effective and timing an explosion for just after an earthquake may necessitate waiting for years for a suitable earthquake to occur near the test site. Developing a method of concealment would itself require tests, so this is an added reason to negotiate a comprehensive test ban.

Ultimately, the only effective method of verification is on-site inspection. Despite improvements in seismic arrays, ambiguity in identifying a certain number of events will remain. This uncertainty must be weighed against the desirability of a comprehensive test ban.

The article makes extensive use of graphs, diagrams and maps which illustrate many of the technical points discussed.

Proposal Abstract K6(G67)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - extra-border stations
   - international network
   (b) International exchange of information
   (c) On-site inspection - selective

3. **Source:**
   Sweden. "Memorandum on the control of an underground test ban treaty". ENDC/191, 19 July 1967.

4. **Summary:**

The paper describes an analysis of the utility of a number of techniques for verifying a CTB. The analysis involved an application of "decision theory". It was assumed, as a starting point in this analysis, that a basic control system would have to meet two political requirements:

(1) It should provide adequate deterrence against violations by making the probability of discovery sufficiently high; a discovery probability of 10 percent being rated as sufficiently high.

(2) It should provide adequate assurance against the risk that a false alarm would induce unwarranted accusations.

The results of the analysis showed that some of the seismic identification methods suggested in the open literature are of limited efficiency. However, the British teleseismic method of "identification by complexity" suggests the possibility of a control system incorporating no more than one on-site inspection in two years. A similar number of inspections would be required using a US identification method employing regional data perhaps obtained through an international data exchange. If these two seismic methods were combined the number of inspections required might be further reduced.

Given such improved seismic identification methods it is possible to talk of control without inspection.

Proposal Abstract K7(G69)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban
   - partial test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information
   (c) International control organization

3. **Source:**
   Japan, ENDC/PV.424, 31 July 1969
   See also: ENDC/PV.416, 3 July 1969.

3. **Summary:**

A CTB treaty should be accomplished by two steps. First, the nuclear weapon states would agree to prohibit underground tests above seismic magnitude 4.75. According to the consensus at a SIPRI meeting in the summer of 1968 there is almost a 100 per cent certainty of detecting a blast over this magnitude. Uncertainty remains for any event below m_b 4.0 (equivalent to a 2 kiloton explosion in granite, 6 kt in tuff, or 25 kt in partially saturated alluvium). This first step would include a commitment by the parties to cooperate with each other in order to devise within a certain period of time a system of verification which would be capable of monitoring explosions below m_b 4.0. The second step would be a complete ban on underground nuclear tests when a system of verification had been worked out.

International exchange of seismic data would play an essential role in both the limited and complete test bans. There is a need to examine present seismic observatories and international exchange of data. There also is a need to standardize measurements and to designate certain observatories to provide data. All states should agree to make seismic data internationally available on a daily basis. This exchange would include complete seismic records to ensure credibility of the data.

An international centre would be required which would report the data promptly to parties since speed is of critical importance.* In addition to this quick reporting centre it would be necessary for another international monitoring centre to objectively analyze seismic data. This center would have four main functions:
(1) to examine reports of the quick reporting center,
(2) to collect necessary data on suspicious events,

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* Reference is made to similar statements by the UK and by Canada in ENDC/PV.404, 17 April 1969.

(3) to analyze data and determine which events were explosions and which earthquakes, and

(4) to regularly supervise the operations of national observatories which were registered as part of the international seismic monitoring system.

Proposal Abstract K8(G69)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban
   - peaceful nuclear explosions

2. **Verification Type:**
   (a) Seismic sensors - extra-border stations
   - international network (Article 2(2))
   (b) International exchange of information (Article 2(2))
   (c) On-site inspection - selective
   - non-obligatory (Article 2(3))
   - challenge
   (d) Complaints procedure - consultation and cooperation (Article 2(3))
   - referral to Security Council (Article 2(4))
   (e) Review conference (Article 5 of CCD/348)

3. **Source:**
   Sweden. "Working paper suggesting possible provisions of a treaty banning underground nuclear weapons tests". ENDC/242, 1 April 1969.
   See also: - ENDC/PV.399, 1 April 1969;
   - ENDC/PV.415, 23 May 1969;
   - CCD/PV.524, 27 July 1971; and
   - CCD/348, 7 September 1971 which is a revised version of ENDC/242.

4. **Summary:**

The aim of the original draft treaty (ENDC/242) and its revision (CCD/348) is to prohibit underground nuclear tests. Parties are also obligated to conduct peaceful nuclear explosions in conformity with international agreements to be negotiated (Article 1).

The main components of the verification system are found in Article 2. According to this provision, each party is under a general obligation to cooperate in good faith to implement the treaty (Article 2(1)). More specifically, parties are to cooperate in an "effective international exchange of seismological data" (Article 2(2)). Parties are also required to clarify any events pertaining to the subject matter of the treaty. In this regard each party is entitled to:

(1) make inquiries and receive information as a result of such inquiries,

(2) invite inspection of its territory (such inspection to be conducted in a manner prescribed by the inviting party), and

(3) make proposals as to how to clarify any doubts remaining after the application of the preceding provisions (Article 2(3)). Should the party under suspicion fail to fully cooperate, a complaint could refer the matter to the Security Council (Article 2(4)).

Concerning the revisions incorporated into the proposal by CCD/348, only minor modifications are made to the verification article requiring more detailed provisions for an interim seismic data exchange network (Protocol 1), for a permanent seismic data exchange network (Protocol 3) and for an exchange network concerning PNEs (Protocol 2). The revised draft treaty also incorporates a provision for a review conference (Article 5).

The basic proposal rests on two assumptions:

(1) that the rate of false alarms would be low (1 per decade), and

(2) that improved seismic detection capabilities, deriving particularly from international exchange of seismic information would be sufficiently powerful to deter potential violators. Sweden contended that a 10% risk of disclosure was sufficient for deterrence and claimed a 50% chance of detection for its system.

Also implicit in the basic proposal described here is the concept of "verification by challenge". This system involves challenging a suspected violator to clarify the nature of any uncertain seismic event. One method of clarification would be to voluntarily invite the complainant to inspect the site of the event.

Proposal Abstract K9(G70)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   Canada. "Working paper concerning seismological capabilities in detecting and identifying underground nuclear explosions". CCD/305, 10 August 1970.
   See also: Sweden. "Technical working paper offering a comparison of two systems for verification of a comprehensive test ban". CCD/306, 12 August 1970.

4. **Summary:**

On 17 April 1969* Canada suggested that countries submit to the UN Secretary General, a list of all seismic stations from which they would be ready to supply records for the purpose of monitoring a test ban. The intent was to determine existing resources available for an international seismic monitoring network. This idea was resubmitted in a more formal working paper in May 1969.** Eventually, the proposal was incorporated in General Assembly Resolution 2604 A(XXIV). The paper under discussion here (CCD/305) is an assessment of the returns made pursuant to this resolution.

Existing seismic data resources available for any international network could detect earthquakes and underground explosions down to m_b 4.0-4.2, occurring in the northern hemisphere at 50% probability. At 90% probability the detection threshold is m_b 4.5-4.7.

Identification is more difficult; the threshold in this case being potentially:

(1) m_b 4.0-4.4 for earthquakes at 50% probability,
(2) m_b 4.5-4.9 for earthquakes at 90% probability,
(3) m_b 5.0-5.4 for underground nuclear blasts at 50% probability, and
(4) m_b 5.5-5.9 for underground nuclear blasts at 90% probability.

Sweden later introduced a working paper (CCD/306) comparing that system suggested by the UK paper (CCD/296), abstract K10(G70) and that suggested by Canada (CCD/305), giving the following capability for both in terms of blast yields:

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* ENDC/PV.404.
** ENDC/251. It was revised in August, 1969.

	Cdn paper's System	UK's 26 Array System
Detection threshold	8 kt	3 kt
Identification threshold	90 kt	12 kt*

The difference between the systems is attributed mainly to the large number of long period arrays included in the UK system and also to the fact that the two working papers used different criteria to calculate the thresholds. In the UK paper, parallel use of a number of identification methods was proposed, whereas the Canadian paper considered only one.

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* If stations in the USSR are excluded the threshold rises to 20 kt.

Proposal Abstract K10(G70)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information
   (c) International control organization

3. **Source:**
   United Kingdom. "Working paper concerning verification of a comprehensive test ban treaty". CCD/296, 28 July 1970.

4. **Summary:**

This paper describes in detail a hypothetical international network of 26 seismic stations (seven of which presently exist), the system's capacity to detect and identify seismic events, and its cost. The system envisages 4 stations established in the Soviet Union.

In the Northern Hemisphere 90 percent of all earthquakes down to a magnitude of m_b 4 (1-2 kt in hard rock) would be detected by at least 4 stations (location) and 3 stations (identification). For nuclear blasts the threshold would be about m_b 4.5 (3-6 kt in hard rock) for identification.

A data collection and collation centre would be established as part of the system to maintain common standards of operation, quality control and reporting. This centre would collate and store data that would be provided to any state party on request. It could also, if desired, present analyses of the data.

The estimated cost of installing the system would be £15 million with an operating cost of £5 million per year.* Each country would staff its own stations. It is believed that the system could be established within 5 years.

The paper also cursorily evaluates some evasion techniques ("decoupling", masking during earthquakes, and simulating earthquakes).

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* This cost estimate is later reduced. See: CCD/351 of 23 September 1971 and CCD/386 of 22 August 1972.

Proposal Abstract K11(G71)

1. **Arms Control Problem:**
Nuclear weapons - comprehensive test ban

2. **Verification Type:**
Seismic sensors - extra-border stations

3. **Source:**
Canada. "Working paper on the seismological detection and identification of underground nuclear explosions". CCD/327 and Add. 1, 29 June 1971.

4. **Summary:**

The paper comes to the following conclusions, amongst others:

(1) The identification threshold of Eurasian underground explosions using existing network is 20 kt except in dry alluvium, where the threshold rises.

(2) The identification threshold of North American explosions is 10-20 kt but with new techniques this could be reduced to 5-10 kt except for dry alluvium.

(3) A corresponding reduction in the identification threshold for Eurasia requires deployment of a limited number of improved single stations, together with a merging of currently available data.

(4) Reduction of the threshold to 1-2 kt except of dry alluvium would require massive investment in arrays situated on the same continent as the events, plus improved analytical techniques.

(5) Concentrating on existing test sites simplifies the identification problem. Estimates for universal coverage are always more pessimistic than capabilities for specific test sites.

(6) The practical potential of 5-10 kt threshold is possible because of modern standard seismograph networks, deployment of arrays by a number of countries, the work of a number of countries on experimental improved single stations, and the ready or potential availability of data from all these.

5. **Selected Comments of States:**

The paper was interpreted by the United Kingdom (CD/486, 12 April 1976) as suggesting that rather than establish a special network for test ban monitoring, it would be better merely to improve the existing World-Wide Standardized Seismic Network.

Proposal Abstract K12(G71)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - extra-border stations
   - international network
   (b) International exchange of information
   (c) Complaints procedure - referral to Security Council
   (d) Review conference

3. **Source:**
   Egypt. CCD/PV.509, 20 April 1971.

4. **Summary:**

All countries should have the ability to obtain rapidly and easily seismic data of concern to them. Therefore the principle of "exchange of data through cooperation" should be recognised in a CTB treaty. But obtaining data on a continuing basis is not itself sufficient; a complaints procedure is also needed. The treaty should include some form of verification by challenge, recourse to the Security Council, mention of a review conference and a withdrawal clause.

Proposal Abstract K13(G71)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (c) International exchange of information

3. **Source:**
   Italy. "Working paper on underground nuclear blasts". CCD/331, 1 July 1971.

4. **Summary:**
   Suggested improvements in international detection and identification techniques include:
   (1) Establishment of an international centre for coordination of research, dissemination of scientific reports on results obtained and data storage.
   (2) Subdivision of each continent into zones with their own centres responsible for data gathering and processing and execution of study programmes.
   (3) Commitment by national authorities to bring their existing observatories into line with agreed standards, and, when necessary, to remedy any deficiencies.
   (4) Commitment by governments to bear operational equipment and research costs and to lend their assistance in the improvement of a world wide seismological network.

Proposal Abstract K14(G71)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - intra-border stations
   (b) Short-range sensors - monitoring devices

3. **Source:**
   Japan. CCD/PV.497, 2 March 1971.
   See also: - Mexico. CCD/PV.504, 25 March 1971.
   - Japan. CCD/PV.801, 17 August 1978.
   - Japan. CD/PV.16, 6 March 1979.

4. **Summary:**
   Japan resurrects the notion of using automatic seismic stations ("black boxes") to monitor a test ban. Mexico took up the Japanese idea and referred to the 1962 Soviet proposal* to install on its territory two or three automatic seismic stations. These devices would have been installed and maintained by Soviet personnel. Mexico called on the USSR to renew its proposal and on the US to accept the idea as a basis for negotiation.

5. **Selected Comments of States:**
   The Soviet Union** reacted to this call by pointing to the American rejection of the earlier proposal and by claiming that there was no evidence that reopening the discussion on black boxes would be fruitful.
   The US in a number of statements*** asserted that it was continuing to conduct research on the feasibility and problems of developing tamper-resistant, tamper indicating, low maintenance, unattended seismic observatories. As a result of this research, the American position regarding "black boxes" was that, while they might be a useful addition to verification capabilities, they were not equivalent to on-site inspection.

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* ENDC/Sc. 1/PV. 43.
** CCD/PV.536, 7 September 1971.
*** See for example: CCD/PV.580, 24 August 1972 and CCD/404, 5 July 1973.

Proposal Abstract K15(G71)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   Seismic sensors - extra-border stations

3. **Source:**
   Japan. "Working paper ... concerning the usefulness of the employment of ocean bottom seismographs and a universally acceptable means of determining the magnitude of seismic events...". CCD/345, 24 August 1971.
   See also: - "Working paper on problems in determining the body wave magnitude". CCD/339, 24 April 1973.

4. **Summary:**

Improved teleseismic capability requires that detection techniques be improved to match the level achieved by the recent development of better analytical methods. Japanese research suggests that the inherent limitations of detection capabilities of land based seismographs can be circumvented by extending the seismic network to the ocean floor. On the sea-bed background noise levels have been found to be less than half that of the quietest land sites. This quietness is neither affected by weather nor subject to seasonal changes. It is suspected that even a single ocean bottom station could detect seismic events at an equivalent sensitivity level to that of a fairly large array station on land. Such ocean bottom stations could, with improvements, be used to locate and identify seismic events.

Present instrumentation is such that seismographs can be sent to depths of several thousand meters and operated for two to five months without maintenance. Data is stored on magnetic tape and could be retrieved when necessary. Furthermore, there is no problem over intruding into sovereign territory if the instruments are placed below the high seas.

The working paper goes on to suggest in detail a possible universally acceptable means of determining the magnitude of seismic events.

Proposal Abstract K16(G71)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors
   (b) Remote sensors - satellites

3. **Source:**
   Netherlands. "Working paper concerning seismic detection and identification of underground nuclear explosions". CCD/323, 18 March 1971.
   See also: - CD/7, 1 March 1979.

4. **Summary:**

The Netherlands summarizes its view of existing capabilities for seismic monitoring in the Northern Hemisphere as follows:

(1) Explosions can be identified with a "reasonable probability" down to a seismic magnitude m_b 5.5 or a yield of about 50 kt in hard rock.

(2) Earthquakes can be identified above m_b 4.8-5.1 with a high degree of confidence.

The working paper then lists three technical methods of improving seismic identification including new methods of analysis and new equipment. By using these techniques it is suggested that the identification threshold can be lowered perhaps to a level of 10 kt in hard rock.

The paper also suggests that both cratering after a blast in dry soil and the extensive mining operations necessary for seismic decoupling of blasts in hard rock are probably detectable by satellite observation. This is important in reducing the possibility of evading a test ban.

In March of 1979, the Netherlands introduced a technical working paper (CD/7) entitled: "On the use of short-period initial motion data for discrimination purposes".

Proposal Abstract K17(G71)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - extra-border stations
   - international network
   (b) International exchange of information

3. **Source:**
   Sweden: CCD/PV.513, 4 May 1971.

4. **Summary:**

Reference is made to a previous Swedish proposal concerning the use of standardized seismic stations in national networks with agreed norms of operational performance and data acceptability. Such a network of national stations would be an efficient base for an international seismic data exchange. It would provide the same kind of data but in more extensive form than a few "black boxes". The credibility of such data, of course, depends on the professional integrity and reputation of the scientific institutes operating the stations.

Proposal Abstract K18(G73)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - extra-border stations
   - international network
   (b) International exchange of information

3. **Source:**
   Canada. "The verification of a comprehensive test ban by seismological means". CCD/406, 10 July 1973.

4. **Summary:**

The paper reviews the status of Canadian seismic research and discusses existing uncertainties in seismic verification. It comes to the following conclusions, amongst others:

(1) There is a 90% chance of applying seismic discrimination techniques to events as low as body wave magnitude m_b 4.5 (5-10 kt in hard rock assuming no evasion).

(2) The current teleseismic limit for positive identification in rock is about 2 to 4 kt. Thus other operational verification techniques need practical consideration including on-site inspection.

(3) Ignoring evasion possibilities, the rate of false alarms using purely seismological methods depends upon the operational methods adopted, the discrimination limit of the deployed network and a policy decision about what constitutes adequate deterrence.

(4) The provision of seismic data from all Eurasian states would enable progress to be made on the residual false alarm problem.

(5) Currently, a multi-step discriminant approach to an operational verification scheme involving multinational cooperation between advanced national facilities appears to provide an attractive way to monitor underground nuclear explosions and could be developed for the purpose of a CTB.

(6) As seismic limits are reached more emphasis will be necessary on cost-effective seismic array monitors using small scale digital processors and on devising optimum methods of verification.

Proposal Abstract K19(G73)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   Netherlands. "Some observations on the verification of a ban on underground nuclear test explosions". CCD/416, 28 August 1973.

4. **Summary:**
   The paper comes to the following conclusions:
   (1) Obligatory on-site inspections would not enhance identification possibilities significantly.
   (2) Realistic possibilities of evading an underground test ban seem to exist for yields up to 10 kt. Significant improvements or extension of seismological hardware will probably not change this. On the other hand, improvements in counter-evasion techniques like spectral analysis, matched filtering and measurement of focal depth could be quite helpful.
   (3) An intensified international exchange of those seismic data which are used for identification of events is needed on a routine basis.

Proposal Abstract K20(G73)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) Remote sensors - satellites
   (c) International exchange of information
   (c) On-site inspection - selective
   - non-obligatory

3. **Source:**
   Sweden, CCD/PV.614, 19 July 1973.
   See also: - "Working paper reviewing recent Swedish scientific work on the verification of a ban on underground nuclear explosions". CCD/405, 10 July 1973.

4. **Summary:**

Seismic monitoring techniques provide sufficient probability of detection, for effective deterrence. But there is a need for more suitably located modern stations, efficient exchange of seismic data and an international centre to receive data, locate events and redistribute information to the parties.

Satellite verification can provide valuable supplementary information to that of the primary verification method (i.e. seismic monitoring). Satellite can monitor small scale activities within selected and limited areas such as known or suspected underground test sites. This adds an extra burden to potential violators. Satellites could play a useful role in avoiding false alarms by confirming the absence of human activities at a suspected test site. Sweden advocates international control over such observation satellites.

On-site inspection should be used not as the primary means of control but as a follow-up methods for events that are detected and located but not identified. The exact nature, and the frequency of inspections required is not clear. Preferably they would be conducted only on invitation. Nevertheless, even without on-site inspection sufficient deterrence can be achieved to prevent violation.

Proposal Abstract K21(A74)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors
   (b) Complaints procedure - consultative commission

3. **Source:**
   Scoville, H. "A Leap Forward in Verification". In SALT: The Moscow Agreements and Beyond, pp. 160-182. Edited by M. Willrich and J.B. Rhinelander. New York: The Free Press, 1974.

4. **Summary:**
   This proposal is based on an understanding that present seismic technology permits detection and identification of all but the lowest yield underground nuclear explosions. It proposes that in order to augment use of such technologies, measures such as those established under Article XII of the 1972 ABM Treaty - that is, use of national technical means of verification, promise of non-interference with these means and promise not to use deliberate concealment measures which impede verification by national technical means - might be useful. Further, the author suggests that a multilateral international consultative commission could be established to provide a forum for obtaining additional clarification. Such measures, he contends, would greatly reduce or even eliminate fears of violations of a comprehensive tests ban treaty.

Proposal Abstract K22(G75)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - extra-border stations (Article 2(1))
   (b) Remote sensors
   (c) International exchange of information (Article 2(2))
   (d) Complaints procedure - consultation and cooperation (Article 2(3))
   - referral to Security Council (Article 2(4))
   (e) On-site inspection - selective
   - non-obligatory (Article 2(3) of CCD/523)

3. **Source:**
   Union of Soviet Socialist Republics. "Draft treaty on the complete and general prohibition of nuclear weapon tests". Annexed to UNGA resolution A/Res/3478 (XXX), 1975.
   See also: - "Draft treaty on the complete and general prohibition of nuclear weapons tests". CCD/523, 22 February 1977.

4. **Summary:**
   The aim of the draft treaty is the prohibition of the testing of nuclear weapons in all environments (Article 1). This ban, however, is not intended to apply to peaceful nuclear explosions (PNEs) which are to be conducted, in the case of non-nuclear weapon states, according to Article 5 of the Non-Proliferation Treaty and, in the case of nuclear weapons states, in conformity with procedures to be agreed upon between nuclear weapons states with due regard to the recommendations of the IAEA (Article 3).

   Verification is to be based on the use of each party's own technical means (Article 2(1)) which presumably means seismic monitoring and satellites. The parties are also obligated "to cooperate in an international exchange of seismic data" (Article 2(2)). Consultation between the parties when necessary is also included (Article 2(3)).

   Should any party ascertain that another party is violating the treaty, it may lodge a complaint with the Security Council providing with the complaint all possible evidence in support of its contention, (Article 2(4)).

   It should be noted, as well, that the draft treaty includes a provision which prevents its coming into force until all nuclear weapon states have ratified it. It should also be pointed out that there is no provision for a review conference.

Proposal Abstract K23(G75)

1. **Arms Control Problem:**
Nuclear weapons - comprehensive test ban

2. **Verification Type:**
Seismic sensors

3. **Source:**
United Kingdom. "Working paper on safeguards against the employment of multiple explosions to simulate earthquakes". CCD/459, 24 July 1975.

4. **Summary:**

The paper describes a technique of detecting the possible evasion of a CTB. The evasion method of concern is simulation of an earthquake using multiple nuclear explosions. The detection technique involves broad band seismic discrimination. The results of experimentation suggest that one could identify the explosive origin of components within a series of blasts, with yields of 50 kt or more. Further improvements would add to the uncertaintly any potential violator must face.

Proposal Abstract K24(A76)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban
   - peaceful nuclear explosions

2. **Verification Type:**
   Seismic sensors

3. **Source:**
   Bolt, Bruce A. Nuclear Explosions and Earthquakes: The Parted Veil. San Francisco: W.H. Freeman, 1976.

4. **Summary:**
   This work focusses on underground nuclear explosions. It is written with the non-expert in mind and covers the following areas:
   (1) The history of international negotiations regarding a test ban.
   (2) Background information on the scientific principles involved in nuclear explosions in general as well as specifically those underground.
   (3) Background information on seismology.
   (4) Discussion of seismic monitoring capabilities (The identification capability in the Northern Hemisphere was about magnitude 4.5 by 1975 using unclassified seismological networks, according to Bolt).
   (5) Discussion of evasion tactics such as concealment in natural earthquakes, simulation, and decoupling.
   (6) The history and potential of peaceful nuclear explosions (PNEs are likely to prove attractive for excavation of water storage, irrigation and large-scale quarrying purposes, concludes Bolt).
   (7) The environmental dangers of underground tests.

Proposal Abstract K25(G76)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) Remote sensors - satellites
   (c) International exchange of information
   (d) Complaints procedure - consultation and cooperation
   (e) International control organization

3. **Source:**
   Sweden. "Working paper on cooperative international measurements to monitor a CTB". CCD/482, 26 March 1976.

4. **Summary:**

The paper is intended as a discussion of further possible international cooperative measures to facilitate global monitoring of a CTB. It has been shown* that identification capability is improved by combining data from several observatories. The basic idea of the proposal in this working paper is to establish a network utilizing existing of planned seismic installations. Such a network has the advantage of being relatively cheap and of being put into operation easily and rapidly. There would be no requirement for uniform equipment of detection procedures, though the stations must have comparable capabilities. The number of stations would be kept small, thus keeping data to manageable proportions.

The whole system would consist of a global network supplemented by local networks to monitor key areas or areas where evasion might be likely (i.e. alluvium deposits). The paper gives an example of a network consisting of 46 stations in 26 countries including 5 in the USSR.

The parameters extracted from recordings at the stations would be regularly transmitted to an international data centre by telex. Full recording could be exchanged by mail when necessary. The international data centre would be charged with collecting and analyzing the data. This is a valuable role because many countries possess limited expertise and facilities to carry out such operations. However, the political assessment of the seismic events detected would be left to the parties themselves. The international data centre would also have the function of conducting consultations and inquiries with designated institutions in order to obtain

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* See: Canada/Sweden, CCD/380, 27 July 1972; and Japan/Sweden, CCD/441, 13 August 1974.

additional information about events insufficiently described by data routinely obtained. It would also provide experts to observe, by invitation, PNEs and large chemical explosions.

For the small residue of events not identified by the above system, further analysis would be made by acquiring additional seismic data, for example, from local seismic station networks or by applying more refined analytical techniques. Satellite photographs of relevant areas could also be requested and analysed. If this did not clarify the event, designated agencies in the country of the event would be consulted. If doubts still remained, the other parties would be left to make their own interpretations and take further steps.

To conduct the tasks described above, a staff of 40 professionals and technicians with appropriate equipment would be required for the data centre. The estimated cost of such a data centre is in the order of $2 million per year. The centre could be set up as an independent body, as part of an existing international body, or it could form a part of an International Disarmament Organization as described elsewhere by Sweden.* The envisaged seismic network would have a detection threshold of m_b 4 for Eurasia and North America and slightly above that for the Southern Hemisphere. The identification threshold for earthquakes would approach m_b 4 in the Northern Hemisphere.

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* See: Sweden. CCD/PV.601, 15 April 1973 and CCD/PV.610, 5 July 1973 (Abstract P4(G73)).

Proposal Abstract K26(G76)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   United Kingdom. "Working paper on the UK's contribution to research on seismological problems relating to underground nuclear tests". CCD/486, 12 April 1976.

4. **Summary:**

The paper suggests a possible seismic network of 20-25 stations (depending on whether stations in the USSR were included) distributed as evenly as possible over the continents. Each station would be equipped with a British type array of seismometers with digital recording of its output so that any spectral band of interest could be reproduced. It would not be necessary to resort to the large and expensive arrays for long period instruments specified in CCD/296* since seismometers of existing design might suffice. The choice of sites would be dictated by geology and low noise level criteria rather than by easy logistics. Each control station would be equipped with an array processor. Data would be communicated by either radio or telex to all cooperating centres.

A network such as that above could detect and identify an explosion of between 3 and 50 kt depending on the location of the explosion and chance noise level. If decoupling or other evasion methods were employed, the lower half of the yield band would not be detected at all.

The cost of deploying 20 control posts of the above type would be about £5 million with an operating cost of £25,000 per station per year.

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* See abstract K10(G70)

Proposal Abstract K27(A77)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban
   - peaceful nuclear explosions

2. **Verification Type:**
   (a) Seismic sensors - intra-border stations
   - extra-border stations
   - international network
   (b) Remote sensors - satellites
   - ELINT
   (c) Short-range sensors - monitoring devices
   - sampling
   (d) On-site inspection - selective
   (e) International exchange of information
   (f) Literature survey

3. **Source:**
   Dahlman, Ola and Hans Israelson. Monitoring Underground Nuclear Explosions. Amsterdam: Elsevier Scientific, 1977.

4. **Summary:**
   This book provides detailed coverage of the political and scientific issues surrounding the verification of a comprehensive test ban. It includes chapters on:
   (1) The test ban negotiations to 1976 with summaries of the positions of several countries on the issue.
   (2) Background information on nuclear explosions.
   (3) Background information on seismology and seismic sources.
   (4) Description of existing seismic instruments (seismographs, recording equipment, array stations, future developments) and existing networks (national, World Wide Standard Stations Network, array stations. Very-long-period Experiment Stations, Seismic Research Observatories, ARPANET, "black boxes").
   (5) Problems and capabilities for signal detection. (The authors conclude that seismic events with magnitudes down to about 4 can be detected over teleseismic distances, but to obtain such a capability a network of stations must be established. To achieve a lower detection threshold, stations at short distances from the even must be employed).
   (6) Problems and capabilities for event definition and location. (The authors state that in most cases seismic events can be located to an accuracy of 10-20 km. If data from ten well distributed stations are available. If calibration data from earlier events in the region are provided (as in the Threshold Test Ban Treaty) then the event can be located to within 5 km).

(7) Problems and capabilities for depth estimation.
(8) Problems and capabilities for identification (which the authors claim is the main remaining problem in detection seismology) including a review of past monitoring experiments (The authors conclude that identification methods can be applied with a high degree of confidence down to the detection threshold of magnitude 4, to distinguish earthquakes and explosions. There might however be a few, mostly low-magnitude, earthquakes which could not be confidently identified using seismological data alone).
(9) Problems and capabilities for yield estimation.
(10) Peaceful Nuclear Explosions - their possible applications, past tests, and future prospects
(11) Review and evaluation of evasion methods including decoupling, multiple explosions and hide-in earthquake methods. Of these the authors conclude that the most feasible is decoupling but only for low yield tests (assuming only seismic verification). A limiting factor on decoupling is that it can only be employed in certain geologic areas which could be monitored by seismic networks).
(12) Review of non-seismological verification methods including on-site inspection, reconnaissance satellites and intelligence methods, with an evaluation of their potential usefulness in a CTB.
(13) Discussion of technical verification capabilities in relation to political requirements together with an outline of an operative monitoring system which would provide adequate verification of a CTB.

"Black boxes":

The advantage to the use of unmanned seismic stations capable of transmitting data to locations outside the host country is that by operating close to seismic events they could increase detection capability. They suffer from the political disadvantage arising from the fact that one country is establishing monitoring equipment in another. Another problem is to ensure that the stations will not be disturbed either by tampering with the station equipment or by artificial seismic disturbance created outside the station. The latter possibility, in the authors' opinion, is particularly important.

Peaceful Nuclear Explosions:

To monitor PNE's so as to ensure that no military advantages are acquired, it would be necessary to combine on-site inspection with provision (well in advance of the explosion) of data concerning yield, type and amount of fissile materials, and other matters. Visual inspection might be able to verify that chemical and not nuclear explosives were used in the case of large chemical explosions. For PNEs, analysis of radioactive products obtained at the explosion site would provide the possibility for confirming whether the explosion was conducted in accordance with the given specifications. Such radiochemical analysis could be carried out by an international agency or by national laboratories on radioactive samples obtained under appropriate international control.

Non-Seismological Identification:

The authors contend that on-site inspection and satellite reconnaissance must be regarded as complements to seismological monitoring. They cannot detect new explosions, but rather can only help identify events already detected and located by seismological means. It is difficult for the authors to understand why on-site inspection has been regarded by some states as a necessary verification method for a CTB. On-site inspections cannot increase the detection capability of the verification system nor counter possible evasion techniques since the idea behind such methods is that the illicit test would go undetected. Visual inspection could be useful for identifying earthquakes either by observing the effect on the environment or, especially, the lack of human activity in the area that would have been necessary if a nuclear test had been conducted. However, lack of human activity could also be verified by satellites. Only in relation to PNEs would on-site inspections be essential.

Because of the magnitude of effort required to cover large areas with high resolution satellite sensors continuous monitoring of whole countries seems unrealistic. Instead, satellite data would be used to supplement seismic data when an event was detected and located seismologically but not identified. The precautions needed to avoid such satellite reconnaissance would greatly complicate the violator's task. However, such satellite verification is applicable only to areas where there is no legitimate mining activity. Also reconnaissance satellites technology is today available only to a few states. If this method is included for monitoring a CTB then the satellite data must be made generally and easily available either directly or through an international data center.

Technical and non-technical intelligence methods could also be employed to monitor a CTB but because of the secrecy surrounding such methods it is not possible to estimate the kind or amount of information that can be achieved by such methods. The authors mention in particular the monitoring of communications in a state. Generally, the efficiency of intelligence methods does not depend on the yield of the tested explosion, but rather on the overall size and structure of the operation.

One other non-seismological verification method is monitoring of the mass media as well as public debate in a country. This could help is assessing particular events (eg. earthquakes) and general public reactions to certain proposals (eg. for a PNE).

A Monitoring System:

The authors propose a system for monitoring a CTB which, apart from being more scientifically detailed, is essentially the same as that suggested by Sweden in CCD/482* (26 March 1976). For the authors, the military significance of any nuclear test increases with the yield of the explosion and explosions below 1 kt have little military significance. The current detection limit of seismic verification is about magnitude 4 or the equivalent of a 1 kt explosion in hard rock. Their system is designed to provide this detection capability.

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* See abstract K25(G76).

PROPOSAL ABSTRACT K28(G77)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   Japan. "Working paper on seismic array stations". CCD/524, 24 February 1977.
   See also: - CCD/PV.733, 3 March 1977; and
   - "Working paper on focal depth resolvability of a multi-array stations system". CCD/540, 3 August 1977.

4. **Summary:**
   CCD/524 paper is a technical discussion of location capability of a multi-array seismic station network. It concludes that it would be possible to locate and even verify small yield blasts (i.e. 20-30 kt) using the existing seismic network if a better data exchange system could be arranged between an appropriate number of array stations.

   It might be possible to use a existing data exchange system (such as the World Meteorological Organization) to connect the main array stations. Experimental work on location could be undertaken using such a network.

Proposal Abstract K29(G77)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information
   (c) On-site inspection - selective
   - challenge
   (d) International control organization
   (e) Remote sensors - satellite
   (f) Short-range sensors - monitoring devices

3. **Source:**
   Japan. CCD/PV.733, 3 March 1977.
   See also: - CCD/PV.776, 2 March 1978.
   - CD/PV.16, March 1979.

4. **Summary:**

Since national means of verifying a CTB treaty are insufficient, Japan proposes the creation of international machinery to: (1) speedily collect and analyze seismic data, and (2) conduct on-site inspections. Such machinery would consist of a committee of experts from both nuclear weapon states and non-nuclear weapon states. Though the main function of the body would be to receive and analyze seismic reports, it would also be empowered to ask for additional information and to recommend on-site inspection.

In CD/PV.16 Japan states that on-site inspections are necessary to supplement any seismological methods of verification. However, if detailed arrangements for seismological verification by national means are reached, then the need for on-site inspection will be reduced so that a method like "verification by challenge" might be considered.

The committee of experts proposed by Japan in 1977 might also be given responsibility for advising on scientific and technical questions relating to verification, including the international seismic data exchange system.

Japan also contends in CD/PV.16 that the verification system for a CTBT would be strengthened if agreement was reached on the setting up, on a reciprocal basis, of appropriate numbers of tamper-proof "black box" automatic seismic stations, as well as on observation by satellite.

Proposal Abstract K30(G77)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban
   - peaceful nuclear explosions

2. **Verification Type:**
   (a) Seismic sensors - international network (Article 4(1))
   (b) On-site inspection - selective
   - non-obligatory (Article 4(2b))
   (c) International exchange of information (Article 4(1))
   (d) Complaints procedure - consultation and cooperation Article 4(2))
   - consultative commission (Article 3(2))
   - referral to Security Council (Article 4(3))
   (e) International control organization
   (f) Review conference (Article 6)

3. **Source:**
   Sweden. "Draft treaty banning nuclear weapons test explosions in all environment". CCD/526, 1 March 1977, and CCD/526/Rev.1, 5 July 1977.*
   See also: - CCD/PV.750, 5 July 1977.

4. **Summary:**

The treaty is intended to establish a comprehensive test ban. Article 1(4) provides for a special transitional arrangement allowing the US and USSR to continue conducting tests until all nuclear weapons states have ratified the treaty. Peaceful nuclear explosions would also be banned unless conducted under international supervision in a manner to be defined in an attached protocol (Article 2).

The main verification and control provisions are found in Articles 3 and 4. The provisions are very similar to those in the Swedish 1969 draft treaty**, including the reliance on seismic monitoring and international exchange of seismic data, and the possibility of a non-obligatory form of inspection. A new element has been added, however, with the provision in paragraph 4 for the use of a Consultative Committee to ensure observance of the treaty. The functions and rules of this body are to be inserted into a protocol.

In PV.750 Sweden makes it clear that the final assessment of data received from the seismic data exchange system would be made by the individual parties to the treaty not by any international body.

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* The organization of the article of the drafts differs between CD/526 and its revision. The numbers referred to here are taken from the revised draft.

** See ENDC/242, abstract K8(G69)

However, the services of one or more data centres would be required to facilitate the interpretation of the data, especially for small countries.

Sweden also rejects the necessity for on-site inspection since it would not increase the deterrent to prospective violators nor avoid false alarms. Seismic monitoring alone is sufficient to achieve these objectives. On-site inspection would be useful only on rare occasions, in the form of an invitation by the host country to inspect.

Proposal Abstract K31(A78)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors
   (b) Remote sensors - satellites

3. **Source:**
   Stockholm International Peace Research Institute. Yearbook of Armaments and Disarmament: 1978. London: Taylor and Francis, 1978, pp. 333-353.

4. **Summary:**

Substantial venting of radioactivity from underground nuclear explosions can be detected using available instruments. In addition, satellite observation can be used to obtain evidence regarding underground tests such as test site preparations, subsidence craters and dust clouds. However, while such non-seismic methods taken together represent a substantial verification capability, they are not effective in every case and therefore ultimate reliance must be placed on seismic monitoring.

The difficulties of seismic monitoring are outlined by SIPRI, as well as the current technological state of the art including networks, instrumentation, unattended seismological observatories and identification techniques. The threshold for identifying seismic events varies with the region, the stations providing the data and the distance from the event of the stations. Currently, it is about magnitude 4.0 or the equivalent of 1 kt in hard rock according to SIPRI. Problems of evasion arising out of decoupling, masking tests in natural earthquakes and earthquake simulation are also addressed. SIPRI concludes that any attempt at evasion would involve a balance of risks, costs and incentives. Since the military incentives for evasion are not large, it is difficult to see why evasions would occur.

Proposal Abstract K32(I78)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   Ad Hoc Group of Scientific Experts. "Report to the CCD of the Ad Hoc Group of Scientific Experts to consider international cooperative measures to detect and identify seismic events". CCD/558, 14 March 1978.

4. **Summary:***

The report is based on a consensus of the experts of the CCD working group. It describes how seismological science can be applied in a cooperative international effort to verify a CTB treaty. The cooperative international effort would have three elements:

(1) a systematic improvement of the observations reported from a network of more than fifty seismological observatories around the globe.
(2) an international exchanges of these data over the Global Telecommunications System of the World Meteorological Organization, and
(3) processing of the data at special international data centres for the use of participant states.

After an introductory chapter, the report gives a brief historical review of earlier studies relevant to the detection and identification of seismic events, though no attempt is made to assess the results of these studies.

The next chapter discusses procedures for extracting and reporting data from individual stations. The recommended procedures include the following:

(1) Data are to be reported in standard form at two levels:
   (a) Level 1: Routine reporting, with minimum delay, of basic parameters of detected seismic signals;
   (b) Level 2: Data transmitted in response to requests for additional information, mainly waveforms for events of particular interest.

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* The following abstract is based mainly on the summary given at beginning of the report (pp. iii-x).

(2) In contrast to current seismological practice, increased emphasis is on parameters for identifying events.
(3) Strict operational requirements are set forth as to scope, consistency, reliability and promptness in the reporting.

The procedures to be applied for detection, location and evaluation of magnitude and depth of seismic events would follow existing standard practices. The Ad Hoc Group considers it outside its mandate to recommend criteria for identification of seismic events.

Chapter 4 deals with the selection of seismograph stations for the network which should include around 50 observatories. Because it is not known which countries will make available stations, the Ad Hoc Group has chosen to present four possible networks.

Network I is based on stations for which information was provided to the Ad Hoc Group.
Network II includes at least one station from each CCD member operating seismograph facilities.
Network III is selected from among all known existing or planned stations according to purely seismological criteria.
Network IV is similar to Network III, but each station is (SRO) hypothetically equipped with high quality instrumentation.

The next chapter deals with the estimated capability of the specified global system. The networks have a significantly greater sensitivity in the northern than in the southern hemisphere. The report summarizes the networks' capabilities on contour maps. The results for the network with the highest capability (Network IV(SRO)) are:

(1) network detection capability for P-waves; 90% chance of detection at a minimum of four stations of events of m_b 3.8-4.2 in the northern hemisphere and of m_b 4.0-4.6 in the southern hemisphere;
(2) network location capability: for a surface event of m_b 5.0, a 90% chance of locating the epicenter by a minimum of four stations with an error not greater than 10-20 km in the northern hemisphere and 20-50 km in the southern hemisphere; and
(3) network detection capability for surface waves: 90% chance of detecting at a minimum of four stations, events of M_s 3.0-3.4 in the northern hemisphere and of M_s 3.4-3.8 in the southern hemisphere.

The paper makes no attempt to assess individual identification parameters nor to incorporate probabilistic models for seismic identification.

The next chapter - chapter 6 - is concerned with data exchange. The Group recommends that:

(1) For Level 1 data (basic signal parameters) use be made of the Global Telecommunication System (GTS) of the World Meteorological Organization (WMO) because of its global availability, proven operation and low cost.
(2) For Level 2 data (requested waveforms) which are usually more voluminous and less urgently needed, digital communication via WMO GTS or telecopying might be used in lieu of mail services.

Time delays for Level 1 data should be a maximum of 3-5 days whereas for Level 2 data a maximum of 4-6 weeks would be reasonable. The use of the GTS for transmission of seismic data has already been authorized by the WMO. The Ad Hoc Group believes that excess capacity of the GTS is sufficiently large to accommodate the expected load of the proposed data exchange.

Chapter 7 deals with the international centres for collection, processing and exchange of seismic data. More than one centre should be created so as to achieve acceptable reliability. For technical reasons related to the GTS it would be desirable to place the International Data Centres in locations where main WMO communications centres are presently situated as well as in some other places (e.g. in the southern hemisphere).

The main tasks of the International Data Centres would be:

(1) To receive Levels 1 and 2 data from seismic stations of the network via the authorized government facility of each state;
(2) To apply agreed analysis procedures to the data for estimating origin time, location, magnitude and depth of seismic events;
(3) To associate reported identification parameters with these events;
(4) To distribute, in accordance with defined procedures and without interpretation of identification parameters, compilations of the complete results of these analyses; and
(5) To act as an archive for reported data and results of the analysis of these data.

Chapter 8 deals with equipment and estimated costs of the proposed system. There are three major components:

(1) Equipment for seismograph stations: The minimum equipment is already available at most of the stations considered. The desirable equipment would be modern, high-quality instrumentation which would ensure data acquisition in numerical form.
(2) Data communications equipment.
(3) The international data centre's modern medium size computer facility.

Detailed costs are not given because of great variations between countries but order of magnitude estimates are included in Table 8.2 of the report.

The concluding chapter contains a proposal for an experimental exercise. The experiment is needed to:

(1) test the overall functioning of the new system,
(2) determine its operational efficiency and deficiencies,
(3) test telecommunications and data exchange procedures, and
(4) obtain practical experience and thereby shorten the lead time necessary to implement the system.

The Ad Hoc Group believes that at least six months will be needed to plan the experiment and an additional one year period will be required to execute and evaluate.

5. **Selected Comments of States:**

A number of countries supported the idea of the proposed experimental testing of the network. These included Sweden (CCD/PV.779, 14 March 1978), the US (CCD/PV.779), Japan (CCD/PV.781, 21 March 1978), Canada (CCD/PV.781), the UK (CCD/PV.780, 16 March 1978, the Federal Republic of Germany (CCD/PV.802, 27 August 1978), Australia (CD/PV.2, 24 January 1979), the Netherlands (CD/PV.16, 6 March 1979), Italy (CD/PV.18, 13 March 1979) and Belgium (CD/PV.18, 13 March 1979).

The USSR (CCD/PV.780, 16 March 1976) while accepting in principle the desirability of the experimental exercise contended that such an experiment could be carried out only after the conclusion of a CTB treaty when it will be known which states would be parties to the agreement. This was necessary since only then could it be determined which countries will decide on the experiment and contribute their seismographic stations to the network. Hungary (CD/PV.17, 8 March 1979) took a similar position.

Japan (CCD/PV.781) pointed out that the USSR's position would delay the carrying out of the experiment and the creation of the monitoring network. As a result, a CTB treaty would not be monitored for a least one year after it was signed since it will take at least that long to set up and conduct the test experiment.

Proposal Abstract K33(I79)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   Ad Hoc Group of Scientific Experts. "Second report of the Ad Hoc Group of Scientific Experts to consider international cooperative measures to detect and identify seismic event". CD/43, 25 July 1979.
   See also: - "Progress report to the Committee on Disarmament on the Fourteenth session of the Ad Hoc Group of Scientific Experts to consider international cooperative measures to detect and identify seismic events". CD/318, 19 August 1982.

4. **Summary:** *

The second report of the Ad Hoc Group deals mainly with technical and operational specifications for the data exchange network proposed in the first report.**

After reviewing its terms of reference and program of work the report deals in Chapter 3 with the specifications for Level 1 data (i.e. data which will be routinely exchanged). While the seismograph stations to be included in the proposed network do not presently have standardized equipment, only minor alterations are likely to be needed. The Group does recommend, however, that it is desirable for all network stations to be equipped with modern seismograph systems capable of continuous digital data recording. Operational procedures at network stations are not identical, but the Group recommends that existing practices continue to be used. Scope and consistency of reporting as well as equipment reliability and precision of calibration measurements will require more stringent standardization.

The parameters that are to constitute Level 1 data are given in the report as well as detailed instructions for their measurement. Because there is a lack of standardized procedures for automated measurements, manual measurement should continue to be used.

All seismic events registered by a station should be reported in terms of Level 1 parameters. An abbreviated form of reporting would be acceptable for events classified by a station's analyst as local

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* The following abstract is based primarily on the summaries given at the beginning of each chapter of the report.

** See abstract K32(I78).

earthquakes, quarry blasts or events belonging to a known earthquake sequence. Complete Level 1 data for these events would be furnished upon request.

Chapter 4 covers the data format and procedures for transmitting Level 1 data. The Group urges that the International Seismic Code be used as the basic format, together with some minor extensions. To ensure transmission reliability on the World Meterological Organization's Global Telecommunications System (GTS) formal arrangements must be made. Few problems are expected for transmitting Level 1 data on the high-speed circuits of the GTS but some difficulties are foreseen on peak load days on certain low-speed circuits (mainly in some regions of the Less Developed World). There is a need for further study of these problems.

The format and procedures for exchange of Level 2 data (i.e. waveforms) are discussed in Chapter 5. Several transmission formats are possible including facsimile transmission, numeric transmission and air mail delivery. All these approaches should be tested in the proposed experimental exercise of the network. Careful study of the use of the GTS for transmitting Level 2 data is required since its present capacity to handle this data is limited. The chapter and its corresponding Appendix specify details which must be provided when requesting Level 2 data as well as suggested data recording media and formats.

In Chapter 6 procedures to be used for data analysis at the international Data Centers are outlined. Data analysis should be performed using well-defined, automatic procedures though occasional interaction by a seismologist would be allowable if properly indicated on the results. Detailed technical procedures for seismic phase association, event location, depth estimation and magnitude determination are described in Appendices to this chapter. While identification data would be compiled and associated with the appropriate event, the Centers would not make any assessments as to the nature of any event.

Results of analysis should be reported via the GTS possibly supplemented by bilateral or multilateral arrangements between states. Preliminary bulletins would be distributed as soon as data allowed an event to be located. Detailed results should follow within a week of the event occurrence.

Each Data Center would have a data bank whose file structures and expected data volume are specified in Appendices to the report. These files would be stored permanently and the contents would be checked against files in other Centres. The Data Centres would normally conduct their tasks independently of one another but some coordination is necessary. There is a need for further research on the procedures to be employed in the Centres.

In the final Chapter the Group makes several recommendations relating to a new mandate for itself and to promotion of national investigations concerning the proposed network.

5. **Selected Comments of States:**

India (CD/PV.47, 2 August 1979) raises questions concerning who will bear the financial burden of standardized equipment for the network stations and the cost of the Data Centres. In a similar vein, Australia (CD/PV.54, 5 February 1980, CD/PV.80 and CD/95 both 22 April 1980) outlines several matters at which it feels the CD should direct its attention. Consideration of the matters now would avoid delay in the conclusion of a multilateral treaty and creation of an institutional framework for an international seismic detection network. This position was supported by Canada (PV.89, 3 July 1980). Among the subjects suggested by Australia for consideration are:

(1) The legal basis for the international seismic network:
   eg. - the need for a separate legal umbrella for administrative, financial and other matters;
   - what will be the relationship with other international bodies?

(2) Administrative and financial aspects:
   eg. - the need for an administrative secretariat and its functions, site, staffing and financing;
   - details regarding data centres and seismic stations;
   - national versus multilateral staffing and financing responsibilities.

(3) Access and information distribution:
   eg. - will non-parties, international organizations and scientific institutions have access?

(4) Role of the UN in the institutional arrangements.

(5) Communications links with WHO.

Proposal Abstract K34(G79)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic Sensors - international network
   (b) International exchange of information

3. **Source:**
   Sweden. "Working paper on International Seismic Datacenter Demonstration Facilities in Sweden". CD/45, 30 July 1979.
   See also: - Sweden. CD/PV.46, 31 July 1979.

4. **Summary:**

This paper gives a description of temporary international seismological data center facilities currently operating in Sweden plus an overview of the results from a recent test conducted using those facilities. In PV.46, the Swedish delegate points out that the International Data centres (for which the Swedish temporary facilities are intended as a model) suggested by the Ad Hoc Group of Scientists* as part of a global seismic monitoring network, will permit all states to base their national assessment of individual seismic events on data from the entire globe. In this way small states will also be able to verify the test ban in a meaningful way.

The working paper begins by outlining the tasks of such a data centre:

(1) receiving and storing Level 1 data transmitted through the World Meteorological Organization's Global Telecommunications System (GTS),
(2) combining data with the appropriate event,
(3) compiling reported identification data,
(4) providing analysis of Level 1 data to the parties within a week of the occurrence of the event,
(5) storing the results of the analyses,
(6) playing a role in the exchange of Level 2 data, and
(7) providing other service functions in connection with test ban verification.

For coordinating the efforts of the centers and ensuring proper execution of their functions, the service of an appropriate international body might be needed. This body would also review new developments in the field.

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* See abstract K32(I78)

The Swedish demonstration included three elements. First there was a temporary computer connection to the GTS. During the demonstration seismic data was transmitted from several countries and received in Sweden.

The second element comprised several computer programs compiled for analysis and handling of Level 1 data. A problem with these programs is that they sometimes result in the generation of spurious events. Fully automatic processing using the programs, however, would permit the production of identical output bulletins. More research is being conducted in this area.

The demonstration facilities were tested using an experimental database based on data from 60 seismological stations over the period of one week. This database constituted the third element of the Swedish demonstration.

On the basis of the test some useful insights were gained. For Level 1 data there is considerable difference between seismic data routinely reported at present and that necessary for test ban verification. It is important that procedures be developed at individual stations to extract and report those additional data needed for test ban verification. This, however, could be quite extensive and tedious work. Some of the seismic data which was suggested by the Ad Hoc Group in their report turned out not to be very useful and its inclusion should be reconsidered. Information on downtimes of individual stations and of their detection capability or actual noise values proved to be of great importance for the analysis of data.

The 60 station network from which the test data was compiled was quite efficient in defining and locating seismic events which supports the conclusion of the Ad Hoc Group that a network of 50 to 60 globally distributed stations will be satisfactory for verification.

Test evidence suggests that data centres would substantially improve their ability to associate short period signals and to define new events if preliminary location data were reported from the individual stations in the global monitoring network. Results suggest also that routine analysis and reporting of long period surface waves is valuable and that short period identification data can be compiled without assessing the nature of the event.

Regarding data without handling routines, the Swedes found that database systems were inferior to specialized routines for data handling, storage and retrieval.

No specific technical problems were encountered regarding the use of the GTS. However, because seismic data is still unfamiliar to GTS operators, tests should be conducted to familiarize them with it.

The compilation of complete records of both short and long period (Level 2) data showed the value of having the full records obtained by individual stations available when assessing and interpreting a seismic event. Consequently, efficient routines for the exchange and compilation of Level 2 data should be established.

The Swedish paper concludes by indicating that the research at these temporary data center facilities will continue.

Proposal Abstract K35(G79)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban
   - peaceful nuclear explosions

2. **Verification Type:**
   (a) Seismic sensors - international network
   - intra-border stations
   (b) Remote sensors
   (c) International exchange of information
   (d) On-site inspection - selective
   (e) International control organization
   (f) Complaints procedure - consultation and cooperation
   (g) Review conference

3. **Source:**
   United Kingdom. CD/PV.46, 31 July 1979.
   See also: - UK/US/USSR. CD/130, 30 July 1980.
   - UK. CCD/PV.780, 16 March 1978.
   - UK. CCD/PV.798, 8 August 1978.

4. **Summary:**

In a statement on behalf of the UK, US and USSR in PV.46 regarding the progress of the tripartite negotiations on a treaty prohibiting nuclear weapon tests in all environments and its protocol covering peaceful nuclear explosions, the UK delegate noted that agreement had been reached on several points:

(1) The treaty should provide for verification by national technical means and for the possibility of on-site inspection.

(2) An exchange of seismic data is an important aspect of verification. In this context the Ad Hoc Group of Seismic Experts' recommendations* will influence the way in which the exchange of seismic data is implemented in practice.

(3) A Committee of Experts drawn from the parties to the treaty should be established to assist in the implementation of the exchange.

(4) After a certain period, there should be a conference of the parties to review the treaty's operation.

A more detailed review of the tripartite talks' progress was presented in a joint working paper in July 1980. Regarding verification the parties have agreed that:

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* See abstract K32(I78)

(1) National technical means of verification will be employed in a manner consistent with generally recognized principles of international law. Parties will undertake not to interfere with NTMs.

(2) An International Exchange of Seismic Data will be established. Parties will have the right to participate in this exchange, to contribute data, and to receive data. The data will be transmitted through the Global Telecommunications System of the World Meterological Organization. International seismic data centres will be established at agreed locations.

(3) A Committee of Experts will be established to consider questions related to the Data Exchange, to which parties can appoint representatives. This body will have its first meeting within 90 days of the entry into force of the treaty.
   (a) This Committee will elaborate arrangements for the Data Exchange including technical standards for participating seismic stations and data centres, form of data to be received from stations, and form of data to be made available by the data centres.
   (b) The Committee will also have ongoing responsibility for facilitating the implementation of the Data Exchange, for reviewing its operation and possible improvements and for considering technological developments affecting its operation.

(4) The Treaty will include a provision for direct consultations and exchanges of inquiries and responses between the parties. A party may request an on-site inspection in the territory of another giving reasons for its request including appropriate evidence. The party receiving the request shall state whether or not it will agree to an inspection giving reasons for any refusal.

(5) There will be provisions for permitting two or more parties, because of special concerns or circumstances, to agree upon additional verification measures. The three negotiating parties have agreed that such additional measures are necessary for themselves. Such measures, while paralleling those of the treaty itself, will specify in greater detail the procedures for on-site inspection, giving a list of rights and functions of the inspectors as well as detailing the role of the host government. In addition, the three parties will negotiate an exchange of supplemental seismic data involving the installation and use of high-quality seismic stations of agreed characteristics.

(6) There will be a review conference provision. Amendments to the treaty will require consent of the permanent members of the Security Council which are parties.

5. Selected Comments by States:

Several delegations were concerned about the timing of the establishment of the Committee of Experts. The Netherlands suggested that a provisional committee be set before the coming into force of

the treaty, which would prevent delay in setting up the Data Exchange system (CD/PV.97, 5 August 1980). Sweden suggested such a role for the Ad Hoc Committee of Seismic Experts (PV.97). See also: Australia (PV.97) and Japan (PV.98, 7 August 1980).

The Netherlands (PV.97) also pointed to the need for a more general political "consultative committee". Canada (PV.99, 8 August 1980) shared this view. There was also concern expressed over the provision for a special, independent verification system limited to the three negotiating parties. See: Pakistan (PV.97), India (PV.97), and Sweden (PV.97).

The Netherlands (PV.97) and Canada (PV.99) favoured a "liberal policy" regarding the seismic network whereby non-parties to the treaty could provide data to the network and receive data from it.

Proposal Abstract K36(I80)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban
   - partial test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   - intra-border stations
   (b) On-site inspection - selective
   (c) Remote sensors - satellite
   - ELINT
   (d) Short-range sensors - monitoring devices

3. **Source:**
   United Nations. Secretary General. "Comprehensive Nuclear Test Ban: Report of the Secretary General". CD/86, 16 April 1980.

4. **Summary:**

This report includes an historical review of negotiations related to a comprehensive nuclear test ban for the period from 1955 to 1979. Verification is identified in the report as one of the major issues still unresolved. The report points out that the problems of verifying a CTB differs in important respects from those of the Limited Test-Ban Treaty of 1963* since clandestine underground nuclear tests under a CTB could provide a military advantage to a violator. The alternative of a threshold test ban poses even more verification problems than a CTB.

It is generally recognized that seismological means are a most effective form of verification and can deter violations. This method will constitute the principal component of a global control system for an underground test ban. After reviewing the reports of the Ad Hoc Group of Scientific Experts** and the progress of the tripartite talks on the CTB in 1979,*** the report refers to the supplemental verification arrangements planned by the UK, US and USSR for themselves as part of the envisaged CTB. These arrangements would apparently consist of the national seismic stations (advanced, tamper-proof stations, nationally manned, as opposed to automatic black boxes). Data from these stations would be continuously and directly transmitted outside the host country. Such stations would help lower the detection threshold and if properly distributed could

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* See abstract J120(T63).
** See abstracts K32(I78) and K33(I79).
*** See abstract K35(G79).

provide supplementary identification data. In addition, they could serve to deter evasion if placed where geological structures might be considered suitable for clandestine tests.

On-site inspection has been urged because there may remain a few events on uncertain origin each year despite a global seismic monitoring network. If the global seismic network is supplemented by national seismic stations, satellite observations and electronic intelligence gathering, the need for on-site inspections should be further reduced.

Questions will arise regarding application of the whole verification system if some verification arrangements are reserved solely for the UK, US and USSR, especially if China and France decide to particpate in the CTB. The report raises several questions concerning these special arrangements. Will other states be required to set up national seismic stations? Will data from such stations be generally available? Will on-site inspections on the territories of the three powers be conducted with the participation of other states as well? Also, what will be the relationship between the special arrangements for the three powers and the general verification system for all the parties?

The Secretary General's report concludes with the assertion that "verification of compliance no longer seems to be an obstacle to reaching agreement".

5. **Selected Comments of States:**

The US representative (PV.97, 5 August 1980) rejected the conclusion of the Secretary General's report that verification was no longer an obstacle. He pointed to a paragraph in the report by the three CTB negotiating parties* which stated that verification provisions must first be agreed in principle and then worked out in detail, a laborious process. It must be done with care because implementation of these measures will have an important impact not only on ensuring compliance, but also on political relations among the parties.

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* CD/130, 30 July 1980; see abstract K35(G79).

Proposal Abstract K37(A81)

1. Arms Control Problem:
   Nuclear weapons - comprehensive test ban
   - partial test ban

2. Verification Type:
   (a) Seismic sensors - extra-border stations
   - intra-border stations
   (b) Remote sensors
   (c) On-site inspection - selection
   (d) Short-range sensors - monitoring devices

3. Source:
   Hussain, Farooq. The Future of Arms Control: Part IV The Impact of Weapons Test Restrictions. Adelphi Papers #165. London: International Institute of Strategic Studies, 1981.

4. Summary:

The author provides a concise review of current capabilities for remote monitoring of nuclear tests. Regarding underground tests he assesses the current seismic detection threshold to be about 1.5 kt for explosions in hard rock and the identification threshold to be between 5 and 10 kt. Methods of evading seismic detection are discussed including past tests on the feasibility of some of these techniques. Of these evasion methods decoupling is the easiest. Such evasion could be thwarted, however, by the use of remote seismic monitoring stations located at selected sites in the US and USSR and by permitting on-site inspection by challenge. With regard to the remote monitoring stations, problems may arise because these devices have not yet been fully tested. Also, because these stations could be inspected by nationals of the countries in which they are located, it may be possible for violators to gauge the detection threshold of the system and thus facilitate evasion.

Many of the limitations on verifying a comprehensive test ban also apply to monitoring a partial test ban such as the Threshold Test Ban Treaty of 1974, some of the verification problems of which are discussed. Hussain concludes that it should be possible to verify within tolerable limits an agreement to restrict both the number and yield of nuclear weapons tests (to roughly six per year at yields of 5 to 10 kt). He believes, however, that a CTB treaty would have little value as a means of restraining further nuclear weapons innovation since the options for significant new developments are virtually exhausted.

Regarding atmospheric tests, Hussain points to the suspected nuclear test in the South Atlantic of 22 September 1979 as indicating

that, even with modern surveillance satellites, violations of the LTBT are still feasible. He also discusses concerns about nuclear testing in the upper atmosphere and outer space. Since all spacecraft are tracked and identified, the chances of such tests successfully evading detection are reduced.

Proposal Abstract K38(A82)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   Seismic sensors - extra-border stations
   - intra-border stations

3. **Source:**
   Sykes, Lynn R., and Jack F. Evernden. "The Verification of a Comprehensive Nuclear Test Ban". Scientific American 247, no. 4, October 1982.

4. **Summary:**

Previous attempts to negotiate a test ban treaty have been thwarted by the conviction that there was no means of assuring compliance with a treaty; small explosions could not be reliably detected and identified. The authors contend that the detection of the smallest explosion is now possible and could be verified with a high degree of accuracy.

The actual means by which such explosions may be identified are described, and the process of identification is thoroughly depicted in graphs, charts and diagrams. Seismic events give off waves which are elastic vibrations in the earth's surface. The detection and measurement of these seismic waves helps to identify an explosion from great distances. There are two types of waves. The first are 'compressional'or primary (P) waves, and the second are 'shear' or secondary (S) waves. Any underground explosion will generate mostly P waves, while earthquakes generate S waves. Two other types of surface waves, known as 'Love' and 'Rayleigh' waves, help to identify seismic events. Simple explosions will not generate Love waves, whereas earthquakes generate both types. Using these methods, the waves produced by an earthquake may thus be distinguished from those produced by an explosion in many instances.

Identification is further facilitated by the location, depth and frequency of given incidents. The position of the explosion may be calculated according to the length and 'travel time' of waves. These methods are accurate to within 10-25 kilometres of the site of the explosion. Explosions under the oceans generate an entirely different 'hydroacoustic' signal from that generated by an earthquake, and are thus easily distinguished from the latter. Since half of all seismic events occur at sea, "the simple act of locating seismic events classifies most of them as earthquakes" (p.49). The calculation of the depth of a seismic event also facilitates identification. Of all earthquakes, 50 to 60% occur 50 kilometres below the earth's surface, while 90% are at a depth of at least 10 kilometres. Explosions, on

the other hand, cannot be conducted more than 15 kilometres below the surface of the earth, and usually are conducted about 2 kilometres down. Consequently, the depth of an event will provide a definite basis for identification in most instances. The depth itself may be determined by a comparison of P and S waves and their time of arrival at fairly proximate seismic stations.

Thus, by ascertaining the depth and location, it is possible to identify almost any seismic event. Moreover, given that a large number of events will take place in countries that do not possess or test nuclear weapons, very few suspicious events actually occur. Only .5% of the world's seismic events, or about 100 a year, occur at a depth and location which indicate that they may be considered as possible nuclear explosions. The characteristics of the waves themselves provide a further clue as to their source. For example, Love waves will be much stronger with a shallow earthquake than with an underground explosion. The initial motion of the earth in P waves will almost always be upwards when generated by an explosion, and may be either up or down when generated by an earthquake. The pattern of P waves generated by earthquakes also tends to be quite asymmetric, whereas explosion P waves are quite uniform. Finally, Rayleigh waves are usually of a much larger magnitude when generated by an earthquake.

Some factors may hinder the identification process, however. The capability of a monitoring station will always be limited by its proximity to the site where alleged explosions occur, as its ability to screen out 'microseisms' or random vibrations of the earth's surface deteriorates with distance. As a result, explosions with a low yield could escape detection in some instances. However, "almost all the seismic areas of the USSR are along its borders, and an external network would be sensitive to events of even smaller magnitude there. The mere detection of a seismic event in most areas of the interior would constitute identification of the event as an explosion" (p.52).

The possibility exists that countries might seek to muffle low-level explosions by setting them off during or soon after an earthquake, although this would be difficult to coordinate. Such muffling could also be accomplished by "detonating the explosion in a large cavity or by using energy-absorbing material in a smaller cavity" (p.52). The use of underground cavities for nuclear tests allows the release of some natural stress, so that the P waves generated by an explosion will more closely resemble those of a small earthquake - this is called 'decoupling'. Love waves will be generated, and the amplitude of Rayleigh waves will also be greater. Decoupling would be possible only where suitable cavities existed, and there are few in the USSR.

The seismic waves produced by an explosion may also be reduced by detonating the device in a 'low-coupling medium' such as dry alluvium but, again, reserves of alluvium in the USSR would limit concealed explosions to 10 kilotons. Finally, explosions could conceivably be concealed where seismic stations were confused by the waves from two or more earthquakes which occurred simultaneously. It is clear that a

monitoring system which relied exclusively on external stations might be susceptible to some of these evasive tactics in its ability to detect low level explosions. Nonetheless, the feasibility of such evasive tactics is questionable; "in contrast to these daunting requirements for successful evasion, the only requirements for a monitoring nation are to operate a network of high-quality seismic stations and to process the data with determination. Against a network of 15 external stations and 15 internal ones the only effective evasion schemes at yields of one kiloton or more would require both decoupling and hiding the explosion signal in an earthquake" (p.54).

On the basis of the evidence presented, it is concluded that the efficacy and reliability of seismic methods of verification are beyond question. While they are admittedly not perfect, the probability of detection is so high that this method of verification affords ample assurance that violations will be detected. A comprehensive test ban would be relatively easier to verify than a partial one, since "the judgment of whether or not a test has taken place will always be less equivocal than an exact determination of yield" (p.55). Furthermore, it is asserted that all technological uncertainties would work against the potential evader with a comprehensive test ban, since the risk of detection would be high.

Proposal Abstract K39(G82)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   Norway. "Working paper on a prototype system for international exchange of seismological data under a comprehensive test ban treaty". CD/310, 11 August 1982.
   See also: - Ad Hoc Group of Scientific Experts. "Report to the CCD of the Ad Hoc Group of Scientific Experts to consider international cooperative measures to detect and identify seismic events". CCD/558, 14 March 1978 (See abstract K32(I78)).
   - Norway. "Working paper: the role of international seismic data exchange under a comprehensive nuclear test ban". CD/395, 19 July 1983.
   - Norway. "Seismic verification of a comprehensive nuclear test ban: future directions". CD/507, 15 June 1984.

4. **Summary:**

The Norwegian working papers are contributions to the work of the Ad Hoc Group of Scientific Experts. A research project, sponsored and initiated in 1980 by the Norwegian government, was undertaken to evaluate how modern telecommunications technology could be used to improve data exchange within a global verification system as proposed by the Ad Hoc Group. The project resulted in the development of a prototype system with the following features:

(1) low-cost microprocessor (type North Star),
(2) data transmission via ordinary telephone lines,
(3) handling of both Level 1 data (daily parameter reports of detected events from each section in the network) and Level 2 data (on request, complete waveform data for events of special interest) as well as messages, and
(4) simple and flexible operation.

The paper concludes that Level 1 and Level 2 data and relevant messages can be exchanged between most countries using standard telephone services. The cost of a minimum configuration would be relatively low (approximately $5,000 (US) in 1982). Line charges would be extra. Norway recommends further experiments in order to permit the incorporation of this method of data exchange into a verification system for a comprehensive test ban treaty.

In working paper CD/395, Norway reports further improvements in the prototype called the Remote Seismic Terminal Enhanced (RSTE). Tests are also being conducted to determine how Level 2 data could be exchanged via INMARSAT, a low cost maritime satellite, as an alternative if land-based communications are inadequate. Other studies have demonstrated the viability of using small-aperture arrays for comprehensive analysis of seismic events at non-teleseismic distances and Norway offers its Norwegian Seismic Array (NORSAR) as a contributing observatory to a proposed global seismological network.

In working paper CD/507, Norway discusses the development of a new Norwegian small aperture array which will incorporate many of the latest technological advances. The paper reviews recent efforts to establish an international exchange of seismic data, in particular Level 2 (waveform) data, using modern telecommunications technology. The paper also reports research results which show that the possibilities of detecting seismic signals of very high frequencies are better than has been assumed. This could lead to improved detection capabilities for weak seismic events.

Proposal Abstract K40(A83)

1. **Arms Control Problem:**
Nuclear weapons - comprehensive test ban

2. **Verification Type:**
Seismic sensors - intra-border stations

3. **Source:**
Hannon, Willard J. "Seismic Verification of a Comprehensive Test Ban". Energy and Technology Review. Lawrence Livermore National Laboratory (May 1983): 50-65.

4. **Summary:**

This article evaluates the capabilities of an in-country seismic station network for monitoring a comprehensive test ban (CTB). Hannon concludes that a seismic monitoring network which includes 15 high quality array stations in the Soviet Union could provide an overall detection capability in the Soviet Union of seismic magnitude 3.0 (or as low as 2.4 in some regions). Considering the threat of cavity decoupling, such a network could detect decoupled explosions with yields as low as 3 to 10 kt with a 90% degree of confidence. Detection of explosions with yields of 1 kt with a 90% degree of confidence would require a more extensive network which includes more than 30 high-quality in-country arrays. It is uncertain whether such a verification regime could be negotiated. In either case, "significant numbers of events would remain unidentified, and these, if unresolved, would pose a significant problem to the continued acceptance of a CTBT" (p.64).

There is a debate over what would constitute "adequate" verification of a CTBT. Some argue that any testing would pose a significant threat to national security, therefore, the degree of confidence in the ability to identify a single clandestine test should approach 90%. Others suggest that only a program of repeated testing is of military significance, therefore, a 10 to 30% degree of confidence in detecting a single test is necessary. A comparison of these approaches shows that, given a 30% degree of confidence for detecting a single test, seven tests could be carried out before the probability of identifying at least one violation would exceed 90%.

In-country seismic stations have a greater ability than external stations to detect seismic waves and to characterize and identify their sources. Data recorded by seismometers can be transmitted unencrypted with a codeword known only to the verifier so that the integrity of the data can be ensured. The data is processed and analyzed to establish the location of the source and to discriminate between explosions and earthquakes. In-country monitoring in the

Soviet Union would be inhibited by the lack of waveform information about seismic signals from Soviet nuclear tests and peaceful nuclear explosions. In fact, this will be "a serious limitation on the US ability to discriminate among small seismic events under a CTBT" (p.54). The Soviets do not face a similar problem because of the wide availability of US seismic data.

The use of seismic arrays instead of simple stations would improve detection capabilities. Figure 4 (p.57) illustrates the short period detection capability at the 90% confidence level of a network of 30 stations including 15 within the USSR which utilize high-quality arrays. Figure 5 (p.58) shows the improvement in detection capability contributed by the use of arrays. Figure 6 (p.58) illustrates the effect of variations in network capabilities such as reducing the confidence level to 30%, reducing the number of stations by 5 and varying station locations by 100 km.

Identification of the source of the seismic wave can be attempted with various methods. If the depth of an event is found to be greater than 15 km, the event can be ruled out as an explosion because current drilling limits are less than 10 km. Event magnitudes of over 4.0 in certain areas of the Soviet Union were thought to indicate explosions, but recent studies of low-level seismicity and earthquakes have suggested that identification of the source cannot be made by detection alone. The ratio of body wave to surface wave (m_b:M_s) can discriminate earthquakes from explosions and variations in spectral content and radiation patterns may also be useful discriminants. However, the problem of false alarms still exists. Figure 9 (p.61) shows that about 1,500 events per year will remain unidentified at the 2-to-3-magnitude level. As a result, "these unidentified events will pose a significant obstacle to continuing confidence that the terms of the treaty are being observed" (p.60).

Evasion techniques for preventing detection must be considered. Explosion decoupling or choosing a site from which the path to the seismic station is through a region which absorbs significant seismic energy are possible methods. Hannon notes that "opportunities for decoupling small events in salt cavities are widespread throughout the Soviet Union" (p.62). However, building cavities large enough to decouple higher yield explosions is difficult. Masking an explosion in an earthquake signal is theoretically possible, but necessitates waiting for an earthquake for an undetermined period. Techniques for predicting or exciting earthquakes of a specific size could make this method of evasion useful and research in this area is being conducted by the US and the USSR for disaster prevention, but no capabilities are currently possessed.

Proposal Abstract K41(G83)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information
   (c) Remote sensors
   (d) International control organization
   (e) Complaints procedure - consultative committee
   - referral to Security Council
   (f) On-site inspection - selective
   - obligatory

3. **Source:**
   Japan. "Verification and compliance of a nuclear test ban". CD/388, 8 July 1983.
   See also: - "Views on a system of international exchange of seismic data". CD/389, 8 July 1983.
   - "Working paper on a contribution to an international monitoring system using a newly installed small seismic array of Japan". CD/390, 8 July 1983.

4. **Summary:**
CD/388 states that since it is nearly impossible to distinguish between a nuclear weapon test explosion and a peaceful nuclear explosion, a comprehensive test ban should prohibit peaceful nuclear explosions as well as nuclear weapon test explosions. Japan proposes a combination of verification methods to monitor compliance with a comprehensive test ban treaty. These methods are:

(a) Remote sensing by national technical means;
(b) An international exchange of seismic data through the Global Telecommunication System of the World Meteorological Organization; and
(c) An international Consultative Committee.

The Consultative Committee would be composed of representatives of all parties and would hold a yearly conference. Its decisions would be taken "in principle" on the basis of consensus. The Committee would be assisted by technical experts with experience in seismic detection. The Committee of Experts would supervise the exchange of seismic data, would make recommendations concerning scientific and technical criteria relating to the system and techniques for on-site inspections and would carry out on-site inspections.

Complaints related to lack of cooperation among parties which inhibits implementation of the treaty would be referred to the

Consultative Committee. More serious complaints relating to violations of the treaty would be handled in two stages. First, a party suspecting a violation may request the Consultative Committee to conduct a factual investigation which may include an on-site inspection. If the results of the investigation do not satisfy the party, it may refer the matter to the Security Council. On-site inspections would be carried out by members of the Committee of Experts under the authority of the Consultative Committee. Such inspections would be considered obligatory.

In working paper CD/390, Japan explains how a small seismic array improved the detection capability and data processing of the Seismological Observatory at Matsushiro in central Japan. The Observatory can now locate an epicentre by itself. Such accomplishments are important for the improvement of an international seismological monitoring system. The working paper uses tables, schematic diagrams and bar graphs to explain improvements in the detection system.

Proposal Abstract K42(G83)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information
   (c) Remote sensors
   (d) On-site inspection - selective
   (e) International control organization
   (f) Review conference

3. **Source:**
   Sweden. "Draft treaty banning any nuclear weapon test explosion in any environment". CD/381, 14 June 1983.

4. **Summary:**

This draft treaty is a revision of the Swedish "Draft treaty banning nuclear weapons test explosions in all environments", CCD/526, 1 March 1977 and CCD/526/Rev.1, 5 July 1977 (see abstract K30(G77)).

The draft treaty proposes the following combination of verification procedures in Article 4 and three protocols:

(1) Remote sensing by national technical means;
(2) An international exchange of seismic data and data on atmospheric radioactivity; and
(3) On-site inspection by an international Consultative Committee.

Protocol 1 discusses the international data exchange. The exchange would be coordinated by designated national bodies, international data centres and the Consultative Committee and its secretariat. The seismological data would be transmitted through the Global Telecommunication System of the World Meteorological Organization (WMO/GTS) or other agreed communication channels. International data centres would be financed by and under the jurisdiction of the state in whose territory they are located. Free and easy access to the data centres would be granted to all representatives of parties to the treaty and to officers of the secretariat of the Consultative Committee. A similar exchange of data on atmospheric radioactivity would also be established. Parties would undertake negotiations on further international verification measures such as the exchange of data on hydro-acoustic signals in the oceans and infra-sound and micro-barographic signals in the atmosphere.

Protocol 2 provides details of the procedures for on-site inspections. On-site inspections may be requested by parties which wish to determine whether an event was a nuclear explosion if bilateral consultations cannot resolve the matter. Requests would be made through the Consultative Committee and would be accompanied by an explanation and supporting evidence. The requesting party would

specify the area to be inspected which must be continuous and not exceed 1,000 km^2 or a length of 50 km in any direction. The receiving party may refuse to grant the request, but would state the reason for its refusal. If the request is granted, an inspection would be conducted by experts chosen by the chairman of the Consultative Committee. The protocol outlines the rights and responsibilities of the inspecting personnel. The on-site inspection would be conducted for fact-finding purposes only and no assessment of the inspected event would be made. The report of the inspectors would present the results of the investigation reflecting, as far as possible, the consensus view of the experts. If consensus is not possible, the report would present the views of all the participating experts.

Parties may also invite an inspection team to observe (by visual means only) large non-nuclear explosions in order to prevent unfounded accusations or misinterpretations of such explosions. The inspectors would issue a factual report of their observations. Protocol 2 also suggests the consideration of other on-site inspection techniques including:

(1) visual inspection from the air and on the ground;
(2) measurement of atmospheric, ground and water radioactivity;
(3) temporary measurement of seismic disturbances to record possible aftershocks and events at greater distances;
(4) seismological reflection measurements, in limited areas, to detect possible sub-surface activities;
(5) measurement of temperature anomalies; and
(6) drilling and measurement in boreholes to record subsurface data.

Protocol 3 charges the international Consultative Committee with overseeing the implementation of the treaty and verifying compliance. The Committee would prepare review conferences at five year intervals to monitor implementation and compliance. The Committee would establish a Technical Expert Group open to governmental experts from all parties. The Group would evaluate the technical performance of the international verification measures and propose changes in the equipment and technical procedures used in the verification system. A permanent secretariat would be established to assist the Consultative Committee and Technical Expert Group particularly in matters relating to the international exchange of seismological data and on-site inspections.

Proposal Abstract K43(G83)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) On-site inspection - selective

3. **Source:**
   United Kingdom. "Working paper: verification aspects of a comprehensive test ban treaty (CTBT)". CD/402, 1 August 1983.

4. **Summary:**

The paper states that adequate verification of a CTBT is necessary to assure states that the treaty is being complied with by all parties and to generate confidence that there is little possibility of undetected violations of the treaty occurring. The paper proposes two methods of verification: seismic verification and on-site inspection. It then proceeds to list their deficiencies which must be overcome. Seismic verification is not as reliable a method as many commentators suggest, according to the paper. The most significant problem is posed by the fact that reliable verification must both detect and identify explosions, that is, it must distinguish between a nuclear explosion and other seismic events such as earthquakes. The identification threshold is about half a magnitude higher than for detection alone. A worldwide seismic monitoring system such as that proposed by the Ad Hoc Group of Scientific Experts would be able to detect and identify seismic events of body wave magnitude 4.5 or more. However, nuclear tests using decoupling from geologic formations could create explosions of up to a few tens of kilotons without producing an event of body wave magnitude 4.5. Explosive tests could also be timed to coincide with earthquakes and could be hidden in this way. Clandestine tests would thus be possible and a reliable verification system would have to overcome this problem.

On-site inspection would be necessary for verification because the interpretation of seismic signals can never give completely conclusive proof that a nuclear explosion has taken place. Fission products are an almost unambiguous indicator of a nuclear explosion. Access to the site and the cavity formed by the explosion is necessary for verification because fission products cannot be detected at a distance. On-site inspections are difficult to arrange, however, because states object to potential infringements of national rights and to threats to national security. Nevertheless, on-site inspections are essential for reliable, adequate verification procedures.

5. **Selected Comments of States:**

The USSR (CD/PV.231, 4 August 1983) criticizes the working paper for implying that until all the technical problems have been solved, there can be no negotiations on a CTBT. Criticism is also leveled at the US and the UK for retreating from an earlier agreement that an international system for the exchange of seismic data would be sufficient for verification (see the tripartite report, CD/130 abstract K35(G79)).

Proposal Abstract K44(A84)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - intra-border stations
   (b) Remote sensors - satellite
   (c) On-site inspection - selective
   (d) Short-range sensors

3. **Source:**
   Glenn, Lewis A. "Verification Limits for Test-Ban Treaty". Nature 310, no. 5976 (2-8 August 1984): 359-362.

4. **Summary:**

The author concludes that "a total ban on all nuclear testing cannot be verified by seismic (or in fact by any other technical) means" (p. 362). If in-country seismic networks were excluded from use in verification so that only extraterritorial monitoring could be used, clandestine explosions of up to 10 kt in yield conducted in certain geographical formations even without cavity decoupling could go undetected. Even larger explosions might remain undetected if they were partially decoupled in cavities big enough to reduce the seismic amplitude by a factor of 5-10.

The most important verification method for verifying a CTB is a network of stations for seismic monitoring and particularly the in-country stations. Satellite monitoring is not especially useful because low-yield explosions in buried cavities do not produce any observable ground-surface motion. On-site inspection might be necessary to investigate ambiguous events. Figure 2 (p. 360) illustrates the overall detection capabilities as a function of the number and type of internal stations. The overall detection capability is the magnitude above which an explosion at any point in 90% of the Soviet Union would be detected with 90% confidence. For example, a network of 22 stations with seismic arrays could detect an event of seismic magnitude as low as 2.9 on the Richter scale with 90% confidence. Figure 3 (p. 361) shows the estimated effects of varying some of the parameters such as reducing the number of stations, varying locations by 100 km and reducing the confidence level to 30%. The author notes that, given a 30% level of confidence for detecting a single event as an explosion, a series of several tests would have to be conducted before the probability of detecting at least one CTB Treaty violation would exceed 90%.

Glenn discusses several methods of distinguishing explosions from earthquakes. First, locating source depth can identify the event because drilling limits are currently less than 10 km. An event originating more than 10 km below the surface is most likely an

earthquake. Second, knowledge of the previous occurrence of earthquakes in a region can be helpful. However, areas may be seismically inactive at the high magnitude levels but not at the low levels relevant to a CTB Treaty. A third discriminant is measurement of the ratio of surface wave to body wave magnitudes (M_s:M_b). This method may not be useful at low magnitudes, particularly if explosions are detonated in long tunnels or odd-shaped cavities.

The article considers opportunities for evading detection. Locating a test site in rock which absorbs significant seismic energy can facilitate evasion. Figure 1 (p.359) measures seismic body wave magnitude against explosive yield for different explosion environments (hard rock, dry alluvium and cavities). The results are based on US data from the Nevada test site, but it is unclear whether the findings are applicable to the Soviet Union. Verification of alleged Soviet violations of the Threshold Test Ban Treaty is complicated by evidence which suggests that an explosion in the Soviet Union registers several tenths of a magnitude unit higher than the same explosion at the Nevada Test Site. Cavity decoupling can permit evasion by reducing the detected magnitude of explosions. Figure 1 shows that with a decoupling factor of 50, an m_b value of 2.7 indicates an explosion of 5 kt in a cavity as opposed to 0.1 kt in tamped hard rock. However, objections to these calculations which were based on observed decoupling effects in nuclear test explosions have been raised on theoretical grounds. A salt cavity of radius 49 m would be necessary to fully decouple a 5 kt explosion. The size of such a cavity makes excavation impractical and excavation of hard rock would be costly even though the necessary cavity size would be less. Nonetheless, excavation of large underground cavities could be disguised as industrial mining and thus evade satellite detection. The cost of solution mining a cavity of 50 m radius in the American Tutum salt dome was estimated at $20 million (1977), but a single cavity might be useful for up to 25 tests over a two year period. With salt, it is also possible to create a primary cavity with a tamped explosion and then enlarge it by exploding larger and larger devices.

Verification capabilities for a CTB treaty would be improved if internal seismic stations were permitted. With internal seismic arrays, explosions exceeding 5-10 kt could probably be detected. The problem of detecting low yield explosions still remains. R.E. Kidder of Lawrence Livermore National Laboratory proposed (in an unpublished letter) a maximally restrictive verifiable test ban (MRVTB) to overcome this problem. This proposal would permit certain low yield tests to be conducted at a single designated and seismically well-characterized site in each country and would require that the explosions not produce a near-field seismic signal in excess of a specified value. The designated sites could be calibrated with radio-chemical probes. The MRVTB could reduce the present yield limit of 150 kt by a factor of 30 with high confidence that neither side was cheating. There would be no incentive to evade the agreement with low yield tests because they would still be permitted and clandestine high yield tests would be detected by the internal seismic network. However, isolated clandestine tests might still go undetected even with a MRVTB.

Proposal Abstract K45(G84)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - intra-border stations
   - extra-border stations
   (b) Remote sensors - satellites

3. **Source:**
   United States. Department of Energy. Sandia National Laboratories. "National Seismic Stations". Sandia Technology 8, no. 2 (November 1984): 26-32.
   See also: - Stokes, Paul A. "The National Seismic Station". Sandia Report (December 1985). SAND81-2134.
   - Abstract J95.2(A86)

4. **Summary:**
   This article discusses Sandia Laboratories' work on developing a prototype National Seismic Station (NSS) system which could be used for verifying a comprehensive test ban treaty (CTBT). A CTB could be monitored by a system consisting of satellites and seismic networks outside the country being monitored and unattended seismic stations and on-site inspections in the country conducting the tests. The prototype NSS which would form a component of such a monitoring system has been operating in the United States for several years.

   The article notes that current seismic technology cannot monitor a CTBT completely, but an NSS can aid in verification. Each NSS employs a "downhole package" (seismometers, authentication circuits and processing electronics) and a surface station to provide electrical power, data storage and transmission and control functions.

   Because the NSS would be located in foreign countries, special measures are incorporated to verify the authenticity of their seismic data. The data authentication system uses a key word which is changed every twelve days. This method does not require encryption of data so that the host country can have immediate access to the data and thereby ensure that only seismic information is being transmitted. The seismometer package is also buried 100 m deep and therefore enjoys a high level of tamper protection. Reliability of the unattended stations is ensured by redundancy in systems and circuitry. A network of six NSSs is presently (1984) deployed in the US and Canada to evaluate the utility of a more extensive network for monitoring seismic events in the USSR as part of a CTBT.

   The article contains useful pictures and graphs. In addition, short summaries are provided describing a seismometer and some techniques used for distinguishing explosions from earthquakes. In

the course of the latter, reference is made to a Lawrence Livermore National Laboratory estimate which predicts a 90% confidence level of detecting an explosion with a seismic signal equivalent to that from a 0.5 kt detonation in hard rock or a 5 kt detonation in dry alluvium. The estimate is based on a network of 15 stations within the Soviet Union and 15 outside. The network could be configured to provide special coverage of areas where decoupled explosions would be most easily carried out and areas of high seismic activity where detonations might be hidden in earthquakes (p.30).

Proposal Abstract K46(I84)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information
   (c) International control organization

3. **Source:**
   Ad Hoc Group of Scientific Experts. "Third report of the Ad Hoc Group of Scientific Experts to consider international cooperative measures to detect and identify seismic events". CD/448, 9 March 1984.
   See also: - Ad Hoc Group of Scientific Experts. "Progress report to the Conference on Disarmament on the eighteenth session of the Ad Hoc Group of Scientific Experts to consider international cooperative measures to detect and identify seismic events". CD/535, 10 August 1984.

4. **Summary:***

The third report of the Ad Hoc Group contains detailed preliminary instructions for the experimental testing of a global system for the international exchange of seismological data which might be established under a future treaty on a comprehensive nuclear test ban. The report also contains the results of national investigations submitted to the Group concerning scientific and technical questions about the global system described in the first and second reports of the Ad Hoc Group.**

After reviewing the Ad Hoc Group's terms of reference and its organization and method of work, the report proceeds, in chapter 3, to describe recent technical developments in seismograph stations and networks (some of these are described in appendices). The Group notes that progress towards standardization of systems has been slow and further work is needed in this area. The Group proposes the establishment of more high quality stations in the southern hemisphere and the inclusion of ocean-bottom seismograph systems to improve the capabilities of the global system.

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* The following abstract is based primarily on the summary given at the beginning of the report (pp. v-ix).

** See abstracts K32(I78) and K33(I79).

In Chapter 4, the report reviews the results of national investigations of the exchange of Level 1 data and concludes that new parameters for the exchange of data might be established after a comprehensive exercise as proposed in the first report.

Chapter 5 reports the results of two trial exchanges of Level 1 data through the World Meteorological Organization's Global Telecommunication System (WMO/GTS) and concludes that the WMO/GTS has the potential to fully achieve the goal of rapid, undistorted transmission of Level 1 data. The report notes that the WMO approved the use of the GTS for the exchange of Level 1 seismic data on a regular basis as of 1 December 1983. The WMO advised the Group that significant improvements in transmission could be obtained only if the GTS is used on a regular basis.

Chapter 6 discusses format and procedures for the exchange of Level 2 data. Some national investigations demonstrated that the rapid exchange of Level 2 data in digital form can be achieved using telecommunications facilities with no restriction on the amount of data that can be processed. The Group recommends that further investigations of possible formats and methods for Level 2 data exchange be conducted preliminary to the comprehensive test proposed in the first report.

Chapter 7 reports on progress in several nations in developing experimental International Data Centres (IDCs) for the proposed global system. An outline of operational procedures for such centres is provided in a "Preliminary Operations Manual for International Data Centres" (Appendix 7). The Group considers automatic Level 2 data processing in the IDCs to be a complex problem, but results of national investigations suggest that, in principle, it is possible to solve the problem.

The final chapter draws conclusions and makes recommendations for further study. The Group indicates that it has developed a preliminary plan for a test of Level 1 data exchange on the WMO/GTS to be carried out in 1984. The Group renews its recommendation made in the first and second reports that a comprehensive experimental exercise of all aspects of the proposed global system be conducted.

The progress report of the eighteenth session of the Ad Hoc Group (CD/535) reports that arrangements were made with the World Meteorological Organization to use the WMO/GTS on a regular basis for a technical test of the exchange and analysis of Level 1 data. The test would be conducted from 15 October to 14 December 1984 and would involve twenty-seven countries.

5. **Selected Comments of States:**

The Netherlands (CD/PV.179, 17 August 1982) supports the establishment of an international monitoring system which integrates both atmospheric and seismic detection methods. The Netherlands suggests expanding the mandate of the Ad Hoc Group and establishing a subsidiary organ of the Group to consider atmospheric detection methods.

The German Democratic Republic (CD/PV.179, 17 August 1982) opposes discussion of the administrative, financial and legal aspects of an international seismic monitoring system before a test ban treaty

is agreed upon and the participating countries have been determined. The GDR believes that existing technical means of verification, including an international exchange of seismic data as well as international cooperation involving verification by challenge, can effectively detect nuclear tests. While supportive of the work of the Ad Hoc Group, the GDR (CD/PV.200, 3 March 1983) wonders if technical questions and new studies are being used to cover the lack of political will to achieve agreement on a CTBT.

India (CD/PV.181, 24 August 1982) expresses its concern that the Ad Hoc Group is delaying progress in negotiating a CTBT and is merely keeping up with technology which rapidly becomes obsolete. It will be some time before a CTBT is negotiated and the purpose of the Ad Hoc Group should be to promote the early conclusion of a CTBT. If India becomes convinced that the Ad Hoc Group is "operating in a vacuum, it would be obliged to review its support for the group".

The Federal Republic of Germany (CD/PV.182, 26 August 1982) also expresses a concern that the work of the Ad Hoc Group not become a purely academic exercise. The FRG proposes more experimental investigation of the data exchange using the WMO/GTS, especially with regard to the possibility of Level 2 data transmission. The Union of Soviet Socialist Republics (CD/PV.197, 24 February 1983) supports the work of the Ad Hoc Group and suggests that its results "already constitute a sound basis for the organization of international measures for the verification of compliance with the future treaty".

Proposal Abstract K47(A85)

1. Arms Control Problem:
Nuclear weapons - comprehensive test ban

2. Verification Type:
(a) Seismic sensors - intra-border stations
- extra-border stations
(b) On-site inspection - selective
(c) Remote sensors - satellite

3. Source:
Hannon, W.J. "Seismic Verification of a Comprehensive Test Ban". Science 227, no. 4684 (18 January 1985): 251-257.

4. Summary:

This article reviews the task and prospects for the seismic verification of a comprehensive test ban. It begins with a review of the goals of verification. It should serve to build confidence, deter large scale violations, provide timely warning of violations, and allow for the appropriate response. The adequacy of a verification system will be ascertained according to a number of factors; one must consider its technical capabilities, cost, the relative importance of the task at hand, and the security goals of the nation in question.

Different sorts of systems may be distinguished according to the degree of national control that they permit. Unilateral national technical means of verification are controlled solely by the monitoring nation, utilizing satellites and seismic stations. Other forms of verification must be negotiated, and require interaction between nations; for example, in-country seismic networks must be negotiated at a bilateral or multilateral level. One of the primary differences between unilateral and negotiated means of verification is in the degree of access to information which each allows.

"Although the national technical means' (NTMs) precise properties are known by only one side or party to a treaty, many properties of and data from the negotiated provisions are known by both sides" (p.252). NTMs may be constrained in the dissemination of information both by a nation's unwillingness to release evidence of violations, and the lack of credibility where monitoring is unilateral. Thus, verification requires both NTMs and negotiated measures; "negotiated elements could include networks of seismic stations within the countries to be monitored, providing data to all treaty participants, and 'voluntary' on-site inspection privileges to resolve ambiguous events" (p.252).

In-country networks for seismic verification are an indispensable component in the verification of a comprehensive test ban treaty. They offer significant advantages in detecting seismic waves because of the proximity of the source. They are also capable of observing

the multiple phases of a disturbance, thereby allowing detection from different angles and identification of the source radiation pattern. "The broad spectra and high frequency content increase opportunities for using spectral differences to distinguish between explosions and earthquakes. The proximity of source and receiver (less than 800 km) helps locate the source more accurately" (p.252). A graph is included to demonstrate how in-country networks benefit from larger amplitude signals, more high frequency information, and multiple identifiable phases.

An in-country network for seismic detection must meet certain requirements in order to use these advantages; "data acquisition equipment must have a large dynamic range and good resolution over a broad range of frequencies. Triaxial seismometers or small seismic arrays are needed to determine the direction from which the waves approach" (p.252). To ensure that the recorded data is accurate, they must be checked, processed and analysed in three steps. First, the data processing will involve "seismic signal detection, association with a common source, measurement of properties, and wave identification" (p.252). The second step identifies characteristics of the source such as "origin time, epicentre and azimuthal variations in the energy radiation pattern as a function of time and frequency" (p.252). Finally, different possible sources must be identified and distinguished.

This network of 30 in-country seismic stations "could be expected to have a 90% probability of detecting seismic events with magnitudes greater than 3.0 or 3.1 in about 90% of the Soviet Union" (p.253). In comparison, distant stations could only detect explosions over 3.8 or 3.9 with the same degree of accuracy. The effectiveness of in-country networks may be mitigated by a number of factors, however. Network capabilities may be limited by the size of the area to be monitored and noise levels and wave propagation properties may reduce seismic sensitivity. Earthquake signals could be used to mask explosion signals, although this approach lacks the flexibility of location or choice of firing time provided by cavity decoupling which involves muffling the seismic signals in underground cavities. "Explosion sites could be selected such that the paths attenuate signals to stations providing the greatest constraint on evasion, or explosions could be detonated during high noise or both" (p.253). Decoupling is a more effective means of deception, and the requisite number of in-country stations will thus depend on the degree to which decoupling mitigates adequate verification. Some materials such as dry alluvium facilitate such decoupling, and "if cavities with explosions-produced wall stress below the elastic limit were constructed, further decoupling gains would be achieved" (p.255). A network of 15 in-country seismic stations could detect decoupled events from 3 to 10 kt in magnitude with 90% confidence. However, those decoupled explosions of 3 kt and under could only be detected with 30% confidence. "It appears that cavity decoupling will significantly challenge comprehensive test ban treaty verification of explosions near 1 kt, even with 30 in-country stations" (p.255).

Seismic verification cannot guarantee that all explosions will be detected or identified, so that "political and military considerations must determine the degree of confidence desired of the verification system" (p.256). More effective networks must be quite extensive, and their political acceptability is not known. On-site inspection has been demanded by the US, yet its effectiveness is also unknown - the usefulness of on-site inspection lies more in its ability to deter, rather than to detect violations.

Proposal Abstract K48(A85)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   Seismic sensors - extra-border stations

3. **Source:**
   Smith, R. Jeffrey. "Dispute Over Soviet Testing Heats Up". Science 228 (May 1985): 1072.

4. **Summary:**

Recent evidence indicates that the seismic methods currently used by the US government for estimating the yield of Soviet nuclear explosions is inaccurate. This article quotes a number of reliable sources which state that such yields have been consistently overestimated by the US administration. A new method for evaluating seismic signals is now available which measures surface waves transmitted through the earth's upper crust; it is a more reliable means of measuring nuclear explosions, "and many Soviet tests appear to have substantially lower yields when this method of analysis is applied" (p. 1072).

Despite recommendations that methods of seismic evaluation be revised in light of this evidence, the US Department of Defense continues to rely on older estimates and non-seismic information provided by human intelligence, communications intercepts, and other physical evidence. It is argued that the existence of ambiguous or conflicting evidence justifies this reliance on non-seismic and perhaps less accurate methods of evaluation. Their reluctance to accept lower yield estimates may be due to the fact that "top Reagan Administration officials have cited the evidence of Soviet cheating as a principle justification for seeking revisions in the treaty" (p. 1072).

Proposal Abstract K49(G85)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   - intra-border stations
   (b) International exchange of information
   (c) On-site inspection - selective
   (d) Complaints procedure - consultative committee
   - consultation and cooperation

3. **Source:**
   Federal Republic of Germany. "Working paper: a proposal for the establishment of an international seismic monitoring and verification system relating to a comprehensive nuclear test ban". CD/612, 10 July 1985.
   See also: - "A system design for the gradual improvement of seismic monitoring and verification capabilities for a comprehensive nuclear test ban". CD/624, 26 July 1985.

4. **Summary:**

The FRG proposes the establishment and continuous operation of an international monitoring and verification system based on current seismic technology without awaiting the conclusion of a comprehensive test ban treaty (CTBT). The system should be based on the international seismic data exchange system as operated during the technical test run of 1984 (see CD/448 and CD/535, abstract K46(I84)). In the interim period, prior to the conclusion of a CTBT, the system should be improved in qualitative and quantitative terms while in permanent operation.

Section C of CD/612 outlines a system design for the gradual improvement of monitoring and verification capabilities. This section summarizes a scientific paper presented in CD/624. The incremental upgrading of the system could occur in the following three phases. In the first phase, the system would use existing seismic installations for the international exchange of seismic data in an extended test mode. The system would consist of 50 to 100 seismic stations and would rely on existing lines of communication for data collection and analysis. The level of verification of this system would equal a magnitude of approximately 5.0 (m_b). This would correspond to an explosive yield of approximately 100 kt in dry alluvium or 10 kt in wet hard rock. Test runs for the rapid exchange of seismic wave form data (Level 2 data) would be conducted and detailed specifications for future stations would be developed. This network could become operational after about two years.

In phase two, the capabilities of the system would be refined and improved to permit a detection threshold of magnitude 4.7 (m_b) which would correspond to a yield of 50 kt in dry alluvium and 5 Kt in wet hard rock. Further system upgrading would consist of adding more stations, providing for real-time communications by satellite and performing the exchange of Level 2 data through International Data Centers (IDCs) on a routine basis. These improvements should lower the detection threshold to 4.0 (m_b) which corresponds to a yield of 5 to 10 kt in dry alluvium or 1 kt in wet hard rock. These improvements could be achieved after periods of approximately 4 and 8 years respectively.

In the third phase, the implementation of internal seismic networks, particularly in the territory of nuclear weapon states could lower the detection threshold within the region to 3.0 (m_b). This would be important and useful for detecting and identifying evasion attempts by decoupling explosions of 10 kt or more in a cavity. In order to detect and identify evasion attempts down to the level of 1 kt, in-country networks with borehole stations or arrays spaced over distances of 500 to 1,000 km in areas where cavity decoupling is possible would be required. Such detection is, apparently, possible. Geological and geophysical data about each region should be exchanged. Real-time communication by satellite would allow IDCs complete access to data from arrays and stations.

The FRG proposes an institutional structure for the verification system consisting of three organs. A Consultative Committee of parties to the treaty would be responsible for political decision-making. The Committee would: supervise and review the implementation of the system; decide on and recommend to parties improvements of the system; serve as a forum for consultation and cooperation in which parties can make inquiries and receive information; serve as a forum in which any party can lodge a complaint and request an on-site inspection; and decide on budgetary questions. The Committee should meet once a year and make decisions on non-procedural questions by consensus. In between meetings, an Executive Group should conduct the business of the Committee. This group should consist of a chairman elected for two years, and fifteen members, of which five should be permanent representatives of the nuclear weapon states. The remaining ten should serve for two years with five members being elected every year.

A Committee of Experts should be responsible for all scientific/technical aspects of the monitoring system. This committee would be subordinate to the Consultative Committee and would be composed of fifteen scientific experts appointed by the Consultative Committee from among candidates nominated by states. The Committee of Experts would: consider and recommend technical improvements to the system; maintain contact with the international data centers, appropriate national authorities and the World Meteorological Organization; undertake technical studies; and identify on-site inspection techniques and conduct international on-site inspections.

The Committee should meet twice a year and submit an annual progress report. The Committee should operate on the basis of consensus, but, where consensus is not possible, differing views should be presented without bias in a comprehensive report.

A Secretariat consisting of a Director and a small staff should assist the other organs in organizational, administrative and financial matters. The Ad Hoc Group of Scientific Experts of the Conference on Disarmament should assume the following functions in the transitional period (they will be performed by the Committee of Experts after the conclusion of a CTBT): supervising the implementation of the system; recommending improvements in the seismic equipment at national seismic stations and communications facilities; coordinating the work of the international data centers, the national authorities and the World Meteorological Organization; acting as a forum for scientific/technical discussions; and conducting technical studies.

Requests for clarification of an international on-site inspection in connection with an event on the territory of another state may be addressed to the state concerned or to the Consultative Committee through the Executive Group. The FRG states that "in any case, States Parties should feel obliged to provide appropriate information and to cooperate in the most effective way possible in order to dispel suspicions of non-compliance" (p.13). Inspection arrangements should be decided upon between the Executive Group of the Consultative Committee and the party to be inspected. The inspection team would present a factual report to the Consultative Committee without assessing the data. The report should be produced by consensus, but if this is not possible, it should reflect the different views.

Proposal Abstract K50(G85)

1. **Arms Control Problem:**
Nuclear weapons - comprehensive test ban

2. **Verification Type:**
(a) Seismic sensors - international network
(b) International exchange of information

3. **Source:**
Japan. "Concrete measures for the realization of the international seismic data exchange system". CD/626, 1 August 1985.
See also: - "Views on a system of international exchange of seismic data". CD/389, 8 July 1983 (see abstract K41(G83)).

4. **Summary:**

Having presented in working paper CD/389 the requirements for effective functioning of the International Seismic Data Exchange System, Japan proceeds in this working paper to elaborate on the concrete measures needed to meet those requirements. The paper examines the technical, administrative and financial aspects of the system based on the first, second and third reports of the Ad Hoc Group of Scientific Experts to Consider International Cooperative Measures to Detect and Identify Seismic Events (see abstracts K32(I78), K33(I79) and K46(I84)). The network model is based on the Network III presented in the first report of the Group of Scientific Experts - that is a system using stations selected from among known existing or planned stations.

The paper covers the following required measures:

(1) Arrangements for seismic observation:
  (a) digitalization of the seismograph system,
  (b) standardization of observation equipments,
  (c) distribution of an operational manual,
  (d) distribution of computer programs for data processing, and
  (e) periodical calibration measurement of seismic devices of each station.

(2) Maintenance of the observation function:
  (a) prevention of interruption in function, and
  (b) requirements for maintenance.

(3) Improvement of the detection and identification capability of the system:
  (a) sophistication of the performance of stations,
  (b) enhancement of the observation capability in the ocean areas and their vicinities,
  (c) measures for high-noise level areas,
  (d) reinforcement of the observation capability covering the areas for traditional nuclear explosion tests, and
  (e) supplementary measures for special areas.

(4) Level 1 data extraction - rationalization of the process of exchanging data:
   (a) specification of the parameters to be exchanged,
   (b) research and development, of filter techniques and others, for Level 1 data extraction,
   (c) promotion of the automation of data extraction, and
   (d) complementary measures for automatic extraction.

(5) Exchange of Level 1 data through the WMO/GTS - communication between the seismic stations and the GTS station.

(6) Communication between national GTS stations and International Data Centres (WMO/GTS):
   (a) improvement of low-speed circuits in the WMO/GTS network,
   (b) improvement of manually operated centres of WMO/GTS,
   (c) transmission format of Level 1 data, and
   (d) familiarization of personnel at GTS stations.

(7) Arrangement for Level 2 data transmission:
   (a) arrangement for communication.

(8) Level 2 data analysis:
   (a) standard Level 2 data analysis procedure, and
   (b) reinforcement of Level 2 data analysis capability of each party.

(9) International Data Centres (IDC):
   (a) establishment of required facilities,
   (b) installation of communication equipment and other related devices, and
   (c) installation of equipment for processing, analysis and storage of data.

(10) Maintaining the continuity of IDC operation:
   (a) employment of sufficient number of personnel, and
   (b) duplication of major equipment.

(11) Assessment of the verification capability of the International Seismic Data Exchange System:
   (a) estimation by computer simulation,
   (b) correction of the assessment by the results of technical tests,
   (c) reassessment after the comprehensive experimental exercise of the system, and
   (d) continuous evaluation during the actual operation.

The paper provides a preliminary estimate of the costs of equipment and personnel suggested by the concrete measures. Calculations are based on the estimated prices in Japan in 1984-1987 and are quoted in US dollars. For example, the total cost of digitalization of seismic recording for 23 stations would be $2,024,000. The standardization of observation equipment would cost $44,988,000 including digitalization for 23 stations. The total cost for three international data centres would be $50,511,000. It would cost $86,470,000 to modernize the capabilities of 10 stations. Ten ocean bottom seismographs would cost $108,300,000 to install. In total, all of the measures proposed by Japan would cost $304,218,500 (excluding personnel and operating costs).

Proposal Abstract K51(G85)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - extra-border stations
   - intra-border stations
   - international network
   (b) On-site inspection - selective
   (c) Remote sensors
   (d) International exchange of information

3. **Source:**
   Norway. "Seismological verification of a comprehensive nuclear test ban". CD/599, 20 June 1985.

4. **Summary:**

This working paper contains a report on a workshop held in Oslo, Norway, between 4 and 7 June 1985, which demonstrated the operation of the Data Processing Centre of NORSAR (Norwegian Seismic Array) to members of the Conference on Disarmament. The paper also contains extracts from a lecture by Dr. Frode Ringdale, Director of NORSAR, entitled "Seismological verification of a comprehensive test ban treaty" and from a lecture by Svein Mykkeltveit, Senior Scientist at NORSAR, entitled "Seismological facilities in Norway".

NORSAR is a large aperture array which is designed to detect seismic events occurring at teleseismic distances (3,000-10,000 km away). The demonstration in the workshop covered:
(1) detection of earthquakes and nuclear explosions,
(2) seismic signal analysis, interactive graphic displays,
(3) seismic instrumentation, station calibration and monitoring, and
(4) international exchange of seismic data.

Participants also saw the field installations of the Norwegian Regional Seismic Array System (NORESS). This small-aperture seismic array incorporates the most recent technological developments and is designed to detect weak seismic events occurring at close distances (less than 3,000 km).

Dr. Ringdale reports that existing seismic networks can usually determine the location of an event to within a few tens of kilometres for well-recorded events. This accuracy declines for detection of small events by only a few stations. However, a "joint location procedure" can be applied if a number of events are detected in the same area. Identifying small-yield explosive tests and distinguishing them from earthquakes is difficult. In order to identify explosions accurately, a verification regime for a CTB treaty will most likely consist of:

(1) national technical means,
(2) on-site inspection, and
(3) international seismic data exchange.

National technical means may include in-country local seismic networks and access to local geological and geophysical data. On-site inspection would be used to investigate ambiguous events and provide more conclusive evidence than that yielded by seismic recording. Radiological sampling and monitoring local seismic activity could be useful techniques. The United States, the Soviet Union and the United Kingdom agreed in principle to having on-site inspections for a comprehensive test ban during negotiations between 1977 and 1980 (see abstract K35(G79)). The international exchange of seismic data would be based on a global system being developed by the Ad Hoc Group of Scientific Experts (see abstract K46(I84)).

Seismic verification cannot provide 100% certainty because of uncertainties associated with detectability levels, explosive coupling efficiency and seismic wave propagation. The proposed seismic detection network being developed by the Ad Hoc Group of Scientific Experts will have a projected detection capability of 90% for events of body wave magnitude 4.0 (roughly equivalent to a 1 kt yield in hard rock). The system will be limited by the large distances between stations and, even with modifications which might lower its detection threshold to m_b 3.5-3.8, will not be able to detect all events of potential interest. Internal seismic networks would therefore be important for improving detection capabilities. Opinions differ but estimates suggest that, with internal networks, event detection capabilities could be lowered to m_b 3.0 or even m_b 2.5 for selected regions.

Mr. Mykkeltveit notes that NORSAR has recorded about 100,000 earthquakes and 500 presumed nuclear explosions since 1970. NORSAR publishes a monthly summary of recorded seismic events which is distributed to seismological agencies in more than 25 countries. NORSAR has a detection capability with 90% probability for events with m_b 4.0 in the teleseismic distance range of 3,000-10,000 km. This capability approaches m_b 3.0 for many regions within the Eurasian Continent. The NORESS array appears to have a detection threshold of about m_b 2.0-2.5 at 1,500 km epicentral distance.

5. Selected Comments of States:

Morocco (CD/PV.314, 20 June 1985) states that the seismological verification workshop in Norway "convincingly proved that it is possible to detect any seismic event, whatever its location and its nature, and thus that effective verification is feasible in the framework of a treaty for the complete prohibition of nuclear tests".

Brazil (CD/PV.315, 25 June 1985) states that "it would appear that the question of verification is no longer an obstacle to the achievement of a nuclear test ban." The results of the workshop in Norway showed that detection and identification of nuclear explosions, even of a small yield, is technically possible.

Commenting on the Norwegian workshop, the United States (CD/PV.316, 27 June 1985) concludes that "a considerable amount of work on the vital matter of verification of and compliance with a nuclear test ban remains to be carried out". The problem of discriminating between earthquakes and explosions, i.e. identifying events of low magnitude, still must be overcome. Evasion techniques and the possibility that nuclear explosions may be announced as large chemical explosions must also be considered.

The United Kingdom (CD/PV.320, 11 July 1985) supports the Norwegian view that "it is essential to establish the global seismological network proposed by the Ad Hoc Group of Scientific Experts".

Proposal Abstract K52(G85)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   United Kingdom. "Seismic monitoring for a comprehensive nuclear test ban". CD/610, 9 July 1985.

4. **Summary:**

In this working paper, the United Kingdom discusses methods for detecting and identifying nuclear test explosions and considers possible techniques for evading detection or masking explosions. The paper evaluates detection methods and the proposed global monitoring network. Current data suggest that a global network of seismic stations could achieve a detection threshold of m_b 4 and an identification threshold of m_b 4.5. This could be sufficient to detect any explosion with a yield greater than a few tens of kilotons, but the United Kingdom urges caution. Assessments are based on highly selective data and considerable extrapolation from research results. In any case, militarily significant testing can be done at yield levels below the detection threshold. It would be premature to make estimates of the effectiveness of regional monitoring. The United Kingdom concludes that "it appears that monitoring at teleseismic ranges by itself would be insufficiently effective to permit a test ban to be brought into place" (p.16). As a result, states could not be expected to subscribe to a comprehensive test ban unless estimated verification capabilities coud be achieved and testing at militarily significant levels could be detected with a high level of certainty.

Forensic seismology seeks to discriminate seismic signals produced by underground nuclear explosions from background seismic noise and to distinguish earthquakes from explosions. The ratio of signal-to-noise can be improved either by sinking seismometers about 100 metres in bore-holes or by using an array of seismometers. Newly developed small seismometers make installation in bore-holes more practical. The United Kingdom instrument is being designed to fit into a bore-hole of 4.5 inches diameter. Seismic monitoring on the sea bed could improve the performance of the global network, but sensors deployed on the ocean floor encounter much ambient noise. Signal-to-noise ratios were improved when seismometers were placed in deep bore-holes beneath the ocean floor.

The significance of a detection threshold of m_b 4 in a test ban context depends on the relationship between m_b and the yield of an underground nuclear explosion. The coupling efficiency, i.e. the efficiency with which explosive energy is converted into seismic waves, becomes important for monitoring. The conversion efficiency for explosions carried out in dry alluvium is about one tenth of that for hard rock. Thus, an explosion registering m_b 4 could be of 1 kt yield in hard rock or 10 kt yield in dry alluvium. Much of western knowledge on the yield/magnitude relationship comes from data from a few test sites, principally the Nevada Test Site (NTS). There are debates about the applicability of this knowledge to test sites in the USSR which are mainly in aseismic regions, i.e. regions where there are no earthquakes and where the upper mantle structure is different from those at NTS. So far, the debates have been inconclusive.

Discrimination of explosions from earthquakes has been attempted by many methods, including estimates of location, depth of focus and first motion, as well as calculations of signal complexity and spectral ratios. A breakthrough in identification came with the discovery that underground explosions generate long period Rayleigh waves with less efficiency than shallow earthquakes of comparable size. The ratio of short period wave magnitude (m_b) to long period waves (M_s) is a key discriminant, but it has been possible to test it against explosion signals from only a few test sites. The differences in geologic structures and levels of seismic activity between the NTS and sites in the USSR may inhibit the effectiveness of this identification method.

There are three possible methods by which a party could seek to conduct an explosion and evade detection. First, firing a sequence of explosions with increasing yields could deceive a seismic monitoring station by causing it to associate a value of m_b from a smaller explosion with a value of M_s from a larger disturbance. This would produce an m_b:M_s ratio similar to that of an earthquake. However, the effectiveness of this evasion scenario is "debatable" and it would probably not be adopted without experimental investigation. Second, a nuclear explosion could be fired after the start of a large earthquake. This method is not likely to be effective for two reasons. Since the explosion signal would emanate from a distinct point which is separate from the earthquake, signal processing techniques could probably separate the two signals. Furthermore, this method requires holding a test in readiness, perhaps for a long period, until an earthquake occurs. This would be inconvenient, but might not be intolerable. Third, an explosion could be decoupled by firing it in a cavity. It is unclear what the maximum size of cavity which would remain stable for a decoupled test would be, but decoupling of an explosion of several tens of kilotons could probably be accomplished. A decoupling factor of 100 can be achieved at frequencies of about 1 Hz, but there is no experimental proof that decoupling would be as effective at the higher yields relevant to a test ban. Despite these technological capabilities, the use of

evasion techniques would depend on a state's evaluation of the value of continued testing for improving security, the merits of evasion versus openly abrogating treaty obligations and the risk of detection.

It appears that monitoring higher seismic frequencies may present more possibilities for test ban verification than originally thought, but more data needs to be gathered and evaluated.

5. **Selected Comments of States:**

The Netherlands (CD/PV.329, 13 August 1985), agrees with the United Kingdom that considerable progress has been made with regard to verification techniques for a CTB, but a number of questions remain to be solved. In particular, the Netherlands points out that there are limitations in using the M_b:M_s criterion as an identification technique. However, improvements in other techniques such as spectrum analysis and the use of various techniques in combination have developed verification capabilities. As a result, the "improved sensitivity of seismometric equipment, combined with automated digital processing, seems to hold promise that the rich variety of seismic events occurring on Earth, whether man-made of natural, can adequately be handled for the purpose of the future treaty.

Despite these improvements in verification capabilities the Netherlands suggests that, because of the possible use of evasion techniques, "whatever we may eventually expect from teleseismology, it seems realistic to recognize that, according to the nuclear-weapon states, an international seismic monitoring network in itself will not be sufficient". The Netherlands therefore suggests that regional networks of in-country seismic stations should be operated in combination with a global teleseismic network to enhance overall verification capabilities.

With regard to verification of the Threshold Test Ban Treaty, the Netherlands remarks that provisions should be made for calibrating seismometers used to measure test yield. The TTBT provides for the exchange of data from calibration tests, but in order to ensure that the information given by each party is accurate, there should be a requirement for the confirmation of calibration yields by on-site inspection. For this purpose, the Netherlands suggests that "both countries may consent in admitting designated personnel of the other for measuring the data of some tests at military test sites, to be used for calibration purposes". The Netherlands recalls that similar opportunities were provided by Article III of the Peaceful Nuclear Explosions Treaty.

Proposal Abstract K52.1(G86)

1. **Arms Control Problem:**
Nuclear weapons - comprehensive test ban

2. **Verification Type:**
Seismic sensors

3. **Source:**
Canada. Department of External Affairs. Seismic Verification. Verification Brochure, no. 1. Ottawa: 1986.

4. **Summary:**

This brochure examines the present state of technology for monitoring an underground test ban, explores the potential for further improving this technology and describes Canadian contributions in this field. Intended for the general public, the brochure includes several graphics, maps and tables to illustrate basic concepts involved in seismic verification of a test ban.

Even assuming the establishment of an extensive seismograph network within the USSR as part of a verification system, the detonation of a device with a yield of .1 kt will probably be undetected. By suitable manipulation such as through cavity decoupling this figure might be increased by a factor of 50 to 100. The Canadian government has undertaken research to assess whether small seismic events could be better monitored if seismic stations such as unmanned "black boxes" were located near to the source of event.

Proposal Abstract K52.2(G86)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors
   (b) On-site inspection - selective

3. **Source:**
   Union of Soviet Socialists Republics. "Letter dated 19 December 1985 addressed to the President of the Conference on Disarmament from the Permanent Representative of the Union of Soviet Socialist Republics transmitting a text entitled "Nuclear Explosions Must be Banned" made public on 19 December 1985". CD/647, 17 January 1986.

4. **Summary:**
   For verification of a moratorium on nuclear testing the national technical means of the United States and the Soviet Union were capable of providing the parties with the certitude that the moratorium was being observed. A further guarantee of the effectiveness of monitoring would be to renounce all nuclear explosions, whether military or for peaceful purposes. With a view of increasing the effectiveness of the moratorium the Soviet Union has also expressed support for the idea of employing an international inspection system. The proposal by six states for the establishment of special stations on their territories to observe the fulfilment of the agreement might be employed. The Soviet Union favours agreement with the United States, in the event of a reciprocol moratorium on nuclear explosions, allowing a number of on-site monitoring measures to eliminate doubts about observance of the moratorium.

Proposal Abstract K52.3(G86)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   Sweden, CD/PV.343, 27 February 1986, pp.20-24.

4. **Summary:**

Sweden maintained that the present state of the art of seismic detection and identification made full verification of a treaty prohibiting underground nuclear testing feasible. Experiences from a fairly dense local network in Sweden showed that detection capabilities of magnitude 1 could be obtained at distances of up to a few hundred kilometres and that such a network also gave a very high location and depth estimation capability. How to utilize recordings at local and regional distances for test-ban verification and how this would improve the overall capability of a global system, merited further consideration. It was the task of the negotiators of a test-ban treaty to reach agreement on the establishment of a sufficiently dense network of seismic stations -- including stations at suitable points on the territories of the nuclear weapon states to measure signals at local and regional distance -- so that all parties to the future treaty would have full assurance that compliance with it could be verified and that cheating was not possible.

Sweden felt that the working paper prepared by Japan (CD/626) gave a good account of the concrete measures needed to realize an international seismic data exchange system. It stressed the need to modernize and standardize seismic stations and to establish modern stations in areas where such stations did not presently exist. It also gave examples on how such modernization could be carried out to establish a homogenous network of high-quality stations able to operate with high reliability. Modern and well-equipped international data centres were important components in this proposed system.

The lack of experience of cavity decoupling and the present difficulty of recording high frequency signals, especially in the continental areas, substantially reduced the credibility of decoupling as a way of conducting clandestine nuclear testing.

Full use must be made of recent developments in science and technology and available techniques must be utilized on a global scale. Continued international cooperation in the developing and testing of methods and procedures and in promoting and exchanging scientific and technical information around the world are important.

"Through such experiments involving a growing number of countries, some with limited experience so far in the use of seismology for test-ban verification, knowledge and experience are spread globally. These experiments offer education and practical training of personnel at a number of stations and data exchange facilities around the world. This is precisely the kind of patient scientific work that is needed to establish how available technology should be most effectively utilized to create an effective global data exchange system to help verify a test ban."

K52.4(G86)

Proposal Abstract K52.4(G86)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors
   (b) On-site inspection - selective

3. **Source:**
   Argentina, India, Mexico and Sweden. "Letter dated 10 March 1986 from the Representatives of Argentina, India, Mexico and Sweden addressed to the President of the Conference on Disarmament transmitting the Joint Message dated 28 February 1986 addressed to the President of the United States of America and the General Secretary of the Central Committee of the Communist Party of the Soviet Union by the Signatories of the Delhi Declaration of 28 January 1985". CD/676, 10 March 1986.
   See also: - Abstract K52.7(G86).
   - Union of Soviet Socialist Republics. "Letter dated 17 March 1986 from the Permanent Representative of the Union of Soviet Socialist Republics addressed to the President of the Conference on Disarmament transmitting the response of Mikhail Gorbachev, General Secretary of the Central Committee of the Communist Party of the Soviet Union, to the Joint Message from the Leaders of Argentina, Greece, India, Mexico, Sweden and Tanzania", CD/680, 18 March 1986.

4. **Summary:**

The six signatories (Argentina, India, Mexico, Tanzania, Sweden and Greece) believed that everything which could be done to create confidence and a positive atmosphere for agreements to halt the nuclear arms race at the next summit meeting of the leaders of the US and the USSR should be encouraged. One such confidence building measure would be to refrain from any nuclear test in the period up to the summit meeting. This could pave the way for an agreement on a mutual and adequately verified moratorium for nuclear explosions. It would also facilitate the negotiation of a comprehensive test ban treaty.

The six signatories reiterated their offer to assist in verifying any halt in nuclear testing, to remove doubts about compliance and possible violations. Such assistance could include on-site inspection as well as monitoring activities both on the territories of the two powers and in their own countries.

5. Selected Comments by States:

In CD/680 Soviet General Secrtary Gorbachev's response is quoted:
As regards the problem of verification...we attach great importance to it, because we have an interest in agreements being honoured unswervingly and in all parties to them being fully convinced that that is so.
With respect to a nuclear test ban, verification can be ensured by national technical means and with the help of international procedures -- including on-site inspection if need be. We propose to the American side the conclusion of an agreement on the granting to observers from both sides of the possibility of visiting, on a mutual basis and upon request, places where unclear phenomena occur in order to eliminate possible doubts as to whether such phenomena are connected with nuclear explosions.
We are willing to take up your proposal -- if, of course, it is accepted by the other side too -- to provide assistance, including on-site inspections, in verifying the halt of nuclear tests.

Proposal Abstract K52.5(G86)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   Sweden. "Nuclear test ban verification". CD/712, 14 July 1986.

4. **Summary:**

The working paper contains an analysis of the technical aspects of nuclear testing and seismological verification. The problems raised by possible evasion scenarios are analyzed. Sweden concluded that it should be possible to create a verification and compliance system that would provide enough confidence that the parties to a nuclear-test ban observe their obligations with regard to underground testing. It was also clear that a considerable amount of work on a system of verification remained to be done. Sweden felt that it was a matter of highest priority to immediately start substantive work on creating such a system because this task, "even when addressed in good faith and with the best of intentions", might require a few years to be successfully resolved. Sweden called for the development and testing of a prototype detection station. In its view it would be possible to monitor nuclear test explosions to any requested level. The capabilities of the system depended primarily on the number of seismic stations used in the verification system, their location and the technical performance of the stations.

Proposal Abstract K52.6(G86)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   Australia. "Proposal for the immediate establishment of a global seismic network as a part of a monitoring and verification system for the future comprehensive nuclear test ban". CD/717, 18 July 1986.

4. **Summary:**

Australia renewed its call for the immediate establishment of an international seismic data exchange. It proposed that the Conference on Disarmament take the following actions:

(1) to establish forthwith a global seismic monitoring network based on existing facilities and equipment;
(2) pledge to make available to this network appropriate national facilities and equipment;
(3) invite non-member countries to make appropriate national facilities and equipment available to this network; and
(4) task the Group of Scientific Experts to prepare, within six months, a plan of action for the further development of the global seismic network.

Proposal Abstract K52.61(I86)

1. **Arms Control Problem:**
Nuclear weapons - comprehensive test ban

2. **Verification Type:**
(a) Seismic sensors - international network
(b) International exchange of information

3. **Source:**
Ad Hoc Group Scientific Experts. "Summary of the fourth report to the Conference on Disarmament of the Ad Hoc Group of Scientific Experts to consider international cooperative measures to detect and identify seismic events (CD/720): Report on the Group of Scientific Experts' Technical Test (GSETT) 1984." CD/681/Rev.1, 31 July 1986.
See also: - "Fourth report to the Conference on Disarmament of the Ad Hoc Group of Scientific Experts to consider interational cooperative measures to detect and identify seismic events: Report on the Group of Scientific Experts' Technical Test (GSETT) 1984." CD/720, 31 July 1986.

4. **Summary:**

CD/681/Rev.1 briefly reiterates the mandate of the Ad Hoc Group of Scientific Experts (GSE) and describes the proposed global system for seismic data exchange outlined in the GSE's prevision reports. It then summarizes the results, experiences and conclusions of the large scale GSETT conducted between 15 October and 15 January 1985. The purposes of the GSETT included:

(1) to develop and test procedures for the regular transmission of Level 1 seismic data from temporary national facilities (TNFs) to Experimental International Data Centres (EIDCs) located in Washington, Moscow and Stockholm;
(2) to transmit bulletins from EIDCs to TNFs;
(3) to test procedures for retransmitting Level 1 data using the World Meteorological Organization's Global Transmission Service (WMO/GTS);
(4) to test procedures for extracting Level 1 parameters at seismic stations;
(5) to develop and test procedures for transmission of Level 1 parameters to TNFs; and
(6) to test proposed procedures at EIDCs for receipt and archiving of Level 1 data and for compilation and distribution of event bulletins over the WMO/GTS.

In all, 75 seismographic stations in 37 countries contributed Level 1 data, though not all provided and received data for the entire test period.

The summary report (CD/681/Rev.1) next outlines the contents of CD/720. Chapters 1 and 2 of CD/720 provide background information on

the GSE. Chapter 3 gives an overview of the GSETT. Chapter 4 describes the participating seismograph stations and TNFs. The geographic distribution of stations was deemed generally adequate. A wide range of equipment and facilities were used including both digital and analogue. This experience reinforced the GSE's view that stations of the proposed international seismic data exchange network should be equipped with digital seismographs with standard characteristics, the details of which requires more work.

Chapter 5 describes the experience in Level 1 data extraction during the GSETT which provided the first opportunity for such a broad scale test. Because of the diversity of contributing facilities, a variety of methods were applied. Statistics are given on the number of parameters reported, time delays and areas where difficulties were encountered. The number of events reported by stations varied from 1 per day to more than 20 per day. During the GSETT one analyst per station was sufficient to extract parameters, however, the workload at sensitive stations would be better met through the use of computers. Difficulties were encountered in extracting certain Level 1 parameters suggesting that further clarification is needed of instructions for measuring these parameters. A large number of local events (such as quarry blasting) imposed a heavier workload on some stations. Instructions for handling such occurrences need further refinement.

Chapter 6 describes the experience in using the WMO/GTS, focussing on three aspects: (1) transmission of Level 1 parameters to EIDCs, (2) transmission of seismic bulletins from EIDCs to participating states, and (3) development and testing of retransmission procedures for missing or garbled messages. A total of 31 stations used the WMO/GTS to send and receive nearly 4000 messages during the test. The average Level 1 message length was about 1,100 symbols. While retransmission procedures did work, they need further improvement. The overall efficiencies of transmitting Level 1 messages to EIDCs averaged 74% initially and 83% after retransmission procedures. These efficiencies differed widely among geographical regions (eg. 96% in Europe and 40% in Peru). The GSETT reconfirmed the need to adhere to established WMO/GTS formats and agreed procedures and demonstrated the need to explore alternative communications in some parts of the world. Participating states received EIDC event bulletins with efficiencies from 83 to 93%.

Chapter 7 describes the experience of the EIDCs. The GSETT provided the first opportunity to test proposed procedures using actual Level 1 data from a global network of facilities. A substantial part of procedures proposed for International Data Centres (IDCs) were tested: each EIDC monitored and received Level 1 data using the WMO/GTS, they analyzed these data according to prescribed methods and they distributed the results to all participating states. During the later part of the test the EIDCs communicated with each other to reconcile event bulletins. The amount of data processed was large and a high degree of automation was achieved at each EIDC.

About 1/4 of the data did not reach any EIDC. Of the data that did, only about 1/2 were associated with a defined event. How to

handle unassociated data is an important question requiring further study. While EIDCs were able to generate and distribute event bulletins in accordance with GSETT schedules, the test showed that procedures for compilation of the bulletins need further improvement and standardization. Improvements are needed in areas such as establishment of standard principles and algorithms for data analysis, establishing efficient communications between data centres and coordinating retransmission requests. While the performance of the EIDCs improved during the course of the test, the GSETT demonstrates the need for additional technical and practical tests of the proposed international seismic data exchange.

The conclusions drawn fromm the GSETT are summarized in Chapter 8 of CD/720. Overall the GSETT proved very successful in providing experience in the practical operation of a global seismic data exchange system. The WMO/GTS in many parts of the world ensures an operative and undistorted transmission of Level 1 data. However, given the shortcomings of the use of the WMO/GTS in some regions, further efforts should be undertaken to demonstrate that reliable transmission of Level 1 data and bulletins can be established using WMO/GTS for all regions of the world and the possibility of upgrading the existing WMO/GTS should be investigated. A number of shortcomings in the use of WMO/GTS could be overcome at the national level.

The procedures developed to collect, exchange, compile and analyze Level 1 data worked satisfactorily, however, some further developments are needed.

The proposed global data exchange system should be equipped with digital seismograph stations which are well sited and capable of continuous recording of data in digital form, and are operated in a standardized way. Standardized technical specifications for such equipment should be worked out. In order to fully utilize data from modern digital seismograph stations for Level 1 data extraction, computer processing is essential. Such procedures, algorithms and computer programs should be developed.

Different IDCs must provide the same results from their final analyses and the number of unassociated observations must be reduced. Procedures for defining seismic events should be further clarified and procedures for continuous exchange of information between IDCs during analysis should be further developed and tested.

Proposal Abstract K52.7(G86)

1. Arms Control Problem:
Nuclear weapons - comprehensive test ban

2. Verification Type:
(a) Seismic sensors - intra-border stations
- international network
(b) International exchange of information
(c) On-site inspection - selective

3. Source:
Argentina, India, Mexico and Sweden. "Letter dated 13 August 1986 addressed to the President of the Conference on Disarmament by the Representatives of Argentina, India, Mexico and Sweden transmitting two documents entitled "Declaration of Mexico" and "Document issued at the Mexico Summit on verification measures" adopted at Ixtapa, Mexico on 7 August 1986.". CD/723, 15 August 1986.
See also: Abstract K52.4(G86)

4. Summary:

These two documents were adopted at Ixtapa, Mexico on 8 August 1986 by Argentina, Greece, India, Mexico, Sweden and Tanzania. The second document ("Document issued at the Mexico Summit on verification measures") examined the verification of a nuclear testing moratorium in co-operation with the United States and the Soviet Union. Two possibilities were considered. First, monitoring of existing test sites, which would be intended to ensure that they were not used for clandestine testing. The three test sites involved could be monitored by a small number of seismic stations placed in the two countries at or near the test sites. Temporary monitoring stations could be established to operate for a period of one year. All data would be available to the six nations and to the United States and the Soviet Union. Data analysis could be a joint undertaking and preliminary analysis would be done at the sites.

The document also considered the possibility of monitoring the territories of the United States and the USSR outside the test sites which would be necessary to ensure that nuclear explosions were not conducted and that natural earthquakes were not misinterpreted as clandestine test explosions. The document suggested the "internationalization" of a number of seismic stations existing in the United States and the USSR by placing observers from the six nations at the stations. Their task would be to verify that the instruments were properly operated and that all the information obtained was reported without omission. The six nations also proposed to establish procedures for on-site inspections of large chemical explosions to ensure that they were not misinterpreted as nuclear explosions.

Proposal Abstract K52.8(G86)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - international network
   (b) International exchange of information

3. **Source:**
   Union of Soviet Socialist Republics. "Seismic verification of the non-conducting of nuclear tests". CD/724, 15 August 1986.

4. **Summary:**
   The Soviet Union noted that, as a result of the intensive development of digital recording devices as well as systems of data transmission and processing in large computer centres, there was now a possibility of the broader use of the actual seismic recordings, or Level II data, in the international system of seismic data exchange. The Soviet Union now considered that the timely transmission of Level II data from stations to the centres and their processing at the international centres would significantly increase the effectiveness of the international seismic data exchange and indicated its agreement that the Ad Hoc Group of Scientific Experts start to develop a system of prompt transmission of Level II data.

Proposal Abstract K53(G72)

1. **Arms Control Problem:**
   Nuclear weapons - partial test ban

2. **Verification Type:**
   Seismic sensors - international network

3. **Source:**
   Japan. CCD/PV.553, 28 March 1972.
   See also: - Canada, Japan, Sweden. "Working paper on measures to improve tripartite cooperation among Canada, Japan and Sweden in the detection, location and identification of underground nuclear explosions by seismological means". CCD/376, 20 July 1972.

4. **Summary:**

Japan proposes an expert meeting to deal with the establishment of a permanent international seismic network to monitor a test ban. The purpose of the meeting would be to select stations and their locations, to select a method of data exchange, to designate coordinating centres for the collecting and storing of data, and to determine methods for preventing intentional alteration of data.

In the interim period, before the network is established, Japan calls for a commitment by the two superpowers not to test above a threshold of m_b 5.75. To verify compliance Japan proposes the use of a tripartite seismograph network of Canadian, Japanese and Swedish stations. CCD/376 of 20 July 1972 presents the results of a trilateral conference of Canada, Japan and Sweden to establish this seismic network.

Proposal Abstract K54(T74)

1. **Arms Control Problem:**
Nuclear weapons - partial test ban

2. **Verification Type:**
(a) Seismic sensors - extra-border stations
(b) Remote sensors
(c) International exchange of information (Protocol)
(d) Complaints procedure - consultation and cooperation - (Article 2(3)).

3. **Source:**
United States/Union of Soviet Socialist Republics. "Text of the Treaty between the US and USSR on the limitation of underground nuclear weapon tests and protocol". (Threshold Test Ban Treaty). CCD/431, 16 July 1974.
Signed: 3 July 1974, (not yet ratified by US).*
See also: - Abstract C47(G84)

4. **Summary:**
The Treaty prohibits underground tests exceeding 150 kt. As well, all future military tests are to be limited to specific test sites. For verification purposes "national technical means", are to be used (Article 2(1) and (2)). Parties are also obligated not to interfere with the other party's national technical means.

The protocol provides for an exchange of detailed information on the basis of reciprocity, concerning:
(1) location of test sites,
(2) geology of the sites,
(3) geographic coordinates of the test after they are conducted, and
(4) yield, data, time, depth and location of two calibrating tests for each test site.

On 17 February 1983, the US submitted to the USSR a request for improving the verification provisions of both the TTBT and the 1976 Peaceful Nuclear Explosions Treaty (see abstract C52(T76)) in order to remove existing uncertainties regarding compliance. The USSR rejected this request on 28 March 1983 saying that the uncertainties referred to by the US would not have arisen if the verification provisions of these unratified treaties had been utilized. (See also Abstract C47(G84).

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* On 13 January 1987, President Reagan submitted the TTBT and PNET to the US Senate for ratification with the condition that the US and USSR agree to additional measures to effectively verify the treaties.

Text of Major Verification Related Provisions:

Article II:

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 the 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. To promote the objectives and implementation of the provisions of this Treaty the Parties shall, as necessary, consult with each other, make inquiries and furnish information in response to such inquiries.

5. Selected Comments by States:

The Treaty (TTBT) has been criticized because the threshold is so high. Sweden CCD/PV.647, 30 July 1974 has claimed that only 10-20% of the nuclear tests conducted in the past by the two superpowers have exceeded 150 kt. The present seismic identification threshold is much lower than this, around 10 kt.

Proposal Abstract K55(A83)

1. **Arms Control Problem:**
   Nuclear weapons - partial test ban
   - peaceful nuclear explosions
   - comprehensive test ban

2. **Verification Type:**
   (a) Seismic sensors - intra-border stations
   (b) On-site inspection - selective
   - sampling

3. **Source:**
   Nordyke, Milo. "The Test Ban Treaties: Verifying Compliance". Energy and Technology Review Lawrence Livermore National Laboratory (May 1983): 1-9.

4. **Summary:**

This article provides an overview of the research activities of the Lawrence Livermore National Laboratory (LLNL) in the United States in connection with verification of the Limited Test Ban Treaty (see abstract J120(T63)), the Threshold Test Ban Treaty (see abstract K54(T74)), the Peaceful Nuclear Explosions Treaty (see abstract C52(T76)) and a possible comprehensive test ban treaty (CTBT). The research focuses on three areas: seismic monitoring research, verification technology developments in non-seismic areas, and arms control and verification support efforts.

Seismic monitoring of a CTBT must cope with the possibility of evasion techniques for hiding the seismic signal from a nuclear test and must attempt to distinguish between earthquakes and explosions which is difficult for events with body wave magnitude less than 4.5. In cooperation with Sandia Laboratories, LLNL developed an evaluation program to assess the quality of the data produced by Sandia's prototype in-country seismic network (see abstract K45(G84)). (The US has proposed the installation of such a network in the US and USSR for monitoring a CTBT). The Regional Seismic Test Network (RSTN) consisted of five in-country seismic station prototypes deployed across North America (see abstract K56(A83)).

RSTN data analysis will facilitate estimation of test yields and will aid CTBT verification by identifying factors which produce explosion-related shear waves. Research on seismic arrays and data processing may help to improve signal-to-noise ratios, identification of seismic phases by their particle motions and speed of propagation across the array and determination of the depth and location of sources. LLNL's Seismic Analysis Code helps seismologists carry out signal processing, analysis and display operations with a command-driven structure. This code has been useful in helping other agencies upgrade their data analysis centres.

LLNL has also conducted research on Soviet nuclear testing practices and Soviet geology in connection with current TTBT issues. Estimating the yield of an explosion often depends upon knowledge of the geological conditions of a particular region. Research has included analysis of signal from Soviet tests recorded in China and analysis of noise levels which affect signal detection.

Non-seismic verification research on technologies that could supplement regional and teleseismic verification techniques has included research on on-site inspection (OSI) techniques. Radiological sampling is the only OSI technique which can produce a positive, unequivocal identification of a nuclear explosion, but sensitive laboratory analysis is necessary to detect traces of argon-37 and Krypton-85 and is difficult because of the short half-life (37 days) of argon-37. Nevertheless, research suggests that radiological gas sampling is both feasible and promising.

A local seismic network (LSN) deployed in an on-site inspection area could detect and locate aftershocks from a nuclear test. In recent tests, scientists were able to locate the site of an explosion to within about 200 m. Aftershocks can be detected for as long as 100 to 300 days after an explosion, depending on geological formations. The LSN is a practical method, but more research is necessary to permit distinctions between aftershocks from explosions and those from other sources.

A surface or near-surface explosion causes a disturbance of particles in the ionosphere which can be detected by observing a frequency shift in a radio signal reflecting off the ionosphere. LLNL has developed a two-dimensional theoretical-calculational model which includes calculations of the propagation of the acoustic pulse of the ionosphere and the radio frequency phase shift.

Research efforts in support of arms control and verification have also included analysis of Soviet peaceful nuclear explosions to provide information useful for verification of the PNET. Knowledge of the types of projects involved and the range of conditions under which on-site verification might have to be carried out would be useful in this regard. Analysis of seismic data and current Soviet literature indicates that the Soviet PNE program involves explosions for three purposes: to stimulate gas production from low permeability reservoirs, to determine geologic structures through deep seismic sounding, and to create industrial-scale underground cavities in salt formations for the storage of liquid gas condensate (see Iris Y. Borg, "Peaceful Nuclear Explosions in Soviet Gas Condensate Fields". Energy and Technology Review Lawrence Livermore National Laboratory (May 1983): 30-37).

Proposal Abstract K56(A83)

1. **Arms Control Problem:**
   Nuclear weapons - partial test ban
   - peaceful nuclear explosions
   - comprehensive test ban

2. **Verification Type:**
   Seismic sensors - intra-border stations

3. **Source:**
   Taylor, Steven R. "The Regional Seismic Test Network". Energy and Technology Review Lawrence Livermore National Laboratory (May 1983): 20-29.

4. **Summary:**

In order to improve America's ability to monitor and verify compliance with present and future treaties limiting or banning nuclear tests, the US Department of Energy installed a Regional Seismic Test Network (RSTN) at five sites in North America. The RSTN is intended to provide engineering experience in locating and operating seismic equipment in climatic and geological conditions which replicate those in the USSR and to evaluate the performance of the prototype system. Another goal is to ascertain the extent of low-level seismicity and to compare it with higher magnitude events in order to establish the requirements for numbers of stations and data processing capabilities.

The stations are spaced about 2000 km apart to monitor both earthquakes and underground explosions at the Nevada Test Site. They transmit high-quality broad band seismic data via satellite to several recording and analysis centres. The sites were chosen in order to approximate the following conditions which might exist if National Seismic Stations (NSS) were to be set up under a CTB treaty: the station separation which might be established, the anticipated geophysical parameters; and the anticipated geophysical properties between NSS stations.

Verification of a CTB treaty is complicated by the necessity of discriminating between earthquakes and explosions. The article uses graphs and figures to explain in detail the different characteristics of the two types of seismic waves produced by each phenomenon. Various techniques have the potential to facilitate discrimination between events. Signal processing techniques can enhance signals for analysis. Information on signal arrival time combined with azimuth estimates from NSS can permit an initial estimate of the locations of regional events. Short period arrays of surface sensors near each NSS site could provide information on geologic structures. This could

help to improve the signal to noise ratio, identify seismic waves, separate simultaneous events and provide azimuth estimates with better accuracy than those from the NSS alone. Synthetic seismograms and multiple filtering techniques may help discrimination and research on seismic velocities and attenuation characteristics may also prove useful in this regard.

Proposal Abstract K57(G75)

1. **Arms Control Problem:**
   Nuclear weapons - peaceful nuclear explosions

2. **Verification Type:**
   (a) Seismic sensors - intra-border stations
   (b) On-site inspection - selective
   - IAEA safeguards

3. **Source:**
   Japan. "... arms control implications of peaceful nuclear explosions". CCD/454, 1 July 1975.
   See also: - CCD/PV.776, 2 March 1978.
   - CD/PV.16, 6 March 1979.

4. **Summary:**

The onus of showing an explosion to be that of a peaceful nuclear device is on the party conducting it. All PNEs should be registered in advance giving details as to proposed purpose, procedures (yield, nature, device, geological information, etc.) and data which the state is prepared to make available to the world community resulting from the test. Possible verification methods include:

(1) seismic monitoring (i.e. certain types of PNEs might have characteristic signatures);
(2) on-site inspection in order to identify the design of the device, and other characteristics of the PNE; and
(3) IAEA safeguards together with use of nuclear material derived from a safeguarded fuel cycle which would at least tell what type of device and the amount of nuclear material that was used.

Certain types of PNEs will be more difficult to verify than others.

In CCD/PV.776 Japan contends that because of the danger of nuclear proliferation, nuclear explosions for peaceful purposes should never by conducted unless agreement is reached upon international observation procedures. It therefore recommends that a provision be included in any CTB agreement to this effect and that states also undertake in the treaty to continue negotiation in good faith on appropriate international supervision.

Proposal Abstract K58(G84)

1. **Arms Control Problem:**
   Nuclear weapons - peaceful nuclear explosions

2. **Verification Type:**
   (a) Seismic sensors - intra-border stations
   (b) On-site inspection - selective
   (c) Short-range sensors - seals

3. **Source:**
   United States. Department of Energy. Sandia National Laboratories. "Instruments for Monitoring Peaceful Nuclear Explosions". Sandia Technology 8, no. 2 (November 1984): 20-25.

4. **Summary:**

This article reviews Sandia Laboratories' work on equipment to verify the Peaceful Nuclear Explosions Treaty (PNET) (see abstract C52(T76)). The PNET permits explosions up to a yield of 150 kt, but requires that if group explosions are conducted, the observer must be able to determine that no individual explosion exceeded 150 kt in yield. The Treaty Protocol provides that the larger the yield of a peaceful nuclear explosion, the more information the party conducting the explosion must provide to the other party and the more on-site observation and instrumentation which must be allowed. The article notes that the PNET is the first treaty with the USSR which allows on-site inspection.

Electrical yield measuring equipment is permitted under the Protocol for verification of group explosions with a planned aggregate yield of between 150 kt and 500 kt. Sandia Laboratories' System, SLIFER (Shorted Location Indicator by Frequency of Electrical Resonance), deduces explosive yield by measuring the rate of propagation of a shock wave through the earth from a nuclear explosion. Such a system could monitor peaceful nuclear explosions under the PNET.

When the planned yield of a group explosion is between 150 kt and 500 kt, observers may also employ a local seismic network to detect possible unauthorized weapon tests hidden in the group explosion. The PNET Protocol allows the observers to establish a seismic network consisting of a number of seismic stations which does not exceed the announced number of explosions plus five. Sandia Laboratories' seismic network consists of twelve stations and one recording trailer. Each seismic station uses three seismometers, signal- processing equipment, signal-transmitting equipment and battery-power.

Sandia Laboratories has developed extensive tamper protection and detection equipment for SLIFER and the seismic stations. This equipment includes trailer door seals and features to protect cables and cable inlets. A random paint pattern can be used as another tamper detection device. The pattern is difficult to reproduce so that unauthorized forced entry of a SLIFER trailer could be detected by comparing photographs of the repainted surface with those of the original surface.

CHAPTER L

LITERATURE SURVEY

Literature surveillance involves the monitoring of openly available sources of information, especially scientific publications, news media, and governmental statements and publications. The technique is closely related to records monitoring and international exchange of information. In its widest meaning, it is applicable to the verification of a wide range of arms control commitments, though the term has recently become identified with the monitoring of scientific literature in the context of a treaty banning chemical and biological weapons (CBWs).

The technique in its broadest sense is a significant element of any national capability to verify compliance with an arms control undertaking. It is certain that many national intelligence gathering and diplomatic services employ some form of literature survey. However, it is very doubtful whether this technique alone can provide sufficient assurance of detecting violations to satisfy many states. Problems include insuring credibility of the information found in open sources and properly interpreting the data acquired. Costs related to the technique do not seem exorbitant especially when it is realized that extensive systems of literature surveillance already exist in one form or another.

One concern about the approach is whether information which might indicate a violation would ever by openly published. It is also possible that false information could be issued to mislead a verification body.

Budgetary Analysis

Budgetary analysis can be described as a special form of literature surveillance though proposals using this approach frequently incorporate the use of other verification techniques to overcome the short-comings of relying on openly published budgetary information. Suggested applications include monitoring commitments in the CBW field and general disarmament undertakings. With regard to the latter, the League of Nations studied the approach before World War II. More recently, the UN Secretary General has considered it in relation to a suggested agreement on restricting military budgets. Unfortunately, there are a number of problems with the use of budgetary analysis. Much budgetary decision-making and accounting activity, particularly that related to military expenditures, is never openly reported. In other cases, quite the opposite may be true: there may be such an abundance of confusing information concerning vast military expenditures that much effort is entailed in sorting out the real picture.

Lack of any commonly agreed procedures for classifying and reporting financial information is another difficulty. Governments may categorize expenditures and receipts differently because of legitimate differences of opinion. To be of much value, a verification system based on budgetary analysis would probably require standardized and open budgetary reporting procedures in all states, a difficult task to accomplish.

In conclusion, it is clearly improbable that either literature surveillance in general or budgetary analysis in particular can at present serve as the primary elements in a verification system. At best they might have value when used in conjunction with more technically efficient techniques or, in the case of budgetary analysis, when supplemented by more intrusive methods.

Proposal Abstract L1(A58)

1. Arms Control Problem:
Any arms control agreement

2. Verification Type:
Literature survey - budgetary analysis

3. Source:
Burkhead, Jesse. "The Control of Disarmament by Fiscal Inspection". In Inspection for Disarmament, pp. 75-84. Edited by Seymour Melman. New York: Columbia University Press, 1958.

4. Summary:

Using the US system of fiscal administration as a model, the author examines the feasibility of controlling disarmament by examination of fiscal records. It is assumed that inspectors would have access to all financial records of individual agencies (e.g. budget presentation, books of account and internal audit) as well as the government's overall financial records.

Two disarmament cases are considered. First, after disarmament had been operative for several years and the US military budget had been greatly reduced then any large military expenditures in violation of the agreement could be detected by fiscal inspection. In the second case, when military spending is at high levels, fiscal inspection could not be expected to reveal moderate expenditures on weapons in violation of an agreement. The US fiscal system is not designed to thwart complicity; if there were agreement among a dozen key officials, moderate expenditures could be hidden successfully. The author reviews several characteristics of the US fiscal system which would contribute to the ineffectiveness of fiscal inspection as well as several ways of disguising the expenditures within the existing budget.

Proposal Abstract L2(A62)

1. **Arms Control Problem:**
   General and complete disarmament

2. **Verification Type:**
   (a) Literature survey - budgetary analysis
   (b) Records monitoring - personnel
   (c) On-site inspection - selective

3. **Source:**
   Deutsch, Karl W. "Communications, Arms Inspection and National Security". In Preventing World War III: Some Proposals, pp. 62-73. Edited by Quincy Wright, William M. Evan and Morton Deutsch. New York: Simon and Schuster, 1962.

4. **Summary:**
   To supplement conventional ground or air inspections on a reciprocal or international basis, Deutsch recommends first content analysis of a country's mass media as well as materials used in the institutions of indoctrination of a country such as schools. The goal would be to detect the psychological groundwork needed for clandestine preparations for large scale war. Second, Deutsch suggests the mutual or international registration of all scientific and technical personnel. Sampling by inspectors could determine the whereabouts of these personnel and their accessibility. Third, budgetary allocations might by inspected. Budgets should therefore be publicized and budget-making organizations should be open to inspection. Finally, exchange of personnel particularly in the scientific fields and in budgetary organizations would be helpful.

 L3(A62)

Proposal Abstract L3(A62)

1. Arms Control Problem:
   Military budgets

2. Verification Type:
   (a) Literature survey - budgetary analysis
   (b) International control organization

3. Source:
   Woods Hole Summer Study. Verification and Response in Disarmament Agreements. Annex Volume I. Washington, D.C.: Institute for Defence Analysis, 1962.

4. Summary:
   This proposal suggests that an international disarmament organization would have the right to audit national budgets in order to verify either the elimination or restriction of military budgets. Public disclosure of data would be limited to that connected with detected violations.

Proposal Abstract L4(I74)

1. **Arms Control Problem:**
   Military budgets

2. **Verification Type:**
   (a) Literature survey - budgetary analysis
   (b) International exchange of information
   (c) Records monitoring - plant
   (d) Remote sensors - satellites
   (e) On-site inspection - selective

3. **Source:**
   United Nations. Secretary General. "Reduction of the military budgets of states permanent members of the Security Council by 10 per cent and utilization of part of the funds thus saved to provide assistance to developing countries", Document A/9770, 14 October 1974.*
   See also: - "Measurement and international reporting of military expenditures:
   Report of the group of experts on reduction of military budgets", Document A/31/222 Rev. 1, 20 October 1976.
   - "Reduction of military budgets". Document A/32/194, 14 September 1977.

4. **Summary:**
   The 1974 Report delves at some length into the difficulties of verification which it sees as a central problem to any agreement on the reduction of military budgets. Verification, as the Report defines it, involves a procedure for obtaining and evaluating information about changes in a state's military expenditures. The need for actual exchange of information is dependent on the degree of trust between the parties. Because of the impact on national security resulting from such budgetary limitations it is likely that states will demand a verification mechanism which will provide timely and incontestable evidence of violations.

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* An adaption of Annex II of this report was prepared for the US Arms Control and Disarmament Agent in 1976. See; Abraham S. Becker and Bengt-Christer Ysander, International Limitations of Military Expenditures: Issues and Problems. Santa Monica, California: Rand Corporation, April 1976, R-1911 ACDA. Also see Abraham S. Becker, Military Expenditures Limitation for Arms Control: Problems and Prospects: With a Documentary History of Recent Proposals. Cambridge, Mass.: Ballinger, 1977.

The type of information required is economic and financial, not numerical estimates of physical forces. The basis for providing this information would be a standardized method of budgetary reporting of military expenditures. The report deals with the problems and possibilities of developing such a method. The verification system likewise would be based on economic and financial data. Because the expenditure limitation would restrict the ability of a party to respond to a violation, more complete and accurate information would be demanded after the limitation was imposed than before, in order to ensure compliance.

The type of additional information demanded would vary with the nature of the agreement. Generally, to verify changes in military expenditures it is necessary to specify base levels of expenditure with confidence. Therefore, verification requires definition of and comparability of military expenditure, price indices and perhaps international purchasing power parities. Supporting data on financial and physical flows compiled at intermediate or even primary levels are also needed to check for evidence of evasion.

The report suggests that it would be helpful to provide information in the form of national income accounts, input-output tables, flow-of-funds accounts and manpower balances which would permit determination of the way in which the military sector fits into the economy of a state as a whole. This would make possible a number of cross-checks to ensure that the size and pattern of the military sector was correctly stated.

The report deals with a number of problems which will be faced by the verification system. To begin with, it points out two general methods of evasion which must be guarded against. These are, first, the artificial reduction of the prices at which military transactions are recorded and, second, the shift of some kinds of military expenditure to non-participating allies or to the civil sector in some way.

Another problem pointed out by the paper is a general one. Countries may differ as to the amount of information which they have published in the past concerning military expenditures. Thus, there is a potential for some countries to gain more than might others from the additional information provided under the agreements.

A further serious problem is the intrusive nature of the verification system. It requires access to much information on force levels and expenditures which conflicts with the traditional interests of states in protecting the security of their military establishment. To avoid this problem indirect verification might be undertaken. This involves detecting physically observable elements of the military budget (e.g. forces, facilities, etc.) by satellites and then estimating the expenditures required to acquire these elements. While such an approach may work for some aspects of the military sector, it does not work for small weapons nor is it capable of dealing with qualitative factors. It also requires interpretation of the data on observables which introduces room for considerable estimate error.

Use of supplementary economic information to help reduce possible errors would lead again to the problem of intrusivness. Satellites also have the problem that they are available only to a limited number of states. To remedy this a joint or international satellite service might be envisaged.

The report goes on to discuss an "information-disclosure ladder" which might assist in building tolerance to increasing levels of intrusiveness. The lowest rung of this ladder would involve simple confidence-building endeavors such as publication of military accounts in aggregated form plus explanatory material. Higher on the ladder there might be provision for price indices and price-cost information for estimation of purchasing power parities to facilitate international comparisons. Historical time series would assist in establishing baselines for measuring changes. Higher still there might be submission of national accounts, input-output tables, research and development, financing and support accounts. At the highest level, information is provided from intermediate and primary national production and distribution units and opportunity is afforded for non-nationals to audit unit records by on-site inspection.

The Group of Experts submitted a further Report in 1976, the purpose of which was to define "the major components of a system of military expenditure concepts, definitions and measurement procedures, along with a corresponding reporting structure" (p.4). The implementation of the international reporting system would, according to the report, constitute only the first step towards realization of expenditure limitations. Other technical issues especially that of verification remain to be resolved. The utilization of the reporting system would serve mainly a confidence-building role. The report concludes by calling for tests to operationalize the reporting scheme.

A third report was issued by the Group of Experts in September 1977, which included the views of a number of states on the previous reports, together with comments by the Group of Experts on these replies. Concerning suggestions that some states are unable to provide the detail demanded by the reporting scheme, the report points out that any attempt to reduce the level of detail will complicate the task of verification. "The more detailed the data required, the easier it becomes to cross-check and verify" (p.23).

Another way of reducing costs of reporting is to retain the level of detail but allow some approximations to be made for some of the entries in the reporting scheme's matrix. But again such an approach would reduce the reliability of the matrix since "the numerous links between the cell entries and financial and physical data beyond the boundaries of the matrix, together with the requirement for internal consistency, both of which give the completed matrix a broad range of verification possibilities, would be much less precise" (p.24). This loss would be reduced if countries reported in detail the procedure used to arrive at such approximations.

Proposal Abstract L5(A75)

1. **Arms Control Problem:**
   Military budgets

2. **Verification Type:**
   (a) Literature survey - budgetary analysis
   (b) International exchange of information

3. **Source:**
   Holzman, F.D. Financial Checks on Soviet Defence Expenditure. Lexington, Mass.: D.C. Heath & Co., 1975. Especially chapter 5, pp. 47-71.

4. **Summary:**

Before giving details of this verification proposal, it would be useful to review some of Holzman's general comments on verification and some other relevant matters he raises.

Holzman believes that financial verification in a centrally planned economy is possible. Despite "the fact that a major part of the resources of the Soviet economy are directly allocated by planners, the Soviet economy is nevertheless largely a money economy in which almost all commodity flows, including those connected with defence, are reflected in financial flows. This means that if the accounts are made available, financial checks of claimed reductions in military expenditures, should in principle be possible and adequate" (p.2). Indeed, since almost all economic activity in the USSR is nationalized and centrally planned, data on military expenditures should be more complete, more systematized, and more available to authorities than may be the case in the West. On the other hand, Holzman continues, the more complete state control suggests that manipulation of data designed to mislead would be easier.

The book describes at length the financial sources of Soviet military expenditures including explicit budgetary categories, other possible budgetary sources, and possible non-budgetary sources. It then deals with with the verification question as it relates to these financial sources.

Budgetary expenditures: The essential requirement for verifying the Soviet budget would be the availability of broader and more detailed information with respect to both defence and non-defence categories. This data must be published by the Soviet Union as part of its regular annual budget. Publication is essential, the author claims, since the Soviets would be more inhibited from falsifying published data than if they merely submitted the data to a verification organization.

In addition, the Soviets must publish similarly detailed budget accounts for the past 5 or 10 years. This would help ensure the reliability of the future budget information since the past budget data would:

(1) Provide a rigid framework within which new data must fit;
(2) Provide a basis for establishing a trend framework within which new data must fit; and
(3) Enable the use of significance tests.

Holzman continues by elaborating on the use of trend analysis, pointing out some serious problems with it, including:

(1) The approach assumes that trends are generated randomly;
(2) Any deviation from the trend would have to be too large to be detected; and
(3) Most importantly, it would be difficult to distinguish between the hiding of clandestine military expenditures in "other" budget categories from the reasonable Soviet adjustment of these "other" categories when resources are released due to legitimate reduction in military expenditures. (That is, if the Soviets reduced their military expenditures by 15%, they would use the released resources elsewhere which would be recorded in the budget as an increase in some category(s). It would be difficult to tell whether this increase was a clandestine military expense or a legitimate "other" expense.) The only way of overcoming this problem is to allow some rights of auditing with regard to items where suspicion arose.

Finally, Holzman points out that as well as more detailed budgetary data, provision of non-budgetary data would help in verification since comparisons could be made between the two sets of information.

The Budget Surplus and Hidden Budget Expenditures: Again the essential requirements for successful verification is the provision of better information by the Soviet Union particularly on the disposition of the budget surplus. It would also be desirable to obtain the complete balance sheet from Gosbank (i.e. the Soviet state bank) and to check the accuracy of the Gosbank balance in a manner similar to that taken with the budget (i.e. trend analysis).

Separate Secret Accounts: Such accounts would be kept outside the budget. It would not be possible to detect them through examining the expenditure side of government finances; concentration would have to be focussed on the revenue side by reconstructing government receipts from a single source of revenue (e.g. the sales tax). If the hidden accounts derived from a number of revenue sources, the problem of detection would be much more difficult. To enable checking concerning separate accounts it is necessary that the Soviets publish greater detail about the revenue side of their budget, including historical data for trend analysis. Other problems concerning this method of checking separate accounts include:

(1) The separate account would have to be large in order to be detected;
(2) Certain sources of revenue do not have rate structures which would facilitate their reconstruction by the verifying body; and
(3) The Soviets have a propensity for unconventional budgetary accounting which would complicate verification.

Bank Credit: To check on the possibility that clandestine military expenditures might be channeled through the banking system in the guise of extensions of credit, it would be necessary to use similar methods to those employed concerning budget expenditures (i.e. trend analysis).

Retained Profits, Amortization Funds and Other "Sources" of Expenditure: There is no very reliable method for verifying these. All methods depend on obtaining detailed accounting of such expenditures. Even if this information is provided problems would arise, such as that resulting from the "netting" of some profits.

Pricing Problems: The major problem in this regard is that reductions in military expenditures could be simulated by manipulating prices, either by reducing sales taxes or by increasing subsidies (especially the latter). Here again the key to verification is the provision of fuller budget information by the Soviets. Problems also arise in distinguishing legitimate changes in factor costs and disguised military expenditures.

The Financial Balance: The USSR compiles, but does not publish, a detailed economic balance of the national economy. Of particular relevance to verification are two elements of this - the Material Balance and the Financial Balance (especially the latter). 'It would be more difficult to falsify the Financial Balance than the budget because of the many interrelationships made explicit in this Balance, because the categories in it are more functionally related to independent aspects of the economy which could be checked, and because falsifying the Balance would be more internally dysfunctional. However, the Financial Balance data would have to be provided by the Soviets, and in somewhat more detailed form, particularly concerning the military categories. Together with historical budget data and other data currently available, the Financial Balance could make verification much easier. However, "even with all these data, it would still undoubtedly be possible to hide military expenditure if the determination to do so were sufficiently great" (p. 71).

Proposal Abstract L6(A75)

1. **Arms Control Problem:**
   Military budgets

2. **Verification Type:**
   (a) Literature survey - budgetary analysis
   - sampling
   (b) International exchange of information
   (c) On-site inspection - selective
   - sampling

3. **Source:**
   Holzman, F.D. Financial Checks on Soviet Defence Expenditures. Lexington, Mass.: D.C. Heath & Co., 1975. Chapter 6, pp. 73-83.

4. **Summary:**

There are problems with verification based on the acquisition of additional data concerning Soviet budgeting expenditures as outlined in Chapter 5 of Holzman's book (see abstract L5(A75)). The Soviets may simply not be willing to provide additional information in the amount necessary for verification. Furthermore, even if such additional information is forthcoming, there will remain serious problems to detecting clandestine military expenditures. Therefore, Holzman proposes an alternative verification method "which does not require the surrender of additional aggregative information, yet...which gives promise of providing as reliable a check on compliance...as may be obtained" (p.73). This method is based on the use of sampling techniques. It would be possible to use this method alone or as a complement to verification based on submission of additional data.

Budget Expenditures: Assuming that all military expenditures go through the budget, the

> ...verification procedure envisaged is to run a sample check on all cheques, vouchers and so forth made out in the Gosbank [i.e. the Soviet state bank] on the budget account. If the sample is random and the distribution "by size" of cheques made out for defence is identical with the size distribution of non-defence cheques, then a relatively small number of cheques would need to be sampled to be able to determine, with a high degree of probability, the percentage that military expenditures are of the total budget expenditures (p.74).

Should the size distributions of defence and of non-defence cheques be significantly different, then larger samples may be required or resort might be made to stratified samples.

Generally, the size of the random sample would vary with the desired level of confidence and acceptable error. For example, a

sample of 27,592 items would give a 99% confidence level that the sample differed no more than .5% from the actual population.

The detection risk for a violator is generally high even with small samples. The risk, however, varies with the amount of cheating involved: the larger the violation the greater the chance of detection. With small violations more care would have to be taken concerning acceptable error factors and therefore larger samples might be required.

The proportion of defence expenditures to total expenditures could be obtained from a sample on the basis of either "numbers" of cheques made out for defence relative to non-defence or on the basis of "sums of values". It would be easier for the Soviets to cheat if the former method is used since they could simply make some non-defence payments in numerous cheques of small denominations.

One problem with this technique might arise if the Soviets made some of their defence expenditures in a few large aggregated amounts which would likely not be caught in the random samples. This difficulty could be avoided by requiring the Soviets to submit their cheques in the form of cumulated totals.

The system outlined would require that the Soviets refrain from making large expenditures in cash. As well, they would have to systematize their accounts and payment system in such a way that it would be possible to devise a means of taking random samples of cheques (e.g. serialize cheques using IBM-type clocks).

In order to prevent hiding of military expenditures under other budget categories at the level of individual payments, the verifying body would have to be allowed the privilege of rigorously auditing selected cheques taken from the random sample to make sure that they were ostensibly made. The number of cheques to be so audited would depend on the size of the sample and the extent of falsification one wished to detect. Nevertheless, it is probable that thousands of cheques would have to be audited.

Total Expenditure (Budget Plus Non-Budget): This approach would require a random sample of all payments made through Gosbank, not merely payments on the budget accounts. It is likely that the Soviets would resist this because it involves higher costs of preparation and higher annoyance factors and because the verifying body would be put in a position where it could reconstruct the structure of the Soviet economy with a high degree of accuracy.

Separate Secret Accounts: As was the case for verification using additional budget data (see abstract L5(A75)), the possibility of separate accounts weakens the effectiveness of certification by sampling because if "accounts are taken entirely out of the regular financial channels, then the random sample is effectively by-passed" (p.81).

To resolve the problem of verifying the absence of separate accounts it is theoretically possible that the verifying body could work from physical military goods and services to the accounts in Gosbank using random samples. But this approach is not practicable since the Soviets could avoid detection by developing a correspondence between those items which are physically hidden and those expenditures which are hidden in the accounts. In addition, there is no way of getting a random sample of the physical counterpart of military expenditures.

Proposal Abstract L7(I80)

1. **Arms Control Problem:**
   Military budgets

2. **Verification Type:**
   (a) Literature survey - budgetary analysis
   (b) International exchange of information
   (c) International control organization

3. **Source:**
   United Nations. Secretary General. "Reduction of military budgets: international reporting of military expenditures". Document A/35/479, 21 October 1980.
   See also: - "Reduction of the military budgets of states permanent members of the Security Council by 10 per cent and utilization of part of the funds thus saved to provide assistance to developing countries". Document A/9770, 14 October 1974 (see abstract L4(I74)).

4. **Summary:**

UN document A/9770 noted that a prerequisite for negotiating the reduction of military expenditures was agreement on the scope and content of the expenditures. UN document A/35/479 is the report of an ad hoc panel on military budgeting composed of experts from seven countries. The panel designed and conducted a practical test of a proposed standard instrument for international reporting of military expenditures. The test analysed replies of fourteen countries.

Comparisons of expenditure data require conversion of expenditures to a common currency. Difficulties in working with exchange rates led the UN Statistical Office to develop an International Comparison Project (ICP) which formulated a set of "purchasing power parities" (PPPs) to be used instead of exchange rates. PPPs can show the equivalence in purchasing power of prices in different pricing systems. While the ICP has not yet calculated military sector PPPs, a proposal to carry out such a project has been submitted to the UN group of experts studying the relationship between disarmament and development.

The international reporting system also requires adjustments to reflect price changes over time. Since few countries have developed price indexes for the military sector, the system may have to rely on more general price indexes such as the consumer price index or the gross national product deflator. Other issues of concern which were addressed by previous expert groups included valuation of resources and stocks of military capital.

The use of the reporting instrument would facilitate verification of agreements to reduce military expenditures by providing cross-classification of expenditures by forces and costs, and by standardizing definitions of categories. Other verification methods which could be examined further include: the relationship between expenditure and related economic information and information which can be obtained by national technical means, the use of a "graduated ladder" of increasing disclosure cited in the 1974 report (annex II, para. 131) and the use of various national accounting systems.

The report concludes that a sound basis now exists for implementing a system of international standardized reporting of military expenditures. The Panel recommends that the UN General Assembly take steps to implement such a system. These steps could include a specific call for the reporting by all states of their military expenditures in accordance with the revised reporting instrument. An effort to inform member states about the system should also be made. An international organization to coordinate the reporting system may be necessary.

Proposal Abstract L8(G73)

1. **Arms Control Problem:**
   Chemical weapons - production

2. **Verification Type:**
   (a) Literature survey
   (b) Remote sensors - satellites
   (c) Records monitoring - economic
   (d) Complaints procedure - referral to United Nations
   (e) International control organization

3. **Source:**
   Sweden. "Working paper on the concept of amplified verification in relation to the prohibition of chemical weapons". CCD/395, 6 March 1973.
   See also: - CCD/PV.590, 8 March 1973;
   - CCD/PV.610, 5 July 1973; and
   - CCD/PV.622, 16 August 1973.

4. **Summary:**

The paper envisages the use of a number of independent verification methods each of which individually is of limited efficiency in detecting a violation. Each, however, could detect (with a known efficiency) changes in normal activities in the chemical field. The cumulative effect of such indications of change would be to trigger further inquiries directed at the suspect party. The occurrence of many warning signs together with an unwillingness to explain them on the part of the suspected party, or to let an investigation take place, would constitute grounds for the complainant to withdraw from the treaty. The problem of a high rate of false alarms would be overcome if each party viewed the alarms not as an accusation of a violation but rather as a warning sign which initiates further inquiry and, therefore, as being merely a routine matter.

It is assumed that the control methods and investigations would be managed by an international agency. It is also assumed that any violation would necessarily involve a number of different activities detectable by different methods of certification.

Sweden includes in the paper a table giving "hypothetical values of revealing probabilities" for a variety of verification techniques. The paper is unclear as to how these estimates were derived.

The paper claims to emphasize "reassurance" rather than "deterrence". Some states find it unacceptable to run the risk of being falsely accused of a violation; therefore the system is not designed to catch a violator red-handed but merely to monitor normal activities relevant to a CW capability. Deterrence, in fact, is unnecessary provided other states receive adequate warning of any violation so that they can prepare defences.

The mechanism envisaged in this paper could be independent of other control mechanisms such as referral of complaints to the UN or verification by invitation.

In PV.622 Sweden, responding to American criticism of the paper, suggests that it is not deterrence that is the primary object of verification but rather confidence-building (i.e. "reassurance"). The paper does not say that deterrence is unimportant, only that reassurance must come first.

Sweden also believes that the use of estimates of the detection probability for the various verification methods suggested (i.e. the "hypothetical values of revealing probabilities"), are not meaningless as the US contends. They are "judgemental probabilities" not of the detection of violation itself, but of deviations from normal activities resulting from the violation.

Sweden also emphasizes that any violation would involve a multiplicity of activities on the part of the violator. A "one activity" violation is the most difficult to detect but, while such a violation is possible, it is a worst case example not applicable to most states.

In PV.610 Sweden claims that the concept of amplified verification is applicable beyond the CW disarmament field.

5. Selected Comments of States:

The US criticized the Swedish proposal on a number of grounds (See CCD/PV.618, 2 August 1972). While the US agreed with the basic idea that verification is enhanced to some extent if a range of activities is monitored by various means, it contended that there are, nevertheless, a number of problems with the Swedish concept of "amplified verification". First, the "hypothetical values of revealing probabilities" suggested in the paper for a number of verification techniques are purely hypothetical since is no evidence to back up the estimates.

Second, the concept of "amplified verification" is based on the idea that a violator will be engaged in a number of activities to create the CW capability. This is not necessarily so; a violator may deliberately limit himself to one or two activities. The probability of detection is, furthermore, related to the scale of these activities. There may be no "amplified verification" resulting from the cumulative possibilities of detection when only one or a few activities are involved.

Third, should "amplified verification" not work, a country could find itself at a significant military disadvantage as a result of a violation which it could not rectify quickly by creating its own CW capability.

Fourth, the odds of detection by various means can be significantly affected by the unpredictable and unknown steps that a violator may take to evade detection.

Fifth, one cannot count on several warning signs occuring simultaneously given the violator's ability to manage and time a violation. Thus, the right of withdrawal cannot be exercised by a

party suspicious of a violation without incurring the political onus of having destroyed the treaty.

Sixth, the US objects to the paper's emphasis on "reassurance" rather than "deterrence". It is impossible to distinguish between the two, since reassurance is based on confidence in the effective deterrent provided by verification systems.

Proposal Abstract L9(G78)

1. **Arms Control Problem:**
   Chemical weapons - production

2. **Verification Type:**
   Literature survey - sampling

3. **Source:**
   Sweden. "Working paper on a methodological investigation for computerized scanning of chemical literature". CCD/569, 24 April 1978.

4. **Summary:**

Manual scanning of relevant literature is time consuming since a large number of journals must be covered. However, there exist a large number of publications of abstracts which facilitate literature searches. Many of these abstract publications appear also on magnetic tape and can be scanned by computers. This paper is intended to investigate suitable methods for utilizing such databases and to evaluate their possible applicability in connection with a CW treaty.

A computerized literature search should ideally catch only relevant items. When comparing manual versus computerized searches, it must be observed that computerized retrieval is advantageous since many concepts (or keywords) can be watched whereas doing this manually would require much greater effort. An evaluation of the size and usefulness of different databases made it clear that the most comprehensive coverage will be obtained when several databases are searched simultaneously.

The study reported in this working paper focussed on the computer readable version of Chemical Abstracts. (This publication in 1977 contained references to approximately 410,000 papers and reports). The study consisted of two parts. First, a preparatory study was carried out on material from five issues of Chemical Abstracts within the field of biochemistry and organic chemistry (26,488 references). These references were manually searched and read by two experienced chemists. These chemists selected out the most interesting references which were then reclassified by a highly qualified scientist as to their "novelty" and "military" interest.

On the basis of this preparatory work, different search strategies were formulated and tested. The main study consisted of the application of selected strategies to twenty subsequent issues of Chemical Abstracts containing 128,740 references. The two chemists scanned the output from the computer and the third scientist reclassified their selected references as in the preparatory study.

The results of this study show that it is possible to formulate effective search strategies for computerized searching of databased literature references in order to acquire information concerning CW agents. The method substantially diminishes the amount of work required for literature surveillance. It appears possible, on the basis of the results here, to reduce the database to 1-4% of its original size, while still retaining 63-69% of relevant references in the material. It seems possible to improve the method and also to apply it to other databases.

CHAPTER M

INTERNATIONAL EXCHANGE OF INFORMATION

An international exchange of information is a formal system of providing information between the parties of an arms control agreement for the specific purpose of verification. It is closely related in many aspects to records monitoring and literature surveillance.

The use of an international exchange of information has been suggested as a verification technique for a number of arms control problems. It has, for example, played an important role in proposals for establishing international networks to monitor a nuclear test ban using seismic sensors (see Chapter K). It has also been suggested as an element for verifying a CW production ban. Indeed, in its widest meaning, it is one of the most pervasive notions regarding verification.

International exchanges of information can take a number of forms. First, states may make declarations. A declaration might be given once, for example, when a treaty comes into force, or it might be repeated periodically. Declarations can convey a wide variety of information; they may, for example, provide lists of existing stocks of weapons, installations or activities. On the other hand, they may merely involve an assertion by high government officials of compliance with an obligation. Usually the difference between a declaration and other forms of information exchange is that a declaration is a public statement to the world at large, which is not directed exclusively to other treaty parties or to some international body. One concern is that such statements may not be subject to verification to prove their veracity.

A second form of international exchange of information involves the direct exchange of data between the parties of an agreement. In this type of scheme, analysis of the data is undertaken by the parties themselves. If desired, such a system could be less open to the public and to other states, than might be a declaration. This approach can probably also handle a greater volume of data than can a declaration. As with declarations, the type of information exchanged can vary considerably.

A third type of information exchange involves an intermediate step between the sender and ultimate receiver in the form of some international body. Reports from parties are sent to the international body which then performs one of two basic activities. It can distribute the information among the parties or it can undertake the analysis of the data and distribute its conclusions. This type of information exchange is an important part of the IAEA safeguards system (see Chapter D).

The information which is exchanged derives, of course, from national sources under the control of national governments. It is, therefore, possible that without some independent method of checking the quality of the data, the information given could be incomplete or in some way misleading. Thus, information exchanges are unlikely to be completely acceptable as the sole method of verification for an agreement, except possibly in cases where no other means of verification presents itself and the objective of the agreement is sufficiently desirable to warrant accepting a limited verification system. However, when used in conjunction with other methods which can provide some confirmation of the information provided, international exchanges of information can be a valuable ingredient in verification and can promote confidence-building.

Proposal Abstract M1(A62)

1. Arms Control Problem:
   Any arms control agreement

2. Verification Type:
   (a) International exchange of information
   (b) Records monitoring - personnel

3. Source:
   Woods Hole Summer Study. Verification and Response in Disarmament Agreements. Annex Volume I. Washington, D.C.: Institute for Defence Analysis, 1962.

4. Summary:
   This proposal seeks to control research and development by creating an international scientific community in which clandestine R&D programs would be more difficult to conceal. The system proposed would involve a voluntary exchange of technical journals and the holding of joint scientific meetings to create the proper ethos for the envisaged international scientific community. An international registry of scientists with semi-annual entries disclosing their current assignments and the nature of their work would be established. Finally, an international control organization might carry out random inspections (by telephone perhaps) to verify the accuracy of entries in the registry.

Proposal Abstract M2(A65)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   (a) International exchange of information
   (b) On-site inspection - selective

3. **Source:**
   Barton, J.H. "Inspection of Technology". Disarmament and Arms Control 3 (1965): 41-49.

4. **Summary:**
   The author offers two suggestions for verifying restrictions of military research and development:
   (1) Free and open exchange of scientific information, as well as internationalization of some R&D (i.e. space exploration) should be instituted.
   (2) All R&D programs exceeding a specified size could be placed under international observation.

Proposal Abstract M3(A83)

1. Arms Control Problem:
   (a) Any arms control agreement
   (b) Nuclear weapons - ballistic missiles
   - cruise missiles

2. Verification Type:
   (a) International exchange of information
   (b) Remote sensors

3. Source:
   Kincade, William H. "Challenges to Verification: Old and New". In The Verification of Arms Control Agreements, pp. 14-30. Edited by Ian Bellany and Coit D. Blacker. London: Frank Cass, 1983.

4. Summary:

Kincade states that the SALT II agreement represented "an historic accomplishment in verification". Doubts about the Treaty's verifiability were unjustified and the question of verification acquired an unwarranted domestic significance. The verification procedures which were negotiated would have been adequate. Of particular importance was the provision for an initial exchange of data on forces (the 'agreed data base') and a semi-annual data exchange throughout the life of the Treaty. This meant that a potential cheater would have to decide every six months whether to submit false data to cover the cheating. Such a submission would entail significant risks and could deter cheating. Extensive rules for inclusion and definitions of objects and activities also facilitated verification. Ambiguity was used in certain instances to allow questions to be raised in the Standing Consultative Commission or to cope with limitations in verification technology.

The evolution of weapons technology and the numerical proliferation of nuclear weapons will pose a challenge for verification in the future. Surveillance technology will also evolve, but will be unable to cope with systems such as 'stealth' aircraft and cruise missiles. It will also be unable to determine whether a warhead is conventional or nuclear. These uncertainties will require cooperative measures for verification along the lines of those developed in the SALT II agreement.

Proposal Abstract M4(A55)

1. **Arms Control Problem:**
   General and complete disarmament

2. **Verification Type:**
   (a) International exchange of information
   (b) Complaints procedure - consultation and cooperation
   (c) On-site inspection - selective

3. **Source:**
   Szilard, L. "Disarmament and the Problem of Peace". Bulletin of the Atomic Scientist 11, no. 2 (October 1955): 297-308.

4. **Summary:**
   This proposal follows a voluntary evidence principle whereby each state, seeking to make its own compliance with the agreement known, would provide other countries with sufficient evidence of its compliance. If a state fails to convince other states, they would be free to seek clarification. Should they fail to get satisfaction, they could abrogate the agreement.

   More specifically, in an agreement on general and complete disarmament, the first stage of which calls for destruction of 3/4 of all guns, tanks and other mobile equipment used for tactical warfare (including warplanes), each country would announce which weapons it plans to destroy and would invite all other parties to the agreement to observe and certify the destruction. To verify the end of production of these weapons, "a few" inspectors could be invited to station themselves in specified factories.

Proposal Abstract M5(A63)

1. **Arms Control Problem:**
   General and complete disarmament

2. **Verification Type:**
   (a) International exchange of information
   (b) On-site inspection - progressive/zonal

3. **Source:**
   Polanyi, J.C. "First Step - Sealed Records Caches?" Disarmament and Arms Control 1 (1963): 5-21.

4. **Summary:**

This proposal seeks to provide a means of verifying the accuracy of declared weapons inventories in a manner that would postpone for as long as possible the necessity of implementing a system of general inspection. As such it is intended to preserve the military balance.

The proposal envisages the use of sealed records caches, each of which would contain lists of a specific set of weapons. The caches would be opened only when the appropriate stage of the disarmament process had been reached. Thus, the records would become available only just prior to the time inspection was to be carried out to verify the elimination of those particular weapons.

The contents of the caches would include inventories in each of the weapons categories specified, i.e. the missiles, aircraft, nuclear stockpiles, CBW stockpiles, warships, tanks, artillery and plants capable of producing these, and armed forces. Economic data would also be included. The records in the caches should consist as far as possible of overlapping documents, drawn from many sources. In this way the possibility of cheating would be substantially reduced.

The author suggests that the caches be located on "neutral soil". Alternatively, each state could locate its caches in some visible and visitable site in its capital city. In either case the caches would be under international control.

Proposal Abstract M6(A64)

1. Arms Control Problem:
   General and complete disarmament

2. Verification Type:
   (a) International exchange of information
   (b) On-site inspection - selective
   (c) Complaints procedure - referral to new international body
   (d) International control organization

3. Source:
   Lall, Betty Goetz. "Information in Arms Control Verification". Bulletin of the Atomic Scientists 20 (October 1964): 43-45.

4. Summary:

The author suggests a procedure for verifying declarations about force levels made at the beginning of the disarmament process. First, each party prepares a list of all armaments to be controlled including information on numbers, characteristics, age and whether stationed in the country or abroad. Second, the declarations are submitted to the International Disarmament Organization which circulates them to the parties. The agreed number of arms are assembled for destruction under IDO supervision and the first IDO inspectors are stationed at production plants. Based on its own figures regarding the weapons stocks of other states, any party may challenge the declaration of another and ask the IDO to resolve the discrepancies. In response to such a challenge a country must provide information to justify its declaration. The IDO would then decide by majority vote what action, if any, should be taken. One possible action might be sending inspectors to one or more parts of the country to ascertain if force levels have been accurately reported. If an investigation is decided upon, the IDO would rule whether the armaments accumulated would be destroyed or whether the disarmament process should be postponed.

The foregoing applies to verifying declarations and protecting against undeclared stocks of weapons. The verification of production limitations would be done by inspection.

Proposal Abstract M7(A81)

1. Arms Control Problem:
   (a) Regional arms control - Europe
   (b) Nuclear weapons - ballistic missiles
   - cruise missiles
   - missile tests
   - manned aircraft

2. Verification Type:
   International exchange of information

3. Source:
   Kincade, William H. "Arms Control: Negotiated Solutions". In Cruise Missiles: Technology, Strategy, Politics, pp. 309-335. Edited by Richard K. Betts. Washington, D.C.: The Brookings Institution, 1981.

4. Summary:

Kincade discusses the need for verification of a long-range theater nuclear force agreement. The systems of immediate concern, the SS-20, Backfire and Pershing II, "do not pose insuperable verification problems" (p. 330), but cruise missiles pose more of a challenge for verification. Kincade notes that there are precedents in arms control agreements which could be used to facilitate verification of cruise missiles. These include: a ban on flight testing and deployment or low deployment numbers, geographical restrictions, launch platform restrictions, prior announcements of modifications or redeployments, exchanges of data, and agreements on production rates. Despite problems, verification does not appear to be "impossible conceptually" (p. 330) as long as measures are agreed upon before the deployment of the more ambiguous types of cruise missiles. Other verification measures could include: size restrictions (to limit range), limits on deployment areas and permissible redeployment, functionally related or externally observable differences, and counting rules.

Proposal Abstract M8(T85)

1. **Arms Control Problem:**
   (a) Regional arms control - nuclear weapons free zones
   (b) Nuclear weapons - proliferation
   - comprehensive test ban

2. **Verification Type:**
   (a) International exchange of information - reports to international body: the South Pacific Bureau for Economic Cooperation (Article 9)
   (b) On-site inspection - IAEA safeguards (Article 4, Annex 2)
   (c) Complaints procedure - consultation and cooperation (Article 10, Annex 4)
   - referral to Consultative Committee (Annex 4)
   (d) International control organization

3. **Source:**
   South Pacific Nuclear Free Zone Treaty.
   Concluded: 6 August 1985.
   Entered into force: 11 December 1986.
   Number of parties as of 28 February 1987: *- to Treaty: 8
   - to Protocols: 2

4. **Summary:**

Under Article 3 of the Treaty, each party undertakes not to manufacture, acquire, possess or have control over any nuclear explosive device either inside or outside the South Pacific Nuclear Free Zone. Each party also undertakes not to provide source or special fissionable material or equipment for its processing, use or production for peaceful purposes unless it is subject to appropriate international safeguards (Article 4). Article 5 enjoins each party to prevent the stationing of any nuclear explosive device in its territory, but each party reserves the right to permit the visits of foreign ships and aircraft in a manner not covered by the rights of innocent passage. Under Article 6, each party undertakes to prevent the testing of any nuclear explosive device in its territory.

The control system for verifying compliance with the Treaty is outlined in Article 8 and comprises the following elements:
(1) reports and exchanges of information,
(2) consultations,
(3) IAEA safeguards applied to peaceful nuclear activities, and
(4) a complaints procedure.

Parties will report "any significant event" affecting the implementation of the Treaty to the Director of the South Pacific Bureau for Economic Cooperation ("the Director") as soon as possible

(Article 9). The Director will report annually to the South Pacific Forum on the status of the Treaty and related matters. The parties will also inform each other of matters related to the Treaty and can request a meeting of the Consultative Committee for consultation and cooperation related to the treaty (Article 10).

Verification of the non-diversion of nuclear material from peaceful nuclear activities to nuclear explosive devices will be accomplished through the application of IAEA safeguards to all source or special fissionable material in all peaceful nuclear activities under a state's jurisdiction (Annex 2). These safeguards will be applied under agreements negotiated between each party and the IAEA. Upon the request of any other party, each party will make available a copy of the most recent report by the IAEA on its inspection activities in the territory of that party (Annex 2(4)).

The first step of the complaints procedure is bilateral consultations between parties concerning a complaint (Annex 4(1)). If the matter is not resolved by this procedure, a party can request a meeting of the Consultative Committee through the Director. A complaint before the Committee will be supported by evidence of a breach of Treaty obligations. If a breach of obligations is discovered, the parties will convene at a meeting of the South Pacific Forum.

Three draft protocols to the Treaty involve countries which are not members of the South Pacific Forum. These protocols will be the subject of consultations between the Forum and those countries. Protocol 1 is open for signature by France, the United Kingdom and the United States. These parties would undertake to apply the prohibitions contained in Articles 3,5 and 6 of the Treaty and the safeguards specified in Article 8(2)(c) and Annex 2 in the territories for which they are internationally responsible within the South Pacific Nuclear Free Zone.

Protocol 2 is open for signature by France, China, the USSR, the United Kingdom and the United States. Under this protocol, parties would undertake not to use or threaten to use any nuclear explosive device against any party to the Treaty or against any territory within the South Pacific Nuclear Free Zone for which a state which has become a party to Protocol 1 is internationally responsible.

Protocol 3 is also open for signature by France, China, the USSR, the United Kingdom and the United States. Under this protocol parties would undertake not to test any nuclear explosive device anywhere within the South Pacific Nuclear Free Zone.

Text of Main Verification Related Provisions:

Article 8

CONTROL SYSTEM

(1) The Parties hereby establish a control system for the purposes of verifying compliance with their obligations under this Treaty.

(2) The control system shall comprise:

(a) reports and exchange of information as provided for in Article 9;

(b) consultations as provided for in Article 10 and Annex 4(1);

(c) the application to peaceful nuclear activities of safeguards by the IAEA as provided for in Annex 2;

(d) a complaints procedure as provided for in Annex 4.

Article 9

REPORTS AND EXCHANGES OF INFORMATION

(1) Each Party shall report to the Director of the South Pacific Bureau for Economic Co-operation (the Director) as soon as possible any significant event within its jurisdiction affecting the implementation of this Treaty. The Director shall circulate such reports promptly to all Parties.

(2) The Parties shall endeavour to keep each other informed on matters arising under or in relation to this Treaty. They may exchange information by communicating it to the Director, who shall circulate it to all Parties.

(3) The Director shall report annually to the South Pacific Forum on the status of this Treaty and matters arising under or in relation to it, incorporating reports and communications made under paragraphs 1 and 2 of this Article and matters arising under Articles 8(2)(d) and 10 and Annex 2(4).

Article 10

CONSULTATIONS AND REVIEW

Without prejudice to the conduct of consultations among Parties by other means, the Director, at the request of any Party, shall convene a meeting of the Consultative Committee established by Annex 3 for consultation and cooperation on any matter arising in relation to this Treaty or for reviewing its operation.

Annex 2

IAEA SAFEGUARDS

(1) The safeguards referred to in Article 8 shall in respect of each Party be applied by the IAEA as set forth in an agreement negotiated and concluded with the IAEA on all source or special fissionable material in all peaceful nuclear activities within the territory of the Party, under its jurisdiction or carried out under its control anywhere.

(2) The agreement referred to in paragraph 1 shall be, or shall be equivalent in its scope and effect to, an agreement required in connection with the NPT on the basis of the material reproduced in document INFCIRC/153 (Corrected) of the IAEA. Each Party shall take all appropriate steps to ensure that such an agreement is in force for it not later than eighteen months after the date of entry into force for that Party of this Treaty.

(3) For the purposes of this Treaty, the safeguards referred to in paragraph 1 shall have as their purpose the verification of the non-diversion of nuclear material from peaceful nuclear activities to nuclear explosive devices.

(4) Each Party agrees upon the request of any other Party to transmit to that Party and to the Director for the information of all Parties a copy of the overall conclusions of the most recent report by the IAEA on its inspection activities in the territory of the Party concerned, and to advise the Director promptly of any subsequent findings of the Board of Governors of the IAEA in relation to those conclusions for the information of all Parties.

Annex 3

CONSULTATIVE COMMITTEE

(1) There is hereby established a Consultative Committee which shall be convened by the Director from time to time pursuant to Articles 10 and 11 and Annex 4(2). The Consultative Committee shall be constituted of representatives of the Parties, each Party being entitled to appoint one representative who may be accompanied by advisers. Unless otherwise agreed, the Consultative Committee shall be chaired at any given meeting by the representative of the Party which last hosted the meeting of Heads of Government of Members of the South Pacific Forum. A quorum shall be constituted by representatives of half of Parties. Subject to the provisions of Article 11, decisions of the Consultative Committee shall be taken by consensus or, failing consensus, by a two-thirds majority of those present and voting. The Consultative Committee shall adopt such other rules of procedure as it sees fit.

(2) The costs of the Consultative Committee, including the costs of special inspections pursuant to Annex 4, shall be borne by the South Pacific Bureau for Economic Co-operation. It may seek special funding should this be required.

Annex 4

COMPLAINTS PROCEDURE

(1) A Party which considers that there are grounds for a complaint that another Party is in breach of its obligations under this Treaty shall, before bringing such a complaint to the Director, bring the subject matter of the complaint to the attention of the Party complained of and shall allow the latter reasonable opportunity to provide it with an explanation and to resolve the matter.

(2) If the matter is not so resolved, the complainant Party may bring the complaint to the Director with a request that the Consultative Committee be convened to consider it. Complaints shall be supported by an account of evidence of breach of obligations known to the complainant Party. Upon receipt of a complaint the Director shall convene the Consultative Committee as quickly as possible to consider it.

(3) The Consultative Committee, taking account of efforts made under paragraph 1, shall afford the Party complained of a reasonable opportunity to provide it with an explanation of the matter.

(4) If, after considering any explanation given to it by the representatives of the Party complained of, the Consultative Committee decides that there is sufficient substance in the complaint to warrant a special inspection in the territory of that Party or elsewhere, the Consultative Committee shall direct that such special inspection be made as quickly as possible by a special inspection team of three suitably qualified special inspectors appointed by the Consultative Committee in consultation with the complained of and complainant Parties, provided that no national of either Party shall serve on the

special inspection team. If so requested by the Party complained of, the special inspection team shall be accompanied by representatives of that Party. Neither the right of consultation on the appointment of special inspectors, nor the right to accompany special inspectors, shall delay the work of the special inspection team.

(5) In making a special inspection, special inspectors shall be subject to the direction only of the Consultative Committee and shall comply with such directives concerning tasks, objectives, confidentiality and procedures as may be decided upon by it. Directives shall take account of the legitimate interests of the Party complained of in complying with its other international obligations and commitments and shall not duplicate safeguards procedures to be undertaken by the IAEA pursuant to agreements referred to in Annex 2(1). The special inspectors shall discharge their duties with due respect for the laws of the Party complained of.

(6) Each Party shall give to special inspectors full and free access to all information and places within its territory which may be relevant to enable the special inspectors to implement the directives given to them by the Consultative Committee.

(7) The Party complained of shall take all appropriate steps to facilitate the special inspection, and shall grant to special inspectors privileges and immunities necessary for the performance of their functions, including inviolability for all papers and documents and immunity from arrest, detention and legal process for acts done and words spoken and written, for the purpose of the special inspection.

(8) The special inspectors shall report in writing as quickly as possible to the Consultative Committee, outlining their activities, setting out relevant facts and information as ascertained by them, with supporting evidence and documentation as appropriate, and stating their conclusions. The Consultative Committee shall report fully to all Members of the South Pacific Forum, giving its decision as to whether the Party complained of is in breach of its obligations under this Treaty.

(9) If the Consultative Committee has decided that the Party complained of is in breach of its obligations under this Treaty, or that the above provisions have not been complied with, or at any time at the request of either the complainant or complained of Party, the Parties shall meet promply at a meeting of the South Pacific Forum.

5. **Selected Comments of States:**

Mexico (CD/PV.333, 27 August 1985) commented that "both the Treaty of Tlatelolco and the South Pacific Treaty contain provisions that establish a control system of remarkable efficiency".

Proposal Abstract M9(A85)

1. Arms Control Problem:
   Nuclear weapons - ballistic missiles
   - missile tests
   - mobile ballistic missiles
   - cruise missiles

2. Verification Type:
   (a) International exchange of information
   (b) Short-range sensors - monitoring devices
   (c) Remote sensors - satellite
   (d) On-site inspection - selective

3. Source:
   Krepon, Michael. "Technology Won't Solve Verification Problems". Bulletin of the Atomic Scientists 41, no. 2 (February 1985): 3-4.

4. Summary:

Krepon observes that "technical fixes" will not solve verification problems posed by arms control agreements covering the new generation of smaller, more mobile nuclear missiles which are difficult to verify. One solution is to negotiate partial agreements which avoid such problems, but this is unsatisfactory because "competition naturally shifts to uncontrolled areas, as can be seen from both the SALT I and II experiences" (p. 3). Comprehensive agreements are more desirable and cooperative measures, either voluntary or negotiated, can enhance confidence in the other side's ability to verify compliance. Cooperative measures in the SALT II agreement include data exchanges on deployed forces, advance notice of missile flight tests and pledges not to impede verification (by encrypting flight test telemetry, for example). Cooperative measures could also assist verification of mobile and cruise missiles. Possible cooperative methods of verification are:

(1) Designation of production facilities and monthly data exchanges on production rates,
(2) Tamper-proof automatic remote sensors installed outside production facilities to monitor the movement of missiles from production facilities to final assembly sites,
(3) Establishment of timetables for missile movement to allow verification by photoreconnaissance satellites, and
(4) Specifying deployment areas for land-based missiles and prohibiting deployments beyond their boundaries.

Counting rules can also help overcome technical obstacles in verification. For example, both sides could agree on numbers of "weapon stations" for SLCMs available on different classes of

submarines and ships. Ships or planes could be designated as MIRVed platforms, if long-range cruise missiles have been either tested or deployed on them. These platforms would then be subject to limitations on MIRVed systems.

On-site inspection is not a realistic verification method, and even with on-site inspection of military warehouses and production facilities, stockpile limitation agreements would be harder to verify than the SALT I and II agreements on deployed forces.

Proposal Abstract M10(A58)

1. Arms Control Problem:
   Nuclear weapons - fissionable materials "cutoff"

2. Verification Type:
   International exchange of information

3. Source:
   Penrose, L.S. "Radiation, Public Health and Inspection for Disarmament". In Inspection for Disarmament. Edited by Seymour Melman. New York: Columbia University Press, 1958.

4. Summary:

This proposal is based on two assumptions:

(1) Organizations intending to conceal clandestine production of fissionable materials would be forced to forego certain protective measures in order to remain as inconspicuous as possible.

(2) If such an organization did use protective measures, they would be readily detectable.

On the basis of these assumptions, it is proposed that hospitals could be instructed to report on unusual frequencies of instances of radiation sickness and other ill-effects resulting from exposure to radioactive materials.

In addition to this measure, inspectors could be on the lookout for evidence of protective measures being taken in certain plants.

Proposal Abstract M11(G68)

1. Arms Control Problem:
   Nuclear weapons - peaceful nuclear explosions

2. Verification Type:
   (a) International exchange of information
   (b) On-site inspection - selective
   - non-obligatory
   (c) International control organization

3. Source:
   Italy: "Working paper on underground nuclear explosions", ENDC/234, 23 August 1968.
   See also: - ENDC/250, 22 May 1969.

4. Summary:

Regulation of explosions for military purposes and those for peaceful purposes should be treated separately. Concerning the latter, the government conducting the PNE should inform the UN before carrying out the explosions, giving all necessary details (date, locality, depth, purpose, yield). All explosions not so announced would be deemed military in purpose. ENDC/250 modifies this idea slightly by suggesting that notification be given to the international service for PNEs to be set up by the IAEA.

Italy also proposes that governments conducting PNEs should invite foreign experts, chosen and approved by them, from non-nuclear states to observe the explosions.

Proposal Abstract M12(I78)

1. Arms Control Problem:
   Nuclear weapons - proliferation

2. Verification Type:
   (a) International exchange of information
   (b) On-site inspection - IAEA safeguards
   (c) International control organization
   (d) Complaints procedure - consultation and cooperation

3. Source:
   International Atomic Energy Agency. "Communications received from certain member states regarding guidelines for the export of nuclear material, equipment or technology". (The Nuclear Suppliers' Group Guidelines). INFCIRC/254, February 1978.

4. Summary:
   This document contains an appendix which provides guidelines concerning nuclear transfers to non-nuclear weapon states prepared by the Nuclear Suppliers' Group*. Formal government assurances are required from recipient states explicitly disallowing the use of materials for creating any nuclear explosive device (para. 2). A "trigger list" (Annex A) identifies potential materials for transfer covered by the guidelines. All nuclear material and facilities on the list should be subject to physical protection to prevent unauthorized use or handling (para. 3). The suppliers should not transfer any article on the list unless it is covered by IAEA safeguards (para. 4). The transfer of sensitive technology and nuclear material of military quality should be limited by the supplier countries and recipients should be encouraged to involve the supplier or multinational participation in the resulting facilities (para. 7). In the case of transfers of enrichment facilities, the recipient should agree not to enrich uranium beyond 20% without the prior consent of the supplier, of which the IAEA should be informed (para. 8). Suppliers and recipients should agree on arrangements for reprocessing, alteration, use, transfer or retransfer of any weapons-usable material (para. 9). Retransfer of trigger list items to third countries should be permitted only if the recipient of the retransfer provides the same assurances as those required by the supplier for the original transfer (para. 10).

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* The Group consists of: Belgium, Canada, Czechoslovakia, France, East Germany, West Germany, Italy, Japan, the Netherlands, Poland, the Soviet Union, Sweden, Switzerland, the United Kingdom, and the United States.

The document contains provisions for various supporting activities to ensure compliance with the guidelines. The suppliers should develop international cooperation on the exchange of physical security information, protection of nuclear materials in transit, and recovery of stolen nuclear materials (para. 11). The suppliers should also support the effective implementation of IAEA safeguards (para. 12). Producers of sensitive equipment should be encouraged to design and construct it so that it can easily be covered by safeguards (para. 13). In the case of a suspected violation of supplier/recipient understandings resulting from the guidelines, the suppliers should consult through diplomatic channels to assess the validity and extent of the alleged violation and to decide on an appropriate response, possibly including the cessation of nuclear transfers to that recipient (para. 14).

Proposal Abstract M13(A81)

1. Arms Control Problem:
   Nuclear weapons - research and development
   - ballistic missiles
   - manned aircraft

2. Verification Type:
   (a) International exchange of information
   (b) Remote sensors

3. Source:
   Welch, Jasper A. "Verification". In Intelligence Policy and National Security, pp. 131-142. Edited by Robert Pfaltzgraff Jr., Uri Ra'anan and Warren Milberg. London: Macmillan Press, 1981.

4. Summary:

Welch points out that verification is a unilateral procedure whereas certain "regulated activities" require active cooperation. Examples of such activities include agreed procedures for dismantling radars, ABM missile launchers and submarines and exchanging one ABM site for another. Unilateral verification to confirm cooperation is still necessary, however, but it is less costly than verification in the absence of cooperation. Welch advocates regulating activities which precede the deployment of a weapon system, i.e. the research, testing, development and production phases. The removal of systems from inventories could also be regulated. Cooperative measures beyond national technical means could facilitate the regulation of activities in these phases. For example, a production count of heavy bombers could be verified by observation of the displayed bombers after final assembly. Monitoring research and development can help identify potential new systems and thereby minimize surprises. "Agreed to" design specifications could be even more useful for identification purposes. These measures would go beyond the SALT approach which has been limited to monitoring the inventory and regulating certain parts of the disposition activities.

Welch applies his approach to monitoring production and disposition of nuclear-powered ballistic missile submarines, strategic aircraft and ICBMs. For example, there are only a few locations where submarines are made and unique characteristics help identify the facilities. Similarly, strategic bombers are constructed at only a few sites. After the airplane is produced, it sits on the flight line ramp for an extended period prior to and during flight testing so it is easily observed. Knowledge of stocks and flows of these systems, characteristics of destruction sites and production locations can

assist the verification and monitoring process. The weapons systems' life cycles can be studied and incorporated into a verification regime which prevents possible covert activities with the following measures:

(1) Controlling production of weapons systems,
(2) Prohibiting storage and development unless otherwise agreed,
(3) Introducing weapon systems into agreed deployment areas using agreed procedures,
(4) Sampling inventories, and
(5) Disposing of deployed weapons and major system components.

Proposal Abstract M14(G70)

1. Arms Control Problem:
   Chemical and biological weapons

2. Verification Type:
   (a) International exchange of information
   (b) Literature survey
   (c) Complaints procedure - referral to Secretary General
   - referral to Security Council
   (d) International control organization

3. Source:
   Sweden. CCD/PV.480, 21 July 1970.
   See also: - CCD/PV.463, 9 April 1970.
   - ENDC/PV.425, 5 August 1969.
   - ENDC/PV.391, 20 August 1968.

4. Summary:

This abstract focusses on a series of statements made by Sweden. That country's suggestions in ENDC/PV.391 are used as the organizing foundation for the discussion which follows. How these ideas are dealt with in later Swedish statements is also included.

A "universal openness" about CBW activities in the scientific literature is desirable (ENDC PV.391). In CCD/PV.463 Sweden points out that this "openness" must concern the chemical agents themselves and, if possible, the whole weapons systems involved.

An international organ such as the World Health Organization could undertake to collect, systematize, and disseminate all information on CBWs available from national and scientific sources (ENDC/PV.391). From this statement it appears that the international body would receive voluntary submissions by states as well as review open literature sources. The nature of the international body is elaborated in CCD/PV.463, where it is stated that the body might be an existing specialized UN agency or a general international disarmament organ. In ENDC/PV.425 Sweden suggests that states undertake "to register with the Secretary General of the UN, relevant scientific and technical material which could then be organized and published by competent staff". In CCD/PV.480 it is made clear that states are to be obligated to report to the international body such relevant data as is agreed upon.

Related to the idea of an international body receiving reports and surveying open literature is the suggestion made in ENDC/PV.425 that there might be provision "for international meetings under the aegis of the UN to evaluate scientific and technical developments within biology and chemistry from the point of view of possible risks of breaches of the undertakings in the convention".

A system of periodic reporting could be developed under which states would transmit information about resources, stocks, laboratories, personnel employed, research in process, future plans, etc. Research and production requirements for peaceful applications would be indicated in these reports. Agreement would be necessary on the precise kind of scientific activities that would be reported in this fashion (ENDC/PV.391). Sweden, in ENDC/PV.425 proposes "generally worded obligations for the parties to take part in an informal exchanges of information on scientific and technical development". Also, as discussed under item 2, Sweden suggests that an international body be the recipient of such information. This is even more clearly stated in CCD/PV.463. In CCD/PV.480 both the idea of an exchange of information between the parties and reports to an international body emerge clearly as separate elements.

More active steps and a gradually expanded verification system would be needed to check against possible gaps in the flow of information or suspicious trends, to press for further information and to question the appropriateness of certain activities. This, in effect, would constitute the beginning of "verification by challenge" (ENDC/PV.391). The essential ideas of this suggestion appear again in CCD/PV.463 where Sweden states that in regard to complaints, it prefers a procedure in several stages which gradually and with increasing seriousness would seek clarification and which, as far as possible, helps to reduce tensions. In CCD/PV.480 Sweden refers to an undertaking whereby the parties would consult and cooperate with each other and with the responsible international agency in solving any problems with regard to the treaty and facilitate any inquiry concerning compliance.

In CCD/PV. 463 Sweden suggests with regard to the complaints procedure that recourse would first be to the Secretary General of the UN who would automatically conduct an investigation before reporting to the Security Council. This procedure would keep separate the functions of fact-finding and of political judgement. This idea seems to disappear, however, by CCD/PV.480 where Sweden refers only to a provision for lodging a complaint with the Security Council.

Some sort of voluntary on-site inspection, involving mutual visits to laboratories by scientific experts. This idea is not mentioned in the three subsequent statements by Sweden (ENDC/PV. 391).

Additional points introduced by Sweden in the later statement but absent in ENDC/PV.391 include the following. In CCD/PV.463 Sweden suggests that verification techniques such as the use of sensors and records monitoring which may already be applied by national agencies, may become more widespread in the future. But it would be premature to create a fully fledged system involving the use of these methods by an international agency. The costs in terms of financial resources, manpower and political discomfort would be too great.

In CCD/PV.480 Sweden adopts from the Socialist draft convention (see abstract N2(G69)), the idea of an undertaking by each state not to permit any legal or physical person on its territory to provide to any recipient, any chemical or biological agent which might be diverted from peaceful uses to military uses, unless the transfer is reported by the state party to the responsible international organ. Sweden also suggests the need for a provision to ensure that the safeguards would not hamper scientific, technical or economic development of the parties.

Proposal Abstract M15(A72)

1. **Arms Control Problem:**
   Biological weapons

2. **Verification Type:**
   International exchange of information

3. **Source:**
   Myrdal, A. The Game of Disarmament. New York: Pantheon, 1972.

4. **Summary:**
   The author notes that the Convention on Bacteriological (Biological) Warfare (1972)* fails to include any verification techniques, and proposes that a requirement be made that states report measures taken to comply with the Treaty, such as the diversion of production facilities to peaceful purposes. A system of accounting for types and quantities of agents and equipment available for prophylactic research is also proposed.

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* See abstract 012(T72)

Proposal Abstract M16(A83)

1. **Arms Control Problem:**
   Biological weapons - production

2. **Verification Type:**
   (a) International exchange of information
   (b) Remote sensors - satellite

3. **Source:**
   Robinson, J.P. Perry. "Discussion of 'The Soviet Union and the Biological Weapons Convention' and a Guide to Sources on the Sverdlovsk Incident". In The Verification of Arms Control Agreements, pp. 41-56. Edited by Ian Bellany and Coit D. Blacker. London: Frank Cass, 1983.
   See also: - Towle, Philip. "The Soviet Union and the Biological Weapons Convention". In The Verification of Arms Control Agreements, pp. 31-40. Edited by Ian Bellany and Coit D. Blacker. London: Frank Cass, 1983 (see abstract C64(A83)).

4. **Summary:**
   This article discusses Philip Towle's article (see abstract C64(A83)) about the outbreak of anthrax in Sverdlovsk oblast in the Soviet Union in 1979 which may have been caused by a violation of the 1972 Biological and Toxin Weapons Convention. Robinson also provides an annotated bibliography on the incident (54 entries) and a chronology of events connected with the incident and its aftermath.

   The author suggests that access to five kinds of information would be necessary to verify Soviet claims that the anthrax epidemic was caused by tainted meat:
   (1) Baseline data indicating the natural occurrence of outbreaks of anthrax in the Soviet Union,
   (2) Detailed symptomatology to allow a differential diagnosis of inhalation versus intestinal anthrax,
   (3) Bacteriological data to verify the diagnosis of anthrax,
   (4) Autopsy data to confirm the differential diagnosis, and
   (5) Circumstantial data (from meteorological records, satellite observations, accounts of special quarantines etc.) to permit consideration of other possible causes.

   American and foreign intelligence services have reportedly obtained data from at least four of the five above categories, but this information has been insufficient to justify "confident" conclusions. The only way to confirm or deny the validity of the Soviet explanation would be through private bilateral discussions at a technical level free from publicity and propaganda. The Soviet Union might release information in such a context; its past silence may have been caused by a desire not to publicize possible administrative failures such as the use of a faulty vaccine or official involvement in black market meat dealing.

Based on what information is available about the Sverdlovsk incident, the author concludes that the Soviet explanation is plausible. There is a 5-10 percent probability of an outbreak of human intestinal anthrax occurring in Sverdlovsk each decade and earlier occurrences of anthrax in Sverdlovsk have been recorded. Reports of pulmonary anthrax must be treated with caution because there is no medical consensus as to what the different symptoms of pulmonary as opposed to intestinal anthrax would be.

Proposal Abstract M17(G72)

1. **Arms Control Problem:**
   Chemical weapons - destruction of facilities
   - production

2. **Verification Type:**
   (a) International exchange of information - declarations
   (b) Short-range sensors - monitoring devices
   - seals
   (c) On-site inspection - selective
   (d) Records monitoring - economic
   (e) Complaints procedure - consultative commission
   - referral to Security Council
   (f) International control organization
   (g) Review conference

3. **Source:**
   United States. "Work programme regarding negotiations on prohibition of chemical weapons". CCD/360, 20 March 1972.

4. **Summary:**
   The paper sets forth some considerations which the US believes are relevant to the question of a prohibition on CWs including verification. According to this paper states might be satisfied with a lower initial level of assurance if the disarmament process occurred in stages. With regard to verification the paper assesses a number of techniques.
   (1) Seals and monitoring devices: These are used to ensure continued inactivity of "mothballed" facilities. They are particularly appropriate for a phased approach to a ban in which CW production facilities are shut down but not initially dismantled.*
   (2) Information exchange: Given the complexity and growth of the chemical industry this technique could be useful. Possible types of information which might be exchanged include:
   (a) quantity, types and uses of organophosphorous products;
   (b) quantity, types and uses of dual purpose chemicals; and
   (c) intended use of major chemical production facilities.
   (3) Declarations: Two types of declarations might be considered:

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* See also: United States, CCD/332, 5 July 1971 (abstract I16(G71)) and CCD/498, 29 June 1976 (abstract I8(G76)).

(a) Periodic declarations regarding activities relevant to an agreement (e.g. annual reaffirmations of compliance with the agreement; annual statements of production figures of certain substances). Such declarations might be issued from the highest government levels to emphasize their continued commitment to the agreement.

(b) Lists of facilities capable of handling highly toxic materials and their location. These declarations would help verify a prohibition on production.**

(4) Remote Sensing Devices: There does not seem to be significant prospect in the near future for the development of long-range sensors that could detect manufacture of storage of CWs. Problems arise with regard to detection sensitivity and to distinguishing between prohibited and non-prohibited substances.

(5) Inspection: This is probably the most efficient and direct way of resolving queries about implementation of a ban at a given site. It would be necessary to agree as to how the location and nature of visits would be chosen.

(6) Monitoring of imports and shipping: Detection of a percentage increase in quantities of certain chemical substances imported might be useful for verifying a ban.

(7) Consultative body: The possibility of a provision for a consultative body might be considered. Such a body could offer additional assurance to parties concerning implementation of the agreement. Its functions might include:

(a) keeping abreast of the military potential of new developments in chemistry;
(b) classifying new chemical substances;
(c) receiving reports from parties regarding their own compliance;
(d) receiving complaints from parties regarding the compliance of others;
(e) arranging inspection visits; and
(f) organizing the review conference.

A number of matters relating to the structure and powers of this consultative body must be considered before it is established (e.g. powers, membership, relationship to other international bodies, funding, staff, etc.).

(8) Security Council: A provision for referral of complaints to the Security Council might be considered for inclusion in a treaty.

(9) Review Conference: A provision for a review conference might be considered.

** See also United States, CCD/PV.613, 17 July 1973.

Proposal Abstract M18(G76)

1. **Arms Control Problem:**
   Chemical weapons - destruction of facilities
   - destruction of stocks
   - production
   - proliferation
   - stockpiling

2. **Verification Type:**
   (a) International exchange of information - declarations (Article 2)
   - reports to inter-national body (Article 8(a))
   (b) National self-supervision - (Article 2(1)(e), Article 5))
   (c) Complaints procedure - consultation and cooperation (Article 10)
   - consultative commission (Article 8)
   - referral to Security Council (Article 10(2))
   (d) Short-range sensors - monitoring devices (Article 9)
   - seals (Article 9)
   (e) On-site inspection - selective (Article 9, 10)
   - obligatory
   (f) Review conference (Article 14)
   (g) International control organization

3. **Source:**
   United Kingdom. "Draft convention on the prohibition of the development, production and stockpiling of chemical weapons and on their destruction". CCD/512, 6 August 1976.
   See also: - CCD/PV.720, 12 August 1976.
   - CCD/PV.752, 12 July 1977.

4. **Summary:**
   The draft treaty provides for declarations by the parties as to stockpiles and CW production facilities before the treaty comes into force (Article 2). It is also implicit in Article 2 that a national body be created to collect information for these declarations and to ensure compliance with the treaty. This element of self-supervision is reinforced by Article 5.

   Article 8 provides for the establishment of a Consultative Committee of parties to oversee the work of the convention. Some of the duties of this body are to receive and evaluate periodic reports from the parties, conduct inquiries on request, verify the destruction of stockpiles, inform parties of results of verification procedures and to consult and cooperate with national organs.

On-site inspection by persons appointed by the Consultative Committee is provided for with respect to:

(1) deactivated production facilities (including periodic inspections) (Article 9(a,b)),
(2) active chemical production facilities (Article 9(c)), and
(3) destruction of stocks (Article 9(d)).

The use of the seals and monitoring devices is also provided for but only in regard to shutdown facilities (Article 9(b)).

Article 10 provides for consultation directly between parties or through the Consultative Committee to resolve complaints. A party may also request an inspection directly or through the Committee. Referral to the Security Council of any complaint is also included.

In PV.752 of July 1977, the UK responded to a number of criticisms which were levelled at the draft convention. First, with regard to the objection that commercial secrets might be disclosed if the provisions of the convention were implemented, the UK recognized this as a justifiable concern but pointed out that similar misgivings were raised concerning IAEA inspections of nuclear facilities, none of which have proved justified. The banning of CWs was, anyway, too important to allow commercial considerations to prevent progress.

Second, with regard to suggestions that it would be futile to monitor the activities of the chemical industry because of its size, the UK stated that this problem could be overcome by restricting reporting and inspection to those plants producing chemicals similar to CWs. Only random checks would be taken of other plants.

In response to a third criticism concerning possible disclosure of military secrets, the UK contended that the draft convention deliberately avoided giving the Consultative Committee control over the weapons and armed forces of the party being verified. Intrusive inspection would be undertaken only in relation to three activities: destruction of stocks, shutdown of CW plants, and production in civilian plants.

The UK also agreed with the suggestion that the best option might be to dismantle CW plants rather than merely shut them down. This would reduce the number of the plants to be inspected.

As to the suggestion that a ban on CWs could be verified by satellite, the UK rejects this because of limited technical feasibility, cost and availability.

With regard to the use of national control committees to verify the ban, the UK feels that such a method would be inadequate alone though it may play a part in a verification system which involves use of a number of methods.

Finally, concerning the use of declarations before the convention enters into force, the UK feels that this is important for the purpose of building confidence. While not being wedded to this approach, the UK believes it necessary that some sort of similar confidence-building measure be incorporated into the convention.

Proposal Abstract M19(G76)

1. Arms Control Problem:
   Chemical weapons - destruction of stocks
   - production

2. Verification Type:
   (a) International exchange of information - declarations
   - reports to international body
   (b) Short-range sensors - monitoring devices
   - seals
   (c) On-site inspection - selective
   - challenge
   (d) International control organization

3. Source:
   United States. CCD/PV.702, 13 April 1976.

4. Summary:

The scope of a CW convention must be based on verification capabilities. It should, therefore, include only verification measures that might be of value for a first stage agreement banning the production of lethal agents and providing for the destruction of an agreed quantity of stocks. By taking this approach it would not be necessary to meet the stricter requirements for the control system of a comprehensive ban.

The verification system would require the use of a variety of techniques. One method would be an exchange of information such as through declarations or periodic reporting to an international authority. But the effectiveness of these is limited, especially in societies with self-sufficient centralized economies. The information if provided would have to be in sufficient detail to be useful for verification but still protect commercial secrets. The example of the "familiarization exchange" provision of the Threshold Test Ban Treaty Protocol is suggested.* The information exchanged would include location of facilities and their ownership, as well as quantities produced, imported, exported and consumed by use category. Information on activities related to CW defense (e.g. expenditures, R&D) would also be useful for building confidence.

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* See abstract K54(T74).

The closing of plants could be verified by tamper-resistant seals and monitoring devices. Inspection, however, would be the best technique, especially for confidence-building. Present proposals concerning inspection, including inspection by challenge, lack sufficient detail to permit their application. The US suggests a number of questions as to inspection details which must be clarified. Finally, the Americans believe that verification of stockpile destruction can only be done adequately by on-site observation of the actual process.

Some sort of international verification organ is also necessary though the effective operation of the treaty must remain the responsibility of the parties. The international body's role would be that of an expert consultative organ to consider new scientific and technological developments, receive and discuss reports from parties, circulate reports, and arrange on-site inspections.

M20(G72)

Proposal Abstract M20(G72)

1. **Arms Control Problem:**
   Chemical weapons - production

2. **Verification Type:**
   (a) International exchange of information - declaration
   - reports to international body
   (b) Complaints procedure - consultation and cooperation
   (c) International control organization

3. **Source:**
   United Kingdom. CCD/PV.575, 8 August 1972.

4. **Summary:**

According to the UK, any comprehensive ban requires a certain amount of on-site inspection as part of its verification scheme. If this is unacceptable,

> ...a limited agreement might be possible on a basis of declarations of national stocks and declarations of national productive capacities provided by member states to an appropriate international body, giving the fullest information on the use by a state of chemical products that would be diverted to CW production by states members of the convention, and there would have to be opportunity for consultation and requests for further information to be handled through the international body concerned. Such a regime would be supported by such national verification techniques as today exist.

Proposal Abstract M21(A80)

1. **Arms Control Problem:**
   Chemical weapons - production
   - stockpiling
   - destruction of facilities
   - destruction of stocks

2. **Verification Type:**
   (a) International exchange of information
   (b) On-site inspection - selective
   - non-obligatory

3. **Source:**
   Lundin, S.J. "Confidence-building Measures and a Chemical Weapons Ban", in: Stockholm International Peace Research Institute, Chemical Weapons: Destruction and Conversion, London: Taylor and Francis, 1980, pp.139-151.

4. **Summary:**

Lundin argues that in certain circumstances, verification of some undertakings in an arms control treaty may not be possible (eg. too intrusive to be politically acceptable or too expensive). In such situations, obligatory confidence-building measures (CBMs) might be employed in lieu of verification. The author considers CBMs to encompass information given without opportunities for verification. He points out, however, that obligatory CBMs should not be considered as a substitute for international verification measures. They should only be contemplated when agreed intrusive verification may not be technically feasible.

Because of the extremely complicated relations between civilian and military conditions involved in a CW convention, obligatory CBMs may be highly relevant. Continuously expressed commitment to a cause (in the form of a continual supply of information on the matter) may make it politically difficult for a country to violate a convention. Further, nationally provided information, perhaps provided over a long time, should also be useful if intrusive international control could be instituted by means of complaints to a consultative committee.

For a CW convention, Lundin suggests consideration of several CBMs. Before the convention, mutual visits to production facilities might be invited. As demonstrated by workshops organized by the FRG and the UK in 1978, these can be done without disclosing industrial secrets. Also declarations on possession of chemical weapons, cooperation on CW protection, and monitoring scientific and technical developments might be considered.

After a convention comes into force the parties might voluntarily invite observers to military manoeuvres when anti-CW training was practiced and to Nuclear, Biological, and Chemical (NBC) protection schools. Obligatory CBMs might also be part of the convention regime. For example, when a CW facility and agents are to be converted to civilian use more extensive information than would otherwise be required might be demanded. Such information might include:

(1) reasons why the material has to be converted instead of destroyed;
(2) details of amounts of CW agents to be converted and the time schedule;
(3) naming the facilities where the conversion will take place; and
(4) identification of where stockpiles of the materials are located.

M22(G75)

Proposal Abstract M22(G75)

1. **Arms Control Problem:**
   Other weapons of mass destruction - environmental modification

2. **Verification Type:**
   International exchange of information

3. **Source:**
   Iran. CCD/PV.680, 12 August 1975.

4. **Summary:**
   According to Iran the act of triggering environmental modifications would be invisible; only the effects would be detectable. Hence there would be considerable problems about detecting violations of the prohibition. Furthermore, somewhat like peaceful nuclear activities, it is difficult to differentiate peaceful from military programmes.

   Iran suggests that international registration of all environmental experimentation might be helpful as a control mechanism.

M23(A85)

Proposal Abstract M23(A85)

1. Arms Control Problem:
   (a) Conventional weapons - ground forces
   (b) Regional arms control - Europe

2. Verification Type:
   (a) International exchange of information
   (b) On-site inspection - control posts
   (c) Remote sensors

3. Source:
   Baskakov, V.M. "Eleven Years of the Vienna Talks". In Defending Europe: Options for Security, pp. 70-81. Edited by Derek Paul. London: Taylor and Francis, 1985.

4. Summary:

The events and disagreements which have occurred in the MBFR process over the past 12 years are chronicled in this paper. It articulates the Soviet position on MBFR and some of the Warsaw Pact's grievances are elucidated. Among these are NATO's verification requirements and their insistence on agreement regarding the balance of forces; "as for the Western package of verification measures, it is obviously exaggerated and disconnected from the main theme - which is reduction of troops and armaments in Central Europe". The contention here is that Western verification proposals exceed the necessary requirements, and in fact constitute an attempt to establish control over USSR forces' activities and to legalize espionage. This is part of a more general assertion that NATO's emphasis on associated measures is misplaced and must not be considered in isolation from the main purpose of the MBFR talks.

Some counter-proposals made by the Soviet Union for verification measures are then explained. These include provisions for an exchange of lists or recalled units, notification of reduction measures, the establishment of three or four observation posts during the reduction period, and the use of national technical means of verification. Such measures are "realistically connected with the nature of the obligations and with the actual reductions and limitations of armed forces".

Finally, NATO and US attempts to ascertain the current balance of forces are criticized as having obstructed progress in MBFR talks to date. The current balance of forces does not pose any substantial threat, and a need for more objective criteria and improved political will in the West is noted.

Proposal Abstract M24(A85)

1. **Arms Control Problem:**
   (a) Conventional weapons - ground forces
   (b) Regional arms control - Europe

2. **Verification Type:**
   (a) International exchange of information
   (b) On-site inspection - control posts

3. **Source:**
   Toogood, John B. "MBFR: Problems and Opportunities". In Defending Europe: Options for Security, pp. 92-102. Edited by Derek Paul. London: Taylor and Francis, 1985.

4. **Summary:**

The inherent virtues of MBFR talks and the opportunities that this forum may provide are discussed here. The two central problems that are identified in this paper on MBFR talks both pertain to verification. These are the Soviet Union's continued penchant for secrecy and the inability of both sides to agree on the nature of verification requirements. Some consideration is also given to the zones in which reductions ought to take place and the means of reaching agreement on this issue.

On the issue of verification provisions, it is noted that there is agreement between East and West with regard to regular exchange of information on troop strengths and deployments, identifiable entry and exit points for movement of troops, and the presence of observers where reductions are conducted. Disagreement occurs over how these measures should be implemented and how stringent they ought to be. It is suggested by the author that these associated measures in themselves might allow the MBFR talks to perform other related tasks besides force reductions. For instance, it may be possible to "develop a code of conduct for military activities in Central Europe", develop mechanisms for crisis control, and other attendant security issues may be discussed within that forum. The military code of conduct would rely on verification measures such as the exchange of information, the notification of activities, and the exchange of observers. The only remaining danger with this emphasis on associated measures is that the original purpose of the MBFR talks might be overlooked. It is concluded that this must be avoided at all costs given its significance, for the notion of actually reducing forces in Central Europe is "truly breathtaking in its scope".

CHAPTER N
NATIONAL SELF-SUPERVISION

The essence of this idea is that each state is to be held responsible for ensuring compliance with an arms control agreement within its territory. This principle is already well established in international law. The rule of pacta sunt servanda - that treaties are binding on parties and must be performed in good faith - is a fundamental principle of the customary law of treaties, according to the International Law Commission's Commentary on the Vienna Convention on the Law of Treaties of 1969, Article 26. It has been held by the Permanent Court of International Justice and by a number of international arbitration tribunals, that the principle of complying with a treaty in good faith is an integral part of this rule.

Proposals concerning self-supervision frequently attempt to be more specific than this, however, by imposing an obligation on the parties to institute appropriate laws and administrative procedures so as to ensure compliance with the treaty within their territorial jurisdiction. Some proposals also require the establishment of a national control body to undertake supervision of compliance.

The obvious difficulty with the idea of self-supervision is that it has the potential for creating a situation where the thief guards the gold. When a national control organization is envisaged there appears more substance to the method. But the credibility of such an organization depends primarily on its independence from the government of the state within which it is to carry out its supervisory role. In some instances it may be difficult to judge to what degree an organization is independent.

Assuming that an independent organization is created, it is then necessary to consider whether the organization will have adequate resources and whether it will be given sufficient access to records and facilities to be able to carry out its functions.

On a more positive note, a national control organization for monitoring a CW production ban could prove doubly attractive to states if the organization could also serve as a domestic system for monitoring chemical production for the purpose of pollution control. It seems quite reasonable, that the requirements of systems designed to meet both objectives would be compatible in many ways. Consequently, a single dual purpose agency might prove more efficient and provide substantial savings. An analogous situation exists already in many states with regard to national supervisory bodies for the control of dangerous and expensive nuclear materials. Such bodies enforce safeguards so as to protect the environment and the health of the public, and to comply with obligations under the NPT.*

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* In this regard, see Chapter D which contains proposals dealing with nuclear safeguards.

It is frequently suggested that any national control bodies which are created be required to report periodically to an international this organization. Related to this idea of requiring international reports, is that of incorporating a clearly defined form of international supervision of the domestic regulatory mechanisms, especially any national control organization. The advantage of this notion is that it would help ensure that domestic rules were being enforced properly by states and thereby increase the credibility of the national self-supervision system.

As an alternative to specific requirements for domestic control mechanisms, a proposal for national self-supervision may include the obligation to give international exposure to laws, administrative procedures, etc., enacted domestically to ensure compliance. This idea, in itself, is rather limited; it still begs the question of ensuring that the domestic rules are enforced properly.

Another idea sometimes suggested in connection with self-supervision is that domestic provisions (i.e. laws, regulations, control bodies, etc.,) might be "harmonized" between states by developing, through international negotiations, some standard provisions or perhaps a model form of national control mechanism. Such an endeavour has considerable merit for defining essential standards and for ensuring that all states are aware of the basic requirements of an effective regulatory mechanism. However, such a model would inevitably to be very general. National regulatory mechanisms must be substantially individual in character because of differences in domestic political and legal systems between countries.

In many cases, it is probable that undertaking arms control obligations will necessarily entail some form of domestic mechanism for ensuring compliance. This may be true regardless of whether specific provisions of the agreement require such a mechanism, especially if a party assumes the obligation to provide detailed data about a complex matter such as the production of chemicals. However, proposals concerning national self-supervision frequently seek to rely on the method as a substitute for more intrusive verification techniques. When such proposals are framed generally, merely stating the obligation to establish domestic mechanisms for enforcement, and when other methods of verification are absent, the proposals have little substance from the perspective of verification.

Proposal Abstract N1(G70)

1. **Arms Control Problem:**
   Chemical and biological weapons

2. **Verification Type:**
   (a) National self-supervision
   (b) Remote sensors - aerial
   - satellites
   (c) Records monitoring - economic
   (d) Literature survey
   (e) International exchange of information - declarations
   - reports to international body
   (f) On-site inspection - selective
   - challenge
   (g) Complaints procedure - consultation and cooperation
   - referral to new international body
   - referral to Security Council
   (h) International control organization

3. **Source:**
   Yugoslavia. CCD/PV.465, 6 April 1970.
   See also: - CCD/302, 6 August 1970.
   - CCD/377, 20 July 1972.

4. **Summary:**
   The following is a summary of the Yugoslavian statements in the above sources.

   PV.465 (1) Measures of self-control:*

   (a) Laws putting under civilian administration or control all institutions now engaged in R&D, and production of CBWs.

   PV.465 (b) Laws prohibiting R&D, production and stockpiling of agents for CB warfare. Decisions on the elimination of stocks and abolition of testing fields as well as all installations producing the weapons. An exception would be made for continuation of work for the purposes of protection and riot control.

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* The enforcement of these laws would be left to the individual state. These self-control measures represent the most important verification procedures according to Yugoslavia.

PV.465 (c) Cessation of military training in the use of CBWs including deletion from military manuals of all rules and regulations pertaining to ways of using and conditions for use of CBWs.

CCD/302 (d) Laws requiring obligatory publication of certain data such as names of institutions and facilities engaged in or which could engage in the prohibited activities. Other laws would require the compilation and reporting of data on production of material and agents which could be used as CBWs as well as the reporting of this information to an international organization.

PV.465 (2) Indirect control by international organization or each party individually:

This involves the collection and analysis of data from each country pertaining to the expenses in certain fields of activity, to the utilization of certain raw materials, semi-finished products and final products, and to the development of scientific and research work which could indicate whether or not there was any activity contrary to the prohibition of CBWs. (This would complement procedure 1 (d) above.)

PV.465 (3) Measures of international control:

(a) Listing by all parties of all institutions, factory proving grounds, etc. which have been engaged in R&D and production of CBWs as well as institutions which could engage in such activity. (This is complementary to 1 (d) above).

PV.465 (b) Governments should on their own initiative provide for appropriately regulated access to show the non-existence of any forbidden activity. This corresponds to Sweden's idea of "verification by challenge".

PV.465 (c) The possibility of control from the air by satellites or other devices for remote detection.

CCD/302 (4) Complaints procedure:

In the case of doubts about implementation of the treaty, any party could enter into consultations with the suspected party to clarify the situation. In case of suspicion of a violation, the complainant should inform other parties and submit its evidence to the international control organ. The international organ would contact the suspected state to conduct inquiries. If this procedure does not clarify the situation satisfactorily, the suspected state may offer to allow verification by on-site inspection. If there is no satisfactory explanation after the above procedures, the complainant could address itself to the Security Council.

In CCD/377, Yugoslavia suggests some further measures. Under national measures of self-control there might also be the following:

(1) Statements by governments, at the time of the treaty's entering into force, about national activities up to that time regarding CWs.

(2) Enactment of national legislation and administrative acts regarding:
   (a) the organization and functioning of the national system of self-control including establishment of a group of experts with full authority to act nationally and cooperate with international bodies.
   (b) the relationship between national and international control and national obligations to submit regular reports of a uniform standard.
   (c) organization of a control system for imports and exports of all chemical substances.

(3) Declassification of all data on R&D and production of CWs.

(4) The exchange of national experts between states.

Yugoslavia also suggests in CCD/377 the establishment of an international control organization. This body would have the functions of:

(1) reviewing the operation of the treaty and fulfillment of obligations of parties;

(2) stimulating and assisting mutual cooperation between parties;

(3) analyzing and classifying new achievements in the chemical field; and

(4) carrying out on-site inspections at the request of the UN Security Council.

This control body would include a council of experts which would conduct any inspections as well as make proposals concerning improvement of control systems. This body could also advise the Security Council about procedures for on-site control and appropriate sanctions against violators.

Proposal Abstract N2(G69)

1. **Arms Control Problem:**
   Chemical and biological weapons - destruction of stocks
   - production
   - proliferation
   - research and development
   - stockpiling

2. **Verification Type:**
   (a) National self-supervision (Articles 4&5)
   (b) Complaints procedure - consultation and cooperation (Article 6)
   - referral to Security Council*
   (c) Review conference**

3. **Source:**
   Socialist States. "Draft convention on the prohibition of the development, production and stockpiling of chemical and bacteriological (biological) weapons and the destruction of such weapons". Document A/7655, submitted to the UNGA, 19 September 1969.
   See also: - Union of Soviet Socialist Republics. CCD/PV.454, 3 March 1970.
   - Revised draft presented in the UNGA.
   - Socialist States, "Draft Biological Weapons Convention", CCD/325 Rev. 1, 30 March 1971.

4. **Summary:**
   Under Article 4 each party becomes "internationally responsible" for compliance with the treaty by legal and physical persons within its territory as well as by its citizens outside its territory. Each party under Article 5 is also obligated to undertake "in accordance with its constitutional procedures, the necessary legislative and administrative measures" to ensure compliance with the convention.

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* An amendment to the Socialist draft CBW convention was introduced on 14 April 1970 by Hungary, Mongolia and Poland (CCD/285). It involved the addition of a provision specifically allowing for referral of any complaint to the Security Council. This amendment was incorporated into the Revised Socialist draft CBW convention of 23 October 1970 as Article 7.

** The review conference provision was suggested by a number of states and was included in the Revised Draft of 23 October 1970.

Parties also undertake to consult and cooperate with each other with the view to resolving any problems which may arise in the application of the convention (Article 6).

5. **Selected Comments of States:**

Mongolia suggests (CCD/464, 14 April 1970) that one possible measure under Article 5 of the Socialist draft CBW convention would be the creation of a special government agency to ensure compliance with the treaty by persons within the state party's jurisdiction. An analogy is drawn to the provisions of the Single Convention on Narcotic Drugs (1961). Other possible national self-supervision measures include:

(1) A national system of compulsory registration of the requirements and the quantity of production of CBW agents;
(2) Strict control of import and export of such agents; and
(3) Strict control of manufacture, import and export of equipment used to develop, produce and stockpile CBW agents.

Proposal Abstract N3(G70)

1. **Arms Control Problem:**
   Chemical and biological weapons - destruction of stocks
   - production

2. **Verification Type:**
   (a) National self-supervision
   (b) International exchange of information
   (c) Complaints procedure - referral to Security Council
   (d) International control organization

3. **Source:**
   Egypt. "Working paper containing suggestions on measures of verification of a ban on chemical and biological weapons". CCD/314, 1 September 1970.

4. **Summary:**
   A basic verification procedure should include the following:
   (1) Each state agrees that within a certain time from entry into force of the treaty, it will undertake all legal, administrative and practical measures condusive to ensuring compliance with the prohibitions and the elimination of stockpiles. Each party agrees to inform the Security Council or some impartial international body, on the steps it has taken in this regard, as well as on the completion of destruction of stockpiles.
   (2) Each state undertakes to forward relevant basic information to be agreed upon, to the impartial international body with a view to assisting the technical process of verification. The assistance of WHO, FAO and other international agencies might be appropriate at this stage.
   (3) In the case of a possible violation, a report would be made to the Security Council which would take the necessary action.

N4(A73)

Proposal Abstract N4(A73)

1. **Arms Control Problem:**
   Chemical weapons - destruction of stocks

2. **Verification Type:**
   (a) National self-supervision
   (b) International exchange of information - declarations

3. **Source:**
   Stockholm International Peace Research Institute. Chemical Disarmament: Some Problems of Verification. Stockholm: Almqvist and Wiksell, 1973, pp. 25-26.

4. **Summary:**

According to this proposal, an agreement calling for the destruction of CW stockpiles would be verified by means of a national control agency* conducting on-site inspection of the destruction process. It would witness and confirm both the completeness of the destruction of the stockpiles, as well as non-contamination of the environment by undesirable products. It is suggested further that following the destruction of the CW stockpiles a solemn declaration should be made by the parties concerned, officially confirming the observance of the stipulations of the convention.

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* See abstract G8(A73) for a description of the sort of control organ envisaged by the SIPRI study.

Proposal Abstract N5(G73)

1. **Arms Control Problem:**
   Chemical weapons - destruction of stocks
   - production

2. **Verification Type:**
   (a) National self-supervision
   (b) International exchange of information - declarations
   (c) On-site inspection - selective
   (d) Remote sensors
   (e) Complaints procedure - consultation and cooperation
   - referral to Security Council
   (f) International control organization
   (g) Review conference

3. **Source:**
   Argentina, Brazil, Burma, Egypt, Ethiopia, Mexico, Morocco, Nigeria, Sweden, and Yugoslavia. "Working paper on the prohibition of the development, production and stockpiling of chemical weapons and on their destruction". CCD/400, 26 April 1973.

4. **Summary:**
   The purpose of a verification system is to give every party a reasonable assurance of compliance with the prohibition. Such assurance can be provided through a combination of national and international measures which complement each other. At least the following elements should be included:
   (1) Self-control by states;
      (a) Declarations, upon entry into force of the treaty, regarding national activities related to the production and development of CWs especially concerning destruction of existing stockpiles;
      (b) Measures such as enactment of laws aimed at implementing the treaty;
      (c) Organization of a national system of control and a control body with authority to cooperate with the international organ; and
      (d) Provision for informing the international control organ of these measures of self-control.
   (2) National means of verification:
      These should be used in accordance with international law. Consultation and cooperation over complaints should be provided for, including procedures within the framework of the UN.

(3) International measures of certification:

These should be undertaken by a qualified and independent international control organ and results should be made available to all parties. The functions of this organ might include collection, analysis and distribution of relevant data and assistance to parties in creating a national self-control mechanism and in developing national verification methods. Parties should render all possible assistance to the international organ including relevant technology at the disposal of the parties. "Non-recurrent" international inspection to verify stockpile destruction might also be provided for.

This verification system should be subject to review and possible improvements, taking into account new scientific and technological developments. The system should be designed and implemented to avoid disclosure of scientific and commercial secrets.

The complaints procedure would involve reference to the Security Council. It is also implied that the international control organ should undertake a fact-finding investigation before the complaint is referred to the Security Council.

5. **Selected Comments of States:**

The US commented on this proposal in detail. The following summarizes its arguments in PV.609, 3 July 1973 and PV.613, 17 July 1973.

Concerning verification of stockpile destruction, there is a problem as to how to ascertain the extent of existing stockpiles. If declarations are relied upon, how is the accuracy of these declarations to be verified? The proposal suggests that "non-recurrent" inspection of the destruction process should take place. Does this mean that only a single short-lived inspection will occur? The problem with this is that the destruction process may take years. Furthermore, there may be need for inspections after the alleged destruction of stocks, should there be any evidence of a violation. The proposal also suggests that the inspection procedures be agreed upon after the treaty comes into force. This is unacceptable to the US. The procedures for verifying an agreement should be agreed upon in detail before the treaty comes into force.

Declarations in a number of forms could be useful for providing information. But they have their limitations, amongst which is the possibility of undeclared facilities, activities or stocks.

The US agrees on the need for national legislation and administrative regulations but questions whether a new national control body is needed. Might not existing bodies suffice? Concerning national control the main issue is whether it alone will provide sufficient reassurance to other parties. This depends on the confidence other parties have that the national control body is independent from the government it monitors and the degree to which it has unimpeded access to all relevant facilities.

National means of verification will undoubtedly be used by states to which they are available but these techniques (e.g. remote sensing, economic monitoring and off-site observation) all have limited utility with regard to a CW ban.

The formality and complexity of the international organ should depend on the scope of the verification activities it is assigned. The US prefers a Consultative Committee because of its flexibility. Both raw data and results of the international organ's analyses should be made available to parties. The requirement of assisting the international body to develop international verification techniques must be tempered because of national security concerns of the parties (e.g. the secrecy of satellite capabilities).

The US agrees with the idea that there must be international investigatory procedures to ascertain the facts before recourse to the Security Council.

N6(G73)

Proposal Abstract N6(G73)

1. **Arms Control Problem:**
   Chemical weapons - destruction of stocks
   - destruction of facilities
   - production

2. **Verification Type:**
   (a) National self-supervision
   (b) International exchange of information
   (c) Literature survey
   (d) Short-range sensors - seals
   - sampling

3. **Source:**
   Socialist States. "Working paper on ways of implementing control over compliance with the convention on the prohibition of the development, production and stockpiling of chemical weapons and on their destruction." CCD/403, 28 June 1973.

4. **Summary:**
   The paper is mainly concerned with elaborating upon Article 4 of the Socialist Draft CW Convention* dealing with national self-supervision. Four developments might be considered:
   (1) National Control Committee:
   This body should, by means of random verification, supervise the destruction of stocks, the closure or conversion to peaceful use of production facilities and the end of production of delivery systems. Composition of the body would be determined by the state party. It might include representatives of governmental and public organizations as well as experts. Modern chemical analysis, seals and on-site inspections would be used by the committee for verification. Reports of the committee would be submitted to the national government and could be published.
   (2) Exchange of information between parties:
   This would be done on a voluntary basis and would involve discussion of data on new chemical substances for peaceful use.
   (3) Statistical analysis:
   This would involve use of data from open publications on production, consumption, trade and storage of raw materials and semi-finished products. Production would be compared with

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* The verification provisions of this draft CW treaty are identical to those of the BW Convention. See Abstract 012(T72).

consumption taking into account other variables. An excess of production over consumption would give grounds for assuming diversion to military use. Where data is missing, estimates could be made.

(4) Limitations on patenting:
Patenting of chemical substances, weapons, equipment and means of delivery which are banned by the treaty should be prohibited and existing patents cancelled.

5. Selected Comments of States:

The US criticized this proposal on a number of grounds (PV.624, 23 August 1973). First, the Americans contended that alone self-supervision is insufficient to assure other parties that violations will be deterred. CW stockpiling, production, and so on are carried out at the behest of the government of a state, not of private organizations within that state. Consequently, confidence in the control committee would depend on its independence from the government it is intended to monitor and its unimpeded access to relevant information.

Second, the Socialist States' proposal suggests that each party itself would determine the nature of the national control bodies. The US disagrees and contends that some standardized procedures would be needed.

The proposal also suggests that the national control committees would report directly to their governments, not to an international body. Thus, even if the committee had the confidence of other parties, there is no assurance that the government through which the information had to pass would not modify the reports.

Finally, the US criticized the limited nature of the proposed information exchange. It is to be voluntary and to deal only with new information.

Proposal Abstract N7(G74)

1. **Arms Control Problem:**
   Chemical weapons - destruction of stocks
   - production
   - proliferation
   - stockpiling

2. **Verification Type:**
   (a) National self-supervision (Article 5)
   (b) International exchange of information (Articles 2 and 6)
   (c) Complaints procedure - consultation and cooperation (Article 7)
   - referral to new international body (Articles 5, 6 and 7)
   - referral to Security Council (Article 10)
   (d) On-site inspection - selective (Article 2(3) and 9)
   - non-obligatory
   - obligatory
   (e) International control organization
   (f) Review Conference (Article 17)

3. **Source:**
   Japan. "Draft convention on the prohibition of development, production and stockpiling CWs and on their destruction". CCD/420, 30 April 1974.
   See also: - CCD/413, 21 August 1973;
   - CCD/PV.623, 21 August 1973.
   - CCD/430, 12 July 1974.

4. **Summary:**

The proposed Convention is to be composed of two sets of documents. First, a general ban on CWs is provided for in the treaty itself. Details of the substances to be banned and the extent of the general ban are to be included in annexes to the treaty. The annex defining scope might be based on either exclusion or inclusion of substances.

With regard to the draft treaty itself each party is obligated under Article 5 to take "any necessary measures" to ensure compliance with the treaty and to notify the International Verification Agency (IVA) concerning which national organ(s) is responsible for these measures. Periodic reports on the functioning of these national measures must be made to the IVA. The functions of the national control organ would include:
(1) observation and supervision of national activities related to the subject of the treaty;

(2) collection of statistical and other information;
(3) preparation of the reports for the IVA; and
(4) cooperating with the IVA especially with regard to supplying information requested by the IVA and accepting inspection.

The IVA is created under Article 6(1). Its functions include:

(1) analyzing and evaluating reports from each party;
(2) requesting explanations and conducting inquiries under Article 8;
(3) conducting inspections under Article 9;
(4) sending notifications and reports under Article 10;
(5) consulting and cooperating with national organs;
(6) recommending amendments to the Annexes;
(7) sending observers under Article 2, to verify destruction of stocks; and
(8) carrying out decisions made by the conference of the parties.

The parties are to consult and cooperate with each other directly or through the IVA under Article 7. Complaints can be made directly to other parties or to the IVA which can then request further information and conduct an investigation (Article 8).

Inspection by invitation is provided for under Article 9(1). The IVA can also notify a suspected party of an impending inspection (Article 9(2)). A state party refusing such inspection must provide adequate reasons (Article 9(3)). The IVA also is required to send observers to verify the destruction of stocks and equipment under Article 2(3).

The IVA must notify parties of the results of its analyses and investigations. It may also, when necessary, report these to the Security Council (Article 10).

The verification scheme of the draft convention is further elaborated in CCD/430 which includes a descriptive chart of the proposed system. The reporting of statistical data constitutes the keystone of the draft convention according to this paper. Production activity is the most highly susceptible activity to verification because it contains a variety of elements. Reports submitted to the IVA by state parties would monitor movements from the unloading of raw materials or intermediates to the loading of end-products. They would be concerned with seven substances related to organophosphorous CWs.

The minimum content of monthly reports to the IVA would include:

(1) importers and amounts imported;
(2) producers, amounts produced, loaded in stock and production capabilities;
(3) wholesalers and amounts purchased and sold;
(4) users and amounts used; and
(5) exporters and amounts shipped.

It is also pointed out in CCD/430 that the IVA would be given the right of free access to the national organ to check its records and data. A list of production facilities would also be provided to the IVA.

Proposal Abstract N8(A79)

1. **Arms Control Problem:**
   (a) Chemical weapons - destruction of stocks
   - destruction of facilities
   (b) Regional arms control - Latin America

2. **Verification Type:**
   (a) National self-supervision
   (b) International control organization
   (c) International exchange of information - reports to international body

3. **Source:**
   Vachon, G.K. "Chemical Disarmament - A Regional Initiative?" Millenium (Journal of International Studies) 8, no.2 (Autumn 1979): 145-154.

4. **Summary:**

The author suggests that the nations of Latin America pursue an agreement to prohibit and control chemical weapons in that region. Such an initiative would follow on the success of the Treaty of Tlatelolco (see abstract D1(T67)) and would constitute valuable progress in the absence of superpower agreement on a chemical weapons convention.

The author notes that there was no organization capable of verifying compliance with the Treaty of Tlatelolco until more than a year after its entry into force. He suggests that "verification of the destruction of existing stockpiles, as well as the verification of the destruction, closure or conversion of factories producing chemical warfare agents, is not an issue [for nations in the region] (p.150). Rather, the countries of Latin America are more concerned with preventing the proliferation of chemical weapons. However, some sort of monitoring procedures might be desired by some countries so that national systems for chemical control might be instituted. Such systems appear feasible and costs may not be prohibitive. The author suggests that the superpowers might be willing to defray some of the costs of setting up control systems.

In return, the superpowers could examine the practical dimensions of such issues in their negotiations as on-site inspection versus extraterritorial monitoring, the possible disclosure of military and industrial secrets and the relationship between national verification agencies and a possible international agency with a monitoring role or a "verification by challenge" role. A Latin American initiative might also provide an incentive for the United Nations to set up an international disarmament agency to receive reports from the national agencies. This would remove the necessity of the countries' setting up a regional coordinating agency.

Proposal Abstract N9(A80)

1. **Arms Control Problem:**
   Chemical weapons - destruction of stocks
   - destruction of facilities
   - production

2. **Verification Type:**
   (a) National self-supervision
   (b) International exchange of information
   (c) International control organization
   (d) Records monitoring - economic
   (e) Short-range sensors - monitoring devices
   - seals

3. **Source:**
   Reutov, O.A. and K.K. Babievsky. "Some aspects of the problem of the destruction of chemical warfare agents". In Stockholm International Peace Research Institute, Chemical Weapons: Destruction and Conversion, pp. 117-121. London: Taylor and Francis 1980.

4. **Summary:**

It is generally felt that on-site inspection of the destruction of chemical weapons raises apprehensions concerning civilian destruction processes and military secrets. It is, therefore, important to establish the level of intrusion required for reasonable assurance of compliance. In the authors' opinion, the destruction should be verified by representatives of the respective national control agency, cooperating effectively with an international consultative commission. After the destruction of existing stockpiles, an official government declaration would be made.

Conversion of CW plants to civilian uses should be carried out under the on-site supervision of representatives of the national control system. It is reasonable in this case that devices be installed to monitor the products manufactured. These devices would be sealed and accessible only to the national control agency. For the control of dual-purpose agents mainly statistical methods should be used.

The authors believe that an international consultative commission could play a role in economic data reporting. It also seems possible that this commission would need to have a sample analysis laboratory for standardizing analytical and data-reporting methods.

N10(G85)

Proposal Abstract N10(G85)

1. **Arms Control Problem:**
   Chemical weapons - destruction of stocks
   - production

2. **Verification Type:**
   (a) National self-supervision
   (b) Remote sensors - satellite
   - sampling
   (c) On-site inspection - selective
   - challenge
   - obligatory
   - non-obligatory
   (d) Complaints procedure - consultative committee
   - referral to Security Council

3. **Source:**
   (Union of Soviet Socialist Republics). "A View from the USSR: IDR Meets Soviet Ambassador Victor Issraelyan". International Defense Review (November 1985): 1737-1738.

4. **Summary:**

In the view of the Soviet Union, four methods of verification would be necessary for a chemical weapons ban.

(1) National means of verification: A national body for checking the chemical industry's implementation of the treaty's provisions. This is especially important for states with a market economy and a private chemical industry.

(2) National technical means: Monitoring by means of satellites, or by sampling water and air, or by monitoring pollution. In the SALT agreements on-site inspection is not necessary because NTMs are adequate. NTMs, however, are not adequate for a CW ban.

(3) International on-site inspection, systematic or permanent: Destruction of CWs would be verified by international inspectors permanently present at the facility from the beginning to the end of the process. They would return when destruction resumed. The production of lethal super-toxic chemicals for non-weapons purposes would be systematically verified by teams of international inspectors present at the special facilities producing these chemicals.

(4) Challenge inspections: If a country is suspected of a violation, it could be challenged by another party to the treaty. The challenge would be based on solid facts and sources. The challenger would decide to go through the treaty's Consultative Committee or to deal directly with the suspected country. The

challenged country could invite him to conduct an on-site inspection. The crucial question is whether the challenged country can refuse an on-site inspection. In the USSR's view, it might refuse on the grounds of national security saying, for example, that the facility in question is producing weapons other than CWs. If still unsatisfied, the challenger could appeal to the Security Council.

The Soviet Ambassador saw no special role for neutral countries in carrying out on-site inspections. If two parties were involved in a conflict over observance of the treaty, a neutral country might offer its good offices. It would be up to the two sides to accept the offer or not.

Proposal Abstract N11(G72)

1. **Arms Control Problem:**
   Chemical weapons - production

2. **Verification Type:**
   (a) National self-supervision
   (b) International exchange of information
   (c) Complaints procedure - consultative commission
   - referral to Security Council
   (d) International control organization

3. **Source:**
   Sweden, CCD/PV.569, 18 July 1972.

4. **Summary:**

Referring to the Socialist States' draft CW treaty of March 28, 1972*, Sweden suggests a number of alterations. Concerning the provisions for verification, Sweden believes that Article 4, which deals with measures of national self-supervision, should include more specific references to the issuing of laws and regulations for control of civilian production and for the establishment of national committees to check compliance. A commitment should be included that all such laws, regulations and enforcement measures will be made known internationally through registration. The use of declarations which would embrace statements about activities, facilities and present stockpiles, might also be incorporated.

Article 5 dealing with consultation and cooperation must also be made more specific. It should include rules about international exchange of information, the sequence and form of inquiry, and other agreed methods of verification.

The aspect of Article 5 dealing with international procedures should define some international machinery that could serve as guarantor that objective verification procedures would be available at the international level before recourse to the Security Council. Similarly, Article 6 which deals with referral of complaints to the Security Council must allow for an objective and separate fact-finding mechanism.

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* See abstract O12(T72). The verification provisions of this draft are identical to those of the BW Convention.

Attached to the treaty would be an annex defining those substances subject to the ban. This would be important for purposes of verification, providing some agreed standards of national implementation.

Another feature of the treaty should be a provision for the creation of a panel of experts to advise on matters of verification. This body might be attached to the Secretariat of the UN or perhaps to some interim form of international disarmament organization.

N12(G72)

Proposal Abstract N12(G72)

1. **Arms Control Problem:**
   Chemical weapons - production

2. **Verification Type:**
   National self-supervision

3. **Source:**
   Sweden. "Working paper on domestic legislation in Sweden regarding chemical substances". CCD/384, 8 August 1972.

4. **Summary:**

Considerable efforts are already being made by experts and organizations in fields other than disarmament to control the vast quantities of chemical agents which are used in civilian life. Disarmament negotiations and agreements might take advantage of the national and international control structures being developed for environmental and health purposes. These structures take the form of submission of statistics, licensing, etc. This working paper reviews Swedish domestic legislation regarding chemical substances.

Proposal Abstract N13(G75)

1. **Arms Control Problem:**
   Chemical weapons - production

2. **Verification Type:**
   National self-supervision

3. **Source:**
   Japan. "Working paper concerning the scope of chemical agents that have justification for peaceful purposes and an example of a national verification system". CCD/466, 14 August 1975.

4. **Summary:**

The control system established under the Japanese domestic "Law Concerning the Screening of Chemical Substances and Regulation of their Manufacture, etc.", may offer an example of the functions of the national organ as suggested in CCD/420 and CCD/430 (See abstract N7(G74)), for ensuring compliance with the obligations of a CW convention. The law is intended to screen chemical substances which require control prior to their production or importation, and to place the necessary controls on the substances thus screened in order to prevent pollution.

The law provides for: (a) the examination of any chemical substances listed, at any time; and (b) the obligation to report intended production or import of any substance not on the aforementioned list, prior to its examination. These new substances are classified as "harmless" or "specified" substances. Specified substances are to be kept under observation.

Proposal Abstract N14(G82)

1. **Arms Control Problem:**
   Chemical weapons - production

2. **Verification Type:**
   (a) National self-supervision
   (b) Remote sensors
   (c) Complaints procedure - consultative committee
   - consultation and cooperation
   (d) International exchange of information
   (e) On-site inspection - selective
   - challenge

3. **Source:**
   German Democratic Republic. CD/PV.165, 23 February 1982.

4. **Summary:**

Three main elements of verification of compliance with a chemical weapons convention are briefly outlined. First, there should be national self-supervision to enforce the international obligations undertaken. The central planning of the chemical industry in the German Democratic Republic would facilitate this method of verification. National self-supervision would be at the discretion of each country. Second, remote sensing by national technical means could play a useful role in verifying compliance. Third, an international complaints procedure should be established which involves a consultative committee and cooperation "within" the United Nations and the Security Council. Requests for information and some form of verification by challenge could be used to establish facts. Parties could also exchange data in order to facilitate verification of compliance.

In the view of the representative of the GDR, "regular and permanent international on-site inspections can only very marginally add to the effectiveness of a verification system" and the value of such inspections is outweighed by serious political, economic, technical and financial problems.

Proposal Abstract N15(G82)

1. **Arms Control Problem:**
   Chemical weapons - production
   - stockpiling
   - destruction of stocks
   - destruction of facilities

2. **Verification Type:**
   (a) National self-supervision
   (b) Remote sensors
   (c) International exchange of information
   (d) International control organization
   (e) On-site inspection - selective
   (f) Complaints procedure - consultative committee
   - referral to Security Council

3. **Source:**
   Union of Soviet Socialist Republics. "Basic provisions of a convention on the prohibition of the development, production and stockpiling of chemical weapons and on their destruction". CD/294, 21 July 1982.
   See also: - USSR, CD/PV.178, 12 August 1982.
   - USSR, CD/PV.235, 18 August 1983.
   - Federal Republic of Germany and the Netherlands. "Preliminary questions concerning CD/294 submitted by the Soviet Union". CD/308, 10 August 1982.

4. **Summary:**
   The document is a draft of the basic provisions for a chemical weapons convention. The provisions relating to verification include a combination of national and international measures. A national verification organization may be established by each party to monitor the fulfillment of obligations by its own facilities. Parties would have the right to monitor the compliance of other parties by using national technical means. International verification measures would be administered within the framework of the United Nations through consultations and cooperation between parties and through the services of the Consultative Committee.

   The Consultative Committee would be established within 30 days after the convention enters into force. Any party would be entitled to have a representative on the Committee. Through the Consultative Committee, parties suspecting a violation of the convention may request information on the matter; if the fact-finding procedure is "exhausted", parties may request an on-site inspection by providing

relevant information and possible supporting evidence. The alleged violating party may refuse the request, but "it should give sufficiently convincing appropriate explanations". The possibility of conducting systematic international on-site inspections during the period of destruction or diversion for permitted purposes of the stocks of chemical weapons should be provided for in the convention. In CD/PV.235 the Soviet Union proposes that provision be made for the establishment of storehouses at the destruction facilities. International verification on a "quota" basis would be permitted at the storehouses during the entire destruction process. The Soviet Union also proposes a differentiated approach such that the frequency of international inspections would depend on criteria such as: the quantity of stocks to be destroyed, the toxicity and danger of stocks, the destructive capacity of facilities and the level of their automation. The convention should also provide for the possibility of carrying out international on-site inspections (perhaps with an agreed quota) of the permitted production of super-toxic lethal chemicals at a specialized facility.

Parties suspecting a breach of obligations by another party may lodge a complaint with the Security Council of the United Nations. Parties would cooperate with any Security Council investigations and would assist any party which makes a request for help if the Security Council deems that that party has been or is being exposed to danger as a result of another party's violation of obligations under the convention.

5. **Selected Comments of States:**

The US (CD/PV.178, 12 August 1982) criticized the document for not clearly explaining the position of the Soviet Union regarding on-site inspection.

The Federal Republic of Germany and the Netherlands (CD/308, 10 August 1982), submitted a list of preliminary questions to facilitate the clarification of CD/294 by the Soviet Union. Questions on verification procedures included:

(1) What specific procedures are referred to in the phrase "international measures of verification shall be carried out through international procedures within the framework of the United Nations?"

(2) How is it to be decided when convening the Consultative Committee is "necessary"?

In the context of the fact-finding procedure relating to compliance with the convention and on-site inspections:

(3) What information is the state which receives a request obligated to provide?

(4) What procedure applies after a challenged state refuses a request for an on-site inspection? Who will decide whether explanations are "appropriate and sufficiently convincing"?

(5) Is it necessary to have suspicion of a violation before submitting any request for an on-site visit in connection with a notification concerning the destruction and dismantling of a chemical weapons production facility?
(6) Would international on-site inspection be agreed to in advance in the convention? To what does the word "possibility" refer in this context?
(7) Would the international on-site inspections referred to in paragraphs 3 and 4 of CD/294 be conducted under the aegis of the Consultative Committee?
(8) What is meant by an "agreed quota"?
(9) As the destruction of production facilities is to be completed only 10 years after the state concerned becomes a party to the CW convention, how is non-production to be verified in the meantime in production facilities which have been mothballed or in which CW stockpiles are being destroyed?

When discussing the "Basic Provisions" (CD/PV.178, 12 August 1982), the representative of the USSR pointed out that neither permanent on-site inspection nor "black boxes" for collecting and processing information is a fool-proof method of verification. A state with dishonest intentions could just fail to declare part of its stocks and these stocks would not be subject to inspection or verification.

The Federal Republic of Germany (CD/PV.185, 7 September 1982) commented that although the Soviet proposals are inadequate in a number of areas, the acknowledgement of the necessity of systematic on-site inspections "shows progress".

Proposal Abstract N16(A83)

1. **Arms Control Problem:**
   Chemical weapons - production
   - stockpiling
   - destruction of stocks
   - destruction of facilities
   - use

2. **Verification Type:**
   (a) National self-supervision
   (b) On-site inspection - selective
   - non-obligatory
   - sampling

3. **Source:**
   Vojvodic, V. "Chemical weapons and disarmament: some facts and comments". In Chemical Weapons and Arms Control: Views from Europe, pp. 57-71. Rome: Centro di Studi Strategici, June 1983.

4. **Summary:**

In a section dealing with verification problems associated with the control of chemical weapons (pp. 67-69), this article notes that while there has been agreement in principle between the US and USSR on the use of on-site inspection as a verification technique, there has been no agreement on the techniques for applying the procedure. Some progress has been made, however. Specifically, the USSR agreed to systematic on-site inspection, according to definite rules, for the verification of the destruction of declared stocks of chemical weapons. (See "Basic provisions of a convention on the prohibition of the development, production and stockpiling of chemical weapons and on their destruction". CD/294, 21 July 1982, abstract N15(G82)). This provision still needs to be clarified further before it can be applied.

"Credible" verification of the existence or use of chemical weapons must depend on a combination of chemical, physical and biological methods implemented on the basis of "national means". In this case, the national means consist of forces and resources linked to one's own territory rather than monitoring foreign territory from satellites (national technical means). International verification should complement national verification. Acceptance of international on-site inspection would be voluntary, but states would endeavour to provide technical assistance in carrying out inspections and would cooperate by providing access to data. Inspections would involve sampling and analysis by using standardized chemical, physical or biological methods. Analyses could be performed in laboratories of the country in which the inspection is being carried out or samples could be sent to "reference" laboratories. Both types of analysis can

be used at the same time. Physical examinations can obtain blood and urine samples and near-site inspection can sample contaminated air and effluent water at a distance from the production plant.

Verification and sampling should be performed "on-time" in case of suspicion of use of chemical weapons. Depending on meteorological conditions, the time period should not exceed two to three weeks for persistent chemical warfare agents or two to three days for non-persistent agents.

Proposal Abstract N17(G84)

1. **Arms Control Problem:**
   Chemical weapons - production
   - destruction of stocks
   - destruction of facilities

2. **Verification Type:**
   (a) National self-supervision
   (b) International control organization
   (c) On-site inspection - selective

3. **Source:**
   Yugoslavia. "Working paper: national verification measures". CD/482, 26 March 1984.
   See also: - "Working paper: some aspects of verification in a chemical weapons convention". CD/298, 26 July 1982.
   - "Working paper: some technical aspects of the verification process in a chemical weapons convention". CD/393, 13 July 1983.

4. **Summary:**

In working paper CD/393, Yugoslavia proposes that the international Consultative Committee should play the principal role in initiating the verification process and in determining the means of verification.

International control and on-site inspection are particularly important for establishing the facts in cases of alleged breaches of a chemical weapons convention. In working paper CD/482, Yugoslavia clarifies its views on the relationship between proposed national verification authorities and the international authority. Because of the huge task facing the consultative committee and an international team of verification experts, "cooperation with the national authority becomes indispensable."

Yugoslavia proposes a verification regime which combines national and international verification measures for three types of chemicals.

(1) Verification of super-toxic lethal chemicals would be carried out by international inspectors in a manner determined by a convention.

(2) Depending on the quantity of stocks of lethal chemicals, verification of these chemicals would be by the international body in close cooperation with the national authority.

(3) The verification of less toxic chemicals could be carried out in almost all stages under the supervision of the national authority.

Yugoslavia proposes that each country be obliged to establish a national authority for verification which would cooperate with the Consultative Committee and submit reports to it. The national authority would be composed of the following:

(1) government representatives,
(2) scientific representatives with expertise in chemistry,
(3) military representatives,
(4) media representatives, and
(5) representatives of one of the parties to the convention designated by the Committee.

The national authority would control production of lethal and other harmful chemicals, and would conduct on-site inspections of production facilities.

Proposal Abstract N18(G85)

1. **Arms Control Problem:**
   Chemical weapons - production
   - destruction of stocks
   - destruction of facilities

2. **Verification Type:**
   (a) National self-supervision
   (b) International control organization

3. **Source:**
   German Democratic Republic. CD/PV.309, 18 April 1985.
   See also: - "Report of the Ad Hoc Committee on Chemical Weapons to the Conference on Disarmament". CD/539, 28 August 1984.

4. **Summary:**

The German Democratic Republic proposes elements of a national verification system in order to further the agreement in principle on an article found in CD/539, 28 August 1984 concerning national measures for implementation of a chemical weapons convention. A national verification organization would cooperate with the international Consultative Committee in verifying the destruction of chemical weapon stocks and production facilities (in the short-term) and the non-production of chemical weapons. A national implementation system would consist of the following elements:

(1) a legal element which allows governments to determine the area of verification,
(2) government-level organizational and functional elements (national organizations), and
(3) facility-level organizational and functional elements.

States would have to pass legislation and establish regulations to ensure compliance with obligations undertaken internationally. Items under control would include chemicals, facilities and international transfers. Chemical production and transfer by multinational corporations would be an item of particular concern.

Proposal Abstract N19(G85)

1. **Arms Control Problem:**
   Chemical weapons - production
   - stockpiling
   - destruction of stocks
   - destruction of facilities

2. **Verification Type:**
   (a) National self-supervision
   (b) International exchange of information - reports to international body
   (c) On-site inspection - selective
   - sampling
   (d) Records monitoring - plant
   (e) International control organization

3. **Source:**
   German Democratic Republic. "National verification measures to implement the convention on the prohibition of chemical weapons". CD/620, 23 July 1985.

4. **Summary:**
   The German Democratic Republic proposes guidelines for establishing a national verification authority and for controlling certain chemicals in connection with a chemical weapons convention. A national system for the implementation of a convention would consist of:
   (1) laws and regulations for supervision and control;
   (2) a national verification authority; and
   (3) organizational and functional elements at the facility level.

   A national verification authority could be specially established or existing institutions could be granted new powers. At the national level, the authority would be responsible for:
   (1) gathering information and monitoring compliance with the convention;
   (2) supervising the process of destruction or diversion for permitted purposes of stockpiles of chemical weapons and the elimination of production facilities for chemical weapons;
   (3) developing recommendations for implementing accounting and control procedures;
   (4) carrying out national inspections and installing technical means of verification in facilities; and
   (5) reporting to the Government on its activities and findings.

At the international level, the authority would be responsible for:

(1) maintaining contact with national authorities of other states and the Consultative Committee;

(2) informing the Consultative Committee about the structure and functions of the national authority and transmitting data to it as provided for in the Convention;

(3) cooperating with the Consultative Committee and other national authorities to solve organizational and technical questions related to the implementation of the convention, in particular, the training of national inspectors in standard verification techniques and the use of relevant equipment; and

(4) facilitating and supporting inspections conducted by the Consultative Committee or its subsidiary organ.

Each facility should facilitate inspections and the installation of verification equipment. Reports from facilities to the national authority should provide the following information: facility design; volume of chemical production and volume of chemicals imported or acquired from other national facilities; use of the chemicals; and export of chemicals or transfer to other facilities within the state. National inspections would examine inventories, make independent measurements, check seals and other containment/surveillance equipment and thus verify reports from the facilities. Inspectors should have the right to visit all relevant facilities and should have access to all facility records on production and use of the chemicals concerned.

Proposal Abstract N20(A73)

1. **Arms Control Problem:**
   Chemical weapons - research and development

2. **Verification Type:**
   (a) National self-supervision
   (b) International exchange of information
   (c) Literature survey

3. **Source:**
   Reutov, O.A., N.N. Melnikov and J. Moravic. "Paper prepared for discussion at the working group meeting on 16-18 December 1972". In: Stockholm International Peace Research Institute, Chemical Disarmament: Some Problems of Verification, especially pp. 43-44. Stockholm: Almqvist and Wiksell, 1973.

4. **Summary:**

To control the research and development stage of CW agent and weapons production, several measures are proposed. First, in order to discourage research specifically concerned with weapons development, it is suggested that national and international patent laws be changed to make CW agents and weapons unpatentable. Such a measure would accompany the termination of existing patents for such agents and weapons.

To supplement this, national control agencies should have access to all research on the toxicity of various chemical compounds, or on the testing of their suitability for military use.

Annually or once every two years, international conferences of experts should be convened:

> ...to consider new information on toxic substances... Representatives of the national control agency should become acquainted with the scientific research work both by studying the relevant published materials and by visiting laboratories and conducting discussions with the scientific staff. The list of such laboratories should be compiled by the national control agencies in every country where a system of national control exists (p.44).

The national control agency should also be empowered to verify experimentally some data if the data furnished by the scientific research laboratory raises doubts. The agency should have the right to publish information on substances with high toxicity. Exchange of information on chemical compounds between governments party to the convention would be useful as well.

Proposal Abstract N21(G75)

1. **Arms Control Problem:**
   Other weapons of mass destruction

2. **Verification Type:**
   (a) National self-supervision (Article 2)
   (b) Complaints procedure - consultation (Article 3(1))
   - referral to Security Council (Article 3(2))

3. **Source:**
   Union of Soviet Socialist Republics. "Draft agreement on the prohibition of the development and manufacture of new types of weapons of mass destruction and new systems of such weapons". Annexed to UNGA Resolution A/RES/3479 (XXX), 1975. It was submitted to the CCD as CCD/511, 3 August 1976.
   See also: - CCD/511/Rev. 1, 8 August 1977.

4. **Summary:**
   The national self-supervision provision is very similar to that of the ENMOD Convention (see abstract 019(T77)). The consultation provision is considerably narrower in scope, however, lacking reference to consultation through appropriate international procedures within the framework of the UN or to services of appropriate international organizations. There is also no provision made for a Consultative Committee of Experts, or a review conference.

Proposal Abstract N22(G74)

1. **Arms Control Problem:**
   Other weapons of mass destruction - environmental modification

2. **Verification Type:**
   (a) National self-supervision (Article 4)
   (b) Complaints procedure - referral to Security Council (Article 6)
   (c) Review conference (Article 9)

3. **Source:**
   Union of Soviet Socialist Republics. "Draft international convention on the prohibition of action to influence the environment and climate for military and other purposes incompatible with the maintenance of international security, human well-being and health". Annex to UNGA resolution A/RES/3264 (XXIX), 1974.

4. **Summary:**
   The control provisions of this draft treaty are very similar to those of the BW Convention (see abstract O12(T72)) and the Socialist draft CW treaty of 1972. Article 4 requires parties to adopt "the necessary measures" to prohibit activities within their territory that are banned by the treaty. Article 6 provides for complaints about violations to be brought before the Security Council. Each party is also obligated to assist the Security Council in its investigations. But, unlike the BW Convention, the provision for consultation and cooperation between the parties prior to recourse to the Security Council is absent.

5. **Selected Comments of States:**
   One of the reasons given by the US (CCD/PV.789, 11 May 1978) for rejecting the all encompassing approach to prohibiting new weapons of mass destruction (instead of individual agreements on specific new types of such weapons) was that if such a treaty were given the verification procedures necessary to make it more than an illusion, it could threaten to obstruct scientific development in areas where it would neither be necessary nor advisable.

CHAPTER O
COMPLAINTS PROCEDURES

Arms control proposals frequently include special provisions for airing and resolving complaints. In this context it is possible to distinguish two types of complaints: those which relate to the general administration of the treaty and those which concern suspected violations. In the case of the former, the review conference or some similar forum would probably be the most appropriate body to consider the matter. In the case of the latter, some special mechanism is often seen to be necessary. It is with this latter situation that this chapter is concerned. Proposals which discuss alleged violations of an agreement but do not specify a complaints procedure are to be found in Chapter A.

The treatment of complaints concerning alleged violations varies widely in a number of respects, making generalizations difficult. For example, proposals may differ as to the nature of mechanism they envisage, as well as the precise responsibilities assigned to the parties under the provision. Furthermore, the role assigned the complaints procedure itself within the verification system also differs from proposal to proposal. In some cases the complaints procedure is viewed as the means of initiating a verifying investigation, in others, as a means of resolving continued uncertainty after previous verification techniques have suggested a violation and, in still others, as a means for ensuring punishment of a proven violator.

It is perhaps most useful to view the complaints procedure as an integral part of the verification system, though not itself a verification "technique". Verification techniques provide the evidence for the generation of complaints as well as their resolution. The complaints procedure concerns itself with the mechanism for dealing with this evidence and the questions which it may raise. The difficulty with many technical methods of monitoring events is that they frequently produce ambiguous results. Furthermore, while one party may be prepared to accept a certain level of proof, others may require stronger evidence. Consequently, it is necessary to establish some agreed procedure for determining the "facts" or at least a forum where differing interpretations of the "facts" can be aired. Moreover, in order to resolve a question over an alleged violation it may prove necessary that additional verification techniques be employed to generate more evidence. To acquire such additional information, parties may have to agree on which methods to employ since these may not be already specified in the treaty.

Some proposals make a distinction between fact-finding (ie. objective gathering of data), and interpretation (ie. on the basis of the collected data). By separating these distinct verification activities, there is less likelihood of compromising the objectivity of fact-finding with the subjectivity of political decision-making. In the case of one multilateral agreement, the 1977 ENMOD Convention (abstract 019(T77)), the former task is given to a consultative committee of experts or a specialized agency of the UN, while the latter is in the hands of the Security Council.

Four basic types of complaints mechanisms can be distinguished. It should be noted that while these mechanisms may perform the function of

dealing with complaints, they may have other functions as well. Moreover, it should also be pointed out that a proposal for the establishment of a complaints procedure may involve the use of more than one of the mechanisms outlined below. Often such a proposal implicitly, and sometimes explicitly, includes the idea of a series of steps operating somewhat like an escalating response ladder.

1. Consultation and Cooperation

This procedure establishes the right of any party with a complaint to "consult" with any other party concerning the complaint and imposes on the other party the obligation to "cooperate" in resolving the problem.

2. Consultative Commissions

A consultative commission is a more formalized procedure for consultations between parties though it is still essentially similar to the consultation and cooperation formula, especially in regard to the voluntary nature of the obligation to cooperate. It involves the creation of a committee of the parties which meets regularly and/or on request. Depending on the proposal, the parties are represented by diplomats and/or experts. The Standing Consultative Commission (SCC) is an example of this type of complaints mechanism. It was created in 1972 as part of the SALT I Accords and the ABM Treaty (abstract J67(T72)). Recent events surrounding the use of the SCC concerning American complaints about Soviet violations of various bilateral agreements suggest some of the limitations of this method for handling complaints.

3. Existing International Organizations

Referral of the complaint to an existing international organization may involve recourse to a specialized organ such as the International Atomic Energy Agency, the World Health Organization, the United Nations Environment Program, or the International Court of Justice. It may also mean referral to a more general body such as the UN Secretary General, the UN Security Council or a regional organization like the Organization of American States. A distinction is sometimes made between use of a general body to receive complaints and a specialized body to conduct the actual investigation.

4. New International Organizations

Creation of new international organizations to deal with complaints has also been proposed. A distinction can be made between proposals envisaging a specialized body usually to deal with complaints involved in only one treaty, and "proposals concerning a general International Disarmament Organization whose jurisdiction would cover a number of treaties as well as a variety of functions.

Some form of complaints procedure is an important, indeed essential, part of any verification system. In certain cases states may consider a complaints procedure alone to be sufficient for providing assurance that violations will be deterred or, if not deterred, that innocent parties will have adequate warning to ensure their safety and a forum for airing their position before abrogating the treaty. Complaints procedures can serve such a role when the arms control measure is not considered to be of great military significance as, for example, the ENMOD Treaty. Where, however, the weapons systems and activities are more

militarily important, where the consequences of a violation are more serious to innocent parties, it is likely that a complaints procedure alone would prove inadequate. Perceptions about what constitutes a military significant weapon, moreover, can change with time. In this context it is worth recalling recent allegations about violations of the 1925 Geneva Protocol prohibiting the use of chemical and biological weapons and of the 1972 Biological Weapons Convention. The lack of effective verification procedures incorporated into these agreements greatly complicated the handling of these allegations and served, in most cases, to defeat attempts by the UN to ascertain the facts, contributing to the growth of suspicions.

The ultimate sanction in most forms of complaints procedure is abrogation of the agreement. Such a sanction is not a step to be taken lightly because of the political onus which would rest on the party responsible for the breakdown of the agreement.

Another difficulty is that a complaints procedure relies on other verification measures to be triggered. As a result, the utility of the complaints procedure's deterrent effect on violators is heavily dependent on the triggering technique's efficiency in detecting a violation. When their sensitivity is low (e.g. economic records monitoring) or where they leave gaps on the range of events detectable (e.g. seismic monitoring), the complaints procedure's effectiveness will be similarly affected. One can not complain of a violation about which one does not know.

Proposal Abstract 01(A77)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   (a) Complaints procedure - consultative commission
   (b) International exchange of information

3. **Source:**
   Agnew, H.M. "A Plan to Lessen Suspicions". Bulletin of the Atomic Scientists 33, no. 3 (March 1977): 6-7

4. **Summary:**

According to the author, the basic problem in American-Soviet relations stems from the closed nature of Soviet society. Until the West and the East develop a mechanism which allows each side to overcome the suspicions which arise from this secrecy the US and USSR will continue to live under unsettling conditions.

Agnew makes two proposals to improve the situation. First, the Soviets must be more forthcoming concerning information on their military capabilities. Second, he proposes that the superpowers "consider establishing a system to avoid misunderstanding in verifying future arms control agreements". A hypothetical example of such misunderstanding might be the detection by the US of a Russian "death ray" production center which in reality is a colour TV production plant. The evidence of the existence of a Soviet "death ray" centre could be used by American defence officials to support the development of an American "death ray". When the Americans begin developing such a weapon as a result of the perceived Soviet threat, the Soviet Union learns of this activity and starts its own "death ray" project.

In order to avert such problems, a procedure might be established which enables each side to bring to the attention of the other, certain facts which cause alarm. The suspected party would be requested to provide an explanation of the information supplied.

The system could be structured like the jury selection process in domestic law. In jury selection each party can reject a certain number of potential "jurors", but a fixed number of "jurors" must be chosen from a finite number of candidates. In an analogous fashion, every three or six months the US and USSR would bring twelve different facts for discussion at a closed meeting. Each fact would be presented in the form of photographs, items of hardware or intercepted messages.

It would be agreed that each nation could on a case by case basis, accept or reject a fact for discussion but that it would have to accept, for example, six of the twelve "facts" for discussion and explanation before the selection period was over. Acceptance or

rejection would be decided in the order in which the facts were presented. Neither side would be presented with the total package and then simply allowed to choose six. For each fact accepted for discussion, the accepting nation would be required to describe what the photograph, piece of hardware or message was all about.

Initially, the nation receiving the information could only listen. No challenge, rebuttal or further questioning would be allowed at the time of presentation. However, since the information received could then be evaluated, related decisions it is hoped, would then be based on less uncertain data than we base them on today. Obviously, there is likely to be dissembling in the replies. But the incentives for candor, and the risks of cheating should also be obvious.

This system is just one of many possibilities. Such a system of information exchange would be a major step toward lessened mistrust between the superpowers. Furthermore, in light of the disparities between the two societies, "in the absence of such an information exchange there is a danger that the results of agreements such as those which have been concluded in the recent past may be slanted in the Soviet favour. Over the long term, the aggregate of such seemingly small advantages could create an overall US-Soviet position which would indeed threaten US national security".

Proposal Abstract O2(A82)

1. Arms Control Problem:
   (a) Any arms control agreement
   (b) Nuclear weapons - ballistic missiles
   - anti-ballistic missiles
   - partial test ban
   (c) Chemical and biological weapons - use
   (d) Chemical weapons - destruction of facilities
   - destruction of stocks

2. Verification Type:
   (a) Complaints procedure - consultative commission
   (b) Remote sensors
   (c) On-site inspection - selective
   (d) International exchange of information

3. Source:
   Einhorn, Robert J. "Treaty Compliance". Foreign Policy no.45 (Winter 1981-82): 29-47.

4. Summary:

This article highlights the importance of verification to ensure compliance with arms control agreements. It begins by assessing the effectiveness of verification capabilities with regard to three arms control agreements. First, a number of issues were raised in the past about implementation of the SALT I Agreement (see abstract J67(T72)). These included: whether the Soviet construction of new silos for launch control purposes was consistent with the ban on building additional silos for ICBMs; whether the use of SA-5 anti-aircraft radar to track ballistic missiles was consistent with the ban on testing such radars in an ABM mode; and whether the replacement of the SS-11 ICBM with the much larger SS-19 was consistent with the ban on converting launchers for light ICBMs to launchers for heavy ones. Second, since 1976 the United States has been unable to verify with confidence whether several Soviet nuclear tests exceeded the 150-kiloton threshold permitted by the Threshold Test Ban Treaty of 1974 (see abstract K54(T74)). The Soviets have not provided information to aid measurements, arguing that they will do so once the United States ratifies the Treaty. Third, evidence has been discovered which suggests the production of biological warfare agents in the Soviet Union and the use of chemical warfare agents in Southeast Asia in violation of the 1972 Biological Weapons Convention (see abstract O12(T72)). If the standard for verification is that it must be capable of protecting US security, then the unverified behaviour mentioned above does not appear threatening, but Einhorn argues that:

> Judging the record solely from the security perspective ... does not appear sensible. Verification and compliance arrangements should not only protect US security; they should also instill confidence in the American public that its interests are being protected and that the agreements are functioning fairly and effectively (p.34).

Einhorn makes a number of recommendations to improve verification capabilities and to promote treaty compliance. Agreements should be formulated in order to minimize uncertainties in monitoring Soviet behaviour and ambiguities in determining whether observed Soviet behaviour is consistent with the agreement. Cooperative measures can enhance verification capabilities. These measures include: arrangements for collecting data such as seismic installations, and measures to facilitate data collection by national technical means, for example, prohibition of concealment and advance notification requirements. Future arms control agreements may require on-site inspection to verify the number of missiles or the destruction of chemical weapons stocks and the dismantling of production facilities. It will be difficult to persuade the Soviets to agree to such measures.

Potential ambiguities should be reduced or eliminated from arms control agreements. Disputes have arisen in the past over Soviet rejection of American unilateral interpretations of treaty provisions and over agreed-to but imprecise treaty obligations. However, problems are created when the elimination of ambiguity is either not feasible or disadvantageous.

Compliance diplomacy can be pursued more effectively in the following ways. Possible violations should be raised routinely, no matter what their military significance is. Productive channels such as the Standing Consultative Commission should be utilized. In response to unresolved issues, the US should "propose a practical solution that gives the United States assurances about future Soviet behaviour even if it does not eliminate uncertainties about - or pass legal judgment on - past Soviet actions" (p.42). The executive branch should share more information with Congress and the American public, but the official release of public reports could inhibit Soviet participation in compliance discussions so this should be handled cautiously.

Proposal Abstract 03(I80)

1. **Arms Control Problem:**
   Regional arms control

2. **Verification Type:**
   (a) Complaints procedure - consultation and cooperation
   (b) On-site inspection - control posts
   (c) Remote sensors

3. **Source:**
   United Nations. Secretary General. "Study on All the Aspects of Regional Disarmament: Report of the Secretary General". A/35/416, 8 October 1980.

4. **Summary:**
   Verification is important in a regional disarmament context. The form and modalities depend on the purposes, scope and nature of the disarmament measure in question as well as on regional peculiarities. Consideration of verification measures should include the establishment of regional consultation and verification mechanisms or agencies and the role that UN organs will play. Regional measures for verification can be combined with broader international mechanisms.

   Other possible verification means include the installation on a reciprocal basis of stationary and/or mobile observation posts, joint or reciprocal air or satellite observation of given areas, or mutual understandings not to impede the use of national technical means of observation.

Proposal Abstract 04(G79)

1. **Arms Control Problem:**
   Regional arms control - outer space

2. **Verification Type:**
   (a) Complaints procedure - referral to Security Council (Article 3)
   (b) National self-supervision (Article 2)

3. **Source:**
   Italy. "Italian proposal for an additional protocol to the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space Including the Moon and Other Celestial Bodies". CD/9, 26 March 1979.

4. **Summary:**

This draft protocol to the Outer Space Treaty (see abstract B24(T67)) bans all military activities from outer space and states that "outer space, including the moon and other celestial bodies shall be used for peaceful purposes only" (Article 1(1)). This specifically encompasses stationing weapons in space or launching them into earth orbit and prohibits the testing of any type of weapon (Article 1(1)). Article 1(2) permits the use of military personnel and equipment for scientific research or other peaceful purposes as well as for participation in any control system to ensure compliance with disarmament and security agreements.

In order to supplement the verification provisions of the Outer Space Treaty (on-site inspection and international exchange of information), the protocol establishes a complaints procedure. Under this procedure, states suspecting a violation of Treaty obligations would be able to lodge a complaint, supported by relevant information and possible evidence, with the Security Council (Article 3(1)). The Security Council could initiate an investigation of the complaint and would inform the parties of the results of the investigation. States would undertake to cooperate with the Security Council in carrying out any investigation (Article 3(2)). Parties would assist any other party which so requests if the Security Council deems that the party has been harmed or will likely be harmed as a result of a violation of the protocol (Article 3(3)).

Measures for national self-supervision are provided for in Article 2. Each party would undertake to "adopt any measures it considers necessary in accordance with its constitutional processes to prohibit and prevent any activity in violation of the provisions of the Protocol anywhere under its jurisdiction or control."

Proposal Abstract O5(A85)

1. **Arms Control Problem:**
   (a) Nuclear weapons - ballistic missiles
   - anti-ballistic missile systems
   - manned aircraft
   - cruise missiles
   - missile tests
   - mobile ballistic missiles
   - reentry vehicles
   - peaceful nuclear explosions
   - comprehensive test ban

   (b) Regional arms control - Europe
   - outer space - ASATs

   (c) Biological weapons - production

2. **Verification Type:**
   Complaints procedure - consultative commission

3. **Source:**
   Caldwell, Ian. "The Standing Consultative Commission: Past Performance and Future Possibilities". In Verification and Arms Control, pp. 217-229. Edited by William C. Potter. Lexington, Mass.: D.C. Heath and Company, 1985.

4. **Summary:**
   The main function of the Standing Consultative Commission (SCC) has been to consider questions relating to compliance with four agreements, the ABM Treaty and the Interim Agreement (see abstract J67(T72)), the Accidents Measures Agreement (1971) and the SALT II Treaty (see abstract J79(T79)). The SCC also performs other functions. It has provided a forum for discussions on means of reducing the danger of inadvertent or accidental nuclear war. The ABM Treaty and the Interim Agreement assigned the SCC the responsibility for overseeing the dismantling, replacement and destruction of offensive and defensive weapons affected by SALT I limitations. The SCC has also conducted reviews of the ABM Treaty (1977 and 1982). Article XVII of the SALT II Treaty called for the SCC to promote the Treatys' objectives and implementation. This accentuated the role and importance of the SCC.

   Under the Nixon, Ford and Carter administrations, the SCC functioned quietly and effectively in a non-polemical, businesslike way. A number of important issues were clarified and this prevented the erosion of the SALT agreements. However, the Reagan administration, approaching compliance with an absolute standard in mind, turned the SCC into a contentious debating forum which made no progress in resolving compliance issues.

The author suggests that there is a great need for the private, businesslike meetings between experts which can occur in the SCC. However, effective operation of the SCC will depend on improvements in relations between the United States and the Soviet Union. There are a number of possible tasks the SCC could undertake in the future. First, the SCC could consider an anti-satellite (ASAT) weapons ban. This would be possible because Article XII of the ABM Treaty states: "Each Party undertakes not to interfere with the national technical means of verification of the other Party." However, other arms control negotiations (Geneva, for example) might be a more appropriate forum in which to tackle this issue. Second, if the US and USSR come to an agreement on ASATs, the SCC would probably be enlisted to implement the agreement and deal with compliance questions. Third, the SCC or a similar organization could be involved in the implementation of other arms control treaties. The Threshold Test Ban Treaty (see abstract K54(T74)) provides for exchange of data and consultations between parties, but does not specify a mechanism to perform such functions. The Peaceful Nuclear Explosions Treaty (see abstract C52(T76)) provides for a Joint Consultative Commission (JCC) to promote the objectives and implementation of the Treaty (Article V). Experience with a JCC would be valuable for verifying compliance with a comprehensive test ban in the future. An agreement limiting intermediate nuclear forces in Europe would also require an SCC-like organization to consider implementation and compliance issues. Multilateral agreements like the Biological Weapons Conventions (see abstract O12(T72)) could benefit from an SCC-type arrangement, too. Fourth, an SCC-like organization could play a role in crisis prevention and crisis management by providing an extra channel for communication during crisis periods as an alternative to more formal diplomatic channels.

Proposal Abstract 06(A85)

1. **Arms Control Problem:**
   Nuclear weapons - ballistic missiles
   - anti-ballistic missile systems

2. **Verification Type:**
   Complaints procedure - consultative commission

3. **Source:**
   Graybeal, Sidney and Michael Krepon. "Making Better Use of the Standing Consultative Commission". International Security 10, no.2 (Fall 1985): 183-199.

4. **Summary:**

The Standing Consultative Commission (SCC) was created by the SALT I Agreement (see abstract J67(T72)) as a mechanism for compliance diplomacy. This article describes the functioning of the SCC and suggests measures to improve its operations.

In many instances, the SCC has worked effectively. It has been involved in establishing procedures for the destruction or dismantlement of certain stategic forces. The SCC also produced an Agreed Statement in 1978 which clarified treaty obligations regarding the use of radars in an ABM mode as well as for range safety and instrumentation purposes. The SCC further clarified these obligations in June 1985. The Agreed Statement was prepared in response to a Soviet practice which may have involved testing of a Soviet air-defence system radar in an ABM mode thereby violating the ABM Treaty. The SCC has thus contributed to verification of arms control agreements. It has, however, been unable to resolve some issues, such as the construction of the Krasnoyarsk radar by the Soviet Union. Some improvements of the SCC are, therefore, desirable.

The authors make the following recommendations:

(1) raise compliance questions first in the SCC, not at higher levels;
(2) avoid using the SCC as a dumping ground for problems which cannot be resolved through negotiations;
(3) use the American SCC delegation's expertise to help avoid treaty language which can create compliance problems;
(4) make sure the facts are accurate before raising issues in the SCC, and don't present problems as violations until the SCC channel has been thoroughly utilized;
(5) rank compliance questions within the SCC as to their degree of importance;
(6) link American and Soviet compliance concerns when they relate to the same objective or purpose of an agreement; and
(7) release more information about the SCC's activities and products.

Proposal Abstract 07(A85)

1. **Arms Control Problem:**
   Nuclear weapons - ballistic missiles
   - anti-ballistic missile systems

2. **Verification Type:**
   Complaints procedure - consultative commission

3. **Source:**
   Smith, R. Jeffrey. "Arms Agreement Breathes New Life Into SCC". Science 229 (9 August 1985): 535-536.

4. **Summary:**
   The author reviews arguments made by both supporters and critics of the Standing Consultative Commission (SCC) created by the SALT I Agreement (see abstract J67(T72)). Supporters, including former SCC officials, argue that the SCC has not been effectively utilized by the Reagan Administration and could benefit from improvements such as investing more authority in the US delegation and showing more commitment to the proceedings. Critics charge that the record of the SCC is poor because it has failed to produce results and does not have the necessary authority over national policymakers to produce compliance. The author notes, however, that the SCC has produced two new agreements (signed June 1985) which give new credibility to the SCC. The first closes a loophole in the ABM Treaty which permitted the Soviets to operate certain air defense radars during missile tests. From now on, the radars may not be operated during missile tests unless potentially hostile aircraft are in the area, and even then the operation of the radars must be fully explained. The second agreement provides for joint preparation of messages on acts by nuclear terrorists that would be transmitted over the Hot Line to avoid US-Soviet misunderstandings.

Proposal Abstract 08(G71)

1. **Arms Control Problem:**
   Chemical and biological weapons - destruction of stocks
   - production

2. **Verification Type:**
   (a) Complaints procedure - consultation and cooperation
   - referral to Security Council
   (b) On-site inspection - selective
   (c) National self-supervision
   (d) International exchange of information
   (e) International control organization

3. **Source:**
   Sweden. "Working paper on a model for a comprehensive agreement concerning the prohibition of chemical and biological means of warfare". CCD/322, 16 March 1971.
   See also: - CCD/PV.499, 9 March 1971.
   - CCD/324, 30 March 1971.

4. **Summary:**

Sweden proposes to classify the objects of the prohibition into three groups:
(1) those agents with exclusively military use and which are super-toxic;
(2) all remaining agents which have some legitimate industrial or medical application; and
(3) ancillary equipment or vectors specifically designed for CB warfare.

Group "1" could be banned completely. Groups "2" and "3" could be banned conditionally.

The verification procedures would concentrate mainly on the agents. Suspicions of violations of the overall ban or corollary prohibitions would be handled within the framework of a detailed complaints procedure. The complaints procedure must take the form of a system of successive steps, including consultations between the parties and other fact-finding measures (e.g. "verification by challenge"). The final step would be referral to the Security Council.

Destruction and disposal of existing stocks of CBWs should be verified through an international procedure. The method of destruction must be easily observable and verifiable.

Verification of the prohibitions on the agents would be a combination of national and international measures. The most rigorous methods would deal with group "1" agents. Any deviation from the complete ban on production of these substances would have to be reported to an international agency, giving reasons for the

production. In the case of any large scale production (i.e. greater than one kilogram) or in the case of suspected undeclared production, the international agency might be entitled to carry out on-site inspection either at the invitation of the suspected party or on an obligatory basis.

Verification of group "2" and group "3" objects would be carried out by national means only, perhaps complemented in some cases be statistical reporting by the parties to an international agency. National self-control might include international harmonization of basic national regulatory mechanisms as has happened in the narcotic drug field.

Proposal Abstract 09(A85)

1. Arms Control Problem:
   Chemical and biological weapons - use - "yellow rain"

2. Verification Type:
   (a) Complaints procedure - referral to Security Council
   - referral to International Court of Justice
   (b) On-site inspection - selective
   - sampling

3. Source:
   Cassell, Paul. "Establishing Violations of International Law: 'Yellow Rain' and the Treaties Regulating Chemical and Biological Warfare". Stanford Law Review 35, (January 1985): 259-295.

4. Summary:

This article considers the current legal status of chemical and biological weapons and the investigative procedures used to monitor compliance with relevant arms control provisions. Unlike the case for other weapons treaties the Geneva Protocol is one of the "few effective arms control regimes in existence today". Problems have arisen however, where alleged breaches have occurred, and the United Nations is currently searching for an effective means of investigating complaints and enforcing treaty provisions. The existing methods are reviewed in this paper, and a proposal for an investigative procedure is put forth.

Currently, the decision as to whether a breach has occurred and how to deal with it ultimately rests with other nations. Neither existing Treaty (the Geneva Protocol and the 1972 Biological Weapons Convention) provide for sanctions in the case of non-compliance; only the latter provides for the referral of complaints to the UN Security Council. The only real sanction that exists is the impact of "negative reactions from the international community" and this impact is not always sufficient to prevent or halt breaches. Without such sanctions, however, the production of chemical and biological weapons may escalate as the US attempts to catch up with the Soviet Union, so that "a new chemical arms race may be imminent".

The existing procedures for the investigation of breaches are deemed to be ineffective, first, because they must often be conducted between adversaries. One party to a treaty is often forced to verify another's breaches simply because there is no impartial group to conduct an investigation. The results of their inquiries are often treated with skepticism, since there are political interests at stake which, it may be argued, undermine objectivity and the validity of scientific evidence. The consultative mechanism established under the Biological Weapons Convention is also of limited utility because it

requires that over 100 parties meet and arrive at some agreement. Furthermore, no provision is made to conduct scientific research, and any studies conducted by member nations will be "perceived as adversary in nature".

The UN verification procedure is rendered ineffective by lack of access to sites, long delays in the initiation of an investigation, and the lack of facilities for analyzing samples and monitoring their collection. It is also asserted that UN investigations have not been conducted in a vigorous manner, and that the General Assembly has been "predisposed to certain conclusions". While the Security Council may enjoy one advantage as an investigative mechanism that has the authority to demand on-site inspection, even this power may be undermined by the veto of one country.

According to the author, all four verification methods are seriously flawed, and an alternate method of investigating alleged breaches is proposed which would establish a permanent organization to investigate allegations. This would permit rapid and efficient fact-finding, and could provide more objective analysis. Funding should be provided on an annual basis and the organization would conduct other peaceful investigations in order to allow operation on a year-round basis. This organization must have the power to demand on-site inspection. While it is acknowledged that this may prove to be a significant obstacle, the growing acceptance of on-site inspection by both the Soviet Union and the US is noted.

In conclusion, it is stated that the success of the procedure rests on the ability to verify the facts for the world community and to show that these facts do constitute a violation of the treaty. It is suggested that when disputes occur, they be submitted to the International Court of Justice for arbitration. This would serve to clarify and resolve treaty interpretation, and would also act as an incentive to agreement.

Proposal Abstract 010(G68)

1. **Arms Control Problem:**
   Biological weapons

2. **Verification Type:**
   Complaints procedure - referral to new international body
   - referral to Security Council

3. **Source:**
   United Kingdom. "Working paper on microbiological warfare". ENDC/231, 6 August 1968.
   See also: - ENDC/PV.387, 6 August 1968.
   - ENDC/PV.404, 17 April 1969.

4. **Summary:**

The verification of a biological weapons convention cannot be accomplished by methods such as the safeguard provisions in the Non-Proliferation Treaty. This is so because the organisms used as BWs have medical and veterinary uses and could be produced quickly, cheaply and without special facilities, in either established or makeshift facilities.

The most effective control provision for a BW treaty is a complaints procedure. ENDC/231 suggests that a competent body of experts, under UN auspices, be created to investigate allegations by any party to the convention which appeared to establish a prima facie case of a violation by another party. The parties would also be obliged to cooperate in any investigation.

In PV.404, the complaints procedure is elaborated. The investigation must be prompt and it would need to have two distinct elements. First, machinery for receiving complaints and initiating an investigation would be required. Second, there would have to be machinery for carrying out the actual work of the investigation. These two functions need not be combined in the same body. Because of the need for speed in investigating complaints, the procedures would have to be automatic. All discovered facts would be sent to the Security Council which would decide on follow-up action.

Proposal Abstract O11(G69)

1. **Arms Control Problem:**
   Biological weapons - destruction of stocks
   - production
   - proliferation
   - research and development
   - stockpiling
   - use

2. **Verification Type:**
   Complaints procedure - referral to Secretary General
   - referral to Security Council

3. **Source:**
   United Kingdom. "Draft convention for the prohibition of biological methods of warfare and accompanying draft Security Council resolution". ENDC/255, 10 July 1969.
   See also: - ENDC/255/Rev. 1, 25 August 1969.

4. **Summary:**

Two complaints procedures were suggested:

(1) Article 3(1) provided for complaints about BW use to be sent to the Secretary General who would investigate immediately and report his findings to the Security Council.

(2) Other complaints, for example, concerning production, possession or use against another party would be addressed to the Security Council itself which could then authorize an investigation by the Secretary General.

This distinction between investigation of use and investigation of production, etc., was justified on the grounds that in the case of use, the complainant would provide the facilities for carrying out the inquiry. Thus quick and automatic investigation would be possible. In the case of production, etc., it would be the accused party who would provide the facilities for investigation and the greater political weight of the Security Council would, therefore, have to be used. In this case the investigating body's function would be the establish the types and quantities of BWs that were in production and report the justification for that production by the state concerned. It would then be up to the Security Council and the individual parties to decide whether the justification was adequate or not and to act accordingly. In other words, there would still be a distinction between the fact-finding stage of the complaints procedure and the political decision stage even when the matter was brought directly to the Security Council.

The draft convention was intended to supplement the Geneva Protocol of 1925. It was to prohibit use of BWs even in self-defence,

by prohibiting research, production, possession and acquisition of BWs for hostile purposes though it did not seek to exclude purely defensive research or the creation of a passive defensive capability.

The British proposal also suggested a draft Security Council resolution which was to be complementary to the draft convention, authorizing the Security Council to establish the complaints machinery and providing as much assurance as possible that complaints would be investigated and the appropriate action taken.

Proposal Abstract 012(T72)

1. **Arms Control Problem:**
   Biological weapons - destruction of stocks
   - production
   - proliferation
   - stockpiling

2. **Verification Type:**
   (a) Complaints procedure - consultation and cooperation (Article 5)
   - referral to Security Council (Article 6)
   (b) National self-supervision (Article 4)
   (c) Review conference (Article 12)

3. **Source:**
   Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. (The Biological Weapons Convention).
   Concluded: 10 April 1972.
   Entered into force: 26 March 1975.
   Number of parties as of 31 December 1986: 105
   See also: - Socialist States. "Draft chemical weapons convention". CCD/361, 28 March 1972. (The verification provisions of this draft are identical to those of the BW Convention).

4. **Summary:**

Article 4 requires parties to undertake "any necessary measures" to implement the Treaty within their territory, in accordance with their constitutional procedures.

The parties also undertake to consult and cooperate to resolve any problems arising with regard to the objectives or the implementation of the Treaty (Article 5). This may occur "through appropriate international procedures within the framework of the United Nations".

Complaints regarding breach of the Treaty may be lodged with the Security Council (Article 6(1)). Evidence in support of the complaint should be included. Parties are also obligated to assist the Security Council in any investigation it may conduct (Article 6(2)).

Text of Main Verification Related Provisions:

Article IV

Each State Party to this Convention shall, in accordance with its constitutional processes, take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition, or retention of the agents, toxins, weapons, equipment and means of delivery specified in article I of the Convention, within the territory of such State, under its jurisdiction or under its control anywhere.

Article V

The States Parties to this Convention undertake to consult one another and to cooperate in solving any problems which may arise in relation to the objective of, or in the application of the provisions of, the Convention. Consultation and cooperation pursuant to this article may also be undertaken through appropriate international procedures within the framework of the United Nations and in accordance with its Charter.

Article VI

(1) Any State Party to this Convention which finds that any other State Party is acting in breach of obligations deriving from the provisions of the Convention may lodge a complaint with the Security Council of the United Nations. Such a complaint should include all possible evidence confirming its validity, as well as a request for its consideration by the Security Council.

(2) Each State Party to this Convention undertakes to cooperate in carrying out any investigation which the Security Council may initiate, in accordance with the provisions of the Charter of the United Nations, on the basis of the complaint received by the Council. The Security Council shall inform the States Parties to the Convention of the results of the investigation.

5. **Selected Comments of States:**

Sweden (CD/PV.29, 24 April 1979 and PV.91, 10 July 1980) deplored the lack of any provision in the BW Convention of any practical mechanism of dealing with complaints such as a consultative committee. The UK shared a similar view (CD/PV.97, 5 August 1980).

Proposal Abstract 013(I80)

1. **Arms Control Problem:**
   Biological weapons - destruction of stocks
   - production
   - proliferation
   - stockpiling

2. **Verification Type:**
   (a) Complaints procedure - consultation and cooperation
   - consultative commission
   - referral to Security Council
   (b) National self-supervision
   (c) Review conference

3. **Source:**
   Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and Their Destruction. Final Document. Geneva: 1980. BWC/CONF.1/10.
   See also: Abstract 013.1(I86)

4. **Summary:**
   Article 4:

   Regarding Article 4 which requires parties to undertake the necessary measures to implement the agreement, the review conference called upon parties which have not yet taken such measures to do so immediately. It also invited states which have enacted such measures to make available copies to the UN Centre for Disarmament for the purpose of consultation.

   Article 5:

   The Conference considered the provisions in Article 5 concerning consultation and cooperation to include the use of various international procedures which would make it possible to ensure effective and adequate implementation of the convention. Such procedures include the right of any party to request that a consultative meeting of experts be convened. Noting the concerns and differing views regarding the adequacy of Article 5, the Conference felt it should be considered again at an appropriate time.

   Article 6:

   The Conference noted the importance of referral of complaints to the Security Council as provided in Article 6 and that no party had yet invoked this provision.

Proposal Abstract 013.1(I86)

1. **Arms Control Problem:**
   Biological weapons - destruction of stocks
   - production
   - proliferation
   - stockpiling

2. **Verification Type:**
   (a) Complaints procedure - consultation and cooperation
   - consultative commission
   - referral to Security Council
   (b) National self-supervision
   (c) International exchange of information
   (d) Review conference

3. **Source:**
   Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and Their Destruction. Final Declaration. Geneva: 1986.
   See also: Abstract 013(I80)

4. **Summary:**
   Article 4:

   Regarding Article 4 which requires parties to undertake the necessary measures to implement the agreement, the Review Conference called upon parties which have not yet taken such measures to do so immediately. The conference noted that parties, as requested by the First Review Conference, have provided the United Nations with information on and the texts of specific legislation or regulatory measures taken by them relevant to this article. It invited parties to continue this practice.

   Article 5:

   The Conference reaffirmed the obligation assumed by parties to consult and cooperate with one another in solving any problems which might arise in relation to the objective of the Convention. Taking into account views expressed concerning the need to strengthen the implementation of Article 5, the Conference agreed that a consultative meeting would be convened promply when requested by any party. The consultative meeting could consider any problems that might arise and suggest ways and means for further clarifying any matter considered ambiguous or unresolved. The consultative meeting or any party could request specialized assistance in solving any of the problems which might arise.

   The Conference further agreed that parties are to implement, on the basis of mutual cooperation, the following measures:

   (1) Exchange of data on research centres and laboratories established for handling, for permitted purposes, biological materials that pose a high individual and community risk.

(2) Exchange of information on all outbreaks of infectious disease and similar occurances caused by toxins that seem to deviate from the normal pattern of occurance.
(3) Encouragement of publication of results of biological research directly related to the Convention.

The Conference also decided to hold in early 1987 an ad hoc meeting of technical experts to finalize modalities for the exchange of information by developing standarized forms and procedures.

Article 6:

The Conference noted the importance of referral of complaints to the Security Council as provided in Article 6. It decided that the Security Council could request the advice of the World Health Organization in carrying out any investigation of complaints.

Proposal Abstract 014(G79)

1. **Arms Control Problem:**
   Chemical weapons - destruction of facilities
   - destruction of stocks
   - production
   - stockpiling

2. **Verification Type:**
   (a) Complaints procedure - consultative commission
   - consultation and cooperation
   - referral to Security and Council
   (b) International exchange of information - declarations
   (c) On-site inspection - selective
   - non-obligatory
   (d) National self-supervision
   (e) International control organization
   (f) Review conference

3. **Source:**
   Poland. "Outline of a convention on the prohibition of the development, production and stockpiling of chemical weapons and on their destruction: Working paper". CD/44, 26 July 1979.

4. **Summary:**
   The outline suggests consideration be given to including provisions for declarations by parties to the CW convention. The declarations would deal with stocks of CWs, production facilities (after entry into force of the convention) and with plans for destruction or conversion of these stocks and facilities. Information could also be exchanged about the process of destruction.

   "Control" would take the form of a combination of national and international procedures. The possibility of establishing national control organizations and their functions should also be considered as well as an undertaking not to interfere with the use of national means of control.

   Another area of consideration should be consultation and cooperation in solving problems arising from application of the convention. This might include use of appropriate international procedures within the framework of the UN and other international organizations. The possibility of lodging complaints with the Security Council and cooperation in carrying out investigations is another suggested provisions. Regarding a Consultative Commission, the functions and procedures of the body should be considered as well as a Preparatory Committee.

   Another suggested provision concerns requests to other parties, in connection with suspected violation of the convention, for information or permission for on-site clarification of factual circumstances.

Finally, provisions for an amendment procedure including an annual review conference should be dealt with.

5. **Selected Comments of States:**

Czechoslovakia (CD/PV.44, 24 July 1979) agreed that the treaty should provide for the obligation to announce a time-table for the destruction of production facilities and of time-limits for supplying information on carrying out the destruction. It would also be useful to provide for the obligation to declare - after the treaty has been signed - stocked CWs, the time-table for their destruction and the time-limits for supplying information.

National control organs should concentrate on verifying the destruction of stocks, the observance of the production ban and complaints concerning violation of the treaty. International procedures should be applied mainly in the case of complaints of violations. The treaty should also provide for the establishment of an international consultative body of experts, which would collect data for the carrying out of national controls and organize an exchange of experience. A review of the implementation of the treaty at regular intervals is recommended, especially in the first period following the conclusion of the treaty when technical problems are expected to arise in connection to destruction of stocks and production plants.

Proposal Abstract 015(G80)

1. **Arms Control Problem:**
   Chemical weapons - destruction of facilities
   - destruction of stocks
   - production
   - stockpiling

2. **Verification Type:**
   (a) Complaints procedure - consultation and cooperation
   - consultative commission
   - referral to Security Council
   (b) International exchange of information - declarations
   (c) Remote sensors
   (d) National self-supervision
   (e) International control organization
   (f) On-site inspection - selective

3. **Source:**
   United States/Union of Soviet Socialist Republics. "Joint US-USSR report on progress in the bilateral negotiations on the prohibition of chemical weapons". CD/112, 7 July 1980.
   See also: - "Joint USSR-United States report on progress in the bilateral negotiations on the prohibition of chemical weapons" CD/48, 7 August 1979.
   - USSR. CCD/PV.788, 9 May 1978.

4. **Summary:**
   Both the US and USSR agreed at an early stage of their negotiations (see CCD/PV.788) that in addition to a general purpose criterion for determining the scope of the treaty's prohibitions, a set of toxicity criteria would be employed. These toxicity criteria, in CD/112, were used to define "super-toxic lethal chemicals", other "toxic lethal chemicals", and "other harmful chemicals". Different levels of prohibition and different methods of verification would be applied on the basis of these toxicity criteria and certain other provisions.

   Both states have also agreed on the need for exchanges of information. First, they have agreed that parties to the convention should make declarations, within thirty days of becoming parties, concerning their stockpiles of CWs and their means of producing these agents. Also, plans for destruction or diversion to permitted uses of declared stocks should be announced which should include information on volumes and timing. Plans for the destruction of relevant production facilities should be declared within a year prior to the commencement of the destruction.

In addition to declarations, the parties to the convention should exchange statements and notifications regarding progress in destroying or diverting (to permitted uses) stocks and means of production as well as concerning completion of the process.

The US and USSR have also agreed that verification should involve both international and national methods. Regarding the former, the two superpowers propose the creation of a Consultative Committee which could be convened by the depository of the convention on the request of any party. The Committee would have a secretariat which would carry out activities of the Committee between its meetings.

To ensure that this Committee can begin work immediately after the convention enters into force, the superpowers have agreed on the necessity for a preparatory committee upon signature of the convention.

The Committee would provide a forum where information could be exchanged between parties (eg. regarding super-toxic lethal chemicals, lethal chemicals and precursors which are produced, acquired and used for permitted purposes). The Committee might also serve as a forum where parties could request information of another party concerning possible violations of the convention.

Consultation and cooperation to resolve complaints concerning compliance with the treaty can take place bilaterally as well as in the Consultative Committee. A request for information can include a request for an on-site investigation though reasons must be given. A party receiving such a request may accept the on-site investigation or refuse, giving appropriate explanations. The US and USSR have not yet agreed (see CD/112) whether on-site investigation together with other verification measures will constitute a verification system capable of providing adequate assurances or whether something more is needed. They have agreed that it is necessary to develop procedures for on-site visits regarding the rights and functions of inspectors and of the host state.

In addition to consultation and cooperation to resolve complaints, a party may also raise a suspected violation of the convention in the UN Security Council. Finally, the Consultative Commission upon the request of a party or of the Security Council may take steps to clarify the state of affairs.

Concerning national methods of verification the superpowers have agreed that national technical means of verification would be employed in a manner consistent with accepted principles of international law. Parties should not try to impede NTMs nor use deliberate concealment.

Regarding other national methods, each party must undertake to adopt appropriate internal measures, in accordance with its constitutional law and procedures, to prohibit and prevent any activity contrary to the convention.

5. **Selected Comments of States:**

Speaking on behalf of the USSR, the Soviet representative (CCD/PV.789, 11 May 1978) stated that the bilateral discussions of verification questions with the US had convinced the Soviet side that a solution can be found on issues still outstanding which, while

ensuring the reliable fulfilment of all the obligations assumed by parties to the convention would not infringe the sovereign rights of those states and would not lead to the disclosure of state or industrial secrets.

Japan (CCD/PV.801, 17 August 1978) stated that since the threshold to be applied to chemical agents to be banned and verification procedures for dual-purpose agents involve technical, specialized and complicated problems, every country is concerned over the strong possibility that such verification procedures may intrude upon its non-military chemical industry. It is therefore necessary for each country to closely examine any treaty's provisions in relation to its national laws. Hence even after the US and USSR present their joint treaty to the CCD sufficient time will be needed to examine it.

In CD/PV.47 (2 August 1979) in response to the US/USSR working paper (CD/480), Japan raised the question of whether data exchanged bilaterally by parties would be made available to all other parties to the convention. During the 1980 session (CD/PV.94, 24 July) Japan stated that the proposed convention should provide for systematic on-site inspections to verify at least the destruction of stocks and the destruction or dismantling of production facilities.

Several other states also referred to the need for on-site inspection. See: Australia (CD/PV.3, 25 January 1979), Italy (CD/PV.29, 24 April 1979), the FRG (CD/PV.29, 24 April 1979, and elsewhere), Egypt (CD/PV.31, 26 April 1979), France (CD/PV.43, 19 July 1979), Denmark (CD/PV.44, 24 July 1979), Pakistan (CD/PV.82, 19 April 1980) and Spain (PV.88, 1 July 1980).

Hungary (CD/PV.9, 8 February 1979), on the other hand, referred to the increasing demands for excessive on-site inspection or the establishment of international machinery for verification which might easily start a life independent from the actual disarmament agreements. Such pressure for absolute verification only serves to block negotiations. Bulgaria (CD/PV.93, 17 July 1980) expressed a similar position claiming that emphasis on on-site inspection serves as a smokescreen to hide a lack of political will.

France (CD/PV.47, 2 August 1979) pointed to the fundamental inequality which exists among states regarding the possibilities of national means of verification. In some countries these are highly developed while in others they are much less so. This situation gives added importance to the problem of international verification. A similar sentiment was expressed by the representative of Spain (PV.88). Pakistan (PV.82) called for international advisory and training services to assist developing states in building CW defenses. The convention should also provide equal and non-discriminatory access to information concerning verification to all parties. Pakistan was also critical of reliance on the Security Council for ensuring compliance in view of the inherent inequality entailed in the procedures of the Council.

Proposal Abstract 015.1(G86)

1. **Arms Control Problem:**
   Chemical weapons - destruction of facilities
   - destruction of stocks
   - production
   - stockpiling
   - use

2. **Verification Type:**
   (a) Complaints procedure - consultative commission
   (b) On-site inspection - selective
   - challenge

3. **Source:**
   Pakistan. "Fact-finding under the future chemical weapons convention". CD/664, 13 February 1986.

4. **Summary:**

The working paper contains suggestions for provisions relating to fact-finding for use in the elaboration of Article IX of the draft chemical weapons convention. Pakistan prefers the use of the term "fact-finding" over "challenge inspection", "challenge procedure" or "on-site-inspection" because it aptly describes the situation being elaborated and sounds less aggressive than the latter terms.

The working paper proposes that all requests for fact-finding should in the first instance be directed to the Executive Council established under the convention, in order to act with greater speed. The issue of fact-finding should come before the Consultative Committee in the event that the Executive Council is unable to resolve an issue in a satisfactory manner.

A party to the Convention having failed to clarify doubts concerning another party's compliance through bilateral consultations would have the right to request the Executive Council to obtain an explanation. The Executive Council would notify the party of the request for clarification within 24 hours of receipt of the request. The notified party should respond within 7 days. If further clarification is needed, the procedure could be repeated.

A party could request that a fact-finding mission be sent to another party in order to clarify any situation considered to be ambiguous. Such a request should be accompanied by concrete elements supporting the doubts of the requesting state. The Executive Council would begin an examination of the request within 2 days and decide whether to send a fact-finding mission within 4 days. If the Executive Council decided that a fact-finding mission would not be sent, the requesting state would have the right to make an additional request, provided it could furnish additional information not included in the first request.

If the Executive Council decided to send a fact-finding mission, it would notify the receiving state within 24 hours of its decision.

The receiving state should respond to the notification within 4 days. The receiving state might decide to:

(1) Comply with the request and permit the fact-finding mission.

(2) Submit a comprehensive inquiry report within 7 days and ask the Executive Council to suspend departure of the mission until it had considered the report. If the receiving state detected a situation of the kind suspected, it should indicate in its report the corrective action taken or proposed. The Executive Council should decide within 4 days whether the explanation satisfied the concerns raised. If the explanation was unsatisfactory, the Executive Council would renew its request within 24 hours of its decision. The receiving state party should respond to this second request within 2 days. If the second request was refused, the Executive Council could request an extraordinary session of the Consultative Committee to consider the situation.

(3) Under exceptional circumstances refuse to allow the fact-finding mission. A refusal of this type should be accompanied by a detailed explanation of its reasons.

Each fact-finding team would consist of three members who would be persons of high standing in the fields of chemistry, chemical technology and medicine. They would serve in their personal capacities and consideration would be given to equitable geographical and political distribution while selecting them. The fact-finding team would not include a national of either the requesting or the receiving state.

If the fact-finding mission determined that an ambiguous situation or breach of the Convention existed, the Executive Council should, within 24 hours, advise the receiving state to take remedial measures. The receiving state should immediately take all steps necessary to bring itself into full compliance and inform the Executive Council of the action taken or proposed to be taken within 7 days. If the receiving state failed to comply with the advice of the Executive Council, the latter should call for an extraordinary session of the Consultative Committee to consider the situation.

An extraordinary session of the Consultative Committee should decide what action to take, including referring the question to the United Nations General Assembly and requesting the latter to take appropriate action under the United Nations Charter.

Use of chemical weapons should be treated as the most serious breach of the Convention. Within 24 hours after receipt of a duly substantiated claim regarding the use of chemical weapons, the Executive Council should inform the parties concerned that a fact-finding mission was being sent. All parties would extend all possible assistance to the fact-finding team in reaching and visiting the sites, ascertaining the facts, and in the transport of samples or material for evidence relating to the possible use of chemical weapons. If the fact-finding team established that chemical weapons had been used, the Executive Council should call for an emergency meeting of the Consultative Committee. The Consultative Committee should convene within 7 days and consider (a) measures to help the affected state and (b) measures against the chemical weapon using state.

Proposal Abstract O16(G72)

1. **Arms Control Problem:**
   Chemical weapons - production

2. **Verification Type:**
   (a) Complaints procedure - consultation and cooperation
   - referral to Secretary General
   - referral to Security Council
   (b) International control organization

3. **Source:**
   Japan. CCD/PV.547, 7 March 1972.
   See also: - CCD/PV.594, 22 March 1973.

4. **Summary:**

Japan reiterates its previous proposals concerning the use of gas chromatography and economic records monitoring as verification techniques.* A complaints procedure is also required. Complaints should be lodged with the Secretary General of the UN together with all available information, who would then conduct an investigation aided by an international panel of experts. The results would be reported to the Security Council.

In PV.594 Japan affirms the need for an international body to observe and control implementation and so obtain objective facts on any violation. Japan supports the Netherlands idea in this regard.** As a first step to such international control it would be helpful to establish a system for monitoring statistics of production, export, etc., of certain chemical substances. A bilateral consultation procedure should precede the activation of the UN complaints procedure.

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* See: abstracts C83(G70) and G5(G70).
** See abstract P29(G71).

Proposal Abstract 017(G75)

1. **Arms Control Problem:**
   Other weapons of mass destruction - environmental modification

2. **Verification Type:**
   Complaints procedure - consultation and cooperation (Article 5(1))
   - referral to Security Council (Article 5(2) and 5(3))

3. **Source:**
   Union of Soviet Socialist Republics. "Draft convention on the prohibition of military or any other hostile use of environmental modification techniques". CCD/471, 21 August 1975. An identical draft was simultaneously submitted by the United States (CCD/472).

4. **Summary:**
   Article 4 is almost identical to Article 4 of the previous Soviet draft ENMOD treaty (see abstract N22(G74)). It requires states to undertake "any necessary measures" to prevent activity within their territory which is banned by the treaty. Article 5 includes provisions similar to that of Article 6 of the earlier USSR draft treaty, concerning referral of complaints to the Security Council and obligations to assist Security Council investigations. But Article 5 also includes, unlike the earlier USSR, draft, a provision under which parties are obligated to consult and cooperate in resolving any problems in relation to the objectives or application to the treaty. Such consultation and cooperation may be undertaken "through appropriate international procedures within the framework of the United Nations".

   It should also be noted that the provision for a review conference of the earlier USSR draft convention has been dropped here.

Proposal Abstract 018(G76)

1. **Arms Control Problem:**
   Other weapons of mass destruction - environmental modification.

2. **Verification Type:**
   (a) Complaints procedure - consultative commission
   - referral to new international body
   - referral to Secretary General
   (b) International control organization

3. **Source:**
   Netherlands. CCD/PV.692, 9 March 1976.
   See also: - Federal Republic of Germany. CCD/PV.697, 25 March 1976.
   - Sweden. CCD/PV.697, 25 March 1976.
   - Australia. CCD/480, 24 February 1976.
   - Romania. CCD/PV.703, 20 April 1976.

4. **Summary:**

An intermediate body is needed with which complaints can be lodged, before the Security Council takes up a matter. Such a body might take a number of forms, including:

(1) A general International Disarmament Organization along lines previously suggested by the Netherlands (see abstract P29(G71)) and Sweden (see abstract P4(G73)).

(2) The Secretary General of the UN might be given a fact-finding role with assistance from specialized bodies.

(3) A committee of parties could be created whose function would be to assist the Secretary General in fact-finding. It would also prepare for the review conference. In could be composed of 10-15 states parties including those permanent members of the Security Council who are parties to the treaty; or it could be restricted only to members of the Security Council who are also parties to the treaty.

Similar ideas were presented by a number of other states in 1976 including the Federal Republic of Germany which called for a special verification committee to keep abreast of scientific and technological developments in the field and to perform a fact-finding function when a complaint arises including the use of on-site inspection.

Sweden also suggested that there was a need for some sort of international machinery to ensure that objective verification procedures are available at an international level, citing the Netherlands' idea of the consultative committee. Sweden wanted more precise rules as to the procedures of consultation and cooperation, preferring a scheme which included a sequence of methods of inquiry, exchange of information and other verification methods culminating only in the final stage with referral of the complaint to the Security Council.

Australia called for a specific provision in the treaty giving specialized UN bodies advisory roles in the adjudication of complaints.

Romania called for periodic conferences of the parties to be used as a forum for "collective verification" of the treaty. This would enable all states to have access to information and data thereby increasing their capability to detect possible violations.

Proposal Abstract 019(T77)

1. **Arms Control Problem:**
   Other weapons of mass destruction - environmental modification.

2. **Verification Type:**
   (a) Complaints procedure - consultation and cooperation (Article 5(1))
   - consultative commission (Article 5(2) and Annex))
   - referral to Security Council (Article 5(3) and 5(4))
   (b) National self-supervision (Article 4)
   (c) International control organization
   (d) Review conference (Article 8)

3. **Source:**
   Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques. (The ENMOD Convention).
   Concluded: 18 May 1977.
   Entered into force for Canada: 11 June 1981.
   Number of parties as of 31 December 1986: 49.

4. **Summary:**

It is important to appreciate the scope of the prohibition incorporated into this Treaty. Each party under the Treaty is banned from engaging in military or other hostile use of environmental modification techniques having widespread, long-lasting or severe effects (Article 1(1)).

With regard to the verification provisions, Article 4 of the convention remains essentially unchanged from the earlier US-USSR draft Treaty (see abstract 017(G75)), though Article 5 has been altered substantially. As in the earlier draft, Article 5 provides for consultation and cooperation either between the parties themselves or through appropriate international procedures. However, the scope of these international procedures has been clarified to include the possibility of fact-finding by existing international organs, and the assistance of the Consultative Committee of Experts established under Article 5(2). The Consultative Committee of Experts can make findings of fact and provide expert opinions; it cannot, however, vote on matters of substance (Annex). The role of the Consultative Committee is, therefore, exclusively one of fact-finding, while political decision-making is left to other procedures, notably the Security Council. A state, thus, has a range of actions with regard to any complaint it may have. The state itself decides which of these courses to pursue.

Text of Main Verification Related Provisions:

Article IV

Each State Party to this Convention undertakes to take any measures it considers necessary in accordance with its constitutional processes to prohibit and prevent any activity in violation of the provisions of the Convention anywhere under its jurisdiction or control.

Article V

1. The States Parties to this Convention undertake to consult one another and to co-operate in solving any problems which may arise in relation to the objectives of, or in the application of the provisions of, the Convention. Consultation and cooperation pursuant to this article may also be undertaken through appropriate international procedures within the framework of the United Nations and in accordance with its Charter. These international procedures may include the services of appropriate international organizations, as well as of a Consultative Committee of Experts as provided for in paragraph 2 of this article.

2. For the purposes set forth in paragraph 1 of this article, the Depositary shall, within one month of the receipt of a request from any State Party to this convention, convene a Consultative Committee of Experts. Any State Party may appoint an expert to the Committee whose functions and rules of procedure are set out in the annex, which constitutes an integral part of this Convention. The Committee shall transmit to the Depositary a summary of its findings of fact, incorporating all views and information presented to the Committee during its proceedings. The Depositary shall distribute the summary to all States Parties.

3. Any State Party to this Convention which has reason to believe that any other State Party is acting in breach of obligations deriving from the provisions of the Convention may lodge a complaint with the Security Council of the United Nations. Such a complaint should include all relevant information as well as all possible evidence supporting its validity.

4. Each State Party to this Convention undertakes to co-operate in carrying out any investigation which the Security Council may initiate, in accordance with the provisions of the Charter of the United Nations, on the basis of the complaint received by the Council. The Security Council shall inform the States Parties of the results of the investigation.

5. Each State Party to this Convention undertakes to provide or support assistance, in accordance with the provisions of the Charter of the United Nations, to any State Party which so requests, if the Security Council decides that such Party has been harmed or is likely to be harmed as a result of violation of the Convention.

Annex to the Convention

Consultative Committee of Experts

1. The Consultative Committee of Experts shall undertake to make appropriate findings of fact and provide expert views relevant to any problem raised pursuant to paragraph 1 of Article V of this Convention by the State Party requesting the convening of the Committee.

2. The work of the Consultative Committee of Experts shall be organized in such a way as to permit it to perform the functions set forth in paragraph 1 of this annex. The Committee shall decide procedural questions relative to the organization of its work, where possible by consensus, but otherwise by a majority of those present and voting. There shall be no voting on matters of substance.

3. The Depositary or his representative shall serve as the Chairman of the Committee.

4. Each expert may be assisted at meetings by one or more advisers.

5. Each expert shall have the right, through the Chairman, to request from States, and from international organizations, such information and assistance as the expert considers desirable for the accomplishment of the Committee's work.

Proposal Abstract 019.1(A84)

1. **Arms Control Problem:**
   Other weapons of mass destruction - environmental modification.

2. **Verification Type:**
   (a) Complaints procedure - consultative commission
   (b) On-site inspection - selective
   (c) Remote sensors

3. **Source:**
   Krass, Allan S. "The Environmental Modification Convention of 1977: The Question of Verification". In Environmental Warfare: A Technical, Legal and Policy Appraisal, pp. 65-76. Edited by Arthur H. Westing. London: Taylor and Francis, 1984.

4. **Summary:**

The paper reviews the provisions of the ENMOD Convention requiring verification (focussing on Article 1(1)) and the mechanisms established in the Convention for verifying them. It then applies general principles of verification to possible extensions of the Convention.

Verification of the Convention is carried out by national technical means and international means. The former are not explicitly mentioned in the agreement but will be used. The latter are outlined in Article 5 which refers to the establishment of a Consultative Commission of Experts to be convened by the UN Secretary General at the request of any party. The Committee is limited to making "appropriate findings of fact" and prohibited from "voting on matters of substance" (Annex to the Convention). This means that the Committee would be restricted to determinations of whether an environmental modification has occurred, what kind of technique had been used and whether the effects were widespread or long-lasting. Definitions of widespread and long-lasting are given in an Understanding relating to the Convention. Findings relating to the "severity" of the effects would be judgemental not factual and are therefore outside the competence of the Committee; they would be a matter for the Security Council. A prima facie case for a violation could be established if any one of the three criteria (ie. severity, long-lasting and widespread) were found to have occurred.

In order to assess the verifiability of the Convention one must identify the range of activities that must be monitored and evaluated. It is difficult to see how many activities specifically referred to in the ENMOD Convention (Article II), could be both effective and covert. Once the range of activities is narrowed to those that are militarily and technologically realistic, the present

Convention seems to present no problem of verifiability. "Because of the threshold provision, violations are limited to relatively large operations (unless smaller-scale operations can be demonstrated to have "severe" effects), so the sensitivity of detection of these activities does not have to be very great in order to detect violations" (p.70). Problems of verification may arise, however, if the Convention is extended beyond its present scope.

In general there are several stages to the process of verification, each involving higher degrees of technical and political judgement:

(1) Monitoring involves gathering data. Judgement is involved in deciding what kinds of data are gathered and what levels of precision, sensitivity and comprehensiveness are needed.
(2) Analysis involves processing the data according to established procedures to reveal objects or activities of interest.
(3) Identification involves judging whether such objects or activities are detected at some level of confidence.
(4) Evaluation involves assessing the significance of the violation.
(5) Response involves deciding on appropriate action.

Clearly, the parties of the Convention wished to confine the Consultative Committee to the first three stages of the process of verification and to assign the Security Council the last two stages.

Monitoring in the case of the ENMOD Convention cannot be continuous because of the nature of the violations and the wording of the Convention itself. It will instead involve ad hoc, timely and extended access to the affected areas and perhaps the areas from which the modifications derive. Such on-site inspection will probably not be a problem with respect to the affected area though it will be with respect to the source area. However, it seems unlikely that the source area will need to be inspected because the ENMOD techniques most likely to be used must be executed at or very near the affected area.

Krass acknowledges the problem of the veto power of permanent members of the Security Council which he feels is unlikely to be changed as it applies to the ENMOD Convention.

Krass suggests that a good case can be made for dropping the threshold provision regarding the scope of the Convention. "If precision in verification had a high priority, then this abandonment of the threshold should be accompanied by an attempt to specify a list of activities prohibited at any level of effect .... if the technical precision of verification is perceived to be of lesser value than the political and symbolic benefits to be gained from a broad, all-inclusive prohibition, then neither a threshold nor a specified list of prohibited technique would be needed" (p. 73).

Another set of possible extensions of the Convention involves the prohibition or limitation of research, development, production and possession of ENMOD technologies. The present Convention prohibits only use. Here the problem for verification lies in the ad hoc nature of the present monitoring scheme under Article 5 as opposed to the continuous monitoring needed for prohibitions on research,

development, production and possession. Evidence of a violation of these provisions is likely to be found in the accused state and therefore the traditional obstacles to the use of on-site inspection arise. One solution might be to provide for continuous or periodic monitoring using technical means under the control of a permanent international scientific group or intergovernmental agency.

Another possible solution would be to have states declare any activities in these new proscribed areas and to place these activities under full civilian control with full freedom of information. Tests could be announced in advance and observers invited. Stockpiles of relevant materials could be declared periodically. Finally, some on-site inspections might be provided for, possibly on a challenge basis. Such confidence-building measures seem better suited to the needs of the Convention than does verification by remote sensing devices. However, these measures do require creation of a substantial and costly administrative and technical infra-structure.

Extension of the scope of the Convention beyond the use of ENMOD techniques would not be verifiable using the present Article 5. Such extension would have to make the case either that its the political value would outweigh the substantial technical and administrative costs of verification or that the broader prohibition would be desirable even without provisions for verification. Krass, however, cautions against the latter alternative referring to the experience with the Biological Weapons Convention.

Proposal Abstract O20(G79)

1. **Arms Control Problem:**
   Other weapons of mass destruction - radiological weapons

2. **Verification Type:**
   (a) Complaints procedure - consultation and cooperation (Article 8(1))
   - consultative commission (Article 8(2) and Annex)
   - referral to Security Council (Article 8(3) and (4))
   (b) National self-supervision (Article 6)
   (c) Review Conference (Article 11)

3. **Source:**
   Union of Soviet Socialist Republics. "Agreed joint USSR-United States proposal on major elements of a treaty prohibiting the development, production, stockpiling and use of radiological weapons". CD/31, 9 July 1979. (The US submitted an identical working paper (CD/32) on the same day).

4. **Summary:**

According to this draft treaty, parties undertake to consult and cooperate to solve any problems arising concerning the objectives or application of the treaty (Article 8(1)). This may be done through appropriate international procedures within the framework of the UN. These international procedures may include the services of appropriate international bodies as well as the Consultative Committee of Experts.

The Consultative Committee will be convened by the Depository (i.e. the UN Secretary General) within a month from the receipt of a request from any party. The Committee will report to the Depository a summary of its findings of fact, incorporating all views presented during its proceedings (Article 8(2)). The Depository or his representative will serve as the chairman of the Committee. Experts on the Committee will have the right to request from states and international organizations information and assistance. Procedural matters will be settled by consensus, whenever possible, or by majority vote. There will be no voting on matters of substance (Annex).

Any party may lodge a complaint, together with all relevant information regarding breach of the treaty, with the Security Council (Article 8(3)). Parties undertake to cooperate with any Security Council investigation. The Council will inform parties of the results of the investigation (Article 8(4)).

Article 6, which is similar to a provision in the ENMOD Convention (see abstract O19(T77)), requires parties to undertake any necessary measures to prevent loss or diversion of radioactive materials within their territory.

5. **Selected Comments of States:**

Several states were unhappy with the verification system outlined in the US/USSR draft treaty. Sweden felt that IAEA safeguards might be preferable to a system of national control of radioactive wastes and that recourse to the Security Council with complaints was undesirable because of the permanent members' veto power. See also: Egypt (CD/PV.77, 10 April 1980) and Pakistan (CD/PV.77). Sweden also preferred a review conference within five years instead of ten as specified in the draft (CD/PV.63, 26 February 1980).

Belgium was concerned that the procedure for convening the Consultative Committee was too slow. Belgium also questioned whether the Depository would have the power to investigate before convening the Committee. Furthermore, the Committee should have the power to deal with problems other than those raised by the party requesting its meeting (CD/PV.76, 9 April 1980).

Japan requested elaboration on several points concerning Article 8 (CD/PV.80, 22 April 1980. Both Italy (CD/PV.42, 17 July 1979) and the Netherlands (CD/PV.76) believed that the verification system in this treaty should not be a precedent for future arms control agreements.

CHAPTER P
INTERNATIONAL CONTROL ORGANIZATIONS

International control bodies can be intended either to deal generally with a number of arms control matters or their scope can be limited to a single measure. A problem with the former course is that it involves supervising a number of arms control agreements each with its own set of parties.

A wide variety of functions for an international control body have been envisaged. Proposals differ considerably as to which they include. For the purpose of description, however, it is possible to suggest a simple scale in terms of the degree of responsibility assigned the international organ in a proposal.

At the lowest end of the scale are organs with the function of receiving reports from parties, perhaps compiling a summary report, and then distributing the information to the parties. Much higher on the scale would be assigning the international agency the function of analyzing, independently of the parties, the information it receives. In effect, this would amount to giving the international body independent judgement by permitting it to come to conclusions about whether a suspicious event had occurred.

Another function related to the previous one which also ranks high on the scale, is that of responsibility for conducting or delegating the conduct of verification techniques such as literature surveillance, on-site inspection and even remote surveillance by satellite.

Also fairly high on the scale is the function of conducting investigations as part of a complaints procedure. Investigations could be conducted only on request or they might be undertaken on the initiative of the international control body itself. In the latter case the degree of responsibility assigned the international organ is considerably greater.

The role of supervising national regulatory mechanisms is another function which might be given an international control body and which ranks high on the scale. Related to this is the duty of checking on the credibility of data received in international exchanges.

A function which lies lower on the scale is that of advising the parties. In this regard, international boards of scientific experts could provide the parties with advice on such matters as the capabilities of various verification techniques, the weight to be given the technical evidence concerning a possible violation, or the sorts of chemical substances to be added to a list of banned substances under a CW convention.

Two other duties which might be undertaken by the international agency are organizing the review conference for a treaty, and providing that body with an evaluation of the verification system. These functions would rank relatively low in the scale of responsibility.

Some clear patterns emerge concerning reactions to proposals involving international control organizations. To begin with, the greater the degree of responsibility with regard to the verification system assigned to the international body (i.e. the higher it ranks on the scale mentioned above), the greater is the resistance it faces from some states,

particularly the superpowers. Another clear pattern is that the wider the scope of the proposed international organ (i.e. the greater the number of arms control agreements with which it is to deal) then the greater the resistance of some states.

To counter this resistance it can be argued that an international control agency, especially one with wide responsibilities is a basic goal of arms control and disarmament. It would give a greater role in arms control to the less powerful but often populous Third World Countries which do not at present have the capability to employ technically advanced verification methods on their own. An international body might also be expected to show greater impartiality as compared to national systems and its determinations to carry more weight internationally. For regional or other arms control agreements where the major powers are less directly involved, creation of international bodies with a specific verification role has sometimes proved to be more feasible. On a global level, the most notable exception to this general pattern is the International Atomic Energy Agency. Chapter D deals with the IAEA safeguards system.

Proposal Abstract P1(A62)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   International control organization

3. **Source:**
   Hammond, Paul Y. "Some Difficulties of Self-Enforcing Arms Agreements". Journal of Conflict Resolution 6, no. 2 (June 1962): 103-115.

4. **Summary:**
   The author argues that an international inspection organization which was assigned responsibility for gathering data would find it difficult not to be drawn into the interpretation of those facts. In the course of acquiring and processing data some interpretations would have to be made. There would also be an incentive for parties to an agreement to use the prestige of the international organization to support their particular views and consequently to press it to interpret the data.

Proposal Abstract P2(A65)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection

3. **Source:**
   Linde, Hans A. "Organization of a 'Mixed' National and International Inspectorate". In Security in Disarmament, pp. 80-106. Edited by Richard J. Barnet and Richard A. Falk. Princeton, New Jersey: Princeton University Press, 1965.

4. **Summary:**
   This article discusses the advantages and organizational requirements of mixed inspectorates. Mixed systems are contrasted with pure adversary and pure international inspection systems. Adversary inspection permits a high degree of confidence on the part of the inspection nation while international inspection may be more acceptable to the inspected. The author contends that a mixed system of inspection can combine the advantages of both systems. Some components of the mixed system would be "adversary" and others "international".

   Linde discusses several options for organizing a mixed system in relation to personnel, equipment, budget, operations, access rights, reporting procedures, administrative direction, political control and the judging of the factual evidence.

Proposal Abstract P3(A68)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   (c) Complaints procedure - referral to new international body
   - referral to International Court of Justice

3. **Source:**
   Wainhouse, D.W. Arms Control Agreements: Designs for Verification and Organization. Baltimore: The John Hopkins Press, 1968, pp. 160-168.

4. **Summary:**

In order to avoid an excessive number of verification groups, each monitoring a separate partial arms control measure, Wainhouse proposes the establishment of a Limited International Disarmament Organization (LIDO). The responsibilities of this agency would probably not be the same for all the agreements it monitors; it must, therefore, be sufficiently flexible to cover a variety of different situations.

The structure of the LIDO will depend in large part on the number of parties to the agreements for which it is responsible and the number of agreements. It is, however, desirable that a General Conference of parties be set up. This body would meet regularly, principally to approve decisions taken by the Control Council. The Council would be small and composed of the militarily significant parties. There would be two categories of membership: permanent and non-permanent.

Initially, the Council could serve as a consultative organ and not have authority to make political judgements on the findings of inspection teams. Such judgements would be the prerogative of the parties themselves or a higher international authority. The Council would also act as a forum for resolving disputes about the implementation of the arms control agreements. If negotiations in the Control Council did not resolve the problem, provision should be made for referral to the International Court of Justice.

The LIDO would have an Administrator who would be chosen by the Control Council and approved by the General Conference with the major military powers, perhaps, having a right to veto. The main duties of the Administrator would be to select LIDO staff, accept and distribute reports, supply inspection teams with common services, act as a secretariat for the Control Council and General Conference, coordinate development of the verification systems for different arms control agreements and mediate any minor administrative problems regarding inspection.

The number of staff of the LIDO must be adequate to carry out effectively and impartially the tasks entrusted to it. The staff need not be large, at first. If the LIDO is to supply inspectors, their appointment would need the approval of the Control Council perhaps with the permanent members of the Council having the right of veto. The main duty of LIDO observers, if participating in a reciprocal inspection system*, would be to ensure the inspections were conducted effectively. If the LIDO inspectors actually conducted the inspection, nationals of the parties to the agreement might be attached to the inspection team.

The budget of the LIDO would be prepared by the Administrator, recommended by the Council and approved by the Conference. Requirements for contributions would be apportioned among the parties by the Control Council.

Access rights of LIDO personnel participating in inspections are crucial. The extent of access inside the territory of a party would be governed by the nature of the object to be inspected and the risk involved from possible violations.

Because the LIDO is conceived of as an expanding organization, making amendments to the treaty should be relatively easy, by a simple majority of the parties plus the consent of the permanent members of the Control Council. There might, as well, be procedural devices for altering the obligations of the parties without formal amendments.

Like the IAEA, the LIDO should be an autonomous international organization within the UN system. Parties would retain the right to resort to the Security Council. As the scope and authority of the LIDO is expanded the LIDO might set up links with regional organizations like the OAS.

In addition to his LIDO proposal Wainhouse's book provides a good discussion of several other verification systems including:

(1) the US proposal to halt production of fissionable materials for weapons purposes (ENDC/134, 26 June 1964);**
(2) the Gomulka Proposals and Rapacki Plans (late 1950s and early 1960s);***
(3) the US proposal for a freeze of strategic nuclear delivery vehicles (21 January 1964); and
(4) the verification of stage I of the proposals for general and complete disarmament (early 1960s)****.

Part II of the book provides a conceptual discussion of verification focussing on the problems likely to arise and general principles for handling them. Wainhouse categorizes verification systems as follows:

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* See discussion below for definition of a reciprocal system
** See abstract D3(G64).
*** See abstract B23(G63).
**** See abstracts P14(G62) and P15(G62).

(1) External verification. [These are now referred to as "national technical means".]
(2) Reciprocal systems (bilateral and multilateral): These are systems in which a state (or group of states) inspects another state (or group).
(3) Mixed systems: Essentially these are reciprocal systems with the addition of personnel from an international body.
(4) International systems: These can take several forms including verification of specific obligations, regional arms control agreements, several agreements, and a GCD agreement.

Wainhouse also identifies several basic principles applicable to any verification system. First, the size and structure of any system is determined by the functions to be performed and the techniques to be utilized. The degree of precision required, costs, logistics and communications requirements will all affect size. Structure will be affected in particular by the number of parties involved and the extent that the system will impinge on national security interests.

Staffing will involve problems such as direction of staff, criteria for selection, recruitment, conditions of employment, privileges and immunities. Operational and support arrangements must also be considered particularly regarding which objects to inspect as well as what to do when a host state contests the right of inspection. Questions of freedom of movement, communications, and logistics arise here. In addition, arrangements for financing the verification system must be specified.

Wainhouse's book also includes chapters dealing with the role of national intelligence in verification and the handling of violations.

Proposal Abstract P4(G73)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   (a) International control organization
   (b) International exchange of information
   (c) Complaints procedure - referral to new international body
   - referral to Security Council

3. Source:
   Sweden. CCD/PV.601, 16 April 1973.
   See also: - CCD/PV.610, 5 July 1973.

4. **Summary:**

Because of the dangers of ad hoc methods and the need for consistant watchfulness over progress in the disarmament field, there is a need for some organizational framework to undertake verification of arms control agreements. The intent here is to rejuvenate old ideas on a general International Disarmament Organization (IDO). Sweden makes reference in this context to the American and Soviet proposals of 1962, to the Standing Consultative Committee of SALT I, to the Arms Control Agency of the WEU and to the review conference provisions of a number of arms control agreements. Sweden acknowledges the problem of establishing a control organ covering existing multilateral treaties with their different adherents.

Any such IDO, according to Sweden, must refrain from combining investigatory and judgemental tasks. Ultimately complaints must be referred to the Security Council. To realize this IDO, a two tier structure, is proposed. First, an intermediary type of IDO would be created, serving parties to various treaties by providing a two-way channel for both receiving and distributing information which is pertinent to the implementation of disarmament measures. This body would function as a clearing house for knowledge on matters relating to implementation.

The second tier of the system would be composed of a number of specialized agencies which would conduct actual investigations. These could include presently existing bodies such as the IAEA and WHO. The IDO would itself not undertake investigation but would assign specific tasks to these specialized agencies.

Proposal Abstract P5(A74)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   (a) International control organization
   (b) International exchange of information
   (c) Remote sensors
   (d) Complaints procedure
   (e) Literature survey

3. **Source:**
   Myrdal, A. "The International Control of Disarmament". Scientific American 231, no. 4 (October 1974): 21-33.

4. **Summary:**

This is a proposal for the creation of an International Disarmament Control Organization (IDCO) under UN auspices "charged with the collection and dissemination of information regarding the fulfillment by the nations of the obligations they incur under disarmament agreements and regarding on-going changes in national armaments". It is based on a before-the-fact theory of deterrence whereby the risk of disclosure of violations would serve to deter violations in the first place. The widespread collection and dissemination of information regarding world armaments and disarmament is seen as fostering a climate of openness in which trust could remove some of the burden of foolproof assurance of compliance prevalent under other verification systems.

Specifically, the IDCO would be "organically and hierarchically built up from the national level to various international levels". The broad base for the information gathering function of the IDCO would be national means of detection and verification used for both internal and international purposes. This would include pertinent satellite surveillance data. The machinery needed for control at the national level would be handled by each state, with the IDCO collating and publishing all collected data. In short, the IDCO would act as a clearing house for information derived from all sources including economic and trade statistics, all manner of open publications, and so on.

The IDCO would also be charged with investigating instances of suspected violations of agreements, although as an investigative organ, it would refer actual charges to the UN Security Council.

Proposal Abstract P6(A78)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   International control organization

3. **Source:**
   Goldblat, J. "Monitoring Arms Control: Do We Need a Global Verification Institution". In Opportunities for Disarmament, pp. 69-78. Edited by J.M.O. Sharp. New York: Carnegie Endowment for International Peace, 1978.

4. **Summary:**

The author reviews verification provisions of twelve post-1945 arms control agreements. He concludes that in spite of elaborate provisions, the verification procedures suffer from a lack of consistency. He points out that many sophisticated technical means of verification are available only to a few states. The consultation procedures included in many treaties are of little value to countries without these means. He also questions the utility of using the UN Security Council as a forum for complaints about compliance. The procedures included in the ENMOD Convention (abstract M11(G77)), however, are a first step toward separating international fact-finding from UN political judgement, which is one of the weaknesses of reliance on the Security Council. In sum, apart from the use of the IAEA to verify compliance with the Non-Proliferation Treaty, verification of arms control agreements remains a monopoly of the great powers. As more significant multilateral arms control agreements are concluded, there will be more emphasis on providing information on compliance to smaller powers.

Institutions to deal with the verification of specific agreements can be set up either as autonomous bodies or as parts of existing international agencies (e.g. IAEA). There have also been suggestions for a global agency covering all arms control agreements. Such a body, would be necessary to monitor a general and comprehensive disarmament agreement. However, it is a moot question whether it would be necessary with respect to disparate, partial measures. Advocates of this approach claim that dissemination of arms control information must be institutionalized to build confidence. Goldblat argues, on the other hand, that such an all-encompassing disarmament organization would have little to do regarding existing agreements since they are unlikely to be violated. New conventions, such as one on CWs, will (like the NPT) require specialized expert bodies for verification. Nor do regional agreements require a world-wide verification organization. Furthermore, regarding the dissemination of arms control information, the UN Secretariat and Center for Disarmament perform this role.

In the future the Centre for Disarmament might perform some auxiliary functions related to the implementation of agreements. It might, for example, coordinate operations conducted by specialized bodies directly involved in verification of different agreements.

Proposal Abstract P7(G78)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   (a) International control organization
   (b) Non-physical/psychological inspection

3. **Source:**
   Italy. "Working paper on international mechanisms for disarmament". CCD/568, 25 April 1978.
   See also: - CCD/PV.784, 25 April 1978.
   - CD/PV.3, 25 January 1979.

4. **Summary:**
   There should be established within the framework of the UN, an international verification organ to supervise, at a technical level and from a legal standpoint, the implementation of arms control agreements. In order to fulfil its mandate the organ should be able to employ all the most recent techniques afforded by science which would assist in ensuring strict, objective and effective international control. Examples of such verification techniques are "sensing, sampling, recording, communicating and interpreting devices".

   In CD/PV.3 Italy reaffirms its belief in an international verification organ designed to offer coherent and adequate solutions from a technical and legal angle. Italy also suggests that it would be desirable for international verification to be accompanied by national controls exercised by public opinion over national governments.

Proposal Abstract P8(G78)

1. **Arms Control Problem:**
   (a) Any arms control agreement
   (b) Chemical weapons - production
   - destruction of stocks
   (c) Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) International control organization
   (b) International exchange of information
   (c) Review conference
   (d) Remote sensors - satellite
   (e) Seismic sensors - international network
   (f) On-site inspection - selective

3. **Source:**
   Netherlands. "Study on the establishment of an international disarmament organization". U.N. Document A/AC.187/108, 5 April 1978.
   See also: - "Note verbale dated 19 May 1982 transmitting working paper concerning an international disarmament organization". UN Document A/S-12/22, 27 May 1982. See abstract P12(G82).
   - Abstract P29(G71)

4. **Summary:**

The Netherlands renews its call for the establishment of an international disarmament organization (see abstract P29(G71)) because of developments in the field of disarmament, in particular, progress towards a chemical weapons convention and a comprehensive test ban. An international disarmament organization linked with the UN could provide the organizational framework for the implementation of arms control and disarmament agreements. While it would mainly concentrate on verification, the organization would also organize review conferences provided for in agreements and would act as a clearing house for information on disarmament. The organization could, at first, be set up for the implementation of a particular agreement and could later be given more functions.

Various agreements could be well served by a disarmament organization. A chemical weapons convention would probably require extensive consultations between parties as well as notification and verification procedures. A permanent staff will likely be required for the implementation of the convention. A comprehensive test ban will establish an international seismic monitoring system with a consultative organ to administer it and resolve technical and organizational problems. An international disarmament organization could streamline the consultation and implementation process for these and future agreements. Information on chemical weapon stockpile destruction, seismic data and results of inspections and fact-finding missions could be centrally stored in an international organization.

The verification function of the organization should be performed with a variety of verification methods, not just satellite observation. The Netherlands believes that "observation by satellite cannot provide all information necessary to verify present and future arms control treaties" (p.3). This is particularly true for verification of a ban on underground nuclear tests and chemical disarmament. Furthermore, there are practical problems in establishing an International Satellite Monitoring Agency (ISMA) as proposed by France (see abstract J5(G78)).

The organization could be set up with a plenary conference, a board of directors and a secretariat assisted by experts who could perform specialized activities such as investigations or technical studies. The Netherlands calls upon the Secretary-General of the UN to consult with member states about the functions and organization of a possible international body.

P9(G78)

Proposal Abstract P9(G78)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   International control organization

3. **Source:**
   Sri Lanka. "Working paper submitted by Sri Lanka on the establishment of a World Disarmament Authority". A/S-10/AC.1/9/Add.1, 8 June 1978.

4. **Summary:**

Sri Lanka calls for the establishment of a World Disarmament Authority as a permanent institution of the UN system. Among its tasks would be the collection and collation of existing information relating to armaments, their production, distribution, transfer, and application. The other major role of the Authority could be the implementation and monitoring of existing disarmament measures as well as those to be negotiated in the future. The Authority could also provide many countries with specialized knowledge on technical aspects of disarmament now available almost exclusively to the Great Powers.

In the context of general and complete disarmament, the Authority could be entrusted with responsibility for controlling and regulating the production and distribution of armaments and determining the purposes for which such armaments are required. It could also give effect to decisions of the Security Council and other organs of the UN.

P10(G82)

Proposal Abstract P10(G82)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   (a) International control organization
   (b) Review conference
   (c) On-site inspection - selective

3. **Source:**
   Italy. "Letter dated 17 June 1982 transmitting working paper on the institution of an international body for the verification of disarmament agreements." UN Document A/S-12/AC.1/19, 18 June 1982.

4. **Summary:**

Italy proposes the establishment of a permanent body in three phases to verify multilateral disarmament agreements. In the first phase, an ad hoc section would be set up under the jurisdiction of the UN Secretariat. The section's tasks would include:

(1) collecting and disseminating data and information related to the application of and compliance with disarmament agreements;
(2) issuing an annual report on the "review of implementation" to members of the UN;
(3) acting as a permanent secretariat to the various Consultative Committees of experts, provided for in existing and future arms control and disarmament agreements, to assist the implementation of complaints procedures;
(4) preparing background papers for review conferences;
(5) assisting disarmament bodies, particularly the Committee on Disarmament, by providing technical information on verification; and
(6) developing knowledge and expertise on verification and anticipating verification requirements of future arms control and disarmament agreements.

In the second phase, the institution could be transformed into a "Centre for the Verification of Disarmament Agreements" under the jurisdiction of the highest ranking UN officer competent for disarmament matters. The centre would perform the same functions as in the first phase, but could also acquire a corps of international inspectors operating along guidelines similar to those of the IAEA. The inspectors would monitor adherence to disarmament agreements in collaboration with consenting states.

In the final phase, either the Centre could become independent or an Agency for verification of disarmament agreements could be established. If an international satellite monitoring agency were established, it would perform complementary functions and in some cases might substitute for operations performed by the international verification body and its inspectors.

Proposal Abstract P11(G82)

1. **Arms Control Problem:**
   Any arms control agreement

2. **Verification Type:**
   International control organization

3. **Source:**
   Japan. "Note verbale dated 25 June 1982 transmitting working paper concerning role of UN in verification". UN Document A/S-12/AC.1/43, 28 June 1982.

4. **Summary:**
   Japan proposes the establishment of an international verification unit within the framework of the UN. The unit would perform the following functions:
   (1) Collecting information concerning compliance with and verification of disarmament agreements;
   (2) Preparing lists of experts to develop the capability of the UN to offer technical assistance, particularly in conducting fact-finding missions; and
   (3) Preparing a study on methods of assuring compliance with existing arms control agreements which do not contain provisions for verification.

Proposal Abstract P12(G82)

1. **Arms Control Problem:**
   (a) Any arms control agreement
   (b) Nuclear weapons - comprehensive test ban
   (c) Chemical weapons - production
   - stockpiling
   - destruction of stocks

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   - challenge
   (c) Seismic sensors
   (d) International exchange of information
   (e) Review conferences
   (f) Remote sensors - satellite
   - sampling
   (g) Short-range sensors - seals

3. **Source:**
   Netherlands. "Note verbale dated 19 May 1982 transmitting working paper concerning an international disarmament organization". UN Document A/S-12/22, 27 May 1982.
   See also: - "Study on the establishment of an international disarmament organization". UN Document A/AC.187/108, 5 April 1978. See abstract P8(G78).
   - Abstract P29(G71)

4. **Summary:**
   This working paper reformulates the Netherlands' 1978 proposal which was put forward at the first special session of the UN on disarmament. The Netherlands proposes the establishment of an international disarmament organization to implement and verify international arms control and disarmament treaties. The organization could prepare and organize review conferences already provided for in several disarmament treaties and could act as a clearing house for information on disarmament. It would also perform specific functions related to verification of agreements.

   The organization should be affiliated to the UN but separate from the UN Centre for Disarmament. The structure of the organization could consist of a plenary conference, a board of directors and a secretariat. The board would ensure the continuous functioning of the organization. The secretariat would consist of a permanent staff assisted by experts who would engage in specialized activities such as special investigations or technical studies. The permanent members of the Security Council should be permanent members of the board. Review conferences could address matters such as electing the board and establishing guidelines for the organization.

The organization could perform specific verification functions provided for in various agreements. In connection with a chemical weapons convention, the organization could facilitate consultations and technical discussions between parties and experts, act as a clearing house for information, collect statistics and take part in on-site inspections. The organization could administer the collection and dissemination of information from seismic and air sampling stations for verification of a comprehensive test ban. It could also handle complaints about violations of a CTB and organize on-site inspections on challenge. A register of experts available at short notice to investigate complaints maintained by the organization could hasten and streamline the verification process. It would also be useful to have a clearing house for information such as data on stockpile destruction, on seismic monitoring and the results of inspections and fact-finding missions.

The Netherlands supports the use of information from observation satellites for verification. If an International Satellite Monitoring Agency were established, it should form part of the international disarmament organization. However high costs and political opposition may prevent the early establishment of an ISMA. Satellite observation would be useful to verify that seals are intact on chemical weapons plants closed under a chemical weapons treaty and on plutonium production reactors under nuclear safeguards. Another possible verification technique is the RECOVER system to enhance nuclear safeguards (see CD/271, abstract I18(G82)). It is a highly cost-effective system which makes use of commercial communications satellites channels.

Proposal Abstract P13(G61)

1. **Arms Control Problem:**
   General and complete disarmament

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection

3. **Source:**
   Union of Soviet Socialist Republics and United States. "Joint statement of agreed principles for disarmament negotiations". ENDC/5, 19 March 1962. (Originally A/4879, 20 September 1961).
   See also: - "Working draft of Part I of the Treaty on general and complete disarmament (in a peaceful world) proposed by the US and USSR". ENDC/40/Rev.1, 31 May 1962.

4. **Summary:**

All disarmament measures should be implemented from beginning to end under strict and effective international control. During and after GCD the most thorough control should be exercised, the nature and extent of such control depending on the particular disarmament measures involved. To implement control and inspection, an International Disarmament Organization should be created within the framework of the UN. IDO inspectors should be assured unrestricted access without veto to all places as necessary for the purpose of effective verification.

In Annexes to ENDC/5 letters exchanged between the US and Soviet representatives are reproduced (the McCloy-Zorin letters). The American letter indicates that it is "a key element in the US position" regarding verification that whenever an agreement stipulates that a certain level of forces may be retained, the verification machinery must have all the rights and powers necessary to ensure that those levels are not exceeded.

The response of the Soviet representative indicated that while favouring thorough and strict international control over GCD measures, the USSR is resolutely opposed to control of armaments retained at any given stage of disarmament. Such control would turn into an international system of legalized espionage.

Proposal Abstract P14(G62)

1. **Arms Control Problem:**
   General and complete disarmament

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - general
   - obligatory
   (c) Records monitoring - economic
   (d) Remote sensors - aerial
   (e) International exchange of information
   - declarations
   - reports to international body
   (f) Complaints procedure - referral to Security Council

3. **Source:**
   Union of Soviet Socialist Republics. "Treaty on general and complete disarmament under strict international control". ENDC/2, 19 March 1962 and ENDC/2/Rev.1, 26 November 1962.
   See also: - "Memorandum of the government of the Union of Soviet Socialist Republics on disarmament negotiations in the Eighteen Nation Committee". ENDC/3, 19 March 1962.
   - Union of Soviet Socialist Republics and United States. "Working draft of Part I of the treaty on general and complete disarmament (in a peaceful world) proposed by the US and USSR". ENDC/40/Rev.1, 31 May 1962.

4. **Summary:**
   Article 2 of the Soviet draft treaty requires that each disarmament measure incorporated into the treaty be accompanied by such control measures "as are necessary for verification". To implement control, an International Disarmament Organization (IDO) composed of all parties to the treaty, will be established within the framework of the UN, to begin operations as soon as the disarmament measures are initiated. The IDO is to have its own staff, recruited internationally, who will be present in all the countries party to the treaty. Representation on the IDO staff will be balanced between the western, eastern and non-aligned blocs. The IDO staff will exercise control over compliance on a temporary or permanent basis depending on the disarmament measure involved. Parties are obligated to submit to the IDO "in good time" such information about their armed forces, military production and military appropriations as is necessary to carry out the disarmament measures of the stage concerned. When the program of GCD is complete, the IDO will continue to supervise compliance to prevent rearmament.

Part V of the draft treaty outlines the structure and functions of the IDO in more detail. Generally, the IDO will deal with questions "pertaining to the supervision of compliance", while "questions connected with the safeguarding of international peace and security ... including preventive and enforcement measures, shall be decided upon by the Security Council".

The IDO will consist of a Conference of parties and a Control Council. The Conference will hold regular sessions at least once a year and special sessions upon request of the Council or a majority of parties. Each party will have one vote. Procedural questions will be decided by simple majority; other matters by a two-thirds majority. Functions of the Conference include:

(1) electing non-permanent members of the Council,
(2) examining reports of the Council,
(3) approving the budget, and reports to other UN bodies,
(4) approving amendments to the treaty, and
(5) proposing matters for consideration by the Council.

The Control Council is to consist of the five permanent members of the Security Council and a number of non-permanent members elected for a period of two years. Representation on the Council is to be balanced between "the three principal groups of states existing in the world". Voting procedures will be the same as for the Conference; the permanent members will not have any veto power.

Functions of the Council include:

(1) directing measures of control,
(2) establishing staff organizations to carry out IDO functions,
(3) devising rules, regulations and instructions for control,
(4) submitting reports to the Conference,
(5) remaining in constant touch with the Security Council and promptly notifying it of any violations,
(6) reviewing results of the implementation of the treaty upon completion of each of the stages of GCD,
(7) recruiting staff from among those recommended by parties,
(8) preparing the budget of IDO, and
(9) requesting from parties such information on their military as may be needed for control.

The IDO's personnel will enjoy the privileges and immunities necessary to exercise "independent and unrestricted control over implementation of the treaty". Financing of the IDO will come from the parties to the treaty according to a scale to be decided. Immediately after the treaty is signed a preparatory committee will be created to set up the IDO.

The disarmament measures to be undertaken are broken down into three stages by the treaty, each of which involves the elimination of several categories of forces. The role of the IDO in verifying these measures is stated in each of the sections of the treaty. The means by which the IDO will do this are primarily general on-site

inspection*, and the analysis of budget, production and other records. In the third stage of disarmament the IDO will have the right to institute a system of aerial inspection over the territories of the parties.

In ENDC/3 the Soviet Union emphasizes that strict and reliable international control is an essential guarantee and an indispensable condition for the successful implementation of GCD. The IDO, however, cannot be trusted with any functions involving the execution of preventive or enforcement measures in regard to the States. This is the duty of the Security Council. The business of the IDO is to establish facts.

The IDO will supervise only reductions in forces not the levels of armed forces retained by parties at any given stage. The USSR rejects the contention that there can be no certainty that states are honouring their disarmament obligations if only reductions are verified. It is in the third and final stage when all armaments are destroyed that control will become unrestricted and comprehensive.

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* It is not clear whether on-site inspection will be general or selective in the first two stages of the Soviet draft treaty. It will be general in the third stage, however.

Proposal Abstract P15(G82)

1. **Arms Control Problem:**
   General and complete disarmament

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   - progressive/zonal
   - control posts
   (c) Remote sensors - aerial
   (d) International exchange of information
   - declarations
   - reports to international body

3. **Source:**
   United States. "Outline of basic provisions of a treaty on general and complete disarmament in a peaceful world". ENDC/30, 18 April 1962.
   See also: - "Declaration on disarmament: A programme for general and complete disarmament in a peaceful world". ENDC/6, 19 March 1962.
   - Union of Soviet Socialist Republics and United States. "Working draft of Part I of the treaty on general and complete disarmament (in a peaceful world) proposed by the US and USSR". ENDC/40/Rev.1, 31 May 1962.

4. **Summary:**
   An International Disarmament Organization (IDO) would be created during stage I of the GCD process upon entry into force of the treaty. It would constitute the main vehicle for verification and would function within the framework of the UN. The IDO is described in section "g" under stage I of the American paper.

   Verification functions of the IDO would be undertaken on the basis of several principles including the following:

   (1) Reduction measures including destruction would be verified at agreed depots or other locations.

   (2) Production, testing and other activities would be verified by the IDO which would have access to declared facilities wherever located.

   (3) Assurance that agreed levels of forces were not exceeded would be provided by the IDO through agreed arrangements which would have the effect of providing that the extent of inspection during any stage was related to the amount of disarmament undertaken and the risk posed to the parties. The US paper suggests as an example of such an arrangement a progressive/zonal inspection scheme. According to this scheme, each party would divide its territory into a number of zones and at the beginning of each step of the disarmament process would submit to the IDO information regarding

total force levels within each zone. The exact location of the armaments would not be revealed prior to the selection of zones for inspection. An agreed number of zones would be progressively inspected by the IDO during Stage I, according to an agreed time schedule. Selection procedures would ensure that the party being inspected did not select the zones to be inspected. Upon selection of the zones, the party being inspected would declare the location of forces within each selected zone. Arrangements would ensure that no undeclared movements of armaments to or from the zone took place. Both aerial and mobile ground inspection would be used. Access within the zone would be free and unimpeded. Once a zone had been inspected it would remain open for inspection as additional zones were selected at later stages of the GCD process. By the end of Stage III all the zones will have been inspected.

The IDO would be composed of a General Conference of the parties, a Control Council of permanent and non-permanent members, and an Administrator. Expert study groups could be established by either the Conference or the Council.

The General Conference would have the following functions, among others:

(1) electing non-permanent members of the Council,
(2) appointing the Administrator,
(3) approving the budget,
(4) requesting the receiving Council reports,
(5) approving reports to the UN,
(6) requesting advisory opinions from the International Court of Justice, and
(7) approving amendments to the treaty.

The functions of the Control Council would include:

(1) recommending candidates for appointment as the Administrator,
(2) adopting rules for implementing the treaty,
(3) establishing procedures and standards for the installation and operation of verification arrangements,
(4) establishing procedures for dissemination of data to parties,
(5) considering reports from the Administrator,
(6) requesting advisory opinions of the International Court of Justice, and
(7) deciding whether each stage in the disarmament process had been satisfactorily completed.

The Administrator would have the following functions, among others:

(1) administering the installation and operation of the verification arrangements,
(2) providing data to the parties,
(3) preparing the budget,
(4) making reports to the Council on the progress of disarmament measures and their verification.

The privileges and immunities of the IDO personnel would be outlined in an annex to the treaty. Finance of the IDO would be borne by the parties according to an agreed scale of contributions.

Disputes which could not be settled by negotiation or by the IDO itself would be referred to the International Court of Justice unless another mode was agreed to by the parties.

A United Nations Peace Observation Corps would also be established, members of which could be dispatched promptly to investigate any situation which might constitute a threat to the peace. Such a body could conceivably play a role in monitoring arms control obligations especially those related to military disengagements.

As disarmament progressed to higher stages, the IDO would be strengthened to ensure its capacity to verify the measures undertaken during these stages. The IDO would continue to operate on the completion of Stage III.

The primary method of verification employed in the draft treaty is on-site inspection by the IDO. Selective and progressive/zonal forms of on-site inspection, as well as control posts, all seem to be present in the treaty at various stages. Aerial as well as ground inspections are envisaged in some situations. Declarations by parties would also be used, as well as notifications and reports to the IDO.

Proposal Abstract P16(A85)

1. **Arms Control Problem:**
   Regional arms control - Europe
   - nuclear weapons free zones

2. **Verification Type:**
   International control organization

3. **Source:**
   Simoni, Arnold. "A Demilitarized Region for Central Europe and the Formation of a Verification Peace Force". In Defending Europe: Options for Security, pp. 112-118. Edited by Derek Paul. London: Taylor and Francis, 1985.

4. **Summary:**

This article explores possibilities for conflict resolution in Central Europe and proposals for nuclear weapons free zones. Central Europe is specified as a critical area given the current force readiness and the increasingly offensive warfighting doctrines of both sides. Stability in that area is "increasingly fragile" and past attempts to formulate peace agreements have been abortive.

The author rejects those proposals which call for a neutral nuclear free zone about 200 miles wide between East and West Europe on the grounds that it would be impractical to operate and difficult to monitor. Instead, an alternate proposal is put forward for the establishment of a nuclear weapons free zone encompassing four European countries - East and West Germany, Czechoslovakia, and Poland. This arrangement would ban all heavy military weapons from this territory and would also prohibit the passage of nuclear and chemical weapons through the zone.

Provisions are made for the verification of this nuclear weapons free zone. A Verification Peace Force is to be created which would verify the agreement, maintain security in a demilitarized zone and "prevent outside powers from trying to exert military pressure" (p.5). In order to be effective, this force will require the cooperation of all states involved, and should meet certain criteria:

(1) the Force should have a well-defined procedure for operation and control;
(2) changes should only be possible through unanimous agreement;
(3) a review board and ombudsman should be established;
(4) the Force should be prevented from interfering in internal conflicts;
(5) its size, armaments, and activities should be well-defined; and
(6) it should be installed at strategically located bases.

It is concluded that, given that these measures are fairly drastic, they are likely to encounter much resistance from states. However, the urgency of the situation is such that there are "few choices and options to this sort of sweeping solution".

P17(A76)

Proposal Abstract P17(A76)

1. **Arms Control Problem:**
   Regional arms control - Indochina

2. **Verification Type:**
   International control organization

3. **Source:**
   Nutt, Anita L. Troika on Trial: Control or Compromise. Santa Monica, Calif.: September 1976. 3 volumes. NTIS AD 822 538.

4. **Summary:**

The focus of the paper is on the control machinery employed to monitor the peace agreements of 1954 concerning Indochina, specifically the International Control Commission. Description of the mechanisms and a history of their implementation are provided. The author attempts to generalize her findings to observations on the use of the troika format (i.e. one representative from each of the East, the West and the non-aligned states) in other arms control contexts. She concludes that there are severe dangers to the use of the troika from the point of view of effective control.

Proposal Abstract P17.1(G85)

1. **Arms Control Problem:**
   Regional arms control - outer space

2. **Verification Type:**
   International control organization

3. **Source:**
   Union of Soviet Socialist Republics. "Letter dated 21 August 1985 addressed to the President of the Conference on Disarmament by the Representative of the Union of Soviet Socialist Republics transmitting the texts of documents connected with the USSR proposal 'the basic directions and principles of international cooperation in the peaceful exploration of outer space under conditions of its non-militarization'".
   See also: - "Letter dated 9 October 1985 from the Representative of the Union of Soviet Socialist Republics on the First Committee to the Chairman of the First Committee". A/C.1/40/4, 9 October 1985.

4. **Summary:**
   As an element of its proposal concerning "international cooperation in the peaceful exploration of outer space under conditions of its non-militarization", the Soviet Union suggests the creation of a World Space Organization. One of the functions of this body would be to "assist, where necessary, in monitoring the observance of agreements already concluded or to be concluded, with a view to preventing an arms race in outer space".

Proposal Abstract P18(A85)

1. **Arms Control Problem:**
   Nuclear weapons - ballistic missiles

2. **Verification Type:**
   International control organization

3. **Source:**
   Leng, Russell and William Epstein. "Calculating Weapons Reductions". Bulletin of the Atomic Scientists 41, no. 2 (February 1985): 39-41.

4. **Summary:**

The authors propose a "point count" plan for reductions in American and Soviet nuclear forces. Each country would be allotted an arbitrary number of points, say 1,000, which it would use to assess the military power of the other side's forces. Points would be distributed according to the military threat posed by a particular force component. After the assessments were exchanged, they would serve as the basis for annual reductions on a percentage basis of nuclear forces. Percentage reductions are important because they would require deeper cuts in the forces of the side with the larger arsenal. This method would reduce the difference between the sizes of the two nuclear forces with each cut. The plan is attractive, the authors suggest, because each side could use whichever system it wanted to make up the point value of cuts.

The following issues would be subject to negotiation before the system could be implemented:

(1) what weapons to include,
(2) the size of the annual percentage reduction,
(3) the annual schedule for the exchange of point distributions, announcement of cuts and disposal of weapons,
(4) how deep to make the cuts (i.e. reductions for how many years), and
(5) the verification of weapon disposal.

The authors propose verification by an international commission. They note that the Soviet Union has indicated a willingness to accept such a measure in the case of real disarmament as opposed to arms control.

Proposal Abstract P19(G61)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   - control posts
   (c) Seismic sensors - extra-border stations
   (d) Short-range sensors - sampling
   (e) Remote sensors - satellites
   - sampling
   - aerial

3. **Source:**
   United Kingdom and United States. "Draft treaty on the discontinuance of nuclear weapon tests". ENDC/9, 21 March 1962. (Originally GEN/DNT/110, 18 April 1961).
   See also: - "Draft treaty banning nuclear weapons tests in all environments". ENDC/58, 27 August 1962, abstract P20(G62).

4. **Summary:**

A Control Organization (CO) is to be set up to assure parties that obligations under the treaty are being carried out. Parties are obligated to cooperate promptly and fully with this body. The CO will consist of a Control Commission, a Detection and Identification System, a Chief Executive Officer and a Conference of the Parties (Articles 2 and 3). The bulk of this draft treaty is composed of very detailed provisions relating to this Control Organization.

The Commission will be composed of three permanent members (UK, US, USSR) plus six non-permanent members elected for two years (Article 4). Decisions are to be made by simple majority vote. The Commission will have the following functions (Article 6):

(1) establishment of procedures and standards for the operation and installation of the Detection System,
(2) appointment of the Chief Executive Officer,
(3) approval of deputy administrators,
(4) establishment of procedures for disseminating data produced by the detection system,
(5) reporting to the Conference,
(6) deciding on location of elements of the Detection System,
(7) deciding on permanent flight routes for overflights by aircraft sampling missions,
(8) conclusion of agreements with states to aid in carrying out treaty provisions,
(9) ensuring research and development into detection methods,

(10) establishment of procedures for conduct of PNEs, and
(11) periodic review of the detection system (Article 14).

The Conference will meet regularly or upon request. Most matters will be decided by simple majority votes. The functions of the Conference include (Article 8):

(1) election of non-permanent members of the Commission,
(2) approval of reports and budget submitted by the Commission,
(3) approval of reports to the UN,
(4) approval of agreements between the CO and other bodies, and
(5) approval of amendments to the treaty.

The Chief Executive Officer will be responsible to the Commission. He will appoint, organize and direct staff except as specifically provided in the draft treaty. Staff will be recruited on as wide a geographic basis as possible, from personnel acceptable to the governments of the countries from which they come. Certain exceptions are provided to this rule of geographic recruitment mainly relating to balance among UK, US and USSR personnel in some situations and composition of inspection teams. The Chief Executive Officer will also prepare the budget of the CO, develop a research and development program concerning detection technology, and recommend details for setting up the Detection System (Article 9). The Chief Executive Officer will also designate by public notice seismic events eligible for on-site inspection. He will send inspection teams if certain conditions are met (see Article 10). A maximum of 20 inspections may be conducted per year on the territory of an original party.

The treaty also provides in detail what is expected of parties in the way of cooperation with the CO (Articles 11 and 12). Special provisions are also made for the conducting and monitoring of PNE (Article 13). Details as to financing of the CO and privileges and immunities of its staff are given as well (Articles 15 and 16).

The Detection and Identification System is outlined at length in Annex I of the draft treaty. It is composed of a headquarters, regional offices, land control posts and ship-based control posts, systems of satellites, radiochemistry laboratories, air and water sampling facilities, on-site inspection facilities and communications facilities. Air sampling will be conducted by aircraft. Criteria for on-site inspection are spelled out in great detail (see Articles 8 and 9 of Annex I) as are other elements of the system.

Annex II outlines the Privileges and Immunities to be accorded CO personnel. A Preparatory Commission is described in Annex III which will come into existence when the treaty is signed with the goal of setting up the CO.

Proposal Abstract P20(G62)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   - obligatory
   (c) Seismic sensors - extra-border stations
   - intra-border stations
   (d) Remote sensors - satellite
   - shipborne

3. **Source:**
   United Kingdom and United States. "Draft treaty banning nuclear weapon tests in all environments". ENDC/58, 27 August 1962.
   See also: - "Draft treaty on the discontinuance of nuclear weapon tests". ENDC/9, 21 March 1962, abstract P19(G61).

4. **Summary:**

An International Scientific Commission will be set up to verify compliance with the treaty. The Commission will include an International Staff and a Verification System. Parties would be obligated to cooperate with the Commission (Article 2).

Article 3 outlines the functions of the Commission which include:
(1) collecting and reporting data on suspicious seismic events and identifying such events,
(2) supervising the Verification System,
(3) consulting with parties to determine the nature of an event,
(4) approving the annual budget,
(5) arranging inspections,
(6) establishing such laboratories and facilities as are needed,
(7) appointing an Executive Officer,
(8) conducting research to improve verification technology, and
(9) arranging conferences of the parties.

The organization and procedures of the Commission are detailed in Article 4. It will be composed of fifteen members of which three will be permanent members (UK, US and USSR). The other members will be determined by a formula intended to maintain a geographic balance of members. Terms for non-permanent members will be three years. Decisions will be by majority vote unless otherwise specified. The Commission will meet when it decides it to be warranted or upon the request of any party. Parties not members of the Commission may participate at its meetings.

The functions and organization of the International Staff are detailed in Articles 5 and 6. Functions include supervising the

collection of data and its analysis as well as manning of the Verification System. An Executive Officer will recruit, organize and oversee the staff which will include qualified scientific and technical personnel.

The Verification System is discussed in Article 7. It is intended to provide rapid and reliable collection and reporting of data. The following "classes" of stations will be included:

(1) Stations manned by nationals of the state in which they are located. Observers will be present at these stations.
(2) Existing stations to be maintained and manned by individual parties.
(3) Stations to be manned by Commission personnel.
(4) Detection equipment located in space, the atmosphere or beneath the sea manned by the Commission or by the parties, as the Commission decides.

Existing stations are to be in operation within six months of the entry into force of the agreement while the newer stations are to be in operation within a year. The general equipment of these stations is listed.

Article 8 describes provisions for on-site inspection. Procedures and criteria for locating and identifying a seismic event are spelled out in general. Data from stations located on the territory of an event can not be used to render the event ineligible for inspection. The Executive Officer will designate suspicious events requiring investigation according to the criteria outlined. An inspection may be carried out on the territory of the UK or US if the USSR requests it or vice versa. Inspections on the territory of any other party may be conducted if the Commission so directs. A maximum number of inspections each year is to be decided upon. The number of inspections on the territory of permanent members is further restricted. Inspection teams will be organized by the Executive Officer and they are to have undisputed and immediate access to the area designated as the location of the event.

The Commission will annually review the treaty and the operations of the Verification System and make reports to the parties (Article 11). Finances are dealt with in Article 12; privileges and immunities in Article 14.

Proposal Abstract P21(G83)

1. **Arms Control Problem:**
   Nuclear weapons - comprehensive test ban

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   (c) International exchange of information

3. **Source:**
   Australia. "International management panel". CD/400, 22 July 1983.

4. **Summary:**

Australia proposes the establishment of an international management panel composed of scientific experts and assisted by a secretariat to "ensure the smooth functioning of the monitoring and verification arrangements established under a CTBT." This panel would be the successor body to the Committee on Disarmament's Ad Hoc Group of Scientific Experts to consider International Cooperative Measures to Detect and Identify Seismic Events. The panel would perform functions similar to those of "groups of experts" established under other treaties, but the unique character of a CTBT requires, in the Australian view, a somewhat different body and hence this paper makes a proposal different from those offered in the Soviet draft basic provisions (CD/346, see abstract J100(G83)) and the Swedish draft treaty (CD/381, see abstract K42(G83)).

The international panel would be independent in scientific and technical matters, but would be responsible to the Consultative Committee on which all parties to a treaty would be represented. The panel would be composed of 15 experts appointed for a five year period by the Depository on the recommendation of the Consultative Committee. The panel would be responsible for:

(1) evaluating the technical operation of and proposing changes to the international monitoring, detection and verification measures, including the techniques and procedures for on-site inspections;
(2) acting as a forum to receive suggestions from States concerning (1) above and to discuss technical matters for which a state seeks clarification;
(3) supervising and monitoring the international exchange of seismic and atmospheric information; and
(4) conducting on-site inspections at the request of the Consultative Committee and reporting the results of inspections to the Committee.

If a request for an on-site inspection is made, both the requesting party and the accepting party would be entitled to appoint an expert, ex officio, to the panel while it considers and implements the on-site inspection request.

P22(G82)

Proposal Abstract P22(G82)

1. **Arms Control Problem:**
   Chemical and biological weapons - use

2. **Verification Type:**
   (a) International control organization
   (b) National self-supervision
   (c) On-site inspection - selective
   - sampling
   (d) Complaints procedure - consultation and cooperation
   - consultative commission
   - referral to United Nations

3. **Source:**
   Belgium. "Note verbale dated 16 June 1982 transmitting memorandum on monitoring of the prohibition of the use in combat of chemical and bacteriological (biological) or toxin weapons". UN Document A/S-12/AC.1/18, 16 June 1982.
   See also: - "Memorandum on monitoring of the prohibition of the use in combat of chemical and bacteriological (biological) or toxin weapons". CD/301, 4 August 1982.

4. **Summary:**

Belgium proposes a protocol on monitoring the use of chemical and biological weapons in combat. The protocol would be linked to the Geneva Protocol of 1925 and the 1972 Biological Weapons Convention. Initially, states would undertake to solve problems relating to compliance through consultation and cooperation on a bilateral basis or through "appropriate international procedures" within the framework of the UN. The latter could involve international organizations such as the World Health Organization or the Advisory Committee established under the Protocol.

An Advisory Committee composed of parties to the Protocol, the Geneva Protocol and the 1972 BW Convention would meet every four years to discuss its methods of work and technical and budgetary questions. A Permanent Committee of ten members appointed for a renewable four year term by the depository of the protocol in consultation with the members of the Advisory Committee would administer the protocol between sessions of the Advisory Committee. A Technical Secretariat would assist the Advisory Committee and the Permanent Committee in designing and improving monitoring procedures. National monitoring agencies would also assist the Advisory Committee in carrying out its duties.

Any member of the Advisory Committee, the depository or the director of the Technical Secretariat may lodge a detailed complaint with supporting evidence with the Permanent Committee concerning a

suspected violation of the prohibition of use of chemical or biological weapons. The Permanent Committee would be convened immediately or not more than five days after the lodging of the complaint. The Committee would consider whether bilateral consultations could solve the dispute and in this regard would offer its good offices. If this is not possible, the Committee would dispatch a fact-finding mission, if possible within forty-eight hours of the events referred to in the complaint. A refusal of the request to send a fact-finding mission must be justified by an explanation showing that such a mission would jeopardize the higher interests of the state at that time. The Permanent Committee may make a new request if it is not satisfied with the explanation. If there is a further refusal, the matter would be reported to the depository who could inform the UN bodies to which a complaint concerning the same events may have been brought.

Samples collected on-site would be analysed by at least two laboratories selected from a list of laboratories proposed by members of the Advisory Committee. The Permanent Committee would transmit a summary of its findings or its "authoritative opinion" to the depository for circulation among all members of the Advisory Committee. If the Advisory Committee and Permanent Committee cannot reach a unanimous decision regarding a determination of facts, the report should reflect the different views that have been presented.

Proposal Abstract P24(G80)*

1. **Arms Control Problem:**
   Chemical weapons - destruction of facilities
   - destruction of stocks
   - production
   - stockpiling
   - use

2. **Verification Type:**
   (a) International control organization
   (b) International exchange of information
   (c) Complaints procedure - referral to new international body

3. **Source:**
   China. "Chinese delegation's proposals on the main contents of a convention on the prohibition of chemical weapons". CD/102, 19 June 1980.
   See also: - CD/PV.89, 3 July 1980.

4. **Summary:**

The Chinese delegation contends that, in order to facilitate verification, stocks and production plants should be destroyed rather that shut down or converted to peaceful uses.

After entry into force of the convention, the parties should, within a specified time, disclose information pertaining to the numbers and locations of CW stocks and production facilities, as well as give a timetable for their destruction.

Stringent and effective measures of international control and supervision should be employed. An international control organ should be created to verify the destruction of CW stocks and plants. It should also be empowered to investigate charges concerning the use of CWs and other violations of the convention. In PV.89 China claims that such an international verification body is necessary in view of the disparity between countries in verification techniques and devices. It should possess qualified experts and advanced verification technology to permit it to discharge its function.

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* There is no abstract P23

Proposal Abstract P25(G79)

1. **Arms Control Problem:**
   Chemical weapons - destruction of stocks
   - production
   - stockpiling
   - binary agents

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   (c) Short-range sensors - sampling

3. **Source:**
   Egypt. CD/PV.31, 26 April 1979.

4. **Summary:**

Compliance with any convention is largely dependent upon the verification methods employed. To be of value the convention must provide a limited degree of assurance to all parties that their compliance with it will not lead to diminished security and that other parties will equally comply with the convention.

Egypt encourages national verification measures including unilateral declarations concerning destruction of stockpiles, national legislation and regulation aimed at implementing the ban, and establishment of a national verification system to coordinate activities with an equivalent international body. However, the national security of parties makes it imperative that verification be universally non-discriminatory in nature and international in application. Only a qualified international verification organ can coordinate national and international verification measures. Only such a organ can be universal and non-discriminatory provided it is given the necessary degree of independence.

Extraterritorial monitoring techniques are only effective in verifying declared intentions related to known chemical plants or unclassified stockpiles or capabilities. These techniques alone cannot guarantee that a prohibition of the development and production of CWs is being complied with. On-site inspection remains the most effective and applicable verification measure capable of providing assurances to parties. The recent UK and FRG workshops* have shown that on-site inspections can be employed without sacrificing industrial secrets. Future workshops encourage development of techniques that allow inspectors to take samples and photographs.

Verification measures should encompass non-organophosphorous agents as well as organophosphorous ones. Binary agents should also be covered.

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* See: - abstracts C69(G79) and C86(G79).

Proposal Abstract P26(G82)

1. **Arms Control Problem:**
   Chemical weapons - destruction of stocks
   - destruction of facilities

2. **Verification Type:**
   (a) International control organization
   (b) Remote sensors
   (c) On-site inspection - selective
   (d) International exchange of information - reports to international body
   (e) National self-supervision

3. **Source:**
   Canada. "A proposed verification organization for a chemical weapons convention". CD/313, 16 August 1982.

4. **Summary:**

The paper proposes a verification regime consisting of three levels of responsibility:
(1) International consultative committee;
(2) International verification organization; and
(3) National authorities.

The International Consultative Committee would be composed of representatives of all parties to the convention and would ensure compliance with the obligations undertaken by verifying the execution of measures agreed upon. The Committee would also periodically report to the appropriate body of the UN to inform it of progress accomplished in implementation of the provisions of the convention and to report any failures in compliance. A small permanent secretariat would act on behalf of the Committee to administer and implement the verification process.

The International Verification Agency (IVA) would carry out the actual verification process on behalf of the International Consultative Committee. This would be accomplished with a combination of verification methods (remote sensing by national technical means, on-site inspection, data analysis). The IVA would also coordinate inspections with national authorities and receive and validate complaints from member States as directed by the Consultative Committee.

Each party would be required to establish a National Implementation Authority to implement and verify the provisions of the convention. These authorities would be expected to carry out routine monitoring required by the convention and to cooperate with the IVA by supplying inspection personnel, documentation, data and information and by receiving and assisting international inspections determined by the IVA according to the instructions of the International Consultative Committee.

Proposal Abstract P27(G82)

1. **Arms Control Problem:**
   Chemical weapons
   - destruction of stocks
   - destruction of production facilities
   - production
   - stockpiling

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   - challenge
   - obligatory
   (c) Remote sensors - satellite
   (d) International exchange of information - declarations
   (e) Complaints procedure - consultative committee
   - referral to Security Council

3. **Source:**
   United Kingdom. "Working paper on verification and the monitoring of compliance in a chemical weapons convention". CD/244, 18 February 1982.
   See also:
   - "Working paper on remote detection of chemical weapon field tests". CCD/371 27 June 1972 (Abstract J136(G72)).
   - "Working paper on the feasibility of extraterritorial surveillance of chemical weapons tests by air monitoring at the borders". CCD/502, 2 July 1976 Corr.1 (Abstract J137(G76)).
   - "Chemical weapons convention: verification and compliance - the challenge element". CD/431, 10 February 1984.
   - CD/PV.157, 23 February 1982.

4. **Summary:**
   The United Kingdom believes that any chemical weapons convention must be adequately verifiable. Working paper CD/244 contains a discussion of draft elements for verification and monitoring of compliance for a convention on chemical weapons. The United Kingdom proposed a combination of national and international means of verification. Parties to the convention may use remote sensing (satellite) to verify implementation of and compliance with a convention. An international consultative committee of experts composed of a representative from each party assisted by one or more advisers and chaired by the Depositary named in the convention would be established. The Consultative Committee would be responsible for monitoring implementation of and compliance with:
   (1) The declaration of existing stockpiles of chemical warfare agents and munitions, chemical munition-filling facilities and chemical warfare agent production facilities,

(2) The non-production of chemical weapons during the implementation period, and
(3) The destruction, dismantling or conversion of stocks and production facilities.

The verification procedure to be used by the Consultative Committee, as set forth in the discussion section, would consist of:

(1) Regular near site inspections in the vicinity of selected chemical factories producing dual-purpose agents for peaceful purposes. This would allow the Consultative Committee to analyse the air, water and soil around the factory and thereby ascertain what the factory is producing without an intrusive on-site inspection,
(2) Monitoring the consumption of potential chemical warfare agents against declared chemical production, and,
(3) On-site inspections undertaken on a challenge basis, or preferably, regularly on the basis of a random selection by the Consultative Committee.

The United Kingdom elaborates upon challenge inspections in working paper CD/431. Challenge inspections would be used in addition to mandatory routine on-site inspection in order to ensure compliance. Challenge inspections could be requested if a violation of the convention is suspected; these inspections would cover declared facilities where a breach is suspected but was not revealed by routine inspection or non-declared facilities which had not been revealed by the challenged country.

The "Draft Elements" (CD/244) provide for the Consultative Committee to initiate an investigation after it receives a complaint of breach of obligations by a party from another party to the Convention. If a party, having received a request for an on-site inspection from the Committee, responds that it is not prepared to allow an on-site inspection, it would be obliged to substantiate its decision. If the Committee still wishes to conduct an on-site inspection, it may ask for additional information or a reconsideration of the decision in the light of new information. Provision is made in working paper CD/431 for an Executive Council assisting the Consultative Committee to begin procedures for a prompt ad hoc on-site inspection if no acceptable clarification is received within seven days. Parties would be under "a stringent obligation to accept challenge on-site inspection". A refusal would require the challenged party to propose within seven days of the refusal alternative on-site inspection measures to establish "beyond reasonable doubt" if a case of non-compliance had occurred. In case of further refusal, the matter may be referred to the Consultative Committee and/or the Security Council.

5. **Selected Comments of States:**

The German Democratic Republic (CD/PV.165, 23 March 1982) deplored the fact that the working paper provides virtually no role for a national verification system.

China (CD/PV.167, 30 March 1982) commented that CD/244 "offers a comparatively comprehensive proposal". China supported on-site

inspection and the establishment of an international control organization to verify destruction of stocks and dismantling of facilities. The organization would be empowered to initiate investigations in connection with a complaints about the use of chemical weapons or other violations and to "take appropriate measures" to deal with a complaint once it has been verified.

Switzerland (CD/PV.165, 23 March 1982) supports on-site inspections and believes that " it is essential that an explanation should be given for any refusal to authorize such an inspection." Provision should be made for a complaints procedure concerning violations including referral to the International Court of Justice, the recognition of whose competence should be obligatory.

Sweden (CD/PV.167, 30 March 1982) supported on-site inspection for verification, but suggested that a more balanced procedure for complaints and verification could have been developed from the elements of CD/220 ("Report of the Ad Hoc Working Group on Chemical Weapons to the Committee on Disarmament" CD/220, 17 August 1981), rather than by creating a new structure.

Proposal Abstract P28(G84)

1. **Arms Control Problem:**
   Chemical weapons - destruction of stocks
   - use

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   - challenge
   (c) National self-supervision
   (d) Review conferences

3. **Source:**
   Socialist States. "The organization and functioning of the Consultative Committee". CD/532, 8 August 1984.

4. **Summary:**

This working paper outlines proposals for the functioning of an international Consultative Committee to verify compliance with a chemical weapons convention. An Executive Council of the Consultative Committee would act on behalf of the Committee between its annual sessions. The Executive Council would be composed of fifteen members (ten members elected by the Consultative Committee for two year terms and the five permanent members of the Security Council). Both the Consultative Committee and Executive Council would take their decisions on substantive matters on the basis of consensus. If consensus is not possible, each party may express and record its opinion. A special session of the Consultative Committee could be convened to consider urgent matters within thirty days of the receipt of such a request.

The functions of the Consultative Committee would include:

(1) Coordinating all forms of verification and acting as liaison between national and international verification bodies;
(2) Developing, with the agreement of parties, standard verification techniques;
(3) Receiving, storing and making available information provided by parties in accordance with the convention;
(4) Facilitating consultations relating to implementation and compliance with the convention;
(5) Adopting specific procedures for on-site inspections;
(6) Verifying reports on the use of chemical weapons;
(7) Considering requests for on-site inspections and, subject to the consent of the host state, conducting on-site inspections;
(8) Assigning inspectors from a technical secretariat to participate in on-site inspections by challenge arranged through bilateral consultation;
(9) Training personnel of the national verification bodies in standard international verification techniques; and
(10) Arranging with parties procedures for sealing chemical weapon production facilities.

Proposal Abstract P29(G71)

1. **Arms Control Problem:**
   (a) Chemical weapons - production
   (b) Any arms control agreement

2. **Verification Type:**
   (a) International control organization
   (b) Complaints procedure - consultative commission
   - referral to new international body
   - referral to Security Council

3. **Source:**
   Netherlands. CCD/PV.502, 18 March 1971.
   See also: - CCD/PV.560, 27 April 1972.
   - CCD/410, 31 July 1973.
   - CCD/PV.617, 31 July 1973.
   - CCD/565, 30 March 1978.
   - CCD/PV.783, 30 March 1978.
   - CCD/PV.799, 10 August 1978.
   - UN Document A/AC.187/108, 5 April 1978, abstract P8(G78).
   - UN Document A/S.12/22, 27 May 1982, abstract P12(G82)

4. **Summary:**

A complaints procedure should consist of two stages:
(1) factual investigation by a body of experts or some international organ, and
(2) only thereafter, at the discretion of the complainant, referral to the Security Council on the strength of the finding of the international organ or body of experts.

The Netherlands intention in taking this approach is to separate the functions of investigation and political judgement. This would avoid complaints becoming too political and incriminating at an early stage.

In PV.560 the Netherlands makes reference to provisions for a consultative committee and to existing treaties such as the Tlatelolco Treaty and the Non-Proliferation Treaty. Such an international verification body might serve as a nucleus for a general international disarmament organ which in due course could take over responsibilities in other arms control fields.

The Netherlands elaborates in CCD/410 on its proposal for creation of a standing organ to support a CW convention. The organ would be composed of a plenary Conference, a Board, and a Secretariat headed by an Administrator. Its functions would include the following:
(1) updating the list of prescribed chemical substances;
(2) providing a clearing house for information exchange of various types;

(3) receiving declarations and reports of various types from the parties;
(4) providing observers for stockpile destruction;
(5) conducting inquiries for supplementary information from parties;
(6) conducting random checks; and
(7) conducting special investigations.

The Conference might consider the results of any investigations, make recommendations to the parties and submit reports to the Security Council of the UN. If such an international organ existed there would be no need for a review conference.

In CCD/565 the Netherlands introduces a very similar proposal concerning an International Disarmament Agency. Such a body is desirable because there is a need for a permanent organization to streamline consultations and implement measures as the number of complex multilateral arms control treaties increases. The new agency would at first be entrusted only with the verification of a CW treaty. However, it would be intended from the beginning that such an organ would take on other tasks, such as the verification of other agreements. Ultimately the agency would become the operational framework for the implementation of international arms control and disarmament agreements with functions mainly in the field of verification. In addition, the Agency would be instrumental in the preparation and organization of review conferences already provided for in several disarmament treaties and could serve, as well, as a clearing house for information on disarmament. The structure of the Agency would be similar to that described in CCD/410.

To realize this organ, the Netherlands proposes first that the UN Secretary General seek the views of UN member states on the functions and structure of the proposed Agency. To this end, the Netherlands suggests that a paragraph be added to the final document of the Special Session on Disarmament. Once replies had been received, a committee could be created to negotiate on the structure and function of the Agency.

Proposal Abstract P30(G81)

1. **Arms Control Problem:**
   Chemical weapons - production
   - stockpiling
   - destruction of facilities
   - temporary conversion of facilities

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   (c) Complaints procedure - consultative committee
   - referral to Security Council
   (d) Remote sensors

3. **Source:**
   The Netherlands. "Consultation and cooperation, verification measures and complaints procedure in the framework of the Convention on the Complete and Effective Prohibition of the Development, Production and Stockpiling of all Chemical Weapons and on Their Destruction". CD/203, 30 July 1981.

4. **Summary:**

The Netherlands proposes a combination of national and international measures for verification of compliance with the Convention on the Complete and Effective Prohibition of the Development, Production and Stockpiling of All Chemical Weapons. A National Implementation Agency would oversee the implementation of the Convention and would collect data and supply it to an international Consultative Committee of experts which would verify compliance with the Convention. The Consultative Committee would oversee the destruction, dismantling and temporary conversion of declared means of production of chemical weapons.

The Consultative Committee would be empowered to conduct on-site inspections to verify compliance. The Committee would also be empowered to enquire into facts concerning alleged ambiguities in or violations of compliance with the Convention. Any party to the Convention would be able to lodge a complaint with the UN Security Council concerning a breach of obligations deriving from the Convention. The Security Council would be competent to investigate such complaints and would report to the parties on the investigation. Provision is also made for each party to the Convention to assist any other party which requests assistance if the Security Council deems that the party has been harmed or is likely to be harmed as a result of the violation of the Convention.

Each party to the Convention may also use remote sensing by national technical means to verify compliance with the Convention. States would undertake not to impede verification by remote sensing.

P31(G82)

Proposal Abstract P31(G82)

1. **Arms Control Problem:**
Chemical weapons - production

2. **Verification Type:**
(a) International control organization
(b) On-site inspection - selective

3. **Source:**
Finland. "Working paper on the relation of verification to the scope of a ban on chemical warfare agents". CD/263, 22 March 1982.

4. **Summary:**

The paper notes that it is difficult to determine an illicit purpose for the development and production of a chemical until the chemical has been used as a chemical warfare agent or placed in munitions or army depositories. Therefore, it is necessary to use additional definitions for chemical warfare agents to facilitate verification. Finland proposes a number of criteria for assisting in verifying the purpose of chemicals. These criteria are:

(1) Toxicity: There seems to be agreement that the most dangerous super-toxic lethal chemicals have no non-hostile use, therefore they can be declared prohibited agents on the basis of toxic properties alone.

(2) A list of prohibited compounds composed by experts of all countries based on an identification of the chemical structure of the compounds.

(3) A standardized verification and identification system for prohibited compounds.

(4) A licencing system with surveillance for monitoring production of dual purpose chemicals with limited civilian use. Production and use outside the licencing system would be prohibited.

Finland suggests that the purpose criterion must be the basis of a ban on such common dual purpose chemicals as hydrogen cyanide or phosgene. Other chemical agents, however, such as mustards, can be banned on the basis of chemical structure. A consultative committee with a permanent secretariat could be responsible for updating the list of prohibited compounds and for controlling the licencing system.

The paper concludes by suggesting that the proposals made do not solve the problem of verification, but if there is agreement upon the scope of the ban, the reliability of the convention would be increased.

Proposal Abstract P32(A83)

1. **Arms Control Problem:**
   Chemical weapons - production
   - stockpiling - destruction of stocks
   - destruction of facilities

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   - obligatory
   (c) Records monitoring - plant
   (d) Complaints procedure - referral to Court of Justice of the European Communities

3. **Source:**
   Amadei, F. and E. Jacchia. "Of Interdiction of Chemical Warfare". In Chemical Weapons and Arms Control: Views from Europe, pp. 9-15. Rome: Centro di Studi Strategici, June 1983.

4. **Summary:**

The authors suggest that an international control agency modelled on the Nuclear Security Control (NSC), a body of the Commission of the European Communities, could be used to verify a chemical weapons convention. The verification system of the NSC is binding upon member states and consists of statements rendered by countries to the Commission and on-site inspections. The statements include information on the fundamental technical characteristics of installations and on nuclear materials so that updating of the accounting of minerals, raw materials and special fissile materials is possible. Inspectors of the NSC have the right of access anytime to any place, to any item of information and to any individual connected with the materials and/or installations subject to inspection. Parties subject to control may appeal any decision of the Commission to the Court of Justice of the Communities.

A similar system of materials accountancy and on-site inspections could be used to verify a chemical weapons convention and in fact could be less complicated than the system used for nuclear materials for the following reasons. First, the quantities of chemicals which would be used to produce chemical weapons are more substantial than the relevant amounts of fissile materials. Second, only a few countries have indigenous commercially exploitable resources of the ore yielding phosphorus used in most lethal nerve gases. Third, only a few dozen plants in the world can process the ore to produce elemental phosphorus. However, because phosphorus has many civilian uses, verification may be hampered by the difficulty of monitoring the movement of large quantities of raw material and by concern for protecting industrial secrets.

P33(G83)

Proposal Abstract P33(G83)

1. **Arms Control Problem**
   Chemical weapons - production
   - stockpiling
   - destruction of stocks
   - destruction of facilities
   - use

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   - obligatory
   (c) Complaints procedure - consultative committee
   - referral to Security Council

3. **Source:**
   United States of America. "United States detailed views on the contents of a chemical weapons ban". CD/343, 10 February 1983.

4. **Summary:**

On the issue of verification, this detailed paper proposes the establishment of a Consultative Committee composed of representatives of the parties to a chemical weapons convention. The Committee would conduct mandatory systematic on-site inspection of:

(1) declared stockpiles;
(2) destruction of declared stocks;
(3) closure and destruction of declared production facilities;
(4) permitted production facilities for super-toxic lethal chemicals for protective purposes; and
(5) production for permitted purposes, of specified types of chemicals which are considered to pose a particular risk.

The Committee would also conduct ad hoc on-site inspections for fact-finding purposes. The Consultative Committee would make no judgement as to whether or not a party is in compliance with the provisions of the convention. A Committee Secretariat would be established to assist the Committee in carrying out its duties.

A party which suspects a violation of the convention may request clarification of the matter bilaterally or through the Consultative Committee. Such a request, which may involve a request for an ad hoc on-site inspection, would include an explanation of the reasons for concern, but conclusive evidence would not be necessary. A fact-finding panel, composed of not more than fifteen members (ten members named for a two year period and the five permanent members of the Security Council), would then promptly conduct a fact-finding inquiry. The fact-finding panel would be empowered to conduct any ad hoc on-site inspections deemed necessary by at least five members

of the panel. The panel would report within six months of the date of its convening. Any party receiving a request for an ad hoc on-site inspection "should have a stringent obligation to permit the inspection". If a party refuses to grant an inspection, the Depositary may promptly notify the Security Council. Any party which remains unsatisfied with the results obtained by the fact-finding panel within six months would be able to request the Depositary to convene a special meeting of the Consultative Committee to discuss the compliance issue.

Fact-finding procedures would also be utilized for investigating reports of the use of chemical weapons. Evidence of use would constitute evidence of violation of the convention.

5. Selected Comments of States:

Most members of the Committee on Disarmament expressed their positions in general on verification elements of a chemical weapons convention such as those outlined in this American paper. Broadly speaking, national positions fell into one of three groupings, but these positions were not mutually exclusive and many countries expressed support for a combination of measures. The groupings presented here describe national positions generally in terms of emphasis.

Many countries supported international on-site inspection including: China (CD/PV.118, 26 March 1981), Pakistan (CD/PV.119, 31 March 1981), United Kingdom (CD/PV.121, 3 April 1981), Japan (CD/PV.123, 9 April 1981), Federal Republic of Germany (CD/PV.138, 16 July 1981), Australia (CD/PV.168, 1 April 1982) and France (CD/PV.172, 20 April 1982). The USSR (CD/PV.211, 12 April 1983) "agreed that the verification of the destruction of stocks and of the production of super-toxic lethal chemicals for permitted purposes should be conducted on the basis of mandatory international on-site verifications". The USSR (CD/PV.243, 21 February 1984) also expressed its willingness to accept the permanent presence of inspectors at a special facility for destruction of some chemicals.

Other countries emphasized national verification measures including: Cuba (CD/PV.124, 14 April 1981), Czechoslovakia (CD/PV.167, 30 March 1982), Bulgaria (CD/PV.178, 12 August 1982) and Venezuela (CD/PV.180, 19 August 1982). The German Democratic Republic (CD/PV.196, 22 February 1983), Bulgaria (CD/PV.204, 17 March 1983) and Yugoslavia (CD/PV.207, 29 March 1983) also commented on the absence of a role for national means of verification in the American document.

Some countries preferred a balance between national and international means of verification. These included Switzerland (CD/PV.137, 14 July 1981), Indonesia (CD/PV.180, 19 August 1982), German Democratic Republic (CD/PV.8 February 1983), Poland (CD/PV.195, 17 February 1983), Spain (CD/PV.227, 12 July 1983) and Romania (CD/PV.256, 5 April 1984).

India (CD/PV.142, 30 July 1981) raised some questions about verification of a chemical weapons convention. India pointed out that the mere presence of toxic chemicals does not indicate that weapons

are being manufactured so it would be useful if experts could develop a method of identifying chemical weapons production facilities based on observable characteristics which distinguish them from civil industrial facilities. On-site inspection would be more useful for verifying the destruction of stocks than for verifying non-production because of the size and complexity of the worldwide chemical industry. More work must be done to consider how national technical means of verification, which evolved for use in bilateral agreements, can be used in a multilateral context. India (CD/PV. 32, 9 August 1983) also expressed a concern that verification of a chemical weapons convention not inhibit the development of the civilian chemical industry in the Third World.

Proposal Abstract P34(G85)

1. **Arms Control Problem:**
   Chemical weapons - production

2. **Verification Type:**
   (a) International control organization
   (b) On-site inspection - selective
   - challenge
   - sampling
   (c) Records monitoring - plant
   (d) Short-range sensors
   (e) Complaints procedure - consultative committee

3. **Source:**
   United Kingdom. "Verification of non-production of chemical weapons: proposals for inspection procedures and data exchange". CD/575, 6 March 1985.
   See also:
   - United Kingdom. "Verification of non-production of chemical weapons". CD/353, 8 March 1983. (See abstract C101(G83)).
   - The Netherlands. "Size and structure of a chemical disarmament inspectorate". CD/445, 7 March 1984. (See abstract C78(G84)).
   - United Kingdom. "Verification of non-production of chemical weapons". CD/514, 10 July 1984.
   - United Kingdom. "Chemical weapons convention: The organs and constitution of the organization". CD/589, 11 April 1985.

4. **Summary:**
   This technical working paper advances proposals on how routine monitoring of the non-production of chemical weapons, as suggested in CD/353 and developed in CD/514, might be applied in an attempt to obtain effective verification while maintaining commercial confidentiality. The paper proposes the establishment of an international inspectorate modelled on that used by the International Atomic Energy Agency. As proposed in the Netherlands paper CD/445, the inspectorate would consist of a Consultative Committee, an Executive Council and a Technical Secretariat of inspectors and supporting staff.

   Inspectors could be authorized to perform the following functions:
   (1) Examine records at the site,
   (2) Measure substances subject to control under the convention,
   (3) Verify measurements and inspect control equipment,
   (4) Observe facility measurement, sampling and calibration procedures, and
   (5) Take duplicate or additional samples for analysis by the inspectorate.

A state would have the right to refuse an inspector designated by the inspectorate. The inspectorate would then designate another inspector. Only two such refusals would be allowed. The movement of inspectors in plants or installations would be regulated by agreement between the inspectorate and inspected states. Access to restricted information would be strictly controlled and if the inspection results did not reveal any cause for concern, the inspectorate would report only that. Information would not be communicated to any other state organizations or personnel.

Annex I to the paper outlines detailed proposals for suggested inspection procedures for declared production facilities for high risk chemicals and precursors. The proposals cover the content of declarations, plant inspection procedures, production details to be provided to inspectors and the areas of the plant to be visited. Annex II proposes a system of reporting data on high and medium risk agents (as defined in CD/514) to the inspectorate. Facilities producing high risk chemicals would be subject to random inspection, but those producing medium risk chemicals would not.

Disputes relating to procedural or administrative difficulties would be referred to the Executive Council if consultations between the inspectorate and a party could not resolve them. The convention would also make provision for arbitration of disputes which could not be resolved by the Executive Council. Substantive problems such as unresolved ambiguities in verification could be referred to the Executive Council if a party could not eliminate doubts.

Working paper CD/514 classifies certain chemicals with legitimate civil use under categories based on "risk". Risk is calculated according to the biological risk of poisoning and the perceived risk to the convention if these chemical agents and key precursors are manufactured industrially. The paper also proposes specific verification measures for each category. High risk chemical agents and high risk precursors would be subject to regular reporting and routine, random on-site inspection outlined in CD/353. Medium risk chemicals and precursors would be subject to regular reporting only, including information exchange on production statistics.

In working paper CD/589, the United Kingdom proposes that a special challenge inspection panel be formed within the inspectorate. The panel would be designated by the director-general of the inspectorate and would be composed of at least seven inspectors or more depending upon the size of the facility to be inspected. Inspectors from the challenging and challenged states would be excluded from participating in a special challenge inspection. Such inspections would be carried out on very short notice so establishing a standing list of qualified experts available on a contingency basis would be useful.

Proposal Abstract P35(G80)

1. **Arms Control Problem:**
   Conventional weapons - aircraft
   - ground forces
   - ships

2. **Verification Type:**
   International control organization

3. **Source:**
   Italy. "Working paper: Control and limitation of international arms transfers". CD/56, 5 February 1980.

4. **Summary:**

Italy advocates setting up, within the UN, an ad hoc body to monitor, control and limit, through agreed procedures, the international arms trade. This body should be structured into a number of regional Committees, corresponding to the areas taken into consideration for transfer restraints, which would include all major arms suppliers and recipients of the region.

A General Conference within this ad hoc body should:

(1) shape general guidelines for control and limitation arrangements,
(2) elaborate legal, technical and military criteria for achievement of such arrangements,
(3) control effective compliance with agreed arrangements, and
(4) keep a register of transactions.

Specific arrangements concerning different areas should then be worked out within the framework of the regional Committees.

CHAPTER Q
REVIEW CONFERENCES

Like complaints procedures, and international control organizations, review conferences form an element in a verification system, though they are not themselves correctly described as a verification "technique". The purpose of a review conferences is to assure the parties to an arms control agreement of its continued effectiveness, providing for a broad examination of whether or not the aims of the agreement are being achieved. Such an examination might include an evaluation of the effectiveness of the control and verification systems incorporated into the agreement. Any deficiencies which had arisen might be pointed out and perhaps improvements made. The resulting changes might involve resolution of relatively minor administrative difficulties or more far-reaching amendments to the treaty provisions.

Consideration of new developments in science and technology has been suggested as a function of the review conference. Since verification often involves the use of highly sophisticated modern technology, the verification system of an arms control treaty may be substantially affected by scientific and technological developments. New methods of detection may have emerged whose use, either in conjunction with or in lieu of the existing verification means, could improve the effectiveness of the verification system. On the other hand, new methods of evasion may have been developed which could increase the chance of avoiding detection. In this case additional techniques might have to be added to the verification system if confidence in its effectiveness is to be maintained.

The review conference also can play an important role in defining the scope of the arms control problem with which the treaty is intended to deal. New aspects of the problem may have surfaced or a new urgency with regard to familiar problems as yet inadequately resolved may have become more evident. Such developments can have important consequences for the verification and control systems by imposing new demands on existing procedures and by requiring modifications to be made to the old system. Cases in point are the review conferences of the Non-Proliferation Treaty (developments in a number of non-nuclear weapons states have placed new urgency on the extension and improvements of IAEA safeguards with regard to nuclear facilities and on the monitoring of peaceful nuclear explosions by some international body) and the BW Convention (the controversy surrounding allegations of CBW use and the increasing potential of genetic recombination techniques for producing biological weapons have argued for an expanded verification system).

It has been suggested that if some form of permanent international control organization is created then provision in a treaty for a review conference would be unnecessary as the functions carried out by such a conference could be undertaken by the international organ. Ideally such an organization would ideally evaluate the verification system continually and have the power to alter its administration if necessary.

It is a moot point whether there actually exists much difference in terms of efficacy between an international control organization which continually monitors and, when necessary, modifies the verification system, and reliance on a periodic review conference which conducts an ex post facto evaluation by providing a forum where complaints about the system can be raised. The former method has the advantage in theory of, perhaps, being more impartial and faster reacting. On the other hand, problems would impede achieving agreement over the establishment of the international body. In fact, the creation of such an organ does not seem practicable at present. Moreover, it is likely that major modifications of the verification system would still require a formal meeting of the parties. One must question, as well, whether a fast reacting organization is really necessary in this context.

On the other hand, the review conference concept faces the problem of being founded on national evaluations of the verification scheme's performance. Many states may not possess a national capability to effectively do this. This problem might be partially rectified if an international body was given limited power to conduct an evaluation of the verification system and to make a report to the parties at a review conference. Another potential difficulty with the review conference is that it might involve a higher level of politicization of issues than an international control organization routinely evaluating the verification system.

The central issue of judging the merits and weaknesses of the review conference in this context is whether any challenges to the verification system which arise are effectively dealt with. The NPT Review Conferences seem to indicate that problems similar to those encountered when negotiating the treaty will be encountered at the review conference and that while the review conference allows questions about the efficacy of the verification system to be discussed, it results in few, if any, concrete modifications to the verification system. This conclusion seems to be borne out by the Sea Bed Treaty Review Conference and the first BW Review Conference. The second BW Review Conference, however, did see agreement on some modest confidence-building measures, involving increased exchanges of information with some relevance to verification.

Some provision for authoritatively evaluating the effectiveness of the verification system in achieving the objectives assigned to it is a valuable element in any meaningful arms control agreement. Given the difficulties over achieving agreement on the creation of an international control organization which could continuously evaluate and, when necessary, modify the verification system, a review conference, despite its limitations, would seem to be the only currently acceptable method to try to meet this objective.

The actual form of the review conference provisions in existing treaties and draft treaties is fairly straightforward. The usual requirement is a meeting of the parties five years after the treaty comes into force.

AUTHOR INDEX

This is an index to authors of verification proposals, commentaries on these proposals and related materials contained in this Compendium. Individual authors and corporate bodies including governments and international organizations are covered. Treaties and international agreements, however, have been incorporated into the Subject Index. Full citations to the source document for each entry are given so that this index can also serve as a selected bibliography to the Compendium.

Arrangement of the entries is letter-by-letter. Sub-arrangement is by date, beginning with the earliest work by the same author. A list of abbreviations used here can be found in the first volume of the Compendium. All references are to proposal abstract numbers.

Key to Proposal Abstract Numbers

Source Codes:

A = Academic
G = Government
I = Intergovernmental body
T = Treaty

Chapter — Type of source

A19.1(I85)

Identification number within chapter — Year of publication

Chapter Codes:

A	Verification, General
B	General On-site Inspection
C	Selective On-site Inspection
D	IAEA Safeguards
E	Progressive/Zonal On-site Inspection
F	Control Posts
G	Records Monitoring
H	Non-Physical/Psychological Inspection
I	Short-range Sensors
J	Remote Sensors
K	Seismic Sensors
L	Literature Survey
M	International Exchange of Information
N	National Self-supervision
O	Complaints Procedure
P	International Control Organization
Q	Review Conference

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SUBJECT INDEX

This analytical subject index uses two general typologies of subject terms to classify the proposal abstracts: terms describing arms control objectives and terms describing types of verification systems. Each of the terms in both these typologies is subdivided in this index according to the categories of the other typology. For example, the term "GENERAL AND COMPLETE DISARMAMENT", which refers to an arms control objective, is subdivided by the terms describing verification systems such as "On-site inspection", "Literature survey", etc. Conversely, each verification descriptive term is subdivided by subject terms dealing with arms control objectives. Of course, only subdivisions for which there are entries in the Compendium are listed.

Someone interested in general and complete disarmament (GCD) will therefore be able to ascertain which GCD proposals abstracted in the Compendium include, for example, general on-site inspection as part of their verification system, simply by looking under "GENERAL AND COMPLETE DISARMAMENT" subdivided by "On-site inspection - general". Similarly, someone interested in general on-site inspection can locate which of these proposals have concerned GCD by looking under "ON-SITE INSPECTION - GENERAL" subdivided by "General and complete disarmament". These examples demonstrate that it is important when using this subject index to be alert to the hierarchical relationships between terms. These hierarchical relationships are indicated by type face and by hyphens.

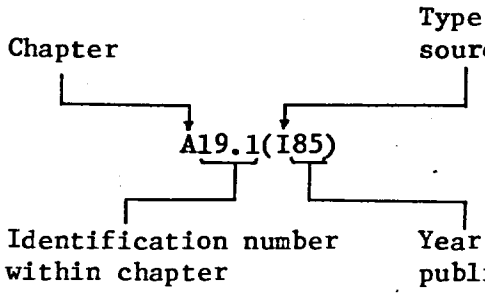
Also covered in this index are arms control treaties and agreements as well as selected institutions and organizations. Arrangement of the entries is letter-by-letter. All references are to proposal abstract numbers.

In order to aid in giving clarity and precision to a complex arms control vocabulary, this index indicates the hierarchical, synonymous and other relationships between terms. The following abbreviations are used to indicate these relationships.

Abbreviations Used

Symbol	Meaning
USE	Use indicated term
UF	Used for
BT	Broader term
NT	Narrower term
RT	Related term
SN	Scope note

Key to Proposal Abstract Numbers



Type of Source Codes:

A = Academic
G = Government
I = International body
T = Treaty

Chapter Codes:

A	Verification, General
B	General On-site Inspection
C	Selective On-site Inspection
D	IAEA Safeguards
E	Progressive/Zonal On-site Inspection
F	Control Posts
G	Records Monitoring
H	Non-Physical/Psychological Inspection
I	Short-range Sensors
J	Remote Sensors
K	Seismic Sensors
L	Literature Survey
M	International Exchange of Information
N	National Self-supervision
O	Complaints Procedure
P	International Control Organization
Q	Review Conference

A

ABM TREATY. 26 May 1972; J67(T72)
- Violations; A12(A84), A28(G84), A37(G85), A38(A83)
AGREEMENT BETWEEN EGYPT AND ISRAEL, AND ANNEX. September 1, 1975; B13(T75)
AGREEMENT GOVERNING THE ACTIVITIES OF STATES ON THE MOON AND OTHER CELESTIAL BODIES (THE MOON TREATY). December 5, 1979; B26(T84)
AGREEMENT ON ENDING THE WAR AND RESTORING PEACE IN VIETNAM AND PROTOCOLS. 27 January 1973; B11(T73)
ANTARCTIC TREATY. 1 December 1959; B7(T59)
- Verification; C19(A66)
Anti-satellite weapons systems
USE REGIONAL ARMS CONTROL - OUTER SPACE - ASATs
Anti-Ballistic Missile Treaty
USE ABM TREATY

ANY ARMS CONTROL AGREEMENT

SN Includes proposals for verification systems which do not identify a specific arms control objective or which are intended for general application

- Complaints procedure
-- consultation and cooperation; A8.1(A82), A20.3(A86), A20.56(G86), J11(I81)
-- consultative and commission; A3(A82), A12(A84), A14(A84), J9(G80), O1(A77), O2(A82)
-- referral to International Court of Justice; P3(A68)
-- referral to new international body; P3(A68), P4(G73), P29(G71)
-- referral to Security Council; A8.1(A82), P4(G73), P5(A74), P29(G71)
- International control organization; A8(A83), A8.1(A82), A20.54(G86), A20.71(G86), B3(A68), C2(A58), C5(A62), C15(A85), H1(A61), H3(A61), J2(G76), J5(G78), J7(A80), P1(A62), P2(A65), P3(A68), P4(G73), P5(A74), P6(A78), P7(G78), P8(G78), P9(G78), P10(G82), P11(G82), P12(G82), P29(G71)
-- ISMA; J5(G78), J6(A80), J7(A80), J10(A81), J11(I81), J12(A82), J14(A82), J16(A82), J22(A83), J23(A83), J26(A84), J29(A84), J31(A84), J31.1(A84), J33(A85), P8(G78), P10(G82), P12(G82)
- International exchange of information; A8(A83), A8.1(A82), A10(G83), A20.4(G86), A20.71(G86), B3(A68), C15(A85), J2(G76), J3(A77), J5(G78), J11(I81), J22(A83), J23(A83), J26(A84), M1(A62), M2(A65), M3(A83), O1(A77), O2(A82), P4(G73), P5(A74), P8(G78), P12(G82)
- Literature survey; G2(A63), H5(A63), P5(A74)
-- budgetary analysis; B1(A61), G1(A63), L1(A58)
- Non-physical/psychological inspection; B1(A61), C2(A58), C7(A67), C9(A72), H1(A61), H2(A61), H3(A62), H4(A63), H5(A63), H6(A63), P7(G78)
- On-site inspection
-- challenge; A20.59(G86), C10(A76), C103(A85)
-- general; A20.71(G86), B1(A61), B2(A65), B2.1(A67), B3(A68), B3.1(A85), G2(A63), J33(A85), P2(A65)
-- IAEA safeguards; A8.1(A82), A16.1(A85), A20.52(G86), A20.54(G86), C11(A83)
-- non-obligatory; C4(A61)
-- obligatory; C103(A85)
-- sampling; B1(A61), C3(A58), C5(A62), C6(A65), C8(A68), G1(A63), G2(A63)
-- selective; A6(A83), A7(A83), A8(A83), A8.1(A82), A10(G83), A13(A84), A14(A84), A16(A85), A17(A85), A20.3(A86), A20.4(G86), A20.53(G86), A20.56(G86), A20.59(G86), A20.592(G86), A20.6(G86), A20.7(G86), A20.72(G86), A20.9(G86), C1(A58), C1(A58), C3(A58), C4(A61), C5(A62), C6(A65), C7(A67), C8(A68), C9(A72), C10(A76), C11(A83), C12(A83), C13(A84), C14(A84), C15(A84), C103(A85), G1(A63), J2(G76), J4(A77), J23(A83), J27(A84), J30(A84), J37(A85), J38(A85), M2(A65), P3(A68), P8(G78), P10(G82)
- Records monitoring
-- economic; B1(A61), C2(A58), C9(A72), G1(A63)

ANY ARMS CONTROL AGREEMENT (cont'd)
-- personnel; G2(A63), M1(A62)
-- plant; B1(A61), G1(A63), G3(A65)
- Remote sensors; A3(A82), A6(A83), A7(A83), A8(A83), A8.1(A82), A10(G83), A14(A84), A17(A85), A19(A85), A20(G85), A20.1(A86), A20.3(A86), A20.4(G86), A20.52(G86), A20.53(G86), A20.59(G86), A20.592(G86), A20.6(G86), A20.72(G86), C5(A62), C11(A83), C14(A84), C15(A85), C103(A85), G2(A63), J2(G76), J4(A77), J9(G80), J15(A82), J23(A83), J37(A85), J41(G85), J68.1(A85), J95.2(A86), M3(A83), P5(A74),
-- aerial; B1(A61), C2(A58), C7(A67), C9(A72), J1(A61), J10(A81), J20(A82), J25(A83), J27(A84), J34(A85), J39(A85),
-- ELINT; A16.1(A85), J13(A82), J17(A82), J27(A84), J35(A85), J39(A85), J71(A69)
-- ground-based; J39(A85)
-- radar; A16.1(A85), J13(A82), J17(A82), J21(A82), J27(A84), J30(A84), J31.1(A84), J34(A85), J35(A85), J39(A85)
-- satellite; A9(A83), A13(A84), A16(A85), A16.1(A85), A18(A85), A20.591(G86), A20.71(G86), B1(A61), C9(A72), C13(A84), J3(A77), J5(G78), J6(A80), J7(A80), J8(A80), J10(A81), J11(I81), J12(A82), J13(A82), J14(A82), J16(A82), J17(A82), J18(A82), J19(A82), J21(A82), J22(A83), J24(A82), J25(A83), J26(A84), J27(A84), J28(A84), J30(A84), J31(A84), J31.1(A84), J32(A84), J33(A85), J34(A85), J35(A85), J36(A85), J38(A85), J39(A85), J40(A85), J71(A69), P8(A78), P12(G82)
- Review conference; P8(G78), P10(G82), P12(G82)
- Seismic sensors; A16.1(A85), C2(A58), C13(A84)
- Short-range sensors; C9(A72), C11(A83)
-- monitoring devices; C5(A62), D38(A82)
-- seals; I1(A78)
- Verification - general; A1(A61), A1.1(A63), A1.2(A78), A2(I78), A2.1(I78), A2.2(G81), A2.3(G81), A3(A82), A4(A83), A5(A83), A6(A83), A7(A83), A8(A83), A8.1(A82), A9(A83), A10(G83), A11(A84), A12(A84), A13(A84), A14(A84), A15(A84), A15.1(A85), A15.2(A85), A16(A85), A16.1(A85), A17(A85), A18(A85), A19(A85), A19.1(I85), A19.2(I85), A20(G85), A20.1(A86), A20.2(G86), A20.3(A86), A20.4(G86), A20.5(G86), A20.51(G86), A20.52(G86), A20.53(G86), A20.54(G86), A20.55(G86), A20.56(G86), A20.57(G86), A20.58(G86), A20.59(G86), A20.591(G86), A20.592(G86), A20.6(G86), A20.7(G86), A20.71(G86), A20.72(G86), A20.8(G86), A20.9(G86), A20.91(G86), A20.92(I86), B3.1(A85), B22.2(A87), J68.1(A85), J95.2(A86)
ARMS CONTROL AGENCY (WESTERN EUROPEAN UNION); C66(G79), C82(A70), C86(G79)

B

Ballistic missiles
USE NUCLEAR WEAPONS - BALLISTIC MISSILES

BIOLOGICAL WEAPONS CONVENTION. 10 April 1972; O12(T72), M15(A72), O13(I80)
- Violations
RT CHEMICAL AND BIOLOGICAL WEAPONS - USE - "Yellow rain" A9(A83), A12(A84), A20(G85), A37(G85), A38(A83), C58(A83), C59(A84), C60(A85), C62(A85), C64(A83), M16(A83), O2(A82)
BIOLOGICAL WEAPONS
BT CHEMICAL AND BIOLOGICAL WEAPONS
RT CHEMICAL WEAPONS
- Complaints procedure
-- referral to new international body; O10(G68)
-- referral to Security Council; O10(G68)
BIOLOGICAL WEAPONS - DESTRUCTION OF STOCKS
SN Includes destruction of biological agents and munitions
- Complaints procedure
-- consultation and cooperation; O12(T72), O13(I80), O13.1(I86)
-- consultative commission; O13(I80), O13.1(I86)
-- referral to Secretary General; O11(G69)
-- referral to Security Council; O11(G69), O12(T72), O13(I80), O13.1(I86)
- International exchange of information; O13.1(I86)
- National self supervision; O12(T72), O13(I80), O13.1(I86)
- Review conference; O12(T72), O13(I80), O13.1(I86)
BIOLOGICAL WEAPONS - PRODUCTION
SN Includes production of biological agents and vectors, as well as the filling of munitions
- Complaints procedure
-- consultation and cooperation; C60(A85), O12(T72), O13(I80), O13.1(I86)
-- consultative commission; O5(A85), O13(I80), O13.1(I86)
-- referral to Secretary General; O11(G69)
-- referral to Security Council; C60(A85), O11(G69), O12(T72), O13(I80), O13.1(I86)
- International exchange of information; M15(A72), M16(A83), O13.1(I86)
- National self-supervision; O12(T72), O13(I80), O13.1(I86)
- On-site inspection
-- selective; C63(A58), C64(A83)
- Records monitoring
-- personnel; C63(A58)
- Remote sensors
-- satellite; C64(A83), M16(A83)
- Review conference; O12(T72), O13(I80), O13.1(I86)
- Verification - general; A8(A83)
BIOLOGICAL WEAPONS - PROLIFERATION
USE BIOLOGICAL WEAPONS - DESTRUCTION OF STOCKS
BIOLOGICAL WEAPONS - RESEARCH AND DEVELOPMENT
- Complaints procedure
-- referral to Secretary General; O11(G69)
-- referral to Security Council; O11(G69)

BIOLOGICAL WEAPONS - RESEARCH AND DEVELOPMENT (cont'd)
- International exchange of information; M15(A72)
- On-site inspection
-- selective; C63(A58)
- Records monitoring
-- personnel; C63(A58)

BIOLOGICAL WEAPONS - STOCKPILING
SN Includes stockpiling of biological agents, vectors and munitions
USE BIOLOGICAL WEAPONS - DESTRUCTION OF STOCKS

BIOLOGICAL WEAPONS - USE
- Complaints procedure
-- referral to Secretary General; O11(G69)
-- referral to Security Council; O11(G69)

Black boxes
USE SHORT RANGE SENSORS - MONITORING DEVICES

Bombers
USE NUCLEAR WEAPONS - MANNED AIRCRAFT
CONVENTIONAL WEAPONS - AIRCRAFT

Budgetary analysis
USE LITERATURE SURVEY - BUDGETARY ANALYSIS

C

CAMOUFLAGE
USE CONCEALMENT - CAMOUFLAGE

CHEMICAL AND BIOLOGICAL WEAPONS
NT CHEMICAL WEAPONS
BIOLOGICAL WEAPONS
- Complaints procedure; M14(G70)
-- consultation and cooperation; N1(G70)
-- referral to new international body; N1(G70)
-- referral to Security Council; N1(G70)
- International control organization; J97(G77), M14(G70), N1(G70)
- International exchange of information; J97(G77), M14(G70)
-- declarations; N1(G70)
-- reports to international body; N1(G70)
- Literature survey; M14(G70), N1(G70)
- National self-supervision; N1(G70)
- On-site inspection
-- challenge; N1(G70)
-- progressive/zonal; C30(A82)
-- selective; C30(A82), J97(G77), N1(G70)
- Records monitoring
-- economic; N1(G70)
- Remote sensors
-- aerial; N1(G70)
-- satellite; N1(G70)

CHEMICAL AND BIOLOGICAL WEAPONS - DESTRUCTION OF STOCKS
SN Includes destruction of agents, vectors and munitions
- Complaints procedure

CHEMICAL AND BIOLOGICAL WEAPONS - DESTRUCTION OF STOCKS (cont'd)
-- consultation and cooperation; N2(G69), O8(G71)
-- referral to Security Council; N2(G69), O8(G71)
- International control organization; O8(G71)
- International exchange of information
-- reports to international body; O8(G71)
- National self-supervision; N2(G69), O8(G71)
- On-site inspection
-- selective; O8(G71)
- Review conference; N2(G69)
- Verification - general; A37(A85)

CHEMICAL AND BIOLOGICAL WEAPONS - PRODUCTION
SN Includes production of agents and the filling of munitions
USE CHEMICAL AND BIOLOGICAL WEAPONS - DESTRUCTION OF STOCKS

CHEMICAL AND BIOLOGICAL WEAPONS - PROLIFERATION
- Complaints procedure
-- consultation and cooperation; N2(G69)
-- referral to Security Council; N2(G69)
- National self-supervision; N2(G69)
- Review conference; N2(G69)

CHEMICAL AND BIOLOGICAL WEAPONS - RESEARCH AND DEVELOPMENT
USE CHEMICAL AND BIOLOGICAL WEAPONS - PROLIFERATION

CHEMICAL AND BIOLOGICAL WEAPONS - STOCKPILING
SN Includes stockpiling of agents and munitions
USE CHEMICAL AND BIOLOGICAL WEAPONS - PROLIFERATION

CHEMICAL AND BIOLOGICAL WEAPONS - USE
RT BIOLOGICAL WEAPONS - USE
CHEMICAL WEAPONS - USE
- Complaints procedure
-- consultation and cooperation; P22(G82)
-- consultative commission; C59(A84), P22(G82)
-- referral to International Court of Justice; O9(A85)
-- referral to Security Council; O9(A85)
-- referral to United Nations; P22(G82)
- International control organization; C55(G82), C56(I84), C57(G85), P22(G82)
- International exchange of information; C59(A84)
- National self-supervision; P22(G82)
- Non-physical/psychological inspection; C56(I84), C57(G85), C62(A85), H9(A83)
- On-site inspection
-- sampling; C55(G82), C56(I84), C57(G85), C58(A83), C61(A85), C62(A85), J94(A84), O9(A85), P22(G82)
-- selective; A38(A83), C55(G82), C56(I84), C57(G85), C58(A83), C60(A85), C61(A85), C62(A85), J94(A84), O9(A85), P22(G82)
- Short-range sensors
-- monitoring devices; C55(G82), C56(I84)
-- sampling; C55(G82), C56(I84), C57(G85)
- Verification - general; A30(A85), A37(G85), A38(A83)
- "Yellow rain"; C58(A83), C59(A84), C60(A85), C61(A85), C62(A85), H9(A83), O9(A85)

CHEMICAL WEAPONS
BT CHEMICAL AND BIOLOGICAL WEAPONS
RT BIOLOGICAL WEAPONS
CHEMICAL WEAPONS - BINARY AGENTS
SN Includes chemical weapons produced by combining two non-lethal substances
- Complaints procedure; C98(A83)
-- consultative commission; C98(A83)
- International control organization; C105(G85), C106(G85), P25(G79)
- International exchange of information; G9(A74)
- On-site inspection
-- challenge; C98(A83)
-- sampling; C94(A82), C95(G82), C96(G82), C97(G82)
-- selective; C94(A82), C95(A82), C96(G82), C97(G82), C98(A83), C105(G85), C106(G85), I17(G77), P25(G79)
- Records monitoring
-- economic; G9(A74)
-- plant; C106(G85), G9(A74)
- Remote sensors; C94(A82), G9(A74)
- Short-range sensors
-- monitoring devices; C98(A83)
-- sampling; I17(G77), P25(G79)
CHEMICAL WEAPONS - DESTRUCTION OF FACILITIES
SN Includes destruction, conversion to peaceful uses or "mothballing" of agent production plants and munitions filling plants
- Complaints procedures; P32(A83)
-- consultation and cooperation; C79(G84), M18(G76), O14(G79), O15(G80)
-- consultative commission; A3(A82), C69(G81), C76(G84), C79(G84), C95(G82), C98(A83), E13(G79), M17(G72), M18(G76), N15(G82), O14(G79), O15(G80), O15.1(G86), P27(G82), P30(G81), P33(G83)
-- referral to new international body; P24(G80)
-- referral to Security Council; C79(G84), M17(G72), M18(G76), N15(G82), O14(G79), O15(G80), P30(G81), P33(G83)
-- referral to United Nations; C76(G84), C95(G82), C102(A85)
- International control organization; A3(A82), C69(G81), C76(G84), C78(G84), C79(G84), C88(A80), C91(G80), C95(G82), C99(A83), C102(A85), C105(G85), C106(G85), C110(G85), E13(G79), J134(G84), M17(G72), M18(G76), M19(G76), N8(A79), N15(G82), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80), P24(G80), P26(G82), P27(G82), P30(G81), P32(A83), P33(G83)
- International exchange of information; C66(G79), C76(G84), M21(A80), N6(G73), N15(G82), P24(G80)
-- declarations; C77(G84), C79(G84), C95(G82), M17(G72), O14(G79), O15(G80)
-- reports to international body; C88(A80), C106(G85), N8(A79), N19(G85), P26(G82)
- National self-supervision; A3(A82), C88(A80), C99(A83), C110(G85), M18(G76), N6(G73), N8(A79), N9(A80), N15(G82), N16(A83), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80), P26(G82)

CHEMICAL WEAPONS - DESTRUCTION OF FACILITIES (cont'd)
- On-site inspection
-- challenge; A3(A82), C76(G84), C78(G84), C80(A85), C88(A80), C95(G82), C98(A83), C102(A85), J134(G84), M19(G76), P27(G82)
-- general; J134(G84)
-- non-obligatory; N16(A83), O14(G79)
-- obligatory; C68(A80), C69.1(G86), C79(G84), M18(G76), P27(G82), P32(A83), P33(G83)
-- progressive/zonal; E13(G79)
-- sampling; C78(G84), C95(G82), N16(A83), N19(G85)
-- selective; A3(A82), A20.2(G86), A20.72(G86), A20.91(G86), C60(A85), C65(A79), C66(G79), C67(G79), C68(A80), C69(G81), C69.1(G86), C76(G84), C77(G84), C78(G84), C79(G84), C80(A85), C87(A80), C88(A80), C91(G80), C95(G82), C98(A83), C99(A83), C102(A85), C105(G85), C106(G85), C110(G85), I16(G71), J133(A80), M17(G72), M18(G76), M19(G76), N15(G82), N16(A83), N17(G84), N19(G85), O2(A82), O14(G79), O15(G80), O15.1(G86), P26(G82), P27(G82), P30(G81), P32(A83), P33(G83)
- Records monitoring
-- plant; C95(G82), N19(G85), P32(A83)
- Remote sensors; C76(G84), C79(G84), C95(G82), J133(A80), J134(G84), N15(G82), O15(G80), P26(G82), P30(G81)
-- satellite; C65(A79), C68(A80), C69(G81), C87(A80), P27(G82)
- Review conference; C79(G84), M17(G82), M18(G76), O14(G79)
- Short-range sensors; C77(G84), C79(G84), C99(A83)
-- monitoring devices; C68(A80), C91(G80), C95(G82), C98(A83), C102(A85), I8(G76), I16(G71), I20(G85), M17(G72), M18(G76), M19(G76), N9(A80)
-- sampling; C68(A80), C95(G82), I16(G71), N6(G73)
-- seals; C65(A79), C68(A80), C69.1(G86), C91(G80), I8(G76), I16(G71), M17(G72), M18(G76), M19(G76), N6(G73), N9(A80)
CHEMICAL WEAPONS - DESTRUCTION OF STOCKS
SN Includes destruction of chemical agents and munitions
- Complaints procedure; P32(A83)
-- consultation and cooperation; C79(G84), M18(G76), N5(G73), N7(G74), O14(G79), O15(G80)
-- consultative commission; A3(A82), C76(G84), C79(G84), C95(G82), C98(A83), E13(G79), M18(G76), N10(G85), N15(G82), O14(G79), O15(G80), O15.1(G86), P27(G85), P33(G83)
-- referral to new international body; N7(G74), P24(G80)
-- referral to Security Council; C79(G84), M18(G76), N3(G70), N5(G73), N7(G74), N10(G85), N15(G82), O14(G79), O15(G80), P27(G82), P33(G83)
-- referral to United Nations; C76(G84), C95(G82), C102(A85)
- International control organization; A3(A82), C45(A76), C65(A79), C69(G81), C75(G83), C76(G84), C78(G84), C79(G84), C88(A80), C95(G82), C99(A83), C102(A85), C105(G85), C106(G85), C110(G85), E13(G79), J134(G84), M18(G76), M19(G76), N3(G70), N5(G73), N7(G74), N8(A79), N9(A80), N15(G82), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80), P8(G78), P12(G82), P24(G80), P25(G79), P26(G82), P27(G82), P28(G84), P32(A83), P33(G83)

CHEMICAL WEAPONS - DESTRUCTION OF STOCKS (cont'd)
- International exchange of information; C66(G79), C76(G84), C109(A83), G9(A74), J135(A77), M21(A80), N3(G70), N6(G73), N9(A80), N15(G82), P8(G78), P12(G82), P24(G80)
-- declarations; C75(G83), C77(G84), C79(G84), C89(A80), C95(G82), C106(G85), N4(A73), N5(G73), O14(G79), O15(G80)
-- reports to international body; C88(A80), C106(G85), N7(G74), N8(A79), N19(G85), P26(G82)
- National self-supervision; A3(A82), C88(A80), C99(A83), C110(G85), M18(G76), N3(G70), N4(A73), N5(G73), N6(G73), N7(G74), N8(A79), N9(A80), N10(G85), N16(A83), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80), P26(G84), P28(G84)
- On-site inspection
-- challenge; A3(A82), C76(G84), C78(G84), C80(A85), C81(A85), C88(A80), C92(A81), C95(G82), C98(A83), C102(A85), J134(G84), N10(G85), O15.1(G86), P27(G82), P28(G84)
-- general; I11(G83), I12(G84), I13(G84)
-- non-obligatory; N10(G85), N16(A83), O14(G79)
-- obligatory; C70(G74), C79(G84), C92(A81), M18(G76), N7(G74), N10(G85), P27(G82), P32(A83), P33(G83)
-- sampling; C78(G84), C95(G82), N16(A83), N19(G85)
-- selective; A3(A82), A20.2(G86), A20.4(G86), A20.53(G86), A20.592(G86), A20.72(G86), C45(A76), C60(A85), C65(A79), C66(G79), C69(G81), C71(G76), C72(G76), C73(G77), C74(A80), C75(G83), C76(G84), C77(G84), C78(G84), C79(G84), C80(A85), C81(A85), C88(A80), C89(A80), C92(A81), C95(G82), C98(A83), C99(A83), C100(A83), C102(A85), C105(G85), C106(G85), C109(A83), C110(G85), G4(A75), I10(G82), J135(A77), M18(G76), M19(G76), N5(G73), N7(G74), N10(G85), N16(A83), N17(G84), N19(G85), O2(A82), O14(G79), O15(G80), O15.1(G86), P8(G78), P12(G82), P25(G79), P26(G82), P27(G82), P28(G84), P32(A83), P33(G83)
- Records monitoring
-- economic; G4(A75), C9(A74), J138(G77)
-- plant; C95(G82), G4(A75), G9(A74), C19(G85), P32(A83)
-- sampling; G4(A75)
- Remote sensors; C74(A80), C76(G84), C79(G84), C81(A85), C95(G82), G9(A74), J134(G84), J135(A77), N5(G73), N15(G82), O15(G80), P26(G82)
-- sampling; N10(G85)
-- satellite; C87(A80), J138(G77), N10(G85), P8(G78), P12(G82), P27(G82)
- Review conference; C79(G84), M18(G76), N5(G73), N7(G74), O14(G79), P8(G78), P12(G82), P28(G84)
- Short-range sensors; C77(G84), C79(G84)
-- monitoring devices; A20.4(G86), C70(G74), C72(G76), C95(G82), C98(A83), C102(A85), I8(G76), I9(G79), I10(G82), I12(G84), I20(G85)
-- sampling; C65(A79), C69(G81), C70(G74), C71(G76), C72(G76), C73(G77), C75(G83), C95(G82), I9(G79), I10(G82), I11(G83), I13(G84), N6(G73), P25(G79)
-- seals; C72(G76), I8(G76), N6(G73), P12(G82)
CHEMICAL WEAPONS - PRODUCTION
SN Includes production of chemical agents and the filling of munitions
- Complaints procedure; A21(A85), C113(A83), L8(G73), P32(A83)

CHEMICAL WEAPONS - PRODUCTION (cont'd)
-- consultation and cooperation; C79(G84), M18(G76), M20(G72), N5(G73), N7(G74), N14(G82), O14(G79), O15(G80)
-- consultative commission; C59(A84), C69(G81), C76(G84), C79(G84), C90(G80), C95(G82), C98(A83), E13(G79), M17(G72), M18(G76), N10(G85), N11(G72), N14(G82), N15(G82), O14(G79), O15(G80), O15.1(G86), P27(G82), P29(G71), P30(G81), P33(G83), P34(G85)
-- referral to General Assembly; C90(G80)
-- referral to new international body; N7(G74), P24(G80), P29(G71)
-- referral to Secretary General; O16(G72)
-- referral to Security Council; C79(G84), C90(G80), M17(G72), M18(G76), N3(G70), N5(G73), N7(G74), N10(G85), N11(G72), N15(G82), O14(G79), O15(G80), O16(G72), P27(G82), P29(G71), P30(G81), P33(G83)
-- referral to United Nations; C76(G84), C95(G82), C102(A85), L8(G73)
- International control organization; C45(A76), C65(A79), C69(G81), C75(G83), C76(G84), C79(G84), C82(A70), C86(G79), C88(A80), C90(G80), C91(G80), C95(G82), C99(A83), C101(G83), C102(A85), C105(G85), C106(G85), C107(G85), C110(G85), E13(G79), G10(G74), L8(G73), M17(G72), M18(G76), M19(G76), M20(G72), N3(G70), N5(G73), N7(G74), N9(A80), N11(G72), N15(G82), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80), O16(G72), P8(G78), P12(G82), P24(G80), P25(G79), P27(G82), P29(G71), P30(G81), P31(G82), P32(A83), P33(G83), P34(G85)
- International exchange of information; C59(A84), C66(G79), C76(G84), C91(G80), C93(G81), C99(A83), C104(G85), C107.1(G86), C109(A83), G9(A74), G12(G86), I14(G71), J135(A77), M21(A80), N6(G73), N9(A80), N11(G72), N14(G82), N15(G82), P8(G78), P12(G82), P24(G80)
-- declarations; C69(G81), C75(G83), C79(G84), C84(A74), C88(A80), C89(A80), C90(G80), C95(G82), C101(G83), C102(A85), C105(G85), C106(G85), C107(G85), C110(G85), M17(G72), M18(G76), M19(G76), N5(G73), O14(G79), O15(G70)
-- reports to international body; C88(A80), C106(G85), C107(G85), D7(A82), M18(G76), M19(G76), M20(G72), N7(G74), N19(G85)
- Literature survey; C99(A83), L8(G73), N6(G73)
-- sampling; L9(G78)
- National self-supervision; C69(G81), C88(A80), C99(A83), G8(A73), G10(G74), I14(G71), M18(G76), N3(G70), N5(G73), N6(G73), N7(G74), N9(A80), N10(G85), N11(G72), N12(G72), N13(G75), N14(G82), N15(G82), N16(A83), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80)
- On-site inspection
-- challenge; C75(G83), C76(G84), C78(G84), C80(A85), C81(A85), C88(A80), C90(G80), C92(A81), C95(G82), C98(A83), C102(A85), C103(A85), C107(G85), C107.1(G86), C107.3(G86), G11(G85), G12(G86), N10(G85), N14(G82), O15.1(G86), P27(G82), P34(G85)
-- IAEA safeguards; D7(A82)
-- non-obligatory; M21(A80), N7(G74), N10(G85), N16(A83), O14(G79)
-- obligatory; C79(G84), C85(G79), C92(A81), C101(G83), C103(A85), C107.1(G86), D7(A82), G10(G74), M18(G76), N10(G85), P27(G82), P32(A83), P33(G83)
-- progressive/zonal; E13(G79)

CHEMICAL WEAPONS - PRODUCTION (cont'd)
-- sampling; C69(G81), C78(G84), C94(A82), C95(G82), C96(G82), C97(G82), C101(G83), C104(G85), C114(A83), G11(G85), N16(A83), P34(G85)
-- selective; A4(A83), A8(A83), A20.2(G86), A20.4(G86), A20.53(G86), A20.592(G86), A20.72(G86), A21(A85), C45(A76), C60(A85), C65(A79), C66(G79), C69(G81), C75(G83), C76(G84), C78(G84), C79(G84), C80(A85), C82(A70), C83(G70), C84(A74), C85(G79), C86(G79), C87(A80), C88(A80), C89(A80), C90(G80), C91(G80), C92(A81), C93(G81), C94(A82), C95(G82), C96(G82), C97(G82), C98(G83), C100(A83), C101(G83), C102(A85), C103(A85), C104(G85), C105(G85), C106(G85), C107(G85), C107.1(G86), C107.2(G86), C107.3(G86), C109(A83), C110(G85), C113(A83), C114(A83), C116(A84), D7(A82), G1(A63), G4(A75), G8(A73), G10(G74), G11(G85), G12(G86), I15(G71), I16(G71), I17(G77), J135(A77), M17(G72), M18(G76), M21(A80), N7(G74), N10(G85), N14(G82), N15(G82), N16(A83), N17(G84), N19(G85), O14(G79), O15(G80), O15.1(G86), P3(G78), P12(G82), P25(G79), P27(G82), P30(G81), P31(G82), P32(A83), P33(G83), P34(G85)
- Records monitoring
-- economic; C65(A79), C88(A80), C91(G80), G5(G70), G6(G70), G7(G71), G8(A73), G9(A74), G10(G74), G11(G85), G12(G86), J138(G77), L8(G73), M17(G72), N7(G74), N9(A80)
-- plant; C82(A70), C86(G79), C95(G82), C102(A85), C104(G85), C106(G85), C107(G85), D7(A82), G5(G70), G8(A73), G9(A74), G10(G74), N19(G85), P32(A83), P34(G85)
- Remote sensors; A8(A83), C76(G84), C79(G84), C81(A85), C94(A82), C95(G82), C103(A85), G9(A74), J135(A77), N5(G73), N14(G82), N15(G82), O15(G80), P30(G81)
-- sampling; C85(G79), C91(G80), N10(G85)
-- satellite; C65(A79), C85(G79), C87(A80), C91(G80), J138(G77), L8(G73), N10(G85), P8(G78), P12(G82), P27(G82)
- Review conference; C79(G84), C90(G80), M17(G72), M18(G76), N5(G73), N7(G74), O14(G79), P8(G78), P12(G82)
- Short-range sensors; C79(G84), I19(G83), P34(G85)
-- monitoring devices; A20.4(G86), C82(A70), C86(G79), C91(G80), C95(G82), C98(A83), C102(A85), C107(G85), D45(G83), G8(A73), G10(G74), I9(G79), I18(G82), I20(G85)
-- sampling; C65(A79), C69(G81), C75(G83), C82(A70), C83(A70), C86(G79), C90(G80), C91(G80), C95(G82), C114(A83), G8(A73), G10(G74), I9(G79), I14(G71), I15(G71), I17(G77), N6(G73), P25(G79)
-- seals; C91(G80), C110(G85), G8(A73), I20(G85), N6(G73), P12(G82)
CHEMICAL WEAPONS - PROLIFERATION
- Complaints procedure
-- consultation and cooperation; M18(G76), N7(G74)
-- consultative commission; M18(G76)
-- referral to new international body; N7(G74)
-- referral to Security Council; M18(G76), N7(G74)
- International control organization; M18(G76)
- International exchange of information; M18(G76)
-- reports to new international body; N7(G74)

CHEMICAL WEAPONS - PROLIFERATION (cont'd)
- National self-supervision; M18(G76), N7(G74)
- Review conference; M18(G76)
CHEMICAL WEAPONS - RESEARCH AND DEVELOPMENT
- Complaints procedure
-- consultative commission; C69(G81)
- International control organization; C69(G81)
- International exchange of information; C93(G81), I14(G71), M19(G76), N20(A73)
- Literature survey; J138(G77), N20(A73)
- National self-supervision; C69(G81), I14(G71), N20(A73)
- On-site inspection
-- selective; C69(G81), C93(G81)
- Remote sensors
-- sampling; C69(G81), J137(G76), J138(G77)
-- satellite; J136(G72), J138(G77)
- Short-range sensors
-- sampling; I14(G71)
CHEMICAL WEAPONS - STOCKPILING
SN Includes stockpiling of both chemical agents and munitions
- Complaints procedure; A21(A85), P32(A83)
-- consultation and cooperation; M18(G76), N7(G74), O14(G79), O15(G80)
-- consultative commission; C59(A84), C69(G81), C76(G84), C90(G80), C95(G82), C98(A83), E13(G79), M18(G76), N15(G82), O14(G79), O15(G80), O15.1(G86), P27(G82), P30(G81), P33(G83)
-- referral to General Assembly; C90(G80)
-- referral to new international body; N7(G74), P24(G80)
-- referral to Security Council; C90(G80), M18(G76), N7(G74), N15(G82), O14(G79), O15(G80), P27(G82), P30(G81), P33(G83)
-- referral to United Nations; C76(G84), C95(G82), C102(A85)
- International control organization; C45(A76), C65(A79), C69(G81), C76(G84), C88(A80), C90(G80), C95(G82), C99(A83), C102(A85), C105(G85), C106(G85), C110(G85), E13(G79), M18(G76), N7(G74), N15(G82), N19(G85), O14(G79), O15(G80), P12(G82), P24(G80), P25(G79), P27(G82), P30(G81), P32(A83), P33(G83)
- International exchange of information; C59(A84), C76(G84), C89(A80), C93(G81), C99(A83), C109(A83), G9(A74), I14(G71), J135(A77), M21(A80), N15(G82), P12(G82), P24(G80)
-- declarations; A3(A82), C69(G81), C88(A80), C90(G80), C95(G82), C102(A85), C106(G85), C110(G85), M18(G76), O14(G79), O15(G80), P27(G82)
-- reports to international body; C88(A80), C106(G85), M18(G76), N7(G74), N19(G85)
- Literature survey; C99(A83)
- National self-supervision; C88(A80), C99(A83), I14(G71), M18(G76), N7(G74), N15(G82), N16(A83), N19(G85), O14(G79), O15(G80)
- On-site inspection
-- challenge; C76(G84), C88(A80), C90(G80), C92(A81), C95(G82), C98(A83), C102(A85), O15.1(G86), P27(G82)
-- IAEA safeguards; D7(A82)
-- non-obligatory; N16(A83), O14(G79)

CHEMICAL WEAPONS - STOCKPILING (cont'd)
-- obligatory; C85(G79), C92(A81), D7(A82), P27(G82), P32(A83), P33(G83)
-- progressive/zonal; E13(G79)
-- sampling; C95(G82), N16(A83), N19(G85)
-- selective; A4(A83), A21(A85), C45(A76), C60(A85), C65(A79), C69(G81), C76(G84), C85(G79), C88(A80), C89(A80), C90(G80), C92(A81), C93(A81), C95(G82), C98(A83), C100(A83), C102(A85), C105(G85), C106(G85), C108(G72), C109(A83), C110(G85), G4(A75), J135(A77), N15(G82), N16(A83), N19(G85), O14(G79), O15(G80), O15.1(G86), P12(G82), P25(G79), P27(G82), P30(G81), P32(A83), P33(G83)
- Records monitoring
-- economic; C88(A80), G4(A75), G9(A74), J138(G77)
-- plant; C95(G82), C102(A85), C106(G85), D7(A82), G4(A75), G9(A74), N19(G85), P32(A83)
-- sampling; G4(A75)
- Remote sensors; A3(A82), C65(A79), C76(G84), C95(G82), C9(A74), J135(A77), N15(G82), O15(G80), P30(G81)
-- sampling; C85(G79)
-- satellites; C85(G79), J138(G77), P12(G82), P27(G82)
- Review conference; C90(G80), M18(G76), N7(G74), O14(G79), P12(G82)
- Short-range sensors
-- monitoring devices; C95(G82), C98(A83), C102(A85), I18(G82), I20(G85)
-- sampling; C90(G80), C95(G82), I14(G71), P25(G79)
-- seals; C110(G85), P12(G82)
CHEMICAL WEAPONS - USE
RT CHEMICAL AND BIOLOGICAL WEAPONS - USE
- Complaints procedure; C113(A83)
-- consultation and cooperation; C79(G84)
-- consultative commission; C76(G84), C79(G84), O15.1(G86), P33(G83)
-- referral to General Assembly; C115(A83)
-- referral to new international body; P24(G80)
-- referral to Secretary General; C112(A83), C115(A83)
-- referral to Security Council; C79(G84), P33(G83)
-- referral to United Nations; C76(G84)
- International control organization; C76(G84), C79(G84), C118(G85), P24(G80), P28(G84), P33(G83)
- International exchange of information; C76(G84), C93(G81)
- Non-physical/psychological inspection; C112(A83), C118(G85)
- On-site inspection
-- challenge; C76(G84), C118(G85), O15.1(G86)
-- non-obligatory; N16(A83)
-- obligatory; C79(G84), P33(G83)
-- sampling; C69(G81), C111(G82), C112(A83), C114(A83), C115(A83), C118(G85), N16(A83)
-- selective; C64(A83), C69(G81), C76(G84), C79(G84), C80(A85), C89(A80), C93(G81), C111(G82), C112(A83), C113(A83), C114(A83), C115(A83), C116(A84), C117(A85), C118(G85), N16(A83), O15.1(G86), P28(G84), P33(G83)

CHEMICAL WEAPONS - USE (cont'd)
- Remote sensors; C76(G84), C79(G84), C81(A85)
- Review conference; C79(G84)
- Short-range sensors; C79(G84)
-- monitoring devices; I9(G79)
-- sampling; I9(G79)
COMPLAINTS PROCEDURE
- Chemical weapons
-- destruction of facilities; P32(A83)
-- destruction of stocks; P32(A83)
-- production; A21(A85), C113(A83), P32(A83)
-- stockpiling; A21(A85), P32(A83)
-- use; C113(A83)
- Nuclear weapons
-- ballistic missiles; A21(A85)
- Regional arms control;
-- Europe; A21(A85)
-- Middle East; A21(A85)
-- outer space - ASATs; J62(G84)
COMPLAINTS PROCEDURE - CONSULTATION AND COOPERATION
SN Includes provisions for consulting with other parties bilaterally, multilaterally or through international organizations
- Any arms control agreement; A8.1(A82), A20.56(G86), J11(I81)
- Biological weapons
-- destruction of stocks; O12(T72), O13(I80), O13.1(I86)
-- production; C60(A85), O12(T72), O13(I80), O13.1(I86)
-- proliferation; O12(T72), O13(I80), O13.1(I86)
-- stockpiling; O12(T72), O13(I80), O13.1(I86)
- Chemical and biological weapons; N1(G70)
-- destruction of stocks; N2(G69), O8(G71)
-- production; N2(G69), O8(G71)
-- proliferation; N2(G69)
-- research and development; N2(G69)
-- stockpiling; N2(G69)
-- use; P22(G82)
- Chemical weapons
-- destruction of facilities; C79(G84), M20(G72), O14(G79), O15(G80)
-- destruction of stocks; C79(G84), M18(G76), N5(G73), N7(G74), O14(G79), O15(G80)
-- production; M18(G76), M20(G72), N5(G73), N7(G74), N14(G82), O14(G79), O15(G80)
-- use; C79(G84)
- Conventional weapons
-- aircraft; C124(T86)
-- ground forces; C124(T86)
- General and complete disarmament; M4(A55)
- Military budgets; B31(I82)
- Nuclear weapons
-- comprehensive test ban; K8(G69), K22(G75), K25(G76), K30(G77), K35(G79), K49(G85), M8(T85)
-- fissionable material "cutoff"; J110(A84)

COMPLAINTS PROCEDURE - CONSULTATION AND COOPERATION (cont'd)
-- partial test ban; K54(T74)
-- peaceful nuclear explosions; K8(G69), K30(G77), K35(G79)
-- proliferation; D2(I76), M8(T85), M12(I78)
-- research and development; A36(A84), J128(G78)
- Regional arms control
-- Antarctica; B7(T59)
-- demilitarization; B7(T59), B26(T79)
-- Europe; C124(T86)
-- general; 03(I80)
-- nuclear weapons free zones; B26(T79), D2(I76), M8(T85)
-- outer space; B26(T79), J47(G82), J48(G83)
-- outer space - ASATs; J48(G83), J61(A84), J64(A85)
-- sea bed; B27(G69), B28(G69), B29(G69), B30(T71)
COMPLAINTS PROCEDURE - CONSULTATIVE COMMISSION
- Any arms control agreement; A3(A82), A14(A84), A20.3(A86), J9(G80), 01(A77), 02(A82), P29(G71)
- Biological weapons
-- destruction of stocks; 013(I80), 013.1(I86)
-- production; 05(A85), 013(I80), 013.1(I86)
-- proliferation; 013(I80), 013.1(I86)
-- stockpiling; 013(I80), 013.1(I86)
- Chemical and biological weapons
-- use; P22(G82)
-- use; "yellow rain"; C59(A84)
- Chemical weapons
-- binary agents; C98(A83)
-- destruction of facilities; C69(G81), C76(G84), C79(G84), C95(G82), C98(A83), E13(G79), M17(G72), M18(G76), N15(G82), 014(G79), 015(G80), 015.1(G86), P27(G82), P30(G81), P33(G83)
-- destruction of stocks; C76(G84), C79(G84), C95(G82), C98(A83), E13(G79), M18(G76), N10(G85), N15(G82), 014(G79), 015(G80), 015.1(G86), P27(G82), P30(G81), P33(G83)
-- production; C59(A84), C69(G81), C76(G84), C79(G84), C90(G80), C95(G82), C98(A83), E13(G79), M17(G72), M18(G76), N10(G85), N11(G72), N14(G82), N15(G82), 014(G79), 015(G80), 015.1(G86), P27(G82), P29(G71), P30(G81), P33(G83), P34(G85)
-- proliferation; M18(G76)
-- research and development; C69(G81)
-- stockpiling; C59(A84), C69(G81), C79(G84), C90(G80), C95(G82), C98(A83), E13(G79), M18(G76), N15(G82), 014(G79), 015(G80), 015.1(G86), P27(G82), P30(G81), P33(G83)
-- use; C76(G84), C79(G84), 015.1(G86), P33(G83)
- Conventional weapons
-- aircraft; B16(T79)
-- ground forces; B13(T75), B16(T79), J140.1(G86)
-- ships; B16(T79), J44(A75)
- Nuclear weapons
-- anti-ballistic missile systems; A28(G84), A28.1(G84), A30(A85), J67(T72), 05(A85), 06(A85), 07(A85)

COMPLAINTS PROCEDURE - CONSULTATIVE COMMISSION (cont'd)
-- ballistic missiles; A28(G84), A28.1(G84), A30(85), J65(A85), J67(T72), J79(T79), J93(A84), O5(A85), O6(A85), O7(A85)
-- comprehensive ban; K21(A74), K30(G77), K41(G83), K49(G85), M8(T85), O5(A85)
-- cruise missiles; A28.1(G84), A30(A85), J65(A85), J79(T79), O5(A85)
-- fissionable material "cutoff"; J109(A80), J110(A84)
-- manned aircraft; A30(A85), J67(T72), J79(T79), O5(A85)
-- missile tests; A30(A85), J65(A85), J79(T79), J85(A80), J125(A74), O5(A85)
-- mobile ballistic missiles; A30(A85), J79(T79), O5(A85)
-- partial test ban; A28.1(G84), A30(A85), C52(T76)
-- peaceful nuclear explosions; C52(T76), K30(G77), O5(A85)
-- proliferation; M8(T85)
-- reentry vehicles; A30(A85), J79(T79), J125(A74), O5(A85)
-- research and development; J65(A85)
- Other weapons of mass destruction
-- environmental modification; O18(G76), O19(T77), O19.1(A84)
-- radiological weapons; C119(A82), O20(G79)
- Regional arms control
-- demilitarization; B11(T73), B13(T75), B15(A78), B16(T79), B22.2(A87), J44(A75)
-- Europe; B22.2(A87), J29(A84), O5(A85)
-- Indian Ocean; J44(A75)
-- Indochina; B11(T73)
-- Mediterranean Sea; J44(A75)
-- Middle East; B13(T75), B15(A78), B16(T79), B22.2(A87)
-- nuclear weapons free zone; M8(T85)
-- outer space; J48(G83)
-- outer space - ASATs; J48(G83), J51(A78), J56(A84), J61(A84), J65(A85), J93(A84), O5(A85)
COMPLAINTS PROCEDURE - REFERRAL TO (existing international body)
SN Subdivided by name of the international body
e.g. COMPLAINTS PROCEDURE - REFERRAL TO SECURITY COUNCIL
- Chemical weapons
-- production; P32(A83)
-- stockpiling; P32(A83)
-- destruction of stocks; P32(A83)
-- destruction of facilities; P32(A83)
COMPLAINTS PROCEDURE - REFERRAL TO GENERAL ASSEMBLY
- Chemical weapons
-- production; C90(G80)
-- stockpiling; C90(G80)
-- use; C115(A83)
- Nuclear weapons
-- peaceful nuclear explosions; D1(T67)
-- proliferation; D1(T67), D2(I76)
- Other weapons of mass destruction
-- radiological weapons; C119(A82)
- Regional arms control
-- Latin America; D1(T67)
-- nuclear weapons free zones; D1(T67), D2(I76)

COMPLAINTS PROCEDURE - REFERRAL TO INTERNATIONAL COURT OF JUSTICE
- Any arms control agreement; P3(A68)
- Chemical and biological weapons
-- use - "yellow rain"; O9(A85)
- Nuclear weapons
-- proliferation; D42(A83)
- Regional arms control
-- Antarctica; B7(T59)
COMPLAINTS PROCEDURE - REFERRAL TO NEW INTERNATIONAL BODY
- Any arms control agreement; P3(A68), P4(G73), P29(G71)
- Biological weapons; O10(G68)
- Chemical and biological weapons; N1(G70)
- Chemical weapons
-- destruction of facilities; P24(G80)
-- destruction of stocks; N7(G74), P24(G80)
-- production; N7(G74), P24(G80), P29(G71)
-- proliferation; N7(G74)
-- stockpiling; N7(G74), P24(G80)
-- use; P24(G80)
- General and complete disarmament; M6(A64)
- Nuclear weapons
-- comprehensive test ban; C35(G69)
-- peaceful nuclear explosions; D1(T67)
-- proliferation; D1(T67), D2(I76)
- Other weapons of mass destruction
-- environmental modification; O18(G76)
- Regional arms control
-- Latin America; D1(T67)
-- nuclear weapons free zones; D1(T67), D2(I76)
COMPLAINTS PROCEDURE - REFERRAL TO ORGANIZATION OF AMERICAN STATES
- Nuclear weapons
-- peaceful nuclear explosions; D1(T67)
-- proliferation; D1(T67)
- Regional arms control
-- Latin America; D1(T67)
-- nuclear weapons free zone; D1(T67)
COMPLAINTS PROCEDURE - REFERRAL TO SECRETARY GENERAL
- Biological weapons
-- destruction of stocks; O11(G69)
-- production; O11(G69)
-- proliferation; O11(G69)
-- research and development; O11(G69)
-- stockpiling; O11(G69)
-- use; O11(G69)
- Chemical and biological weapons; M14(G70)
- Chemical weapons
-- production; O16(G72)
-- use; C112(A83), C115(A83)
- Other weapons of mass destruction
-- environmental modification; O18(G76)

COMPLAINTS PROCEDURE - REFERRAL TO SECRETARY GENERAL (cont'd)
- Regional arms control
-- demilitarization; B26(T79)
-- nuclear weapons free zone; B26(T79)
-- outer space; B26(T79)
COMPLAINTS PROCEDURE - REFERRAL TO SECURITY COUNCIL
- Any arms control agreement; A8.1(A82), P4(G73), P5(A74), P29(G71)
- Biological weapons; O10(G68)
-- destruction of stocks; O11(G69), O12(T72), O13(I80), O13.1(I86)
-- production; C60(A85), O11(G69), O12(T72), O13(I80), O13.1(I86)
-- proliferation; O11(G69), O12(T72), O13(I80), O13.1(I86)
-- research and development; O11(G69)
-- stockpiling; O11(G69), O12(T72), O13(I80), O13.1(I86)
-- use; O11(G69)
- Chemical and biological weapons; M14(G70), N1(G70)
-- destruction of stocks; N2(G69), O8(G71)
-- production; N2(G69), O8(G71)
-- proliferation; N2(G69)
-- research and development; N2(G69)
-- stockpiling; N2(G69)
-- use -"yellow rain"; O9(A85)
- Chemical weapons
-- destruction of facilities; C79(G84), M17(G72), M18(G76), N15(G82), O14(G79), O15(G80), P27(G82), P30(G81), P33(G83)
-- destruction of stocks; C79(G84), M18(G76), N3(G70), N5(G73), N7(G74), N10(G85), N15(G82), O14(G79), O15(G80), P27(G82), P33(G83)
-- production; C79(G84), C90(G80), M17(G72), M18(G76), N3(G70), N5(G73), N7(G74), N10(G85), N11(G72), N15(G82), O14(G79), O15(G80), O16(G72), P27(G82), P29(G71), P30(G81), P33(G83)
-- proliferation; M18(G76), N7(G74)
-- stockpiling; C90(G80), M18(G76), N7(G74), N15(G82), O14(G79), O15(G80), P27(G82), P30(G81), P33(G83)
-- use; C79(G84), P33(G83)
- General and complete disarmament; P14(G62)
- Nuclear weapons
-- comprehensive test ban; J100(G83), K8(G69), K12(G71), K22(G75), K30(G77), K41(G83)
-- peaceful nuclear explosions; D1(T67), K8(G69), K30(G77)
-- proliferation; D1(T67)
-- research and development; J128(G78)
- Other weapons of mass destruction; N21(G75)
-- environmental modification; N22(G74), O17(G75), O19(T77)
-- radiological weapons; O20(G79)
- Regional arms control
-- Latin America; D1(T67)
-- nuclear weapons free zones; D1(T67), D2(I76)
-- outer space; J49(A84), O4(G79)
-- outer space - ASATs; O4(G79)
-- sea bed; B27(G69), B29(G69), B30(T71)

COMPLAINTS PROCEDURE - REFERRAL TO UNITED NATIONS
SN Includes procedures for referral of complaints to the United Nations which do not specify a particular organ of the UN
- Chemical and biological weapons
-- use; P22(G82)
- Chemical weapons
-- destruction of facilities; C76(G84), C95(G82), C102(A85)
-- destruction of stocks; C76(G84), C95(G82), C102(A85)
-- production; C76(G84), C95(G82), C102(A85), L8(G73)
-- stockpiling; C76(G84), C95(G82), C102(A85)
-- use; C76(G84)

COMPLIANCE
SN Includes theoretical discussions of compliance (see "general" subdivision) and general references to compliance with particular arms control agreements. For specific instances of non-compliance, see "violations" under specific arms control agreement headings (e.g. SALT II - Violations)
- Biological Weapons Convention; C113(A83), O9(A85)
- General; A19.2(I85), A30(A85), A31(A85), B3(A68), J2(G76), J93(A84)
- SALT I and ABM Treaty; A9(A83), J67(T72), O2(A82), O6(A85), O7(A85)
- Threshold Test Ban Treaty; O2(A82)

CONCEALMENT
- Camouflage; J1(A61), J29(A84), J71(A69), J81(A80), J82(A80), J85(A80), J123(A82), J140(A74)
- Encryption
SN Includes encryption of telemetry from missile tests
A6(A83), A12(A84), A28(G84), A37(G85), J9(G80), J35(A85), J58(A84), J73(A76), J75(A79), J79(T79), J80(A80), J85(A80), J87(A80), J88(A80), J89(A81), M9(A85)
- Falsifying records; D3(G64), G3(A65), L1(A85), L4(I74), L5(A75), L6(A75)
- General
SN Includes deception, diversion and evasion attempts, miscellaneous concealment measures and prohibitions of deliberate concealment
A35(A84), B25(G70), C65(A79), C68(A80), C69(G81), C87(A80), D49(A84), G10(G74), I15(G71), J1(A61), J36(A85), J57(A84), J58(A84), J61(A84), J67(T72), J68(A78), J82(A80), J94(A84), J107(A85), J118(A80), J119(A84), J122(A85), J125(A74), J126(A78), M10(A58)
- Seismic
UF Decoupling
SN Includes masking or concealment of a nuclear test explosions by simulating earthquakes, seismic decoupling or concealment in natural earthquakes
C36(A85), J35(A85), J96(A72), J122(A85), K5(A66), K10(G70), K16(G71), K19(G73), K23(G75), K24(A76), K25(G76), K26(G76), K27(A77), K31(A78), K36(I80), K37(A81), K38(A82), K40(A83), K43(G83), K44(A84), K45(G84), K47(A85), K49(G85), K52(G85), K55(A83), K58(G84)

CONFERENCE ON CONFIDENCE- AND SECURITY-BUILDING MEASURES AND DISARMAMENT IN EUROPE. (CCSBMDE). 19 September 1986; C124(T86)
Conference on Security and Cooperation in Europe. (CSCE).
USE HELSINKI FINAL ACT
CONVENTIONAL WEAPONS
RT REGIONAL ARMS CONTROL
CONVENTIONAL WEAPONS - AIRCRAFT
- Complaints procedure
-- consultation and cooperation; C124(T86)
-- consultative commission; B16(T79)
- International control organization; P35(G80)
- On-site inspection
-- control posts; B16(T79), B35(G70)
-- general; B16(T79), B35(G70)
-- obligatory; B16(T79)
-- selective; B16(T79), B35(G70), C124(T86)
- Remote sensors
-- aerial; B16(T79), B35(G70), C124(T86)
- Short-range sensors
-- monitoring devices; B16(T79), B35(G70), C124(T86)
- Verification - general; A35(A84)
CONVENTIONAL WEAPONS - GROUND FORCES
- Complaints procedure
-- consultation and cooperation; C124(T86)
-- consultative commission; B13(T75), B16(T79), J140.1(G86)
- International control organization; C15(A85), C121(A62), P35(G80)
-- ISMA; J45.1(A84), J50.2(G87)
- International exchange of information; A8(A83), A20.4(G86), A21(A85), A37(G85), B34(A61), C15(A85), C122(A84), C123(A85), J139(A74), J140.1(G86), M23(A85), M24(A85)
- On-site inspection
-- control posts; A4(A83), A20.2(G86), A20.4(G86), B13(T75), B16(T79), B35(G70), C122(A84), C123(A85), J139(A74), J140.1(G86), M23(A85), M24(A85)
-- general; B3.1(A86), B13(T75), B16(T79), B34(A61), B35(G70)
-- non-obligatory; C123(A85)
-- obligatory; B13(T75), B16(T79)
-- sampling; B34(A61)
-- selective; A8(A83), A20.4(G86), A20.53(G86), A20.592(G86), A20.6(G86), A20.91(G86), B16(T79), B35(G70), C15(A85), C121(A62), C121.1(A68), C122(A84), C123(A85), C124(T86), J140.1(G86)
- Remote sensors; A4(A83), A8(A83), A20.2(G86), A20.53(G86), A20.592(G86), A20.91(G86), C122(A84), C123(A85), J140.1(G86), M23(A85)
-- aerial; A21(A85), B13(T75), B16(T79), B35(G70), C15(A85), C121(A62), C121.1(A68), C122(A84), C123(A85), C124(T86), J139(A74)
-- ground-based; J50.1(A86)
-- satellites; J45.1(A84), J50.1(A86), J50.2(G87), J68(A78), J139(A74), J140(A74)
- Short-range sensors

CONVENTIONAL WEAPONS - GROUND FORCES (cont'd)
-- monitoring devices; B13(T75), B16(T79), B35(G70), C124(T86)
- Verification - general; A21(A85), A29(A85), A37(G85), B3.1(A86)
CONVENTIONAL WEAPONS - SHIPS
- Complaints procedure
-- consultative commission; B16(T79), J44(A75)
- International control organization; P35(G80)
- On-site inspection
-- control posts; B16(T79)
-- general; B16(T79)
-- obligatory; B16(T79)
-- selective; B16(T79), C121.1(A68), J95.1(A85), J141(I85)
- Remote sensors; J95.1(A85)
-- aerial; B16(T79), C121.1(A68), J44(A75), J141(I85)
-- satellite; J44(A75), J141(I85)
-- shipboard; J141(I85)
CONVENTION ON THE PROHIBITION OF MILITARY OR ANY OTHER HOSTILE USE OF ENVIRONMENTAL MODIFICATION TECHNIQUES. 18 May 1977. O19(T77), O19.1(A84)
Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. 10 April 1972
USE BIOLOGICAL WEAPONS CONVENTION
Cooperative measures
USE ON-SITE INSPECTION
INTERNATIONAL EXCHANGE OF INFORMATION
Costs
USE FINANCES
Cruise missiles
USE NUCLEAR WEAPONS - CRUISE MISSILES

D

Deception
USE CONCEALMENT - General
Decoupling
USE CONCEALMENT - Seismic
Demilitarization
USE REGIONAL ARMS CONTROL - DEMILITARIZATION

E

Encryption
USE CONCEALMENT - Encryption
ENVIRONMENTAL MODIFICATION CONVENTION. 18 May 1977; O19(T77), O19.1(A84)
Environmental modification weapons
USE OTHER WEAPONS OF MASS DESTRUCTION - ENVIRONMENTAL MODIFICATION
Evasion techniques
USE CONCEALMENT

F

Falsifying records
USE CONCEALMENT - Falsifying records
FINANCES
UF Costs
SN Includes explicit substantive discussions of monetary costs or financing of a verification system. Subdivided by type of verification system.
- International control organization; C18(A64), P2(A65), P3(A68), P14(G62), P19(G61), P20(G62)
-- ISMA; J5(G78), J11(G81), J12(A82), J14(A82)
- International Surveillance of Airborne Radioactivity (ISAR); J99(G83)
- Literature survey; L4(I74)
- On-site inspection
-- IAEA safeguards; D12(I72), D37(A82)
- RECOVER; I20(G85)
- Regional arms control
-- demilitarization; B11(T73), B13(T75)
-- Indochina; B11(T73)
-- Middle East; B13(T75), B16(T79)
- Remote sensors
-- aerial; J126(A78)
-- satellite; J5(G78), J7(A80), J8(A80)
- Seismic sensors
-- international network; K10(G70), K25(G76), K26(G76), K50(G85)
Fiscal analysis
USE LITERATURE SURVEY - BUDGETARY ANALYSIS

G

GENERAL AND COMPLETE DISARMAMENT
- Complaints procedure
-- consultation and cooperation; M4(A55)
-- referral to new international body; M6(A64)
-- referral to Security Council; P14(G62)
- International control organization; B4(A62), C17(A62), C18(A64), E2(A62), E6(A64), H7(A62), M6(A64), P13(G61), P14(G62), P15(G62)
- International exchange of information; B4(A62), E6(A64), M4(A55), M5(A63), M6(A64)
-- declarations; E1(A62), P14(A62), P15(G62)
-- reports to international body; N2(G69), P14(G62), P15(G62)
- Literature survey
-- budgetary analysis; L2(A62)
- Non-physical/psychological inspection; C17(A62), E1(A62), H7(A62),
- On-site inspection
-- control posts; E2(A62), J42(G57), P15(G62)
-- general; B4(A62), B5(A63), E6(A64), P13(G61), P14(G62)

GENERAL AND COMPLETE DISARMAMENT (cont'd)
-- obligatory; P14(G62), P15(G62)
-- progressive/zonal; C17(A62), E1(A62), E2(A62), E3(A62), E4(A62), E5(A63), E6(A64), E7(A65), J43(A68), M5(A63), P15(G62)
-- sampling; B4(A62), C17(A62), E7(A65)
-- selective; B4(A62), C16(A62), C17(A62), C18(A64), C18.1(A69), E6(A64), L2(A62), M4(A55), M6(A64), P15(G62)
- Records monitoring
-- economic; C17(A62), E5(A63), P14(G62)
-- personnel; E5(A63), L2(A62)
- Remote sensors
-- aerial; B5(A63), E1(A62), E4(A62), E5(A63), E6(A64), J42(G57), J43(A68), P14(G62), P15(G62)
- Short-range sensors; C17(A62)
GENEVA PROTOCOL. (1925);
- Violations
RT CHEMICAL AND BIOLOGICAL WEAPONS - USE - "Yellow rain"
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USE ON-SITE INSPECTION - IAEA SAFEGUARDS
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USE REMOTE SENSORS
INTERIM AGREEMENT BETWEEN THE UNITED STATES OF AMERICA AND THE UNION OF SOVIET SOCIALIST REPUBLICS ON CERTAIN MEASURES WITH RESPECT TO THE LIMITATIONS OF STRATEGIC OFFENSIVE ARMS. 26 May 1972
USE SALT I TREATY
Intermediate-range forces
USE NUCLEAR WEAPONS subdivided by appropriate type of delivery system, eg. NUCLEAR WEAPONS - BALLISTIC MISSILES
INTERNATIONAL COMMISSION OF CONTROL AND SUPERVISION; B11(T73)
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INTERNATIONAL CONTROL ORGANIZATION
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- Any arms control agreement; A8(A83), A8.1(A82), A20.54(G86), A20.71(G86), B3(A68), C2(A58), C5(A62), C15(A85), C55(G82), H1(A61), H2(A61), J2(G76), J5(G78), J7(A80), P1(A62), P2(A65), P3(A68), P4(G73), P5(A74), P6(A78), P7(G78), P8(G78), P9(G78), P10(G82), P12(G82), P29(G71)

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- Chemical weapons
-- binary agents; C105(G85), C106(G85), P25(G79)
-- destruction of facilities; A3(A82), C69(G81), C76(G84), C78(G84), C79(G84), C88(A80), C91(G80), C95(G82), C99(A83), C102(A85), C105(G85), C106(G85), C110(G85), E13(G79), J134(G84), M17(G72), M18(G76), M19(G76), N8(A79), N15(G82), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80), P24(G80), P26(G82), P27(G82), P30(G81), P32(A83), P33(G83)
-- destruction of stocks; A3(A82), C45(A76), C65(A79), C69(G81), C75(G83), C76(G84), C78(G84), C79(G84), C33(A80), C95(G82), C99(A83), C102(A85), C105(G85), C106(G85), C110(G85), E13(G79), J134(G84), M18(G76), M19(G76), N3(G70), N5(G73), N7(G74), N8(A79), N9(A80), N15(G82), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80), P8(G78), P12(G82), P24(G80), P25(G79), P26(G82), P27(G82), P28(G84), P30(G81), P32(A83), P33(G83)
-- production; C45(A76), C65(A79), C69(G81), C75(G83), C76(G84), C78(G84), C79(G84), C82(A70), C86(G79), C88(A80), C90(G80), C91(G80), C95(G82), C99(A83), C101(G83), C102(A85), C105(G85), C106(G85), C107(G85), C110(G85), D7(A82), E13(G79), G10(G74), L8(G73), M17(G72), M18(G76), M19(G76), M20(G72), N3(G70), N5(G73), N7(G74), N9(A80), N11(G72), N15(G82), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80), O16(G72), P8(G78), P12(G82), P24(G80), P25(G79), P27(G82), P29(G71), P30(G81), P31(A82), P32(A83), P33(G83), P34(G85)
-- proliferation; M18(G76)
-- research and development; C69(G81)
-- stockpiling; C45(A76), C65(A79), C69(G81), C76(G84), C88(A80), C90(G80), C95(G82), C99(A83), C102(A85), C105(G85), C106(G85), C110(G85), D7(A82), E13(G79), M18(G76), N7(G74), N15(G82), N19(G85), O14(G79), O15(G80), P12(G82), P24(G80), P25(G79), P27(G82), P30(G81), P32(A83), P33(G83)
-- use; C76(G84), C79(G84), C118(G85), P24(G80), P28(G84), P33(G83)
- Conventional weapons
-- aircraft; P35(G80)
-- ground forces; C15(A85), C121(A62), P35(G80)
-- ships; P35(G80)
- General and complete disarmament; B4(A62), C17(A62), C18(A64), E2(A62), E6(A64), H7(A62), M6(A64), P13(G61), P14(G62), P15(G62)
- Military budgets; B31(I82), L3(A62), L7(I80)
- Nuclear weapons; B32(A77)
-- ballistic missiles; C15(A85), C30(A82), P18(A85)
-- comprehensive test ban; C18(A64), C32(G63), C34(G69), C35(G69), D7(A82), H8(A63), I5(G62), J100(G83), J101(G84), K2(G62), K4(G65), K7(G69), K10(G70), K13(G71), K20(G73), K25(G76), K29(G77), K30(G77), K32(I78), K33(I79), K34(G79), K35(G79), K41(G83), K42(G83), K46(I84), M8(T85), P8(G78), P12(G82), P19(G61), P20(G62), P21(G83)

INTERNATIONAL CONTROL ORGANIZATION (cont'd)
-- fissionable material "cutoff"; C39(G62), J124(A83)
-- missile tests; C43(A63)
-- partial test ban; K7(G69)
-- peaceful nuclear explosions; C48(G71), C49(I73), C50(G75), D1(T67), K30(G77), K35(G79), M11(G68)
-- proliferation; A3(A82), D1(T67), D2(I76), J124(A83), M8(T85), M12(I78)
- Other weapons of mass destruction
-- environmental modification; O18(G76), O19(T77)
- Regional arms control
-- Africa; C22(A62)
-- demilitarization; B11(T73)
-- Europe; C15(A85), H7(A62), P16(A85)
-- Indochina; B11(T73)
-- Latin America; D1(T67), N8(A79), P17(A76)
-- Middle East; C22(A62)
-- nuclear weapons free zones; C22(A62), D1(T67), D2(I76), M8(T85), P16(A85)
-- outer space; P17.1(G85)
-- outer space - ASATs; J54(A83)
INTERNATIONAL CONTROL ORGANIZATION - ISMA
RT REMOTE SENSORS - SATELLITE
- Any arms control agreement; J5(G78), J6(A80), J7(A80), J10(G81), J11(I81), J12(A82), J14(A82), J16(A82), J22(A83), J23(A83), J26(A84), J29(A84), J31(A84), J31.1(A84), J33(A85), J40(A85), P8(G78), P10(G82), P12(G82)
- Conventional weapons - ground forces; J45.1(A84), J50.2(G87)
- Regional arms control
-- Europe; J45.1(A84), J50.2(G87)
-- outer space; J14(A82), J50(A84), J50.2(G87)
-- outer space - ASATs; J14(A82), J59(A84)
INTERNATIONAL EXCHANGE OF INFORMATION
RT LITERATURE SURVEY
RECORDS MONITORING
SEISMIC SENSORS - INTERNATIONAL NETWORK
- Any arms control agreement; A8(A83), A8.1(A82), A10(G83), A20.4(G86), A20.71(G86), B3(A68), C15(A85), J2(G76), J3(A77), J5(G78), J11(I81), J22(A83), J23(A83), J26(A84), M1(A62), M2(A65), M3(A83), O1(A77), O2(A82), P4(G73), P5(A74), P8(G78), P12(G82)
- Biological weapons
-- destruction of stocks; O13.1(I86)
-- production; M15(A72), M16(A83), O13.1(I86)
-- proliferation; O13.1(I86)
-- research and development; M15(A72)
-- stockpiling; O13.1(I86)
- Chemical and biological weapons; J97(G77), M14(G70)
-- use - "yellow rain"; C59(A84)
- Chemical weapons
-- binary agents; G9(A74)

INTERNATIONAL EXCHANGE OF INFORMATION (cont'd)
-- destruction of facilities; C66(G79), C76(G84), M21(A80), N6(G73), N15(G82), P24(G80)
-- destruction of stocks; C66(G79), C76(G84), C109(A83), G9(A74), J135(A77), M21(A80), N3(G70), N6(G73), N9(A80), N15(G82), P8(G78), P12(G82), P24(G80)
-- production; C59(A84), C66(G79), C76(G84), C91(G80), C93(G81), C99(A83), C104(G85), C107.1(G86), C109(A83), G9(A74), G12(G86), I14(G71), J135(A77), M21(A80), N3(G70), N6(G73), N9(A80), N11(G72), N14(G84), N15(G82), P8(G78), P12(G82), P24(G80)
-- proliferation; M18(G76)
-- research and development; C93(G81), I14(G71), N20(A73)
-- stockpiling; C59(A84), C76(G84), C89(A80), C93(G81), C99(A83), C109(A83), G9(A74), I14(G71), J135(A77), M21(A80), N15(G82), P12(G82), P24(G80)
-- use; C76(G84), C93(G81)
- Conventional weapons
-- ground forces; A8(A83), A20.4(G86), A21(A85), A37(G85), B34(A61), C15(A85), C122(A84), C123(A85), J139(A74), J140.1(G86), M23(A85), M24(A85)
- General and complete disarmament; B4(A62), E6(A64), M4(A55), M5(A63), M6(A64)
- Military budgets; A8(A83), B31(I28), L4(I74), L5(A75), L6(A75), L7(I80)
- Nuclear weapons
-- anti-ballistic missiles; C25.1(G85)
-- ballistic missiles; A21(A85), A27(A84), C15(A85), J79(T79), M3(A83), M7(A81), M9(A85), M13(A81)
-- comprehensive test ban; A20.91(G86), J100(G83), J101(G84), K4(G65), K6(G67), K8(G69), K9(G70), K12(G71), K13(G71), K17(G71), K18(G73), K19(G73), K22(G75), K26(G76), K27(A77), K28(G77), K39(G82), K41(G83), K42(G83), K46(I84), K49(G85), K50(G85), K51(G85), K52(G85), K52.3(G86), K52.5(G86), K52.6(G86), K52.61(I86), K52.7(G86), K52.8(G86), P8(G78), P12(G82), P21(G83)
-- cruise missiles; A4(A83), J79(T79), M3(A83), M7(A81), M9(A85)
-- fissionable material "cutoff"; M10(A58)
-- manned aircraft; J79(T79), M7(A81), M13(A81)
-- missile tests; A27(A84), C43(A63), J79(T79), J127(A78), M7(A81), M9(A85)
-- mobile ballistic missiles; J79(T79), M9(A85)
-- partial test ban; C52(T76), K54(T74)
-- peaceful nuclear explosions; A8(A83), C52(T76), K54(T74), M11(G68)
-- proliferation; M12(I78)
-- reentry vehicles; J79(T79), J127(A78)
-- research and development; M13(A81)
- Other weapons of mass destruction; M22(G75)
- Regional arms control
-- Antarctica; B7(T59), C19(A66)
-- demilitarization; B7(T59), B24(T67), C19(A66)
-- Europe; A21(A85), C15(A85), C122(A84), C123(A85), J139(A74), M7(A81), M23(A85), M24(A85)

INTERNATIONAL EXCHANGE OF INFORMATION (cont'd)
-- Middle East; A21(A85)
-- nuclear weapons free zones; B24(T67)
-- outer space; B24(T67), C25.1(G85), J49(A84)
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INTERNATIONAL EXCHANGE OF INFORMATION - DECLARATIONS
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- Chemical weapons
-- destruction of facilities; C77(A84), C79(A84), G95(G82), M17(G72), O14(G79), O15(G80)
-- destruction of stocks; C75(G83), C77(G84), C79(G84), C89(A80), C95(G82), N4(A73), N5(G73), O14(G79), O15(G80)
-- production; C69(G81), C75(G83), C79(G84), C84(A74), C88(A80), C89(A80), C90(G80), C95(G82), C101(G83), C102(A85), C105(G85), C106(G85), C107(G85), C110(G85), M17(G72), M18(G76), M19(G76), M20(G72), N5(G73), O14(G79), O15(G80)
-- stockpiling; C69(G81), C88(A80), C90(G80), C95(G82), C102(A85), C106(G85), C110(G85), M18(G76), O14(G79), O15(G80), P27(G82)
- General and complete disarmament; E1(A62), P14(G62), P15(G62)
- Nuclear weapons
-- ballistic missiles; C28(A62), E12(A65), J132(A84)
-- cruise missiles; J94(A84)
-- fissionable material "cutoff"; D3(G64), D6(G79)
-- manned bombers; C28(A62), E12(A65)
-- missile tests; E12(A65)
-- research and development; J132(A84)
- Regional arms control
-- Europe; C21(A84)
INTERNATIONAL EXCHANGE OF INFORMATION - REPORTS TO INTERNATIONAL BODY
RT ON-SITE INSPECTION - IAEA SAFEGUARDS
- Chemical and biological weapons; N1(G70)
-- destruction of stocks; O8(G71)
-- production; O8(G71)
- Chemical weapons
-- destruction of facilities; C88(A80), C106(G85), N8(A79), N19(G85), P26(G82)
-- destruction of stocks; C88(A80), C106(G85), N7(G74), N8(A79), N19(G85), P26(G82)
-- production; C88(A80), C106(G85), C107(G85), M18(G76), M19(G76), M20(G72), N7(G74), N19(G85)
-- proliferation; N7(G74)
-- stockpiling; C88(A80), C106(G85), M18(G76), N7(G74), N19(G85)
- General and complete disarmament; E2(A62), P14(G62), P15(G62)
- Nuclear weapons
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-- partial test ban; K7(G69)
-- peaceful nuclear explosion; M11(G68)

INTERNATIONAL EXCHANGE OF INFORMATION - REPORTS TO INTERNATIONAL BODY (cont'd)
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- Regional arms control
-- Latin America; N8(A79)
-- nuclear weapons free zone; M8(T85)
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Joint Statement of Principles and Basic Guidelines for Subsequent Negotiations on the Limitation of Strategic Arms. 18 June 1979;
USE SALT I TREATY

L

LEGALITY
SN Includes discussion of the legality of a verification system
B10(A71), C2(A58), C7(A67), C9(A72), C12(A83), J6(A80), J7(A80), J10(A81), J11(G81), J12(A82), J50(A84), J82(A80), K33(I79)
LIMITED TEST BAN TREATY. 5 August 1963. J120(T63)
- Violations; A37(G85)
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RT INTERNATIONAL EXCHANGE OF INFORMATION
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- Any arms control agreement; G2(A63), H6(A63), P5(A74)
- Chemical and biological weapons; M14(G70), N1(G70)
- Chemical weapons
-- production; C99(A83), L8(G73), N6(G73)
-- research and development; J138(G77), N20(A73)
-- stockpiling; C99(A83)
- Nuclear weapons
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LITERATURE SURVEY - BUDGETARY ANALYSIS
- Any arms control agreement; B1(A61), G1(A63), L1(A58)
- General and complete disarmament; L2(A62)
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RT ON-SITE INSPECTION - SAMPLING
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-- consultation and cooperation; B31(I82)
- International control organization; B31(I82), L3(A62), L7(I80)
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Mobile Missiles
USE NUCLEAR WEAPONS - CRUISE MISSILES
- MOBILE BALLISTIC MISSILES
MOON TREATY. 5 December 1979; B26(T79)
Mutual Balanced Force Reduction Talks
USE REGIONAL ARMS CONTROL - EUROPE

N

NATIONAL SELF-SUPERVISION
RT ON-SITE INSPECTION - IAEA SAFEGUARDS
- Biological weapons
-- destruction of stocks; O12(T72), O13(I80), O13.1(I86)
-- production; O12(T72), O13(I80), O13.1(I86)
-- proliferation; O12(T72), O13(I80), O13.1(I86)
-- stockpiling; O12(T72), O13(I80), O13.1(I86)
- Chemical and biological weapons; N1(G70)

NATIONAL SELF-SUPERVISION (cont'd)
-- destruction of stocks; N2(G69), O8(G71)
-- production; N2(G69), O8(G71)
-- proliferation; N2(G69)
-- research and development; N2(G69)
-- stockpiling; N2(G69)
-- use; P22(G82)
- Chemical weapons
-- destruction of facilities; A3(A82), C88(A80), C99(A83), C110(G85), M18(G76), N6(G73), N8(A79), N9(A80), N15(G82), N16(A83), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80), P26(G82)
-- destruction of stocks; A3(A82), C88(A80), C99(A83), C110(G85), M18(G76), N3(G70), N4(A73), N5(G73), N6(G73), N7(G74), N8(G79), N9(A80), N10(G85), N15(G82), N16(A83), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80), P26(G82), P28(G84)
-- production; C69(G81), C88(A80), C99(A83), G8(A73), G10(G74), I14(G71), M18(G76), N3(G70), N5(G73), N6(G73), N7(G74), N9(A80), N10(G85), N11(G72), N12(G72), N13(G75), N14(G82), N15(G82), N16(A83), N17(G84), N18(G85), N19(G85), O14(G79), O15(G80)
-- proliferation; M18(G76), N7(G74)
-- research and development; C69(G81), I14(G71), N20(A73)
-- stockpiling; C88(A80), C99(A83), I14(G71), M18(G76), N7(G74), N15(G82), N16(A83), N19(G85), O14(G79), O15(G80)
-- use; N16(A83)
- Nuclear weapons
-- proliferation; D2(I76)
- Other weapons of mass destruction; N21(G75)
-- environmental modification; N22(G74), O19(T77)
-- radiological weapons; O20(G79)
- Regional arms control
-- Latin America; N8(A79)
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-- outer space - ASATs; J48(G83), O4(G79)
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USE REMOTE SENSORS
New weapons of mass destruction
USE OTHER WEAPONS OF MASS DESTRUCTION
NON-INTERFERENCE; J68(A78), J139(A74)
- National technical means; A8(A83), A27(A84), B31(I82), C79(G84), C122(A84), J9(G80), J27(A84), J47(G82), J61(A84), J67(T72), J76(A79), J79(T79), J81(A80), J87(A80), J91(A81), J94(A84), K21(A74), K35(G79), K54(T74), O3(I80), O5(A85), O15(G80)
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- Any arms control agreement; B1(A61), C2(A58), C7(A67), C9(A72), H1(A61), H2(A61), H3(A62), H4(A63), H5(A63), H6(A63), P7(G78)
- Chemical and biological weapons
-- use; C56(I84), C57(G85)
-- use - "yellow rain"; C62(A85), H9(A83)
- Chemical weapons
-- use; C112(A83), C118(G85)

NON-PHYSICAL/PSYCHOLOGICAL INSPECTION (cont'd)
- General and complete disarmament; C71(A62), E1(A62), H7(A62)
- Nuclear weapons
-- ballistic missiles; B1(A61), C30(A82), E11(A62)
-- comprehensive test ban; H8(A63)
-- fissionable material "cutoff"; D8(A85)
-- proliferation; B1(A61)
-- research and development; B1(A61)
- Regional arms control
-- Europe; H7(A62)
NON-PROLIFERATION TREATY. 1 July 1968; D9(T68), D16(I75)
NUCLEAR FREEZE
SN Includes comprehensive discussions of verification of a nuclear freeze. See also individual components of a freeze for specific verification methods:
RT NUCLEAR WEAPONS - COMPREHENSIVE TEST BAN
- CRUISE MISSILES
- FISSIONABLE MATERIAL "CUTOFF"
- MISSILE TESTS
- RESEARCH AND DEVELOPMENT
A27(A84), A36(A84), J94(A84), J124(A83), J129(A82), J131(A83), J132(A84)
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USE NUCLEAR WEAPONS - RESEARCH AND DEVELOPMENT
NUCLEAR SUPPLIERS' GROUP GUIDELINES. February 1978; M12(I78)
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- International control organization; B32(A77)
- On-site inspection
-- general; B32(A77)
-- obligatory; B32(A77)
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USE NUCLEAR WEAPONS - BALLISTIC MISSILES
Nuclear weapons - ALCMs
USE NUCLEAR WEAPONS - CRUISE MISSILES
NUCLEAR WEAPONS - ANTI-BALLISTIC MISSILE SYSTEMS
- Complaints procedure
-- consultative commission; A28(G84), A30(A85), J67(T72), O5(A85), O6(A85), O7(A85)
- International exchange of information; C25.1(G85)
- On-site inspection - selective; A38(A83), C25.1(G85)
- Remote sensors; A20.1(A86), A28(G84), A37(G85), J67(T72), J68.1(A85), J90(A81), O2(A82)
-- ELINT; J122(A85)
-- ground-based; J122(A85)
-- radar; J122(A85)
-- satellites; J68(A78), J122(A85)
-- shipboard; J122(A85)
- Short-range sensors
-- monitoring devices; I3(A71)
- Verification - general; A20.1(A86), A28(G84), A30(A85), A31(A85), A37(G85), A38(A83)

NUCLEAR WEAPONS - BALLISTIC MISSILES
UF Nuclear weapons - ALBMs
- FOBs
- ICBMs
- SLBMs
- SLBM submarines
- Complaints procedure; A21(A85)
-- consultative commission; A28(G84), A30(A85), J65(A85), J67(T72), J79(T79), J85(A80), J93(A84), O5(A85), O6(A85), O7(A85)
- International control organization; C15(A85), C30(A82), P18(A85)
- International exchange of information; A21(A85), A27(A84), C15(A85), J79(T79), M3(A83), M7(A81), M9(A85), M13(A81)
-- declarations; C28(A62), E12(A65), J132(A84)
- Non-physical/psychological inspection; B1(A61), C30(A82), E11(A62)
- On-site inspection
-- challenge; J94(A84)
-- control posts; E9(A60), E11(A62)
-- general; B33(A78)
-- non-obligatory; C123(A85)
-- progressive/zonal; C28(A62), C30(A82), E9(A60), E10(A61), E11(A62), E12(A65)
-- sampling; C27(A61), E10(A61)
-- selective; A6(A83), A20.2(G86), A20.4(G86), A20.53(G86), A20.592(G86), A20.91(G86), A21(A85), A38(A83), C15(A85), C26(A61), C27(A61), C28(A62), C29(G62), C30(A82), C123(A85), J41(G85), J70(G62), J75(A79), J86(A80), J93(A83), J94(A84), J95.1(A85), M9(A85), O2(A82)
- Records monitoring
-- economic; C26(A61)
-- personnel; C28(A62)
-- plant; C27(A61), C29(G62), E10(A61)
- Remote sensors; A4(A83), A6(A83), A8(A83), A20.1(A85), A20.2(G86), A20.4(G86), A20.53(G86), A20.592(G86), A20.91(G86), A24(G79), A26(A81), A28(G84), A37(G85), B33(A78), C15(A85), C29(G62), C123(A85), J41(G85), J67(T72), J68.1(A85), J70(G62), J73(A76), J75(A79), J77(A79), J8(A80), J84(A80), J86(A80), J87(A80), J90(A81), J91(A81), J92(A83), J93(A84), J94(A84), J95.1(A85), J95.2(A86), J132(A84), M3(A83), O2(A82)
-- aerial; E9(A60), E10(A61), E11(A62), J39(A85), J69(A61), J74(A79), J76(A79), J79(T79), J81(A80), J85(A80), J89(A81), J92.1(A83)
-- ELINT; J39(A85), J71(A69), J74(A79), J79(T79), J80(A80), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J122(A85)
-- ground-based; J39(A85), J65(A85), J78(A79), J79(T79), J80(A80), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J122(A85)
-- radar; J35(A85), J39(A85), J65(A85), J74(A79), J76(A79), J78(A79), J79(T79), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J122(A85)
-- satellite; A21(A85), J35(A85), J39(A85), J68(A78), J69(A61), J71(A69), J72(A73), J74(A79), J76(A79), J78(A79), J79(T79), J80(A80), J81(A79), J82(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J95(A85), J122(A85), J131(A83), M9(A85)

NUCLEAR WEAPONS - BALLISTIC MISSILES (cont'd)
-- shipboard; J74(A79), J76(A79), J79(T79), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J122(A85)
- Short-range sensors; M9(A85)
-- monitoring devices; I2(A69), I3(A71), I4(A81)
- Verification - general; A6(A83), A20.1(A86), A21(A85), J23(A77), A24(G79), A25(A81), A26(A81), A27(A84), A28(G84), A29(A85), A30(A85), A31(A85), A37(G85), A38(A83)
NUCLEAR WEAPONS - COMPREHENSIVE TEST BAN
- Complaints procedure
-- consultation and cooperation; K8(G69), K22(G75), K25(G76), K30(G77), K35(G79), K49(G85), M8(T85)
-- consultative commission; K21(A74), K30(G77), K41(G83), K49(G85), M8(T85), O5(A85)
-- referral to new international body; C35(G69)
-- referral to Security Council; J100(G83), K8(G69), K12(G71), K22(G75),K30(G77), K41(G83)
- International control organization; C18(A64), C32(G63), C34(G69), C35(G69), H8(A63), I5(G62), J100(G83), J101(G84), K2(G62), K4(G65), K7(G69), K10(G70), K13(G71), K20(G73), K25(G76), K29(G77), K30(G77), K32(I78), K33(I79), K34(G79), K35(G79), K41(G83), K42(G83), K46(I84), M8(T85), P8(G78), P12(G82), P19(G61), P20(G62), P21(G83)
- International exchange of information; A20.91(G86), J100(G83), J101(G84), K4(G65), K6(G67), K8(G69), K9(G70), K12(G71), K17(G71), K18(G73), K19(G73), K22(G75), K26(G76), K27(A77), K28(G77), K39(G82), K41(G83), K42(G83), K46(I84), K49(G85), K50(G85), K51(G85), K52(G85), K52.3(G86), K52.5(G86), K52.6(G86), K52.61(I86), K52.7(G86), K52.8(G86), P8(G78), P12(G82), P21(G83)
-- report to international body; M8(T85)
-- reports to new international body; K7(G69), K10(G70), K13(G71), K20(G73), K25(G76), K29(G77), K30(G77), K32(I78), K33(I79), K34(G79), K35(G79)
- Literature survey; K27(A77)
- Non-physical/psychological inspection; H8(A63)
- On-site inspection
-- challenge; C33(G66), J132(A84), K8(G69), K29(G77), P12(G82)
-- control posts; C18(A64), P19(G61)
-- IAEA safeguards; D7(A82), D38(A82), D45(G83)
-- non-obligatory; J100(G83), K2(G62), K8(G69), K20(G73), K22(G75), K30(G77)
-- obligatory; C31(G63), C32(G63), C35(G69), C36(A85), J101(G84), K41(G83), P19(G61), P20(G62)
-- sampling; K51(G85), K55(A83)
-- selective; A3(A82), A20.2(G86), A20.4(G86), A20.53(G86), A20.592(G86), A20.6(G86), A20.72(G86), A27(A84), C18(A64), C31(G63), C32(G63), C33(G66), C34(G69), C35(G69), C36(A85), C46(A83), J68.1(A85), J92.1(A83), J97(G77), J100(G83), J129(A82), J131(A83), J132(A84), K2(G62), K5(A66), K6(G67), K8(G69), K20(G73), K22(G75), K27(A77), K29(G77), K30(G77), K35(G79), K36(I80), K37(A81), K41(G83), K42(G83), K43(G83), K44(A84), K47(A85), K49(G85), K51(G85), K52.2(G86), K52.3(G86), K52.7(G86), K55(A83), P8(G78), P12(G82), P19(G61), P20(G62), P21(G83)

NUCLEAR WEAPONS - COMPREHENSIVE TEST BAN (cont'd)
- Remote sensors; A3(A82), A20.2(G86), A20.4(G86), A20.53(G86), A20.592(G86), A20.72(G86), C18(A64), C36(A85), D7(A82), J97(G77), J100(G83), J101(G84), K22(G75), K35(G79), K37(A81), K41(G83), K42(G83), K51(G85)
-- aerial; P19(G61)
-- ELINT; J27(A84), K27(A77), K36(I80)
-- ground-based; J29(A84)
-- radar; J29(A84), J98(A83)
-- sampling; J99(G83), P12(G82), P19(G61)
-- satellite; J29(A84), J96(A72), J131(A83), K16(G71), K20(G73), K25(G76), K27(A77), K29(G77), K31(A78), K36(I80), K44(A84), K45(G84), K47(A85), P8(G78), P19(G61), P20(G62)
-- shipboard; P20(G62)
- Review conference; D16(I75), K8(G69), K12(G71), K30(G77), K35(G79), K42(G83), P8(G78), P12(G82)
- Seismic sensors; A20.1(A86), C18(A64), C34(G69), C46(A83), D7(A82), J68.1(A85), J95(A85), J97(G77), K2(G62), K3(G62), K5(A66), K16(G71), K52.1(G86), K52.2(G86), K52.3(G86), P12(G82)
-- extra-border stations; C32(G63), J95.2(A86), J131(A83), K6(G67), K8(G69), K11(G71), K12(G71), K15(G71), K17(G71), K18(G73), K22(G75), K27(A77), K37(A81), K38(A82), K45(G84), K47(A85), K48(A85), K51(G85), P19(G61), P20(G62)
-- international network; A3(A82), A20.91(G86), I5(G62), J29(A84), J101(G84), K4(G65), K6(G67), K7(G69), K8(G69), K9(G70), K10(G70), K12(G71), K13(G71), K17(G71), K18(G73), K19(G73), K20(G73), K25(G76), K26(G76), K27(A77), K28(G77), K29(G77), K30(G77), K32(I78), K33(I79), K34(G79), K35(G79), K36(I80), K39(G82), K41(G83), K43(G83), K49(G85), K50(G85), K51(G85), K52(G85), K52.3(G86), K52.5(G86), K52.6(G86), K52.61(I86), K52.7(G86), K52.8(G86), P8(G78)
-- intra-border stations; A3(A82), A4(A83), A27(A84), C31(G63), C32(G63), C36(A85), I5(G62), J29(A84), J35(A85), J94(A84), J95.2(A86), J122(A85), J129(A82), J132(A84), K1(A58), K14(G71), K27(A77), K35(G79), K36(I80), K37(A81), K38(A82), K40(A83), K44(A84), K45(G84), K47(A85), K49(G85), K51(G85), K52.7(G86), K55(A83), K56(A83), P20(G62)
- Short-range sensors; A27(A84), K44(A84)
-- monitoring devices; C31(G63), C32(G63), I5(G62), J95.2(A86), K14(G71), K27(A77), K29(G77), K36(I80), K37(A81)
-- RECOVER; D38(A82), D45(G83)
-- sampling; P19(G61)
- Verification - general; A20.1(A86), A27(A84)

NUCLEAR WEAPONS - CRUISE MISSILES
UF Nuclear weapons - ALCMs
- GLCMs
- SLCMs
-Complaints procedure
-- consultative commission; A30(A85), J65(A85), J79(T79), O5(A85)
- International exchange of information; J79(T79), M3(A83), M7(A81), M9(A85)

NUCLEAR WEAPONS - CRUISE MISSILES (cont'd)
-- declarations; J94(A84)
- On-site inspection
-- challenge; J94(A84), J107(A85)
-- general; B33(A78)
-- obligatory; J107(A85)
-- selective; A4(A83), C37(G77), C38(A82), C38.1(G85), I5.1(A86), J75(A79), J86(A80), J94(A84), J95(A85), J95.1(A85), M9(A85)
- Remote sensors; A20.1(A86), A26(A81), B33(A78), C38(A82), C38.1(G85), I5.1(A86), J68.1(A85), J73(A76), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J94(A84), J95.1(A85), J95.2(A86), J106(A84), J129(A82), J132(A84), M3(A83)
-- aerial; J74(A79), J79(T79), J81(A80), J92.1(A83), J126(A78)
-- ELINT; J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- ground-based; J65(A85), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- radar; J65(A85), J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83), J103(A83)
-- satellite; J74(A79), J79(T79), J81(A80), J82(A80), J88(A80), J92.1(A83), J102(A77), J104(A83), J105(A83), J107(A85), J131(A83), M9(A85)
-- shipboard; J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
- Short-range sensors; M9(A85)
-- monitoring devices; I5.1(A86), J75(A79), J95(A85)
- Verification - general; A20.1(A86), A25(A81), A26(A81), A30(A85), A31(A85), A32(A81), A33(A83), A34(A88)

Nuclear weapons - destruction of delivery vehicles
USE NUCLEAR WEAPONS subdivided by appropriate type of delivery system(s), e.g. NUCLEAR WEAPONS - BALLISTIC MISSILES

Nuclear weapons - destruction of warhead stocks
USE NUCLEAR WEAPONS - FISSIONABLE MATERIAL "CUTOFF"

NUCLEAR WEAPONS - FISSIONABLE MATERIAL "CUTOFF"
SN Includes the production, stockpiling and destruction of nuclear warheads
UF Nuclear weapons - destruction of warhead stocks
- warhead stockpiling
- Complaints procedure
-- consultation and cooperation; J110(A84)
-- consultative commission; J109(A80), J110(A84)
- International control organization; C39(G62), D8(A85), J124(A83)
- International exchange of information; M10(A58)
-- declarations; D3(G64), D6(G79)
- Non-physical/psychological inspection; D8(A85)
- On-site inspection
-- IAEA safeguards; D3(G64), D4(G66), D5(G69), D6(G79), D7(A82), D8(A85), D40(A83), J94(A84), J92.1(A83), J95.2(A86), J109(A80), J110(A84), J129(A82), J131(A83), J132(A84)
-- selective; C39(G62), C40(A83), I6(G66), J109(A80), J110(A84), J124(A83), J131(A83)
- Records monitoring
-- plant; C39(G62)

NUCLEAR WEAPONS - FISSIONABLE MATERIAL "CUTOFF" (cont'd)
- Remote sensors; J94(A84), J95.2(A86), J108(G79), J109(A80), J124(A83), J132(A84)
-- ELINT; D8(A85)
-- satellite; D8(A85), J110(A84), J131(A83)
- Short-range sensors; J131(A83)
-- monitoring devices; D3(G64), I6(G66), J95.2(A86), J110(A84), J129(A82)
-- sampling; D3(G64)
-- seals; J129(A82)
Nuclear weapons - FOBs
USE NUCLEAR WEAPONS - BALLISTIC MISSILES
Nuclear weapons free zones
USE REGIONAL ARMS CONTROL - Nuclear weapons free zones
Nuclear weapons - GLCMs
USE NUCLEAR WEAPONS - CRUISE MISSILES
Nuclear weapons - ICBMs
USE NUCLEAR WEAPONS - BALLISTIC MISSILES
NUCLEAR WEAPONS - MANNED AIRCRAFT
- Complaints procedure
-- consultative commission; A30(A85), J67(T72), J79(T79), O5(A85)
- International exchange of information; J79(T79), M7(A81), M13(A81)
-- declarations; C28(A62), E12(A65)
- On-site inspection
-- control posts; E9(A60)
-- general; B33(A78)
-- progressive/zonal; C28(A62), E9(A60), E12(A65)
-- sampling; C27(A61)
-- selective; A4(A83), A38(A83), C26(A61), C27(A61), C28(A62), C41(A61), C42(G62), J75(A79), J86(A80)
- Records monitoring
-- economic; C26(A61)
-- personnel; C28(A62)
-- plant; C27(A61)
- Remote sensors; A20.1(A86), A26(A81), A27(A84), B33(A78), J67(T72), J68.1(A85), J73(A76), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J91(A81), J94(A84), J95.2(A86), M13(A81)
-- aerial; C41(A61), C42(G62), E9(A60), J39(A85), J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- ELINT; J39(A85), J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- ground-based; J39(A85), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- radar; C42(G62), J39(A85), J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- satellite; J39(A85), J74(A79), J79(T79), J81(A80), J82(A80), J86(A80), J88(A80), J92.1(A83), J107(A85), J122(A85), J131(A83)
-- shipboard; J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
- Short-range sensors
-- monitoring devices; J75(A79)
- Verification - general; A20.1(A86), A25(A81), A26(A81), A27(A84), A30(A85), A31(A85), A35(A84), A38(A83)

Nuclear weapons - MARVs
USE NUCLEAR WEAPONS - REENTRY VEHICLES
Nuclear weapons - MIRVs
USE NUCLEAR WEAPONS - REENTRY VEHICLES
NUCLEAR WEAPONS - MISSILE TESTS
- Complaints procedure
-- consultative commission; A30(A85), J65(A85), J79(T79), J85(A80), J125(A74), O5(A85)
- International control organization; C43(A63)
- International exchange of information; A4(A83), A27(A84), C43(A63), J79(T79), J127(A78), M7(A81), M9(A85)
-- declarations; E12(A65)
- On-site inspection
-- progressive/zonal; E12(A65)
-- selective; C43(A63), J75(A79), J86(A80), J112(A62), J113(A62)
- Remote sensors; A20.1(A86), A26(A81), A37(G85), J68.1(A85), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J91(A81), J92(A83), J95.2(A86), J127(A78), J129(A82), J132(A84)
-- aerial; J74(A79), J76(A79), J79(T79), J81(A80), J89(A81), J92.1(A83), J111(A61), J115(A80)
-- ELINT; J29(A84), J35(A85), J39(A85), J74(A79), J80(A80), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J95(A85), J115(A80)
-- ground-based; J65(A85), J78(A79), J79(T79), J80(A80), J81(A80), J88(A80), J89(A81), J92.1(A83), J115(A80), J122(A85)
-- radar; E12(A65), J35(A85), J65(A85), J74(A79), J76(A79), J78(A79), J79(T79), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J111(A61), J112(A62), J113(A62), J114(A72), J122(A85), J125(A74), J131(A83)
-- satellite; J74(A79), J76(A79), J78(A79), J79(T79), J80(A80), J82(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J111(A81), J114(A72), J115(A80), J112(A85), J125(A74), J131(A83), M9(A85)
-- shipboard; J74(A79), J76(A79), J79(T79), J81(A80), J88(A80), J89(A81), J92.1(A83), J114(A72), J115(A80), J122(A85), J125(A74)
- Short-range sensors
-- monitoring devices; J75(A79)
- Verification - general; A20.1(A86), A25(A81), A26(A81), A30(A85), A31(A85), A37(G85)
NUCLEAR WEAPONS - MOBILE BALLISTIC MISSILES
- Complaints procedure
-- consultative commission; A30(A85), J79(T79), O5(A85)
- International exchange of information; J79(T79), M9(A85)
- On-site inspection
-- sampling; C44(A80)
-- selective; C44(A80), J75(A79), J86(A80), J117(A79), J118(A80), J119.1(A83)
- Remote sensors; A20.1(A86), A26(A81), J73(A76), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J92(A83), J95.2(A86), J116(A79), J118(A80), J119(A84)
-- aerial; J74(A79), J79(T79), J81(A80), J92.1(A83), J126(A78)

NUCLEAR WEAPONS - MOBILE BALLISTIC MISSILES (cont'd)
-- ELINT; J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- ground-based; J79(T79), J81(A80), J88(A80), J92.1(A83)
-- radar; J74(A79), J7(T79), J81(A80), J88(A80), J92.1(A83)
-- satellite; J74(A79), J79(T79), J81(A80), J82(A80), J88(A80), J92.1(A83), J117(A79), J119.1(A83), J122(A85)
-- shipboard; J74(A79), J79(T79), J81(A80), J88(A80)
- Short-range sensors
-- monitoring devices; J75(A79), J117(A79), M9(A85)
- Verification - general; A20.1(A86), A25(A81), A26(A81), A30(A85), A31(A85)

Nuclear weapons - MRVs
USE NUCLEAR WEAPONS - REENTRY VEHICLES

Nuclear weapons - non-proliferation
USE NUCLEAR WEAPONS - PROLIFERATION

Nuclear weapons - numerical limitations on delivery vehicles
USE NUCLEAR WEAPONS subdivided by appropriate type of delivery system(s), e.g. NUCLEAR WEAPONS - BALLISTIC MISSILES

NUCLEAR WEAPONS - PARTIAL TEST BAN
- Complaints procedure
-- consultation and cooperation; K54(T74)
-- consultative commission; A30(A85), C52(T76)
- International control organization; K7(G69)
- International exchange of information; C52(T76), K54(T74)
-- referral to new international body; K7(G69)
- On-site inspection
-- obligatory; C52(T76)
-- sampling; K55(A83)
-- selective; C45(A76), C46(A83), C47(G84), C52(T76), I4(A81), K36(I80), K37(A81), K55(A83)
- Remote sensors; A37(G85), K37(A81), K54(T74), O2(A82)
-- ELINT; K36(I80)
-- ground-based; C45(A76), J120(T63), J122(A85)
-- sampling; C45(A76), J120(T63), J122(A85)
-- satellite; C45(A76), J29(A84), J39(A85), J95(A85), J120(T63), J121(G84), J122(A85), K36(I80)
- Seismic sensors; C46(A83), J95(A85)
-- extra-border stations; C52(T76), K37(A81), K54(T74)
-- international network; K7(G69), K36(I80), K53(G72)
-- intra-border stations; A4(A83), K36(I80), K37(A81), K55(A83), K56(A83)
- Short-range sensors
-- monitoring devices; C52(T76), K36(I80), K37(A81)
-- sampling; I7(G84)
- Verification - general; A30(A85), A31(A85), A37(G85)

NUCLEAR WEAPONS - PEACEFUL NUCLEAR EXPLOSIONS
- Complaints procedure
-- consultation and cooperation; K8(G69), K30(G77), K35(G79)
-- consultative commission; C52(T76), K30(G77), O5(A85)
-- referral to General Assembly; D1(T67)
-- referral to new international body; D1(T67)

NUCLEAR WEAPONS - PEACEFUL NUCLEAR EXPLOSIONS (cont'd)
-- referral to Organization of American States; D1(T67)
-- referral to Security Council; D1(T67), K8(G69), K30(G77)
- International control organization; D1(T67), C48(G71), C49(I73), C50(G75), K30(G77), K35(G79), M11(G68)
- International exchange of information; A8(A83), C52(T76), K8(G69), M11(G68)
- Literature survey; K27(A77)
- On-site inspection
-- challenge; K8(G69)
-- IAEA safeguards; D1(T67), D9(T68), D16(I75), K57(G76)
-- non-obligatory; M11(G68)
-- obligatory; C36(A85), C45(A76), C52(T76)
-- sampling; I4(A81), K55(A83)
-- selective; A8(A83), C36(A85), C45(A76), C46(A83), C48(G71), C49(I73), C50(G75), C51(G76), C52(T76), I4(A81), K27(A77), K30(G77), K35(G79), K55(A83), K57(G75), K58(G84), M11(G68)
- Remote sensors; J122.1(A81), K35(G79)
-- satellite; C45(A76)
- Review conference; D9(T68), D16(I75), K8(G69), K30(G77), K35(G79)
- Seismic sensors; C46(A83), K24(A76)
-- extra-border stations; C52(T76)
-- international network; K35(G79)
-- intra-border stations; I4(A81), K35(G79), K55(A83), K56(A83), K57(G75), K58(G84)
- Short-range sensors
-- monitoring devices; C49(I73), C52(T76)
-- sampling; K27(A77)
-- seals; C49(I73), K58(G84)

Nuclear weapons - production of delivery vehicles
USE NUCLEAR WEAPONS subdivided by appropriate type of delivery system(s), e.g. NUCLEAR WEAPONS - BALLISTIC MISSILES

NUCLEAR WEAPONS - PROLIFERATION
UF Nuclear weapons - non-proliferation
- Complaints procedure
-- consultation and cooperation; D2(I76), M8(T85), M12(I78)
-- consultative commission; M8(T85)
-- referral to General Assembly; D1(T67), D2(I76)
-- referral to new international body; D1(T67), D2(I76)
-- referral to International Court of Justice; D42(A83)
-- referral to Organization of American States; D1(T67)
-- referral to Security Council; D1(T67), D2(I76)
- International control organization; A3(A82), D1(T67), D2(I76), J124(A83), M8(T85), M12(I78)
- International exchange of information; M12(I78)
-- reports to international body; M8(T85)
- National self-supervision; D2(I76)
- Non-physical/psychological inspection; B1(A61)
- On-site inspection
-- general; D18(G77)

NUCLEAR WEAPONS - PROLIFERATION (cont'd)
-- IAEA safeguards; A3(A82), A8(A83), A21(A85), C19(A66), C30(A82), C45(A76), C58(A83), D1(T67), D2(I76), D9(T68), D10(I68), D11(I70), D12(I72), D13(G74), D14(A75), D15(I75), D16(I75), D17(A77), D18(G77), D19(I77), D20(I78), D21(A79), D22(A79), D23(A80), D24(A80), D25(A80), D26(I80), D27(I80), D28(A81), D29(A81), D30(A81), D31(A81), D32(A81), D33(A81), D34(A81), D35(I81), D36(A82), D37(A82), D38(A82), D39(I82), D40(A83), D41(A83), D42(A83), D43(A83), D44(A83), D45(G83), D46(I83), D47(A84), D48(A84), D49(A84), D50(A84), D51(G84), D52(I84), D53(A85), D54(A85), D55(A85), D56(I85), J9(G80), J94(A84), J95.2(A86), J132(A84), M8(T85), M12(I78)
-- selective; A21(A85), J9(G80), J124(A83)
- Remote sensors; D18(G77), J124(A83)
-- aerial; J123(A82)
-- satellite; J123(A82)
- Review conference; D9(T68), D16(I75)
- Short-range sensors
-- monitoring devices; A21(A85), D25(A80), D29(A81), D31(A81), D34(A81), D48(A84), D51(G84), D52(I84), I18(G82)
-- RECOVER; D29(A81), D33(A81), D34(A81), D38(A82), D45(G83)
-- seals; D25(A80), D31(A81), D33(A81), D34(A81), D48(A84), D51(G84), D52(I84)

NUCLEAR WEAPONS - REENTRY VEHICLES
UF Nuclear weapons - MARVs
- MIRVs
- MRVs
- Complaints procedure
-- consultative commission; A30(A85), J79(T79), J125(A74), O5(A85)
- International exchange of information; J79(T79), J127(A78)
- On-site inspection
-- selective; C53(A70), J75(A79), J86(A80)
- Remote sensors; A20.1(A86), A26(A81), J68.1(A85), J73(A76), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J95.2(A86), J127(A78)
-- aerial; J74(A79), J79(T79), J81(A80), J89(A81), J92.1(A83), J126(A78)
-- ELINT; J74(A79), J79(T79), J80(A80), J81(A80), J88(A80), J89(A81), J92.1(A83)
-- ground-based; J79(T79), J80(A80), J81(A80), J88(A80), J89(A81), J92.1(A83)
-- radar; J35(A85), J74(A79), J79(T79), J81(A80), J88(A80), J89(A81), J92.1(A83), J114(A72), J125(A74)
-- satellite; J35(A85), J68(A78), J74(A79), J79(T79), J80(A80), J81(A80), J82(A80), J88(A80), J89(A81), J92.1(A83), J114(A72), J122(A85), J125(A74)
-- shipboard; J74(A79), J79(T79), J81(A80), J88(A80), J89(A81), J92.1(A83), J114(A72), J125(A74)
- Short-range sensors
-- monitoring devices; J75(A79)
- Verification - general; A20.1(A86), A25(A81), A26(A81), A30(A85), A31(A85)

NUCLEAR WEAPONS - RESEARCH AND DEVELOPMENT
UF Nuclear neutron weapons
- Complaints procedure
-- consultation and cooperation; A36(A84), J128(G78)
-- consultative commission; J65(A85)
-- referral to Security Council; J128(G78)
- International exchange of information; M13(A81)
-- declarations; J132(A84)
- Non-physical/psychological inspection; B1(A61)
- On-site inspection
-- challenge; J94(A84)
-- selective; C54(A61), J94(A84), J130(A83)
- Records monitoring
-- economic; B1(A61), C54(A61)
-- plant; B1(A61), C54(A61)
- Remote sensors; J65(A85), J92(A83), J94(A84), J128(G78), J130(A83), J132(A84)
-- satellite; J131(A83)
- Verification - general; A36(A84)

Nuclear weapons - SLBMs
USE NUCLEAR WEAPONS - BALLISTIC MISSILES

Nuclear weapons - SLBM Submarines
USE NUCLEAR WEAPONS - BALLISTIC MISSILES

Nuclear weapons - SLCMs
USE NUCLEAR WEAPONS - CRUISE MISSILES

Nuclear weapons - warhead stockpiling
USE NUCLEAR WEAPONS - FISSIONABLE MATERIALS "CUTOFF"

O

ON-SITE INSPECTION
RT SHORT-RANGE SENSORS

ON-SITE INSPECTION - CHALLENGE
- Any arms control agreement; A20.59(G86), C10(A76), C103(A85)
- Chemical and biological weapons; N1(G70)
- Chemical weapons
-- binary agents; C98(A83)
-- destruction of facilities; A3(A82), C76(G84), C78(G84), C80(A85), C88(A80), C95(G82), C98(A83), C102(A85), J134(G84), M19(G76), O15.1(G86), P27(G82)
-- destruction of stocks; A3(A82), C76(G84), C78(G84), C80(A85), C81(A85), C88(A80), C92(A81), C95(G82), C98(A83), C102(A85), J134(G84), N10(G85), O15.1(G86), P27(G82), P28(G84)
-- production; C75(G83), C76(G84), C78(G84), C80(A85), C81(A85), C88(A80), C90(G80), C92(A81), C95(G82), C98(A83), C102(A85), C103(A85), C107(G85), C107.1(G86), C107.3(G86), G11(G85), G12(G86), N10(G85), N14(G82), O15.1(G86), P27(G82), P34(G85)
-- stockpiling; C76(G84), C88(A80), C90(G80), C92(A81), C95(G82), C98(A83), C102(A85), O15.1(G86), P27(G82)

ON-SITE INSPECTION - CHALLENGE (cont'd)
-- use; C76(G84), C118(G85), O15.1(G86)
- Military budgets; B31(I82)
- Nuclear weapons
-- ballistic missiles; J94(A84)
-- comprehensive test ban; C33(G66), J132(A84), K8(G69), K29(G77), P12(G82)
-- cruise missiles; J94(A84), J107(A85)
-- peaceful nuclear explosions; K8(G69)
- Regional arms control
-- Europe; A3(A82), C81(A85)
ON-SITE INSPECTION - CONTROL POSTS
- Conventional weapons
-- aircraft; B16(T79), B35(G70)
-- ground forces; A4(A83), A20.2(G86), A20.4(G86), B13(T75), B16(T79), B35(G70), C122(A84), C123(A85), J139(A74), J140.1(G86), M23(A85), M24(A85)
-- ships; B16(T79)
- General and complete disarmament; E2(A62), J42(G57), P15(G62)
- Nuclear weapons
-- ballistic missiles; E9(A60), E11(A62)
-- comprehensive test ban; C18(A64), P19(G61)
-- manned aircraft; E9(A60)
- Regional arms control
-- demilitarization; B13(T75), B14(A78), B16(T79), B22.1(A85), B22.2(A87), F1(A64), F2(A65)
-- disarmament; O3(I80)
-- Europe; B22.1(A85), B22.2(A87), B23(G63), B35(G70), C122(A84), C123(A85), F1(A64), F2(A65), J45(A76), J139(A74), M23(A85), M24(A85)
-- Middle East; B13(T75), B16(T79), B22.1(A85), B22.2(A87)
ON-SITE INSPECTION - GENERAL
- Any arms control agreement; A20.71(G86), B1(A61), B2(A65), B2.1(A67), B3(A68), B3.1(A85), G2(A63), I33(A85), P2(A65)
- Chemical weapons
-- destruction of facilities; J134(G84)
-- destruction of stocks; I11(G83), I12(G84), I13(G84),J134(G84)
- Conventional weapons
-- aircraft; B16(T79), B35(G70)
-- ground forces; B3.1(A85), B13(T75), B16(T79), B34(A61), B35(G70)
-- ships; B16(T79)
- General and complete disarmament; B4(A62), B5(A63), E6(A64), P13(G61), P14(G62)
- Military budgets; B31(I82)
- Nuclear weapons; B32(A77)
-- ballistic missiles; B33(A78)
-- cruise missiles; B33(A78)
-- manned aircraft; B33(A78)
-- proliferation; D18(G77)
- Regional arms control
-- Antarctica; A8(A83), B7(T59)

ON-SITE INSPECTION - GENERAL (cont'd)
-- any agreement; B6(A62)
-- demilitarization; B7(T59), B8(A66), B9(G69), B10(A71), B11(T73), B12(A74), B13(T75), B14(A78), B15(A78), B16(T79), B17(A83), B18(A83), B19(A84), B20(A84), B21(A84), B22(A85), B22.1(A85), B22.2(A87), B24(T67), B26(T70)
-- Europe; B22.1(A85), B22.2(A87), B23(G63), B33(A78), B35(G70)
-- Indochina; B11(T73)
-- Middle East; B13(T75), B15(A78), B16(T79), B17(A83), B19(A84), B22(A85), B22.1(A85), B22.2(A87)
-- nuclear weapons free zones; B26(T79), B33(A78)
-- outer space; B24(T67), B26(T79)
-- outer space - ASATs; B25(A82)
-- sea bed; B9(G69), B27(G69), B28(G69), B29(G69), B30(T71)

ON-SITE INSPECTION - IAEA SAFEGUARDS
UF Safeguards
RT INTERNATIONAL CONTROL ORGANIZATION
INTERNATIONAL EXCHANGE OF INFORMATION - REPORTS TO INTERNATIONAL BODY
NATIONAL SELF-SUPERVISION
ON-SITE INSPECTION - SAMPLING
- SELECTIVE
RECORDS MONITORING - PLANT
SHORT-RANGE SENSORS - MONITORING DEVICES
- SAMPLING
- SEALS
- Any arms control agreements; A8.1(A82), A16.1(A85), A20.52(G86), C11(A83)
- Nuclear weapons
-- comprehensive test ban; D38(A82), D45(G83)
-- fissionable material "cutoff"; D3(G64), D4(G66), D5(G69), D6(G79), D7(A82), D8(A85), D40(A83), J92.1(A83), J94(A84), J95.2(A86), J109(A80), J110(A84), J129(A82), J131(A83), J132(A84)
-- peaceful nuclear explosions; D1(T67), D9(T68), D16(I75) K57(G75)
-- proliferation; A3(A82), A8(A83), A21(A85), C19(A66), C30(A82), C45(A76), C58(A83), D1(T67), D2(I76), D9(T68), D10(I68), D11(I70), D12(I72), D13(G74), D14(A75), D15(I75), D16(I75), D17(A77), D18(G77), D19(I77), D20(I78), D21(A79), D22(A79), D23(A80), D24(A80), D25(A80), D26(I80), D27(I80), D28(A81), D29(A81), D30(A81), D31(A81), D32(A81), D33(A81), D34(A81), D35(I81), D36(A82), D37(A82), D38(A82), D39(I82), D40(A83), D41(A83), D42(A83), D43(A83), D44(A83), D45(G83), D46(I83), D47(A84), D48(A84), D49(A84), D50(A84), D51(G84), D52(I84), D53(A85), D54(A85), D55(A85), D56(I85), J9(G80), J94(A84), J95.2(A86), J132(A84), M8(T85), M12(I78)
- Chemical weapons
-- production; D7(A82)
-- stockpiling; D7(A82)
- Regional arms control
-- Latin America; D1(T67)
-- nuclear weapons free zones; D1(T67), D2(I76)

ON-SITE INSPECTION - NON-OBLIGATORY
SN Includes inspection by invitation and provisions for refusal of a request for inspection
- Any arms control agreement; C4(A61)
- Chemical weapons
-- destruction of facilities; N16(A83), O14(G79)
-- destruction of stocks; N10(G85), N16(A83), O14(G79)
-- production; M21(A80), N7(G74), N10(G85), N16(A83), O14(G79)
-- stockpiling; N16(A83), O14(G79)
-- use; N16(A83)
- Conventional weapons
-- ground forces; C123(A85)
- Nuclear weapons
-- ballistic missiles; C123(A85)
-- comprehensive test ban; J100(G83), K2(G62), K8(G69), K20(G73), K22(G75), K30(G77)
-- peaceful nuclear explosions; M11(G68)
- Regional arms control
-- demilitarization; B24(T67)
-- Europe; C123(A85)
-- nuclear weapons free zone; B24(T67)
-- outer space; B24(T67)
-- sea bed; B27(G69), B30(T71)

ON-SITE INSPECTION - OBLIGATORY
SN Includes systems where the requirement to allow on-site inspection of some form is legally binding
- Any arms control agreement; C103(A85)
- Chemical weapons
-- destruction of facilities; C68(A80), C69.1(G86), C79(G84), M18(G76), P27(G82), P32(A83), P33(G83)
-- destruction of stocks; C70(G74), C79(G84), C92(A81), M18(G76), N7(G74), N10(G85), P27(G82), P32(A83), P33(G83)
-- production; C79(G84), C85(G79), C92(A81), C101(G83), C103(A85), G10(G74), M18(G76), N10(G85), P27(G82), P32(A83), P33(G83)
-- stockpiling; C85(G79), C92(A81), P27(G82), P32(A83), P33(G83)
-- use; C79(G84), P33(G83)
- Conventional weapons
-- aircraft; B16(T79)
-- ground forces; B13(T75), B16(T79)
-- ships; B16(T79)
- General and complete disarmament; P14(G62), P15(G62)
- Nuclear weapons; B32(A77)
-- comprehensive test ban; C31(G63), C32(G63), C35(G69), C36(A85), J101(G84), K41(G83), P19(G61), P20(G62)
-- cruise missiles; J107(A85)
-- partial test ban; C52(T76)
-- peaceful nuclear explosions; C36(A85), C45(A76), C52(T76)
-- proliferation; M8(T85)
- Regional arms control
-- Antarctica; B7(T59)

ON-SITE INSPECTION - OBLIGATORY (cont'd)
-- demilitarization; B7(T59), B13(T75), B16(T79), B24(T67), B26(T79)
-- Middle East; B13(T75), B16(T79)
-- nuclear weapons free zones; B24(T67), B26(T79)
-- outer space; B24(T67), B26(T79)
ON-SITE INSPECTION - PROGRESSIVE/ZONAL
- Chemical and biological weapons; C30(A82)
- Chemical weapons
-- destruction of facilities; E13(G79)
-- production E13(G79)
-- stockpiling; E13(G79)
- General and complete disarmament; C17(A62), E1(A62), E2(A62), E3(A62), E4(A62), E5(A63), E6(A64), E7(A65), J43(A68), M5(A63), P15(G62)
- Nuclear weapons
-- ballistic missiles; C28(A62), C30(A82), E9(A60), E10(A61), E11(A62), E12(A65)
-- manned aircraft; C28(A62), E9(A60), E12(A65)
-- missile tests; E12(A65)
- Regional arms control; E8(G63)
-- demilitarization; F1(A64)
-- Europe; F1(A64)
ON-SITE INSPECTION - SAMPLING
UF Sampling
RT LITERATURE SURVEY - SAMPLING
ON-SITE INSPECTION - IAEA SAFEGUARDS
RECORDS MONITORING - SAMPLING
REMOTE SENSORS - SAMPLING
SHORT-RANGE SENSORS - SAMPLING
- Any arms control agreement; A20.54(G86), B1(A61), C3(A58), C5(A62), C6(A65), C8(A68), G1(A63), G2(A63)
- Chemical and biological weapons
-- use; C55(G82), C56(I84), C57(G85), P22(G82)
-- use - "yellow rain"; C58(A83), C59(A84), C61(A85), C62(A85), O9(A85)
- Chemical weapons
-- binary agents; C94(A82), C95(G82), C96(G82), C97(G82)
-- destruction of facilities; C78(G84), C95(G82), N16(A83), N19(G85)
-- destruction of stocks; C78(G84), C95(G82), N16(A83), N19(G85)
-- production; C69(G81), C78(G84), C94(A82), C95(G82), C96(G82), C97(G82), C101(G83), C104(G85), C114(A83), D7(A82), G11(G85), N16(A83), P34(G85)
-- stockpiling; C95(G82), D7(A82), N16(A83), N19(G85)
-- use; C69(G81), C111(G82), C112(A83), C114(A83), C115(A83), C118(G85), N16(A83)
- Conventional weapons
-- ground forces; B34(A61)
- General and complete disarmament; B4(A62), C17(A62), E7(A65)
- Military budgets; B31(I82), L6(A75)
- Nuclear weapons

ON-SITE INSPECTION - SAMPLING (cont'd)
-- ballistic missiles; C27(A61), E10(A61)
-- comprehensive test ban; K51(G85), K55(A83)
-- manned bombers; C27(A61)
-- mobile ballistic missiles; C44(A80)
-- partial test ban; K55(A83)
-- peaceful nuclear explosions; I4(A81), K55(A83)
ON-SITE INSPECTION - SELECTIVE
RT ON-SITE INSPECTION - IAEA SAFEGUARDS
- Any arms control agreement; A6(A83), A7(A83), A8(A83), A8.1(A82), A10(G83), A13(A84), A14(A84), A16(A85), A16.1(A85), A17(A85), A20.4(G86), A20.53(G86), A20.56(G86), A20.59(G86), A20.592(G86), A20.6(G86), A20.7(G86), A20.72(G86), A20.9(G86), C1(A58), C2(A58), C3(A58), C4(A61), C5(A62), C6(A65), C7(A67), C8(A68), C9(A72), C10(A76), C11(A83), C12(A83), C13(A84), C14(A84), C15(A84), C103(A85), G1(A63), J2(G76), J4(A77), J23(A83), J27(A84), J30(A84), J37(A85), J38(A85), J68.1(A85), M2(A65), P3(A68), P8(G78), P10(G82)
- Biological weapons
-- production; C63(A58), C64(A83)
-- research and development; C63(A58)
- Chemical and biological weapons; C30(A82), J97(G77), N1(G70)
-- use; A38(A83), C55(G82), C56(I84), C57(G85), P22(G82)
-- use - "yellow rain"; C59(A84), C60(A85), C61(A85), C62(A85), O9(A85)
- Chemical weapons
-- binary agents; C94(A82), C95(G82), C96(G82), C97(G82), C98(A83), C105(G85), C106(G85), I17(G77), P25(G79)
-- destruction of facilities; A3(A82), A20.2(G86), A20.72(G86), A20.91(G86), C60(A85), C65(A79), C66(G79), C67(G79), C68(A80), C69(G81), C69.1(G86), C76(G84), C77(G84), C78(G84), C79(G84), C80(A85), C87(A80), C88(A80), C91(G80), C95(G82), C98(A83), C98(A83), C99(A83), C102(A85), C105(G85), C106(G85), C110(G85), I16(G71), J133(A80), M17(G72), M18(G76), M19(G76), N15(G82), N16(A83), N17(G84), N19(G85), O2(A82), O14(G79), O15(G80), O15.1(G86), P26(G82), P27(G82), P30(G81), P32(A83), P33(G83)
-- destruction of stocks; A3(A82), A20.2(G86), A20.4(G86) A20.53(G86), A20.592(G86), A20.72(G86), C45(A76), C60(A85), C65(A79), C66(G79), C69(G81), C71(G76), C72(G76), C73(G77), C74(A80), C75(G83), C76(G84), C77(G84), C78(G84), C79(G84), C80(A85), C81(A85), C88(A80), C89(A80), C92(A81), C95(G82), C98(A83), C99(A83), C100(A83), C102(A85), C105(G85), C106(G85), C109(A83), C110(G85), G4(A75), I10(G82), J135(A77), M18(G76), M19(G76), N5(G73), N7(74), N10(G85), N16(A83), N17(G84), N19(G85), O2(A82), O14(G79), O15(G80), O15.1(G86), P8(G78), P12(G82), P25(G78), P26(G82), P27(G82), P28(G84), P32(A83), P33(G83)
-- production; A4(A83), A8(A83), A20.2(G86), A20.4(G86) A20.53(G86), A20.592(G86), A20.72(G86), A21(A85), C45(A76), C60(A85), C65(A79), C66(G79), C69(G81), C75(G83), C76(G84), C78(G84), C79(G84), C80(A85), C82(A70), C83(G70), C84(A74), C85(G79), C86(G79), C87(A80), C88(A80), C89(A80), C90(G80), C91(G80), C92(A81), C93(G81), C94(A82), C95(G82), C96(G82), C97(G82), C98(A83),

ON-SITE INSPECTION - SELECTIVE (cont'd)
C100(A83), C101(G83), C102(A85), C103(A85), C104(G85), C105(G85), C106(G85), C107(G85), C107.1(G86), C107.2(G86), C107.3(G86), C109(A83), C110(G85), C113(A83), C114(A83), C116(A84), G1(A63), G4(A75), G8(A73), G10(G74), G11(G85), G12(G86), I15(G71), I16(G71), I17(G77), J135(A77), M17(G72), M18(G76), M21(A80), N7(G74), N10(G85), N15(G82), N16(A83), N17(G84), N19(G85), O14(G79), O15(G80), O15.1(G86), P8(G78), P12(G82), P25(G79), P27(G82), P30(G81), P31(G82), P32(A83), P33(G83), P34(G85)
-- research and development; C69(G81), C93(G81)
-- stockpiling; A4(A83), A21(A85), C45(A76), C60(A85), C65(A79), C69(G81), C76(G84), C85(G79), C88(A80), C89(A80), C90(G80), C92(A81), C93(G81), C95(G82), C98(A83), C100(A83), C102(A85), C105(G85), C106(G85), C108(G72), C109(A83), I110(G85), G4(A75), J135(A77), N15(G82), N16(A83), N19(G85), O14(G79), O15(G80), O15.1(G86), P12(G82), P25(G79), P27(G82), P30(G81), P32(A83), P33(G83)
-- use; C64(A83), C69(G81), C76(G84), C79(G84), C80(A85), C89(A80), C93(G81), C111(G82), C112(A83), C113(A83), C114(A83), C115(A83), C116(A84), C117(A85), C118(G85), N16(A83), O15.1(G86), P28(G84), P33(G83)
- Conventional weapons
-- aircraft; B16(T79), B35(G70), C124(T86)
-- ground forces; A8(A83), A20.4(G86), A20.53(G86), A20.592(G86), A20.6(G86), A20.91(G86), B16(T79), B35(G70), C15(A85), C121(A62), C121.1(A68), C122(A84), C123(A85), C124(T86), J140.1(G86)
-- ships; B16(T79), C121.1(A68), J95.1(A85), J141(I85)
- General and complete disarmament; B4(A62), C16(A62), C17(A62), C18(A64), C18.1(A69), E6(A64), L2(A62), M4(A55), M6(A64), P15(G62)
- Military budgets; B31(I82), L4(I74), L6(A75)
- Nuclear weapons
-- anti-ballistic missiles; A38(A83), C25.1(G85)
-- ballistic missiles; A6(A83), A20.2(G86), A20.4(G86), A20.53(G86), A20.592(G86), A20.91(G86), A21(A85), A38(A83), C15(A85), C26(A61), C27(A61), C28(A62), C29(G62), C30(A82), C123(A85), J41(G85), J70(G62), J75(A79), J86(A80), J93(A83), J94(A84), J95.1(A85), M9(A85), O2(A82)
-- comprehensive test ban; A3(A82), A20.2(G86), A20.4(G86), A20.53(G86), A20.592(G86), A20.6(G86), A20.72(G86), A27(A84), C18(A64), C31(G63), C32(G63), C33(G66), C34(G69), C35(G69), C36(A85), C46(A83), J68.1(A85), J92.1(A83), J97(G77), J100(G83), J129(A82), J131(A83), J132(A84), K2(G62), K5(A66), K6(G67), K8(G69), K20(G73), K22(G76), K27(A77), K29(G77), K30(G77), K35(G79), K36(I80), K41(G83), K42(G83), K43(G83), K44(A84), K47(A85), K49(G85), K51(G85), K52.2(G86), K52.4(G86), K52.7(G86), K55(A83), P8(G78), P12(G82), P19(G61), P20(G62), P21(G83)
-- cruise missiles; A4(A83), C37(G77), C38(A82), C38.1(G85), I5.1(A86), J75(A79), J86(A80), J94(A84), J95(A85), J95.1(A85), M9(A85)
-- fissionable material "cutoff"; C39(G62), C40(A83), I6(G66), J109(A80), J110(A84), J124(A83), J131(A83)

ON-SITE INSPECTION - SELECTIVE (cont'd)
-- manned aircraft; A4(A83), A38(A83), C26(A61), C27(A61), C28(A62), C41(A61), C42(G62), J75(A79), J86(A80)
-- missile tests; C43(A63), J75(A79), J86(A80), J112(A62), J113(A62)
-- mobile ballistic missiles; C44(A80), J75(A79), J86(A80), J117(A79), J118(A80), J119.1(A83)
-- partial test ban; C45(A76), C46(A83), C47(G84), C52(T76), I4(A81), K36(I80), K37(A81), K55(A83)
-- peaceful nuclear explosions; A8(A83), C36(A85), C45(A76), C46(A83), C48(G71), C49(I73), C50(G75), G51(G76), C52(T76), I4(A81), K27(A77), K30(G77), K35(G79), K55(A83), K57(G75), K58(G84), M11(G68)
-- proliferation; A21(A85), J9(G80), J124(A83), M8(T85)
-- reentry vehicles; C53(A70), J75(A79), J86(A80)
-- research and development; C54(A61), J94(A84), J130(A83)
- Other weapons of mass destruction
-- ENMOD; O19.1(A84)
-- radiological weapons; C119(A82), C120(G84)
- Regional arms control
-- Africa; C22(A62)
-- Antarctica; C19(A66)
-- demilitarization; B16(T79), B22.2(A87), C19(A66)
-- Europe; A3(A82), B22.2(A87), B35(G70), C15(A85), C20(A84), C21(A84), C81(A85), C122(A84), C123(A85), C124(T86)
-- Middle East; B16(T79), B22.2(A87), C22(A62)
-- nuclear weapons free zones; C22(A62), C23(A63), M8(T85)
-- outer space; A20.4(G86), A20.53(G86), A20.592(G86), A20.6(G86), A20.72(G86), A20.91(G86), C25.1(G85), J49(A84)
-- outer space - ASATs; C24(A77), C25(A84), J57(A84), J58(A84), J59(A84), J63(G84), J64(A85)
OTHER WEAPONS OF MASS DESTRUCTION
UF New weapons of mass destruction
- Complaints procedure
-- consultation and cooperation; N21(G75)
-- referral to Security Council; N21(G75)
- National self-supervision; N21(G75)
OTHER WEAPONS OF MASS DESTRUCTION - ENVIRONMENTAL MODIFICATION
UF Environmental modification weapons
- Complaints procedure
-- consultation and cooperation; O17(G75), O19(T77)
-- consultative commission; O18(G76), O19(T77), O19.1(A84)
-- referral to new international body; O18(G76)
-- referral to Secretary General; O18(G76)
-- referral to Security Council; N22(G74), O17(G75), O19(T77)
- International control organization; O18(G76), O19(T77)
- International exchange of information; M22(G75)
- On-site inspection-selective; O19.1(A84)
- National self-supervision; N22(G74), O19(T77)
- Remote sensors; O19.1(A84)
- Review conference; N22(G74), O19(T77)
- Verification - general; A8(A83)

OTHER WEAPONS OF MASS DESTRUCTION - RADIOLOGICAL WEAPONS
UF Radiological weapons
- Complaints procedure
-- consultation and cooperation; O20(G79)
-- consultative commission; C119(A82), O20(G79)
-- referral to General Assembly; C119(A82)
-- referral to Security Council; O20(G79)
- National self-supervision; O20(G79)
- On-site inspection
-- selective; C119(A82), C120(G84)
- Review conference; N22(G74), O19(T77)
- Verification - general; A8(A83)
OUTER SPACE TREATY. 27 January 1967; B24(T67)

P

PARTIAL TEST BAN TREATY.
USE Limited Test Ban Treaty
PEACEFUL NUCLEAR EXPLOSIONS TREATY. 23 JUNE 1976. C52(T76)
Peacekeeping Forces
USE ON-SITE INSPECTION - GENERAL
Peace Observation Forces
USE ON-SITE INSPECTION - GENERAL
PERSONNEL
SN Includes explicit substantive discussions of personnel requirements of a verification system
B8(A66), B10(A71), B14(A78), B23(G63), B35(G70), C5(A62), C17(A62), C18(A64), C23(A63), C39(G62), C42(G62), C52(T76), C55(G82), C56(I84), C57(G85), C59(A84), C69(G81), C78(G84), C82(A70), C86(G79), C111(G82), C112(A83), C113(A83), C118(A85), D18(G77), D23(A80), D31(A81), D32(A81), D33(A81), D37(A82), D41(A83), D46(I83), D47(A84), D50(A84), D55(A85), G8(A73), I6(G66), J23(A83), J70(G62), K25(G76), N17(G84), P2(A65), P3(A68), P14(G62), P15(G62), P17(A76), P19(G61), P20(G62)

R

Radiological Weapons
USE OTHER WEAPONS OF MASS DESTRUCTION - RADIOLOGICAL WEAPONS
RECORDS MONITORING
RT INTERNATIONAL EXCHANGE OF INFORMATION
LITERATURE SURVEY
RECORDS MONITORING - ECONOMIC
- Any arms control agreement; B1(A61), C2(A58), C9(A72), G1(A63)
- Chemical and biological weapons; N1(G70)
- Chemical weapons
-- binary agents; G9(A74)
-- destruction of stocks; G4(A75), G9(A74), J138(G77)

RECORDS MONITORING - ECONOMIC (cont'd)
-- production; C65(A79), C88(A80), C91(G80), G5(G70), G6(G70), G7(G71), G8(A73), G9(A74), G10(G74), G11(G85), G12(G86), J138(G77), L8(G73), M17(G72), N7(G74), N9(A80)
-- stockpiling; C88(A80), G4(A75), G9(A74), J138(G77)
- General and complete disarmament; C17(A62)
- Military budgets; B31(I82)
- Nuclear weapons
-- ballistic missiles; C26(A61), E10(A61)
-- manned aircraft; C26(A61)
-- research and development; B1(A61), C54(A61)
- Regional arms control
-- Europe; B23(G63)

RECORDS MONITORING - PERSONNEL
- Any arms control agreement; G2(A63), M1(A62)
- Biological weapons
-- production; C63(A58)
-- research and development; C63(A58)
- General and complete disarmament; E5(A63), L2(A62)
- Nuclear weapons
-- ballistic missiles; C28(A62)
-- manned aircraft; C28(A62)
-- research and development; C54(A61)

RECORDS MONITORING - PLANT
RT ON-SITE INSPECTION - IAEA SAFEGUARDS
- Any arms control agreement; B1(A61), G1(A63), G3(A65)
- Chemical weapons
-- binary agents; G9(A74)
-- destruction of facilities; C95(G82), N19(G85), P32(A83)
-- destruction of stocks; C95(G82), G4(A75), G9(A74), N19(G85), P32(A83)
-- production; C82(A70), C86(G79), G95(G82), C102(A85), C104(G85), C106(G85), C107(G85), G5(G70), G8(A73), G9(A74), G10(G74), N19(G85), P32(A83), P34(G85)
-- stockpiling; C95(G82), C102(A85), C106(G85), G4(A75), G9(A74), N19(G85), P32(A83)
- Military budgets; L4(I74)
- Nuclear weapons
-- ballistic missiles; C27(A61), C29(G62), E10(A61)
-- fissionable material "cutoff"; C39(G62)
-- manned aircraft; C27(A61)
-- research and development; B1(A61)

RECORDS MONITORING - SAMPLING
UF Sampling
RT LITERATURE SURVEY - SAMPLING
ON-SITE INSPECTION - SAMPLING
REMOTE SENSORS - SAMPLING
SHORT-RANGE SENSORS - SAMPLING
- Any arms control agreement; G1(A63)
- Chemical weapons
-- destruction of stocks; G4(A75)
-- stockpiling; G4(A75)

RECOVER (Remote Continual Verification system)
USE SHORT-RANGE SENSORS - MONITORING DEVICES - RECOVER
REGIONAL ARMS CONTROL
SN (a) Includes regions defined geographically (e.g. Europe) or environmentally (e.g. outer space)
(b) Subdivided by name of geographic region or by type of environment, as appropriate
UF Mutual Balanced Force Reduction Talks
RT CONVENTIONAL WEAPONS
- Africa; C22(A62)
- Antarctica; A8(A83), B7(T59), C19(A66)
- Complaints procedure; A21(A85), J62(G84)
-- consultation and cooperation; A8(A83), B7(T59), B26(T79), B27(G69), B28(G69), B29(G69), B30(T71), C124(T86), D2(J76), J47(G82), J48(G83), J61(A84), J64(A85), M8(T85), O3(I80)
-- consultative commission; B11(T73), B13(T75), B15(A78), B16(T79), B22.2(A87), J29(A84), J44(A75), J48(G83), J51(A78), J56(A84), J61(A84), J65(A85), J93(A84), M8(T85), O5(A85)
-- referral to General Assembly; D1(T67), D2(I76)
-- referral to International Court of Justice; B7(T59)
-- referral to new international body; D1(T67), D2(I76)
-- referral to Organization of American States; D1(T67)
-- referral to Secretary General; B26(T79)
-- referral to Security Council; B27(G69), B29(G69), B30(T71), J49(A84), O4(G79)
- Demilitarization;
SN Includes partial or complete elimination of arms and/or forces in a region, as well as disengagement or withdrawal of forces
B7(T59), B8(A66), B10(A71), B12(A74), B13(T75), B14(A78), B15(A78), B16(T79), B17(A83), B18(A83), B19(A84), B20(A84), B21(A84), B22(A85), B22.1(A85), B22.2(A87), B24(T67), B26(T79), F1(A64), F2(A65), J44(A75)
- Europe; A3(A82), A19(A85), A21(A85), A29(A85), B6(A62), B22.1(A85), B22.2(A87), B23(G63), B33(A78), B35(G70), C15(A85), C20(A84), C21(A84), C81(A85), C122(A84), C123(A85), C124(T86), F1(A64), F2(A65), H7(A62), J29(A84), J45(A76), J45.1(A84), J50.2(G87), J139(A74), M7(A81), M23(A85), M24(A85), O5(A85), P16(A85)
- Indian Ocean; J44(A75)
- Indochina; B11(T73), B12(A74), P17(A76)
- International control organization; B11(T73), C15(A85), C22(A62), D1(T67), D2(I76), H7(A62), J54(A83), M8(T85), N8(A79), P16(A85), P17(A76), P17.1(G85)
-- ISMA; J14(A82), J45.1(A84), J50(A84), J50.2(G87), J59(A84)
- International exchange of information; A21(A85), B7(T59), B24(T67), C19(A66), C25.1(G85), C122(A84), C123(A85), J49(A84), J54(A83), J56(A84), J58(A84), J59(A84), J62(G84), J139(A74), M7(A81), M23(A85), M24(A85)
-- declarations; C21(A84)
-- reports to international body; J51(A78), M8(T85), N8(A79)

REGIONAL ARMS CONTROL (cont'd)
- Latin America; A8(A83), D1(T67), N8(A79)
- Mediterranean Sea; J44(A75)
- Middle East; A21(A85), B13(T75), B15(A78), B16(T79), B17(A83), B19(A84), B22(A85), B22.1(A85), B22.2(A87), C22(A62)
- National self-supervision; D2(I76), J48(G83), N8(A79), O4(G79)
- Non-physical/psychological inspection; H7(A62)
- Nuclear Weapons Free Zones; B24(T67), B26(T79), B33(A78), C22(A62), C23(A63), D1(T67), D2(I76), M8(T85), P16(A85)
- On-site inspection
-- challenge; A3(A82), C81(A85)
-- control posts; B13(T75), B14(A78), B16(T79), B22.1(A85), B22.2(A87), B23(G63), B35(G70), C122(A84), C123(A85), J45(A76), J139(A74), F1(A64), F2(A65), M23(A85), M24(A85), O3(I80)
-- general; A8(A83), B6(A62), B7(T59), B8(A66), B9(G69), B10(A71), B11(T73), B12(A74), B13(T75), B14(A78), B15(A78), B16(T79), B17(A83), B18(A83), B19(A84), B20(A84), B21(A84), B22(A85), B22.1(A85), B22.2(A87), B23(G63), B24(T67), B26(T79), B27(G69), B28(G69), B29(G69), B30(T71), B33(A78), B35(G70)
-- IAEA safeguards; D1(T67), D2(I76)
-- non-obligatory; B24(T67), B27(G69), B30(T71), C123(A85)
-- obligatory; B7(T59), B13(T75), B16(T79), B24(T67), B26(T79)
-- progressive/zonal; E8(G63), F1(A64)
-- selective; A3(A82), A8(A83), A20.4(G86), A20.53(G86), A20.592(G86), A20.6(G86), A20.72(G86), A20.91(G86), B16(T79), B22.2(A87), B35(G70), C15(A85), C19(A66), C20(A84), C21(A84), C22(A62), C23(A63), C24(A77), C25(A84), C25.1(G85), C81(A85), C122(A84), C123(A85), C124(T86), J49(A84), J57(A84), J58(A84), J59(A84), J63(G84), J64(A85)
- outer space; A8(A83), A20.4(G86), A20.53(G86), A20.592(G86), A20.6(G86), A20.72(G86), A20.91(G86), B24(T67), B26(T79), C25.1(G85), J14(A82), J46(A82), J47(G82), J48(G83), J49(A84), J50(A84), J50.1(A86), J50.2(G87), J122(A85), O4(G79), P17.1(G85)
- outer space - ASATS; A22(A84), A22.1(G84), B25(A82), C24(A77), C25(A84), J14(A82), J48(G83), J51(A78), J52(A83), J52.1(A83), J53(A83), J54(A83), J55(A83), J56(A84), J57(A84), J58(A84), J59(A84), J60(A84), J61(A84), J62(G84), J63(G84), J64(A85), J65(A85), J66(A85), J66.1(A85), J68.1(A85), J81(A80), J93(A84), J95.2(A86), J103(A83), J122(A85), O4(G79), O5(A85)
- Remote sensors; A3(A82), A19(A85), B28(G69), B29(G69), B33(A78), C15(A85), C21(A84), C81(A85), C122(A84), C123(A85), J45(A76), J47(G82), J48(G83), J50(A84), J51(A78), J54(A83), J57(A84), J60(A84), J61(A84), J62(G84), J68.1(A85), J93(A84), M23(A85), O3(I80)
-- aerial; A21(A85), B7(T59), B13(T75), B16(T79), B18(A83), B20(A84), B22.1(A85), B22.2(A87), B23(G63), B35(G70), C15(A85), C22(A62), C122(A84), C123(A85), C124(T86), E8(G63), J44(A75), J139(A74)
-- ELINT; J64(A85), J66(A85)
-- ground-based; J50.1(A86), J52(A83), J55(A83), J56(A84), J58(A84), J59(A84), J63(G84), J64(A85), J64(A85), J66.1(A85), J81(A80), J122(A85)

REGIONAL ARMS CONTROL (cont'd)
-- radar; B16(A83), J55(A83), J56(A84), J59(A84), J64(A85), J65(A85), J66.1(A85), J103(A83), J122(A85)
-- satellite; A21(A85), B22.2(A87), B23(G63), C23(A63), C24(A77), J14(A82), J44(A75), J45.1(A84), J49(A84), J50.1(A86), J50.2(G87), J52(A83), J52.1(A83), J53(A83), J55(A83), J56(A84), J58(A84), J59(A84), J63(G84), J64(A85), J66(A85), J66.1(A85), J103(A83), J122(A85), J139(A74)
- Review conference; B7(T59), B26(T79), B28(G69), B29(G69), B30(T71)
- Sea bed; A8(A83), B9(G69), B27(G69), B28(G69), B29(G69), B30(T71)
- Short-range sensors; B17(A83), B19(A84), B22.1(A85), J66(A85)
-- monitoring devices; B13(T75), B15(A78), B16(T79), B17(A83), B18(A83), B19(A84), B22.2(A87), B35(G70), C124(T86), J64(A85)
-- seismic sensors; B17(A83), B18(A83), B19(A84)
- Verification - general; A19(A85), A21(A85), A22(A84), A22.1(G84), A29(A85), B22.2(A87)

Remote Continual Verification (RECOVER)
USE SHORT-RANGE SENSORS - MONITORING DEVICES - RECOVER

REMOTE SENSORS
UF Intelligence methods
National technical means
RT SEISMIC SENSORS
INTERNATIONAL EXCHANGE OF INFORMATION - ISMA
- Any arms control agreement; A3(A82), A6(A83), A7(A83), A8(A83), A10(G83), A14(A84), A17(A85), A19(A85), A20(G85), A20.1(A86), A20.3(G86), A20.4(G86), A20.52(G86), A20.53(G86), A20.59(G86), A20.592(G86), A20.6(G86), A20.72(G86), C5(A62), C11(A83), C14(A84), C15(A85), C103(A85), G2(A63), J2(G76), J4(A77), J9(G80), J15(A82), J23(A83), J37(A85), J41(G85), J68.1(A85), M3(A83), P5(A74)
- Chemical weapons
-- binary agents; C94(A82), G9(A74)
-- destruction of facilities; C76(G84), C79(G84), C95(G82), J133(A80), J134(G84), N15(G82), O15(G80), P26(G82), P30(G81)
-- destruction of stocks; C74(A80), C76(G84), C79(G84), C81(A85), C95(G82), G9(A74), J134(G84), J135(A77), N5(G73), N15(G82), O15(G80), P26(G82)
-- production; A8(A83), C76(G84), C79(G84), C81(A85), C94(A82), C95(G82), C103(A85), G9(A74), J135(A77), N5(G73), N14(G82), N15(G82), O15(G80), P30(G81)
-- stockpiling; A3(A82), C65(A79), C76(G84), C95(G82), G9(A74), J135(A77), N15(G82), O15(G80), P30(G81)
-- use; C76(G84), C79(G84), C81(A85)
- Conventional weapons
-- ground forces; A4(A83), A8(A83), A20.2(G86), A20.53(G86), A20.592(G86), A20.91(G86), C122(A84), C123(A85), J140.1(G86), M23(A85)
- Military budgets; B31(I82)
- Nuclear weapons
-- anti-ballistic missile systems; A20.1(A86), A28(G84), A37(G85), J67(T72), J68.1(A85), J90(A81), O2(A82)

REMOTE SENSORS (cont'd)
-- ballistic missiles; A4(A83), A6(A83), A8(A83), A20.1(A86), A20.2(G86), A20.4(G86), A20.53(G86), A20.592(G86), A20.91(G86), A24(G79), A26(A81), A28(G84), A37(G85), B33(A78), C15(A85), C29(G62), C123(A85), J41(G85), J67(T72), J68.1(A85), J70(G62), J73(A76), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J91(A81), J92(A83), J93(A84), J94(A84), J95.1(A85), J95.2(A86), J132(A84), M3(A83), O2(A82)
-- comprehensive test ban; A3(A82), A20.2(G86), A20.4(G86), A20.53(G86), A20.592(G86), A20.72(G86), C18(A64), C36(A85), D7(A82), J68.1(A85), J97(G77), J100(G83), J101(G84), K22(G75), K35(G79), K37(A81), K41(G83), K42(G83), K51(G85)
-- cruise missiles; A20.1(A86), A26(A81), B33(A78), C38(A82), C38.1(G85), A68.1(A85), I5.1(A86), J73(A76), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J94(A84), J95.1(A85), J95.2(A86), J106(A84), J129(A82), J132(A84), M3(A83)
-- fissionable materials "cutoff"; J94(A84), J95.2(A86), J108(G79), J109(A80), J124(A83), J132(A84)
-- manned aircraft; A20.1(A86), A26(A81), A27(A84), B33(A78), J67(T72), J68.1(A85), J73(A76), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J91(A81), J94(A84), J95.2(A86), M13(A81)
-- missile tests; A20.1(A86), A26(A81), A37(G85), J68.1(A85), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J91(A81), J92(A83), J95.2(A86), J127(A82), J129(A83), J132(A86)
-- mobile ballistic missiles; A20.1(A86), A26(A81), J68.1(A85), J73(A76), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J92(A83), J95.2(A86), J116(A79), J118(A80), J119(A84)
-- partial test ban; A37(G85), K37(A81), K54(T74), O2(A82)
-- peaceful nuclear explosions; J122.1(A81), K35(G79)
-- proliferation; D18(G77), J124(A83)
-- reentry vehicles; A20.1(A86), A26(A81), J68.1(A85), J73(A76), J75(A79), J77(A79), J83(A80), J84(A80), J86(A80), J87(A80), J90(A81), J95.2(A86), J127(A78)
-- research and development; J65(A85), J92(A83), J94(A84), J128(G78), J130(A83), J132(A84)
- Other weapons of mass destruction - environmental modification; O19.1(A84)
- Regional arms control
-- disarmament; O3(I80)
-- Europe; A3(A82), A19(A85), B33(A78), C21(A84), C81(A85), C122(A84), C123(A85), J45(A76), M23(A85)
-- nuclear weapons free zone; B33(A78)
-- outer space; J46(A82), J47(G82), J48(G83), J50(A84)
-- outer space - ASATs; J48(G83), J51(A78), J54(A83), J57(A84), J60(A84), J61(A84), J62(G84), J68.1(A85), J93(A84), J95.2(A86)
REMOTE SENSORS - AERIAL
- Any arms control agreement; B1(A61), C2(A58), C7(A67), C9(A72), J1(A61), J10(A81), J20(A82), J25(A83), J27(A84), J34(A85), J39(A85)

REMOTE SENSORS - AERIAL (cont'd)
- Chemical and biological weapons; N1(G70)
- Conventional weapons
-- aircraft; B16(T79), B35(G70), C124(T86)
-- ground forces; A21(A85), B13(T75), B16(T79), B35(G70), C15(A85), C121(A62), C121.1(A68), C122(A84), C123(A85), C124(T86), J139(A74)
-- ships; B16(T79), C121.1(A68), J44(A75), J141(I85)
- General and complete disarmament; B5(A63), E1(A62), E4(A62), E5(A63), E6(A64), J42(G57), J43(A68), P14(G62), P15(G62)
- Nuclear weapons
-- ballistic missiles; E9(A60), E10(A61), E11(A62), J39(A85), J69(A61), J74(A79), J76(A79), J79(T79), J81(A80), J85(A80), J89(A81), J92.1(A83)
-- comprehensive test ban; P19(G61)
-- cruise missiles; J74(A79), J79(T79), J81(A80), J126(A78), J92.1(A83)
-- manned aircraft; C41(A61), C42(G62), E9(A60), J39(A85), J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- missile tests; J74(A79), J76(A79), J79(T79), J81(A80), J89(A81), J92.1(A83), J111(A61), J115(A80)
-- mobile ballistic missiles; J74(A79), J79(T79), J81(A80), J92.1(A83), J126(A78)
-- proliferation; J123(A82)
-- reentry vehicles; J74(A79), J79(T79), J81(A80), J89(A81), J92.1(A83), J126(A78)
- Regional arms control; E8(G63)
-- Africa; C22(A62)
-- Antarctica; B7(T59)
-- demilitarization; B7(T59), B13(T75), B15(A78), B16(T79), B18(A83), B20(A84), B22.1(A85), B22.2(A87), J44(A75)
-- Europe; A21(A85), B22.1(A85), B22.2(A87), B23(G63), B35(G70), C15(A85), C122(A84), C124(T86), J139(A74)
-- Indian Ocean; J44(A75)
-- Mediterranean Sea; J44(A75)
-- Middle East; A21(A85), B13(T75), B15(A78), B16(T79), B22.1(A85), B22.2(A87), C22(A62)

Remote sensors - air sampling at borders
USE REMOTE SENSORS - SAMPLING

REMOTE SENSORS - ELINT
- Any arms control agreement; A16.1(A85), J13(A82), J17(A82), J27(A84), J35(A85), J39(A85), J71(A69)
- Nuclear weapons
-- anti-ballistic missile systems; J122(A85)
-- ballistic missiles; J39(A85), J71(A69), J74(A79), J79(T79), J80(A80), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J122(A85)
-- comprehensive test ban; J29(A84), K27(A77), K36(I80)
-- cruise missiles; J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- fissionable material "cut-off"; D8(A85)
-- manned aircraft; J39(A85), J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)

REMOTE SENSORS - ELINT (cont'd)
-- missile tests; J29(A84), J35(A85), J39(A85), J74(A79), J80(A80), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J95(A85), J115(A80)
-- mobile ballistic missiles; J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- partial test ban; K36(I80)
-- reentry vehicles; J74(A79), J79(T79), J80(A80), J81(A80), J88(A80), J89(A81), J92.1(A83)
- Regional arms control
-- outer space - ASATs; J64(A85), J66(A85)

REMOTE SENSORS - GROUND-BASED
- Any arms control agreement; J39(A85)
- Nuclear weapons
-- anti-ballistic missile systems; J122(A85)
-- ballistic missiles; J39(A85), J65(A85), J78(A79), J79(T79), J80(A80), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J122(A85)
-- comprehensive test ban; J29(A84)
-- cruise missiles; J65(A85), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- manned aircraft; J39(A85), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- missile tests; J65(A85), J78(A79), J79(T79), J80(A80), J81(A80), J88(A80), J89(A81), J92.1(A83), J115(A80), J122(A85)
-- mobile ballistic missiles; J79(T79), J81(A80), J88(A80), J92.1(A83)
-- partial test ban; C45(A76), J120(T63), J122(A85)
-- reentry vehicles; J79(T79), J80(A80), J81(A80), J88(A80), J89(A81), J92.1(A83)
- Regional arms control
-- outer space; J122(A85)
-- outer space - ASATs; J52(A83), J55(A83), J56(A84), J58(A84), J59(A84), J63(G84), J64(A85), J65(A85), J66.1(A85), J81(A80), J122(A85)

REMOTE SENSORS - RADAR
- Any arms control agreement; A16.1(A85), J13(A82), J17(A82), J21(A82), J27(A84), J30(A84), J31.1(A84), J34(A85), J35(A85), J39(A85)
- Nuclear weapons
-- anti-ballistic missile systems; J122(A85)
-- ballistic missiles; J35(A85), J39(A85), J65(A85), J74(A79), J76(A79), J78(A79), J79(T79), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J122(A85)
-- comprehensive test ban; J29(A84), J98(A83)
-- cruise missiles; J65(A85), J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83), J103(A83)
-- manned aircraft; C42(G62), J39(A85), J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- missile tests; E12(A65), J35(A85), J65(A85), J74(A79), J76(A79), J78(A79), J79(T79), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J111(A61), J112(A62), J113(A62), J114(A72), J122(A85), J125(A74), J131(A83)
-- mobile ballistic missiles; J74(A79), J79(T79), J81(A80), J88(A80)

REMOTE SENSORS - RADAR (cont'd)
-- reentry vehicles; J35(A85), J74(A79), J79(T79), J81(A80), J88(A80), J89(A81), J92.1(A83), J125(A74)
- Regional arms control
-- demilitarization; B18(A83)
-- outer space; J122(A85)
-- outer space - ASATs; J55(A83), J56(A84), J58(A84), J59(A84), J64(A85), J65(A85), J66.1(A85), J103(A83), J122(A85)

REMOTE SENSORS - SAMPLING
UF Remote sensors - air sampling at borders
Sampling
RT LITERATURE SURVEY - SAMPLING
ON-SITE INSPECTION - SAMPLING
RECORDS MONITORING - SAMPLING
SHORT-RANGE MONITORING - SAMPLING
- Chemical weapons
-- destruction of stocks; N10(G85)
-- production; C85(G79), C91(G80), J138(G77), N10(G85)
-- research and development; C69(G81), J137(G76), J138(G77)
-- stockpiling; C85(G79)
- Nuclear weapons
-- comprehensive test ban; J99(G83), P12(G82), P19(G61)
-- partial test ban; C45(A76), J120(T63), J122(A85)

REMOTE SENSORS - SATELLITE
- Any arms control agreement; A9(A83), A13(A84), A16(A85), A16.1(A85), A18(A85), A20.591(G86), A20.71(G86), B1(A61), C9(A72), C13(A84), J3(A77), J5(G78), J6(A80), J7(A80), J8(A80), J10(A81), J11(I81), J12(A82), J13(A82), J14(A82), J16(A82), J17(A82), J18(A82), J19(A82), J21(A82), J22(A83), J24(A83), J25(A83), J26(A84), J27(A84), J28(A84), J30(A84), J31(A84), J31.1(A84), J32(A84), J33(A85), J34(A85), J35(A85), J36(A85), J38(A85), J39(A85), J40(A85), J71(A69), P8(G78), P12(G82)
- Biological weapons
-- production; C64(A83), M16(A83)
- Chemical and biological weapons; N1(G70)
- Chemical weapons
-- destruction of facilities; C65(A79), C68(A80), C69(G81), C87(A80), P27(G82)
-- destruction of stocks; C87(A80), J138(G77), N10(G85), P8(G78), P12(G82), P27(G82)
-- production; C65(A79), C85(G79), C87(A80), C91(G80), J138(G77), L8(G73), N10(G85), P8(G78), P12(G82), P27(G82)
-- research and development; J136(G72), J138(G77)
-- stockpiling; C85(G79), J138(G77), P12(G82), P27(G82)
- Conventional weapons
-- ground forces; J45.1(A84), J50.2(G87), J68(A78), J139(A74), J140(A74)
-- ships; J44(A75), J141(I85)
- Military budgets; L4(I74)
- Nuclear weapons;
-- anti-ballistic missile systems; J68(A78), J122(A85)

REMOTE SENSORS - SATELLITE (cont'd)
-- ballistic missiles; A21(A85), J35(A85), J39(A85), J68(A78), J69(A61), J71(A69), J72(A73), J74(A79), J76(A79), J78(A79), J79(T79), J80(A80), J81(A80), J82(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J95(A85), J122(A85), J131(A83), M9(A85)
-- comprehensive test ban; J29(A84), J96(A72), J131(A83), K16(G71), K20(G73), K25(G76), K27(A77), K29(G77), K31(A78), K36(I80), K44(A84), K45(G84), K47(A85), P8(G78), P19(G61), P20(G62)
-- cruise missiles; J74(A79), J79(T79), J81(A80), J82(A80), J88(A80), J92.1(A83), J102(A77), J104(A83), J105(A83), J107(A85), J131(A83), M9(A85)
-- fissionable materials "cut-off"; D8(A85), J110(A84), J131(A83)
-- manned aircraft; J39(A85), J74(A79), J79(T79), J81(A80), J82(A80), J86(A80), J88(A80), J92.1(A83), J107(A85), J122(A85), J131(A83)
-- missile tests; J74(A79), J76(A79), J78(A79), J79(T79), J80(A80), J82(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J111(A61), J114(A72), J115(A80), J122(A85), J125(A74), J131(A83), M9(A85)
-- mobile ballistic missiles; J74(A79), J79(T79), J81(A80), J82(A80), J88(A80), J92.1(A83), J117(A79), J119.1(A83), J122(A85)
-- partial test ban; C45(A76), J29(A84), J39(A85), J95(A85), J120(T63), J121(G84), J122(A85), K36(I80)
-- peaceful nuclear explosions; C45(A76)
-- proliferation; J123(A82)
-- reentry vehicles; J35(A85), J68(A78), J74(A79), J79(T79), J80(A80), J81(A80), J82(A80), J88(A80), J89(A81), J92.1(A83), J114(A72), J122(A85), J125(A74)
-- research and development; J131(A83)
- Regional arms control
-- demilitarization; B22.2(A87)
-- Europe; A21(A85), B22.2(A87), J45.1(A84), J50.2(A87)
-- Middle East; A21(A85), B22.2(A87)
-- outer space; J14(A82), J49(A84), J50.2(A87), J122(A85)
-- outer space - ASATs; C24(A77), J14(A82), J52(A83), J52.1(A83), J53(A83), J55(A83), J56(A84), J58(A84), J59(A84), J63(G84), J64(A85), J66(A85), J66.1(A85), J103(A83), J122(A85)

REMOTE SENSORS - SHIPBOARD
- Conventional weapons
-- ships; J141(I85)
- Nuclear weapons
-- anti-ballistic missile systems; J122(A85)
-- ballistic missiles; J74(A79), J76(A79), J79(T79), J81(A80), J85(A80), J88(A80), J89(A81), J92.1(A83), J122(A85)
-- comprehensive test ban; P20(G62)
-- cruise missiles; J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- manned aircraft; J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- missile tests; J74(A79), J76(A79), J79(T79), J81(A80), J88(A80), J89(A81), J92.1(A83), J114(A72), J115(A80), J122(A85), J125(A74)
-- mobile ballistic missiles; J74(A79), J79(T79), J81(A80), J88(A80), J92.1(A83)
-- reentry vehicles; J74(A79), J79(T79), J81(A80), J88(A80), J89(A81), J92.1(A83), J114(A72), J125(A74)

REVIEW CONFERENCE
- Anti-ballistic missiles systems; J67(T62)
- Any arms control agreement; P8(G78), P10(G82), P12(G82)
- Biological weapons
-- destruction of stocks; O12(T72), O13(I80), O13.1(I86)
-- production; O12(T72), O13(I80), O13.1(I86)
-- proliferation; O12(T72), O13(I80), O13.1(I86)
-- stockpiling; O12(T72), O13(I80), O13.1(I86)
- Chemical and biological weapons
-- destruction of stocks; N2(G69)
-- production; N2(G69)
-- proliferation; N2(G69)
-- research and development; N2(G69)
-- stockpiling; N2(G69)
- Chemical weapons
-- destruction of facilities; C79(G84), M17(G82), M18(G76), O14(G79)
-- destruction of stocks; C79(G84), M18(G76), N5(G73), N7(G74), O14(G79), P8(G78), P12(G82), P28(G84)
-- production; C79(G84), C90(G80), M17(G72), M18(G76), N5(G73), N7(G74), O14(G79), P8(G78), P12(G82)
-- proliferation; M18(G76)
-- stockpiling; C90(G80), M18(G76), N7(G74), O14(G79), P12(G82)
-- use; C79(G84)
- Nuclear weapons
-- comprehensive test ban; K8(G69), K12(G71), K30(G77), K35(G79), K42(G83), P8(G78), P12(G82)
-- peaceful nuclear explosions; D9(T68), K8(G69), K30(G77), K35(G79)
-- proliferation; D9(T68), D16(I75)
- Regional arms control
-- Antarctica; B7(T59)
-- demilitarization; B7(T59), B26(T79)
-- nuclear weapons free zone; B26(T79)
-- outer space; B26(T79)
-- sea bed; B28(G69), B29(G69), B30(T71)

S

Safeguards
USE ON-SITE INSPECTION - IAEA SAFEGUARDS
SALT I TREATIES. 26 May 1972; J67(T72)
- Verification
SN Includes verification of entire agreement. See also individual provisions under appropriate type of delivery system, e.g. NUCLEAR WEAPONS - BALLISTIC MISSILES
A28(G84), A37(G85), I3(A71), J73(A76), J83(A80), J91(A81)
- violations; A28(G84), A37(G85), J67(T72), J73(A86), J75(A79), J83(A80), J91(A81)

SALT II TREATY. 18 June 1979; J79(T79)
- Verification
SN Includes verification of entire agreement. See also individual provisions under appropriate type of delivery system, e.g., NUCLEAR WEAPONS - BALLISTIC MISSILES
A8(A83), A12(A84), A24(G79), A25(A81), A26(A81), A28(G84), A37(G85), J9(G80), J73(A76), J74(A79), J75(A79), J76(A79), J77(A79), J79(T79), J80(A80), J81(A80), J82(A80), J85(A80), J86(A80), J87(A80), J88(A80), J90(A81), J115(A80), J122(A85)
- Violations; A12(A84), A37(G85)
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USE LITERATURE SURVEY - SAMPLING
ON-SITE INSPECTION - SAMPLING
RECORDS MONITORING - SAMPLING
REMOTE SENSORS - SAMPLING
SHORT-RANGE SENSORS - SAMPLING
SEA BED TREATY. 11 February 1971; B30(T71)
SEISMIC SENSORS
RT REMOTE SENSORS
- Any arms control agreement; A16.1(A85), C2(A58), C13(A84)
- Nuclear weapons
-- comprehensive test ban; A20.1(A86), C18(A64), C34(G69), C46(A83), D7(A82), J95(A85), J95.2(A86), J97(G77), K2(G62), K3(G62), K5(A66), K16(G71), K52.1(G86), K52.2(G86), K52.4(G86), P12(G82)
-- partial test ban; C46(A83), J95(A85)
-- peaceful nuclear explosions; C46(A83), K24(A76)
SEISMIC SENSORS - EXTRA-BORDER STATIONS
- Nuclear weapons
-- comprehensive test ban; C32(G63), J95.2(A86), J122(A85), J131(A83), K6(G67), K8(G69), K11(G71), K12(G71), K15(G71), K17(G71), K18(G73), K22(G75), K27(A77), K37(A81), K38(A82), K45(G84), K47(A85), K48(A85), K51(G85), P19(G61), P20(G62)
-- partial test ban; C52(T76), K37(A81), K54(T74)
-- peaceful nuclear explosions; C52(T76)
SEISMIC SENSORS - INTERNATIONAL NETWORK
SN Includes systems for the international collection and exchange of seismic data
RT INTERNATIONAL EXCHANGE OF INFORMATION
- Nuclear weapons
-- comprehensive test ban; A3(A82), A20.91(G86), I5(G62), J29(A84), J68.1(A85), J101(G84), K4(G65), K6(G67), K7(G69), K8(G69), K9(G70), K10(G70), K12(G71), K13(G71), K17(G71), K18(G73), K19(G73), K20(G73), K25(G76), K26(G76), K27(A77), K28(G77), K29(G77), K30(G77), K32(I78), K33(I79), K34(G79), K35(G79), K36(I80), K39(G82), K41(G83), K43(G83), K49(G85), K50(G85), K51(G85), K52(G85), K52.3(G86), K52.5(G86), K52.6(G86), K52.61(I86), K52.7(G86), K52.8(G86), P8(G78)
-- partial test ban; K7(G69), K36(I80), K53(G72)
-- peaceful nuclear explosions; K35(G79)
SEISMIC SENSORS - INTRA-BORDER STATIONS
- Nuclear weapons

SEISMIC SENSORS - INTRA-BORDER STATIONS (cont'd)
-- comprehensive test ban; A3(A82), A4(A83), A27(A84), C31(G63), C32(G63), C36(A85), I5(G62), J29(A84), J35(A85), J94(A84), J95.2(A86), J122(A85), J129(A82), J132(A84), K1(A58), K14(G71), K27(A77), K35(G79), K36(I80), K37(A81), K38(A82), K40(A83), K44(A84), K45(G84), K47(A85), K49(G85), K51(G85), K52.7(G86), K55(A83), K56(A83), P20(G62)
-- partial test ban; A4(A83), K36(I80), K37(A81), K55(A83), K56(A83)
-- peaceful nuclear explosions; I4(A81), K35(G79), K55(A83), K56(A83), K57(G75), K58(G84)

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RT ON-SITE INSPECTION
- Any arms control agreement; C9(A72), C11(A83)
- Chemical weapons
-- destruction of facilities; C77(G84), C79(G84), C99(A83)
-- destruction of stocks; C77(G84), C79(G84)
-- production; C79(G84), I19(G83), P34(G85)
-- use; C79(G84)
- General and complete disarmament; C17(A62)
- Military budgets; B31(I82)
- Nuclear weapons
-- ballistic missiles; M9(A85)
-- comprehensive test ban; A27(A84), K44(A84)
-- cruise missiles; M9(A85)
-- fissionable material "cut-off"; J131(A83)
- Regional arms control
-- demilitarization; B17(A83), B19(A84)
-- outer space - ASATs; J66(A85)

Short-range sensors - black boxes
USE SHORT-RANGE SENSORS - MONITORING DEVICES

Short-range sensors - blood sampling
USE SHORT-RANGE SENSORS - SAMPLING

Short-range sensors - cameras
USE SHORT-RANGE SENSORS - MONITORING DEVICES

Short-range sensors - chemical analysis
USE SHORT-RANGE SENSORS - SAMPLING

Short-range sensors - closed-circuit TV
USE SHORT-RANGE SENSORS - MONITORING DEVICES

Short-range sensors - effluent and emission analysis
USE SHORT-RANGE SENSORS - SAMPLING

Short-range sensors - electronic early warning stations
USE SHORT-RANGE SENSORS - MONITORING DEVICES

SHORT-RANGE SENSORS - MONITORING DEVICES
UF Short-range sensors - Black boxes
- Cameras
- Closed-circuit TV
- Electronic early warning stations
- Remote Continual Verification (RECOVER)
- Seismic sensors
RT ON-SITE INSPECTION - IAEA SAFEGUARDS
- Any arms control agreement; C5(A62), D38(A82)

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- Chemical and biological weapons
-- use; C55(G82), C56(I84), C57(G85)
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-- destruction of facilities; C68(A80), C91(G80), C95(G82), C98(A83), C102(A85), I16(G71), I20(G85), M17(G72), M18(G76), M19(G76), N9(A80)
-- destruction of stocks; A20.4(G86), C70(G74), C72(G76), C95(G82), C98(A83), C102(A85), I8(G76), I9(G79), I10(G82), I12(G84), I20(G85)
-- production; A20.4(G86), C82(A70), C86(G79), C91(G80), C95(G82), C98(A83), C102(A85), C107(G85), G8(A73), G10(G74), I9(G79), I18(G82), I20(G85)
-- stockpiling; C95(G82), C98(A83), C102(A85), I18(G82), I20(G85)
-- use; J9(G79)
- Conventional weapons
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-- ground forces; B13(T75), B16(T79), B35(G70), C124(T86)
- Nuclear weapons
-- anti-ballistic missile system; I3(A71)
-- ballistic missiles; I26(A69), I3(A71), I4(A81), J75(A79)
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-- cruise missiles; I5.1(A86), J75(A79), J95(A85)
-- fissionable material "cut-off"; D3(G64), I6(G66), J95.2(A86), J110(A84), J129(A82)
-- manned aircraft; J75(A79)
-- missile tests; J75(A79)
-- mobile ballistic missiles; J75(A79), J117(A79), M9(A85)
-- partial test ban; C52(T76), K36(I80), K37(A81)
-- peaceful nuclear explosions; C49(I73), C52(T76)
-- proliferation; A21(A85), D25(A80), D29(A81), D31(A81), D33(A81), D34(A81), D38(A82), D45(G83), D48(A84), D51(G84), D52(I84), I10(G82)
-- reentry vehicles; J75(A79)
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- Regional arms control
-- demilitarization; B13(T75), B15(A78), B16(T79), B17(A83), B18(A83), B19(A84), B22.1(A85)
-- Europe; B22.1(A85), B22.2(A87), B35(G70), C124(T86)
-- Middle East; B13(T75), B15(A78), B16(T79), B17(A83), B19(A84), B22.1(A85), B22.2(A87)
-- outer space - ASATs; J64(A85)

SHORT-RANGE SENSORS - SAMPLING
UF Sampling
Short-range sensors - blood sampling
- chemical analysis
- effluent and emission analysis
- toxicological analysis

SHORT-RANGE SENSORS - SAMPLING (cont'd)
RT LITERATURE SURVEY - SAMPLING
ON-SITE INSPECTION - IAEA SAFEGUARDS
ON-SITE INSPECTION - SAMPLING
RECORDS MONITORING - SAMPLING
REMOTE SENSORS - SAMPLING
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- Chemical weapons
-- binary agents; I17(G77), P25(G79)
-- destruction of facilities; C68(A80), C95(G82), I16(G71), N6(G73)
-- destruction of stocks; C65(A79), C69(G81), C70(G74), C71(G76), C72(G76), C73(G77), C75(G83), C95(G82), I9(G79), I10(G82), J11(G83), I13(G84), N6(G73), P25(G79)
-- production; C65(A79), C69(G81), C75(G83), C82(A70), C83(A70), C86(G79), C90(G80), C91(G80), C95(G82), C114(A83), G8(A73), G10(G74), I9(G79), I14(G71), I15(G71), I17(G77), N6(G73), P25(G79)
-- research and development; I14(G71)
-- stockpiling; C90(G80), C95(G82), I14(G71), P25(G79)
-- use; I9(G79)
- Nuclear weapons
-- comprehensive test ban; P19(G61)
-- fissionable material "cut-off"; D3(G64)
-- partial test ban; I7(G84)
-- peaceful nuclear explosions; K27(A77)
SHORT-RANGE SENSORS - SEALS
RT ON-SITE INSPECTION - SAFEGUARDS
- Any arms control agreement; I1(A78)
- Chemical weapons
-- destruction of facilities; C65(A79), C68(A80), C69.1(G86), C91(G80), I8(G76), I16(G71), M17(G72), M18(G76), M19(G76), N6(G73), N9(A80)
-- destruction of stocks; C72(G76), I8(G76), N6(G73), P12(G82)
-- production; C91(G80), C110(G85), D7(A82), G8(A73), I20(G85), N6(G73), P12(G82)
-- stockpiling; C40(G85), D7(A82), P12(G82)
- Nuclear weapons
-- fissionable material "cut-off"; J129(A82)
-- peaceful nuclear explosions; C49(I73), K58(G84)
-- proliferation; D25(A80), D31(A81), D33(A81), D34(A81), D48(A84), D51(G84), D52(I84)
Short-range sensors - seismic sensors
USE SHORT-RANGE SENSORS - MONITORING DEVICES
Short-range sensors - toxicological analysis
USE SHORT-RANGE SENSORS - SAMPLING
SINAI DISENGAGEMENT AGREEMENT. 1 September 1975; B13(T75)
SOUTH PACIFIC NUCLEAR FREE ZONE TREATY. 6 August 1985; M8(T85)
Space weapons
USE REGIONAL ARMS CONTROL - OUTER SPACE
Strategic Arms Limitation Talks
USE SALT I, SALT II

T

Tactical nuclear weapons
USE NUCLEAR WEAPONS subdivided by appropriate type of delivery system, e.g., NUCLEAR WEAPONS - BALLISTIC MISSILES
TAMPER-PROTECTION
SN Includes tamper-proof seals and containers as well as tamper detection methods
A4(A83), C68(A80), C72(G76), D7(A82), D8(A85), D35(I81), D48(A84), D51(G84), I1(A78), I3(A71), I5(G62), I6(G66), I8(G76), I13(G84), I16(G71), J2(G76), J95(A85), J110(A84), K14(G71), K27(A77), K36(I80), K45(G84), M9(A85), M19(G76)
THRESHOLD TEST BAN TREATY. 16 July 1974; K54(T74), K37(A81)
- Violations; A12(A84), A37(G85)
TREATY BANNING NUCLEAR WEAPON TESTS IN THE ATMOSPHERE, IN OUTER SPACE, AND UNDER WATER. 5 August 1963; J120(T63)
Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-ballistic Missile Systems. 26 May 1972;
USE ABM TREATY
Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Strategic Offensive Arms and Protocol. 18 June 1979;
USE SALT II TREATY
Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Underground Nuclear Weapon Tests and Protocol. 3 July 1974;
USE THRESHOLD TEST BAN TREATY
TREATY BETWEEN THE UNITED STATES OF AMERICA AND THE UNION OF SOVIET SOCIALIST REPUBLICS ON UNDERGROUND NUCLEAR EXPLOSIONS FOR PEACEFUL PURPOSES AND PROTOCOL. 23 June 1976; C52(T76)
TREATY FOR THE PROHIBITION OF NUCLEAR WEAPONS IN LATIN AMERICA. (Treaty of Tlatelolco). 14 February 1967; D1(T67)
TREATY OF PEACE BETWEEN THE ARAB REPUBLIC OF EGYPT AND THE STATE OF ISRAEL AND ANNEXES. 26 March 1979. PROTOCOL TO THE EGYPTIAN-ISRAELI TREATY OF PEACE. 3 August 1979; B16(T79)
TREATY OF TLATELOLCO. 14 February 1967; D1(T67)
TREATY ON PRINCIPLES GOVERNING THE ACTIVITIES OF STATES IN THE EXPLORATION AND USE OF OUTER SPACE, INCLUDING THE MOON AND OTHER CELESTIAL BODIES. 27 January 1967; B24(T67)
TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS. 1 July 1968; D9(T68), D16(I75)
TREATY ON THE PROHIBITION OF THE EMPLACEMENT OF NUCLEAR WEAPONS AND OTHER WEAPONS OF MASS DESTRUCTION ON THE SEA BED AND THE OCEAN FLOOR AND IN THE SUBSOIL THEREOF. 11 February 1971; B30(T71)

U

UNITED STATES SINAI SUPPORT MISSION; B13(T75)

V

VERIFICATION - GENERAL

SN Includes discussions which do not refer to a specific method of verification as well as general and theoretical discussions of verification and compliance.

- Any arms control agreement; A1(A61), A1.1(A63), A1.2(A78), A2(I78), A2.1(I78), A2.2(G81), A2.3(G81), A3(A82), B3.1(A85), A4(A83), A5(A83), A6(A83), A7(A83), A8(A83), A8.1(A82), A9(A83), A10(G83), A11(A84), A12(A84), A13(A84), A14(A84), A15(A84), A15.1(A85), A15.2(A85), A16(A85), A16.1(A85), A17(A85), A18(A85), A19(A85), A19.1(I85), A19.2(I85), A20(G85), A20.1(A86), A20.2(G86), A20.3(A86), A20.4(G86), A20.5(G86), A20.51(G86), A20.52(G86), A20.53(G86), A20.54(G86), A20.55(G86), A20.56(G86), A20.57(G86), A20.58(G86), A20.59(G86), A20.591(G86), A20.592(G86), A20.6(G86), A20.7(G86), A20.71(G86), A20.72(G86), A20.8(G86), A20.9(G86), A20.91(G86), A20.92(I86), C13(A84), J2(G76), J4(A77), J68.1(A85), J95.2(A86)
- Biological weapons
-- production; A8(A83)
- Chemical and biological weapons
-- production; A37(A85)
-- use; A30(A85), A37(G85), A38(A83)
- Conventional weapons
-- aircraft; A35(A84)
-- ground forces; A21(A85), A29(A85), A37(G85), B3.1(A85)
- Nuclear weapons
-- anti-ballistic missile systems; A28(G84), A28.1(G84), A30(A85), A31(A85), A37(G85), A38(A83)
-- ballistic missiles; A6(A83), A21(A85), A23(A77), A24(G79), A25(A81), A26(A81), A27(A84), A28(G84), A28.1(G84), A29(A85), A30(A85), A31(A85), A37(G85), A38(A83)
-- comprehensive test ban; A27(A84)
-- cruise missiles; A25(A81), A26(A81), A28.1(G84), A30(A85), A31(A85), A32(A81), A33(A83), A34(A83)
-- manned aircraft; A25(A81), A26(A81), A27(A84), A30(A85), A31(A85), A35(A84), A38(A83)
-- missile tests; A25(A81), A26(A81), A30(A85), A31(A85), A37(G85)
-- mobile ballistic missiles; A25(A81), A26(A81), A30(A85), A31(A85)
-- partial test ban; A28.1(G84), A30(A85), A31(A85), A37(G85)
-- reentry vehicles; A25(A81), A26(A81), A30(A85), A31(A85)
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-- environmental modification; A8(A83)
-- radiological weapons; A8(A83)
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USE Specific arms control agreement heading (e.g. SALT II - Violations)

Y

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USE CHEMICAL AND BIOLOGICAL WEAPONS - USE - "Yellow rain"

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ENDC/3, 19 March 1962. USSR. (GCD). P14(G62)
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CCD/416, 28 August 1973. Netherlands. (CTB). K19(G73)

1974

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CCD/441, 13 August 1974. Japan/Sweden. (CTB). K25(G76)

1975

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CCD/454, 1 July 1975. Japan. (PNEs). K57(G75)
CCD/459, 24 July 1975. UK. (CTB). K23(G75)
CCD/466, 14 August 1975. Japan. (CWs). N13(G75)
CCD/471, 21 August 1975. USSR. (ENMOD). O17(G75)
CCD/472, 21 August 1975. USA. (ENMOD). O17(G75)

1976

CCD/480, 24 February 1976. Australia. (ENMOD). O18(G76)
CCD/481, 26 March 1976. Sweden. (CTB). C51(G76)
CCD/482, 26 March 1976. Sweden. (CTB). K25(G76)
CCD/485, 9 April 1976. Sweden. (CWs). C71(G76)
CCD/486, 12 April 1976. UK. (CTB). K11(G71), K26(G76)

CCD/497, 29 June 1976. USA. (CWs). C72(G76)
CCD/498, 29 June 1976. USA. (CWs). I8(G76)
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1977

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CCD/524, 24 February 1977. Japan. (CTB). K28(G77)
CCD/526, 1 March 1977. Sweden. (CTB). K30(G77)
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CCD/533, 22 April 1977. Netherlands. (CWs). I17(G77)
CCD/538, 3 August 1977. USSR. (CWs). J138(G77)
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CCD/540, 3 August 1977. Japan. (CTB). K28(G77)

1978

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CCD/559, 10 March 1978. Socialist States. (Nuclear Neutron Weapons). J128(G78)
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CCD/568, 25 April 1978. Italy. (Any Arms Control Agreement). P7(G78)
CCD/569, 24 April 1978. Sweden. (CWs). L9(G78)

1979

CD/7, 1 March 1979. Netherlands. (CTB). K16(G71)
CD/9, 26 March 1979. Italy. (Outer Space). O4(G79)
CD/14, 25 April 1979. Finland. (CWs). I9(G79)
CD/15, 24 April 1979. UK. (CWs). C67(G79)
CD/31, 9 July 1979. USSR. (Radiological Weapons). O20(G79)
CD/32, 9 July 1979. USA. (Radiological Weapons). O20(G79)
CD/37, 12 July 1979. Federal Republic of Germany. (CWs). C86(G79)
CD/39, 16 July 1979. Finland. (CWs). I9(G79)
CD/43, 25 July 1979. Ad Hoc Group of Scientific Experts. (CTB). K33(I79)
CD/44, 26 July 1979. Poland. (CWs). O14(G79)
CD/45, 30 July 1979. Sweden. (CTB). K34(G79)
CD/48, 7 August 1979. USA/USSR. (CWs). O15(G80)

1980

CD/56, 5 February 1980. Italy. (Conventional Weapons). P35(G80)
CD/95, 22 April 1980. Australia. (CTB). K33(I79)
CD/102, 19 June 1980. China. (CWs). P24(G80)
CD/103, 29 June 1980. Finland. (CWs). I9(G79)
CD/104, 26 June 1980. France. (CWs). C91(G80)
CD/106, 27 June 1980. France. (CWs). C91(G80)
CD/112, 7 July 1980. USA/USSR. (CWs). 015(G80)
CD/113, 8 July 1980. Canada. (CWs). C90(G80)
CD/130, 30 July 1980. UK/USA/USSR. (CTB). K35(G79)

1981

CD/142, 10 February 1981. Sweden. (CWs). C93(G81)
CD/164, 19 March 1981. Finland. (CWs). I9(G79)
CD/167, 26 March 1981. Canada. (CWs). C69(G81)
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1982

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CD/257, 8 March 1982. Sweden. (CTB). J99(G83)
CD/263, 22 March 1982. Finland. (CWs). P31(G82)
CD/265, 24 March 1982. Federal Republic of Germany. (CWs). C95(G82)
CD/270, 31 March 1982. Indonesia and Netherlands. (CWs). I10(G82)
CD/271, 1 April 1982. USA/UK/Australia. (CWs). I18(G82)
CD/274, 7 April 1982. USSR. (Outer Space). J47(G82)
CD/294, 21 July 1982. USSR. (CWs). N15(G82)
CD/301, 4 August 1982. Belgium. (CBWs). P23(G82)
CD/307, 10 August 1982. Netherlands. (CWs). C96(G82)
CD/308, 10 August 1982. FRG/Netherlands. (CWs). N15(G82)
CD/310, 11 August 1982. Norway. (CTB). K39(G82)
CD/311, 11 August 1982. Norway. (CWs). C111(G82)
CD/313, 16 August 1982. Canada. (CWs). P26(G82)
CD/325, 6 September 1982. Sweden. (CWs). I10(G82)
CD/326, 6 September 1982. Federal Republic of Germany. (CWs). C95(G82)

1983

CD/343, 10 February 1983. USA. (CWs). P33(G83)
CD/346, 16 February 1983. USSR. (CTB). J100(G83)
CD/350, 28 February 1983. Spain. (CWs). I19(G83)
CD/353, 8 March 1983. UK. (CWs). C101(G83)
CD/381, 14 June 1983. Sweden. (CTB). K42(G83)
CD/387, 6 July 1983. USA. (CWs). I11(G83)

CD/388, 8 July 1983. Japan. (CTB). K41(G83)
CD/389, 8 July 1983. Japan. (CTB). K41(G83)
CD/390, 8 July 1983. Japan. (CTB). K41(G83)
CD/393, 13 July 1983. Yugoslavia. (CWs). N17(G84)
CD/395, 19 July 1983. Norway. (CTB). K39(G82)
CD/396, 19 July 1983. Norway. (CWs). C111(G82)
CD/397, 19 July 1983. Norway. (CWs). C101(G83)
CD/400, 22 July 1983. Australia. (CTB). P21(G83)
CD/402, 1 August 1983. UK. (CTB). K43(G83)
CD/403, 11 August 1983. Sweden. (CTB). J99(G83)

1984

CD/425, 18 January 1984. Sweden. (CWs). I11(G83), I13(G84)
CD/431, 10 February 1984. UK. (CWs). P27(G82)
CD/443, 5 March 1984. China. (CWs). C76(G84)
CD/445, 7 March 1984. Netherlands. (CWs). C78(G84)
CD/448, 9 March 1984. Ad Hoc Group of Scientific Experts. (CTB). K46(I84)
CD/482, 26 March 1984. Yugoslavia. (CWs). N17(G84)
CD/494, 3 April 1984. France. (CWs). C77(G84)
CD/500, 18 April 1984. USA. (CWs). C79(G84)
CD/507, 15 June 1984. Norway. (CTB). K39(G82)
CD/510, 18 June 1984. USSR. (Outer Space). J62(G84)
CD/514, 10 July 1984. UK. (CWs). P34(G85)
CD/516, 13 July 1984. USA. (CWs). C79(G84)
CD/518, 17 July 1984. Federal Republic of Germany. (CWs). I12(G84)
CD/530, 3 August 1984. Sweden. (Radiological Weapons). C120(G84)
CD/531, 6 August 1984. Australia. (CTB). J101(G84)
CD/532, 8 August 1984. Socialist States. (CWs). P28(G84)
CD/535, 10 August 1984. Ad Hoc Group of Scientific Experts. (CTB). K46(I84)
CD/537, 17 August 1984. Denmark. (CWs). C101(G83)
CD/541, 9 October 1984. Australia. (CWs). C101(G83)

1985

CD/575, 6 March 1985. UK. (CWs). P34(G85)
CD/585, 2 April 1985. Spain. (CWs). C101(G83)
CD/589, 11 April 1985. UK. (CWs). P34(G85)
CD/599, 20 June 1985. Norway. (CTB). K51(G85)
CD/601, 20 June 1985. Norway. (CWs). C118(G85)
CD/610, 9 July 1985. UK. (CTB). K52(G85)
CD/612, 10 July 1985. Federal Republic of Germany. (CTB). K49(G85)
CD/613, 10 July 1985. Yugoslavia. (CWs). C107(G85)
CD/619, 23 July 1985. Japan. (CWs). I20(G85)
CD/620, 23 July 1985. German Democratic Republic. (CWs). N19(G85)
CD/624, 26 July 1985. Federal Republic of Germany. (CTB). K49(G85)
CD/626, 1 August 1985. Japan. (CTB). K50(G85)
CD/627, 1 August 1985. Federal Republic of Germany. (CWs). C104(G85)

CD/630, 5 August 1985. France. (CWs). C110(G85)
CD/632, 20 August 1985. Sweden. (CWs). C106(G85)
CD/638, 20 August 1985. USSR. (CTB). J100(G83)

1986

CD/647, 17 January 1986. USSR (CTB). K52.2(G86)
CD/649, 20 January 1986. USSR. (CTB). A20.2(G86)
CD/664, 13 February 1986. Pakistan. (CW). 015.1(G86)
CD/676, 10 March 1986. Argentina, India, Mexico and Sweden. (CTB). K52.4(G86)
CD/680, 18 March 1986. USSR. (CTB). K59(G86)
CD/681/Rev.1, 31 July 1986. Ad Hoc Group of Scientific Experts. (CTB). K52.61(I86)
CD/685, 3 April 1986. USA. (CW). C79(G84)
CD/698, 4 June 1986. Australia. (CW). G12(G86)
CD/700, 16 June 1986. Hungary. (Conventional weapons). J140.1(G86)
CD/706, 20 June 1986. Netherlands. (CW). C107.2(G86)
CD/712, 14 July 1986. Sweden. (CTB). K52.5(G86)
CD/715, 15 July 1986. UK. (CW). C107.3(G86)
CD/717, 18 July 1986. Australia. (CTB). K52.6(G86)
CD/720, 31 July 1986. Ad Hoc Group of Scientific Experts. (CTB). K52.61(I86)
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CD/724, 15 August 1986. USSR. (CTB). K52.8(G86)

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ENDC/182, 25 August 1966. USA
ENDC/258, 14 August 1969. UK
CCD/329, 29 June 1971. Sweden
CCD/330, 30 June 1971. USA
CCD/349, 7 September 1971. Netherlands
CCD/363/Rev. 1, 25 April 1972. UK
CCD/402, 28 June 1973. UK
CCD/407, 10 July 1973. USA
CCD/408, 10 July 1973. Japan
CCD/411, 31 July 1973. Norway
CCD/440, 13 August 1974. UK
CCD/442, 13 August 1974. Japan
CCD/457, 14 July 1975. Canada/Japan/Sweden
CCD/487 and Corr.1, 12 April 1976. UK
CCD/488, 12 April 1976. UK
CCD/489, 13 April 1976. Japan
CCE/509, 28 April 1976. Finland
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CD/534, 13 August 1984. Ad Hoc Group of Scientific Experts
CD/714, 14 July 1986. Norway

LIST OF TECHNICAL WORKING PAPERS ON CHEMICAL WEAPONS VERIFICATION NOT INCLUDED IN THE COMPENDIUM

CD/508, 15 June 1984. Norway
CD/514, 10 July 1984. UK
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