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**A QUANTITATIVE WORKING PAPER  
ON THE  
COMPENDIUM OF ARMS CONTROL  
VERIFICATION PROPOSALS**

by

**Alan Crawford  
F.R. Cleminson  
Ernest Gilman**

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COMPENDIUM OF ARMS CONTROL  
VERIFICATION PROPOSALS

by

Mr. Alan Crawford

Editors: LCol F.R. Cleminson

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This report does not necessarily represent the views  
of the Canadian Department of National Defence.

OTTAWA, CANADA

REVISED AUGUST 1980

ABSTRACT

This study is a quantitative analysis of the contents of the COMPENDIUM OF ARMS CONTROL VERIFICATION PROPOSALS, published simultaneously as ORAE Report R73 and CD-99, June 1980. The statistical information is obtained from the Reference Matrix and Source Index of the Compendium. Calculations are based on simple frequency scores.

RESUME

Cette étude est un analyse quantitative du contenu du "Compendium des propositions concernant la vérification de la limitation des armes", qui était publié simultanément comme Rapport No. 73 du CAR Op et CD-99, juin 1980. Les renseignements statistiques ont été obtenus de la "Reference Matrix" et du "Source Index". Les calculs sont basés sur des comptes de fréquences simples.

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## 1. Introduction

This paper, presented to the U.N. Committee on Disarmament as CD-127, in July, is based on a quantitative analysis of the contents of the Compendium of Arms Control Verification Proposals<sup>1</sup> using simple frequency scores derived from the Reference Matrix (page 6) and Source Index (pages 336-356).<sup>2</sup> Before looking at the results of this investigation, it is necessary to recognize certain anomalies in the data set since these may profoundly affect the weight which can be given any conclusions which may be presented. Two of these anomalies in the data set relate to its lack of comprehensiveness over time and to the scope of coverage of international arms control negotiating forums. Only one period of time and one international body were rigorously examined: the Conference of the Committee on Disarmament (CCD) for the years 1969 to 1978 (spring). Coverage of other forums and other time periods is less extensive. On the other hand, the review of the secondary sources, which forms the other portion of the data set covered a much broader period fairly rigorously - from 1958 to 1978.

Related to the issue of coverage is the question of the necessity of relying exclusively on unclassified documents. This problem is of uncertain proportions, but it is possible that much valuable work on the question of verification may exist as classified documents and consequently is not covered here. Members of the Committee on Disarmament may wish to consider contributions from more restricted sources.

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<sup>1</sup> Published simultaneously as ORAE Report No. R73 and CD-99 in June 1980.

<sup>2</sup> A copy of the Matrix follows below, page 21. Numbers underlined in the Matrix refer to the proposal abstracts which deal with existing international agreements or those which may be of the broadest interest to the reader.

Another weakness of the data set derives from the interpretative approach to what constituted a verification "proposal". In many cases, particularly in official documents it was difficult to distinguish a "new" proposal from a repeated and rephrased old one. There was also some problem with regard to brief statements concerning verification. Whether such a statement merited being called a "proposal" was often hard to decide. While such difficulties may have been less for the secondary sources, they still have had some impact on the results for the entire data set.

Related to the failure to rigorously define a "proposal" is the question of interpretation. It seems likely that there are many documents which one abstractor might have considered a "proposal", but which another might not have. But the possibility remains that some information may have been lost and that an error factor in the coverage of the data set may have been introduced. Another aspect of the question concerns the classification of the proposal by the abstractor. Consequently, it is obvious that this paper, although quantitative in nature, is shaded in a subjective manner.

There is a methodological question related to the addition of indicators. As will be evident in the discussion of the results, scores under various indicators have simply been added to create new cumulative categories without any rigorous underlying theoretical justification for this action. It may be, for example, that one general on-site inspection proposal is not the equivalent, in terms of its intrusiveness, of one proposal for records monitoring.

Hence adding the scores in each category to achieve an overall measure of "intrusiveness" may not be fully justified, and indeed may be misleading. One possible solution to these difficulties would be to weigh different indicators according to some theoretical criteria or importance. Defining such criteria rigorously is never easy and the nature of this paper precluded any long term approach to the subject. While this problem is acknowledged, it can still be contended that there is some validity to the simple addition of scores to generate new indicators.

Two other potentially fruitful avenues to the analysis of the data have also had to be foregone because of structural limitations. These include, first the introduction of some form of control for time. This might be particularly worthwhile if the data set were expanded in temporal scope. Second, only a very superficial analysis of the activities of key states has been undertaken. A closer examination of the proposals made by particular states might prove interesting, especially in relation to such questions as:

- (a) What are the arms control verification problems to which they most frequently address themselves? and
- (b) What are their most favoured verification methods?

A further consideration which should be mentioned concerns the fact that some of the conclusions which follow are based on the assumption that the data set reflects the degree of preoccupation of arms controllers with a particular arms control problem. This assumption might be

challenged since the data set deals only with verification proposals, not with arms control proposals in general. Nevertheless, it seems reasonable to argue that the degree of preoccupation with the verification issue will reflect the degree of concern of states with arms control in general.

Finally, an important question can be raised regarding whether it is valid to draw conclusions about the behaviour of individuals within a diverse group on the basis of gross behaviour patterns of the group as a whole. It seems likely that there is an ecological fallacy involved here. The crux of this difficulty is that it is very difficult to establish causal relationships on the basis of this data. Nevertheless, it has been done in some instances in the discussion that follows. The intent in doing this is not to contend that the data provides proof of the suggested relationship but only to provide some hypotheses which may warrant future research and to provide some conclusions which have a certain degree of validity in order to give an overview of the data set.

## 2. The Analysis of the Reference Matrix Data

In the descriptive analysis which follows two basic questions will constitute the primary focus of interest. First, what arms control problems have received the greatest attention in the context of the verification issue? Second, what verification methods seem to be preferred and in what situations?

Three additional matrices were calculated on the basis of the entries in the Reference Matrix. The first of these includes all entries and is called the "Total Population" or TP Matrix. The second is composed only of entries derived from the proposals made by states or other official bodies and it also includes successfully concluded arms control agreements. This matrix is entitled the "State Proposal Sample" or SPS Matrix. Finally, a matrix was constructed using only entries from abstracts dealing with existing arms control agreements. This was called the "Arms Control Agreement" or ACA Matrix.

In order to facilitate comparisons, several of the categories in the Reference Matrix were combined by simple addition. These new categories are summarized in Table 1. In the following discussion, comparisons will first be made between the TP and SPS matrices moving from general observations to the more specific.

(a) High Proportion of State Proposals: The first general result to emerge from the comparison of the two Matrices was that entries deriving from official sources constituted a relatively high proportion of all the entries on the TP Matrix (584 of 801 or 73%). Apart from the fact that there were clearly more state proposals abstracted than was the case for those from secondary sources (114 (59%) and 80 (41%) respectively of a total of 194 proposals), it might also be plausible that many proposals by states, especially during negotiations for formal agreements, are more detailed than might be those from secondary sources. It may also be that individual state proposals cover a greater range of verification techniques than do proposals from secondary sources.

Looking along the horizontal axis (i.e. the arms control objectives typology), several general observations emerge.

(b) Notable Absences: It is first interesting to consider the complete absence of state proposals dealing with certain categories of arms control problems, in the SPS Matrix. The absence of verification proposals by states in relation to General and Complete Disarmament (GCD) is quite obvious. This is clearly a result of the limitations on the period covered in the study. Such proposals occurred during the fifties and the early sixties but since that time they have been absent. Statements favouring GCD may still be made by states but little effort has been given as to how such an agreement will be verified.

The second notable absence relates to the verification of a missile test ban. This is particularly noteworthy given the obvious value such a restriction might have for controlling the strategic arms race. It may be that public verification proposals on this question have been made in forums not covered by the data set. On the other hand, the blank cells in the SPS Matrix could indicate that this matter has lacked serious public consideration.

A third notable absence concerns the monitoring of agreements restricting naval forces. There was only one secondary source proposal found dealing with this matter, suggesting that this subject demanded only slight attention. Explanations for the dearth of state proposals in this context might be similar to those postulated in regard to missile test bans: either consideration has been given to the matter in some forum not covered by the data set or,

alternatively, states do not consider the matter to be a major problem. The lack of proposals in secondary sources, on the other hand, is less readily explicable.

Finally, the absence of consideration with regard to the verification of restrictions on the general R&D of nuclear weapons is not altogether surprising, given the extreme difficulty of verifying any type of ban on R&D and also the fact that this category overlaps substantially with others in the arms control typology.

### 3. Predominant Arms Control Problems

With regard to the TP Matrix, proposals dealing with the verification of commitments relating to two general arms control problems - Chemical and Biological Weapons (CBWs) and nuclear weapons - tend to predominate. Entries dealing with CBWs constitute 46% of all entries on the TP Matrix while nuclear weapons entries are 33% of the total. When the SPS Matrix is considered the emphasis given by states to CBW verification is striking. Fifty-nine percent (59%) of all entries by states deal with this matter and the number of entries concerned with nuclear weapons have declined to 28% of the total. Nevertheless, CBWs and nuclear weapons are still the problems given most attention in the SPS Matrix.

### 4. Chemical/Bacteriological Weapons

Several factors may tend to explain these observations. First, the data set is flawed in that it focuses on one major arms control negotiating forum - the CD. While the focus on CD arms control verification is considered a flaw in a general overview, the data set is particularly pertinent to the CD in its on-going negotiation. However if other forums of

discussion had been included, the figures might have changed substantially. Second, the apparent emphasis on CBWs especially in the SPS Matrix may genuinely indicate the importance which states assign the question of verifying a CBW agreement as well as the considerable difficulty in agreeing on a verification system.

#### 5. Nuclear Weapons

The decline in importance of nuclear weapons in the SPS Matrix suggests that much of the discussion in relation to control of these weapons occurs in the SALT forum which is not covered in the Compendium. The fact that the nuclear weapon delivery vehicles receive least attention seems to support this interpretation. Nevertheless, the nuclear weapons category still forms the second largest group of entries in the SPS Matrix which probably reflects the weight given the perceived threat to international peace posed by these weapons.

Another notable feature of the two Matrices relates to the two general sub-categories of nuclear weapons - warhead technology and delivery vehicles. In the TP Matrix of the total of 268 entries dealing with nuclear weapons 157 (59%) deal with warhead technology while 111 (41%) deal with delivery vehicles. The difference, however, is much more striking in the SPS Matrix where 138 (85%) of a total of 163 entries relate to warhead technology and only 25 (15%) to delivery vehicles.<sup>3</sup> If these observations can be relied upon (i.e. if they are not merely a reflection of the limited scope of the data set), they suggest that verification proposals relating to delivery vehicles are very much a private concern of the superpowers. Another possible explanation might be that there is not much discussed at all perhaps because it is considered to be verifiable between

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<sup>3</sup> Even this figure of 25 entries might be reduced since many derive from UK proposals made in the early sixties and thus are very dated.

the superpowers using "national technical means".

## 6. Conventional Weapons

Another marked feature of the distribution of the entries in both Matrices along the arms control objective axis is the surprising lack of entries dealing with the verification of agreements concerning conventional weapons. Entries regarding conventional weapons comprise only 3.2% of the total in the TP Matrix and 1.5% in the SPS Matrix. Indeed, in the case of the SPS Matrix, there is even greater interest shown in the verification of restrictions on New Mass Destruction Weapons. The reason this is so unexpected is that the vast majority of wars waged to date have been fought using conventional weapons. In contrast, CBWs and nuclear weapons have been very rarely used and have in terms of percentages of resultant overall casualties been relatively insignificant. Several explanations may be suggested for this observation.

(a) The data set focuses mainly on one arms control negotiating forum. If, for example, the MBFR discussions had been covered, a different pattern might have emerged.

(b) It might be argued that entries under the GCD and Military Budget categories should have also been included as dealing with conventional weapons thereby indicating greater interest in conventional armaments. The grounds for this view are that these two additional categories partly involve restrictions on conventional weapons. While this may be true, the same argument could be made with regard to the

CBWs and the Nuclear Weapons categories since GCD and Military Budget proposals also involve restrictions on these weapons as well as conventional arms. Even if this line of thought is accepted, however, there would still be a marked difference in emphasis with regard to conventional armaments as compared to CBWs and nuclear weapons.

#### 7. Notable Absences

As was the case for the arms control problem typology, it is interesting to consider the absence of entries dealing with certain verification techniques in the SPS Matrix. The first noticeable disappearance which occurs relates to Progressive/Zonal On-Site Inspection. This is not a revelation given the association of this technique with GCD and with attempts in the early sixties to verify control of reductions in nuclear weapon delivery vehicles. The former objective has ceased to be a real arms control issue for states while the latter has come to be verified by "national technical means".

The second absence which is not so clear-cut as the first, concerns verification proposals dealing with Control Posts. In this case, there is a drop from 8 entries in the TP Matrix to 1 entry in the SPS Matrix. This is somewhat of a surprise since this technique would seem to have greater contemporary interest for arms controllers than might Progressive/Zonal Inspection, for example, regarding Regional Arms Control.

Finally, entries dealing with Non-Physical/Psychological inspection disappear when the SPS Matrix is considered. This is not amazing, since this form of verification is probably viewed by many states as being too nebulous and too intrusive for serious consideration.

#### 8. Predominant Verification Emphasis

Some noticeable patterns emerge when the broad categories of intrusive, non-intrusive, and ancillary verification methods are considered. To begin with, there is a remarkable equality in the frequency of intrusive and non-intrusive entries in the TP Matrix: 35.2% of all entries deal with intrusive verification while 35.5% relate to non-intrusive methods. Ancillary elements form 29% of the entries in the TP Matrix. When the SPS Matrix is looked at, there is a significant change in this pattern. First, the proportion of intrusive entries declines to 26% of the total. This reduction however, does not appear to be reflected in an increase in the proportion of non-intrusive methods, which remains about the same (37%) as for the TP Matrix. Rather there is an increase in the role that ancillary elements play in the verification proposals of states to 37% of the total. This suggests that in formal negotiations for arms control agreements, states become more concerned with the details of the proposed treaty, as was postulated above in item 1. States seem to place more emphasis on provisions in the verification system regarding the general administration of the system and what is done once indications of a violation arise. Secondary sources, on the other hand, place relatively greater emphasis on the methods of acquiring the initial indications of a violation.

#### 9. Verification Emphasis in General Arms Control Problem Categories

With regard to CBWs, greater emphasis seems to be placed on non-intrusive means and ancillary verification elements than on intrusive verification techniques. This pattern is present in both Matrices but is more striking in the SPS Matrix. It may in part reflect the facts that a high proportion of proposals dealing with CBWs originated

with states (see item 3 above) and that states seem relatively more concerned with ancillary elements than are secondary sources (see item 8 above). Alternatively, this observation may reflect a genuine perception that intrusive verification of a CBW agreement is unlikely to be acceptable to many states or that it would not be of much help even if it were.

A more complicated pattern emerges for nuclear weapons. In the TP Matrix when entries dealing with the total Nuclear Weapons category are considered, intrusive techniques are more frequent (45%) than either non-intrusive (35%) or ancillary elements (20%). When the SPS Matrix is viewed, this changes: non-intrusive methods are the most frequent (40%) followed by ancillary elements (31%) with the intrusive categories coming last (29%). The responsibility for this decline in the role of intrusive verification seems to rest mainly with the reduction in intrusive entries for nuclear weapon delivery systems. This decline probably reflects a realization by states that intrusive verification with respect to highly sensitive delivery vehicles is both very objectionable to the states possessing these arms and perhaps unnecessary given improvements in long-range sensing. The fact that non-intrusive verification is more emphasized than ancillary elements in all three general categories relating to nuclear weapons (i.e. Total Nuclear Weapons, Delivery Systems, and Warhead Technology) contrasts with the situation for CBWs where the emphasis is about the same.

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<sup>4</sup> This position of intrusive techniques is even less when it is realized that all the intrusive entries dealing with delivery vehicles derive from proposals of the UK made in the early sixties.

As might be expected, verification proposals dealing with GCD focus primarily on intrusive verification methods (65%). Here two factors must be noted. First, the GCD verification proposals all derive from non-state sources. Second, the proposals are invariably from the early sixties before major developments in satellite reconnaissance.

With regard to Regional Arms Control more emphasis is placed on ancillary elements in the SPS Matrix than is true for the TP Matrix. This is consistent with the general pattern in both Matrices.

In the TP Matrix, the GCD, Conventional Weapons, Total Nuclear Weapons, and Regional Arms Control categories constitute the general arms control problem areas where intrusive verification is favoured. Non-intrusive methods are emphasized in two categories: Military Budgets and CBWs. Ancillary elements are favoured only in the New Mass Destruction Weapons category.

In the SPS Matrix, intrusive-verification predominates only in the Conventional Weapons Category. Non-intrusive methods are favoured in the Military Budget and Total Nuclear Weapons categories. In the other general categories ancillary elements rank first.

Up to this point, the discussion has been concerned with the distribution of entries in the general categories of the two Matrices. There are, however, some interesting patterns in the individual categories of the arms control objectives and verification systems typologies.

10. Predominant Verification Methods

In the SPS Matrix the two most favoured verification methods are both ancillary elements to verification systems: Complaints Procedures and International Control Organizations. Selective On-Site Inspection is a close third. In the TP Matrix this order is different with Selective Inspection preceding the other two. The emphasis on Complaints Procedures especially by states is not unforeseen as this method obviously forms a valuable element in any verification system. Somewhat surprising, however, is the emphasis on international control organizations. Given the clear reluctance of some states to agree to such international bodies, it might be expected that interest in them would have declined. Nevertheless, some form of international control body still seems to be viewed as a valuable element in a verification system by many arms controllers.

The stress on selective inspection is not too astonishing: if inspection is incorporated into an arms control agreement it is likely to take the form of selective inspection rather than any other type, except perhaps in certain situations such as GCD or Regional Arms Control. Furthermore, inspection in general is probably one of the most attractive means of verifying compliance with a commitment. This continued emphasis on inspection despite its perennial rejection by many countries on the grounds of intrusion is noteworthy. It either reflects continued hope that states reluctant to accept inspection will consider their position or possibly a desire to prevent conclusion of an agreement by making the proposal unacceptable.

Fourth ranking in relative importance in both Matrices is International Exchange of Information. What is perhaps most surprising about this observation is that it ranks so low. On the face of it, one might expect exchange of information to be much more prolific of proposals.

11. Predominant Verification Methods for CBWs

Regarding the four aspects of the control of CBWs there is little change in the patterns between the two Matrices. In the categories of R&D and Stockpiling much more emphasis is placed on non-intrusive verification and ancillary elements than on intrusive means. The most frequently favoured verification methods are National Self-Supervision and Complaints Procedures.

For the CBW Production category in both Matrices, intrusive verification emerges in a much more equal position to the non-intrusive and ancillary categories. Several explanations might be suggested for this result. It may be a reflection of the scope of the data set. Alternatively, it may indicate a perception of the need for a variety of techniques to be applied to the control of production. Finally, it may simply indicate a lack of consensus among arms controllers as to which method might to be employed.

Perhaps amazingly, intrusive verification is less emphasized for the Destruction of CBWs category than are ancillary elements and non-intrusive methods though the spread is less striking than for the R&D and Stockpiling categories. If this observation can be trusted, it is

astonishing since of all the four CBW categories, Destruction would seem to be the one where intrusion would be least objectionable (since it could be restricted to certain sites) and yet most demanded (since the destruction of existing stocks would have the most immediate impact on national security).

Another point worth mentioning in regard to the verification of CBW agreements is the high proportion of entries constituted by National Self-Supervision. Indeed, National Self-Supervision seems to be primarily a CBW verification technique since it is proposed in few other arms control problem areas. This emphasis on Self-Supervision may indicate a certain desperation on the part of arms controllers with regard to the verification of CBW agreements since many believe that the technique is not very effective in assuring confidence in compliance. Such desperation may also be evidenced by the emphasis on complaints procedures as well. On the other hand, the emphasis on self-supervision may be concentrated in the proposals of only certain states.

Several other verification methods like Self-Supervision seem also to be heavily concentrated under the CBW categories. Entries for Short-Range Sensors in both Matrices, are found mainly in the CBW categories particularly in relation to verification of a production ban. Literature Surveys and Review Conferences tend to be most frequently suggested for CBW in both Matrices, while Records Monitoring and Complaints Procedures are also highly favoured for CBW verification proposals in the SPS Matrix. Much of this concentration, of course, reflects the extent to which the data set is distorted in favour of CBW proposals.

12. Predominant Verification Methods for Nuclear Weapons

As to Nuclear Weapons Warhead Technology, perhaps the least surprising observation to emerge is the emphasis in the Partial and Comprehensive Test Ban categories on Seismic Sensors and International Exchange of Information (i.e. seismic data exchanges), a pattern which is present in both Matrices. An important point with regard to these two categories of arms control problems is that they tend to skew the overall pattern for the cumulative Warhead Technology category. Without the entries in these categories the emphasis would be very much more strongly towards intrusive verification and ancillary elements, particularly Selective On-Site Inspection and International Control Organizations. Such a result is to be expected since unlike underground nuclear blasts, the other categories of Warhead Technology are less easily observed from a distance.

With regard to Nuclear Weapons Delivery Vehicles, emphasis across all the categories seems to be relatively constant. In the TP Matrix this emphasis is primarily on Selective On-Site Inspection and Remote Sensors. As mentioned elsewhere, intrusive verification almost disappears in the SPS Matrix with regard to delivery systems. This is particularly true when it is realized that all the intrusive entries in the SPS Matrix relate to proposals made by the UK in the early sixties and thus are somewhat outdated given the development in remote sensors. Indeed, it is suspected that most of the intrusive verification entries in the TP Matrix, in this regard, also derive from proposals in the early sixties.

13. Predominant Verification Methods for Other Arms Control Problems

With respect to Regional Arms Control, most emphasis is placed in the TP Matrix on Remote Sensors, Complaints Procedures and general inspection. In the SPS Matrix, the order of relative importance changes somewhat with Complaints Procedures and general inspection substantially outranking Remote Sensors. This may indicate a degree of scepticism on the part of some states with regard to the capabilities of remote sensors in this context.

Verification of New Mass Destruction Weapons is primarily through complaints procedures and other ancillary methods. A number of explanations for this might be suggested. It may be that arms controllers perceive the unlikelihood that such weapons will ever be developed and hence the undesirability of complex and contentiously intrusive verification systems. They may also perceive the difficulty of detecting such weapons even by the most intrusive verification techniques.

It is difficult to assess when a particular verification proposal is "successful". Nevertheless, a gross comparison can be made of the way that entries from existing arms control agreements rank in a matrix as compared to the TP and SPS Matrices.

Twelve arms control treaties and agreements have been abstracted. The ACA Matrix summarizes the entries for this sample. Comparing the columns, this Matrix tends to confirm earlier observations that CBWs and nuclear weapons are more

emphasized than conventional weapons in arms control negotiations, at least in the context of the verification issue related to the CD. Somewhat unexpected perhaps, is that Regional Arms Control receive comparable emphasis to CBWs and nuclear weapons.

In general, when looking at the verification systems there is a considerably stronger emphasis on ancillary elements (especially complaints procedures) than is true in either the TP or SPS Matrix. This reinforces earlier observations that as the consideration of an arms control problem becomes more formal there is a shift towards discussion of ancillary elements. Unlike the SPS Matrix, slightly more attention is given intrusive techniques in the ACA Matrix. The responsibility for this change rests with two arms control problem categories - Conventional Weapons and Regional Arms Control. It is to be noted, however, that three of the agreements which fall into the Regional Arms Control category concern areas which to date have been of peripheral military importance - Antarctica, outer space, and the sea bed - where broad rights of intrusive inspection are likely to be infrequently exercised. Consequently little cost has been involved in agreeing to such verification although this may change in the future. Therefore, the difference of the ACA Matrix from the SPS Matrix with regard to intrusive verification may not have great meaning.

The sparse data in the CBW column seems to support the general pattern in both the TP and SPS Matrices favouring ancillary elements and non-intrusive methods over intrusive verification. Agreements dealing generally with nuclear weapons, however, show a different pattern from both the TP and SPS Matrices. In the TP Matrix intrusive means are favoured; in the SPS Matrix it is the non-intrusive category which predominates. In the ACA Matrix, it is ancillary elements which rank first followed by non-intrusive methods

and then intrusive means. This again tends to confirm the movement towards consideration of ancillary aspects of verification systems as discussions become more formal. The two subcategories of nuclear weapons - Delivery Systems and Warhead Technology both bear out this pattern. Again the emphasis on Warhead Technology is greater than on delivery vehicles as mentioned in item 3 above.

One final point warrants mention. This is the increase in emphasis given the use of remote sensors in the ACA Matrix (12.5%) over the TP (8.6%) and SPS Matrices (5.8%). This seems to confirm the belief that these devices have come to play a crucial role in verification. Moreover, it may be that what is verifiable by remote sensors tends to determine what the content of arms agreements will be.

#### 14. Ranking of State Participation

On a preliminary analysis of the verification proposals broken down by state authors, two very simple frequency counts were made: first proposals made by each state, and, second, entries for each state in the Source Index. These figures are presented in Table 5.

ARMS CONTROL

		ANY ARMS CONTROL AGREEMENT	GENERAL AND COMPLETE DISARMAMENT	CHEMICAL AND BIOLOGICAL WEAPONS				NUCLEAR WEAPONS												
				RESEARCH AND DEVELOPMENT	PRODUCTION	STOCKPILING	DESTRUCTION	WARHEAD TECHNOLOGY												
								RESEARCH AND DEVELOPMENT	FISSILE MATERIALS "CUTOFF"	NON-PROLIFERATION	PEACEFUL NUCLEAR EXPLOSIONS	PARTIAL TEST BAN	COMPREHENSIVE TEST BAN	MANNED BOMBERS	SAFETY					
VERIFICATION PROPOSALS	INTRUSIVE	CHAPTER I GENERAL	II 1,2																	
		CHAPTER II SELECTIVE	II 1,2 XII 2	II 3 XII 3	II 4 XII 10 XII 2, 10, 11 XIII 4	II 4, 5, 6, 7 V 5, 6 VII 2, 3, 4, 5 XII 2, 10, 11 XIII 4	II 8 XII 8 XII 10, 11 XII 4	II 9, 10, 11, 12 13 XII 8, 9 XII 2, 9, 10, 11 14 XIII 4	II 14	II 16, 16, 17, 18 21, 32 VII 7	II 19, 20, 21, 22 49, 46	II 20, 22, 23, 24 25, 26, 27, 45 IX 1, 17, 27 XI 14		II 24, 29, 30, 31 19, 8, 7, 16, 22 27, 28		II 32, 33, 35, 41 32				
		CHAPTER III PROGRESSIVE ZONAL		III 1, 2, 3, 4, 5 VIII 4 XII 4													II 35 II 38	II 36 II 67		
		CHAPTER IV CONTROL POSTS		III 1 VIII 3																
		CHAPTER V RECORDS MONITORING	XI 1	II 4 X 1	II 4 VIII 7 X 1 XII 2	II 4, 5 V 2, 3, 4, 5, 6 VIII 7 X 1 XII 2, 10	V 3 VIII 7 X 1 XII 6 XII 2	VII 7 XII 2	II 14	II 35							II 32, 33, 35 II 32	II 32, 33, 35 II 32		
	CHAPTER VI NON-PHYSICAL PSYCHOLOGICAL	VI 1, 2, 3, 4, 5, 6																		
	SENSORS	CHAPTER VII SHORT RANGE SENSORS			VII 1 VIII 7 XII 10	V 5, 6 V 5, 6 VII 1, 2, 3, 4, 5 XII 7, 10	VII 3 VIII 7 XII 6 XII 7, 10	II 9, 10, 11, 12 12 VII 4 VIII 7 XII 10		VII 7		II 27								
		CHAPTER VIII REMOTE SENSORS	VIII 1, 2	II 4 VIII 3, 4	VIII 5, 6, 7 X 1 XII 2	VII 7 X 1 XII 2	VIII 7 XII 2							VIII 8 IX 2	VII 9 IX 12, 19, 24	IX 4 VIII 10, 11, 16 21	VII 15 IX 15, 2			
		CHAPTER IX SEISMIC SENSORS											IX 1, 7, 24, 27	IX 2, 3, 8	IX 2, 4, 10, 16, 17 8, 11, 21, 22 23, 24, 25, 26 27, 28, 29					
	CHAPTER X TEMPERATURE SURVEY	VI 4		VIII 7 X 1, 2 XI 5, 10 XII 2	VII 7 X 1, 2 XII 2	VII 7 X 1, 5 XII 2	VII 7 XII 2													
	CHAPTER XI INTERNATIONAL EXCHANGE OF INFORMATION	VIII 1, 2 XII 1, 2 XII 1, 2	XI 3, 4	VII 1 XI 5, 6, 7, 8, 10 XII 2, 4, 6, 9, 10 XIII 4	II 7 VII 1 XI 5, 6, 7, 8, 9 11 XII 2, 4, 6, 9 10 10, 11 XIII 4	VII 1 XI 5, 6, 7, 8, 9 12 XII 2, 6, 6, 9 10 XII 2	XII 2, 4, 6, 9 10, 14 XIII 4		XI 13			II 27 IX 7, 24, 27 XI 14	IX 3, 8	XI 1, 10, 11, 12 14, 16, 18 17, 22, 24 25, 26, 27 28, 29						
	CHAPTER XII NATIONAL SELF SUPERVISION			VIII 1 XII 1 to 6, 8 9, 10, 11 12, 13 XIII 4, 5	V 5, 6 VII 1 XII 1 to 9, 10 11, 12, 13 XIII 4, 5	VII 3 XII 1 to 9, 10 11, 12 XIII 4, 5	XII 1, 2, 4, 5 6, 8, 9, 10 11, 12, 14 XIII 4, 5		XI 13	II 46										
	ANCILLARY ELEMENTS OF VERIFICATION PROPOSALS	CHAPTER XIII COMPLAINTS PROCEDURES	II 2 XIII 1 XIII 1, 4	XI 1	X 1 XI 5, 6, 9 XII 1, 2, 4, 6, 9 11 XIII 2, 3, 4, 5 XIV 4	X 1 XI 5, 6, 8, 11 XII 1, 2, 4, 6 9, 11 XIII 2, 3, 4 5, 8 XIV 4	X 1 XI 5, 6, 8 XII 1, 2, 4, 6, 9 11 XIII 2, 3, 4, 5 XIV 4	XI 9 XII 1, 2, 4, 6 9, 11 XIII 2, 3, 4, 5 XIV 4			II 45 II 46	II 27, 45 IX 7, 24, 27	IX 3	IX 2, 4, 10, 11, 12 14, 16, 18 17, 22, 24 25, 26, 27						
		CHAPTER XIV INTERNATIONAL CONTROL ORGANIZATIONS	VII 1, 2 XII 2 XIV 1, 2, 3, 4	III 1	X 1 XI 4, 6, 8, 9 XII 2, 4, 6, 9 11 XIII 2 XIV 4	V 6 X 1 XI 5, 6, 8, 9, 11 XII 2, 4, 6, 9, 11 13 XIII 4, 6 XIV 4	X 1 XI 5, 6, 8, 9 XII 2, 4, 6, 9 11 XIII 4 XIV 4	XI 8, 9 XII 2, 4, 6, 9 11 XIII 4 XIV 4	II 16, 17, 21	II 20, 21, 22 45, 46	II 20, 22, 24 25, 45 IX 34, 27 XI 14	IX 8	IX 2, 4, 10, 11, 12 14, 16, 18 17, 22, 24 25, 26, 27							
		CHAPTER XV REVIEW CONFERENCES			X 8 XII 1, 9, 11 XIII 5	XI 6, 9 XII 1, 9, 11 XIII 5	XI 6, 9 XII 1, 9, 11 XIII 5	XI 8, 9 XII 1, 9, 11 XIII 5			II 20	II 20 IX 7, 27		IX 7, 11, 27						



TABLE 1  
New Categories

- A. The Arms Control Objective Typology
1. Total CBWs - combining the four categories under the heading "Chemical and Biological Weapons".
  2. Total Nuclear Weapons - combining the thirteen categories under the heading "Nuclear Weapons".
  3. Nuclear Weapons - Warhead Technology - combining the six categories under the sub-heading "Nuclear Weapons - Warhead Technology".
  4. Nuclear Weapons - Delivery Vehicles - combining the seven categories under the sub-heading "Nuclear Weapons - Delivery Vehicles".
  5. Total Conventional Weapons - combining the four categories under the heading "Conventional Weapons".
  6. New Mass Destruction Weapons - combining the categories "Environmental Modification" and "New Weapons of Mass Destruction".
- B. The Verification System Typology
7. Total Intrusive - combining the seven categories under the heading "Intrusive".\*
  8. Total Non-Intrusive - combining the five categories under the heading "Non-Intrusive".
  9. Total Ancillary Elements - combining the three categories under the heading "Ancillary Elements of Verification Systems".

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\* "Intrusive" in this context means physically intrusive.

CATEGORY LABELS FOR TABLES 2 TO 4

Horizontal Axis:

- A) Any Arms Control Agreement
- B) General and Complete Disarmament
- C) Total CBWs
- D) Nuclear Weapons - Warhead Technology
- E) Nuclear Weapons - Delivery Vehicles
- \*F) Total Nuclear Weapons
- G) Total Conventional Weapons
- H) Regional Arms Control
- I) New Mass Destruction Weapons
- J) Military Budgets
- K) Row Total

Vertical Axis:

- 1. General On-Site Inspection
- 2. Selective On-Site Inspection
- 3. Progressive/Zonal On-Site Inspection
- 4. Control Posts
- 5. Records Monitoring
- 6. Non-Physical/Psychological Inspection
- 7. Short-Range Sensors
- \*8. Total Intrusive
- 9. Remote Sensors
- 10. Seismic Sensors
- 11. Literature Survey
- 12. International Exchange of Information
- 13. National Self-Supervision
- \*14. Total Non-Intrusive
- 15. Complaints Procedures
- 16. International Control Organizations
- 17. Review Conference
- \*18. Total Ancillary Elements
- 19. Column Total

- NOTE:
- 1. Entries in Tables 2 to 4 are arranged in the following order:  
absolute frequency,  
row percent,  
column percent.
  - 2. Items marked \* represent subtotals derived by adding other rows and columns and therefore should not be included in the row and column totals.
  - 3. Detailed breakdown of the frequency scores for the Reference Matrix have not been provided.

TABLE 2: TOTAL POPULATION (TP) MATRIX

1		2 10.5 8.7			5 26.3 4.5	5 26.3 1.9	3 15.8 11.5	9 47.3 16.7			19 - 2.4
2	3 2.3 9.7	2 1.5 8.7	45 34.6 12.1	36 22.9 23.4	30 23.1 27.9	66 50.8 24.6	6 4.6 23.1	6 4.6 11.1		2 1.5 18.2	130 - 16.2
3		7 28.0 30.4			17 68.1 15.3	17 68.0 6.3		1 4.0 1.9			25 - 3.1
4		2 25.0 8.7					2 2.5 7.7	4 50.0 7.4			8 - 1.0
5	1 1.9 4.3	2 3.7 8.7	23 42.6 6.2	2 3.7 1.2	24 44.4 21.6	26 48.1 9.7		1 1.9 1.9		1 1.9 9.1	54 - 6.7
6	6 66.7 19.4			1 11.1 1.6	1 11.1 1.9	2 22.2 1.8		1 11.1 1.9			9 - 1.1
7			30 81.1 8.1	2 5.4 1.2	2 5.4 1.8	4 10.8 1.5	2 5.4 7.7	1 2.7 1.9			37 - 4.6
8	10 3.8 32.3	15 5.3 65.2	98 34.8 26.3	41 14.5 26.1	79 28.0 71.2	120 42.6 44.7	13 4.6 50.0	23 8.2 42.6		3 1.1 27.3	282 - 35.2
9	2 2.9 6.5	3 4.3 13.0	13 18.8 3.4	6 8.7 3.8	25 36.2 22.5	31 44.9 11.6	8 11.5 30.8	10 14.5 18.5	7 1.5 25.0	1 1.5 9.1	69 - 8.6
10				34 100.0 21.7		34 100.0 12.7					34 - 4.2
11	1 4.3 4.3		18 78.3 4.8							4 17.4 36.4	23 - 2.9
12	7 7.9 22.6	2 2.2 8.7	47 52.8 12.6	26 29.2 16.6	1 1.1 1.9	27 30.3 10.1		2 2.2 3.7	1 1.1 8.3	3 3.4 27.3	89 - 11.1
13			63 78.8 16.9	2 2.5 1.2		2 2.5 1.8		1 1.4 1.9	4 5.7 50.0		70 - 8.7
14	10 3.5 32.3	5 1.8 21.7	141 49.5 37.9	68 23.9 43.3	26 9.1 23.4	94 33.0 35.1	8 2.8 30.8	13 4.6 24.1	6 2.1 37.5	8 2.8 72.7	285 - 35.5
15	4 3.8 12.9	1 1.0 4.3	59 57.8 15.9	14 13.7 8.9	4 3.9 3.6	11 17.6 6.7	4 3.9 15.4	10 9.8 18.5	6 5.9 83.3		102 - 12.7
16	7 7.4 22.6	2 2.1 8.7	50 52.6 13.4	27 28.4 17.1	2 2.1 1.8	29 30.5 10.8	1 1.1 3.8	4 4.2 7.4	2 2.1 16.7		95 - 11.9
17			24 64.9 6.5	7 7.4 4.5		7 7.4 2.6		4 10.8 7.4	2 5.4 16.7		37 - 4.6
18	11 4.7 35.5	3 1.3 13.0	133 56.8 35.8	48 20.5 30.5	6 2.6 5.4	54 23.1 20.1	5 2.1 19.2	18 7.7 33.3	10 4.3 62.5		234 - 29.2
19	31 3.9	23 2.9	372 46.4	157 19.6	111 13.9	268 33.4	26 3.2	54 6.7	16 2.0	11 1.4	801 - -
	A	B	C	D	E	F*	G	H	I	J	K

EA  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19

1

TABLE 3: STATE PROPOSAL SAMPLE (SPS) MATRIX

					5	5	2	8			
1					33.3 20.0	33.3 3.1	13.3 22.2	53.3 22.9			15 - 2.6
2		38 49.4 11.0	30 39.0 21.7		5 6.5 20.0	35 45.5 21.5		3 3.9 8.6		1 1.3 20.0	77 - 13.2
3											
4								1 3.0 2.9			1
5		20 76.9 5.8			5 19.2 20.0	5 19.2 3.1				1 3.8 20.0	26 - 2.5
6											
7		28 84.8 8.1	2 6.1 1.4			2 6.1 1.3	2 6.1 22.2	1 3.0 2.9			33 - 5.7
8		86 55.6 24.8	32 21.1 23.2		15 9.9 60.0	47 30.9 28.8	4 2.6 44.4	13 8.6 37.1		2 1.3 40.0	152 - 26.1
9	1 2.9 11.1	13 38.2 3.7	5 14.7 3.6		6 17.6 24.0	11 32.4 6.7	3 8.8 33.3	4 11.7 11.4	1 2.9 8.3	1 2.9 20.0	34 - 5.8
10			28 100.0 20.3			28 100.0 17.2					28 - 4.8
11		17 94.4 4.9								1 5.6 20.0	18 - 3.1
12	2 2.8 22.2	40 57.3 11.5	24 33.4 17.4			24 33.4 14.7		2 2.8 5.7	1 1.4 8.3	1 1.4 20.0	71 - 12.2
13		59 90.8 17.0	1 1.5 .7			1 1.5 .6		1 1.5 2.9	4 6.1 50.0		65 - 11.1
14	3 1.4 33.3	129 59.7 37.2	59 27.3 42.8		6 2.7 24.0	65 30.1 39.9	3 1.4 33.3	7 3.2 20.0	6 2.1 37.5	3 1.4 60.0	216 - 36.9
15	2 2.1 22.2	59 62.1 17.0	14 14.7 10		4 4.2 16.0	18 18.9 11.0	2 2.1 22.2	8 8.4 22.9	6 6.3 83.3		95 - 16.2
16	4 4.8 44.4	49 58.3 14.1	26 31.0 18.8			26 31.0 16.0		3 3.6 8.6	2 2.4 16.7		84 - 14.4
17		24 64.9 6.9	7 18.9 5.1			7 18.9 4.3		4 10.8 11.4	2 5.4 16.7		37 - 6.3
18	6 2.7 66.6	132 61.1 38.0	47 21.8 34.1		4 1.9 16.0	51 23.6 31.2	2 .9 22.2	15 6.9 42.9	10 4.3 62.5		216 - 36.9
19	9 1.5 -	0 347 59.4 -	138 23.6 -		25 4.3 -	163 27.9 -	9 1.5 -	35 6.0 -	16 2.0 -	5 .9 -	584 -
	A	B	C	D	E	F	G	H	I	J	K

\*

TABLE 4: ARMS CONTROL AGREEMENTS (ACA) MATRIX

1						1 20.0 20.0	4 80.0 22.2		5 - 10.4		
2		3 75.0 42.9		3 75.0 16.7			1 25.0 5.6		4 - 8.3		
3											
4						1 50.0 20.0	1 50.0 5.6		2 - 4.2		
5											
6											
7		1 33.3 14.3		1 33.3 5.6	1 33.3 20.0	1 33.3 5.6		3 - 6.3			
8		4 28.6 25.0		4 28.6 22.2	3 21.4 60.0	7 50.0 38.9		14 - 29.2			
9		2 33.3 28.6	1 16.7 50.0	3 50.0 16.7	1 16.7 20.0	2 33.3 11.1		6 - 12.5			
10		1 100.0 14.3		1 100.0 5.6				1 - 2.1			
11											
12		2 50.0 28.6		2 50.0 11.1		2 50.0 11.1		4 - 8.3			
13	1 50.0 33.3						1 50.0 25.0	2 - 4.2			
14	1 7.8 33.3	5 38.5 31.5	1 7.8 50.0	6 46.2 33.3	1 7.8 20.0	4 30.8 22.2	1 7.8 25.0	13 - 27.1			
15	1 9.1 33.3	3 27.3 42.9	1 9.1 50.0	4 36.4 22.2	1 9.1 20.0	4 36.4 22.2	1 9.1 25.0	11 - 29.9			
16		2 50.0 28.6		2 50.0 11.1		1 25.0 11.1	1 25.0 25.0	4 - 8.3			
17	1 16.7 33.3	2 33.3 28.6		2 33.3 11.1		2 33.3 11.1	1 16.7 25.0	6 - 12.5			
18	2 9.5 66.7	7 33.3 43.8	1 4.8 50.0	8 38.1 44.4	1 4.8 20.0	7 33.3 38.9	3 14.3 75.0	21 - 43.8			
19	3 6.3 -	16 33.3 -	2 4.2 -	18 35.4 -	3 10.4 -	18 37.5 -	4 8.3 -	48 -			
	C	D	E	F	G	H	I	K			

TABLE 5

Ranking of State Participation\*

Proposals:

	<u>absolute #</u>	<u>column %</u>
1. Sweden	19	18.8
2. USA	16	15.8
3. Japan	13	12.9
4. USSR	9)	8.9
Socialist States	3)	3.0
Mongolia	1)	1.0
Combined	13	12.9
5. UK	11	10.9
6. Canada	6	5.9
7. Netherlands	6	5.9
8. Italy	4	4.0
9. Lesser Developed Countries	13	12.9
Total	101	

Source Index Entries:

	<u>absolute #</u>	<u>column %</u>
1. Sweden	38	18.7
2. USA	34	16.7
3. USSR	18)	8.9
Socialist States	6)	3.0
Mongolia	1)	.5
Romania	1)	.5
Combined	26	12.8
4. Japan	23	11.3
5. UK	16	7.9
6. Canada	12	5.9
7. Netherlands	12	5.9
8. Italy	6	3.0
9. Lesser Developed Countries	18	8.9
Total	185	

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\* A few states which made infrequent proposals have been excluded from this Table.

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