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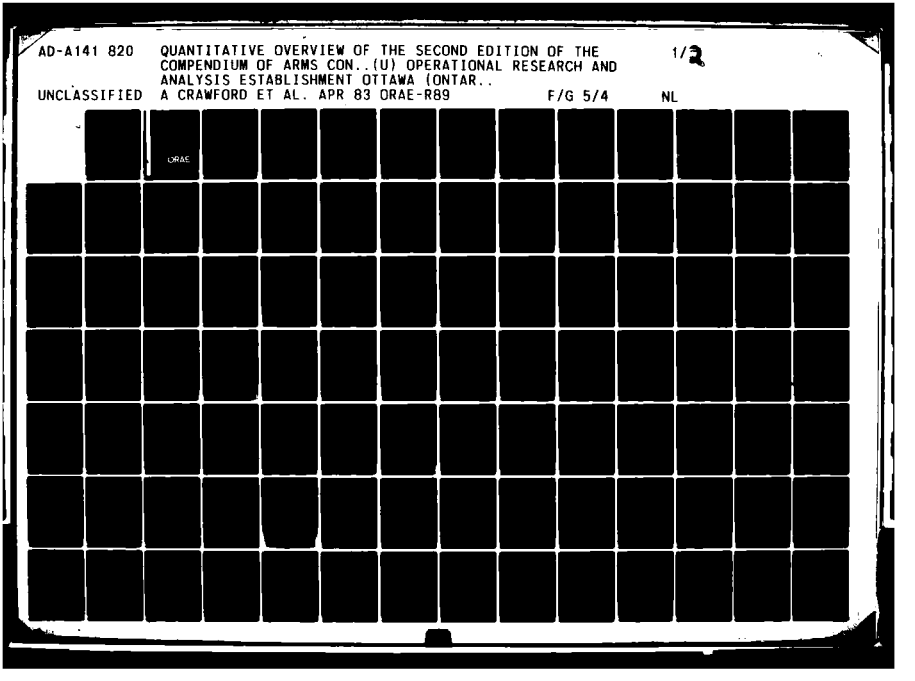

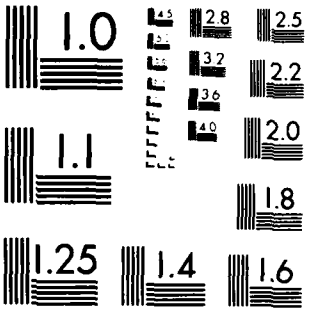

QUANTITATIVE OVERVIEW OF THE SECOND EDITION OF THE COMPENDIUM OF ARMS CONTROL VERIFICATION PROPOSALS

BY

A. CRAWFORD

E. GILMAN

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QUANTITATIVE OVERVIEW OF THE SECOND EDITION OF THE COMPENDIUM OF ARMS CONTROL VERIFICATION PROPOSALS

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Editor: Dr. E. GILMAN

OTTAWA, CANADA APRIL 1983

ABSTRACT

This paper is intended to give a purely descriptive, quantitative overview of the proposals which were incorporated into the COMPENDIUM OF ARMS CONTROL VERIFICATION PROPOSALS (Second Edition), ORAE Report No. R81, March 1982 (also CD/275, April 1982). By outlining general historical patterns for the debate on the verification issue, fruitful routes for future negotiations may be suggested. The descriptive analysis of the verification debate may also have more general relevance by providing a miniature representation of the course of arms control negotiations at a broader level.

RÉSUMÉ

Ce rapport a pour but de donner une revue purement descriptive et quantitative des propositions incluses dans "Compendium of Arms Control Verification Proposals (Deuxième Edition)", Rapport CARO No. R81, mars 1982 (aussi CD/275, avril 1982). En soulignant les grandes lignes historiques du débat au sujet de la vérification, des avenues prometteuses pour de prochaines négociations peuvent être suggérées. L'analyse descriptive du débat au sujet de la vérification peut aussi avoir une application plus générale en tant que représentation en miniature du déroulement des négociations sur le contrôle des armements à un plus large niveau.

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ABBREVIATIONS

ABM	Antiballistic Missiles
"Any"	Any Arms Control Agreement category
Ball	Ballistic Missiles
CBWs	Chemical/Biological Weapons
CCD	Conference of the Committee on Disarmament
CD	Committee on Disarmament
CTB	Comprehensive Test Ban
ENDC	Eighteen Nation Disarmament Committee
Exch.	Information Exchanges
Fiss	Fissionable Materials "Cutoff"
GCD	General and Complete Disamament
ICOs	International Control Organizations
IGOs	Intergovernmental body/organization
Lit. Survey	Literature Survey
Missile T.B.	Missile Test Ban
NSS	National Self Supervision
NWs	Nuclear Weapons
NWD	Nuclear Weapons Delivery (Systems)
NWW	Nuclear Weapons Warhead (Technology)
OWMD	Other Weapons of Mass Destruction
PNEs	Peaceful Nuclear Explosions
Prolif	Proliferation
PTB	Partial Test Ban
P/Z	Progressive/Zonal Inspection
R & D	Research and Development

REFERENCE MATRIX

IMS CONTROL OBJECTIVES

NUCLEAR WEAPONS

DELIVERY SYSTEM TECHNOLOGY

	BALLISTIC MISSILES	MOBILE BALLISTIC MISSILES	REENTRY VEHICLES	CRUISE MISSILES	MISSILE TESTS	ANTI BALLISTIC MISSILE SYSTEMS	MANNED AIRCRAFT
	A2(A78)			A2(A78)			A2(A78)
	B28(A61) B29(A61) B30(G62) B31(A62) H7(G62) H12(A79) H20(A80)	B32(A80) H12(A79) H20(A80) *H23(A79)* H24(A80)	B33(A70) H12(A79) H20(A80)	H12(A79) H20(A80)	B34(A83) H12(A79) H20(A80) H30(A82) H31(A82)		B28(A61) B29(A61) B31(A62) B35(A61) B36(G62) H12(A79) H20(A80)
	B31(A62) C1 (A60) C2 (A61) C3 (A63) C4 (A64)				C4(A65)		B31(A62) C1(A60) C4(A65)
	C1(A60) C3(A63)						C1(A60)
	B28(A61) B29(A61) B30(G62) B31(A62) C2 (A61)						B28(A61) B29(A61) B31(A62)
	C3(A63)						
	G3 (A68) G4 (A71) H12(A79)	H12(A79) *H23(A79)*	H12(A79)	H12(A79)	H12(A79)	*G4(A71)*	H12(A79)
	A2 (A78) H9 (A78) H17(A80) B28(A61) *H16(A80)* *H26(A78)* C1 (A60) *H10(A79)* H18(A80) C2 (A61) *H11(T79)* H19(A80) C3 (A63) H12(A79) H20(A80) G3 (A68) H13(A79) H22(A79) G4 (A71) H14(A80) *H23(A79)* H12 (A79) H15(A80) H24(A80) H13(A79) *H26(A78)*	H9(A78) H17(A80) *H26(A78)* *H10(A79)* H18(A80) *H11(T79)* H19(A80) H12(A79) H20(A80) H13(A79) H22(A79) H14(A80) *H23(A79)* *H16(A80)* H24(A80)	H9 (A78) *H16(A80)* *H26(A78)* *H10(A79)* H17(A80) H27(A78) *H11(T79)* H18(A80) *H32(A72)* H12(A79) H19(A80) H34(A78) H13(A79) H20(A80) H14(A80) H21(A81) H15(A80) H25(A74)	A2 (A78) *H16(A80)* H9 (A79) H17(A80) *H10(A79)* H18(A80) *H11(T79)* H19(A80) H12(A79) H20(A80) H13(A79) *H26(A78)* H14(A80) *H28(A77)*	C4 (A65) *H16(A80)* H27(A78) *H10(A79)* H17(A80) H29(A61) *H11(T79)* H18(A80) H30(A82) H12(A79) H19(A80) H31(A82) H13(A79) H20(A80) *H32(A72)* H14(A80) H21(A81) H35(A80) H15(A80) H25(A74)	*H33(T72)* H34(A78)	A2 (A78) H12(A79) H20(A80) B35(A61) H13(A79) *H33(T72)* B36(G62) H14(A80) C1 (A60) *H16(A80)* H9 (A78) H17(A80) *H10(A79)* H18(A80) *H11(T79)* H19(A80)
	H11(T79)	*H11(T79)*	*H11(T79)* H27(A78)	*H11(T79)*	B34(A83) C4 (A65) *H11(T79)* H27(A78)		B31(A62) C4 (A65) *H11(T79)*
		H11(T79)	*H11(T79)* H25(A74)	*H11(T79)*	*H11(T79)* H25(A74)	*H33(T72)*	*H11(T79)* *H33(T72)*
					B34(A83)		

ARMS CONTROL OI

NUCLEAR WEAP

WARHEAD TECHNOLOGY

KEY:

CHAPTER — B19(I73) — SOURCE TYPE

IDENTIFICATION NUMBER WITHIN CHAPTER — YEAR OF PUBLICATION

SOURCE TYPE CODES:

A = ACADEMIC
G = GOVERNMENT
I = INTERGOVERNMENTAL BODY
T = TREATY

			RESEARCH AND DEVELOPMENT	FISSIONABLE MATERIALS 'CUTOFF'	PROLIFERATION	PEACEFUL NUCLEAR EXPLOSIONS	PARTIAL TEST BAN	COMPREHENSIVE TEST BAN	BALLISTIC MISSILES
VERIFICATION PROPOSALS	INTRUSIVE	ON-SITE INSPECTION	CHAPTER A GENERAL	A1(A77)	A1(A77) B14(G77)	A1(A77) B14(G77)				A2(A78)
			CHAPTER B SELECTIVE	B1(A61)	B2(G62) B3(G64) B4(G66) B5(G69) B6(G79) G1(G66) H3(A80)	B7(T68) B14(G77) B8(I68) B15(A79) B9(I70) B16(I80) B10(I72) B17(A80) B11(G74) B62(T67) B12(I75) B63(I76) B13(I75)	B7(T68) B62(T67) B13(I75) I11(G75) B18(G71) I29(A77) B19(I73) I31(G77) B20(G75) I37(G79) B21(G76) K2(G68) B22(T76)	B22(T76) I38(I80) I39(A81)	B23(G63) I9(G69) I38(I80) B24(G63) I21(G73) I39(A81) B25(G66) I24(G75) N1(G61) B26(G69) I29(A77) N2(G62) B27(G69) I31(G77) I5(G62) I32(G77) I8(G67) I37(G79)	B28(A61) B29(A61) B30(G62) B31(A62) H7(G62) H12(A79) H20(A80)
			CHAPTER C PROGRESSIVE/ ZONAL							B31(A62) C1 (A60) C2 (A61) C3 (A63) C4 (A64)
			CHAPTER D CONTROL POSTS					N1(G61)		C1(A60) 63)
			CHAPTER E RECORDS MONITORING	B1(A61)	B2(G62)	B8(I68) B9(I70) B10(I72) B12(I75) B17(A80)				[illegible] (A61) (G62) (A62)
			CHAPTER F NON-PHYSICAL/ PSYCHOLOGICAL INSPECTION					F1(A63)		(A62)
		SENSORS	CHAPTER G SHORT-RANGE SENSORS		B3(G64) G1(G66)	B8(I68) B9(I70) B10(I72) B12(I75) B14(G77) B15(A79) B16(I80)	B19(I73) B22(T76) I29(A77)	B22(T76) I38(I80) I39(A81)	B23(G63) I39(A81) B24(G63) N1(G61) G2(G62) I13(G71) I29(A77) I32(G77) I38(I80)	G3 (A69) G4 (A71) H12(A79)
			CHAPTER H REMOTE SENSORS	H1(G78)	H2(G79) H3(A80)	B14(G77)	I37(G79)	H4(T63) I3(T74) I38(I80) I39(A81)	H5(A72) I33(A78) I14(G71) I37(G79) I21(G73) I38(I80) I24(G75) I39(A81) I27(G76) N1(G61) I29(A77) N2(G62) I32(G77)	A2 (A78) H9 (A76) H17(A80) B30(G62) H10(A79) H18(A80) C1 (A60) H11(I79) H19(A80) C2 (A61) H12(A79) H20(A80) C3 (A62) H13(A79) H21(A81) H6 (A61) H14(A80) H33(T72) H7 (G62) H15(A80) H34(A78) H8 (A73) H16(A80)
			CHAPTER I SEISMIC SENSORS				B22(T76) I1(G75) I26(A76) I37(G79)	B22(T76) I2(G72) I3(T74) I10(G69) I38(I80) I39(A81)	B23(G63) I7 (G65) I14(G71) I21(G73) I28(G76) I35(I79) B24(G63) I8 (G67) I15(G71) I22(G73) I29(A77) I36(G79) B27(G69) I9 (G69) I16(G71) I23(A74) I30(G77) I37(G79) G2 (G62) I10(G69) I17(G71) I24(G75) I31(G77) I38(I80) I4 (A58) I11(G70) I18(G71) I25(G75) I32(G77) I39(A81) I5(G62) I12(G70) I19(G71) I26(A76) I33(A78) N1(G61) I6 (G62) I13(G71) I20(G73) I27(G76) I34(I78) N2(G62)	
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			CHAPTER K INTERNATIONAL EXCHANGE OF INFORMATION		B3(G64) B6(G79) K1(A58)	B8(I68) B9(I70) B10(I72) B12(I75) B17(A80)	B22(T76) I9(G69) K2(G68)	B22(T76) I3(T74) I10(G69)	I7(G65) I16(G71) I28(G76) I8(G67) I18(G71) I29(A77) I9(G69) I20(G73) I30(G77) I10(G69) I21(G73) I31(G77) I11(G70) I22(G73) I32(G77) I12(G70) I24(G75) I34(I78) I15(G71) I27(G76) I35(I79)	B31(A62) C4 (A65) H11(I79)
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			CHAPTER N INTERNATIONAL CONTROL ORGANIZATIONS	A1(G77)	A1(A77) B2(G62) B5(G69)	A1(A77) B13(I75) B7(T68) B14(G77) B8(I68) B15(A79) B9(I70) B16(I80) B10(I72) B17(A80) B11(G74) B62(T67) B12(I75) B63(I76)	B7(T68) B13(I75) B14(G71) B18(I73) B20(G75) B62(T67) I31(G77)	I10(G69)	B24(G63) I10(G69) I34(I78) B26(G69) I11(G70) I35(I79) B27(G69) I18(G71) I36(G79) F1(A63) I21(G73) I37(G79) G2(G62) I27(G76) N1(G61) I5(G62) I31(G77) N2(G62) I7(G65) I32(G77)	
			CHAPTER O REVIEW CONFERENCES			B7(T68)	B7(T68) I9(G69) I31(G77) I37(G79)		I9(G69) I15(G71) I31(G77) I37(G79)	

REFERENCE MATRIX

ARMS CONTROL OBJECTIVES

CHEMICAL AND/OR BIOLOGICAL WEAPONS					CONVENTIONAL WEAPONS			
RESEARCH AND DEVELOPMENT	PRODUCTION	STOCKPILING	DESTRUCTION OF FACILITIES AND STOCKS	OTHER WEAPONS OF MASS DESTRUCTION	GROUND FORCES	AIRCRAFT	NAVAL	REGIONAL ARMS CONTROL
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B37 (A58) B47 (G81) B58 (G81) L1 (G70)	B37 (A58) B38 (A70) B39 (G70) B40 (A74) B41 (G79) B42 (G79) B43 (A60) B44 (A80) B45 (G80) B46 (G80) B47 (G81) B53 (A79) B55 (G79) B58 (G81) E4 (A71) E5 (G74) E6 (A75) E7 (A6[illegible]) G6 (G71) G8 (G7[illegible]) G9 (G77) K6 (A80) K7 (G72) K9 (G76) L1 (G70) L11 (G74) M1 (G71) M7 (G79) M8 (G80) N4 (G79)	B42 (G79) B43 (A80) B46 (G80) B47 (G81) B48 (G7[illegible]) B53 (A79) B58 (G81) E6 (A76) L1 (G70) M7 (G79) M8 (G80) N4 (G79)	B43 (A80) B44 (A80) B45 (G80) B49 (G74) B50 (G76) B51 (G76) B52 (G77) B53 (A79) B54 (G79) B55 (G79) B56 (A80) B57 (A80) B58 (G81) E6 (A76) [illegible] L11 (G74) M8 (G80) N4 (G79)		A3 [illegible] A14 (T79) [illegible]	A3 [illegible] A14 (T79)	A14 (T79)	A14 (T79) [illegible]
	C5 (G79)	C5 (G79)	C5 (G79)					[illegible] A74
					A3 (G70) A12 (T75) A14 (T79) H40 (A74)	A3 (G70) A14 (T79)	A14 (T79)	[illegible] H40 (A[illegible] H43 (A[illegible] M13 [illegible]
B37 (A58) L1 (G70)	B37 (A58) B38 (A70) B41 (G79) B45 (G80) B53 (A79) E1 (G70) E2 (G70) E3 (G71) E4 (A73) E5 (G74) H38 (G77) J1 (G73) K7 (G72) L1 (G70) L11 (G74) L12 (A80)	E6 (A76) H38 (G77) L1 (G70)	E6 (A76) H38 (G77) L1 (G70)					[illegible]
								[illegible]
G5 (G71)	B38 (A70) B39 (G70) B41 (G79) B45 (G80) B46 (G80) B53 (A79) B58 (G81) E4 (A73) E5 (G74) G5 (G71) G6 (G71) G9 (G77) G10 (G79) L10 (G73) N4 (G79)	B46 (G80) G5 (G71) N4 (G79)	B45 (G80) B49 (G74) B50 (G76) B51 (G76) B52 (G77) B53 (A79) B57 (A80) B58 (G81) G[illegible] (G76) G8 (G71) G10 (G79) K7 (G72) K8 (G76) K9 (G76) [illegible] L12 (A80) N4 (G79)		A3 (G70) A12 (T75) A14 (T79)	A3 (G70) A14 (T79)		A3 [illegible] A12 (T75) A13 (A76) A14 (T79)
B58 (G81) H36 (G72) H37 (G76) H38 (G77) L1 (G70)	B42 (G79) B44 (A80) B45 (G80) B53 (A79) H38 (G77) J1 (G73) L1 (G70) L9 (G73) M8 (G80)	B42 (G79) B53 (A79) H38 (G77) L1 (G70) M8 (G80)	B44 (A80) B45 (G80) B53 (A79) B56 (A80) B57 (A80) B58 (G81) H38 (G77) H34 (A80) L1 (G70) L9 (G73) M8 (G80)		A3 (G70) A12 (T75) A14 (T79) [illegible] (A62) H34 (A78) H40 (A74) H41 (A74)	A3 (G70) A14 (T79)	A14 (T79) H42 (A75)	A[illegible] (A76) A3 (G70) A6 (G63) A11 (T59) A12 (T75) A13 (A76) A14 (T79) A17 (G[illegible] A18 (G[illegible] B60 (A[illegible] B61 (A[illegible] B64 (A[illegible] H18 (A[illegible] H40 (A[illegible]
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B47 (G81) G5 (G71) K3 (G70) K4 (A72) K8 (G76) L1 (G70) L4 (A73)	B40 (A74) B43 (A80) B45 (G80) B46 (G80) B47 (G81) B55 (G79) B58 (G81) G5 (G71) K3 (G70) K4 (A72) K5 (G72) K6 (A80) K7 (G72) K8 (G76) K9 (G76) L1 (G70) L5 (G72) L7 (G70) L9 (G73) L10 (G73) L11 (G74) L12 (A80) M1 (G71) M7 (G79) M8 (G80) N5 (G80)	B43 (A80) B46 (G80) B47 (G81) B58 (G81) G5 (G71) K3 (G70) K6 (A80) K9 (G73) L1 (G70) L11 (G74) M7 (G79) M8 (G80) N5 (G80)	B43 (A80) B55 (G79) K3 (G70) K6 (A80) K7 (G72) L1 (G70) L7 (G70) L8 (A73) L9 (G73) L10 (G73) L11 (G74) L12 (A80) M1 (G71) M7 (G79) M8 (G80) N5 (G80)	K10 (G75)	A4 (A61) H40 (A74)			A11 (T59) [illegible] H4[illegible] (A73) H44 (A78)
G58 (G81) G5 (G71) L1 (G70) L4 (G73) L6 (G69)	B58 (G81) E4 (A73) E5 (G74) G5 (G71) K9 (G76) L1 (G70) L2 (G72) L3 (G75) L5 (G72) L6 (G69) L7 (G70) L9 (G73) L10 (G73) L11 (G74) L12 (A80) M1 (G71) M5 (T72) M6 (I80) M7 (G79) M8 (G80)	G5 (G71) K9 (G76) L1 (G70) L6 (G69) L11 (G74) M5 (T72) M6 (I80) M7 (G79) M8 (G80)	K9 (G76) L1 (G70) L6 (G69) L7 (G70) L8 (A73) L9 (G73) L10 (G73) L11 (G74) L12 (A80) M1 (G71) M5 (T72) M6 (I80) M7 (G79) M8 (G80)	[illegible] M12 (G79)				B63 (A76)
B58 (G81) K3 (G70) L1 (G70) L6 (G69) M4 (G69)	B46 (G80) B58 (G81) C5 (G79) J1 (G73) K3 (G70) K5 (G72) K7 (G72) K9 (G76) L1 (G70) L5 (G72) L6 (G69) L7 (G70) L9 (G73) L11 (G74) M1 (G71) M2 (G68) M3 (G72) M4 (G69) M5 (T72) M6 (I80) M7 (G79) M8 (G80) N3 (G71) N5 (G80)	B46 (G80) B58 (G81) C5 (G79) K3 (G70) K9 (G76) L1 (G70) L6 (G69) L11 (G74) M4 (G69) M5 (T72) M6 (I80) M7 (G79) M8 (G80) N5 (G80)	B58 (G81) C5 (G79) K3 (G70) K7 (G72) K9 (G76) L1 (G70) L6 (G69) L7 (G70) L9 (G73) L11 (G74) M1 (G71) M4 (G69) M5 (T72) M6 (I80) M7 (G79) M8 (G80) N5 (G80)	L13 (G74) L14 (G7[illegible]) M9 (G75) M10 (G76) M11 (T77) M12 (G79)	A12 (T75) A14 (T79)	A14 (T79)	A14 (T79) H42 (A75)	A11 (T59) [illegible] A14 (T79) A15 (T7[illegible]) [illegible] A16 (G69) A19 (G[illegible] A20 (T[illegible] B62 [illegible] B63 [illegible] H42 (A[illegible] H44 (A[illegible] M13 [illegible]
B58 (G81) K3 (G70) L1 (G70)	B38 (A70) B41 (G79) B45 (G80) B46 (G80) B53 (A79) B58 (G81) C5 (G79) E5 (G74) J1 (G73) K3 (G70) K5 (G72) K7 (G72) K8 (G76) K9 (G76) L1 (G70) L5 (G72) L7 (G70) L9 (G73) L11 (G74) L12 (A80) M1 (G71) M2 (G72) M3 (G73) M[illegible] (G79) M8 (G80) N3 (G71) N4 (G79) N5 (G80)	B46 (G80) B53 (A79) B58 (G81) C5 (G79) K3 (G70) K9 (G76) L1 (G70) L11 (G74) M7 (G79) M8 (G80) N4 (G79) N5 (G80)	B45 (G80) B53 (A79) B58 (G81) C5 (G79) K3 (G70) K7 (G72) K8 (G76) K9 (G76) L1 (G70) L7 (G70) L9 (G73) L11 (G74) L12 (A80) M1 (G71) M7 (G79) M8 (G80) N4 (G79) N5 (G80)	M10 (G76) M11 (T77)	B59 (A62) N7 (G80)	N7 (G80)	N[illegible] (G80)	A15 [illegible] B60 (A[illegible]) B62 [illegible] B63 [illegible] [illegible] (A62) N[illegible] (A76)
L6 (G69)	B46 (G80) K7 (G72) K9 (G76) L6 (G69) L9 (G73) L11 (G74) M5 (T72) M6 (I80) M7 (G79)	B46 (G80) K9 (G76) L6 (G69) L11 (G74) M5 (T72) M6 (I80) M7 (G79)	K7 (G72) K9 (G76) L6 (G69) L9 (G73) L11 (G74) M5 (T72) M6 (I80) M7 (G79)	L13 (G74) M11 (T77) M12 (G79)				A11 (T59) [illegible] A[illegible] (G69) A20 [illegible]

E MATRIX

L OBJECTIVES

KEY

SOURCE TYPE CODES:

- A — ACADEMIC
- G — GOVERNMENT
- I — INTERGOVERNMENTAL BODY
- T — TREATY

CONVENTIONAL WEAPONS								
A3 (G70) A12(T75) A14(T79) B59(A62) H34(A78) H40(A74) H41(A74)	A3 (G70) A14(T79)	A14(T79) H42(A75)	A1 A8 A17(G69) H42(A75) A3 (G70) A18(G69) H43(A76) A8 (G63) B60(A52) H44(A78) A12(T75) B61(A63) M13(I80) A14(T79) B64(A77) A15(A78) H16(A80) A14(T79) H40(A74)	J4(I74)	A22(A63) N10(G62) C7 (A62) C9 (A63) C10(A64) H45(G57) H46(A68) N9 (G62)	E8 (A63) H47(G76) H48(A77) H49(G78) H50(A80) H51(A80) N15(A74)	CHAPTER H REMOTE SENSORS	SENSORS
							CHAPTER I SEISMIC SENSORS	
				J3(A62) J4(I74) J5(A75) J6(A75)	J7(A62)	E7 (A63) E8 (A63) F8 (A63) J8 (A58) N15(A74)	CHAPTER J LITERATURE SURVEY	
A4 (A61) H40(A74)			A17(G69) A2 (T67) H43(A76) H44(A78)	J4(I74) J5(A75) J6(A75)	A23(A62) N10(G62) C6 (A62) C10(A64) K11(A55) K12(A43) K13(A64) N9 (G62)	A24(A68) N14(G73) H47(G76) N15(A74) H48(A77) H49(G78) K14(A62) K15(A65) M14(A77)	CHAPTER K INTERNATIONAL EXCHANGE OF INFORMATION	NON-INTRUSIVE
			B63(I76)				CHAPTER L NATIONAL SELF SUPERVISION	
A12(T75) A14(T79)	A14(T79)	A14(T79) H42(A75)	A11(T59) A17(G69) A12(T75) A20(T71) A1 (A78) B62(T67) A14(T79) B63(I76) A15(T73) H42(A75) A17(G69) H44(A78) A17(G69) M13(I80)		K11(A55) K13(A64) N9 (G62)	M14(A77) N3 (G71) N13(A68) N14(G73) N15(A74)	CHAPTER M COMPLAINTS PROCEDURE	ANCILLARY ELEMENTS OF VERIFICATION PROPOSALS
B59(A62) N7 (G80)	N7(G80)	N7(G80)	A12(T73) B60(A52) B62(T67) B63(I76) F2 (A62) N8 (A76)	J3(A62)	A23(A62) N10(G62) C6 (A62) C10(A64) F2 (A62) K13(A64) N8 (G61) N9 (G62)	A24(A68) N11(A62) N18(G78) F3 (A61) N12(A65) F4 (A61) N13(A68) H47(G76) N14(G73) H49(G78) N15(A74) H51(A80) N16(A78) N3 (G71) N17(G78)	CHAPTER N INTERNATIONAL CONTROL ORGANIZATIONS	
			A11(T59) A17(G69) A16(A64) A20(T71)				CHAPTER O REVIEW CONFERENCES	

CHAPTER	ON-SITE INSPECTION	
A GENERAL		INTRUSIVE
B SELECTIVE		
C PROGRESSIVE ZONAL		
D CONTROL POSTS		
E RECORDS MONITORING		
F NON PHYSICAL PSYCHOLOGICAL INSPECTION		
G SHORT RANGE SENSORS		
H REMOTE SENSORS	SENSORS	
I SEISMIC SENSORS		
J LITERATURE SURVEY		NON-INTRUSIVE
K INTERNATIONAL EXCHANGE OF INFORMATION		
L NATIONAL SELF SUPERVISION		
M COMPLAINTS PROCEDURE		ANCILLARY ELEMENTS OF VERIFICATION PROPOSALS
N INTERNATIONAL CONTROL ORGANIZATIONS		
O REVIEW CONFERENCES		

VERIFICATION PROPOSALS

QUANTITATIVE OVERVIEW OF THE SECOND EDITION OF THE COMPENDIUM OF ARMS CONTROL VERIFICATION PROPOSALS

I Introduction

The Compendium of Arms Control Verification Prosposals (Second Edition)* is a quick reference catalogue to 296 arms control verification proposals. The proposals surveyed in the Compendium originate in the publications and statements of governments and intergovernment bodies as well as the academic literature on the subject. This paper is intended to serve as a purely descriptive, quantitative analysis of the contents of the Compendium. As such it will describe the shape and focus of discussions on the issue of verification over the past twenty years.

It is hoped as well, that the paper will prove not only of interest as an historical overview but that it will have some practical relevance for policy making in the present. By indicating general patterns in the past it may perhaps suggest more fruitful routes to agreement in the future. It should, however, be emphasized that past patterns can only be suggestive of future potentialities. What has succeeded in the past may fail in the future and vice versa, because of changing conditions within countries and the international system.

It may also be argued that a descriptive overview of the discussions on verification has relevance beyond the analysis of this particular issue given the crucial nature

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* ORAE Report No. R81 by A. Crawford, F.R. Cleminson, D.A. Grant and E. Gilman, March 1982. Also CD/275, February 1982.

of verification in arms control discussions. Since agreements on controlling armaments and forces have a direct impact on the national security of states many governments demand assurance that other parties will comply with their undertakings in any arms control agreements. Because of this view verification seems most likely to be discussed substantively when detailed consideration is being given to an arms control agreement. This paper's descriptive analysis of the verification issue may therefore also shed light on more general trends in arms control talks. For example, concentration of verification discussions regarding the control of certain weapons systems may also indicate preoccupation with the dangers to peace posed by those weapons.

II Quality of the Dataset

A. Coverage

The coverage of the second edition of the Compendium is much broader than that of first; more than a hundred new proposal abstracts are included. Consequently, greater weight can be given the observations made in this paper than was true for the quantitative description* of the first edition. Nevertheless, some important points must be mentioned in this context.

An attempt has been made to thoroughly cover discussions on verification in the Committee on

* Alan Crawford, F.R. Cleminson and Ernest Gilman, "A Quantitative Working Paper on the Compendium of Arms Control Verification Proposals", ORAE Report No. R76, August 1980. Also CD/127, July 1980.

Disarmament (CD) and its predecessors: the Conference of the Committee on Disarmament (CCD) and the Eighteen Nation Disarmament Committee (ENDC). The reader can be reasonably confident that all significant proposals on the issue between 1962 and 1981 in these bodies has been included in the Compendium. The documents of other UN bodies were examined, though in less depth. Few substantive proposals were found in these documents, however.

The massive literature produced by the many branches of the US government was also reviewed, though discussions in US Congressional committees were excluded from consideration. Some relevant items emerged from this search and these are included in the most recent edition of the new Compendium.

Academic literature on the topic of verification was also examined, especially for the period from 1970 to 1981. There may remain some items from the 1960s which were not retrieved, although the coverage of the Compendium for this period can still be described as adequate to indicate general patterns.

It should also be noted that coverage is limited by the necessity of relying exclusively on unclassifed documents. This problem is of uncertain proportions; it is possible that much valuable work on the question of verification may exist in the form of classified sources.

B. Definition of a Proposal

One possible weakness of the data set derives from the interpretation of what constitutes a verification proposal. This question has two aspects. First, it was often difficult, especially for official documents, to

distinguish a "new" verification proposal from a repeated and rephrased old one. Second, it was sometimes hard to decide whether brief statements regarding verification merited being considered a proposal. While these problems are likely to have been less important for proposals originating with academic sources, they still may have had some impact on the results described in this paper.

In addition to the general problem of defining a proposal there may also be varying interpretation between abstractors. It is quite possible that there were some documents which one abstractor might have considered a proposal but which another might not. Similarly there may have been variations in the way a proposal was classified. This potential source of inaccuracy has been considerably reduced in the second edition of the Compendium by a review of all the proposals carried over from the first edition.

C. Cumulation of Categories

There is a methodological question relating to the addition of indicators. As will be evident in the following discussion, scores for various categories have 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 equivalent, in terms of its intrusiveness or political acceptability, to one proposal for records monitoring. Hence adding the scores in each of these two categories to achieve an overall measure for "Intrusive" verification systems may not be fully justified and indeed may even be misleading. While this problem is acknowledged, it is still contended that there is considerable validity to such cumulation to generate new indicators.

Finally, as was true for the quantitative review of the first edition of the Compendium, an important question can be raised regarding the validity of conclusions about the behaviour of individuals within a diverse group, which are drawn on the basis of gross behaviour patterns of the group as a whole. There may be statistical fallacy involved here, the crux of which is that it is very difficult to establish causal relationships for this type of data. Nevertheless, this sort of conclusion has been made in some instances in the discussions which follow. The intent in doing this is not to show that the data provides proof of the suggested relationship. Rather, it is done to offer some hypotheses which may warrant future research and to provide some observations having face validity for descriptive purposes.

D. Data Manipulation

In order to facilitate this descriptive analysis, the data contained in the Reference Matrix of the Compendium has been manipulated to produce several new categories. This process involved for the most part combining existing categories into new ones and eliminating duplicate entries between categories. In addition, entries were broken down according to certain variables (such as source of the proposal and the year it was made) in order to generate further data for analysis. In the discussion which follows the changes that were made will be clearly spelled out when applicable. Table I gives a list the major changes.

TABLE 1

NEW CATEGORIES GENERATED FROM THE REFERENCE MATRIX DATA

NEW CATEGORIES	EXPLANATION*
1. Nuclear Weapons Warhead (Technology) (NWW)	A combination of the 6 Arms Control Objectives categories which deal with Nuclear Warhead Technology, eliminating any duplicate entries between the 6 categories.
2. Nuclear Weapons Delivery (Systems) (NWD)	A combination of the 7 Arms Control Objectives categories which deal with Nuclear Delivery Systems, eliminating any duplicate entries between the 7 categories.
3. Total Nuclear Weapons (NWs)	A combination of the 13 Arms Control Objectives categories which deal with Nuclear Weapons, eliminating any duplicate entries between the 13 categories.
4. Chemical/Biological Weapons (CBWs)	A combination of the 4 Arms Control Objectives categories which deal with Chemical/Biological Weapons, eliminating any duplicate entries between the 4 categories.
5. Conventional Weapons	A combination of the 3 Arms Control Objectives categories which deal with Con-

* See the Reference Matrix above pp.VIII + IX, to identify, the individual categories which have been combined.

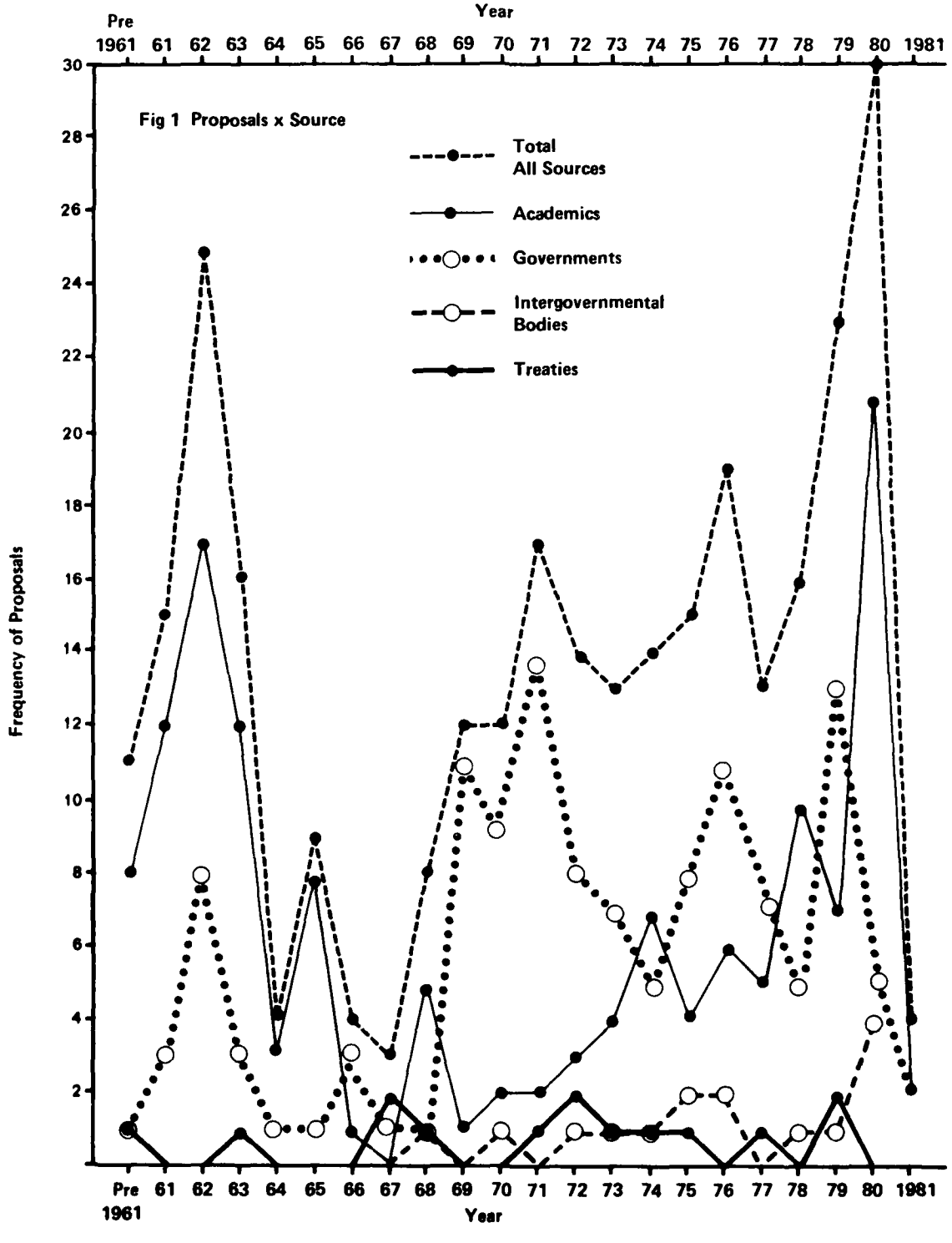
		ventional Weapons, eliminating any duplicate entries between the 3 categories.
6.	Row Total	A combination of 25 Arms Control Objectives categories, eliminating any duplicate entries between the 25 categories.
7.	Row Total (Including duplicates)	A combination of the following Arms Control Objectives categories without eliminating duplicate entries: Total NWs, CBWs, Conventional Weapons, Other Weapons of Mass Destruction, Regional Arms Control, Military Budgets, GDC, Any Arms Control Agreement.
8.	Intrusive Verification Techniques	A combination of the 7 intrusive Verification Systems categories, eliminating any duplicate entries between the 7 categories.
9.	Non-Intrusive Verification Techniques	A combination of the 5 non-intrusive Verification Systems categories, eliminating any duplicate entries between the 5 categories.
10.	Ancillary Elements of Verification Systems	A combination of the 3 Ancillary Elements categories, eliminating any duplicate entries between the 3 categories.
11.	Column Total	A combination of the 15 Verification Systems categories,

		eliminating any duplicate entries between the 15 categories.
12.	Column Total (including duplicates)	A combination of the 15 Verification Systems categories, without eliminating any duplicate entries between the 15 categories.

III Distribution of Proposals Over Time

The distribution over time of the 296 proposals abstracted in the Compendium (disregarding the nature of the arms control objectives to which they relate and the verification systems they involve) is presented in Figure 1. There is a clear trough during the mid-sixties resulting, perhaps, from the disillusionment which set in following the lack of success of earlier negotiations on General and Complete Disarmament. In the late sixties there is a revival of interest in verification, which persists with some ups and downs throughout the seventies, reaching a high point in 1980.

Figure 1 also presents the temporal distribution of proposals broken down by source. The trough which was mentioned above as occurring in the mid-sixties is much more prolonged for academics than for governments. Concern by academic sources slowly but persistently increases during the seventies, in contrast to that of governments. In the case of the latter, there is a strong resurgence of concern with verification during the late sixties and early


Year
Pre 1961
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
1981
Fig 1 Proposals x Source
Total All Sources
Academics
Governments
Intergovernmental Bodies
Treaties
Frequency of Proposals
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
Pre 1961
Year

seventies period. This increase is followed by a marked decline from 1972 to 1974, with sporadic revivals of interest in the later 1970's.

There seems to be no clear relationship between the frequency of academic and government proposals persisting over the entire period, though there are some periods of shorter duration (e.g. 1960 to 1964) where a stronger association appears to exist. On the other hand, there may be a mild association between government concern over verification, as evidenced by the number of proposals they make, and the emergence of treaties involving verification provisions. The high points in the treaties line (1967, 1972, and 1979) follow a year after or coincide with substantial increases in the government line. There is also a similar coincidence of declines between the frequency of government proposals and that of treaties.

IV Predominant Arms Control Objectives

A. General Overview

(i) Introduction

The most frequently addressed Arms Control Objective among the 296 proposals in the Compendium is the question of Nuclear Weapons (NWs); 129 proposals (44%) deal with this problem (see Table 2). Chemical/Biological Weapons (CBWs) is next in prominence, accounting for 74 of the 296 (25%). Proposals lacking a specific arms control target (i.e. the Any Arms Control Agreement category) are the object of 36 of the 296 proposals (12%) followed by Regional Arms Control with 34(11%). Conventional Weapons account for only 10 of the proposals (3%).

TABLE 2

PREDOMINANT ARMS CONTROL OBJECTIVES X SOURCE

Total n = 296	Government n = 127	Academic n = 142	Treaties n = 14	Intergovernmental Bodies n = 13
1. Nuclear Weapons 129 (44%)*	1. NWs, 55 (43%)	1. NWs, 56 (39%)	1a. NWs, 7 (50%)	1. NWs, 11 (85%)
2. Chemical/ Biological Weapons, 74 (25%)	2. CBWs, 54 (42.5%)	2. "Any" 30 (21%)	1b. Regional Arms Control, 7 (50%)	2. Regional Arms Control, 2 (15%)
3. Any Arms Control Agreement, 36 (12%)	3a. OWMD, 6 (5%)	3. Regional Arms Control, 19 (13%)	2. Conventional Weapons, 2 (14%)	3a. CBWs, 1 (8%)
4. Regional Arms Control, 34 (11%)	3b. Regional Arms Control, 6 (5%)	4. CBWs, 18 (13%)	3a. CBWs, 1 (7%)	3b. Military Budgets, 1 (8%)
5. General and Complete Disarmament, 19 (6%)	3c. "Any" 6 (5%)	5. GCD, 15 (11%)	3b. OWMD, 1 (7%)	
6. Conventional Weapons, 10 (3%)	4. Conventional Weapons, 2 (2%)	6. Conventional Weapons 6 (4%)		
7. Other Weapons of Mass Destruction, 7 (2%)		7. Military Budgets, 3 (3%)		
8. Military Budgets, 4 (1%)				

* Column percentages. Note that for this and following tables, figures in the columns may not add up to column totals since individual proposals may deal with more than one arms control objective just as they may incorporate more than one verification method. Note also that percentage figures have been rounded off. The initial figure indicates ranking.

(ii) Break-Down by Source

Of the 296 verification proposals abstracted in the second edition of the Compendium, 127 (43%) originate with governments. Academics are responsible for 142 (48%) and intergovernmental bodies for 13 (4%). Fourteen treaties were abstracted accounting for 5% of the proposal abstracts.

When government generated proposals alone are considered, the arms control problem which is most frequently the focus are NWs (43%). CBWs, however, have received about the same amount of attention (42.5%). Two arms control problems (Other Weapons of Mass Destruction (OWMD) and Regional Arms Control) are each dealt with in 5% of the 127 government proposals. Government proposals which lack a specific arms control target (i.e. the "Any" category), also rank at this level (5%). Conventional Weapons are the focus for less than 2% of the government proposals.

Academic sources were also most preoccupied with NWs, though at a slightly lower level than were governments. Fifty-six of the 142 academic proposals (39%) are directed at NWs. Proposals which lack a focus on a specific arms control problem (i.e. the "Any" category) rank next in terms of frequency with 30(21%). Regional Arms Control (13.4%) ranks next followed by CBWs (12.7%) and GCD (11%). Interestingly, academics seem just as unconcerned as do governments with the verification of controls on Conventional Weapons; only 6 of their 142 proposals (4%) are directed at this topic.

Those intergovernmental bodies for which proposals are abstracted focus overwhelmingly on NWs (85%). This predominance reflects the fact that the International Atomic

Energy Agency is responsible for many of the proposals from intergovernmental bodies included in the Compendium. Regional Arms Control ranks next (15%), followed by CBWs and Military budgets (both 8%).

When treaties are considered, both NWs and Regional Arms Control are equally prominent; 7 of the 14 treaties relate to either one or the other of these topics. International agreements which are in some way concerned with Conventional Weapons rank next, being involved in 2 treaties (14%), followed by CBWs and Other Weapons of Mass Destruction (each the focus of 1 treaty).

(iii) Some Comments

Academic sources seem much more diffuse in the targeting of their proposals than are governments. This is suggested by two facts. To begin with, academic proposals more frequently fail to have any specific arms control target, thus being placed in the Any Arms Control Agreement category. Second, governments seem to concentrate their proposals on a few specific targets (especially NWs and CBWs) while academics spread their interest over more areas.

The considerable difference between the emphasis placed on CBWs by governments and by academics (42% vs 13%) is likely, at least in part, a result of the attention given the discussions in the CD and its predecessor organizations by the authors of the Compendium. Nevertheless, it may also reflect a difference in the perceived importance of this topic between the two communities. The difference in emphasis by governments and by academics given to Regional Arms Control (5% vs 13%) and GCD (3% vs. 11%) may reflect a similiar difference in perception.

The shared lack of interest by governments and academics in the verification of controls on conventional weapons is particularly noteworthy. The relatively high degree of emphasis in treaties reflects the fact that several disengagement agreements were abstracted. These disengagement agreements deal with both regional arms control and conventional weapons. The marriage of these two arms control categories, which is also present to a limited extent in government proposals, suggests perhaps a perception that conventional weapons may best be controlled on a regional basis.

The overall lack of concern for conventional weapons verification seems at variance with two facts. First, conventional weapons have in the past been responsible for far more war-related deaths then have mass effect weapons like NWs and CBWs, and this remains true today. Second, conventional weapons still constitute the greatest portion of the arsenals of most countries of the world. Apparently, many governments and many academics believe these weapons remain essential to national security. Alternatively, control of conventional weapons may be seen by these two communities as too daunting a task to be attempted.

(iv) Ratio of Duplicate Entries to Unique Proposals

It is possible to derive figures for the number of unique proposals in each of the eight general Arms Control Objectives categories* as well as the number of entries in each category. The latter figure incorporates the duplication caused by proposals involving more than one

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* These eight categories are listed in the first column of Table 2.

verification type. Subtracting the number of unique proposals from the number of entries for each Arms Control Objectives category gives an indication of the degree to which proposals in that category involve more than one verification technique. This in turn may suggest the level of difficulty with which the proponents of the verification schemes view the particular arms control problem in question. In other words, a large ratio of duplicates to proposals in a category suggests that the proposals in that category tend to involve more than one verification technique, perhaps because that arms control problem is seen to be not easily amenable to verification. Table 3 presents the figures for each of eight general Arms Control Objectives categories. The highest ratio of duplicate entries to unique proposals exists for the Military Budget category (2.0) followed closely by GCD (1.95) and CBWs (1.93). It seems that arms controllers view these areas as requiring several techniques for adequate verification hence they tend to include more than one method when they propose their verification schemes.

At the other end of the scale is the Any Arms Control Agreement category in which proposals lacking any specific arms control target are included. Here arms controllers tend more often to include a single verification technique in their proposed schemes.

Generally, it is interesting to note that for most of the categories there is a relatively strong tendency to include more than one verification method in proposals.

B. Predominant Arms Control Objectives By Category

(i) Nuclear Weapons

(a) General Patterns

TABLE 3

RATIO OF DUPLICATE ENTRIES TO PROPOSALS

IN THE ARMS CONTROL OBJECTIVES CATEGORIES

Arms Control Objectives	Number of Proposals	Number of Entries	Number of Duplicates	Ratio of Duplicates to Proposals
1. Military Budgets	4	12	8	2.0
2. General and Complete Disarmament	19	56	37	1.95
3. Chemical/Biological Weapons	74	217	143	1.93
4. Regional Arms Control	34	90	56	1.65
5. Conventional Weapons	10	26	16	1.6
6. Nuclear Weapons	129	320	191	1.5
7. Other Weapons of Mass Destruction	7	16	9	1.4
8. Any Arms Control Agreement	36	67	31	.8

Of the 296 proposals abstracted, 129 (44%) are concerned specifically with NWs*. Proposals dealing with Nuclear Weapons Warhead (Technology) (NWW) are involved in 81 of these (63%) while those dealing with Nuclear Weapons Delivery (Systems) (NWD) account for 48 (37%) (see Table 4). Surprisingly, not a single proposal of the 129 is directed at the verification of controls on both Warhead Technology and Delivery Systems, suggesting a clear differentiation in the perceived verification requirements in these two areas.

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* Excluding GCD proposals.

Regarding the Total NWs category, there are almost equal numbers of government and academic source proposals: 55 government and 56 academic. Eleven proposals from intergovernmental bodies were abstracted as well as 7 treaties.

The distribution of academic and government proposals between the two NW subcategories is interesting. Government proposals predominate in the Warhead Technology category whereas academic proposals outnumber those from governments for the Delivery Systems proposals. In percentage terms, 64% (52) of the 81 Warhead Technology proposals originate with governments compared to 16% (13) from academic sources. Of the 48 Delivery System proposals, 90% (43) come from academics while only 6% (3) originate with governments. These figures suggest that most governments have come to recognize that verification of Nuclear Delivery Systems is primarily the concern of those states, especially the superpowers, which possess such weapons systems. The superpowers, for their part, tend to conduct their verification discussions concerning Delivery Systems in private which means that few of their proposals will be abstracted in the Compendium. Academic sources, on the other hand, appear to feel less reticent about suggesting verification schemes for Nuclear Delivery Systems, especially in the context of the SALT II verification controversy.

Figures 2 to 4 present the distribution of proposals dealing with Nuclear Weapons and the two main subcategories Warhead Technology and Delivery Systems, over the time period covered by the Compendium. Concern with Warhead Technology (Figure 2) is much more persistent through the twenty year period than is that for Delivery Systems. There are two distinct peaks for the latter occurring in the early sixties and the late seventies.

TABLE 4
NUCLEAR WEAPONS CATEGORIES X SOURCE X GENERAL VERIFICATION CATEGORIES

	Total All Sources	Government	Academic	Treaties	Intergovern-mental Bodies
NW (Total)	n = 129	n = 55	n = 56	n = 7	n = 11
Intrusive	73 (57%)*	33 (60%)	28 (50%)	3 (43%)	9 (82%)
Non Intrusive	97 (75%)	42 (76%)	43 (77%)	5 (71%)	7 (64%)
Ancillary Elements	51 (40%)	28 (51%)	7 (13%)	6 (86%)	10 (91%)
NW Warhead Technology	n = 81	n = 52	n = 13	n = 5	n = 11
Intrusive	50 (62%)*	30 (58%)	8 (62%)	3 (60%)	9 (82%)
Non-Intrusive	59 (73%)	39 (75%)	10 (77%)	3 (60%)	7 (64%)
Ancillary Elements	47 (58%)	28 (54%)	5 (38%)	4 (80%)	10 (91%)
NW Delivery Systems	n = 48	n = 3	n = 43	n = 2	n = 0
Intrusive	23 (48%)*	3 (100%)	20 (47%)	0	0
Non-Intrusive	38 (79%)	3 (100%)	33 (77%)	2 (100%)	0
Ancillary Elements	4 (8%)	0	2 (5%)	2 (100%)	0

* Column percentages. Note that individual proposals may include several verification techniques.

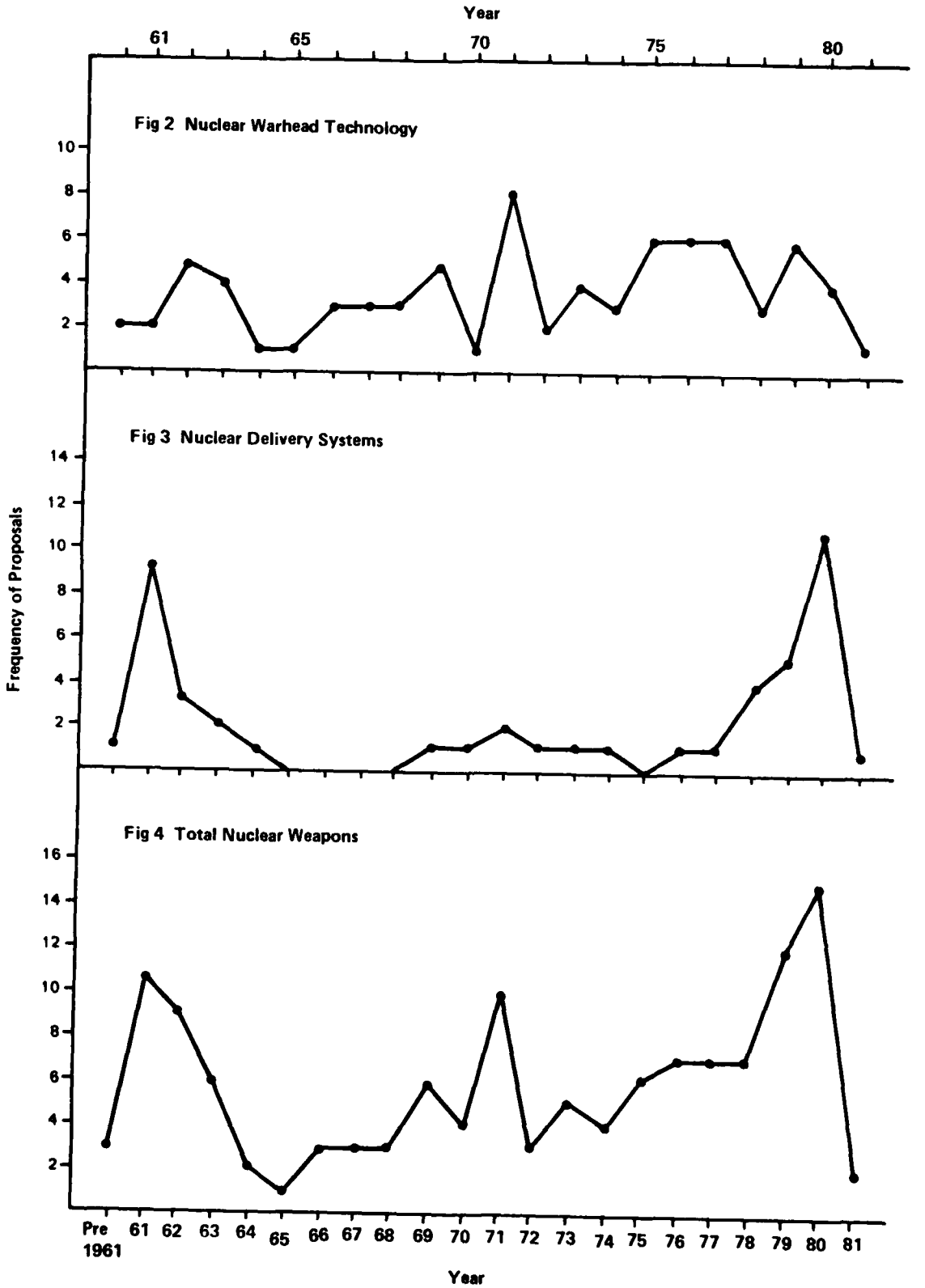
Year
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Fig 2 Nuclear Warhead Technology
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Fig 3 Nuclear Delivery Systems
Frequency of Proposals
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Fig 4 Total Nuclear Weapons
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Pre 1961
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81
Year

(b) General Verification Categories

This section will examine the distribution of the three general verification categories (Intrusive, Non-Intrusive and Ancillary Elements) for proposals dealing with NWs. First, the distribution, disregarding the source of the proposals, will be considered. Next, the distribution of these general verification categories for different types of sources will be discussed. Table 4 provides the basic data for this section.

(1) NW Categories x General Verification Categories

Of the 129 NW proposals 97 (75%) involve Non-Intrusive verification techniques. Intrusive methods are less prominent; 73 of the proposals (57%) include these. Ancillary Elements are involved in 51 (40%).

The figures in Table 4 suggest that Non-Intrusive verification is favoured for both the Warhead Technology and Delivery Systems subcategories to roughly the same degree (73% vs 79%). Intrusive measures, however, seem to receive more attention in the Warhead Technology area than is the case for Delivery System verification (62% vs 48%). It may be that Non-Intrusive techniques such as Remote Sensors have become viewed by proposers of Delivery Systems verification schemes as adequate to ensure compliance in this area. Proposers of Warhead Technology verification systems, in contrast, seem to have less confidence in Non-Intrusive Techniques, requiring other methods to back them up. The heavier emphasis on Ancillary Elements in Warhead Technology proposals seems to support this interpretation.

(2) NW Categories X General Verification Categories X Type of Source

When government NW proposals alone are examined the predominance of Non-Intrusive systems remains, 42 of the 55 government proposals (76%) involve Non-Intrusive systems. Intrusive techniques are involved in 33 (60%) and Ancillary Elements in 28 (51%). It should be recalled that most government NW proposals deal with Warhead Technology where the above distribution between the three general verification categories is very similar. Government proposals dealing with Delivery Systems, however, show equal emphasis on Intrusive and Non-Intrusive methods. No government Delivery Systems proposal includes Ancillary Elements.

The emphasis of academic sources on Non-Intrusive methods is about the same as for governments. Forty-three of the 56 NW proposals from academics (77%) involve Non-Intrusive techniques. Intrusive methods are involved in 28 (50%) and Ancillary Elements in only 7 (13%). The latter figure is quite different from the situation for government proposals.

The majority of academic NW proposals deal with Delivery Systems as mentioned above. Again (as was true for government proposals dealing with Warhead Technology) the pattern for this subcategory is similar to that for the total NW category.

For the 13 academic proposals dealing with Warhead Technology 10 (77%) involve Non-Intrusive methods, 8 (62%) include Intrusive techniques, and 5 (38%) Ancillary Elements. It seems that academics are more prone, in relative terms to talk about verifying controls on Warhead

Technology than governments are to address verification of Delivery Systems.

Intergovernmental bodies focus their attention exclusively on Warhead Technology reflecting perhaps the apparent belief of most governments that Delivery System verification is the private preserve of the superpowers. Ancillary Elements are the most favoured general verification approach for intergovernmental bodies.

Five treaties were abstracted dealing with Warhead Technology and two with Delivery Systems. The latter are the SALT I and II agreements which involve Non-Intrusive methods and Ancillary Elements without any Intrusive techniques. The 5 treaties dealing with Warhead Technology show a slight preference for Ancillary Elements (4), with equal prominence being given both Intrusive and Non-Intrusive systems (each 3).

(c) Specific Verification Categories

When particular types of verification techniques are examined (see Table 5), the most frequently proposed verification method for NWs as a whole is Selective Inspection which is involved in 62 of the 129 NW proposals (48%). Next comes Remote Sensors with 57 (44%) followed by Seismic Sensors with 46 (36%).

The verification techniques most favoured for Warhead Technology are Selective Inspection and Seismic Sensors each of which is involved in 46 of the 81 proposals dealing with this topic (57%). ICOs are suggested in 39 of the 81 (48%) followed by Information Exchanges with 34 (42%). For the 48 Delivery Systems proposals the emphasis is on Remote Sensors with 38 (79%), followed by Selective Inspection with 16 (33%).

In the case of the Warhead Technology proposals, there seems to be a strong association, at least for governments, between Seismic Sensors, Selective Inspection, ICOs and Information Exchanges. This reflects interest in international exchanges of seismic data through some sort of international body as a method of verifying nuclear test bans (see also Table 7).

The emphasis for Delivery Systems proposals on the use of Remote Sensors reflects the preoccupation of academic sources with this technique. Governments place equivalent weight on Remote Sensors and Selective Inspection in this context.

As perhaps might be expected, intergovernmental bodies strongly favour ICOs in their proposals; this method is involved in 10 of the 11 intergovernmental proposals (91%). Next in emphasis is Selective Inspection (9) followed by Short Range Sensors (7) and Information Exchanges (6). These methods reflect the fact that many of the proposals from intergovernmental bodies relate to the International Atomic Energy Agency (IAEA) safeguards.

The specific verification techniques involved in the 2 treaties relating to Delivery Systems (i.e. SALT I and II) are Remote Sensors and Complaints Procedures. No specific methods stand out for the 5 treaties dealing with Warhead Technology, however. Selective Inspection (3), Complaints Procedures (3), Remote Sensors (2), Seismic Sensors (2) and Information Exchanges (2) are all involved in these 5 treaties.

TABLE 5

NUCLEAR WEAPONS CATEGORIES X SOURCE X SPECIFIC VERIFICATION CATEGORIES

A Total NWs	Total All Sources n = 129	Government n = 55	Academic n = 56
	1. Selective Inspection 62 (48%)*	1. Seismic 35 (64%)	1. Remote 38 (68%)
	2. Remote Sensors 57 (44%)	2. Selective 31 (56%)	2. Selective 19 (34%)
	3. Seismic Sensors 46 (36%)	3. ICOs 24 (44%)	
	4a. Exch. 39 (30%)	4. Exch. 23 (42%)	
	4b. ICOs 39 (30%)	5. Remote 14 (25%)	
	5. Short Range Sensors 24 (19%)		
	6. Complaints Procedures 17(13%)		
	7. Records monitoring 12 (9%)		
	n = 81	n = 52	n = 13
B Nuclear Warhead Technology	1a. Selective 46 (57%)*	1. Seismic 35 (67%)	1. Seismic 6 (46%)
	1b. Seismic 46 (57%)	2. Selective 28 (54%)	2. Selective 6 (46%)
	2. ICOs 39 (48%)	3. ICOs 24 (46%)	3. Remote 5 (38%)
	3. Exch. 34 (42%)	4. Exch. 23 (44%)	
	4. Short Range 20 (25%)	5. Remote 11 (21%)	
	5. Remote 19 (23%)		
	6. Complaints 14 (17%)		
	n = 48	n = 3	n = 43
C Nuclear Delivery Systems	1. Remote 38 (79%)*	1a. Selective 3 (100%)	1. Remote 33 (77%)
	2. Selective 16 (33%)	1b. Remote 3 (100%)	2. Selective 13 (30%

* Column percentages.

(d) NW Subcategories

(1) General

The total NW category is composed of 13 subcategories, each of which relates to some aspect of the control of NWs. The Warhead Technology group is composed of 6 of these 13 subcategories while the remaining 7 make-up the Delivery Systems (see Data Manipulation section of this paper, p.5).

Of the 7 Warhead Technology subcategories, the most prominent concern in terms of the frequency of proposals is with a Comprehensive Test Ban (CTB) - (See Table 6A). Proposals dealing with a CTB account for 45 of the 81 (56%) in the Warhead Technology group. Of these 45 proposals, 34 orginate with governments (76%), 8 with academics (18%) and 3 with intergovernmental bodies (7%).

Peaceful Nuclear Explosions (PNEs) with 15 of the 81 Warhead Technology proposals (18.5%) and Proliferation with 14 (17%) rank next. In the case of PNE proposals, government proposals predominate with 8 of the 15 (53%). This is not true for Proliferation proposals, however, where intergovernmental bodies account for 7 of the 14, reflecting the presence of the IAEA in this field. There are also more academic proposals (3) dealing with Proliferation than government ones (2), in contrast to the situation for PNEs.

In the Delivery System subcategories the preeminence of academic proposals is clearly evident (See Table 6B). The most frequently addressed subcategory is Ballistic Missiles which accounts for 29 of the 48 Delivery System proprosals (60%). Next in concern is Missile Tests with 21 (44%) followed by Manned Aircraft with 20 (42%) and Reentry Vehicles with 19 (40%).

TABLE 6

NUCLEAR WEAPONS SUBCATEGORIES X SOURCE

NW Subcategory	Govt	Academic	Treaty	IGO	Total	
1. Comprehensive Test Ban	34	8	0	3	45	A) Nuclear Warhead Technology Subcategories
2. Peaceful Nuclear Explosions	8	2	3	2	15	
3. Proliferation	2	3	2	7	14	
4. Fissionable Materials "Cutoff"	6	3	0	0	9	
5. Partial Test Ban	2	1	3	1	7	
6. Research and Development	1	2	0	0	3	
Total entries	53	19	8	13	93	
1. Ballistic Missiles	2	25	2	0	29	B) Nuclear Delivery Systems Subcategories
2. Missile Tests	0	20	1	0	21	
3. Manned Aircraft	1	17	2	0	20	
4. Reentry Vehicles	0	18	1	0	19	
5. Mobile Missiles	0	15	1	0	16	
6. Cruise Missiles	0	13	1	0	14	
7. Anti-Ballistic Missiles	0	2	1	0	3	
Total entries	3	110	9		122	

An interesting feature of the Warhead Technology and Delivery System groups revealed in Table 6 relates to the number of the duplicated entries between the subcategories. In the case of Warhead Technology, when the entries in each of the subcategories are added without eliminating duplicates, the total is 93. Of the 93 entries, 81 are accounted for by separately abstracted proposals. The remaining 12 duplicate entries (i.e. 93-81) relate to proposals which deal with more than one of the arms control subcategories. The corresponding figures for the Delivery System category (122-48) indicate that there are 74 duplicate entries among those subcategories. This suggests that proposals dealing with the verification of Delivery Systems are very likely to focus on several types of delivery systems. In contrast, the Warhead Technology subcategories seem to be perceived as more distinct in terms of verification requirements and hence proposals tend to be limited to each subcategory.

The temporal distribution for some of the Nuclear Warhead Technology subcategories is given in Figures 5 to 9. The peak in the 1975 to 1977 period for Peaceful Nuclear Explosions (Figure 7) seems to be a result of the Indian atomic test in 1974. Concern regarding a Comprehensive Test Ban (Figure 9) seems to have been relatively persistent through the seventies. The peak in the early seventies probabably results from technological improvements in long-range seismic sensing.

Regarding the subcategories for Delivery systems (which are not graphed) there seem to be two general patterns. For two types of delivery systems (Mobile Ballistic Missiles and Cruise Missiles) proposals are concentrated during the late seventies, with none earlier than 1976. Concern with Reentry Vehicles is also

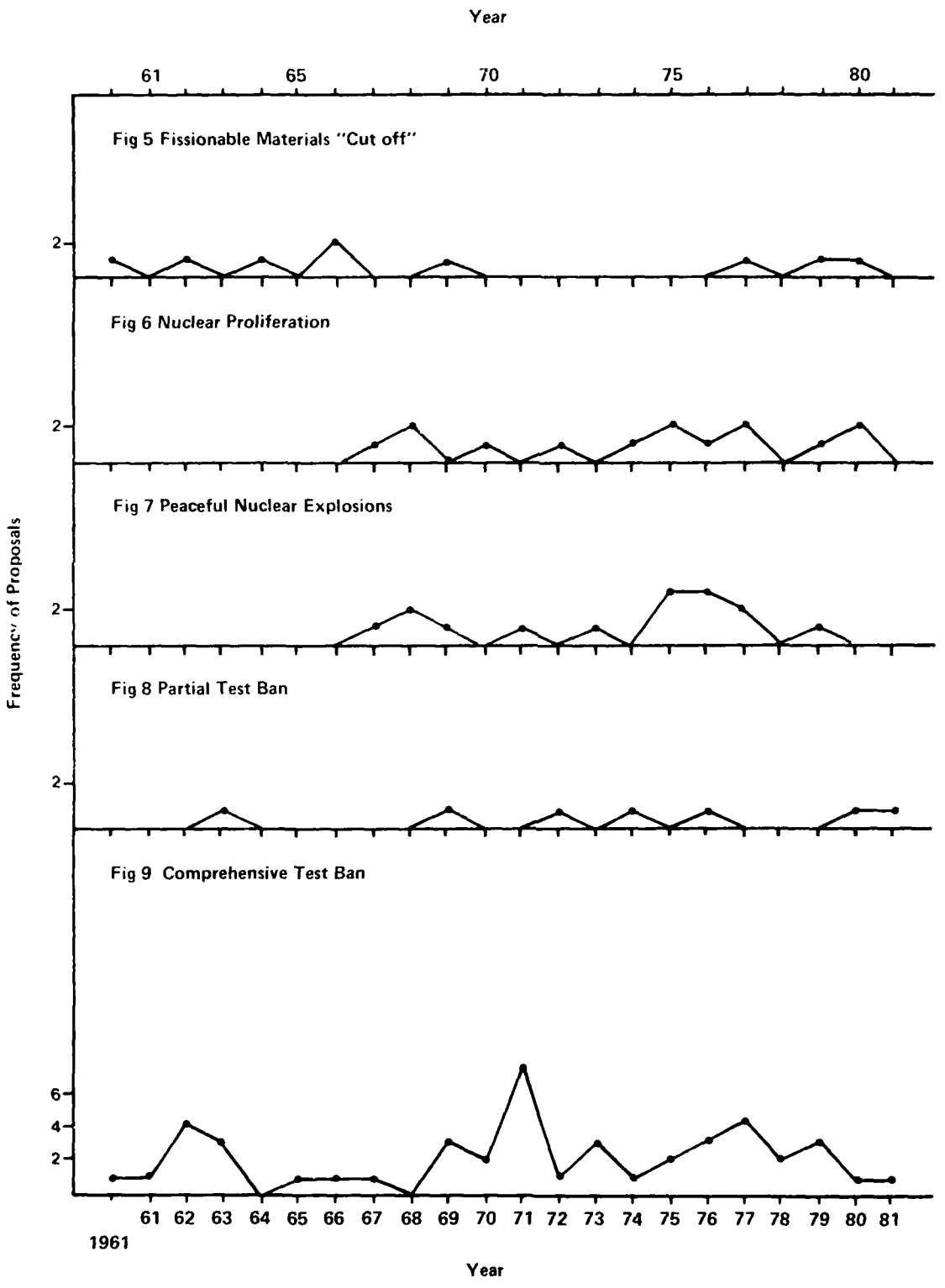
Year
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Fig 5 Fissionable Materials "Cut off"
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Fig 6 Nuclear Proliferation
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Fig 7 Peaceful Nuclear Explosions
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Fig 8 Partial Test Ban
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Fig 9 Comprehensive Test Ban
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1961
Year
Frequency of Proposals

concentrated in this period though there were several proposals dealing with this topic occurring before 1976, the earliest being in 1970. The second general pattern is present in the temporal distribution for three subcategories (Ballistic Missiles, Missile Tests and Manned Aircraft). For these subcategories there seems to be two peaks, one during the early sixties and one during the late seventies.

(2) Specific Verification Categories

The favoured verification technique for Comprehensive Test Ban proposals is, not surprisingly, Seismic Sensors. Of the 45 CTB proposals, 42 (93%) include this technique (See Table 7). Next in emphasis is Information Exchanges with 23 (51%), followed by ICOs with 20 (44%) and Selective Inspection with 18 (40%).

The seven Partial Test Ban proposals show similar strong emphasis on Seismic Sensors (6 of 7 or 86%). International Control Organizations are considerably less favoured here than in CTB proposals (14% vs 44%) while Short Range Sensors ranks equally with Selective Inspection and Information Exchanges (each 43%) Remote Sensors, are, proportionally, more strongly emphasized in PTB proposals than in CTB ones (57% vs 29%).

There is a clear, strong preference in proposals concerned with PNEs for Selective Inspection. Thirteen of the 15 PNE proposals (87%) include this technique. ICOs are present in 60% of the 15 PNE proposals and Complaints Procedures in 33%.

The emphasis on Selective Inspection in proposals dealing with Proliferation of NWs is even stronger than was the case for PNEs. Of the 14 Proliferation proposals 13

TABLE 7

NUCLEAR WEAPONS SUBCATEGORIES X SPECIFIC VERIFICATION CATEGORIES

	A. Nuclear Warhead Technology						B. Nuclear Delivery Systems						
	R&D	Fiss	Prolif.	PNEs	PTB	CTB	Ball.	Mobile	Reentry	Cruise	Missile Tests	ABM	Manned Aircraft
General	1	1	2							1			1
Selective	1	7	13	13	3	18	7	5	3	2	5		7
P/Z											5		3
Control Posts						1	2						1
Records	1	1	5				5						3
Non-Physical						1	1						
Short Range		2	7	3	3	9	3	2	1	1	1	1	1
Remote	1	2	1	1	4	13	23	15	18	14	20	2	16
Seismic				4	6	42							
Lit. Survey				1		1							
Exch.		3	5	3	3	23	3	1	2	1	4		3
NSS			5										
Complaints	1	1	2	5	2	8	2	1	2	1	2	1	2
ICO	1	3	13	9	1	20					1		
Review			1	4		4							
No. of Unique Proposals	3	9	14	15	7	45	29	16	19	14	21	3	20

(93%) include Selective Inspection. Also involved in 93% of the Proliferation proposals are ICOs. Short-Range Sensors rank next (50%); followed by a group of three techniques (Records Monitoring, Information Exchanges and National Self-Supervision) each of which are involved in 33% of the Proliferation proposals. It is worth

recalling that intergovernmental bodies were responsible for a large share of Proliferation proposals (50%) which may help explain the emphasis on some of these methods.

The preference in the 9 proposals dealing with a "Cutoff" of Fissionable Materials is for Selective Inspection (78%). Next in rank are Information Exchanges and ICOs (each 33%).

With regard to the Delivery System subcategories, the clear, strong preference in 6 of the 7 subcategories is for Remote Sensors. Selective Inspection receives about the same degree of emphasis across these 6 subcategories, though at a substantially lower level than does Remote Sensors. In contrast to the situation for the first edition of the Compendium, the proposals including Selective Inspection in this context are not solely from the early 1960s.

After Selective Inspection, the verification methods preferred in the 6 subcategories of Delivery Systems are Information Exchanges and Complaint Procedures.

The single subcategory of Delivery Systems which does not follow the above pattern is that for ABMs. Here only three proposals were abstracted, one of which is the SALT I Treaty. Remote Sensors are included in 2 of the 3 ABM proposals.

(ii) Chemical/Biological Weapons

(a) General

This Arms Control Objective ranks second to NWs in terms of the total number of proposals focussing upon it; 74 of the 296 proposals (25%) are directed at CBWs. Of these, government originated proposals are by far the most predominant with 54 of the 74 (73%) - (see Table 8).

Proposals from academic sources rank second with 18 (24%). Only one treaty and one proposal by an intergovernmental body were abstracted.

In terms of general verification categories, 52 (70%) of the CBW proposals involve Intrusive methods, 46 (62%) Non-Intrusive techniques and 32 (43%) Ancillary Elements. When the 54 government proposals are considered alone the figure are respectively: 38 (70%), 31 (57%) and 28 (52%).

For academic sources the emphasis is somewhat different from that for governments with Ancillary Elements falling considerably in relative importance (11% vs 52%) and Non-Intrusive methods increasing (72% vs 57%). Academic source proposals involving Intrusive techniques are somewhat more emphasized than is the case in government proposals (78% vs 70%).

The specific verification techniques which predominate in proposals dealing with CBWs are listed in Table 8. Selective Inspection is the one most favoured by both government and academic sources, though much more strongly by the latter. On the other hand, government proposals shows a much stronger disposition towards International Control Organizations and Complaints Procedures than does the scholarly literature. The preference for Short-Range Sensors and National Self-Supervision is also somewhat stronger in government proposals while Remote Sensors and Records Monitoring receive proportionally more attention in academic proposals. Information Exchanges receive about the same emphasis in both academic and government proposals.

TABLE 8

CHEMICAL/BIOLOGICAL WEAPONS X SPECIFIC VERIFICATION METHODS

Total All Sources n = 74	Government n = 54	Academic n = 18
1. Selective 41 (55%)*	1. Selective 28 (52%)	1. Selective 13 (72%)
2a. Exch. 28 (38%)	2. ICOs 25 (48%)	2. Exch. 7 (39%)
2b. ICOs 28 (38%)	3a. Short Range 21 (39%)	3. Records 6 (33%)
3. Short Range 26 (35%)	3b. Exch. 21 (39%)	4a. Short Range 5 (28%)
4. Complaints 23 (31%)	3c. Complaints 21 (39%)	4b. Remote 5(28%)
5. NSS 22 (30%)	4. NSS 16 (30%)	5. NSS 4 (22%)
6. Records 17 (23%)	5. Records 11 (20%)	
7. Remote 15 (20%)	6. Remote 10 (19%)	

* Column percentages.

(b) CBW Subcategories

The CBW category is composed of 4 subcategories. Comparing these 4 subcategories, it is clear that most attention has been focussed upon the verification of Production restrictions (see Table 9). Of the 74 CBW proposals 59 (80%) deal with Production, 40 (54%) with the Destruction of Stocks and Facilities, 25 (34%) with Stockpiling and 13 (18%) with Research and Development. This rank order remains the same for both government and academic source proposals.

The ratio of duplicated entries between subcategories to the number of proposals gives an indication of how strongly the subcategories overlap in the minds of those respnsible for the proposals. In other words do arms controllers tend to direct their proposals at a specific

subcategory (eg. Production of CBWs or Stockpiling of CBWs) or do they direct them at several subcategories simultaneously?

For CBWs the ratio of duplicate entries to the number of proposals is 63:74 or .85. This figure is higher than that for Nuclear Warhead Technology (.15) where the focus of proposals tends to be on specific subcategories. The ratio is lower than that for Nuclear Delivery Systems (1.5) where proposals tend to be concerned with many subcategories simultaneously. The ratio for government CBW proposals is higher than that for academic ones suggesting that governments are less prone to limit their verification proposals to specific aspects of the CBW question than are academics.

(c) Temporal Distribution

The distribution over time of proposals dealing with CBWs is given in Figure 10. Concern with the verification of CBWs seems very much to be limited to the seventies. It also seems to be characterized by large fluctuations of interest during this period.

(iii) Conventional Weapons

Only 10 of 296 proposals abstracted in the Compendium deal with the verification of controls on conventional weapons. In view of the proportion of military budgets spent on these weapons and the number of war related deaths attributable to them, this clear lack of interest by all sources is quite suprising. Of the 10 proposals, 2 originated with governments, 5 with academics and 2 are

related to treaties. Non-Intrusive verification methods are involved in 9 of the 10 proposals, Intrusive methods in 6, and Ancillary Elements in 5. The single most favoured verification technique is Remote Sensors which is involved in 8 of the 10 proposals. Control Posts and General Inspection rank next in emphasis (each 4 of 10), followed by Selective Inspection and Complaints Procedures (each 3 of 10).

TABLE 9

CHEMICAL/BIOLOGICAL WEAPONS SUBCATEGORIES X SOURCE

CBW Subcategory	Government	Academic	Treaty	IGO	Total
Research and Development	11	2	0	0	13
Production	45	12	1	1	59
Stockpiling	19	4	1	1	25
Destruction of Stocks and Facilities	28	10	1	1	40
Total Entries	103	28	3	3	137

TABLE 10

CONVENTIONAL WEAPONS SUBCATEGORIES X SOURCE

Conventional Weapons Subcategories	Government	Academic	Treaty	IGO	Total
Ground Forces	2	5	2	0	9
Aircraft	0	2	1	0	3
Ships	1	1	1	0	3
Total Entries	3	8	4	0	15

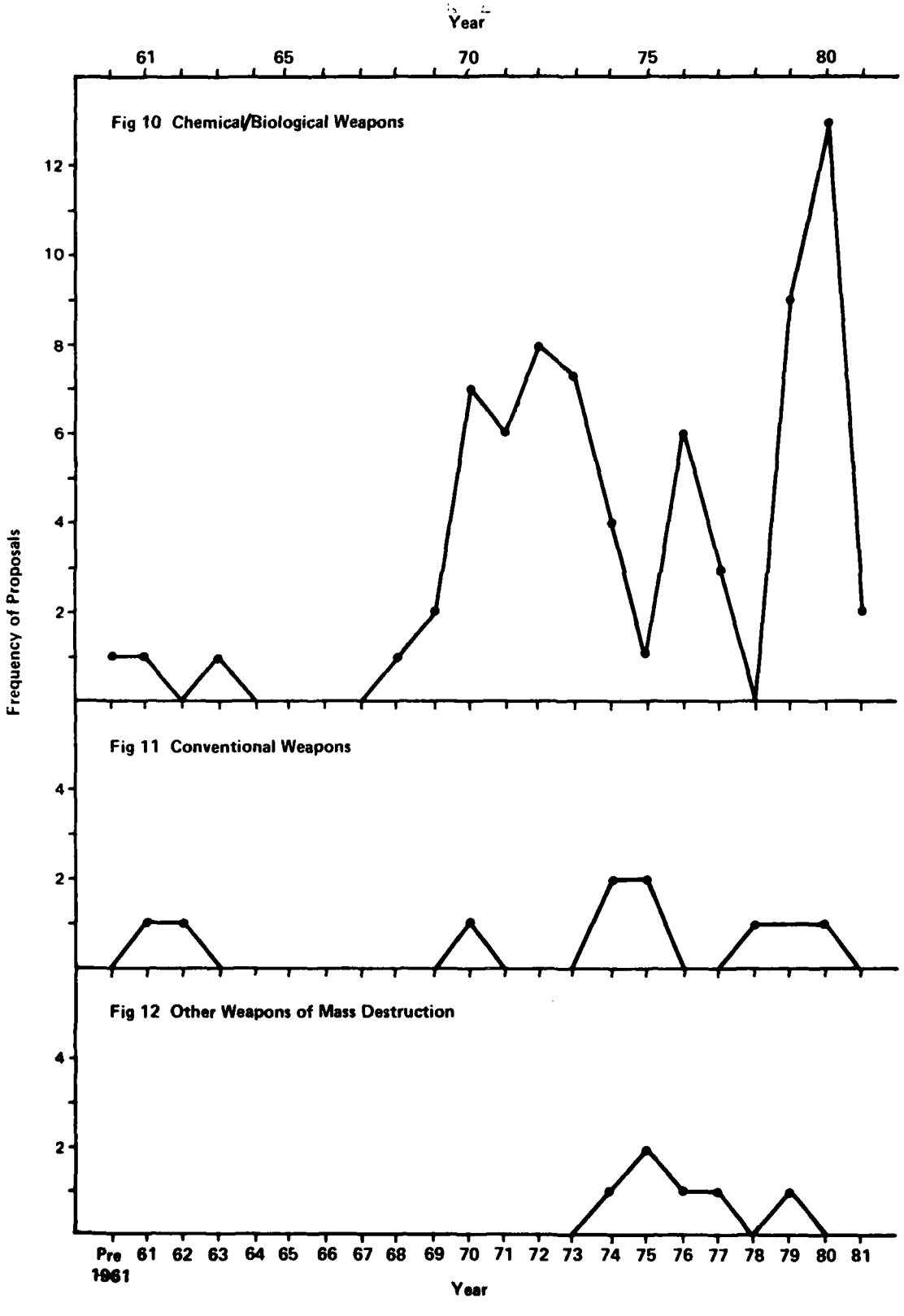
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Fig 10 Chemical/Biological Weapons
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Frequency of Proposals
Fig 11 Conventional Weapons
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Fig 12 Other Weapons of Mass Destruction
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With regard to type of source, academics clearly favour Remote Sensors more than governments (5 to 1). Both treaties, interestingly, involve intrusive techniques such as General Inspection and Control Posts as well as less intrusive ones such as Remote Sensors. Complaints Procedures are also involved in both treaties. It seems that in the case of Conventional weapons, states are prepared to demand and to accept some very intrusive measures to ensure compliance with the terms of an agreement.

The Conventional Weapons category is composed of 3 sub-categories. Of these 3 subcategories proposals dealing with Ground Forces predominate being present in 9 of the 10 proposals (see Table 10). Aircraft and Ships are each focussed on in 3 of the 10 proposals. When duplicate entries are considered academics appear to be a little more likely than are governments to make their proposals applicable to several of the Conventional Weapons subcategories.

The temporal distribution of Conventional Weapons proposals is shown in Figure 11. Interest in this arms control area appears to be somewhat sporadic over the period covered by the Compendium.

(iv) Other Weapons of Mass Destruction

Only 7 of the 296 proposals (2%) deal with this category of arms control objective. It is almost exclusively a preoccupation of governments; 6 of the 7 proposals orginate with governments. One treaty (the Environmental Modification Treaty) is abstracted. In terms of the the general verification approaches adopted, Ancillary Elements are involved in 6 of the 7 proposals and

TABLE 11

REGIONAL ARMS CONTROL X SOURCE X SPECIFIC VERIFICATION CATEGORIES

Total All Sources n = 34	Government n = 6	Academic n = 19	Treaties n = 7	IGOs n = 2
1. General 19 (56%)*	1. General 6 (100%)	1. Remote 10 (53%)	1a. General 6 (86%)	1. Complaints 2 (100%)
2. Remote 18 (53%)	2. Remote 4 (67%)	2. General 7 (37%)	1b. Complaints 6 (86%)	
3. Complaints 14 (41%)	3. Complaints 3 (50%)	3. Control Post 5 (26%)	2. Remote 3 (43%)	
4. Control Post 10 (29%)	4. Review 2 (33%)	4a. Complaints 3 (16%)		
5. Selective 7 (21%)		4b. ICOs 3 (16%)		
6. ICOs 6 (18%)				

* Column percentages.

Non-Intrusive methods in 5. There are no Intrusive methods included in any of the 7 proposals. The specific verification method emphasized most is Complaints Procedures which is present in 6 of 7 proposals. It is followed by National Self-Supervision with 4 and Review Conferences with 3.

Figure 12 illustrates the distribution over time of the 7 OWMD proposals. Concern over this type of weapon seems to have emerged only during the mid-seventies.

(v) Regional Arms Control

This category ranks fourth in terms of numbers of proposals; 34 of the 296 proposals (11%) are concerned with Regional Arms Control. Of these 19 (56%) are attributable to academic sources, 7 (21%) to treaties, 6 (18%) to governments and 2 (6%) to intergovernmental bodies.

Intrusive verification methods are involved in 30 of the 34 proposals in this category (88%). Second in rank are Non-Intrusive methods with 20 (59%), followed by Ancillary Elements with 16 (47%). The most favoured specific verification technique (see Table 11) is the highly intrusive General Inspection which is included in 19 of the proposals (56%). This technique is strongly favoured by governments; it is involved in all 6 government proposals. It is also, along with Complaints Procedures, the most favoured method in treaties, being involved in 6 of the 7 treaties. As was true for Conventional Weapons, it appears that some states at least, are willing to accept very intrusive verification procedures in some arms control situations. The next most frequently suggested verification method in this area is Remote Sensors which is included in 18 proposals (53%). This is followed by Complaints Procedures with 14 (41%) and Control Posts with 10 (29%).

Academic sources include Remote Sensors most frequently in their proposals; 10 of the 19 academic proposals (53%) involved this technique. It is followed by General Inspection with 7 (37%) and Control Posts with 5 (26%).

Figure 13 shows the temporal distribution of Regional Arms Control proposals. Concern with this arms control area seems to be relatively persistent over the 20 year period covered by the Compendium.

(vi) Military Budgets

Only 4 proposals dealing with this topic were abstracted. Three of these originate with academics and one with an intergovernmental body. Non-Intrusive methods are mentioned in all four of the proposals, Intrusive methods in two and Ancillary Elements in one. Of the specific verification techiques, Literature Surveys is the most frequently mentioned (4), followed by Information Exchanges (3) and Selective Inspection (2). Three of the four proposals occur during the mid-seventies.

(vii) General and Complete Disarmament

Of the 296 proposals abstracted in the Compendium 19 deal with GCD (6%). Academics were responsible for 15 of these and governments 4. All of the 19 proposals involved some type of Intrusive verification, 14 included Non-Intrusive methods and 9 Ancillary Elements.

Progressive/Zonal Inspection is the most frequently suggested means of verification for GCD. It is involved in 9 of the 19 proposals (47%). Remote Sensors, Information Exchanges and ICOs each rank next in preference (8),

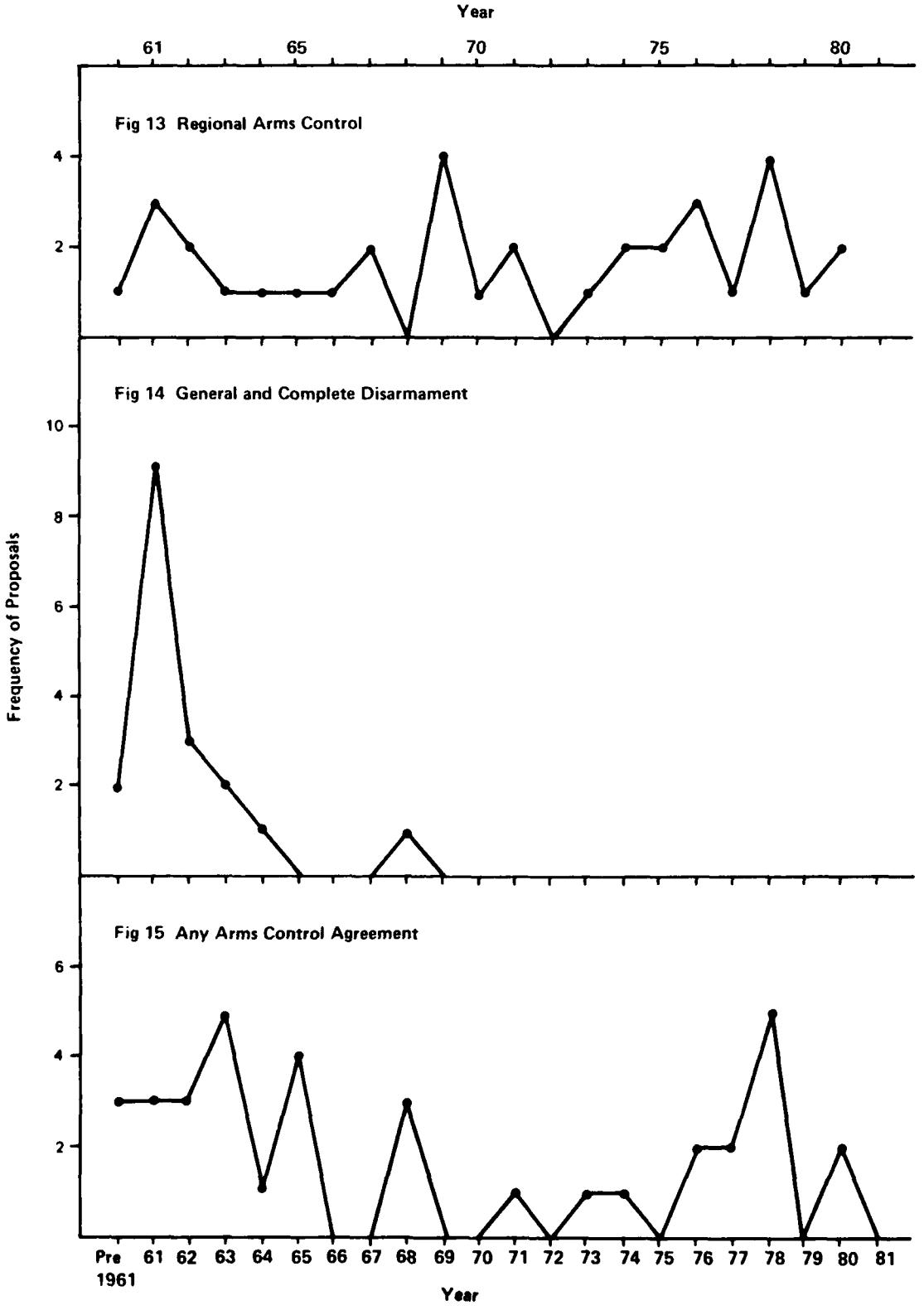
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Fig 13 Regional Arms Control
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Fig 14 General and Complete Disarmament
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Frequency of Proposals
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followed closely by Selective Inspection (7). General Inspection is included in 5 of the 19 proposals.

The distribution of GCD proposals over time is presented in Figure 14. As is evident in this graph, these proposals occur almost exclusively in the early sixties which may help explain the emphasis on intrusive verification. Arms controllers at this early period may have been more optimistic about the acceptability of intrusive verification methods. GCD, because of the comprehensive nature of restrictions involved and the pervasive effects on national security, also seems to favour demands for intrusive verification.

(viii) Any Arms Control Agreement Category

This category covers proposals which lack a specifically identified arms control target. It ranks third among the Arms Control Objective categories in terms of the number of proposals; 36 of the 296 proposals fall into this category (12%). A high proportion of these 36 proposals (30 or 83%) originate with academics. Only 6 (17%) come from governments.

Intrusive verification methods are included in 24 of the 36 proposals (67%) while Non-Intrusive methods and Ancillary Elements are mentioned in 16 proposals (44%). Academics show more of a preference for Intrusive methods than do governments which favour Ancillary Elements.

The individual verification method (see Table 12) which is most emphasized is Intergovernmental Control Organizations, present in 15 of the 36 proposals (42%). Governments favour this method much more than do academics in terms of the proportion of their proposals involving it

TABLE 12

ANY ARMS CONTROL AGREEMENT CATEGORY X SOURCE X SPECIFIC VERIFICATION CATEGORIES

Total All Sources n = 36	Government n = 6	Academic n = 30
1. ICOs 15 (42%)	1. ICOs 6 (100%)	1a. Selective 9 (30%)
2. Selective 10 (28%)	2. Exch. 3 (50%)	1b. ICOs 9 (30%)
3. Exch. 9 (25%)	3. Remote 2 (33%)	2a. Non-Physical 6 (20%)
4a. Non-physical 7 (19%)	4. Complaints 2 (33%)	2b. Exch. 6 (20%)
4b. Remote 7 (19%)		3a. Remote 5 (17%)
5a. Lit. Surveys 5 (14%)		3b. Lit. Survey 5 (17%)
5b. Complaints 5 (14%)		4a. General 4 (13%)
		4b. Records 4 (13%)

(100% vs 30%). Selective Inspection ranks next with 10 of the 36 proposals (27%) mentioning this technique. In this case, however, the interest of governments and academics is more equal (17% vs 30%). Information Exchanges receives attention in 9 proposals (3 government and 6 academic). Non-physical/Psychological Inspection is included in 7 (1 government and 6 academic). Remote Sensors are mentioned in 7 proposals (2 government and 5 academic). Literature Surveys and Complaints Procedures rank next each with 5. Academics prefer the former over the latter.

The temporal distribution of proposals falling into the Any Arms Control Agreement category is presented in Figure 15. These proposals seem to occur relatively sporadically throughout the period covered.

V Predominant Verification Methods

A. General Overview

(i) Introduction

The foregoing sections have examined the contents of the Compendium of Arms Control Verification Proposals from the point of view of the Arms Control Objective categories to see which problems received the most attention and to see which verification techniques were favoured in each problem area. The following sections will examine the Compendium's contents from the perspective of the Verification Systems categories. The aim in this portion of the paper will be to see which verification techniques receive most attention and which arms control problems are most associated with each technique.

(ii) Ratio of Duplicate Entries to Unique Proposals

Comparing the ratios of duplicate entries to proposals for each verification type may indicate which methods are being applied to several arms control problems. For example, a relatively high ratio suggests that arms controllers see a particular technique as being useful in the verification of more than one area of arms control since they tend to direct their proposals which involve this technique at more than one arms control objective.

Table 13 gives this ratio for the 15 verification categories. As might be expected the ratios are much smaller than was true in Table 3 when Arms Control Objective categories were compared. Proposers are less likely to direct verification schemes at more than one arms control problem than they are to include several verification methods in a scheme which is directed at a particular problem.

The verification technique which is most likely to be directed at more than one arms control problem in an individual proposal is Control Posts (.25). Complaints Procedures (.203) ranks next, followed by Non-Physical/Psychological Inspection (.2) and General Inspection (.16). Several of the verification techniques have no duplicated entries.

B. General Verification Categories

(i) Broken-Down By Source

Examining first the three general categories of verification systems (Intrusive, Non-Intrusive and Ancillary Elements) 198 of the 296 proposals (67%) involve Non-Intrusive verification techniques, 183 (62%) Intrusive ones and 131 (44%) Ancillary Elements. When the 127 government proposals are considered alone, Non-Intrusive methods predominate with 82 (65%) followed closely by Intrusive methods with 80 (63%) and Ancillary Elements with 74 (58%).

The 142 academic proposals involve Intrusive techniques most frequently. Ninety-eight of these academic proposals (69%) include Intrusive techniques, 82 (58%) involve Non-Intrusive ones and only 32 (23%) Ancillary Elements. Academics seem less reticent with regard to suggesting Intrusive verification methods than are governments perhaps due to the latter's traditional concerns regarding national sovereignty and security. Governments also seem considerably more interested in Ancillary Elements which may reflect a greater concern by officials with the administrative and legal details of arms control agreements.

Intergovernmental bodies include Ancillary Elements in 12 of their 13 proposals (92%). Not surprisingly this high figure reflects an emphasis on one kind of Ancillary

TABLE 13

RATIO OF DUPLICATE ENTRIES TO PROPOSALS IN THE VERIFICATION SYSTEMS

CATEGORIES

Verification Systems Category	Number of Proposals	Number of * Entries	Number of Duplicates	Duplicates/ Proposals
1. Control Posts	16	20	4	.25
2. Complaints	59	71	12	.203
3. Non-physical	10	12	2	.2
4. General	30	35	5	.16
5. ICO	90	101	11	.1
6. Remote	105	114	9	.09
7. Info. Exchange	90	94	4	.044
8. Selective	127	132	5	.039
9a. Progressive/Zonal	16	16	0	0
9b. Records Monitoring	38	38	0	0
9c. Short-Range	55	55	0	0
9d. Seismic	46	46	0	0
9e. Literature Survey	18	18	0	0
9f. NSS	32	32	0	0
9g. Review	21	21	0	0
Intrusive	198	206	9	.05
Non-Intrusive	183	211	28	.15
Ancillary Elements	131	136	5	.04

* In the following categories: NWs, CBWs, Conventional Weapons, Other Weapons of Mass Destruction, Regional Arms Control, Military Budgets, CCD, Any Arms Control Agreement.

verification method -- International Control Organizations. More interesting, perhaps, is the high involvement here of Intrusive techniques (85%) compared to Non-Intrusive ones (69%). Intergovernmental bodies, like academics, seem less concerned than governments with national sovereignty and related issues.

Of the 14 treaties abstracted, 13 (93%) involve Ancillary Elements of some type. This emphasis on Ancillary methods is probably to be expected in formal, legally binding agreements. Intrusive methods are included in 9 of the treaties (64%) while Non-Intrusive techniques are present in 10 (71%).

(ii) Broken-Down by Arms Control Objectives

(a) Intrusive Techniques

Of the 296 proposals abstracted, there are 198 (67%) which involve at least one Intrusive technique. The breakdown of these Intrusive proposals by Arms Control Objectives is given in Table 14. NWs predominate, being the focus of 73 (37%) of the 198 proposals. Warhead Technology alone is the target in 50 proposals (25%) while Delivery Systems are the concern of 23 (12%). CBWs follow NWs as the next most favoured arms control focus for Intrusive proposals; 52 of the 198 Intrusive proposals (26%) relate to CBWs. Regional Arms Control is the object of 30 of the Intrusive proposals (15%).

Intrusive verification proposals orginating with governments focus most on CBWs; 38 of the 80 government proposals (48%) deal with this problem. NWs are dealt with in 33 (41%), with most concentrating on Warhead Technology. For academic sources, in contrast, CBWs rank much lower in

TABLE 14

INTRUSIVE VERIFICATION CATEGORY X SOURCE X ARMS CONTROL OBJECTIVES CATEGORIES

Total All Sources n = 198	Government n = 80	Academic n = 98	Treaties n = 9	IGOs n = 11
1. NWs 73 (37%)	1. CBWs 38 (48%)	1. NWs 28 (29%)	1. Regional 7 (78%)	1a. NWs 9 (82%)
2. CBWs 52 (26%)	2. NWs 33 (41%)	2. "Any" 22 (22%)	2a. NWs 3 (33%)	1b. NWW 9 (82%)
3. NWW 50 (25%)	3. NWW 30 (38%)	3. NWD 20 (20%)	2b. NWW 3 (33%)	2. Regional 2 (18%)
4. Regional 30 (15%)	4. Regional 6 (8%)	4a. Regional 15 (15%)	3. Conven-tional 2 (22%)	
5. "Any" 24 (12%)	5. GDC 4 (5%)	4b. GCO 15 (15%)		
6. NWDs 23 (12%)		5. CBWs 14 (14%)		
7. GCD 19 (10%)		6. NWW 8 (8%)		

TABLE 15

NON-INTRUSIVE VERIFICATION CATEGORY X SOURCE X

ARMS CONTROL OBJECTIVES CATEGORIES

Total All Sources n = 183	Government n = 82	Academic n = 82	Treaties n = 10	IGOs n = 9
1. NWs 97 (53%)	1. NWs 42 (51%)	1. NWs 43 (52%)	1. NWs 5 (50%)	1a. NWs 7 (78%)
2. NWW 59 (32%)	2. NWW 39 (48%)	2. NWD 33 (40%)	2. Regional 4 (40%)	1b. NWW 7 (78%)
3. CBW 46 (25%)	3. CBWs 31 (38%)	3a. CBWs 13 (16%)	3. NWW 3 (30%)	2. Regional 2 (22%)
4. NWD 38 (21%)	4a. CWMD 4 (5%)	3b. "Any" 13 (16%)		
5. Regional 20 (11%)	4b. Regional 4 (5%)	4. GCO 11 (12%)		
6. "Any" 16 (9%)		5. Regional 10 (12%)		
7. GCD 14 (8%)				
8. Conven-tional 9 (5%)				

emphasis being involved in only 14 of the 98 Intrusive academic proposals (14%). First in importance for academics are NWs with 28 of the 98 proposals (29%). Proposals without any specific arms control focus (i.e. the "Any" category) are involved in 22 of the academic proposals (22%) with Regional Arms Control and GCD following next, each with 15 proposals (15%). These figures also indicate that Intrusive proposals originating with governments tend to be concentrated on fewer arms control problems than those from academics.

Of the 9 treaties which involve Intrusive verification techniques, 7 (78%) deal with Regional Arms Control. Nuclear Warhead Technology is a focus of a third of the treaties and Conventional Weapons 22%. Intergovernmental bodies concentrate their 11 Intrusive proposals on Nuclear Warhead Technology (82%).

(b) Non-Intrusive Techniques

The order of emphasis for the 183 Non-Intrusive proposals, disregarding type of source, is similar to that for the Intrusive ones (see Table 15). NWs again predominate, though the proportion of Non-Intrusive proposals focussing on NWs is substantially greater than the proportion of Intrusive ones focussing on it (53% vs 37%). Warhead Technology in both cases account for most of these NW proposals though again the proportion is higher for the Non-Intrusive category (32% vs 25%). Proposals dealing with Nuclear Delivery Systems also form a greater proportion of the Non-Intrusive category than the Intrusive one (21% vs 12%).

CBWs are involved in 25% of the Non-Intrusive proposals, about the same as for the Intrusive category. Regional Arms Control also receives about the same emphasis in both categories.

For government proposals involving Non-Intrusive techniques, NWs are the favoured target (51%) with the majority of these dealing with Warhead Technology. CBWs rank next with 31 of the 82 government proposals (38%).

NWs are also the main concern of the 82 academic proposals which involve Non-Intrusive methods, to about the same degree as for government originated proposals (52% vs 51%). However, the emphasis in these academic proposals is mainly on Delivery Systems instead of Warhead Technology. As is true for the Intrusive category, academic proposals which lack a specific arms control target (i.e. the "Any" category) rank high here.

The main focus of the 10 treaties which involve Non-Intrusive measures are NWs (50%), followed by Regional Arms Control (40%). Conventional Weapons are involved in 20% of the treaties. When the proposals of intergovernmental bodies are considered, the same pattern as for the Intrusive category emerges: Nuclear Warhead Technology predominates with a few proposals focussing on Regional Arms Control.

(c) Ancillary Elements

Again NWs are the main concern. Fifty-one of the 131 proposals which involve Ancillary Elements deal with NWs with the main focus being Warhead Technology (see Table 16). CBWs rank next (24%) followed by Regional Arms Control and the "Any" category (each 12%).

For the 74 proposals coming from governments, the main focus is equally on Nuclear Warhead Technology and CBWs (each 38%). The main emphasis in the 32 academic proposals involving Ancillary Elements, is the "Any" category (31%) followed by NWs (22%).

The pattern for the 13 treaties which involve Ancillary Elements is similar to that for treaties involving Non-Intrusive techniques: NWs and Regional Arms Control are of about equal importance. Again, as well, Nuclear Warhead Technology constitutes the main interest of inter-governmental bodies.

(iii) Temporal Distribution

Figure 16 presents the distribution over time of proposals which involve some type of Intrusive verification technique. There are two main peaks in this graph: the period from 1961 to 1963 and the period from 1979 to 1980. Most of the proposals involved in these two peaks originate with non-government sources.

The temporal distribution of proposals involving Non-Intrusive techniques is given in Figure 17. Again there are peaks in the early sixties and the late seventies. However, here the latter peak is the larger instead of the other way round as for Intrusive proposals. This second peak during the late seventies is made up overwhelmingly, of non-government proposals.

Figure 18 shows the temporal distribution of proposals which include Ancillary Elements of verification systems. While there is, again, a clear peak during the early sixties, the peak for the late seventies which was evident in the previous two graphs is much less pronounced here. There is only one period (1969) when non-government proposals substantially predominate.

TABLE 16

ANCILLARY ELEMENTS VERIFICATION CATEGORY X SOURCE X

ARMS CONTROL OBJECTIVES CATEGORIES

Total All Sources n = 131	Government n = 74	Academic n = 32	Treaties n = 13	IGOs n = 12
1. NWs 51 (39%)	1a. NWs 28 (38%)	1. "Any" 10 (31%)	1a. NWs 6 (46%)	1a. NWs 10 (23%)
2. NWW 47 (36%)	1b. NWW 28 (38%)	2. NWs 7 (22%)	1b. Regional 6 (46%)	1b. NWW 10 (23%)
3. CBWs 32 (24%)	1c. CBWs 28 (38%)	3a. Regional 6 (19%)	2. NWW 4 (31%)	
4a. Regional 16 (12%)	2. "Any" 6 (8%)	3b. GCD 6 (19%)		
4b. "Any" 16 (12%)		4. NWW 5 (16%)		
5. GCD 9 (7%)				

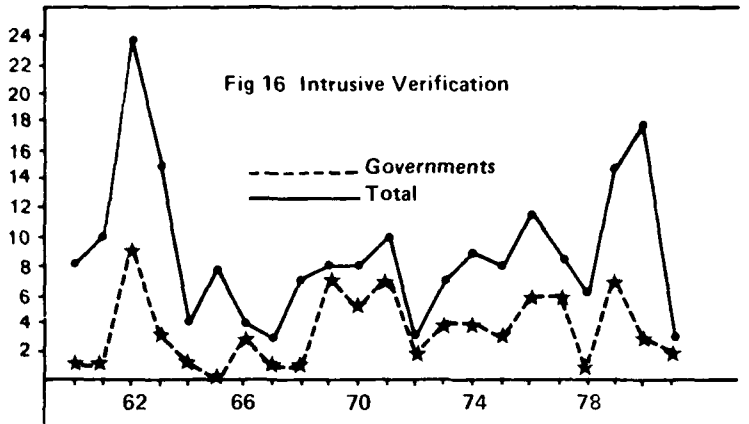


Fig 16 Intrusive Verification

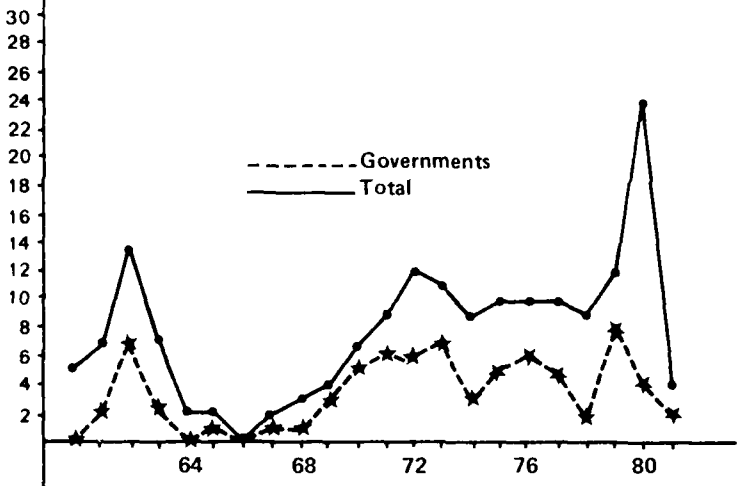


Fig 17 Non-Intrusive Verification

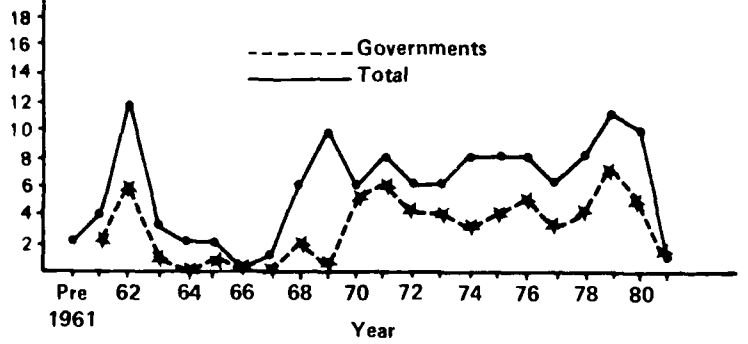


Fig 18 Ancillary Elements

C. Specific Verification Categories

(i) Broken-Down By Source

The specific verification technique which appears most frequently, in all the proposals abstracted in the Compendium is Selective Inspection (see Table 17). Of the 296 proposals, 127 include this technique (43%). Next in rank are Remote Sensors with 105 proposals (35%) followed by Information Exchanges and International Control Organizations each of which are involved in 90 proposals (30%). Complaints Procedures receives attention in 59 of the 296 proposals (20%). The other verification categories are all involved in less than 20% of the proposals.

Selective Inspection is involved in more government proposals than any other technique. Of the 127 government originated proposals, 61 involve Selective Inspection (48%). In second place instead of Remote Sensors (which ranks sixth (24%) for government proposals) is ICOs with 50 proposals (39%) followed closely by Information Exchanges with 49 (38.5%). Other methods which are included in more than 20% of the 127 government proposals are Complaints Procedures (29%), Seismic Sensors (28%), Short-Range Sensors (24%) and Remote Sensors (24%).

The emphasis by governments on Selective Inspection -- an Intrusive verification method - seems somewhat inconsistent with the fact that six of the next seven verification techniques involved in government proposals ranked by emphasis are either Non-Intrusive ones or Ancillary Elements. Despite the political drawbacks of intrusive on-site inspection and technological improvements in some non-intrusive methods such as satellites, governments in general still seem ready to place heavy emphasis on inspection.

TABLE 17

SPECIFIC VERIFICATION CATEGORIES X SOURCE

Total All Sources n = 296	Government n = 127	Academic n = 142	Treaties n = 14	ICOs n = 13
1. Selective 127 (43%)*	1. Selective 61 (48%)	1. Remote 64 (45%)	1. Complaints 13 (93%)	1. ICOs 11 (85%)
2. Remote 105 (35%)	2. ICOs 50 (39%)	2. Selectivel 52 (37%)	2. Remote 7 (50%)	2. Selective 10 (77%)
3a. Exch. 90 (30%)	3. Exch. 49 (39%)	3. Exch. 29 (20%)	3. General 6 (43%)	3a. Short-Range 7 (54%)
3b. ICOs 90 (30%)	4. Complaints 37 (29%)	4. ICOs 24 (17%)	4a. Exch. 5 (36%)	3b. Exch. 7 (54%)
4. Complaints 59 (20%)	5. Seismic 35 (28%)	5. Records 18 (13%)	4b. ICOs 5 (36%)	4. NSS 6 (46%)
5. Short-Range 55 (19%)	6a. Short-Range 31 (24%)	6. General 17 (12%)	4c. Review 5 (36%)	5. Records 5 (38%)
6. Seismic 46 (16%)	6b. Remote 31 (24%)	7a. P/Z 14 (10%)	5. Selective 4 (29%)	6a. Remote 3 (23%)
7. Records 37 (13%)	7. NSS 19 (15%)	7b. Short-Range 14 (10%)	6. Short-Range 3 (21%)	6b. Seismic 3 (23%)
8. NSS 32 (11%)	8. Records 15 (12%)	8. Lit. Survey 11 (8%)	7a. Control 2 (14%)	6c. Complaints 3 (23%)
9. General 30 (10%)	8b. Review 15 (12%)	9. Non-Physical 9 (6%)	7b. Seismic 2 (14%)	7a. Control 1 (8%)
10. Review 21 (7%)	9. General 7 (6%)	10. Control 8 (6%)	7c. NSS 2 (14%)	7b. Lit. Survey 1 (8%)
11. Lit. Survey 18 (6%)	10. Lit. Survey 6 (5%)	11a. Seismic 6 (4%)		7c. Review 1 (8%)
12a. P/Z 16 (5%)	11. Control 5 (4%)	11b. Complaints 6 (4%)		
12b. Control 16 (5%)	12. P/Z 2 (2%)	12. NSS 5 (4%)		
13. Non-Physical 10 (3%)	13. Non-Physical 1 (1%)			

* Column percentages.

Academic sources seem to have considerably greater faith in Remote Sensors than do governments. This method ranks first for academics, being involved in 64 of the 142 academic proposals (45%). This difference in emphasis may be due in part to the fact that detailed information about many types of Remote Sensors is only available to a relatively few governments. Because of the sensitive nature of this information these particular governments may be slow to publicly provide an accurate picture of the capabilities of these systems. When they are discussed in a verification context, as by the superpowers, the discussions may be in private and hence are not included in the Compendium.

Like governments, however, academic sources still place substantial emphasis on Selective Inspection in their verification schemes, including it in 52 of their 142 proposals (37%). As was true for government proposals, Exchanges of Information ranks third in emphasis (20%). Other technique are considered in less than 20% of the 142 academic proposals. This heavier concentration on a few verification methods suggests that academic sources tend to include fewer methods in their verification schemes than do governments.

As mentioned elsewhere intergovernmental bodies show a strong favouritism in their 13 proposals for ICOs as a verification method (85%). Selective Inspection also ranks very high (77%). Short-Range Sensors and Information Exchanges both rank third (54%) with National Self-Supervision involved in 6 of the 13 proposals (46%). The presence of these methods probably reflects the concern of intergovernmental bodies with IAEA safeguards which combine National Self-Supervision with periodical inspections conducted by an International Control Organization using Short-Range Sensors to check the accuracy

of reports submitted by parties to an agreement (i.e. Information Exchanges).

The rank order of verification techniques included in the 14 treaties abstracted in the Compendium is interesting because these constitute, in effect, arms control areas where the verification scheme has been successfully negotiated. Complaints Procedures rank highest (93%), not surprisingly perhaps since the successful resolution of complaints can be a key issue in a working verification system. Remote Sensors are involved in 50% of treaties in contrast to the relative lack of interest shown in these methods by governments in general. General Inspection ranks third (43%) while Selective Inspection receives less emphasis (29%). At least for some kinds of arms control treaties, the highly intrusive General Inspection seems to have been an acceptable verification method. Ranking in fourth place are Information Exchanges, International Control Organizations and Review Conferences (each 36%).

Some verification techniques do not receive much emphasis by any source. These include Non-Physical/Psychological Inspection, Progressive/Zonal Inspection, Control Posts, and Literature Surveys. The specialized application of some of these approaches may affect their perceived utility; for others, there may be simply a lack of faith in their efficacy.

(ii) Broken-Down By Arms Control Objectives

(a) General Inspection

Thirty of the 296 proposals abstracted (10%) include this highly intrusive technique as part of their verification scheme. Seven of these 30 originate with governments, 17 with academic sources and 6 are treaties.

The favoured arms control focus for these proposals regardless of source is Regional Arms Control (see Table 18). Governments and treaties in particular emphasize General Inspection for Regional Arms Control. General and Complete Disarmament ranks next in emphasis as a target for government General Inspection proposals; while GCD is third in rank for academic proposals involving General Inspection. Second in rank for academics are proposals without any specific arms control target (i.e. the "Any" category). General Inspection seems to receive greatest attention in the context of the verification of arms control provisions covering extensive geographic areas as examplified by the emphasis on Regional Arms Control and GCD.

Figure 19 illustrates the distribution over time of proposals which involve General Inspection. This technique seems to be relatively persistent over the period covered, though the frequency with which it is proposed is low throughout. The only notable concentration of government General Inspection proposals occurs in relation to discussions in 1969 concerning the Sea Bed Treaty.

(b) Selective Inspection

This verification technique is the one most frequently cited, being included in 127 of the 296 proposals (43%). Of these 127, 61 originate with governments (48%), 52 with academics (41%), 4 are treaties (3%) and 10 come from intergovernmental bodies (8%).

NWs are the primary focus of proposals which involve Selective Inspection, regardless of the source responsible for the proposal (see Table 19). Ninety percent of Selective Inspection proposals from intergovernment bodies

TABLE 18

GENERAL INSPECTION X SOURCE X ARMS CONTROL OBJECTIVES

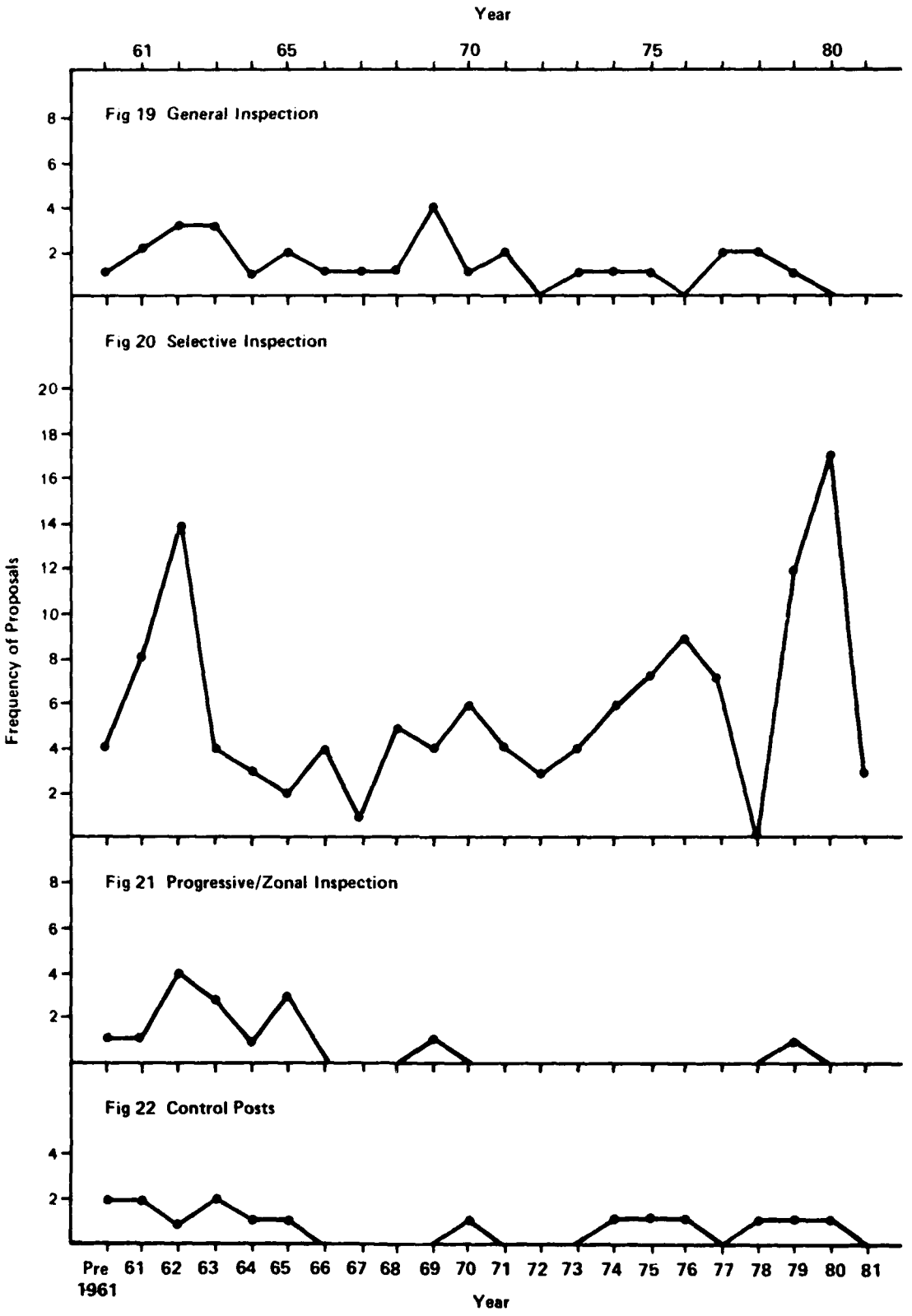
Total All Sources n = 30	Government n = 7	Academic n = 17	Treaties n = 6	IGOs n = 0
1. Regional 19 (63%)*	1. Regional 6 (86%)	1. Regional 7 (41%)	1. Regional 6 (100%)	
2. GCD 5 (17%)	2. GCD 2 (29%)	2. "Any" 4 (24%)	2. Conventional 2 (33%)	
3a. Conventional 4 (13%)		3. GCD 3 (18%)		
3b. "Any" 4 (13%)				

TABLE 19

SELECTIVE INSPECTION X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 127	Government n = 61	Academic n = 52	Treaties n = 4	IGOs n = 10
1. NWs 62 (49%)	1. NWs 31 (51%)	1. NWs 19 (37%)	1a. NWs 3 (75%)	1a. NWs 9 (90%)
2. NWW 46 (36%)	2a. NWW 28 (46%)	2a. NWD 13 (25%)	1b. NWW 3 (75%)	1b. NWW 9 (90%)
3. CBW 41 (32%)	2b. CBWs 28 (46%)	2b. CBWs 13 (25%)	2. Regional 2 (50%)	
4. NWD 16 (13%)	3. NWD 3 (5%)	3. "Any" 9 (17%)		
5. "Any" 10 (8%)		4a. NWW 6 (12%)		
		4b. GCD 6 (12%)		

* **Column percentages.**


Year
61
65
70
75
80
Fig 19 General Inspection
8
6
4
2
Fig 20 Selective Inspection
Frequency of Proposals
20
18
16
14
12
10
8
6
4
2
Fig 21 Progressive/Zonal Inspection
8
6
4
2
Fig 22 Control Posts
4
2
Pre 1961
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81
Year

are directed at NWs; 75% of the treaties including this technique deal with NWs as do 51% of government Selective Inspection proposals. Academic sources concentrate less on NWs proportionally (only 37%) than the other source types, though NWs still ranks first in order of emphasis for academics. Also, while the other source types focus primarily on Warhead Technology, academics concentrate more on Delivery Systems.

CBWs rank after NWs in emphasis for both governments (46%) and academics (25%) though the degree of emphasis differs substantially. The "Any" category again ranks fairly high in emphasis as a target of academic Selective Inspection proposals (17%) in contrast to government proposals (2%).

The distribution over time of proposals which include Selective Inspection is pictured in Figure 20. Two large peaks occur during the periods from 1961 to 1962 and from 1979 to 1980. The latter is composed of a large proportion of academic proposals and relates to discussions on SALT II.

(c) Progressive/Zonal Inspection

Of the 16 proposals involving this techique, 14 originate with academics. The favoured target of these academic proposals (57%) is GCD (see Table 20). Nuclear Delivery Systems rank next in emphasis (36%).

As Figure 21 illustrates, proposals involving Progressive/Zonal Inspection are almost exclusively limited to the early sixties. It is notable that while interest in Progressive/Zonal Inspection dropped off with the decline in emphasis on GCD, the same does not appear to have been true for General Inspection which has become associated with Regional Arms Control.

TABLE 20

PROGRESSIVE/ZONAL INSPECTION X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 16	Government n = 2	Academic n = 14	Treaties n = 0	IGOs n = 0
		1. GCD 8 (57%)*		
		2a. NWs 5 (36%)		
		2b. NWD 5 (36%)		

TABLE 21

CONTROL POSTS X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 16	Government n = 5	Academic n = 8	Treaties n = 2	IGOs n = 1
1. Regional 10 (63%)*	1a. Regional 2 (40%)	1. Regional 5 (63%)	1a. Regional 2 (100%)	
2. Conventional 4 (25%)	1b. GCD 2 (40%)	2a. NWs 2 (25%)	1b. Conventional 2 (100%)	
		2b. NWW 2 (25%)		

* Column percentages.

(d) Control Posts

Of the 16 proposals involving Control Posts 5 came from governments, 8 from academics, 2 are treaties and one originates with an intergovernmental body. Regional Arms Control is the main focus of the 16 proposals particularly the 8 from academic sources (see Table 21). GCD receives the same level of emphasis as does Regional Arms Control for government proposals while Nuclear Delivery Systems ranks second for academic proposals. The two treaties which involve this technique both involve Regional Arms Control and Conventional Weapons.

No particular pattern emerges in terms of the temporal distribution of proposals involving Control Posts (see Figure 22).

e. Records Monitoring

Of the 296 proposals Abstracted 38 (13%) include Records Monitoring as part of their verification system. Academic proposals account for more of these 38 than do government proposals (47% vs 39%). Five proposals from intergovernmental bodies include this technique; 4 of these relate to Nuclear Warhead Technology (see Table 22).

Governments concentrate 73% of their proposals involving Records Monitoring on CBWs and 13% on NWs. Academics, on the other hand, divide their attention in this context equally between CBW and NWs (each 33%). Again academic proposals more frequently lack a specific arms control target than do government ones, as indicated by the number of academic proposals in the "Any" category (4 vs 0).

Figure 23 illustrates the distribution over time of proposals involving Records Monitoring. A major peak occurred during the 1961-1963 period due mainly to academic proposals dealing with several arms control topics. The smaller concentration of Records Monitoring proposals in 1970 deal mainly with CBWs.

(f) Non-Physical/Psychological Inspection

This technique, which is involved in only 10 of the 296 proposals (3%), is mainly associated with academic sources (9 of the 10). Of these, 9 proposals lack a specific arms control focus (i.e. the "Any" category) as does the only government proposal involving this technique (see table 23). As is true for proposals involving Progressive/Zonal Inspection, those including Non-Physical/Psychological Inspection are concentrated mainly during the early sixties (see Graph 24).

(g) Short-Range Sensors

Fifty-five verification proposals are abstracted which involve the use of Short-Range Sensors (19% of the 296 proposals). Most of these (31 or 56%) come from government sources, 14 (25%) come from academics and 3 (5%) are found in treaties. Intergovernmental bodies are responsible for 7 of the 55 proposals in this category (13%), all of which concern Nuclear Warhead Technology (see Table 24).

Governments concentrate their proposals which involve Short-Range Sensors to a large degree on CBWs (68%) with Nuclear Warhead Technology being the target of 29%. Academics, in contrast, focus their proposals most on NWs in general (50%), with 36% dealing with CBWs. The main focus of the 3 treaties which include Short-Range Sensors is Regional Arms Control.

TABLE 22

RECORDS MONITORING X SOURCE X ARMS CONTROL OBJECTIVES

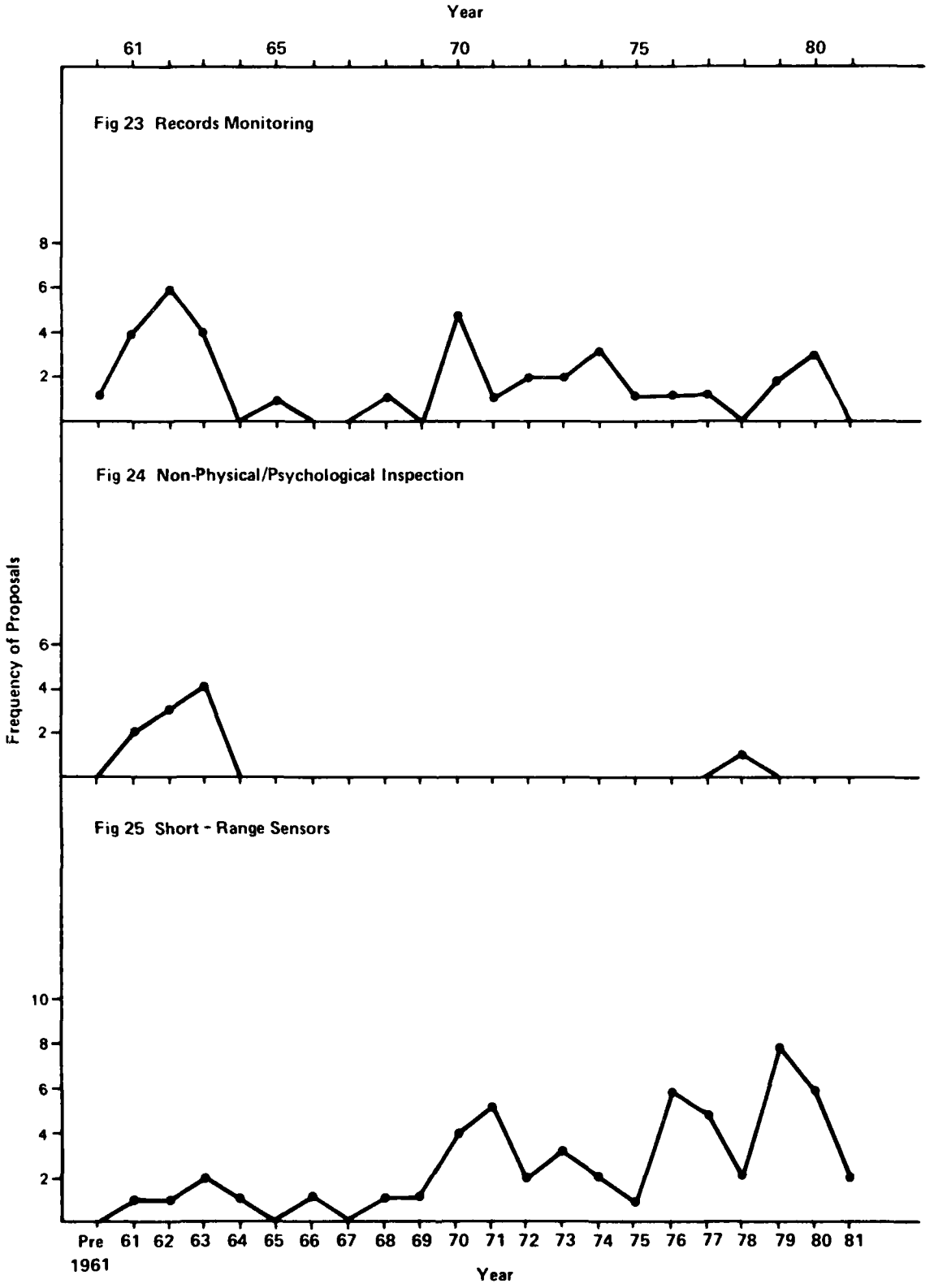
Total All Sources n = 38	Government n = 15	Academic n = 18	Treaties n = 0	IGOs n = 5
1. CBWs 17 (45%)*	1. CBW 11 (73%)	1a. NWs 6 (33%)		1a. NWs 4 (80%)
2. NWs 12 (32%)	2. NWs 2 (13%)	1b. CBWs 6 (33%)		1b. NWW 4 (80%)
3. NWW 7 (18%)		2a. NWD 4 (22%)		
4. NWD 5 (13%)		2b. "Any" 4 (22%)		
5. "Any" 4 (11%)				

TABLE 23

NON-PHYSICAL/PSYCHOLOGICAL INSPECTION X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 10	Government n = 1	Academic n = 9	Treaties n = 0	IGOs n = 0
		1. "Any" 6 (67%)		
		2. NWs 2 (22%)		

* Column percentages.


Year
61
65
70
75
80
Fig 23 Records Monitoring
8
6
4
2
Fig 24 Non-Physical/Psychological Inspection
Frequency of Proposals
6
4
2
Fig 25 Short - Range Sensors
10
8
6
4
2
Pre 1961
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81
Year

Interest in Short-Range Sensors seems to have increased progressively over the time period covered (see Figure 25). This may reflect a growing preoccupation with "technological fixes" to verification problems, or, perhaps, a greater concern regarding the efficacy of some verification systems presently employed such as IAEA Safeguards.

(h) Remote Sensors

There are 105 proposals (35% of the 296 abstracted which include Remote Sensors as part of their verification system; the second most frequently employed technique. These 105 proposals include 31 from governments (30%), 64 from academic (61%), 7 from treaties (7%) and 3 from intergovernmental bodies (3%).

NWs constitute the arms control problem most often the focus of proposals involving Remote Sensors (see Table 25). Governments direct 14 of their 31 proposals (45%) at this topic while 38 of the 64 academic Remote Sensor proposals (59%) do so. Academics, however, are mainly concerned with Delivery System Technology and governments with Warhead Technology. CBWs are next in emphasis for governments (32%) followed by Regional Arms Control (13%). Next in rank after NWs for academic sources is Regional Arms Control. Treaties which involve Remote Sensors are primarily concerned with NWs (57%) followed by Regional Arms Control (43%).

Figure 26 shows the distribution of proposals involving Remote Sensors over the time period covered. The graph clearly shows the great interest by academics in this technique in the context of the SALT II verification debate of the late seventies. The other major peak of interest

TABLE 24

SHORT-RANGE SENSORS X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 55	Government n = 31	Academic n = 14	Treaties n = 3	IGOs n = 7
1. CBWs 26 (47%)*	1. CBWs 21 (68%)	1. NWs 7 (50%)	1. Regional 2 (67%)	1a. NWs 7 (100%)
2. NWs 24 (44%)	2a. NWs 9 (29%)	2. CBWs 5 (36%)		1b. NWW 7 (100%)
3. NWW 20 (36%)	2b. NWW 9 (29%)	3. NWD 4 (29%)		
4a. NWD 4 (7%)		4. NWW 3 (21%)		
4b. Regional 4 (7%)				

TABLE 25

REMOTE SENSORS X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 105	Government n = 31	Academic n = 64	Treaties n = 7	IGOs n = 3
1. NWs 57 (54%)	1. NWs 14 (45%)	1. NWs 38 (59%)	1. NWs 4 (57%)	
2. NWD 38 (36%)	2. NWW 11 (35%)	2. NWD 33 (52%)	2. Regional 3 (43%)	
3. NWW 19 (18%)	3. CBWs 10 (32%)	3. Regional 10 (16%)		
4. Regional 18 (17%)	4. Regional 4 (13%)			
5. CBWs 15 (14%)				

* Column percentages.

occurs in 1962 and involves both government and academic proposals.

(i) Seismic Sensors

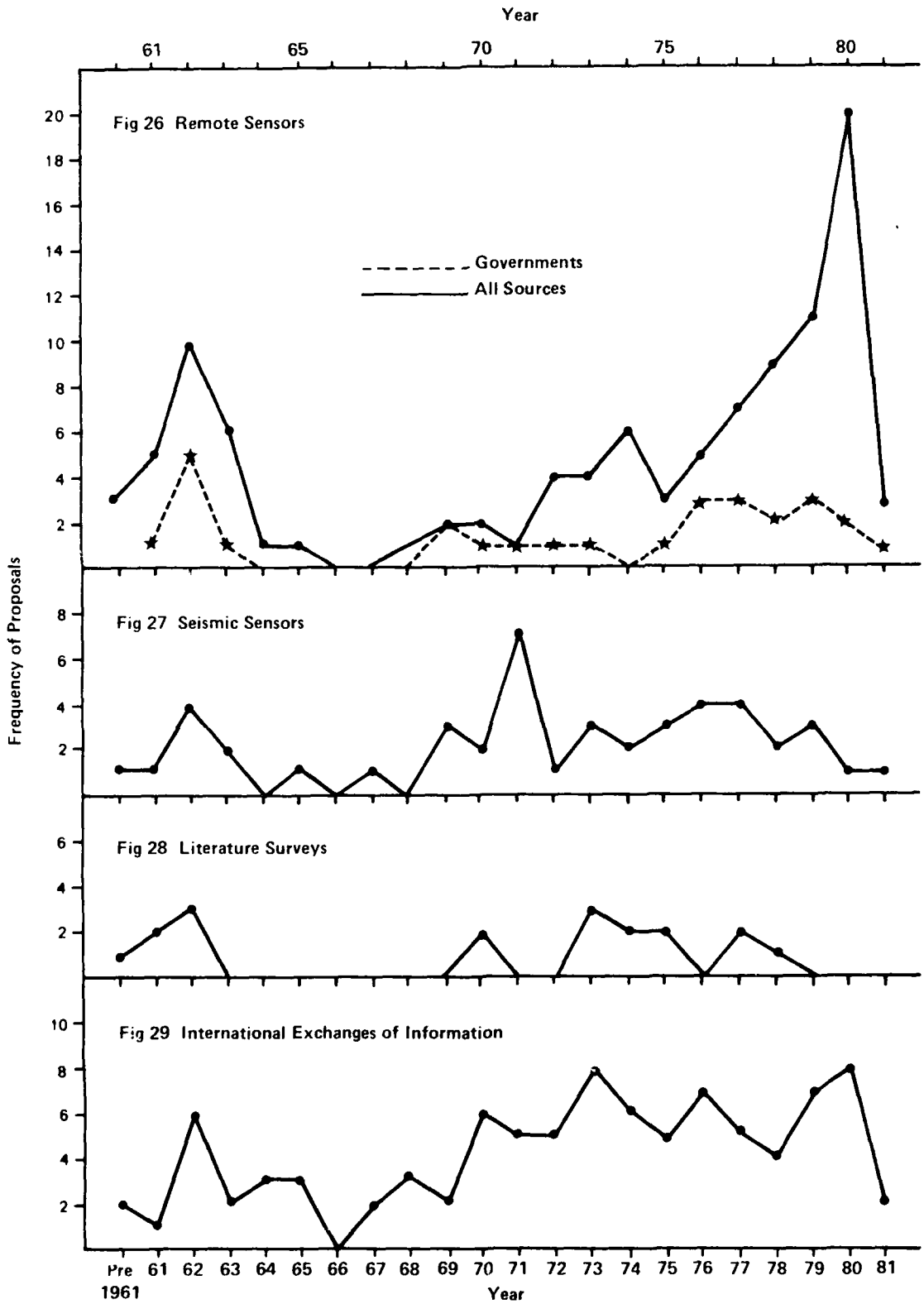
Of the 296 proposals abstracted 46 involve long-range Seismic Sensors (16%). Governments are the major source of these proposals being responsible for 35 of the 46 (76%). All proposals involving this verification technique, not surprisingly, deal with Nuclear Warhead Technology.

Interest in this verification technique reached a peak in 1971 (see Figure 27). After declining somewhat from this high point, interest seems to have remained at a relatively constant, though low level. This pattern may reflect the reaction of arms controllers to technological improvements in the method.

(j) Literature Surveys

This technique is involved in 18 of 296 proposals (6%), of which 6 originate with governments, 11 with academics and 1 with an intergovernmental body. All of the government proposals involving Literature Surveys relate to CBWs, while only one of the 11 academic proposals does so (see Table 26). Academics most frequently suggest this technique without specifying any particular arms control target. Three of the 11 academic proposals (27%) are directed at the control of Military Budgets as is the single proposal originating with an intergovernmental body.

Figure 28 illustrates the distribution of Literature Survey proposals over time. No notable pattern seems to emerge.


Year
61
65
70
75
80
Fig 26 Remote Sensors
Governments
All Sources
Frequency of Proposals
Fig 27 Seismic Sensors
Fig 28 Literature Surveys
Fig 29 International Exchanges of Information
Pre 1961
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81
Year

(k) International Exchanges of Information

Information Exchanges are involved in 90 of the 296 proposals (30%) making it, as well as International Control Organizations, the third most frequently cited verification method. The majority of these 90 proposals originate with governments (49 or 54%). Academics account for 29 (32%), treaties for 5 (6%) and intergovernmental bodies for 7 (8%).

NWs are the main focus of attention for these proposals regardless of the type of source generating them (see Table 27). The proportion of interest given them varies considerably, however, among the four types of sources. Intergovernmental bodies concentrate 6 of the 7 proposals (86%) on NWs, while 3 of the 5 treaties relate to this arms control topic. Of the 49 government proposals involving Information Exchanges, 23 (47%) deal with NWs. The figure for the 29 academic proposals is 7 (24%), which is the same number of academic proposals that focus on CBWs. Nuclear Warhead Technology is the aspect of NWs which receive most attention by all the source type except academics for whom Delivery Systems is the main concern.

CBWs rank after NWs, in terms of emphasis, for government sources; 21 of the 49 government Information Exchange proposals (43%) relate to this topic. Twenty-four percent of academic proposals deal with CBWs. Proposals dealing with GDC and with "Any Arms Control" problem each constitute 21% of the 29 academic proposals. As occurs in several other verification categories, governments seem to concentrate their proposals on fewer arms control topics than do academics.

The distribution of Information Exchange proposals over time is presented in Figure 29. This graph seems to

TABLE 26

LITERATURE SURVEY X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 18	Government n = 6	Academic n = 11	Treaties n = 0	IGOs n = 1
1. CBWs 7 (39%)*	1. CBWs 61 (100%)	1. "Any" 5 (45%)		
2. "Any" 5 (28%)		2. Military Budgets 3 (27%)		
3. Military Budgets 4 (22%)				

TABLE 27

INFORMATION EXCHANGES X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 90	Government n = 49	Academic n = 29	Treaties n = 5	IGOs n = 7
1. NWs 39 (43%)	1a. NWs 23 (47%)	1a. NWs 7 (24%)	1. NWs 3 (60%)	1a. NWs 6 (86%)
2. NWW 34 (38%)	1b. NWW 23 (47%)	1b. CBWs 7 (24%)	2a. NWW 2 (40%)	1b. NWW 6 (86%)
3. CBW 28 (31%)	2. CBWs 21 (43%)	2a. GCD 6 (21%)	2b. Regional 2 (40%)	
4. "Any" 9 (10%)	3. "Any" 3 (6%)	2b. "Any" 6 (21%)		

* Column percentages.

show that there was increasing recognition during the seventies of the need for formalized Information Exchanges in the context of arms control verification.

(l) National Self-Supervision

This technique which is present in 32 of the 296 proposals (11%), is mainly associated with CBWs (see Table 28). Among the 19 government proposals involving National Self-Supervision, 16 (84%) deal with CBWs. Four of the 5 academic proposals also deal with CBWs as does 1 of the 2 treaties involving this technique. In contrast, Nuclear Warhead Technology is the focus of 4 of the 6 proposals from intergovernmental bodies which involve National self-Supervision.

Figure 30 illustrates the distribution over time of National Self-Supervision proposals. It appears, on the basis of this graph, that this technique emerged as a formal verification method only during the seventies.

(m) Complaints Procedures

Complaints Procedures are involved in 59 of the 296 proposals abstracted in the Compendium (20%). Government proposals constitute the largest group of these with 37 (63%) followed by treaties with 13 (22%), academic proposals with 6 (10%) and those from intergovernmental bodies with 3 (5%).

CBWs are the most popular targets for government proposals which involve Complaints Procedures; 21 of the 37 government proposals (57%) focus on this arms control problem (see Table 29). Nuclear Warhead Technology ranks next in preference for governments (22%). Academics divide their attention equally between three arms control categories: NWs, Regional Arms Control and "Any Arms Control Agreement".

TABLE 28

NATIONAL SELF-SUPERVISION X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 32	Government n = 19	Academic n = 5	Treaties n = 2	IGOs n = 6
1. CBWs 22 (69%)*	1. CBWs 16 (84%)	1. CBWs 4 (80%)		1a. NWs 4 (67%)
2a. NWs 5 (16%)	2. OWMD 3 (16%)			1b. NWW 4 (67%)
2b. NWW 5 (16%)				
3. OWMD 4 (13%)				

TABLE 29

COMPLAINTS PROCEDURES X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 59	Government n = 37	Academic n = 6	Treaties n = 13	IGOs n = 3
1. CBWs 23 (39%)	1. CBWs 21 (57%)	1a. NWs 3 (50%)	1. Regional 6 (46%)	1. Regional 2 (67%)
2. NWs 17 (29%)	2a. NWs 8 (22%)	1b. Regional 3 (50%)	2. NWs 5 (38%)	
3a. NWW 14 (24%)	2b. NWW 8 (22%)	1c. "Any" 3 (50%)	3. NWW 3 (38%)	
3b. Regional 14 (24%)	3. OWMD 5 (14%)			
4. OWMD 6 (10%)				

* Column percentages.

Of the 13 treaties which involve Complaints Procedures, 6 (46%) focus on Regional Arms Control and 5 (38%) on NWs. Proposals from intergovernmental bodies are mainly concerned with Regional Arms Control.

Interest in Complaints Procedures seems to have grown up during the late sixties and to have remained relatively persistent through the seventies (see Figure 31). This may reflect, in part, the belief that this method could replace other, more contentiously intrusive methods of verification.

(n) International Control Organizations

Together with Information Exchanges, this verification category ranks third after Remote Sensors in terms of the number of proposals which employ it (90 of 296 or 30%). ICOs are most popular with governments; 50 of the 90 proposals involving the method (56%) are from governments. Academic sources are responsible for 24 of the 90 (27%), intergovernmental bodies for 11 (12%) and treaties for 5 (6%).

Governments address 26 of their 50 ICO proposals (52%) at the control of CBWs and 24 (48%) at Nuclear Warhead Technology (see Table 30). Academics most often do not focus their ICO proposals on specific arms control problems as indicated by the fact that 9 of their 24 proposals (38%) fall into the "Any" category. Only 12% of government proposals involving ICOs lack a specific arms control target. GCD (21%) ranks next in preference for academics whereas governments show much less emphasis on this topic (6%). Nuclear Warhead Technology and Regional Arms Control each account for 13% of the academic proposals involving ICOs.

TABLE 30

INTERNATIONAL CONTROL ORGANIZATIONS X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 90	Government n = 50	Academic n = 24	Treaties n = 5	IGOs n = 11
1a. NWs 39 (43%)*	1. CBWs 26 (52%)	1. "Any" 9 (38%)	1a. NWs 2 (40%)	1a. NWs 10 (91%)
1b. NWW 39 (43%)	2a. NWs 24 (48%)	2. GCD 5 (21%)	1b. NWW 2 (40%)	1b. NWW 10 (91%)
2. CBWs 28 (31%)	2b. NWW 24 (48%)	3a. NWs 3 (13%)	1c. Regional 2 (40%)	
3. "Any" 15 (17%)	3. "Any" 6 (12%)	3b. NWW 3 (13%)		
4. GCD 8 (9%)		3c. Regional 3 (13%)		

TABLE 31

REVIEW CONFERENCES X SOURCE X ARMS CONTROL OBJECTIVES

Total All Sources n = 21	Government n = 15	Academic n = 0	Treaties n = 5	IGOs n = 1
1. CBWs 9 (43%)	1. CBWs 7 (47%)		1. Regional 2 (40%)	
2a. NWs 5 (24%)	2a. NWs 4 (27%)			
2b. NWW 5 (24%)	2b. NWW 4 (27%)			
3. Regional 4 (19%)				

* Column percentages.

Intergovernmental bodies concentrate their 11 ICO proposals almost exclusively on Nuclear Warhead Technology (91%). Treaties involving ICOs divide their main emphasis equally between Warhead Technology and Regional Arms Control.

The distribution over time of proposals which include ICOs is shown in Figure 32. Interest in ICOs peaked in the early sixties. After declining for some time, interest revived in the late sixties and seems to have been relatively consistent since then. This renewed interest may reflect the perception by arms controllers that some multilateral body is needed to implement verification provisions.

(o) Review Conferences

Of the 296 proposals abstracted in the Compendium, 21 include Review Conferences (7%). Fifteen of these 21 originate with governments (71%), 5 with treaties (24%) and 1 with an intergovernmental body. CBWs (47%) are the main focus of government proposals which include Review Conferences, followed by Nuclear Warhead Technology with 27% (see Table 31). Regional Arms Control accounts for 40% of the treaties involving Review Conferences.

Figure 33 shows the distribution of proposals involving Review Conferences over the time period covered. Interest in this method seems to hae been more sporadic than for the other two Ancillary Elements (Complaints Procedures and ICOs) though this interest, like the pattern for the other two, has been confined to the period after the late sixties.

VI State Participation

A. By Countries

Table 32 lists in rank order states which participated substantively in discussions of the verification issue. The rankings are based on the frequency of entries for each state in the Author Index of the Compendium. It should be noted that the Author Index includes, in addition to the abstracted proposals made by states, any comments on proposals which have been incorporated into the Compendium. Thus the data used in Table 32 (and Table 33) reflects state participation in a sense which is broader than the making of verification proposals alone.

Considering first participation in substantive verification discussions in general, the state which addresses the issue most is Sweden. Japan ranks next followed by the USA and the UK. The Soviet Union is in fifth position.

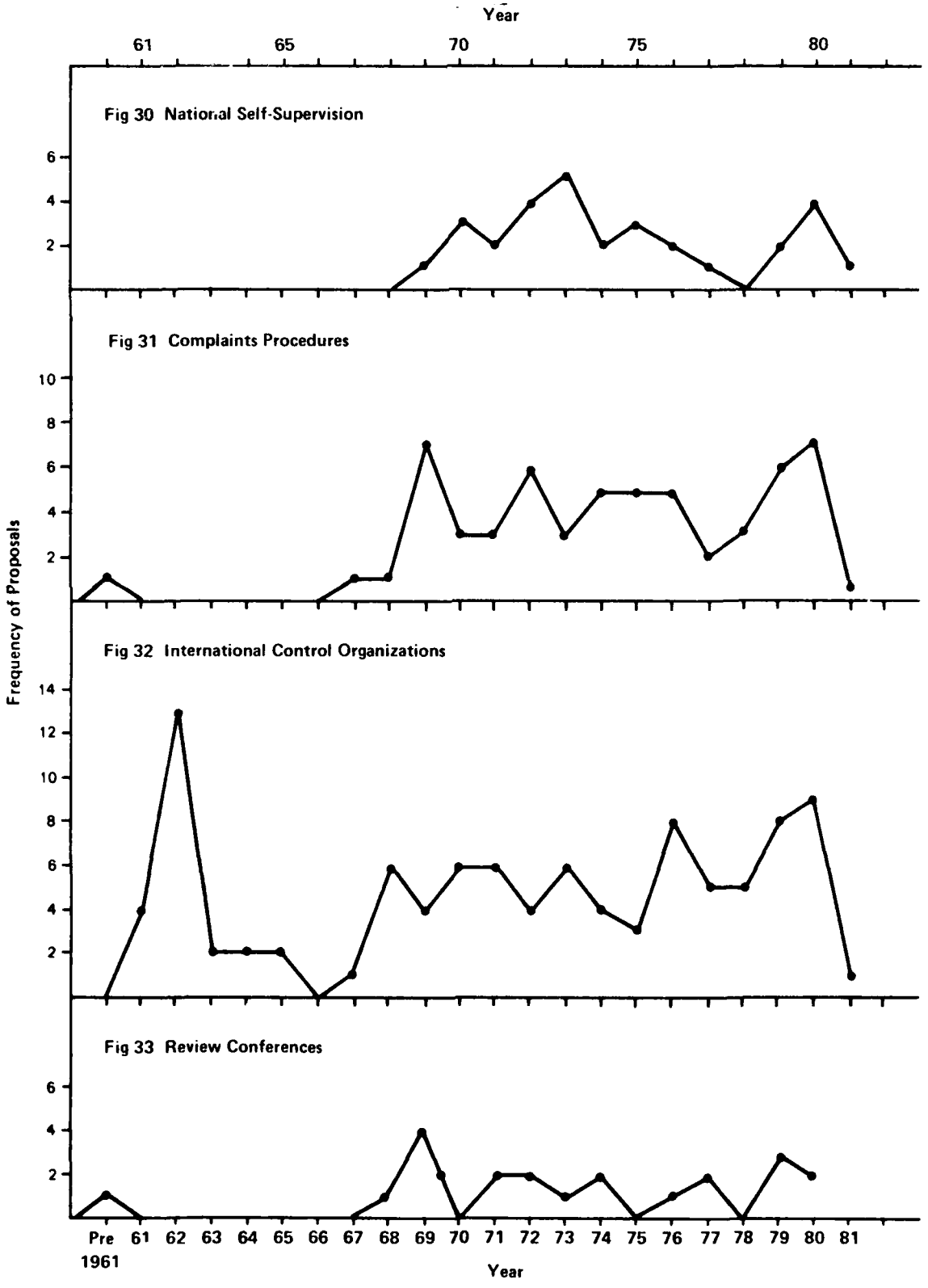
Sweden is most concerned with NWs to which 24 of its 43 entries (56%) are addressed. Next priority is given to CBWs with 15 (35%). Japan too shows most concern with NWs followed by CBWs. Of Japan's 39 entries, 24 deal with NWs (62%), the same number of NW related entries as for Sweden. Fourteen of Japan's entries (36%) focus on CBWs, making Japan a close second to Sweden in terms of participation in the CBW verification debate.

The UK and the USA also show this primary concern with NW verification. Twenty-two of the UK's 33 entries (67%) and 17 of the 38 American entries (45%) relate to this topic. Of these four states the prominence given NW verification over other arms control verification areas is least strong in the case of the USA.

TABLE 32

STATE PARTICIPATION X ARMS CONTROL OBJECTIVES

Total	Nuclear Weapons	Chemical/ Biological Weapons	Other Weapons of Mass Destruction	Other Arms Control Objectives Categories (Cumulated)
1. Sweden 43	1a. Sweden 24	1. Sweden 15	1. USSR 5	1. USA 5
2. Japan 39	1b. Japan 24	2. Japan 14	2. USA 3	2a. Italy 4
3. USA 38	2. UK 22	3. USA 13	3. Sweden 2	2b. USSR 4
4. UK 33	3. USA 17	4a. UK 11		3. Canada 3
5. USSR 23	4. Canada 11	4b. Finland 11		4a. France 2
6. Nthlds 18	5. Nthlds 9	5. Nthlds 8		4b. Sweden 2
7. Canada 17	6. USSR 7	6. USSR 7		4c. USA/USSR (Joint) 2
8. Finland 12	7. Australia 6			
9. Italy 11				
10. Australia 8				
11. France 6				
12a. FRG 5				
12b. Socialist States (Joint) 5				
12c. USA/USSR (Joint) 5				


Year
61
65
70
75
80
Fig 30 National Self-Supervision
6
4
2
Fig 31 Complaints Procedures
10
8
6
4
2
Frequency of Proposals
Fig 32 International Control Organizations
14
12
10
8
6
4
2
Fig 33 Review Conferences
6
4
2
Pre 1961
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81
Year

In contrast to the greater weight given NW verification by the four states previously mentioned, the USSR gives equal emphasis to NWs and CBWs (each 7 of 23 entries or 30%). The Soviet Union ranks sixth and seventh in terms of participation, respectively, in the NW and CBW verification debates.

When the Other Weapons of Mass Destruction (OWMDs) subcategory is considered, the USSR ranks first in terms of participation followed by the USA and Sweden. Finally, it is the USA which addresses arms control areas other than NWs CBWs and OWMDs most frequently. Italy and the USSR rank next.

B. By Blocs

Table 33 sets out the participation in verification discussions of selected groups of states. It is based on a simple cumulation of the scores for countries which are members of these groups of states. The West, which includes 13 countries here, is by far the most prolific in its comments and proposals regarding the verification issue. This is true overall and for each of the 4 arms control subcategories in Table 33. The 10 NATO countries included in this dataset rank second in terms of overall participation. They also rank second for 3 of the 4 arms control subcategories in Table 33, the exception being Other Weapons of Mass Destruction where the 7 Socialist countries rank equally with NATO. The non-aligned group of 10 countries, are in third place overall as well as for NWs and CBWs. They fall to last position for the other two arms control subcategories. The Socialist States are in last place overall and for NWs and CBWs. They rise to second place for the other two subcategories.

TABLE 33

BLOC PARTICIPATION X ARMS CONTROL OBJECTIVES

Total	Nuclear Weapons	Chemical/ Biological Weapons	Other Weapons of Mass Destruction	Other Arms Control Objectives Categories (Cumulated)
1. West 184	1. West 99	1. West 62	1. West 9	1. West 14
2. NATO 135	2. NATO 69	2. NATO 45	2a. NATO 7	1b. NATO 14
3. Non-aligned 73	3. Non-aligned 34	3. Non-aligned 31	2b. Socialist 7	2. Socialist 4
4. Socialist 35	4. Socialist 8	4. Socialist 16	3. Non-aligned 5	3. Non-aligned 3
5. Warsaw Pact 33				

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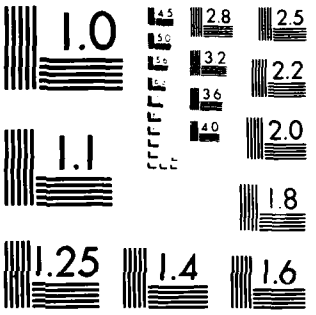

In terms of number of proposals and comments the West, NATO and the Non-aligned groups are most concerned with NWs followed by CBWs. It is the West which shows the greatest preoccupation with NWs over CBWs. In contrast to this, the Socialist states are twice as interested in CBWs verification than they are in NW verification.

The disparity in emphasis given the issue of verification between East and West is clear on the basis of these figures. Of the two superpowers the USA is more concerned with verification than is the USSR. The disparity is still more evident when the figures for NATO and the Warsaw Pact are considered. When Western countries are compared to the Socialist States the difference is even greater.

Non-aligned states also show considerable interest in the verification issue, roughly half that of the NATO countries and about twice that of the Socialist bloc.

C. Favoured Verification Methods of Selected Countries

This section examines the preferred verification techniques of selected states. The data which appears in Table 35 is based on the proposals of the indicated states only, and excludes comments.

Twenty of the 22 American proposals abstracted in the Compendium (91%) involve some type of Intrusive verification. This emphasis on Intrusive techniques by the USA is by far the stongest of the five countries included in Table 35. Non-Intrusive methods are involved in 11 American proposals (50%) and Ancillary Elements in 8 (36%).

TABLE 34

FAVOURED VERIFICATION METHODS OF SELECTED COUNTRIES

Verification Method	USA	USSR	USA/USSR*	SWEDEN	JAPAN	UK	UK/USA	UK/USA/USSR
General	3	2	1					
Selective	17	3	2	10	5	8	3	1
Progressive/ Zonal	1							
Control Posts	4						1	
Record Monitoring	3	2		1	1	4		
Non-Physical								
Short-Range	13	2	1	1	3	3	2	
Intrusive	20	6	4	11	7	10	3	1
Remote	7	3	3	3	1	6	2	1
Seismic	2	2	1	9	7	4	3	1
Lit. Survey		1		3		1		
Info. Exchange	5	2	3	14	4	4		1
NSS		2	2	3	3	1		1
Non-Intrusive	11	6	5	16	10	12	3	1
Complaints	3	4	9	9	3	5		1
ICOs	7	1	2	10	4	7	2	1
Review	2	1	2	2	2	1		1
Ancillary Elements	8	4	8	11	5	7	2	1
Total proposals	22	9	8	23	14	17	3	1

* Includes bilateral treaties.

The UK shows a slightly greater interest in Non-Intrusive measures as opposed to Intrusive ones; 12 of the UKs 17 proposals (71%) deal with the former and 10 (59%) with the latter. Ancillary Elements are present in 7 (41%).

The emphasis in the Soviet Union's proposals is equally on Intrusive and Non-Intrusive techniques; 6 of the 9 USSR proposals (67%) involve each of these. Four of the Soviet proposals (44%) include Ancillary Elements.

It is interesting to examine the 8 proposals made jointly by the USA and the USSR, including 4 bilateral treaties between the two superpowers. Non-Intrusive verification techniques receive greater emphasis in these proposals (5 of 8 or 63%) than do Intrusive methods (50%). However, Ancillary Elements are present in all the 8 proposals. These figures would appear to argue that agreement between the USA and USSR requires that the Americans reduce their emphasis on Intrusive methods.

Japan and Sweden show greatest interest in Non-Intrusive methods followed by Intrusive techniques and Ancillary Elements.

In terms of particular verification techniques, the USA places most emphasis on Selective Inspection, which is involved in 17 of the 22 American proposals (77%). Another technique which is closely related to Selective Inspection (Short Range Sensors) ranks second in emphasis (59%) for the Americans. Remote Sensors and International Control Organizations are tied for third place with 7 (32%) each.

The UK also places greatest emphasis on Selective Inspection; 8 of the 17 British proposals (47%) involve this method. This emphasis, however, is substantially less than

is the case for Americans. Following closely in second place for the UK is International Control Organizations (41%). Remote Sensors ranks next (35%) followed by Complaints Procedures (29%).

The USSR most often includes an Ancillary Element in its verification proposals. This is Complaints Procedures which is involved in 4 of the 9 Soviet proposals (44%). Selective Inspection and Remote Sensors each rank next in emphasis with 3 (33%). It is worth noting that there is only one Soviet proposal which includes an International Control Organization and this relates to the debate on GCD during the early sixties.

Two verification techniques receive greatest emphasis in joint USA/USSR proposals. These are Remote Sensors and Information Exchanges which are involved in 3 of the 9 proposals (33%).

The most popular verification technique in Swedish proposals is Information Exchanges which is involved in 14 of the 23 proposals (61%). Selective Inspection and International Control Organizations are tied for second place, each with 10 (43%). In the case of Japan, Seismic Sensors receive greatest emphasis being involved in 7 of the 14 Japanese proposals (50%). Selective Inspection ranks next (36%) followed by Information Exchanges and ICOs (each 29%).

D. Correlation of Select Countries and Blocs

Table 34 gives Pearson product-moment correlations between the frequency of comments and proposals of selected countries and blocs for each year from 1962 to 1980.* Several observations seem to emerge from the results of this analysis. First, the Socialist states seem to be much more identified with the USSR in terms of the frequency of their contributions to verification discussions than is the case for either NATO countries with the USA or the West group with the USA. This suggests, perhaps, a stronger bloc cohesiveness on this issue among the Socialist States than among NATO and Western countries.

The second observation is that participation by the Non-aligned states seems to show greater association with the participation of NATO countries than with that of the Socialist States.

Third, participation by NATO and the Socialist States also is fairly closely associated suggesting perhaps a proposal-response relationship. This relationship may involve debate on the same issue or it may involve a pattern where one side is talking about one arms control area and the other side responds by focussing on another area.

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* The data used to calculate these correlations incorporate joint proposals and statements.

TABLE 35

CORRELATIONS BETWEEN PARTICIPATION OF

SELECT COUNTRIES AND BLOCS

USSR	Socialist	.91
Sweden	Non-aligned	.78
NATO	Socialist	.74
USA	NATO	.69
NATO	Non-aligned	.65
USA	West	.60
USA	Socialist	.60
Socialist	Non-aligned	.42

VII General Observations

Among the more obvious observations emerging from the descriptive analysis presented are the following:

A. There is a considerable reduction of interest in the issue by all four sources of verification proposals during the mid-sixties.

B. Some arms control objectives receive considerably more attention in the context of discussions on verification than do others.

C. Different sources show distinct preferences for particular arms objectives in discussions on verification.

D. Academic sources are more prone to make their verification schemes generally applicable than are governments.

E. The boundaries between the categories of arms control objectives used in the Compendium seem to be fairly sharp in the minds of arms controllers.

F. Certain verification methods are mainly associated with one or a few arms control objectives.

G. Different sources show distinct preferences for specific verification methods.

H. Some verification methods receive little attention by any source.

I. Discussion of some verification methods and of some arms control objectives are limited to specific time periods.

J. Certain countries show distinct preferences for specific arms control objectives in their discussions on verification.

K. Blocs of nations differ in their participation in verification discussions.

L. Certain countries show distinct preferences for specific verification methods.

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13. ABSTRACT

This paper is intended to give a purely descriptive, quantitative overview of the proposals which were incorporated into the COMPENDIUM OF CONTROL VERIFICATION PROPOSALS (Second Edition), ORAE Report No. R81, March 1982 (also CD/275, April 1982). By outlining general historical patterns for the debate on the verification issue, fruitful routes for future negotiations may be suggested. The descriptive analysis of the verification debate may also have more general relevance by providing a miniature representation of the course of arms control negotiations at a broader level.

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Compendium
Arms control
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