

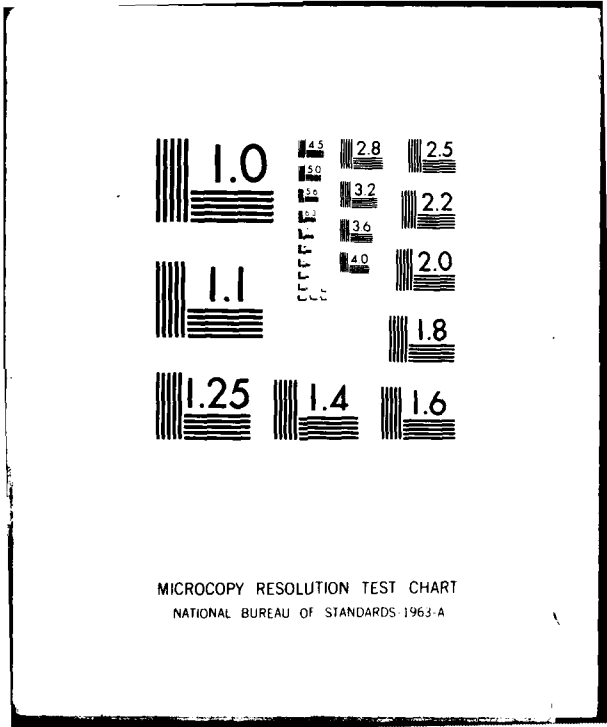
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**DOD THEATER NUCLEAR FORCES
SURVIVABILITY AND SECURITY (TNFS²):
COMPENDIUM OF ASSESSMENTS RELATED
TO TNFS²C³ PROGRAM**

Volume I

The BDM Corporation
7915 Jones Branch Drive
McLean, Virginia 22102

31 December 1979

Topical Report for Period 27 November 1978—31 December 1979

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PREFACE

This compendium of related command, control and communications (C³) assessments has been developed to assist the DNA TNF S² C³ Program Manager in the formulation of policy choices for higher level decision. Each program, assessment and related document identified in the compendium has been analyzed and correlated with the tentatively identified specific C³ issues wherever possible. The results of the analysis and correlation effort have been structured in a format designed to optimize the utility of the data.

Three attributes of each assessment/document have been highlighted:

- (1) Date of publication of effort (where appropriate). This provides a sense of the technological framework within which each assessment/document was completed.
- (2) Numerical indication of impact. This empirically-derived judgement provides a measure of the significance of each assessment/document to the TNF S² C³ Program. The judgement has been based on extensive work in the TNF C³ area and comparisons of the compendium programs/assessments/documents with each other and with the objectives of the TNF S² C³ Program.
- (3) Applicability to the seven tentatively identified specific TNF C³ issues. These issues include: U.S. Custodial Communications, Interoperable US/NATO Secure Voice, Jam Resistant Communications, OPSEC, Physical Survivability and Security, Satellite Communications, and Restoral/Reconstitution.

Certain assessments or related documents because of their scope and/or objectives have been listed as "Requirements Studies" or "Bibliographies".

The information on each compendium entry will provide the Program Manager with the means to consider both whether and how best to consider the results of a particular assessment or related document in formulating the desired policy choices. The envisioned structure for such formulation

deliberately focuses upon the Program Manager as the key agent in the process because of the perceived need for a single authority having a comprehensive knowledge of C³ requirements and the issues arising from them.

There are a significant number of currently on-going or projected study efforts or programs the results of which may impact on the objectives and direction of the TNF S² C³ Program. These efforts include some of the more comprehensive approaches such as the ACE Requirements Study, the NICS II Architecture work, and the activities of the USEUCOM Nuclear Communications Task Force. In addition, a number of potentially relevant more specific tactical C³ improvement/upgrade programs are in various stages of development or implementation. These include:

- (1) Joint Tactical Communications Program (TRI-TAC)
- (2) Joint Multichannel Trunking and Switching System (JMTSS)
- (3) Jam Resistant Secure Communications (JRSC)
- (4) Position Location Reporting System (PLRS)
- (5) U.S. Army Theater Nuclear Force Survivability (TNF S)
- (6) Integrated Tactical Communications System (INTACS)
- (7) Joint Tactical Information Distribution System (JTIDS)
- (8) SELREL Improvement Program (SELRIP)
- (9) Deployable WWMCCS C³ Capability (DWC⁴)
- (10) U.S. Army Theater Communications System (TCS)
- (11) Communications Support Requirements - Echelons Above Corps (COMSREAC-85)

In most cases, it is too early to positively identify or predict the impact of the various on-going programs on the TNF S² C³ Program. However, all of the above programs merit continuing close monitoring by the TNF S² C³ Program Manager to identify possible correlation of their efforts and results with the TNF S² C³ Program. In those cases where a direct applicability to TNF S² C³ Program objectives has been identified, information on the relevant program has been included in the compendium. Similarly, where reports or other documents have been produced under such programs (and it has been determined that these reports/documents have

potential applicability to the TNF S² C³ Program) the specific reports/ documents have been included in the TNF S² C³ compendium.

As additional program results become available and applicability to the TNF S² C³ Program becomes better defined, each of the on-going programs should be reexamined to determine:

- (1) How their results can be most effectively integrated into the TNF S² C³ Program effort; and
- (2) What, if any, steps might be taken to avoid duplication of effort and better integrate the separate program activities with the TNF S² C³ Program.

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SECTION 1

INTRODUCTION AND ORGANIZATION

1.1 PURPOSE AND SCOPE

The DOD TNF S² Program has been undertaken by the Defense Nuclear Agency to enhance theater nuclear force effectiveness through improved survivability and security. The command, control and communications (C³) issues of TNF S² focus on a variety of operational entities, command and support functions, political and military requirements, and supporting communications systems. The specific supporting roles and the communications requirements vary with the operational circumstances and the perceived threat.

The objective of the TNF S² C³ Program is to enhance TNF effectiveness through near term and long term improvements in the survivability and security of those US national, non-US national, and NATO command, control and communications systems and procedures which support the theater nuclear force. Specifically, the program provides for an in-depth examination of the survivability and security aspects of those C³ systems and procedures associated with the deployment, maintenance and employment of theater nuclear forces. The basic concept and overall approach of the TNF S² C³ Program provides for early identification of issues and the testing of potential technological and procedural improvements.

This particular report has as its purpose the identification and analysis of relevant C³ programs and assessments conducted outside the TNF S² C³ Program in order to determine their applicability to TNF S² C³ Program objectives. The study is comprised of two parts:

- (1) Identification of TNF C³ programs and assessments, and
- (2) Analysis and correlation of the identified assessments to the TNF S² C³ Program.

Each report or document which has been identified has been evaluated in terms of:

- (1) How it may impact on the TNF S² C³ Program;
- (2) The significance of its contents with respect to TNF S² C³ Program objectives and issues; and

- (3) How relevant results of past, ongoing, or future assessments may be integrated into the TNF S² C³ Program.

This volume contains the results of the evaluation process described above. The compendium listing the relevant C³ program/assessments and related documents is published separately as an Appendix to this report to facilitate its intergration with the existing TNF S² Compendium.

1.2 ORGANIZATION OF THE COMPENDIUM

Each assessment and document which has been identified and included in this compendium has been described in terms of: its bibliographical information, a TNF S² Related Compendium code letter and C³ code number, and an abstract of the document.

1.2.1 Bibliographical Information

Each entry in this compendium should contain the following bibliographical information:

- (1) Title of Document,
- (2) Contractor/Agency Author and Location,
- (3) Technical Report Number (or Access/Log Number),
- (4) Contracting Agency and Location,
- (5) Contract Number,
- (6) Date of Document,
- (7) Classification of Document,
- (8) AD Number (if DDC document) and
- (9) Distribution (Limited, etc.)

In some cases an entry may not contain all of the aforementioned bibliographical data because complete information was not available or because the project is ongoing. These entries were retained in the survey to keep the compendium as comprehensive as possible. The missing data will be compiled as it becomes available and will be included in future revisions of this document. Figure 1 depicts a sample worksheet format that can be reproduced for the purpose of submitting additions to the TNF S² Related Compendium.

Title of Document:
Contractor/Agency Author and Location:
Technical Report No. (or Access/Log No.):
Contracting Agency and Location:
Contract No.:
Date of Document:
Classification of Document:
AD No. (If DDC Document):
Distribution:

CODE:

SUMMARY:

1120/79W

Figure 1. TNF S² related compendium format.

1.2.2 TNF S² Related Compendium Code Letter

The TNF S² Related Compendium Code Letter indicates the various TNF S² C³ Program areas a particular source addresses. The TNF S² Related Compendium categorizes data sources according to their relationship(s) to the following areas of overall program concern:

(1) Threat,	CODE LETTER:	A
(2) C ³ ,		B
(3) Security,		C
(4) Survivability,		D
(5) Theater Nuclear Force,		E
(6) Simulations and Models,		F
(7) Testing, and		G
(8) Miscellaneous.		H

1.2.3 TNF S² C³ Code Number

All of the programs and documents included in the TNF S² C³ Program compendium (Appendix B) have been identified with a TNF S² Related Compendium Code Letter "B" indicating a relationship to the general C³ area. Where appropriate, additional general TNF S² areas have also been identified.

To further assist the reviewer in identifying the information available in a particular report or document source, each entry in Appendix B has been assigned a C³ code number in addition to the code letter "B". The C³ code number indicates a relationship within the general C³ area to one or more of the following more specific areas of TNF S² C³ Program concern:

(1) Threat to C ³	CODE NUMBER:	1
(2) Security of C ³ facilities		2
(3) Survivability of C ³ facilities		3
(4) C ³ Requirements		4
(5) C ³ Modeling and Simulation		5
(6) C ³ Testing		6

Therefore, a B.5 code entry in Appendix B, for example, would indicate that the entry relates to the general C³ area and in particular to

the modeling and simulation of C³ systems or networks. Similarly, a B.3.4 entry would indicate a particular relationship to survivability issues for C³ facilities as well as C³ requirements.

The scope of the related area indicated by each of the TNF S² C³ code numbers is as follows:

- (1) Threat to C³. (Code number 1) This area encompasses consideration of the complete spectrum of threats to C³ systems and procedures including sabotage, terrorist actions, electronic warfare (including direction finding and jamming), COMSEC and OPSEC procedures, conventional attack and nuclear weapons effects.
- (2) Security of C³ facilities. (Code number 2) This area includes consideration of vulnerabilities and corrective actions which would impact on the security of C³ facilities and which could have an impact on the overall effectiveness of the theater nuclear force. It includes considerations of protective measures to enhance security (such as provision of improved alarm systems or reinforced guard forces).
- (3) Survivability of C³ facilities. (Code number 3) This area includes consideration of vulnerabilities and corrective actions which would impact on the survivability of C³ facilities and which could have an impact on the overall effectiveness of the theater nuclear force. It includes consideration of such measures as increased hardening and the use of multiple paths and interlocking networks.
- (4) C³ Requirements. (Code number 4) This area includes consideration of C³ facilities, systems and procedures required to support the four primary functions of the TNF: Deployment; Employment; Storage, Maintenance and Security; and Readiness and Reliability. It includes establishment and analysis of information need lines and communications connectivity requirements.
- (5) C³ Modeling and Simulation. (Code number 5) This area includes consideration of modeling and simulation activities conducted to assess the capabilities and limitations of the C³ systems, networks, and procedures which support the TNF. It includes digital

and hybrid simulations designed to represent C³ equipment or systems under realistic conditions.

- (6) C³ Testing. (Code number 6) This area includes consideration of the results of C³ test programs which could have an impact on the objectives of the TNF S² C³ Program. It includes both direct and indirect test results.

1.2.4 Document Abstract

The third part of each entry consists of an abstract of the document which indicates the scope and type of information contained within the data source and, where appropriate, a summary of key results.

1.3 ORGANIZATION OF THE INDEX

Two indices are provided for the user's convenience. The first index is an alphabetical arrangement of the program/document titles with appropriate code entries and page numbers. The second index is a chronological arrangement of the program/document titles with the most recent (or on-going or projected) program/documents being listed first. Again, the appropriate code entries and page numbers are provided. These indices are located in Appendix A and B, respectively, in Volume II.

SECTION 2
THE RELATIONSHIP OF THE COMPENDIUM TO THE
TNF S² C³ PROGRAM

2.1 INDIVIDUAL PROGRAM/DOCUMENT RELATIONSHIPS

Table 1 depicts graphically the relationship and relevance of each document included in the compendium to the TNFS² C³ Program. The potential impact and significance of the results of a specific assessment or related document are represented by a numerical value on a scale of 1 to 10 in the "Impact/Significance" column. The larger the number, the greater the relevance to the TNFS² C³ Program. The impact/significance number also reflects the age of the information. For example, a designation of five indicates an assessment or related document containing old but still useful data. Numbers above this level reflect increasing utility both in terms of how recently the assessment was completed (if not currently on-going or planned) and in the degree of detail and scope of the pertinent information. Numbers between 1 and 4 generally indicate older assessments which contain data which may be useful primarily in the development of a current baseline including capabilities and deficiencies.

2.2 GENERAL RELATIONSHIPS AMONG PROGRAMS/DOCUMENTS

The entries in the "Specific Issues" columns in the table are related to the previous technical report in this series. The "Specific Issues" entry indicates relevance to the specific C³ issues which have been tentatively identified. The "Index" column refers the reader to the appropriate page of the compendium. The indication that a particular document addresses one or more specific TNF S² C³ issues does not indicate that either the scope or detail of the relevant discussion in that document meets some predetermined standard. Consequently, there may be marked differences among a group of documents in the amount of information each contains on a given issue which the table indicates each document addresses in common with several others in that group.

Table 1. Relationship of individual programs/documents to TNF S²C³ issues.

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT/SIGNIFICANCE	SPECIFIC ISSUES						
			US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	OPSEC	PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
MINUTES, DNA PROGRAM, 2ND INCA COORDINATION MEETING	B-2.89	2	●		●				
INTEGRATED TACTICAL COMMUNICATIONS SYSTEM, TASK IV, REFINED ALTERNATIVE MRTF COMMUNICATIONS CONCEPTS	B-2.81	2							●
AN OVERVIEW OF HF COMMUNICATIONS IN A NUCLEAR ENVIRONMENT	B-2.88	5	●				●		
NUCLEAR VULNERABILITY ASSESSMENT OF TACTICAL SHIPBOARD ELECTRONIC SYSTEMS	B-2.56	5							
ANALYSIS OF THE 1985 TACTICAL NUCLEAR LAND BATTLE	B-2.48	4		(REQUIREMENTS STUDY)					
U.S. BLUE RIDGE (LCC19) COMMUNICATIONS EFFECTIVENESS EVALUATION	B-2.52	3							
INTRODUCTION TO NUCLEAR WEAPONS EFFECTS ON NAVAL HIGH FREQUENCY COMMUNICATIONS SYSTEMS	B-2.58	2	●						
TACTICAL SATELLITE COMMUNICATIONS COST EFFECTIVENESS ANALYSIS STUDY (TACSATCOM), VOLUME III, APPENDIX G, THREAT TO U.S. ARMY COMMUNICATIONS	B-2.24	5						●	
COMMUNICATIONS ELECTRONICS-75 ICE-79), PHASE I, FIELD ARMY, VOLUME 4, ANNEX E COMMUNICATIONS SYSTEMS CONCEPTS	B-2.22	4					●		
INTEGRATED NUCLEAR COMMUNICATIONS ASSESSMENT, PHASE I REPORT	B-2.31	5					●		
NAVAL TELECOMMUNICATIONS SYSTEM ARCHITECTURE, 1975-1985	B-2.54	5		(REQUIREMENTS STUDY)					
ANALYSIS OF TYPICAL THEATER ARMY COMMUNICATION LINKS IN A NUCLEAR ENVIRONMENT	B-2.85	5					●		
WB USNCOM VULNERABILITY AND SURVIVABILITY STUDY, FINAL REPORT	B-2.83	4					●		
MINUTES, DNA INCA PROGRAM, 8TH COORDINATION MEETING	B-2.92	4					●	●	
EUROPEAN THEATER NUCLEAR FORCES C ³ SYSTEMS STUDY, FINAL REPORT	B-2.48	5		(REQUIREMENTS STUDY)					
MINUTES, DNA INCA PROGRAM, 5TH COORDINATION MEETING	B-2.86	4					●	●	
NAVY TACTICAL NUCLEAR WEAPONS STUDY, VOLUME I	B-2.44	3					●		
MINUTES, DNA INCA PROGRAM, 4TH COORDINATION MEETING	B-2.91	3	●				●		
MINUTES, DNA INCA PROGRAM, 3RD COORDINATION MEETING	B-2.90	2	●				●		
PROTECTION OF THE NICS AGAINST NUCLEAR EXPLOSION EFFECTS	B-2.23	5					●		

Table 1. Relationship of individual programs/documents to
TNF S²C³ issues. (Continued)

PROGRAM / DOCUMENT TITLE	SPECIFIC ISSUES									
	INDEX	IMPACT / SIGNIFICANCE	US CUSTODIAL COMMUNICATIONS	INTEROPERABLE COMMUNICATIONS	JAM RESISTANT US-NATO SECURE VOICE	JOPREC	PHYSICAL SURVIVABILITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION	
MINIMUM ESSENTIAL EMERGENCY COMMUNICATIONS NETWORK SYSTEM ENGINEER	B-2.18	5					●			
JOURNAL OF DEFENSE RESEARCH, VOLUME 8, NO. 4	B-2.18	3			●					
IMPROVING THE EFFECTIVENESS OF NATO'S THEATER NUCLEAR FORCE	B-2.38	5					●			
ANALYSIS OF TWO-WAY AND REPORT BACK THEATER COMMUNICATIONS	B-2.71	4					●			
COMPARISON OF SOVIET AND U.S. GROUND FORCE CAPABILITIES IN ELECTRONIC WARFARE, VOLUMES I AND II AND EXECUTIVE BRIEFING	B-2.28	6			●		●			
MINUTES, DNA INCA PROGRAM, 8TH COORDINATION MEETING	B-2.83	4					●			
EUROPEAN COMMAND, CONTROL, AND COMMUNICATIONS STUDY GROUP, FINAL REPORT	B-2.37	5								
NAVY C ³ STUDY	B-2.43	5								
INCA PROPAGATION PATH EFFECTS ASSESSMENT FOR SATELLITE AND TROPOSCATTER COMMUNICATIONS IN THE TACTICAL THEATER	B-2.79	4	●					●		
COLLECTION AND PROCESSING OF INFORMATION PERTINENT TO THE TACTICAL NUCLEAR BATTLEFIELD	B-2.21	5								
IMPACT OF SABOTAGE ON DCS FACILITIES, PHASE I	B-2.15	6					●			
IMPACT OF SABOTAGE ON MANNED DCS FACILITIES, TASK 1, SURVEY AND ANALYSIS	B-2.13	8					●			
IMPACT OF SABOTAGE IN MANNED DCS FACILITIES, TASK 2, COST BENEFITS ANALYSIS	B-2.5	8					●			
MULTIPLE SYSTEMS EVALUATION PROGRAM, FINAL REPORT ON CRITICAL COMMUNICATIONS FOR TACTICAL NUCLEAR DELIVERY SYSTEMS	B-2.16	5								(REQUIREMENTS STUDY)
ASSESSMENT OF NCA-TO-THEATER C ³ SYSTEMS	B-2.4	8					●			
SHAPE C ² SURVIVABILITY SUPPORT PROGRAM	B-2.1	7					●			
BLAST EFFECTS ON US WEAPONS SYSTEMS, VEHICLE SYSTEMS, AND C ³ EQUIPMENT	B-2.3	7					●			
NUCLEAR WEAPONS EFFECTS VULNERABILITY TESTS	B-2.2	8					●			
DEVELOPMENT OF ELECTRONIC VULNERABILITY INFORMATION SOURCES	B-2.9	7					●			

Table 1. Relationship of individual programs/documents to TNF S²C³ issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	OPSEC	SPECIFIC ISSUES		
							PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
INVESTIGATION OF THE VULNERABILITY/SURVIVABILITY OF SYSTEMS SUPPORTING THE NCA DECISION PROCESS	0-2.17	0					●	●	
NET TECHNICAL ASSESSMENT: IMPACT OF EW ON TARGET KILL ROLES AT U.S. BRIGADE/SOVIET REGIMENTAL LEVEL	0-2.32	5		●	●				
MINUTES, DNA INCA PROGRAM, 10TH COORDINATION MEETING	0-2.95	4							
INTEGRATED TACTICAL INFORMATION SYSTEMS DESIGN STUDY	0-2.90	5		(REQUIREMENTS STUDY)					
ELECTRONIC WARFARE VULNERABILITY OF U.S. ARMY SELECTED OVERSEAS TACTICAL UNITS	0-2.47	0		●	●				
MINUTES, DNA INCA PROGRAM, 9TH COORDINATION MEETING	0-2.94	4					●		
EMP ASSESSMENT FOR ARMY TACTICAL COMMUNICATIONS SYSTEMS: TRANSMISSION SYSTEMS SERIES NO. 1 - RADIO TERMINAL SET AN/TRC-145	0-2.78	4					●		
EMP VULNERABILITY ANALYSIS OF RADIO SETS AN/PRC-77, AN/VRC-94, AND AN/GRC-100	0-2.83	4					●		
ARCHITECTURE FOR TACTICAL SWITCHED COMMUNICATIONS SYSTEMS	0-2.72	7		(REQUIREMENTS STUDY)					
EVALUATION OF SURVIVABILITY/RECOVERABILITY ASPECTS OF THE DCS SYSTEM CONTROL	0-2.82	7							●
IMPACT OF ESM INTELLIGENCE ON CORPS LEVEL COMBAT	0-2.30	5		●					
U.S. FORWARD AIR DEFENSE EW VULNERABILITY	0-2.36	6		●	●				
PROCEEDINGS OF THE TWENTY SECOND ANNUAL JOINT ELECTRONIC WARFARE CONFERENCE, VOLUME 1	0-2.49	4		●				●	
EUROPEAN DCS SURVIVABILITY ENHANCEMENTS STUDY	0-2.94	7		(REQUIREMENTS STUDY)					
EFFECTIVENESS OF HARDENING SHIPS, VOLUME 1, EXECUTIVE SUMMARY	0-2.50	5							
EFFECTIVENESS OF HARDENING SHIPS, VOLUME 2	0-2.51	0							
U.S. NAVY SATELLITE COMMUNICATIONS VULNERABILITY: INITIAL ASSESSMENT OF THE VULNERABILITY OF SATELLITE COMMUNICATIONS TO INTERCEPT, GEOPOSITIONING, AND EXPLOITATION THROUGH 1990	0-2.20	7						●	
JOINT BATTLEFIELD NUCLEAR OPTION PROCEDURES STUDY	0-2.90	3	●						

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Table 1. Relationship of individual programs/documents to TNF S²C³ issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO COMMUNICATIONS	JAW RESISTANT COMMUNICATIONS	DPRC	SPECIFIC ISSUES		
							PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
REQUIREMENTS AND SOLUTIONS FOR COMMUNICATIONS ELEMENT: THEATER NUCLEAR WAR, ANNEX 2	0-2.60	8				(REQUIREMENTS STUDY)			
REQUIREMENTS AND SOLUTIONS FOR COMMAND AIDS ELEMENT: THEATER NUCLEAR WAR, ANNEX 4	0-2.70	8				(REQUIREMENTS STUDY)			
REQUIREMENTS AND SOLUTIONS FOR DATA COLLECTION AND PROCESSING ELEMENT: THEATER NUCLEAR WAR, ANNEX 3	0-2.80	8				(REQUIREMENTS STUDY)			
SOVIET REC THREAT TO TNF. VOLUME II. FINAL REPORT	0-2.96	7			●	●	●		
AFWMCCS PERFORMANCE IN AN EW ENVIRONMENT, PHASE I. FINAL REPORT	0-2.97	7			●		●		
AFCEA SYMPOSIUM "INTERNATIONAL INTEROPERABILITY, COMMUNICATIONS, COMMAND AND CONTROL"	0-2.25	5	●						
JOURNAL OF DEFENSE RESEARCH: TACTICAL C ³	0-2.00	5					●		
IMPACT OF SELECTED COUNTER C ³ OPERATIONS ON SOVIET TACTICAL MISSION EFFECTIVENESS	0-2.30	5					●		
ANNUAL DEFENSE REPORT FOR FY1979	0-2.20	7					●		
INITIAL VULNERABILITY ASSESSMENT OF EXISTING AND MICS STAGE 1 COMMUNICATIONS FACILITY	0-2.55	6					●		
COMMAND, CONTROL, AND COMMUNICATIONS FOR U.S. THEATER NUCLEAR FORCES IN PACOM	0-2.122	4							
INFORMATION REQUIREMENTS FOR THE CONVENTIONAL/NUCLEAR BATTLEFIELD	0-2.123	5					(REQUIREMENTS STUDY)		
DEFENSE SCIENCE BOARD TASK FORCE ON THEATER NUCLEAR FORCES RESEARCH AND DEVELOPMENT REQUIREMENTS	0-2.124	6					(REQUIREMENTS STUDY)		
EUROPEAN THEATER ANALYSIS, APPENDIX A, 1989 SCENARIO, NATO FORCES	0-2.125	6			●				
OPERATIONAL CONCEPTS FOR THE NUCLEAR TOMAHAWK GROUND LAUNCHED CRUISE MISSILE	0-2.126	7					(REQUIREMENTS STUDY)		
FIELD ARTILLERY ORGANIZATION AND SYSTEM REQUIREMENTS, 1981-1986, VOLUME III, 1986 TIME FRAME	0-2.127	6					(REQUIREMENTS STUDY)		
JOINT TEST OF VULNERABILITY OF U.S. TACTICAL DATA LINKS, DESIGN DEFINITION PHASE	0-2.128	7			●				

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Table 1. Relationship of individual programs/documents to TNF S²C³ issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	SPECIFIC ISSUES						
			US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	OPSEC	PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
WWMCCS ARCHITECTURAL ALTERNATIVES FOR THEATER NUCLEAR WAR, SIXTH REPORT, VOLUME I, EXECUTIVE OVERVIEW AND ARCHITECTURAL SUMMARY	B-2.117	7			(REQUIREMENTS STUDY)				
WWMCCS ARCHITECTURAL ALTERNATIVES FOR THEATER NUCLEAR WAR, VOLUME 2, ARCHITECTURAL ALTERNATIVES	B-2.118	7			(REQUIREMENTS STUDY)				
CANDIDATE BROAD ARCHITECTURAL ALTERNATIVES AND DECISION CONSIDERATIONS FOR THE WWMCCS, NINTH REPORT, EXECUTIVE OVERVIEW	B-2.119	7			(REQUIREMENTS STUDY)				
IMPLICATIONS OF TACTICAL BATTLEFIELD SITUATIONS AND SYSTEMS ON THE REQUIREMENTS FOR THE WWMCCS ARCHITECTURE	B-2.120	7			(REQUIREMENTS STUDY)				
WWMCCS ARCHITECTURAL ALTERNATIVES AND DECISION CONSIDERATIONS FOR CRISIS SITUATIONS, EIGHTH REPORT	B-2.121	7			(REQUIREMENTS STUDY)				
IDENTIFICATION OF SOME TOPICS FOR A PROPOSED ARPA TACTICAL WARFARE STUDIES PROGRAM	B-2.133	2			(REQUIREMENTS STUDY)				
SOVIET CAPABILITY TO CONDUCT ELECTRONIC WARFARE AGAINST US SPACE SYSTEMS	B-2.136	6	●		●		●		
ECCM FOR DEFENSE COMMUNICATIONS SYSTEM (DCS)	B-2.142	7						●	
WARSAW PACT SIGNAL INTELLIGENCE AND ELECTRONIC WARFARE THREAT TO US GROUND FORCES	B-2.138	5							●
SATELLITE COMMUNICATIONS FOR THE GLCM LAUNCH CONTROL CENTER	B-2.137	8					●		
ANTI-JAM POLICY STUDY, FINAL REPORT, VOLUME II, ANTI-JAM REQUIREMENTS	B-2.144	8			●				
ECCM FOR DCS	B-2.149	7						●	
TASK FORCE 8 COMMUNICATIONS, COMMAND AND CONTROL, FINAL REPORT	B-2.147	8			(REQUIREMENTS STUDY)				
NATO INTEGRATED COMMUNICATIONS SYSTEM STAGE II ARCHITECTURE, VOLUME II (PLUS ANNEXES)	B-2.146	8			(REQUIREMENTS STUDY)				
RATIONALIZATION/STANDARDIZATION WITHIN NATO, FIFTH SECDEF REPORT TO THE CONGRESS	B-2.148	8	●		●			●	
HALLARD 1 VULNERABILITY ANALYSIS	B-2.146	7			●				
INITIAL USE OF JOINT MULTICHANNEL TRUNKING AND SWITCHING SYSTEMS (JMTSS) ANALYSIS (DPLAN 4182)	B-2.82	7			(REQUIREMENTS STUDY)				

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Table 1. Relationship of individual programs/documents to TNF S²C³ issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO SECURE VOICE	OPSEC	PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION	SPECIFIC ISSUES	
JMSS MANAGEMENT/IMPLEMENTATION PLAN, SECOND DRAFT	B-2.75	8								(REQUIREMENTS STUDY)
GROUND MOBILE FORCES SATELLITE COMMUNICATIONS, VOLUME I, OPERATIONAL CONCEPTS	B-2.140	7								(REQUIREMENTS STUDY)
GROUND MOBILE FORCE SATELLITE COMMUNICATIONS, VOLUME II, CONTROL CONCEPTS	B-2.141	7								(REQUIREMENTS STUDY)
NUCLEAR COMMUNICATIONS TASK FORCE (NCTAF) REPORT	B-2.143	9								(REQUIREMENTS STUDY)
OPERATIONAL CONCEPT FOR THE NCTAF PROPOSED COMMUNICATIONS ENHANCEMENTS	B-2.14	9	●	●		●	●			
ALLIED COMMAND EUROPE (ACE) NUCLEAR COMMAND & CONTROL IMPROVEMENT PROGRAM	B-2.8	8								(REQUIREMENTS STUDY)
US EUCON COMMAND AND CONTROL SOLUTIONS	B-2.10	8								(REQUIREMENTS STUDY)
DEVELOPMENT OF SCOPE FOR IMPROVING THE SURVIVABILITY/ SECURITY OF THE THEATER NUCLEAR FORCE	B-2.11	7								(REQUIREMENTS STUDY)
WWMCCS ARCHITECTURAL PLAN, ELEVENTH REPORT	B-2.12	7								(REQUIREMENTS STUDY)
TACTICAL COMMAND AND CONTROL SYSTEM INTERCEPT VULNERABILITY ANALYSIS, VOLUME I, INTRODUCTION AND SUMMARY	B-2.133	3								
AN ASSESSMENT OF THE TECHNOLOGY FOR CONTROL OF FORCES AND WEAPONS ON THE BATTLEFIELD, INTERIM REPORT	B-2.134	3								
IMPROVING TACTICAL COMMAND AND CONTROL IN CENTRAL EUROPE	B-2.135	4								(REQUIREMENTS STUDY)
TO&E OF TAC COMSEC SYSTEM, RED FLAG 77.7	B-2.34	5								
LAUNCH CONTROL CENTER COMMUNICATIONS STUDY	B-2.50	7								(REQUIREMENTS STUDY)
CENTRALIZED C ³ IN NATO: FORCE MULTIPLIER OR SHORT CIRCUIT?	B-2.130	7								

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Table 1. Relationship of individual programs/documents to TNF S²C³ issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	DISEC	SPECIFIC ISSUES		
							PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
ANALYSIS OF BASELINE TACTICAL C ³ VULNERABILITY IN A NUCLEAR ENVIRONMENT	B-2.53	6		●					
SURVIVABILITY AND EMPLOYMENT OF TACTICAL NUCLEAR AND CONVENTIONAL AIRPOWER IN CENTRAL NATO, PHASE I	B-2.42	4							
NUCLEAR SURVIVABILITY AND VULNERABILITY OF NAVAL C ³ SYSTEMS IN EUROPEAN THEATER OPERATIONS	B-2.46	5							
PACIFIC SATELLITE COMMUNICATIONS EMP SURVIVABILITY	B-2.61	5					●		
TELECOMMUNICATIONS COUNTER-COUNTER MEASURES FOR TACTICAL COMMAND AND CONTROL SYSTEMS	B-2.67	6		●					
NTA: TACTICAL AIR SUPPORT OF U.S. FORWARD AREA GROUND COMMANDERS IN AN EW ENVIRONMENT	B-2.40	5		●					
EMP ASSESSMENT FOR ARMY TACTICAL COMMUNICATIONS SYSTEMS: TRANSMISSION SYSTEMS SERIES NO. 2. RADIO TERMINAL SET AN/TRC-117	B-2.64	6		●		●			
REQUIREMENTS FOR U.S. EUROPEAN C ³ SUPPORT	B-2.74	6							
EUROPEAN C ³ IMPLEMENTATION STUDY, FINAL REPORT	B-2.38	6							
ADAPTABLE HF COMMUNICATION SYSTEMS FOR USE IN A NUCLEAR ENVIRONMENT	B-2.110	5	●						●
AIR DEFENSE MATERIEL EMP VULNERABILITY SURVEY OF ARMY TACTICAL SYSTEMS	B-2.57	5					●		
CENTRAL REGION AIR COMMAND AND CONTROL, INFORMATION FLOW ANALYSIS, PART I	B-2.111	5							
CENTRAL REGION AIR COMMAND AND CONTROL, VOLUME II	B-2.112	7							
SECURITY AND SURVIVABILITY OF THEATER NUCLEAR WEAPONS LOGISTICAL SUPPORT CAPABILITIES, DRAFT FINAL REPORT	B-2.113	7					●		
A DISCUSSION OF ISSUES OF TACTICAL NUCLEAR WARFARE	B-2.114	3							
TNF S ² COMMUNICATIONS PROGRAM MANAGEMENT PLAN	B-2.115	7							
BIBLIOGRAPHY OF RDA REPORTS ON TACTICAL PROGRAM	B-2.116	6							

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Table 1. Relationship of individual programs/ documents to TNF S²C³ issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO COMMUNICATIONS	JAW RESISTANT US-NATO SECURE VOICE	D/SEC	PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION	SPECIFIC ISSUES	
NUCLEAR SURVIVABLE C ² SYSTEM	0-2.7	0					●				
ASSESSMENT OF THE IMPACT OF SURVEILLANCE AND ELECTRONIC WARFARE SYSTEMS ON COMBAT OPERATIONS	0-2.8	0					●				
AFWMCCS EW, PHASE II, FINAL REPORT	0-2.87	7		●							
SOVIET GROUND FORCES COMMAND, CONTROL, AND COMMUNICATIONS SYSTEMS AT THE TACTICAL LEVEL	0-2.77	7									
COMMAND, CONTROL AND COMMUNICATIONS FOR US-NATO THEATER NUCLEAR FORCES	0-2.86	3	●								
EW VULNERABILITY AND CONSEC POSTURE OF C ³ OF PERSHING SYSTEM	0-2.73	0			●						
ASSESSMENT AND MODELS OF MOBILE COMMAND POST SURVIVABILITY IN A TACTICAL NUCLEAR ENVIRONMENT, DRAFT FINAL REPORT	0-2.29	6					●				
REPRESENTATIVE COMMAND POST CONFIGURATIONS C ³ STRUCTURES AND REFERENCE DATA, VOLUME I	0-2.41	6									
INCA PHASE I: STUDY OF THE EFFECT OF A TACTICAL NUCLEAR ENVIRONMENT ON THE PERFORMANCE OF EM SYSTEMS	0-2.76	4	●	●			●				
NUCLEAR DOCTRINE, ORGANIZATION AND EQUIPMENT (NUODRE) COMMAND AND CONTROL STUDY	0-2.27	3								(REQUIREMENTS STUDY)	
COMMUNICATIONS AND TARGET ACQUISITION CONCEPTS IN TACTICAL NUCLEAR WARFARE	0-2.98	3						●			
TACTICAL RADIO COMMUNICATION SYSTEM CONCEPT STUDY	0-2.99	3								(REQUIREMENTS STUDY)	
AIR FORCE TACTICAL FORCES 1986 STUDY, VOLUME IX, COMMAND, CONTROL AND COMMUNICATIONS MISSION REQUIREMENTS	0-2.186	2								(REQUIREMENTS STUDY)	
TACTICAL AWACS MEASURES OF EFFECTIVENESS	0-2.191	3									
THEATER NUCLEAR C ² , VOLUME I, FINAL REPORT	0-2.102	0	●		●		●				
THEATER NUCLEAR C ² , VOLUME II, APPENDICES	0-2.103	0			●		●				
FACTORS INVOLVED IN BATTLEFIELD ELECTROMAGNETIC COVER AND DECEPTION (BELCAD), VOLUMES I AND II (APPENDICES)	0-2.104	5		●							

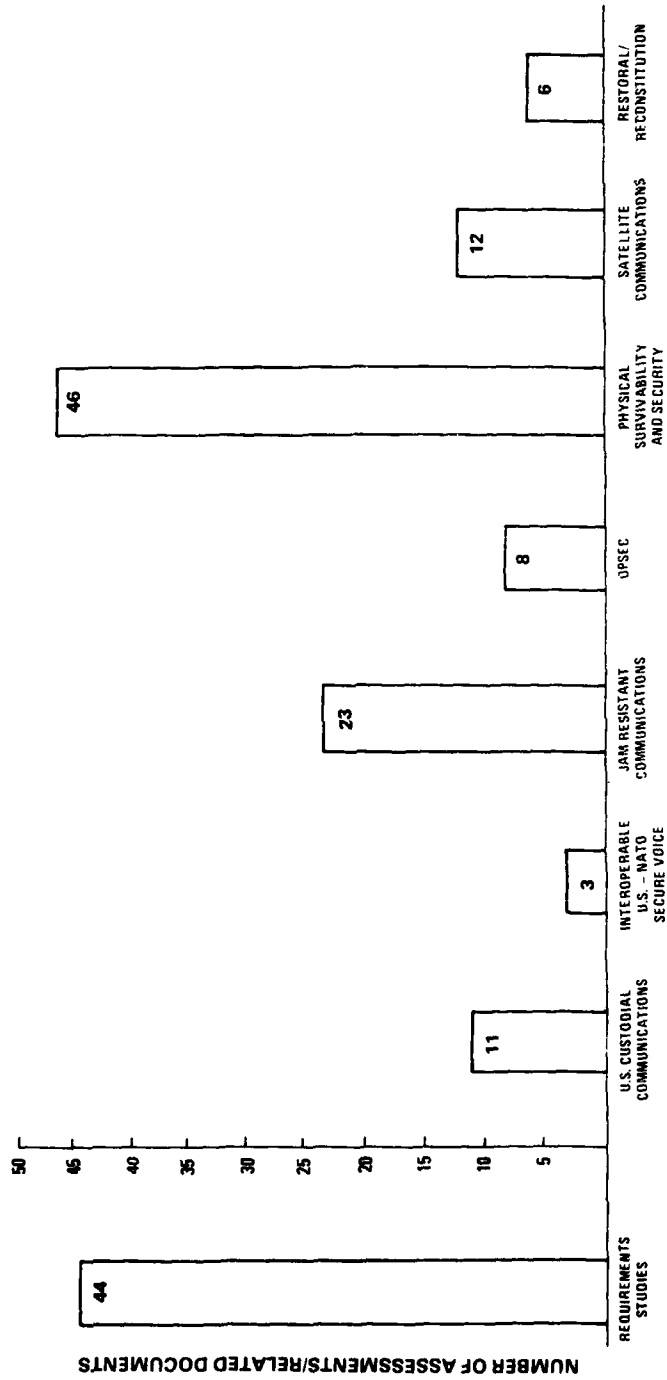
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Table 1. Relationship of individual programs/documents to TNF S²C³ issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	DPSEC	SPECIFIC ISSUES		
							PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
TITLE AND ABSTRACTS OF TECHNICAL REPORTS, TECHNICAL MEMORANDA, AND PROFESSIONAL PAPERS PUBLISHED BY THE SHAPE TECHNICAL CENTER	B-2.105	5					(BIBLIOGRAPHY)		
JRSC EXECUTING COMMANDERS TERMINAL SYSTEM/ SUBSYSTEM ANALYSIS	B-2.106	6					(REQUIREMENTS STUDY)		
AIR FORCE TACTICAL FORCES 1985 STUDY, VOLUME IX, COMMAND, CONTROL AND COMMUNICATIONS MISSION REQUIREMENTS (ANNEXES)	B-2.107	2					(REQUIREMENTS STUDY)		
REPORT TO NATO C ³ INITIATIVES TASK FORCE ON C ³ NUCLEAR SURVIVABILITY ISSUES	B-2.108	6					●		
PRELIMINARY THEATER C ³ NUCLEAR SURVIVABILITY ASSESSMENT	B-2.109	4					●		
THEATER NUCLEAR PROGRAMS SYNTHESIS, VOLUME I, SYTHESIS REPORT	B-2.129	7					(REQUIREMENTS STUDY)		
THEATER NUCLEAR PROGRAMS SYNTHESIS, VOLUME II, STUDY SUMMARIES	B-2.131	7					(REQUIREMENTS STUDY)		
OPERATIONAL CONCEPT FOR THE TOMAHAWK GROUND LAUNCHED CRUISE MISSILE	B-2.132	6					(REQUIREMENTS STUDY)		
ANALYSIS OF THE SURVIVABILITY AND VULNERABILITY OF E-3A IN CENTRAL EUROPE	B-2.130	5					●		

2.3 DISTRIBUTION OF PREVIOUS EFFORT

Figure 2 depicts graphically the number of compendium entries which contain information pertinent to each of the tentatively identified TNF S² C³ specific issues. A separate bar portraying the number of more comprehensive assessments of the TNF S² C³--those identified as Requirements Studies in the Compendium--is also shown for purposes of comparison. This information indicates the relative weight of effort previously allocated to the study and evaluation of questions which are directly related to the specific C³ issues. Figure 2 also indicates which specific issues are candidates for further work and which are less candidates for further study and evaluation than for integration with other work done previously. For example, only three programs/documents in the compendium directly address the specific issue of Interoperable US-NATO Secure Voice. On the other hand, 46 programs/documents deal with the specific issue of Physical Survivability and Security. This suggests that specific Interoperability issues may be candidates for further assessment before recommendations on possible new programs, if needed, can be formulated. By comparison, all that may need to be done in the area of the Physical Survivability and Security issue is to evaluate and coordinate previous programs to ensure that they have been assigned proper priority and adequate funding. While the potential utility to the TNF S² C³ Program Manager of such comparisons is obvious, he will have to examine each candidate for further assessment carefully on its own merits since those assessments that have been conducted in a relatively little studied issue area may well be so recent, comprehensive in treatment, or of such excellence as to preclude the need for additional work. It must also be remembered, as indicated previously, that the amount of information contained in different compendium entries which deal with a particular specific issue may vary markedly.



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Figure 2. Number of assessments addressing each specific TNF S²C³ issue.

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