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DEPARTMENT OF DEFENSE
INTERFACE STANDARD

CONNECTIONLESS DATA TRANSFER
APPLICATION LAYER STANDARD

AMSC N/A **AREA DCPS**

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FOREWORD

This military standard is approved for use by all Departments and Agencies of the Department of Defense (DoD).

This military standard is produced by the Radio Information Transfer Technical Working Group (RITTWG). The MIL-STD-2045 document series was established within the Data Communication Protocol Standards (DCPS) Standardization Area to allow for the enhancement of commercial standards or the development of standards that are unique to DoD.

Specific details and instructions for establishing a MIL-STD-2045 document, as well as profile development guidelines, are documented in the RITTWG Management Plan. RITTWG Working Groups (WGs) are responsible for standard development, formal service and agency coordination, and approval.

This military standard does not supersede the scope of Allied Communication Publication (ACP) 123 with US SUPP-1. ACP 123 with US SUPP-1 addresses message handling communications protocol and procedures for the exchange of military messages.

The Preparing Activity (PA) for this standard is USA CECOM LCMC, ATTN: AMSEL-SE-CD (Chairman, Combat Net Radio Working Group (CNRWG), Fort Monmouth, NJ 07703. The custodians for the document are identified in the Defense Standardization Program, “Standardization Directory (SD1)” under Standardization Area DCPS.

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this military standard should be addressed to the PA at the above address by letter.

Comments, suggestions, or questions on this document should be addressed to CDR, USA CECOM LCMC, ATTN: AMSEL-SE-CD Chairman, (CNRWG), Building 1209, Fort Monmouth, NJ 07703 or emailed to CNRWG@conus.army.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

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1 SCOPE

1.1 Purpose.

This military standard presents the minimum essential technical parameters in the form of a mandatory system standard and optional design objectives for interoperability and compatibility among digital message transfer devices (DMTDs), between DMTDs and applicable command, control, communications, computers, and intelligence (C4I) systems and among C4I systems using digital data for information transfer over limited bandwidth communication channels.

1.2 Scope.

This military standard addresses part of the communications protocol and procedures for the exchange of digital data among DMTDs, between DMTDs and C4I systems, and among C4I systems participating in inter- and intra-Service tactical networks. The material is presented in the context of the Open Systems Interconnection (OSI), as documented in national and international standards.

1.3 Application guidance.

This military standard applies to the design, construction, and development of new equipment and systems, and to the retrofit of existing equipment and systems.

2 APPLICABLE DOCUMENTS

2.1 General.

The documents listed in this section are specified in sections 3, 4, and 5 of this standard. This section does not include documents cited in other sections of this standard or recommended for additional information as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they will meet all specified requirements documents cited in sections 3, 4, and 5 of this standard, whether or not they are listed.

2.2 Government documents.

2.3 Specifications, standards, and handbooks.

The following specifications, standards, and handbooks form a part of this military standard to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the current issue of the DoD Index of Specifications and Standards (DoDISS) and supplements thereto, cited in the solicitation (see 6.2).

DEPARTMENT OF DEFENSE STANDARDS:

FEDERAL:

FED-STD-1037	*Glossary of Telecommunication Terms*
FIPS 180-1	*Secure Hash Standard (SHS)*
FIPS 186-2	*Digital Signature Standard (DSS)*
FIPS 10-4	*Countries, Dependencies, Areas of Special Sovereignty, and Their Principal Administrative Divisions*

MILITARY:

MIL-STD-188-220	*DoD Interface Standard, Digital Message Transfer Device Subsystems*
MIL-STD-2500	*National Imagery Transmission Format (NITF) Version 2.1 For the National Imagery Transmission Format Standard (NITFS)*
MIL-STD-6016	*DoD Interface Standard, Tactical Data Link (TDL) 16 Message Standard*
MIL-STD-6017	*DoD Interface Standard, Variable Message Format (VMF) MIL-STD-6017*
MIL-STD-6040	*DoD Interface Standard U.S. Message Text Formatting Program Description of U.S. Message Text Formatting Program (USMTF)*
Joint Pub (JP) 1-02	*DoD Dictionary of Military and Associated Terms*

NATIONAL SECURITY AGENCY CENTRAL SECURITY SERVICE:

DOI-103	*Defense Special Security Communications System (DSSCS) Operating Instructions System - Data Procedures DOI-103*

[Unless otherwise indicated, copies of federal and military standards are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.] Department of Defense Standards documents are available at the ASSIST website: http://assist.daps.dla.mil. MIL-STD-6016, MIL-STD-6017, MIL-STD-6040 can be obtained from [Director, Defense Information System Agency (DISA), Center for Systems Engineering Architectures and Integration (GE3) Interoperability Standards Division (GE33), 5600 Columbia Pike, Falls Church, VA, 22041-2717.]

2.3.1 Other Government documents, drawings, and publications.
The following other Government documents, drawings, and publications form a part of this military standard to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

Standard Change Catalogs (SCCs) and Interface Change Proposals (ICPs) based on this document, approved or otherwise, shall not be implemented in or by any platform or system. Approved SCC/ICPs shall be incorporated in the next release of this document.

2.3.2 North Atlantic Treaty Organization (NATO) Standardization Agreements (STANAG) documents, drawings, and publications.
The following NATO STANAG documents, drawings, and publications form a part of this military standard to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

STANAG 4545 *Edition 1 – NATO Secondary Imagery Format (NSIF) Version 1.0*

2.4 Non-Government publications.
The following documents form a part of this military standard to the extent specified herein. Unless otherwise specified, the issues of the documents that are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

INTERNATIONAL ORGANIZATION for STANDARDIZATION (ISO):

ISO 7498-1 *Information Processing Systems -- Open Systems Interconnection -- Basic Reference Model.*

[ISO standards are available from the American National Standards Institute (ANSI), Inc., 1430 Broadway, New York, NY 10018.]

OTHER:

Lempel-Ziv-Welch *"A technique for high performance data compression"*, Terry A. Welch, IEEE Computer, Vol. 17, No. 6, pp. 8-19, June 1984

Lempel-Ziv 1977 *"A universal algorithm for sequential data compression"*, J. Ziv and A. Lempel, IEEE Transactions on Information Theory, Vol IT-23, No. 3, pp 337-343, May 1977.

RFC 1951 *"DEFLATE Compressed Data Format Specification version 1.3"*, L. Peter Deutsch, May 1996.

RFC 1952 *"GZIP file format specification, version 4.3"*, L. Peter Deutsch, May 1996.

2.5 Order of precedence.

In the event of a conflict between the text of this military standard and the references cited herein, the text of this military standard takes precedence. Nothing in this MIL-STD, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3 DEFINITIONS

3.1 Definitions of terms.

This section defines the terms and definitions used in this military standard.

Acknowledge		The act of notifying a unit transmitting data that the data has been received as a valid data.
Are		"Are" is used to introduce background information provided to enhance understanding of requirements. "Are" is not a directive.
Bit		A binary digit. In the binary system of numbering, each digit can only have one of two values (0 or 1). (Derived from ACP 167E)
Compatibility		The capability of two or more items or components of equipment or materiel to exist or function in the same system or environment without mutual interference. (Joint Pub 1-02)
Data Element		A basic unit (class) of information having a unique meaning and subcategories (data items) of distinct units or values. Examples of data elements are military personnel grade, sex, race, geographic location, and military unit. (Joint Pub 1-02) The VMF data element is the Data Use Identifier (DUI).
Data Field Identifier (DFI)		A category of data whose specification includes one or more Data Use Identifier (DUI) specifications. Each DUI's class of data must fall within the bounds of the DFI category.
Data Item		A subunit of descriptive information or value classified under a data element. For example, the data element "military personnel grade" contains data items such as sergeant, captain, and colonel. (Joint Pub 1-02).
	Disused	A DI value that was previously named but is no longer valid. A DISUSED value cannot be renamed without determining if coordinated implementation is required.
	Illegal	A term used to describe a bit code that is not a permissible entry into the tactical data system(s) supporting interface. (For example, a 9-bit DUI called HEADING that has legal values of 0-359 that represents degrees has illegal values of 360-511.)
	No Statement	A data item that indicates that no information on this DUI is being transmitted. (This does not necessarily indicate that the originator does not have the information.) The procedure to transmit a no statement value is to set the presence indicator to zero. Receipt of a presence indicator set to zero shall be interpreted as no statement.
	Reserved	A data item that indicates it cannot be used because it is intended for a planned future use.
	To Be Determined	This indicates that the data item design is incomplete. (DI names and bit codes will be specified at a later time.)
	Undefined	A term used to describe a bit code that has no currently assigned value but may have a value assigned in the future. (This occurs in logically coded items (DUIs) in which all the DIs in the DUI do not have assigned values.)
	Unknown	A data item that indicates that other values available for this DUI have not been determined by the originator.
Data Link		The means of connecting one location to another for the purpose of transmitting and receiving data. (Joint Pub 1-02)

Data Use Identifier (DUI)	A data element (class of data). The DUI specification determines the name and permitted contents of each message field to which the DUI is assigned, as explained below. A Data Field Identifier (DFI) specification includes a specification for each DUI under that DFI. Each DUI specification identifies the DUI name, and the data items and associated bit codes employed by the DUI. When a DUI is designated as the contents of a VMF message field, the DUI name is the field name, and the data items employed by the DUI are (subject to any implementation or message restrictions) the data items which may be conveyed in that field.
Default Condition	The state automatically assumed by a terminal's hardware or software in the absence of an input directing otherwise.
Digital Message Transfer Device (DMTD)	A portable data terminal device with limited message generation and processing capability. DMTDs are used for remote access to automated C4I systems and to other DMTDs. The environment encompasses point-to-point, point-to-multipoint, relay and broadcast transfer of information over data communications links. (MIL-STD-188-220)
Directive	(1) A military communication in which policy is established or a specific action is ordered. (Joint Pub 1-02) (2) A plan issued with a view to putting it in effect when so directed, or in the event that a stated contingency arises. (Joint Pub 1-02) (3) Broadly speaking, any communication that initiates or governs action, conduct, or procedure. (Joint Pub 1-02)
Field Presence Indicator (FPI)	A one bit field used to indicate the presence or absence of the following field.
Field Recurrence Indicator (FRI)	A one bit field used to indicate the repeatability of a field.
Global Multicast	Global multicast addressing, used when broadcasting messages to all systems on a broadcast subnetwork.
Group Multicast	Group multicast addressing, used when broadcasting messages to multiple (but not all) stations on a broadcast subnetwork.
Group Presence Indicator (GPI)	A one bit field used to indicate the presence or absence of the following group.
Group Recurrence Indicator (GRI)	A one bit field used to indicate the repeatability of a group.
Interoperability	(1) The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together. (Joint Pub 1-02) (2) The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases. (Joint Pub 1-02) (3) The ability to exchange data in a prescribed manner and the processing of such data to extract intelligible information which can be used to control/coordinate operations.
Is	"Is" is used to introduce background information provided to enhance understanding of requirements. "Is" is not a directive.
Joint	Connotes activities, operations, organization, etc., in which elements of more than one Service of the same nation participate. (Joint Pub 1-02)
Link 16	A secure, jam-resistant, nodeless data link which utilizes the Joint Tactical Information Distribution System, and the protocols, conventions and fixed word

	message formats defined by the MIL-STD-6016.
Mandatory Field	A field which shall contain data with each transmission of the message.
May	The word “may” in the text expresses a permissible practice or action, not a mandatory requirement.
Message	Any thought or idea expressed briefly in a plain, coded, or secret language, prepared in a form suitable for transmission by any means of communications. (Joint Pub 1-02)
Message Standard	A set of protocols consisting of rules, procedures, formats, data element definitions, or other conventions for information exchange and related interactions agreed upon between cooperating systems to ensure interoperability.
Minimum Implementation	The statement of minimum data exchange requirements that must be implemented by Service/Agency systems participating on a Variable Message Format (VMF) Interface to ensure the continued flow of information. This is defined in terms of requirements that must be met at four different levels: Functional, Message, Case, and Data Element.
Multicast	Multicast is the delivery of information to a group of destinations simultaneously using the most efficient strategy to deliver the messages over each link of the network only once, creating copies only when the links to the destinations split.
Must	The word “must” in the text is used in legislative or regulatory requirements with which both the customer and the vendor shall comply.
Nested Group	Any group within a group.
NET ID	The IP address is divided into two parts: the network portion of the IP address (NET ID) and the host portion of the IP address (HOST ID). The network MASK identifies the network portion of the IP address. The subnetwork mask is set to all “1”s for the portion of the IP address (e.g 255.255.255.0) that is the NET ID. For example using the previous IP mask with the following IP address IPv4 192.168.0.1, the first 3 octets would be the NETID (i.e., 192.168.0) and the last octet would be the HOSTID which is determined by the 24 bit mask.
Network	In information technology, a network is a series of points or nodes interconnected by communication paths. Networks can interconnect with other networks and contain subnetworks.
Operator	“Operator” is the person entering and receiving tactical information within a TDS, as appropriate to the capability to which a particular requirement applies. No attempt is made to specify the operator position or title expected to carry out specified actions or use specified capabilities, because these vary among systems and platforms.
Optional Field	A field which is not designated as a mandatory field. An optional field shall be preceded by an FPI or be nested within a group which includes a GPI.
Receipt/Compliance	The acknowledgment of a message and/or an indication of intent to respond to a message, either by machine acknowledgment or operator action.
Shall	“Shall” is directive, indicating a mandatory capability or requirement that must be implemented, and that is testable.
Should	The word “should” in the text expresses a recommendation or advice on implementing such a requirement, not a mandatory requirement.
Streaming/Undelimited	Streaming/undelimited as used in this document defines a service provided by a transport layer (e.g., TCP) that does not have an end-of –packet indication, but instead it provides a stream of data bytes. When using streaming/undelimited transport layer it is for the application to define the end of the packet by breaking the transport connection on each packet or by specifying the end-of-packet in the application data (e.g., MIL-STD-2045-47001).

Subnetwork	A subnetwork is a separately identifiable part of a larger network that typically represents a certain limited number of host computers, the hosts in a building or geographic area, or the hosts on an individual local area network.
Tactical Data Link (TDL)	A JCS approved standardized communications link suitable for transmission of digital information. A TDL is characterized by its standardized message formats and transmission characteristics.
Technical Interface Design Plan (TIDP)	An engineering implementation plan that specifies the technical standards required to achieve compatibility and interoperability. The plan includes a comprehensive technical description of the operational interface, message implementation, methods, and rules for processing data between operational facilities and a final list of effective Service/Agency facilities/systems.
Testable	The ability to be verified with one of the standard verification methods (i.e., Inspection, Analysis, Demonstration, or Test).
User Data	This portion of the application PDU shall contain the application process messages or data. The User Data is individually encoded and zero padded before it is passed to the Application Layer to have the Application Header added.
VMF	Variable Message Format (VMF) is a bit oriented digital information standard consisting of variable length messages suitable for near real time data exchange in a bandwidth constrained combat environment.
VMF Unit	A system, platform, or unit communicating directly on a data link using VMF.
XML-VMF Document	An XML compliant representation of a given VMF message format.
XML-VMF Mapping	The description of how an XML-VMF Document is derived from its respective VMF message format.
Will	"Will" is used to introduce background information provided to enhance understanding of requirements. "Will" is not a directive.

3.2 Abbreviations and acronyms.

Abbreviations and acronyms used in this military standard are defined below. In addition, those listed in the current edition of FED-STD-1037 that are pertinent to standards referenced by this document have been included for the convenience of the reader.

ABRRC	Abort Request Retry Count
ABRRL	Abort Request Retry Limit
ABRT	Abort Request Timer
ACP	Allied Communication Publication
ALP	Application Layer Protocol
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
C	Conditional
C4I	Command, Control, Communications, Computers, and Intelligence
CANTCO	Cannot Comply
CANTPRO	Cannot Process
CAT	Category
CECOM	Communications-Electronics Command
CNR	Combat Network Radio
CNRWG	Combat Net Radio Working Group
DACR	Destination Abort Confirm Received
DARPA	Defense Advanced Research Projects Agency
DCPS	Data Communication Protocol Standards
DISA	Defense Information Systems Agency

DMTD	Digital Message Transfer Device
DoD	Department of Defense
DoDISS	Department of Defense Index of Specifications and Standards
DOI	DSSCS Operating Instruction
DPRL	DSPICS Requirements List
DRFST	Destination Reference Freeze State Timer
DS	Destination Status
DSA	Digital Signature Algorithm
DSPICS	DoD Standard Profile Implementation Conformance Statements
DSS	Digital Signature Standard
DSSCS	Defense Special Security Communications System
DTG	Date-Time Group
EDT	End of Data Transfer
EISRIAI	Estimated Inter-Segment Receive Interval Adjustment Increment
EISRIAP	Estimated Inter-Segment Interval Aging Period
EISRIAS	Estimated Inter-Segment Interval Aging Steps
EISRIAT	Estimated Inter-Segment Interval Aging Timer
EISRILT	Estimated Inter-Segment Receive Interval Lifetime
EISRIT	Estimated Inter-Segment Receive Interval Time
EISRITF	Expired Inter-Segment Receive Interval Timer Factor
ERTD	Estimated Round Trip Delay
ERTDAI	Estimated Round Trip Delay Adjustment Increment
ERTDAP	Estimated Round Trip Delay Aging Period
ERTDAS	Estimated Round Trip Delay Aging Steps
ERTDAT	Estimated Round Trip Delay Aging Timer
ERTDLT	Estimated Round Trip Delay Lifetime
ESATF	Expired Segment Acknowledgment Timer Factor
FAD	Functional Area Designator
FED-STD	Federal Standard
FIPS	Federal Information Processing Standard
FPI	Field Presence Indicator
FRI	Field Recurrence Indicator
GPI	Group Presence Indicator
GRI	Group Recurrence Indicator
HAVCO	Have Complied
HLEN	Header Length
HNSR	Highest Numbered Segment Received
HNSS	Highest Numbered Segment Sent
HOPCNT	Hop Count
ICP	Interface Change Proposal
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IISRIT	Initial Inter-Segment Receive Interval Timer
IL	Internet Layer Header Size
IP	Internet Protocol
IRTD	Initial Round Trip Delay
ISO	International Organization for Standardization
ISRIT	Inter-Segment Receive Interval Timer
ISRITDF	Inter-Segment Receive Interval Timer Down Factor
ISRITEC	Inter-Segment Receive Interval Timer Expirations Count
ISRITEL	Inter-Segment Receive Interval Timer Expirations Limit
ISRITJF	Inter-Segment Receive Interval Timer Jitter Factor

ISRITUF	Inter-Segment Receive Interval Timer Up Factor
ISRT	Inter-Segment Receive Timer
ISST	Inter-Segment Send Timer
ISSTAF	Inter-Segment Send Timer Adjustment Factor
IXMP	Information Transfer Management Panel
JTF	Joint Task Force
LCMC	Life Cycle Management Command
LNUS	Lowest Numbered Unacknowledged Segment
JTF	Joint Task Force
LRA	Least Recently Active
LSB	Least Significant Bit
LSN	Last Segment Number
LZ	Lempel-Ziv
LZW	Lempel-Ziv-Welch
M	Mandatory
MESR	Maximum Estimated Round Trip Delay (ERTD) to Saved Estimated Round Trip Delay (SERTD) Ratio
MESRITR	Maximum Estimated Inter-Segment Interval Time (EISRIT) to Saved Estimated Inter-Segment Receive Interval Time (SEISRIT) Ratio
MIL-STD	Military Standard
MIN IMP	Minimum Implementation
MISRIT	Measured Inter-Segment Receive Interval Time
MR	Machine Receipt
MRTD	Measured Round Trip Delay
MSB	Most Significant Bit
MSS	Maximum Segment Size
MTU	Maximum Transfer Unit
NA	Not Applicable
NCA	National Command Authority
ND	Not Determined
NITF	National Imagery Transmission Format
NITFS	National Imagery Transmission Format System
NLPT	Network Layer Pass Through
NOMST	Number of Missing Segment Threshold
NOSNR	Number of Segments Not Received
NOSR	Number of Segments Received
NS	Number of Stations
NSIF	NATO Secondary Imagery Format
OACR	Originator Abort Confirm Received
OPRACK	Operator Acknowledge
ORFST	Originator Reference Freeze State Timer
ORTS	Originator Status
OSI	Open Systems Interconnection
P/F	Poll/Final
PAIT	Partial Acknowledgment Interval Timer
PAITAF	Partial Acknowledgment Interval Timer Adjustment Factor
PASSN	Partial Acknowledgment Starting Segment Number
PDU	Protocol Data Unit
QOS	Quality of Service
QSO	Queue Size in Octets
R/C	Receipt/Compliance

RDM	Redistributed Message
REISRIT	Relaxed Estimated Inter-Segment Receive Interval Time
RERTD	Relaxed Estimated Round Trip Delay
RFAIT	Request for Acknowledgment Interval Timer
RFAITAF	Request for Acknowledgment Interval Timer Adjustment Factor
RFARC	Request for Acknowledgment Retry Count
RFARL	Request for Acknowledgment Retry Limit
RFC	Request for Comments
RSCT	Received Segment Count Threshold
RT	Reassembly Timer
RTD	Round Trip Delay
RTDJF	Round Trip Delay Jitter Factor
RTDDF	Round Trip Delay Down Factor
RTDUF	Round Trip Delay Up Factor
RTEC	Reassembly Timer Expiration Count
RTECL	Reassembly Timer Expiration Count Limit
S/R	Segmentation/Reassembly
SAT	Segment Acknowledgment Time
SCC	Standard Change Catalog
SCL	Segment Credit Limit
SCT	Segment Credit Threshold
SCU	Segment Credits Used
SCUMF	Segment Credits Used Multiplication Factor
SD1	Standardization Directory
SEISRIT	Saved Estimated Inter-Segment Receive Interval Time
SERTD	Saved Estimated Round Trip Delay
SH	Segmentation/Reassembly Header Size
SHA-1	Secure Hash Algorithm
SHS	Secure Hash Standard
SINCGARS	Single Channel Ground and Airborne Radio System
SLNUS	Smallest Lowest Number Unacknowledged Segment
SN	Segment Number
SPI	Security Parameters Information
SRC	Segment Retry Count
SRCL	Segment Retry Count Limit
SRL	Segment Range Limit
SSN	Starting Segment Number
SSRLPO	Segment Send Rate Limit Per Originator
STANAG	NATO Standard Agreement
T2AT	Type 2 Acknowledgment Timer
TAFRFTTCT	Time Allowed from Request for Transfer to Complete Timer
TBD	To Be Determined
TCP	Transmission Control Protocol
TDL	Tactical Data Link
TE	Test Edition
TIDP-TE	Technical Interface Design Plan-Test Edition
TOS	Type of Service
UDP	User Datagram Protocol
ULP	Upper Layer Protocols
UMF	User Message Format
URN	Unit Reference Number

USMTF	United States Message Text Format
VMF	Variable Message Format
WG	Working Group
WILCO	Will Comply
XML	eXtensible Markup Language
XOR	Exclusive OR

4 GENERAL REQUIREMENTS

4.1 Application layer users.

In the context of this MIL-STD, the user of the application layer is the application process that requires the communications services to effect information exchange (the transfer of digital data) between end systems.

4.2 Interoperability.

Interoperability of the application entity between end systems shall be achieved by implementing the application layer protocol (ALP) specified in this MIL-STD. This standard defines the minimum essential data communications parameters and protocol conventions that are necessary to support the handling and exchange of single messages or concatenated messages [a series of messages that are combined together in a single user data block for delivery to the same destination(s)] over subnetworks and point-to-point links.

4.3 Application layer services provided.

The ALP provides the following services to the application process in order to facilitate the reliable exchange and distribution of messages of data between end user systems:

a. Identification of intended communications partners.

b. Identification of privacy/security mechanisms required.

c. Passing of quality-of-service parameters (performance and non-performance parameters).

d. Synchronization of cooperating application processes.

e. Message handling (distribution, receipting, and monitoring).

f. Identification of constraints on data syntax (character sets, data structure).

g. Message or data transfer via connectionless operation.

h. Optional security services.

4.4 System standards and design.

The parameters and other requirements specified in this military standard are mandatory if the word shall is used in connection with the parameter value or requirement under consideration. Non-mandatory objectives are indicated in parentheses after a standardized parameter value or by the words should, can or may in connection with the parameter value or requirement under consideration. APPENDIX E also indicates whether specific parameters or other requirements are mandatory or optional. All users of this document will take into consideration all parts of the document before making decisions to define, procure or implement systems. In the event that there is an apparent conflict between the main volume and APPENDIX E, then one of the following actions shall be taken:

a. The “mandatory” option shall be selected over the “optional” one.

b. The matter should be referred to the Combat Network Radio Working Group (CNRWG) for adjudication.

This document contains numerous essential technical parameters in the form of mandatory and optional fields where in some situations the parent capability is optional but the value is mandatory if the optional field/group is specified present. Even though the child value is mandatory, it does not mean the parent capability is mandatory.

Example: The Version field is a mandatory field and valid data must be entered. In the case of the GPI for G3 (Information Address Group), it is mandatory that data must be entered in the GPI field. If GPI for G3 is specified “1” (Present), then it is mandatory that the appropriate data be specified in the GRI for R2. The fact that the GRI field is mandatory when the optional group G3 is specified present does not mean the GPI field must always be specified “1” (Present).

5 SPECIFIC REQUIREMENTS

5.1 Application layer.

This application layer provides the simplified message-handling protocol.

5.2 Application Protocol Data Unit (PDU).

The application PDU shall be composed of an application header and user data, as shown in FIGURE 1.

LSB	MSB	LSB	MSB
Application Header		User Data	

FIGURE 1. Application PDU structure

5.3 Application header.

The application header shall consist of the fields shown in TABLE I. The application header may contain two categories of fields, mandatory (M) and conditional (C). A conditional field is dependent upon the presence or absence of other fields. The order of fields shall follow that shown in TABLE I. The application header shall always be a multiple of 8 bits. If an application header is not a multiple of 8 bits, it shall be zero filled so that it becomes a multiple of 8 bits.

TABLE I. Application header

Field Name	CAT	Group Code	Repeat Code	Description/ Resolution	Maximum Field Size (bits)
VERSION	M			MIL-STD-2045-47001 VERSION NUMBER	4
FPI	M			COMPRESSION TYPE	1
DATA COMPRESSION TYPE					2
GPI	M			ORIGINATOR ADDRESS GROUP	1
FPI		G1			1
URN		G1			24
FPI		G1			1
UNIT NAME		G1			448
GPI	M			RECIPIENT ADDRESS GROUP (See 5.6.3.a)	1
GRI		G2	R1(N) 0<=N<=16		1
FPI		G2	R1		1
URN		G2	R1		24

TABLE I. Application header - Continued

Field Name	CAT	Group Code	Repeat Code	Description/ Resolution	Maximum Field Size (bits)
FPI		G2	R1		1
UNIT NAME		G2	R1		448
GPI	M			INFORMATION ADDRESS GROUP (See 5.6.3.a)	1
GRI		G3	R2(16 - N)		1
FPI		G3	R2		1
URN		G3	R2		24
FPI		G3	R2		1
UNIT NAME		G3	R2		448
FPI	M				1
HEADER SIZE					16
GPI	M			FUTURE USE 1	1
GROUP SIZE		G4			12
<Future information group(s) and/or field(s) will be present here>		G4			0 - 4095 (i.e., GROUP SIZE)
GPI	M			FUTURE USE 2	1
GROUP SIZE		G5			12
<Future information group(s) and/or field(s) will be present here>		G5			0 - 4095 (i.e., GROUP SIZE)
GPI	M			FUTURE USE 3	1
GROUP SIZE		G6			12
<Future information group(s) and/or field(s) will be present here>		G6			0 - 4095 (i.e., GROUP SIZE)
GPI	M			FUTURE USE 4	1
GROUP SIZE		G7			12
<Future information group(s) and/or field(s) will be present here>		G7			0 - 4095 (i.e., GROUP SIZE)
GPI	M			FUTURE USE 5	1
GROUP SIZE		G8			12

TABLE I. Application header - Continued

Field Name	CAT	Group Code	Repeat Code	Description/ Resolution	Maximum Field Size (bits)
<Future information group(s) and/or field(s) will be present here>		G8			0 - 4095 (i.e., GROUP SIZE)
GRI	M		R3(16)	MESSAGE HANDLING GROUP	1
UMF	M		R3		4
FPI	M		R3		1
MESSAGE STANDARD VERSION			R3		4
GPI	M		R3	VMF MESSAGE IDENTIFICATION GROUP	1
FAD		G9	R3		4
MESSAGE NUMBER		G9	R3		7
FPI		G9	R3		1
MESSAGE SUBTYPE		G9	R3		7
FPI	M		R3		1
FILE NAME			R3		448
FPI	M		R3		1
MESSAGE SIZE			R3		20
OPERATION INDICATOR	M		R3		2
RETRANSMIT INDICATOR	M		R3		1
MESSAGE PRECEDENCE CODE	M		R3		3
SECURITY CLASSIFICATION	M		R3		2
FPI	M		R3		1
FRI			R3/R4(16)		1
CONTROL/RELEASE MARKING			R3/R4		9
GPI	M		R3	ORIGINATOR DTG	1
YEAR		G10	R3		7
MONTH		G10	R3		4
DAY		G10	R3		5
HOUR		G10	R3		5
MINUTE		G10	R3		6

TABLE I. Application header - Continued

Field Name	CAT	Group Code	Repeat Code	Description/ Resolution	Maximum Field Size (bits)
SECOND		G10	R3		6
FPI		G10	R3	DTG EXTENSION	1
DTG EXTENSION		G10	R3		12
GPI	M		R3	PERISHABILITY DTG	1
YEAR		G11	R3		7
MONTH		G11	R3		4
DAY		G11	R3		5
HOUR		G11	R3		5
MINUTE		G11	R3		6
SECOND		G11	R3		6
GPI	M		R3	ACKNOWLEDGMENT REQUEST GROUP	1
MACHINE ACKNOWLEDGE REQUEST INDICATOR		G12	R3		1
OPERATOR ACKNOWLEDGE REQUEST INDICATOR		G12	R3		1
OPERATOR REPLY REQUEST INDICATOR		G12	R3		1
GPI	M		R3	RESPONSE DATA GROUP	1
YEAR		G13	R3	DTG OF MESSAGE BEING ACKNOWLEDGED	7
MONTH		G13	R3		4
DAY		G13	R3		5
HOUR		G13	R3		5
MINUTE		G13	R3		6
SECOND		G13	R3		6
FPI		G13	R3	DTG EXTENSION	1
DTG EXTENSION		G13	R3		12
R/C		G13	R3	RESPONSE TO ACKNOWLEDGE REQUEST	3

TABLE I. Application header - Continued

Field Name	CAT	Group Code	Repeat Code	Description/ Resolution	Maximum Field Size (bits)
FPI		G13	R3		1
CANTCO REASON CODE		G13	R3		3
FPI		G13	R3		1
CANTPRO REASON CODE		G13	R3		6
FPI		G13	R3		1
REPLY AMPLIFICATION		G13	R3		350
GPI	M		R3	REFERENCE MESSAGE DATA GROUP	1
GRI		G14	R3/R5(4)		1
FPI		G14	R3/R5		1
URN		G14	R3/R5		24
FPI		G14	R3/R5		1
UNIT NAME		G14	R3/R5		448
YEAR		G14	R3/R5		7
MONTH		G14	R3/R5		4
DAY		G14	R3/R5		5
HOUR		G14	R3/R5		5
MINUTE		G14	R3/R5		6
SECOND		G14	R3/R5		6
FPI		G14	R3/R5	DTG EXTENSION	1
DTG EXTENSION		G14	R3/R5		12
GPI	M		R3	FUTURE USE 6	1
GROUP SIZE		G15	R3		12
<Future information group(s) and/or field(s) will be present here>		G15			0 - 4095 (i.e., GROUP SIZE)
GPI	M		R3	FUTURE USE 7	1
GROUP SIZE		G16	R3		12
<Future information group(s) and/or field(s) will be present here>		G16			0 - 4095 (i.e., GROUP SIZE)
GPI	M		R3	FUTURE USE 8	1

TABLE I. Application header - Continued

Field Name	CAT	Group Code	Repeat Code	Description/ Resolution	Maximum Field Size (bits)
GROUP SIZE		G17	R3		12
<Future information group(s) and/or field(s) will be present here>		G17			0 - 4095 (i.e., GROUP SIZE)
GPI	M		R3	FUTURE USE 9	1
GROUP SIZE		G18	R3		12
<Future information group(s) and/or field(s) will be present here>		G18			0 - 4095 (i.e., GROUP SIZE)
GPI	M		R3	FUTURE USE 10	1
GROUP SIZE		G19	R3		12
<Future information group(s) and/or field(s) will be present here>		G19			0 - 4095 (i.e., GROUP SIZE)
GPI	M		R3	MESSAGE SECURITY GROUP	1
SECURITY PARAMETERS INFORMATION		G20	R3		4
GPI		G20	R3	KEYING MATERIAL GROUP	1
KEYING MATERIAL ID LENGTH		G20/ G21	R3		3
KEYING MATERIAL ID		G20/ G21	R3		64
GPI		G20	R3	CRYPTOGRAPHIC INITIALIZATION GROUP	1
CRYPTOGRAPHIC INITIALIZATION LENGTH		G20/ G22	R3		4
CRYPTOGRAPHIC INITIALIZATION		G20/ G22	R3		1024
GPI		G20	R3	KEY TOKEN GROUP	1
KEY TOKEN LENGTH		G20/ G23	R3		8
FRI		G20/ G23	R3/R6(17)		1
KEY TOKEN		G20/ G23	R3/R6		16384
GPI		G20	R3	AUTHENTICATION (A) GROUP	1
AUTHENTICATION DATA (A) LENGTH		G20/ G24	R3		7

TABLE I. Application header - Continued

Field Name	CAT	Group Code	Repeat Code	Description/ Resolution	Maximum Field Size (bits)
AUTHENTICATION DATA (A)		G20/ G24	R3	DIGITAL SIGNATURE	8192
GPI		G20	R3	AUTHENTICATION (B) GROUP	1
AUTHENTICATION DATA (B) LENGTH		G20/ G25	R3		7
AUTHENTICATION DATA (B)		G20/ G25	R3	DIGITAL SIGNATURE	8192
SIGNED ACKNOWLEDGE REQUEST INDICATOR		G20	R3		1
GPI		G20	R3	MESSAGE SECURITY PADDING GROUP	1
MESSAGE SECURITY PADDING LENGTH		G20/ G26	R3		8
FPI		G20/ G26	R3		1
MESSAGE SECURITY PADDING		G20/ G26	R3		2040
GPI	M			FUTURE USE 11	1
GROUP SIZE		G27			12
<Future information group(s) and/or field(s) will be present here>		G27			0 - 4095 (i.e., GROUP SIZE)
GPI	M			FUTURE USE 12	1
GROUP SIZE		G28			12
<Future information group(s) and/or field(s) will be present here>		G28			0 - 4095 (i.e., GROUP SIZE)
GPI	M			FUTURE USE 13	1
GROUP SIZE		G29			12
<Future information group(s) and/or field(s) will be present here>		G29			0 - 4095 (i.e., GROUP SIZE)
GPI	M			FUTURE USE 14	1
GROUP SIZE		G30			12
<Future information group(s) and/or field(s) will be present here>		G30			0 - 4095 (i.e., GROUP SIZE)
GPI	M			FUTURE USE 15	1

TABLE I. Application header - Continued

Field Name	CAT	Group Code	Repeat Code	Description/ Resolution	Maximum Field Size (bits)
GROUP SIZE		G31			12
<Future information group(s) and/or field(s) will be present here>		G31			0 - 4095 (i.e., GROUP SIZE)

5.4 Application header formatting.
The application header shall use a variable format syntax and format structure. The syntax and formatting procedures are defined below.

5.5 Syntax.
The application header consists of an ordered collection of bits (ones and zeros). A group is a combination of two or more related fields designated as a group. There are two types of groups, “G” groups and “R” groups. A “G” group is a combination of related fields. An “R” group is a repeatable combination of related fields. Presence and recurrence indicators as defined below shall be allowed in groups. The following syntax fields shall be used in the selection of fields to be transmitted:

a. Field Presence Indicators (FPIs). An FPI is a one-bit field used to indicate the presence or absence of the following field.

b. Field Recurrence Indicators (FRIs). An FRI is a one-bit field used to indicate the repeatability of a field.

c. Group Presence Indicators (GPIs). A GPI is a one-bit field used to indicate the presence or absence of the following group.

d. Group Recurrence Indicators (GRIs). A GRI is a one-bit field used to indicate the repeatability of a group.

5.5.1 Field Presence Indicator (FPI).
The FPIs are used to indicate the presence (FPI = 1) or absence (FPI = 0) of the following field and are not used for mandatory fields or single bit fields. These indicators are transparent to the user, allowing the user to send only those fields containing information when use of those fields is not mandatory.

5.5.2 Field Recurrence Indicator (FRI).
Fields may be designated as repeatable through a 1-bit FRI. If a field is preceded by an FPI, FPI = 1 shall precede the first occurrence of the FRI and is not present for following repetitions. If the FPI = 0, neither the FRI nor the field is present in the application header. An FRI = 1 indicates the recurrence of the field after this iteration. An FRI = 0 indicates the field will not occur after this iteration.

5.5.3 Group Presence Indicator (GPI).
A group is a combination of related fields. FPIs, FRIs, GPIs, and GRIs shall be allowed in groups. If a group is preceded by a GPI, then the GPI indicates the presence (GPI = 1) or absence (GPI = 0) of the group.

5.5.4 Group Recurrence Indicator (GRI).
An “R” group is repeatable and shall be preceded by a GRI. A “G” group is not repeatable and shall not be preceded by a GRI. If an “R” group is preceded by a GPI, GPI = 1 shall precede the first occurrence of the GRI

and is not present for following repetitions. If the GPI = 0, neither the GRI nor the group is present in the application header. A GRI = 1 indicates the recurrence of the group after this iteration. A GRI = 0 indicates the group will not occur after this iteration.

5.5.5 End-of-literal field marker.

The end-of-literal field marker, a 7-bit ANSI ASCII DELETE character (1111111), is used to indicate the end of free-text, character-oriented, literal fields only. The maximum literal field size is specified for each such field in TABLE I. Either the end-of-literal field marker or the field maximum length shall signify the end of a text field. The application header processing software shall be capable of recognizing both conditions.

5.5.6 Data-field construction procedures.

The following construction procedures prescribe the sequence in which the application header fields are linearly joined before passing data to the next lower protocol layer. The header is constructed with elemental data fields ordered as specified in this standard. The data elements for the application header are as specified in this standard. There are two representations for data elements: 7-bit ANSI ASCII characters and binary numbers. All fields shall be joined least significant bit (LSB) first. The LSB of the first data field or field/group indicator shall be LSB-justified within the first byte of the message buffer. The LSB of each successive data field shall be concatenated to the most significant bit (MSB) of the preceding data field. The characters in a literal field are joined such that the LSB of the first character immediately follows the MSB of the previous field. The LSB of the second character immediately follows the MSB of the first character. This pattern is repeated until all characters of the field are joined. FIGURE 2 uses the first few fields of the application header (from TABLE I) as an example of the data field bit order. An example of a complete application header is provided in APPENDIX B. Bit No. 1 of FIGURE 2 maps to the LSB of the application header shown in FIGURE 1. FIGURE 2 is interpreted as follows:

BIT NO.	FIELD NAME	VALUE/CODE	MEANING
1 - 4	Version	4	MIL-STD-2045-47001D w/CHANGE 1
5	FPI for Data Compression	0	NOT PRESENT
6	GPI for Originator Address Group	0	NOT PRESENT
7	GPI for Recipient Address Group	0	NOT PRESENT
8	GPI for Information Address Group	0	NOT PRESENT
9	FPI for Header Size	0	NOT PRESENT
10	GPI for Future Use 1	0	NOT PRESENT
11	GPI for Future Use 2	0	NOT PRESENT
12	GPI for Future Use 3	0	NOT PRESENT
13	GPI for Future Use 4	0	NOT PRESENT
14	GPI for Future Use 5	0	NOT PRESENT
15	GRI for Message Handling Group	0	NOT REPEATABLE
16 - 19	UMF	2	VMF K-Series
20	FPI for Message Standard Version	0	NOT PRESENT
21	GPI for VMF Message Identification Group	1	PRESENT
22 - 25	FAD	1	GENERAL INFORMATION EXCHANGE
…	…	…	…

	OCTET 1								OCTET 2								OCTET 3								
	2^0	...	...	...	...	...	...	2^7	2^0	...	...	...	...	...	...	2^7	2^0	...	...	...	...	...	...	2^7	2^0
	L S B			M S B												L S B			M S B			L S B			M S B
Field	Version				FPI	GPI	GPI	GPI	FPI	GPI	GPI	GPI	GPI	GPI	GRI	UMF				FPI	GPI	FAD			
Value	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0

FIGURE 2. Application protocol data field bit order (example)

5.5.6.1 ASCII data element.
In a data element composed of a string of 7-bit ANSI ASCII characters, the left most character shall be stored in memory first.

5.5.6.2 Binary data element.
In a data element composed of a binary code, it shall be interpreted as a single data field.

5.5.6.3 Header format notations.
The header format is depicted in TABLE I; the notations used to describe the header format are as follows:

a. Category. The category shall display an "M" for those fields that are mandatory. All other fields are conditional.

b. Group Code. The group codes in TABLE I represent a logical grouping of information that is implemented as a "G" group. "G" groups within a header will be notated as GN where N indicates that numbered grouping (i.e., G1 indicates the first "G" group within the header, etc.). Nested groups are indicated by "GN/GN" notation where the left-most group is the highest level of the nesting and the right-most group is the current, lowest level.

c. Repeat codes. The repeat codes in TABLE I denote group appearance, nesting of groups, and maximum repetitions. The following notations are used:

(1) R - Indicates this field is repeatable.

(2) RN - Indicates this field is part of a group that can be repeated, with N specifying the group number (that is, R1 indicates the first repeatable group in the message).

(3) (N) - Appears with the first field of a repeatable group, that is, R3(16), and indicates the maximum number of appearances of the group in the message. The example, R3(16), indicates the third repeatable group of the message that can appear a maximum of sixteen times.

(4) RN/RN - Indicates nested repeating groups. Example R3/R4 R4 is nested in R3.

5.5.6.4 Future Use Groups.
The Future Use Groups were designed to take into consideration future Application Header expansion while retaining backward compatibility between various MIL-STD-2045-47001 versions. The premise is that once all systems have implemented version D and greater, no new fields shall be added outside these Future Use Groups.

a. These groups shall be specified "0" (Not Present) for MIL-STD-2045-47001D w/CHANGE 1. Refer to paragraph 5.7.2.1.9, Case 9.

b. A Future Use Group structures shall contain a mandatory Group Size field as its first field. Including the Group Size field will allow implementation of versions D and D w/CHANGE 1 to count out and ignore the appropriate number of bits and then resume reading the header, i.e. system A with version D implemented, receives a version E application header from system B. The Group Size field is a mandatory 12-bit field indicating the size, in bits, of the group including all of the fields inside this group except the Group Size field.

c. As additional groups are added within a primary future "nested" use group, a nested group numbering scheme shall be used. The following is an example: G4 [Future Use 1], G4.1 [Nested Future Use group 4.1], G4.2 [Nested Future Use group 4.2].

d. Version field and Future Use Groups relationships.

(1) Version D w/CHANGE 1. If the Version field is specified "3" (MIL-STD-2045-47001D) or "4" (MIL-STD-2045-47001D w/CHANGE 1), then all the Future Use Groups are specified "0" (Not Present).

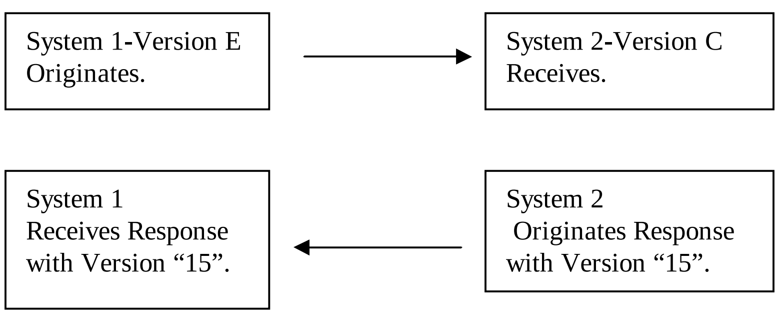
(2) Post Version D w/CHANGE 1. If the Version field is specified "5" through "14" (post version D w/CHANGE 1 versions of MIL-STD-2045-47001), then Future Use Groups may be specified "1" (Present) depending upon existence of new fields in those individual groups.

e. Examples of Future Use Groups structures are contained in APPENDIX B.

f. Originating system to receiving system relationships.

FIGURE 3 provides a graphical representation of two situations. In Situation I, a system implementing version D or later sends a message to a system implementing version C or earlier. In this case, the receiving system shall respond with a MIL-STD-2045-47001 Response with the Version field specifying "15" (Version Sent Not Implemented). In Situation II, a system implementing version D or later sends a message to the system implementing version D or later. In this case, the receiving system shall process the received message in accordance with paragraph 5.5.6.4.

Situation I – A Version E System Transmits to a Version C System



Situation II – A Version E System Transmits to a Version D System

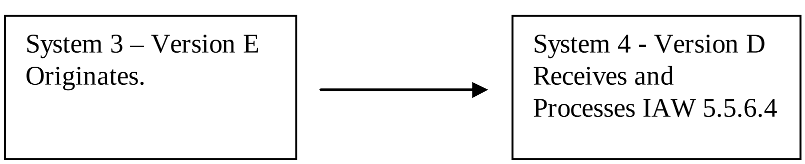


FIGURE 3. System compatibility relationship examples

5.6 Application header fields.

5.6.1 Version.
This field shall be a 4-bit binary codeword representing the version of the MIL-STD-2045-47001 header being used for the message. TABLE II lists the MIL-STD-2045-47001 revision indicated by the Version code. The version code 15 shall be used in a response to indicate that the receiving system does not implement the MIL-STD-2045-47001 version originally sent. Only the Version field, data compression type FPI, originator address group and recipient address group shall be required in this case. If a system receives a version not implemented and is not backward compatible then it shall reply with bit code "15" (Version Sent Not Implemented). If a system implementing versions "D" and above receives a bit code representing an "Undefined" value (identifying a future version of MIL-STD-2045-47001), then the system shall process in accordance with paragraph 5.5.6.4.

TABLE II. Version codes

Code MSB - LSB	**MIL-STD-2045-47001 Revision**
0000 (0)	MIL-STD-2045-47001
0001 (1)	MIL-STD-2045-47001B
0010 (2)	MIL-STD-2045-47001C
0011 (3)	MIL-STD-2045-47001D
0100 (4)	MIL-STD-2045-47001D w/CHANGE 1
0101-1110 (5-14)	Undefined
1111 (15)	Version Sent Not Implemented

5.6.2 Data compression type.
The absence of this field signifies that data compression is not used. When present, this field shall be a 2-bit binary codeword representing whether the message or messages contained in the User Data portion of the Application PDU have been Unix compressed using compress/uncompress (LZW algorithm) or compressed using GZIP (LZ-77 algorithm). TABLE III lists the Data Compression indicated by the Data Compression Type. When any type of optional data compression is indicated and multiple messages are present in the User Data portion of the Application PDU, all messages shall be compressed and each message shall be compressed independently of the other messages.

TABLE III. Data compression type codes

Code MSB-LSB	**Compression**	**Reference Compression Algorithm**
00 (0)	Unix compress/uncompress	Lempel-Ziv-Welch Compression Algorithm, Welch 1984
01 (1)	GZIP	RFC 1951 and RFC 1952 (Lempel-Ziv Compression Algorithm, Lempel-Ziv 1977)
10-11 (2-3)	Undefined	

5.6.3 Originator, recipient, and information addressee fields.
These fields shall contain addresses that represent the names of the originating and receiving person(s) or process(es). The receiving application layer shall use the recipient and information fields to determine how the message shall be handled or delivered after the decoding process. The value in these fields depends on the person or process receiving the message. If a person is to be designated, the fields shall uniquely identify the individual so that the message may be routed to a specific mailbox or terminal. If a process is to be designated, these fields shall uniquely identify the process. The process shall be associated with an end system to define the address uniquely. The following requirements apply to recipient and information addressee fields:

a. The recipient and information addressee fields shall be extendible to a combined total of 16 addressees.

b. When the recipient address is not present (GPI = 0) and the information address group is not present (GPI = 0), the message shall be broadcast in accordance with lower layer broadcast rules.

c. Message Concatenation. For additional information see paragraph 5.7.2.5.6.

5.6.3.1 Unit Reference Number (URN) field.
This field shall be a 24-bit binary code used to uniquely identify friendly military units, broadcast networks and multicast groups. URN 16777215 identifies a broadcast and would be used to send a message to the local subnetwork without routing (e.g., radio subnetwork, data link address of 127, IP broadcast without routing, or Local Area Network subnetwork broadcast without routing). The Broadcast URN shall not be acknowledged. A URN that identifies a multicast group would represent a sometimes large group of users, typically organized by echelon. The applicable codes for this field are specified in the MIL-STD-6017. The URN field and the Unit Name field are mutually exclusive fields (one or the other, not both).

5.6.3.2 Unit Name field.
This field shall be a variable size field up to a maximum of 448 bits. It shall be in a character-coded format and used to uniquely identify a friendly military individual, unit, broadcast group or multicast group. This field is divided into 64 groups of 7 bits each representing an ANSI ASCII character. Special characters are legal. ANSI ASCII Delete (1111111) shall be used as an end-of-text marker if the field is not at the maximum length. The Broadcast URN (16777215) shall have the corresponding unit name of Broadcast URN. The URN field and the Unit Name field are mutually exclusive fields (one or the other, not both).

5.6.4 User Message Format (UMF) field.
This field shall be a 4-bit binary codeword representing the message formats shown in TABLE IV. This field indicates the format of the message that is contained in the user data field and has association with the other message format-dependent fields, including, Functional Area Designator (FAD) (see 5.6.5), Message Number (see 5.6.6), Message Subtype (see 5.6.7), CANTCO Reason, (see 5.6.23), and CANTPRO Reason (see 5.6.24). The

applicable codes for these fields are associated with the corresponding UMF in appendices to this document as shown in TABLE IV.

TABLE IV. UMF codes

Type of Message Format	**Code** MSB - LSB	**Message Format-Dependent Field/Code Reference**
Link 16 (J-series message)	0000 (0)	MIL-STD-6016
Binary File	0001 (1)	5.6.4.1
Variable Message Format (VMF) (K-series message)	0010 (2)	APPENDIX A
National Imagery Transmission Format System (NITFS)	0011 (3)	5.6.4.7
Redistributed Message (RDM)	0100 (4)	5.6.4.2
United States Message Text Format (USMTF)	0101 (5)	5.6.4.3
(DOI-103)	0110 (6)	5.6.4.4
eXtensible Markup Language (XML) - Message Text Format (MTF)	0111 (7)	5.6.4.5
eXtensible Markup Language (XML) - Variable Message Format (VMF)	1000 (8)	5.6.4.6
Undefined	1001 – 1111 (9 - 15)	TBD

5.6.4.1 Binary file.
The transfer of a binary file or data block is indicated by setting the UMF field to “1” (0001). The block of data being transferred is a “logical binary file” whose format and content is not dictated by the file system or specific software application resident in the interfacing host processors. The binary file data is placed in the User Data portion of the application PDU. The file name is indicated in the File Name field (see 5.6.8) and the file size is indicated in the Message Size field (see 5.6.9). Except as indicated below, all other fields in the Message Handling Repeatable Group (R3) are used as defined in APPENDIX A. For file transfers, the GPI for the VMF Message Identification Group (G9) shall be set to 0.

5.6.4.2 Redistributed message.
Redistributed Messages shall be indicated by a UMF field of ‘4’ (0100). Redistributed Messages in MIL-STD-2045-47001 function similarly to forwarding an e-mail message. When a station receives a message, it may determine that the message should be forwarded to one or more other recipients. This determination could be automatic (i.e. all messages from Address X will be automatically forwarded to Address Y), or may be the result of operator action (i.e. the operator feels another unit should have the information contained in the message and manually forwards the message). Regardless, the mechanism for determining which messages should be forwarded is beyond the scope of this document, and should be determined by specific platform requirements.

A Redistributed Message shall consist of two components: the Original Message and the Redistribution Header. When a station forwards a message, the Original Message (the entire Application PDU, i.e. the Application Header plus the User Data) shall be placed in the User Data portion of the Redistributed Message. The Application Header and User Data of the Original Message shall not be modified. The Redistribution Header shall contain the address of the station performing the message forwarding as the Originator Address, shall set the UMF field to Redistributed Message, and can specify each destination as either a recipient or information only copy. The Redistribution Header shall use the same Operation Indicator, Security Classification, and Control/Release Marking that were contained in the Original Message Application Header.

When a station receives a message containing a UMF field indicating a Redistributed Message, it shall process the Redistribution Header accordingly and then continue to process the Original Message. The destination shall process the Original Message even though it is not specified in the destination address list of the Original Message. The destination shall respond to any actions required by the Acknowledgment Request Group (G12) indicated in the Redistribution Header. However, the destination shall not respond to any actions required by the Acknowledgment Request Group (G12) indicated in the Application Header of the Original Message.

If the optional Redistributed Message capability is implemented in a system, there shall be a mechanism for the Application Layer to process both the Redistribution Header and the Original Message Application Header, and to indicate that the received message was redistributed.

Except as indicated below, all other fields in the Message handling Repeatable Group (R3) are used as defined in APPENDIX A. For Redistributed Messages, the GPI for the VMF Message Identification Group (G9) shall be set to 0.

5.6.4.3 USMTF messages.

The format of USMTF messages is defined in MIL-STD-6040. The transfer of a USMTF file or data block is indicated by setting the code field to “5” (0101). The block of data being transferred is in USMTF format whose content is not dictated by the file system or software application resident in the interfacing host processors. For UMFs of this type the GPI for the VMF Message Identification Group (G9) shall be set to 0.

5.6.4.4 DOI-103 messages.

The transfer of a DOI-103 file or data block is indicated by setting the code field to “6” (0110). The block of data being transferred is in USMTF format whose content is not dictated by the file system or software application resident in the interfacing host processors. For UMFs of this type the GPI for the Message Identification Group (G9) shall be set to 0.

5.6.4.5 XML-MTF.

The format of XML-MTF messages is defined in MIL-STD-6040, Annex A. The Transfer of an XML-MTF file or data block is indicated by setting the code field to binary "7" (0111). The block of data being transferred is in XML-MTF format whose content is not dictated by the file system or software application resident in the interfacing host processors. For UMF of this type the GPI for VMF Message Identification Group (G9) shall be set to 0 (Not Present).

5.6.4.6 XML-VMF.

The format of XML-VMF messages is defined in MIL-STD-6017, Appendix F. The Transfer of an XML-VMF file or data block is indicated by setting the code field to binary "8" (1000). The block of data being transferred is in XML-VMF format whose content is not dictated by the file system or software application resident in the interfacing host processors. For UMF of this type the GPI for VMF Message Identification Group (G9) shall be set to 1 (Present).

5.6.4.7 NITFS.
The format of NITFS image transfers are defined in MIL-STD-2500B, Notice 2 and STANAG 4545, Edition 1. The transfer of a NITFS image is indicated by setting the code field to binary "3" (0011). Each file transferred shall comply with the National Imagery Transmission Format Standard (NITFS) 2.1 Tactical Profile. The NITFS is a group of standards specifying the format, compression, and communication of image files and amplifying information such as text, graphics, and location. The NITF is the primary document within the standard that specifies the file format, and is designated as US DOD Interface Standard, MIL-STD-2500. The NITF establishes the requirements for the file format component of the NITFS, provides a detailed description of the standard file format structure, and specifies the valid data content and format for all fields defined within an NITF file. The NATO Secondary Imagery Format (NSIF) Version 1.0, referenced as STANAG 4545, Edition 1 is the NATO equivalent to the NITF 2.1, therefore, any reference to NITF implies NSIF.

5.6.4.8 Message Standard Version.
This field shall be a 4-bit binary codeword (0 - 15) representing the message standard. This field indicates the version of the message standard that is contained in the user data field and has association with the UMF field. For those standards that do not support baseline implementation by the year, will be denoted by the Revision/Reissue. For the VMF and XML-VMF bit codes 11 through 15 are reserved for those situations outside the current numbering scheme. The message standard versions for the supported UMF codes are shown in TABLE V.

TABLE V. Message Standard Version based on UMF codes

MSG STD Ver Bit Code	**Link 16 (MIL-STD-6016) [0]**	**Binary File [1]**	**VMF [2]**	**NITFS MIL-STD-2500 [3]**	**RDM [4]**	**USMTF (MIL-STD-6040) [5]**	**DOI-103 [6]**	**XML-MTF [7]**	**XML-VMF [8]**
0	6016	Illegal	TIDP-TE R2	2500B Notice 2	Illegal	1993	Undef	Undef	Undef
1	6016A	Illegal	TIDP-TE R3	Undef	Illegal	1995	Undef	Undef	Undef
2	6016B	Illegal	TIDP-TE R4	Undef	Illegal	1997	Undef	Undef	Undef
3	6016C	Illegal	TIDP-TE R5	Undef	Illegal	1998	Undef	Undef	TIDP-TE R5
4	6016D	Illegal	TIDP-FTE R6	Undef	Illegal	1999	Undef	Undef	TIDP-FTE R6
5	6016E	Illegal	6017	Undef	Illegal	2000	Undef	Undef	6017
6	6016F	Illegal	6017A	Undef	Illegal	2001	Undef	2001	6017A
7	6016G	Illegal	6017B	Undef	Illegal	2002	Undef	2002	6017B
8	6016H	Illegal	6017C	Undef	Illegal	2003	Undef	2003	6017C
9	6016I	Illegal	6017D	Undef	Illegal	2004	Undef	2004	6017D
10	6016J	Illegal	6017E	Undef	Illegal	2005	Undef	2005	6017E
11	6016K	Illegal	Reserved	Undef	Illegal	2006	Undef	2006	Reserved
12	6016L	Illegal	Reserved	Undef	Illegal	2007	Undef	2007	Reserved
13	6016M	Illegal	Reserved	Undef	Illegal	2008	Undef	2008	Reserved
14	6016N	Illegal	Reserved	Undef	Illegal	2009	Undef	2009	Reserved
15	6016O	Illegal	Reserved	Undef	Illegal	2010	Undef	2010	Reserved

5.6.5 Functional Area Designator (FAD) field.
This field shall contain a 4-bit binary codeword that identifies the functional area of a specific VMF message using codewords. The FAD combined with the Message Number field is used to define the applicable VMF message. The applicable codes for this field are specified in APPENDIX A as referenced TABLE A-I.

5.6.6 Message Number field.
This field shall contain a 7-bit binary codeword that represents the number that identifies a specific VMF message within a functional area (see 5.6.5). The Message Number value shall range from 1 to 127, bit code 0 is illegal.

5.6.7 Message Subtype field.
This field shall contain a 7-bit binary codeword that represents the number that identifies a specific case (see A.3.4) within a VMF message. The case depends on the setting of the UMF field (see 5.6.4), Functional Area Designator field (see 5.6.5) and Message Number field (see 5.6.6) as is specified in APPENDIX A as referenced in TABLE IV and TABLE A-II.

5.6.8 File Name.
The File Name field shall be a character coded, variable length field of up to 64 7-bit ANSI ASCII characters (448 bits). It indicates the name of the computer file or data block contained in the User Data portion of the application PDU. The last four characters of the field may consist of a period followed by a three-character ending, indicative of the file type (e.g., .txt, .doc, .exe, .bin). Special characters are legal. ANSI ASCII Delete (1111111) shall be used as an end-of-text marker if the field is not at the maximum length.

5.6.9 Message Size field.
This field shall contain a 20-bit binary number indicating the size, in bytes, of the associated message. Within the user data, a message which is not a multiple of 8 bits, shall be zero-filled so that it becomes a multiple of 8 bits. When optional message compression is used, the message size field shall reflect the size of the message after it has been compressed. This field is required when there is more than one occurrence of the Message Handling Group (R3 in TABLE I) or, when there is a single occurrence of the Message Handling Group and a streaming/undelimited transport (such as TCP) is being used, but not when a delimited transport (such as UDP and S/R) is being used. If the transport protocol is unknown, a streaming/undelimited transport should be assumed when determining whether the message size field is required.

5.6.10 Operation Indicator field.
This field shall be a 2-bit binary codeword, as shown in TABLE VI, indicating the operational function of the message used in support of an operation, exercise, simulation or test.

TABLE VI. Operation Indicator codes

Operation Indicator	**Code** MSB - LSB	**Explanation**
Operation	00 (0)	A military action or the carrying out of a strategic tactical, service, training, or administrative military mission; the process of carrying on combat, including movement, supply, attack, defense and maneuvers needed to gain the objectives of any battle or campaign. (JP 1-02)
Exercise	01 (1)	A military maneuver or simulated wartime operation involving planning preparation, and execution. It is carried out for the purpose of training and evaluation. It may be a combined, joint, or single-Service exercise, depending on participating organizations. (JP 1-02)
Simulation	10 (2)	Bogus message(s) initiated from simulated video, computer-generated or other input such as a scenario generator for training purposes.
Test	11 (3)	Message(s) inserted for the purpose of validating connectivity and interoperability of communications components and Command, Control, Communications, Computers and Intelligence (C4I) system(s).

5.6.11 Retransmit Indicator field.
This shall be a one-bit field indicating whether a message is a retransmission. This field set to 1 shall affirm that the message is a retransmission. This field set to 0 shall indicate that the message is not a retransmission.

5.6.12 Message Precedence field.
This field shall be a 3-bit binary codeword indicating the relative precedence of a message as shown in TABLE VII.

TABLE VII. Message Precedence codes

Precedence	**Code** MSB - LSB	**Explanation**
Reserved	110-111 (6 – 7)	
CRITIC/ECP	101 (5)	Used for (1)the NCA and certain designated commanders of Unified and Specified Commands, and then only for certain designated emergency action command and control messages and (2) for certain designated units that use the DOI-103 message format to communicate with National Command Level and then only for certain messages satisfying CRITIC criteria. These messages shall be processed ahead of all other application data and interrupt lower precedence traffic.

TABLE VII. Message Precedence codes

Precedence	Code MSB - LSB	Explanation
Flash Override	100 (4)	Used for messages of higher precedence than Flash but lower than CRITIC/ECP.
Flash	011 (3)	Used for initial enemy contact messages or operational combat messages of extreme urgency.
Immediate	010 (2)	Used for messages relating to situations that gravely affect the security of national/allied forces or populace and that require immediate delivery to the addressee(s).
Priority	001 (1)	Used for messages that require expeditious action by the addressee(s) and/or furnishes essential information for the conduct of operations in progress when routine precedence will not suffice.
Routine	000 (0)	Used for all types of messages that justify transmission by rapid means unless of sufficient urgency to require a higher precedence.

5.6.13 Security Classification field.
This field shall be a 2-bit codeword indicating the security classification of the message as shown in TABLE VIII.

5.6.14 Control and Release Marking field.
This optional repeatable 9 bit field is intended to support the exchange of a list of up to 16 country codes (refer to MIL-STD-6017, DFI/DUI 4127/005, Nationality, Data Items) with which the message may be released. This field may be repeated up to 16 times in conjunction with its associated FRI.

TABLE VIII. Security Classification codes

Classification	Code MSB - LSB
Unclassified	00 (0)
Confidential	01 (1)
Secret	10 (2)
Top secret	11 (3)

5.6.15 Originator Date-Time Group (DTG).
These fields shall contain date and time information indicating the time, expressed in Zulu (Universal Time Coordinate) Time, that the message was prepared. This group combination shall be 33 bits long and shall contain data fields representing the year, month, day, hour, minute, and seconds of the message. Coding for each data field shall be as shown in TABLE IX.

If the SECOND field specifies "63" (NO STATEMENT), the receiving system shall process this value as "0" seconds.

TABLE IX. DTG codes

Element	# Bits	Data Items	Code (MSB LSB)
Year	7		(0000000 – 1111111)
		2000 through 2094	0 through 94
		1995 through 1999	95 through 99
		Undefined	100 through 127
Month	4		(0000 – 1111)
		Illegal	0
		January	1
		February	2
		March	3
		April	4
		May	5
		June	6
		July	7
		August	8
		September	9
		October	10
		November	11
		December	12
		Illegal	13 through 15

TABLE IX. DTG codes Continued

Day	5	 Illegal 1 through 31	(00000 – 11111) 0 1 through 31
Hour (24 hour clock)	5	 0 through 23 Illegal	(00000 – 11111) 0 through 23 24 through 31
Minute	6	 0 through 59 Illegal	(000000 – 111111) 0 through 59 60 through 63
Second	6	 0 through 59 Illegal No Statement	(000000 – 111111) 0 through 59 60 through 62 63

5.6.16 DTG Extension field.
This field shall be a 12-bit binary field containing a value that uniquely identifies each message. This field is mandatory if more than one message is sent with the same Originator DTG.

5.6.17 Time Perishability DTG.
The fields in this group provide the latest time the message is still of value. These fields shall be encoded as specified in 5.6.15.

5.6.18 Machine Acknowledge Request Indicator field.
This field shall be a 1-bit binary codeword indicating whether the originator of a message requires a machine acknowledge for the message. This field set to 1 shall affirm that a machine acknowledgment is required. This field set to 0 shall indicate that a machine acknowledgment is not required.

5.6.19 Operator Acknowledge Request Indicator field.
This field shall be a 1-bit binary codeword indicating whether the originator of a message requires an operator acknowledgment for the message from the recipient. This field set to 1 shall affirm that an operator acknowledgment from the recipient is required. This field set to 0 shall indicate that an operator acknowledgement is not required.

5.6.20 Operator Reply Request Indicator field.
This field shall be a 1-bit binary codeword indicating whether the originator of a message requires an operator reply to the message. This field set to 1 shall affirm that an operator reply to the message is required. This field set to 0 shall indicate that an operator reply is not required.

5.6.21 Message Acknowledgment DTG.
The fields in this group provide the date and time of the original message that is being acknowledged. These fields shall be encoded as specified in 5.6.15.

5.6.22 Receipt/Compliance (R/C) field.
This field shall be a 3-bit binary codeword representing the R/C codes shown in TABLE X.

TABLE X. R/C codes

Type of R/C	Code MSB - LSB	Used by	Explanation
Undefined	000 (0)		
Machine Receipt [MR]	001 (1)	Recipient	Automatically generated in response to a machine acknowledge request from the originator to indicate that the original message can be successfully processed at the ultimate destination.
Cannot Process [CANTPRO]	010 (2)	Recipient	Automatically generated to indicate that an original message cannot be successfully processed at the ultimate destination.
Operator Acknowledge [OPRACK]	011 (3)	Recipient	A positive operator-generated acknowledgment to indicate receipt of a message at the ultimate destination.
Will Comply [WILCO]	100 (4)	Recipient	An operator reply generated to indicate that a received message is understood and that the ultimate destination will comply.
Have Complied [HAVCO]	101 (5)	Recipient	An operator reply generated to indicate that a received message is understood and that the ultimate destination has complied.
Cannot Comply [CANTCO]	110 (6)	Recipient	An operator reply generated to indicate that a received message cannot or will not be carried out.
Undefined	111 (7)		

5.6.23 Cannot Comply (CANTCO) Reason field.
This user-defined field shall be a 3-bit binary codeword indicating the reason that a recipient cannot comply with a particular message. The applicable codes for this field depend on the setting of the UMF field and are specified in APPENDIX A as referenced in TABLE IV.

5.6.24 Cannot Process (CANTPRO) Reason field.
This user-defined field shall be a 6-bit binary codeword indicating the reason that a particular message cannot be processed by a recipient or information addressee. It shall be used only in R/C messages. The applicable codes for this field depend on the setting of the UMF field and are specified in APPENDIX A as referenced in TABLE IV.

5.6.25 Reply Amplification field.
This field shall be a variable size up to a maximum of 350 bits. It shall be a character-coded field to provide textual data for an amplification of the recipient's reply to a message, if necessary. This field is divided into 50

groups of 7 bits each representing an ANSI ASCII character. Special characters are legal. ANSI ASCII Delete (1111111) shall be used as an end-of-text marker if the field is not at the maximum length.

5.6.26 Reference Message Data group.
This group is used to reference existing messages that are related to the subject message contained in the User Data portion of the application PDU. The elements of this group are used to uniquely identify a reference message by specifying the originator address group and DTG. For example, if the subject message is a response to a previously exchanged request message, then the Reference Message Data Group may contain the originator and DTG of the request message.

5.6.27 Header Size field.
This field shall be a 16-bit binary number indicating the size, in octets, of the header. All fields contained in the header, including all header fields preceding the Header Size field, the Header Size field itself, and all header fields following the Header Size field, are included in the octet count. This optional field is required when sending multiple messages over a streaming transport mechanism, e.g. persistent TCP connection.

5.6.28 Security Parameter Information (SPI).
This field shall be a 4-bit binary field, as shown in TABLE XI, indicating the identities of the parameters and algorithms that enable unambiguous security processing. This provides for 16 unique security implementations. Security implementations will differ in that all implementation may not provide the same security services or use the same algorithms and parameters.

TABLE XI. Security Parameter Information type codes

Code MSB - LSB	**Reference**
0000 (0)	Authentication (using SHA-1 and DSA) / No Encryption
0001 – 1111 (1 – 15)	Undefined

It should be noted that the maximum field sizes are quite large in order to support newer and future cryptographic algorithms and very large key sizes. TABLE XII provides guidance on current typical sizes. In addition APPENDIX D provides the actual field sizes used when the SPI value is 0.

TABLE XII. SPI typical field sizes

Field Name	**Size (bits)**
Keying Material ID	0 - 64
Cryptographic Initialization	0 - 128
Key Token	0 - 512
Authentication Data (A)	320 - 1024
Authentication Data (B)	320 - 1024
Message Security Padding	0 - 128

5.6.29 Keying Material ID Length.
This field shall be a 3-bit binary field that defines the size, in octets, of the Keying Material ID field. A value of zero (0) defines the length as one (1) octet and a value of seven (7) defines the length as eight (8) octets. The Keying Material ID Length value shall range from 0 to 7.

5.6.30 Keying Material ID.
This field shall be a variable size up to a maximum of 64 bits. This binary field identifies the key, a unique value, which was used for encryption. The SPI shall specify the value used for this field.

5.6.31 Cryptographic Initialization Length.
This field shall be a 4-bit binary field that defines the size, in 64-bit blocks, of the Cryptographic Initialization field. A value of zero (0) defines the length as one (1) 64-bit block and a value of 15 defines the length as 16 64-bit blocks. The Cryptographic Initialization Length value shall range from 0 to 15.

5.6.32 Cryptographic Initialization.
This field shall be a variable size up to a maximum of 1024 bits. This binary field identifies a sequence of bits used by the originator and recipient to initialize the encryption and decryption process. The mechanism that describes how Cryptographic Initialization is achieved and the format of initialization data is determined by the value of the SPI.

5.6.33 Key Token Length.
This field shall be an 8-bit binary field that defines the size, in 64-bit blocks, of the Key Token field. A value of zero (0) defines the length as one (1) 64-bit block and a value of 255 defines the length as 256 64-bit blocks. The Key Token Length value shall range from 0 to 255. A key token maybe required for each originator, recipient and information addressee. The FRI field allows for up to 17 key tokens per message.

5.6.34 Key Token.
This field shall be a variable size up to a maximum of 16,384 bits. This binary field that contains information, which enables each member of each address group to decrypt the user data associated with this message header. The mechanism that describes how Key Tokens are generated, validated, and processed is specified by the value of the SPI.

5.6.35 Authentication Data (A) Length.
This field shall be a 7-bit binary field that defines the size, in 64-bit blocks, of the Authentication Data (A) field. A value of zero (0) defines the length as one (1) 64-bit block and a value of 127 defines the length as 128 64-bit blocks. The Authentication Data (A) Length value shall range from 0 to 127.

5.6.36 Authentication Data (A).
This field shall be a variable size up to a maximum of 8192 bits. This binary field is created by the originator of the message. It provides both connectionless integrity and data origin authentication (proof of origin). The mechanism that describes how Authentication Data (A) is generated, validated, and processed is specified by the value of the SPI.

5.6.37 Authentication Data (B) Length.
This field shall be a 7-bit binary field that defines the size, in 64-bit blocks, of the Authentication Data (B) field. A value of zero (0) defines the length as one (1) 64-bit block and a value of 127 defines the length as 128 64-bit blocks. The Authentication Data (B) Length value shall range from 0 to 127.

5.6.38 Authentication Data (B).
This field shall be a variable size up to a maximum of 8192 bits. This binary field is created by the party sending the response acknowledgment message. It consists of a digital signature (proof of receipt) of the message which is being acknowledged. The acknowledgment message itself shall also contain Authentication Data (A). The mechanism that describes how Authentication Data (B) is generated, validated, and processed is specified by the value of the SPI.

5.6.39 Signed acknowledge request indicator.
This field shall be a 1-bit binary field indicating whether the originator of a message requires a signed response from the recipient. This field set to 1 shall indicate that a signed response is required from the recipient. This field set to 0 shall indicate that a signed response is not required.

5.6.40 Message Security Padding Length.
This field shall be an 8-bit binary field that defines the size, in octets, of the message security padding field. A value of zero (0) defines the length as zero (0) octets and a value of 255 defines the length as 255 octets. The Message Security Padding Length value shall range from 0 to 255.

5.6.41 Message Security Padding.
This field shall be a variable size up to a maximum of 2040 bits. This binary field is necessary for a block encryption algorithm so that the message content to be encrypted is a multiple of the encryption block length. The value of the SPI shall specify the message security padding rules.

5.6.42 Group Size field.
This field shall be a 12-bit binary number indicating the size, in bits, of the Future Use Group in which this field is contained. A value of "0" should not be used for this field. If the parent group is specified present then this child field is mandatory.

5.7 Application header formatting rules and construction procedures.
The case and condition syntax and procedures tabulated below shall be applied in the formatting and construction of the application header.

5.7.1 Case and conditionality statement syntax.
The purpose of the case and conditionality statements is to rigorously and unambiguously define the construction rules for the application header so that it will be possible to achieve consistent construct implementations across multiple systems. They include cases for each use of the application header and the inter-element conditionalities within the application header for basic processing, defaults, legal entries, and special considerations.

5.7.1.1 Logical operators.
Natural language does not lend itself to rigorous and unambiguous expression, therefore it is necessary to use well established logical operators to establish precise, mathematical meaning for logical relationships. The logical operators that will be used in this document are:

AND - separates two discrete values and evaluates to true if both of the discrete values are true.

OR - inclusive OR separates two discrete values and evaluates to true if at least one of the discrete conditions is true.

XOR - exclusive OR separates two discrete values and evaluates to true if and only if one, not both, of the discrete conditions is true.

NOT - a simple negation of the condition so that if A is true then NOT A would yield false.

The following truth table (TABLE XIII) illustrates the meaning of the logical operator definitions given above. The table shows, for example, that given both “A” and “B” as true, then “NOT A” will yield false. “A AND B” will yield true, “A OR B” will yield true, and “A XOR B” will yield false. “A AND B” in this example represents names or action designators.

TABLE XIII. Logical operator definitions

A	B	NOT A	A AND B	A OR B	A XOR B
TRUE	TRUE	FALSE	TRUE	TRUE	FALSE
TRUE	FALSE	FALSE	FALSE	TRUE	TRUE
FALSE	TRUE	TRUE	FALSE	TRUE	TRUE
FALSE	FALSE	TRUE	FALSE	FALSE	FALSE

5.7.1.2 Application.
Case and conditionality statements are used only to restrict the structure of the application header to a well-defined subset of the possible legal configurations that are specified by the application rules of application header construction.

5.7.1.3 Reserved words.
Case statements reserved words that will be used in this document are:

CASE -	Identifies the title (purpose) under which the statement is defined.
END CASE -	Ends the case statement.
IF...THEN...ELSE -	Describes conditions under which statements are valid. The statement always starts with “IF” and shall end with “ENDIF”. An “IF” statement selects for execution, one or none of the enclosed sequence of statements depending on the (truth) value of one or more corresponding conditions.
ELSIF -	This keyword is used to extend the flexibility of the “IF...THEN...ELSE” construct. It is used when multiple conditions need to be evaluated in order to determine a logic path. Multiple “ELSIF” conditions are permitted. The general form is: IF *condition* THEN *sequence of statements* ELSIF *condition* THEN *sequence of statements* ELSE *sequence of statements* ENDIF
ENDIF -	Ends condition statement.

5.7.1.4 Cases.
Case statements are a form of expressing a condition. The construct in this document indicates there shall be at least two alternatives. Case statements are used when a condition statement becomes too complex. A case statement may include an “XOR” (Exclusive OR) operator when it is possible to accomplish the same purpose in one or more ways. A case statement may also include an “OR” operator when any, or all, of several data elements can be used. Unlike cases in MIL-STD-6017, cases in MIL-STD-2045-47001 are not mutually exclusive and may be used together as required by the nature of the data being transmitted.

5.7.1.5 Conditions.
Condition statements define the conditions under which a data group, data element, or value in a data element may be used. The condition statement is very structured in its use. The following is an example of the format of a conditional statement:

```
IF (condition)
        THEN  (Sequence of Statements)
ELSIF (condition)
        THEN (Sequence of Statements)
ELSE (Sequence of Statements)
ENDIF
```

For the execution of an “IF” statement, the condition specified after “IF”, and any conditions specified after other keywords are evaluated in succession until one evaluates to “TRUE”, or all conditions are evaluated and yield “FALSE”. If one condition evaluates to “TRUE”, then the corresponding sequence of statements are executed. If all conditions evaluate to “FALSE” and an “ELSE” statement is present, the sequence of statements associated with the “ELSE” are executed; otherwise, none of the sequence statements are executed.

5.7.1.6 Defaults.
Defaults will be defined only if the receiving system’s default value is of concern to the interface.

5.7.1.7 Expected response.
The expected response by the system receiving an application header will depend on the content of the header fields and shall be stated as it relates to the case and conditionality statements for the header.

5.7.1.8 Special considerations.
Special considerations cover those exceptions that cannot be defined under the preceding paragraphs.

5.7.1.9 Application header receipt.
Upon receipt of an application header, a system shall validate the presence of all mandatory groups and fields, determine that all occurrence category conditions are satisfied, and validate the legality of all field entries to determine the legality of the header. This receipt processing is required for each header.

5.7.2 Cases and conditions for the application header.

5.7.2.1 Cases.

5.7.2.1.1 Case 1: Message is an original message.

```
THIS CASE REQUIRES
        GPI for Group 13 [Response Data Group] shall be “0” (Not Present)
        AND     User Data body shall be present
END CASE
```

5.7.2.1.2 Case 2: Message is an acknowledgment message.

```
THIS CASE REQUIRES
        GPI for Group 13 [Response Data Group] shall be “1” (Present)
        AND     GPI for Group 11 [Perishability DTG Group] shall be “0” (Not Present)
        AND     GPI for Group 12 [Acknowledgment Request Group] shall be “0” (Not Present)
        AND     User Data shall not be present
END CASE
```

5.7.2.1.3 Case 3: Message is not a XML or XML-VMF message.

THIS CASE REQUIRES
UMF shall be “0” (Link 16 (J-series message))
OR UMF shall be “1” (Binary File)
OR UMF shall be “3” (National Imagery Transmission Format System (NITFS))
OR UMF shall be “4”(Redistributed Message (RDM))
OR UMF shall be “5”(United States Message Text Format (USMTF))
OR UMF shall be “6” (DOI-103)
OR UMF shall be “7” (eXtensible Markup Language (XML) - Message Text Format (MTF))
AND GPI for Group 9 [VMF Message Identification Group] shall be “0” (Not Present)
AND User Data shall be present
END CASE

5.7.2.1.4 Case 4: Message is a redistributed message.

THIS CASE REQUIRES
UMF shall be “4” (Redistributed Message)
AND GPI for Group 9 [Message Identification Group] shall be “0” (Not Present)
AND User Data shall be present
END CASE

5.7.2.1.5 Case 5: Message was compressed.

THIS CASE REQUIRES
FPI for Data Compression shall be “1” (Present)
AND GPI for Group 13 [Response Data Group] shall be “0” (Not Present)
AND User Data shall be present
END CASE

5.7.2.1.6 Case 6: Message has security services applied.

THIS CASE REQUIRES
GPI for Group 20 [Message Security Group] shall be “1” (Present)
END CASE

5.7.2.1.7 Case 7: Message is a signed acknowledgment.

THIS CASE REQUIRES
GPI for Group 13 [Response Data Group] shall be "1" (Present)
AND GPI for Group 11 [Perishability DTG Group] shall be "0" (Not Present)
AND GPI for Group 12 [Acknowledgment Request Group] shall be "0" (Not Present)
AND GPI for Group 24 [Authentication (A) Group] shall be "1" (Present)
AND GPI for Group 25 [Authentication (B) Group] shall be "1" (Present)
AND Signed Acknowledge Request Indicator shall be "0" (Signed Response Not Required)
AND User Data shall not be present
END CASE

5.7.2.1.8 Case 8: Message is an XML-VMF message.

THIS CASE REQUIRES
UMF shall be "8" (XML-VMF)
AND GPI for G9 [Message Identification Group] shall be "1" (Present)
AND User Data shall be present
END CASE

5.7.2.1.9 Case 9: Backward compatibility of "Future Use" groups until they are used.

THIS CASE REQUIRES
GPI for Group 4 [Future Use 1] shall be "0" (Not Present)
GPI for Group 5 [Future Use 2] shall be "0" (Not Present)
GPI for Group 6 [Future Use 3] shall be "0" (Not Present)
GPI for Group 7 [Future Use 4] shall be "0" (Not Present)
GPI for Group 8 [Future Use 5] shall be "0" (Not Present)
GPI for Group 15 [Future Use 6] shall be "0" (Not Present)
GPI for Group 16 [Future Use 7] shall be "0" (Not Present)
GPI for Group 17 [Future Use 8] shall be "0" (Not Present)
GPI for Group 18 [Future Use 9] shall be "0" (Not Present)
GPI for Group 19 [Future Use 10] shall be "0" (Not Present)
GPI for Group 27 [Future Use 11] shall be "0" (Not Present)
GPI for Group 28 [Future Use 12] shall be "0" (Not Present)
GPI for Group 29 [Future Use 13] shall be "0" (Not Present)
GPI for Group 30 [Future Use 14] shall be "0" (Not Present)
GPI for Group 31 [Future Use 15] shall be "0" (Not Present)
END CASE

5.7.2.1.10 Case 10: Message is a VMF message.

THIS CASE REQUIRES
UMF shall be "2" (VMF)
AND GPI for G9 [VMF Message Identification Group] shall be "1" (Present)
END CASE

5.7.2.2 Conditions.

5.7.2.2.1 Condition 1.
IF the Originator Address Group is not present, THEN an acknowledgment shall not be requested.

IF GPI for Group 1 [Originator Address Group] is set to “0” (Not Present)
THEN GPI for Group 12 [Acknowledgment Request Group] shall be set to “0” (Not Present)
ENDIF

5.7.2.2.2 Condition 2.
IF the bit-encoded URN is present, THEN the character-encoded Unit Name shall not be present in the same address group.

IF FPI for URN is set to “1” (Present)
THEN FPI for Unit Name shall be set to “0” (Not Present)
ENDIF

5.7.2.2.3 Condition 3.
IF the bit-encoded URN is not present, THEN the character-encoded Unit Name shall be present in the same address group.

IF FPI for URN is set to “0” (Not Present)
THEN FPI for Unit Name shall be set to “1” (Present)
ENDIF

5.7.2.2.4 Condition 4.
IF the character-encoded Unit Name is present, THEN the bit-encoded URN shall not be present in the same address group.

IF FPI for Unit Name is set to “1” (Present)
THEN FPI for URN shall be set to “0” (Not Present)
ENDIF

5.7.2.2.5 Condition 5.
IF the character-encoded Unit Name is not present, THEN the bit-encoded URN shall be present in the same address group.

IF FPI for Unit Name is set to “0” (Not Present)
THEN FPI for URN shall be set to “1” (Present)
ENDIF

5.7.2.2.6 Condition 6.
This paragraph is left blank to maintain paragraph conformity.

5.7.2.2.7 Condition 7.
IF Message Handling Group (R3) repeats, THEN Message Size and Header Size shall be present.

IF GRI of R3 [Message Handling Group] is set to “1” (Repeated)
THEN FPI for Message Size shall be set to “1” (Present)
AND FPI for Header Size shall be set to "1" (Present)
ENDIF

5.7.2.2.8 Condition 8.
IF the message is not a CANTCO, THEN CANTCO Reason Code shall not be present.

IF R/C is NOT set to “6” (CANTCO)
THEN FPI for CANTCO Reason Code shall be set to “0” (Not Present)
ENDIF

5.7.2.2.9 Condition 9.
IF the message is not a CANTPRO, THEN CANTPRO Reason Code shall not be present.

IF R/C is NOT set to “2” (CANTPRO)
THEN FPI for CANTPRO Reason Code shall be set to “0” (Not Present)

ENDIF

5.7.2.2.10 Condition 10.
This paragraph is left blank to maintain paragraph conformity.

5.7.2.2.11 Condition 11.
IF the Machine Acknowledge OR Operator Acknowledge OR Operator Reply Request Indicators are set to “1”, THEN the Originator DTG group shall be present.

IF Machine Acknowledge Request Indicator is set to “1” (Machine Acknowledgment Required)
OR Operator Acknowledge Request Indicator is set to “1” (Operator Acknowledgment Required)
OR Operator Reply Request Indicator is set to “1” (Operator Reply Required)
THEN GPI for Group 10[Originator DTG] shall be set to “1” (Present)
ENDIF

5.7.2.2.12 Condition 12.
This paragraph is left blank to maintain paragraph conformity.

5.7.2.2.13 Condition 13.
IF the Security Parameters Information is “0” (Authentication (using SHA-1 and DSA)/ No Encryption) THEN GPI for Keying Material Group, GPI for Cryptographic Initialization Group, GPI for Key Token Group, AND GPI for Message Security Padding Group shall all be set to “0” (Not Present), AND the GPI for Authentication Data (A) Group shall be set to “1” (Present).

IF Security Parameters Information is set to “0” (Authentication (using SHA-1 and DSA)/ No Encryption)
THEN GPI for Group 21 [Keying Material Group] shall be set to “0” (Not Present)
AND GPI for Group 22 [Cryptographic Initialization Group] shall be set to “0” (Not Present)
AND GPI for Group 23 [Key Token Group] shall be set to “0” (Not Present)
AND GPI for Group 24 [Authentication (A) Group] shall be set to “1” (Present)
AND GPI for Group 26 [Message Security Padding Group] shall be set to “0” (Not Present)
ENDIF

5.7.2.2.14 Condition 14.
IF the GPI for Acknowledgment Request Group is set to “0” (Not Present) THEN the Signed Acknowledge Request Indicator shall be set to “0” (Signed Acknowledgment Not Required).

IF GPI for Group 12 [Acknowledgment Request Group] is set to “0” (Not Present)
THEN Signed Acknowledge Request Indicator shall be set to “0” (Signed Acknowledgment Not Required).
ENDIF

5.7.2.2.15 Condition 15.
IF the Signed Acknowledge Request Indicator is set to “1” (Signed Acknowledgment Required) THEN the Acknowledgment Request Group shall be set to “1” (Present).

IF Signed Acknowledge Request Indicator is set to “1” (Signed Acknowledgment Required)
THEN GPI for Group 12 [Acknowledgment Request Group] shall be set to “1” (Present).
ENDIF

5.7.2.2.16 Condition 16.
IF the User Message Format (UMF) field is set to "6" (DOI-103), THEN the Message Precedence is "5" (CRITIC/ECP).

IF UMF is set to "6" (DOI-103),
THEN Message Precedence is set to "5" (CRITIC/ECP)
ENDIF

5.7.2.2.17 Condition 17.
IF Retransmit Indicator is set to "1" (Retransmitted Message)
THEN GPI for G10 [Originator DTG] shall be set to "1" (Present) identifying the original date-time-group of the original message
ENDIF

5.7.2.2.18 Condition 18.
If UMF is set to "2" (Variable Message Format (VMF)) THEN the FPI for Message Standard Version field is set to "1" (PRESENT).

IF UMF is set to "2" (Variable Message Format (VMF))
THEN FPI for Message Standard Version shall be set to "1" (Present)
ENDIF

5.7.2.3 Defaults.
Default values for Message Precedence, Acknowledgments, and Message Classification shall be user defined.

5.7.2.4 Expected response.

5.7.2.4.1 Machine Acknowledge requested.

IF Machine Acknowledge Requested Indicator is set to "1" (Machine Acknowledgment Required)
THEN Response shall have R/C set to "1" (Machine Receipt)
OR Response shall have R/C set to "2" (CANTPRO)
ENDIF

5.7.2.4.2 Operator Acknowledge requested.

IF Operator Acknowledge Requested Indicator is set to "1" (Operator Acknowledgment Required)
THEN Response shall have R/C set to "3" (OPRACK)
OR Response shall have R/C set to "2" (CANTPRO)
ENDIF

5.7.2.4.3 Operator Reply Requested.

IF Operator Reply Requested Indicator is set to "1" (Operator Reply Required)
THEN Response shall have R/C set to "4" (WILCO)
OR Response shall have R/C set to "5" (HAVCO)
OR Response shall have R/C set to "6" (CANTCO)
OR Response shall have R/C set to "2" (CANTPRO)
ENDIF

5.7.2.4.4 Signed Acknowledge Requested.

IF Signed Acknowledge Request Indicator is set to "1" (Signed Acknowledgment Required)
THEN Response shall have GPI for Group 25[Authentication (B) Group] set to "1" (Present)
OR {Response shall have R/C set to "2" (CANTPRO)
AND [CANTPRO Reason Code is specified "27" (Authentication Failure)
OR CANTPRO Reason Code is specified "28" (Certificate not found)
OR CANTPRO Reason Code is specified "29" (Certificate invalid)
OR CANTPRO Reason Code is specified "30" (Do not support this SPI value)
OR CANTPRO Reason Code is specified "31" (Can not generate a signed acknowledgment)]}
ENDIF

5.7.2.5 Special considerations.

5.7.2.5.1 Perishable data check. Discard messages that are too old.

IF GPI for Group 11 [Perishability DTG Group] is set to "1" (Present)
AND Group 11 [Perishability DTG Group] is earlier than current DTG
THEN User Data shall be ignored
AND
IF Machine Acknowledgment Request indicator is set to "1" (Machine Acknowledgment Required)
THEN Response shall have R/C set to "2" (CANTPRO)
AND a CANTPRO Reason Code set to "25" (Message too Old, Based On Perishability)
ENDIF
ENDIF

5.7.2.5.2 Response to version non-interoperability.

Version code is set to "15" (Version Sent Not Implemented) if recipient does not implement the MIL-STD-2045-47001 version sent.

IF Recipient does not implement Version sent
THEN Version shall be set to "15" (Version Sent Not Implemented)
AND FPI for Data Compression Type shall be set to "0" (Not Present)
AND GPI for Group 1 [Originator Address Group] shall be set to "1" (Present)
AND Originator Address specified is the Original Recipient
AND GPI for Group 2 [Recipient Address Group] shall be set to "1" (Present)
AND Recipient Address specified is the Originator of the original message
ENDIF

5.7.2.5.3 Broadcast transmission check.

IF the Recipient Address Group is not present, AND the Information Address Group is not present THEN the message shall be a broadcast transmission.

IF GPI for Group 2 [Recipient Address Group] is set to "0" (Not Present)
AND GPI for Group 3 [Information Address Group] is set to "0" (Not Present)
THEN the message shall be broadcast in accordance with lower layer broadcast protocols
ENDIF

5.7.2.5.4 Originator DTG check.
IF the Originator DTG is ambiguous, THEN the DTG Extension shall be present.

IF Originator DTG is equal to the Originator DTG of a previously sent message
THEN FPI for DTG Extension shall be set to "1" (Present)
AND DTG Extension shall be unique
ENDIF

5.7.2.5.5 Message sent via a streaming/undelimited transport protocol check.
If Message Handling Group (R3) only occurs once and the message is being sent via a streaming/undelimited transport protocol, such as TCP, then Message Size and Header Size shall be present.

IF GRI of R3 [Message Handling Group] is set to "0" (Not Repeated)
AND the message is being sent via a streaming/undelimited transport
THEN FPI for Message Size shall be set to "1" (Present)
AND FPI for Header Size shall be set to "1" (Present)
ENDIF

5.7.2.5.6 Message concatenation.
When concatenating messages, the Originator, Recipient and Information Address Groups shall be common for all concatenated messages and therefore will appear once in the Application Header. The Message Handling Group (R3) shall repeat to specify information about each concatenated message. Each occurrence of the Message Handling Group [R3] shall be matched to its respective message in the User Data portion. The total size of any single User Data portion (e.g. a single VMF message) within a concatenated message block shall not exceed 1 megabyte (1,048,575 bytes).

IF GPI for Group 1 [Originator Address Group] is set to "1" (Present)
OR GPI for Group 2 [Recipient Address Group] is set to "1" (Present)
OR GPI for Group 3 [Information Address Group] is set to "1" (Present)
THEN (Group 1 [Originator Address Group], Group 2 [Recipient Address Group], and Group 3 [Information Address Group] addresses are common to all concatenated messages)
AND GRI for R3 [Message Handling Group] shall be set to "1" (Repeated)
AND Each iteration shall match in sequence specifying information about its respective concatenated message
AND FPI for Message Size shall be set to "1" (Present)
AND FPI for Header Size shall be set to "1" (Present)
AND Message Size (any single message within the concatenated block) shall not exceed1,048,575 bytes
ENDIF

5.7.2.5.7 Message case and message subtype relationship.

IF Cases exist for transmitted VMF message
THEN FPI for Message Subtype is specified "1" (Present)
ENDIF

5.7.2.5.8 Sending response to a large message.
If the received message size is greater than the Maximum Segment Size AND Response(s) were requested AND the message was received via a reliable transport mechanism (e.g. S/R, TCP, etc.) THEN send the response(s) via a reliable transport mechanism.

IF The received message size is greater than Maximum Segment Size
AND GPI for G12 [Acknowledgment Request Group] is set to "1" (Present)
AND the message was received via a reliable transport mechanism
THEN Response(s) to the received message shall be sent via a reliable transport mechanism
ENDIF

5.7.2.5.9 DTG extension to DTG of message being acknowledged.

IF GPI for Group 13 [Response Data Group] is set to "1" (Present)
THEN
IF FPI for DTG Extension discriminating the Originator DTG is set to "1" (Present)
THEN Response message shall have GPI for Group 13 [Response Data Group] identifying the DTG of message being acknowledged is set to "1" (Present)
AND FPI for DTG Extension discriminating the DTG of message being acknowledged shall be set to "1" (Present)
ELSE
Response message shall have GPI for Group 13 [Response Data Group] identifying the DTG of message being acknowledged is set to "1" (Present)
AND FPI for DTG Extension discriminating the DTG of message being acknowledged is set to "0" (Not Present)
ENDIF
ENDIF

5.7.2.5.10 Decompression of messages prior to parsing.

IF FPI for Data Compression Type field is set to "1" (Present)
THEN Receiving system shall decompress the user data prior to parsing
ENDIF

5.7.2.5.11 Unit Name usage in a response message.

IF FPI for Unit Name identifying the originator is set to "1" (Present)
THEN Response message shall have the FPI for Unit Name identifying the recipient is set to "1" (Present)
AND FPI for URN is set to "0" (Not Present)
ENDIF

5.7.2.5.12 URN usage in a response message.

IF FPI for URN identifying the originator is set to "1" (Present)
THEN Response message shall have the FPI for URN identifying the recipient set to "1" (Present)
AND FPI for Unit Name shall be set to "0" (Not Present)
ENDIF

5.7.2.5.13 Addressee URN uniqueness.
A specified URN shall occur at most once as an addressee of a message, either as a recipient destination or as an information destination. Duplicate destination URNs in the recipient address group and the information address group of a message are not permitted.

5.7.2.5.14 Message that uses Segmentation/Reassembly protocol.

IF Data transfer is greater than the Maximum Segment Size (MSS) permitted
AND (Data package is transported via CNR networks using UDP
OR Data package is transported via CNR networks using n-layer pass through)
THEN Message Segmentation/Reassembly protocol shall be used
ENDIF

5.7.2.5.15 UMF Codes in the Acknowledgment Header.
If the message is an Acknowledgment Header, then UMF code shall be the same as the UMF code for the message being acknowledged.

5.7.2.5.16 VMF Message Identification Group in Acknowledgment Header.
If the message is an Acknowledgment Header, then Group 9 [VMF Message Identification Group] shall be the same as the Group 9 [VMF Message Identification Group] for the message being acknowledged.

5.7.2.5.17 Messages that should use MIL-STD-188-220 N-layer pass through.
The intent of this special condition is to provide guidance as to when N-layer pass through should be used to transmit messages when MIL-STD-188-220 is used as the lower level protocol. This allows for stations to automatically determine when to use N-layer pass through which reduces network overhead associated with IP headers.

IF ((the message is broadcast according to 5.6.3b)
OR (the only destination address specified is the broadcast URN)
OR (all destination addresses (i.e., all recipient and information addresses) are in same IP subnetwork as the Originator))
THEN N-layer pass-through should be used
ENDIF

Note: The above assumes stations in the same MIL-STD-188-220 subnetwork have identical NETIDs (i.e., the logical combination of the IP Subnet Mask and the IP Address). Determining when a Destination URN(s) is in the same subnetwork as the Originator URN can be implemented by converting the URN(s) to IP addresses and using the IP Subnet Mask specified for the subnetwork.

5.7.2.6 Minimum implementation (MIN IMP).
A platform/system shall implement those items defined in this document as being MIN IMP, i.e., they are mandatory. Unless otherwise stated, MIN IMP items shall be required for transmission and reception. Upon reception, MIN IMP items shall always be processed and understood. The term “understood” shall be taken to mean some form of post-parsing processing, i.e., display to an operator, adding to a database, etc. MINIMP items shall not be discarded prior to such action.

MIN IMP occurs at several levels as follows:

a. All fields marked “M” in TABLE I application header.

b. All fields within groups of TABLE I where the GPI is specified present, except for those that could be mutually exclusive such as in the Acknowledgement Request Group (G12).

c. Cases, as defined in TABLE XIV.

d. Expected Responses as defined in TABLE XV.

e. Special Considerations as defined in TABLE XVI.

TABLE XIV. Case level minimum implementation.

Case	Title	Transmit	Receive
1	Message is an original message.	M	M
2	Message is an acknowledgment message.	M	M
3	Message is not a XML or XML-VMF message.	M	M
4	Message is a redistributed message.	O	M
5	Message was compressed.	O	M
6	Message has security services applied.	O	O
7	Message is a signed acknowledgment.	O	O
8	Message is an XML-VMF message.	O	O
9	Backward compatibility of “Future Use” groups until they are used.	M	M
10	Message is a VMF message.	O	O

TABLE XV. Expected response minimum implementation.

Expected Response	Title	Transmit	Receive
1	Machine Acknowledge requested.	M	M
2	Operator Acknowledge requested.	M	M
3	Operator Reply requested.	M	M
4	Signed Acknowledge requested.	O	O

TABLE XVI. Special consideration minimum implementation.

Special Consideration	Title	Transmit	Receive
1	Perishable Data Check.	M	M
2	Response to version non-interoperability.	M	M
3	Broadcast Transmission Check.	M	M
4	Add DTG Extension when Originator DTGs are the same.	M	M
5	Message sent via a streaming/undelimited transport protocol.	M	M
6	Message Concatenation	O	M
7	Message Case and Message Subtype Relationship.	M	M
8	Sending Response to a large message.	M	M
9	DTG Extension to DTG of Message Being Acknowledged.	M	M
10	Decompression of messages prior to parsing.	M	M
11	Unit Name usage in a response message.	M	M
12	URN usage in a response message.	M	M
13	Address URN uniqueness.	M	M
14	Message uses Segmentation/Reassembly protocol.	M	M
15	UMF codes in the Acknowledgment Header	M	M

TABLE XVI. Special consideration minimum implementation.

Special Consideration	Title	Transmit	Receive
16	VMF Message Identification Group in Acknowledgment Header	M	M
17	Messages that should use MIL-STD-188-220 N-layer pass through	O	O

5.7.2.7 Field level minimum implementation.
When a system implements either a mandatory or an optional field, it shall implement all field values for that field and processing logic to use all field values for transmission and reception

5.7.3 User data.
This portion of the application PDU contains the application process messages or data.

5.7.4 Message acknowledgments.
A message acknowledgment is a report back to the originator on a receiving station's receipt of and intentions with respect to a received message. Acknowledgment requests are directed to message recipients only; they do not apply to information addressees. Acknowledgments are implemented in the acknowledgment header format.

5.7.4.1 Acknowledgment header format.
Machine and operator acknowledgment request indicators are used by the originator to request a specific response from the receiving station, or appropriate operator, for selective acknowledgment of message receipt and compliance with the message instructions. A receiving station shall respond to the originator by sending an acknowledgment header. Depending on the type of acknowledgment request from the originator or the type of system involved, the response may be machine-generated (automatic) or operator-generated (manual) or a combination thereof. The acknowledgment header consists of the following groups and fields (see also 5.7.2.1.2):

a. Acknowledgment originator address group (G1)

b. Acknowledgment recipient address group (R1)

c. Message Handling Group (R3). Within Message Handling Group, the Response Data Group (G13), shall include the DTG of message being acknowledged and the R/C field.

5.7.4.2 Message accountability.
The application header shall be used for the detection of duplicate messages and to associate an acknowledgment header with the original requesting message. The received fields of originator address group, originator DTG, and DTG Extension are used to uniquely identify a message. The originator shall guarantee the uniqueness of this combination of fields by ensuring that no original message is transmitted having the same DTG and DTG Extension.

a. Duplicate message check. The originator address group, originator DTG, and DTG Extension fields of each received message are compared with the corresponding fields of previous messages. Any duplicate messages (including retransmitted messages) shall be acknowledged if required and shall otherwise be ignored (discarded).

b. Acknowledgment matching. The originator address group, DTG of message being acknowledged, and DTG Extension fields of each received acknowledgment header are compared with the recipient address group, Originator DTG, and DTG Extension fields of previously originated messages that require acknowledgment. The message handling application shall maintain DTG, Originator Address, and DTG Extension information about previously received messages for a period of time long enough to exhaust the message originator's retransmission timers. Acknowledgment headers that match original messages shall be processed; unmatched Acknowledgment headers shall be ignored (discarded).

5.7.4.3 Message retransmission.
A retransmission capability shall be provided to enable the automatic retransmission of a message that has not received an acknowledgment when one was requested. Automatic Retransmissions shall only apply if a machine acknowledgment is requested. Any Application layer acknowledgment precludes message retransmission.

a. The number of automatic retransmissions shall be selectable with a range of 0 to 3. The parameter governing the number of retransmissions shall be separately selectable for each Originator DTG/DTG Extension combination.

b. A timer shall be provided to schedule the automatic retransmission. An expiration timer shall be selectable with a range of 5 to 600 seconds. Upon expiration of the timer, provided an acknowledgment has not been received, the message shall be retransmitted by the originating system. If an acknowledgment is not received prior to expiration of the timer on the final retransmission, the operator shall be notified. Messages containing perishable data and requiring acknowledgment shall have the Perishability DTG set to a time later than the retransmit timeout.

5.8 Processing factors.

5.8.1 Application process.
The application process shall provide the application layer the bit-oriented or character-oriented messages that satisfy information exchange requirements.

5.8.2 Message formats.
The message formats shall be user-defined. The UMF field in the application layer header specifies the message format that is being used in the application process.

5.8.3 Lower layer interactions.
Several application layer fields are used to indicate a desire for special handling or quality of service (QOS) from the lower layer protocols. The lower layer protocols should use these indications as guidance for providing the requested service.

5.8.3.1 Security Classification.
This application layer field as described in TABLE VIII provides the desired guidance to the lower layers for establishing security classification.

5.8.3.2 Message Precedence.
This application layer field as described in TABLE VII provides the desired guidance to the lower layers for setting message transmission precedence.

5.8.3.3 Quality of Service (QOS).
The QOS desired by the application layer is derived from multiple fields: Message Size, Message Precedence, Originator DTG, Time Perishability DTG, and Machine Acknowledgment Request Indicator. The following QOS parameters are mapped from these application layer fields:

a. Normal/High Throughput

b. Normal/Low Delay

c. Normal/High Reliability

These QOS parameters are based on the following conditions:

```
IF (Time Perishability DTG - Originator DTG) <= Perish
        AND Precedence <> Routine
THEN Delay = Low
ELSIF (Time Perishability DTG - Originator DTG) > Perish
        AND Message Acknowledgment Indicator == 1
        AND Message Size >= Message Size Threshold
THEN Reliability = High
ELSIF Message Size >= Message Size Threshold
        AND Delay == Normal
        AND Reliability == Normal
THEN Throughput = High
ELSE Delay = Normal
        AND Throughput = Normal
        AND Reliability = Normal
ENDIF
```

where:

Message Size Threshold has a default value of (3*480 = 1440) bytes. Message Size Threshold shall be a parameter with a range of 1 to 1,048,575 bytes.

Perish shall be a parameter with a range of 1 to 10800 seconds.

5.8.3.4 Originator address group.
This application layer group as described in 5.6.3 provides guidance to the lower layers for the originator address.

5.8.3.5 Recipient address group.
This application layer group as described in 5.6.3 provides guidance to the lower layers for the destination address.

5.8.3.6 Message broadcast indicators.
The absence of a Recipient Address group and the absence of an Information Address group as described in 5.6.3 provides guidance to the lower layers for broadcast options.

5.8.3.7 Destination port number.
The port named "mil-2045-47001" has been registered with the Internet Assigned Number Authority and has been assigned port number 1581 (decimal) to indicate the MIL-STD-2045-47001 ALP as defined by this standard. This "mil-2045-47001" port shall be passed as the destination port parameter value to the lower layer protocol (e.g., UDP, TCP, or S/R) when exchanging UMF defined in TABLE IV. TABLE XVII shows the port numbers that shall be used for IP/UDP data exchanges using the "47001" ALP. (See C.3.2.1 for a discussion on exchanging data using the S/R protocol). If n-layer pass through is invoked without S/R, the next lower layer is the intranet layer and destination port number is not required.

TABLE XVII. Port Numbers for PDUs related to the exchange of 47001 ALP

"47001" messages sent via UDP/IP	
UDP Destination Port number	UDP Source Port number
1581	Any value

5.8.4 Application header padding.

The application header shall always be a multiple of 8 bits. If an application header is not a multiple of 8 bits, it shall be zero-filled so that it becomes a multiple of 8 bits. This field shall be variable in size 0 - 7 bits. This padding allows the message portion to start on a byte boundary.

6 NOTES

This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.

6.1 Subject term (key word) listing.

The following key words and phrases apply to this MIL-STD.

Application Header
Application Layer
Combat Network Radio (CNR)
DOI-103
Link 16
MIL-STD-188-220
MIL-STD-2045-47001
MIL-STD-6016
MIL-STD-6017
MIL-STD-6040
NITFS
Receipt/Compliance (R/C)
Security Extension Protocol (SEP)
Segmentation/Reassembly (S/R)
TIDP-TE
Unit Reference Number (URN)
USMTF
VMF

6.2 Issue of the DoD index of specifications and standards (DODISS).

When this military standard is used in procurement, the applicable issue of the DoDISS will be cited in the solicitation.

6.3 Management of TCP connections.

When TCP is used to transport the MIL-STD-2045-47001 ALP over low bit rate combat network radio (CNR) networks, the overhead for opening and closing connections can contribute substantially to the offered load presented to the CNR network. The following conventions for the management of TCP connections used to transport the ALP are offered to allow the amount of overhead generated as the result of opening and closing TCP connections to be controlled.

a. When a MIL-STD-2045-47001 message becomes available for transport, a TCP connection will be opened to the destination if a connection to the destination hasn't already been established.

b. An established TCP connection to a given destination will be gracefully closed if no activity (transmitted or received data) occurs on the connection within some configurable time period of the most recent activity on that connection.

c. If a connection already exists to a given destination and an additional connection offer is received from the same destination, the older connection will be closed at the end of the normal completion of any pending message transports such that only one connection is maintained and utilized for each destination.

d. MIL-STD-2045-47001 messages will be offered for transport over the TCP connection to the specified destination in the order established by the Message Precedence field of the MIL-STD-2045-47001 Application Header. If a higher priority message becomes available for transport to a destination while a lower priority message is in the process of being transported to the same destination, the transport of the higher priority message will begin immediately after the transport of the lower priority message is completed. Lower priority messages that have not already been offered for transport on the connection should not be offered for transport until after higher priority messages have been offered for transport on the connection.

e. The number of connections/destinations that can be utilized simultaneously by a single MIL-STD-2045-47001 application should be limited to a configurable number. Once this limit is reached there are two reasons additional connections might need to be established: either a message becomes available locally for transport to an additional destination, or a connection offer is received from a new remote source.

(1) In the case of a locally generated message to an additional destination, the Least Recently Active (LRA) connection, that is not currently being used for the transport of messages, should be closed prior to the establishment of a connection to the new destination. If all connections are actively being used, then the new message transport request should be discarded and treated as a transport failure.

(2) In the case that a connection offer is accepted from an additional remote source, the LRA connection that is not currently being used for the transport of messages should be closed. If all connections are actively being used, then the new recently accepted connection should be abruptly closed. Abruptly closing the newly accepted connection will terminate any pending transmissions from the remote source and inform the remote source that any pending messages were not transported successfully.

6.4 Application header initial settings.

TABLE XVIII provides guidance to be used to describe the initial settings of the Application Header used by all systems to facilitate initial interoperability. These initial settings are proposed to support minimum requirements for message transmissions.

TABLE XVIII mimics TABLE I with the last two columns being replaced with “Prefill Value” and “Data Item” columns. The prefill column identifies the bit code associated with this field. The data item column information identifies the meaning or source of the information associated with this field.

The following symbology is used with this table:

(shaded)	Not part of the initial settings.
Ww	Provided by Mission Computer, based MIL-STD-2045-47001 Version
xxxxx x	URN pre-designated/assigned and resident in the mission computer.
Yy	Based on message FAD, message number and message subtype.
zz	Time data derived from the mission computer.

TABLE XVIII. Application header initial settings

Field Name	CAT	Group Code	Repeat Code	Prefill Value	Data Item
VERSION	M			ww	Mission Computer Fill (Version D or higher)
FPI	M			0	Not Present

TABLE XVIII. Application header initial settings - Continued

Field Name	CAT	Group Code	Repeat Code	Prefill Value	Data Item
DATA COMPRESSION TYPE					
GPI (Originator)	M			1	Present
FPI		G1		1	Present
URN		G1		xxxxxx	Mission Computer Fill
FPI		G1		0	Not Present
UNIT NAME		G1			
GPI (Addressee(s))	M			1	Present
GRI		G2	R1(N) 0<=N<= 16	0	Not Repeated
FPI		G2	R1	1	Present
URN		G2	R1	xxxxxx	Mission Computer/Operator Fill
FPI		G2	R1	0	Not Present
UNIT NAME		G2	R1		
GPI (Info Addressee(s))	M			0	Not Present
GRI		G3	R2(16 - N)		
FPI		G3	R2		
URN		G3	R2		
FPI		G3	R2		
UNIT NAME		G3	R2		
FPI	M			0	Not Present
HEADER SIZE					
GPI (Future Use Group 1)	M	G4		0	Not Present
GPI (Future Use Group 2)	M	G5		0	Not Present
GPI (Future Use Group 3)	M	G6		0	Not Present
GPI (Future Use Group 4)	M	G7		0	Not Present
GPI (Future Use Group 5)	M	G8		0	Not Present
GRI (Message Handling Group)	M		R3(16)	0	Not Repeated
UMF	M		R3	2	Variable Message Format (VMF)
FPI	M		R3	1	Present

TABLE XVIII. Application header initial settings - Continued

Field Name	CAT	Group Code	Repeat Code	Prefill Value	Data Item
MESSAGE STANDARD VERSION			R3	5	MIL-STD-6017
GPI (VMF Message Identification Group)	M		R3	1	Present
FAD		G9	R3	yy	Message Dependent
MESSAGE NUMBER		G9	R3	yy	Message Dependent
FPI		G9	R3	yy	Message Dependent
MESSAGE SUBTYPE		G9	R3	yy	Message Dependent
FPI	M		R3	0	Not Present
FILE NAME			R3		
FPI	M		R3	0	Not Present
MESSAGE SIZE			R3		
OPERATION INDICATOR	M		R3	0	Operation
RETRANSMIT INDICATOR	M		R3	0	Not a Retransmission
MESSAGE PRECEDENCE CODE	M		R3	7	Routine
SECURITY CLASSIFICATION	M		R3	0	Unclassified
FPI	M		R3	0	Not Present
FRI			R3/R4 (16)		
CONTROL/RELEASE MARKING			R3/R4		
GPI (Originator DTG)	M		R3	1	Present
YEAR		G10	R3	zz	Auto Fill
MONTH		G10	R3	zz	Auto Fill
DAY		G10	R3	zz	Auto Fill
HOUR		G10	R3	zz	Auto Fill
MINUTE		G10	R3	zz	Auto Fill
SECOND		G10	R3	zz	Auto Fill
FPI		G10	R3	0	Not Present
DTG EXTENSION		G10	R3		
GPI (Perishability DTG)	M		R3	0	Not Present
YEAR		G11	R3		
MONTH		G11	R3		

TABLE XVIII. Application header initial settings - Continued

Field Name	CAT	Group Code	Repeat Code	Prefill Value	Data Item
DAY		G11	R3		
HOUR		G11	R3		
MINUTE		G11	R3		
SECOND		G11	R3		
GPI (Acknowledgment Request Group)	M		R3	1	Present
MACHINE ACKNOWLEDGE REQUEST INDICATOR		G12	R3	1	Machine Acknowledgment Required
OPERATOR ACKNOWLEDGE REQUEST INDICATOR		G12	R3	0	Operator Acknowledgment Not Required
OPERATOR REPLY REQUEST INDICATOR		G12	R3	0	Operator Reply Not Required
GPI (Response Data Group)	M		R3	0	Not Present
YEAR		G13	R3		
MONTH		G13	R3		
DAY		G13	R3		
HOUR		G13	R3		
MINUTE		G13	R3		
SECOND		G13	R3		
FPI		G13	R3		
DTG EXTENSION		G13	R3		
R/C		G13	R3		
FPI		G13	R3		
CANTCO REASON CODE		G13	R3		
FPI		G13	R3		
CANTPRO REASON CODE		G13	R3		
FPI		G13	R3		
REPLY AMPLIFICATION		G13	R3		
GPI (Reference Message DTG)	M		R3	0	Not Present
GRI		G14	R3/R5(4)		
FPI		G14	R3/R5		
URN		G14	R3/R5		

TABLE XVIII. Application header initial settings - Continued

Field Name	CAT	Group Code	Repeat Code	Prefill Value	Data Item
FPI		G14	R3/R5		
UNIT NAME		G14	R3/R5		
YEAR		G14	R3/R5		
MONTH		G14	R3/R5		
DAY		G14	R3/R5		
HOUR		G14	R3/R5		
MINUTE		G14	R3/R5		
SECOND		G14	R3/R5		
FPI		G14	R3/R5		
DTG EXTENSION		G14	R3/R5		
GPI (Future Use Group 6)	M	G15	R3	0	Not Present
GPI (Future Use Group 7)	M	G16	R3	0	Not Present
GPI (Future Use Group 8)	M	G17	R3	0	Not Present
GPI (Future Use Group 9)	M	G18	R3	0	Not Present
GPI (Future Use Group 10)	M	G19	R3	0	Not Present
GPI (Message Security Group)	M		R3	0	Not Present
SECURITY PARAMETERS INFORMATION		G20	R3		
GPI (Keying Material Group)		G20	R3		
KEYING MATERIAL ID LENGTH		G20/ G21	R3		
KEYING MATERIAL ID		G20/ G21	R3		
GPI (Cryptographic Initialization Group)		G20	R3		
CRYPTOGRAPHIC INITIALIZATION LENGTH		G20/ G22	R3		
CRYPTOGRAPHIC INITIALIZATION		G20/ G22	R3		
GPI (Key Token Group)		G20	R3		
KEY TOKEN LENGTH		G20/ G23	R3		
FRI		G20/ G23	R3/R6 (17)		

TABLE XVIII. Application header initial settings - Continued

Field Name	CAT	Group Code	Repeat Code	Prefill Value	Data Item
KEY TOKEN		G20/ G23	R3/R6		
GPI (Authentication (A) Group)		G20	R3		
AUTHENTICATION DATA (A) LENGTH		G20/ G24	R3		
AUTHENTICATION DATA (A)		G20/ G24	R3		
GPI		G20	R3		
AUTHENTICATION DATA (B) LENGTH		G20/ G25	R3		
AUTHENTICATION DATA (B)		G20/ G25	R3		
SIGNED ACKNOWLEDGE REQUEST INDICATOR		G20	R3		
GPI		G20	R3		
MESSAGE SECURITY PADDING LENGTH		G20/ G26	R3		
FPI		G20/ G26	R3		
MESSAGE SECURITY PADDING		G20/ G26	R3		
GPI	M	G27		0	Not Present
GPI	M	G28		0	Not Present
GPI	M	G29		0	Not Present
GPI	M	G30		0	Not Present
GPI	M	G31		0	Not Present

6.5 <u>Changes from previous issue.</u>
Marginal notations are used in this revision to identify changes with respect to the previous issue.

APPENDIX A

APPLICATION HEADER FIELDS AND CODES FOR VMF

A.1 General.

A.1.1 Scope.
This appendix contains definition of the VMF codes and values for application header fields that are dependent on the setting of the UMF field.

A.1.2 Application.
This appendix is conditional based on the setting of the UMF field as indicated in 5.6.4 and TABLE IV of this standard. If the UMF field is set to "2" (VMF), this appendix is mandatory for application headers pertaining to VMF messages. For all other settings of UMF field, this appendix is optional.

A.2 Applicable documents.

GOVERNMENT STANDARDS

MIL-STD-6017	DoD Interface Standard, Variable Message Format (VMF) MIL-STD-6017

A.3 Codeword tables.

A.3.1 Unit reference number codewords.
The VMF codes for the URN field shall be in accordance with the MIL-STD-6017.

A.3.2 FAD codewords.
The VMF codes for the FAD field are defined in TABLE A-I. The FAD field is defined in 5.6.5 of this document. The combination of the FAD field and the Message Number field shall point to the message number that appears in the Message Descriptions of the MIL-STD-6017. For example, if the UMF = 2 (VMF K-Series), FAD = 1 (General Information Exchange), and Message Number = 1 (Free Text Message), then this corresponds to message number K01.1, in the 'Message and Purpose Table' of the MIL-STD-6017.

TABLE A-I. FAD codewords

Functional Area	**Code** MSB - LSB
Network Control	0000 (0)
General Information Exchange	0001 (1)
Fire Support Operations	0010 (2)
Air Operations	0011 (3)

TABLE A-I. FAD codewords – Continued

Functional Area	**Code** MSB - LSB
Intelligence Operations	0100 (4)
Land Combat Operations	0101 (5)
Maritime Operations	0110 (6)
Combat Service Support	0111 (7)
Special Operations	1000 (8)
Joint Task Force (JTF) Operations Control	1001 (9)
Air Defense/Air Space Control	1010 (10)
Undefined	1011-1111 (11–15)

A.3.3 Message Number codewords.
The VMF codes for the Message Number field are listed in the MIL-STD-6017. The Message Number field is defined in 5.6.6 of this document.

A.3.4 Message Subtype codewords.
The VMF codes for the Message Subtype field are listed in TABLE A-II. The Message Subtype field is defined in 5.6.7 of this document. The combination of the FAD field (see 5.6.5), the Message Number field (see 5.6.6) and the Message Subtype field (see 5.6.7) identifies a specific case within a multi-purpose message.

A.3.4.1 MIL-STD-6017 message cases as message subtypes.
Case statements define the rules for the preparation of each message for transmission and/or reception. These statements include the specific function of a message, its purpose(s), and the conditions for the use of data groups and data elements within that message. Cases for each VMF message variant are found in the MIL-STD-6017, K-Series Message Formats Message Processing section of the parent message.

TABLE A-II. MIL-STD-6017 message subtypes

Message Subtype Case Number	**Code** MSB - LSB	
No Cases	0000000 (0)	
Case 1.1 through Case 1.127	0000001 through 1111111 (1 through 127)	In increments of 1 case.

A.3.5 CANTCO Reason codewords.
The VMF codes for the CANTCO Reason field are defined in TABLE A-III. The CANTCO Reason field is defined in 5.6.23 of this document.

TABLE A-III. CANTCO Reason codewords

CANTCO reason	**Code** MSB - LSB
Communications problem	000 (0)
Ammunition problem	001 (1)
Personnel problem	010 (2)
Fuel problem	011 (3)
Terrain/Environment problem	100 (4)
Equipment problem	101 (5)
Tactical Situation problem	110 (6)
Other	111 (7)

A.3.6 CANTPRO Reason codewords.
The VMF codes for the CANTPRO Reason field are defined in TABLE A-IV. The CANTPRO Reason field is defined in 5.6.24 of this document.

TABLE A-IV. CANTPRO Reason codes

CANTPRO Reason	**Code** MSB - LSB
Undefined	000000 (0)
Field content invalid	000001 (1)
Message incorrectly routed	000010 (2)
Address inactive	000011 (3)
Reference point unknown to receiving agency	000100 (4)

TABLE A-IV. CANTPRO Reason codes – Continued

CANTPRO Reason	Code MSB - LSB
Fire units shall be controlled by receiving agency	000101 (5)
Mission shall be controlled by receiving agency	000110 (6)
Mission number unknown by receiving agency	000111 (7)
Target number unknown by receiving agency	001000 (8)
Schedule number unknown by receiving agency	001001 (9)
Incorrect controlling address for a given track number	001010 (10)
Track number not in own track file	001011 (11)
Invalid according to given field	001100 (12)
Message cannot be converted	001101 (13)
Agency file full	001110 (14)
Agency does not recognize this message number	001111 (15)
Agency cannot correlate message to current file content	010000 (16)
Agency limit exceeded on repeated fields or groups	010001 (17)
Agency computer system inactive	010010 (18)
Addressee unknown	010011 (19)
Can't forward (agency failure)	010100 (20)
Can't forward (link failure)	010101 (21)
Illogical juxtaposition of header fields	010110 (22)
Cannot uncompress Unix (LZW) compressed data	010111 (23)
Cannot uncompress LZ-77 compressed data	011000 (24)
Message too old, based on Perishability	011001 (25)

TABLE A-IV. CANTPRO Reason codes – Continued

CANTPRO Reason	**Code** MSB - LSB
Security level restriction	011010 (26)
Authentication Failure	011011 (27)
Certificate not found	011100 (28)
Certificate invalid	011101 (29)
Do not support this SPI value	011110 (30)
Can not generate a signed acknowledgement	011111 (31)
Response not available for retransmission	100000 (32)
Undefined	100001-111111 (33 – 63)

A.3.7 Data field construction procedures for VMF messages/user data.
The following construction procedures prescribe the sequence in which the message fields are linearly joined to create the user data. The message is constructed with elemental data fields ordered as specified in the message descriptions provided in the MIL-STD-6017. The data elements for the messages are also as specified in the MIL-STD-6017. There are two representations for data elements: 7-bit ANSI ASCII characters and binary numbers. All fields shall be joined LSB first. The LSB of the first data field or field/group indicator shall be LSB-justified within the first byte of the message buffer. The LSB of each successive data field or field/group indicator shall be the LSB of the user data shown in FIGURE 2 of this document. The characters in a literal field are joined such that the LSB of the first character immediately follows the MSB of the previous field. The LSB of the second character immediately follows the MSB of the first character. This pattern is repeated until all characters of the field are joined.

APPENDIX B

EXAMPLE OF APPLICATION LAYER PDU AND VMF MESSAGE CONSTRUCTION

B.1 General.

B.1.1 Scope.
This appendix provides examples illustrating the construction of the Application Layer PDU and VMF Message data buffers (or streams).

B.1.2 Application.
This appendix is not a mandatory part of MIL-STD-2045-47001. The information contained herein is intended for guidance only.

B.2 Example application layer PDU construction.
This section provides an example illustrating the construction of the Application Layer PDU data buffer (or stream).

B.2.1 Application layer data exchange.
The relationship of the Application Layer to other communication layers is shown in FIGURE B-1. A layered communication model is used in this example for consistency with the principles of the ISO OSI reference model. The model discussed here is tailored to focus attention specifically on the Application Layer, and the data it produces. A user of the Application Layer exchanges user data with its peer at another node by sending and receiving the User Data via the Application Layer. The Application Layer sends and receives the User Data transparently by producing and exchanging an Application Layer PDU with its peer at another node. The Application Layer PDU consists of the Application Header concatenated with the User Data, and is sent and received via lower communication layers. The lower communication layers send and receive the User Data transparently over a variety of communications media.

The format of the Application Layer PDU is defined in terms of the actual data buffer or data stream used to exchange the PDU between the Application Layer and the lower communication layers. The rationale for using the PDU's data buffer/stream to define the format is 1) for consistency with industry standard commercial communications hardware and software (e.g., UNIX implementations of TCP/IP), which exchange data with other software when sending or receiving as a buffer or stream of octets; 2) to provide a definition independent of the specifics of any other communication layer, consistent with the ISO OSI model principle of making communication layers independent; and 3) to avoid differences in the bit representations used to implement communications on different media. For example, on Ethernet LAN media each octet is sent LSB first, but on FDDI media each octet is sent MSB first. To achieve a universal definition of the PDU format, its representation is defined independent of the other communication layers. The relationship of the Application Layer PDU's data buffer/stream to the Application Layer is depicted in FIGURE B-2. The Application Layer PDU is defined as a buffer or stream of octets. The rational for treating the PDU as a series of octets is for consistency with the way communications data is handled by industry standard commercial communications hardware and software and for independence from platform-dependent byte ordering issues. The Application Header and the User Data are each individually defined as a series of octets for the same reasons.

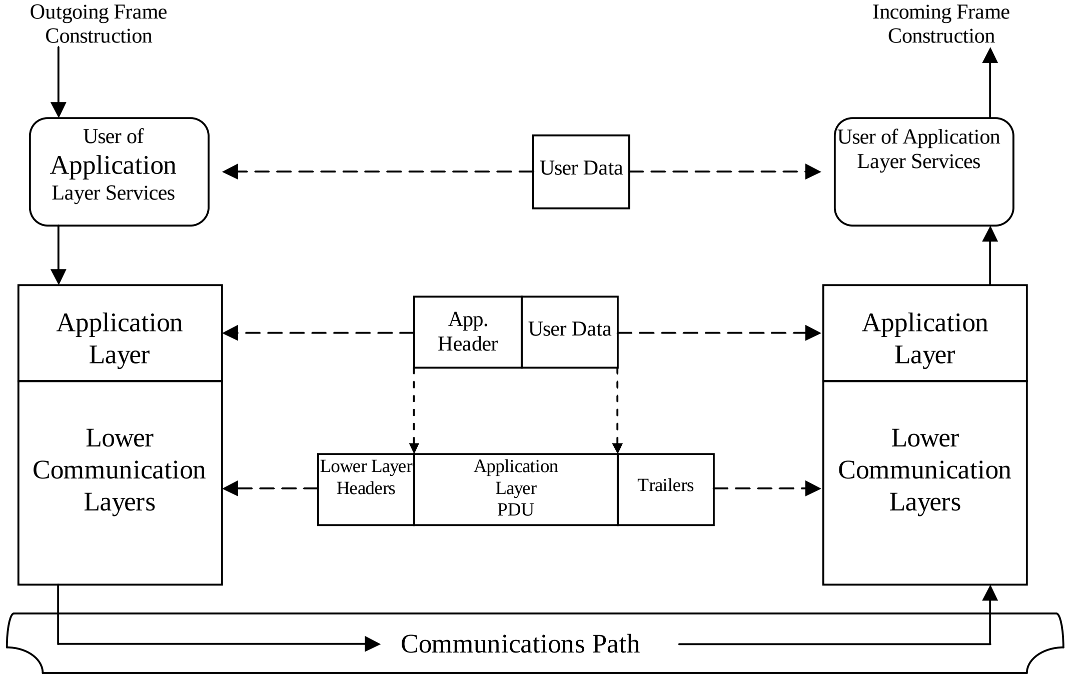


FIGURE B-1. Application layer interaction with other communications layers

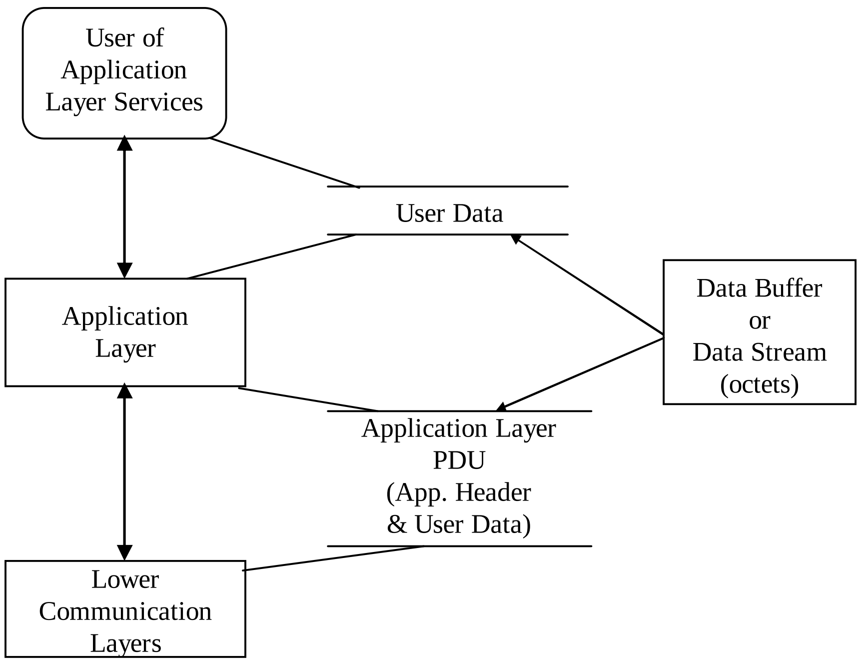


FIGURE B-2. Exchange of application layer PDU between communications layers

B.2.2 <u>Example.</u>
The construction of an Application Layer PDU is illustrated by the example in TABLE B-I. Example construction of application layer PDU. The first four columns of the table provide a description of each field in the example, the field length in bits, and the value of the field in both decimal and binary representations. The last four columns show the physical encoding of the Application Layer PDU. In the fifth column, Field Fragments, the bits of each field are placed in octets. The bit(s) of each field are positioned in an octet such that the LSB of the field is positioned in the least significant unencoded bit of the octet, the next LSB of the field is placed in the next least significant unencoded bit of the octet, and repeated until all of the bits of the field have been encoded. When an octet is filled before all the bits of a field are encoded, the process is continued encoding the next octet with the remaining bits of the field. This field/octet encoding procedure is performed starting with the first field and octet, and repeated for each successive field and individual octet, in order, until the encoding is completed. When a field has groups, the field encoding procedure is performed starting with the first group, and repeated for each successive group and individual octet, in order, until the encoding of the field is completed. The Unit Name field illustrates the encoding of a field with groups. Note the LSB of a field or octet is defined as the bit having the weight of 20 when the field or octet is represented as a numeric value. X’s are used to identify bits that are not associated with the field being encoded. The sixth column, Octet Value - Binary, assembles the bits contributed by successive fields into complete octets, represented in binary. The seventh column, Octet Value - Hexadecimal, represents the octet value in hexadecimal. The last column, Octet Number, numbers the octets from first to last starting with 0.

When all fields have been encoded, any remaining unencoded bits in the last octet are filled with zeroes (zero padded). The Application Header is individually encoded and zero padded. The User Data is individually encoded and zero padded before it is passed to the Application Layer to have the Application Header added.

Unit Name is a variable length field. It can be terminated either with an end of text marker, or by using the maximum number of bits. In this example, the field is terminated with the Application Header end of text marker, the ANSI ASCII Delete character.

The Application Header is followed by the User Data. The User Data is shown as a single 10-octet message to complete the Application Layer PDU.

TABLE B-I. Example construction of application layer PDU

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
Application Header							
Version	4	3	0011	XXXX0011			
FPI	1	0	0	XXX0XXXX			
Data Compression Type	2	NA					
GPI for Originator Address	1	1	1	XX1XXXXX			
FPI for URN	1	1	1	X1XXXXXX			
URN	24	207	000000000000000011001111	1XXXXXXX	11100011	E3	0
				01100111	01100111	67	1
				00000000	00000000	00	2

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
				X0000000			

TABLE B-I. Example construction of application layer PDU – Continued

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
FPI for Unit Name	1	1	1	1XXXXXXX	10000000	80	3
Unit Name (Note 1)	448 max	UNITA					
	7	85	1010101	X1010101			
	7	78	1001110	0XXXXXXX	01010101	55	4
				XX100111			
	7	73	1001001	01XXXXXX	01100111	67	5
				XXX10010			
	7	84	1010100	100XXXXX	10010010	92	6
				XXXX1010			
	7	65	1000001	0001XXXX	00011010	1A	7
				XXXXX100			
End of text marker (ANSI ASCII DEL)	7	127	1111111	11111XXX	11111100	FC	8
				XXXXXX11			
GPI for Recipient Address Group	1	1	1	XXXXX1XX			
GRI for R1	1	0	0	XXXX0XXX			
FPI for URN	1	1	1	XXX1XXXX			
URN	24	3	000000000000000000000011	011XXXXX	01110111	77	9
				00000000	00000000	00	10
				00000000	00000000	00	11
				XXX00000			
FPI for Unit Name	1	0	0	XX0XXXXX			
Unit Name	448	NA					
GPI for Information Address Group	1	0	0	X0XXXXXX			
GRI for R2	1	NA					
FPI for URN	1	NA					

TABLE B-I. Example construction of application layer PDU – Continued

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
URN	24	NA					
FPI for Unit Name	1	NA					
Unit Name	448	NA					
FPI for Header Size	1	0	0	0XXXXXXX	00000000	00	12
Header Size	16	NA					
GPI for FUTURE USE 1	1	0	0	XXXXXXX0			
GPI for FUTURE USE 2	1	0	0	XXXXXX0X			
GPI for FUTURE USE 3	1	0	0	XXXXX0XX			
GPI for FUTURE USE 4	1	0	0	XXXX0XXX			
GPI for FUTURE USE 5	1	0	0	XXX0XXXX			
GRI for R3	1	0	0	XX0XXXXX			
UMF	4	2	0010	10XXXXXX	10000000	80	13
				XXXXXX00			
FPI for Message Standard Version	1	0	0	XXXXX0XX			
Message Standard Version	4	NA					
GPI for VMF Message Identification Group	1	1	1	XXXX1XXX			
FAD	4	15	1111	1111XXXX	11111000	F8	14
Message Number	7	99	1100011	X1100011			
FPI for Message Subtype	1	0	0	0XXXXXXX	01100011	63	15
Message Subtype	7	NA					
FPI for File Name	1	0	0	XXXXXXX0			
File Name	448	NA					
FPI for Message Size	1	0	0	XXXXXX0X			
Message Size	20	NA					
Operation Indicator	2	1	01	XXXX01XX			
Retransmit Indicator	1	0	0	XXX0XXXX			
Message Precedence Codes	3	2	010	010XXXXX	01000100	44	16
Security Classification	2	0	00	XXXXXX00			
FPI for Control/Release Marking	1	0	0	XXXXX0XX			
FRI	1	NA					
Control/Release Marking	9	NA					
GPI for Originator DTG	1	1	1	XXXX1XXX			
Year	7	4	0000100	0100XXXX	01001000	48	17
				XXXXX000			

TABLE B-I. Example construction of application layer PDU – Continued

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
Month	4	2	0010	X0010XXX			
Day	5	14	01110	0XXXXXXX	00010000	10	18
				XXXX1110			
Hour	5	15	01111	1111XXXX	11111110	FE	19
				XXXXXXX0			
Minute	6	27	011011	X011011X			
				1XXXXXXX	10110110	B6	20
Second	6	55	110111	XXX11011			
FPI for DTG Extension	1	0	0	XX0XXXXX			
DTG Extension	12	NA					
GPI for Perishability DTG	1	0	0	X0XXXXXX			
Year	7	NA					
Month	4	NA					
Day	5	NA					
Hour	5	NA					
Minute	6	NA					
Second	6	NA					
GPI for Acknowledgment Request Group	1	1	1	1XXXXXXX	10011011	9B	21
Machine Acknowledge Request Indicator	1	1	1	XXXXXXX1			
Operator Acknowledge Request Indicator	1	0	0	XXXXXX0X			
Operator Reply Request Indicator	1	0	0	XXXX0XXX			
GPI for Response Data Group	1	0	0	XXX0XXXX			
Year	7	NA					
Month	4	NA					
Day	5	NA					
Hour	5	NA					
Minute	6	NA					
Second	6	NA					
FPI for DTG Extension	1	NA					
DTG Extension	12	NA					
R/C	3	NA					

TABLE B-I. Example construction of application layer PDU – Continued

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
FPI for CANTCO Reason Code	1	NA					
CANTCO Reason Code	3	NA					
FPI for CANTPRO Reason Code	1	NA					
CANTPRO Reason Code	6	NA					
FPI for Reply Amplification	1	NA					
Reply Amplification	350	NA					
GPI for Reference Message Data Group	1	0	0	XX0XXXXX			
GRI	1	NA					
FPI for URN	1	NA					
URN	24	NA					
FPI for Unit Name	1	NA					
Unit Name	448	NA					
Year	7	NA					
Month	4	NA					
Day	5	NA					
Hour	6	NA					
Minute	6	NA					
Second	6	NA					
FPI for DTG Extension	1	NA					
DTG Extension	12	NA					
GPI for FUTURE USE 6	1	0	0	X0XXXXXX			
GPI for FUTURE USE 7	1	0	0	0XXXXXXX	00000001	01	22
GPI for FUTURE USE 8	1	0	0	XXXXXXX0			
GPI for FUTURE USE 9	1	0	0	XXXXXX0X			
GPI for FUTURE USE 10	1	0	0	XXXXX0XX			
GPI for Message Security Group	1	0	0 (If the GPI is zero the other GPIs are not sent.)	XXXX0XXX			
Security Parameters Information	4	NA	NA				
GPI for Keying Material Group	1	NA					
Keying Material ID Length	3	NA					
Keying Material ID	64	NA					

TABLE B-I. Example construction of application layer PDU – Continued

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
GPI for Cryptographic Initialization Group	1	NA					
Cryptographic Initialization Length	4	NA					
Cryptographic Initialization	1024	NA					
GPI for Key Token Group	1	NA					
Key Token Length	8	NA					
FRI	1	NA					
Key Token	16384	NA					
GPI for Authentication Data (A) Group	1	NA					
Authentication Data (A) Length	7	NA					
Authentication Data (A)	8192	NA					
GPI for Authentication Data (B) Group	1	NA					
Authentication Data (B) Length	7	NA					
Authentication Data (B)	8192	NA					
Signed Acknowledge Request Indicator	1	NA					
GPI for Message Security Padding Group	1	NA					
Message Security Padding Length	8	NA	NA				
FPI for Message Security Padding	1	NA	NA				
Message Security Padding	2040	NA	NA				
GPI for FUTURE USE 11	1	0	0	XXX0XXXX			
GPI for FUTURE USE 12	1	0	0	XX0XXXXX			
GPI for FUTURE USE 13	1	0	0	X0XXXXXX			
GPI for FUTURE USE 14	1	0	0	0XXXXXXX	00000000	00	23
GPI for FUTURE USE 15	1	0	0	XXXXXXX0			
(Zero Padding)	7	0	0000000	0000000X	00000000	00	24
User Data							
Message 1	5*8						25-29

Note 1: One and only one of the fields Unit Name and URN are to be present. Unit Name is shown present only for illustrative purposes, and is incorrectly shown with the URN also present.

B.3 Example VMF message construction.
This section provides an example illustrating the construction of the VMF Message data buffer (or stream).

B.3.1 VMF message data exchange.
The relationship of the VMF Messaging Services to other communication layers is shown in FIGURE B-3. A layered communication model is used in this example for consistency with the principles of the ISO OSI reference model. The model discussed here is tailored to focus attention specifically on VMF Messaging Services, and the data it produces. A user of VMF Messaging Services exchanges Message Content with its peer at another node by sending and receiving the Message Content via the VMF Messaging Services. VMF Messaging Services sends and receives the Message Content by converting the Message Content to Message Data and exchanging the Message Data with its peer at another node. The VMF Message Data is sent and received via lower communication layers. The lower communication layers send and receive the VMF Message Data transparently over a variety of communications media. Note that VMF Messaging Services would ordinarily use Application Layer services from the lower communication layers to send and receive Message Data. The Message Data would then appear in the Application Layer PDU's User Data field.

The format of the Message Data is defined in terms of the actual data buffer or data stream used to exchange the Message Data between the VMF Messaging Services and the lower communication layers. The rationale for using the Message Data's data buffer/stream to define the format is 1) for consistency with industry standard commercial communications hardware and software (e.g., UNIX implementations of TCP/IP), which exchange data with other software when sending or receiving as a buffer or stream of octets; 2) to provide a definition independent of the specifics of any other communication layer, consistent with the ISO OSI model principle of making communication

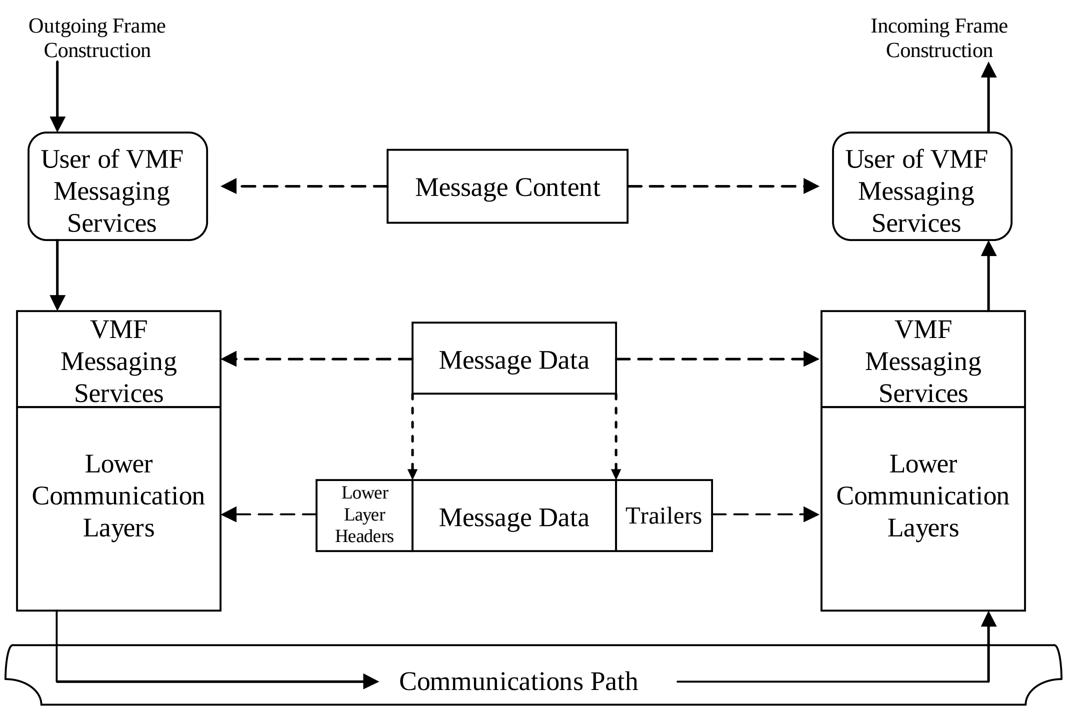


FIGURE B-3. VMF message services interaction with other communications layers

layers independent; and 3) to avoid differences in the bit representations used to implement communications on different media. For example, on Ethernet LAN media each octet is sent LSB first, but on FDDI media each octet is sent MSB first. To achieve a universal definition of the Message Data format, its representation is defined independent of the other communication layers. The relationship of the Message Data's data buffer/stream to the VMF Messaging Services is depicted in FIGURE B-4. The Message Data is defined as a buffer or stream of octets. The rational for treating the Message Data as a series of octets is for consistency with the way communications data is handled by industry standard commercial communications hardware and software and for independence from platform-dependent byte ordering issues.

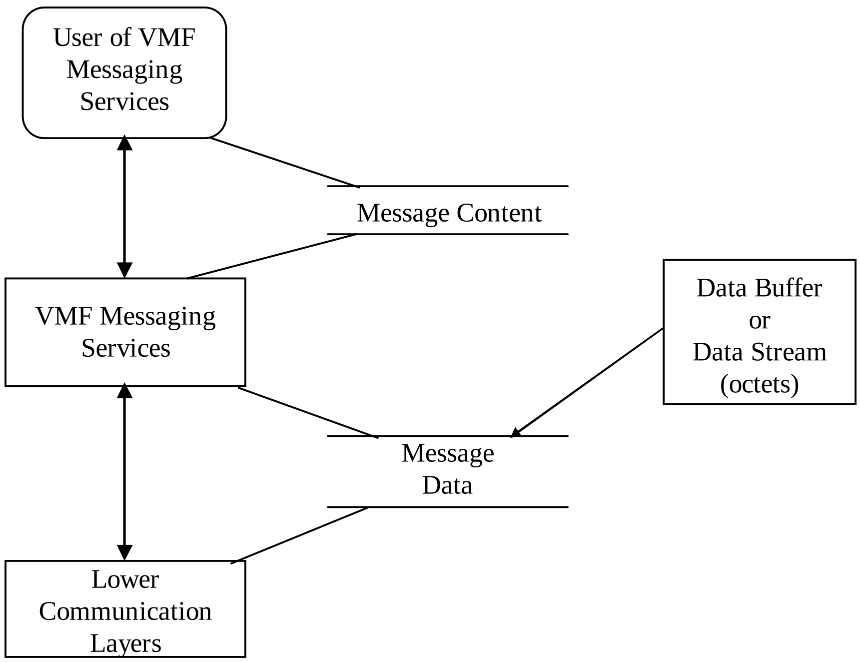


FIGURE B-4. Exchange of message data between communications layers

B.3.2 Example.

The construction of VMF Message Data is illustrated by the example in TABLE B-II. Example construction of fictitious VMF message data. The first four columns of the table provide a description of each field in the example, the field length in bits, and the value of the field in both decimal and binary representations. The last four columns show the physical encoding of the VMF Message Data. In the fifth column, Field Fragments, the bits of each field are placed in octets. The bit(s) of each field are positioned in an octet such that the LSB of the field is positioned in the least significant unencoded bit of the octet, the next LSB of the field is placed in the next least significant unencoded bit of the octet, and repeated until all of the bits of the field have been encoded. When an octet is filled before all the bits of a field are encoded, the process is continued encoding the next octet with the remaining bits of the field. This field/octet encoding procedure is performed starting with the first field and octet, and repeated for each successive field and individual octet, in order, until the encoding is completed. When a field has groups, the field encoding procedure is performed starting with the first group, and repeated for each successive group and individual octet, in order, until the encoding of the field is completed. The Target Number field illustrates the encoding of a field with groups. Note the LSB of a field or octet is defined as the bit having the weight of 20 when the field or octet is represented as a numeric value. X's are used to identify bits that are not associated with the field being encoded. The sixth column, Octet Value - Binary, assembles the bits contributed by successive fields into complete octets, represented in binary. The seventh column, Octet Value - Hexadecimal, represents the octet value in hexadecimal. The last column, Octet Number, numbers the octets from first to last starting with 0.

When all fields have been encoded, any remaining unencoded bits in the last octet are filled with zeroes (zero padded). Each VMF Message is individually encoded and zero padded.

TABLE B-II. Example construction of fictitious VMF message data

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
Field 1	5	0	00000	XXX00000			
FPI	1	1	1	XX1XXXXX			
Field 2 (ASCII CHAR)	7	66(B)	1000010	10XXXXXX	10100000	A0	1
				XXX10000			
FPI	1	1	1	XX1XXXXX			
Field 3 (A1234)	21						
Group 1 (ASCII CHAR)		65 (A)	1000001	01XXXXXX	01111000	78	2
				XXX10000			
Group 2		1234	00010011010010	010XXXXX	01010000	50	3
				10011010	10011010	9A	4
				XXXXX000			
FPI	1	0	0	XXXX0XXX			
Field 4	21	NA					
GPI	1	0	0	XXX0XXXX			
Field 5	5	NA					
Field 6	6	NA					
Field 7	6	NA					
FPI	1	0	0	XX0XXXXX			
Field 8	7	NA					
GPI	1	0	0	X0XXXXXX			
Field 9	24	NA					
Field 10	32	NA					
Field 11	5	NA					
Field 12	5	NA					
Field 13	6	NA					
Field 14	6	NA					
(Zero Padding)	1	0	0	0XXXXXXX	00000000	00	5

B.3.3 Example.
TABLE B-III. Example of Future Use Groups provides an example of the use of Future Use Groups. The Future Use Groups were designed to take into consideration future Application Header expansion but yet retain backward compatibility between various MIL-STD-2045-47001 versions. The premise is that once all systems have implemented version D and greater no new fields shall be added outside these Future Use Groups. Refer to paragraph 5.5.6.4 for further descriptions.

TABLE B-III. Example of Future Use Groups

Field Name	CAT	Group Code	Repeat Code	Description/ Resolution	Maximum Field Size (bits)
GPI	M			FUTURE USE 1	1
GROUP SIZE		G4			12
FPI		G4			1
NEW FIELD A1		G4			4
FPI		G4			1
NEW FIELD A2		G4			6
GPI FOR G4.1*		G4/G4.1*			1
GPI FOR G4.2*		G4/G4.2*			1
GPI FOR G4.3*		G4/G4.3*			1
GPI	M			FUTURE USE 2	1
GROUP SIZE		G5			12
FPI		G5			1
NEW FIELD B1		G5			2
FPI		G5			1
NEW FIELD B2		G5			8
GPI FOR G5.1		G5/G5.1			1
GPI FOR G5.2		G5/G5.2			1
GPI FOR G5.3		G5/G5.3			1
GPI	M			FUTURE USE 3	1
GROUP SIZE		G6			12
FPI		G6			1
NEW FIELD C1		G6			2
FPI		G6			1
NEW FIELD C2		G6			8
GPI FOR G6.1		G6/G6.1			1
GPI FOR G6.2		G6/G6.2			1
GPI FOR G6.3		G6/G6.3			1
GPI	M			FUTURE USE 4	1
GROUP SIZE		G7			12
GPI	M			FUTURE USE 5	1
GROUP SIZE		G8			12
GPI	M		R3	FUTURE USE 6	1
GROUP SIZE		G15	R3		12
FPI		G15	R3		1
NEW FIELD D1		G15	R3		3

FPI		G15	R3		1
NEW FIELD D2		G15	R3		7
GPI FOR G15.1		G15/G15.1	R3		1

TABLE B-III. Example of Future Use Groups – Continued

Field Name	CAT	Group Code	Repeat Code	Description/ Resolution	Maximum Field Size (bits)
GPI FOR G15.2		G15/G15.2	R3		1
GPI FOR G15.3		G15/G15.3	R3		1
GPI	M		R3	FUTURE USE 7	1
GROUP SIZE		G16	R3		12
FPI		G16	R3		1
NEW FIELD E1		G16	R3		4
FPI		G16	R3		1
NEW FIELD E2		G16	R3		5
GPI FOR G16.1		G16/G16.1	R3		1
GPI FOR G16.2		G16/G16.2	R3		1
GPI FOR G16.3		G16/G16.3	R3		1
GPI	M		R3	FUTURE USE 8	1
GROUP SIZE		G17	R3		12
GPI	M		R3	FUTURE USE 9	1
GROUP SIZE		G18	R3		12
GPI	M		R3	FUTURE USE 10	1
GROUP SIZE		G19	R3		12
GPI	M			FUTURE USE 11	1
GROUP SIZE		G27			12
FPI		G27			1
NEW FIELD F1		G27			5
FPI		G27			1
NEW FIELD F2		G27			5
GPI FOR G27.1		G27/G27.1			1
GPI FOR G27.2		G27/G27.2			1
GPI FOR G27.3		G27/G27.3			1
GPI	M			FUTURE USE 12	1
GROUP SIZE		G28			12
GPI	M			FUTURE USE 13	1
GROUP SIZE		G29			12
GPI	M			FUTURE USE 14	1
GROUP SIZE		G30			12
GPI	M			FUTURE USE 15	1
GROUP SIZE		G31			12

* Groups G4.1 – G4.3, describe future nested groups within group 4.

APPENDIX C

SEGMENTATION/REASSEMBLY PROTOCOL

C.1 General.

C.1.1 Scope.
Segmentation/Reassembly (S/R) protocol has an important capability of being able to segment a large information transfer when it is transmitted over bandwidth limited communication channels. The S/R protocol has an important mechanism that tries to ensure that segments will only be re-sent if they were not previously received. This concept is referred to as Selective Retransmission, the goal of which is to avoid most unnecessary resends of large segments over bandwidth limited CNR networks. In addition to Selective Retransmission, the S/R Protocol ensures that IP Fragmentation will not occur on an IPv4 network, and can be configured such that the Data Link Layer Maximum Transmission Unit size is not violated. The S/R protocol provides reliable connectionless service on top of UDP or N-layer pass through with minimum overhead. The S/R Protocol does not address use with TCP at the Transport Layer, as the CNR WG strongly discourages the use of TCP on CNR networks. This appendix specifies the S/R protocol, the notation, the S/R parameters, and the S/R processing for interoperability among CNR networks. It is designed specifically with CNR network usage in mind. The S/R procedures are set forth in the following paragraphs.

The S/R procedure described here handles the S/R protocol transparently to the application. The S/R protocol shall be automatically applied to application layer PDUs that exceed a specified segment size. If the S/R protocol is implemented with the default parameters specified in this appendix, and used in conjunction with MIL-STD-188-220 and the default parameters specified in that document for Intranet Fragmentation/Reassembly Protocol, the Intranet Fragmentation/Reassembly Protocol specified in MIL-STD-188-220D and later versions will be precluded from invocation.

There are two S/R Protocols defined in this appendix: S/R Basic and S/R Enhanced. All platforms shall implement either S/R Basic or S/R Enhanced in order to be compliant with the specification. The S/R Basic Protocol is intended to provide minimum interoperability in order to exchange large messages between platforms. The S/R Enhanced Protocol is provided for platforms that desire greater efficiency over the air at the expense of a more complex implementation. If a platform implements the S/R Enhanced Protocol, it does not have to implement the S/R Basic Protocol, as the two protocols are designed to be fully compatible. Any station using S/R Basic should be able to send and receive messages to and from any station using S/R Enhanced, and vice versa. The variables, parameters, and timers used by the S/R Basic Protocol are a subset of the S/R Enhanced Protocol, however, in some cases the internal actions taken when timers expire differ between the two versions of the protocol, but in a way that is intended to preserve interoperability.

The S/R process shall take place at the interface between the Application Layer and the next lower level layer (e.g., Transport Layer or Intranet Layer).

C.1.2 Application.
This appendix is a mandatory part of MIL-STD-2045-47001.

C.1.3 Definitions.

C.1.3.1 Definitions of terms.
The following terms are used in this Appendix:

a. Sent: For the purpose of the S/R Appendix, the term "sent" refers to the action of the S/R Layer making a data transfer request to the next lower level layer in the protocol stack (e.g., UDP or N-Layer Pass Through) to transmit data.

b. Originator: The station sending Application PDU segments.

c. Destination: The station receiving Application PDU segments.

d. Application PDU Identifier: The unique identifier used to determine the Application PDU of the current transfer. This identifier consists of the Originator Address combined with the unique Serial Number of the transfer.

e. Request for Acknowledgment: An Originator is said to have issued a Request for Acknowledgment any time it sends an Acknowledgement Request or a segment with the P-bit = 1.

f. Unsent Segment: A segment is considered an Unsent Segment only the first time it is transmitted by an Originator. If a segment is re-sent for any reason, it is no longer considered an Unsent Segment.

g. Variable: Variables are dynamic. They are tracked by either the Originator or Destination as appropriate and are reset, incremented, or calculated when certain events occur during run-time.

h. Parameter: Parameters are values used in calculations by either an Originator or Destination and are passed into the system (i.e., using a configuration message or non-volatile storage). These Parameters usually remain fixed during run-time; however systems implementing advanced algorithms may wish to adjust these variables during run-time based on measured data collected during operation. This appendix provides minimum, maximum, and default values for Parameters. The default values presented in this appendix will not be optimal for all system configurations and shall be stored in such a way that systems are able to alter the default values, e.g., load a new set of tables from a CD-ROM.

i. Rate Limited CNR: Low bandwidth radio networks that are used for tactical combat operations. Communication over these radios is characterized by frequent transmissions which are corrupted even after Forward Error Correction (FEC) has been applied at the receiver, e.g., networks using VHF SINCGARS waveform.

j. Selective Retransmission: Mechanism by which only segments that were not received by a Destination are retransmitted, as opposed to retransmitting all segments of a transaction.

k. Bit Mask: Field in the Partial Acknowledgment PDU consisting of a series of bits (i.e., set to value 1 or 0) where each bit in the field represents the acknowledgment status of a corresponding data segment.

l. OUTSTANDING Segment Number: Any segment that has been sent, but for which acknowledgments have not been received and processed from all ACTIVE Destinations.

C.1.3.2 Summary of S/R acronyms, terms, explanations, and applications.
S/R acronyms, terms, explanations, and applications used in this appendix are defined in TABLE C-I. below for convenience of the reader.

Constant in the Remarks field refers to a parameter whose value is assigned during initialization and does not change unless the network configuration changes.

TABLE C-I. Summary of S/R acronyms, terms, explanations, and applications

S/R Items	Description	Cross Reference	Maintained By (Originator (O) /Destination (D))	Remarks	Basic / Enhanced
ABRRC	Abort Request Retry Count	C.3.6.7.2 C.3.6.7.3 C.3.6.5.5	O/D		Enhanced
ABRRL	Abort Request Retry Limit	C.3.6.5.5	O/D	Constant	Enhanced
ABRT	Abort Request Timer	C.3.6.5.5	O		Enhanced
DACR	Destination Abort Confirm Received	C.3.6.7.2	O		Enhanced
DRFST	Destination Reference Freeze State Timer	C.3.6.5.3	D		Enhanced
DS	Destination Status	C.3.6.7.2 C.3.6.5.2	O		Basic & Enhanced
EDT	End of Data Transfer	C.1.4 C.3.3.1.3 C.3.3.2 C.3.4.1	N/A	Terminology	N/A
EISRIAI	Estimated Inter-Segment Receive Interval Adjustment Increment	C.3.6.5.12	D		Enhanced
EISRIAP	Estimated Inter-Segment Interval Aging Period	C.3.6.3.1.f	D	Constant	Enhanced
EISRIAS	Estimated Inter-Segment Interval Aging Steps	C.3.6.7.1 C.3.6.5.12	D		Enhanced
EISRIAT	Estimated Inter-Segment Interval Aging Timer	C.3.6.5.12	D		Enhanced
EISRILT	Estimated Inter-Segment Receive Interval Lifetime	C.3.6.7.1	D	Constant	Enhanced
EISRIT	Estimated Inter-Segment Receive Interval Time	C.3.6.7.1 C.3.6.6.3 C.3.6.5.11 C.3.6.5.12	D		Enhanced
EISRITF	Expired Inter-Segment Receive Interval Timer Factor	C.3.6.5.11	D	Constant	Enhanced

TABLE C-I. Summary of S/R acronyms, terms, explanations, and applications - Continued

S/R Items	Description	Cross Reference	Maintained By (Originator (O) /Destination (D))	Remarks	Basic / Enhanced
ERTD	Estimated Round Trip Delay	C.3.6.7.1 C.3.6.5.9 C.3.6.5.4 C.3.6.5.5 C.3.6.6.1	O		Enhanced
ERTDAI	Estimated Round Trip Delay Adjustment Increment	C.3.6.5.9	O		Enhanced
ERTDAP	Estimated Round Trip Delay Aging Period	C.3.6.5.9 C.3.6.5.12	O	Constant	Enhanced
ERTDAS	Estimated Round Trip Delay Aging Steps	C.3.6.7.1 C.3.6.5.9	O		Enhanced
ERTDAT	Estimated Round Trip Delay Aging Timer	C.3.6.5.9	O		Enhanced
ERTDLT	Estimated Round Trip Delay Lifetime	C.3.6.7.1		Constant	Enhanced
ESATF	Expired Segment Acknowledgment Timer Factor	C.3.6.5.4	O	Constant	Enhanced
HNSR	Highest Numbered Segment Received	C.3.3.3.2	D		Basic & Enhanced
HNSS	Highest Numbered Segment Sent	C.3.6.7.2 C.3.6.5.4	O		Basic & Enhanced
HOPCNT	Hop Count	C.3.6.7.1	O/D		Basic & Enhanced
IISRIT	Initial Inter-Segment Receive Interval Timer	C.3.6.7.1 C.3.6.5.1 C.3.6.5.12	D		Basic & Enhanced
IRTD	Initial Round Trip Delay	C.3.6.7.1 C.3.6.5.9	O		Basic & Enhanced
ISRIT	Inter-Segment Receive Interval Timer	C.3.6.5.11 C.3.6.6.3	D		Basic & Enhanced
ISRITDF	Inter-Segment Receive Interval Timer Down Factor	C.3.6.6.3	D	Constant	Enhanced
ISRITEC	Inter-Segment Receive Interval Timer Expirations Count	C.3.6.6.3 C.3.6.7.3 C.3.6.5.11	D		Enhanced

TABLE C-I. Summary of S/R acronyms, terms, explanations, and applications - Continued

S/R Items	Description	Cross Reference	Maintained By (Originator (O) /Destination (D))	Remarks	Basic / Enhanced
ISRITEL	Inter-Segment Receive Interval Timer Expirations Limit	C.3.6.5.11	D	Constant	Enhanced
ISRITJF	Inter-Segment Receive Interval Timer Jitter Factor	C.3.6.5.11 C.3.6.6.3	D	Constant	Enhanced
ISRITUF	Inter-Segment Receive Interval Timer Up Factor	C.3.6.6.3	D	Constant	Enhanced
ISRT	Inter-Segment Receive Timer	C.3.6.5.10 C.3.6.6.3	D		Basic & Enhanced
ISST	Inter-Segment Send Timer	C.3.6.5.7	O		Enhanced
ISSTAF	Inter-Segment Send Timer Adjustment Factor	C.3.6.5.7	O	Constant	Enhanced
LNUS	Lowest Numbered Unacknowledged Segment	C.3.6.6.2 C.3.6.7.2	O		Basic & Enhanced
LSN	Last Segment Number	C.3.3.2.2 C.3.6.5.11	O/D		Basic & Enhanced
MESR	Maximum Estimated Round Trip Delay (ERTD) to Saved Estimated Round Trip Delay (SERTD) Ratio	C.3.6.5.4	O	Constant	Enhanced
MESRITR	Maximum Estimated Inter-Segment Receive Interval Time (EISRIT) to Saved Estimated Inter-Segment Receive Interval Time (SEISRIT) Ratio	C.3.6.5.11	D	Constant	Enhanced
MISRIT	Measured Inter-Segment Receive Interval Time	C.3.6.6.3	D		Basic & Enhanced
MRTD	Measured Round Trip Delay	C.3.6.6.1	O		Basic & Enhanced
MSS	Maximum segment size	C.3.1	O/D	Constant	Basic & Enhanced

TABLE C-I. Summary of S/R acronyms, terms, explanations, and applications - Continued

S/R Items	Description	Cross Reference	Maintained By (Originator (O) /Destination (D))	Remarks	Basic / Enhanced
NOMST	Number of Missing Segment Threshold	C.3.6.2.1.f	D	Constant	Enhanced
NOSNR	Number of Segments Not Received	C.3.6.7.3 C.3.6.5.3	D		Enhanced
NOSR	Number of Segments Received	C.3.6.7.3 C.3.6.5.11	D		Enhanced
NS	Number of Stations	C.3.6.3.3.y	O		Enhanced
OACR	Originator Abort Confirm Received	C.3.6.7.3	D		Enhanced
ORFST	Originator Reference Freeze State Timer	C.3.6.5.6	O		Enhanced
PAIT	Partial Acknowledgment Interval Timer	C.3.6.5.8	D		Enhanced
PAITAF	Partial Acknowledgment Interval Timer Adjustment Factor	C.3.6.5.8	D	Constant	Enhanced
PASSN	Partial Acknowledgment Starting Segment Number	C.3.6.6.2	O		Basic & Enhanced
QSO	Queue Size in Octets	Specified in the MIL-STD-188-220 Parameter Tables	N/A	Terminology	N/A
REISRIT	Relaxed Estimated Inter-Segment Receive Interval Time	C.3.6.7.1 C.3.6.6.3 C.3.6.5.11 C.3.6.5.3	D		Enhanced
RERTD	Relaxed Estimated Round Trip Delay	C.3.6.7.1 C.3.6.5.4	O		Basic & Enhanced
RFAIT	Request for Acknowledgment Interval Timer	C.3.6.5.2	O		Basic & Enhanced
RFAITAF	Request for Acknowledgment Interval Timer Adjustment Factor	C.3.6.5.2	O	Constant	Enhanced
RFARC	Request for Acknowledgment Retry Count	C.3.6.7.2 C.3.6.5.2	O		Basic & Enhanced

TABLE C-I. Summary of S/R acronyms, terms, explanations, and applications - Continued

S/R Items	Description	Cross Reference	Maintained By (Originator (O) /Destination (D))	Remarks	Basic / Enhanced
RFARL	Request for Acknowledgment Retry Limit	C.3.6.5.3	O	Constant	Basic & Enhanced
RSCT	Received Segment Count Threshold	C.3.6.2.1.e	D	Constant	Enhanced
RT	Reassembly Timer	C.3.6.5.1 C.3.6.6.3 C.3.6.5.11	D		Enhanced
RTD	Round Trip Delay	C.3.6.6.1	N/A	Terminology	N/A
RTDJF	Round Trip Delay Jitter Factor	C.3.6.6.1	O	Constant	Enhanced
RTDDF	Round Trip Delay Down Factor	C.3.6.6.1	O	Constant	Enhanced
RTDUF	Round Trip Delay Up Factor	C.3.6.6.1	O	Constant	Enhanced
RTEC	Reassembly Timer Expiration Count	C.3.6.5.1	D		Enhanced
RTECL	Reassembly Timer Expiration Count Limit	C.3.6.5.1	D	Constant	Enhanced
SAT	Segment Acknowledgment Time	C.3.6.5.4	O		Enhanced
SCL	Segment Credit Limit	C.3.6.5.3	O	Constant	Basic & Enhanced
SCT	Segment Credit Threshold	C.3.6.2.1.b	O	Constant	Enhanced
SCU	Segment Credits Used	C.3.6.7.2 C.3.6.5.4 C.3.6.5.2	O		Basic & Enhanced
SCUMF	Segment Credits Used Multiplication Factor	C.3.6.5.2	O	Constant	Enhanced
SEISRIT	Saved Estimated Inter-Segment Receive Interval Time	C.3.6.7.1 C.3.6.6.3 C.3.6.5.11	D		Enhanced
SERTD	Saved Estimated Round Trip Delay	C.3.6.7.1 C.3.6.6.1	O		Basic & Enhanced
SLNUS	Smallest Lowest Number Unacknowledged Segment	C.3.6.6.2 C.3.6.7.2	O		Basic & Enhanced

TABLE C-I. Summary of S/R acronyms, terms, explanations, and applications - Continued

S/R Items	Description	Cross Reference	Maintained By (Originator (O) /Destination (D))	Remarks	Basic / Enhanced
SN	Segment Number	C.3.6.6.3 C.3.3.2.1	O/D		Basic & Enhanced
SRC	Segment Retry Count	C.3.6.5.4	O		Basic & Enhanced
SRCL	Segment Retry Count Limit	C.3.5.1.1.2 C.3.5.3.1.a	O	Constant	Basic & Enhanced
SRL	Segment Range Limit	C.3.6.2.1.c	O	Constant	Enhanced
SSN	Starting Segment Number	C.3.3.3.1	O/D		Basic & Enhanced
SSRLPO	Segment Send Rate Limit Per Originator	C.3.6.5.7	O		Enhanced
T2AT	Type 2 Acknowledgment Timer	C.3.6.7.1 C.3.6.5.7	O	Constant from MIL-STD-188-220 Parameter Tables	Enhanced
TAFRFTTCT	Time Allowed from Request for Transfer to Complete Timer	C.3.6.5.13	O		Enhanced

C.1.4 Summary of S/R procedures.
The procedures described in this appendix provide a detailed explanation of the S/R Protocol. This paragraph is intended to provide a high-level overall summary of the protocol, and is not intended to provide requirements or to be used as implementation guidance. This paragraph should be considered “for information only”.

There are two primary methods of transmitting S/R data that differ on what action is taken at the End of Data Transfer (EDT). When the EDT Acknowledgment Not Required scheme is used, the Destination takes no autonomous action when it believes the data transfer is complete. The EDT Acknowledgment Required scheme requires the Destination to transmit an acknowledgment to the Originator when the Destination believes that the data transfer is complete. Additionally, in S/R Enhanced, the Destination automatically transmits Partial Acknowledgments periodically during the transaction triggered by additional timers and thresholds. The EDT acknowledgment will either be triggered when the Destination successfully receives the final S/R Data Segment, or when the Destination’s Reassembly Timer expires and it has not received the full transfer. In the former case, the Destination provides an automatic confirmation to the Originator that the transmission has successfully completed. In the latter case, the Destination provides an automatic indication to the Originator that the Destination missed some portion of the data transfer, and that missing data should be retransmitted. All Data Segments include a “Poll/Final Bit", often referred to as the “P-bit” or “P/F bit”, used to solicit a response from the recipient of the Data Segment, further explained in section C.3.3.1.5. In both acknowledgment schemes, the Originator can solicit an acknowledgment at any time by either transmitting a Acknowledgment Request PDU or by setting the P-bit equal to “1” for any given Data Segment PDU.

Regardless of the overall acknowledgment scheme employed, the Originator and Destination stations maintain a series of Timers, Counters, Parameters, and Variables used to facilitate the S/R procedures. These mechanisms attempt to ensure that an efficient and robust transfer of the data is conducted. The Timers and Counters are used to regulate the flow of Data Segments, automatically generate Partial Acknowledgments to the Originator, and employ a selective retransmission scheme that minimizes wasted bandwidth.

Systems are always free to perform only one-to-one transmission of Application PDUs, however, the S/R protocol described in this appendix provides for one-to-many transmissions as well. Transmission to multiple destinations is handled in much the same fashion as transmission to a single destination. The detailed explanation of the protocol indicates when an Originator keeps multiple sets of values for multiple destinations or when values can be shared when performing a one-to-many transmission.

C.2 Applicable documents.

RFC 791	Internet Protocol -- DARPA Internet Protocol Specification
RFC 768	User Datagram Protocol
RFC 1122	Requirements for Internet Hosts -- Communication Layers
RFC 2460	Internet Protocol, Version 6 (IPv6) Specification
MIL-STD-188-220D	Digital Message Transfer Device Subsystems

C.3 Overall operation.

MIL-STD-2045-47001 formatted messages, i.e., Application Layer protocol data units (PDUs), which are larger than the designated Segment Size, shall be segmented by the Originator prior to transmission, and reassembled at the Destination prior to delivery to the application. The designated Segment Size shall be less than or equal to the MSS for the applicable configuration, and greater than or equal to three octets (in order to support transferring a one megabyte payload in a maximum of 65,535 segments). Each segment shall be encapsulated in a single S/R PDU. Each S/R PDU is then transmitted in one UDP PDU, or one Intranet Layer PDU. S/R PDUs sent using UDP or n-layer pass through may be lost, and hence an acknowledgment mechanism may be employed to ensure reliable delivery of all segments in a connectionless transport environment. The retransmission strategy is defined to fulfill an acknowledgment scheme. The Destination shall not assume that segments will be received in the order that they were transmitted, however in S/R Basic, a Destination does not begin a reassembly transaction until the first segment of the transaction (i.e., a Data Segment PDU with Segment Number of “1”) is received.

The S/R procedure is designed to handle all aspects of the S/R protocol transparently to the application. If the data passed to the S/R Layer in the S/R-unitdata request from the application exceeds the specified Segment Size it shall be transmitted as multiple segments with an S/R header appended to each segment. Destinations shall be responsible for ensuring that segments are reassembled in the proper order, regardless of the order of reception. Note that S/R protocol concerns itself only with the S/R header and does not examine or modify the message itself (other than to perform segmentation).

Application Layer PDUs with an associated Precedence of Routine shall be sent as EDT Acknowledgment Not Required. Application Layer PDUs with an associated Message Precedence of Priority or higher shall be sent as EDT Acknowledgment Required, except when sending segments to Multicast addresses in the S/R Basic protocol, in which case all segments are always sent EDT Acknowledgment Not Required.

S/R Segments, regardless of the Precedence and/or Type of Service of the associated Application Layer PDU, when sent over a MIL-STD-188-220 CNR, should not be sent as a Data Link Layer Type 3 Packets, since the guarantee of delivery is provided via S/R Acknowledgments.

C.3.1 Maximum segment size (MSS).
The MSS shall be based on the equations below.

MTU	:	Maximum Transfer Unit size at the Network Layer
SH	:	S/R header size
UDP	:	UDP header size
IPHS	:	IP header size

MSS(IP) = MTU - (SH + UDP + IPHS) for IP datagrams; and

MSS(n-layer pass through) = MTU – SH for n-layer pass through

MSS(Packet Mode) = MTU – SH for n-layer pass through using Packet Mode

NOTE: It is desirable that IP datagrams, which will be transmitted across multiple subnetworks, do not exceed 576 octets with IPv4 or 1280 octets with IPv6. A MSS of 496 octets for both IPv4 and IPv6 will assure that IP fragmentation will not occur at any IP router/gateway devices. The following components take on maximized constant values based on the definitions provided within this appendix:

MTU	= 576 octets (IPv4) or 1280 octets (IPv6) or 3090 octets (NLP)
SH	= 12 octets
UDP	= 8 octets
IPHS	= 60 octets (IPv4) or 174 octets (IPv6)

Thus: MSS(IPv4) = 576 – (12 + 8 + 60) = 496
or
MSS(IPv6) = 1280 – (12 + 8 + 174) = 1086
or
MSS(NLP) = 3090 – 12 = 3078 (theoretical); 496 (default – see section C.3.1.2)

C.3.1.1 MSS for IP datagram exchanges.
The MSS value for both IPv4 and IPv6 shall be computed based on the MTU value for the network layer employed by each system based on the formulas in section C.3.1. For MIL-STD-188-220 networks, this value is specified in the MIL-STD-188-220 Parameter Table. For MIL-STD-188-220 networks, if an MTU value is not present in the MIL-STD-188-220 Parameter Table for a given network configuration, then an MTU of 576 shall be used for IPv4, and an MTU of 1280 shall be used for IPv6.

C.3.1.2 MSS for n-layer pass through exchanges.
The MSS value for n-layer pass through shall be computed based on the MTU value specified in the MIL-STD-188-220 Parameter Tables using the formulas in section C.3.1. An MTU of 576 shall be used when no MTU value in the MIL-STD-188-220 Parameter Tables is applicable for the network configuration.

Since neither UDP nor IP are present with n-layer pass through, IP fragmentation is not a concern. Therefore the only theoretical limitation on size is based on maximum transmission size allowed by the intranet layer. For n-layer pass through, the following components take on the maximized constant values provided below.

MTU = 3090 octets (theoretical) or 576 (mandated default)
SH = 12 octets

Thus: MSS = 3090 – 12 = 3078 octets (theoretical) = 496 (mandated default for CNR when no value in Parameter Table)

Although the MSS for n-layer pass through is theoretically 3078 octets, the mandated MSS value for n-layer pass through is 496 octets in the absence of a MIL-STD-188-220 Parameter Table MTU value.

C.3.1.3 MSS for Packet Mode exchanges.
S/R is not used for Packet Mode.

C.3.2 Interface with peer-to-peer layers.
The S/R protocol interacts with both the next higher layer e.g., the MIL-STD-2045-47001 Application Layer Protocol (ALP) and the next lower layer, which is either UDP or the Intranet Layer if n-layer pass through is invoked. Several primitives are used to pass information for the sending and receiving of data across the upper layer boundary:

a. When sending to a single destination unicast IP address, requests for transfer of data should be made by the upper layer (Application layer), using the S/R-Unitdata Request primitive with the following parameters:

S/R-Unitdata Request
- Destination unicast IP Address - IN Parameter
- Source unicast IP Address - IN Parameter
- Source S/R Port - IN Parameter
- End of Data Transfer Acknowledge Required (TRUE/FALSE) - IN Parameter
- Time Allowed From Request For Transfer To Complete - IN Parameter
- IP TOS - IN Parameter (IPv4)
- IP Differentiated Services – IN Parameter (IPv6)
- Data/Data Length - IN Parameter
- Application PDU Identifier - OUT Parameter

b. When sending to a single destination unicast Link address via MIL-STD-188-220 n-layer pass through (NLP), requests for transfer of data should be made by the upper layer (Application layer), using the S/R-Unitdata Request primitive, with the following parameters. The value of the parameter "Source IP unicast Address on the destination net" is used to specify which 188-220 net the message is to be sent over in cases where a single station is attached to multiple 188-220 nets and has a different Source IP unicast address on each net.

S/R-Unitdata Request
- Source IP unicast Address on the destination net - IN Parameter
- Destination Data Link Address - IN Parameter
- Source Data Link Address - IN Parameter
- Source S/R Port - IN Parameter
- End of Data Transfer Acknowledge Required (TRUE/FALSE) - IN Parameter
- Time Allowed From Request For Transfer To Complete - IN Parameter
- IP TOS - IN Parameter
- IP Differentiated Services – IN Parameter (IPv6)
- Data/Data Length - IN Parameter

Application PDU Identifier - OUT Parameter

c. When sending to multiple unicast destination IP addresses that are on the same MIL-STD-188-220 net (using selective directed broadcast, reference RFC 1770), requests for transfer of data should be made by the upper layer (Application layer), using the S/R-Unitdata Request primitive with the following parameters. The use of this mechanism allows the transfer to be supported at the Data Link layer using reliable MIL-STD-188-220 services, e.g., Type 2 with multiple unicast addresses.

S/R-Unitdata Request
Net-directed IP broadcast Address - IN Parameter (This must correspond to a MIL-STD-188-220 net)
Array (2-9) of Destination unicast IP Addresses - IN Parameter
Source unicast IP Address - IN Parameter
Source S/R Port - IN Parameter
End of Data Transfer Acknowledge Required (TRUE/FALSE) - IN Parameter
Time Allowed From Request For Transfer To Complete - IN Parameter
IP TOS - IN Parameter
IP Differentiated Services – IN Parameter (IPv6)
Data/Data Length - IN Parameter
Application PDU Identifier - OUT Parameter

d. When sending to a multiple destination unicast Link address via MIL-STD-188-220 NLP, requests for transfer of data should be made by the upper layer (Application layer), using the S/R-Unitdata Request primitive, with the following parameters. The use of this mechanism allows the transfer to be supported at the data link layer using reliable MIL-STD-188-220 services, e.g., Type 2 with multiple unicast addresses. In S/R Enhanced, if the global broadcast Link address, e.g., 7-bit address 127, is specified as one of the unicast destination Data Link addresses, the source Data Link unicast address of the acknowledgment for the first Segment from any Destination should be dynamically added to the list of Destination unicast Data Link Addresses (if not already present). The dynamically added Destination unicast Data Link address will be treated the same as Destination unicast Data Link addresses specified by the Application, i.e., the destination should have an opportunity to receive subsequent segments and the result of the transfer to the destination should be reported to the Application via a S/R-Status Indication. The value of the parameter "Source IP unicast Address on the destination net" is used to specify which 188-220 net the message is to be sent over in cases where a single station is attached to multiple 188-220 nets and has a different Source IP unicast address on each net.

S/R-Unitdata Request
Source IP unicast Address on the destination net - IN Parameter
Array (2-16) of Destination unicast Data Link Addresses - IN Parameter
Destination Data Link Address - IN Parameter
Source Data Link Address - IN Parameter
Source S/R Port - IN Parameter
End of Data Transfer Acknowledge Required (TRUE/FALSE) - IN Parameter
Time Allowed From Request For Transfer To Complete - IN Parameter
IP TOS - IN Parameter
IP Differentiated Services – IN Parameter (IPv6)
Data/Data Length - IN Parameter
Application PDU Identifier - OUT Parameter

e. When sending to multiple unicast destination IP addresses via multicast, broadcast, or net-directed broadcast, requests for transfer of data should be made by the upper layer (Application layer), using the S/R Unitdata Request primitive with the following parameters. The use of this mechanism allows the transfer to be supported at the data link layer using unacknowledged MIL-STD-188-220 services. In S/R Enhanced, if the global broadcast IP address, i.e., 255.255.255.255, is specified a one of the unicast destination IP addresses, the source IP unicast address of the acknowledgment for the first Segment from any Destination should be dynamically added to the list Destination unicast IP Addresses. The dynamically added Destination unicast IP address will be treated the same as Destination unicast IP addresses specified by the Application, i.e., the destination should have an opportunity to receive subsequent segments and the result of the transfer to the destination should be reported to the Application via a SR -Status Indication.

S/R-Unitdata Request
IP Address - IN Parameter (Must be multicast, broadcast, or net-directed broadcast)
Array (2-16) of Destination unicast IP Addresses - IN Parameter
Source unicast IP Address - IN Parameter
Source S/R Port - IN Parameter
End of Data Transfer Acknowledge Required (TRUE/FALSE) - IN Parameter
Time Allowed From Request For Transfer To Complete - IN Parameter
IP TOS - IN Parameter
IP Differentiated Services - IN Parameter (IPv6)
Data/Data Length - IN Parameter
Application PDU Identifier - OUT Parameter

f. When aborting transfer, use the S/R-Unitdata Abort Request primitive, with the following parameters. This primitive should be used by both the Originator and the Destination and will cause an Abort Request PDU to be sent appropriately.

S/R-Unitdata Abort Request
Application PDU Identifier - IN Parameter

g. When requesting the status of a transfer, use the S/R-Unitdata Transfer Progress Request primitive, with the following parameters. This primitive should be used by both the Originator and the Destination.

S/R-Unitdata Transfer Progress Request
Application PDU Identifier - IN Parameter
Percentage Transferred - OUT Parameter

h. Indications should be provided to the upper layer if requested, when the first Data Segment is received through the S/R-First-Segment Indication primitive, with the following parameters. This indication allows the Destination to optionally examine the contents of the first segment, e.g., MIL-STD-2045-47001 Application Header, and decide whether or not the transfer should be aborted.

S/R-First-Segment Indication
Application PDU Identifier - OUT Parameter (Originator and Serial Number)
Data/Data Length - OUT Parameter (Data/Data Length for the first segment only)

i. Indications should be provided to the upper layer if requested, when data is received through the S/R - Unitdata Indication primitive, with the following parameters:

S/R-Unitdata Indication
Originator (IP Address or Link Address) - OUT Parameter
Data/Data Length - OUT Parameter

j. Indications should be provided to the upper layer if requested, when data is received through the S/R - Status Indication primitive, with the following parameters. In the case of a request with multiple destinations, multiple indications may be received.

S/R-Status Indication
Array (1-16) of
Record
Destination (IP Address or Link Address) - OUT
Acknowledgment Result - OUT Parameter (SUCCESS or FAILURE)
Acknowledgment Failure Reason - OUT Parameter (e.g., descriptive string)
End Record
Application PDU Identifier - OUT Parameter

C.3.2.1 UDP/IP Datagram exchanges.
The source port parameter provided in the S/R-Unitdata Request and the destination port parameter as specified in TABLE C-II shall be placed in corresponding Source and Destination Port fields of the S/R header for exchanges via UDP/IP. The port named "udp-sr-port", which has been registered with the Internet Assigned Number Authority and assigned port number 1624 (decimal), shall be specified as the destination UDP port in all S/R invocations of the UDP service interface for sending of S/R PDUs (e.g., Data Segment, Acknowledgment Request, Partial Acknowledgment, etc.). At the receiving station, a destination UDP port value of 1624 shall indicate the S/R protocol as defined by this standard. For example, when stations use S/R to support the exchange the MIL-STD-2045-47001 ALP via UDP/IP, the values indicated in TABLE C-II shall be used for the S/R and UDP Destination/Source Port fields.

TABLE C-II. S/R and UDP Destination/Source Port field values for S/R PDUs sent via UDP/IP in support of MIL-STD-2045-47001 ALP exchanges

Field	Value
S/R Destination Port	1581 ("mil-2045-47001")
S/R Source Port	Any value, as specified in S/R-Unitdata Request
UDP Destination Port	1624 ("udp-sr-port")
UDP Source Port	Any value

C.3.2.2 MIL-STD-188-220 n-layer pass through (NLP) exchanges**.**
The source port parameters provided in the SR-Unitdata Request and the destination port parameter as specified in TABLE C-III shall be placed in the corresponding Source and Destination Port fields of the S/R header for exchanges via MIL-STD-188-220 NLP. The MIL-STD-188-220 Intranet Message Type field value of 10, "Segmentation/Reassembly (S/R) Protocol" has been reserved for sending S/R PDUs (e.g., Acknowledgment Request, Partial Acknowledgment, etc.) via MIL-STD-188-220 NLP. At the receiving station, MIL-STD-188-220 Intranet Message Type field value of 10, shall indicate the S/R protocol as defined by this standard. For example, when stations use S/R to exchange the MIL-STD-2045-47001 ALP via MIL-STD-188-220 NLP, the values indicated in TABLE C-III shall be used for the S/R Destination/Source Port fields and MIL-STD-188-220 Intranet Message Type field.

TABLE C-III. S/R Destination/Source Port and MIL-STD-188-220 Intranet Message Type field values for S/R PDUs sent via MIL-STD-188-220 NLP in support of MIL-STD-2045-47001 ALP exchanges.

Field	**Value**
S/R Destination Port	1581 ("mil-2045-47001")
S/R Source Port	Any value, as specified in S/R-Unitdata Request
MIL-STD-188-220 Intranet Message Type	10, "Segmentation/Reassembly (S/R) Protocol"

C.3.3 S/R PDU format.
PDU bit ordering for all PDUs described in section C.3.3 shall be implemented as shown in TABLE C-IX . The same S/R PDUs are used for both S/R Basic and S/R Enhanced.

C.3.3.1 Common S/R header.
FIGURE C-1 depicts the S/R header that shall precede all S/R segments defined in this appendix to complete a S/R PDU.

Source Port			Destination Port
Type	HLEN	P/F	Serial Number

FIGURE C-1. Segmentation/Reassembly header

Where:

Source Port:	16 bits
Destination Port:	16 bits
Type:	3 bits
HLEN:	12 bits
P/F:	1 bit
Serial Number:	16 bits

C.3.3.1.1 Source Port.
This 16-bit port number identifies the application process that is sending the Application PDU that is being transported by S/R. Its value is established by the Source Port parameter that is passed on the S/R service interface sending the request.

C.3.3.1.2 Destination Port.
This 16-bit port number identifies the application process that will receive the Application PDU that is being transported by S/R. Its value is established by TABLE C-II and TABLE C-III.

C.3.3.1.3 Type.
This field identifies the types of S/R PDUs in accordance with the three-bit sequences as specified in TABLE C-IV. below.

TABLE C-IV. Types of S/R PDUs

S/R PDU Type	Decimal Value
Data Segment with End of Data Transfer Acknowledgment required	0
Data Segment with End of Data Transfer Acknowledgment not required	2
Partial Acknowledgment	4
Complete Acknowledgment	6
Abort Request	1
Abort Confirm	5
Acknowledgment Request	3
Undefined	7

C.3.3.1.4 Header length (HLEN).
This 12-bit field indicates the total length of the S/R header in 32-bit words. The maximum value for the Header length is 104.

C.3.3.1.5 Poll/Final (P/F).
This 1-bit field is used to request a response from the recipient of the PDU.

a. When a Data Segment is received with the P/F bit set to “1”, the Destination shall respond with a Partial Acknowledgment or a Complete Acknowledgment with P/F bit set to “1”.

b. When an Abort Request is received with the P/F bit set to “1”, the receiving unit shall return an Abort Confirm with P/F bit set to “1”.

c. The P/F bit does not apply to Acknowledgment Request PDUs.

d. When sending requests, the P/F bit is referred to as the P-bit. When sending responses, the P/F bit is referred to as the F-bit.

C.3.3.1.6 Serial Number.
This 16-bit number is assigned by the Originator and uniquely identifies the Application PDU to which this segment belongs. Originator(s) shall manage Serial Numbers such that they are not ambiguous, for example, increment the serial number from 0 to 65,535 before reusing values to send additional Application PDUs. Since two Originators can choose the same serial number for different Application PDUs, Destination(s) must consider both the S/R PDU Source Address and Segment Serial Number field (which combine to form the Application PDU Identifier) in order to associate the S/R PDU with the intended Application PDU.

C.3.3.2 Data segment.
Application PDUs that are larger than the specified Segment Size shall be segmented and sent to the destination addressee as the data portion of the data segment. The Segment Size shall be user configurable, and shall default to MSS. No segment of a single Application PDU shall exceed MSS octets in length. The length of the data portion of each segment of a single Application PDU shall be the same (i.e., equal to the specified Segment Size) except possibly for the last segment, which may be shorter. If the last segment does not require the full segment size used for previous segments, it shall not be zero padded. Two types of data segments may be used in order to indicate whether an EDT acknowledgment is required or not required. If an EDT acknowledgment is required, the destination addressee shall respond with a Complete Acknowledgment after correctly receiving all segments of an Application PDU. If the S/R Enhanced Protocol is employed the Destination shall respond with a Partial

Acknowledgment if its Reassembly Timer expires and not all expected segments have been received. The format of the data segment is shown in the FIGURE C-2.

Source Port			Destination Port
Type	HLEN	P/F	Serial Number
Segment Number			Last Segment Number
Data Portion			

Type = 0 or 2; HLEN = 3

FIGURE C-2. Data segment

Where:

Segment Number:	16 bits
Last Segment Number:	16 bits

C.3.3.2.1 Segment Number.
This 16-bit number identifies the segment's position in the overall Application PDU and is assigned by the Originator. It is used in the reassembly process by the Destination. The Segment Number of the first segment in the transmission shall be 1.

C.3.3.2.2 Last Segment Number.
This 16-bit number indicates the total number of segments in the Application PDU identified by the Serial Number. The Last Segment Number (LSN) shall be greater than or equal to the Segment Number assigned to the first segment in the transmission.

C.3.3.3 Partial Acknowledgment PDU.
The Partial Acknowledgment is used by the recipient to inform the Originator which segments have been received. No data field shall be permitted with the Partial Acknowledgment. The format of the Partial Acknowledgment is shown in FIGURE C-3.

Source Port			Destination Port
Type	HLEN	P/F	Serial Number
Starting Segment Number			Bit Mask/Padding
<Bit Mask/Padding (If the Bit Mask is greater than 16 bits it is extended in 32 bit increments)>			
…			

Type = 4

FIGURE C-3. Partial acknowledgment

Where:

Starting Segment Number (SSN):	16 bits
Bit Mask:	HNSR – SSN + 1 bits
Padding:	0 through 31 bits

C.3.3.3.1 Starting Segment Number (SSN).
This 16-bit number indicates that all segments prior to this number have been successfully received in sequence (this identifies the first sequential segment number, i.e., the lowest segment number that has not yet been received).

This number also indicates the segment corresponding to the first bit in the Bit Mask field. The first bit in the Bit Mask field shall always have a value of not received.

C.3.3.3.2 Acknowledgment segments bitmap.
The bits in this field are used to indicate which segments of an Application PDU have or have not been successfully received at the Destination. A bit set (1) means the segment has been correctly received. A bit reset (0) indicates the segment was not received. These bits are relative to the Starting Segment Number. The first bit of this field corresponds to the Starting Segment Number and shall always be reset (0). Any additional segments that have been received with a Segment Number greater than the Starting Segment Number shall be indicated with a bit set (1). This field is extensible in 32-bit increments. Implementations shall support a maximum size of 3248 bits for this field. The actual size of the Bit Mask field in number of bits shall be:

Highest Numbered Segment Received (HNSR) – Starting Segment Number + 1

If no segments have been received, the Starting Segment Number shall equal 1 and the Highest Numbered Segment Received shall equal 1, which results in a Bit Mask field size of 1. The single bit composing the Bit Mask field shall be set to bit reset (0).

C.3.3.3.3 Padding.
Padding shall be used to ensure that the PDU ends on a 32-bit boundary. Padding bits shall be set to bit reset (0).

C.3.3.4 Complete Acknowledgment PDU.
The Complete Acknowledgment is used by the destination addressee to inform the Originator that all segments of an Application PDU associated with the Serial Number were received correctly. No data field shall be permitted with the Complete Acknowledgment. The format of the Complete Acknowledgment is shown in FIGURE C-4. below.

<table>
<tr><td colspan="3">Source Port</td><td>Destination Port</td></tr>
<tr><td>Type</td><td>HLEN</td><td>P/F</td><td>Serial Number</td></tr>
</table>

Type = 6; HLEN = 2

FIGURE C-4. Complete acknowledgment

C.3.3.5 Abort Request PDU.
The Abort Request shall be used to abort the transfer of an Application PDU. Either the Application PDU Originator or its Destination may initiate the abort action. No data field shall be permitted with the Abort Request. When a Destination receives an Abort Request from the Originator, any received segments associated with the Serial Number are discarded. When an Originator receives an Abort Request from the Destination, the Originator shall stop transmitting segments associated with the Serial Number to that Destination and report a failed transmission as appropriate to the Application Layer. If the sender of the Abort Request desires an Abort Confirm, the P/F bit shall be set to 1. In S/R Basic, the P/F bit shall be set to “0” (i.e., Abort Confirms are not requested). The format of the Abort Request is shown in FIGURE C-5. The Abort Request frame shall be sent to indicate that the sender is no longer willing to continue the transfer of the Application PDU..

Source Port			Destination Port
Type	HLEN	P/F	Serial Number

Type = 1; HLEN = 2

FIGURE C-5. Abort Request

C.3.3.6 Abort Confirm PDU.
After receiving an Abort Request with the P/F bit set to 1, the receiving unit shall confirm its acceptance of the abort by transmitting an Abort Confirm. No data field shall be permitted with the Abort Confirm. All received segments with the same Serial Number identified in the Abort Request are discarded. The format of the Abort Confirm is shown in FIGURE C-6.

Source Port			Destination Port
Type	HLEN	P/F	Serial Number

Type = 5; HLEN = 2

FIGURE C-6. Abort Confirm

C.3.3.7 Acknowledgment Request.
An Acknowledgment Request PDU shall be used by the Application PDU Originator to request the acknowledgment status of all previous transmitted Data Segments. Upon receiving an Acknowledgment Request PDU, the Destination shall return a Partial Acknowledgment PDU to the Originator if not all data segments have been received, a Complete Acknowledgment if all data segments have been received, or an Abort Request PDU if the receiver wishes to terminate the transfer. No data field shall be permitted with the Acknowledgment Request PDU. The format of the Acknowledgment Request PDU is shown in FIGURE C-7.

Source Port			Destination Port
Type	HLEN	P/F	Serial Number
Last Sent Segment Number			Padding

Type = 3, P/F = 1; HLEN = 3

FIGURE C-7. Acknowledgment Request PDU

Where:

Last Sent Segment Number:	16 bits
Padding:	16 bits

C.3.3.7.1 P/F bit.
The P/F bit shall always have a value of bit set to 1 for Acknowledgment Requests.

C.3.3.7.2 Last Sent Segment Number (LSSN).
This 16-bit number is used in the Acknowledgment Request to indicate the highest segment number that had been sent at the time that the Acknowledgment Request was issued.

C.3.3.7.3 Padding.
The size of the Padding field shall be 16 bits to ensure that the PDU ends on a 32-bit boundary. Padding bits shall be set to 0. The Destination station shall ignore this field.

C.3.4 Data segment acknowledgment schemes.
A Selective Retransmission scheme shall be employed that allows the Destination to inform the Originator which data segments have been received. The Originator only retransmits segments after a reasonable period of time has passed and the Destination specifically indicates that the segment was not received via a Partial Acknowledgement. Several mechanisms exist by which the Originator can solicit acknowledgments from the Destination.

Acknowledgment requests and responses that are used with the S/R protocol are defined as follows:

a. Acknowledgment Request PDU: This PDU is sent by an Originator to solicit a response from a Destination. The Destination shall respond either with a Partial Acknowledgment PDU, a Complete Acknowledgment PDU, or an Abort Request PDU. This provides a mechanism for an Originator to explicitly request an acknowledgment from a Destination without having to transmit a data segment.

b. Data Segment PDU with P-bit = 1: The Originator can set the P-bit = 1 in any data segment to solicit a response from the Destination. The Destination shall respond with either a Partial Acknowledgment PDU or a Complete Acknowledgment PDU with the F-bit = 1, or an Abort Request PDU. This provides a mechanism for an Originator to explicitly request an acknowledgment from a Destination without having to send a separate Acknowledgment Request PDU.

c. Partial Acknowledgment PDU: A Partial Acknowledgment PDU is used by the Destination to inform the Originator which segments have and have not been received.

d. Complete Acknowledgment PDU: A Complete Acknowledgment PDU is used by the Destination to inform the Originator that all segments of an Application PDU were received.

e. Abort Request PDU: An Abort Request PDU can be issued to indicate that the sender is no longer willing to continue the transfer of the Application PDU.

Two data segment acknowledgment schemes are defined: EDT Acknowledgment Required and EDT Acknowledgment Not Required. All data segments associated with the same Serial Number shall use the same data segment acknowledgment scheme, i.e., all data segments with the same Serial Number shall contain the same Type field value.

C.3.4.1 End of Data Transfer (EDT) Acknowledgment Required scheme.
The EDT Acknowledgment Required scheme is an acknowledgment scheme that requires the Destination to either respond to the Originator with an unsolicited Complete Acknowledgment when all data segments have been received or an unsolicited Partial Acknowledgment if not all data segments have been received and the Destination's Reassembly Timer has expired. Additionally, for the S/R Enhanced Protocol, the Destination shall transmit unsolicited Partial Acknowledgment PDUs to the Originator periodically during the S/R transaction as dictated by the Partial Acknowledgment Interval Timer (PAIT) behavior. The Destination may also respond to Data Segment PDUs with an Abort Request PDU.

In the S/R Enhanced Protocol, the Reassembly Timer is a local timer maintained by the receiver of the data segments that assists in performing the reassembly function. This timer determines how long a receiver waits to receive all data segments of a transmission. The Reassembly Timer is started upon receipt of a Data Segment with EDT Acknowledgment Required PDU, and is updated as subsequent data segments are received. The initial value of the reassembly timer is based on the network characteristics and the number of data segments to be received, and is updated based on the rate of reception of subsequent segments. All data segments of a single Application PDU should be received before the Reassembly Timer expires. The Reassembly Timer is further described in paragraph C.3.6.5.1

C.3.4.2 End of Data Transfer Acknowledgment Not Required scheme.

The EDT Acknowledgment Not Required scheme is an acknowledgment scheme that requires no unsolicited actions to be taken by the Destination at any time. The Destination shall only send an acknowledgment in response to an Acknowledgment Request PDU or a Data Segment PDU with P-bit = 1. The Destination may also respond to Data Segment PDUs with an Abort Request PDU.

C.3.5 S/R Basic procedures.

C.3.5.1 S/R Basic Overview.

The S/R Basic Protocol allows for efficient exchange of segmented large messages between an Originator and multiple Destinations, including the standard S/R Selective Retransmission mechanism. In the S/R Basic Protocol mixed-mode Destination Addresses shall be handled as separate S/R Transactions, one for Unicast Addresses and one for Multicast Addresses. A single S/R Basic transaction shall only contain Unicast Addresses or Multicast Addresses (including the Global address), but may not contain both. Therefore, if mixed-mode Destination Addresses are specified in the S/R-Unitdata Request, the S/R Basic Protocol shall automatically generate two separate transactions, one for the Unicast Addresses and one for the Multicast Addresses, and therefore start two transactions transparently to the Application. This is done to reduce network flooding based on receiving acknowledgments from potentially large multicast groups or the global address.

The S/R Basic Protocol provides a simplified flow control mechanism that is based upon a Segment Credit Limit (SCL). Systems implementing the S/R Basic Protocol will be able to have transmitted messages received by systems implementing either the S/R Basic Protocol or the S/R Enhanced Protocol. Systems implementing the S/R Basic Protocol will be able to receive messages transmitted by systems implementing either the S/R Basic Protocol or the S/R Enhanced Protocol.

When an Abort Request PDU is issued in the S/R Basic Protocol, the P-bit shall be set to the value “0”, as the S/R Basic Protocol does not request Abort Confirm PDUs to be issued.

C.3.5.1.1 S/R Basic Segmentation.

The Originator shall map the original application PDU into an ordered sequence of segments. Each segment shall be the specified Segment Size octets in length, with the possible exception of the last segment that can be less than the specified Segment Size octets in length. If the last segment is less than the specified Segment Size octets in length, it shall not be padded. The host can configure the Segment Size to any legal value up to but not exceeding MSS. Destinations shall verify the Segment Size for each segment is the same (with the possible exception of the last segment) and abort any transaction where a segment with an incorrect segment size is received. If no Segment Size is specified, MSS shall be used for the Segment Size. The Originator shall assign a single, unique Serial Number to each application PDU and copy it into the header of each segment associated with that application PDU. Serial Numbers are managed by each Originator in accordance with paragraph C.3.3.1.6. Each data segment shall then be sequentially sent, starting with segment number equal to 1. The Originator shall track which segments have and have not been acknowledged for each Destination. Every segment specifies the Last Segment Number (the total number of segments in the Application PDU) and its Segment Number (segment sequence number of the current segment).

Multiple S/R transfers can be enacted simultaneously by an Originator, and are distinguished by their Application PDU Identifier, however, due to the complexity of S/R transactions, it is encouraged that an Originator only maintain a single S/R transaction at a time.

Each S/R segment shall be transmitted in one UDP Request or one Intranet Layer Request (if n-layer pass through is used) by the Originator. The Originator shall indicate in the segmentation header whether the transfer of the Application PDU requires an EDT Acknowledgment or does not require an EDT Acknowledgment. All Data Segment PDUs associated with the same serial number shall use the same Type field value (i.e., either all Data Segment PDUs will be EDT Acknowledgment Required or EDT Acknowledgment Not Required for a given transaction).

If the Originator wishes to abort the transfer of the Application PDU, it shall transmit an Abort Request PDU to the Destination and shall set the P-bit = 0.

C.3.5.1.1.1 Transmitting to Multicast Addresses.
When transmitting to Multicast Addresses, which includes the Global Address, in the S/R Basic Protocol, the Originator shall only transmit each Data Segment PDU once. The Originator shall set the P-bit = 0 for all Data Segment PDUs. No flow control, acknowledgments, or retries are used when transmitting to Multicast Addresses. All Data Segment PDUs shall be sent as EDT Acknowledgment Not Required.

C.3.5.1.1.2 Transmitting to Unicast Addresses.
When transmitting to Unicast Addresses in the S/R Basic Protocol, the Originator shall indicate in the S/R header that an acknowledgment is required by setting the P-bit = 1 when transmitting the first segment. Subsequent segments shall not be sent until the Originator receives an acknowledgment for the first segment from all Destination(s) or any non-responsive destinations are pruned (i.e., the Destination Status is set to INACTIVE).

The Originator shall then engage in Flow Control procedures in order to achieve efficient transmission of Data Segment PDUs. Flow Control shall be restricted by a Segment Credit Limit, representing the maximum number of unacknowledged segments allowed at any given time, and governed by a set of timers. Flow Control procedures are discussed in detail in section C.3.5.2, and the Timers used with S/R Basic are discussed in detail in section C.3.5.3. The general operation of the Flow Control procedures involves the Originator issuing a Request for Acknowledgment to the Destination(s) when the Segment Credit Limit (SCL) is reached. The Originator shall only send data segments that will not cause the number of unacknowledged segments to exceed the Segment Credit Limit.

The Originator shall retransmit only data segments that were not received by one or more Destination(s) as indicated by a Partial Acknowledgment PDU received from the Destination(s) prior to the expiration of the Request for Acknowledgment Interval Timer (RFAIT). Missing data segments are retransmitted a finite number of times until either acknowledgment(s) indicate all data segments have been received or the transfer of the Application PDU is aborted with a given Destination. The number of retry attempts for a segment shall be limited by the Segment Retry Count Limit (SRCL) parameter. In the case that multiple Data Segments are available at the same time for sending, Data Segments with lower Segment Numbers shall be resent/sent before Data Segments with higher Segment Numbers.

Each time the Originator issues a Request for Acknowledgment, it shall start a Request for Acknowledgment Interval Timer (RFAIT). If the RFAIT expires without the receipt of an acknowledgment from any Destinations, the Originator shall transmit an Acknowledgment Request PDU. If an acknowledgment is not received from a Destination after Request For Acknowledgement Retry Limit (RFARL) number of tries, that Destination is marked INACTIVE. The transfer of the Application PDU shall be aborted to the INACTIVE Destination and an error indication should be returned to the Upper Layer Protocol. The S/R Basic Protocol then continues the transaction with any remaining ACTIVE Destinations. If the RFAIT is active and another Request for Acknowledgment is issued by the Originator for any reason, the RFAIT shall be restarted. The RFAIT is further described in paragraph C.3.5.5.1.

When the Originator sends a Data Segment PDU with EDT Acknowledgment Required and Segment Number = Last Segment Number, then the P-bit shall be set to 1, requesting an acknowledgment.

C.3.5.1.2 S/R Basic Reassembly.
The Destination shall monitor for S/R segments to arrive. The source address of the Originator (as provided by the lower level protocol) combined with the S/R header Serial Number, forms the Application PDU Identifier, which uniquely identifies the Application PDU to which each segment belongs. On n-layer pass through networks, it is the serial number and source data link address which establish each unique data stream; on IP networks, it is the serial number and source IP address which establish each unique data stream. In the S/R Basic Protocol, only a segment with a "Segment Number" field value of "1" will start an S/R receive transaction.

Each Destination shall reassemble the segments in the proper order, regardless of the order of reception. Each Destination shall track which segments have and have not been received for each Application PDU Identifier such that duplicate received segments can be detected and ignored. Once a complete Application PDU is reassembled, it shall be forwarded to the application.

When the Destination receives any Request for Acknowledgment it shall respond with either a Partial Acknowledgment PDU, Complete Acknowledgment PDU, or Abort Request PDU as appropriate. If the Destination receives a data segment with EDT Acknowledgment Required (Type field = 0), and this data segment completes the Application PDU, then it shall respond with a Complete Acknowledgment PDU.

If the Destination receives an Abort Request PDU, it shall discard any data segments already received associated with that Application PDU. If the Abort Request has the P-bit = 1, the Destination shall respond with an Abort Confirm PDU with F-bit = 1 to the Originator.

If the Destination wishes to abort the transfer of the Application PDU, it shall transmit an Abort Request PDU to the Originator with the P-bit = 0.

C.3.5.2 S/R Basic Flow Control.
The purpose of the Flow Control scheme is to limit the rate at which segments are transmitted to prevent unnecessary traffic on the network for non-responsive Destinations.

C.3.5.2.1 S/R Basic Flow Control parameters and behaviors.
The values of the S/R Flow Control parameters shall be initially defined based on the network characteristics and the S/R operation. The parameter for S/R Basic Flow Control is:

Segment Credit Limit (SCL): The maximum number of Data Segments that the Originator may have outstanding (i.e., sent and unacknowledged) for a single Application PDU simultaneously. Once this limit is reached, no additional segments can be sent by the Originator until some of the outstanding segments have been acknowledged. The Originator shall solicit an acknowledgment by setting the P-bit = 1 when it sends the Data Segment that causes the number of outstanding segments to reach the SCL. The maximum value for SCL is derived from the limitation of the number of bits that can be used in the Bit Mask field of a Partial Acknowledgment PDU.

C.3.5.2.2 S/R Basic Flow Control parameter values.
The default values below will not be optimal for all CNR networks. Systems shall have the ability to change the parameters listed in the TABLE C-V below. The CNRWG will publish tables with recommended values for MIL-STD-188-220D networks on the CNRWG Website.

TABLE C-V. Programmable S/R flow control parameters

S/R Flow Control Parameter Description	Abbreviation	Min	Max	Default	Guidance
Segment Credit Limit	SCL	1	16	5 segments	Total octets (i.e Segment Size * SCL) should not exceed the Originator queue size (e.g., QSO) specified in the MIL-STD-188-220 Parameter Tables.

C.3.5.3 S/R Basic timing parameters and variables.
The S/R Basic Protocol makes use of several timers in order to facilitate an efficient exchange of segmented data. This section describes the timers, the parameters used by the timers, and the formulas used to calculate the timers.

C.3.5.3.1 S/R Basic timing parameters.
The values of the S/R Timers are initially determined based on Parameters provided to the system. These parameters are defined based on the network characteristics and the S/R operation. The S/R timing parameters are as follows:

a. Segment Retry Count Limit (SRCL): The number of times that an Originator shall retransmit a Data Segment based on a received Partial Acknowledgment indicating a missing segment before aborting the transfer of the Application PDU.

b. Request For Acknowledgement Retry Limit (RFARL): The number of consecutive times that an Originator shall re-transmit a request for acknowledgment without receiving an acknowledgment from the Destination before aborting the transfer of the Application PDU.

c. Maximum Request for Acknowledgment Interval Timer Value (MAX_RFAIT_VALUE): The maximum amount of time that the Originator should wait for a response to a Request for Acknowledgment from a Destination.

d. Maximum Inter Segment Receive Interval Timer Value (MAX_ISRIT_VALUE): The maximum amount of time that a Destination should wait for the next segment in an S/R Transaction to be received. This value should always be at least three times the MAX_RFAIT_VALUE.

C.3.5.3.2 S/R Basic timing parameter default values.

The default values below will not be optimal for all CNR networks. Systems shall have the ability to change the parameters listed in TABLE C-VI below either dynamically or during system initialization. The CNRWG will publish tables with recommended values for MIL-STD-188-220D networks in the future at the CNRWG Website.

TABLE C-VI. Programmable S/R parameters

S/R Parameter Description	Abbreviation	Minimum	Maximum	Default Value
Request For Acknowledgement Retry Limit	RFARL	1	10	3 Retries
Segment Retry Count Limit	SRCL	0	5	2 Retries
Maximum RFAIT Value	MAX_RFAIT_VALUE	30	600	60 seconds
Maximum ISRIT Value	MAX_ISRIT_VALUE	90	2400	210 seconds

C.3.5.3.3 S/R Basic timing variables.
The value of the S/R variables may be recalculated or adjusted dynamically during S/R operation. The modification of these variables is based not only on the Parameters defined above, but several S/R Variables that are tracked during operation. In general, the system must maintain one set of the following Variables for the duration of each S/R transaction (composed of an Originator, Destination, and Application PDU). The S/R timing Variables are as follows:

a. Request For Acknowledgement Retry Count (RFARC): The number of times an Originator has re-transmitted a Request for Acknowledgement without receiving an acknowledgment from the Destination. The Originator shall maintain the RFARC for each Destination.

b. Measured Round Trip Delay (MRTD): The measured value from the time a Data Segment is sent until the time the acknowledgement of that segment is received. The Originator shall measure the MRTD only for segments sent using the Unsent Segments procedure (i.e., not when segments are resent).

c. Smallest Lowest Numbered Unacknowledged Segment (SLNUS): The Segment Number of the lowest numbered segment that has been sent by the Originator but for which an acknowledgment has not yet been received from all ACTIVE Destinations. The Originator shall maintain the SLNUS for each active transfer. If there is only one Destination, then the SLNUS will equal the LNUS for that Destination.

d. Last Segment Number (LSN): The final Segment Number of the current Application PDU. The Originator shall maintain the LSN for each active transfer. The Destination shall also maintain the LSN for each active transfer.

e. Highest Numbered Segment Sent (HNSS): The Segment Number of the highest numbered segment that has been sent by the Originator. The Originator shall maintain the HNSS for each active transfer.

f. Measured Inter-Segment Receive Interval Time (MISRIT): The measured time between receiving the current segment and the previous segment. The Destination shall measure the MISRIT when a segment is received for an active transfer.

g. Relaxed Estimated Round Trip Delay (RERTD): The adjusted ERTD to account for variation in transmission times. The Originator shall maintain the RERTD for each Destination.

h. Segment Credits Used (SCU): The current number of segments that have been sent but not acknowledged by all Destinations. The Originator shall maintain the SCU for each active transfer.

i. Saved Estimated Round Trip Delay (SERTD): The currently saved value of the ERTD. Updates to this value are only made based on actual measurements. The Originator shall maintain the SERTD for each Destination.

j. Segment Retry Count (SRC): The number of times that a segment has been re-sent by the Originator to all active Destinations. The Originator shall maintain the SRC for each active transfer.

k. Partial Acknowledgment Starting Segment Number (PASSN): This refers to the value of the SSN contained in the Partial Acknowledgment currently being processed by the Originator.

l. Segment Number (SN): This refers to the value of the Segment Number field contained in the Data Segment of an active transfer currently being processed by the Originator

m. Hop Count (HOPCNT): Stations shall maintain the maximum HOPCNT of all other stations with which it has an active transfer. This value may not be available in all systems (e.g., systems that do not implement MIL-STD-188-220 Topology Updates to maintain an Topology Map), in which case a default value of 1 shall be used.

n. Initial Inter-Segment Receive Interval Timer (IISRIT): The initial value for the ISRIT. This value is calculated as per the equation in section C.3.5.7.3. This variable shall be calculated for each Destination.

o. Initial Round Trip Delay (IRTD): The initial value for the ERTD. This value is calculated as per the equation in section C.3.5.7.2. This variable shall be calculated for each Destination.

p. Lowest Numbered Unacknowledged Segment (LNUS): The Segment Number of the lowest numbered segment that has been sent by the Originator but for which an acknowledged has not yet been received by the Destination. The Originator shall maintain the LNUS for each Destination with which it has an active transfer.

q. Destination Status (DS): The Originator shall maintain the DS for each Destination associated with a transfer. If the Originator is still attempting to successfully complete the transfer for the Destination, the value shall be ACTIVE. If the Originator has aborted the transfer to the Destination, the value shall be INACTIVE.

r. Originator Status: The Destination shall maintain the Originator Status for each Application PDU Identifier. If the Destination is still attempting to successfully reassemble segment associated with the Application PDU Identifier, the value shall be ACTIVE. If the Destination has aborted the transfer to the Destination or sent a complete acknowledgment, the value shall be INACTIVE.

C.3.5.4 Detailed S/R Basic Procedures

C.3.5.4.1 S/R Basic Procedure for sending Unsent (data) Segments to Multicast Addresses.
The following is the entirety of the mandatory process for transmitting segments to Multicast Addresses, which includes the Global Address. In the S/R Basic Protocol, segments sent to Multicast Addresses should be sent as Data Segments with EDT Not Required. The P-bit should be set to “0” on all Data Segment PDUs transmitted to a Multicast Address. No S/R Timers are required by the S/R Basic Protocol at the Originator when transmitting to Multicast Addresses. Any responses received by the Originator referring to the Multicast S/R Transaction may be ignored.

The goal of the procedure herein is to send each Data Segment PDU to each Multicast Address one time. There is no mechanism for acknowledgments or retries in the S/R Basic Protocol for Multicast Addresses. In order to account for systems that may be implementing Data Link Layer concatenation, the first segment of the transaction must be transmitted over the air before additional segments are sent down the protocol stack for transmission. This is necessary to allow the timers on the receiver to be properly initialized.

The Originator of the S/R Multicast transaction shall, at a minimum, perform the following logic:

Send the first Data Segment PDU in the transfer with P-bit = 0 and EDT Acknowledgment Not Required. Wait for the transmission of the first Data Segment to complete

WHILE (not all data segments have been sent as Unsent Segments)
LOOP
Send the next Data Segment in the transfer with P-bit = 0 and EDT Acknowledgment Not Required
END WHILE LOOP

This ends the mandatory procedures for sending S/R messages to Multicast Addresses. Implementers may desire to enhance the procedures for Multicast transactions by allowing for flow control, retransmission of segments, destination discovery, or other procedures described in the S/R Enhanced section for Multicast transactions. Enhancing the Multicast transaction logic is permissible as long as the station can interoperate with systems only implementing the mandatory components of S/R Basic Multicast transactions described in this section.

C.3.5.4.2 S/R Basic Procedure for sending Unsent (Data) Segments to Unicast Addresses.
The intent of this procedure is to send each Data Segment of an Application PDU one time. Once a Data Segment has been sent, it is no longer unsent. Retries are not handled by this procedure, only the initial transmission of each segment. Unsent Segments are only transmitted when there is space available in the "window" (i.e., the Segment Credits Used does not exceed the Segment Credit Limit) and further Acknowledgments are not expected (i.e., when the Request for Acknowledgment Interval Timer is not running). The first segment of an S/R Transaction is always sent with the P-bit set to 1, requesting an acknowledgment. Additional segments of a transfer will not be transmitted until each Destination responds to the first segment or has been eliminated as a non-responsive Destination. Subsequent segments are sent in groups up to the Segment Credit Limit in number, and the P-bit is only set in the last segment in the "window", which prevents unnecessary acknowledgments from being requested.

When the Originator is sending the first segment of a transaction or receives a Partial Acknowledgment that causes SLNUS to increase (and therefore the SCU to decrease), or prunes a destination that causes SLNUS to increase (and therefore the SCU to decrease), it shall take the following actions:

WHILE ((there are still Unsent Segments)
AND (SCU is less than the SCL, i.e., (SCU < SCL))
AND (The RFAIT is not running))
LOOP
IF (HNSS == 0)
THEN
Send the first Data Segment PDU in the transfer with P-bit = 1 **--** (Request an Acknowledgment)
Record that Segment Number 1 is OUTSTANDING
Set the SCU = 1
Set the Destination Status for each Destination to Active (DS = ACTIVE)
Set the RFARC for each Destination = 0
Set SLNUS = 1
Set LNUS for each Destination = 1
Start the RFAIT according to C.3.5.5.1
Start the MRTD counter.
ELSE
IF (SCU == SCL **-** 1) **--** (Next Segment sent will reach the Segment Credit Limit)
OR (HNSS == LSN **-** 1) **--** (Next Segment is the Last Segment)
THEN
Send the next Data Segment in the transfer with P-bit=1 **--** (Request for Acknowledgment)
Record that the Segment Number of the Data Segment just sent is OUTSTANDING
Increment the SCU by 1

Start the RFAIT according to C.3.5.5.1
Start the MRTD counter.
ELSE
Send the next Data Segment in the transfer with P-bit=0
Record that the Segment Number of the Data Segment just sent is OUTSTANDING
Increment the SCU by 1
ENDIF
ENDIF
Set the SRC for this segment to 0
Update the HNSS
END WHILE LOOP

C.3.5.4.3 S/R Basic Procedure for processing acknowledgment.

a. The intent of this procedure is two-fold. First, this procedure determines if the number of Segment Credits Used can be reduced due to the fact that all Destinations have positively acknowledged reception of a specific Data Segment. Second, this procedure records which Data Segments were missed by any Destination and therefore need to be resent. The actual retransmission of Data Segments is handled by a separate procedure. If all Destinations transmit an Acknowledgment, then the Request for Acknowledgment Interval Timer can be stopped instead of waiting for it to expire.

When an Originator receives a Partial Acknowledgment PDU, it shall take the following actions:

IF the Serial Number matches an Application PDU Identifier
AND the Partial Acknowledgment source matches a Destination associated with the matching Application PDU Identifier
THEN
IF the DS == ACTIVE for the Destination that sent the Partial Acknowledgment
THEN
IF the MRTD counter is running
Update the Round Trip Delay Timers according to C.3.5.6.1.
ENDIF
Set the RFARC for this Destination to 0
Set SavedLNUS = LNUS
Set SavedSLNUS = SLNUS
Update LNUS for this Destination and SLNUS according to C.3.5.6.2
IF LNUS < > SavedLNUS **--** (i.e., LNUS has changed)
Record that this Destination has acknowledged all segments up to LNUS
FOR Each Segment Number that is OUTSTANDING
IF All Active Destinations have acknowledged the segment
THEN
Decrement the SCU by 1
Record that this Segment Number is NOT OUTSTANDING
ENDIF
END FOR LOOP
ENDIF
IF (LNUS < HNSS + 1) **--** (i.e., there is a Bit Mask field to process)
THEN

```
                **FOR** (Each bit to process in the Bit Mask field of the Partial Acknowledgment
                  PDU, there will be HNSS+1 – LNUS bits to loop over.  Bits not present in
                  the Bit Mask from HNSR to HNSS are treated as if they exist and are set to
                  zero (0))
                LOOP
                    IF the current bit of the Bit Mask equals 1
                        Record that this Destination has acknowledged this segment
                        IF All Active Destinations have acknowledged the segment
                            AND the Segment Number is OUTSTANDING
                        THEN
                            Decrement the SCU by 1
                            Record that this Segment Number is NOT OUTSTANDING
                        ENDIF
                    ENDIF
                END FOR LOOP
            ELSE  -- There is no Bit Mask field to process (i.e., LNUS == HNSS +1)
                Record that this destination has acknowledged all sent segments.
                FOR (Each segment from SLNUS to HNSS)
                    IF (All Destinations have acknowledged the segment)
                        AND the Segment Number is OUTSTANDING
                    THEN
                        Decrement SCU by 1
                        Record that this Segment Number is NOT OUTSTANDING
                    ENDIF
                END FOR LOOP
            ENDIF
            IF The RFARC for all ACTIVE Destinations is 0
            THEN
                Stop the RFAIT according to C.3.5.5.1
                Send any remaining Unsent Segments according to C.3.5.4.2
            ENDIF
        ELSE -- (The Destination that sent the Partial Acknowledgment is INACTIVE)
            Send an Abort Request PDU with P-bit = 0 to the Destination that generated the
              Partial Acknowledgment
        ENDIF
    ELSE -- (either the serial number does not match any Application PDU Identifier, or the source
            of the Partial Acknowledgment does not match any of the Destination associated with
            the Application PDU identifier)
        Send an Abort Request PDU back to the source of the Partial Acknowledgment with P-bit =
          0 using the Application PDU Identifier sent by the source of the Partial Acknowledgment
    ENDIF
```

b. The intent of this procedure is to mark any Destination that sends a Complete Acknowledgment as INACTIVE, meaning that the transaction to that particular Destination is finished. If all Destinations are finished, processing for this transaction can end.

When an Originator receives a Complete Acknowledgment PDU, it shall take the following actions:

```
    IF the Serial Number matches an Application PDU Identifier
```

AND the Complete Acknowledgment PDU source matches a Destination associated with the matching Application PDU Identifier
THEN
IF the DS == ACTIVE for the Destination that sent the Complete Acknowledgment PDU
THEN
Set the DS = INACTIVE for this destination
ENDIF
IF the DS == INACTIVE for all Destinations
THEN
Stop all timers, counters, etc. associated with this transaction.
Segments associated with the Application PDU are discarded by the Originator.
Issue notification to Upper Layer Protocol that transaction is complete.
ENDIF
ELSE – (the serial number does not match an identifier or the Destination is not known)
Ignore the received Complete Acknowledgment PDU.
ENDIF

C.3.5.4.4 S/R Basic Procedure for resending unacknowledged data segments.
The intent of this procedure is to resend any Data Segment that was missed by at least one Destination. Resent Data Segments are transmitted to all active Destinations in order to prevent destinations timing out due to inactivity from the Originator (recall that duplicate segments received by a Destination are discarded). It is also the intent of this procedure to ensure that only the last sent segment in a window of segments has the P-bit set to 1.

This procedure shall be executed any time the (RFAIT Stops) or (the RFAIT Expires and at least one Partial Acknowledgment was received).

FOR Each sent segment that is not fully acknowledged **--** (i.e., not all Destinations have acked the segment)
IF SRC < SRCL
THEN
IF HNSS == 1
THEN -- (must retransmit first segment)
Resend the unacknowledged Segment to all active Destination(s) with P-bit = 1
Start the RFAIT according to C.3.5.5.1
ELSE IF ((SCU == SCL)
OR (HNSS == LSN)) **--** (only resending unacknowledged segments)
THEN
IF Segment is last Segment of FOR LOOP
THEN
Resend the unacknowledged Segment to all active Destination(s) with P-bit = 1
Start the RFAIT according to C.3.5.5.1
ELSE
Resend the unacknowledged Segment to all active Destination(s) with P-bit = 0
ENDIF
ELSE -- (resend unacknowledged segments after which new Unsent Segments will be sent)
Resend the unacknowledged Segment to all active Destination(s) with P-bit = 0
ENDIF
Increment the SRC for this segment
ELSE -- (the SRC >= SRCL then)

Send an Abort Request PDU with P-Bit = 0 to the Unicast Address of active Destination(s) that have not acknowledged the segment.
Provide an S/R Status Indication to the Upper Layer Protocol (ULP) indicating failure for any Destination(s) that did not acknowledge the segment.
Set the Destination Status (DS) to INACTIVE for the Destination(s) that did not acknowledge the segment.
IF All Destination(s) are INACTIVE
THEN
Stop all timers, counters, etc. associated with this transaction.
Segments associated with the Application PDU are discarded by the Originator.
Issue notification to Upper Layer Protocol that transaction is complete.
ELSE -- (at least one Destination is still ACTIVE)
IF (Segment is Last Segment of FOR LOOP)
AND ((SCU == SCL) **OR** (HNSS == LSN))
THEN
Issue an Acknowledgment Request PDU to all Destinations with DS == ACTIVE
ENDIF
Set SavedSLNUS = SLNUS
SLNUS = Smallest LNUS associated with any ACTIVE Destination
IF SLNUS <> SavedSNLUNS
THEN
FOR Each Segment Number that is OUTSTANDING
IF All Active Destinations have acknowledged the segment
THEN
Decrement the SCU by 1
Record that this Segment Number is NOT OUTSTANDING
ENDIF
END FOR LOOP
ENDIF
ENDIF
ENDIF
END FOR LOOP

C.3.5.4.5 S/R Basic Procedure for processing received data segment(s).
The intent of this procedure is to receive and reassemble each Data Segment in its proper place in the Application PDU that is being reassembled. When a Data Segment with a Segment Number of "1" is received and it does not match a current Application PDU Identifier, a new reassembly transaction is started. If the segment is not the first segment, and does not match an existing Application PDU Identifier, the segment is discarded and the transaction is aborted, as a processing error must have occurred.

When a Destination receives a Data Segment it shall take the following actions:

IF the Serial Number and source address does not match an Application PDU Identifier
THEN
IF the Segment Number of the received segment == 1
THEN
Create a new Application PDU Identifier indicating that no segments have been received.
Initialize receive variables associated with the new Application PDU identifier according to C.3.5.7.3
Set the Originator Status associated with the new Application PDU Identifier to ACTIVE.

Generate a S/R-First-Segment Indication to the Application.
ELSE
IF P-Bit == 1 in the received segment
THEN
Transmit an Abort Request PDU with P-bit = 0 to the Originator.
ENDIF
ENDIF
ENDIF
IF the Serial Number and source address of the received segment match an Application PDU Identifier
THEN
IF Originator Status == ACTIVE
THEN
Stop the Inter-Segment Receive Timer (ISRT) according to C.3.5.5.2
Stop the Inter-Segment Receive Interval Timer (ISRIT) according to C.3.5.5.3
IF the segment number was not previously received
THEN
Record the segment as having been received.
Reassemble the data at the proper location in the Application PDU based on the Segment Number
IF (P-Bit == 1 in the received segment)
OR (the received segment completes the Application PDU, i.e., all segments have now been received at least once **AND** the Data Segment is EDT Acknowledgment Required (Type == 0))
THEN -- (Its time to acknowledge segments)
IF all segments have now been received
THEN
Send a Complete Acknowledgment
Set the Originator Status to INACTIVE and remember that all segments were received.
ELSE -- (some segments have not been received yet)
Send a Partial Acknowledgment indicating which segment have and have not been received (i.e. those segments between HNSR and SSN that have not been received).
ENDIF
ELSE -- (no acknowledgment needs to be sent yet for the non-duplicate segment)
IF all segments have now been received (but EDT Acknowledgment not Required)
THEN
Set the Originator Status to INACTIVE and remember that all segments were received.
ENDIF
ENDIF
ELSE -- (it is a duplicate segment on an active transfer)
IF (the P-Bit == 1 in the received segment)
THEN -- (Its time to acknowledge segments that have been received)
Send a Partial Acknowledgment indicating which segment have and have not been received.
ENDIF
Discard the duplicate segment
ENDIF
IF not all segments have been received
Restart the ISRT according to C.3.5.5.2
Restart the ISRIT according to C.3.5.5.3
ENDIF
ELSE -- (the Originator is INACTIVE)
IF P-Bit == 1 in the received segment

THEN
IF all segments were received **--** (i.e., the transaction was complete)
THEN
Send a Complete Acknowledgment PDU
ELSE -- (all segments were not received)
Transmit an Abort Request PDU with P-bit = 0 to the Originator.
ENDIF
ENDIF
Discard the received Segment (associated with the inactive Application PDU Identifier)
ENDIF
ENDIF

C.3.5.4.6 S/R Basic Procedure for processing a received Acknowledgment Request PDU.
The intent of this procedure is for a Destination to respond to the Originator with either a Partial Acknowledgment PDU or Complete Acknowledgment PDU as appropriate.

When a Destination receives an Acknowledgment Request PDU it shall take the following actions:

IF the Serial Number and source address does not match an Application PDU Identifier
THEN
Transmit Partial Acknowledgment to the Originator indicating that no segments have been received (i.e. the Starting Segment Number of the Partial Acknowledgment will be '1')

ELSE -- (the Serial Number and source address matches an Application PDU Identifier)
IF (Originator Status == ACTIVE) **--** (all segments have not yet been received)
THEN
Stop the Inter-Segment Receive Timer (ISRT) according to C.3.5.5.2
Stop the Inter-Segment Receive Interval Timer (ISRIT) according to C.3.5.5.3
Send a Partial Acknowledgment indicating which segment have and have not been received.
Restart the ISRT according to C.3.5.5.2
Restart the ISRIT according to C.3.5.5.3
ELSE --(the matching Originator is INACTIVE)
IF all segments were received
THEN
Send a Complete Acknowledgment PDU
ELSE -- (all segments were not received)
Send an Abort Request PDU with P-Bit = 0 to the Unicast Address of the Originator
ENDIF
ENDIF
ENDIF

C.3.5.4.7 S/R Basic Procedure for processing a received Abort Request PDU.

a. The intent of this procedure is for a Destination to terminate processing of a transaction when it receives an Abort Request.

When a Destination receives an Abort Request PDU it shall take the following actions:

IF the Serial Number matches an Application PDU Identifier

```
   AND (Originator Status == ACTIVE) -- (all segments have not yet been received)
THEN
     Stop all timers, counters, etc. associated with this transaction.
     Segments associated with the Application PDU are discarded by the Originator.
     Set Originator Status = INACTIVE
ENDIF
IF (P-bit == 1 in received Abort Request PDU)
THEN
     Send an Abort Confirm PDU with the Serial Number specified in the Abort Request PDU
ENDIF
```

b. The intent of this procedure is to remove a Destination from the list of ACTIVE Destinations when an Originator receives an Abort Request from a Destination.

When an Originator receives an Abort Request PDU it shall take the following actions;

```
IF the Serial Number matches an Application PDU Identifier where this station is a Destination
   AND (Destination Status == ACTIVE)
THEN
   Set Destination Status = INACTIVE
   IF All Destinations are INACTIVE
   THEN
        Stop the timers, counters, etc. associated with this transaction.
        Segments associated with the Application PDU are discarded by the Originator.
        Issue notification to Upper Layer Protocol that transaction is complete
   ELSE -- (at least one Destination is still ACTIVE)
        Set SavedSLNUS = SLNUS
        SLNUS = Smallest LNUS associated with any ACTIVE Destination
        IF SLNUS <> SavedSNLUNS
        THEN
            FOR Each Segment Number that is OUTSTANDING
                IF All Active Destinations have acknowledged the segment
                THEN
                    Decrement the SCU by 1
                    Record that this Segment Number is NOT OUTSTANDING
                ENDIF
            END FOR LOOP
        ENDIF
        IF The RFARC for all ACTIVE Destinations is 0
        THEN  -- (First resend any unacknowledged segments, which is triggered by stopping the
                  RFAIT, then send any remaining Unsent Segments if there are segment credits
                  available)
            Stop the RFAIT according to C.3.5.5.1
            Send any remaining Unsent Segments according to C.3.5.4.2
        ENDIF
    ENDIF
ENDIF
IF (P-bit == 1 in received Abort Request PDU)
THEN
```

Send an Abort Confirm PDU with the Serial Number specified in the Abort Request PDU
ENDIF

C.3.5.5 S/R Basic timers.
The S/R Protocol shall use the following Timers in order to facilitate an efficient exchange of segmented data between the Originator and the Destination.

C.3.5.5.1 Request for Acknowledgment Interval Timer (RFAIT).
The RFAIT shall be run at the Originator to predict a time by which a response to a Request for Acknowledgment should be received. The Originator shall maintain one RFAIT for each active Application PDU Identifier.

a. **Starts:** The RFAIT shall be started (or stopped then restarted) at the Originator each time a Request for Acknowledgment is issued. If the RFAIT is already running when a Request for Acknowledgment is issued, the RFAIT shall be restarted, i.e., stopped then started again. Only one RFAIT shall be running at any given time for each Application PDU that is active at the Originator. The RFAIT value shall be calculated according to the procedure below each time it is started or restarted. The RERTD selected for use in the following equation shall be the largest of any active Destination (DS=ACTIVE).

Increment the RFARC for all ACTIVE Destinations by 1.
RFAIT = Max(RERTD)
IF RFAIT > MAX_RFAIT_VALUE
THEN
RFAIT = MAX_RFAIT_VALUE
ENDIF

b. **Stops:** The RFAIT shall be stopped when a Partial Acknowledgment or Complete Acknowledgment is received from all Destinations, at this time all Unacknowledged Segments (i.e. any Data Segment that has not been acknowledged by all ACTIVE Destinations) will be resent according to C.3.5.4.4, then any Unsent Segments will be sent according to C.3.5.4.2

Note: The MRTD is not updated when the RFAIT timer is stopped because received Partial Acknowledgments are inherently ambiguous, i.e., the Originator can never know with certainty which specific S/R PDU received by the Destination caused the Partial Acknowledgment to be sent.

c. **Expires:** When the RFAIT expires at the Originator, meaning that at least one Destination did not send an Acknowledgment, the following shall occur:

FOR 1 to (Number of Destinations with DS == ACTIVE) **--** (Loop over all ACTIVE Destinations)
LOOP
IF RFARC for the Destination >= RFARL
THEN
Send an Abort Request to the Destination with P-Bit = 0.
Provide an S/R Status Indication to the ULP indicating failure for any Destinations that did not acknowledge the segment.
Set the DS to INACTIVE for the Destination
IF All Destinations are INACTIVE
THEN
Stop the timers, counters, etc. associated with this transaction.
Segments associated with the Application PDU are discarded by the Originator.

```
                Issue notification to Upper Layer Protocol that transaction is complete
                EXIT RFAIT Expires Procedure -- (S/R Transaction processing is complete)
            ELSE -- (at least one Destination is still ACTIVE)
                Set SavedSLNUS = SLNUS
                SLNUS = Smallest LNUS associated with any ACTIVE Destination
                IF SLNUS <> SavedSNLUNS
                THEN
                    FOR Each Segment Number that is OUTSTANDING
                        IF All Active Destinations have acknowledged the segment
                        THEN
                            Decrement the SCU by 1
                            Record that this Segment Number is NOT OUTSTANDING
                        ENDIF
                    END FOR LOOP
                ENDIF
            ENDIF
        ENDIF
    END FOR LOOP
    IF At least one Partial Acknowledgment PDU was received during the RFAIT period
    THEN
        Resend all Unacknowledged Segments (i.e. any Data Segment that has not been acknowledged by all
        ACTIVE Destinations) according to C.3.5.4.4.
    ELSE
        Issue an Acknowledgement Request PDU to all Destinations with DS ==ACTIVE
        Start the RFAIT according to C.3.5.5.1
    ENDIF
    Send any remaining Unsent Segments according to C.3.5.4.2
```

C.3.5.5.2 Inter-Segment Receive Timer (ISRT).

The ISRT shall be used to measure the time between received S/R PDUs at the Destination as required to update the estimate for the Inter-Segment Receive Interval Timer. The Destination shall maintain one ISRT for each Application PDU as described below.

a. **Starts:** When a Data Segment PDU or Acknowledgment Request PDU is received, the time at which the PDU was received is recorded.

b. **Stops:** When the next Data Segment PDU or Acknowledgment Request PDU is received, the elapsed time since receipt of the previous segment is calculated and stored as the MISRIT, if it is greater than the currently stored MISRIT value. This time shall be used to update the ISRIT according to C.3.5.5.3. The ISRT shall only be restarted if not all of the segments associated with the Application PDU have been received.

```
IF (ISRT > MISRIT)
THEN
    MISRIT = ISRT
ENDIF
```

c. Expires**:** The ISRT never expires; it is only used to measure the interval between the receipts of segments with the same Application PDU Identifier.

C.3.5.5.3 Inter-Segment Receive Interval Timer (ISRIT).
The ISRIT shall be used to predict a time by which the next segment should be received at the Destination. The Destination shall maintain one ISRIT for each Application PDU as described below.

a. **Starts:** When a segment is received, the ISRIT shall be started or restarted to predict a time by which the next segment should be received. The value of ISRIT shall be set according to C.3.5.6.3.

b. **Stops:** When the next segment is received, the ISRIT shall be stopped and then restarted if all segments have not been received.

c. **Expires:** When the ISRIT expires, the transaction shall be aborted.

   Destination shall send an Abort Request PDU with P-Bit = 0
   Destination shall discard segments associated with the Application PDU

C.3.5.6 Basic Timer equations.
This section contains additional equations related to timers.

C.3.5.6.1 Round Trip Delay (RTD) equations.
The following sequence of equations shall be used to calculate the RERTD, and the SERTD. In S/R Basic, the worst case RTD for each Destination is kept. The RFAIT is based on RERTD. After the first segment is sent and acknowledged, the first "full credit window" of segments will be issued. For this first "full credit window" set of segments, RERTD will be given a very conservative, worst case value, based on the "window size" (i.e. Segment Credit Limit). Subsequent RERTD values will be based on actual measured MRTD values. This is done to optimize RERTD for implementations that may concatenate segments at the Data Link Layer.

```
Stop MRTD Counter.
IF (HNSS == 1)
THEN
    RERTD = IRTD * 2.2 * SCL
ELSE
    IF MRTD > SERTD
    THEN
        SERTD = MRTD
    ENDIF
    RERTD = SERTD * 2.2
ENDIF
```

C.3.5.6.2 LNUS and SLNUS equations.
When a Partial Acknowledgment is received, the following sequence of equations shall be used to update the LNUS associated with the Destination that sent the Partial Acknowledgment. When the LNUS is updated, the SLNUS is updated to the smallest LNUS value associated with any active Destination.

```
IF PASSN > LNUS
THEN
    LNUS = PASSN
    SLNUS = Smallest LNUS associated with any ACTIVE Destination associated with the same Application
      PDU Identifier as specified by the serial number field of the Partial Acknowledgment.
```

ENDIF

C.3.5.6.3 Segment reception equations.
When a segment is received the following sequence of equations shall be used to calculate the ISRIT and start/restart the ISRT.

IF SN <= 1
AND The segment is not a duplicate
THEN
    ISRT = 0
    Start ISRT
    ISRIT = IISRIT * (Max SRCL Value) * 2.2 **--** (reference Table C-VI)
    Start ISRIT
ELSE **--** i.e., ((SN == 1 **AND** the segment is a duplicate) **OR** SN>1)
    ISRIT = MISRIT * (Max SRCL Value) * 2.2 **--** (reference Table C-VI)
    IF ISRIT > MAX_ISRIT_VALUE
    THEN
        ISRIT = MAX_ISRIT_VALUE
    ENDIF
    Start ISRIT
ENDIF

C.3.5.7 Basic Initialization equations.

C.3.5.7.1 Network enable initialization.
Before any segments have been sent or received (e.g., upon enabling the net), the following sequence of equations shall be used to initialize parameter values.

HOPCNT = 1 (unless another value can be obtained by the system, e.g., querying the Intranet Layer in a MIL-STD-188-220 system and obtaining the value from the Topology Map, in which case use the Maximum of the Hopcounts for each of the recipients being transmitted to)

C.3.5.7.2 Application PDU transmit initialization.
Each time an Originator initiates the transfer of an Application PDU, the following sequence of equations shall be used to initialize the following parameter values associated with that Application PDU.

SCU =	0	
HNSS =	0	
LNUS =	0	(For each Destination)
SLNUS =	LNUS	
DS =	ACTIVE	(For each Destination)

IF Transfer occurs directly over a MIL-STD-188-220 net and T2AT is available
THEN
    IRTD = HOPCNT * T2AT (T2AT taken from MIL-STD-188-220 Protocol Parameter Tables. This equation calculates a default value that can be used for Destinations on the same net. This calculation is performed when the net is enabled based on the net's configuration. The default value for the net may be modified by the operator.)
ELSE

IF Number of Stations on the Network is available
THEN
IRTD = HOPCNT * (Number of Stations on the Network) * 2 sec
ELSE
IRTD = HOPCNT * 30 sec
ENDIF
ENDIF

For sending the first segment, RERTD will be based on IRTD.

SERTD = 0
RERTD = IRTD * 2.2

C.3.5.7.3 Application PDU receive initialization.
Each time a Destination begins reception of a new Application PDU, the following sequence of equations shall be used to initialize the following parameter values associated with that Application PDU Identifier.

IF Transfer occurs directly over a MIL-STD-188-220 net and T2AT is available
THEN
IISRIT = HOPCNT * T2AT (T2AT taken from MIL-STD-188-220 Protocol Parameter Tables. This equation calculates a default value that can be used for Originators on the same net. This calculation is performed when the net is enabled based on the net's configuration. The default value for the net may be modified by the operator.)
ELSE
IF Number of Stations on the Network is available
THEN
IISRIT = HOPCNT * (Number of Stations on the Network) * 3 sec
ELSE
IISRIT = HOPCNT * 30 sec
ENDIF
ENDIF

MISRIT = IISRIT

C.3.6 S/R Enhanced procedures.
The S/R Enhanced protocol described below is a full, stand-alone protocol implementation and does not rely on the S/R Basic protocol above.

C.3.6.1 S/R Enhanced Overview.
The S/R Enhanced procedures offers improved performance over the S/R Basic procedures, enhancing both the efficiency and the capabilities of the S/R Basic Protocol. In the S/R Enhanced Protocol mixed-mode Destination Addresses shall be permitted. A single S/R Enhanced transmission may contain any mix of Unitcast Addresses and/or Multicast Addresses (including the Global address). When an Abort Request PDU is issued in the S/R Enhanced Protocol, if an Abort Confirm PDU response is desired, the P-bit shall be set (i.e., set to the value "1"). This allows for retries of Abort commands.

The S/R Enhanced Protocol provides a complex flow control mechanism that is based not only upon a Segment Credit Limit (also called a Window Size or Windowing Scheme), but an assortment of adjustment factors and aging mechanisms. The S/R Enhanced protocol also introduces the concept of the Reference Freeze State, and several additional timers and counters used to trigger automated actions in an effort to prevent stalls in the transmission path. Systems implementing the S/R Enhanced Protocol will be able to have transmitted messages received by systems implementing either the S/R Basic Protocol or the S/R Enhanced Protocol. Systems implementing the S/R Enhanced Protocol will be able to receive messages transmitted by systems implementing either the S/R Basic Protocol or the S/R Enhanced Protocol.

The S/R Enhanced Protocol also adds the concept of "Destination Learning" when transmitting messages to Multicast Addresses, including the Global Address, that allows the Originator to build an address list of Unitcast Addresses that the message is being transmitted to based on the response to the first segment sent to the Multicast Address(es).

C.3.6.1.1 S/R Enhanced Segmentation.
The Originator shall map the original application PDU into an ordered sequence of segments. Each segment shall be the specified Segment Size bytes in length, with the possible exception of the last segment that can be less than the specified Segment Size bytes in length. If the last segment is less than the specified Segment Size octets in length, it shall not be padded. The host can configure the Segment Size to any value up to but not exceeding MSS. If no Segment Size is specified by the host, MSS shall be used for the Segment Size. The Originator shall assign a single, unique Serial Number to each application PDU and copy it into the header of each segment associated with that application PDU. Serial Numbers are managed by each Originator in accordance with paragraph C.3.3.1.6. Each data segment shall then be sequentially sent, starting with segment number equal to 1. The Originator shall track which segments have and have not been acknowledged for each Destination.

Every segment shall specify the Last Segment Number (the total number of segments in the Application PDU) and it's Segment Number (segment sequence number of the current segment). Multiple S/R transfers can be enacted simultaneously by an Originator, and are distinguished by their Application PDU Identifier, however, due to the complexity of S/R transactions, it is encouraged that an Originator only enact a single S/R transaction at a time.

Each S/R segment shall be transmitted in one UDP Request or one Intranet Layer Request (if n-layer pass through is used) by the Originator. The Originator shall indicate in the segmentation header whether the transfer of the Application PDU requires an EDT Acknowledgment (Type field = 0) or does not require an EDT Acknowledgment (Type field = 2). All data segments associated with the same serial number shall use the same Type field value.

For the first segment, the Originator shall indicate in the S/R header that an acknowledgment is required by setting the P-bit = 1. Subsequent segments shall not be sent until the Originator receives an acknowledgment for the first segment from all Destination(s). The Originator and Destination(s) shall then engage in Flow Control procedures in order to achieve efficient transmission of Data Segments. Flow Control shall be restricted by a Credit Limit, representing the maximum number of unacknowledged segments allowed at any given time, and governed by a series of timers. Flow Control procedures are discussed in detail in section C.3.6.2, and the Timers used with S/R Flow Control are discussed in detail in section C.3.6.3. The general operation of the Flow Control procedures involves the Originator periodically issuing a Request for Acknowledgment to the Destination(s) in order to manage the number of outstanding unacknowledged segments. The Originator shall not send any data segments that will cause the number of unacknowledged segments to exceed the Segment Credit Limit (SCL).

The Originator shall retransmit only data segments that were not received by one or more Destination(s) as indicated by a Partial Acknowledgment (Type field = 4) received from the Destination(s) subsequent to the expiration of the Segment Acknowledgment Timer (SAT). Missing data segments shall only be retransmitted a finite number of times until either acknowledgment(s) indicate all data segments have been received or the transfer of the Application PDU is aborted with a given Destination. The number of retry attempts for a segment shall be limited by the Segment Retry Count Limit (SRCL) parameter. In the case that multiple Data Segments are available at the same time for sending, Data Segments with lower Segment Numbers shall be resent/sent before Data Segments with higher Segment Numbers.

Each time the Originator issues a Request for Acknowledgment, it shall start a Request for Acknowledgment Interval Timer (RFAIT). If the RFAIT expires without the receipt of an acknowledgment from all Destinations, the Originator shall transmit an Acknowledgment Request (Type field = 3). If acknowledgment(s) are not received from all Destination(s) after Request For Acknowledgement Retry Limit (RFARL) number of tries, the transfer of the Application PDU shall be aborted and an error indication shall be returned to the Upper Layer Protocol. If the RFAIT is active and another Request for Acknowledgment is issued by the Originator for any reason, the RFAIT shall be restarted. The RFAIT is further described in paragraph C.3.6.5.2.

When the Originator sends a Data Segment with EDT Acknowledgment Required (Type Field = 0) and Segment Number = Last Segment Number, then the P-bit shall be set to 1, requesting an acknowledgment. When the transfer of the Application PDU is complete, either successfully or unsuccessfully, the Originator shall place the associated Application PDU Identifier in the Reference Freeze State, see paragraph C.3.6.1.3.

If the Originator wishes to abort the transfer of the Application PDU, it shall transmit an Abort Request (Type field = 1) to the Destination. If the Originator wishes to receive confirmation of the abort, then it shall set the P-bit = 1 in the Abort Request. If the Originator receives an Abort Request or an Abort Confirm, the Originator shall set the Destination Abort Confirm Received (DACR) for that Destination to TRUE.

C.3.6.1.2 S/R Enhanced Reassembly.

The Destination shall monitor for S/R segments to arrive. The source address of the Originator (as provided by the lower level protocol) combined with the S/R header Serial Number, forms the Application PDU Identifier, which uniquely identifies the Application PDU to which each segment belongs. On N-layer pass through networks, it shall be the serial number and source data link address which establish each unique data stream; on IP networks, it shall be the serial number and source IP address which establish each unique data stream. Each Destination shall reassemble the segments in the proper order, regardless of the order of reception. Each Destination shall track which segments have and have not been acknowledged for each Application PDU Identifier such that duplicate received segments can be detected and ignored. Once a complete Application PDU is reassembled, it shall be forwarded to the application. The Destination shall not forward an incomplete Application PDU to the application.

When the Destination receives any Request for Acknowledgment corresponding to an Application PDU that is not in Reference Freeze State, it shall respond with either a Partial Acknowledgment or Complete Acknowledgment as appropriate. If a Partial Acknowledgment was recently transmitted prior to receiving a Request For Acknowledgment, then the transmission of the next Partial Acknowledgment may be delayed as a means of controlling the number of Partial Acknowledgment sent by the Destination. If the Destination receives a data segment with EDT Acknowledgment Required (Type field = 0) and the P-bit = 0, and this data segment completes the Application PDU, then it shall respond with a Complete Acknowledgment (Type field = 6) and the F-bit = 0.

When the Destination receives a Data Segment (Type field = 0 or 2) or an Acknowledgment Request (Type field = 3), then it shall start a Reassembly Timer. For each different Application PDU Identifier, a different Reassembly Timer shall be used. The Reassembly Timer shall be based on interval timing between reception of segments and the number of segments not yet received. When the Application PDU is successfully reassembled, the Reassembly Timer associated with that Application PDU Identifier shall be terminated. Reassembly Timer behavior is described in paragraph C.3.6.5.1.

If the data segments associated with the Application PDU are of type EDT Acknowledgment Not Required (Type field = 2), and the Reassembly Timer expires before the Application PDU is successfully reassembled, the Destination shall discard any data segments already received associated with that Application PDU and transmit an

Abort Request (Type field = 1) with the P-bit = 1 to the Originator. The Destination shall then enter the Reference Freeze state for this Application PDU.

If the Data Segments associated with the Application PDU are of type EDT Acknowledgment Required (Type field = 0), and the Reassembly Timer expires before the Application PDU is successfully reassembled, then the Destination shall transmit a Partial Acknowledgment (Type field = 4) to the Originator and restart the Reassembly Timer. If no further data is received from the Originator after the Reassembly Timer Expiration Count Limit number of Partial Acknowledgments are transmitted, then the Destination shall discard any Data Segments already received associated with that Application PDU and transmit an Abort Request (Type field = 1) to the Originator with the P-bit = 1. When the transfer of the Application PDU is complete, either successfully or unsuccessfully, the Destination shall place the associated Application PDU Identifier in the Reference Freeze State, see paragraph C.3.6.1.3.

If the Destination receives an Abort Request (Type field = 1), it shall discard any data segments already received associated with that Application PDU and enter the Reference Freeze state for that Application PDU. If the Abort Request has the P-bit = 1, the Destination shall respond with an Abort Confirm (Type field = 5) with F-bit = 1 to the Originator. If the Destination receives an Abort Request, the Destination shall set the Originator Abort Confirm Received (OACR) for the Originator to TRUE.

If the Destination wishes to abort the transfer of the Application PDU, it shall transmit an Abort Request (Type field = 1) to the Originator. If the Destination wishes to receive confirmation of the abort, then it shall set the P-bit = 1 in the Abort Request. If the Destination receives an Abort Confirm, the Destination shall set the OACR for the Originator to TRUE.

When the Destination receives any Request for Acknowledgment or Data Segment corresponding to an Application PDU that is in Reference Freeze State, if the OACR is FALSE and all segments were previously received then a Complete Acknowledgment shall be sent to the Originator. If the OACR is FALSE and not all segments were previously received then an Abort Request with P-bit = 1 shall be sent to the Originator. If the OACR is TRUE then an Abort Request with P-bit = 0 shall be sent to the Originator.

C.3.6.1.3 Reference Freeze State.

The Reference Freeze State is used to reduce uncertainty concerning re-used Serial Numbers. Serial Numbers form a part of the Application PDU Identifier. While Serial Numbers are defined to be unique, there comes a point in time where an Originator may need to start re-using Serial Numbers to start a new transfer. The Reference Freeze states helps Destinations determine if an Application PDU Identifier for a given Data Segment is part of a completed transfer or a new transfer. It also helps Originators determine if responses from a Destination are part of a completed transfer or a current transfer.

Once a transfer is complete, either successfully or unsuccessfully, the Originator and Destination shall place the associated Application PDU Identifier in the Reference Freeze State. If a data segment is received with an Application PDU Identifier that is currently in a Reference Freeze State, it is considered part of a previously completed transfer and shall be ignored. Once an Application PDU Identifier is removed from the Reference Freeze State, S/R PDUs with that Application PDU Identifier shall be accepted.

The timers related to the Reference Freeze State for Originators and Destinations are explained in sections C.3.6.5.6 and C.3.6.5.3 respectively.

C.3.6.2 Enhanced Flow Control.

The purpose of the Flow Control scheme is to limit the rate at which segments are transmitted such that segments are not discarded by lower layer protocols.

C.3.6.2.1 S/R Enhanced Flow Control parameters and behaviors.
The values of the S/R Flow Control parameters shall be initially defined based on the network characteristics and the S/R operation. The parameters and behaviors for S/R Flow Control are as follows:

a. Segment Credit Limit (SCL): The maximum number of Data Segments that the Originator may have outstanding (i.e., sent and unacknowledged) for a single Application PDU simultaneously. Once this limit is reached, no additional segments shall be sent by the Originator until some of the outstanding segments have been acknowledged. The Originator shall solicit an acknowledgment by setting the P-bit = 1 when it sends the Data Segment that causes the number of outstanding segments to reach the SCL. The maximum value for SCL is derived from the MTU size.

b. Segment Credit Threshold (SCT): The number of outstanding (i.e., sent and unacknowledged) S/R Data Segments per Application PDU that can be sent by an Originator before the station shall request an acknowledgment. The goal of the SCT is for the Originator to request an acknowledgment before reaching the SCL, which blocks the transmission of more segments. The Originator shall solicit an acknowledgment by setting the P-bit = 1 when it sends the Data Segment that causes the number of outstanding segments to exceed the SCT.

c. Segment Range Limit (SRL): The maximum difference between the Smallest Lowest Numbered Unacknowledged Segment (SLNUS) and the Highest Numbered Segment Sent (HNSS). Once this limit is reached, no additional segments shall be sent by the originator until the SLNUS has been acknowledged. The purpose of this parameter is to limit the size of the Bitfield field in a Partial Acknowledgment. The maximum value for SRL is derived from the MTU size.

d. Segment Send Rate Limit Per Originator (SSRLPO): The maximum rate at which an Originator can send segments over a network. The purpose of the SSRLPO is to limit the rate at which segments can be sent by each originator to something that is less than the maximum rate that the net can support. For MIL-STD-188-220 nets, the Originator shall calculate the minimum timer interval between sending segments, and use the value to set the ISST as described in C.3.6.5.7.

e. Received Segment Count Threshold (RSCT): The maximum number of S/R Data Segments received (new or duplicate) by the Destination per Application PDU since the last acknowledgement was sent. The Destination shall generate an appropriate acknowledgement PDU (Partial or Complete) and transmit it to the Originator when it receives the End of Data Transfer Acknowledgment required (Type 0) Data Segment that causes the number of received segments since the last acknowledgement was sent to reach the RSCT. The goal of the RSCT is for the Destination to acknowledge some segments before the Originator reaches the SCL, which blocks the transmission of more segments.

f. Number of Missing Segments Threshold (NOMST): The number of segments with Segment Numbers less than the Highest Numbered Segment Received (HNSR) that are missing at the Destination, i.e., Data Segments that were sent by the Origination but have not yet been received by the Destination, that triggers action by the Destination. The Destination shall send a Partial Acknowledgment to the Originator when it receives the End of Data Transfer Acknowledgment required (Type 0) Data Segment that causes this threshold to be reached. The goal of the NOMST is for the Destination to acknowledge some segments before the Originator reaches the SCL, which blocks the transmission of more segments.

C.3.6.2.2 S/R Enhanced Flow Control parameter values.
The default values below will not be optimal for all CNR networks. Systems shall have the ability to change the parameters listed in TABLE C-VII below either dynamically or during system initialization. The CNRWG will publish tables with recommended values for MIL-STD-188-220D networks in the future on the CNRWG Website .

TABLE C-VII. Programmable S/R flow control parameters

S/R Flow Control Parameter Description	Abbreviation	Min	Max	Default	Guidance
Segment Credit Limit	SCL	1	3216	5 segments	Total octets should not exceed Originator queue size (e.g., QSO)
Segment Credit Threshold	SCT	1	SCL	4 segments	75% of SCL
Segment Range Limit	SRL	1	3216	16 segments	300% of SCL
Received Segment Count Threshold	RSCT	1	SCT	2 segments	50% of SCL
Number of Missing Segments Threshold	NOMST	1	SCT	2 segments	50% of SCL

C.3.6.3 S/R Enhanced timing parameters and variables.
The S/R Protocol makes use of several timers in order to facilitate an efficient exchange of segmented data. This section describes the timers, the parameters used by the timers, and the formulas used to calculate the timers.

C.3.6.3.1 S/R Enhanced timing parameters.
The values of the S/R Timers are initially determined based on Parameters provided to the system. These parameters are defined based on the network characteristics and the S/R operation. The S/R timing Parameters are as follows:

a. Abort Request Retry Limit (ABRRL): Maximum number of times an Abort Request with P-bit = 1 can be re-sent without receiving a response before abandoning the transmission.

b. Request for Acknowledgment Interval Timer Adjustment Factor (RFAITAF): Scale factor used to adjust the Saved Estimated Round Trip Delay (SERTD) for retry values of the RFAIT.

c. Expired Inter-Segment Receive Interval Timer Factor (EISRITF): The amount by which the ISRIT shall be increased when a segment is not received within the expected amount of time.

d. Estimated Round Trip Delay Aging Period (ERTDAP): The interval between adjustments to the Estimated Round Trip Delay (ERTD) due to aging during periods of inactivity. This value shall always be equal to or less than the ERTDLT.

e. Estimated Round Trip Delay Lifetime (ERTDLT): The amount of time it will take to adjust the ERDT back up to the Initial Round Trip Delay (IRTD) due to aging during periods of inactivity.

f. Estimated Inter-Segment Receive Interval Aging Period (EISRIAP): The interval between adjustments to the Estimated Inter-Segment Receive Interval Timer (EISRIT) due to aging in the absence of additional received segments. This value shall always be equal to or less than the Estimated Inter-Segment Receive Lifetime (EISRILT).

g. Estimated Inter-Segment Receive Interval Lifetime (EISRILT): The amount of time it will take to adjust the EISRIT back up to the Initial Inter-Segment Receive Interval Timer (IISRIT) due to aging in the absence of additional received segments.

h. Expired Segment Acknowledgment Timer Factor (ESATF): The amount by which you increase the ERTD when an acknowledgment is not received within the expected amount of time.

i. Inter-Segment Receive Interval Timer Down Factor (ISRITDF): A scaling factor applied to the difference between the most recent Measured Inter-Segment Receive Interval Time (MISRIT) and the current EISRIT to lower the EISRIT.

j. Inter-Segment Receive Interval Timer Expirations Limit (ISRITEL): The maximum number of times the ISRIT can expire without receiving additional segments before aborting the transfer of the Application PDU.

k. Inter-Segment Receive Interval Time Jitter Factor (ISRITJF): A scaling factor used to adjust the EISRIT in order to account for transmission timing variance.

l. Inter-Segment Receive Interval Timer Up Factor (ISRITUF): A scaling factor applied to the difference between the most recent MISRIT and the current EISRIT to increase the EISRIT.

m. Maximum ERTD to SERTD Ratio (MESR): Value used to limit the amount the ERTD can be increased due to an expired SAT.

n. Maximum EISRIT to SEISRIT Ratio (MESRITR): Value used to limit the amount the EISRIT can be increased due to an expired ISRIT.

o. Partial Acknowledgment Interval Timer Adjustment Factor (PAITAF): The amount by which the REISRIT is adjusted to set the PAIT.

p. Initial Round Trip Delay (IRTD): The initial estimated value of the round trip delay between the Originator and Destination.

q. Round Trip Delay Jitter Factor (RTDJF): A scaling factor used to adjust the ERTD in order to account for transmission timing variance.

r. Round Trip Delay Up Factor (RTDUF): A scaling factor applied to the difference between the most recent Measured Round Trip Delay (MRTD) and the current ERTD. Once applied, the resulting value is added to the current ERTD, resulting in a new ERTD.

s. Round Trip Delay Down Factor (RTDDF): A scaling factor applied to the difference between the most recent MRTD and the current ERTD. Once applied, the resulting value is subtracted from the current ERTD, resulting in a new Estimated Round Trip Delay.

t. Hop Count (HOPCNT): The number of separate times a segment must be transmitted (including transmission by the Originator and intermediate relay points) in order for the segment to reach its Destination. If the segment reaches the Destination on the first attempt, no Link Layer retries are necessary.

u. Segment Credits Used Multiplication Factor (SCUMF): The amount by which the SAT is increased per each previously sent segment that has not yet been acknowledged.

v. Segment Retry Count Limit (SRCL): The number of times that an Originator shall retransmit a Data Segment based on a received Partial Acknowledgment indicating a missing segment before aborting the transfer of the Application PDU.

w. Request For Acknowledgement Retry Limit (RFARL): The number of consecutive times that an Originator shall re-transmit a request for acknowledgment without receiving an acknowledgment from the Destination before aborting the transfer of the Application PDU.

x. Reassembly Timer Expiration Count Limit (RTECL): For an EDT Acknowledgment Required transfer, the number of times that a Destination shall transmit a Partial Acknowledgment without receiving additional Data Segments from the Originator before aborting the transfer of the Application PDU. For an EDT Acknowledgment Not Required transfer, the number of times the RT shall expire before the Destination aborts the transfer of the Application PDU.

C.3.6.3.2 S/R Enhanced timing parameter default values.

The default values below will not be optimal for all CNR networks. Systems shall have the ability to change the parameters listed in TABLE C-VIII below. The CNRWG will publish tables with recommended values for MIL-STD-188-220D networks in the future on the CNRWG Website.

TABLE C-VIII. Programmable S/R parameters

S/R Parameter Description	Abbreviation	Minimum	Maximum	Default Value
Abort Request Retry Limit	ABRRL	1	10	2
Request For Acknowledgement Retry Limit	RFARL	1	10	2
Request For Acknowledgement Interval Timer Adjustment Factor	RFAITAF	0.1	1.0	0.75
Expired Inter-Segment Receive Interval Timer Factor	EISRITF	1.0	10.0	1.15
Estimated Round Trip Delay Aging Period	ERTDAP	100 ms	ERTDLT	ERTDLT/10
Estimated Round Trip Delay Lifetime	ERTDLT	1 minute	1440 minutes	60 minutes
Estimated Inter-Segment Receive Interval Aging Period	EISRIAP	100 ms	EISRILT	EISRILT/10
Estimated Inter-Segment Receive Interval Lifetime	EISRILT	1 minute	1440 minutes	60 minutes
Expired Segment Acknowledgment Timer Factor	ESATF	1.0	10.0	1.15
Inter-Segment Receive Interval Timer Down Factor	ISRITDF	0.0	1.0	0.4
Inter-Segment Receive Interval Timer Expirations Limit	ISRITEL	1	10	5
Inter-Segment Receive Interval Time Jitter Factor	ISRITJF	1.0	2.0	1.5
Inter-Segment Receive Interval Timer Up Factor	ISRITUF	0.0	1.0	0.8
Inter-Segment Send Timer Adjustment Factor	ISSTAF	0.0	10.0	1.0
Segment Retry Count Limit	SRCL	0	5	1 Retry

S/R Parameter Description	Abbreviation	Minimum	Maximum	Default Value
Round Trip Delay Up Factor	RTDUF	0.0	1.0	0.8
Round Trip Delay Down Factor	RTDDF	0.0	1.0	0.4
Maximum ERTD to SERTD Ratio	MESR	1	10	4
Maximum EISRIT to SEISRIT Ratio	MESRITR	1	10	4
Partial Acknowledgment Interval Timer Adjustment Factor	PAITAF	0	10	1
Reassembly Timer Expiration Count Limit	RTECL	0	10	3

TABLE C-VIII. Programmable S/R parameters - Continued

S/R Parameter Description	Abbreviation	Minimum	Maximum	Default Value
Round Trip Delay Jitter Factor	RTDJF	1.0	2.0	1.5
Segment Credit Limit	SCL	1	3216	5
Segment Credits Used Multiplication Factor	SCUMF	1.0	2.0	1.1
Segment Range Limit	SRL	1	3216	16

C.3.6.3.3 S/R Enhanced timing variables.
The value of the S/R Timers shall be capable of being recalculated or adjusted dynamically during S/R operation. The modification of these timers is based not only on the Parameters defined above, but several S/R Variables that are tracked during operation. In general, the system must maintain one set of the following Variables for each S/R transfer (composed of an Originator, Destination, and Application PDU). The S/R timing Variables are as follows:

a. Abort Request Retry Count (ABRRC): The number of times an Abort Request with P-bit = 1 has been re-sent without receiving a response. The Originator shall maintain the ABRRC for each active transfer. The Destination shall also maintain the ABRRC for each active transfer.

b. Request For Acknowledgement Retry Count (RFARC): Number of times an Originator has re-transmitted a Request for Acknowledgement without receiving an acknowledgment from the Destination. The Originator shall maintain the RFARC for each Destination.

c. Estimated Inter-Segment Receive Interval Time (EISRIT): Estimated time at which the next segment will be received at the Destination. The Destination shall maintain the EISRIT for each Originator.

d. Measured Round Trip Delay (MRTD): The measured value from the time a Data Segment is sent until the time the acknowledgement of that segment is received, or from the time an Abort Request is sent until the time the coupled Abort Confirm is received. The Originator shall measure the MRTD when an acknowledgment is received for an Unsent Segment of an active transfer.

e. Estimated Round Trip Delay (ERTD): The current estimated value of the round trip delay to a Destination. This value is calculated. The Originator shall maintain the ERTD for each Destination with which it has an active transfer.

f. Estimated Round Trip Delay Adjustment Increment (ERTDAI): The amount by which the ERTD is adjusted due to aging in the absence of activity. The Originator shall maintain the ERTDAI for each Destination with which it has an active transfer.

g. Estimated Round Trip Delay Aging Steps (ERTDAS): The number of times the ERTD will be increased due to aging in the absence of activity. This value shall be calculated. The Originator shall maintain the ERTDAS for each Destination with which it has an active transfer.

h. Estimated Inter-Segment Receive Interval Adjustment Increment (EISRIAI): The amount by which the EISRIT is adjusted due to aging in the absence of additional received segments. The Destination shall maintain the EISRIAI for each Originator.

i. Estimated Inter-Segment Receive Interval Aging Steps (EISRIAS): The number of times the EISRIT will be increased due to aging in the absence of additional received segments. This value shall be calculated. The Destination shall maintain the EISRIAS for each Originator.

j. Smallest Lowest Numbered Unacknowledged Segment (SLNUS): The Segment Number of the lowest numbered segment that has been sent by the Originator but for which an acknowledgment has not yet been received from all Destinations. The Originator shall maintain the SLNUS for each active transfer. If there is only one Destination, then the SLNUS will equal the LNUS for that Destination.

k. Inter-Segment Receive Interval Timer Expirations Count (ISRITEC): The number of times the ISRIT has expired without receiving additional segments. The Destination shall maintain the ISRITEC for each active transfer.

l. Last Segment Number (LSN): The final Segment Number of the current Application PDU. The Originator shall maintain the LSN for each Destination with which it has an active transfer. The Destination shall also maintain the LSN for each active transfer.

m. Highest Numbered Segment Sent (HNSS): The Segment Number of the highest numbered segment that has been sent by the Originator. The Originator shall maintain the HNSS for each active transfer.

n. Measured Inter-Segment Receive Interval Time (MISRIT): The measured time between receiving the current segment and the previous segment. The Destination shall measure the MISRIT when a segment is received for an active transfer.

o. Number Of Segments Not Received (NOSNR): The number of segments that the Destination has not yet received from the Originator. This number shall include both Data Segments that were sent by the Originator but not received by the Destination and Data Segments that have not yet been sent by the Originator. The Destination shall maintain the NOSNR for each active transfer.

p. Relaxed Estimated Inter-Segment Receive Interval Time (REISRIT): The adjusted EISRIT to account for jitter in transmission times. The Destination shall maintain the REISRIT for each Originator.

q. Relaxed Estimated Round Trip Delay (RERTD): The adjusted ERTD to account for jitter in transmission times. The Originator shall maintain the RERTD for each Destination.

r. Reassembly Timer Expiration Count (RTEC): The number of times the RT has expired without receiving all of the segments associated with an Application PDU. The Destination shall maintain the RTEC for each active transfer.

s. Segment Credits Used (SCU): The current number of segments that have been sent but not acknowledged by all Destinations. The Originator shall maintain the SCU for each active transfer.

t. Saved Estimated Inter-Segment Receive Interval Time (SEISRIT): The currently saved value of the estimated time at which the next segment will be received at the Destination. Updates to this value are only made based on actual measurements. The Destination shall maintain the SEISRIT for each Originator.

u. Saved Estimated Round Trip Delay (SERTD): The currently saved value of the ERTD. Updates to this value are only made based on actual measurements. The Originator shall maintain the SERTD for each Destination.

v. Number Of Segments Received (NOSR): The total number of segments received at the Destination for the given Application PDU. The Destination shall maintain the NOSR for each active transfer.

w. Segment Retry Count (SRC): The number of times that a segment has been re-sent by the Originator to all active Destinations. The Originator shall maintain the SRC for each active transfer.

x. Partial Acknowledgment Starting Segment Number (PASSN): This refers to the value of the SSN contained in the Partial Acknowledgment currently being processed by the Originator.

y. Number of Stations (NS): The number of stations on the network. The NS can be determined via several methods, including but not limited to MIL-STD-188-220 XNP Messages, Operator Interface, or pre-loaded System Configuration.

z. Segment Number (SN): This refers to the value of the Segment Number field contained in the Data Segment of an active transfer currently being processed by the Originator.

aa. Hop Count (HOPCNT): The number of hops set by the system for a given Destination. This allows the system to be modified from the initial guesses for the IRTD and IISRIT to account for the number of MIL-STD-188-220 intranet hops and/or IP internet hops to the Destination. This value shall be set as per equation in section C.3.6.7.1. The Originator shall maintain the HOPCNT for each Destination with which it has an active transfer.

bb. Initial Inter-Segment Receive Interval Timer (IISRIT): The initial value for the ISRIT. This value is calculated as per equation in section C.3.6.7.1. This variable shall be calculated for each Destination.

cc. Initial Round Trip Delay (IRTD): The initial value for the ERTD. This value is calculated as per equation in section C.3.6.7.1. This variable shall be calculated for each Destination.

dd. Inter-Segment Send Timer (ISST): This value is calculated according to C.3.6.5.7. There shall be one ISST per net at the Originator.

ee. Lowest Numbered Unacknowledged Segment (LNUS): The Segment Number of the lowest numbered segment that has been sent by the Originator but for which an acknowledged has not yet been received by the Destination. The Originator shall maintain the LNUS for each Destination with which it has an active transfer.

ff. Destination Status (DS): The Originator shall maintain the DS for each Destination associated with a transfer. If the Originator is still attempting to successfully complete the transfer for the Destination, the value shall be ACTIVE. If the Originator has aborted the transfer to the Destination, the value shall be INACTIVE.

gg. Destination Abort Confirm Received (DACR): The Originator shall maintain the DACR for each Destination associated with an Application PDU Identifier. Indicates whether or not the Originator has received an Abort Request for an Abort Confirm from the Destination.

hh. Originator Abort Confirm Received (OACR): The Destination shall maintain the OACR for each Application PDU Identifier. Indicates whether or not the Destination has received an Abort Request for an Abort Confirm from the Originator.

ii. Originator Status: The Destination shall maintain the Originator Status for each Application PDU Identifier. If the Destination is still attempting to successfully reassemble segment associated with the Application PDU Identifier, the value shall be ACTIVE. If the Destination has aborted the transfer to the Destination or sent a complete acknowledgment, the value shall be INACTIVE.

C.3.6.4 Detailed S/R Enhanced Procedures

C.3.6.4.1 S/R Enhanced Procedure for sending Unsent (data) segments.
When the Originator is sending the first segment or receives a Partial Acknowledgment that causes SLNUS to increase, it shall take the following actions:

```
WHILE ((not all data segments have been sent as Unsent Segments)
        AND (SCU is less than the SCL, i.e., (SCU < SCL))
        AND (The SRL has not been reached, i.e., ((HNSS – SLNUS) < SRL))
        AND (The RFAIT is not running)
        AND (The ISST is not running)
        AND ((SLNUS >=1) OR ((SLNUS <= 0) AND (HNSS<=0)))
LOOP
    IF ((HNSS==0) AND (SLNUS <=1))
    THEN
        Send the first Data Segment in the transfer with P-bit=1        -- (Request an Acknowledgment)
        Set the Destination Status for each Destination to Active (DS = ACTIVE)
        SLNUS=1
        LNUS=1
        Start the RFAIT according to C.3.6.5.2
    ELSE
      IF ((HNSS > 1        -- (more than one segment has been sent)
            AND ((SCU == SCT) OR (SCU == SCL - 1))
            OR (SN == LSN) -- (Next Segment is the Last Segment)
      THEN
          Send the next Data Segment in the transfer with P-bit=1     -- (Request for Acknowledgment)
          Start the RFAIT according to C.3.6.5.2
      ELSE
          Send the next Data Segment in the transfer with P-bit=0
      ENDIF
    ENDIF
    Start SAT according to C.3.6.5.4.
    Set the SRC for this segment to 0
    Increment the SCU by 1
    Update the HNSS
END WHILE LOOP
```

C.3.6.4.2 S/R Enhanced procedure for processing received data segment(s).
When a Destination receives a Data Segment it shall take the following actions:

IF the Serial Number and source address does not match an Application PDU Identifier
THEN
    Create a new Application PDU Identifier indicating that no segments have been received.
    Initialize receive variables associated with the new Application PDU identifier according to C.3.6.7.3
    IF the Segment Number of the received segment == 1
    THEN
        Set the Originator Status associated with the new Application PDU Identifier to ACTIVE.
        Generate a S/R-First-Segment Indication to the Application.
    ELSE
        Set the Originator Status associated with the new Application PDU Identifier to INACTIVE
        Set the OACR associated with the new Application PDU Identifier to TRUE
    ENDIF
ENDIF
IF the Serial Number and source address of the received segment match an Application PDU Identifier
THEN
    IF Originator Status == ACTIVE
    THEN
        Stop the Inter-Segment Receive Timer (ISRT) according to C.3.6.5.10
        Stop the Inter-Segment Receive Interval Timer (ISRIT) according to C.3.6.5.11
        Stop Reassembly Timer (RT) according to C.3.6.5.1
        Increment the segments received by 1 since the last Partial Acknowledgment was sent.
        IF the segment number was not previously received
        THEN
            Mark the segment as having been received.
            Reassemble the data at the proper location in the Application PDU based on the Segment Number
            IF (PAIT is not running **AND** the P-Bit==1 in the received segment)
              OR the received segment completes the Application PDU, i.e., all segments have now been received at least once **AND** the Data Segment is EDT Acknowledgment Required (Type == 0)
              OR ((Type field of the received segment == 0, i.e., EDT Acknowledgment Required)
                    AND ((segments received since the Last Partial Acknowledgment was sent == RSCT)
                        OR (Number of Missing Segments has changed from being < NOMST >= NOMST)))
            THEN -- (Its time to acknowledge segments)
                IF all segments have now been received
                THEN
                    Send a Complete Acknowledgment
                    Set the Originator Status to INACTIVE and remember that all segments were received.
                    Start the Destination Reference Freeze State Timer (DRFST) according to C.3.6.5.3
                ELSE (some segments have not been received yet)
                    Send a Partial Acknowledgment indicating which segment have and have not been received.
                    Set the segments received since the last Partial Acknowledgment was sent, to 0
                    Stop the PAIT (if it's running) and then restart the PAIT according to C.3.6.5.8
                ENDIF
            ELSE (no acknowledgment needs to be sent yet for the non-duplicate segment)
                IF all segments have now been received (but EDT Acknowledgment not Required)

```
                THEN
                    Set the Originator Status to INACTIVE and remember that all segments were received.
                ENDIF
            ENDIF
        ELSE (it is a duplicate segment on an active transfer)
            IF (PAIT is not running AND the P-Bit==1 in the received segment)
              OR ((Type field of the received segment == 0, i.e., EDT Acknowledgment Required) AND
                (segments received since the  Last Partial Acknowledgment was sent == RSCT))
            THEN -- (Its time to acknowledge segments that have been received)
                Send a Partial Acknowledgment indicating which segment have and have not been received.
                Set the segments received since the last Partial Acknowledgment was sent, to 0
                Stop the PAIT (if it's running) and then Restart the PAIT according to C.3.6.5.8
            ELSE -- (no acknowledgment needs to be sent yet)
                -- No further action required
            ENDIF
        Discard the duplicate segment
        ENDIF
        IF not all segments have been received
            Restart the ISRT according to C.3.6.5.10
            Restart the ISRIT according to C.3.6.5.11
            Restart the Reassembly Timer (RT) according to C.3.6.5.1
        ENDIF
    ELSE -- (the Originator is INACTIVE)
        IF all segments were received
        THEN
            IF P-Bit==1 in the received segment
            THEN
                Send a complete acknowledgment
            ENDIF
        ELSE -- (all segments were not received)
            IF the OACR associated with the new Application PDU Identifier to == FALSE
            THEN
                IF the segment is not a duplicate
                THEN
                    Mark the Segment as having been received
                    Increment the Number Of Segments Received (NOSR) by 1
                    Restart the DRFST according to C.3.6.5.3
                ENDIF
                IF ABRT is not already running for the Application PDU Identifier
                  AND P-Bit==1 in the received segment
                THEN
                    Send an Abort Request with P-Bit =1 to the unicast address of the Originator
                    Start the ABRT according to C.3.6.5.8
                ENDIF
            ENDIF
        ENDIF
        Discard the received Segment (associated with the inactive Application PDU Identifier)
    ENDIF
ENDIF
```

C.3.6.4.3 S/R Enhanced procedure for processing acknowledgment.

a. When an Originator receives a Partial Acknowledgment, it shall take the following actions:

For each Partial Acknowledgment received by the Originator:

```
IF the Serial Number matches an Application PDU Identifier
    AND the Partial Acknowledgment source does not match any of the unicast Destinations
    associated with the matching Application PDU identifier
    AND the global broadcast address was specified by the application as one of unicast
    Destination IP addresses
    AND HNSS == 1
THEN
    Add the unicast source IP address of the Partial Acknowledgment to the list of Destinations
    for the Application PDU Identifier and the new Destination's status to active (DS=ACTIVE).
ENDIF
IF the Serial Number matches an Application PDU Identifier
    AND the Partial Acknowledgment source matches a Destination associated with the
    matching Application PDU Identifier
THEN
      IF the DS == ACTIVE for the Destination that sent the Partial Acknowledgment
      THEN
            Set SavedLNUS = LNUS
            Set SavedSLNUS = SLNUS
            Update LNUS for this Destination and SLNUS according to C.3.6.6.2
            IF LNUS < > SavedLNUS -- (i.e., LNUS has changed)
                Record that this Destination has acknowledged all segments up to LNUS
                Decrement SCU by (SLNUS – SavedSLNUS)  -- (if SLNUS has not changed,
                                                          SCU will not change)
            ENDIF

            IF (LNUS < HNSS + 1) -- (i.e., there is a Bit Mask field to process)
            THEN
                FOR (Each bit to process in the Bit Mask field of the Partial Acknowledgment
                PDU)
                LOOP
                    IF the current bit of the bit mask equals 0
                    THEN
                        Resend the unacknowledged Data Segments according to C.3.6.4.4.
                    ELSE -- (the current bit of the bit mask equals 1)
                        Set the RFARC for the Destination to 0
                        IF All Destinations have acknowledged the segment
                        THEN
                            Decrement the SCU by 1
                            IF The RFARC for all Destinations is 0
                            THEN
                                Stop the RFAIT according to C.3.6.5.2
                            ENDIF
```

ENDIF
ENDIF
END FOR LOOP
ELSE -- There is no Bitfield field to process (i.e., LNUS == HNSS +1)
Set the RFARC for the Destination to 0
ENDIF
IF (SLNUS==HNSS + 1) **--** All Destinations have all Segments
THEN
SCU=0
IF The RFARC for all Destinations is 0
THEN
Stop the RFAIT according to C.3.6.5.2
ENDIF
ENDIF
Send any remaining Unsent Segments according to C.3.6.4
ELSE -- (The Destination that sent the Partial Acknowledgment is INACTIVE)
IF ((DACR == FALSE)
AND (All segments were not acknowledged by the Destination))
THEN
Send an Abort Request with P-bit=1 to the Destination that generated the Partial Acknowledgment
Start the ABRT according to C.3.6.5.8
ENDIF
ENDIF
ELSE -- (either the serial number does not match any Application PDU Identifier, or the source of the Partial Acknowledgment does not match any of the Destination associated with the Application PDU identifier)
Send an Abort Request back to the source of the Partial Acknowledgment with P-bit=0
ENDIF

b. When an Originator receives a Complete Acknowledgment, it shall take the following actions:

For each Complete Acknowledgment received by the Originator:

IF the Serial Number matches an Application PDU Identifier
AND the Complete Acknowledgment source matches a Destination associated with the matching Application PDU Identifier
THEN
IF the DS == ACTIVE for the Destination that sent the Complete Acknowledgment
THEN
Set the DS = INACTIVE for this destination
ENDIF
IF the DS == INACTIVE for all Destinations
THEN
Stop the RFAIT according to C.3.6.5.2
Run the ORFST according to C.3.6.5.6 **--**(All segments were acknowledged by all Destinations)
ENDIF
ENDIF

C.3.6.4.4 <u>S/R Enhanced procedure for resending unacknowledged data segments.</u>
When the Originator is processing a valid Partial Acknowledgment, for each segment corresponding to a bit in the bit mask with a value of 0 (unacknowledged), it shall take the following actions:

```
IF the SAT for the missing segment has expired
THEN
    IF SRC < SRCL
    THEN
        IF the ISST is not running
        THEN
            IF More than one Destination has not acknowledged the segment being resent
            THEN
                IF SCU >= SCT
                  OR HNSS == 1
                  OR SN == LSN
                THEN
                    Resend the unacknowledged Segment to all active Destination(s) with P-bit=1
                    Start the RFAIT according to C.3.6.5.2
                ELSE
                    Resend the unacknowledged Segment to all active Destination(s) with P-bit=0
                ENDIF
            ELSE -- (Only one Destination has not acknowledged the segment)
                IF SCU >= SCT
                  OR All segments have been sent once
                  OR HNSS == 1
                THEN
                    Resend the unacknowledged Segment to the Destination(s) unicast address with P-
                    bit=1
                    Start the RFAIT according to C.3.6.5.2
                ELSE
                    Resend the unacknowledged Segment to the Destination(s) unicast address with P-
                    bit=0
                ENDIF
        ENDIF
        Restart the SAT for the Segment according to C.3.6.5.4
    ENDIF
ELSE -- (the SRC >= SRCL then)
    Send an Abort Request with P-Bit =1 to the unicast address of active Destination(s) that have not
      acknowledged the segment.
    Start the ABRT according to C.3.6.5.8
    Provide an SR Status Indication to the Upper Layer Protocol (ULP) indicating failure for any
      Destination(s) that did not acknowledge the segment.
    Set the Destination Status (DS) to INACTIVE for the Destination(s) that did not acknowledge the
      segment.
    IF All Destination(s) are INACTIVE
    THEN
        Stop the TAFRFTTCT and all other timers associated with this transaction.
```

Segments associated with the Application PDU are discarded by the Originator.
Place the associated Application PDU Identifier in the Originator Reference Freeze State and start the Originator Reference Freeze State Timer (ORFST).
ENDIF
ENDIF
ELSE -- (the SAT is still running)
No Operation (Do not resend the Segment because the SAT is still running)
ENDIF

C.3.6.4.5 S/R Enhanced Procedure for processing a received Acknowledgment Request PDU. When a Destination receives an Acknowledgment Request PDU it shall take the following actions:

IF the Serial Number and source address does not match an Application PDU Identifier
THEN
Create a new Application PDU Identifier indicating that no segments have been received.
Initialize receive variables associated with the new Application PDU identifier according to C.3.6.7.3
Set the Originator Status associated with the new Application PDU Identifier to ACTIVE.
Send a Partial Acknowledgment indicating no segments have been received.
Set the segments received since the last Partial Acknowledgment was sent to 0
Start PAIT according to C.3.6.5.8
ELSE -- (the Serial Number and source address matches an Application PDU Identifier)
IF Originator Status == ACTIVE **--** (all segments have not yet been received)
THEN
IF PAIT is not running
Send a Partial Acknowledgment indicating which segment have and have not been received.
Set the segments received since the last Partial Acknowledgment was sent to 0
Start PAIT according to C.3.6.5.8
END IF
ELSE --(the Originator Status is INACTIVE)
IF all segments were received
THEN
Send a Complete Acknowledgment
ELSE (all segments were not received)
IF the OACR associated with the new Application PDU Identifier == FALSE
AND ABRT is not already running for the Application PDU Identifier
THEN
Send an Abort Request with P-Bit = 1 to the unicast address of the Originator
Start the ABRT according to C.3.6.5.8
ENDIF
ENDIF
ENDIF
ENDIF

C.3.6.5 S/R Enhanced timers.

The S/R Protocol shall use the following Timers in order to facilitate an efficient exchange of segmented data between the Originator and the Destination.

C.3.6.5.1 Reassembly Timer (RT).
The Reassembly Timer shall be run at the Destination to predict a time by which all segments should be received. If the Reassembly Timer expires more than the RTECL times, the transfer shall be terminated. The system shall be able to configure the RTECL Parameter. The Destination shall maintain one RT for each active Application PDU Identifier.

a. **Starts:** The RT shall be started at the Destination when the first Data Segment or Acknowledgement Request associated with an Application PDU is received. The RT shall be initialized using the value described by C.3.6.6.3 to estimate the time at which all Data Segments should have been received/reassembled. When the RT is started at the Destination the RTEC shall be set to 0. As subsequent segments are received, the RT shall be restarted using a new projected time calculated as described by C.3.6.6.3 (based on the measured time interval between received segments and the number of segments that are yet to be received). The RT shall also be restarted using this same equation if it expires before all segments are received and the Retry Counter is less than the RTECL.

b. **Stops:** The RT shall always be running at the Destination when a transfer is active and not all segments have been received. The RT shall only be stopped when all segments have been received. If the transfer was EDT Acknowledgement Required, then a Complete Acknowledgment shall be sent when the RT is stopped, the Application PDU Identifier shall be placed in the Destination Reference Freeze State, and the DRFST shall be started.

c. **Expires:** When RT expires at the Destination station the following shall occur:

IF RTEC >= RTECL

THEN
Send an Abort Request with P-Bit = 0.
Segments associated with the Application PDU are discarded.
Place the associated Application PDU Identifier in the Destination Reference Freeze State and start the DRFST.
ELSE -- (if the RTEC < RTECL then)
The RTEC shall be incremented by 1.
IF the transfer is EDT Acknowledgment Required
THEN
Send a Partial Acknowledgment.
ENDIF
Increase the ISRIT on a non-persistent basis according to C.3.6.5.11 c to reflect the fact that none of the missing segments were received as expected.
Restart the RT timer as described above with a new projected time as described in C.3.6.6.3.
ENDIF

C.3.6.5.2 Request for Acknowledgment Interval Timer (RFAIT).
The RFAIT shall be run at the Originator to predict a time by which a response to a Request for Acknowledgment should be received. The Originator shall maintain one RFAIT for each active Application PDU Identifier.

a. **Starts:** The RFAIT shall be started (or stopped then restarted) at the Originator each time a Request for Acknowledgment is issued. If the RFAIT is already running when a Request for Acknowledgment is issued, the RFAIT shall be restarted, i.e., stopped then started again. Only one RFAIT shall be running at any given time for each Application PDU that is active at the Originator. The RFAIT value shall be calculated according to the procedure below each time it is started or restarted. The RERTD and SERTD selected for use in the following equation shall be the largest of any active Destination (DS=ACTIVE) with a RFARC greater than 0.

IF RFARC == 0 for all Destinations
THEN
    RFAIT = RERTD * SCUMF**SCU
ELSE
    RFAIT = SERTD * RFAITAF
ENDIF

b. **Stops:** The RFAIT shall be stopped when a Partial Acknowledgment or Complete Acknowledgment is received from all Destinations. If RFAIT is stopped because all segments associated with an Application PDU have been acknowledged, the Originator shall place the Application PDU Identifier in the Reference Freeze State and then start an Originator Reference Freeze State Timer (ORFST).

Note: The ERTD is not updated when the RFAIT timer is stopped because received Partial Acknowledgments are inherently ambiguous, i.e., the Originator can never know with certainty which specific S/R PDU received by the Destination caused the Partial Acknowledgment to be sent.

c. Expires**:** When the RFAIT expires at the Originator, meaning that at least one Destination did not send an Acknowledgment, the following shall occur:

FOR 1 .. (Number of Destinations with DS == ACTIVE)
LOOP
    IF RFARC for the Destination >= RFARL
    THEN
        Send an Abort Request to the Destination with P-Bit = 1.
        Provide an SR Status Indication to the ULP indicating failure for any Destinations that did not acknowledge the segment.
        Set the DS to INACTIVE for the Destination
        IF All Destinations are INACTIVE
        THEN
            Stop the TAFRFTTCT.
            Segments associated with the Application PDU are discarded.
            Place the associated Application PDU Identifier in the Originator Reference Freeze State and start the ORFST.
            EXIT FOR LOOP -- (This causes an immediate exit from the FOR LOOP)
        ELSE
            Check to see if SCU can be updated (i.e., the Destination just made INACTIVE was the only destination that had not acknowledged outstanding sent segments) and update accordingly.
        ENDIF
    ELSE -- (if the RFARC < RFARL then)
        Increment the RFARC 1.

Issue another Acknowledgement Request (causing the RFAIT to be restarted).
ENDIF
END FOR LOOP
IF The number of active Destinations (DS == ACTIVE) > 0
THEN
IF RFARC > 0 for more than one active Destination (DS == ACTIVE)
THEN
Issue an Acknowledgement Request to all Destinations with DS ==ACTIVE
ELSE
Issue an Acknowledgement Request to one Destination
ENDIF
ENDIF

C.3.6.5.3 Destination Reference Freeze State Timer (DRFST).
The DRFST shall be run at the Destination to predict a time from when a transfer completes, either successfully or unsuccessfully, until no additional frames associated with the given Application PDU Identifier will be received. The Destination shall maintain one DRFST for each completed Application PDU Identifier transfer. The following general behavior is observed when the DRFST is running:

a. **Starts:** The DRFST shall be started, using the value specified by the equations below, when a transfer is completed at the Destination. The Destination shall remember if the transfer associated with the Application PDU Identifier was successful or unsuccessful and the Application PDU Identifier associated with the transfer.

NOSNR = LSN – NOSR
IF SCL < NOSNR
THEN
DRFST = (SCL * REISRIT) + (RFARL * REISRIT)
ELSE
DRFST = (NOSNR * REISRIT) + (RFARL * REISRIT)
ENDIF

b. **Stops:** The DRFST shall only stop when it expires or when it gets restarted.

c. Expires**:** When the DRFST expires at the Destination, the associated Application PDU Identifier shall be transitioned out of the Reference Freeze State. The Destination shall release all memory required to store information about the associated transfer. Any Data Segments or Acknowledgment Requests subsequently received by the Destination with the same Application PDU Identifier are treated as a new transfer, causing the destination to start reassembling the new transfer.

C.3.6.5.4 Segment Acknowledgment Timer (SAT).
The SAT shall be run at the Originator to predict a time by which a sent or resent Data Segment should have been acknowledged by all Destination(s). The SAT shall also be used to measure the time from when an Unsent Segment was sent until it was acknowledged by any Destination. The Originator shall maintain one SAT for each Data Segment that has been sent but not yet acknowledged by all Destination(s).

a. **Starts:** The SAT shall be started at the Originator immediately after each segment is sent or resent to all active Destinations. The SAT value shall be calculated according to the equation below when it is started. Only one SAT timer shall be running at any given time for each segment associated with the same Application PDU. The SAT shall be calculated, used for each Destination and the largest SAT shall be utilized.

SAT = RERTD * SCUMF**SCU

IF an Unsent Segment was sent
THEN
  --Do nothing
ELSE -- (if a segment was resent)
  Increment SRC for the associated segment by 1
ENDIF
Start the ISST

b. **Stops: The** SAT shall only be stopped if all active Destinations have acknowledged the segment. The following procedure shall be performed any time an acknowledgement is received. Note that the receipt of a single Partial Acknowledgement or Complete Acknowledgement can cause the following procedure to be performed for multiple SATs associated with any newly acknowledged segment.

IF the acknowledged segment is an Unsent Segment **--** (i.e., the associated SRC == 0)
THEN
  Use the time from when the segment was sent until when it was acknowledged to update ERTD according to C.3.6.6.1.
  Restart the Estimated Round Trip Delay Aging Timer (ERTDAT)
ENDIF
IF The SAT is still running
 AND All active Destinations have acknowledged the segment
THEN
  Stop the SAT
ENDIF

Note: The ERTD is not updated if a resent segment is acknowledged because the acknowledgment is ambiguous, i.e., it could have resulted from the first send of the segment or a subsequent resend of the segment. Time measurements based on when an ambiguous acknowledgment is received are assumed to be inaccurate and therefore cannot be used to update the ERTD.

c. **Expires:** When the SAT expires the Originator shall perform the procedure below for each of the Destination(s) that did not acknowledge the segment.

IF (ERTD * ESATF) < (SERTD * MESR)
THEN
  ERTD = ERTD * ESATF
ELSE
  ERTD = SERTD * MESR
ENDIF
RERTD = ERTD * RTDJF
Restart the ERTDAT.

C.3.6.5.5 Abort Request Timer (ABRT).
The ABRT shall be run at the Originator to predict a time by which an Abort Confirm should have been received from the Destination. The Originator shall maintain one ABRT for each Application PDU. The ABRT shall be run at the Destination to predict a time by which an Abort Confirm should have been received from the Originator. The Destination shall maintain one ABRT for each Application PDU.

a. **Starts:** The ABRT shall be started at the Originator each time an Abort Request is sent with the P-Bit = 1. Only one ABRT shall be running per Application PDU at the Originator. The value of the ABRT shall be set according to the following equation. The first time an Abort Request is sent, the ABRRC shall be set equal to 0. The RERTD selected for use in the following equation shall be the largest of any active Destination (DS==ACTIVE) that the Abort Request is being addressed to.

IF ABRRC == 0
THEN
    ABRT = RERTD * SCUMF**SCU
ELSE
    ABRT = RERTD
ENDIF

The value of the ABRT shall be set according to the following equation at the Destination.

ABRT = 2 * ISRIT

b. **Stops:** The ABRT shall be stopped at the Originator or Destination when an Abort Confirm is received with a matching Application PDU Identifier or when an Abort Request is received with a matching Application PDU Identifier.

IF an Abort Request has only been sent once (i.e., ABRRC == 0) when the corresponding Abort Confirm is received
THEN
    The time from when the Abort Request was sent until when the corresponding Abort Confirm is received is used at the Originator to update ERTD according to C.3.6.6.1.
ENDIF

c. **Expires:** When the ABRT expires

IF ABRRC < ABRRL
THEN
    The ABRRC shall be incremented by 1.
    Send the Abort Request again with P-Bit = 1
    Restart the ABRT
ENDIF

C.3.6.5.6 Originator Reference Freeze State Timer (ORFST).
The ORSFT shall be run at the Originator to predict a time at which an Application PDU Identifier can be safely reused as part of a new transfer. The Originator shall maintain one ORFST for each Application PDU transfer that has completed. The following general behavior is observed when the ORFST is running:

a. **Starts:** The Originator shall start the ORFST when an Application PDU transfer is completed, either successfully or unsuccessfully to all Destination(s). The associated Application PDU Identifier shall not be reused until this timer expires. If the ORFST is running and an ABRT is not running when a Partial Acknowledgement is received corresponding to the Application PDU Identifier, an Abort Request shall be sent by the Originator with the P-Bit = 0. The value of the ORFST shall be set according to the equation below.

ORFST = 2 * RERTD * (LSN - HNSS)

b. **Stops:** The ORFST shall be stopped by the Originator if all of the Application PDU Identifiers at the Originator are either in an active or frozen state when another message needs to be sent. In this case the Originator shall search for the ORFST with the least time remaining. This ORFST shall be stopped such that a new message can be sent reusing the associated Application PDU Identifier, without the Application PDU Identifier being ambiguous to any destination.

c. **Expires:** When the ORFST expires, the associated Application PDU Identifier shall be transitioned out of the Reference Freeze State such that it can be reused as part of subsequent message exchanges without the Application PDU Identifier being ambiguous to any destination.

C.3.6.5.7 Inter-Segment Send Timer (ISST).
The ISST shall be run at the Originator to help control the rate at which segments are sent or resent when communicating over Rate Limited CNR. The Originator shall maintain only one ISST per CNR net. All Application PDUs sent over the CNR net are controlled by the corresponding ISST.

a. **Starts:** The ISST shall be started at the Originator after a Data Segment is sent or resent over a CNR net. The timer value shall be set according to the equation below. Only one ISST shall be started for each independent Rate Limited CNR that an Originator participates on, not one per Application PDU. This timer shall be used by the Originator to manage the transmit rate of Data Segments over an individual CNR net so as to limit the CNR bandwidth utilized for the transfer of segments within a given time period. The ISST manages transmit flow control for a given network as a whole whether a single Application PDU or multiple Application PDUs are being transmitted simultaneously. The next segment of any given Application PDU shall not be sent or resent while the ISST is active, even when Segment Credit is available and SRL has currently not been exceeded for individual Application PDUs. The ISST, which manages the network as a whole, shall take precedence over the Segment Credit Limits and Segment Range Limits, which manage individual Application PDUs.

IF Transfer occurs directly over a MIL-STD-188-220 net
THEN
ISST = ISSTAF * T2AT / (2 * NS)
ELSE
ISST = 0 **--**(This is a default value that may need to be modified by the operator for each destination. The 0 default value is intended to be used over high-speed WAN/LANs.)
ENDIF

Note: The ISST will help avoid frequent discards at lower layers by offering segments at a rate that is less than the net's maximum rate. It will also help improve reliability in cases where a Destination will not acknowledge any segments, i.e., the use of segment credits to perform flow control and avoid discards is not possible.

To avoid blocking (i.e., situations where the Originator is not sending segments to any Destination even when multiple segments are available for transfer to different Destinations) it is recommended that only one message at a time is segmented and sent to any one Destination. Also, it is recommended that the number of messages to different Destinations being sent at the same time over CNR should be limited to help avoid the situation where a number of transfers have started but they are taking too long to complete because the source rate restriction. When S/R simultaneous message transfer limits are reached for a CNR net, it is valid for the S/R Layer to report transfer failures back to the application for the most recent transfer request, even though no attempt was made to send any segments.

b. **Stops:** The Originator shall stop the ISST when the Originator disconnects from the CNR net.

c. **Expires:** When the ISST expires at the Originator, another Segment can be resent/sent over the corresponding Rate Limited CNR. The Application PDU Identifier of the next segment to be resent/sent shall be fairly (e.g., randomly) selected from the pool of Application PDU Identifiers associated with transfers over the given CNR net that are not blocked due to the SCL and/or the SRL. Fairly selecting the Application PDU Identifier will help ensure that all simultaneous transfers progress to completion at similar rates. The segment with the lowest Segment Number shall always be resent/sent first according to C.3.6.4/C.3.6.4.4. Giving segments with the lowest Segment Number priority to be resent/sent will result in an increased likelihood that Segment Credit will be available and that the SRL will not be exceeded for any transfer over the given CNR net.

C.3.6.5.8 Partial Acknowledgment Interval Timer (PAIT).
The PAIT helps the Destination avoid sending frequent Partial Acknowledgments for a small number of segments. If a Request for Acknowledgment is received by a Destination and the PAIT is running, the transmission of the associated Partial Acknowledgement shall be delayed until after the PAIT expires, until the NOMST is reached, or until the RSCT is reached. The Destination shall maintain one PAIT for each Application PDU.

a. **Starts:** The PAIT shall be started whenever a Partial Acknowledgment is sent by the Destination. Only one PAIT shall be running at the destination per Application PDU. The value of the PAIT shall be set according to the equation below.

IF NOSNR >= SCL
THEN
PAIT = PAITAF * REISRIT
ELSE
PAIT = 0 (When an Acknowledgement is requested, send the Partial Acknowledgement without delay)
ENDIF

b. **Stops:** The PAIT shall be stopped when the NOMST is reached, the RSCT is reached, or when all segments for the associated Application PDU have been received by the Destination. When the PAIT is stopped a Partial Acknowledgment or Complete Acknowledgment shall be sent by the Destination as appropriate. If a Partial Acknowledgment is sent, the PAIT shall be restarted.

c. **Expires:** When the PAIT expires at the Destination:

IF one or more requests for acknowledgment have been received since the PAIT was started
THEN

Send a Partial Acknowledgment
Restart the PAIT
ENDIF

C.3.6.5.9 Estimated Round Trip Delay Aging Timer (ERTDAT).
If the last exchange with a Destination resulted in the ERTD being less than the IRTD, the ERTDAT shall be used to increase the ERTD back to the IRDT on a non-persistent basis during idle periods. The idea is that prior positive experience by an Originator during active periods with a Destination is less likely to be applicable in the future as time passes without any new activity occurring between the Originator and the Destination. The Originator maintains one ERTDAT for each Application PDU.

a. **Starts:** The ERTDAT shall be started, or restarted, each time the ERTD is updated when the SAT timer is stopped because an Unsent Segment is acknowledged, or when the SAT expires. The ERTDAT shall also restarted when it expires if the updated ERTD < IRDT. The value of the ERTDAT shall be set according to the equation below.

IF ERTD < IRTD
THEN
ERTDAI = (IRTD – ERTD) / ERTDAS
ERTDAT = ERTDAP
Start ERTDAT
ENDIF

b. **Stops:** The ERTDAT shall be stopped each time the ERTD is updated, i.e., when the SAT timer is stopped because an Unsent Segment is acknowledged or when the SAT expires.

c. **Expires:** When the ERTDAT expires the ERTD is adjusted according to the equation below. If ERTDAT < IRDT then the ERTDAT is restarted.

ERTD = ERTD + ERTDAI
IF ERTD < IRTD
THEN
ERTDAT = ERTDAP
Start ERTDAT
ENDIF

C.3.6.5.10 Inter-Segment Receive Timer (ISRT).
The ISRT shall be used to measure the time between received segments at the Destination as required to update the estimate for the reassembly time. The Destination shall maintain one ISRT for each Application PDU.

a. **Starts:** When a segment is received, the time at which the segment was received is recorded.

b. **Stops:** When the next segment is received, the elapsed time since receipt of the previous segment is calculated and stored as the MISRIT. This time shall be used to update both the ISRIT and the RT according to C.3.6.6.3. The ISRT shall be restarted if not all of the segments associated with the Application PDU have been received.

c. **Expires:** The ISRT never expires; it is only used to measure the interval between the receipts of segments with the same Application PDU Identifier.

C.3.6.5.11 Inter-Segment Receive Interval Timer (ISRIT).
The ISRIT shall be used to predict a time by which the next segment should be received at the Destination. The Destination shall maintain one ISRIT for each Application PDU.

a. **Starts:** When a segment is received, the ISRIT shall be started or restarted to predict a time by which the next segment should be received. The value of ISRIT shall be set according to C.3.6.6.3.

b. **Stops:** When the next segment is received, the ISRIT shall be stopped and then restarted if not all segments have not been received.

c. **Expires:** When the ISRIT expires, the ISRIT and RT values shall be updated according to the equation below. The ISRIT and RT shall then be restarted as appropriate.

ISRITEC = ISRITEC + 1
IF ISRITEC < ISRITEL
THEN
    IF (EISRIT * EISRITF) < (SEISRIT * MESRITR)
    THEN
        EISRIT = EISRIT * EISRITF
        REISRIT = EISRIT * ISRITJF
    ENDIF
    ISRIT = REISRIT
    Start ISRIT
    RT = REISRIT * (LSN – NOSR)
    Start RT
ELSE
    Destination shall send an Abort Request with P-Bit = 0
    Destination shall discard segments associated with the Application PDU
    Destination shall place the associated Application PDU Identifier in the Destination Reference Freeze State and start the DRFST.
ENDIF

C.3.6.5.12 Estimated Inter-Segment Receive Interval Aging Timer (EISRIAT).
If the last segment received from an Originator resulted in the EISRIT less than the IISRIT, the EISRIAT shall be used to increase the EISRIT back to the IISRIT on a non-persistent basis during idle periods. The idea is that prior positive experience by a Destination during active periods with an Originator is less likely to be applicable in the future as time passes without any new activity occurring between the Destination and the Originator.

a. **Starts:** The EISRIAT shall be started, or restarted, each time the EISRIT is updated when a segment is received or the ISRIT expires. The EISRIAT shall also be restarted when it expires if the updated EISRIT < IISRIT. The value of the EISRIAT shall be set according to the equation below.

IF EISRIT < IISRIT
THEN
    EISRIAI = (IISRIT – EISRIT) / EISRIAS
    EISRIAT = EISRIAP
    Start EISRIAT
ENDIF

b. **Stops:** The EISRIAT shall be stopped each time the EISRIT is updated, i.e., when a segment is received or the ISRIT expires.

c. **Expires:** When the EISRIAT expires the EISRIT shall be adjusted according to the equation below. If EISRIAT < IISRIT then the EISRIAT is restarted.

EISRIT = EISRIT + EISRIAI
IF EISRIT < IISRIT
THEN
  EISRIAT = EISRIAP
  Start EISRIAT
ENDIF

C.3.6.5.13 Time Allowed From Request For Transfer To Complete Timer (TAFRFTTCT).
The TAFRFTTCT limits the time from when the transfer request is made until it must be completed.

a. **Starts:** The TAFRFTTCT shall be started when the transfer request is received by the S/R Layer and shall be set according to the equation below.

TAFRFTTCT = The parameter specified in the S/R-Unitdata request sent by the application.

b. **Stops:** The TAFRFTTCT shall be stopped when the Destination Status for all Destinations transitions to INACTIVE.

c. **Expires:** When the TAFRFTTCT expires, an Abort Request shall be sent to all active Destinations and provide an appropriate S/R-Status Indication primitive.

C.3.6.6 Enhanced Timer equations.
This section contains additional equations related to timers.

C.3.6.6.1 Round Trip Delay (RTD) equations.
The following sequence of equations shall be used to calculate the ERTD, RERTD, and the SERTD.

IF MRTD < SERTD
THEN
  ERTD = SERTD - (RTDDF * (SERTD - MRTD))
ELSE
  ERTD = SERTD + (RTDUF * (MRTD - SERTD))
ENDIF
SERTD = ERTD
RERTD = ERTD * RTDJF

C.3.6.6.2 LNUS and SLNUS equations.
When a Partial Acknowledgment is received, the following sequence of equations shall be used to update the LNUS associated with the Destination that sent the Partial Acknowledgment. When the LNUS is updated, the SLNUS is updated to the smallest LNUS value associated with any active Destination.

IF PASSN > LNUS

THEN
LNUS = PASSN
SLNUS = Smallest LNUS associated with any active Destination associated with the same Application PDU Identifier as specified by the serial number field of the Partial Acknowledgment.
ENDIF

C.3.6.6.3 Segment reception equations.
When a segment is received the following sequence of equations shall be used to calculate the EISRIT and start/restart the ISRT, ISRIT, and RT.

IF SN <= 1
AND The segment is not a duplicate
THEN
ISRITEC = 0
ISRT = 0
Start ISRT
ELSE ((SN <= 1 **AND** the segment is a duplicate) **OR** SN>1)
IF MISRIT < SEISRIT
THEN
EISRIT = SEISRIT – (ISRITDF * (SEISRIT– MISRIT))
ELSE
EISRIT = SEISRIT + (ISRITUF * (MISRIT – SEISRIT))
ENDIF
IF SN > 2
THEN
SEISRIT = EISRIT
ENDIF
REISRIT = EISRIT * ISRITJF
ISRIT = REISRIT
Start ISRIT
RT = REISRIT * (LSN – NOSR)
Start RT
ENDIF

C.3.6.7 Enhanced Initialization equations.

C.3.6.7.1 Network enable initialization.
Before any segments have been sent or received (e.g., upon enabling the net), the following sequence of equations shall be used to initialize parameter values.

HOPCNT = 1 (This is a default value that may need to be modified by the operator for each destination)

IF Transfer occurs directly over a MIL-STD-188-220 net
THEN
IRTD = HOPCNT * T2AT (T2AT taken from MIL-STD-188-220 Protocol Parameter Tables. This equation calculates a default value that can be used for Destinations on the same net. This calculation is performed when the net is enabled based on the net's configuration. The default value for the net may be modified by the operator.)
ELSE

IRTD = HOPCNT * 10 sec. (This is a default value that may need to be modified by the operator for each destination)

ENDIF

ERTD = IRTD
SERTD = ERTD
RERTD = ERTD * RTDJF
ERTDAS = ERTDLT / ERTDAP (This is initialized for each destination when the first message is sent to that destination, after the net is enabled)

IF Transfer occurs directly over a MIL-STD-188-220 net

THEN

IISRIT = HOPCNT * T2AT (T2AT taken from MIL-STD-188-220 Protocol Parameter Tables. This equation calculates a default value that can be used for Originators on the same net. This calculation is performed when the net is enabled based on the net's configuration. The default value for the net may be modified by the operator.)

ELSE

IISRIT = HOPCNT * 10 sec. (This is a default value that may need to be modified by the operator for each destination)

ENDIF

EISRIT = IISRIT
SEISRIT = EISRIT
REISRIT = EISRIT * ISRITJF
EISRIAS = EISRILT / EISRIAP

C.3.6.7.2 Application PDU transmit initialization.

Each time an Originator initiates the transfer of an Application PDU, the following sequence of equations shall be used to initialize the following parameter values associated with that Application PDU.

SCU =	0	
HNSS =	0	
LNUS =	0	(For each Destination)
SLNUS =	LNUS	
RFARC =	0	(For each Destination)
ABRRC =	0	(For each Destination)
DS =	ACTIVE	(For each Destination)
DACR =	FALSE	(For each Destination)

C.3.6.7.3 Application PDU receive initialization.

Each time a Destination begins reception of a new Application PDU, the following sequence of equations shall be used to initialize the following parameter values associated with that Application PDU Identifier.

ABRRC = 0
NOSNR = 0
NOSR = 0
ISRITEC = 0
OACR = FALSE

C.3.7 S/R Basic / S/R Enhanced Interoperability Notes and Considerations
This section represents notes from the designers and does not contain any requirements, and is provided only for informational purposes. The S/R Basic protocol was designed with the intention that it would be fully interoperable with the S/R Enhanced protocol. An example of the considerations that were taken into account include, but are not limited to:

1. The S/R Basic protocol does not issue Abort Request PDUs with the P-Bit = 1, however, if it receives an Abort Request PDU with P-Bit = 1, it will respond with an Abort Confirm PDU.
2. The S/R Basic protocol does not attempt to optimize its timers and counters, rather it uses worst case values. While this will results in less efficient performance, it will still remain interoperable with the S/R Enhanced protocol.
3. The S/R Basic protocol does not solicit any responses from stations when using Group Multicast addressing, however, the S/R Enhanced protocol may cause unsolicited responses to be issued. In this event, the S/R Basic protocol logic should disregard these responses.
4. The S/R Basic protocol does not issue any unsolicited responses, however, any PDU received with the P-bit = 1 will be responded to by a station using the S/R Basic protocol, which will facilitate interoperability with the S/R Enhanced protocol.
5. The S/R Basic protocol does not maintain a "Reference Freeze State", rather, it relies on the nature of the Serial Number field in the S/R header to provide robust enough separation of S/R Transactions over time.
6. There may be cases where an S/R Enhanced system expects an automatically generated response and if the destination is an S/R Basic system, this response will not be automatically generated. In this event, there is logic in the S/R Enhanced protocol to explicitly request this response, and an S/R Basic system will generate a response to the explicit request.

C.3.8 Examples.
This section does not contain any requirements, and is provided for guidance and informational purposes.

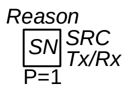
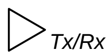
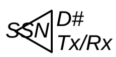
TABLE C-IX illustrates the construction of the S/R PDU - Acknowledgment Request Segment (Type=3) and the bit ordering for this PDU. The first four columns of the table provide a description of each field in the example, the field length in bits, and the value of the field in both decimal and binary representations. The last four columns show the physical encoding of the S/R header. In the fifth column, Field Fragments, the bits of each field are placed in octets. The bit(s) of each field are positioned in an octet such that the MSB of the field is positioned in the most significant unencoded bit of the octet, the next MSB of the field is placed in the next most significant unencoded bit of the octet, and repeated until all of the bits of the field have been encoded. When an octet is filled before all the bits of a field are encoded, the process is continued by encoding the next octet with the remaining bits of the field. This field/octet encoding procedure is performed starting with the first field and octet, and repeated for each successive field and individual octet, in order, until the encoding is completed. X's are used to identify bits that are not associated with the field being encoded. The sixth column, Octet Value - Binary, assembles the bits contributed by successive fields into complete octets, represented in binary. The seventh column, Octet Value - Hexadecimal, represents the octet value in hexadecimal. The last column, Octet Number, numbers the octets from first to last starting with 0.

Each S/R PDU is individually encoded. For this example, the Source Port has a value of 5000, the Destination Port has a value of 1581, the Type equals 3 for Acknowledgment Request, HLEN equals 3, P/F equals 1, Serial Number has a value of 16000, Last Sent Segment Number has a value of 260 and the Padding is zero (0).

FIGURE C-9 through FIGURE C-13 illustrate the Basic S/R process. Symbols used in these figures are described in FIGURE C-8.

TABLE C-IX. Example of construction of S/R PDU (Acknowledgment Request)

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
Source Port	16	5000	0001001110001000	00010011	00010011	13	0
				10001000	10001000	88	1
Destination Port	16	1581	0000011000101101	00000110	00000110	06	2
				00101101	00101101	2D	3
Type	3	3	011	011XXXXX			
HLEN	12	3	000000000011	XXX00000	01100000	60	4
				0000011X			
P/F	1	1	1	XXXXXXX1	00000111	07	5
Serial Number	16	16000	0011111010000000	00111110	00111110	3E	6
				10000000	10000000	80	7
Last Sent Segment Number	16	260	0000000100000100	00000001	00000001	01	8
				00000100	00000100	04	9
Padding	16	0	0000000000000000	00000000	00000000	00	10
				00000000	00000000	00	11

Symbol	Description
	= DATA SEGMENT PDU w/o PBIT
	= DATA SEGMENT PDU w/ PBIT SET
	= ACKNOWLEDGEMENT REQUEST PDU
	= PARTIAL ACKNOWLEDGEMENT PDU
	= COMPLETE ACKNOWLEDGEMENT PDU
	= ABORT REQUEST PDU
	= ABORT CONFIRM PDU
	= EVENT or CONDITION

Notes:
- ❑ Segment Retry Count (SRC) is displayed only for the Originator, and only if the retry count is not equal to 1.
- ❑ PDU transmission or reception is indicated by ‘Tx’ or ‘Rx’, respectively.
- ❑ SN = Segment Number
  SSN = Starting Segment Number
  D# = Destination Number

FIGURE C-8. S/R Example Scenario Symbol Key

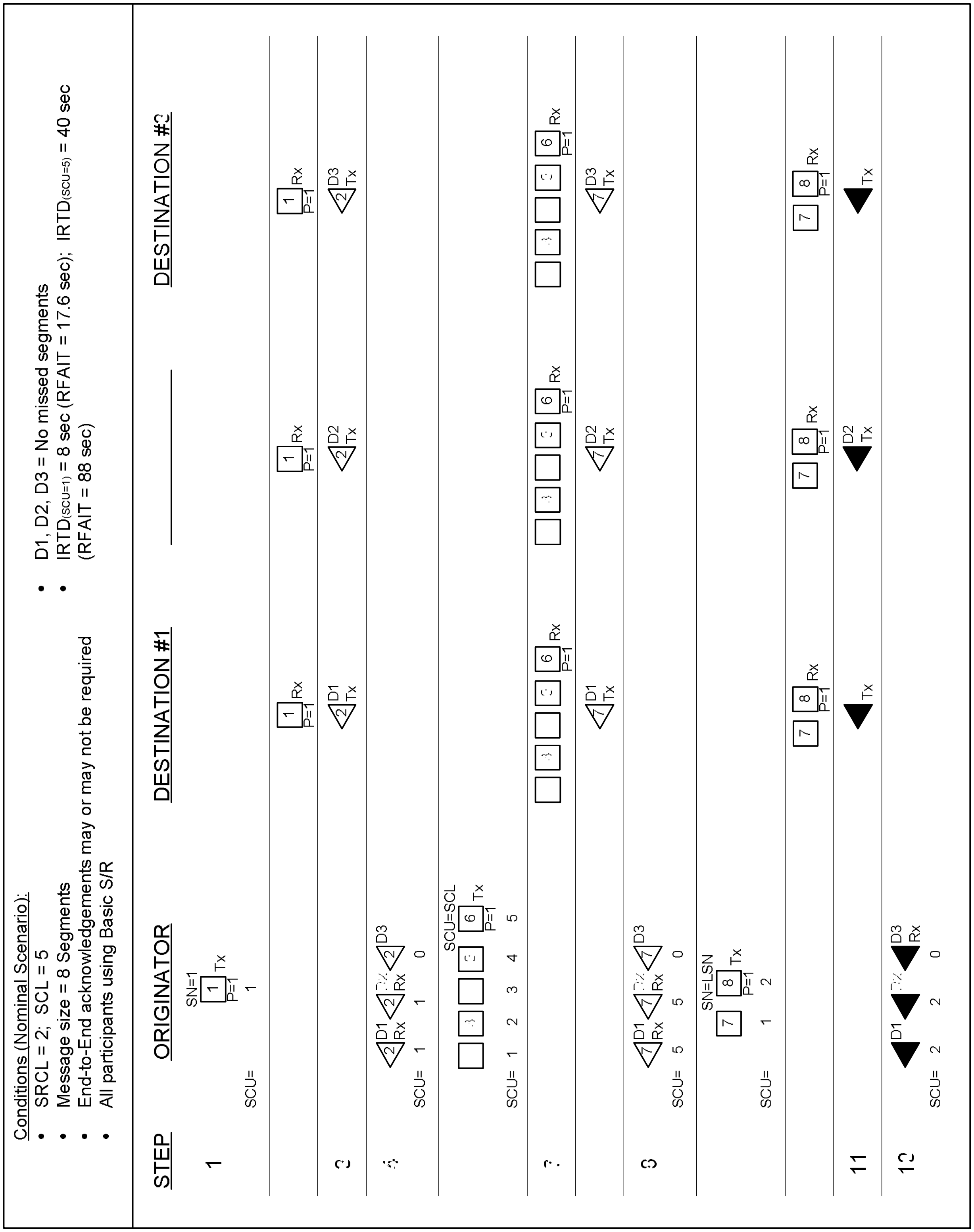

Conditions (Nominal Scenario):
SRCL = 2; SCL = 5
Message size = 8 Segments
End-to-End acknowledgements may or may not be required
All participants using Basic S/R
D1, D2, D3 = No missed segments
IRTD(SCU=1) = 8 sec (RFAIT = 17.6 sec); IRTD(SCU=5) = 40 sec
(RFAIT = 88 sec)
STEP
ORIGINATOR
DESTINATION #1
SN=1
SCU=
SCU=SCL
SN=LSN
Tx
Rx
P=1
D1
D2
D3
1
11

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FIGURE C-9. S/R Example Scenario, Nominal

Notes:

- Step 1 - Originator initiates transaction with Segment #1 and sets the P-bit. No further segments are sent until all destinations have acknowledged receipt. Segment Credits Used (SCU) is incremented to 1, and the Request For Acknowledgement Interval Timer (RFAIT) is started. Refer to section C.3.5.4.2.
- Step 2 - Destinations receive Segment #1 and initialize S/R timers. Refer to section C.3.5.4.5.
- Step 3 - Destinations transmit a partial acknowledgement, which confirms connectivity. The Starting Segment Number (SSN) is set to 2, indicating the next segment which is ready to be received.
- Step 4 - Originator receives all partial acknowledgements as separate transmissions, not necessarily in the order shown. The RFAIT is stopped, and SCU is decremented to 0, when the final partial acknowledgement is received. The Request For Acknowledgement Retry Count (RFARC) for all destinations that send a partial acknowledgement is set to 0. Refer to sections C.3.5.4.3.a and C.3.5.5.1.b.
- Step 5 - Originator S/R layer sends segments to lower layer applications as individual PDUs. These layers (e.g. Data Link layer) may or may not concatenate them into a single transmission. SCU is incremented for each PDU sent. The P-bit is set only for the last PDU in the sequence when the Segment Credit Limit (SCL) is reached. Sending the last PDU with the P-bit set causes the RFAIT to start, and the RFARC for all destinations to be incremented by 1.
- Step 6 - Destinations receive segments and stop/restart the Inter-Segment Receive Interval Timer (ISRIT), waiting for the next PDU to arrive.
- Step 7 - Destinations transmit a partial acknowledgement (because Segment #6 PDU had the P-bit set), with the SSN set to 7, indicating the next segment ready to be received.
- Step 8 - Originator receives all partial acknowledgements as separate transmissions, not necessarily in the order shown. Measured Round Trip Delay (MRTD) for each destination is recorded, and each corresponding Saved Estimated Round Trip Delay (SERTD) is recalculated. The RFAIT is stopped, and SCU is decremented to 0, when the final partial acknowledgement is received, indicating that there are no outstanding segments that need to be retransmitted, and allowing further transmission of Unsent segments. Refer to section C.3.5.4.3.a.
- Step 9 - Originator sends remaining Unsent segments, until the Last Segment Number (LSN) is reached, incrementing SCU for each PDU sent. The P-bit is set on the final segment. The RFAIT is restarted, but is now based on the MRTD in lieu of the IRTD. Refer to sections C.3.5.4.2 and C.3.5.5.1.a.
- Step 10 - Destinations receive segments, including the final segment, and send the reassembled message to the upper layer protocol.
- Step 11 - Destinations transmit a complete acknowledgement per C.3.5.4.5.
- Step 12 - Originator receives all complete acknowledgements, and marks all destinations as Inactive, terminating the transaction and reporting status to the upper layer protocol. Refer to section C.3.5.4.3.b.

FIGURE C-9. S/R Example Scenario, Nominal - Continued

Conditions (Missed Segments Scenario):

- SRCL = 2; SCL = 5; RFARL = 2
- Message size = 9 Segments
- End-to-End acknowledgements may or may not be required
- All participants using Basic S/R

- D1 = No missed segments
- D2, D3 = Occasional missed segments
- D4 = No reception
- IISRIT = 15 sec (ISRIT = 165 sec); IRTD$_{(SCU=1)}$ = 10 sec (RFAIT = 22 sec); IRTD$_{(SCU=5)}$ = 50 sec (RFAIT = 110 sec)

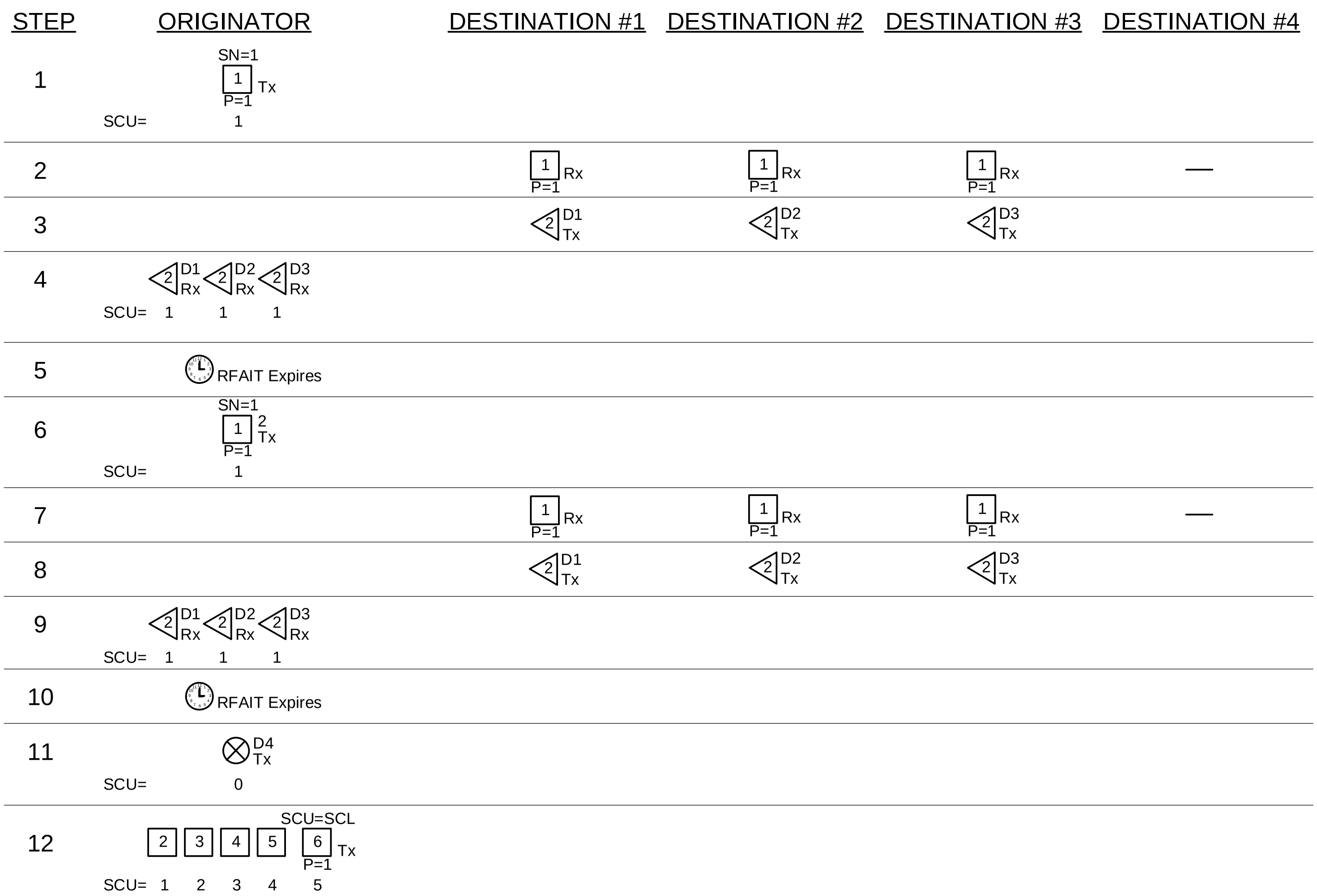

FIGURE C-10. S/R Example Scenario, Missed Segments

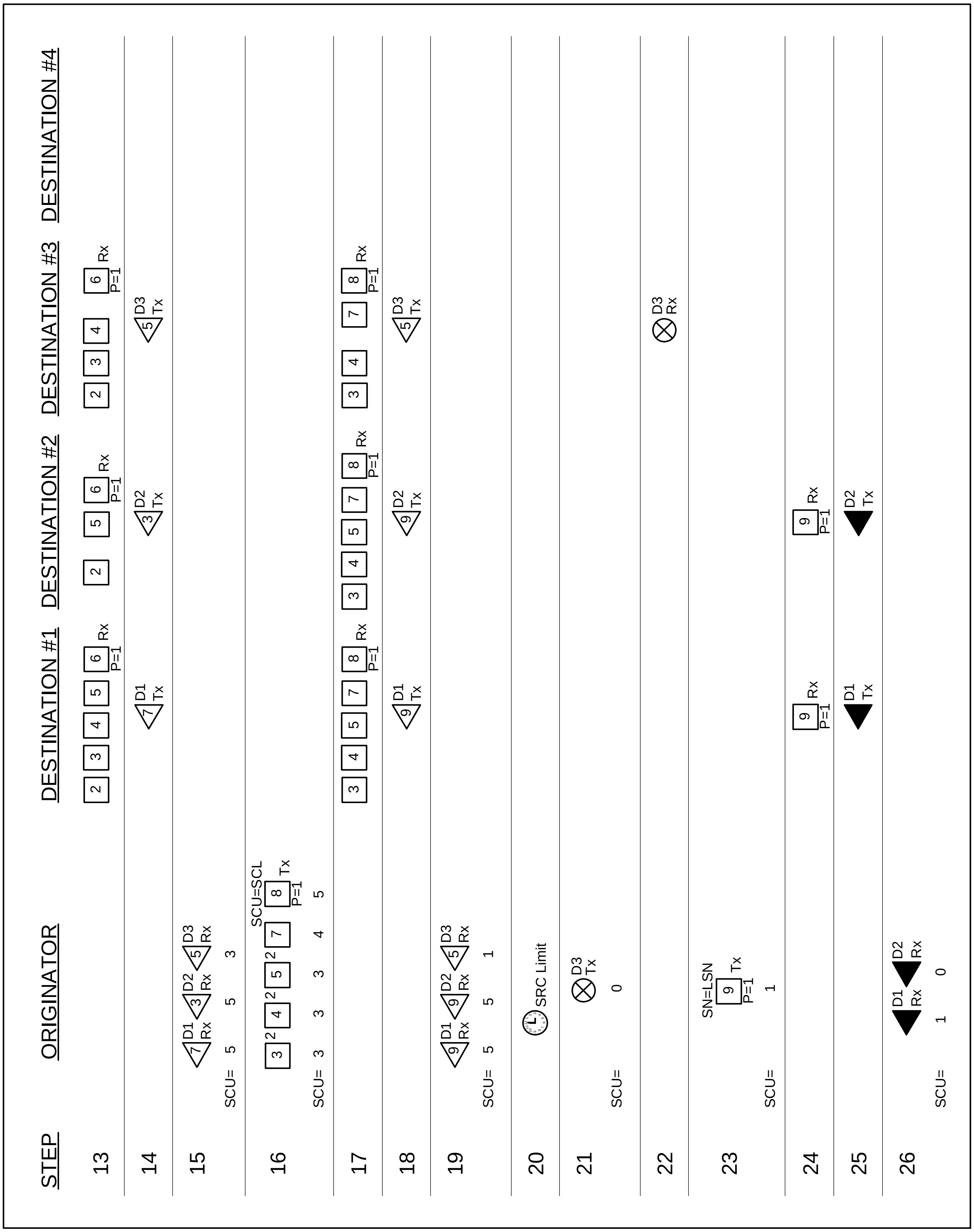
STEP
ORIGINATOR
DESTINATION #1
DESTINATION #2
DESTINATION #3
DESTINATION #4
13
14
15
16
17
18
19
20
21
22
23
24
25
26
SCU=SCL
SRC Limit
SN=LSN
SCU=

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FIGURE C-10. S/R Example Scenario, Missed Segments - Continued

Notes:

Step 1 - Originator initiates transaction with Segment #1 and sets the P-bit. No further segments are sent until all destinations have acknowledged receipt. Segment Credits Used (SCU) is incremented to 1. Refer to section C.3.5.4.2.

❑ Step 2 - Destinations (except D4) receive Segment #1 and initialize S/R timers. Refer to section C.3.5.4.5.

Step 3 - Destinations transmit a partial acknowledgement, which confirms connectivity. The Starting Segment Number (SSN) is set to 2, indicating the next segment which is ready to be received.

❑ Step 4 - Originator receives partial acknowledgements as separate transmissions, not necessarily in the order shown. SCU is not decremented because partial acknowledgement from D4 is outstanding. The Request For Acknowledgement Retry Count (RFARC) for all destinations that send a partial acknowledgement is set to 0. Refer to section C.3.5.4.3.a.

Step 5 - The Request For Acknowledgement Interval Timer (RFAIT) expires, indicating that an acknowledgement was not received. The RFARC for D4 is incremented to 2. Refer to section C.3.5.5.1.

❑ Step 6 - Segment #1 is resent to all destinations with the P-bit set, and the Originator restarts the RFAIT. Segment Retry Count (SRC) is incremented to 2. SCU is not incremented, as this segment is being resent. Refer to section C.3.5.4.4.

Step 7 - Destinations (except D4) receive Segment #1 again and stop/restart all timers.

❑ Step 8 - Destinations transmit a partial acknowledgement, even though Segment #1 had previously been received and acknowledged.

Step 9 - Same as Step 4.

❑ Step 10 - The RFAIT expires again. The originator notes that the RFARC for D4 is equal to the Request For Acknowledgement Retry Limit (RFARL), and marks D4 as Inactive and sends status to the upper layer protocol. The SCU is decremented to account for destination pruning. Refer to section C.3.5.5.1.

Step 11 - Originator sends an Abort Request to D4.

❑ Step 12 - Originator S/R layer sends segments to lower layer protocols as individual PDUs. These layers (e.g. Data Link layer) may or may not concatenate them into a single transmission. SCU is incremented for each PDU sent. The P-bit is set only for the last PDU in the sequence when the Segment Credit Limit (SCL) is reached.

Step 13 - Destinations receive segments and stop/restart the Inter-Segment Receive Interval Timer (ISRIT), waiting for the next PDU to arrive. D2 and D3 do not receive all segments. Refer to section C.3.5.4.5.

❑ Step 14 - Destinations transmit a partial acknowledgement, with the SSN set to the next segment ready to be received. If one or more segments since the last partial acknowledgement request are missing, the SSN will be set to the last received contiguous segment plus 1. Additional missing segments (if any) are indicated in the partial acknowledgement Bit Mask subfield. Refer to Figure C-3.

❑ Step 15 - Originator receives all partial acknowledgements as separate transmissions, not necessarily in the order shown. SCU is decremented to 3 when the final partial acknowledgement is received, indicating that there are 3 outstanding segments that need to be retransmitted. The RFARC for all stations is set to 0. Refer to C.3.5.4.3.a.

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FIGURE C-10. S/R Example Scenario, Missed Segments - Continued

Notes (Continued):

- Step 16 - Originator resends unacknowledged segments to all destinations, but does not increment the SCU. Refer to section C.3.5.4.4. Additional Unsent segments can be sent because SCU is less than the SCL. Two additional segments are sent, incrementing SCU for each PDU sent. The P-bit is set on last PDU in the sequence when the SCL is reached.
- Step 17 - Destinations receive segments, some of which may have been previously received, and stop/restart the ISRIT, waiting for the next PDU to arrive. D3 does not receive all segments.
- Step 18 - Destinations transmit a partial acknowledgement, with the SSN set to the next segment ready to be received. If one or more segments since the last partial acknowledgement request are missing, the SSN will be set to the last received contiguous segment plus 1.
- Step 19 - Originator receives all partial acknowledgements as separate transmissions, not necessarily in the order shown. SCU is decremented to 1 when the final partial acknowledgement is received, indicating that only Segment #5 remains outstanding. The RFARC for all stations is set to 0. Refer to C.3.5.4.3.a.
- Step 20 - The Segment Retry Count Limit (SRCL) for Segment #5 is reached, as Segment #5 was twice not received. The originator marks D3 as Inactive, even though other segments were acknowledged by that destination, since D3 had not received Segment #5 and the SRC for Segment #5 was equal to the SRCL. Refer to section C.3.5.4.4.
- Step 21 - The Originator sends an Abort Request to D3, and decrements SCU.
- Step 22 - D3 receives Abort Request and terminates this transaction. Refer to section C.3.5.4.7.a.
- Step 23 - Originator sends the last Unsent segment, reaching the Last Segment Number, and sets the P-bit. SCU is incremented. Refer to section C.3.5.4.2.
- Step 24 - Destinations receive the final segment and send the reassembled message to the upper layer protocol.
- Step 25 - Destinations transmit a complete acknowledgement per C.3.5.4.5.
- Step 26 - Originator receives all complete acknowledgements, and marks all destinations as Inactive, terminating the transaction and reporting status to the upper layer protocol. Refer to section C.3.5.4.3.b.

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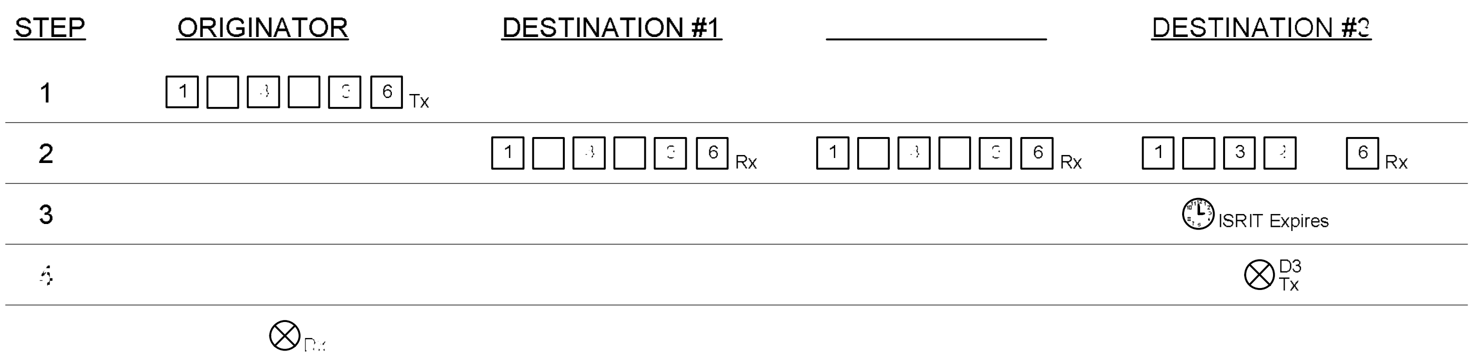
FIGURE C-10. S/R Example Scenario, Missed Segments - Continued

Conditions (Multicast Scenario):

- Message size = 6 Segments
- D1, D2, D3 = Members of multicast group
- D1, D2 = No missed segments
- All participants using Basic S/R
- D3 = Occasional missed segments
- IISRIT = 12 sec (ISRIT = 132 sec)



Notes:

- Step 1 - Originator S/R layer sends segments to lower layer protocols as individual PDUs. These layers (e.g. Data Link layer) may or may not concatenate them into a single transmission. The P-bit is not set for any PDU, and End-to-End acknowledgements are not required. No timers are initiated. The originator considers the transaction complete upon transmission of the last PDU.
- Step 2 - Destinations initiate S/R timers, but they do not acknowledge any received segments nor request retransmission of any missing segments. If any segments are not received, the entire message is discarded. D1 and D2 send the reassembled message to the upper layer protocol (ULP).
- Step 3 - The Inter-Segment Receive Interval Timer (ISRIT) expires at D3, since no further segments have been received from the Originator. Received segments for this transaction are discarded. Notification of the failed message may or may not be sent to the ULP.
- Step 4 - D3 transmits an Abort Request, since not all segments were received and the ISRIT expired.
- Step 5 - Originator receives the Abort Request from D3, but disregards it since the Originator has already completed the transaction.

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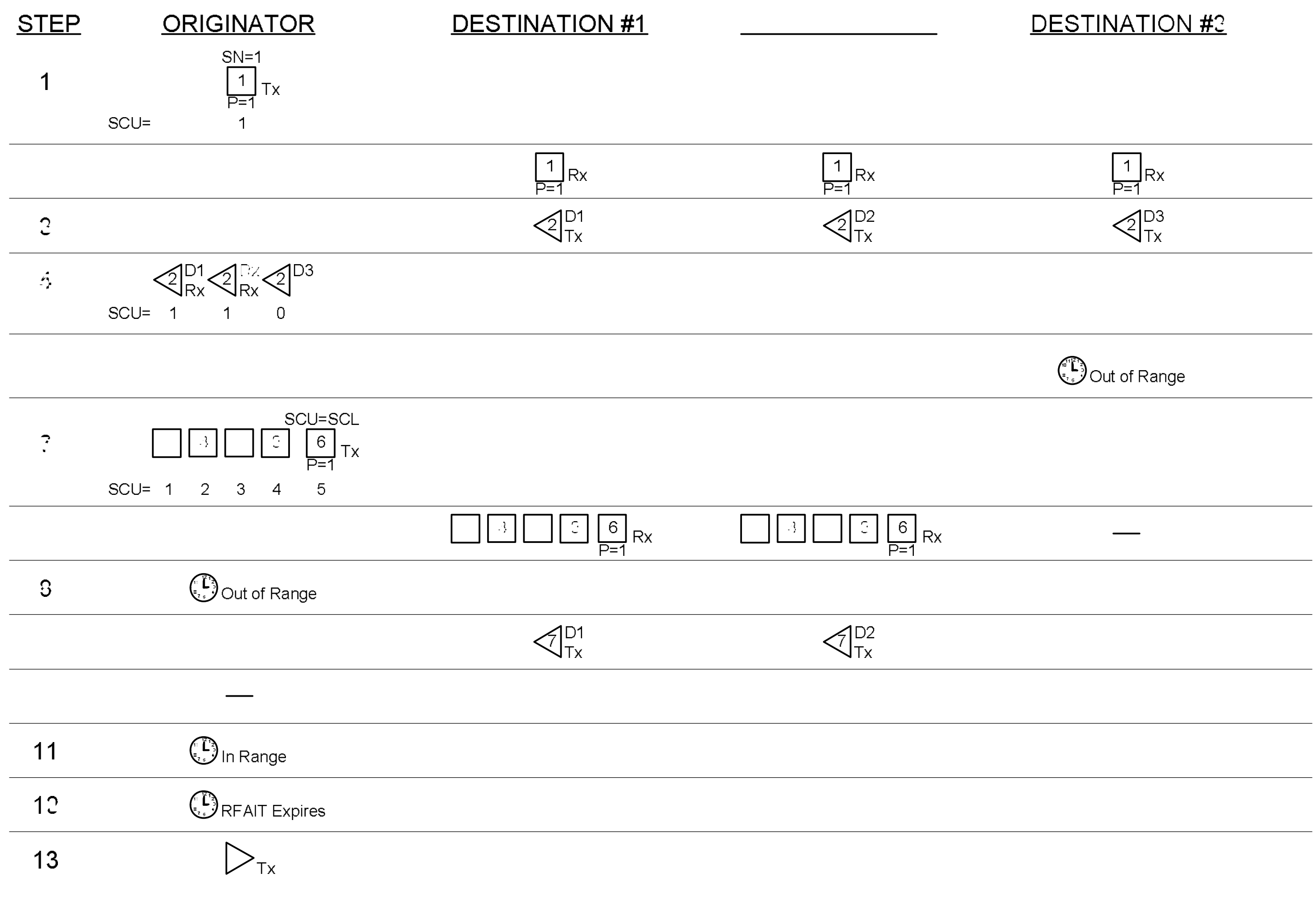
FIGURE C-11. S/R Example Scenario, Multicast

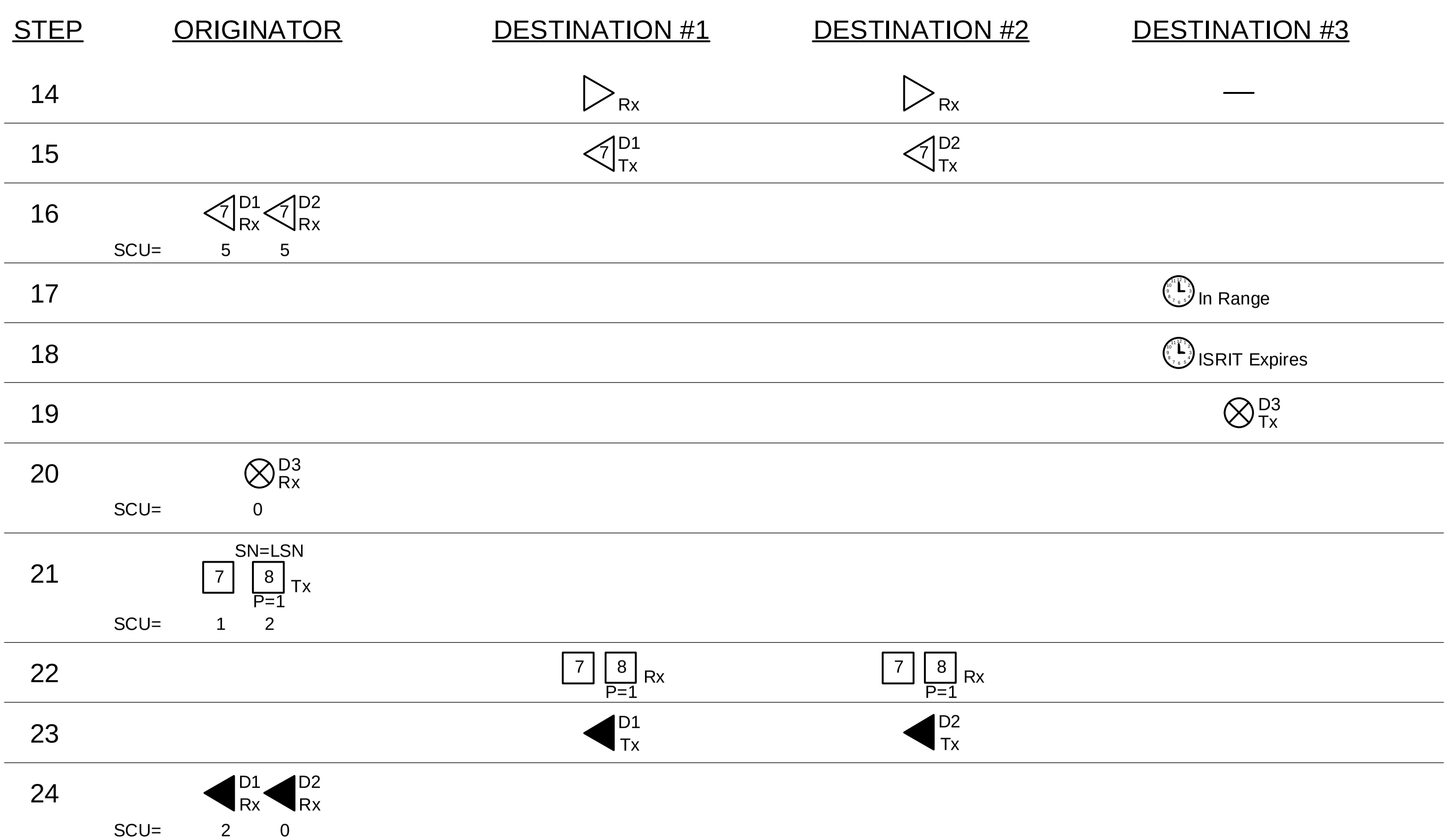
Conditions (Temporarily Out of Range Scenario):

- SRCL = 2; SCL = 5; RFARL = 2
- Message size = 8 Segments
- End-to-End acknowledgements may or may not be required
- All participants using Basic S/R
- D1, D2 = No missed segments
- O, D3 = In and out of communications range
- IISRIT = 12 sec (ISRIT = 132 sec); IRTD(SCU=1) = 8 sec (RFAIT = 17.6 sec); IRTD(SCU=5) = 40 sec (RFAIT = 88 sec)



APPENDIX C

FIGURE C-12, S/R Example Scenario, Temporarily Out of Range



Notes:

Step 1 - Originator initiates transaction with Segment #1 and sets the P-bit. No further segments are sent until all destinations have acknowledged receipt. Segment Credits Used (SCU) is incremented to 1. Refer to section C.3.5.4.2.

- Step 2 - Destinations receive Segment #1 and initialize S/R timers. Refer to section C.3.5.4.5.
- Step 3 - Destinations transmit a partial acknowledgement, which confirms connectivity. The Starting Segment Number (SSN) is set to 2, indicating the next segment which is ready to be received.

APPENDIX C

FIGURE C-12, S/R Example Scenario, Temporarily Out of Range - Continued

Notes (Continued):

Step 4 - Originator receives partial acknowledgements as separate transmissions, not necessarily in the order shown. SCU is decremented when the final partial acknowledgement is received. The Request For Acknowledgement Retry Count (RFARC) for all destinations that send a partial acknowledgement is set to 0. Refer to section C.3.5.4.3.a.

❑ Step 5 - D3 falls out of communications range. (Nodes moving in and out of range are not S/R actions, but are physical inputs to this scenario.)

Step 6 - Originator S/R layer sends segments to lower layer protocols as individual PDUs. These layers (e.g. Data Link layer) may or may not concatenate them into a single transmission. SCU is incremented for each PDU sent. The P-bit is set only for the last PDU in the sequence when the Segment Credit Limit (SCL) is reached.

❑ Step 7 - Destinations (except D3) receive segments and stop/restart the Inter-Segment Receive Interval Timer (ISRIT), waiting for the next PDU to arrive. Refer to section C.3.5.4.5.

Step 8 - Originator falls out of communications range. (Nodes moving in and out of communications are not S/R actions, but are physical inputs to this scenario.)

❑ Step 9 - Destinations transmit a partial acknowledgement, with the SSN set to the next segment ready to be received. For all segments received, the SSN is set to 7.

Step 10 - Originator does not receive partial acknowledgements.

❑ Step 11 - Originator regains communications with the other nodes.

Step 12 - The Request For Acknowledgement Interval Timer (RFAIT) expires, without any acknowledgements received. The RFARC for all destinations is incremented to 2. Refer to section C.3.5.5.1.

❑ Step 13 - Originator transmits an Acknowledgement Request PDU to all destinations, and restarts the RFAIT.

Step 14 - D1 and D2 receive Acknowledgement Request and update timers. Refer to sections C.3.5.4.6 and C.3.5.5.2.

❑ Step 15 - D1 and D2 transmit partial acknowledgements, with the SSN set to the next segment ready to be received. This is a repeat of the partial acknowledgement sent earlier, as no additional segments have been received.

Step 16 - Originator receives partial acknowledgements from D1 and D2 as separate transmissions, not necessarily in the order shown, and continues to wait for an acknowledgement from D3. SCU is not decremented at this time.

❑ Step 17 - D3 regains communications with the other nodes.

Step 18 - D3 ISRIT expires, as no segments since Segment #1 have been received.

❑ Step 19 - D3 aborts the transaction without any attempt to recover, and sends an Abort Request. Refer to section C.3.5.5.3.c.

Step 20 - Originator receives D3 Abort Request and marks D3 as Inactive. SCU is decremented to 0, indicating that there are no outstanding segments that need to be retransmitted, and allowing further transmission of Unsent segments. Refer to section C.3.5.4.7.

❑ Step 21 - Originator sends remaining Unsent segments, until the Last Segment Number (LSN) is reached, incrementing SCU for each PDU sent. The P-bit is set on the final segment. Refer to section C.3.5.4.2.

Step 22 - Destinations receive segments, including the final segment, and send the reassembled message to the upper layer protocol.

❑ Step 23 - Destinations transmit a complete acknowledgement per C.3.5.4.5.

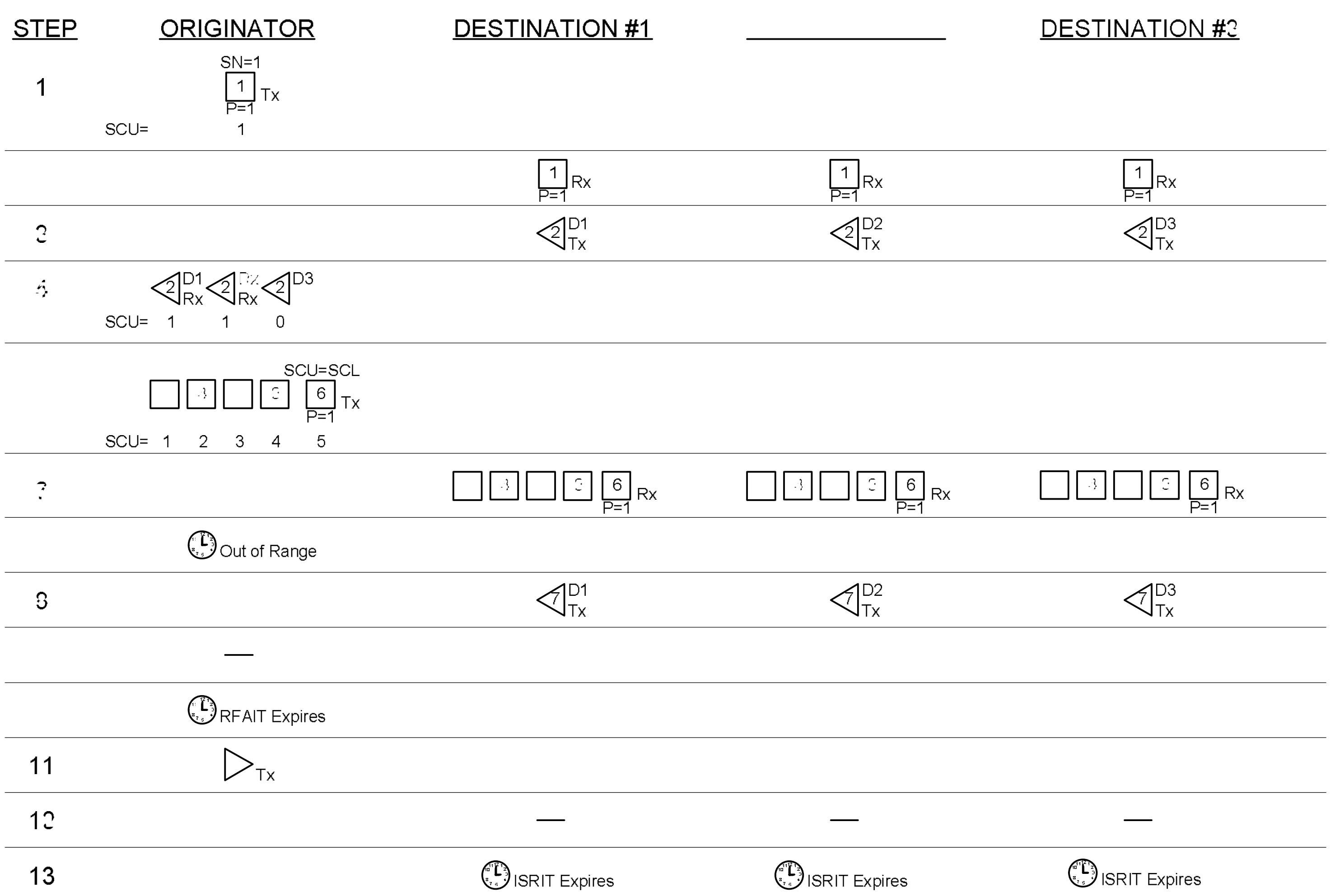
❑ Step 24 - Originator receives all complete acknowledgements, and marks all destinations as Inactive, terminating the transaction and reporting status to the upper layer protocol. Refer to section C.3.5.4.3.b.

APPENDIX C

FIGURE C-12, S/R Example Scenario, Temporarily Out of Range - Continued

Conditions (Permanently Out of Range Scenario):

- SRCL = 2; SCL = 5; RFARL = 2
- Message size = 8 Segments
- End-to-End acknowledgements may or may not be required
- All participants using Basic S/R
- D1, D2, D3 = No missed segments
- O = Loses communications range
- IISRIT = 12 sec (ISRIT = 132 sec); IRTD$_{(SCU=1)}$ = 8 sec (RFAIT = 17.6 sec); IRTD$_{(SCU=5)}$ = 40 sec (RFAIT = 88 sec)



APPENDIX C

FIGURE C-13, S/R Example Scenario, Permanently Out of Range

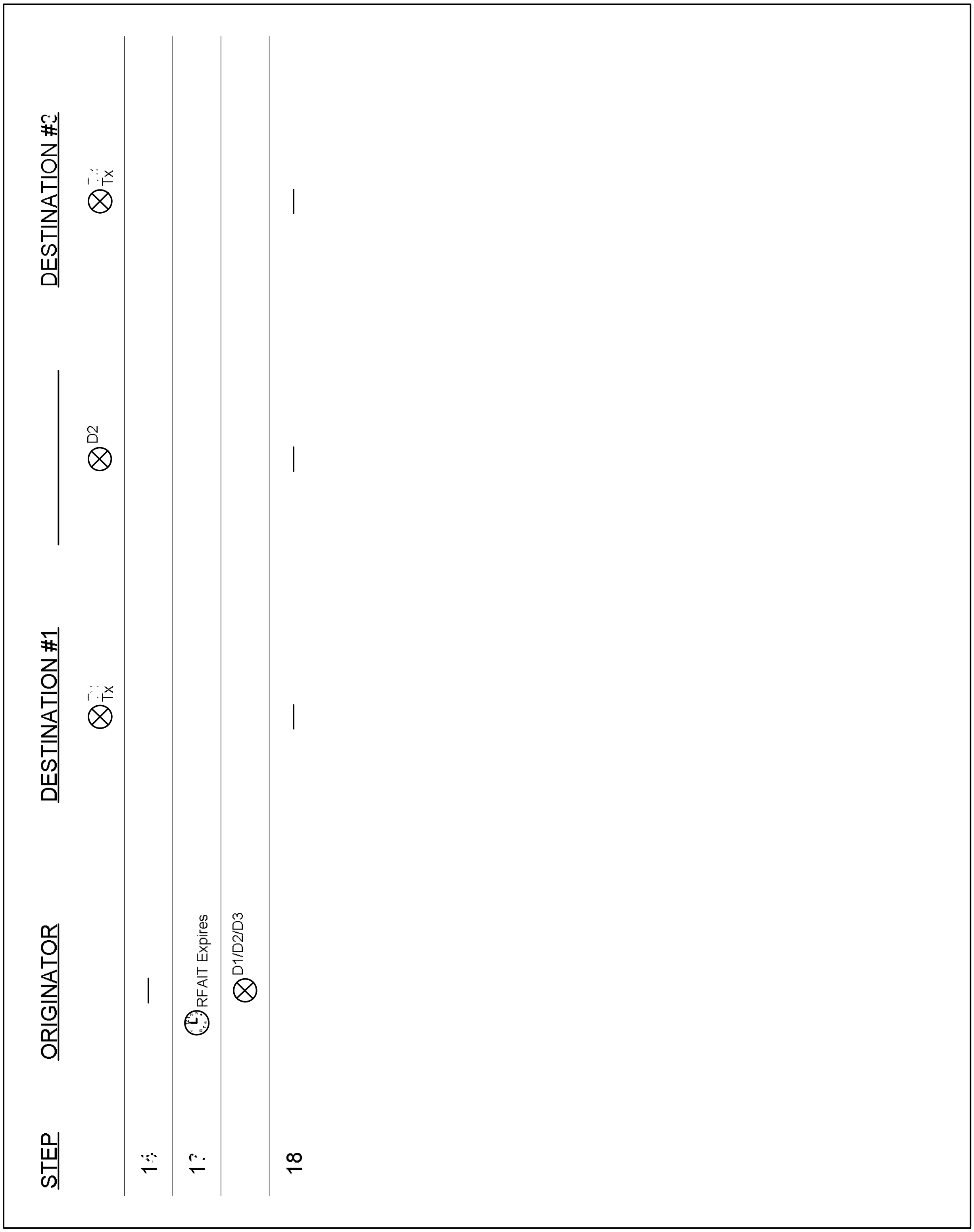

STEP
ORIGINATOR
DESTINATION #1
DESTINATION #2
Tx
D2
Tx
RFAIT Expires
D1/D2/D3
18

FIGURE C-13. S/R Example Scenario, Permanently Out of Range - Continued

Notes:

- Step 1 - Originator initiates transaction with Segment #1 and sets the P-bit. No further segments are sent until all destinations have acknowledged receipt. Segment Credits Used (SCU) is incremented to 1. Refer to section C.3.5.4.2.
- Step 2 - Destinations receive Segment #1 and initialize S/R timers. Refer to section C.3.5.4.5.
- Step 3 - Destinations transmit a partial acknowledgement, which confirms connectivity. The Starting Segment Number (SSN) is set to 2, indicating the next segment which is ready to be received.
- Step 4 - Originator receives partial acknowledgements as separate transmissions, not necessarily in the order shown. SCU is decremented when the final partial acknowledgement is received. The Request For Acknowledgement Retry Count (RFARC) for all destinations that send a partial acknowledgement is set to 0. Refer to section C.3.5.4.3.a.
- Step 5 - Originator S/R layer sends segments to lower layer protocols as individual PDUs. These layers (e.g. Data Link layer) may or may not concatenate them into a single transmission. SCU is incremented for each PDU sent. The P-bit is set only for the last PDU in the sequence when the Segment Credit Limit (SCL) is reached.
- Step 6 - Destinations receive segments and stop/restart the Inter-Segment Receive Interval Timer (ISRIT), waiting for the next PDU to arrive. Refer to section C.3.5.4.5.
- Step 7 - Originator falls out of communications range. (Nodes moving in and out of communications are not S/R actions, but are physical inputs to this scenario.)
- Step 8 - Destinations transmit a partial acknowledgement, with the SSN set to the next segment ready to be received.
- Step 9 - Originator does not receive any partial acknowledgements.
- Step 10 - The Request For Acknowledgement Interval Timer (RFAIT) expires, without any acknowledgements received. The RFARC for all destinations is incremented to 2. Refer to section C.3.5.5.1.c.
- Step 11 - Originator transmits an Acknowledgement Request PDU to all destinations.
- Step 12 - Destinations do not receive Acknowledgement Request.
- Step 13 - D1, D2, and D3 ISRITs expire, as no segments since Segment #6 have been received.
- Step 14 - D1, D2, and D3 abort the transaction without any attempt to recover, and send an Abort Request. Refer to section C.3.5.5.3.c.
- Step 15 - Originator does not receive the Abort Request from any destination.
- Step 16 - The RFAIT expires again. The originator notes that the RFARC for all destinations is equal to the Request For Acknowledgement Retry Limit (RFARL), and marks all destinations as Inactive. Refer to section C.3.5.5.1.c.
- Step 17 - Originator sends an Abort Request to all destinations and reports status to the upper layer protocol.
- Step 18 - Destinations do not receive the Abort Request.

FIGURE C-13. S/R Example Scenario, Permanently Out of Range - Continued

APPENDIX D

SECURITY EXTENSION PROTOCOL

D.1 General.

D.1.1 Scope.
This appendix provides a description of the features and values associated with each SPI code currently defined in TABLE D-I.

D.1.2 Application.
This appendix is mandatory for systems implementing SEP.

D.2 Applicable documents.
GOVERNMENT STANDARDS

None.

D.3 Definitions.
Refer to Section 3 of this standard.

D.4 General requirements.

D.4.1 SPI 0 authentication using SHA-1 and DSA/no encryption.
The SEP implementation, SPI field "0", is designed to provide message authentication for the MIL-STD-2045-47001 application header and associated user data. Security services provided by this SEP implementation include: 1) Data origin authentication; 2) Connectionless integrity; 3) Non-repudiation with proof of origin (message signature); and 4) Non-repudiation with proof of delivery (signed acknowledgment). This implementation does not provide confidentiality. Confidentiality is a security service that protects information from unauthorized disclosure through the use of data encryption.

D.4.1.1 Message Security Group.
The Message Security Group shall consist of the fields in TABLE D-I when Case 6, condition 13 and expected response 5.7.2.4.4 apply. This example depicts the construction of a response message to an originator who requested a signed acknowledgement. The values of the Authentication Data (A) and Authentication Data (B) are values, which are dependent upon the message content and signature keys of the sender and cannot be specified in this example. Values, which cannot be determined, are denoted with "ND". For the sake of simplicity it was assumed that the portion of application header proceeding Group 20, was a multiple of 8 bits, so that G20 would start a new octet.

APPENDIX D

TABLE D-I. Example construction of the SEP

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
GPI for Message Security Group	1	1	1	XXXXXXX1			
Security Parameters Information	4	0	0000	XXX0000X			
GPI for Keying Material Group	1	0	0	XX0XXXXX			
Keying Material ID Length	3	NA					
Keying Material ID	64	NA					
GPI for Cryptographic Initialization Group	1	0	0	X0XXXXXX			
Cryptographic Initialization Length	4	NA					
Cryptographic Initialization	1024	NA					
GPI for Key Token Group	1	0	0	0XXXXXXX	00000001	01	1
Key Token Length	8	NA					
FRI	1	NA					
Key Token	16384	NA					
GPI for Authentication Data (A) Group	1	1	1	XXXXXXX1			
Authentication Data (A) Length	7	4	0000100	0000100X	00001001	09	2
Authentication Data (A) (Note 1)	320	ND	10001011	11001000	11001000	C8	3
			10101100	11011000	11011000	D8	4
			00011010	11011100	11011100	DC	5
			10110110	10110110	10110110	B6	6
			01100100	00101101	00101101	2D	7
			00010000	10111010	10111010	BA	8
			01000011	10110100	10110100	B4	9
			01011100	01010101	01010101	55	10
			10110111	11010001	11010001	D1	11
			00011000	00100110	00100110	26	12
			00011111	11110100	11110100	F4	13
			10010101	01011000	01011000	58	14
			10110001	00100100	00100100	24	15
			01101010	11011111	11011111	DF	16
			10111001	01010110	01010110	56	17
			01111100	00011111	00011111	1F	18

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
			10010010	01011111	01011111	5F	19

TABLE D-I. Example construction of the SEP – Continued

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
			10110011	00110100	00110100	34	20
			01000001	11100010	11100010	E2	21
			11000000	01000001	01000001	41	22
			01000001	11000000	11000000	C0	23
			11100010	01000001	01000001	41	24
			00110100	10110011	10110011	B3	25
			01011111	10010010	10010010	92	26
			00011111	01111100	01111100	7C	27
			01010110	10111001	10111001	B9	28
			11011111	01101010	01101010	6A	29
			00100100	10110001	10110001	B1	30
			01011000	10010101	10010101	95	31
			11110100	00011111	00011111	1F	32
			00100110	00011000	00011000	18	33
			11010001	10110111	10110111	B7	34
			01010101	01011100	01011100	5C	35
			10110100	01000011	01000011	43	36
			10111010	00010000	00010000	10	37
			00101101	01100100	01100100	64	38
			10110110	10110110	10110110	B6	39
			11011100	00011010	00011010	1A	40
			11011000	10101100	10101100	AC	41
			11001000	10001011	10001011	8B	42
GPI for Authentication Data (B) Group	1	1	1	XXXXXXX1			
Authentication Data (B) Length	7	4	0000100	0000100X	00001001	09	43
Authentication Data (B) (Note 1)	320	ND	10001011	11001000	11001000	C8	44
			10101100	11011000	11011000	D8	45
			00011010	11011100	11011100	DC	46
			10110110	10110110	10110110	B6	47
			01100100	00101101	00101101	2D	48
			00010000	10111010	10111010	BA	49
			01000011	10110100	10110100	B4	50
			01011100	01010101	01010101	55	51
			10110111	11010001	11010001	D1	52

TABLE D-I. Example construction of the SEP – Continued

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
			00011000	00100110	00100110	26	53
			00011111	11110100	11110100	F4	54
			10010101	01011000	01011000	58	55
			10110001	00100100	00100100	24	56
			01101010	11011111	11011111	DF	57
			10111001	01010110	01010110	56	58
			01111100	00011111	00011111	1F	59
			10010010	01011111	01011111	5F	60
			10110011	00110100	00110100	34	61
			01000001	11100010	11100010	E2	62
			11000000	01000001	01000001	41	63
			01000001	11000000	11000000	C0	64
			11100010	01000001	01000001	41	65
			00110100	10110011	10110011	B3	66
			01011111	10010010	10010010	92	67
			00011111	01111100	01111100	7C	68
			01010110	10111001	10111001	B9	69
			11011111	01101010	01101010	6A	70
			00100100	10110001	10110001	B1	71
			01011000	10010101	10010101	95	72
			11110100	00011111	00011111	1F	73
			00100110	00011000	00011000	18	74
			11010001	10110111	10110111	B7	75
			01010101	01011100	01011100	5C	76
			10110100	01000011	01000011	43	77
			10111010	00010000	00010000	10	78
			00101101	01100100	01100100	64	79
			10110110	10110110	10110110	B6	80
			11011100	00011010	00011010	1A	81
			11011000	10101100	10101100	AC	82
			11001000	10001011	10001011	8B	83
Signed Acknowledge Request Indicator	1	1	1	XXXXXXX1			
GPI for Message Security Padding Group	1	0	0	XXXXXX0X			
Message Security Padding Length	8	NA	NA				

TABLE D-I. Example construction of the SEP – Continued

FIELD				OCTET BUFFER/STREAM			
TITLE	LENGTH (Bits)	VALUE (Dec)	VALUE (Binary) MSB 2^n LSB 2^0	FIELD FRAGMENTS MSB 2^7 LSB 2^0	OCTET VALUE (Binary) MSB 2^7 LSB 2^0	OCTET VALUE (Hex)	OCTET NO
FPI for Message Security Padding	1	NA	NA				
Message Security Padding	2040	NA	NA				

Note 1 - The values in these fields are based upon random numbers generated at the time the signature is created. It is not therefore possible to determine the actual values, which would be placed in these fields. For illustrative purposes, we have chosen the values (r and s) found in Appendix 5 of FIPS 186-2.

D.4.1.1.1 Security Parameters Information.
The Security Parameters Information (SPI) is set to "0" to identify the SEP-0 implementation.

D.4.1.1.2 Keying Material ID Length.
Confidentiality is not provided therefore Keying Material ID is not present.

D.4.1.1.3 Cryptographic Initialization Length.
Confidentiality is not provided therefore Cryptographic Initialization is not present.

D.4.1.1.4 Key Token Length.
Confidentiality is not provided therefore key tokens are not present.

D.4.1.1.5 Authentication Data (A).

D.4.1.1.5.1 Message is an original message.
The Authentication Data (A) field provides for data origin authentication, connectionless integrity and non-repudiation with proof of origin. It is generated by digitally signing the hash of both the application header and user data. The 160-bit hash is computed by the SHA-1 hashing algorithm. Note that the SHA-1 algorithm requires padding to be added to the original message to ensure it is a multiple of 512 bits, but this padding is utilized only by SHA-1 and should not be transmitted. The 320-bit signature is then computed from this 160-bit hash by the Digital Signature Algorithm (DSA). For purposes of hashing, the Authentication data (A) field shall be set to 320 zeroes; once the 320-bit signature has been generated from the 160-bit hash, the Authentication data (A) field shall be set to this 320-bit signature value. The input to the hash starts with the LSB of the first field of the application header. This corresponds with the header version field. It ends with the last byte of the uncompressed user message. When multiple user messages are present, a signature is calculated for each user message for which authentication is desired by digitally signing the hash of both the application header (with all Authentication data (A) fields zeroed out) and that particular instance of the user message.

D.4.1.1.5.2 Message is a signed acknowledgement.
When the message being prepared is a signed acknowledgement, both the Authentication data (A) and Authentication data (B) fields are required (see Section 5.7.2.1.7). Verification of Authentication Data (B) fields

shall be performed in accordance with the DSA using the original message header and user data. In this case, non-zeroed Authentication Data (A) fields of the original message are used for the hash calculation.

D.4.1.1.6 Authentication Data (B).
The Authentication Data (B) field provides for non-repudiation with proof of delivery (signed acknowledgment). It is generated by digitally signing the hash of both the entire original application header and the user data of the message being acknowledged. In this case the Authentication data (A) fields of the original message being acknowledged are included within the hash calculation. The hashing algorithm is SHA-1. The signature algorithm is the DSA. The input to the hash starts with the LSB of the first field of the original application header. This corresponds with the header version field. It ends with the last byte of the uncompressed original user data of the message being acknowledged.

D.4.1.1.7 Signed Acknowledge Request Indicator.
This field is set to “1” when the message originator is requesting a signed acknowledgment from the recipient.

D.4.1.1.8 Message Security Padding.
Confidentiality is not provided therefore GPI for Message Security Padding is “0” (not present).

APPENDIX E

DoD STANDARDIZED PROFILE IMPLEMENTATION CONFORMANCE STATEMENTS (DSPICS) REQUIREMENTS LIST (DPRL) FOR MIL-STD-2045-47001D w/CHANGE 1

E.1 General.
This appendix has two functions:

1. It provides the DoD Standardized Profile Implementation Conformance Statements (DSPICS) Requirements List (DPRL) for MIL-STD-2045-47001D w/CHANGE 1 implementations. An implementation's completed DPRL is called the DSPICS. The DSPICS states which features, capabilities and options have been implemented by any specific system built using this standard.

2. It provides a summary of which MIL-STD-2045-47001 features and capabilities are mandatory or optional. In the event that there is an apparent conflict between this appendix and the main volume, one of the following actions shall be taken:

a. The "mandatory" option shall be selected in preference to the "optional" option.

b. The matter shall be referred to the CNRWG for adjudication.

This document contains numerous essential technical parameters in the form of mandatory and optional fields where in some situations the parent capability is optional but the value is mandatory if the optional field/group is specified present. Even though the child value is mandatory, it does not mean the parent capability is mandatory. Example: The Version field is a mandatory field and valid data must be entered. In the case of the GPI for G3 (Information Address Group), it is mandatory that data must be entered in the GPI field. If GPI for G3 is specified "1" (Present) then it is mandatory that the appropriate data be specified in the GRI for R2 field. The fact that the GRI field is mandatory when the optional group G3 is specified present does not mean the GPI field must always specified "1" (Present).

The main part of this appendix is a fixed-format questionnaire divided into a number of major sub-sections; these can be divided into sub-sections, each containing a group of individual items. Answers to the questionnaire items shall be provided in the Support column by marking an answer (i.e., by check the applicable entry) to indicate a restricted choice (Yes, or No) or by entering a value or a range of values.

The DSPICS questionnaire consists of 9 main sections:

(1) Pre-Application Header Requirements
(2) MIL-STD-2045-47001D w/CHANGE 1, TABLE I, Application Header
(3) Post Application Header Receipt Requirements
(4) Cases
(5) Conditions
(6) Expected Response Requirements
(7) Special Considerations
(8) Segmentation/Reassembly Protocol
(9) Security Extension Protocol

An item number in the first column identifies each item. The second column contains the field name, statement of function, or the question to be answered. The third column contains the reference to the material that specifies the item in the main body of the standard. The fourth column records the status of the item – whether support is mandatory, optional, prohibited or conditional and fifth column for answers. The last column is to be used to list comments by their numerical endnote designator.Implementers shall show the extent of compliance by completing the DPRL. That is, compliance to all mandatory requirements and the options that are not supported are shown. If a conditional requirement is inapplicable, the “No” choice shall be used. If a mandatory requirement is not satisfied, exception information must be supplied by entering a reference note in the Notes column, to an accompanying rationale for the noncompliance.

E.1.1 Scope.
This appendix contains the minimum set of MIL-STD-2045-47001 features required for joint interoperability. It is intended to be used by a variety of personnel including system designers, procurers, implementers, developers and users. The following shall use the DSPICS:

a. The protocol implementer, as a checklist to reduce the risk of failure to conform to the standard through oversight and to inform any interested parties of the system implementation.

b. The supplier and acquirer or potential acquirer of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the standard DSPICS performa.

c. The user or potential user of the implementation, as a basis for initially checking the level of the interoperability with another implementation. (Note that while interoperability can never be guaranteed, failure to interoperate can often be predicted from incompatible DSPICSs.)

d. A protocol tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

E.1.2 Application.
This appendix is a mandatory part of MIL-STD-2045-47001.

E.2 Applicable documents.
None.

E.3 Notation.
The following notations and symbols are used in the DPRL to indicate the status of features:

STATUS SYMBOL

M	Mandatory. A field which shall contain data with each transmission of the Application Header.
M.<n>	Support of every item of the group labeled by the same numeral <n> required, but only one is active at a time.
O	Optional. A field which is not designated as a mandatory field. An optional field shall be preceded by an FPI or be nested within a group which includes a GPI.
O.<n>	Optional, <n> is the number of optional selections.
P	Item Number
P:O.<n>	Parent item number of this option and number of options related to the parent when there is more than one.
C	Conditional. Condition statements defined the conditions under which a data group, data element, or value in a data element may be used. The condition statement is very structured

	in its use.
E	Mutually Exclusive. One or another field specified must occur, but not both.
NA	Not applicable (i.e., logically impossible in the scope of the profile).
X	Excluded or prohibited.
i	Out of scope of profile (left as an implementation choice).

The O.<n> notation is used to show a set of selectable options (i.e., one or more of the set must be implemented) with the same identifier <n>.

NOTATIONS FOR CONDITIONAL STATUS

<predicate>::	This notation introduces a group of items, all of which are conditional on <predicate>.
<predicate>:	This notation introduces a single item, which is conditional on <predicate>.
<index>:	This predicate symbol means that the status following it applies only when the DSPICS states that the features identified by the index are supported. In the simplest case, <index> is the identifying tag of a single DSPICS item. The symbol <index> also may be a Boolean expression composed of several indices.
<index>::	When this group predicate is true, the associated clause should be completed.

In each case, the predicate may identify a profile feature, or a Boolean combination of predicates. ("^" is the symbol for logical negation.)

SUPPORT COLUMN SYMBOLS

Yes	Supported by the implementation.
No	Not supported by the implementation.
NA	Not applicable
The support of every item as claimed by the implementer is stated by checking the appropriate answer (Yes or No) in the support column.	

E.4 Implementation requirements.
This appendix categorizes requirements, identified by MIL-STD-2045-47001 paragraph numbers, as Mandatory, Conditional or Optional. Unless otherwise specified, the category assigned to a requirement applies to all subordinate subparagraphs for the requirement. Fully compliant systems shall implement all mandatory and conditional requirements. Minimally compliant systems shall implement all mandatory requirements and some conditional requirements as described in this appendix.

E.5 Detailed requirements.

TABLE E-I. Pre-Application header requirements

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
1.1	Application Layer	5.1	NA		
1.1.1	The application layer shall provide the simplified message-handling protocol.	5.1	M M	Yes ___ ___ No ___ ___	
1.2	Application Protocol Data Unit (PDU)	5.2	M M	Yes ___ ___ No ___ ___	
1.2.1	Application PDU shall be in accordance with FIGURE 1.	5.2	M M	Yes ___ ___ No ___ ___	
1.3	Application Header	5.3	M M	Yes ___ ___ No ___ ___	
1.3.1	Application Header shall be in accordance with TABLE I.	5.3	M M	Yes ___ ___ No ___ ___	
1.3.2	The order of fields shall follow that shown in TABLE I.	5.3	M M	Yes ___ ___ No ___ ___	
1.3.3	Shall be in multiples of 8 bits. If necessary zero fill.	5.3	M M	Yes ___ ___ No ___ ___	
1.4	Application Header Formatting	5.4	M M	Yes ___ ___ No ___ ___	
1.4.1	Application Header Formatting shall be in accordance with variable format syntax and format structure.	5.4	M M	Yes ___ ___ No ___ ___	
1.5	Syntax	5.5	M M	Yes ___ ___ No ___ ___	
1.5.1	Presence and recurrence indicators as defined below shall be allowed in groups.	5.5	M M	Yes ___ ___ No ___ ___	
1.5.2	Syntax, the following fields shall be used:	5.5	M M	Yes ___ ___ No ___ ___	
1.5.2.1	Field Presence Indicator (FPI)	5.5.1	1.5.2:M	Yes ___ ___ No ___ ___	
1.5.2.2	Field Recurrence Indicator (FRI)	5.5.2	1.5.2:M	Yes ___ ___ No ___ ___	

TABLE E-I. Pre-Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
1.5.2.2.1	If a field is preceded by an FPI, FPI = 1 shall precede the first occurrence of the FRI and is not present for following repetitions.	5.5.2	1.5.2.2:M	Yes ___ ___ No ___ ___	
1.5.2.3	Group Presence Indicator (GPI)	5.5.3	1.5.2:M	Yes ___ ___ No ___ ___	
1.5.2.3.1	FPIs, FRIs, GPIs, and GRIs shall be allowed in groups.	5.5.3	1.5.2.3:M	Yes ___ ___ No ___ ___	
1.5.2.4	Group Recurrence Indicator (GRI)	5.5.4	1.5.2:M	Yes ___ ___ No ___ ___	
1.5.2.4.1	An “R” group is repeatable and shall be preceded by a GRI.	5.5.4	1.5.2.4:M	Yes ___ ___ No ___ ___	
1.5.2.4.2	A “G” group is not repeatable and shall not be preceded by a GRI.	5.5.4	1.5.2.4:M	Yes ___ ___ No ___ ___	
1.5.2.4.3	If an “R” group is preceded by a GPI, GPI = 1 shall precede the first occurrence of the GRI and is not present for following repetitions.	5.5.4	1.5.2.4:M	Yes ___ ___ No ___ ___	
1.5.2.5	End-of-Literal Field Marker	5.5.5	M M	Yes ___ ___ No ___ ___	
1.5.2.5.1	Either the end-of-literal field marker or the field maximum length shall signify the end of a text field.	5.5.5	1.5.2.5:M	Yes ___ ___ No ___ ___	
1.5.2.5.2	The application header processing software shall be capable of recognizing both conditions.	5.5.5	1.5.2.5:M	Yes ___ ___ No ___ ___	
1.5.2.6	Data-Field Construction Procedures	5.5.6	M M	Yes ___ ___ No ___ ___	
1.5.2.6.1	All fields shall be joined LSB first.	5.5.6	1.5.2.6:M	Yes ___ ___ No ___ ___	

APPENDIX E

TABLE E-I. Pre-Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
1.5.2.6.2	The LSB of the first data field or field/group indicator shall be LSB-justified within the first byte of the message buffer.	5.5.6	1.5.2.6:M	Yes ___ ___ No ___ ___	
1.5.2.6.3	The LSB of each successive data field shall be concatenated to the MSB of the preceding data field.	5.5.6	1.5.2.6:M	Yes ___ ___ No ___ ___	
1.5.2.6.4	ASCII Data Element	5.5.6.1	1.5.2.6:M	Yes ___ ___ No ___ ___	
1.5.2.6.4.1	In a data element composed of a string of 7-bit ANSI ASCII characters, the left most character shall be stored in memory first.	5.5.6.1	1.5.2.6.4:M	Yes ___ ___ No ___ ___	
1.5.2.6.5	Binary Data Element	5.5.6.2	1.5.2.6:M	Yes ___ ___ No ___ ___	
1.5.2.6.5.1	In a data element composed of a binary code, it will be stored as a single data field.	5.5.6.2	1.5.2.6.5:M	Yes ___ ___ No ___ ___	
1.5.2.6.6	Header Format Notations	5.5.6.3	1.5.2.6:M	Yes ___ ___ No ___ ___	
1.5.2.6.6.1	The category shall display an “M” for those fields that are mandatory.	5.5.6.3.a	1.5.2.6.6:M	Yes ___ ___ No ___ ___	
1.5.2.6.7	Future Use Groups	5.5.6.4	1.5.2.6:M	Yes ___ ___ No ___ ___	
1.5.2.6.7.1	Systems have implemented version D and greater, no new fields shall be added outside these Future Use Groups	5.5.6.4	1.5.2.6.7:M	Yes ___ ___ No ___ ___	
1.5.2.6.7.2	These groups shall be specified "0" (Not Present) for MIL-STD-2045-47001D w/CHANGE 1.	5.5.6.4.a	1.5.2.6.7:M	Yes ___ ___ No ___ ___	

APPENDIX E

TABLE E-I. Pre-Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
1.5.2.6.7.3	A Future Use Group structures shall contain a mandatory Group Size field as its first field.	5.5.6.4.b	1.5.2.6.7:M	Yes ___ ___ No ___ ___	
1.5.2.6.7.4	As additional groups are added within a primary future “nested” use group, a nested group numbering scheme shall be used.	5.5.6.4.c	1.5.2.6.7:M	Yes ___ ___ No ___ ___	
1.5.2.6.7.5	Originating System to Receiving System Relationships	5.5.6.4.f	1.5.2.6.7:M	Yes ___ ___ No ___ ___	
1.5.2.6.7.5.1	A system implementing version D or later sends a message to a system implementing version C or earlier. In this case, the receiving system shall respond with a MIL-STD-2045-47001 Response with the Version field specifying “15” (Version Sent Not Implemented)	5.5.6.4.f	1.5.2.6.7.5:M	Yes ___ ___ No ___ ___	
1.5.2.6.7.5.2	A system implementing version D or later sends a message to the system implementing version D or later. In this case, the receiving system shall process the received message in accordance with paragraph 5.5.6.4.	5.5.6.4.f	1.5.2.6.7.5:M	Yes ___ ___ No ___ ___	
1.6	Application Header Formatting Rules and Construction Procedures	5.7	M M	Yes ___ ___ No ___ ___	
1.6.1	The case and condition syntax and procedures tabulated below shall be applied in the formatting and construction of the application header.	5.7	1.6:M	Yes ___ ___ No ___ ___	
1.6.1.1	Reserved Words	5.7.1.3	1.6.1:M	Yes ___ ___ No ___ ___	

APPENDIX E

TABLE E-I. Pre-Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
1.6.1.1.1	The statement always starts with "IF" and shall end with "ENDIF".	5.7.1.3	1.6.1.1:M	Yes ___ ___ No ___ ___	
1.6.1.2	Cases	5.7.1.4	1.6.1:M	Yes ___ ___ No ___ ___	
1.6.1.3	Conditions	5.7.1.5	1.6.1:M	Yes ___ ___ No ___ ___	
1.6.1.4	Defaults	5.7.1.6	1.6.1:M	Yes ___ ___ No ___ ___	
1.6.1.5	Expected Responses	5.7.1.7	1.6.1:M	Yes ___ ___ No ___ ___	
1.6.1.5.1	The expected response by the system receiving an application header will depend on the content of the header fields and shall be stated as it relates to the case and conditionality statements for the header.	5.7.1.7	1.6.1.5:M	Yes ___ ___ No ___ ___	
1.6.1.6	Special Considerations	5.7.1.8	1.6.1:M	Yes ___ ___ No ___ ___	
1.7	User Data	5.7.3	M M	Yes ___ ___ No ___ ___	
1.8	Message Acknowledgments	5.7.4	M M	Yes ___ ___ No ___ ___	
1.8.1	Acknowledgment Header Format	5.7.4.1	1.8:M	Yes ___ ___ No ___ ___	
1.8.1.1	A receiving station shall respond to the originator by sending an acknowledgment header.	5.7.4.1	1.8.1:M	Yes ___ ___ No ___ ___	
1.8.1.2	The acknowledgment header consists of the following groups and fields	5.7.4.1	1.8.1:M	Yes ___ ___ No ___ ___	
1.8.1.2.1	Acknowledgment originator address group (G1)	5.7.4.1.a	1.8.1:M	Yes ___ ___ No ___ ___	
1.8.1.2.2	Acknowledgment recipient address group (R1)	5.7.4.1.b	1.8.1:M	Yes ___ ___ No ___ ___	
1.8.1.2.3	Message Handling Group (R3)	5.7.4.1.c	1.8.1:M	Yes ___ ___ No ___ ___	

TABLE E-I. Pre-Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
1.8.1.2.3.1	Within Message Handling Group, the Response Data Group (G13), shall include the DTG of message being acknowledged and the R/C field.	5.7.4.1.c	1.8.1:M	Yes ___ ___ No ___ ___	
1.8.2	Message Accountability	5.7.4.2	1.8:M	Yes ___ ___ No ___ ___	
1.8.2.1	The application header shall be used for the detection of duplicate messages and to associate an acknowledgment header with the original requesting message.	5.7.4.2	1.8.2:M	Yes ___ ___ No ___ ___	
1.8.2.2	The originator shall guarantee the uniqueness of this combination of fields by ensuring that no original message is transmitted having the same DTG and DTG Extension.	5.7.4.2	1.8.2:M	Yes ___ ___ No ___ ___	
1.8.2.3	Any duplicate messages (including retransmitted messages) shall be acknowledged if required and shall otherwise be ignored (discarded).	5.7.4.2.a	1.8.2:M	Yes ___ ___ No ___ ___	
1.8.2.4	Acknowledgment headers that match original messages shall be processed; unmatched Acknowledgment headers shall be ignored (discarded).	5.7.4.2.b	1.8.2:M	Yes ___ ___ No ___ ___	
1.8.3	Message Retransmission	5.7.4.3	1.8:M	Yes ___ ___ No ___ ___	

TABLE E-I. Pre-Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
1.8.3.1	A retransmission capability shall be provided to enable the automatic retransmission of a message that has not received an acknowledgment when one was requested.	5.7.4.3	1.8.3:M	Yes ___ ___ No ___ ___	
1.8.3.2	Automatic Retransmissions shall only apply if a machine acknowledgment is requested.	5.7.4.3	1.8.3:M	Yes ___ ___ No ___ ___	
1.8.3.3	The number of automatic retransmissions shall be selectable with a range of 0 to 3.	5.7.4.3.a	1.8.3:M	Yes ___ ___ No ___ ___	
1.8.3.4	The parameter governing the number of retransmissions shall be separately selectable for each Originator DTG/DTG Extension combination.	5.7.4.3.a	1.8.3:M	Yes ___ ___ No ___ ___	
1.8.3.5	A timer shall be provided to schedule the automatic retransmission.	5.7.4.3.b	1.8.3:M	Yes ___ ___ No ___ ___	
1.8.3.6	An expiration timer shall be selectable with a range of 5 to 600 seconds.	5.7.4.3.b	1.8.3:M	Yes ___ ___ No ___ ___	
1.8.3.7	Upon expiration of the timer, provided an acknowledgment has not been received, the message shall be retransmitted by the originating system.	5.7.4.3.b	1.8.3:M	Yes ___ ___ No ___ ___	

TABLE E-I. Pre-Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
1.8.3.8	If an acknowledgment is not received prior to expiration of the timer on the final retransmission, the operator shall be notified.	5.7.4.3.b	1.8.3:M	Yes ___ ___ No ___ ___	
1.8.3.9	Messages containing perishable data and requiring acknowledgment shall have the Perishability DTG set to a time later than the retransmit timeout.	5.7.4.3.b	1.8.3:M	Yes ___ ___ No ___ ___	
1.9	Processing Factors	5.8	M M	Yes ___ ___ No ___ ___	
1.9.1	Application Process	5.8.1	1.9:M	Yes ___ ___ No ___ ___	
1.9.1.1	The application process shall provide the application layer the bit-oriented or character-oriented messages that satisfy information exchange requirements.	5.8.1	1.9.1:M	Yes ___ ___ No ___ ___	
1.9.2	Message Formats	5.8.2	1.9:M	Yes ___ ___ No ___ ___	
1.9.2.1	The message formats shall be user-defined.	5.8.2	1.9.2:M	Yes ___ ___ No ___ ___	
1.9.3	Quality of Service (QOS)	5.8.3.3	O O	Yes ___ ___ No ___ ___	
1.9.3.1	Message Size Threshold shall be a parameter with a range of 1 to 1,048,575 bytes.	5.8.3.3	1.9.3:M	Yes ___ ___ No ___ ___	
1.9.3.2	Perish shall be a parameter with a range of 1 to 10800 seconds.	5.8.3.3	1.9.3:M	Yes ___ ___ No ___ ___	
1.9.4	Destination Port Number	5.8.3.7	M M	Yes ___ ___ No ___ ___	

TABLE E-I. Pre-Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
1.9.4.1	This “mil-2045-47001” port (1581) shall be passed as the destination port parameter value to the lower layer protocol when exchanging UMF defined in TABLE IV.	5.8.3.7	1.9.4:M	Yes ___ ___ No ___ ___	
1.9.4.2	TABLE XVII shows the port numbers that shall be used for IP/UDP data exchanges using the “47001” ALP.	5.8.3.7	1.9.4:M	Yes ___ ___ No ___ ___	
1.10	Application Header Padding	5.8.4	M M	Yes ___ ___ No ___ ___	
1.10.1	The application header shall always be a multiple of 8 bits.	5.8.4	1.7:M	Yes ___ ___ No ___ ___	
1.10.2	If an application header is not a multiple of 8 bits, it shall be zero-filled so that it becomes a multiple of 8 bits.	5.8.4	1.7:M	Yes ___ ___ No ___ ___	
1.10.3	This field shall be variable in size 0 - 7 bits.	5.8.4	1.7:M	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.1	VERSION	5.6.1 5.7.2.5.2	M M	Yes ___ ___ No ___ ___	
2.1.a	MIL-STD-2045-47001	5.6.1	2.1:O.<6>	Yes ___ ___ No ___ ___	
2.1.b	MIL-STD-2045-47001B	5.6.1	2.1:O.<6>	Yes ___ ___ No ___ ___	
2.1.c	MIL-STD-2045-47001C	5.6.1	2.1:O.<6>	Yes ___ ___ No ___ ___	
2.1.d	MIL-STD-2045-47001D	5.6.1 5.7.2.1.9	2.1:O.<6>	Yes ___ ___ No ___ ___	
2.1.e	MIL-STD-2045-47001D w/CHANGE 1	5.6.1 5.7.2.1.9	2.1:O.<6>	Yes ___ ___ No ___ ___	
2.1.f	VERSION SENT NOT	5.6.1	2.1:O.<6>	Yes ___ ___	

	IMPLEMENTED	5.7.2.5.2		No ___ ___	
2.2	FPI	5.5.1 5.7.2.1.5 5.7.2.5.2 5.7.2.5.10	M M	Yes ___ ___ No ___ ___	
2.2.a	NOT PRESENT	5.5.1	2.2:M.<2>	Yes ___ ___ No ___ ___	
2.2.b	PRESENT	5.5.1	2.2:M.<2>	Yes ___ ___ No ___ ___	
2.2.1	DATA COMPRESSION TYPE	5.6.2	O M	Yes ___ ___ No ___ ___	
2.2.1.a	UNIX COMPRESS/ UNCOMPRESS	5.6.2	2.2.1:O	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.2.1.b	GZIP	5.6.2	2.2.1:M	Yes ___ ___ No ___ ___	
2.3	GPI FOR G1 (ORIGINATOR ADDRESS GROUP)	5.5.3 5.6.3 5.7.2.1.2 5.7.2.2.1 5.7.2.5.2 5.7.2.5.6	M M	Yes ___ ___ No ___ ___	
2.3.a	NOT PRESENT	5.5.3	2.3:M.<2>	Yes ___ ___ No ___ ___	
2.3.b	PRESENT	5.5.3	2.3:M.<2>	Yes ___ ___ No ___ ___	
2.3.1	FPI	5.5.1 5.7.2.2.2 5.7.2.2.5	2.3:M	Yes ___ ___ No ___ ___	
2.3.1.a	NOT PRESENT	5.5.1	2.3.1:M.<2>	Yes ___ ___ No ___ ___	
2.3.1.b	PRESENT	5.5.1	2.3.1:M.<2>	Yes ___ ___ No ___ ___	
2.3.1.1	URN	5.6.3.1 A.3.1	2.3.1.b:M 2.3.2.b:E	Yes ___ ___ No ___ ___	
2.3.2	FPI	5.5.1 5.7.2.2.3 5.7.2.2.4	2.3:M	Yes ___ ___ No ___ ___	
2.3.2.a	NOT PRESENT	5.5.1	2.3.2:M.<2>	Yes ___ ___ No ___ ___	
2.3.2.b	PRESENT	5.5.1	2.3.2:M.<2>	Yes ___ ___ No ___ ___	
2.3.2.1	UNIT NAME	5.6.3.2	2.3.2.b:M 2.3.1.b:E	Yes ___ ___ No ___ ___	
2.4	GPI FOR G2 (RECIPIENT ADDRESS GROUP)	5.5.3 5.6.3 5.7.2.1.2 5.7.2.5.2 5.7.2.5.3 5.7.2.5.6	M M	Yes ___ ___ No ___ ___	
2.4.a	NOT PRESENT	5.5.3	2.4:M.<2>	Yes ___ ___ No ___ ___	
2.4.b	PRESENT	5.5.3	2.4:M.<2>	Yes ___ ___ No ___ ___	
2.4.1.1	GRI FOR R1 (0<=N<=16)	5.5.4 5.7.2.1.2	2.4.b:M	Yes ___ ___ No ___ ___	
2.4.1.1.a	NOT REPEATED	5.5.4	2.4.1.1:M.<2>	Yes ___ ___ No ___ ___	

APPENDIX E

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.4.1.1.b	REPEATED	5.5.4	2.4.1.1:M.<2>	Yes ___ ___ No ___ ___	
2.4.1.1.1	The recipient and information addressee fields shall be extendible to a combined total of 16 addressees.	5.6.3a.	2.4.1.1:M	Yes ___ ___ No ___ ___	
2.4.1.2	FPI	5.5.1 5.7.2.2.2 5.7.2.2.5	O M	Yes ___ ___ No ___ ___	
2.4.1.2.a	NOT PRESENT	5.5.1	2.4.1.2:M.<2>	Yes ___ ___ No ___ ___	
2.4.1.2.b	PRESENT	5.5.1	2.4.1.2:M.<2>	Yes ___ ___ No ___ ___	
2.4.1.2.1	URN	5.6.3.1 A.3.1	2.4.1.2.b:M 2.4.1.3.1:E	Yes ___ ___ No ___ ___	
2.4.1.3	FPI	5.5.1 5.7.2.2.3 5.7.2.2.4	O M	Yes ___ ___ No ___ ___	
2.4.1.3.a	NOT PRESENT	5.5.1	2.4.1.3:M.<2>	Yes ___ ___ No ___ ___	
2.4.1.3.b	PRESENT	5.5.1	2.4.1.3:M.<2>	Yes ___ ___ No ___ ___	
2.4.1.3.1	UNIT NAME	5.6.3.2	2.4.1.3.b:M 2.4.1.2.1:E	Yes ___ ___ No ___ ___	
2.5	GPI FOR G3 (INFORMATION ADDRESS GROUP)	5.5.3 5.6.3 5.7.2.1.2 5.7.2.5.3 5.7.2.5.6	M M	Yes ___ ___ No ___ ___	
2.5.a	NOT PRESENT	5.5.3	2.5:M.<2>	Yes ___ ___ No ___ ___	
2.5.b	PRESENT	5.5.3	2.5:M.<2>	Yes ___ ___ No ___ ___	
2.5.1.1	GRI FOR R2 (16 – N)	5.5.4	2.5.b:M	Yes ___ ___ No ___ ___	
2.5.1.1.a	NOT REPEATED	5.5.4	2.5.1.1:M.<2>	Yes ___ ___ No ___ ___	
2.5.1.1.b	REPEATED	5.5.4	2.5.1.1:M.<2>	Yes ___ ___ No ___ ___	
2.5.1.1.1	The recipient and information addressee fields shall be extendible to a combined total of 16 addressees.	5.6.3.a.	2.5.1.1:M	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.5.1.2	FPI	5.5.1 5.7.2.2.2 5.7.2.2.5	O M	Yes ___ ___ No ___ ___	
2.5.1.2.a	NOT PRESENT	5.5.1	2.5.1.2:M.<2>	Yes ___ ___ No ___ ___	
2.5.1.2.b	PRESENT	5.5.1	2.5.1.2:M.<2>	Yes ___ ___ No ___ ___	
2.5.1.2.1	URN	5.6.3.1 A.3.1	2.5.1.2.b:M 2.5.1.3.1:E	Yes ___ ___ No ___ ___	
2.5.1.3	FPI	5.5.1 5.7.2.2.3 5.7.2.2.4	O M	Yes ___ ___ No ___ ___	
2.5.1.3.a	NOT PRESENT	5.5.1	2.5.1.3:M.<2>	Yes ___ ___ No ___ ___	
2.5.1.3.b	PRESENT	5.5.1	2.5.1.3:M.<2>	Yes ___ ___ No ___ ___	
2.5.1.3.1	UNIT NAME	5.6.3.2	2.5.1.3.b:M 2.5.1.2.1:E	Yes ___ ___ No ___ ___	
2.6	FPI	5.5.1	M M	Yes ___ ___ No ___ ___	
2.6.a	NOT PRESENT	5.5.1	2.6:M.<2>	Yes ___ ___ No ___ ___	
2.6.b	PRESENT	5.5.1	2.6:M.<2>	Yes ___ ___ No ___ ___	
2.6.1	HEADER SIZE	5.6.27 5.7.2.2.7 5.7.2.5.5 5.7.2.5.6	2.6.b:M 6.5:M 6.6:M 6.12:M	Yes ___ ___ No ___ ___	
2.7	GPI FOR G4 (FUTURE USE 1)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.7.a	NOT PRESENT	5.5.3	2.7:M.<2>	Yes ___ ___ No ___ ___	
2.7.b	PRESENT	5.5.3	2.7:E.<2>	Yes ___ ___ No ___ ___	
2.7.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.8	GPI FOR G5 (FUTURE USE 2)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.8.a	NOT PRESENT	5.5.3	2.8:M.<2>	Yes ___ ___ No ___ ___	
2.8.b	PRESENT	5.5.3	2.8:E.<2>	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.8.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.9	GPI FOR G6 (FUTURE USE 3)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.9.a	NOT PRESENT	5.5.3	2.9:M.<2>	Yes ___ ___ No ___ ___	
2.9.b	PRESENT	5.5.3	2.9:E.<2>	Yes ___ ___ No ___ ___	
2.9.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.10	GPI FOR G7 (FUTURE USE 4)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.10.a	NOT PRESENT	5.5.3	2.10:M.<2>	Yes ___ ___ No ___ ___	
2.10.b	PRESENT	5.5.3	2.10:E.<2>	Yes ___ ___ No ___ ___	
2.10.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.11	GPI FOR G8 (FUTURE USE 5)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.11.a	NOT PRESENT	5.5.3	2.11:M.<2>	Yes ___ ___ No ___ ___	
2.11.b	PRESENT	5.5.3	2.11:E.<2>	Yes ___ ___ No ___ ___	
2.11.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.12.1	GRI FOR R3 (MESSAGE HANDLING GROUP) (16)	5.5.4 5.6.9 5.7.2.1.2 5.7.2.2.7 5.7.2.5.5 5.7.2.5.6	M M	Yes ___ ___ No ___ ___	
2.12.1.a	NOT REPEATED	5.5.4	2.12.1:M.<2>	Yes ___ ___ No ___ ___	
2.12.1.b	REPEATED	5.5.4	2.12.1:M.<2>	Yes ___ ___ No ___ ___	
2.12.2	UMF	5.6.4	M M	Yes ___ ___ No ___ ___	
2.12.2.a	LINK 16 (J-SERIES)	5.6.4	2.12.2:O.<9>	Yes ___ ___ No ___ ___	
2.12.2.b	BINARY FILE	5.6.4.1 5.7.2.1.3	2.12.2:O.<9>	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.2.c	VARIABLE MESSAGE FORMAT (VMF) (K-SERIES)	5.6.4	2.12.2:O.<9>	Yes ___ ___ No ___ ___	
2.12.2.d	NATIONAL IMAGERY TRANSMISSION FORMAT SYSTEM (NITFS)	5.6.4 5.6.4.7	2.12.2:O.<9>	Yes ___ ___ No ___ ___	
2.12.2.e	REDISTRIBUTED MESSAGE	5.6.4.2 5.7.2.1.4	2.12.2:O.<9>	Yes ___ ___ No ___ ___	
2.12.2.e.1	Redistributed Messages shall be indicated by a UMF field of ‘4’ (0100)	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.e.2	A Redistributed Message shall consist of two components: the Original Message and the Redistribution Header	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.e.3	When a station forwards a message, the Original Message (the entire Application PDU, i.e. the Application Header plus the User Data) shall be placed in the User Data portion of the Redistributed Message	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.e.4	The Application Header and User Data of the Original Message shall not be modified	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.e.5	The Redistribution Header shall contain the address of the station performing the message forwarding as the Originator Address	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.e.6	The Redistribution Header shall set the UMF field to Redistributed Message	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.2.e.7	The Redistribution Header shall use the same Operation Indicator, Security Classification, and Control/Release Marking that were contained in the Original Message Application Header	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.e.8	When a station receives a message containing a UMF field indicating a Redistributed Message, it shall process the Redistribution Header accordingly and then continue to process the Original Message	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.e.9	The destination shall process the Original Message even though it is not specified in the destination address list of the Original Message	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.e.10	The destination shall respond to any actions required by the Acknowledgment Request Group (G12) indicated in the Redistribution Header	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.e.11	The destination shall not respond to any actions required by the Acknowledgment Request Group (G12) indicated in the Application Header of the Original Message	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.2.e.12	If the optional Redistributed Message capability is implemented in a system, there shall be a mechanism for the Application Layer to process both the Redistribution Header and the Original Message Application Header, and to indicate that the received message was redistributed	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.e.13	For Redistributed Messages, the GPI for the VMF Message Identification Group (G9) shall be set to 0	5.6.4.2	2.12.2.e:M	Yes ___ ___ No ___ ___	
2.12.2.f	UNITED STATES MESSAGE TEXT FORMAT (USMTF)	5.6.4.3	2.12.2:O.<9>	Yes ___ ___ No ___ ___	
2.12.2.g	DOI-103	5.6.4.4	2.12.2:O.<9>	Yes ___ ___ No ___ ___	
2.12.2.h	XML-MTF	5.6.4.5	2.12.2:O.<9>	Yes ___ ___ No ___ ___	
2.12.2.i	XML-VMF	5.6.4.6	2.12.2:O.<9>	Yes ___ ___ No ___ ___	
2.12.3	FPI	5.5.1	M M	Yes ___ ___ No ___ ___	
2.12.3.a	NOT PRESENT	5.5.1	2.12.3:M.<2>	Yes ___ ___ No ___ ___	
2.12.3.b	PRESENT	5.5.1	2.12.3:M.<2>	Yes ___ ___ No ___ ___	
2.12.3.1	MESSAGE STANDARD VERSION	5.6.4.8	2.12.3.b:M	Yes ___ ___ No ___ ___	
2.12.4	GPI FOR G9 (VMF MESSAGE IDENTIFICATION GROUP)	5.5.3 5.7.2.1.2 5.7.2.1.3	2.12.2.c:M	Yes ___ ___ No ___ ___	
2.12.4.a	NOT PRESENT	5.5.3	2.12.4:M.<2>	Yes ___ ___ No ___ ___	
2.12.4.b	PRESENT	5.5.3	2.12.4:M.<2>	Yes ___ ___ No ___ ___	

APPENDIX E

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.4.1	FAD	5.6.5 A.3.2	2.12.2.c:M 2.12.4.b:M	Yes ___ ___ No ___ ___	
2.12.4.2	MESSAGE NUMBER	5.6.6	2.12.2.c:M 2.12.4.b:M	Yes ___ ___ No ___ ___	
2.12.4.3	FPI	5.5.1 5.7.2.5.7	2.12.2.c:M 2.12.4.1:M 2.12.4.2:M	Yes ___ ___ No ___ ___	
2.12.4.3.a	NOT PRESENT	5.5.1	2.12.4.3:M.<2>	Yes ___ ___ No ___ ___	
2.12.4.3.b	PRESENT	5.5.1	2.12.4.3:M.<2> 2.12.2.c:O 2.12.4.1:O 2.12.4.2:O 6.7:M	Yes ___ ___ No ___ ___	
2.12.4.3.1	MESSAGE SUBTYPE	5.6.7 A.3.4	2.12.4.3.b:M	Yes ___ ___ No ___ ___	
2.12.5	FPI	5.5.1 5.7.2.1.2	M M	Yes ___ ___ No ___ ___	
2.12.5.a	NOT PRESENT	5.5.1	2.12.5:M.<2>	Yes ___ ___ No ___ ___	
2.12.5.b	PRESENT	5.5.1	2.12.5:M.<2> 2. 12.2.b:O	Yes ___ ___ No ___ ___	
2.12.5.1	FILE NAME	5.6.8	2.12.5.b:M 2.12.2.b:M	Yes ___ ___ No ___ ___	
2.12.6	FPI	5.5.1 5.7.2.1.2 5.7.2.2.7 5.7.2.5.5 5.7.2.5.6	2.2:M 2. 12.1:M	Yes ___ ___ No ___ ___	
2.12.6.a	NOT PRESENT	5.5.1	2.12.6:M.<2>	Yes ___ ___ No ___ ___	
2.12.6.b	PRESENT	5.5.1	2.12.6:M.<2>	Yes ___ ___ No ___ ___	
2.12.6.1	MESSAGE SIZE	5.6.9 5.7.2.2.7 5.7.2.5.5 5.7.2.5.6	2.12.6.b:M 6.5:M 6.6:M 6.12:M	Yes ___ ___ No ___ ___	
2.12.7	OPERATION INDICATOR	5.6.10	M M	Yes ___ ___ No ___ ___	
2.12.8	RETRANSMIT INDICATOR	5.6.11 5.7.2.2.17	M M	Yes ___ ___ No ___ ___	
2.12.8.a	NOT A RETRANSMITTED MESSAGE	5.6.11	2.12.8:O.<2>	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.8.b	RETRANSMITTED MESSAGE	5.6.11 5.7.2.2.17	2.12.8:O.<2>	Yes ___ ___ No ___ ___	
2.12.9	MESSAGE PRECEDENCE CODE	5.6.12	M M	Yes ___ ___ No ___ ___	
2.12.10	SECURITY CLASSIFICATION	5.6.13	M M	Yes ___ ___ No ___ ___	
2.12.11	FPI	5.5.1 5.7.2.1.2	M M	Yes ___ ___ No ___ ___	
2.12.11.a	NOT PRESENT	5.5.1	2.12.11:M.<2>	Yes ___ ___ No ___ ___	
2.12.11.b	PRESENT	5.5.1	2.12.11:M.<2>	Yes ___ ___ No ___ ___	
2.12.11.1	CONTROL/RELEASE MARKING	5.6.14	2.12.11.b:M	Yes ___ ___ No ___ ___	
2.12.12	GPI FOR G10 (ORIGINATOR DTG)	5.5.3 5.6.15 5.7.2.1.2 5.7.2.2.11 5.7.2.2.17	M M 2.12.8.b:M 2.12.14.1:M 2.12.14.2:M	Yes ___ ___ No ___ ___	
2.12.12.a	NOT PRESENT	5.5.3	2.12.12:M.<2>	Yes ___ ___ No ___ ___	
2.12.12.b	PRESENT	5.5.3	2.12.12:M.<2>	Yes ___ ___ No ___ ___	
2.12.12.1	YEAR	5.6.15	2.12.12.b:M	Yes ___ ___ No ___ ___	
2.12.12.2	MONTH	5.6.15	2.12.12.b:M	Yes ___ ___ No ___ ___	
2.12.12.3	DAY	5.6.15	2.12.12.b:M	Yes ___ ___ No ___ ___	
2.12.12.4	HOUR	5.6.15	2.12.12.b:M	Yes ___ ___ No ___ ___	
2.12.12.5	MINUTE	5.6.15	2.12.12.b:M	Yes ___ ___ No ___ ___	
2.12.12.6	SECOND	5.6.15	2.12.12.b:M	Yes ___ ___ No ___ ___	
2.12.12.7	FPI	5.5.1 5.7.2.5.4	2.12.12.b:M	Yes ___ ___ No ___ ___	
2.12.12.7.a	NOT PRESENT	5.5.1	2.12.12.7:M.<2>	Yes ___ ___ No ___ ___	
2.12.12.7.b	PRESENT	5.5.1	2.12.12.7:M.<2>	Yes ___ ___ No ___ ___	
2.12.12.7.1	DTG EXTENSION	5.6.16	2.12.12.7.b:M	Yes ___ ___ No ___ ___	

APPENDIX E

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.13	GPI FOR G11 (PERISHABILITY DTG)	5.5.3 5.6.17 5.7.2.1.2 5.7.2.5.1	O M	Yes ___ ___ No ___ ___	
2.12.13.a	NOT PRESENT	5.5.3	2.12.13:M.<2>	Yes ___ ___ No ___ ___	
2.12.13.b	PRESENT	5.5.3	2.12.13:M.<2>	Yes ___ ___ No ___ ___	
2.12.13.1	YEAR	5.6.15	2.12.13.b:M	Yes ___ ___ No ___ ___	
2.12.13.2	MONTH	5.6.15	2.12.13.b:M	Yes ___ ___ No ___ ___	
2.12.13.3	DAY	5.6.15	2.12.13.b:M	Yes ___ ___ No ___ ___	
2.12.13.4	HOUR	5.6.15	2.12.13.b:M	Yes ___ ___ No ___ ___	
2.12.13.5	MINUTE	5.6.15	2.12.13.b:M	Yes ___ ___ No ___ ___	
2.12.13.6	SECOND	5.6.15	2.12.13.b:M	Yes ___ ___ No ___ ___	
2.12.14	GPI FOR G12 (ACKNOWLEDGMENT REQUEST GROUP)	5.5.3 5.7.2.1.2 5.7.2.2.1 5.7.2.2.14 5.7.2.2.15 5.7.2.5.8	M M	Yes ___ ___ No ___ ___	
2.12.14.a	NOT PRESENT	5.5.3	2.12.14:M.<2>	Yes ___ ___ No ___ ___	
2.12.14.b	PRESENT	5.5.3	2.12.14:M.<2>	Yes ___ ___ No ___ ___	
2.12.14.1	MACHINE ACKNOWLEDGE REQUEST INDICATOR	5.6.18 5.7.2.2.11 5.7.2.2.15 5.7.2.5.1 5.7.4.1	2.12.14.b:M	Yes ___ ___ No ___ ___	
2.12.14.2	OPERATOR ACKNOWLEDGE REQUEST INDICATOR	5.6.19 5.7.2.2.11 5.7.2.2.15 5.7.2.5.2	2.12.14.b:M	Yes ___ ___ No ___ ___	
2.12.14.3	OPERATOR REPLY REQUEST INDICATOR	5.6.20 5.7.2.2.11 5.7.2.5.3	2.12.14.b:M	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.15	GPI FOR G13 (RESPONSE DATA GROUP)	5.5.3 5.6.21 5.7.2.1.1 5.7.2.1.2 5.7.2.1.5 5.7.2.5.9	4.1.2:M	Yes ___ ___ No ___ ___	
2.12.15.a	NOT PRESENT	5.5.3	2.12.15:M.<2>	Yes ___ ___ No ___ ___	
2.12.15.b	PRESENT	5.5.3	2.12.15:M.<2>	Yes ___ ___ No ___ ___	
2.12.15.1	YEAR (DTG OF MESSAGE BEING ACKNOWLEDGED)	5.6.15	2.12.15.b:M	Yes ___ ___ No ___ ___	
2.12.15.2	MONTH	5.6.15	2.12.15.b:M	Yes ___ ___ No ___ ___	
2.12.15.3	DAY	5.6.15	2.12.15.b:M	Yes ___ ___ No ___ ___	
2.12.15.4	HOUR	5.6.15	2.12.15.b:M	Yes ___ ___ No ___ ___	
2.12.15.5	MINUTE	5.6.15	2.12.15.b:M	Yes ___ ___ No ___ ___	
2.12.15.6	SECOND	5.6.15	2.12.15.b:M	Yes ___ ___ No ___ ___	
2.12.15.7	FPI	5.5.1 5.7.2.5.9	2.12.15.b:M	Yes ___ ___ No ___ ___	
2.12.15.7.a	NOT PRESENT	5.5.1	2.12.15.7:M.<2>	Yes ___ ___ No ___ ___	
2.12.15.7.b	PRESENT	5.5.1	2.12.15.7:M.<2>	Yes ___ ___ No ___ ___	
2.12.15.7.1	DTG EXTENSION	5.6.16	2.12.15.7.b:M 4.1.2:M 6.8:M	Yes ___ ___ No ___ ___	
2.12.15.8	R/C	5.6.22 5.7.2.4.1	4.1.2:M	Yes ___ ___ No ___ ___	
2.12.15.8.a	MACHINE RECEIPT [MR]	5.6.22 5.7.2.2.8 5.7.2.2.9	2.12.15.8:M.<6>	Yes ___ ___ No ___ ___	
2.12.15.8.b	CANNOT PROCESS [CANTPRO]	5.6.22 5.7.2.2.8 5.7.2.4.1 5.7.2.4.2 5.7.2.4.3 5.7.2.4.4 5.7.2.5.1	2.12.15.8:M.<6>	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.15.8.c	OPERATOR ACKNOWLEDGE [OPRACK]	5.6.22 5.7.2.2.8 5.7.2.2.9 5.7.2.4.2	2.12.15.8:M.<6>	Yes ___ ___ No ___ ___	
2.12.15.8.d	WILL COMPLY [WILCO]	5.6.22 5.7.2.2.8 5.7.2.2.9 5.7.2.4.3	2.12.15.8:M.<6>	Yes ___ ___ No ___ ___	
2.12.15.8.e	HAVE COMPLIED [HAVCO]	5.6.22 5.7.2.2.8 5.7.2.2.9 5.7.2.4.3	2.12.15.8:M.<6>	Yes ___ ___ No ___ ___	
2.12.15.8.f	CANNOT COMPLY [CANTCO]	5.6.22 5.7.2.2.9 5.7.2.4.3	2.12.15.8:M.<6>	Yes ___ ___ No ___ ___	
2.12.15.9	FPI	5.5.1	M M	Yes ___ ___ No ___ ___	
2.12.15.9.a	NOT PRESENT	5.5.1	2.12.15.9:M.<2> 4.2.8:M	Yes ___ ___ No ___ ___	
2.12.15.9.b	PRESENT	5.5.1	2.12.15.9:M.<2> 2.12.15.8.f:O	Yes ___ ___ No ___ ___	
2.12.15.9.1	CANTCO REASON CODE	5.6.23 5.7.2.2.8 A.3.5	2.12.15.9.b:M	Yes ___ ___ No ___ ___	
2.12.15.9.1.a	COMMUNICATIONS PROBLEM	5.6.23 A.3.5	2.12.15.9.1:O.<8>	Yes ___ ___ No ___ ___	
2.12.15.9.1.b	AMMUNITION PROBLEM	5.6.23 A.3.5	2.12.15.9.1:O.<8>	Yes ___ ___ No ___ ___	
2.12.15.9.1.c	PERSONNEL PROBLEM	5.6.23 A.3.5	2.12.15.9.1:O.<8>	Yes ___ ___ No ___ ___	
2.12.15.9.1.d	FUEL PROBLEM	5.6.23 A.3.5	2.12.15.9.1:O.<8>	Yes ___ ___ No ___ ___	
2.12.15.9.1.e	TERRAIN/ENVIRONM ENT PROBLEM	5.6.23 A.3.5	2.12.15.9.1:O.<8>	Yes ___ ___ No ___ ___	
2.12.15.9.1.f	EQUIPMENT PROBLEM	5.6.23 A.3.5	2.12.15.9.1:O.<8>	Yes ___ ___ No ___ ___	
2.12.15.9.1.g	TACTICAL SITUATION PROBLEM	5.6.23 A.3.5	2.12.15.9.1:O.<8>	Yes ___ ___ No ___ ___	
2.12.15.9.1.h	OTHER	5.6.23 A.3.5	2.12.15.9.1:O.<8>	Yes ___ ___ No ___ ___	
2.12.15.10	FPI	5.5.1 5.7.2.2.9	M M	Yes ___ ___ No ___ ___	
2.12.15.10.a	NOT PRESENT	5.5.1	2.12.15.10:M.<2> 4.2.9:M	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.15.10.b	PRESENT	5.5.1	2.12.15.10:M.<2> 2. 12.15.8.b:O	Yes ___ ___ No ___ ___	
2.12.15.10.1	CANTPRO REASON CODE	5.6.24 A.3.6	2.12.15.10.b:M	Yes ___ ___ No ___ ___	
2.12.15.10.1.a	FIELD CONTENT INVALID	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.b	MESSAGE INCORRECTLY ROUTED	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.c	ADDRESS INACTIVE	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.d	REFERENCE POINT UNKNOWN TO RECEIVING AGENCY	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.e	FIRE UNITS SHALL BE CONTROLLED BY RECEIVING AGENCY	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.f	MISSION SHALL BE CONTROLLED BY RECEIVING AGENCY	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.g	MISSION NUMBER UNKNOWN BY RECEIVING AGENCY	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.h	TARGET NUMBER UNKNOWN BY RECEIVING AGENCY	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.i	SCHEDULE NUMBER UNKNOWN BY RECEIVING AGENCY	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.j	INCORRECT CONTROLLING ADDRESS FOR A GIVEN TRACK NUMBER	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.k	TRACK NUMBER NOT IN OWN TRACK FILE	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.l	INVALID ACCORDING TO GIVEN FIELD	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.m	MESSAGE CANNOT BE CONVERTED	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.n	AGENCY FILE FULL	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.15.10.1.o	AGENCY DOES NOT RECOGNIZE THIS MESSAGE NUMBER	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.p	AGENCY CANNOT CORRELATE MESSAGE TO CURRENT FILE CONTENT	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.q	AGENCY LIMIT EXCEEDED ON REPEATED FIELDS OR GROUPS	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.r	AGENCY COMPUTER SYSTEM INACTIVE	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.s	ADDRESSEE UNKNOWN	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.t	CAN'T FORWARD (AGENCY FAILURE)	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.u	CAN'T FORWARD (LINK FAILURE)	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.v	ILLOGICAL JUXTAPOSITION OF HEADER FIELDS	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.w	CANNOT UNCOMPRESS UNIX (LZW) COMPRESSED DATA	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.x	CANNOT UNCOMPRESS LZ-77 COMPRESSED DATA	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.y	MESSAGE TO OLD, BASED ON PERISHABILITY	5.6.24 5.7.2.5.1 A.3.6	2.12.15.10.1:O.<32> 6.1:M	Yes ___ ___ No ___ ___	
2.12.15.10.1.z	SECURITY LEVEL RESTRICTION	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.aa	AUTHENTICATION FAILURE	5.6.24 5.7.2.4.4 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.bb	CERTIFICATE NOT FOUND	5.6.24 5.7.2.4.4 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.cc	CERTIFICATE INVALID	5.6.24 5.7.2.4.4 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.15.10.1.dd	DO NOT SUPPORT THIS SPI VALUE	5.6.24 5.7.2.4.4 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.ee	CAN NOT GENERATE A SIGNED ACKNOWLEDGMENT	5.6.24 5.7.2.4.4 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.10.1.ff	RESPONSE NOT AVAILABLE FOR RETRANSMISSION	5.6.24 A.3.6	2.12.15.10.1:O.<32>	Yes ___ ___ No ___ ___	
2.12.15.11	FPI	5.5.1	M M	Yes ___ ___ No ___ ___	
2.12.15.11.a	NOT PRESENT	5.5.1	2.12.15.11:M.<2>	Yes ___ ___ No ___ ___	
2.12.15.11.b	PRESENT	5.5.1	2.12.15.11:M.<2>	Yes ___ ___ No ___ ___	
2.12.15.11.1	REPLY AMPLIFICATION	5.6.25	2.12.15.11.b:M	Yes ___ ___ No ___ ___	
2.12.16	GPI FOR G14(REFERENCE MESSAGE DATA GROUP)	5.5.3 5.6.26 5.7.2.1.2	M M	Yes ___ ___ No ___ ___	
2.12.16.a	NOT PRESENT	5.5.3	2.12.16:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.b	PRESENT	5.5.3	2.12.16:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.1	GRI FOR R4 (4)	5.5.4 5.6.26	2.12.16.b:M	Yes ___ ___ No ___ ___	
2.12.16.1.1.a	NOT REPEATED	5.5.4	2.12.16.1.1:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.1.b	REPEATED	5.5.4	2.12.16.1.1:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.2	FPI	5.5.1 5.7.2.2.2 5.7.2.2.5 5.7.2.5.11 5.7.2.5.12	2.12.16.b:M	Yes ___ ___ No ___ ___	
2.12.16.1.2.a	NOT PRESENT	5.5.1	2.12.16.1.2:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.2.b	PRESENT	5.5.1	2.12.16.1.2:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.2.1	URN	5.6.3.1	2.12.16.1.2.b:M 2.12.16.1.3.1:E	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.16.1.3	FPI	5.5.1 5.7.2.2.3 5.7.2.2.4 5.7.2.5.11 5.7.2.5.12	2.12.16:M	Yes ___ ___ No ___ ___	
2.12.16.1.3.a	NOT PRESENT	5.5.1	2.12.16.1.3:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.3.b	PRESENT	5.5.1	2.12.16.1.3:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.3.1	UNIT NAME	5.6.3.2	2.12.16.1.3.b:M 2.12.16.1.2.1:E	Yes ___ ___ No ___ ___	
2.12.16.1.4	YEAR	5.6.15	2.12.16.b:M	Yes ___ ___ No ___ ___	
2.12.16.1.5	MONTH	5.6.15	2.12.16.b:M	Yes ___ ___ No ___ ___	
2.12.16.1.6	DAY	5.6.15	2.12.16.b:M	Yes ___ ___ No ___ ___	
2.12.16.1.7	HOUR	5.6.15	2.12.16.b:M	Yes ___ ___ No ___ ___	
2.12.16.1.8	MINUTE	5.6.15	2.12.16.b:M	Yes ___ ___ No ___ ___	
2.12.16.1.9	SECOND	5.6.15	2.12.16.b:M	Yes ___ ___ No ___ ___	
2.12.16.1.10	FPI	5.5.1	2. 12.16.b:M	Yes ___ ___ No ___ ___	
2.12.16.1.10.a	NOT PRESENT	5.5.1	2.12.16.1.10:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.10.b	PRESENT	5.5.1	2.12.16.1.10:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.10.1	DTG EXTENSION	5.6.16	2.12.16.1.10.b:M	Yes ___ ___ No ___ ___	
2.12.16.1.11	GPI FOR G15 (FUTURE USE 6)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.12.16.1.11.a	NOT PRESENT	5.5.3	2.12.16.1.11:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.11.b	PRESENT	5.5.3	2.12.16.1.11:E.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.11.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.12.16.1.12	GPI FOR G16 (FUTURE USE 7)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.16.1.12.a	NOT PRESENT	5.5.3	2.12.16.1.12:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.12.b	PRESENT	5.5.3	2.12.16.1.12:E.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.12.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.12.16.1.13	GPI FOR G17 (FUTURE USE 8)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.12.16.1.13.a	NOT PRESENT	5.5.3	2.12.16.1.13:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.13.b	PRESENT	5.5.3	2.12.16.1.13:E.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.13.1	GROUP SIZE	5.5.6.4 5.6.4.2	O M	Yes ___ ___ No ___ ___	
2.12.16.1.14	GPI FOR G18 (FUTURE USE 9)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.12.16.1.14.a	NOT PRESENT	5.5.3	2.12.16.1.14:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.14.b	PRESENT	5.5.3	2.12.16.1.14:E.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.14.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.12.16.1.15	GPI FOR G19 (FUTURE USE 10)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.12.16.1.15.a	NOT PRESENT	5.5.3	2.12.16.1.15:M.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.15.b	PRESENT	5.5.3	2.12.16.1.15:E.<2>	Yes ___ ___ No ___ ___	
2.12.16.1.15.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.12.17	GPI FOR G20 (MESSAGE SECURITY GROUP)	5.5.3 5.7.2.1.2 5.7.2.1.6 APPENDI X D	M M	Yes ___ ___ No ___ ___	
2.12.17.a	NOT PRESENT	5.5.3	2.12.17:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.b	PRESENT	5.5.3	2.12.17:M.<2> 4.1.6:M	Yes ___ ___ No ___ ___	
2.12.17.1	SECURITY PARAMETERS INFORMATION	5.6.28 5.7.2.2.13 D.4.1	2.12.17.b:M	Yes ___ ___ No ___ ___	

APPENDIX E

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.17.1.a	AUTHENTICATION (USING SHA-1 AND DSA) / NO ENCRYPTION	5.6.28 D.4.1.1.1	2.12.17.1:M	Yes ___ ___ No ___ ___	
2.12.17.2	GPI FOR G21 (KEYING MATERIAL GROUP)	5.5.3 5.7.2.2.13	2.12.17.b:M	Yes ___ ___ No ___ ___	
2.12.17.2.a	NOT PRESENT	5.5.3	2.12.17.2:M.<2> 2.12.17.1.a:M	Yes ___ ___ No ___ ___	
2.12.17.2.b	PRESENT	5.5.3	2.12.17.2:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.2.1	KEYING MATERIAL ID LENGTH	5.6.29 D.4.1.1.2	2.12.17.2.b:M 2. 12.17.1:C	Yes ___ ___ No ___ ___	
2.12.17.2.2	KEYING MATERIAL ID	5.6.30	2.12.17.2.b:M 2. 12.17.1:C	Yes ___ ___ No ___ ___	
2.12.17.3	GPI FOR G22(CRYPTOGRAPHI C INITIALIZATION GROUP)	5.5.3 5.7.2.2.13	2.12.17.b:M	Yes ___ ___ No ___ ___	
2.12.17.3.a	NOT PRESENT	5.5.3	2.12.17.3:M.<2> 2.12.17.1.a:M	Yes ___ ___ No ___ ___	
2.12.17.3.b	PRESENT	5.5.3	2.12.17.3:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.3.1	CRYPTOGRAPHIC INITIALIZATION LENGTH	5.6.31 D.4.1.1.3	2.12.17.3.b:M 2.12.17.1:C	Yes ___ ___ No ___ ___	
2.12.17.3.2	CRYPTOGRAPHIC INITIALIZATION	5.6.32	2.12.17.3.b:M 2.12.17.1:C	Yes ___ ___ No ___ ___	
2.12.17.4	GPI FOR G23 (KEY TOKEN GROUP)	5.5.3 5.7.2.2.13	2.12.17.b:M	Yes ___ ___ No ___ ___	
2.12.17.4.a	NOT PRESENT	5.5.3	2.12.17.4:M.<2> 2.12.17.1.a:M	Yes ___ ___ No ___ ___	
2.12.17.4.b	PRESENT	5.5.3	2.12.17.4:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.4.1	KEY TOKEN LENGTH	5.6.33 D.4.1.1.4	2.12.17.4.b:M 2.12.17.1:C	Yes ___ ___ No ___ ___	
2.12.17.4.2	FRI (17)	5.5.2	2.3, 2.4, 2.5, 2. 12.17.4:C	Yes ___ ___ No ___ ___	
2.12.17.4.2.a	NOT REPEATED	5.5.2	2.12.17.4.2:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.4.2.b	REPEATED	5.5.2	2.12.17.4.2:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.4.3	KEY TOKEN	5.6.34	2.12.17.4.b:M 2.12.17.1:C	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.12.17.5	GPI FOR G24 (AUTHENTICATION GROUP (A))	5.5.3 5.7.2.2.13 D.4.1.1.5	2.12.17.b:M	Yes ___ ___ No ___ ___	
2.12.17.5.a	NOT PRESENT	5.5.3	2.12.17.5:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.5.b	PRESENT	5.5.3	2.12.17.5:M.<2> 2.12.17.1.a:M	Yes ___ ___ No ___ ___	
2.12.17.5.1	AUTHENTICATION DATA (A) LENGTH	5.6.35	2.12.17.5.b:M 2.12.17.1:C	Yes ___ ___ No ___ ___	
2.12.17.5.2	AUTHENTICATION DATA (A)	5.6.36 D.4.1.1.5.1	2.12.17.5.b:M 2.12.17.1:C	Yes ___ ___ No ___ ___	
2.12.17.6	GPI FOR G25(AUTHENTICATIO N GROUP (B))	5.5.3 5.7.2.4.4 D.4.1.1.6	2.12.17.b:M	Yes ___ ___ No ___ ___	
2.12.17.6.a	NOT PRESENT	5.5.3	2.12.17.6:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.6.b	PRESENT	5.5.3	2.12.17.6:M.<2> 2.12.17.7:C 2.12.14.b:C	Yes ___ ___ No ___ ___	
2.12.17.6.1	AUTHENTICATION DATA (B) LENGTH	5.6.37	2.12.17.6.b:M	Yes ___ ___ No ___ ___	
2.12.17.6.2	AUTHENTICATION DATA (B)	5.6.38 D.4.1.1.6	2.12.17.6.b:M	Yes ___ ___ No ___ ___	
2.12.17.7	SIGNED ACKNOWLEDGE REQUEST INDICATOR	5.6.39 5.7.2.2.14 5.7.2.4.4 D.4.1.1.7	2.12.17.b:M	Yes ___ ___ No ___ ___	
2.12.17.8	GPI FOR G26 (MESSAGE SECURITY PADDING GROUP)	5.5.3 5.7.2.2.13	2.12.17.b:M	Yes ___ ___ No ___ ___	
2.12.17.8.a	NOT PRESENT	5.5.3	2.12.17.8:M.<2> 2.12.17.1.a:M	Yes ___ ___ No ___ ___	
2.12.17.8.b	PRESENT	5.5.3	2.12.17.8:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.8.1	MESSAGE SECURITY PADDING LENGTH	5.6.40	2.12.17.8.b:M	Yes ___ ___ No ___ ___	
2.12.17.8.2	FPI	5.5.1	2.12.17.8.b:M	Yes ___ ___ No ___ ___	
2.12.17.8.2.a	NOT PRESENT	5.5.1	2.12.17.8.2:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.8.2.b	PRESENT	5.5.1	2.12.17.8.2:M.<2>	Yes ___ ___ No ___ ___	
2.12.17.8.2.1	MESSAGE SECURITY PADDING	5.6.41 D.4.1.1.8	2.12.17.8.2.b:M	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.13	GPI FOR G27 (FUTURE USE 11)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.13.a	NOT PRESENT	5.5.3	2.13:M.<2>	Yes ___ ___ No ___ ___	
2.13.b	PRESENT	5.5.3	2.13:E.<2>	Yes ___ ___ No ___ ___	
2.13.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.14	GPI FOR G28 (FUTURE USE 12)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.14.a	NOT PRESENT	5.5.3	2.14:M.<2>	Yes ___ ___ No ___ ___	
2.14.b	PRESENT	5.5.3	2.14:E.<2>	Yes ___ ___ No ___ ___	
2.14.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.15	GPI FOR G29 (FUTURE USE 13)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.15.a	NOT PRESENT	5.5.3	2.15:M.<2>	Yes ___ ___ No ___ ___	
2.15.b	PRESENT	5.5.3	2.15:E.<2>	Yes ___ ___ No ___ ___	
2.15.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.16	GPI FOR G30 (FUTURE USE 14)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.16.a	NOT PRESENT	5.5.3	2.16:M.<2>	Yes ___ ___ No ___ ___	
2.16.b	PRESENT	5.5.3	2.16:E.<2>	Yes ___ ___ No ___ ___	
2.16.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	
2.17	GPI FOR G31 (FUTURE USE 15)	5.5.3 5.5.6.4 5.7.2.1.9	O M	Yes ___ ___ No ___ ___	
2.17.a	NOT PRESENT	5.5.3	2.17:M.<2>	Yes ___ ___ No ___ ___	
2.17.b	PRESENT	5.5.3	2.17:E.<2>	Yes ___ ___ No ___ ___	

TABLE E-II. Application header requirements - Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
2.17.1	GROUP SIZE	5.5.6.4 5.6.42	O M	Yes ___ ___ No ___ ___	

TABLE E-III. Post application header receipt requirements

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
3.1	Application Header Receipt	5.7.1.9	M M	Yes ___ ___ No ___ ___	
3.1.1	Upon receipt of an application header, validate the presence of all mandatory groups and fields.	5.7.1.9	3.1:M	Yes ___ ___ No ___ ___	
3.1.2	Validate that all occurrence category conditions are satisfied, and validate the legality of all field entries to determine the legality for the header.	5.7.1.9	3.1:M	Yes ___ ___ No ___ ___	

TABLE E-IV. Cases

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
4.1.1	**CASE 1:** Message is an original message. **THIS CASE REQUIRES** GPI for G13 [Response Data Group] is specified “0” (NOT PRESENT) **AND** User Data shall be present **END CASE**	5.7.2.1.1 5.7.2.6	M M	Yes ___ ___ No ___ ___	

4.1.2	**CASE 2**: Message is an acknowledgment message. **THIS CASE REQUIRES** GPI for Group 13 [Response Data Group] is specified "1" (PRESENT) **AND** GPI for G11 [Perishability DTG] is specified “0” (NOT PRESENT) **AND** GPI for G12 [Acknowledgment Request Group] is specified “0” (NOT PRESENT) **AND** the User Data shall not be present **END CASE**	5.7.2.1.2 5.7.4.2 5.7.2.6	M	M	Yes ___ ___ No ___ ___	

TABLE E-IV. Cases -Continued

Item Number	Field Name	Reference	Status Tx	Status Rx	Support Tx Rx	Notes
4.1.3	**CASE 3**: Message is not a VMF or XML-VMF message. **THIS CASE REQUIRES** UMF is specified "0" (LINK 16 (J-SERIES MESSAGE)) OR UMF is specified "1" (BINARY FILE) OR UMF is specified "3" (NATIONAL IMAGERY TRANSMISSION FORMAT SYSTEM (NITFS)) OR UMF is specified "4" (REDISTRIBUTED MESSAGE (RDM)) OR UMF is specified "5" (UNITED STATES MESSAGE TEXT FORMAT (USMTF)) OR UMF is specified "6" (DOI-103) OR UMF is specified "7" (EXTENSIBLE MARKUP LANGUAGE (XML) - MESSAGE TEXT FORMAT (MTF)) **AND** GPI for G9 [VMF Message Identification Group] is specified "0" (NOT PRESENT) **END CASE**	5.7.2.1.3 5.7.2.6	M	M	Yes ___ ___ No ___ ___	
4.1.4	**CASE 4**: Message is a Redistributed Message. **THIS CASE REQUIRES** UMF is specified "4" (Redistributed Message) **AND** GPI for G9 [VMF Message Identification Group] is specified "0" (NOT PRESENT) **AND** User Data shall be present **END CASE**	5.7.2.1.4 5.7.2.6	O	M	Yes ___ ___ No ___ ___	
4.1.5	**CASE 5**: Message was compressed. **THIS CASE REQUIRES** FPI for Data Compression is specified "1" (PRESENT) **AND** GPI for G13 [Response Data Group] is specified "0" (NOT PRESENT) **AND** User Data shall be present **END CASE**	5.7.2.1.5 5.7.2.6	O	M	Yes ___ ___ No ___ ___	
4.1.6	**CASE 6:** Message has security services applied. **THIS CASE REQUIRES** GPI for G20 [Message Security Group] is specified "1" (PRESENT) **END CASE**	5.7.2.1.6 5.7.2.6	O	O	Yes ___ ___ No ___ ___	

APPENDIX E

TABLE E-IV. Cases -Continued

Item Number	Field Name	Reference	Status Tx	Status Rx	Support Tx Rx	Notes
4.1.7	**CASE 7:** Message is a signed acknowledgment. **THIS CASE REQUIRES** GPI for G13[Response Data Group] is specified “1” (PRESENT) **AND** GPI for G11[Perishability DTG Group] is specified “0” (NOT PRESENT) **AND** GPI for G12 [Acknowledgment Request Group] is specified “0” (NOT PRESENT) **AND** GPI for G24 [Authentication (A) Group] is specified “1” (PRESENT) **AND** GPI for G25 [Authentication (B) Group] is specified “1” (PRESENT) **AND** Signed Acknowledge Request Indicator is specified “0” (SIGNED RESPONSE NOT REQUIRED) **AND** User Data shall be present **END CASE**	5.7.2.1.7 5.7.2.6	O	O	Yes ___ ___ No ___ ___	
4.1.8	**CASE 8**: Message is an XML-VMF message. **THIS CASE REQUIRES** UMF is specified "8" (XML-VMF) **AND** GPI for G9 [Message Identification Group] is specified "1" (Present) AND User Data shall be present **END CASE**	5.7.2.1.8 5.7.2.6	O	O	Yes ___ ___ No ___ ___	

TABLE E-IV. Cases -Continued

Item Number	Field Name	Reference	Status Tx	Status Rx	Support Tx Rx	Notes
4.1.9	**CASE 9:** Backward Compatibility of "Future Use" groups until they are used. **THIS CASE REQUIRES** GPI for G4 [Future Use 1] is specified "0" (NOT PRESENT) **AND** GPI for G5 [Future Use 2] is specified "0" (NOT PRESENT) **AND** GPI for G6 [Future Use 3] is specified "0" (NOT PRESENT) **AND** GPI for G7 [Future Use 4] is specified "0" (NOT PRESENT) **AND** GPI for G8 [Future Use 5] is specified "0" (NOT PRESENT) **AND** GPI for G15 [Future Use 6] is specified "0" (NOT PRESENT) **AND** GPI for G16 [Future Use 7] is specified "0" (NOT PRESENT) **AND** GPI for G17 [Future Use 8] is specified "0" (NOT PRESENT) **AND** GPI for G18 [Future Use 9] is specified "0" (NOT PRESENT) **AND** GPI for G19 [Future Use 10] is specified "0" (NOT PRESENT) **AND** GPI for G27 [Future Use 11] is specified "0" (NOT PRESENT) **AND** GPI for G28 [Future Use 12] is specified "0" (NOT PRESENT) **AND** GPI for G29 [Future Use 13] is specified "0" (NOT PRESENT) **AND** GPI for G30 [Future Use 14] is specified "0" (NOT PRESENT) **AND** GPI for G31 [Future Use 15] is specified "0" (NOT PRESENT) **END CASE**	5.7.2.1.9 5.7.2.6	M	M	Yes ___ ___ No ___ ___	
4.1.10	**CASE 10:** Message is a VMF message. **THIS CASE REQUIRES** UMF shall be "2" (VMF) AND GPI for G9 [VMF Message Identification Group] is specified "1" (Present) **END CASE**	5.7.2.1.10 5.7.2.6	E.5.1.1.1.1		Yes ___ ___ No ___ ___	

TABLE E-V. Conditions

Item Number	Field Name	Reference	Status Tx	Status Rx	Support Tx Rx	Notes
4.2.1	**CONDITION 1:** **IF** GPI for G1 [Originator Address Group] is specified "0" (NOT PRESENT) **THEN** GPI for G12[Acknowledgment Request Group] is specified "0" (NOT PRESENT) **ENDIF**	5.7.2.2.1	M	M	Yes ___ ___ No ___ ___	
4.2.2	**CONDITION 2:** **IF** FPI for URN is specified "1" (PRESENT) **THEN** FPI for Unit Name is specified "0" (NOT PRESENT) **ENDIF**	5.7.2.2.2	M	M	Yes ___ ___ No ___ ___	
4.2.3	**CONDITION 3:** **IF** FPI for URN is specified "0" (NOT PRESENT) **THEN** FPI for Unit Name is specified "1" (PRESENT) **ENDIF**	5.7.2.2.3	M	M	Yes ___ ___ No ___ ___	
4.2.4	**CONDITION 4:** **IF** FPI for Unit Name is specified "1" (PRESENT) **THEN** FPI for URN is specified "0" (NOT PRESENT) **ENDIF**	5.7.2.2.4	M	M	Yes ___ ___ No ___ ___	
4.2.5	**CONDITION 5:** **IF** FPI for Unit Name is specified "0" (NOT PRESENT) **THEN** FPI for URN is specified "1" (PRESENT) **ENDIF**	5.7.2.2.5	M	M	Yes ___ ___ No ___ ___	
4.2.6	**CONDITION 6**: This paragraph is left blank to maintain paragraph conformity.	5.7.2.2.6	NA			
4.2.7	**CONDITION 7:** **IF** GRI for R3 is specified "1" (REPEATED) **THEN** FPI for Message Size is specified "1" (PRESENT) **AND** FPI for Header Size is specified "1" (PRESENT) **ENDIF**	5.7.2.2.7	M	M	Yes ___ ___ No ___ ___	
4.2.8	**CONDITION 8:** **IF** R/C is NOT specified "6" (CANTCO) **THEN** FPI for CANTCO Reason Code is specified "0" (NOT PRESENT) **ENDIF**	5.7.2.2.8	M	M	Yes ___ ___ No ___ ___	
4.2.9	**CONDITION 9:** **IF** R/C is NOT specified "2" (CANTPRO) **THEN** FPI for CANTPRO Reason Code is specified "0" (NOT PRESENT) **ENDIF**	5.7.2.2.9	M	M	Yes ___ ___ No ___ ___	
4.2.10	**CONDITION 10:** This paragraph is left blank to maintain paragraph conformity.	5.7.2.2.10	NA			

TABLE E-V. Conditions-Continued

Item Number	Field Name	Reference	Status Tx	Status Rx	Support Tx Rx	Notes
4.2.11	**CONDITION 11:** **IF** Machine Acknowledge Request Indicator is specified “1” (MACHINE ACKNOWLEDGMENT REQUIRED) **OR** Operator Acknowledge Request Indicator is specified “1” (OPERATOR ACKNOWLEDGMENT REQUIRED) **OR** Operator Reply Request Indicator is specified “1” (OPERATOR REPLY REQUIRED) **THEN** GPI for G10[Originator DTG] is specified “1” (PRESENT) **ENDIF**	5.7.2.2.11	M	M	Yes ___ ___ No ___ ___	
4.2.12	**CONDITION 12:** This paragraph is left blank to maintain paragraph conformity.	5.7.2.2.12	NA			
4.2.13	**CONDITION 13:** **IF** Security Parameters Information is specified “0” (AUTHENTICATION (USING SHA-1 AND DSA)/NO ENCRYPTION)) **THEN** GPI for G21 [Keying Material Group] is specified “0” (NOT PRESENT) **AND** GPI for G22[Cryptographic Initialization Group] is specified “0” (NOT PRESENT) **AND** GPI for G23[Keying Token Group] is specified “0” (NOT PRESENT) **AND** GPI for G24 [Authentication (A) Group] is specified “1” (PRESENT) **AND** GPI for G26 [Message Security Padding Group] is specified “0” (NOT PRESENT) **ENDIF**	5.7.2.2.13	O	M	Yes ___ ___ No ___ ___	
4.2.14	**CONDITION 14:** **IF** GPI for G12 [Acknowledgment Request Group] is specified “0” (NOT PRESENT) **THEN** Signed Acknowledge Request Indicator is specified “0” (SIGNED ACKNOWLEDGMENT NOT REQUIRED) **ENDIF**	5.7.2.2.14	O	M	Yes ___ ___ No ___ ___	
4.2.15	**CONDITION 15:** **IF** Signed Acknowledge Request Indicator is specified “1” (SIGNED ACKNOWLEDGMENT REQUIRED) **THEN** GPI for G12 [Acknowledgment Request Group] is specified “1” (PRESENT) **ENDIF**	5.7.2.2.15	O	M	Yes ___ ___ No ___ ___	

TABLE E-V. Conditions-Continued

Item Number	Field Name	Reference	Status Tx	Status Rx	Support Tx Rx	Notes
4.2.16	**CONDITION 16:** **IF** UMF is specified “6” (DOI-103), **THEN** Message Precedence is specified “5” (CRITIC/ECP) **ENDIF**	5.7.2.2.16	O	M	Yes ___ ___ No ___ ___	
4.2.17	**CONDITION 17:** **IF** Retransmit Indicator is specified “1” (RETRANSMITTED MESSAGE) **THEN** GPI for G10 [Originator DTG] is specified “1” (PRESENT) identifying the original date-time-group of the original message **ENDIF**	5.7.2.2.17	O	M	Yes ___ ___ No ___ ___	
4.2.18	**CONDITION 18:** **IF** UMF is set to “2” (Variable Message Format (VMF)) **THEN** FPI for Message Standard Version is specified “1” (PRESENT) **ENDIF**	5.7.2.2.18	M	M	Yes ___ ___ No ___ ___	

TABLE E-VI. Expected response requirement

Item Number	Field Name	Reference	Status Tx	Status Rx	Support Tx Rx	Notes
5.1	Machine Acknowledge Requested: **IF** Machine Acknowledge Request Indicator is specified “1” (MACHINE ACKNOWLEDGMENT REQUIRED) **THEN** Response Message R/C is specified “1” (MACHINE RECEIPT) **OR** Response Message R/C is specified “2” (CANTPRO) **ENDIF**	5.7.2.4.1 5.7.2.6	M	M	Yes ___ ___ No ___ ___	
5.2	Operator Acknowledge Requested: **IF** Operator Acknowledge Request Indicator is specified “1” (OPERATOR ACKNOWLEDGMENT REQUIRED) **THEN** Response Message R/C is specified “3” (OPERATOR ACKNOWLEDGE) **OR** Response Message R/C is specified “2” (CANTPRO)	5.7.2.4.2 5.7.2.6	M	M	Yes ___ ___ No ___ ___	

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
	ENDIF				

TABLE E-VI. Expected response requirement -Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
5.3	Operator Reply Requested: **IF** Operator Reply Request Indicator is specified "1" (OPERATOR REPLY REQUIRED) **THEN** Response Message R/C is specified "4" (WILCO) **OR** Response Message R/C is specified "5" (HAVCO) **OR** Response Message R/C is specified "6" (CANTCO) **OR** Response Message R/C is specified "2" (CANTPRO) **ENDIF**	5.7.2.4.3 5.7.2.6	M M	Yes ___ ___ No ___ ___	
5.4	Signed Acknowledge Requested: **IF** Signed Acknowledge Request Indicator is specified "1" (SIGNED ACKNOWLEDGMENT REQUIRED) **THEN** Response shall have GPI for G25 [Authentication (B) Group] is specified "1" (PRESENT) **OR** {Response shall have R/C is specified "2" (CANTPRO) **AND** [CANTPRO Reason Code is specified "27" (AUTHENTICATION FAILURE) **OR** CANTPRO Reason Code is specified "28" (CERTIFICATE NOT FOUND) **OR** CANTPRO Reason Code is specified "29" (CERTIFICATE INVALID) **OR** CANTPRO Reason Code is specified "30" (DO NOT SUPPORT THIS SPI VALUE) **OR** CANTPRO Reason Code is specified "31" (CAN NOT GENERATE A SIGNED ACKNOWLEDGMENT)]} **ENDIF**	5.7.2.4.4 5.7.2.6	O O	Yes ___ ___ No ___ ___	
5.5	In a data element composed of a binary code, it shall be interpreted as a single data field.	5.5.6.2	M	Yes ___ ___ No ___ ___	

TABLE E-VII. Special considerations

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
6.1	Perishable Data Check: **IF** GPI for G11 [Perishable Data DTG] is specified "1" (PRESENT) **AND** G11 [Perishable Data DTG] is earlier than current DTG **THEN** User Data shall be ignored **AND** **IF** Machine Acknowledge Request Indicator is specified "1" (MACHINE ACKNOWLEDGMENT REQUIRED) **THEN** Response Message R/C is specified "2" (CANTPRO) **AND** CANTPRO Reason Code is specified "25" (MESSAGE TOO OLD, BASED ON PERISHABILITY) **ENDIF** **ENDIF**	5.7.4.1 5.7.2.6	M M	Yes ___ ___ No ___ ___	
6.2	Response to version non-interoperability. **IF** Recipient does not implement Version sent **THEN** Version is specified "15" (VERSION SENT NOT IMPLEMENTED) **AND** FPI for Data Compression Type is specified "0" (NOT PRESENT) **AND** GPI for Group 1 [Originator Address Group] is specified "1" (PRESENT) **AND** Originator specified is the Original Recipient **AND** GPI for Group 2 [Recipient Address Group] is specified "1" (PRESENT) **AND** Recipient specified is the Originator of the original message **ENDIF**	5.7.4.2 5.7.2.6	M M	Yes ___ ___ No ___ ___	
6.3	Broadcast Transmission Check. **IF** GPI for G2 [Recipient Address Group] is specified "0" (NOT PRESENT) **AND** GPI for G3 [Information Address Group] is specified "0" (NOT PRESENT) **THEN** message shall be broadcast in accordance with lower layer broadcast protocols **ENDIF**	5.6.3.b. 5.7.4.3 5.7.2.6	M M	Yes ___ ___ No ___ ___	
6.4	Add DTG Extensions when Originator DTGs are the same: **IF** Originator DTG is equal to the Originator DTG of a previously sent message **THEN** FPI for DTG Extension is specified "1" (PRESENT)	5.7.2.5.4 5.7.2.6	M M	Yes ___ ___ No ___ ___	

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
	AND DTG Extension shall be unique **ENDIF**				

TABLE E-VII. Special considerations -Continued

Item Number	Field Name	Reference	Status Tx	Status Rx	Support Tx Rx	Notes
6.5	Message sent via a streaming/undelimited transport protocol: **IF** GRI for R3 is specified "0" (NOT REPEATED) **AND** the message is being set via a streaming/undelimited transport **THEN** FPI for Message Size is specified "1" (PRESENT) **AND** FPI for Header Size is specified "1" (PRESENT) **ENDIF**	5.7.2.5.5 5.7.2.6	M	M	Yes ___ ___ No ___ ___	
6.6	Message concatenation: The total size of any single User Data portion (e.g. a single VMF message) within a concatenated message block shall not exceed 1 megabyte (1,048,575 bytes) **IF** GPI for G1 [Originator Address Group] is specified "1" (PRESENT) (**OR** GPI for G2 [Recipient Address Group] is specified "1" (PRESENT) **OR** GPI for G3 [Information Address Group] is specified "1" (PRESENT)) **THEN** (Groups G1 [Originator Address Group], G2 [Recipient Address Group] and G3 [Information Address Group] addresses are common to all concatenated messages) **AND** GRI for R3 [Message Handling Group] is specified "1" (REPEATED) **AND** Each iteration shall match in sequence specifying information about its respective concatenated message **AND** FPI for Message Size is specified "1" (PRESENT) **AND** FPI for Header Size is specified "1" (PRESENT) **AND** Message Size (any single message within the concatenated block) shall not exceed 1,048,575 bytes **ENDIF**	5.7.2.5.6 5.7.2.6	O	M	Yes ___ ___ No ___ ___	
6.7	Message Case and Message Subtype Relationship: **IF** Cases exist for transmitted VMF message **THEN** FPI for Message Subtype is specified "1" (PRESENT) **ENDIF**	5.7.2.5.7 5.7.2.6	M	M	Yes ___ ___ No ___ ___	

TABLE E-VII. Special considerations -Continued

Item Number	Field Name	Reference	Status Tx	Status Rx	Support Tx Rx	Notes
6.8	Sending Response to a large message: **IF** The received Message Size is greater than Maximum Segment Size **AND** The received message GPI for G12 [Acknowledgment Request Group] is specified "1" (PRESENT) **AND** The message was received via a reliable transport mechanism **THEN** Response(s), to the received message shall be sent via a reliable transport mechanism **ENDIF**	5.7.2.5.8 5.7.2.6	M	M	Yes ___ ___ No ___ ___	

6.9	DTG Extension to DTG of Message Being Acknowledged.
	IF GPI for G13 [Response Data Group] is specified "1" (PRESENT)
	THEN
	IF FPI for DTG Extension discriminating the Originator DTG is specified "1" (PRESENT)
	THEN Response message shall have GPI for G13[Response Data Group] identifying the DTG of Message Being Acknowledged is specified "1" (PRESENT)
	AND FPI for DTG Extension discriminating the DTG of Message Being Acknowledged is specified "1" (PRESENT)
	ELSE
	Response message shall have GPI for G13 [Response Data Group] identifying the DTG of Message Being Acknowledged is specified "1" (PRESENT)
	AND FPI for DTG Extension discriminating the DTG of Message Being Acknowledged is specified "0" (NOT PRESENT)
	ENDIF
	ENDIF
		5.7.2.5.9
		5.7.2.6
			M	M	Yes ___ ___
					No ___ ___	

TABLE E-VII. Special considerations -Continued

Item Number	Field Name	Reference	Status Tx	Status Rx	Support Tx Rx	Notes
6.10	Decompression of messages prior to parsing. **IF** FPI for Data Compression Type field is specified "1" (PRESENT) **THEN** Receiving system shall decompress the user data prior to parsing **ENDIF**	5.7.2.5.10 5.7.2.6	M	M	Yes ___ ___ No ___ ___	
6.11	Unit Name usage in a response message. **IF** FPI for Unit Name identifying the originator is specified "1" (PRESENT) **THEN** Response message shall have the FPI for Unit Name identifying the recipient is specified "1" (PRESENT) **AND** FPI for URN is specified "0" (NOT PRESENT) **ENDIF**	5.7.2.5.11 5.7.2.6	M	M	Yes ___ ___ No ___ ___	
6.12	URN usage in a response message. **IF** FPI for URN identifying the originator is specified "1" (PRESENT) **THEN** Response message shall have the FPI for URN identifying the recipient specified "1" (PRESENT) **AND** FPI for Unit Name is specified "0" (NOT PRESENT) **ENDIF**	5.7.2.5.12 5.7.2.6	M	M	Yes ___ ___ No ___ ___	
6.13	Addressee URN uniqueness. A specified URN shall occur at most once as an addressee of a message either as a recipient destination or as an information destination. A duplicate destination URN in the recipient address group and the information address group of a message is not permitted.	5.7.2.5.13 5.7.2.6	M	M	Yes ___ ___ No ___ ___	
6.14	Message uses Segmentation/Reassembly protocol: **IF** Data transfer is greater than the maximum segment size (MSS) permitted **AND** (Data package is transported via CNR using UDP **OR** Data package is transported via CNR using N-Layer Pass Through) **THEN** Message Segmentation/Reassembly protocol shall be used **ENDIF**	5.7.2.5.14 5.7.2.6 C.1.1	M	M	Yes ___ ___ No ___ ___	
6.15	UMF codes in the Acknowledgment Header: If the message is an Acknowledgment Header then the UMF code shall be the same as the UMF code for the message being acknowledged.	5.7.2.5.15 5.7.2.6	M	M	Yes ___ ___ No ___ ___	

TABLE E-VII. Special considerations -Continued

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
6.16	VMF Message Identification Group in Acknowledgment Header: If the message is an Acknowledgment Header, then Group 9 [VMF Message Identification Group] shall be the same as the Group 9 [VMF Message Identification Group] for the message being acknowledged.	5.7.2.5.16 5.7.2.6	M M	Yes ___ ___ No ___ ___	
6.17	**IF** ((the message is broadcast according to 5.6.3b) OR (the only destination address specified is the broadcast URN) OR (all destination addresses (i.e. all recipient and information addresses) are in same IP subnetwork as the Originator)) **THEN** N-layer pass-through should be used **ENDIF**	5.7.2.5.17	O.....O	Yes ___ ___ No ___ __	
6.18	Message Accountability	5.7.4.2	M	Yes ___ ___ No ___ __	
6.18.1	The message handling application shall maintain DTG, Originator Address, and DTG Extension information about previously received messages for a period of time long enough to exhaust the message originator's retransmission timers.	5.7.4.2.b	6.18:M	Yes ___ ___ No ___ __	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements

Item Number	Field Name	Reference	Status	Support	Notes
7.1	SEGMENTATION/REASSEMBLY PROTOCOL	5.7.2.5.14 APPENDIX C C.1.2 (MIL-STD-188-220D 5.4.1.1.2.5)	6.14:M	Yes ___ No ___	
7.2	SCOPE	C.1.1	NA		
7.2.1	Definition of Terms	C.1.3.1	M	Yes ___ No ___	
7.2.1.a	Parameter values shall be stored in such a way that systems are able to alter the default values.	C.1.3.1.h	7.2.1:M	Yes ___ No ___	
7.2.a	The S/R protocol shall be automatically applied to application layer messages that exceed the a specified segment size.	C.1.1	7.1:M	Yes ___ No ___	
7.2.b	All platforms shall implement either S/R Basic or S/R Enhanced in order to be compliant with the specification.	C.1.1	7.1:M	Yes ___ No ___	
7.2.b.1	S/R Basic Protocol	C.1.1	7.1:O.<2>	Yes ___ No ___	

APPENDIX E

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.2.b.2	S/R Enhanced Protocol	C.1.1	7.1:O.<2>	Yes ___ No ___	
7.2.c	The S/R process shall take place at the interface between the Application Layer and the next lower level layer (e.g., Transport Layer or Intranet Layer).	C.1.1	7.1:M	Yes ___ No ___	
7.3	Overall Operation.	C.3	7.1:M	Yes ___ No ___	
7.3.a	MIL-STD-2045-47001 formatted messages, i.e., Application Layer protocol data units (PDUs), which are larger than the designated Segment Size, shall be segmented by the Originator prior to transmission, and reassembled at the Destination prior to delivery to the application.	C.3	7.3:M	Yes ___ No ___	
7.3.b	The designated Segment Size shall be less than or equal to the MSS for the applicable configuration, and greater than or equal to three octets (in order to support transferring a one megabyte payload in a maximum of 65,535 segments).	C.3	7.3:M	Yes ___ No ___	
7.3.c	Each segment shall be encapsulated in a single S/R PDU.	C.3	7.3: M	Yes ___ No ___	
7.3.d	The Destination shall not assume that segments will be received in the order that they were transmitted, however in S/R Basic, a Destination does not begin a reassembly transaction until the first segment of the transaction (i.e., a Data Segment PDU with Segment Number of “1”) is received.	C.3	7.3:M	Yes ___ No ___	
7.3.e	If the data passed to the S/R Layer in the S/R-unitdata request from the application exceeds the specified Segment Size it shall be transmitted as multiple segments with an S/R header appended to each segment.	C.3	7.3:M	Yes ___ No ___	
7.3.f	Destinations shall be responsible for ensuring that segments are reassembled in the proper order, regardless of the order of reception.	C.3	7.3:M	Yes ___ No ___	
7.3.g	Application Layer PDUs with an associated Precedence of Routine shall be sent as EDT Acknowledgment Not Required, except when sending segments to Multicast addresses in the S/R Basic protocol, in which case all segments are always sent EDT Acknowledgment Not Required.	C.3	7.3:M	Yes ___ No ___	7.3.g
7.3.h	Application Layer PDUs with an associated Precedence of Priority or higher shall be sent as EDT Acknowledgment Required.	C.3	7.3:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.1	The MSS shall be based on the equations below. MTU: Maximum Transfer Unit size at the Network Layer SH: S/R header size UDP: UDP header size IPHS: IP header size MSS(IP) = MTU - (SH + UDP + IPHS) for IP datagrams; and MSS(n-layer pass through) = MTU – SH for n-layer pass through MSS(Packet Mode) = MTU – SH for n-layer pass through using Packet Mode	C.3.1	7.2 7.3:M	Yes ___ No ___	
7.3.1.1	MSS for IP Datagram Exchanges.	C.3.1.1	7.3.1:M	Yes ___ No ___	
7.3.1.1.a	The MSS value for both IPv4 and IPv6 shall be computed based on the MTU value for the network layer employed by each system based on the formulas in section C.3.1. For MIL-STD-188-220 networks, this value is specified in the MIL-STD-188-220 Parameter Table.	C.3.1.1	7.3.1.1:M	Yes ___ No ___	
7.3. 1.1.b	For MIL-STD-188-220 networks, if an MTU value is not present in the MIL-STD-188-220 Parameter Table for a given network configuration, then an MTU of 576 shall be used for IPv4.	C.3.1.1	7.3.1.1:M	Yes ___ No ___	
7.3. 1.1.c	For MIL-STD-188-200 networks, if an MTU value is not present in the MIL-STD-188-220 Parameter Table for a given network configuration, then an MTU of 1280 shall be used for IPv6.	C.3.1.1	7.3.1.1:M	Yes ___ No ___	
7.3.1.2	MSS for N-layer Pass Through Exchanges.	C.3.1.2	7.3.1:M	Yes ___ No ___	
7.3.1.2.a	The MSS value for n-layer pass through shall be computed based on the MTU value specified in the MIL-STD-188-220 Parameter Tables using the formulas in section C.3.1.	C.3.1.2	7.3.1.2:M	Yes ___ No ___	
7.3.1.2.b	An MTU of 576 shall be used when no MTU value in the MIL-STD-188-220 Parameter Tables is applicable for the network configuration.	C.3.1.2	7.3.1.2:M	Yes ___ No ___	
7.3.2	Interface with peer-to-peer layers.	C.3.2	7.1:M	Yes ___ No ___	
7.3.2.1	UDP/IP Datagram Exchanges.	C.3.2.1	7.3:M	Yes ___ No ___	
7.3.2.1.a	The source port parameter provided in the S/R-Unitdata Request and the destination port parameter as specified in TABLE C-II shall be placed in corresponding Source and Destination Port fields of the S/R header.	C.3.2.1	7.3.2:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.2.1.b	The port named "udp-sr-port" has been registered with the Internet Assigned Number Authority and assigned port number 1624 (decimal), shall be specified as the destination UDP port in all S/R invocations of the UDP service interface for sending of S/R PDUs (e.g., Data Segment, Acknowledgment Request, Partial Acknowledgment, etc.).	C.3.2.1	7.3.2.1:M	Yes ___ No ___	
7.3.2.1.c	At the receiving station, a destination UDP port value of 1624 shall indicate the S/R protocol as defined by this standard.	C.3.2.1	7.3.2.1:M	Yes ___ No ___	
7.3.2.1.d	When stations use S/R to support the exchange the MIL-STD-2045-47001 ALP via UDP/IP, the values indicated in TABLE C-II shall be used for the S/R and UDP Destination/Source Port fields.	C.3.2.1	7.3.2.1:M	Yes ___ No ___	
7.3.2.2	MIL-STD-188-220 N-layer Pass Through (NLP) Exchanges.	C.3.2.2	7.3:M	Yes ___ No ___	
7.3.2.2.a	The source port parameters provided in the SR-Unitdata Request and the destination port parameter as specified in TABLE C-III shall be placed in the corresponding Source and Destination Port fields of the S/R header for exchanges via MIL-STD-188-220 NLP.	C.3.2.2	7.3.2.2:M	Yes ___ No ___	
7.3.2.2.b	At the receiving station, MIL-STD 188-220 Intranet Message Type field value of 10 shall indicate the S/R protocol as defined by this standard.	C.3.2.2 (MIL-STD-188-220D 5.4.1.1.2.5)	7.3.2.2:M	Yes ___ No ___	
7.3.2.2.c	When stations use S/R to exchange the MIL-STD-2045-47001 ALP via MIL-STD-188-220 NLP, the values indicated in TABLE C-III shall be used for the S/R Destination/Source Port fields and MIL-STD-188-220 Intranet Message Type field.	C.3.2.2	7.3.2.2:M	Yes ___ No ___	
7.3.3	S/R PDU Format	C.3.3	7.1:M	Yes ___ No ___	
7.3.3.a	PDU bit ordering for all PDUs described in section C.3.3 shall be implemented as shown in TABLE C-VIII	C.3.3	7.3.3:M	Yes ___ No ___	
7.3.3.1	Common S/R Header	C.3.3.1	7.3.3:M	Yes ___ No ___	
7.3.3.1.a	Figure C-1 depicts the S/R header that shall precede all S/R segments defined in this appendix to complete a S/R PDU.	C.3.3.1	7.3.3:M	Yes ___ No ___	
7.3.3.1.1	Source Port.	C.3.3.1.1	7.3.3.1:M	Yes ___ No ___	
7.3.3.1.2	Destination Port.	C.3.3.1.2	7.3.3.1:M	Yes ___ No ___	
7.3.3.1.3	Type.	C.3.3.1.3	7.3.3.1:M	Yes ___ No ___	
7.3.3.1.3.a	Data Segment with End of Data Transfer Acknowledgment required shall be Type 0.	C.3.3.1.3	7.3.3.1.3:O <7>	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.3.1.3.b	Abort Request shall be Type 1.	C.3.3.1.3	7.3.3.1.3: O<7>	Yes ___ No ___	
7.3.3.1.3.c	Data Segment with End of Data Transfer Acknowledgment not required shall be Type 2.	C.3.3.1.3	7.3.3.1.3: O<7>	Yes ___ No ___	
7.3.3.1.3.d	Acknowledgment Request shall be Type 3.	C.3.3.1.3	7.3.3.1.3: O<7>	Yes ___ No ___	
7.3.3.1.3.e	Partial Acknowledgment shall be Type 4.	C.3.3.1.3	7.3.3.1.3: O<7>	Yes ___ No ___	
7.3.3.1.3.f	Abort Confirm shall be Type 5.	C.3.3.1.3	7.3.3.1.3: O<7>	Yes ___ No ___	
7.3.3.1.3.g	Complete Acknowledgment shall be Type 6.	C.3.3.1.3	7.3.3.1: O<7>	Yes ___ No ___	
7.3.3.1.4	Header Length (HLEN).	C.3.3.1.4	7.3.3.1:M	Yes ___ No ___	
7.3.3.1.5	Poll/Final (P/F). This 1-bit field is used to request a response from the recipient of the PDU.	C.3.3.1.5	7.3.3.1:M	Yes ___ No ___	
7.3.3.1.5.a	When a data segment is received with the P/F bit set to "1", the Destination shall respond with a Partial Acknowledgment or a Complete Acknowledgment with P/F bit set to "1".	C.3.3.1.5.a	7.3.3.1.5: M	Yes ___ No ___	
7.3.3.1.5.b	When an Abort Request is received with the P/F bit set to "1", the receiving unit shall return an Abort Confirm with P/F bit set to "1".	C.3.3.1.5.b	7.3.3.1.5: M	Yes ___ No ___	
7.3.3.1.6	Serial Number.	C.3.3.1.6	7.3.3.1:M	Yes ___ No ___	
7.3.3.1.6.a	Originating systems (Originators) shall manage Serial Numbers such that they are not ambiguous, for example, increment the serial number from 0 to 65,535 before reusing values to send additional Application PDUs.	C.3.3.1.6	7.3.3.1.6: M	Yes ___ No ___	
7.3.3.2	Data Segment PDU.	C.3.3.2	7.3.3.1.3.a: M 7.3.3.1.3.c: M	Yes ___ No ___	
7.3.3.2.a	Application PDUs that are larger than the specified Segment Size shall be segmented and sent to the destination addressee as the data portion of the data segment.	C.3.3.2	7.3.3.2:M	Yes ___ No ___	
7.3.3.2.b	The Segment Size shall be user configurable, and shall default to MSS.	C.3.3.2	7.3.3.2:M	Yes ___ No ___	
7.3.3.2.c	No segment of a single Application PDU shall exceed MSS octets in length.	C.3.3.2	7.3.3.2:M	Yes ___ No ___	
7.3.3.2.d	The length of the data portion of each segment of a single Application PDU shall be the same (i.e., equal to the specified Segment Size) except possibly for the last segment, which may be shorter.	C.3.3.2	7.3.3.2:M	Yes ___ No ___	
7.3.3.2.e	If the last segment does not require the full segment size used for previous segments, it shall not be zero padded.	C.3.3.2	7.3.3.2:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.3.2.f	Two types of data segments may be used in order to indicate whether an EDT acknowledgment is required or not required	C.3.3.2	7.3.3.2:M	Yes ___ No ___	
7.3.3.2.f.1	If an EDT acknowledgment is required, the destination addressee shall respond with a Complete Acknowledgment after correctly receiving all segments of an Application PDU.	C.3.3.2	7.3.3.2.f:M	Yes ___ No ___	
7.3.3.2.f.2	If the S/R Enhanced Protocol is employed the Destination shall respond with a Partial Acknowledgment if its Reassembly Timer expires and not all expected segments have been received.	C.3.3.2	7.3.3.2.f:M	Yes ___ No ___	
7.3.3.2.1	Segment Number.	C.3.3.2.1	7.3.3.2:M	Yes ___ No ___	
7.3.3.2.1.a	The Segment Number of the first segment in the transmission shall be 1.	C.3.3.2.1	7.3.3.2.1: M	Yes ___ No ___	
7.3.3.2.2	Last Segment Number.	C.3.3.2.2	7.3.3.2:M	Yes ___ No ___	
7.3.3.2.2.a	The Last Segment Number (LSN) shall be greater than or equal to the Segment Number assigned to the first segment in the transmission.	C.3.3.2.2	7.3.3.2.2: M	Yes ___ No ___	
7.3.3.3	Partial Acknowledgment PDU.	C.3.3.3	7.3.3.1.3.e: M	Yes ___ No ___	
7.3.3.3.a	No data field shall be permitted with the Partial Acknowledgment.	C.3.3.3	7.3.3.3:M	Yes ___ No ___	
7.3.3.3.1	Starting Segment Number (SSN).	C.3.3.3.1	7.3.3.3: M	Yes ___ No ___	
7.3.3.3.1.a	The first bit in the Bit Mask field shall always have a value of not received.	C.3.3.3.1	7.3.3.3.1: M	Yes ___ No ___	
7.3.3.3.2	Acknowledgment Segments Bit Mask.	C.3.3.3.2	7.3.3.3:M	Yes ___ No ___	
7.3.3.3.2.1	The first bit of this field corresponds to the Starting Segment Number and shall always be reset (0).	C.3.3.3.2	7.3.3.3.2: M	Yes ___ No ___	
7.3.3.3.2.2	Any additional segments that have been received with a Segment Number greater than the Starting Segment Number shall be indicated with a bit set (1).	C.3.3.3.2	7.3.3.3.2: M	Yes ___ No ___	
7.3.3.3.2.3	Implementations shall support a maximum size of 3248 bits for this field.	C.3.3.3.2	7.3.3.3.2: M	Yes ___ No ___	
7.3.3.3.2.4	The actual size of the Bit Mask field in number of bits shall be: Highest Numbered Segment Received (HNSR) – Starting Segment Number + 1	C.3.3.3.2	7.3.3.3.2: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.3.3.2.5	If no segments have been received, the Starting Segment Number shall equal 1 and the Highest Numbered Segment Received shall equal 1, which results in a Bit Mask field size of 1.	C.3.3.3.2	7.3.3.3.2: M	Yes ___ No ___	
7.3.3.3.2.6	The single bit composing the Bit Mask field shall be set to bit reset (0).	C.3.3.3.2	7.3.3.3.2: M	Yes ___ No ___	
7.3.3.3.3	Padding.	C.3.3.3.3	7.3.3.3:M	Yes ___ No ___	
7.3.3.3.3.1	Padding shall be used to ensure that the PDU ends on a 32-bit boundary.	C.3.3.3.3	7.3.3.3.3: M	Yes ___ No ___	
7.3.3.3.3.2	Padding bits shall be set to bit reset (0).	C.3.3.3.3	7.3.3.3.3: M	Yes ___ No ___	
7.3.3.4	Complete Acknowledgment PDU.	C.3.3.4	7.3.3.1.3.g: M	Yes ___ No ___	
7.3.3.4.1	No data field shall be permitted with the Complete Acknowledgment.	C.3.3.4	7.3.3.4:M	Yes ___ No ___	
7.3.3.5	Abort Request PDU.	C.3.3.5	7.3.3.1.3.b: M	Yes ___ No ___	
7.3.3.5.1	The Abort Request shall be used to abort the transfer of an Application PDU.	C.3.3.5	7.3.3.5:M	Yes ___ No ___	
7.3.3.5.2	No data field shall be permitted with the Abort Request. When a Destination receives an Abort Request from the Originator, any received segments associated with the Serial Number are discarded.	C.3.3.5	7.3.3.5:M	Yes ___ No ___	
7.3.3.5.3	When an Originator receives an Abort Request from the Destination, the Originator shall stop transmitting segments associated with the Serial Number to that Destination and report a failed transmission as appropriate to the Application Layer.	C.3.3.5	7.3.3.5:M	Yes ___ No ___	
7.3.3.5.4	If the sender of the Abort Request desires an Abort Confirm, the P/F bit shall be set to 1.	C.3.3.5	7.3.3.5:M	Yes ___ No ___	
7.3.3.5.5	In S/R Basic, the P/F bit shall be set to "0" (i.e., Abort Confirms are not requested).	C.3.3.5	7.3.3.5:M	Yes ___ No ___	
7.3.3.5.6	The Abort Request frame shall be sent to indicate that the sender is no longer willing to continue the transfer of the Application PDU.	C.3.3.5	7.3.3.5:M	Yes ___ No ___	
7.3.3.6	Abort Confirm PDU.	C.3.3.6	7.3.3.1.3.f: M	Yes ___ No ___	
7.3.3.6.1	After receiving an Abort Request with the P/F bit set to bit 1, the receiving addressee shall confirm its acceptance of the abort by transmitting an Abort Confirm.	C.3.3.6	7.3.3.6:M	Yes ___ No ___	
7.3.3.6.2	No data field shall be permitted with the Abort Confirm.	C.3.3.6	7.3.3.6:M	Yes ___ No ___	
7.3.3.7	Acknowledgment Request PDU.	C.3.3.7	7.3.3.1.3.d: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.3.7.1	An Acknowledgment Request PDU shall be used by the Application PDU Originator to request the acknowledgment status of all previous transmitted Data Segments.	C.3.3.7	7.3.3.7:M	Yes ___ No ___	
7.3.3.7.2	Upon receiving an Acknowledgment Request PDU, the Destination shall return a Partial Acknowledgment PDU to the Originator if not all data segments have been received, a Complete Acknowledgment if all data segments have been received, or an Abort Request PDU if the receiver wishes to terminate the transfer.	C.3.3.7	7.3.3.7:M	Yes ___ No ___	
7.3.3.7.3	No data field shall be permitted with the Acknowledgment Request PDU.	C.3.3.7	7.3.3.7:M	Yes ___ No ___	
7.3.3.7.4	P/F Bit.	C.3.3.7.1	7.3.3.7:M	Yes ___ No ___	
7.3.3.7.4.1	The P/F bit shall always have a value of bit set (1) for Acknowledgment Requests.	C.3.3.7.1	7.3.3.7.4: M	Yes ___ No ___	
7.3.3.7.5	Last Sent Segment Number (LSSN).	C.3.3.7.2	7.3.3.7:M	Yes ___ No ___	
7.3.3.7.6	Padding Field.	C.3.3.7.3	7.3.3.7:M	Yes ___ No ___	
7.3.3.7.6.1	The size of the Padding field shall be 16 bits to ensure that the PDU ends on a 32-bit boundary.	C.3.3.7.3	7.3.3.7.6: M	Yes ___ No ___	
7.3.3.7.6.2	Padding bits shall be set to 0.	C.3.3.7.3	7.3.3.7.6: M	Yes ___ No ___	
7.3.3.7.6.3	The Destination station shall ignore this field.	C.3.3.7.3	7.3.3.7.6: M	Yes ___ No ___	
7.3.4	Data segment acknowledgment schemes.	C.3.4	7.1:M	Yes ___ No ___	
7.3.4.a	A Selective Retransmission scheme shall be employed that allows the Destination to inform the Originator which data segments have been received.	C.3.4	7.3.4:M	Yes ___ No ___	
7.3.4.a.1	a. Acknowledgment Request PDU: This PDU is sent by an Originator to solicit a response from a Destination. The Destination shall respond either with a Partial Acknowledgment PDU, a Complete Acknowledgment PDU, or an Abort Request PDU.	C.3.4.a	7.3.4.a:M	Yes ___ No ___	
7.3.4.a.2	b. Data Segment PDU with P-bit = 1: The Originator can set the P-bit = 1 in any data segment to solicit a response from the Destination. The Destination shall respond with either a Partial Acknowledgment PDU or a Complete Acknowledgment PDU with the F-bit = 1, or an Abort Request PDU.	C.3.4.b	7.3.4.a:M	Yes ___ No ___	
7.3.4.b	All data segments associated with the same Serial Number shall use the same data segment acknowledgment scheme, i.e., all data segments with the same Serial Number shall contain the same Type field value.	C.3.4	7.3.4:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.4.1	End of Data Transfer (EDT) Acknowledgment Required Scheme	C.3.4.1	7.3.4:M	Yes ___ No ___	
7.3.4.1.a	The S/R Enhanced Protocol, the Destination shall transmit unsolicited Partial Acknowledgment PDUs to the Originator periodically during the S/R transaction as dictated by the Partial Acknowledgment Interval Timer (PAIT) behavior.	C.3.4.1	7.3.4:M	Yes ___ No ___	
7.3.4.2	End of Data Transfer (EDT) Acknowledgment Not Required Scheme	C.3.4.2	7.3.4:M	Yes ___ No ___	
7.3.4.2.a	The Destination shall only send an acknowledgment in response to an Acknowledgment Request PDU or a Data Segment PDU with P-bit = 1.	C.3.4.2	7.3.4:M	Yes ___ No ___	
7.3.5	S/R Basic Procedures.	C.3.5	7.2.b:M	Yes ___ No ___	
7.3.5.1	S/R Basic Overview	C.3.5.1	7.2.b.1:M	Yes ___ No ___	
7.3.5.1.a	In the S/R Basic Protocol mixed-mode Destination Addresses shall be handled as separate S/R Transactions, one for Unicast Addresses and one for Multicast Addresses.	C.3.5.1	7.3.5.1:M	Yes ___ No ___	
7.3.5.1.b	A single S/R Basic transaction shall only contain Unicast Addresses or Multicast Addresses (including the Global address), but may not contain both.	C.3.5.1	7.3.5.1:M	Yes ___ No ___	
7.3.5.1.c	When an Abort Request PDU is issued in the S/R Basic Protocol, the P-bit shall be set to the value "0", as the S/R Basic Protocol does not request Abort Confirm PDUs to be issued.	C.3.5.1	7.3.5.1:M	Yes ___ No ___	
7.3.5.1.1	Basic Segmentation	C.3.5.1.1	7.3.5.1:M	Yes ___ No ___	
7.3.5.1.1.a	The Originator shall map the original application PDU into an ordered sequence of segments.	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.b	Each segment shall be the specified Segment Size octets in length, with the possible exception of the last segment that can be less than the specified Segment Size octets in length.	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.c	If the last segment is less than the specified Segment Size octets in length, it shall not be padded.	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1d	Destinations shall verify the Segment Size for each segment is the same (with the possible exception of the last segment) and abort any transaction where a segment with an incocrrect segment size is received	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.e	If no Segment Size is specified, MSS shall be used for the Segment Size.	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.f	The Originator shall assign a single, unique Serial Number to each application PDU and copy it into the header of each segment associated with that application PDU.	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.g	Each data segment shall then be sequentially sent, starting with segment number equal to 1.	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.5.1.1.h	The Originator shall track which segments have and have not been acknowledged for each Destination.	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.i	Each S/R segment shall be transmitted in one UDP Request or one Intranet Layer Request (if n-layer pass through is used) by the Originator.	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.j	The Originator shall indicate in the segmentation header whether the transfer of the Application PDU requires an EDT Acknowledgment or does not require an EDT Acknowledgment.	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.k	All data segments associated with the same serial number shall use the same Type field value (i.e., either all Data Segment PDUs will be EDT Acknowledgment Required or EDT Acknowledgment Not Required for a given transaction).	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.l	If the Originator wishes to abort the transfer of the Application PDU, it shall transmit an Abort Request PDU to the Destination and shall set the P-bit = 0.	C.3.5.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.1	Transmitting to Multicast Addresses	C.3.5.1.1.1	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.1 .a	When transmitting to Multicast Addresses, which includes the Global Address, in the S/R Basic Protocol, the Originator shall only transmit each Data Segment PDU once.	C.3.5.1.1.1	7.3.5.1.1.1: M	Yes ___ No ___	
7.3.5.1.1.1 .b	The Originator shall set the P-bit = 0 for all Data Segment PDUs.	C.3.5.1.1.1	7.3.5.1.1.1: M	Yes ___ No ___	
7.3.5.1.1.1 .c	All Data Segment PDUs shall be sent as EDT Acknowledgment Not Required.	C.3.5.1.1.1	7.3.5.1.1.1: M	Yes ___ No ___	
7.3.5.1.1.2	Transmitting to Unicast Addresses	C.3.5.1.1.2	7.3.5.1.1: M	Yes ___ No ___	
7.3.5.1.1.2 .a	When transmitting to Unicast Addresses in the S/R Basic Protocol, the Originator shall indicate in the S/R header that an acknowledgment is required by setting the P-bit = 1 when transmitting the first segment.	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2 .b	Subsequent segments shall not be sent until the Originator receives an acknowledgment for the first segment from all Destination(s) or any non-responsive destinations are pruned (i.e., the Destination Status is set to INACTIVE).	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2 .c	The Originator shall then engage in Flow Control procedures in order to achieve efficient transmission of Data Segment PDUs.	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2 .d	Flow Control shall be restricted by a Segment Credit Limit, representing the maximum number of unacknowledged segments allowed at any given time, and governed by a set of timers.	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2 .e	The Originator shall only send data segments that will not cause the number of unacknowledged segments to exceed the Segment Credit Limit.	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.5.1.1.2.f	The Originator shall retransmit only data segments that were not received by one or more Destination(s) as indicated by a Partial Acknowledgment PDU received from the Destination(s) prior to the expiration of the Request for Acknowledgment Interval Timer (RFAIT).	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2.g	The number of retry attempts for a segment shall be limited by the Segment Retry Count Limit (SRCL) parameter.	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2.h	In the case that multiple Data Segments are available at the same time for sending, Data Segments with lower Segment Numbers shall be resent/sent before Data Segments with higher Segment Numbers.	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2.i	Each time the Originator issues a Request for Acknowledgment, it shall start a Request for Acknowledgment Interval Timer (RFAIT).	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2.j	If the RFAIT expires without the receipt of an acknowledgment from any Destinations, the Originator shall transmit an Acknowledgment Request PDU.	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2.k	The transfer of the Application PDU shall be aborted to the INACTIVE Destination and an error indication should be returned to the Upper Layer Protocol.	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2.l	If the RFAIT is active and another Request for Acknowledgment is issued by the Originator for any reason, the RFAIT shall be restarted.	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.1.2.m	When the Originator sends a Data Segment with EDT Acknowledgment Required PDU and Segment Number = Last Segment Number, then the P-bit shall be set to 1, requesting an acknowledgment.	C.3.5.1.1.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.1.2	Basic Reassembly	C.3.5.1.2	7.3.5.1:M	Yes ___ No ___	
7.3.5.1.2.a	The Destination shall monitor for S/R segments to arrive.	C.3.5.1.2	7.3.5.1.2: M	Yes ___ No ___	
	Each Destination shall reassemble the segments in the proper order, regardless of the order of reception.	C.3.5.1.2	7.3.5.1.2: M	Yes ___ No ___	
7.3.5.1.2.b	Each Destination shall track which segments have and have not been received for each Application PDU Identifier such that duplicate received segments can be detected and ignored.	C.3.5.1.2	7.3.5.1.2: M	Yes ___ No ___	
7.3.5.1.2.c	Once a complete Application PDU is reassembled, it shall be forwarded to the application.	C.3.5.1.2	7.3.5.1.2: M	Yes ___ No ___	
7.3.5.1.2.d	When the Destination receives any Request for Acknowledgment it shall respond with either a Partial Acknowledgment PDU, Complete Acknowledgment PDU, or Abort Request PDU as appropriate.	C.3.5.1.2	7.3.5.1.2: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.5.1.2.e	If the Destination receives a data segment with EDT Acknowledgment Required (Type field = 0), and this data segment completes the Application PDU, then it shall respond with a Complete Acknowledgment PDU.	C.3.5.1.2	7.3.5.1.2: M	Yes ___ No ___	
7.3.5.1.2.f	If the Destination receives an Abort Request PDU, it shall discard any data segments already received associated with that Application PDU.	C.3.5.1.2	7.3.5.1.2: M	Yes ___ No ___	
7.3.5.1.2.g	If the Abort Request has the P-bit = 1, the Destination shall respond with an Abort Confirm PDU with F-bit = 1 to the Originator.	C.3.5.1.2	7.3.5.1.2: M	Yes ___ No ___	
7.3.5.1.2.h	If the Destination wishes to abort the transfer of the Application PDU, it shall transmit an Abort Request PDU to the Originator with the P-bit = 0.	C.3.5.1.2	7.3.5.1.2: M	Yes ___ No ___	
7.3.5.2	S/R Basic Flow Control	C.3.5.2	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.2.1	S/R Basic Flow Control Parameters and Behaviors	C.3.5.2.1	7.3.5.2:M	Yes ___ No ___	
7.3.5.2.1.1	The values of the S/R Flow Control parameters shall be initially defined based on the network characteristics and the S/R operation.	C.3.5.2.1	7.3.5.2.1: M	Yes ___ No ___	
7.3.5.2.1.1.a	The parameter for S/R Basic Flow Control is: <u>Segment Credit Limit (SCL)</u>	C.3.5.2.1	7.3.5.2.1: M	Yes ___ No ___	
7.3.5.2.1.1.a.1	The Originator shall solicit an acknowledgment by setting the P-bit = 1 when it sends the Data Segment that causes the number of outstanding segments to reach the SCL.	C.3.5.2.1	7.3.5.2.1: M	Yes ___ No ___	
7.3.5.2.2	S/R Basic Flow Control Parameter Values	C.3.5.2.2	7.3.5.2:M	Yes ___ No ___	
7.3.5.2.2.1	Systems shall have the ability to change the parameters listed in the TABLE C-V.	C.3.5.2.2	7.3.5.2.2: M	Yes ___ No ___	
7.3.5.3	S/R Basic Timing Parameters and Variables	C.3.5.3	7.3.5.1.1.2: M	Yes ___ No ___	
7.3.5.3.1	S/R Basic Timing Parameters	C.3.5.3.1	7.3.5.3:M	Yes ___ No ___	
7.3.5.3.1.a	<u>Segment Retry Count Limit (SRCL)</u>: The number of times that an Originator shall retransmit a Data Segment based on a received Partial Acknowledgment indicating a missing segment before aborting the transfer of the Application PDU.	C.3.5.3.1.a	7.3.5.3.1: M	Yes ___ No ___	
7.3.5.3.1.b	<u>Request For Acknowledgement Retry Limit (RFARL)</u>: The number of consecutive times that an Originator shall re-transmit a request for acknowledgment without receiving an acknowledgment from the Destination before aborting the transfer of the Application PDU.	C.3.5.3.1.b	7.3.5.3.1: M	Yes ___ No ___	
7.3.5.3.2	S/R Basic Timing Parameter Default Values	C.3.5.3.2	7.3.5.3:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.5.3.2.a	Systems shall have the ability to change the parameters listed in TABLE C-VI either dynamically or during system initialzation.	C.3.5.3.2	7.3.5.3.2: M	Yes ___ No ___	
7.3.5.3.3	S/R Basic Timing Variables: In general, the system must maintain one set of the following Variables for the duration of each S/R transaction (composed of an Originator, Destination, and Application PDU)	C.3.5.3.3	7.3.5.3:M	Yes ___ No ___	
7.3.5.3.3.a	Request For Acknowledgement Retry Count (RFARC): The number of times an Originator has re-transmitted a Request for Acknowledgement without receiving an acknowledgment from the Destination. The Originator shall maintain the RFARC for each Destination.	C.3.5.3.3.a	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.b	Measured Round Trip Delay (MRTD): The measured value from the time a Data Segment is sent until the time the acknowledgement of that segment is received. The Originator shall measure the MRTD only for segments sent using the Unsent Segments procedure (i.e., not when segments are resent).	C.3.5.3.3.b	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.c	Smallest Lowest Numbered Unacknowledged Segment (SLNUS): The Segment Number of the lowest numbered segment that has been sent by the Originator but for which an acknowledgment has not yet been received from all ACTIVE Destinations. The Originator shall maintain the SLNUS for each active transfer. If there is only one Destination, then the SLNUS will equal the LNUS for that Destination.	C.3.5.3.3.c	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.d	Last Segment Number (LSN): The final Segment Number of the current Application PDU. .	C.3.5.3.3.d	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.d.1	The Originator shall maintain the LSN for each active transfer	C.3.5.3.3.d	7.3.5.3.3.d: M	Yes ___ No ___	
7.3.5.3.3.d.2	The Destination shall also maintain the LSN for each active transfer.	C.3.5.3.3.d	7.3.5.3.3.d: M	Yes ___ No ___	
7.3.5.3.3.e	Highest Numbered Segment Sent (HNSS): The Segment Number of the highest numbered segment that has been sent by the Originator. The Originator shall maintain the HNSS for each active transfer.	C.3.5.3.3.e	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.f	Measured Inter-Segment Receive Interval Time (MISRIT): The measured time between receiving the current segment and the previous segment. The Destination shall measure the MISRIT when a segment is received for an active transfer.	C.3.5.3.3.f	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.g	Relaxed Estimated Round Trip Delay (RERTD): The adjusted ERTD to account for jitter in transmission times. The Originator shall maintain the RERTD for each Destination.	C.3.5.3.3.g	7.3.5.3.3: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.5.3.3.h	Segment Credits Used (SCU): The current number of segments that have been sent but not acknowledged by all Destinations. The Originator shall maintain the SCU for each active transfer.	C.3.5.3.3.h	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.i	Saved Estimated Round Trip Delay (SERTD): The currently saved value of the ERTD. Updates to this value are only made based on actual measurements. The Originator shall maintain the SERTD for each Destination.	C.3.5.3.3.i	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.j	Segment Retry Count (SRC): The number of times that a segment has been re-sent by the Originator to all active Destinations. The Originator shall maintain the SRC for each active transfer.	C.3.5.3.3.j	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.k	Partial Acknowledgment Starting Segment Number (PASSN): This refers to the value of the SSN contained in the Partial Acknowledgment currently being processed by the Originator.	C.3.5.3.3.k	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.l	Segment Number (SN): This refers to the value of the Segment Number field contained in the Data Segment of an active transfer currently being processed by the Originator	C.3.5.3.3.l	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3. m	Hop Count (HOPCNT):	C.3.5.3.3.m	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3. m.1	Stations shall maintain the maximum HOPCNT of all other stations with which it has an active transfer.	C.3.5.3.3.m	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3. m.2	This value may not be available in all systems, in which case a default value of 1 shall be used.	C.3.5.3.3.m	7.3.5.3.3.k: M	Yes ___ No ___	
7.3.5.3.3.n	Initial Inter-Segment Receive Interval Timer (IISRIT): The initial value for the ISRIT. This value is calculated as per the equation in section C.3.5.7.3. This variable shall be calculated for each Destination.	C.3.5.3.3.n	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.o	Initial Round Trip Delay (IRTD): The initial value for the ERTD. This value is calculated as per the equation in section C.3.5.7.2. This variable shall be calculated for each Destination.	C.3.5.3.3.o	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.p	Lowest Numbered Unacknowledged Segment (LNUS): The Segment Number of the lowest numbered segment that has been sent by the Originator but for which an acknowledged has not yet been received by the Destination. The Originator shall maintain the LNUS for each Destination with which it has an active transfer.	C.3.5.3.3.p	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.3.3.q	Destination Status (DS): The Originator shall maintain the DS for each Destination associated with a transfer. If the Originator is still attempting to successfully complete the transfer for the Destination, the value shall be ACTIVE. If the Originator has aborted the transfer to the Destination, the value shall be INACTIVE.	C.3.5.3.3.q	7.3.5.3.3: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.5.3.3.r	Originator Status: The Destination shall maintain the Originator Status for each Application PDU Identifier. If the Destination is still attempting to successfully reassemble segment associated with the Application PDU Identifier, the value shall be ACTIVE. If the Destination has aborted the transfer to the Destination or sent a complete acknowledgment, the value shall be INACTIVE.	C.3.5.3.3.r	7.3.5.3.3: M	Yes ___ No ___	
7.3.5.4	Detailed S/R Basic Procedures	C.3.5.4	7.3.5:M	Yes ___ No ___	
7.3.5.4.1	S/R Basic Procedure for Sending Unsent (data) Segments to Multicast Addresses	C.3.5.4.1	7.3.5.4:M	Yes ___ No ___	
7.3.5.4.1.a	The Originator of the S/R Multicast transaction shall, at a minimum, perform the following logic: Send the first Data Segment PDU in the transfer with P-bit = 0 and EDT Acknowledgment Not Required. Wait for the transmission of the first Data Segment to complete. **WHILE (**not all data segments have been sent as Unsent Segments) **LOOP** Send the next Data Segment in the transfer with P-bit = 0 and EDT Acknowledgment Not Required **END WHILE LOOP**	C.3.5.4.1	7.3.5.4.1: M	Yes ___ No ___	
7.3.5.4.2	S/R Basic Procedure for Sending Unsent (data) Segments to Unicast Addresses	C.3.5.4.2	7.3.5.4:M	Yes ___ No ___	
7.3.5.4.2.a	When the Originator is sending the first segment of a transaction or receives a Partial Acknowledgment that causes SLNUS to increase (and therefore the SCU to decrease), or prunes a destination that causes SLNUS to increase (and therefore the SCU to decrease), it shall take the actions as described in paragraph C.3.5.4.2.	C.3.5.4.2	7.3.5.4:M	Yes ___ No ___	
7.3.5.4.3	S/R Basic Procedure for Processing Acknowledgment	C.3.5.4.3	7.3.5.4:M	Yes ___ No ___	
7.3.5.4.3.1	When an Originator receives a Partial Acknowledgment PDU, it shall take the actions as described in paragraph C.3.5.4.3.a.	C.3.5.4.3.a	7.3.5.4.3: M	Yes ___ No ___	
7.3.5.4.3.2	When an Originator receives a Complete Acknowledgment PDU, it shall take the actions described in paragraph C.3.5.4.3.b.	C.3.5.4.3.b	7.3.5.4.3: M	Yes ___ No ___	
7.3.5.4.4	S/R Basic Procedure for Resending Unacknowledged Data Segments	C.3.5.4.4	7.3.5.4:M	Yes ___ No ___	
7.3.5.4.4.1	This procedure shall be executed any time the (RFAIT Stops) or (the RFAIT Expires and at least one Partial Acknowledgment was received).	C.3.5.4.4	7.3.5.4.4: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.5.4.5	S/R Basic Procedure for Processing Received Data Segment(s)	C.3.5.4.5	7.3.5.4:M	Yes ___ No ___	
7.3.5.4.5.1	When a Destination receives a Data Segment it shall take the actions described in paragraph C.3.5.4.5.	C.3.5.4.5	7.3.5.4.5: M	Yes ___ No ___	
7.3.5.4.6	S/R Basic Procedure for Processing a Received Acknowledgment Request PDU	C.3.5.4.6	7.3.5.4:M	Yes ___ No ___	
7.3.5.4.6.1	When a Destination receives an Acknowledgment Request PDU it shall take the actions described in paragraph C.3.5.4.6.	C.3.5.4.6	7.3.5.4.6: M	Yes ___ No ___	
7.3.5.4.7	S/R Basic Procedure for Processing a Received Abort Request PDU	C.3.5.4.7	7.3.5.4:M	Yes ___ No ___	
7.3.5.4.7.1	When a Destination receives an Abort Request PDU it shall take the actions described in paragraph C.3.5.4.7.a.	C.3.5.4.7.a	7.3.5.4.7: M	Yes ___ No ___	
7.3.5.4.7.2	When an Originator receives an Abort Request PDU it shall take the actions described in paragraph C.3.5.4.7.b.	C.3.5.4.7.b	7.3.5.4.7: M	Yes ___ No ___	
7.3.5.5	S/R Basic Timers	C.3.5.5	7.3.5:M	Yes ___ No ___	
7.3.5.5.a	The S/R Protocol shall use the following Timers in order to facilitate an efficient exchange of segmented data between the Originator and the Destination.	C.3.5.5	7.3.5.5:M	Yes ___ No ___	
7.3.5.5.1	Request for Acknowledgment Interval Timer (RFAIT).	C.3.5.5.1	7.3.5.5:M	Yes ___ No ___	
7.3.5.5.1.a	The RFAIT shall be run at the Originator to predict a time by which a response to a Request for Acknowledgment should be received.	C.3.5.5.1	7.3.5.5:M	Yes ___ No ___	
7.3.5.5.1.b	The Originator shall maintain one RFAIT for each active Application PDU Identifier.	C.3.5.5.1	7.3.5.5:M	Yes ___ No ___	
7.3.5.5.1.1	The RFAIT shall be started (or stopped then restarted) at the Originator each time a Request for Acknowledgment is issued.	C.3.5.5.1.a	7.3.5.5.1: M	Yes ___ No ___	
7.3.5.5.1.1 .a	If the RFAIT is already running when a Request for Acknowledgment is issued, the RFAIT shall be restarted, i.e., stopped then started again.	C.3.5.5.1.a	7.3.5.5.1: M	Yes ___ No ___	
7.3.5.5.1.1 .b	Only one RFAIT shall be running at any given time for each Application PDU that is active at the Originator.	C.3.5.5.1.a	7.3.5.5.1: M	Yes ___ No ___	
7.3.5.5.1.1 .c	The RFAIT value shall be calculated according to the procedure below each time it is started or restarted. Increment the RFARC for all ACTIVE Destinations by 1. RFAIT = Max(RERTD) **IF** RFAIT > MAX_RFAIT_VALUE **THEN** RFAIT = MAX_RFAIT_VALUE **ENDIF**	C.3.5.5.1.a	7.3.5.5.1: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.5.5.1.1.d	The RERTD selected for use in the following equation shall be the largest of any active Destination (DS=ACTIVE).	C.3.5.5.1.a	7.3.5.5.1: M	Yes ___ No ___	
7.3.5.5.1.2	The RFAIT shall be stopped when a Partial Acknowledgment or Complete Acknowledgment is received from all Destinations, at this time Unacknowledged Segments will be resent according to C.3.5.4.4 then any Unsent Segments will be sent according to C.3.5.4.2.	C.3.5.5.1.b	7.3.5.5.1: M	Yes ___ No ___	
7.3.5.5.1.3	When the RFAIT expires at the Originator, meaning that at least one Destination did not send an Acknowledgment, the following shall occur as described in paragraph C.3.5.5.1.c.	C.3.5.5.1.c	7.3.5.5.1: M	Yes ___ No ___	
7.3.5.5.2	Inter-Segment Receive Timer (ISRT)	C.3.5.5.2	7.3.5.5:M	Yes ___ No ___	
7.3.5.5.2.a	The ISRT shall be used to measure the time between received S/R PDUs at the Destination as required to update the estimate for the Inter-Segment Receive Interval Timer.	C.3.5.5.2	7.3.5.5.2: M	Yes ___ No ___	
7.3.5.5.2.b	The Destination shall maintain one ISRT for each Application PDU.	C.3.5.5.2	7.3.5.5.2: M	Yes ___ No ___	
7.3.5.5.2.1	This time shall be used to update the ISRIT according to C.3.5.5.3.	C.3.5.5.2.b	7.3.5.5.2: M	Yes ___ No ___	
7.3.5.5.2.2	The ISRT shall only be restarted if not all of the segments associated with the Application PDU have been received.	C.3.5.5.2.b	7.3.5.5.2: M	Yes ___ No ___	
7.3.5.5.3	Inter-Segment Receive Interval Timer (ISRIT)	C.3.5.5.3	7.3.5.5:M	Yes ___ No ___	
7.3.5.5.3.a	The ISRIT shall be used to predict a time by which the next segment should be received at the Destination.	C.3.5.5.3	7.3.5.5.3: M	Yes ___ No ___	
7.3.5.5.3.b	The Destination shall maintain one ISRIT for each Application PDU.	C.3.5.5.3	7.3.5.5.3: M	Yes ___ No ___	
7.3.5.5.3.1	When a segment is received, the ISRIT shall be started or restarted to predict a time by which the next segment should be received.	C.3.5.5.3.a	7.3.5.5.3: M	Yes ___ No ___	
7.3.5.5.3.2	The value of ISRIT shall be set according to C.3.5.6.3.	C.3.5.5.3.a	7.3.5.5.3: M	Yes ___ No ___	
7.3.5.5.3.3	When the next segment is received, the ISRIT shall be stopped and then restarted if all segments have not been received.	C.3.5.5.3.b	7.3.5.5.3: M	Yes ___ No ___	
7.3.5.5.3.4	When the ISRIT expires, the transaction shall be aborted.	C.3.5.5.3.c	7.3.5.5.3: M	Yes ___ No ___	
7.3.5.5.3.4.1	Destination shall send an Abort Request PDU with P-Bit = 0	C.3.5.5.3.c	7.3.5.5.3.4: M	Yes ___ No ___	
7.3.5.5.3.4.2	Destination shall discard segments associated with the Application PDU	C.3.5.5.3.c	7.3.5.5.3.4: M	Yes ___ No ___	
7.3.5.6	Basic Timer Equations	C.3.5.6	7.3.5:M	Yes ___ No ___	
7.3.5.6.1	Round Trip Delay (RTD) Equations	C.3.5.6.1	7.3.5.6:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.5.6.1.a	The following sequence of equations shall be used to calculate the RERTD, and the SERTD, according to C.3.5.6.1.	C.3.5.6.1	7.3.5.6.1:M	Yes ___ No ___	
7.3.5.6.2	LNUS and SLNUS Equations	C.3.5.6.2	7.3.5.6:M	Yes ___ No ___	
7.3.5.6.2.a	When a Partial Acknowledgment is received, the following sequence of equations shall be used to update the LNUS associated with the Destination that sent the Partial Acknowledgment, according to C.3.5.6.2.	C.3.5.6.2	7.3.5.6.2:M	Yes ___ No ___	
7.3.5.6.3	Segment Reception Equations	C.3.5.6	7.3.5.6:M	Yes ___ No ___	
7.3.5.6.3.a	When a segment is received the following sequence of equations shall be used to calculate the ISRIT and start/restart the ISRT, according to C.3.5.6.3.	C.3.5.6.3	7.3.5.6.3:M	Yes ___ No ___	
7.3.5.7	Basic Initialization Equations	C.3.5.7	7.3.5:M	Yes ___ No ___	
7.3.5.7.1	Network Enable Initialization	C.3.5.7.1	7.3.5.7:M	Yes ___ No ___	
7.3.5.7.1.a	Before any segments have been sent or received (e.g., upon enabling the net), the following sequence of equations shall be used to initialize parameter values, according to C.3.5.7.1.	C.3.5.7.1	7.3.5.7:M	Yes ___ No ___	
7.3.5.7.2	Application PDU Transmit Initialization	C.3.5.7.2	7.3.5:M	Yes ___ No ___	
7.3.5.7.2.a	Each time an Originator initiates the transfer of an Application PDU, the following sequence of equations shall be used to initialize the following parameter values associated with that Application PDU, according to C.3.5.7.2.	C.3.5.7.2	7.3.5.7:M	Yes ___ No ___	
7.3.5.7.3	Application PDU Receive Initialization	C.3.5.7.3	7.3.5:M	Yes ___ No ___	
7.3.5.7.3.a	Each time a Destination begins reception of a new Application PDU, the following sequence of equations shall be used to initialize the following parameter values associated with that Application PDU Identifier, according to C.3.5.7.3.	C.3.5.7.3	7.3.5.7:M	Yes ___ No ___	
7.3.6	S/R Enhanced Procedures	C.3.6	7.2.b.2:M	Yes ___ No ___	
7.3.6.1	S/R Enhanced Overview.	C.3.6.1	7.2.b:M	Yes ___ No ___	
7.3.6.1.a	In the S/R Enhanced Protocol mixed-mode Destination Addresses shall be permitted.	C.3.6.1	7.3.6.1:M	Yes ___ No ___	
7.3.6.1.b	When an Abort Request PDU is issued in the S/R Enhanced Protocol, if an Abort Confirm PDU response is desired, the P-bit shall be set (i.e., set to the value "1").	C.3.6.1	7.3.6.1:M	Yes ___ No ___	
7.3.6.1.1	S/R Enhanced Segmentation	C.3.6.1.1	7.3.6.1:M	Yes ___ No ___	
7.3.6.1.1.a	The Originator shall map the original application PDU into an ordered sequence of segments.	C.3.6.1.1	7.3.6.1.1:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.1.1.b	Each segment shall be the specified Segment Size bytes in length, with the possible exception of the last segment which can be less than the specified Segment Size bytes in length.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.c	If no Segment Size is specified by the host, MSS shall be used for the Segment Size.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.d	The Originator shall assign a single, unique Serial Number to each application PDU and copy it into the header of each segment associated with that application PDU.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.e	Each data segment shall then be sequentially sent, starting with segment number equal to 1.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.f	The Originator shall track which segments have and have not been acknowledged for each Destination.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.g	Every segment shall specify the Last Segment Number (the total number of segments in the Application PDU) and it's Segment Number (segment sequence number of the current segment).	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.h	Each S/R segment shall be transmitted in one UDP Request or one Intranet Layer Request (if n-layer pass through is used) by the Originator.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.i	The Originator shall indicate in the segmentation header whether the data transfer requires an End of Data Transfer Acknowledgment (Type field = 0) or does not require an End of Data Transfer Acknowledgment (Type field = 2).	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.j	All data segments associated with the same serial number shall use the same Type field value.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.k	For the first segment, the Originator shall indicate in the S/R header that an acknowledgment is required by setting the P-bit = 1.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.l	Subsequent segments shall not be sent until the Originator receives an acknowledgment for the first segment from all Destination(s).	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1. m	The Originator and Destination(s) shall then engage in Flow Control procedures in order to achieve efficient transmission of Data Segments.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.n	Flow Control shall be restricted by a Credit Limit, representing the maximum number of unacknowledged segments allowed at any given time, and governed by a series of timers.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.o	The Originator shall not send any data segments that will cause the number of unacknowledged segments to exceed the Segment Credit Limit (SCL).	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.p	The Originator shall retransmit only data segments that were not received by one or more Destination(s) as indicated by a Partial Acknowledgment (Type field = 4)	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	

APPENDIX E

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.1.1.q	Missing data segments shall only be retransmitted a finite number of times until either acknowledgment(s) indicate all data segments have been received or the transfer of the Application PDU is aborted with a given Destination.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.r	The number of retry attempts for a segment shall be limited by the Segment Retry Count Limit (SRCL) parameter.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.s	In the case that multiple Data Segments are available at the same time for sending, Data Segments with lower Segment Numbers shall be resent/sent before Data Segments with higher Segment Numbers.	C.3.6.1.1	7.3.6..1:M	Yes ___ No ___	
7.3.6.1.1.t	Each time the Originator issues a Request for Acknowledgment, it shall start a Request for Acknowledgment Interval Timer (RFAIT).	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.u	If the RFAIT expires without the receipt of an acknowledgment from all Destinations, the Originator shall transmit an Acknowledgment Request (Type field = 3).	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.v	If acknowledgment(s) are not received from all Destination(s) after Request For Acknowledgement Retry Limit (RFARL) number of tries, the transfer of the Application PDU shall be aborted and an error indication shall be returned to the Upper Layer Protocol.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1. w	If the RFAIT is active and another Request for Acknowledgment is issued by the Originator for any reason, the RFAIT shall be restarted.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.x	When the Originator sends a Data Segment with EDT Acknowledgment Required (Type Field = 0) and Segment Number = Last Segment Number, then the P-bit shall be set to 1, requesting an acknowledgment.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.y	When the transfer of the Application PDU is complete, either successfully or unsuccessfully, the Originator shall place the associated Application PDU Identifier in the Reference Freeze State, see paragraph C.3.6.1.3.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.z	If the Originator wishes to abort the transfer of the Application PDU, it shall transmit an Abort Request (Type field = 1) to the Destination.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.a a	If the Originator wishes to receive confirmation of the abort, then it shall set the P-bit = 1 in the Abort Request.	C.3.6.1.1	7.3.6.1.1: M	Yes ___ No ___	
7.3.6.1.1.a b	If the Originator receives an Abort Request or an Abort Confirm, the Originator shall set the DACR for that Destination to TRUE.	C.3.6.1.1	7.3.5.1:M	Yes ___ No ___	
7.3.6.1.1.a c	If the last segment is less than the specified Segment Size octets in length, it shall not be padded.	C.3.6.1.1	7.3.5.1:M	Yes ___ No ___	
7.3.6.1.2	S/R Enhanced Reassembly	C.3.6.1.2	7.3.6.1:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.1.2.a	The Destination shall monitor port for S/R segments to arrive. The source address of the Originator (as provided by the lower level protocol) combined with the S/R header Serial Number, forms the Application PDU Identifier, which uniquely identifies the Application PDU to which each segment belongs. On N-layer pass through networks, it shall be the serial number and source data link address which establish each unique data stream; on IP networks, it shall be the serial number and source IP address which establish each unique data stream.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.b	Each Destination shall reassemble the segments in the proper order, regardless of the order of reception.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.c	Each Destination shall track which segments have and have not been acknowledged for each Application PDU Identifier such that duplicate received segments can be detected and ignored.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.d	Once a complete Application PDU is reassembled, it shall be forwarded to the application.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.e	The Destination shall not forward an incomplete Application PDU to the application.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.f	When the Destination receives any Request for Acknowledgment corresponding to an Application PDU that is not in Reference Freeze State, it shall respond with either a Partial Acknowledgment or Complete Acknowledgment as appropriate.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.g	If the Destination receives a data segment with EDT Acknowledgment Required (Type field = 0) and the P-bit = 0, and this data segment completes the Application PDU, then it shall respond with a Complete Acknowledgment (Type field = 6) and the F-bit = 0.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.h	When the Destination receives a Data Segment (Type field = 0 or 2) or an Acknowledgment Request (Type field = 3), then it shall start a Reassembly Timer.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.i	For each different Application PDU Identifier, a different Reassembly Timer shall be used.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.j	The Reassembly Timer shall be based on interval timing between reception of segments and the number of segments not yet received.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.k	When the Application PDU is successfully reassembled, the Reassembly Timer associated with that Application PDU Identifier shall be terminated. Reassembly Timer behavior is described in paragraph C.3.6.5.1.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.1.2.l	If the data segments associated with the Application PDU are of type EDT Acknowledgment Not Required (Type field = 2), and the Reassembly Timer expires before the Application PDU is successfully reassembled, the Destination shall discard any data segments already received associated with that Application PDU and transmit an Abort Request (Type field = 1) with the P-bit = 1 to the Originator.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.m	The Destination shall then enter the Reference Freeze state for this Application PDU.	C.3.6.1.2	7.3.6.1.2.k: M	Yes ___ No ___	
7.3.6.1.2.n	If the Data Segments associated with the Application PDU are of type EDT Acknowledgment Required (Type field = 0), and the Reassembly Timer expires before the Application PDU is successfully reassembled, then the Destination shall transmit a Partial Acknowledgment (Type field = 4) to the Originator and restart the Reassembly Timer.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.o	If no further data is received from the Sending station after the Reassembly Timer Expiration Count Limit number of Partial Acknowledgments are transmitted, then the Receiving station shall discard any Data Segments already received associated with that Application PDU and transmit an Abort Request (Type field = 1) to the Sending station with the P-bit = 1.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.p	When the transfer of the Application PDU is complete, either successfully or unsuccessfully, the Destination shall place the associated Application PDU Identifier in the Reference Freeze State, see paragraph C.3.6.1.3.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.q	If the Destination receives an Abort Request (Type field = 1), it shall discard any data segments already received associated with that Application PDU and enter the Reference Freeze state for that Application PDU.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.r	If the Abort Request has the P-bit = 1, the Destination shall respond with an Abort Confirm (Type field = 5) with F-bit = 1 to the Originator.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.s	If the Destination receives an Abort Request, the Destination shall set the Originator Abort Confirm Received (OACR) for the Originator to TRUE.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.t	If the Destination wishes to abort the transfer of the Application PDU, it shall transmit an Abort Request (Type field = 1) to the Originator.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.u	If the Destination wishes to receive confirmation of the abort, then it shall set the P-bit = 1 in the Abort Request.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.v	If the Destination receives an Abort Confirm, the Destination shall set the OACR for the Originator to TRUE.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.56.1.2.w	When the Destination receives any Request for Acknowledgment or Data Segment corresponding to an Application PDU that is in Reference Freeze State, if the OACR is FALSE and all segments were previously received then a Complete Acknowledgment shall be sent to the Originator.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.x	If the OACR is FALSE and not all segments were previously received then an Abort Request with P-bit = 1 shall be sent to the Originator.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.2.y	If the OACR is TRUE then an Abort Request with P-bit = 0 shall be sent to the Originator.	C.3.6.1.2	7.3.6.1.2: M	Yes ___ No ___	
7.3.6.1.3	Reference Freeze State	C.3.6.1.3	7.3.6.1:M	Yes ___ No ___	
7.3.6.1.3.a	Once a transfer is complete, either successfully or unsuccessfully, the Originator and Destination shall place the associated Application PDU Identifier in the Reference Freeze State.	C.3.6.1.3	7.3.6.1.3: M	Yes ___ No ___	
7.3.6.1.3.b	If a data segment is received with an Application PDU Identifier that is currently in a Reference Freeze State, it is considered part of a previously completed transfer and shall be ignored.	C.3.6.1.3	7.3.6.1.3: M	Yes ___ No ___	
7.3.6.1.3.c	Once an Application PDU Identifier is removed from the Reference Freeze State, S/R PDUs with that Application PDU Identifier shall be accepted.	C.3.6.1.3	7.3.6.1.3: M	Yes ___ No ___	
7.3.6.2	Enhanced Flow Control	C.3.6.2	7.3.6:M	Yes ___ No ___	
7.3.6.2.1	S/R Enhanced Flow Control Parameters and Behaviors	C.3.6.2.1	7.3.6.2:M	Yes ___ No ___	
7.3.6.2.1.a	The values of the S/R Flow Control parameters shall be initially defined based on the network characteristics and the S/R operation.	C.3.6.2.1	7.3.6.2.1: M	Yes ___ No ___	
7.3.6.2.1.1	Segment Credit Limit (SCL): The maximum number of Data Segments that the Originator may have outstanding (i.e., sent and unacknowledged) for a single Application PDU simultaneously. Once this limit is reached, no additional segments shall be sent by the Originator until some of the outstanding segments have been acknowledged. The Originator shall solicit an acknowledgment by setting the P-bit = 1 when it sends the Data Segment that causes the number of outstanding segments to reach the SCL. The maximum value for SCL is derived from the MTU size.	C.3.6.2.1.a	7.3.6.2.1: M	Yes ___ No ___	
7.3.6.2.1.2	Segment Credit Threshold (SCT)	C.3.6.2.1.b	7.3.6.2.1: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.2.1.2.a	Segment Credit Threshold (SCT): The number of outstanding (i.e., sent and unacknowledged) S/R Data Segments per Application PDU that can be sent by an Originator before the station shall request an acknowledgment.	C.3.6.2.1.b	7.3.6.2.1: M	Yes ___ No ___	
7.3.6.2.1.2.b	The Originator shall solicit an acknowledgment by setting the P-bit = 1 when it sends the Data Segment that causes the number of outstanding segments to exceed the SCT.	C.3.6.2.1.b	7.3.6.2.1: M	Yes ___ No ___	
7.3.6.2.1.3	Segment Range Limit (SRL): The maximum difference between the Smallest Lowest Numbered Unacknowledged Segment (SLNUS) and the Highest Numbered Segment Sent (HNSS). Once this limit is reached, no additional segments shall be sent by the originator until the SLNUS has been acknowledged. The purpose of this parameter is to limit the size of the Bitfield field in a Partial Acknowledgment. The maximum value for SRL is derived from the MTU size.	C.3.6.2.1.c	7.3.6.2.1: M	Yes ___ No ___	
7.3.6.2.1.4	Segment Send Rate Limit Per Originator (SSRLPO): The maximum rate at which an Originator can send segments over a network. The purpose of the SSRLPO is to limit the rate at which segments can be sent by each originator to something that is less than the maximum rate that the net can support. For MIL-STD-188-220 nets, the Originator shall calculate the minimum timer interval between sending segments, and use the value to set the ISST as described in C.3.6.5.7.	C.3.6.2.1.d	7.3.6.2.1: M	Yes ___ No ___	
7.3.6.2.1.5	Received Segment Count Threshold (RSCT): The maximum number of S/R Data Segments received (new or duplicate) by the Destination per Application PDU since the last acknowledgement was sent. The Destination shall generate an appropriate acknowledgement PDU (Partial or Complete) and transmit it to the Originator when it receives the End of Data Transfer Acknowledgment required (Type 0) Data Segment that causes the number of received segments since the last acknowledgement was sent to reach the RSCT.	C.3.6.2.1.e	7.3.6.2.1: M	Yes ___ No ___	
7.3.6.2.1.6	Number of Missing Segments Threshold (NOMST): The number of segments with Segment Numbers less than the Highest Numbered Segment Received (HNSR) that are missing at the Destination, i.e., Data Segments that were sent by the Origination but have not yet been received by the Destination, that triggers action by the Destination. The Destination shall send a Partial Acknowledgment to the Originator when it receives the End of Data Transfer Acknowledgment required (Type 0) Data Segment that causes this threshold to be reached.	C.3.6.2.1.f	7.3.6.2.1: M	Yes ___ No ___	
7.3.6.2.2	S/R Enhanced Flow Control Parameter Values	C.3.6.2.2	7.3.6.2:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.2.2.a	Systems shall have the ability to change the parameters listed in TABLE C-VII either dynamically or during system intialization.	C.3.6.2.2	7.3.6.2.2: M	Yes ___ No ___	
7.3.6.3	S/R Enhanced Timing Parameters and Variables	C.3.6.3	7.3.6:M	Yes ___ No ___	
7.3.6.3.1	S/R Enhanced Timing Parameters	C.3.6.3.1	7.3.6.3:M	Yes ___ No ___	
7.3.6.3.1.a	<u>Abort Request Retry Limit (ABRRL)</u>: Maximum number of times an Abort Request with P-bit = 1 can be re-sent without receiving a response before abandoning the transmission.	C.3.6.3.1.a	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.b	<u>Request for Acknowledgment Interval Timer Adjustment Factor (RFAITAF)</u>: Scale factor used to adjust the Saved Estimated Round Trip Delay (SERTD) for retry values of the RFAIT.	C.3.6.3.1.b	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.c	<u>Expired Inter-Segment Receive Interval Timer Factor (EISRITF)</u>: The amount by which the ISRIT shall be increased when a segment is not received within the expected amount of time.	C.3.6.3.1.c	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.d	<u>Estimated Round Trip Delay Aging Period (ERTDAP)</u>: The interval between adjustments to the Estimated Round Trip Delay (ERTD) due to aging during periods of inactivity. This value shall always be equal to or less than the ERTDLT.	C.3.6.3.1.d	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.e	<u>Estimated Round Trip Delay Lifetime (ERTDLT)</u>: The amount of time it will take to adjust the ERDT back up to the Initial Round Trip Delay (IRTD) due to aging during periods of inactivity.	C.3.6.3.1.e	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.f	<u>Estimated Inter-Segment Receive Interval Aging Period (EISRIAP)</u>: The interval between adjustments to the Estimated Inter-Segment Receive Interval Timer (EISRIT) due to aging in the absence of additional received segments. This value shall always be equal to or less than the Estimated Inter-Segment Receive Lifetime (EISRILT).	C.3.6.3.1.f	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.g	<u>Estimated Inter-Segment Receive Interval Lifetime (EISRILT)</u>: The amount of time it will take to adjust the EISRIT back up to the Initial Inter-Segment Receive Interval Timer (IISRIT) due to aging in the absence of additional received segments.	C.3.6.3.1.g	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.h	<u>Expired Segment Acknowledgment Timer Factor (ESATF)</u>: The amount by which you increase the ERTD when an acknowledgment is not received within the expected amount of time.	C.3.6.3.1.h	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.i	<u>Inter-Segment Receive Interval Timer Down Factor (ISRITDF)</u>: A scaling factor applied to the difference between the most recent Measured Inter-Segment Receive Interval Time (MISRIT) and the current EISRIT to lower the EISRIT.	C.3.6.3.1.i	7.3.6.3.1: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.3.1.j	Inter-Segment Receive Interval Timer Expirations Limit (ISRITEL): The maximum number of times the ISRIT can expire without receiving additional segments before aborting the transfer of the Application PDU.	C.3.6.3.1.j	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.k	Inter-Segment Receive Interval Time Jitter Factor (ISRITJF): A scaling factor used to adjust the EISRIT in order to account for transmission timing variance.	C.3.6.3.1.k	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.l	Inter-Segment Receive Interval Timer Up Factor (ISRITUF): A scaling factor applied to the difference between the most recent MISRIT and the current EISRIT to increase the EISRIT.	C.3.6.3.1.l	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1. m	Maximum ERTD to SERTD Ratio (MESR): Value used to limit the amount the ERTD can be increased due to an expired SAT.	C.3.6.3.1.m	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.n	Maximum EISRIT to SEISRIT Ratio (MESRITR): Value used to limit the amount the EISRIT can be increased due to an expired ISRIT.	C.3.6.3.1.n	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.o	Partial Acknowledgment Interval Timer Adjustment Factor (PAITAF): The amount by which the REISRIT is adjusted to set the PAIT.	C.3.6.3.1.o	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.p	Initial Round Trip Delay (IRTD): The initial estimated value of the round trip delay between the Originator and Destination.	C.3.6.3.1.p	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.q	Round Trip Delay Jitter Factor (RTDJF): A scaling factor used to adjust the ERTD in order to account for transmission timing variance.	C.3.6.3.1.q	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.r	Round Trip Delay Up Factor (RTDUF): A scaling factor applied to the difference between the most recent Measured Round Trip Delay (MRTD) and the current ERTD. Once applied, the resulting value is added to the current ERTD, resulting in a new ERTD.	C.3.6.3.1.r	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.s	Round Trip Delay Down Factor (RTDDF): A scaling factor applied to the difference between the most recent MRTD and the current ERTD. Once applied, the resulting value is subtracted from the current ERTD, resulting in a new Estimated Round Trip Delay.	C.3.6.3.1.s	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.t	Hop Count (HOPCNT): The number of separate times a segment must be transmitted (including transmission by the Originator and intermediate relay points) in order for the segment to reach its Destination. If the segment reaches the Destination on the first attempt, no Link Layer retries are necessary.	C.3.6.3.1.t	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.u	Segment Credits Used Multiplication Factor (SCUMF): The amount by which the SAT is increased per each previously sent segment that has not yet been acknowledged.	C.3.6.3.1.u	7.3.6.3.1: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.3.1.v	Segment Retry Count Limit (SRCL): The number of times that an Originator shall retransmit a Data Segment based on a received Partial Acknowledgment indicating a missing segment before aborting the transfer of the Application PDU.	C.3.6.3.1.v	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.w	Request For Acknowledgement Retry Limit (RFARL): The number of consecutive times that an Originator shall re-transmit a request for acknowledgment without receiving an acknowledgment from the Destination before aborting the transfer of the Application PDU.	C.3.6.3.1.w	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.1.x	Reassembly Timer Expiration Count Limit (RTECL): For an EDT Acknowledgment Required transfer, the number of times that a Destination shall transmit a Partial Acknowledgment without receiving additional Data Segments from the Originator before aborting the transfer of the Application PDU. For an EDT Acknowledgment Not Required transfer, the number of times the RT shall expire before the Destination aborts the transfer of the Application PDU.	C.3.6.3.1.x	7.3.6.3.1: M	Yes ___ No ___	
7.3.6.3.2	S/R Enhanced Timing Parameter Default Values	C.3.6.3.2	7.3.6.3:M	Yes ___ No ___	
7.3.6.3.2.a	Systems shall have the ability to change the parameters listed in TABLE C-VIII.	C.3.6.3.2	7.3.6.3.2: M	Yes ___ No ___	
7.3.6.3.3	S/R Enhanced Timing Variables	C.3.6.3.3	7.3.6.3:M	Yes ___ No ___	
7.3.6.3.3.a	The value of the S/R Timers shall be capable of being recalculated or adjusted dynamically during S/R operation.	C.3.6.3.3	7.3.6.3:M	Yes ___ No ___	
7.3.6.3.3.1	Abort Request Retry Count (ABRRC):	C.3.6.3.3.a	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.1.a	The number of times an Abort Request with P-bit = 1 has been re-sent without receiving a response. The Originator shall maintain the ABRRC for each active transfer.	C.3.6.3.3.a	7.3.6.3.3.1: M	Yes ___ No ___	
7.3.6.3.3.1.b	The Destination shall also maintain the ABRRC for each active transfer.	C.3.6.3.3.a	7.3.6.3.3.1: M	Yes ___ No ___	
7.3.6.3.3.2	Request For Acknowledgement Retry Count (RFARC): Number of times an Originator has re-transmitted a Request for Acknowledgement without receiving an acknowledgment from the Destination. The Originator shall maintain the RFARC for each Destination.	C.3.6.3.3.b	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.3	Estimated Inter-Segment Receive Interval Time (EISRIT): Estimated time at which the next segment will be received at the Destination. The Destination shall maintain the EISRIT for each Originator.	C.3.6.3.3.c	7.3.6.3.3: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.3.3.4	Measured Round Trip Delay (MRTD): The measured value from the time a Data Segment is sent until the time the acknowledgement of that segment is received, or from the time an Abort Request is sent until the time the coupled Abort Confirm is received. The Originator shall measure the MRTD when an acknowledgment is received for an Unsent Segment of an active transfer.	C.3.6.3.3.d	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.5	Estimated Round Trip Delay (ERTD): The current estimated value of the round trip delay to a Destination. This value is calculated. The Originator shall maintain the ERTD for each Destination with which it has an active transfer.	C.3.6.3.3.e	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.6	Estimated Round Trip Delay Adjustment Increment (ERTDAI): The amount by which the ERTD is adjusted due to aging in the absence of activity. The Originator shall maintain the ERTDAI for each Destination with which it has an active transfer.	C.3.6.3.3.f	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.7	Estimated Round Trip Delay Aging Steps (ERTDAS): The number of times the ERTD will be increased due to aging in the absence of activity. This value shall be calculated. The Originator shall maintain the ERTDAS for each Destination with which it has an active transfer.	C.3.6.3.3.g	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.8	Estimated Inter-Segment Receive Interval Adjustment Increment (EISRIAI): The amount by which the EISRIT is adjusted due to aging in the absence of additional received segments. The Destination shall maintain the EISRIAI for each Originator.	C.3.6.3.3.h	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.9	Estimated Inter-Segment Receive Interval Aging Steps (EISRIAS): The number of times the EISRIT will be increased due to aging in the absence of additional received segments. This value shall be calculated. The Destination shall maintain the EISRIAS for each Originator.	C.3.6.3.3.i	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.10	Smallest Lowest Numbered Unacknowledged Segment (SLNUS): The Segment Number of the lowest numbered segment that has been sent by the Originator but for which an acknowledgment has not yet been received from all Destinations. The Originator shall maintain the SLNUS for each active transfer.	C.3.6.3.3.j	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.11	Inter-Segment Receive Interval Timer Expirations Count (ISRITEC): The number of times the ISRIT has expired without receiving additional segments. The Destination shall maintain the ISRITEC for each active transfer.	C.3.6.3.3.k	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.11.1	Last Segment Number (LSN): The final Segment Number of the current Application PDU.	C.3.6.3.3.l	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.11.a	The Originator shall maintain the LSN for each Destination with which it has an active transfer.	C.3.6.3.3.l	7.3.6.3.3.11.1:M	Yes ___ No ___	

APPENDIX E

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.3.3.11.b	The Destination shall also maintain the LSN for each active transfer.	C.3.6.3.3.l	7.3.6.3.3.11.1:M	Yes ___ No ___	
7.3.6.3.3.12	Highest Numbered Segment Sent (HNSS): The Segment Number of the highest numbered segment that has been sent by the Originator. The Originator shall maintain the HNSS for each active transfer.	C.3.6.3.3.m	7.3.6.3.3:M	Yes ___ No ___	
7.3.6.3.3.13	Measured Inter-Segment Receive Interval Time (MISRIT): The measured time between receiving the current segment and the previous segment. The Destination shall measure the MISRIT when a segment is received for an active transfer.	C.3.6.3.3.n	7.3.6.3.3:M	Yes ___ No ___	
7.3.6.3.3.14	Number Of Segments Not Received (NOSNR): The number of segments that the Destination has not yet received from the Originator. This number shall include both Data Segments that were sent by the Originator but not received by the Destination and Data Segments that have not yet been sent by the Originator. The Destination shall maintain the NOSNR for each active transfer.	C.3.6.3.3.o	7.3.6.3.3:M	Yes ___ No ___	
7.3.6.3.3.15	Relaxed Estimated Inter-Segment Receive Interval Time (REISRIT): The adjusted EISRIT to account for jitter in transmission times. The Destination shall maintain the REISRIT for each Originator.	C.3.6.3.3.p	7.3.6.3.3:M	Yes ___ No ___	
7.3.6.3.3.16	Relaxed Estimated Round Trip Delay (RERTD): The adjusted ERTD to account for jitter in transmission times. The Originator shall maintain the RERTD for each Destination.	C.3.6.3.3.q	7.3.6.3.3:M	Yes ___ No ___	
7.3.6.3.3.17	Reassembly Timer Expiration Count (RTEC): The number of times the RT has expired without receiving all of the segments associated with an Application PDU. The Destination shall maintain the RTEC for each active transfer.	C.3.6.3.3.r	7.3.6.3.3:M	Yes ___ No ___	
7.3.6.3.3.18	Segment Credits Used (SCU): The current number of segments that have been sent but not acknowledged by all Destinations. The Originator shall maintain the SCU for each active transfer.	C.3.6.3.3.s	7.3.6.3.3:M	Yes ___ No ___	
7.3.6.3.3.19	Saved Estimated Inter-Segment Receive Interval Time (SEISRIT): The currently saved value of the estimated time at which the next segment will be received at the Destination. Updates to this value are only made based on actual measurements. The Destination shall maintain the SEISRIT for each Originator.	C.3.6.3.3.t	7.3.6.3.3:M	Yes ___ No ___	
7.3.6.3.3.20	Saved Estimated Round Trip Delay (SERTD): The currently saved value of the ERTD. Updates to this value are only made based on actual measurements. The Originator shall maintain the SERTD for each Destination.	C.3.6.3.3.u	7.3.6.3.3:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.3.3.21	Number Of Segments Received (NOSR): The total number of segments received at the Destination for the given Application PDU. The Destination shall maintain the NOSR for each active transfer.	C.3.6.3.3.v	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.22	Segment Retry Count (SRC): The number of times that a segment has been re-sent by the Originator to all active Destinations. The Originator shall maintain the SRC for each active transfer.	C.3.6.3.3.w	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.23	Partial Acknowledgment Starting Segment Number (PASSN): This refers to the value of the SSN contained in the Partial Acknowledgment currently being processed by the Originator.	C.3.6.3.3.x	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.24	Number of Stations (NS): The number of stations on the network. The NS can be determined via several methods, including but not limited to MIL-STD-188-220 XNP Messages, Operator Interface, or pre-loaded System Configuration.	C.3.6.3.3.y	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.25	Segment Number (SN): This refers to the value of the Segment Number field contained in the Data Segment of an active transfer currently being processed by the Originator.	C.3.6.3.3.z	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.26	Hop Count (HOPCNT): The number of hops set by the system for a given Destination. This allows the system to be modified from the initial guesses for the IRTD and IISRIT to account for the number of MIL-STD-188-220 intranet hops and/or IP internet hops to the Destination. This value shall be set as per equation in section C.3.6.7.1. The Originator shall maintain the HOPCNT for each Destination with which it has an active transfer.	C.3.6.3.3.aa	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.27	Initial Inter-Segment Receive Interval Timer (IISRIT): The initial value for the ISRIT. This value is calculated as per equation in section C.3.6.7.1. This variable shall be calculated for each Destination.	C.3.6.3.3.bb	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.28	Initial Round Trip Delay (IRTD): The initial value for the ERTD. This value is calculated as per equation in section C.3.6.7.1. This variable shall be calculated for each Destination.	C.3.6.3.3.cc	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.29	Inter-Segment Send Timer (ISST): This value is calculated according to C.3.6.5.7. There shall be one ISST per net at the Originator.	C.3.6.3.3.dd	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.30	Lowest Numbered Unacknowledged Segment (LNUS): The Segment Number of the lowest numbered segment that has been sent by the Originator but for which an acknowledged has not yet been received by the Destination. The Originator shall maintain the LNUS for each Destination with which it has an active transfer.	C.3.6.3.3.ee	7.3.6.3.3: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.3.3.31	Destination Status (DS): The Originator shall maintain the DS for each Destination associated with a transfer. If the Originator is still attempting to successfully complete the transfer for the Destination, the value shall be ACTIVE. If the Originator has aborted the transfer to the Destination, the value shall be INACTIVE.	C.3.6.3.3.ff	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.32	Destination Abort Confirm Received (DACR): The Originator shall maintain the DACR for each Destination associated with an Application PDU Identifier. Indicates whether or not the Originator has received an Abort Request for an Abort Confirm from the Destination.	C.3.6.3.3.gg	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.33	Originator Abort Confirm Received (OACR): The Destination shall maintain the OACR for each Application PDU Identifier. Indicates whether or not the Destination has received an Abort Request for an Abort Confirm from the Originator.	C.3.6.3.3.hh	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.3.3.34	Originator Status: The Destination shall maintain the Originator Status for each Application PDU Identifier. If the Destination is still attempting to successfully reassemble segment associated with the Application PDU Identifier, the value is ACTIVE. If the Destination has aborted the transfer to the Destination or sent a complete acknowledgment, the value is INACTIVE.	C.3.6.3.3.ii	7.3.6.3.3: M	Yes ___ No ___	
7.3.6.4	Detailed S/R Enhanced Procedures	C.3.6.4	7.3.6:M	Yes ___ No ___	
7.3.6.4.1	S/R Enhanced Procedure for Sending Unsent (Data) Segments	C.3.6.4.1	7.3.6.4:M	Yes ___ No ___	
7.3.6.4.1.a	When the Originator is sending the first segment or receives a Partial Acknowledgment that cause SLNUS to increase, it shall take the actions as described in C.3.6.4.1.	C.3.6.4.1	7.3.6.4.1: M	Yes ___ No ___	
7.3.6.4.2	S/R Procedure for Processing Received Data Segment(s)	C.3.6.4.2	7.3.6.4:M	Yes ___ No ___	
7.3.6.4.2.a	When the Destination receives a Data Segment it shall take the actions as described in C.3.6.4.2.	C.3.6.4.2	7.3.6.4.2: M	Yes ___ No ___	
7.3.6.4.3	S/R Enhanced Procedure for Processing Acknowledgment	C.3.6.4.3	7.3.6.4:M	Yes ___ No ___	
7.3.6.4.3.a	When an Originator receives a Partial Acknowledgment, it shall take the actions as described in C.3.6.4.3.a.	C.3.6.4.3.a	7.3.6.4.3: M	Yes ___ No ___	
7.3.6.4.3.b	When an Originator receives a Complete Acknowledgment, it shall take the actions as described in C.3.6.4.3.b.	C.3.6.4.3.b	7.3.6.4.3: M	Yes ___ No ___	
7.3.6.4.4	S/R Enhanced Procedure for Resending Unacknowledged Data Segments	C.3.6.4.4	7.3.6.4:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.4.4.a	When the Originator is processing a valid Partial Acknowledgment, for each segment corresponding to a bit in the bitmask with a value of 0 (unacknowledged), it shall take the actions as described in C.3.6.4.4.	C.3.6.4.4	7.3.6.4.4: M	Yes ___ No ___	
7.3.6.4.5	S/R Enhanced Procedure for Processing a Received Acknowledgement Request PDU.	C.3.6.4.5	7.3.6.4:M	Yes ___ No ___	
7.3.6.4.5.a	When a Destination receives an Acknowledgement Request PDU it shall take the actions as described in C.3.6.4.5.	C.3.6.4.5	7.3.6.4.5: M	Yes ___ No ___	
7.3.6.5	S/R EnhancedTimers	C.3.6.5	7.3.6:M	Yes ___ No ___	
7.3.6.5.a	The S/R Protocol shall use the all Timers as described in C.3.6.5.1 through C.3.6.5.13 in order to facilitate an efficient exchange of segmented data between the Originator and the Destination.	C.3.6.5	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.1	Reassembly Timer (RT)	C.3.6.5.1	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.1.a	The Reassembly Timer shall be run at the Destination to predict a time by which all segments should be received.	C.3.6.5.1	7.3.6.5.1: M	Yes ___ No ___	
7.3.6.5.1.b	If the Reassembly Timer expires more than the Reassembly Timer Expiration Count Limit (RTECL) times, the transfer shall be terminated.	C.3.6.5.1	7.3.6.5.1: M	Yes ___ No ___	
7.3.6.5.1.c	The system shall be able to configure the RTECL Parameter.	C.3.6.5.1	7.3.6.5.1: M	Yes ___ No ___	
7.3.6.5.1.d	The Destination shall maintain one RT for each active Application PDU Identifier.	C.3.6.5.1	7.3.6.5.1: M	Yes ___ No ___	
7.3.6.5.1.1	Reassembly Timer (RT) starts:	C.3.6.5.1.a	7.3.6.5.1: M	Yes ___ No ___	
7.3.6.5.1.1.a	The RT shall be started at the Destination when the first Data Segment or Acknowledgement Request associated with an Application PDU is received.	C.3.6.5.1.a	7.3.6.5.1.1: M	Yes ___ No ___	
7.3.6.5.1.1.b	The RT shall be initialized using the value described by C.3.6.6.3 to estimate the time at which all Data Segments should have been received/reassembled.	C.3.6.5.1.a	7.3.6.5.1.1: M	Yes ___ No ___	
7.3.6.5.1.1.c	When the RT is started at the Destination the RTEC shall be set to 0.	C.3.6.5.1.a	7.3.6.5.1.1: M	Yes ___ No ___	
7.3.6.5.1.1.d	As subsequent segments are received, the RT shall be restarted using a new projected time calculated as described by C.3.6.6.3 (based on the measured time interval between received segments and the number of segments that are yet to be received).	C.3.6.5.1.a	7.3.6.5.1.1: M	Yes ___ No ___	
7.3.6.5.1.1.e	The RT shall also be restarted using this same equation if it expires before all segments are received and the Retry Counter is less than the RTECL.	C.3.6.5.1.a	7.3.6.5.1.1: M	Yes ___ No ___	
7.3.6.5.1.2	Reassembly Timer (RT) stops:	C.3.6.5.1.b	7.3.6.5.1: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.1.2.a	The RT shall always be running at the Destination when a transfer is active and not all segments have been received.	C.3.6.5.1.b	7.3.6.5.1.2: M	Yes ___ No ___	
7.3.6.5.1.2.b	The RT shall only be stopped when all segments have been received.	C.3.6.5.1.b	7.3.6.5.1.2: M	Yes ___ No ___	
7.3.6.5.1.2.c	If the transfer was EDT Acknowledgement Required, then a Complete Acknowledgment shall be sent when the RT is stopped, the Application PDU Identifier shall be placed in the Destination Reference Freeze State, and the Destination Reference Freeze State Timer (DRFST) shall be started.	C.3.6.5.1.b	7.3.6.5.1.2: M	Yes ___ No ___	
7.3.6.5.1.3	Reassembly Timer (RT) expires:	C.3.6.5.1.c	7.3.6.5.1: M	Yes ___ No ___	
7.3.6.5.1.3.a	When RT expires at the Destination station the behaviors as specified in PDL form shall occur according to C.3.6.5.1.c.	C.3.6.5.1.c	7.3.6.5.1.3: M	Yes ___ No ___	
7.3.6.5.2	Request for Acknowledgment Interval Timer (RFAIT)	C.3.6.5.2	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.2.a	The RFAIT shall be run at the Originator to predict a time by which a response to a Request for Acknowledgment should be received.	C.3.6.5.2	7.3.6.5.2: M	Yes ___ No ___	
7.3.6.5.2.b	The Originator shall maintain one RFAIT for each active Application PDU Identifier.	C.3.6.5.2	7.3.6.5.2: M	Yes ___ No ___	
7.3.6.5.2.1	Request for Acknowledgment Interval Timer (RFAIT) starts**:**	C.3.6.5.2.a	7.3.6.5.2: M	Yes ___ No ___	
7.3.6.5.2.1.a	The RFAIT shall be started (or stopped then restarted) at the Originator each time a Request for Acknowledgment is issued.	C.3.6.5.2.a	7.3.6.5.2.1: M	Yes ___ No ___	
7.3.6.5.2.1.b	If the RFAIT is already running when a Request for Acknowledgment is issued, the RFAIT shall be restarted, i.e., stopped then started again.	C.3.6.5.2.a	7.3.6.5.2.1: M	Yes ___ No ___	
7.3.6.5.2.1.c	Only one RFAIT shall be running at any given time for each Application PDU that is active at the Originator.	C.3.6.5.2.a	7.3.6.5.2.1: M	Yes ___ No ___	
7.3.6.5.2.1.d	The RFAIT value shall be calculated according to the procedure below each time it is started or restarted.	C.3.6.5.2.a	7.3.6.5.2.1: M	Yes ___ No ___	

7.3.6.5.2.1.e	The RERTD and SERTD selected for use in the following equation shall be the largest of any active Destination (DS=ACTIVE) with a RFARC greater than 0.
	IF RFARC == 0 for all Destinations
	THEN
	RFAIT = RERTD * SCUMF**SCU
	ELSE
	RFAIT = SERTD * RFAITAF
	ENDIF
		C.3.6.5.2.a	7.3.6.5.2.1: M	Yes ___
				No ___	

7.3.6.5.2.2	Request for Acknowledgment Interval Timer (RFAIT) stops:	C.3.6.5.2.b	7.3.6.5.2: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.2.2.a	The RFAIT shall be stopped when a Partial Acknowledgment or Complete Acknowledgment is received from all Destinations.	C.3.6.5.2.b	7.3.6.5.2.2: M	Yes ___ No ___	
7.3.6.5.2.2.b	If RFAIT is stopped because all segments associated with an Application PDU have been acknowledged, the Originator shall place the Application PDU Identifier in the Reference Freeze State and then start an Originator Reference Freeze State Timer (ORFST).	C.3.6.5.2.b	7.3.6.5.2.2: M	Yes ___ No ___	
7.3.6.5.2.2.c	The ERTD is not updated when the RFAIT timer is stopped because received Partial Acknowledgments are inherently ambiguous, i.e., the Originator can never know with certainty which specific S/R PDU received by the Destination caused the Partial Acknowledgment to be sent.	C.3.6.5.2.b	7.3.6.5.2.2: M	Yes ___ No ___	
7.3.6.5.2.3	Request for Acknowledgment Interval Timer (RFAIT) expires:	C.3.6.5.2.c	7.3.6.5.2: M	Yes ___ No ___	
7.3.6.5.2.3.a	When the RFAIT expires at the Originator, meaning that at least one Destination did not send an Acknowledgment, the behaviors as specified in PDL form shall occur, according to C.3.6.5.2.c.	C.3.6.5.2.c	7.3.6.5.2.3: M	Yes ___ No ___	
7.3.6.5.3	Destination Reference Freeze State Timer (DRFST)	C.3.6.5.3	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.3.a	The DRFST shall be run at the Destination to predict a time from when a transfer completes, either successfully or unsuccessfully, until no additional frames associated with the given Application PDU Identifier will be received.	C.3.6.5.3	7.3.6.5.3: M	Yes ___ No ___	
7.3.6.5.3.b	The Destination shall maintain one DRFST for each completed Application PDU Identifier transfer.	C.3.6.5.3	7.3.6.5.3: M	Yes ___ No ___	
7.3.6.5.3.1	The DRFST starts**:**	C.3.6.5.3.a	7.3.6.5.3: M	Yes ___ No ___	

7.3.6.5.3.1.a	The DRFST shall be started, using the value specified by the equations below, when a transfer is completed at the Destination.
	NOSNR = LSN – NOSR
	IF SCL < NOSNR
	THEN
	DRFST = (SCL * REISRIT) + (RFARL * REISRIT)
	ELSE
	DRFST = (NOSNR * REISRIT) + (RFARL * REISRIT)
	ENDIF
		C.3.6.5.3.a	7.3.6.5.3.1: M	Yes ___
				No ___	

7.3.6.5.3.1.b	The Destination shall remember if the transfer associated with the Application PDU Identifier was successful or unsuccessful and the Application PDU Identifier associated with the transfer.	C.3.6.5.3.a	7.3.6.5.3.1: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.3.2	DRFST stops:	C.3.6.5.3.b	7.3.6.5.3: M	Yes ___ No ___	
7.3.6.5.3.2.a	The DRFST shall only stop when it expires or when it gets restarted.	C.3.6.5.3.b	7.3.6.5.3.2: M	Yes ___ No ___	
7.3.6.5.3.3	DRFST expires:	C.3.6.5.3.c	7.3.6.5.3: M	Yes ___ No ___	
7.3.6.5.3.3.a	When the DRFST expires at the Destination, the associated Application PDU Identifier shall be transitioned out of the Reference Freeze State.	C.3.6.5.3.c	7.3.6.5.3.3: M	Yes ___ No ___	
7.3.6.5.3.3.b	The Destination shall release all memory required to store information about the associated transfer.	C.3.6.5.3.c	7.3.6.5.3.3: M	Yes ___ No ___	
7.3.6.5.3.3.c	Any Data Segments or Acknowledgment Requests subsequently received by the Destination with the same Application PDU Identifier are treated as a new transfer, causing the destination to start reassembling the new transfer.	C.3.6.5.3.c	7.3.6.5.3.3: M	Yes ___ No ___	
7.3.6.5.4	Segment Acknowledgment Timer (SAT)	C.3.6.5.4	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.4.a	The SAT shall be run at the Originator to predict a time by which a sent or resent Data Segment should have been acknowledged by all Destination(s).	C.3.6.5.4	7.3.6.5.4: M	Yes ___ No ___	
7.3.6.5.4.b	The SAT shall also be used to measure the time from when an Unsent Segment was sent until it was acknowledged by any Destination.	C.3.6.5.4	7.3.6.5.4: M	Yes ___ No ___	
7.3.6.5.4.c	The Originator shall maintain one SAT for each Data Segment that has been sent but not yet acknowledged by all Destination(s).	C.3.6.5.4	7.3.6.5.4: M	Yes ___ No ___	
7.3.6.5.4.1	SAT starts**:**	C.3.6.5.4.a	7.3.6.5.4: M	Yes ___ No ___	
7.3.6.5.4.1.a	The SAT shall be started at the Originator immediately after each segment is sent or resent to all active Destinations.	C.3.6.5.4.a	7.3.6.5.4.1: M	Yes ___ No ___	
7.3.6.5.4.1.b	The SAT value shall be calculated according to the equation below when it is started. SAT = RERTD * SCUMF**SCU **IF** an Unsent Segment was sent **THEN** **--** Do nothing **ELSE --** (if a segment was resent) Increment SRC for the associated segment by 1 **ENDIF** Start the ISST	C.3.6.5.4.a	7.3.7.4.4.1: M	Yes ___ No ___	
7.3.6.5.4.1.c	Only one SAT timer shall be running at any given time for each segment associated with the same Application PDU.	C.3.6.5.4.a	7.3.6.5.4.1: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.4.1 .d	The SAT shall be calculated, used for each Destination and the largest SAT shall be utilized.	C.3.6.5.4.a	7.3.6.5.4.1: M	Yes ___ No ___	
7.36.5.4.2	SAT stops:	C.3.6.5.4.b	7.3.6.5.4: M	Yes ___ No ___	
7.3.6.5.4.2 .a	The SAT shall only be stopped if all active Destinations have acknowledged the segment.	C.3.6.5.4.b	7.3.6.5.4.2: M	Yes ___ No ___	
7.3.6.5.4.2 .b	The procedure as specified in PDL form shall be performed any time an acknowledgement is received. Note that the receipt of a single Partial Acknowledgement or Complete Acknowledgement can cause the procedure as specified in PDL form to be performed for multiple SATs associated with any newly acknowledged segment.	C.3.6.5.4.b	7.3.6.5.4.2: M	Yes ___ No ___	
7.36.5.4.3	SAT expires:	C.3.6.5.4.c	7.3.6.5.4: M	Yes ___ No ___	

7.3.6.5.4.3 .a	When the SAT expires the Originator shall perform the procedure below for each of the Destination(s) that did not acknowledge the segment.
	IF (ERTD * ESATF) < (SERTD * MESR)
	THEN
	ERTD = ERTD * ESATF
	ELSE
	ERTD = SERTD * MESR
	ENDIF
	RERTD = ERTD * RTDJF
	Restart the ERTDAT
		C.3.6.5.4.c	7.3.6.5.4.3: M	Yes ___ No ___	

7.3.6.5.5	Abort Request Timer (ABRT)	C.3.6.5.5	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.5.a	The ABRT shall be run at the Originator to predict a time by which an Abort Confirm should have been received from the Destination.	C.3.6.5.5	7.3.6.5.5: M	Yes ___ No ___	
7.3.6.5.5.b	The Originator shall maintain one ABRT for each Application PDU.	C.3.6.5.5	7.3.6.5.5: M	Yes ___ No ___	
7.3.6.5.5.c	The ABRT shall be run at the Destination to predict a time by which an Abort Confirm should have been received from the Originator.	C.3.6.5.5	7.3.6.5.5: M	Yes ___ No ___	
7.3.6.5.5.d	The Destination shall maintain one ABRT for each Application PDU.	C.3.6.5.5	7.3.6.5.5: M	Yes ___ No ___	
7.3.6.5.5.1	ABRT starts**:**	C.3.6.5.5.a	7.3.6.5.5: M	Yes ___ No ___	
7.3.6.5.5.1 .a	The ABRT shall be started at the Originator each time an Abort Request is sent with the P-Bit = 1.	C.3.6.5.5.a	7.3.6.5.5.1: M	Yes ___ No ___	
7.3.6.5.5.1 .b	Only one ABRT shall be running per Application PDU at the Originator.	C.3.6.5.5.a	7.3.6.5.5.1: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes

7.3.6.5.5.1.c	The value of the ABRT shall be set according to the following equation.
	IF ABRRC == 0
	THEN
	ABRT = RERTD * SCUMF**SCU
	ELSE
	ABRT = RERTD
	ENDIF
		C.3.6.5.5.a	7.3.6.5.5.1: M	Yes ___
				No ___	

7.3.6.5.5.1.d	The first time an Abort Request is sent, the ABRRC shall be set equal to 0.	C.3.6.5.5.a	7.3.6.5.5.1: M	Yes ___ No ___	

7.3.6.5.5.1.e	The RERTD selected for use in the following equation shall be the largest of any active Destination (DS==ACTIVE) that the Abort Request is being addressed to.
	IF ABRRC == 0
	THEN
	ABRT = RERTD * SCUMF**SCU
	ELSE
	ABRT = RERTD
	ENDIF
		C.3.6.5.5.a	7.3.6.5.5.1: M	Yes ___
				No ___	

7.3.6.5.5.1.f	The value of the ABRT shall be set according to the following equation at the Destination. ABRT = 2 * ISRIT	C.3.6.5.5.a	7.3.6.5.5.1: M	Yes ___ No ___	
7.3.6.5.5.2	ABRT stops:	C.3.6.5.5.b	7.3.6.5.5: M	Yes ___ No ___	
7.3.6.5.5.2.a	The ABRT shall be stopped at the Originator or Destination when an Abort Confirm is received with a matching Application PDU Identifier or when an Abort Request is received with a matching Application PDU Identifier.	C.3.6.5.5.b	7.3.6.5.5.2: M	Yes ___ No ___	
7.3.6.5.5.3	ABRT expires:	C.3.6.5.5.c	7.3.6.5.5: M	Yes ___ No ___	
7.3.6.5.5.3.a	When the ABRT expires **IF** ABRRC < ABRRL **THEN** The ABRRC shall be incremented by 1. Send the Abort Request again with P-Bit = 1 Restart the ABRT **ENDIF**	C.3.6.5.5.c	7.3.6.5.5.3: M	Yes ___ No ___	
7.3.6.5.6	Originator Reference Freeze State Timer (ORFST)	C.3.6.5.6	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.6.a	The ORSFT shall be run at the Originator to predict a time at which an Application PDU Identifier can be safely reused as part of a new transfer.	C.3.6.5.6	7.3.6.5.6: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.6.b	The Originator shall maintain one ORFST for each Application PDU transfer that has completed.	C.3.6.5.6	7.3.6.5.6: M	Yes ___ No ___	
7.3.6.5.6.1	ORFST starts**:**	C.3.6.5.6.a	7.3.6.5.6: M	Yes ___ No ___	
7.3.6.5.6.1.a	The Originator shall start the ORFST when an Application PDU transfer is completed, either successfully or unsuccessfully to all Destination(s).	C.3.6.5.6.a	7.3.6.5.6.1: M	Yes ___ No ___	
7.3.6.5.6.1.b	The associated Application PDU Identifier shall not be reused until this timer expires.	C.3.6.5.6.a	7.3.6.5.6.1: M	Yes ___ No ___	
7.3.6.5.6.1.c	If the ORFST is running and an ABRT is not running when a Partial Acknowledgement is received corresponding to the Application PDU Identifier, an Abort Request shall be sent by the Originator with the P-Bit = 0.	C.3.6.5.6.a	7.3.6.5.6.1: M	Yes ___ No ___	
7.3.6.5.6.1.d	The value of the ORFST shall be set according to the equation below. ORFST = 2 * RERTD * (LSN - HNSS)	C.3.6.5.6.a	7.3.6.5.6.1: M	Yes ___ No ___	
7.3.6.5.6.2	ORFST stops:	C.3.6.5.6.b	7.3.6.5.6: M	Yes ___ No ___	
7.3.6.5.6.2.a	The ORFST shall be stopped by the Originator if all of the Application PDU Identifiers at the Originator are either in an active or frozen state when another message needs to be sent.	C.3.6.5.6.b	7.3.6.5.6.2: M	Yes ___ No ___	
7.3.6.5.6.2.b	In this case the Originator shall search for the ORFST with the least time remaining.	C.3.6.5.6.b	7.3.6.5.6.2: M	Yes ___ No ___	
7.3.6.5.6.2.c	This ORFST shall be stopped such that a new message can be sent reusing the associated Application PDU Identifier, without the Application PDU Identifier being ambiguous to any destination.	C.3.6.5.6.b	7.3.6.5.6.2: M	Yes ___ No ___	
7.3.6.5.6.3	ORFST expires:	C.3.6.5.6.c	7.3.6.5.6: M	Yes ___ No ___	
7.3.6.5.6.3.a	When the ORFST expires, the associated Application PDU Identifier shall be transitioned out of the Reference Freeze State such that it can be reused as part of subsequent message exchanges without the Application PDU Identifier being ambiguous to any destination.	C.3.6.5.6.c	7.3.6.5.6.3: M	Yes ___ No ___	
7.3.6.5.7	Inter-Segment Send Timer (ISST)	C.3.6.5.7	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.7.a	The ISST shall be run at the Originator to help control the rate at which segments are sent or resent when communicating over Rate Limited CNR.	C.3.6.5.7	7.3.6.5.7: M	Yes ___ No ___	
7.3.6.5.7.b	The Originator shall maintain only one ISST per CNR net.	C.3.6.5.7	7.3.6.5.7: M	Yes ___ No ___	
7.3.6.5.7.1	ISST starts**:**	C.3.6.5.7.a	7.3.6.5.7: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes

7.3.6.5.7.1.a	The ISST shall be started at the Originator after a Data Segment is sent or resent over a CNR net. The timer value shall be set according to the equation below.
	IF Transfer occurs directly over a MIL-STD-188-220 net
	THEN
	ISST = ISSTAF * T2AT / (2 * NS)
	ELSE
	ISST = 0 **--**(This is a default value that may need to be modified by the operator for each destination. The 0 default value is intended to be used over high-speed WAN/LANs.)
	ENDIF
		C.3.6.5.7.a	7.3.6.5.7.1: M	Yes ___
				No ___	

7.3.6.5.7.1.b	Only one ISST shall be started for each independent Rate Limited CNR that an Originator participates on, not one per Application PDU.	C.3.6.5.7.a	7.3.6.5.7.1: M	Yes ___ No ___	
7.3.6.5.7.1.c	This timer shall be used by the Originator to manage the transmit rate of Data Segments over an individual CNR net so as to limit the CNR bandwidth utilized for the transfer of segments within a given time period.	C.3.6.5.7.a	7.3.6.5.7.1: M	Yes ___ No ___	
7.3.6.5.7.1.d	The ISST manages transmit flow control for a given network as a whole whether a single Application PDU or multiple Application PDUs are being transmitted simultaneously.	C.3.6.5.7.a	7.3.6.5.7.1: M	Yes ___ No ___	
7.3.6.5.7.1.e	The next segment of any given Application PDU shall not be sent or resent while the ISST is active, even when Segment Credit is available and SRL has currently not been exceeded for individual Application PDUs.	C.3.6.5.7.a	7.3.6.5.7.1: M	Yes ___ No ___	
7.3.6.5.7.1.f	The ISST, which manages the network as a whole, shall take precedence over the Segment Credit Limits and Segment Range Limits, which manage individual Application PDUs.	C.3.6.5.7.a	7.3.6.5.7.1: M	Yes ___ No ___	
7.3.6.5.7.2	ISST stops:	C.3.6.5.7.b	7.3.6.5.7: M	Yes ___ No ___	
7.3.6.5.7.2.a	The Originator shall stop the ISST when the Originator disconnects from the CNR net.	C.3.6.5.7.b	7.3.6.5.7.2: M	Yes ___ No ___	
7.3.6.5.7.3	ISST expires:	C.3.6.5.7.c	7.3.6.5.7: M	Yes ___ No ___	
7.3.6.5.7.3.a	When the ISST expires at the Originator, another Segment can be resent/sent over the corresponding Rate Limited CNR.	C.3.6.5.7.c	7.3.6.5.7.3: M	Yes ___ No ___	
7.3.6.5.7.3.b	The Application PDU Identifier of the next segment to be resent/sent shall be fairly (e.g., randomly) selected from the pool of Application PDU Identifiers associated with transfers over the given CNR net that are not blocked due to the SCL and/or the SRL.	C.3.6.5.7.c	7.3.6.5.7.3: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.7.3.c	Fairly selecting the Application PDU Identifier will help ensure that all simultaneous transfers progress to completion at similar rates.	C.3.6.5.7.c	7.3.6.5.7.3: M	Yes ___ No ___	
7.3.6.5.7.3.d	The segment with the lowest Segment Number shall always be resent/sent first according to C.3.6.4/C.3.6.4.4.	C.3.6.5.7.c	7.3.6.5.7.3: M	Yes ___ No ___	
7.3.6.5.7.3.e	Giving segments with the lowest Segment Number priority to be resent/sent will result in an increased likelihood that Segment Credit will be available and that the SRL will not be exceeded for any transfer over the given CNR net.	C.3.6.5.7.c	7.3.6.5.7.3: M	Yes ___ No ___	
7.3.6.5.8	Partial Acknowledgment Interval Timer (PAIT)	C.3.6.5.8	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.8.a	If a Request For Acknowledgment is received by a Destination and the PAIT is running, the transmission of the associated Partial Acknowledgement shall be delayed until after the PAIT expires, until the NOMST is reached, or until the RSCT is reached.	C.3.6.5.8	7.3.6.5.8: M	Yes ___ No ___	
7.3.6.5.8.b	The Destination shall maintain one PAIT for each Application PDU.	C.3.6.5.8	7.3.6.5.8: M	Yes ___ No ___	
7.3.6.5.8.1	PAIT starts**:**	C.3.6.5.8.a	7.3.6.5.8: M	Yes ___ No ___	
7.3.6.5.8.1.a	The PAIT shall be started whenever a Partial Acknowledgment is sent by the Destination.	C.3.6.5.8.a	7.3.6.5.8.1: M	Yes ___ No ___	
7.3.6.5.8.1.b	Only one PAIT shall be running at the destination per Application PDU.	C.3.6.5.8.a	7.3.6.5.8.1: M	Yes ___ No ___	

7.3.6.5.8.1.c	The value of the PAIT shall be set according to the equation below.
	IF NOSNR >= SCL
	THEN
	PAIT = PAITAF * REISRIT
	ELSE
	PAIT = 0 (When an Acknowledgement is requested, send the Partial Acknowledgement without delay)
	ENDIF
		C.3.6.5.8.a	7.3.6.5.8.1: M	Yes ___
				No ___	

7.3.6.5.8.2	PAIT stops:	C.3.6.5.8.b	7.3.6.5.8: M	Yes ___ No ___	
7.3.6.5.8.2.a	The PAIT shall be stopped when the NOMST is reached, the RSCT is reached, or when all segments for the associated Application PDU have been received by the Destination.	C.3.6.5.8.b	7.3.6.5.8.2: M	Yes ___ No ___	
7.3.6.5.8.2.b	When the PAIT is stopped a Partial Acknowledgment or Complete Acknowledgment shall be sent by the Destination as appropriate.	C.3.6.5.8.b	7.3.6.5.8.2: M	Yes ___ No ___	
7.3.6.5.8.2.c	If a Partial Acknowledgment is sent, the PAIT shall be restarted.	C.3.6.5.8.b	7.3.6.5.8.2: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.8.3	PAIT expires:	C.3.6.5.8.c	7.3.6.5.8: M	Yes ___ No ___	
7.3.6.5.8.3.a	When the PAIT expires at the Destination: **IF** one or more requests for acknowledgment have been received since the PAIT was started **THEN** Send a Partial Acknowledgment Restart the PAIT **ENDIF**	C.3.6.5.8.c	7.3.6.5.8.3: M	Yes ___ No ___	
7.3.6.5.9	Estimated Round Trip Delay Aging Timer (ERTDAT)	C.3.6.5.9	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.9.a	If the last exchange with a Destination resulted in the ERTD being less than the Initial Round Trip Delay (IRTD), the ERTDAT shall be used to increase the ERTD back to the IRDT on a non-persistent basis during idle periods.	C.3.6.5.9	7.3.6.5.9: M	Yes ___ No ___	
7.3.6.5.9.b	The Originator maintains one ERTDAT for each Application PDU.	C.3.6.5.9	7.3.6.5.9: M	Yes ___ No ___	
7.3.6.5.9.1	ERTDAT starts**:**	C.3.6.5.9.a	7.3.6.5.9: M	Yes ___ No ___	
7.3.6.5.9.1.a	The ERTDAT shall be started, or restarted, each time the ERTD is updated when the SAT timer is stopped because an Unsent Segment is acknowledged, or when the SAT expires.	C.3.6.5.9.a	7.3.6.5.9.1: M	Yes ___ No ___	
7.3.6.5.9.1.b	The ERTDAT shall also restarted when it expires if the updated ERTD < IRDT.	C.3.6.5.9.a	7.3.6.5.9.1: M	Yes ___ No ___	
7.3.6.5.9.1.c	The value of the ERTDAT shall be set according to the equation below. **IF** ERTD < IRTD **THEN** ERTDAI = (IRTD – ERTD) / ERTDAS ERTDAT = ERTDAP Start ERTDAT **ENDIF**	C.3.6.5.9.a	7.3.6.5.9.1: M	Yes ___ No ___	
7.3.6.5.9.2	ERTDAT stops:	C.3.6.5.9.b	7.3.6.5.9: M	Yes ___ No ___	
7.3.6.5.9.2.a	The ERTDAT shall be stopped each time the ERTD is updated, i.e., when the SAT timer is stopped because an Unsent Segment is acknowledged or when the SAT expires.	C.3.6.5.9.b	7.3.6.5.9.2: M	Yes ___ No ___	
7.3.6.5.9.3	ERTDAT expires:	C.3.6.5.9.b	7.3.6.5.9: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.9.3.a	When the ERTDAT expires the ERTD is adjusted according to the equation below. ERTD = ERTD + ERTDAI **IF** ERTD < IRTD **THEN** ERTDAT = ERTDAP Start ERTDAT **ENDIF**	C.3.6.5.9.c	7.3.6.5.9.3: M	Yes ___ No ___	
7.3.6.5.9.3.b	If ERTDAT < IRDT then the ERTDAT is restarted.	C.3.6.5.9.c	7.3.6.5.9.3: M	Yes ___ No ___	
7.3.6.5.10	Inter-Segment Receive Timer (ISRT)	C.3.6.5.10	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.10.a	The ISRT shall be used to measure the time between received segments at the Destination as required to update the estimate for the reassembly time.	C.3.6.5.10	7.3.6.5.10: M	Yes ___ No ___	
7.3.6.5.10.b	The Destination shall maintain one ISRT for each Application PDU.	C.3.6.5.10	7.3.6.5.10: M	Yes ___ No ___	
7.3.6.5.10.1	ISRT starts**:**	C.3.6.5.10.a	7.3.6.5.10: M	Yes ___ No ___	
7.3.6.5.10.1.a	When a segment is received, the time at which the segment was received is recorded.	C.3.6.5.10.a	7.3.6.5.10.1:M	Yes ___ No ___	
7.3.6.5.10.2	ISRT stops:	C.3.6.5.10.b	7.3.6.5.10: M	Yes ___ No ___	
7.3.6.5.10.2.a	When the next segment is received, the elapsed time since receipt of the previous segment is calculated and stored as the MISRIT.	C.3.6.5.10.b	7.3.6.5.10.2:M	Yes ___ No ___	
7.3.6.5.10.2.b	This time shall be used to update both the ISRIT and the RT according to C.3.6.6.3.	C.3.6.5.10.b	7.3.6.5.10.2:M	Yes ___ No ___	
7.3.6.5.10.2.c	The ISRT shall be restarted if not all of the segments associated with the Application PDU have been received.	C.3.6.5.10.b	7.3.6.5.10.2:M	Yes ___ No ___	
7.3.6.5.10.3	ISRT expires:	C.3.6.5.10.c	7.3.6.5.10: M	Yes ___ No ___	
7.3.6.5.10.3.a	The ISRT never expires; it is only used to measure the interval between the receipts of segments with the same Application PDU Identifier.	C.3.6.5.10.c	7.3.6.5.10.3:M	Yes ___ No ___	
7.3.6.5.11	Inter-Segment Receive Interval Timer (ISRIT)	C.3.6.5.11	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.11.a	The ISRIT shall be used to predict a time by which the next segment should be received at the Destination.	C.3.6.5.11	7.3.6.5.11: M	Yes ___ No ___	
7.3.6.5.11.b	The Destination shall maintain one ISRIT for each Application PDU.	C.3.6.5.11	7.3.6.5.11: M	Yes ___ No ___	
7.3.6.5.11.1	ISRIT starts**:**	C.3.6.5.11.a	7.3.6.5.11: M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.11.1.a	When a segment is received, the ISRIT shall be started or restarted to predict a time by which the next segment should be received.	C.3.6.5.11.a	7.3.6.5.11.1:M	Yes ___ No ___	
7.3.6.5.11.1.b	The value of ISRIT shall be set according to C.3.6.6.3.	C.3.6.5.11.a	7.3.6.5.11.1:M	Yes ___ No ___	
7.3.6.5.11.2	ISRIT stops:	C.3.6.5.11.b	7.3.6.5.11:M	Yes ___ No ___	
7.3.6.5.11.2.a	When the next segment is received, the ISRIT shall be stopped and then restarted if not all segments have not been received.	C.3.6.5.11.b	7.3.7.46.5.11.2:M	Yes ___ No ___	
7.3.6.5.11.3	ISRIT expires:	C.3.6.5.11.c	7.3.6.5.11:M	Yes ___ No ___	

7.3.6.5.11.3.a	When the ISRIT expires, the ISRIT and RT values shall be updated according to the equation below.
	ISRITEC = ISRITEC + 1
	IF ISRITEC < ISRITEL
	THEN
	IF (EISRIT * EISRITF) < (SEISRIT * MESRITR)
	THEN
	EISRIT = EISRIT * EISRITF
	REISRIT = EISRIT * ISRITJF
	ENDIF
	ISRIT = REISRIT
	Start ISRIT
	RT = REISRIT * (LSN – NOSR)
	Start RT
	ELSE
	Destination shall send an Abort Request with P-Bit = 0
	Destination shall discard segments associated with the Application PDU
	Destination shall place the associated Application PDU Identifier in the Destination Reference Freeze State and start the DRFST.
	ENDIF
		C.3.6.5.11.c	7.3.6.5.11.3:M	Yes ___
				No ___	

7.3.6.5.11.3.b	The ISRIT and RT shall then be restarted as appropriate.	C.3.6.5.11.c	7.3.6.5.11.3:M	Yes ___ No ___	
7.3.6.5.12	Estimated Inter-Segment Receive Interval Aging Timer (EISRIAT)	C.3.6.5.12	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.12.a	If the last segment received from an Originator resulted in the EISRIT less than the Initial Inter-Segment Receive Interval Aging Timer (IISRIT), the EISRIAT shall be used to increase the EISRIT back to the IISRIT on a non-persistent basis during idle periods.	C.3.6.5.12	7.3.6.5.12:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.12.b	The EISRIAT shall be started, or restarted, each time the EISRIT is updated when a segment is received or the ISRIT expires.	C.3.6.5.12	7.3.6.5.12: M	Yes ___ No ___	
7.3.6.5.12.1	EISRIAT starts**:**	C.3.6.5.12.a	7.3.6.5.12: M	Yes ___ No ___	
7.3.6.5.12.1.a	The EISRIAT shall be started, or restarted, each time the EISRIT is updated when a segment is received or the ISRIT expires.	C.3.6.5.12.a	7.3.6.5.12.1:M	Yes ___ No ___	
7.3.6.5.12.1.b	The EISRIAT shall also be restarted when it expires if the updated EISRIT < IISRIT.	C.3.6.5.12.a	7.3.6.5.12.1:M	Yes ___ No ___	
7.3.6.5.12.1.c	The value of the EISRIAT shall be set according to the equation below. **IF** EISRIT < IISRIT **THEN** EISRIAI = (IISRIT – EISRIT) / EISRIAS EISRIAT = EISRIAP Start EISRIAT **ENDIF**	C.3.6.5.12.a	7.3.6.5.12.1:M	Yes ___ No ___	
7.3.6.5.12.2	EISRIAT stops:	C.3.6.5.12.b	7.3.6.5.12: M	Yes ___ No ___	
7.3.6.5.12.2.a	The EISRIAT shall be stopped each time the EISRIT is updated, i.e., when a segment is received or the ISRIT expires.	C.3.6.5.12.b	7.3.6.5.12.2:M	Yes ___ No ___	
7.3.6.5.12.3	EISRIAT expires:	C.3.6.5.12.c	7.3.6.5.12: M	Yes ___ No ___	
7.3.6.5.12.3.a	When the EISRIAT expires the EISRIT shall be adjusted according to the equation below. EISRIT = EISRIT + EISRIAI **IF** EISRIT < IISRIT **THEN** EISRIAT = EISRIAP Start EISRIAT **ENDIF**	C.3.6.5.12.c	7.3.6.5.12.3:M	Yes ___ No ___	
7.3.6.5.12.3.b	If EISRIAT < IISRIT then the EISRIAT is restarted.	C.3.6.5.12.c	7.3.6.5.12.3:M	Yes ___ No ___	
7.3.6.5.13	Time Allowed From Request For Transfer To Complete Timer (TAFRFTTCT)	C.3.6.5.13	7.3.6.5:M	Yes ___ No ___	
7.3.6.5.13.1	TAFRFTTCT starts**:**	C.3.6.5.13.a	7.3.6.5.13: M	Yes ___ No ___	
7.3.6.5.13.1.a	The TAFRFTTCT shall be started when the transfer request is received by the S/R Layer and shall be set according to the equation below. TAFRFTTCT = The parameter specified in the S/R Unitdata request sent by the application.	C.3.6.5.13.a	7.3.6.5.13.1:M	Yes ___ No ___	

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.5.13.2	TAFRFTTCT stops:	C.3.6.5.13.b	7.3.6.5.13:M	Yes ___ No ___	
7.3.6.5.13.2.a	The TAFRFTTCT shall be stopped when the Destination Status for all Destinations transitions to INACTIVE.	C.3.6.5.13.b	7.3.6.5.13.2:M	Yes ___ No ___	
7.3.6.5.13.3	TAFRFTTCT expires:	C.3.6.5.13.c	7.3.6.5.13:M	Yes ___ No ___	
7.3.6.5.13.3.a	When the TAFRFTTCT expires, an Abort Request shall be sent to all active Destinations and provide an appropriate SR – Status Indication primitive.	C.3.6.5.13.c	7.3.6.5.13.3:M	Yes ___ No ___	
7.3.6.6	Enhanced Timer Equations	C.3.6.6	7.3.6:M	Yes ___ No ___	
7.3.6.6.1	Round Trip Delay (RTD) Equations	C.3.6.6.1	7.3.6.6:M	Yes ___ No ___	
7.3.6.6.1.a	The sequence of equations as described in C.3.6.6.1 shall be used to calculate the Estimated RTD (ERTD), Relaxed Estimated (RERTD), and the Saved Estimated RTD (SERTD).	C.3.6.6.1	7.3.6.6.1:M	Yes ___ No ___	
7.3.6.6.2	LNUS and SLNUS Equations	C.3.6.6.2	7.3.6.6:M	Yes ___ No ___	
7.3.6.6.2.a	When a Partial Acknowledgment is received, the sequence of equations as described in C.3.6.6.2 shall be used to update the LNUS associated with the Destination that sent the Partial Acknowledgment.	C.3.6.6.2	7.3.6.6.2:M	Yes ___ No ___	
7.3.6.6.3	Segment Reception Equations	C.3.6.6.3	7.3.6:M	Yes ___ No ___	
7.3.6.6.3.a	When a segment is received the sequence of equations as described in C.3.6.6.3shall be used to calculate the Estimated Inter-Segment Receive Interval Time (EISRIT) and start/restart the Inter-Segment Receive Timer (ISRT), Inter-Segment Receive Interval Timer (ISRIT), and Reassembly Timer (RT).	C.3.6.6.3	7.3.6.6.3:M	Yes ___ No ___	
7.3.6.7	Enhanced Initialization Equations	C.3.6.7	7.3.6:M	Yes ___ No ___	
7.3.6.7.1	Network Enable Initialization	C.3.6.7.1	7.3.6.7:M	Yes ___ No ___	
7.3.6.7.1.a	Before any segments have been sent or received (e.g., upon enabling the net), the sequence of equations as described in C.3.6.7.1 shall be used to initialize parameter values.	C.3.6.7.1	7.3.6.7.1:M	Yes ___ No ___	
7.3.6.7.2	Application PDU Transmit Initialization	C.3.6.7.2	7.3.6:M	Yes ___ No ___	
7.3.6.7.2.a	Each time an Originator initiates the transfer of an Application PDU, the sequence of equations as described in C.3.6.7.2 shall be used to initialize the parameter values associated with that Application PDU	C.3.6.7.2	7.3.6.7.2:M	Yes ___ No ___	

APPENDIX E

TABLE E-VIII. Segmentation/Reassembly Protocol requirements – Continued

Item Number	Field Name	Reference	Status	Support	Notes
7.3.6.7.3	Application PDU Receive Initialization	C.3.6.7.3	7.3.6:M	Yes ___ No ___	
7.3.6.7.3.a	Each time a Destination begins reception of a new Application PDU, the sequence of equations as described in C.3.6.7.3 shall be used to initialize the parameter values associated with that Application PDU Identifier.	C.3.6.7.3	7.3.6.7.3: M	Yes ___ No ___	

APPENDIX E

TABLE E-IX. Security Extension Protocol requirements.

Item Number	Field Name	Reference	Status Tx Rx	Support Tx Rx	Notes
8.1	Security Extension Protocol	5.7.2.1.6 5.7.2.1.7 5.7.2.2.13 5.7.2.4.4 APPENDIX D	4.1.6: M 4.1.7:M	Yes ___ ___ No ___ ___	
8.1.1	This appendix is mandatory for systems implementing SEP.	D.1.2	8.1:M	Yes ___ ___ No ___ ___	
8.1.2	The Message Security Group shall consist of the fields in TABLE D-I when Case 6, condition 13 and expected response 5.7.2.4.4 apply.	D.4.1.1	8.1:M	Yes ___ ___ No ___ ___	
8.1.2.1	The Authentication data (A) field shall be set to 320 zeroes	D.4.1.1.5.1	8.1.2:M	Yes ___ ___ No ___ ___	
8.1.2.2	Once the 320-bit signature has been generated from the 160-bit hash, the Authentication data (A) field shall be set to this 320-bit signature value	D.4.1.1.5.1	8.1.2:M	Yes ___ ___ No ___ ___	
8.1.2.3	Verification of Authentication Data (B) fields shall be performed in accordance with the DSA using the original message header and user data.	D.4.1.1.5.2	8.1.2:M	Yes ___ No ___	

APPENDIX F

COMBAT NET RADIO PLATFORM - SYSTEM IMPLEMENTATION

F.1 General.

F.1.1 Scope.
This appendix provides a template (TABLE F-I) describing MIL-STD-2045-47001 platform and system implementation of fields and protocols associated with each platform/system. The repository of data collected from all platform and system implementations shall be located on the CNRWG website: https://www.us.army.mil/suite/page/495338.

F.1.2 Application.
This appendix is a mandatory part of MIL-STD-2045-47001. PMOs and systems implementers shall submit updates to this table every time their respective system is updated/revised or otherwise changed. The CNRWG facilitator shall insert the data into the CNRWG website spreadsheet.

F.2 Applicable documents.
None.

F.3 Definitions.

Data Item: A subunit of descriptive information or value classified under a data element. For example, the data element "military personnel grade" contains data items such as sergeant, captain, and colonel. (Joint Pub 1-02).

F.4 General requirements.

F.4.1 Reason for table.
MIL-STD-2045-47001 has a large number of parameters and data items (DI) that makes it difficult to achieve interoperability between operational systems. A table providing the MIL-STD-2045-47001 Application Header implementations down to the elemental level, protocols and associated ports cross referenced to each system implementation will reduce interoperability problems. The table is intended to give a realistic and truthful idea of a system's operational capabilities and limitations rather than its technical implementation which can be obtained from the Implementers Profile Statement and/or DSPICS.

F.4.1.1 Process explanation.
TABLE F-I is the template an individual platform/system would fill out and submit to the CNRWG facilitator for inclusion into the repository. TABLE F-II is a fictious abbreviated example of when TABLE F-I is completed. TABLE F-III is an abbreviated example of the repository of MIL-STD-2045-47001 Platform – System Implementation located on the CNRWG website spreadsheet.

F.4.2 Table construction.
The table is constructed as follows:

a. Column 1, MIL-STD-2045-47001D w/CHANGE 1 Fields: specifies the MIL-STD 2045-47001 Application Header field.

b. Column 2, Category (CAT): describes the field category (Mandatory or Optional).

c. Columns 3, Data Items and 4, Bit Codes: provides the bit code and data item respectively of each of the fields.

d. Column 5 Platform/System and Version Implementation Codes (Plat/Syst and Ver Imp Codes), provides a separate column for each platform/system described.

e. Column 6, Comments, is used to:

(1) Describe any differences between the platform/systems implementation and the way it is described in MIL-STD-2045-47001D w/CHANGE 1.

(2) Any other additional information that may be useful to aid operational interoperability.

F.4.2.1 Platform/System and version implementation codes (column 5).
Implementation codes are broadly separated into two functions transmit (T) and receive (R). Each of these are further divided into field and DI implementations. The following subparagraphs describe the form of system implementation used within each field by each system.

F.4.2.1.1 Field level transmit codes.

Code	**Explanation**
T	The system shall transmit all data from the indicated field.
NT	The system shall not originate the indicated field.
RT	The system shall not originate the indicated field but shall redistribute it.
Tn	The system shall originate only the specified data item value "n" for the field specified.
TBD	To be determined.

F.4.2.1.1.1 DI level transmit codes.

Code	**Explanation**
T	The system shall originate the DI value for the field specified.
NT	The system shall not originate the DI value for the field specified, but shall perform required receipt/compliance actions/responses.
RT	The system shall not originate the DI value for the specified field, but shall retransmit it.
TBD	To be determined.

F.4.2.1.2 Field level receive codes.

Code	**Explanation**
R	The system shall process the indicated field in a positive manner, i.e., not discard it. This typically, but not always , will involve displaying or storing in a database at least some of the data for operator call down.
NP	The system shall not process the indicated field but shall perform required receipt/compliance actions/responses on the associated message.
DM	The system shall discard the entire message upon receipt of the indicated field, but shall perform required receipt/compliance actions/responses on the associated message.
Rn	The system shall process the indicated field as if specific DI value "n" has been received.
TBD	To be determined.

F.4.2.1.2.1 DI level receive codes.

Code	Explanation
R	The system shall process the indicated DI in a positive manner, i.e. not discard it. This typically will involve displaying or storing in a database the data for operator call down. For example, if a system claims to be "R" for UMF field Value 3 (NITFS), then that system shall be capable of displaying the associated imagery file either immediately or by recalling it from a database. If the system discards the file then NP or DM shall be used.
NP	The system shall not process the indicated DI but shall perform required receipt/compliance actions/responses the associated message.
DM	The system shall discard the entire message upon receipt of the indicated DI, but shall perform required receipt/compliance actions/responses the associated message.
Rn	The system shall process the indicated DI as if specific DI value "n" had been received.
TBD	To be determined.

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE)

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
VERSION	M				
		Original	0		
		B	1		
		C	2		
		D	3		
		D w/CHANGE 1	4		
		Undefined	5-14		
		Version Set Not Implemented	15		
FPI	M				
		Not Present	0		
		Present	1		
COMPRESSION	O				
		Unix Compress/ Uncompress	0		
		GZIP	1		
		Undefined	2-3		
GPI	M				GPI for G1. Originator Address Group.
		Not Present	0		
		Present	1		
FPI	O				
		Not Present	0		
		Present	1		

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
URN	O		Note 1		Originator.

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
FPI	O				
		Not Present	0		
		Present	1		
UNIT NAME	O		Note 2		Originator.
GPI	M				GPI for G2. Recipient Address Group.
		Not Present	0		
		Present	1		
GRI	O				GRI FOR R1.
		Not Repeated	0		
		Repeated	1		R1(N) 0<=N<=16.
FPI	O				
		Not Present	0		
		Present	1		
URN	O		Note 1		Recipient.
FPI	O				
		Not Present	0		
		Present	1		
UNIT NAME	O		Note 2		RECIPIENT.
GPI	M				GPI for G3. Information Address Group.
		Not Present	0		
		Present	1		
GRI	O				
		Not Repeated	0		
		Repeated	1		R2(16 – N).
FPI	O				
		Not Present	0		
		Present	1		
URN	O		Note 1		INFORMATION RECIPIENT.
FPI	O				
		Not Present	0		
		Present	1		
UNIT NAME	O		Note 2		Information Recipient.
FPI	M				
		Not Present	0		
		Present	1		
HEADER SIZE	O				

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Illegal	0		
		1 – 65,535 Bytes	1 - 65535		
GPI	M				GPI for G4. Future Use 1.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		Total size of G4.
GPI	M				GPI FOR G5. FUTURE USE 2.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G5.
GPI	M				GPI FOR G6. FUTURE USE 3.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G6.
GPI	M				GPI FOR G7. FUTURE USE 4.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G7.
GPI	M				GPI FOR G8. FUTURE USE 5.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G8.
GRI	M				GRI FOR R3. MESSAGE HANDLING GROUP.
		Not Repeated	0		
		Repeated	1		R3(16).
UMF	M				
		Link 16	0		
		Binary File	1		
		Variable Message Format (VMF)	2		
		Nationality Imagery Transmission Format System (NITFS)	3		

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Redistributed Message (RDM)	4		
		United States Message Text Format (USMTF)	5		
		DOI-103	6		
		eXtensible Markup Language (XML) – Message Text Format (MTF)	7		
		eXtensible Markup Language (XML) – Variable Message Format (VMF)	8		
		Undefined	9 - 15		
FPI	M				
		Not Present	0		
		Present	1		
Message Standard Version	O				
		Refer to TABLE V for Data Item/Bit Code associations.	0 - 15		
GPI	M				GPI FOR G9. VMF MESSAGE IDENTIFICATION GROUP.
		Not Present	0		
		Present	1		
FAD	O				
		Network Control	0		
		General Information Exchange	1		
		Fire Support Operations	2		

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Air Operations	3		
		Intelligence Operations	4		
		Land Combat Operations	5		
		Maritime Operations	6		
		Combat Service Support	7		
		Special Operations	8		
		Joint Task Force (JTF) Operations Control	9		
		Air Defense/Air Space Control	10		
		Undefined	11 - 15		
MESSAGE NUMBER	O				
		Illegal	0		
		1 - 127	1 - 127		
FPI	O				
		Not Present	0		
		Present	1		
MESSAGE SUBTYPE	O				
		No Cases	0		
		Case 1.1 – Case 1.127	1 - 127		
FPI	M				
		Not Present	0		
		Present	1		
FILE NAME	O		Note 3		
FPI	M				
		Not Present	0		
		Present	1		
MESSAGE SIZE	O				
		Illegal	0 - 7		
		8 – 1,048,575 Bytes	8 - 1048575		
OPERATION INDICATOR	M				
		Operation	0		

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Exercise	1		
		Simulation	2		
		Test	3		
RETRANSMIT INDICATOR	M				
		Message is not a Retransmission	0		
		Message is a Retransmission	1		
MESSAGE PRECEDENCE CODE	M				
		Routine	0		
		Priority	1		
		Immediate	2		
		Flash	3		
		Flash Override	4		
		Critic/ECP	5		
		Reserved	6 - 7		
SECURITY CLASSIFICATION	M				
		Unclassified	0		
		Confidential	1		
		Secret	2		
		Top Secret	3		
FPI	M				
		Not Present	0		
		Present	1		
FRI	O				
		Not Repeated	0		
		Repeated	1		R4(16)
CONTROL/RELEASE MARKING	O				
		No Statement	0		
		Note 4	1 - 342		
		Undefined	343 - 511		
GPI	M				GPI FOR G10. ORIGINATOR DTG.
		Not Present	0		
		Present	1		
YEAR	O				
		2000 - 2094	0 - 94		

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	C A T	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		1995 - 1999	95 - 99		
		Undefined	100 - 127		
	O				
		Illegal	0		
		January	1		
		February	2		
		March	3		
		April	4		
		May	5		
		June	6		
		July	7		
		August	8		
		September	9		
		October	10		
		November	11		
		December	12		
		Illegal	13 - 15		
DAY	O				
		Illegal	0		
		1 - 31	1 - 31		
HOUR	O				(24 HOUR CLOCK).
		0 - 23	0 - 23		
		Illegal	24 - 31		
MINUTE	O				
		0 - 59	0 – 59		
		Illegal	60 - 63		
SECOND	O				
		0 - 59	0 – 59		
		Illegal	60 - 62		
		No Statement	63		
FPI	O				
		Not Present	0		
		Present	1		
DTG EXTENSION	O				
		0 - 4095	0 - 4095		
GPI	M				GPI FOR G11. PERISHABILITY DTG.
		Not Present	0		
		Present	1		
YEAR	O				
		2000 - 2094	0 - 94		
		1995 - 1999	95 - 99		

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Undefined	100 - 127		
MONTH	O				
		Illegal	0		
		January	1		
		February	2		
		March	3		
		April	4		
		May	5		
		June	6		
		July	7		
		August	8		
		September	9		
		October	10		
		November	11		
		December	12		
		Illegal	13 - 15		
DAY	O				
		Illegal	0		
		1 - 31	1 - 31		
HOUR	O				(24 HOUR CLOCK).
		0 - 23	0 - 23		
		Illegal	24 - 31		
MINUTE	O				
		0 - 59	0 – 59		
		Illegal	60 - 63		
SECOND	O				
		0 - 59	0 – 59		
		Illegal	60 - 62		
		No Statement	63		
GPI	M				GPI FOR G12. ACKNOWLEDGMENT REQUEST GROUP.
		Not Present	0		
		Present	1		
MACHINE ACKNOWLEDGE REQUEST INDICATOR	O				
		Machine Acknowledgment Not Required	0		

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Machine Acknowledgment Required	1		
OPERATOR ACKNOWLEDGE REQUEST INDICATOR	O				
		Operator Acknowledgment Not Required	0		
		Operator Acknowledgment Required	1		
OPERATOR REPLY REQUEST INDICATOR	O				
		Operator Reply Not Required	0		
		Operator Reply Required	1		
GPI	M				GPI FOR G13. RESPONSE DATA GROUP.
		Not Present	0		
		Present	1		
YEAR	O				
		2000 - 2094	0 - 94		
		1995 - 1999	95 - 99		
		Undefined	100 - 127		
MONTH	O				
		Illegal	0		
		January	1		
		February	2		
		March	3		
		April	4		
		May	5		
		June	6		
		July	7		
		August	8		
		September	9		
		October	10		
		November	11		
		December	12		
		Illegal	13 - 15		
DAY	O				

APPENDIX F

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Illegal	0		
		1 - 31	1 - 31		
HOUR	O				(24 HOUR CLOCK).
		0 - 23	0 - 23		
		Illegal	24 - 31		
MINUTE	O				
		0 - 59	0 – 59		
		Illegal	60 - 63		
SECOND	O				
		0 - 59	0 – 59		
		Illegal	60 - 62		
		No Statement	63		
FPI	O				
		Not Present	0		
		Present	1		
DTG EXTENSION	O				
		0 - 4095	0 - 4095		
R/C	O				
		Undefined	0		
		Machine Receipt (MR)	1		
		Cannot Process (CANTPRO)	2		
		Operator Acknowledge (OPRACK)	3		
		Will Comply (WILCO)	4		
		Have Complied (HAVCO)	5		
		Cannot Comply (CANTCO)	6		
		Undefined	7		
FPI	O				
		Not Present	0		
		Present	1		
CANTCO REASON CODE	O				
		Communications problem	0		
		Ammunition problem	1		

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Personnel problem	2		
		Fuel problem	3		
		Terrain/Environment problem	4		
		Equipment problem	5		
		Tactical Situation problem	6		
		Other	7		
FPI	O				
		Not Present	0		
		Present	1		
CANTPRO REASON CODE	O				
		Undefined	0		
		Field content invalid	1		
		Message incorrectly routed	2		
		Address inactive	3		
		Reference point unknown to receiving agency	4		
		Fire units shall be controlled by receiving agency	5		
		Mission shall be controlled by receiving agency	6		
		Mission number unknown by receiving agency	7		

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Target number unknown by receiving agency	8		
		Schedule number unknown by receiving agency	9		
		Incorrect controlling address for a given track number	10		
		Track number not in own track file	11		
		Invalid according to given field	12		
		Message cannot be converted	13		
		Agency file full	14		
		Agency does not recognize this message number	15		
		Agency cannot correlate message to current file content	16		
		Agency limit exceeded on repeated fields or groups	17		
		Agency computer system inactive	18		
		Addressee unknown	19		
		Can’t forward (agency failure)	20		

APPENDIX F

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Can't forward (link failure)	21		
		Illogical juxtaposition of header fields	22		
		Cannot uncompress Unix (LZW) compressed data	23		
		Cannot uncompress LZ-77 compressed data	24		
		Message too old, based on Perishability	25		
		Security level restriction	26		
		Authentication Failure	27		
		Certificate not found	28		
		Certificate invalid	29		
		Do not support this SPI value	30		
		Can not generate a signed acknowledgement	31		
		Response not available for retransmission	32		
		Undefined	33 - 63		
FPI	O				
		Not Present	0		
		Present	1		
REPLY AMPLIFICATION	O				
GPI	M				GPI FOR G14. REFERENCE MESSAGE DATA GROUP.

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Not Present	0		
		Present	1		
GRI	O				
		Not Repeated	0		
		Repeated	1		R5(4).
FPI	O				
		Not Present	0		
		Present	1		
URN	O		Note 1		
FPI	O				
		Not Present	0		
		Present	1		
UNIT NAME	O		Note 2		
YEAR	O				
		2000 - 2094	0 - 94		
		1995 - 1999	95 - 99		
		Undefined	100 - 127		
MONTH	O				
		Illegal	0		
		January	1		
		February	2		
		March	3		
		April	4		
		May	5		
		June	6		
		July	7		
		August	8		
		September	9		
		October	10		
		November	11		
		December	12		
		Illegal	13 - 15		
DAY	O				
		Illegal	0		
		1 - 31	1 - 31		
HOUR	O				(24 HOUR CLOCK).
		0 - 23	0 - 23		
		Illegal	24 - 31		
MINUTE	O				
		0 - 59	0 – 59		
		Illegal	60 - 63		
SECOND	O				

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		0 - 59	0 – 59		
		Illegal	60 - 62		
		No Statement	63		
FPI	O				
		Not Present	0		
		Present	1		
DTG EXTENSION	O				
		0 - 4095	0 - 4095		
GPI	M				GPI FOR G15. FUTURE USE 6.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G15.
GPI	M				GPI FOR G16. FUTURE USE 7.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G16.
GPI	M				GPI FOR G17. FUTURE USE 8.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G17.
GPI	M				GPI FOR G18. FUTURE USE 9.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G18.
GPI	M				GPI FOR G19. FUTURE USE 10.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G19.
GPI	M				GPI FOR G20. MESSAGE SECURITY GROUP.
		Not Present	0		
		Present	1		
SECURITY PARAMETERS INFORMATION	O				

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		Authentication (using SHA-1 and DSA)/ No Encryption	0		
		Undefined	1 - 15		
GPI	M				GPI FOR G21. KEYING MATERIAL GROUP.
		Not Present	0		
		Present	1		
KEYING MATERIAL ID LENGTH	O				
		1 – 8 Octets	0 - 7		
KEYING MATERIAL ID	O				
		$0 – (2^{64} – 1)$	$0 – (2^{64} – 1)$		
GPI	O				GPI FOR G22. CRYPTOGRAPHIC INITIALIZATION GROUP.
		Not Present	0		
		Present	1		
CRYPTOGRAPHIC INITIALIZATION LENGTH	O				
		1 – 15 64-Bit Blocks	0 – 7		
CRYPTOGRAPHIC INITIALIZATION	O				
		$0 – (2^{1024} – 1)$	$0 – (2^{1024} – 1)$		
GPI	O				GPI FOR G23. KEY TOKEN GROUP.
		Not Present	0		
		Present	1		
KEY TOKEN LENGTH	O				
		1 – 256 64-Bit Blocks	0 – 255		
FRI	O				
		Not Repeated	0		
		Repeated	1		R6(17).
KEY TOKEN	O				

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
		$0 – (2^{16384} – 1)$	$0 – (2^{16384} – 1)$		
GPI	O				GPI FOR G24. AUTHENTICATION (A) GROUP.
		Not Present	0		
		Present	1		
AUTHENTICATION DATA (A) LENGTH	O				
		1 – 128 64-Bit Blocks	0 - 127		
AUTHENTICATION DATA (A)	O				DIGITAL SIGNATURE.
		$0 – (2^{8192} – 1)$	$0 – (2^{8192} – 1)$		
GPI	O				GPI FOR G25. AUTHENTICATION (B) GROUP.
		Not Present	0		
		Present	1		
AUTHENTICATION DATA (B) LENGTH	O				
		1 – 128 64-Bit Blocks	0 - 127		
AUTHENTICATION DATA (B)	O				DIGITAL SIGNATURE.
		$0 – (2^{8192} – 1)$	$0 – (2^{8192} – 1)$		
SIGNED ACKNOWLEDGE REQUEST INDICATOR	O				
		Signed Response is Not Required	0		
		Signed Response is Required	1		
GPI	O				GPI FOR G26. MESSAGE SECURITY PADDING GROUP.
		Not Present	0		
		Present	1		

APPENDIX F

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
MESSAGE SECURITY PADDING LENGTH	O				
		0 – 255 Octets	0 – 255		
FPI	O				
		Not Present	0		
		Present	1		
MESSAGE SECURITY PADDING	O				
		0 – (2^{2040} – 1)	0 – (2^{2040} – 1)		
GPI	M				GPI FOR G27. FUTURE USE 11.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G27.
GPI	M				GPI FOR G28. FUTURE USE 12.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G28.
GPI	M				GPI FOR G29. FUTURE USE 13.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G29.
GPI	M				GPI FOR G30. FUTURE USE 14.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G30.
GPI	M				GPI FOR G31. FUTURE USE 15.
		Not Present	0		
		Present	1		
GROUP SIZE	O				
		0 – 4095 Bits	0 - 4095		TOTAL SIZE OF G31.
SEGMENTATION AND REASSEMBLY (S/R)					
SECURITY EXTENSION PROTOCOL (SEP)					

TABLE F-I. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (TEMPLATE) - Continued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	C A T	DATA ITEMS	BIT CODE	Plat/Syst and Ver Imp Codes	COMMENTS
LEGEND: VMF Syntax Field Categories: M = Mandatory O = Optional Note 1: System implements the full field size of 24 bits, in accordance with paragraph 5.6.3.1. Note 2: System implements ANSI ASCII characters and maximum field size in accordance with paragraph 5.6.3.2. Note 3: System implements ANSI ASCII characters and maximum field size in accordance with paragraph 5.6.8. Note 4: System implements MIL-STD-6017, DFI/DUI 4127/005, Nationality, Data Items in accordance with paragraph 5.6.14. Note 5: System implements ANSI ASCII characters and maximum field size in accordance with paragraph 5.6.25.					

F.4.3 MIL-STD-2045-47001 Platform – system implementation (example).
TABLE F-II is an abbreviated example of the MIL-STD-2045-47001 Platform – System Implementation submission.

TABLE F-II. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (EXAMPLE)

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	C A T	DATA ITEMS	BIT CODE	ALPHA BLOCK II	COMMENTS
VERSION	M			T/R	
		Original	0	NT/NP	
		B	1	NT/NP	
		C	2	NT/NP	
		D	3	T3/R3	
		D w/CHANGE 1	4	T4/R4	
		Undefined	5-14	TBD	
		Version Set Not Implemented	15	T15/R15	
FPI	M			T/R	
		Not Present	0	T/R	
		Present	1	T/R	
COMPRESSION	O			T/R	
		Unix Compress/Uncompress	0	T/R	

TABLE F-II. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (EXAMPLE)

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	ALPHA BLOCK II	COMMENTS
		GZIP	1	T/R	
		Undefined	2-3	NT/DM	
GPI	M			T/R	GPI for G1. Originator Address Group.
		Not Present	0	NT/NP	
		Present	1	T1/R1	
FPI	O			T/R	
		Not Present	0	NT/NP	
		Present	1	T1/R1	
URN	O		Note 1	T/R	Originator.
FPI	O			T/R	
		Not Present	0	T/R	
		Present	1	T/R	
UNIT NAME	O		Note 2	T/R	Originator.
GPI	M			T/R	GPI for G2. Recipient Address Group.
		Not Present	0	NT/NP	
		Present	1	T1/R1	
GRI	O			T/R	GRI for R1.
		Not Repeated	0	NT/NP	
		Repeated	1	T1/R1	R1(N) 0<=N<=16.
FPI	O			T/R	
		Not Present	0	T/R	
		Present	1	T1/R1	
URN	O		Note 1	T/R	Recipient.

TABLE F-II. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (EXAMPLE) - Contiunued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	ALPHA BLOCK II	COMMENTS
FPI	O			T/R	
		Not Present	0	T/R	
		Present	1	T/R	
UNIT NAME	O		Note 2	T/R	RECIPIENT.
. . .	. . .	. . .	. . .	. . .	. . .
SEGMENTATION AND REASSEMBLY (S/R)				T/R	

APPENDIX F

TABLE F-II. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION (EXAMPLE) - Contiunued

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	ALPHA BLOCK II	COMMENTS
SECURITY EXTENSION PROTOCOL (SEP)				T/R	

Note 1: System implements the full field size of 24 bits, in accordance with paragraph 5.6.3.1.
Note 2: System implements ANSI ASCII characters and maximum field size in accordance with paragraph 5.6.3.2.
Note 3: System implements ANSI ASCII characters and maximum field size in accordance with paragraph 5.6.8.
Note 4: System implements MIL-STD-6017, DFI/DUI 4127/005, Nationality, Data Items in accordance with paragraph 5.6.14.
Note 5: System implements ANSI ASCII characters and maximum field size in accordance with paragraph 5.6.25.

APPENDIX F

F.4.4 CNRWG website MIL-STD-2045-47001 platform – system implementation spreadsheet example.
TABLE F-III is an abbreviated example of the MIL-STD-2045-47001 Platform – System Implementation CNRWG website spreadsheet. The data inserted is fictional and is not to be construed as actual implementation data.

TABLE F-III. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	ALPHA	BRAVO	CHARLIE	DELTA	ECHO	FOX-TROT	GOLF	COMMENTS
VERSION	M			T/R	T/R	T/R	T/R	T/R	T/R	T/R	
		Original	0	NT/NP	NT/NP	NT/NP	T0/R0	NT/NP	NT/NP	NT/NP	
		B	1	NT/NP	T1/R1	T1/R1	NT/NP	NT/NP	T1/R1	NT/NP	
		C	2	NT/NP	NT/NP	NT/NP	NT/NP	T2/R2	NT/NP	NT/NP	
		D	3	T3/R3	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	T3/R3	
		D w/CHANGE 1	4	T4/R4	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	
		Undefined	5-14	TBD	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	TBD	
		Version Set Not Implemented	15	T15/R15	T15/R15	NT/NP	NT/NP	T15/R15	T15/R15	T15/R15	
FPI	M			T/R	T/R	T/R	T/R	T/R	T/R	T/R	
		Not Present	0	T/R	T0/R0	T/R	T/R	T/R	T0/R0	T/R	
		Present	1	T/R	NT/NP	T/R	T/R	T/R	NT/NP	T/R	
COMPRESSION	O			T/R	NT/DM	T/R(1)	T/R(1)	T/R(1)	NT/DM	T/R(1)	(1) Although CHARLIE, DELTA, ECHO, and GOLF implements both forms of data compression, only one shall be selected, prior to the mission and must apply to all messages sent during that mission.
		Unix Compress/Uncompress	0	T/R	NT/DM	NT/NP	NT/R0	T/R	NT/DM	T/R	
		GZIP	1	T/R	NT/DM	T1/R1	NT/NP	T/R	NT/DM	T/R	

TABLE F-III. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	ALPHA	BRAVO	CHARLIE	DELTA	ECHO	FOX-TROT	GOLF	COMMENTS
		Undefined	2-3	NT/DM	NT/DM	NT/DM	NT/DM	NT/DM	NT/DM	NT/DM	

TABLE F-III. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION - CONTINUED

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	ALPHA	BRAVO	CHARLIE	DELTA	ECHO	FOX-TROT	GOLF	COMMENTS
GPI	M			T/R	T/R	T/R	T/R	T/R	T/R	T/R	
		Not Present	0	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	
		Present	1	T1/R1	T1/R1	T1/R1	T1/R1	T1/R1	T1/R1	T1/R1	
FPI	O			T/R	T/R	T/R	T/R	T/R	T/R	T/R	
		Not Present	0	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	
		Present	1	T1/R1	T1/R1	T1/R1	T1/R1	T1/R1	T1/R1	T1/R1	
URN	O		Note 1	T/R	T/R	T/R	T/R	T/R	T/R	T/R	
FPI	O			T/R	T/R	T/R	T/R	T/R	T/R	T/R	
		Not Present	0	T/R	T0/R0	T/R	T/R	T/R	T0/R0	T/R	
		Present	1	T/R	NT/NP	T/R	T/R	T/R	NT/NP	T/R	
UNIT NAME	O		Note 2	T/R	NT/NP	T/R	T/R(2)	T/R (2)	NT/NP	T/R	(2) DELTA and ECHO implement VMF ANSI ASCII codes ANBS.
GPI	M			T/R	T/R	T/R	T/R	T/R	T/R	T/R	
		Not Present	0	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	NT/NP	
		Present	1	T1/R1	T1/R1	T1/R1	T1/R1	T1/R1	T1/R1	T1/R1	
GRI	O			T/R	T/R	T/R	T/R	T/R	T/R	T/R	
		Not Repeated	0	T/R	T/R	NT/NP	NT/NP	NT/NP	T/R	T/R	
		Repeated	1	T1/R1(16)	T1/R1(16)	T1/R1(16)	T1/R1	T1/R1	T1/R1(16)	T1/R1(16)	
FPI	O			T/R	T/R	T/R	T/R	T/R	T/R	T/R	
		Not Present	0	T/R	T/R	T/R	T/R	T/R	T/R	T/R	
		Present	1	T1/R1	T0/R0	T/R	T/R	T/R	T0/R0	T1/R1	
URN	O		Note 1	T/R	T/R	T/R	T/R	T/R	T/R	T/R	
FPI	O			T/R	T/R	T/R	T/R	T/R	T/R	T/R	
		Not Present	0	T/R	T0/R0	T0/R0	T/R	T/R	T0/R0	T/R	
		Present	1	T/R	NT/DM	NT/DM	T/R	T/R	NT/DM	T/R	

TABLE F-III. MIL-STD-2045-47001 PLATFORM – SYSTEM IMPLEMENTATION - CONTINUED

MIL-STD-2045-47001D w/CHANGE 1 FIELDS	CAT	DATA ITEMS	BIT CODE	ALPHA	BRAVO	CHARLIE	DELTA	ECHO	FOX-TROT	GOLF	COMMENTS
UNIT NAME	O		Note 2	T/R	NT/DM	NT/DM	T/R(2)	T/R(2)	NT/DM	T/R	(2) DELTA and ECHO implement VMF ANSI ASCII codes ANBS.
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	
SEGMENTATION AND REASSEMBLY (S/R)				T/R	NT/DM	T/R	T/R	T/R	T/R	T/R	
SECURITY EXTENSION PROTOCOL (SEP)				T/R	NT/DM	T/R	T/R	T/R	T/R	T/R	

Note 1: System implements the full field size of 24 bits, in accordance with paragraph 5.6.3.1.
Note 2: System implements ANSI ASCII characters and maximum field size in accordance with paragraph 5.6.3.2.
Note 3: System implements ANSI ASCII characters and maximum field size in accordance with paragraph 5.6.8.
Note 4: System implements MIL-STD-6017, DFI/DUI 4127/005, Nationality, Data Items in accordance with paragraph 5.6.14.
Note 5: System implements ANSI ASCII characters and maximum field size in accordance with paragraph 5.6.25.

CONCLUDING MATERIAL

a. Preparing activity:

US Army CECOM Life Cycle Management Command (USA CECOM LCMC): CR1

b. Custodians:

Army:	CR1
Navy:	OM
Air Force:	02
DISA:	DC1

c. Review activities:

OSD:	IR, SE
Army:	AC, AV, CR, IE, MI, PT, TM1, TM3
Navy:	CG, CH, EC, MC, ND
Air Force:	11, 13, 33, 99
DCMA:	CM
NIMA:	MP
DIA:	DI
NSA:	NS
NORAD& USSPACECOM:	US

d. **Project number**:

DCPS-2007-001

e. **NOTE:**

The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil