

Variable Message Format (VMF)

**Tactical Information Exchange
Integration Office (TIE IO)
Defence Materiel Organisation**

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(Contractor to the Commonwealth)

Agenda

- What is VMF?
- Types of Systems
- Required Standards
- MIL-STD-6017 – Variable Message Format
- MIL-STD-2045-47001 – Application Header
- MIL-STD-188-220 – Digital Message Transfer Device Subsystems
- Interoperability Issues

What is Variable Message Format?

- bit-oriented digital information
- variable length messages
- US MIL-STD –
 - used by US Services and Agencies, UK (digital CAS only) and ADF
 - Other nations showing interest
- small bandwidth systems
- primarily combat net radio below brigade HQ

What is Variable Message Format? (cont)

- formatted messages specified in the MIL-STD
 - Limited scope for tailoring at implementation
 - Allows for user defined variability upon transmission
- Used on internet style networks or point to point networks

What is Variable Message Format? (cont)

- The term VMF is used to describe a total system that facilitates the exchange of 'K' Series messages described in MIL-STD-6017
- VMF is media independent
 - Can use wireless (V/UHF, SATCOM, HF), or wired systems such as Ethernet or fibre optic cable systems
- **Be Specific** when using the term VMF!

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Types of Systems

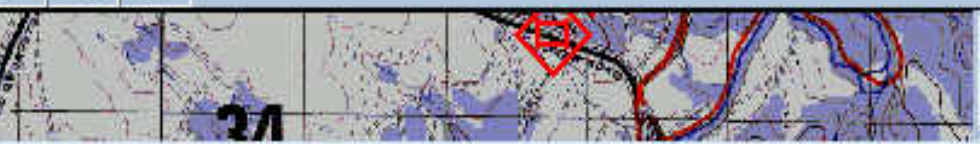
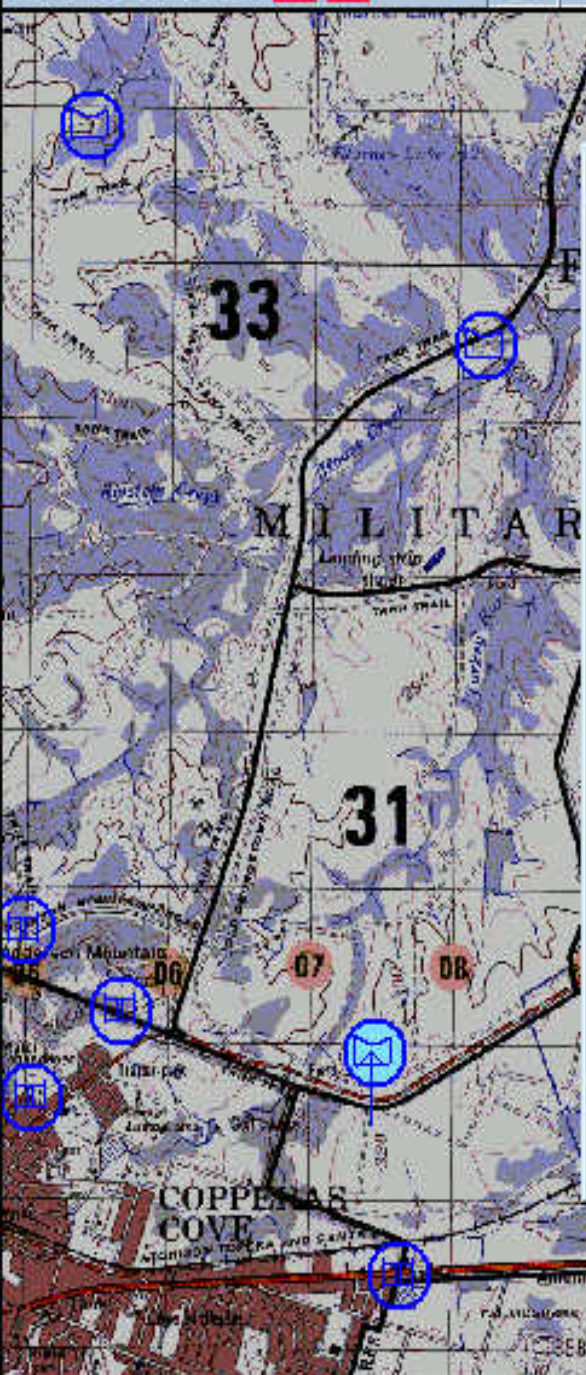
- Situational Awareness (SA)
 - FBCB2/BFT
- SA/C2
 - FBCB2
 - C2PC
- Fire Support
 - AFATDS
- Terminal Attack Control
 - TLDHS



C2CE



FBCB2



Nav... ctct ~~Auto Center~~

Combat Messages

SALT MEDEVAC NBC 1 Fire Mission Check Fire All SITREP

Equipment 1: (Target) Location:

Tank 1 + 14RPV 12747 51496 Map LRF

Equipment 2: DTG: Now

<None> 0 - 161815Z----- DTG

Equipment 3: Speed: Course:

<None> 0 <None> <None>

Activity: Stationary

CFF Msg

Method of Engagement: Immediate Suppression

Message sent at 161817ZJAN2004

Send Save Long Form Message... Close Help



AFATDS



USMC TLDHS / StrikeLink™ System Architecture



Artillery



Naval Gunfire



HIMARS



Mortars



AV-8B



F-16



F/A-18



AFATDS



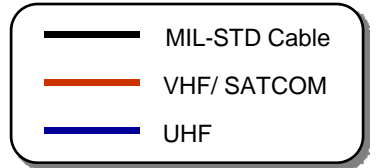
PRC-117F



StrikeLink™ MRT



Vector 21B
(CLRF)

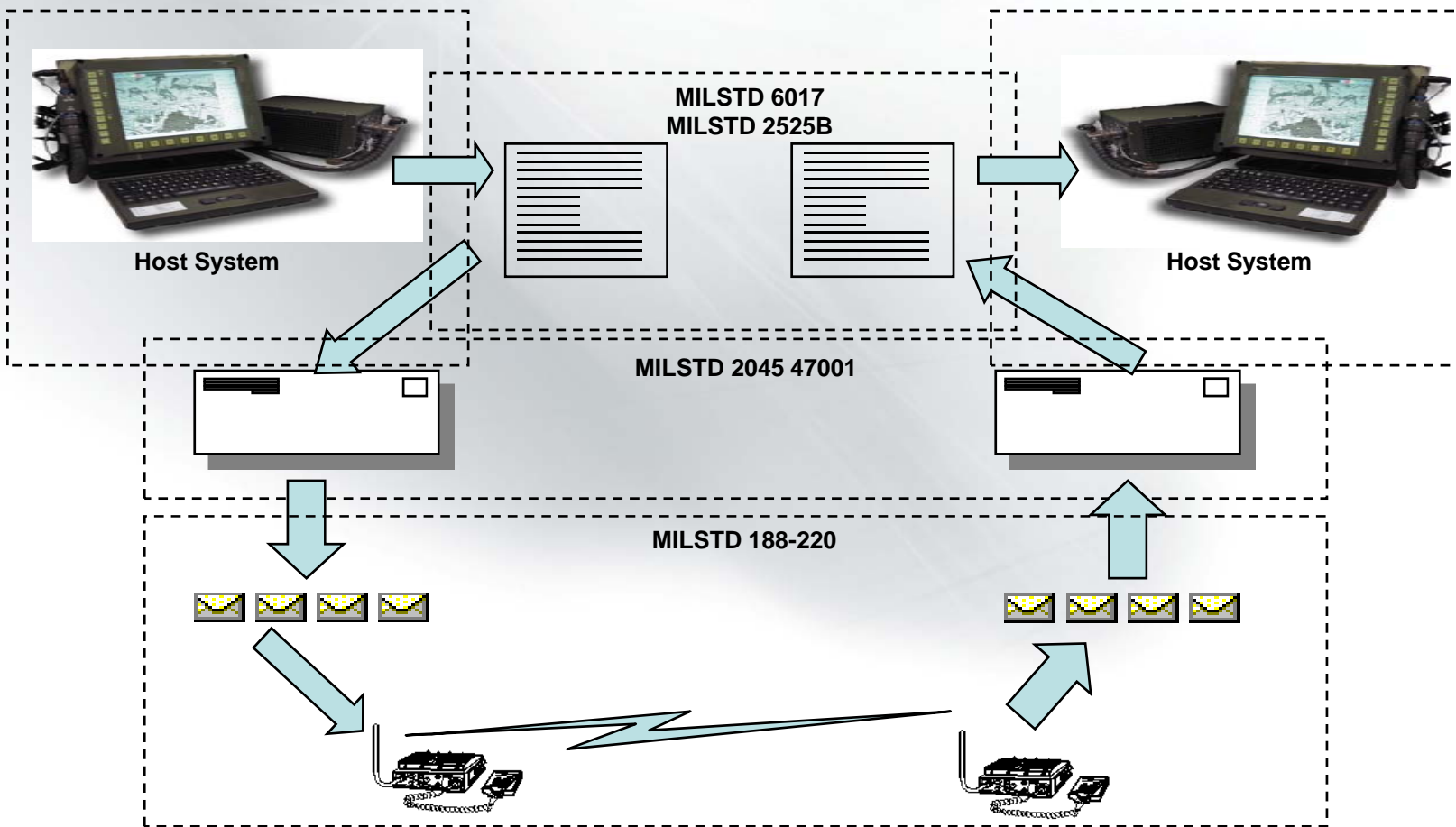


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VMF Related Military Standards

- The systems require a 'stack' comprising three standards:
 - The message format described in MIL-STD-6017;
 - A header that must precede the message, described in MIL-STD-2045-47001;
 - A transmission medium, normally MIL-STD-188-220 or EPLRS.



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MIL-STD-6017

- Describes
 - format and specific content of 'K' series messages
 - processing rules and information to interpret the message maps
 - layout of all messages and a Data Element Dictionary (DED)

Message Overview

- VMF supports the following Functional Areas:
 - K00 - Network Control (4)
 - K01 - General Information Exchange (4)
 - K02 - Fire Support (54)
 - K03 - Air (3)
 - K04 - Intelligence (11)
 - K05 - Land Combat (20)
 - K06 - Maritime Operations (0)
 - K07 - Combat Service (12)
 - K08 - Special Ops (1)
 - K09 - Joint Task Force Control (0)
 - K10 - Air Defence/Air Space Control (1)
 - TOTAL VMF Messages in MIL-STD-6017 = **110**

Message Overview

- Minimum Message Implementation:
 - K01.1 – Free Text
 - K01.2 – Unit Reference Query
 - K05.1 – Position Report

Message Overview

- Situational Awareness:
 - K01.1 – Free Text
 - K01.2 – Unit Reference Query
 - K05.1 – Position Report
 - K04.1 – Observation Report
 - K02.5 – Shell Report
 - K05.19 – Entity Data Message (system Dependant)
 - K04.2 – Obstacle Report
 - K04.3 – Land Route Report
 - K04.13 – Basic Weather
 - K05.17 - Overlay

Message Overview

- All Arms Call For Fire:
 - K02.4 – Call for Fire
 - K02.14 – Message to Observer
 - K02.6 – Observer Mission Update
 - K02.22 – Subsequent Adjust
 - K02.16 – End of Mission

Message Overview

- Digital Close Air Support (CAS):
 - K02.27 – Close Air Support Request
 - K02.28 – CAS BDA
 - K02.31 – Mission Request Rejection
 - K02.32 – CAS Request Acceptance
 - K02.33 – CAS Aircrew Briefing (9 Line Brief)
 - K02.34 – Aircraft On-Station
 - K02.35 - Aircraft Depart Initial Point
 - K02.36 – Aircraft Mission Update
 - K02.57 – Acft Atk Posn and Tgt Designation
 - K02.58 – CAS Acft Final Atk Control
 - K02.59 – Request for K02.57

Message Overview

- Others:
 - K05.14 – Situation Report
 - K05.15 – Field Orders
 - K05.2 – NBC 1 (five additional more complex messages available)
 - K07.1 – Medical Evacuation
 - K07.10 – Emergency Resupply Request
 - K07.11 – Emergency Resupply Response

Message Structure

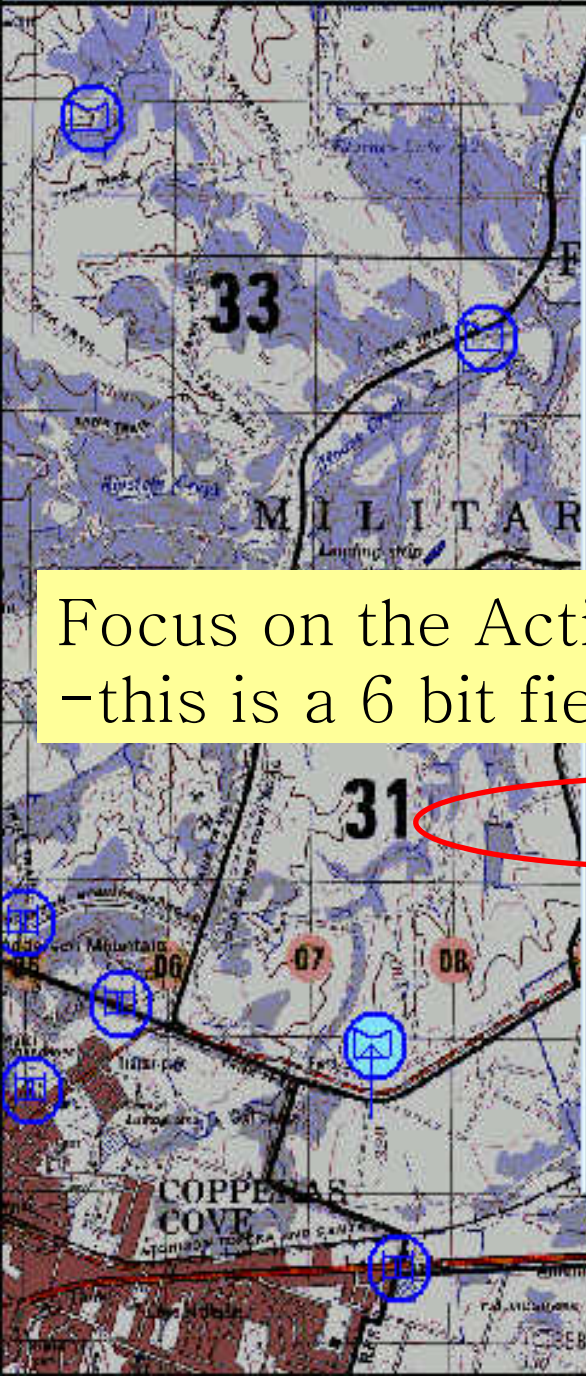
- Messages constructed of clearly defined fields
- Fields can be singular or repeated
- Related fields can be grouped
- There are two types of Groups:
 - ‘G’ Group – group of related fields
 - ‘R’ Group – repeatable group of related fields
- Field lengths vary dependant upon field definition and structure

Message Structure

- Field content:
 - Defined in Appendix B – Data Element Dictionary (DED)
 - Normally a binary number representing a word defined in the DED
 - Can be character based – 7 bit ASCII code
 - Can be alphanumeric – Target Number AA1234
- Field Types:
 - Mandatory (M)
 - Optional (X)
 - Optional – no category marking

Syntax Fields

- Control fields that are transparent to the user
- Provide for variability in VMF Messages
- Two types:
 - Presence
 - Repeat
- Presence fields:
 - Field Presence Indicator (FPI)
 - Group Presence Indicator (GPI)
- Repeat fields:
 - Field Recurrence Indicator (FRI)
 - Group Recurrence Indicator (GRI)



Combat Messages

SALT MEDEVAC NBC 1 Fire Mission Check Fire All SITREP

Equipment 1: (Target)
 Tank 1 Location: 14RPV 12747 51496 Map LRF

Equipment 2:
 <None> 0 DTG: 161815Z----- Now DTG

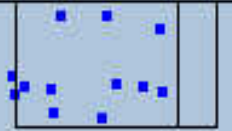
Speed: <None> Course: <None>

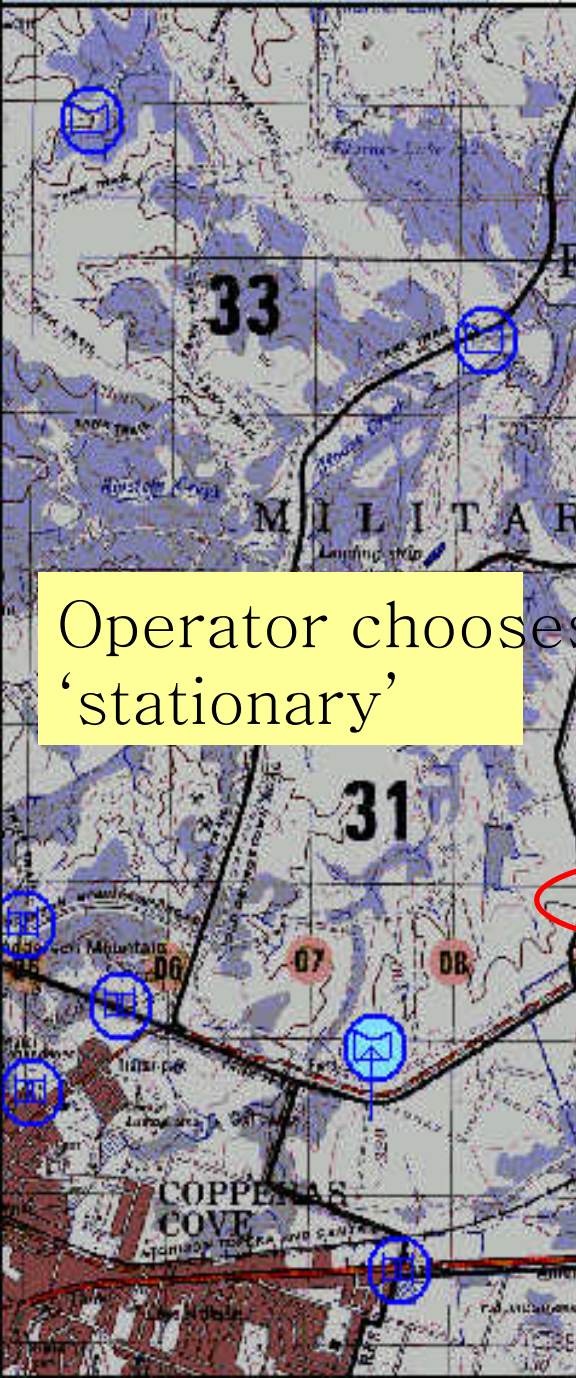
Activity: Stationary CFF Msg
 Method of Engagement: Immediate Suppression

Message sent at 161817ZJAN2004

Send Save Long Form Message... Close Help

Focus on the Activity Menu
-this is a 6 bit field in VMF





Combat Messages

SALT MEDEVAC NBC 1 Fire Mission Check Fire All SITREP

Equipment 1: (Target)

Tank ▼ 1 +
-

Location:

14RPV 12747 51496 Map LRF

Equipment 2:

<None> ▼ 0 +
-

DTG:

161815Z----- Now
DTG

Equipment 3:

<None> ▼ 0 +
-

Speed:

<None> ▼ Course: <None> ▼

Activity:

Stationary ▼

CFF Msg

Method of Engagement:

Immediate Suppression ▼

Message sent at 161817ZJAN2004

Send

Save

Long Form Message...

Close

Help



DPI NAME
4152 ACTIVITY/ACTION

DATA ITEM (CONTINUED)	BIT CODE	EXPLANATION
MOVING	11	
GUARDING	12	
COVERING	13	
RECONNOITERING	14	
REPAIRING	15	
SECURING	16	
ADJUSTING	17	
EVACUATING	18	
INTERROGATING	19	
DISPLACING	20	
REQUESTING RE-SUPPLY	21	
REQUESTING AIR SUPPORT	22	
REQUESTING FIRE SUPPORT	23	
REQUESTING	24	
REINFORCEMENTS		
REQUESTING CHANGES TO	25	
COORDINATION MEASURES		
STATIONARY	26	
DESTROYED	27	
ASSEMBLING	28	
MINE CLEARING	29	
MINE LAYING	30	
REFUELING	31	
BOMBING	32	
ELECTRONIC WARFARE	33	
RIVER CROSSING	34	
NO ACTIVITY	35	
HOVERING	36	
ORBITING	37	
CHAFF LAYING	38	
TRANSITING	39	
ACQUIRING/TRACKING	40	
SHADOWING	41	
INTERVENING	42	
ELECTRONIC PROTECTION	43	
(EP)		
ABORTING MISSION	44	
STANDOFF OPERATIONS	45	
LAUNCHING	46	
FIRE SUPPORT	47	
SPECIAL OPERATIONS	48	

Stationary in the data element dictionary equates to a bit code of '26'

System transmits the binary number for '26' - '011010'

Free Text versus Data Element Dictionary

- **Activity** Drop Down Menu – this is a **6 bit** field
 - Operator chooses ‘stationary’
 - Equates to digital number ‘26’
 - System transmits ‘011010’
 - Receive systems displays ‘stationary’
- Alternative in Free Text
 - Free Text uses ASCII code – seven bits per character
 - Operator types in ‘stationary’
 - System transmits seven bits per character
 - Seven bits by 10 characters – **70 bits**

Unit Identification

- Each VMF Unit (VU) is allocated a Unit Reference number (URN)
- The URN is a 24 bit number (0 through to 16,777,215)
- Each URN is unique with the allocation blocks detailed in the DED
- URNs are used for addressing and also to facilitate unique identification for track numbers and reported entities
 - $URN + EISN = EIRN$
- Allies are allocated blocks of URNs from the US Combatant Command (COCOM) that they support
 - ADF URNs are allocated by PACOM
 - Keep URN allocation regardless of the COCOM you deploy with
- US developing a Joint URN (JURN) database and management concept
- URN are used as a key to populate and manage the URN Lookup Table

URN Lookup Table

- Six fields mandated in the standard
 - URN-24 bit field
 - Unit Short Name – 1-30 characters
 - Unit Long Name – 1-64 characters
 - Service/Agency – one alphanumeric character from a list defined in the standard
 - Nationality – two characters from a list defined in the DED
 - MIL-STD-2525 Symbol Code – 15 characters denoting the symbol to be displayed for this URN-derived from MIL-STD-2525
- URN Lookup table ideally populated from a CD prior to deployment
- Can be updated by use of the K01.2 Unit Reference Query message
- Many systems have implemented these fields incorrectly, thereby requiring separate database management for each system
- US JURN initiative looking to address this non-conformance

Symbology

- VMF systems are tied to MIL-STD-2525 symbology
- Symbology can be denoted by using the 15 character symbol code (as described in the URN Lookup Table)
- Symbology normally denoted by using embedded fields within each message
 - Far more efficient from a bandwidth perspective
 - Can display additional information-comments/modifiers
 - Configuration management overhead to maintain currency with changes to 2525
- Due to embedded fields, versions of 6017 are tied to versions of 2525
 - 6017 tied to MIL-STD-2525B Change 1
 - 6017A tied to MIL-STD-2525B Change 2
 - 6017B tied to MIL-STD-2525C

MIL-STD-6017 Configuration Management

- Controlled US standard managed by US Defense Information Systems Agency (DISA)
- Distribution in Australia controlled by TIE IO
 - Government agencies
 - Industry in contract to deliver systems
- ‘A’ version published
- ‘B’ version to be published in early 2009

MIL-STD-6017 Configuration Management

- Changes managed by the JMTCCB
- Changes proposed by the VMFSG
 - Chaired by DISA
 - US C/S/A representation
 - UK and Australia have observer status
 - New messages and changes presented and discussed

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MIL-STD-2045-47001

- Describes the header that precedes a 'K' series message
- Includes:
 - Addressing information
 - Type of message (VMF, MTF etc)
 - Message standard version
 - Message number (K04.1 etc)
 - Acknowledgement requests and responses
 - Reason codes (why cannot comply etc)
 - Security information
 - Segmentation/reassembly

MIL-STD-2045-47001

- Uses same field structure and syntax as MIL-STD-6017
- No backward compatibility until current version
- 'D' version features 'Future Use Groups' to facilitate backwards compatibility in the 'E' and future versions
- 'D Change 1' recently published to correct errors in the 'D' version
- Developed and managed by the Combat Net Radio Working Group (CNRWG)
- Approved for public release-unlimited distribution

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MIL-STD-188-220

- Describes the means for transmitting data over V/UHF
- Defines the first three layers of the ISO OSI model
 - Standard Internet RFCs are used to describe the Internet Layer

MIL-STD-188-220

- MIL-STD-188-220 is a Carrier Sense Multiple Access (CSMA) type of protocol.
- Access slots are derived based upon a timing model
- Varying types of service and network access algorithms provide for flexible implementation
- **Types of Service:**
 - Type 1 – Simple, no acknowledgement
 - Type 2 – Very complex, windowed acknowledgement
 - Type 3 – Complex, coupled acknowledgement
 - Type 4 – Slightly complex, decoupled acknowledgement
- **Classes of Station:**
 - Class A – Type 1 and 3 - **Mandatory**
 - Class B - Type 1, Type 2, Type 3
 - Class C – Type 1, Type 3, Type 4
 - Class D – Type 1, Type 2, Type 3, Type 4

Network Access Delay (NAD) Schemes

- Access is based upon a common sense of when the network is quiet
- At this time, access slots commence
- The width of the slots are determined by network settings based upon radio timing parameters
- Station access to the slots is determined by the type of NAD scheme
- Two main types of NAD:
 - Deterministic
 - Probabilistic
- The majority of schemes are Probabilistic as they rely on the generation of random numbers and are prone to collisions
- Random-NAD (R-NAD) is probabilistic and can result in collisions
 - Each station generates a random number between 1 and the (number of stations*3/4)
 - The number generated determines the access slot they are allocated

Types of Network

- Fire Support Nets
 - Large number of critical messages
 - High throughput and high reliability
 - Type 2 connection oriented service
 - Deterministic Adaptive Prioritized (DAP) NAD
- Situational Awareness Nets
 - Large number of repetitive position reports
 - High throughput, lower reliability
 - Type 1 connectionless non-acknowledged service
 - Random NAD (R-NAD)

MIL-STD-188-220

- 'D Change 1' recently published to correct errors in the 'D' version
- Developed and managed by the Combat Net Radio Working Group (CNRWG)
- Approved for public release-unlimited distribution
- No backward compatibility until current version
- Every attempt will be made to ensure a minimum level of backward compatibility with the 'D Change 1' version

Interoperability Issues

- MIL-STD-6017
 - Different versions of the standard (TIDP Revision 6, 6017, 6017A etc)
 - Implementing different messages within the same standard
 - Implementing different optional fields within the same message
- MIL-STD-2045-47001
 - Different versions of the standard (47001B, C, D)
 - Versions after D backwards compatible to D
 - Different implementation of the fields within the header
- MIL-STD-188-220
 - Different versions of the standard (188-220B, C, D)
 - Versions after D backwards compatible to D
 - degraded service
 - Different implementation of the optional features

Questions

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