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NAVAL SURFACE WARFARE CENTER
Dahlgren, Virginia 22448-5100

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COMMON NAVY WARFIGHTING DISPLAY SYMBOLOGY IMPLEMENTATION GUIDE

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WARFARE SYSTEMS DEPARTMENT

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This document provides guidance for the implementation of Common Warfighting Symbology (MIL-STD-2525) in shipboard tactical and operational displays and is applicable to both new acquisition and modernization programs. The document provides recommended visualization options as provided by the standard, tailored for maritime operations. The document also recommends Navy-specific symbol modifiers that are presently not in MIL-STD-2525 but are components of previous Navy tactical symbology sets, including the Naval Tactical Display System (NTDS) and the Ship Self-Defense System (SSDS).

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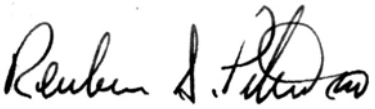
FOREWORD

This document describes the guidance for the implementation of Common Warfighting Symbology (MIL-STD-2525) in shipboard tactical and operational displays and is applicable to both new acquisition and modernization programs. The document provides recommended visualization options as provided by the standard, tailored for maritime operations. The document also recommends Navy-specific symbol modifiers that are presently not in MIL-STD-2525 but are components of previous Navy tactical symbology sets, including the Naval Tactical Display System (NTDS) and the Ship Self-Defense System (SSDS).

This document has been reviewed by Robert G. Hill, Head, Engineering and Command Environment Division, Warfare Systems Department.

Approved by:



REUBEN S. PITTS III, Head
Warfare Systems Department

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GLOSSARY

Term	Definition
ADS	Aegis Display System
C2	Command and Control
COI	Community of Interest
COMAIR	Commercial Aircraft
CPL	Common Presentation Layer
CRT	Cathode Ray Tube
DCA	Defensive Counter-Air
DDG 1000	Next-Generation Destroyer
DISA	Defense Information Systems Agency
DNC	Digital Nautical Chart
DoD	Department of Defense
DTED	Digital Terrain Elevation Display
DTG	Date/Time Group
ECDIS-N	Electronic Chart Display and Information System–Navy
FM	Field Manual
GCCS-M	Global Command and Control Systems–Maritime
GUI	Graphical User Interface
HM	Helicopter Mine Countermeasure
HMI	Human-Machine Interface
HSB	Hue, Saturation, Brightness
HSL	Hue, Saturation, Luminance
ID	Identification
IFF	Identification, Friend or Foe
IWS	Integrated Warfare Systems
JSF	Joint Strike Fighter
LCD	Liquid Crystal Display
LCS	Littoral Combat Ship
LSD	Large-Screen Display
MCRP	Marine Corps Reference Publication
MEDAL	Mine Warfare and Environmental Decision Aids Library
METOC	Metrological and Oceanographic
MIL-STD	Military Standard
MOOTW	Military Operations Other Than War
NATO	North Atlantic Treaty Organization
NAVSEA	Naval Sea Systems Command
NFCS	Naval Fire Control Systems
NRT	Non-real Time
NSWCDD	Naval Surface Warfare Center, Dahlgren Division
NTDS	Naval Tactical Display System
NTSC	National Television System Committee
OA	Open Architecture
ONR	Office of Naval Research
PAL	Phase Alternation Line
PEO	Program Executive Office

GLOSSARY (Continued)

Term	Definition
PU	Participating Unit
RGB	Red, Green, Blue
SME	Subject-Matter Expert
SRS	Software Requirement Specification
SSDS	Ship Self-Defense System
SSMC	Symbology Standards Management Committee
STANAG	Standardized Agreement
TACSIT	Tactical Situation Display
TDL	Tactical Data Link
Yu'v'	Luminance/Chrominance

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1.0 SCOPE

This document provides guidance for the implementation of Common Warfighting Symbology (MIL-STD-2525) in shipboard tactical and operational displays and is applicable to both new acquisition and modernization programs. The document provides recommended visualization options as provided by the standard, tailored for maritime operations. The document also recommends Navy-specific symbol modifiers that are presently not in MIL-STD-2525 but are components of previous Navy tactical symbology sets, including the Naval Tactical Display System (NTDS) and the Ship Self-Defense System (SSDS). Throughout this guide, reference to MIL-STD-2525 refers to the most recent iteration, MIL-STD-2525B symbology, Change 2 (see Reference 1). To download the most recent version of the standard and respective symbology set, visit the Defense Information Systems Agency (DISA) MIL-STD-2525 Web site, <https://www.us.army.mil/suite/portaltop.do?$p=portal.home>.

The contents of this *Implementation Guide* are applicable to MIL-STD-2525, Section 5, Detailed Requirements, and the following MIL-STD-2525 appendixes: Appendix A, C^2 Symbology: Units, Equipment, and Installations; and Appendix B, C2 Symbology: Military Operations, which contains information regarding the presentation and display of special points and tactical graphics. Although relevant, implementation guidance regarding Appendix C, Meteorological and Oceanographic (METOC) Symbology; Appendix D, Signals Intelligence Symbology; and Appendix E, Military Operations Other Than War (MOOTW) Symbology, is not specified within the current document. This *Implementation Guide* was written in compliance with the Naval Sea Systems Command (NAVSEA) *Common Presentation Layer (CPL) Specification Style Guide for Human-Computer Interfaces* (Reference 2).

2.0 BACKGROUND

MIL-STD-2525 is mandated as the symbology standard for Joint-designated Department of Defense (DoD) programs. MIL-STD-2525 was derived from the land symbology set incorporating U.S. Army Field Manual (FM) 1-02/ Marine Corps Reference Publication (MCRP) 5-12A, *Operational Terms and Graphics*, and maritime symbology derived from the North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) 4420, *Display Symbology and Colours for NATO Maritime Units*. MIL-STD-2525 is also harmonized with NATO STANAG 2019 (APP 6), *Military Symbols for Land-Based Systems*. Presently, MIL-STD-2525 is most widely implemented in Army and Marine Corps systems.

A preliminary study compared Aegis Display System (ADS)/NTDS symbols and modifiers to those available in MIL-STD-2525 (Reference 3). Findings from the study included the following:

1. MIL-STD-2525 provided significantly greater information inherent in the symbols for air and sea surface vehicular tracks and an approximately equivalent level of information for subsurface vehicular tracks.

2. A significant proportion of special points and Aegis-specific symbols had no adequate matches in MIL-STD-2525.

3. Several ADS/NTDS symbol modifiers would require alterations if MIL-STD-2525 were to be used on an Aegis platform.

Based on these preliminary findings, efforts were directed to bridge the gaps between NTDS and MIL-STD-2525 symbology to enable implementation of MIL-STD-2525 on current and future ship classes and combat systems.

To address Navy requirements, revisions, and additions to maritime and air/space, symbology sets have been incorporated into MIL-STD-2525. Concurrently, the Navy has begun implementation of MIL-STD-2525 symbology across multiple platforms and systems to include Virginia-class submarine tactical and navigation displays, the Mine Warfare and Environmental Decision Aids Library (MEDAL), the Electronic Chart Display and Information System – Navy (ECDIS-N), the Naval Fire Control System (NFCS), the MH-60 series of helicopters, Helicopter Mine (HM) Countermeasure Squadrons 14 and 15, the Joint Strike Fighter (JSF), and the Global Command and Control System – Maritime (GCCS-M) Version 4.X, which implements MIL-STD-2525 as an alternative display system with NTDS. MIL-STD-2525 is also planned for implementation in both flights of the Littoral Combat Ship (LCS) and the next-generation destroyer, DDG 1000.

The Naval Surface Warfare Center, Dahlgren Division (NSWCDD), Human Systems Integration Branch (W62), has conducted multiple studies on implementing MIL-STD-2525 in tactical displays within the context of current and future ship classes. The Office of Naval Research (ONR) and the Program Executive Office Integrated Warfare Systems (PEO IWS) have been active sponsors of both empirical and operationally realistic usability analyses to validate that MIL-STD-2525 can meet the requirements of the Navy's family of combat systems.

Empirical studies conducted at NSWCDD to better understand the characteristics of the symbols and how they relate to objective human performance measures were developed by human factors engineers, systems engineers, and Navy subject-matter experts (SMEs) and incorporated active-duty fleet personnel and SMEs as participants. The majority of research was conducted with surface ship applications, addressing topics such as symbol colors, symbol frame and fill, symbol size, speed leaders, commercial aircraft (COMAIR) symbols, engagement modifiers, new icons, and design for large-screen displays. The results of these studies were used to formulate the guidelines contained within this *Implementation Guide* (Section 5.0, Symbol Characteristics).

The contents of the *Implementation Guide* are either in accordance with MIL-STD-2525 or documented in proposed changes to the standard. Recommendations for changes to MIL-STD-2525 have been submitted to both the Navy Symbology Standards Management Committee (SSMC) voting representative and the SSMC chair. Supporting information for this *Implementation Guide* is included in the appendixes. Appendix A was developed to help standardize the implementation of the new symbol set, the recommended MIL-STD-2525 symbology. Appendix B specifies map background colors and graphical overlays. Appendix C includes existing discrepancies between the current version of the standard and recommendations within the *Implementation Guide*. Appendix D contains luminance/chrominance values for color displays. Appendix E covers the alternate unfilled color set; Appendix F, the recommended filter settings; and Appendix G, the *Implementation Guide* requirements terminology.

3.0 PURPOSE

The purpose of this document is to provide the requisite technical underpinnings for Navy programs to implement MIL-STD-2525 in a standardized and uniform manner. As the Navy continues to move toward open architecture and common display components, the common implementation of MIL-STD 2525 is a key supporting element. The content of this document provides the means to refine and tailor the symbology standard for maritime operations, as well as addressing gaps in the standard specific to maritime symbols and modifiers.

The document is intended to provide Navy systems engineering teams the technical information necessary for developing requirements across the various levels of the specification tree. For this reason, the information in this document is written as requirement statements, where the words “shall” and “should” have been carefully chosen. For the areas of the document that are written as shall statements, we envision that systems engineering teams will treat the information presented herein as a draft requirement and reiterate the wording in the appropriate program specification documents. For the areas in this document that are written as “should” statements, we envision that systems engineering teams will implement the concept, unless deemed inappropriate for a particular display and/or tactical application. See Appendix G for a further definition of the requirement statement terms.

The implementation of MIL-STD-2525 as the common tactical display symbology across warfighting systems can enable the following:

1. Common training requirements across systems due to common symbology

2. Reduced training time due to uniform application across platforms and systems

3. Increased situational awareness due to representation of additional track information inherent in MIL-STD-2525 track symbols

4. Opportunities for greater automation and decision support due to increased symbol filtering capabilities

5. Improved human and total system performance

4.0 SYMBOLOGY DEFINITIONS

Definitions used in this section are excerpts from MIL-STD-2525 definitions. Definitions of affiliation (or threat) were taken from MIL-STD-6016C (Reference 4) and submitted for incorporation within MIL-STD-2525. Definitions cited below were taken from sources other than MIL-STD-2525:

1. Affiliation. The threat posed by the warfighting object being represented. The basic affiliation categories are unknown, friend, neutral, and hostile (synonymous with identity).

2. Assumed Friend. A track that is assumed to be a friend because of its characteristics, behavior, or origin (MIL-STD-6016).

3. Attribute. A distinctive feature or characteristic such as line, shape, color, texture (fill), edge, mass, and value.

4. Battle Dimension. The operating domain (i.e., ground or land, sea surface, air, subsurface) for the warfighting object within the battlespace (synonymous with category). The MIL-STD-2525 definition for category.

5. Category. The operating domain (i.e., ground or land, sea surface, air, subsurface) for the warfighting object within the battlespace (synonymous with battle dimension).

6. Engagement Domain. An environment that is primarily based on the command and control of weapons systems and designed to facilitate rapid identification and judgment based on the need to engage or not to engage.

7. Faker. A friendly track acting as a hostile for exercise purposes (MIL-STD-6016).

8. Fields. A defined area in which a limited combination of alphanumeric and other characters, indicators, and/or abbreviations are grouped/situated in an established way around a symbol/icon, line, area, point, or boundary and used for the purpose of providing additional information about the associated object or battlespace geometry.

9. Frame. The geometric border of a symbol that provides an indication of the affiliation, battle dimension, and status of a warfighting object.

10. Friend. A track belonging to a declared friendly nation (MIL-STD-6016).

11. Hostile. A track declared to belong to any opposing nation, party, group, or entity, which by virtue of its behavior or information collected on it such as characteristics, origin, or nationality contributes to the threat to friendly forces (MIL-STD-6016).

12. Icon. The innermost part of a symbol that provides a graphic representation of a warfighting object. It may be a pictogram, abstract symbol, or letter code to depict the function and/or type of the entity it represents.

13. Identity. The threat posed by the warfighting object being represented. The basic affiliation categories are unknown, friend, neutral, and hostile (synonymous with affiliation).

14. Indicator. One of several specific graphical additions to a symbol used to provide additional information pictorially vice textually.

15. Joker. A friendly track acting as a suspect for exercise purposes (MIL-STD-6016).

16. Modifier. Optional text or graphics that provide additional information about a symbol or tactical graphic.

17. Neutral. A track or contact whose characteristics, behavior, origin, or nationality indicate that it is neither supporting nor opposing friendly forces (MIL-STD-6016).

18. Special Points. A point of interest that cannot be classified as a vehicle, installation, or unit (e.g., oil rig, Defensive Counter-Air (DCA) station, waypoint, drop zone, ground zero).

19. Status. A determination or declaration as to whether a track's or object's location is existing/present or is planned/anticipated at the time that the symbology is generated or the time associated/presented with the symbology itself.

20. Suspect. A track that is potentially hostile because of its characteristics, behavior, origin, or nationality (MIL-STD-6016).

21. Symbol. An object that presents information.

22. Symbol Identification Code. An alphanumeric code based on a database structure that provides the minimum elements required to construct the basic icon and/or a complete symbol.

23. Tactical Symbol. A category of warfighting symbology that provides information about the affiliation, battle dimension, status, and mission of a warfighting object.

24. Track. (1) The graphic and/or alphanumeric representation of successive positions of a moving object, point, or bearing whose position and/or characteristics are collected from sensors and/or other data sources. (2) A collated set of data associated with a track number for the purpose of representing the position and/or characteristics of a specific object, point, or bearing (MIL-STD-6016).

25. Unknown. An evaluated track that has not been identified (MIL-STD-6016).

5.0 SYMBOL CHARACTERISTICS

A basic tactical symbol shall be composed of the following:

1. A shape and frame (geometric border) that denotes battle dimension (space, air, ground, sea surface, or subsurface) and affiliation (friendly, hostile, neutral, or unknown).

2. An icon or letter code centered inside the frame that determines the warfighting object.

3. Modifiers that provide amplification information regarding the warfighting object.

4. Color that denotes the affiliation of the symbol.

Figure 1 displays an example of a symbol.

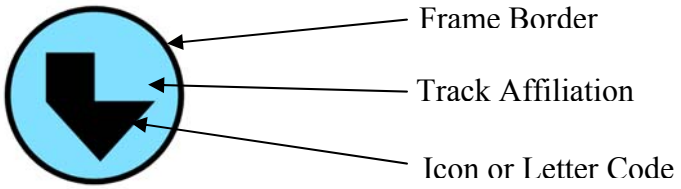


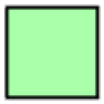
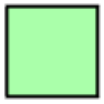
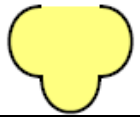
Figure 1. Friendly Sea Surface Symbol – Aircraft Carrier

Research regarding MIL-STD-2525 symbology was conducted primarily with de-saturated Aegis Baseline 6.1.7 map background colors and approved graphical overlay colors from prior color use doctrine. Red/Green/Blue (RGB) values for both Aegis map backgrounds and graphical overlays are specified in Appendix B. Alternative map displays including color and black and white satellite imagery, a Digital Nautical Chart (DNC), an air navigation chart, and a Digital Terrain Elevation Display (DTED) were also evaluated to validate the extent to which results can be generalized. The following implementation guidance was determined to be applicable across all aforementioned map displays.

5.1 Basic Symbol Shapes

Both the basic symbol shape and the symbol color shall represent symbol affiliation. For filled symbols, the frame surrounding the shape shall be monochrome, either black (RGB: 0, 0, 0) or white (RGB: 255, 255, 255), for friendly, hostile, unknown, and neutral symbols. In contrast, for assumed friend, suspect, and pending symbols, the frame shall alternate between black and white. This differs from the present MIL-STD-2525 methodology of using a "?" modifier for assumed friend, suspect, and pending symbols but was validated in the NSWCDD research and is currently being proposed for both MIL-STD-2525 and NATO's APP-6A. The basic symbol shapes and colors shown in Table 1 shall be used.

Table 1. MIL-STD-2525 Basic Symbols

Affiliation	Friend	Assumed Friend	Hostile	Suspect	Neutral	Unknown	Pending
Space							
Air							
Ground*							
Sea Surface							
Subsurface							

* Friend and assumed friend ground equipment symbols shown. Friend and assumed friend units are represented by rectangles instead of circles.

5.2 Symbol Color

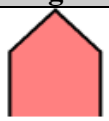
5.2.1 Symbol Color—Filled Symbols

The following four colors shall be used to denote affiliation for MIL-STD-2525 symbols: red (hostile and suspect), blue (friendly and assumed friend), yellow (unknown), and green (neutral). A fifth color, purple, should also be used to denote COMAIR. Research has validated that the use of purple to denote COMAIR significantly improves operator performance in the

discrimination between military and commercial air tracks. The use of purple to denote COMAIR is currently being proposed for inclusion in MIL-STD-2525.

There should be flexibility in selection of the luminosity (hereafter referred to as brightness) of a color to maximize operator effectiveness; however, hue and saturation levels shall remain constant, as indicated in Tables 2 and 3. Operators should be allowed to vary the brightness of symbols by affiliation during runtime to aid their own performance and suit their preference.

Table 2. Symbol Display Options

Affiliation	Dark	Medium	Light
Hostile			
Suspect*			
Friendly			
Assumed Friend*			
Unknown			
Neutral			
COMAIR**			

* Suspect and assumed friend symbols have black and white dotted frame borders.
** COMAIR is depicted with an assumed friend affiliation.

Table 3. RGB Values for Filled Symbols

Affiliation	Dark		Medium		Light*	
	RGB	HSL	RGB	HSL	RGB	HSL
Hostile	200, 0, 0	0, 255, 100	255, 48, 49	0, 255, 152	255, 128, 128	0, 255, 192
Suspect	200, 0, 0	0, 255, 100	255, 48, 49	0, 255, 152	255, 128, 128	0, 255, 192
Friendly	0, 107, 140	138, 255, 70	0, 168, 220	138, 255, 110	128, 224, 255	138, 255, 192
Assumed Friend	0, 107, 140	138, 255, 70	0, 168, 220	138, 255, 110	128, 224, 255	138, 255, 192
Unknown	225, 220, 0	42, 255, 110	255, 255, 0	42, 255, 128	255, 255, 128	42, 255, 192
Neutral	0, 160, 0	85, 255, 80	0, 226, 0	85, 255, 113	170, 255, 170	85, 255, 213
COMAIR	80, 0, 80	213, 255, 40	128, 0, 128	213, 255, 64	255, 161, 255	213, 255, 208
* The Light symbol color set is the default color set listed in MIL-STD-2525.						

There is an acceptable range of brightness values for each of the colors specified. The user should be provided the means to select a brightness level within the bounds of the color range or to select the default value for all colors. We recommend that there be a finite number of steps between the dark set (minimum luminance) and light set (maximum luminance) for all colors to provide sufficient flexibility while allowing for discrete selection. Table 3 illustrates the maximum and minimum filled symbol color options. The light symbol color set represents the original default values as specified in the MIL-STD; whereas, the medium and dark symbol color sets represent secondary color sets that were empirically validated in a series of trials. Table 3 lists the RGB values and the hue, saturation, and luminance (HSL) values for the dark, medium, and light color sets. The darker and lighter color sets shall represent the recommended minimum and maximum color luminance levels for MIL-STD-2525, respectively.

Within each affiliation's color, hue and saturation remain constant while luminosity is the sole source of color variance. Any luminance level that falls between the dark set and light set for a particular color is an acceptable symbol fill color option. For instance, in regard to hostile tracks, HSL levels for the darker set are 0, 255, and **100**; whereas, the lighter set registers 0, 255, and **192**. Notice that hue and saturation remain constant while luminance shifted from 100 for the darker colors and to 192 for the lighter colors. Therefore, any luminance level between 100 and 192, with the hue and saturation held constant, is a viable alternative. One intermediate color set, the medium color set, has received extensive testing at NSWCDD. Human performance was maintained on operator tasks and legibility was preserved using this symbol set. Moreover, operators highly preferred this option vice the default (light) symbol color option. The dark symbol color set also had comparable results amid testing, whereby human performance was maintained and legibility was preserved. Symbols lighter or darker than those specified in this document have not been evaluated; therefore, they should not be used.

The recommendation to provide varying levels of color presentation for user selection is due to several factors:

1. Varying ambient lighting levels and/or map backgrounds make it necessary to adjust the brightness of the symbols to provide the optimal contrast between figure and ground.

2. Due to eye fatigue from the extended duration spent in front of the console, the watchstander requires the ability to adjust the brightness of the symbols to ease the strain upon the eyes.

3. The actual color projected by differing display hardware technology—liquid crystal display (LCD), cathode ray tube (CRT), projection, etc.—varies considerably, resulting in the need for operators to adjust the color settings for their particular equipment.

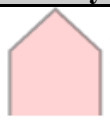
In those cases, where RGB or HSL values are insufficient to capture the presentation of colored symbology, visual output standards should be used. Appendix D contains comparable luminance and chrominance values (Yu'v') to the RGB values listed in Table 3. The Yu'v' values represent RGB color space in some display formats specified by the National Television System Committee (NTSC) and by other transmission standards communities; i.e., phase alternation line (PAL).

5.2.1.1 Deemphasized Filled Symbols. The capability of filled symbols to become dimmed or appear translucent upon the Tactical Situation Display (TACSIT) should be made available as a symbol filter option. The dimming of symbols may prove useful to deemphasize or emphasize tracks upon the display, depending on how the watchstander chooses to filter or render his symbols. In addition, dimming symbols has also been shown as an effective means to declutter the tactical display (Reference 5). Alternatively, changing the transparency (or opacity) of filled symbols may also aid in viewing overlapping symbols in a cluttered, highly trafficked tactical display (Reference 6).

To deemphasize symbols, either of two validated methods should be used. Deemphasized symbols may be created by changing the brightness of a given affiliation color to dim the symbol (Reference 5). Table 4 depicts the dimmed symbols, while Table 5 lists the dimmed symbols' values according to RGB, HSL, and hue/saturation/brightness (HSB). Deemphasized symbols may also be created by changing the opacity of the selected symbol set to 35 percent (35 percent visible/65 percent transparent (Reference 6). Table 4 depicts transparent symbols that were created from the default symbol color set. COMAIR was depicted as an assumed friend. Based upon the ID Matrix, a COMAIR symbol is depicted as either an assumed friend or an unknown-evaluated track.

The preferred method should be selected based upon the tactical display background with which it will be used to ensure adequate visibility and usability. Tests conducted at NSWCDD demonstrated that the legibility of icons and/or letter codes for dimmed symbols was statistically similar to those of the light, dark, and default symbol sets. Operator performance using dimmed symbols was also similar to light, dark, and default symbol sets. Transparent symbols were not empirically tested at NSWCDD.

Table 4. Dimmed Symbols and Transparent Symbols

Affiliation	Dimmed Symbols*	Transparent Symbols**
Hostile		
Suspect†		
Friendly		
Assumed Friend†		
Unknown		
Neutral		
COMAIR†§		

* All values, except for COMAIR, were taken from Reference 5.
** Transparent symbols were created from the MIL-STD-2525 default symbol color set.
† Suspect, assumed friend, and assumed friend COMAIR are depicted with black and white dotted frame borders.
§ COMAIR is depicted with an assumed friend affiliation.

Table 5. RGB, HSL, and HSB Values for Dimmed Symbols*

Affiliation	RGB	HSL	HSB
Hostile	77, 39, 39	0, 84, 58	0, 50%, 30%
Suspect	77, 39, 39	0, 84, 58	0, 50%, 30%
Friendly	39, 71, 77	135, 84, 58	190, 50%, 30%
Assumed Friendly	39, 71, 77	135, 84, 58	190, 50%, 30%
Unknown	77, 77, 39	42, 84, 58	60, 50%, 30%
Neutral	52, 77, 52	85, 49, 65	120, 33%, 30%
COMAIR	77, 49, 77	213, 57, 63	300. 37%, 30%
* All values, except for COMAIR, were taken from Reference 5.			

5.2.2 Symbol Color – Unfilled Symbols

Track symbols shall be displayable in an unfilled format in addition to the default filled symbols (see Figure 2) on an operator-selectable basis. Their use shall be selectable on a global or entire display basis. In addition, unfilled symbols should be selectable across affiliation, battle dimension, or both as well as for individual tracks.

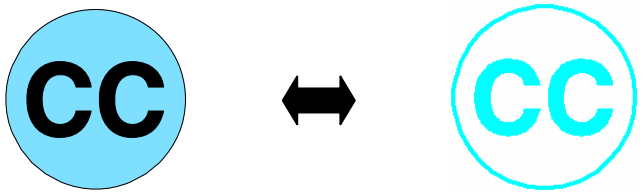


Figure 2. Filled (left) vs. Unfilled Symbols (right)

Table 6 illustrates the unfilled symbols options across affiliations for the default symbol color sets. Note that, while the luminance of the filled symbology should be operator-selectable, the unfilled set shall only be presented in the default symbol color set, as those recommended in either MIL-STD-2525 or in Appendix E. MIL-STD-2525 symbols are based upon full-color gun levels. The MIL-STD-2525 RGB (HSL) values for use with unfilled symbols are listed in Table 7. Note, that full-color gun values are dichotomously based on RGB values being either completely *on* (i.e., 255) or completely *off* (i.e., 0). For hostile, friendly, unknown, and neutral tracks, the frame color shall change from either black or white to the affiliation color, while the filled portion inside the frame shall become transparent. In contrast, for suspect, assumed friend, and COMAIR tracks, frames shall alternate between affiliation color and white; while the filled portion inside the frame shall become transparent. Frame colors for suspect (red) and assumed friend (blue) tracks shall be presented using color values specified for the medium color set (see Section 5.2.1). These colors were shown to provide good contrast between white and red/blue frame colors and between black and red/blue frame colors.

If full-color gun values are not preferred for unfilled symbol representation, an alternate unfilled symbol set, listed in Appendix E, should be used; otherwise, one shall adhere to the default MIL-STD-2525 values listed in Table 7. The alternate symbol set has been validated on de-saturated Aegis map backgrounds (Appendix B).

Table 6. Unfilled Symbol Display Options

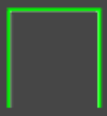
Affiliation	Unfilled Set
Hostile	
Unknown	
Friendly	
Neutral	
Assumed Friend	
Suspect	
COMAIR	

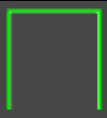
Table 7. RGB Values for Unfilled Symbols

Affiliation	Unfilled Color Set	
	RGB	HSL
Hostile	255, 0, 0	0, 255, 128
Suspect*	255, 48, 49	0, 255, 152
Friendly	0, 255, 255	127, 255, 128
Assumed Friend*	0, 168, 220	138, 255, 110
Unknown	255, 255, 0	42, 255, 128
Neutral	0, 255, 0	85, 255, 128
COMAIR**	255, 0, 255	213, 255, 128
* Suspect and assumed friend tracks utilize medium filled color sets (Section 5.2.1). ** All colors conform to MIL-STD-2525 except for COMAIR.		

5.2.3 Symbol Frame Color

Filled symbols shall be displayed with either a black (RGB = 0, 0, 0) frame or a white (RGB = 255, 255, 255) frame for hostile, friendly, neutral, and unknown symbols. Filled symbol frame color (white or black) should be operator-selectable but only for a display as a whole as opposed to individual symbols or groups of symbols. If only one filled symbol frame color is provided, the two options should be evaluated to determine which provides the best contrast with the background TACSIT. Examples are shown in Table 8. Note that, for assumed friend and suspect symbols, the frame shall be made of alternating black (0, 0, 0) and white (255, 255, 255) lines. Border colors for unfilled symbols are listed in Table 7. For unfilled assumed friend and suspect symbols, solid colored frames shall be changed from black and white alternating lines to affiliation ID color and white alternating lines.

Table 8. Frame Colors

Affiliation	Frame Colors*		
	Black	White	Unfilled
Hostile			
Unknown			
Friendly			
Neutral			
Assumed Friend			
Suspect			
* Filled colors are depicted as medium color set (Section 5.2).			

5.3 Symbol Size

5.3.1 Symbol Size – Console Displays

There are several sizes of symbols that may be displayed (see Table 9). For use of MIL-STD-2525 symbology upon shipboard tactical displays, the default size for the symbol fits within a 24 x 24 pixel box on a 1280 x 1024 display. The user shall have the option to display symbols at a default size, an enlarged size, or a dot. The user should also have the option to display symbols at a reduced size. Table 9 represents minimum symbol sizes at a 20-in. viewing distance (Reference 7, Section 5.2.1.6.1). All symbol frame sizes, except dots, meet the minimum legibility requirements for visual displays: 20 – 30 arc minutes (Reference 7, Section 5.2.1.6.4.1). If console resolution exceeds 1280 x 1024, pixel size will change. Therefore, using screen resolutions other than 1280 x 1024, one determines the minimal overall symbol size shall conform to the values of icon size (in.), visual angle, and arc minute listed within Table 9.

Table 9. Symbol Size on Console Displays (1280 x 1024 resolution)

Symbol Size	Pixel Size (1280 x 1024)	% Δ from Default	Size of Icon on Screen	Visual Angle	Arc Minute
Default	24 x 24	N/A	0.19 in.	.54	32.4
Enlarged	32 x 32	+33%	0.25 in.	.72	42.6
Reduced	16 x 16	−33%	0.13 in.	.37	22.2
Dots	8 x 8	−67%	0.06 in.	.17	10.2
Note: Viewing distance = 20 in.					

Internal icons or letter codes should be displayed in both the default and enlarged sized symbols but shall not be included within reduced sized symbols due to compromised legibility. In comparison to guidelines established in MIL-STD-2525, a smaller default size is recommended for Navy displays. A smaller default size is recommended for Navy tactical displays because the size recommended in MIL-STD-2525 is based upon allowing all internal icons for land symbols to be discernable. MIL-STD-2525 uses the enlarged symbol size as its default symbol size. Given that land symbols, used primarily by the U.S. Army and U.S. Marine Corps, have smaller and more intricate internal icons than those symbols required for maritime operations, a smaller overall default symbol size will still preserve icon legibility for use within Navy tactical displays. However, for use in joint environments or for use within communities of interest (COIs) concerned with detailed land symbology, the *enlarged* symbol size (as specified in Table 9 and in MIL-STD-2525) should be used as the default symbol size for battle dimensions.

5.3.2 Symbol Size—Large Screen Displays (LSDs)

LSDs shall utilize equivalent symbol sizes as the different symbols seen upon the console. Table 10 lists the minimum size requirements for LSDs at a 10-ft viewing distance. The size of the default and enlarged symbols meet the minimum requirements for text upon LSDs (Reference 7, Sections 5.2.5.2.1 and 5.2.5.3.4.2). If the viewing distance of the LSD deviates from 10 ft, the minimum visual angle (or arc minute), as posted in Table 10 shall apply.

Table 10. Symbol Size on LSDs

Symbol Size	Size of Icon on Screen	Minimum Resolution Required	Visual Angle	Arc Minute
Default	0.75 in.	1280 X 1024	.36	21.3
Enlarged	1.00 in.	1280 X 1024	.48	28.4
Reduced	0.50 in.	1280 X 1024	.24	14.2
Dots	0.25 in.	1280 X 1024	.12	7.1
Note: Viewing Distance = 10 ft				

5.4 Symbol Size Scale

To accommodate variability in screen resolution, size, and user visualization, the user may have the ability to adjust the scale factor applied to symbol sizes. This scale factor should provide the user the ability to increase the symbol display size up to 1.5 times larger than the initial size for all symbols. We recommend that the user be given display controls to adjust this scale. Figure 3 shows an example user interface for selecting the symbol size scale appropriately. The symbol size scale adjusts the overall magnitude of all the symbols on the screen. Hence symbols rendered as *reduced*, *default*, *enlarged*, or *dots* would all be increased by up to 150 percent, while still maintaining the size differential across the size options.

Figure 3. Example Set Symbol Size Scale

5.5 Notched Neutral Affiliation Symbol Fill

Filled neutral symbols may be displayed with either color fill or notched color fill, as shown in Table 11. Fill or notch fill may be operator-selectable but only for a display as a whole as opposed to individual symbols or groups of symbols. The notch primarily helps to alleviate confusion between neutral symbol battle dimensions or categories (air, surface, subsurface) when no icons or letter codes were present upon the symbols. Prior tests have shown significantly improved operator performance in distinguishing battle dimension for neutral tracks, while using notched symbology when icons or letter codes are absent. Therefore, notched symbols should be used in circumstances where icon or letter code specification upon the neutral symbols is absent. However, given that there is neither a benefit nor a detriment in operator performance regarding notched neutral symbols when icons or letter codes are present, the use of notched neutral symbols is arbitrary.

Table 11. Fill and Notch Fill

Affiliation	Air		Surface		Subsurface	
	Fill	Notch	Fill	Notch	Fill	Notch
Neutral						

5.6 Civilian Symbols

5.6.1 Civilian Sea Surface Symbols

Civilian surface tracks should be operator-selectable as framed or unframed, as shown in Table 12. The size of the icon within the framed symbol is identical to the size of the icon without a frame. When civilian tracks are framed, they have white icons to denote nonmilitary tracks. In contrast, when civilian tracks go unframed, civilian icons become filled with their affiliation color. Black-filled pictorial icons shall be reserved for military tracks, whereas white-filled icons shall be reserved for nonmilitary tracks.

Table 12. Unframed Civilian Surface

Civilian Tracks	Framed	Unframed
Merchant		
Fishing		
Leisure Craft		
Law Enforcement		
Hovercraft		

5.6.2 Civilian Air Symbols

In contrast to civilian sea surface tracks, all civilian air symbols shall remain framed, as required in MIL-STD-2525. White icons within the symbol frames will help discriminate civilian aircraft from black icons on air tracks, which represent military aircraft. Further delineation has

been made to better distinguish commercial air tracks from other civilian air tracks. The next section contains additional details.

5.7 Commercial Air Symbols

Operators should be given the ability to display tracks identified as COMAIR with a purple symbol fill (filled symbols) or frame shape (unfilled symbols). This deviates from the MIL-STD-2525 guidance to depict symbols in the color of their affiliation, but deviations are permitted when additional differentiation is required (MIL-STD-2525, Sections 5.3.2 and 5.4.6, paragraph b). Additionally, a proposal has been submitted to the SSMC to formalize the use of purple to denote COMAIR symbols. Table 13 shows the COMAIR symbols as both filled and unfilled, for both assumed friend and unknown identities. Operational procedures in effect for track identification (ID), typically known as the Operational Tasking ID (OPTASK ID) Supplement or ID Matrix, determine whether COMAIR tracks will be identified as unknown-evaluated or assumed friend. Regardless, tracks with the MIL-STD-6016C (Reference 4) civil airliner platform statement should be mapped to the purple color scheme. As a result of a battery of research, it has been recommended and since supported to have COMAIR tracks easily segregated from other tracks on the tactical display. The use of an alternate symbol fill color has garnered the most support and has been linked with superior operator performance and positive watchstander reviews.

Table 13. COMAIR Track Display

Affiliation	Filled			Unfilled
	Dark	Medium	Light	
Assumed Friend				
Unknown				

5.8 Jokers, Fakers, and Unknown Affiliation/Battle Dimension Symbols

A single letter shall be presented outside the symbol in the upper right-hand corner of the symbol to denote joker (J) or faker (K) tracks during training or tracks whose affiliation and battle dimension are unknown (U) after evaluation. The letter shall be uppercase in a boldfaced sans serif font (e.g., Arial or Verdana) and should be depicted with the same color as the symbol's external frame border. The size of the letter should approximate one-third of the height of the default-sized symbol and shall be placed on the upper right-hand corner of the symbol (see Table 14). Size will vary based upon the resolution adopted.

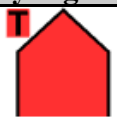
Table 14. Joker, Faker, and Unknown Symbols

Joker	
Faker	
Unknown	

5.9 External Modifiers

A single letter modifier shall be presented outside the symbol in the upper left-hand corner when denoting tactically significant tracks (T), non-real-time tracks (N), training/simulation tracks (S), etc. It shall be uppercase in a boldfaced sans serif font (e.g., Arial or Verdana). It shall also be in black text in a colored box of the same RGB value as its associated symbol (see Table 15). The ID colored box should be approximately one-third the height and width of the symbol and shall be located in the upper left-hand corner of the symbol. Legibility of the alphanumeric modifiers was determined to be adequate in tests of operator performance.

Table 15. Examples of Single-Letter Modifiers

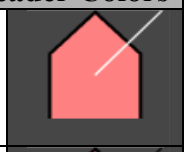
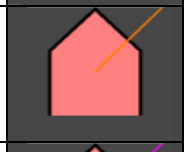
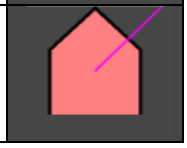
Affiliation	Tactically Significant (T)	Non-Real-Time (N)	Training/ Simulation (S)
Hostile			
Friendly			

5.10 Speed Leaders

Speed leaders shall be presented in a color that is easily discriminable from its background and whose color does not conflict with MIL-STD-2525 affiliation colors. For example, upon Aegis 6.1.7 grayscale map backgrounds, white (RGB = 255, 255, 255) provides good contrast and should be used. Acceptable speed leader colors include, but are not limited to, white (RGB = 255, 255, 255), black (RGB = 0, 0, 0), orange (RGB = 255, 128, 0), and magenta (255, 0, 255).

Determination of speed leader color should be operator-selectable. Speed leaders shall be layered on top of the symbol fill, symbol frame, and symbol icon. The speed leader shall originate from the same location that the internal icon or letter code is centered upon. The length of the speed leader should be proportional to the speed of the track. Table 16 depicts examples of a symbol with the speed leader options.

Table 16. Speed Leader Color Options

Speed Leader Colors	
White	
Black	
Orange	
Magenta	

5.11 Engagement Modifiers

MIL-STD-2525 should be implemented with a set of text-based engagement modifiers. Testing was conducted comparing NATO STANAG 4420, hybrid NTDS/SSDS, simplified NTDS, and text-based engagement modifiers. Results showed unequivocal support for using the text-based engagement modifiers. Legibility of the modifiers was acceptable, and the intuitiveness of the text-based modifiers surpassed the other modifier options.

Engagement modifiers should be shown on both the hostile target track that is being engaged and on the friendly track conducting the engagement. The text should be sans serif font (e.g., Arial or Verdana), boldfaced type. It should be black text on either a red or a blue (same RGB values as its associated symbol) box. The engagement modifier text tags should have the following structure:

A:BBB-CC

where

A = R when it is a remote engagement, or
A (and the following ":") is omitted when it is a local engagement

BBB = "ASN" for the Assign/Cover stage, or
BBB = "ENG" for the Engage stage, or

BBB = “MIF” for the Missiles in Flight stage where applicable

CC = “M” for missile engagement
CC = “G” for gun engagement
CC = “T” for torpedo engagement
CC = “A” for attack aircraft engagement
CC = “D” for DCA (defensive counter-air) engagement
CC = “AS” for ASW air engagement
CC = “EA” for electronic attack/laser engagement
CC = “ED” for electronic defense engagement
CC = “UV” for unmanned vehicle (drone) engagements

NOTE: Field CC is only 1 character wide when only 1 character is used (e.g., M, G, D, A, & T)

The set of engagement modifiers for local engagements are shown in Table 17 for both the hostile targets and friendly participating units (PUs) or shooters. The set of engagement modifiers for remote engagements is shown in Table 18 for both hostile targets and friendly PUs or shooters.

Table 17. Local Engagement Modifiers

Weapon Modifier	Assign (ASN)		Engage (ENG)		Missile in Flight (MIF)	
	Target	Shooter	Target	Shooter	Target	Shooter
Missile (M)	ASN-M	ASN-M	ENG-M	ENG-M	MIF-M	MIF-M
Gun (G)	ASN-G	ASN-G	ENG-G	ENG-G	N/A	N/A
Torpedo (T)	ASN-T	ASN-T	ENG-T	ENG-T	N/A	N/A
Attack Aircraft (A)	ASN-A	ASN-A	ENG-A	ENG-A	N/A	N/A
Defensive Counter-Air (D)	ASN-D	ASN-D	ENG-D	ENG-D	N/A	N/A
ASW Engagement (AS)	ASN-AS	ASN-AS	ENG-AS	ENG-AS	N/A	N/A
Electronic Attack (EA)	ASN-EA	ASN-EA	ENG-EA	ENG-EA	N/A	N/A
Electronic Defense (ED)	ASN-ED	ASN-ED	ENG-ED	ENG-ED	N/A	N/A
Unmanned Vehicle (UV)	ASN-UV	ASN-UV	ENG-UV	ENG-UV	N/A	N/A

Table 18. Remote Engagement Modifiers

Weapon Modifier	Assign (ASN)		Engage (ENG)		Missile in Flight (MIF)	
	Target	Shooter	Target	Shooter	Target	Shooter
Missile (M)	R:ASN-M	R:ASN-M	R:ENG-M	R:ENG-M	R:MIF-M	R:MIF-M
Gun (G)	R:ASN-G	R:ASN-G	R:ENG-G	R:ENG-G	N/A	N/A
Torpedo (T)	R:ASN-T	R:ASN-T	R:ENG-T	R:ENG-T	N/A	N/A
Attack Aircraft (A)	R:ASN-A	R:ASN-A	R:ENG-A	R:ENG-A	N/A	N/A
Defensive Counter-Air (D)	R:ASN-D	R:ASN-D	R:ENG-D	R:ENG-D	N/A	N/A
ASW Engagement (AS)	R:ASN-AS	R:ASN-AS	R:ENG-AS	R:ENG-AS	N/A	N/A
Electronic Attack (EA)	R:ASN-EA	R:ASN-EA	R:ENG-EA	R:ENG-EA	N/A	N/A
Electronic Defense (ED)	R:ASN-ED	R:ASN-ED	R:ENG-ED	R:ENG-ED	N/A	N/A
Unmanned Vehicle (UV)	R:ASN-UV	R:ASN-UV	R:ENG-UV	R:ENG-UV	N/A	N/A

The engagement modifiers shall be placed directly above the target and the PU symbols. The height of the engagement modifier should be one-fourth the height of its symbol. Table 19 illustrates the placement of engagement modifiers on a hostile air target.

Table 19. Example Local and Remote Missile Engagements

Engagement	Assign (ASN)	Engage (ENG)	Missile in Flight (MIF)
Local			
Remote (R)			

Pairing lines should also be used in conjunction with engagement modifiers. Pairing lines should connect the friendly PU to the hostile target and shall also connect ships' controlling engaged assets; i.e., unmanned vehicles, attack aircraft, and DCA. A suggested presentation of pairing lines would be a subdued off-white line; i.e., RGB = 200, 200, 200; HSL = 170, 0, 200, with a stroke width of 4; however, the color of the pairing line should be discriminable from the map background and should not be operator-selectable. Potential alternate pairing line color may include black, white, orange, and magenta.

5.12 Text Tags

Text tags should be either gray (RGB =192, 192, 192; HSL = 170, 0, 192) in color or a color that is easily discriminable from its map background, such as black, white, orange, or magenta. Text tags should be written in sans serif font (e.g., Arial or Verdana) and may be boldfaced to improve legibility. The tags should be left justified in a box located on the right side of the symbol. The vertical center of the box should be aligned with the speed leader origin.

The text tags should be displayed in the order of the hierarchy shown in Table 20 (the top tag is listed at the top of the hierarchy).

Table 20. Suggested Text Tag Descriptions and Placement

Placement	Tag Name	Max. Number of Characters	Description	Example
Top Tag	Track Number	7	"TN XXXXX" where XXXXX is the 4-5 digit track number	'TN 01234"
↓	Identification, Friend or Foe (IFF) mode 2	6	"2:XXXX" where XXXX is the value of mode 2	"2:1234"
	IFF mode 3	6	"3:XXXX" where XXXX is the value of mode 3	"3:1234"
	Altitude/Depth	7	"XX.XKFt" where XX.X is the altitude/depth in thousands of feet	"32.1KFt"
	Text 1	12	"XXXXXXXXXXXX" where XXXXXXXXXXXX are mixed case alphanumeric characters depending upon how the user defined the tags	"REAGAN"
Bottom Tag	Text 2	12	"XXXXXXXXXXXX" where XXXXXXXXXXXX are mixed case alphanumeric characters depending upon how the user defined the tags	"Carrier"

Table 21 shows some examples of logical text tag combinations for different track identities and types for default sized symbols.

Table 21. Example Text Tags

Battle Dimension	Friendly	Hostile	Suspect	Unknown
Air	2:2223 35.2Kft Striker	TN 1234 35.2Kft MiG 29	TN 1234 35.2Kft MiG 29	TN 1234 35.2Kft Civil?
Surface	DD 21	TN 1234 Patrol	TN 1234 Kiev	TN 1234 COI?
Subsurface	2:2223 OHIO	TN 1234 0.5Kft Kilo	TN 1234 0.5Kft SSN	TN 1234 0.5Kft POSSUB

5.13 Hierarchy of Display for Symbol Elements/Attributes

The symbol elements/attributes should be layered on the display according to the hierarchy shown in Table 22.

Table 22. Hierarchy for Symbol Elements/Attributes

Top-most Layer	Engagement Modifier
↓	Text tags
	Single letter modifier for TACSIG, non-real time (NRT), etc.
	Speed leader
	Icon or letter code
Bottom-most Layer	Symbol fill; symbol outline

An example of a track with all the above display elements is shown in Figure 4.

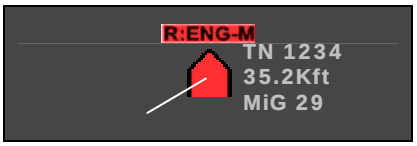
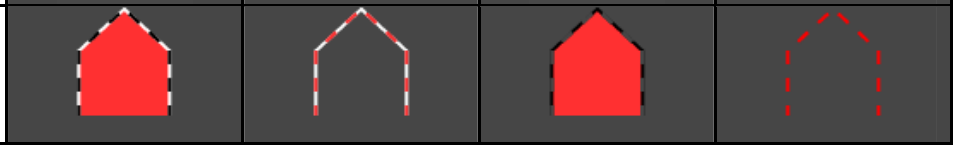


Figure 4. Example Track with all Display Elements

5.14 Planned/Anticipated Track Locations

Currently, MIL-STD-2525 uses a dashed line (white or black depending on frame color selection) for planned/anticipated track locations. Therefore, to distinguish planned/anticipated symbols from assumed friend and suspect tracks, assumed friend and suspect tracks shall constitute ID-colored and white alternating lines (refer to Table 2). Table 23 represents the differences between assumed affiliation tracks and planned/anticipated tracks.

Table 23. Assumed Affiliation and Planned/Anticipated Tracks

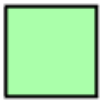
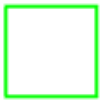
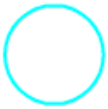
Affiliation	Assumed Affiliation Tracks		Planned/ Anticipated Tracks	
	Filled	Unfilled	Filled	Unfilled
Assumed Friend				
Suspect				

6.0 OPERATOR-SELECTABLE SYMBOL FEATURES

6.1 MIL-STD-2525 Symbol Rendering Flexibility

MIL-STD-2525 has set aside provisions for multiple rendering options for a given symbol (refer to MIL-STD-2525, Section 5.4.5, Symbol Display Hierarchy and Table IX, Tactical Symbol Display Option Hierarchy). Provided this flexibility, the operator should be able to render MIL-STD-2525 symbology on either chromatic or monochromatic displays and display the symbols with or without icons, as filled or unfilled symbols, or as dots when location is all the information that is required or needed, and with or without frames when available (see Section 6.9, below for symbol framing). Table 24 represents some of the permitted symbol combinations. The following sections below define each of the symbol rendering options that should be provided to operators. Appendix F provides an example symbol filter with recommended default settings specified.

Table 24. MIL-STD-2525 Example Operator-Selectable Filter Options*

Option	Neutral Nonmilitary Merchant	Friendly Destroyer	Hostile Fixed-Wing Fighter	Unknown Military Fixed Wing
Frame: Yes Fill: Yes Icon: Yes				
Frame: Yes Fill: No Icon: Yes				
Frame: Yes Fill: Yes Icon: No				
Frame: Yes Fill: No Icon: No				
Frame: No Fill: Yes Icon: Yes		**N/A**	**N/A**	**N/A**
Dot Frame: No Fill: Yes Icon: No				

* All symbols depicted may also be presented monochromatically in black and white.

6.2 Symbol Fill

Operators shall be provided the option to globally render all their symbols as either filled or unfilled. In addition, operators should be given the flexibility to render specific classes of symbols (i.e., battle dimension and/or affiliation) or individual symbols (i.e., track number 1234) as either filled or unfilled. Filled symbols should be the default setting due to improved symbol detection vice unfilled symbols in highly dense, cluttered environments.

6.3 Symbol Size

Operators shall be provided the option of enlarging and/or diminishing the size of their symbols. The *default* symbol size as specified in Section 5.3 shall be used as the standard display size. Operators shall also be provided the option to render symbols as dots; however, operators should not be allowed to turn symbols off. Operators should be allowed to make global size

changes, i.e., all tracks large; local size changes, by battle dimension and/or affiliation; and individual track size changes.

6.4 Symbol Color

Operators should be provided the means to adjust the luminance of the affiliation and COMAIR symbol colors. Color adjustments should be allowed for global changes, i.e., all symbols; local changes, i.e., battle dimension and/or affiliation; and individual icons. If operators are not permitted to change luminance, the default color should be the *light* symbol color for filled symbols, which coincides with the color recommendations of MIL-STD-2525, and the default color for unfilled symbols will remain as specified by MIL-STD-2525.

6.5 Symbol Frame Color

Operators should be allowed to globally select either black (RGB: 0,0,0) or white (RGB: 255,255,255) as a frame border color for all filled symbols. Selection of black or white frames should be determined based upon viewing characteristics of the hardware, software (i.e., map background), and environmental conditions (i.e., ambient lighting). Black frame borders are suggested as the default setting due to superior symbol-to-map background contrast across most types of map displays; i.e., DTED maps, DNC, air navigation charts.

6.6 Speed Leaders

Operators should be allowed to select the color of the speed leader, as specified in Section 5.10. Choice of speed leaders should be one that provides for significant contrast between the symbol and map background in order to ensure the selection is perceptually discriminable. Operators should also be able to disable speed leaders locally (by battle dimension and/or affiliation) and by individual tracks but should not be able to disable speed leaders globally (all on/all off). Speed leaders should be enabled (on) as the default setting.

6.7 Text Tags

Operators should be allowed to append text tags to the MIL-STD-2525 symbology as specified in Section 5.12. Text tags should include the provisions for including track number, IFF modes 2 and 3, altitude, and individual text. Operators should be allowed to select at a global, local, and/or individual level whether text tags are displayed. We recommend that the default setting is to have text tags disabled and have the operator enable the set(s) deemed necessary and appropriate.

6.8 Symbol Dimming

Operators should be allowed to deemphasize tracks by making symbols less bold than other symbols. This deemphasizing may be accomplished by either dimming the symbols or by increasing their transparency, as specified in Section 5.2.1.1. Operators should be allowed to dim symbols globally (i.e., all symbols), locally (i.e., battle dimension and/or affiliation), and by individual tracks. We recommend that the default setting is for symbols should be of normal boldness versus dimmed.

6.9 Symbol Framing

Operators should be allowed to turn symbol frames off for those symbols designated as frame optional. Examples of frame optional symbols include civilian sea surface symbols (see Section 5.6.1) and most ground equipment symbols (refer to MIL-STD-2525 for a complete listing). For the default setting, symbol frames should be on. Operators should be allowed to make the appropriate symbols unframed globally, locally, and individually.

6.10 Icon/Symbol Amplification

Operators should be allowed to portray the level of icon/symbol amplification deemed necessary. The default setting should be full the level of symbol detail. This section is reserved for further specification and will be revised upon the completion of the new maritime symbology and air/space symbology sets that will be incorporated into MIL-STD-2525C.

6.11 Track History

Operators should be allowed to portray the track history of any given track. Operators should have the ability to turn track history on for tracks globally (all on/all off), locally (by battle dimension and/or affiliation), and individually. The default setting for track history should be off.

6.12 Neutral Notch

Implementers may provide operators with a means to alter neutral symbol fill. The creation of a “notch” fill within a neutral symbol’s frame borders aids the operator’s performance in detecting and identifying neutral tracks with no symbol icon. If implemented, operators should have the ability to activate it globally across all neutral tracks (as depicted in Table 11). The default setting should be set using the standard symbol fill as opposed to the notch fill.

REFERENCES

1. MIL-STD-2525B with Change 2, *Common Warfighting Symbology, DoD Interface Standard*, 7 Mar 2007.

2. *Common Presentation Layer Specification: A Style Guide and Requirement Specification for Navy Human Computer Interfaces, Rev. 2*, MPR Associates, Inc., Jul 2006.

3. Chavez, L.; Winters, J.; Hildebrand, G.; Wallace, D.; and White, D., *Situation Awareness in the CIC: Automated Watch Turnover, Tactical Symbology, and Situation Assessment Tasks*, NSWCDD/TR-02/48, Aug 2002, Dahlgren, VA.

4. MIL-STD-6016C, *Tactical Data Link (TDL) 16 Message Standard*, 28 Mar 2005.

5. St. John, M.; Feher, B. A.; and Morrison, J. G., *Evaluating Alternative Symbologies for Decluttering Geographical Displays*, Space and Naval Warfare System Center, Technical Report SSC-1890, San Diego, CA, 2002.

6. St. John, M.; Smallman, H. S.; Manes, D. I.; Feher, B. A.; and Morrison, J. G., "Heuristic Automation For Decluttering Tactical Displays," *Human Factors,* 47, 2005, pp. 509-525.

7. MIL-STD-1472F, *Department of Defense Design Criteria Standard: Human Engineering*, 23 Aug 1999.

APPENDIX A—RECOMMENDED MIL-STD-2525 SYMBOLOGY

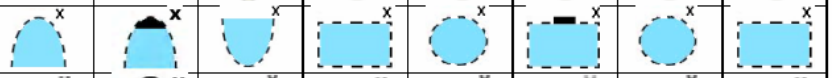
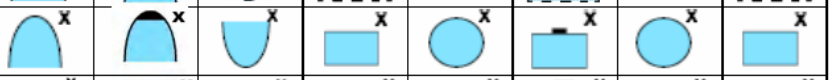
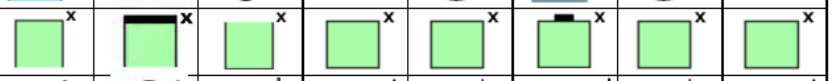
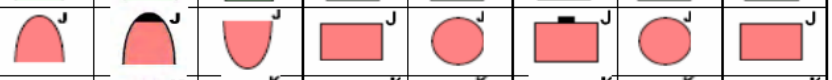
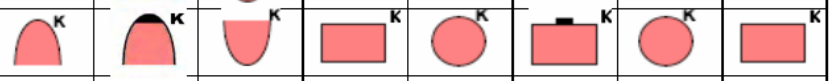
This appendix was developed to help standardize the implementation of the new symbol set. The symbol and special point libraries for Aegis Baseline 7 Phase 1C/1R and Ship Self-Defense System (SSDS) Mk 2 were reviewed to identify the subset of symbols that would need MIL-STD-2525 equivalents for use in today's principal surface combatants. MIL-STD-6016C, *TDL 16 Message Standard*, was reviewed to identify other potential symbols that were not used by either Aegis or SSDS but could be included in future combat systems. References A-1 through A-5 were used.

This appendix consists of six matrices: identity, air and space, sea surface, subsurface, land, and reference points (Tables A-1 through A-6). The identity matrix shows the MIL-STD-6016C "Identity" statements mapped against MIL-STD-2525, Aegis, and SSDS Mk 2 symbols (listed by "Category"). The remaining five matrices are divided into columns listing the MIL-STD-6016C platform/amplification statements and the corresponding "Friend" symbols and symbol names for each symbol set. Aegis and SSDS symbology were not displayed due to classification issues; however, Aegis and SSDS symbol names are listed. "N/A" is used to denote that a particular symbol or platform statement is "not applicable" to that combat system or standard. For example, in the air and space matrix, both Aegis and SSDS have symbols for a "LAMPS Helicopter;" but MIL-STD-6016C and MIL-STD-2525 do not. The matrices illustrate the symbols to use when implementing symbols for the MIL-STD-6016 codes listed.

In those cases, when an exact match to a MIL-STD-2525 symbol was not possible, a new icon or symbol was created (i.e., rail facility). The status of these proposed symbols is "to be determined" pending review by the Symbology Standards Management Committee. These proposed symbols are highlighted with a yellow background in the "Notes" column and the use of "TBD" in the "RECOMMENDED MIL-STD-2525 Hierarchy" column.

There were several instances where MIL-STD-2525 symbology had multiple options to choose from due to more detailed symbol decomposition. For example, both Aegis and SSDS have single symbols for "missile," while MIL-STD-2525 has nine different symbols for "missiles-in-flight" and dozens of symbols for the various types of missile launchers. In those cases, the least specific symbol of the MIL-STD-2525 hierarchy was recommended. Additionally, where Aegis and SSDS have a limited symbol set representing "ground" tracks, MIL-STD-2525 has hundreds to pick from. To complicate matters, these MIL-STD-2525 symbols are further subdivided into unit, equipment, and installation types. Given that this analysis is benchmarked against MIL-STD-6016 tactical data messages for vehicular tracks, most land symbols are mapped to the MIL-STD-2525 vehicular (equipment-level) symbol.

Table A-1. MIL-STD-6016C Identity Statements Mapped Against MIL-STD-2525

MILSTD 6016C - IDENTITY (DFI: 376) IDENTITY AMPLIFYING DESCRIPTOR (DUI 001)	BIT CODE	MILSTD 2525								
		UNK	AIR	SPACE	SUB	GROUND UNIT	GROUND EQUIP	GROUND INSTALL	SURF	SOF
EXERCISE PENDING	0									
EXERCISE UNKNOWN	1									
EXERCISE ASSUMED FRIEND	2	N/A								
EXERCISE FRIEND	3	N/A								
EXERCISE NEUTRAL	4	N/A								
JOKER	5	N/A								
FAKER	6	N/A								

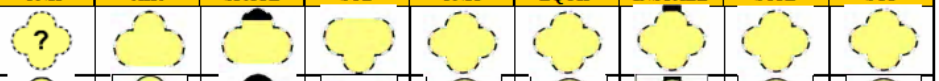
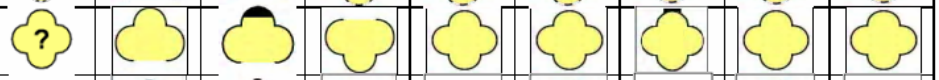
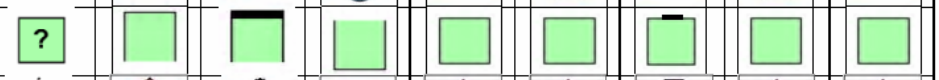
MILSTD 6016C - IDENTITY (DFI: 376) IDENTITY, EVALUATED (DUI 002) & IDENTITY (DUI 007)	BIT CODE	MILSTD 2525								
		UNK	AIR	SPACE	SUB	GROUND UNIT	GROUND EQUIP	GROUND INSTALL	SURF	SOF
PENDING	0									
UNKNOWN	1									
ASSUMED FRIEND	2									
FRIEND	3									
NEUTRAL	4									
SUSPECT	5									
HOSTILE	6									

Table A-2. MIL-STD-6016C Air and Space Statements Mapped Against MIL-STD-2525

MILSTD 6016C - PLATFORM (DFI: 1797) AIR PLATFORM (DUI 001)	BIT CODE	MILSTD 2525 Hierarchy	MILSTD 2525 SYMBOL	ADS/NTDS NAME	SSDS NAME	NOTES
NO STATEMENT	0	WAR.AIRTRK		No statement	No statement	
FIGHTER	1	WAR.AIRTRK.MIL.FIXD.FTR		Fighter	N/A	
FIGHTER BOMBER	2	N/A		Fighter/ Bomber	N/A	Recommend WAR.AIRTRK.MIL.FIXD.FTR
ATTACK	3	WAR.AIRTRK.MIL.FIXD.ATK		Attack	N/A	
BOMBER	4	WAR.AIRTRK.MIL.FIXD.BMB		Bomber	N/A	
RECONNAISSANCE	5	WAR.AIRTRK.MIL.FIXD.RECON		Reconnaissance	N/A	2525 has multiple designations for reconnaissance aircraft. See WAR.AIRTRK.MIL.FIXD.RECON series.
TANKER	6	WAR.AIRTRK.MIL.FIXD.TNK		Tanker	N/A	
TANKER (BOOM ONLY)	7	TBD		Tanker (Boom only)	Tanker (Boom)	
TANKER (DROGUE ONLY)	8	TBD		Tanker (Drogue only)	Tanker (Drogue)	
INTERCEPTOR	9	WAR.AIRTRK.MIL.FIXD.INCR		N/A	Interceptor	
TRANSPORT	10	WAR.AIRTRK.MIL.FIXD.CGOALT		N/A	N/A	2525 has multiple cargo/transport designations. See WAR.AIRTRK.MIL.FIXD.CGOALT series. 2525 also has designations for "Fixed Wing - Utility" aircraft. See WAR.AIRTRK.MIL.FIXD.UTY series.
AIRBORNE COMMAND POST (ACP)	11	WAR.AIRTRK.MIL.FIXD.ABNCP		N/A	N/A	
MISSILE CARRIER	12	N/A		Missile Carrier	Missile Platform	Recommend WAR.AIRTRK.MIL
MISSILE	13	WAR.AIRTRK.WPN.MSLIF		Missile	Missile	2525 has multiple designations for missile types. See WAR.AIRTRK.WPN.MSLIF series.
ELECTRONIC WARFARE (EW)	14	WAR.AIRTRK.MIL.FIXD.ECM		Electronic Warfare (EW)	Jammer	Symbol available only for Suspect or Hostile ID in SSDS
ANTISUBMARINE WARFARE (ASW)	15	WAR.AIRTRK.MIL.FIXD.ASBWCB		Anti-Sub Warfare (ASW)	ASW Aircraft	This 2525 symbol is for "carrier-based" ASW fixed wing aircraft.
AIRBORNE EARLY WARNING AND CONTROL (AEW)	16	WAR.AIRTRK.MIL.FIXD.RECON.ABNEW		AEW and Control (AEWC)	N/A	
MARITIME PATROL AIRCRAFT (MPA)	17	WAR.AIRTRK.MIL.FIXD.PAT		Maritime Patrol Aircraft (MPA)	N/A	
SEARCH AND RESCUE (SAR)	18	WAR.AIRTRK.MIL.FIXD.CSAR		N/A	N/A	
DRONE	19	WAR.AIRTRK.MIL.FIXD.DRN		Drone	N/A	2525 has multiple designations for drone/RPV aircraft. See WAR.AIRTRK.MIL.FIXD.DRN and WAR.AIRTRK.MIL.ROT.DRN series.
REMOTELY PILOTED VEHICLE (RPV)	20	WAR.AIRTRK.MIL.FIXD.DRN		N/A	N/A	2525 has multiple designations for drone/RPV aircraft. See WAR.AIRTRK.MIL.FIXD.DRN and WAR.AIRTRK.MIL.ROT.DRN series.
FIXED WING GUNSHIP	21	WAR.AIRTRK.MIL.FIXD.ATK		N/A	N/A	
CIVIL, AIRLINER	22	TBD		N/A	N/A	Optional implementation of 2525 symbol. Current symbol is WAR.AIRTRK.CVL.FIXD 
CIVIL, GENERAL	23	WAR.AIRTRK.CIV		Civil, General	Civilian	
LIGHTER THAN AIR (LTA)	24	WAR.AIRTRK.CIV.LTA		N/A	N/A	See also WAR.AIRTRK.MIL.LTA for military LTA symbol 
GLIDER	25	N/A		N/A	N/A	Recommend WAR.AIRTRK
DECOY	26	TBD		N/A	N/A	
HELICOPTER (HELO)	27	WAR.AIRTRK.MIL.ROT		Helicopter	N/A	See also WAR.AIRTRK.CVL.ROT for civil helicopter symbol. 
ATTACK HELICOPTER	28	WAR.AIRTRK.MIL.ROT.ATK		N/A	N/A	
HELICOPTER GUNSHIP	29	WAR.AIRTRK.MIL.ROT.ATK		Helicopter Gunship	N/A	

Table A-2. MIL-STD-6016C Air and Space Statements Mapped Against MIL-STD-2525 (Continued)

ANTISUBMARINE WARFARE HELICOPTER (ASW HELO)	30	WAR.AIRTRK.MIL.ROT.ASBW		ASW Helo	ASW Helo	
MINE WARFARE HELICOPTER	31	TBD		N/A	N/A	
TRANSPORT HELICOPTER	32	WAR.AIRTRK.MIL.ROT.UTY		N/A	N/A	2525 has multiple designations for Utility helos (light, med, heavy). See WAR.AIRTRK.MIL.ROT.UTY series.
TACTICAL SUPPORT	33	N/A		N/A	N/A	Recommend WAR.AIRTRK.MIL
PATROL	34	WAR.AIRTRK.MIL.FIXD.PAT		N/A	N/A	
MISCELLANEOUS FIXED WING	35	WAR.AIRTRK.MIL.FIXD		N/A	N/A	
MISSILE CONTROL UNIT	36	N/A		Missile Control Unit	N/A	Recommend WAR.AIRTRK.MIL
SURFACE-TO-AIR MISSILE (SAM)	37	WAR.AIRTRK.WPN.MSLIF.SLM.SAM		Surface-to-Air Missile	N/A	
AIR-TO-SURFACE MISSILE (ASM)	38	WAR.AIRTRK.WPN.MSLIF.ALM.ASM		Air-to-Surface Missile	N/A	
SURFACE-TO-SURFACE MISSILE (SSM)	39	WAR.AIRTRK.WPN.MSLIF.SLM.SSM		Surface-to-Surface Missile	N/A	
LOGISTIC	40	WAR.AIRTRK.MIL.FIXD.UTY		Logistic	N/A	2525 has designations for "Fixed Wing - Utility" aircraft. See WAR.AIRTRK.MIL.FIXD.UTY series. 2525 also has multiple cargo/transport designations. See WAR.AIRTRK.MIL.FIXD.CGOALT series.
AIR-TO-AIR MISSILE (AAM)	41	WAR.AIRTRK.WPN.MSLIF.ALM.AAM		Air-to-Air Missile	N/A	
SUBSURFACE-TO-SURFACE MISSILE	42	WAR.AIRTRK.WPN.MSLIF.SBSM		Subsurface-to-Surface Missile	N/A	
SURFACE-TO-SUBSURFACE MISSILE	43	WAR.AIRTRK.WPN.MSLIF.SLM.SSUM		Surface-to-Subsurface Missile	N/A	
CRUISE MISSILE	44	WAR.AIRTRK.WPN.MSLIF.CM		Cruise Missile	N/A	
BALLISTIC MISSILE	45	WAR.AIRTRK.WPN.MSLIF.BLST		Ballistic Missile	N/A	
AIRBORNE LAND SURVEILLANCE	46	N/A		N/A	N/A	Recommend WAR.AIRTRK.MIL.FIXD.RECON.ABNEW
AIRBORNE LASER	47	N/A		N/A	N/A	Recommend WAR.AIRTRK.MIL
LAMPS Helicopter	N/A	N/A		LAMPS MK 3	LAMPS Helo	Recommend WAR.AIRTRK.MIL.ROT.ASBW
MILSTD 6016C - PLATFORM (DFI: 1797) SPACE PLATFORM (DUI 005)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
SATELLITE	1	WAR.SPC.SAT		N/A	N/A	
BASE	2	WAR.SPC.SST		N/A	N/A	2525 designates this symbol as "Space Station."
WEAPON	3	TBD		N/A	N/A	Proposed 2525 symbol.
TRANSPORT	4	WAR.SPC.CSV		N/A	N/A	2525 designates this symbol as "Crewed Space Vehicle."
PATROL	5	N/A		N/A	N/A	Recommend WAR.SPC.CSV
SUPPORT	6	N/A		N/A	N/A	Recommend WAR.SPC.CSV
DEBRIS	7	N/A		TBM Debris	N/A	Recommend WAR.SPC
DECOY	8	TBD		N/A	N/A	
SPACE, GENERAL	31	WAR.SPC		N/A	No Statement	
BALLISTIC MISSILE, GENERAL, UNKNOWN	62	TBD		Tactical Ballistic Missile (TBM)	N/A	

Table A-3. MIL-STD-6016C Surface Statements Mapped Against MIL-STD-2525

MILSTD 6016C - PLATFORM (DFI: 1797) SURFACE PLATFORM (DUI 002)	BIT CODE	MILSTD 2525 Hierarchy	MILSTD 2525 SYMBOL	ADS/NTDS NAME	SSDS NAME	NOTES
NO STATEMENT	0	WAR.SSUF		No statement/ Unknown	No statement	
AIRCRAFT CARRIER (CV)	1	WAR.SSUF.CBTT. LNE.CRR		Aircraft Carrier	Carrier	
BATTLESHIP	2	WAR.SSUF.CBTT. LNE.BBS		Battleship	N/A	
CRUISER	3	WAR.SSUF.CBTT. LNE.CRU		Cruiser	N/A	
DESTROYER	4	WAR.SSUF.CBTT. LNE.DD		Destrover	N/A	
FRIGATE	5	WAR.SSUF.CBTT. LNE.FFR		Frisate	N/A	
FAST PATROL BOAT	6	TBD		Fast Patrol Boat	N/A	
AMPHIBIOUS	7	WAR.SSUF.CBTT. AMPWS		Amphibious	N/A	
LHA/LHD	8	WAR.SSUF.CBTT. AMPWS.ASTVES		LHA/LHD	N/A	
AMPHIBIOUS ASSAULT COMMAND SHIP (LCC)	9	N/A		LCC (CMDSHIP)	N/A	Recommend WAR.SSUF.CBTT.AMPWS
LANDING CRAFT (LC)	10	WAR.SSUF.CBTT. AMPWS.LNDCRT		N/A	N/A	
TROOP SHIP	11	WAR.SSUF.CBTT. AMPWS.LNDSHP		N/A	N/A	Since all US Navy amphibs carry troops, this symbol could be used to denote LPD & LSD classes. LSTs have a separate 2525 symbol. See WAR.SSUF.CBTT.AMPWS.LNDSHP.TANK
TANKER/OILER	12	WAR.SSUF.NCBTT UWRPM		N/A	N/A	
AUXILIARY SHIP	13	WAR.SSUF.NCBTT		Auxiliary Ship	N/A	
MINE WARFARE SHIP	14	WAR.SSUF.CBTT. MNEWV		Mine Warfare Ship	N/A	
MINE COUNTERMEASURES MARITIME VESSEL (MCMV)	15	WAR.SSUF.CBTT. MNEWV.MNESWE		N/A	N/A	2525 has multiple designations for mine warfare ships (layer, sweeper, hunter, drone, etc) See WAR.SSUF.CBTT.MNEWV series.
HOSPITAL SHIP	16	WAR.SSUF.NCBTT HSPSHP		N/A	N/A	
SURFACED SUBMARINE	17	TBD		N/A	Surfaced Submarine	
HYDROFOIL	18	TBD		Hydrofoil	N/A	
AIR CUSHION VEHICLE	19	WAR.SSUF.CBTT. HOV		Air Cushion Vehicle	N/A	
INTELLIGENCE COLLECTOR	20	WAR.SSUF.NCBTT INT		Intelligence Collector	N/A	
SURVEY VESSEL	21	WAR.SSUF.NCBTT INT		N/A	N/A	
NON-MILITARY	22	WAR.SSUF.NMIL. MCT		Non-military	Civilian	
LANDING PLATFORM	23	WAR.SSUF.CBTT. AMPWS.LNDCRT		N/A	N/A	Assumed "Landing Platform" was equivalent to a landing craft
LANDING SHIP	24	WAR.SSUF.CBTT. AMPWS.LNDSHP		N/A	N/A	

Table A-3. MIL-STD-6016C Surface Statements Mapped Against MIL-STD-2525 (Continued)

COMMAND	25	N/A		N/A	N/A	Recommend WAR.SSUF.CBTT.AMPWS
OCEAN RESEARCH	26	WAR.SSUF.NCBTT.INT	JI	N/A	N/A	
PATROL	27	WAR.SSUF.CBTT.PAT		Patrol	N/A	
SUPPORT	28	WAR.SSUF.NCBTT.FLTSUP	AS	N/A	N/A	
FISHING VESSEL	29	WAR.SSUF.NMIL.FSG		N/A	N/A	Multiple 2525 symbols for fishing vessels. See WAR.SSUF.NMIL.FSG series.
MERCHANT VESSEL	30	WAR.SSUF.NMIL.MCT		Merchant Vessel	N/A	Multiple 2525 symbols for merchant vessels. See WAR.SSUF.NMIL.MCT series.
PATROL CRAFT ESCORT	31	N/A		N/A	N/A	Recommend WAR.SSUF.NCBTT
AMPHIBIOUS GENERAL ASSAULT	32	WAR.SSUF.CBTT.AMPWS.ASTVES	LA	N/A	N/A	
MISSILE CONTROL UNIT	33	N/A		Missile Control Unit	N/A	Recommend WAR.SSUF.CBTT
DECOY	34	TBD		Decoy	N/A	
MISSILE PLATFORM	N/A	N/A		N/A	Missile Platform	Recommend WAR.SSUF.CBTT
OWNSHIP	N/A	TBD		Ownship	Ownship	
UNMANNED SURFACE VESSEL (USV)	N/A	TBD		N/A	N/A	
LITTORAL COMBATANT	N/A	TBD	LL	N/A	N/A	
LITTORAL COMBATANT - SUW MISSION PACKAGE	N/A	TBD	LL SUW	N/A	N/A	
LITTORAL COMBATANT - MIW MISSION PACKAGE	N/A	TBD	LL MIW	N/A	N/A	
LITTORAL COMBATANT - ASW MISSION PACKAGE	N/A	TBD	LL ASW	N/A	N/A	
ASW PATROL BOAT	N/A	TBD	PC	N/A	N/A	

Table A-4. MIL-STD-6016C Subsurface Statements Mapped Against MIL-STD-2525

MILSTD 6016C - PLATFORM (DFI: 1797) SUBSURFACE PLATFORM (DUI 003)	BIT CODE	MILSTD 2525 Hierarchy	MILSTD 2525 SYMBOL	ADS/NTDS NAME	SSDS NAME	NOTES
NO STATEMENT	0	WAR.SBSUF		No statement	Default	
SUBMARINE PROPULSION UNKNOWN	1	WAR.SBSUF.SUB		N/A	N/A	
DIESEL ELECTRIC SUBMARINE GENERAL	2	WAR.SBSUF.SUB.CNVPRN		Diesel Electric Sub General	N/A	
DIESEL ELECTRIC ATTACK SUBMARINE	3	WAR.SBSUF.SUB.CNVPRN.ATK		N/A	N/A	
DIESEL ELECTRIC MISSILE SUBMARINE	4	WAR.SBSUF.SUB.CNVPRN.MSL		Diesel Electric Missile Sub	Missile Platform	2525 also distinguishes between "missile" and "guided missile" submarines (I.e., SSG). See WAR.SBSUF.SUB.CNVPRN.GDD.
DIESEL ELECTRIC BALLISTIC MISSILE SUBMARINE	5	WAR.SBSUF.SUB.CNVPRN.BLST		N/A	Missile Platform	
TYPE 1 DIESEL	6	N/A		Type 1 Diesel	N/A	Recommend using WAR.SBSUF.SUB.CNVPRN.
TYPE 2 DIESEL	7	N/A		Type 2 Diesel	N/A	Recommend using WAR.SBSUF.SUB.CNVPRN.
TYPE 3 DIESEL	8	N/A		Type 3 Diesel	N/A	Recommend using WAR.SBSUF.SUB.CNVPRN.
NUCLEAR SUBMARINE GENERAL	9	WAR.SBSUF.SUB.NPRN		Nuclear Sub General	N/A	
NUCLEAR ATTACK SUBMARINE	10	WAR.SBSUF.SUB.NPRN.ATK		N/A	N/A	
NUCLEAR MISSILE SUBMARINE	11	WAR.SBSUF.SUB.NPRN.MSL		Nuclear Missile Sub	Missile Platform	2525 also distinguishes between "missile" and "guided missile" submarines (I.e., SSGN). See WAR.SBSUF.SUB.NPRN.GDD.
NUCLEAR BALLISTIC MISSILE SUBMARINE	12	WAR.SBSUF.SUB.NPRN.BLST		Nuclear Ballistic Missile Sub	Missile Platform	
TYPE I NUCLEAR	13	N/A		Type I Nuclear	N/A	Recommend using WAR.SBSUF.SUB.NPRN.
TYPE II NUCLEAR	14	N/A		Type II Nuclear	N/A	Recommend using WAR.SBSUF.SUB.NPRN.
TYPE III NUCLEAR	15	N/A		Type III Nuclear	N/A	Recommend using WAR.SBSUF.SUB.NPRN.
TYPE IV NUCLEAR	16	N/A		Type IV Nuclear	N/A	Recommend using WAR.SBSUF.SUB.NPRN.
TYPE V NUCLEAR	17	N/A		Type V Nuclear	N/A	Recommend using WAR.SBSUF.SUB.NPRN.
NON-SUBMARINE	18	TBD		Non-Submarine	Non-Submarine	
SURFACE VESSEL	19	WAR.SSUF		N/A	Surface	
TORPEDO	20	WAR.SBSUF.UH2.WPN		Torpedo	Torpedo	
MINE	21	TBD		Mine	Mine	
DECOY	22	TBD		Acoustic Decoy	Decoy	
WRECK	23	TACGRP.OTH.SSU.BSR.BTMRTN.WRKND		N/A	Wreck	2525 list two types of wrecks. This is for the "non-dangerous wreck." See also TACGRP.OTH.SSUBSR.BTMRTN.WRKND.WRKD for the "dangerous wreck" 
SEABED PIPELINE	24	N/A		N/A	Pipeline	2525 has no discrete "hookable" symbol but uses METOC.OCA.MMD.PPELNE to represent it on a digital map or chart. Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF instead.
FISH/MARINE LIFE	25	TACGRP.OTH.SSU.BSR.MARLFE		N/A	Fish	
SWIMMER/FROGMAN	26	WAR.SBSUF.NSUB.DVR		N/A	Frogman/ Swimmer	
KNUCKLE/WAKE	27	TACGRP.OTH.SSU.BSR.SA		N/A	Knuckle	
ATTACK SUBMARINE	28	N/A		N/A	N/A	2525 submarine symbols are designated by propulsion type first, then mission. There are no generic symbols for mission only (I.e. attack or cruise missile). Recommend WAR.SBSUF.SUB.NPRN.ATK
CRUISE MISSILE LAUNCHER	29	N/A		Cruise Missile Launcher	Missile Platform	2525 submarine symbols are designated by propulsion type first, then mission. There are no generic symbols for mission only (I.e. attack or cruise missile). Recommend WAR.SBSUF.SUB.NPRN.MSL
PINNACLE/SEAMOUNTAIN	30	TACGRP.OTH.SSU.BSR.BTMRTN.SBR.SOO		N/A	Pinnacle	
NON-MILITARY SUBMERSIBLE	31	WAR.SBSUF.SUB.OTH		N/A	Civilian	This symbol depicts "Other Submersible (Rescue, Research, Underwater Tug)" but it is military. 2525 not have an equivalent symbol for non-military. 
TYPE VI NUCLEAR	33	N/A		Type VI Nuclear	N/A	Recommend using WAR.SBSUF.SUB.NPRN.
TYPE VII NUCLEAR	34	N/A		Type VII Nuclear	N/A	Recommend using WAR.SBSUF.SUB.NPRN.

Table A-4. MIL-STD-6016C Subsurface Statements Mapped Against MIL-STD-2525 (Continued)

CONVENTIONAL (COMMAND AND CONTROL)	35	N/A		Conventional (Command and Control)	N/A	Recommend WAR.SBSUF.SUB.CNVPRN
CONVENTIONAL (AUXILIARY)	36	N/A		N/A	N/A	Recommend WAR.SBSUF.SUB.CNVPRN
NUCLEAR (COMMAND AND CONTROL)	37	N/A		Nuclear (Command and Control)	N/A	Recommend WAR.SBSUF.SUB.NPRN
MISSILE CONTROL UNIT	49	N/A		Missile Control Unit	N/A	Recommend WAR.SBSUF.SUB.NPRN
UNMANNED UNDERWATER VEHICLE (UUV)	N/A	TBD		N/A	N/A	
SMALL OBJECT	N/A	N/A		Small Object	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
MINE, KINGFISHER	N/A	TBD		Mine, Kingfisher	N/A	
MILSTD 6016C - SONOBUOY TYPE (DFI: 349) SONOBUOY TYPE (DUI 001)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD 2525 SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
BT	1	TACGRP.C2GM.GNL.PNT.USW.SNBY.BT		Sonobuoy, BT	N/A	
LOFAR	2	TACGRP.C2GM.GNL.PNT.USW.SNBY.LOFAR		Sonobuoy, LOFAR	LOFAR Sonobuoy	Blinks if holding contact
RO	3	TACGRP.C2GM.GNL.PNT.USW.SNBY.RO		Sonobuoy, RO	N/A	Blinks if holding contact
DIFAR	4	TACGRP.C2GM.GNL.PNT.USW.SNBY.DIFAR		Sonobuoy, DIFAR	DIFAR/VLAD Sonobuoy	Blinks if holding contact
VLAD	10	TACGRP.C2GM.GNL.PNT.USW.SNBY.VLAD		Sonobuoy, VLAD	DIFAR/VLAD Sonobuoy	Blinks if holding contact
DICASS	13	TACGRP.C2GM.GNL.PNT.USW.SNBY.DICASS		Sonobuoy, DICASS	DICASS Sonobuoy	Blinks if holding contact
AMBIENT NOISE	N/A	TACGRP.C2GM.GNL.PNT.USW.SNBY.ANM		Sonobuoy, Ambient Noise	N/A	
SONOBUOY KINGPIN	N/A	TACGRP.C2GM.GNL.PNT.USW.SNBY.KGP		N/A	N/A	
MILSTD 6016C - DATA REPORT TYPE (DFI: 357) SUBSURFACE TRACK TYPE (DUI 001)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD 2525 SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
SUBSURFACE TRACK	0	WAR.SBSUF		No statement	Default	
SURFACED SUBMARINE	1	TBD		N/A	Surfaced Submarine	
SNORKELING SUBMARINE	2	TBD		N/A	N/A	
DATUM	4	TACGRP.C2GM.GNL.PNT.USW.UH2.DTM		Datum	Datum	
MILSTD 6016C - CONFIDENCE LEVEL (DFI: 358) SUBSURFACE TRACK CONFIDENCE LEVEL (DUI 001)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD 2525 SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
UNCLASSIFIED	1	N/A		N/A	N/A	Recommend WAR.SBSUF.SUB
POSSIBLE SUBMARINE LOW ONE	2	TBD		Possible Sub 1-4	N/A	
POSSIBLE SUBMARINE LOW TWO	3	TBD		Possible Sub 1-4	N/A	
POSSIBLE SUBMARINE HIGH THREE	4	TBD		Possible Sub 1-4	N/A	
POSSIBLE SUBMARINE HIGH FOUR	5	TBD		Possible Sub 1-4	N/A	
PROBABLE SUBMARINE	6	TBD		Probable Sub	Probable Submarine	
CERTAIN SUBMARINE	7	TBD		Certain Sub	Certain Submarine	
NON SUBMARINE	8	TBD		Non-Submarine	Non-Submarine	
SURFACE VESSEL	9	WAR.SSUF		Surface	Surface	

Table A-5. MIL-STD-6016C Land Statements Mapped Against MIL-STD-2525

MILSTD 6016C - PLATFORM (DFI: 1797) LAND PLATFORM (DUI 004)	BIT CODE	MILSTD 2525 Hierarchy	MILSTD 2525 SYMBOL	ADS/NTDS NAME	SSDS NAME	NOTES
NO STATEMENT	0	WAR.GRDTRK		No statement/ Unknown	Land	
TROOP CONCENTRATION/ UNIT	1	WAR.GRDTRK.UNT		Troop Concentration	Troop Concentration Unit	
HEADQUARTER COMPLEX	2	WAR.GRDTRK.UNT.C2HQ		HQ Complex	Headquarters Complex	2525 also uses symbol modifiers found in Table A-II to designate HQ units at the various command levels.
COMMAND/ CONTROL/ COMMAND AND CONTROL CENTER	3	WAR.GRDTRK.UNT.C2HQ		C2 Center	Headquarters/ Command Center	
ASSEMBLY AREA	4	N/A		N/A	Assembly Area	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF. See also TACGRP.C2GM.GNL.ARS.ABYARA for the template to create an "assembly area" tactical graphic overlay.
INSTALLATION/FACILITY, MILITARY	5	WAR.GRDTRK.INS.MILBF		N/A	Military Facility Installation	2525 uses two symbol sets to designate military facilities. See the WAR.GRDTRK.INS.MILBF series for "Military Base" facilities and WAR.GRDTRK.INS.MMF for "Military Materiel" facilities.
INSTALLATION/FACILITY, CIVILIAN	6	TBD		N/A	Civilian Installation	Proposed 2525 symbol. 2525 has multiple designations for installations and facilities. See the WAR.GRDTRK.INS series.
AIRFIELD/AIRBASE	7	WAR.GRDTRK.INS.MILBF.AB		Airfield/Airbase	Airfield	
PORT/HARBOR FACILITY	8	WAR.GRDTRK.INS.MILBF.SP		N/A	Port Facility	
STORAGE SITE	9	WAR.GRDTRK.INS.RMP		N/A	Storage Site	2525 uses multiple designations for storage facilities (mine, nuclear, petroleum, etc.) See WAR.GRDTRK.INS.RMP series.
TACTICAL POSITION	10	N/A		N/A	Tactical Position	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
FORTIFICATION	11	TBD		N/A	Fort	Proposed 2525 symbol. Current symbol is  TACGRP.MOBSU.SU.ESTOF
INTERSECTION	12	N/A		N/A	Intersection	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
CONVOY	13	WAR.GRDTRK.EQT.GRDVEH		Convoy	Convoy	Recommend WAR.GRDTRK.EQT.GRDVEH. Current symbol is a tactical graphic. See TACGRP.CSS.I 
COMBAT VEHICLE	14	WAR.GRDTRK.EQT.GRDVEH.ARMD		N/A	Combat Vehicle	Recommend WAR.GRDTRK.EQT.GRDVEH.ARMD. 2525 divides ground vehicles into six categories (armored, engineer, utility, civilian, train & pack animals). See WAR.GRDTRK.EQT.GRDVEH series for details.
COMBAT SUPPORT VEHICLE	15	WAR.GRDTRK.EQT.GRDVEH.ENGVEH		N/A	Combat Support Vehicle	Recommend WAR.GRDTRK.EQT.GRDVEH.ENGVEH. 2525 divides ground vehicles into six categories (armored, engineer, utility, civilian, train & pack animals). See WAR.GRDTRK.EQT.GRDVEH series for details.
VEHICLE, OTHER	16	WAR.GRDTRK.EQT.GRDVEH.UTYVEH.LCCTRK		N/A	Vehicle	Recommend WAR.GRDTRK.EQT.GRDVEH.UTYVEH.LCCTRK. 2525 divides ground vehicles into six categories (armored, engineer, utility, civilian, train & pack animals). See WAR.GRDTRK.EQT.GRDVEH series for details.
TANK	17	WAR.GRDTRK.EQT.GRDVEH.ARMD.TANK		N/A	Tank	2525 uses several designations for types of tanks. See WAR.GRDTRK.EQT.GRDVEH.ARMD.TANK series.
TRAIN	18	WAR.GRDTRK.EQT.GRDVEH.TRNLCO		N/A	Train	
REMOTELY PILOTED VEHICLE	19	TBD		N/A	Remote Piloted Vehicle	
MORTAR	20	WAR.GRDTRK.EQT.WPN.MORT		N/A	Mortar	2525 uses several designations for types of mortars. See WAR.GRDTRK.EQT.WPN.MORT series.
FIELD ARTILLERY	21	WAR.GRDTRK.EQT.WPN.HOW		Artillery	Field Artillery	2525 uses several designations for types of howitzers. See WAR.GRDTRK.EQT.WPN.HOW series.
AIR DEFENSE ARTILLERY	22	WAR.GRDTRK.EQT.WPN.ADFG		Air Defense Artillery	Air Artillery	2525 uses several designations for types of air defense guns. See WAR.GRDTRK.EQT.WPN.ADFG series.
ROCKET LAUNCHER	23	WAR.GRDTRK.EQT.WPN.SRL		N/A	Rocket Launcher	2525 uses several designations for types of rocket launchers. See WAR.GRDTRK.EQT.WPN.SRL series.
MISSILE LAUNCHER	24	WAR.GRDTRK.EQT.WPN.MSLL		Missile Launcher	Launcher	2525 uses several designations for types of missile launchers. See WAR.GRDTRK.EQT.WPN.MSLL series.
SPECIAL WEAPON	25	TBD		N/A	Special Weapon	Proposed 2525 symbol. Combined WAR.GRDTRK.EQT.WPN.MSLL and WAR.GRDTRK.INS.MMF.NENY.NMP.WPNGR.
BRIDGE	26	TACGRP.MOBSU.OBSTBP.CSGSTE.BRG		Bridge	Bridge	
BUILDING/STRUCTURE	27	WAR.GRDTRK.INS		N/A	Building	2525 has multiple designations for various civilian installation and facilities. See the WAR.GRDTRK.INS series.
POWER FACILITY	28	WAR.GRDTRK.INS.SRUF.EPF		N/A	Power Facility	2525 has several designations for "power facility" based on the type of power generation. See WAR.GRDTRK.INS.SRUF.EPF series.
RAIL FACILITY	29	TBD		Railroad	Rail Facility	Proposed 2525 symbol. Combined WAR.GRDTRK.UNT.CSS.TPT.RHD.CRP and WAR.GRDTRK.INS.TSPF
TERRAIN	30	N/A	See Note	N/A	Terrain	2525 doesn't have a terrain symbol nor is one recommended. Terrain can be depicted beneath the symbology using digital maps.

Table A-5. MIL-STD-6016C Land Statements Mapped Against MIL-STD-2525 (Continued)

NAVAID SITE	31	N/A		NAVAID Site	NAVAID Site	Recommend WAR.GRDTRK.INS
COMMUNICATION SITE	32	WAR.GRDTRK.INS.SRUF.TCF		Communications Site	Communication Site	This symbol depicts a "telecommunications facility." 2525 also has several designations for "Signal" units. See WAR.GRDTRK.UNT.CS.SIGUNT series.
RADAR SITE	33	WAR.GRDTRK.EQT.SNS.RAD		Radar Site	Radar	
ANTENNA/EMITTER	34	TBD		N/A	Antenna	Proposed 2525 symbol. Modified WAR.GRDTRK.UNT.CS.SIGUNT.RDOUNT
BUFFER CENTER	35	N/A		Buffer Center	Buffer Center	Recommend WAR.GRDTRK.INS
ELECTRONIC WARFARE SITE	36	TBD		N/A	EW Site	Proposed 2525 symbol. Combined WAR.GRDTRK.UNT.CS.MILINT.SIGINT.ECW and WAR.GRDTRK.INS
SURVEILLANCE SITE	37	TBD		Surveillance Site	Surveillance Site	Proposed 2525 symbol. Combined WAR.GRDTRK.UNT.CS.MILINT.SVL and WAR.GRDTRK.INS
BRIDGING EQUIPMENT	38	WAR.GRDTRK.EQT.GRDVEH.ENGVEH.BRG		N/A	Bridging Equipment	
MINE WARFARE EQUIPMENT	39	WAR.GRDTRK.EQT.GRDVEH.ENGVEH.MCVEH		N/A	Mine Warfare Equipment	2525 has symbol sets for mine "laying" and "clearing" equipment. For mine clearing vehicles, see WAR.GRDTRK.EQT.GRDVEH.ENGVEH.MCVEH series. For "mine laying' equipt, see WAR.GRDTRK.EQT.GRDVEH.ENGVEH.MLVEH series.
SURFACE-TO-AIR MISSILE (SAM) SITE	40	WAR.GRDTRK.EQT.WPN.MSLL.ADF AD		SAM site	SAM site	2525 has multiple designations for SAM site types. See WAR.GRDTRK.EQT.WPN.MSLL.ADFAD series.
SURFACE-TO-SURFACE MISSILE (SSM) SITE	N/A	WAR.GRDTRK.EQT.WPN.MSLL.SUF		SSM site	SSM site	2525 has multiple designations for SAM site types. See WAR.GRDTRK.EQT.WPN.MSLL.SUF series.
MARITIME HEADQUARTERS	41	TBD		Maritime HQ	Maritime Headquarters	Proposed 2525 symbol. Combined WAR.GRDTRK.UNT.C2HQ and WAR.GRDTRK.INS.MILBF.SP
AIR SUPPORT RADAR TEAM (ASRT)	42	TBD		Air Support Radar Team	Air Support Radar Team	Proposed 2525 symbol. Combined WAR.GRDTRK.EQT.SNS.RAD and WAR.GRDTRK.UNT
DIRECT AIR SUPPORT CENTER (DASC)	43	TBD		Direct Air Support Center	Direct Air Support Center	Proposed 2525 symbol. Combined WAR.GRDTRK.EQT.SNS.RAD and WAR.GRDTRK.INS
FORWARD AIR CONTROL PARTY (FACP)	44	TBD		Forward Air Control Party	Forward Air Control Party	Proposed 2525 symbol. Combined TACGRP.C2GM.DEF.PNT.OBSPST.FWDOP and WAR.GRDTRK.UNT
BATTALION OPERATIONS CENTER (BOC)	45	WAR.GRDTRK.UNT.CS.SIGUNT.CMDOPN		Battalion Operation Center	Battalion Ops Center	2525 does not have a specific symbol for "Battalion Operations Center." This symbol depicts a "Combat Support - Signal Unit - Command Operations" unit. A symbol modifier of "AF" from Table A-II would mean "HQ Battalion."
TACTICAL DATA SYSTEM (TDS)	46	N/A		Tactical Data System	Tactical Data System	Recommend WAR.GRDTRK.INS
DECOY	47	N/A	See Note	N/A	N/A	2525 does not have symbols for decoy vehicles or units. It uses symbol modifiers to indicate "feint dummy" units at various command levels. See Table A-II.
TRACKED VEHICLE	48	N/A	See Note	N/A	Tracked Vehicle	2525 uses symbol modifiers "MQ" and "MR" to identify "tracked" units or equipment. See Table A-II.
THEATER HIGH ALTITUDE AREA DEFENSE (THAAD)	49	WAR.GRDTRK.EQT.WPN.MSLL.ADF AD.THT		Theater High Altitude Area Defense	Theater High Altitude Area Defense	2525 has multiple designations for theater air defense sites. See WAR.GRDTRK.EQT.WPN.MSLL.ADFAD.THT series.
JOINT TACTICAL GROUND STATION (JTAGS)	50	N/A		Joint Tactical Ground Station	Joint Tac Ground Station	Recommend WAR.GRDTRK.INS
ARMOR	51	WAR.GRDTRK.UNT.CBT.ARM		N/A	N/A	
CAVALRY	52	WAR.GRDTRK.UNT.CBT.RECON.CVY		N/A	N/A	2525 has several symbols for various types of "cavalry" units. See WAR.GRDTRK.UNT.CBT.RECON.CVY series.
ENGINEER	53	WAR.GRDTRK.UNT.CBT.ENG		N/A	N/A	2525 has several symbols for various types of "engineer" units. See WAR.GRDTRK.UNT.CBT.ENG series.
AIRBORNE/SPECIAL OPERATIONS	54	WAR.GRDTRK.UNT.CBT.INF.ABN		N/A	N/A	2525 has multiple designations for "airborne", "air assault" & "special operations" units. This symbol depicts "airborne infantry." There are also symbols for "airborne" and "air assault" armor, anti-armor, engineers, field artillery & reconnaissance. Special operations have their own symbol set. See WAR.SOFUNT series.
AVIATION	55	WAR.GRDTRK.UNT.CBT.AVN		N/A	N/A	2525 has multiple symbols to depict "ground track aviation" units. See WAR.GRDTRK.UNT.CBT.AVN series.
AIR DEFENSE SITE	56	N/A		N/A	N/A	2525 has multiple designations for air defense units and launchers. Recommend WAR.GRDTRK.EQT.WPN.MSLL.ADFAD.
BALLISTIC MISSILE DEFENSE SITE	57	WAR.GRDTRK.EQT.WPN.MSLL.ADF AD.THT		TBM Site	N/A	
GENERAL TROOPS	N/A	N/A		General Troops	N/A	Recommend WAR.GRDTRK.UNT
BG EXTERNAL SENSOR	N/A	WAR.GRDTRK.EQT.SNS		BG External Sensor	N/A	
GENERAL SENSOR	N/A	WAR.GRDTRK.EQT.SNS		General Sensor	N/A	
FRIENDLY MISSILE SITE	N/A	WAR.GRDTRK.EQT.WPN.MSLL		Friendly Missile Site	N/A	
HOSTILE MISSILE SITE	N/A	WAR.GRDTRK.EQT.WPN.MSLL		Hostile Missile Site	N/A	

Table A-6. MIL-STD-6016C Reference Points Statements Mapped Against MIL-STD-2525

MILSTD 6016C - POINT TYPE AMPLIFICATION (DFI: 379) POINT TYPE AMPLIFICATION (DUI 002) HAZARD (0)	BIT CODE	MILSTD 2525 Hierarchy	MILSTD 2525 SYMBOL	ADS/NTDS NAME	SSDS NAME	NOTES
NO STATEMENT	0	N/A		N/A	General Hazard / Undefined	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
NAVIGATION	1	TACGRP.OTH.HAZ.NVGL		Navigation	Navigation	
MINE	2	TACGRP.OTH.HAZ.SML		Mine	Mine	This symbol comes from the 2525 "Tactical Graphics - Other - Hazard" list. Specific mine symbols can be found in the WAR.SBSUF.UH2WPN.SMNE series.
IMPACT POINT	3	TACGRP.C2GM.GNL.PNT.WPN.IMTPNT		Impact Point	Impact Point	
GROUND ZERO	4	TACGRP.C2GM.GNL.PNT.WPN.GRDZRO		Ground Zero	Ground Zero	See also TACGRP.MOBSU.NBC.NDGZ for a symbol which allows for more detailed information to be portrayed.
AIM/WEAPON ENTRY POINT	5	TACGRP.C2GM.GNL.PNT.WPN.ENTPNT		Water Entry Pt.	Aim / Weapon Entry Point	
MISSILE LAUNCH POINT	6	TACGRP.C2GM.GNL.PNT.WPN.MSLPNT		Missile Launch Pt.	Missile Launch Point	
ELECTRONIC ATTACK (EA) DECOY	7	N/A		Decoy (ECM)	Electronic Countermeasure Decoy	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
ENGAGEMENT POINT	8	N/A		N/A	Engagement Point	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
OIL RIG	9	TACGRP.OTH.HAZ.OLRG		N/A	Oil Rig	See also the "Oil/Gas Rig" symbol found at METOC.OCA.MMD.OLRG
DAN BUOY	N/A	N/A		N/A	Dan Buoy	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
MILSTD 6016C - POINT TYPE AMPLIFICATION (DFI: 379) POINT TYPE AMPLIFICATION (DUI 002) REFERENCE POINT (GENERAL) (1)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD 2525 SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
NO STATEMENT	0	TBD		General	General Reference	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
MARSHALL POINT	1	TBD		Marshall	Marshall Point	
WAYPOINT	2	TBD		Waypoint	Way Point	
CORRIDOR TAB	3	TBD		Corridor Tab	Corridor Tab	
POSITION AND INTENDED MOVEMENT (PIM)	4	TBD		Position of Intended Movement	Position and Intended Movement	
DISPOSITION CENTER	5	N/A		Disposition Ctr.	Disposition Center	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
FORMATION CENTER	6	TACGRP.C2GM.GNL.PNT.FRMN		Formation Ctr.	Formation Center	
SEARCH AREA	7	TACGRP.C2GM.GNL.PNT.USW.SRHARA		N/A	Search Area	2525 lists this symbol in the "GENERAL - POINTS -UNDER SEA WARFARE -SEARCH" section. No other "search area" symbols are listed.
VICTOR LIMA (VL)	8	N/A		N/A	Victor Lima	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
SUBMARINE POSITION AND INTENDED MOVEMENT (SIM)	9	N/A		N/A	Submarine Intended Movement	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
DEFENDED ASSET	11	N/A		Defended Asset (TBM)	Defended Asset	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
DATA LINK REFERENCE POINT	N/A	TACGRP.C2GM.GNL.PNT.REFPNT.DLRP		Data Link Reference Point	Data Link Reference Point	
MILSTD 6016C - POINT TYPE AMPLIFICATION (DFI: 379) POINT TYPE AMPLIFICATION (DUI 002) STATION (GENERAL) (2)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD 2525 SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
NO STATEMENT	0	TBD		N/A	General Station	
TOMCAT	1	TBD		N/A	Tomcat	Proposed 2525 symbol for standardization. Current symbol is TACGRP.C2GM.GNL.PNT.ACTL.TMC
PICKET	2	TBD		N/A	Picket	
RENDEZVOUS	3	TBD		Rendezvous Point	Rendezvous	
REPLENISHMENT	5	TBD		N/A	Replenishment	
RESCUE	6	TBD		Rescue Station	Rescue	

Table A-6. MIL-STD-6016C Reference Points Statements Mapped Against MIL-STD-2525 (Continued)

MILSTD 6016C - POINT TYPE AMPLIFICATION (DFI: 379) POINT TYPE AMPLIFICATION (DUI 002) STATION (AIR) (3)	BIT CODE	MILSTD 2525 Hierarchy	MILSTD 2525 SYMBOL	ADS/NTDS NAME	SSDS NAME	
NO STATEMENT	0	TBD		N/A	General Station Air	
COMBAT AIR PATROL (CAP)	1	TBD		CAP	CAP	
AIRBORNE EARLY WARNING (AEW)	2	TACGRP.C2GM.GNL.PNT.ACTL.ABNEW		AEW	AEW	
ANTISUBMARINE WARFARE (ASW) FIXED WING	3	TBD		ASW (F/W)	ASW Fixed Wing	
ANTISUBMARINE WARFARE (ASW) HELICOPTER (HELO)	4	TBD		ASW (Helo)	ASW Helo	
REPLENISHMENT	5	TBD		Replenishment Station	Replenishment	
STRIKE INITIAL POINT (IP)	6	TBD		Strike Initial Point	Strike Initial Point	
TACAN	7	TBD		TACAN	TACAN	
TANKER	8	TBD		N/A	Tanker	
ORBIT, RACE TRACK	9	TBD		N/A	Orbit, Race Track	
ORBIT, FIGURE EIGHT	10	TBD		N/A	Orbit, Figure Eight	
ORBIT, RANDOM CLOSED	11	TBD		N/A	Orbit, Random Closed	
ORBIT POINT	12	TBD		N/A	Orbit Point	
RESCUE	N/A	TBD		N/A	N/A	
MILSTD 6016C - POINT TYPE AMPLIFICATION (DFI: 379) POINT TYPE AMPLIFICATION (DUI 002) AREA (GENERAL) (5)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD 2525 SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
NO STATEMENT	0	N/A	N/A	N/A	General Area	
SEARCH	1	TACGRP.C2GM.GNL.PNT.USW.SRH.ARA		N/A	Search	2525 lists this symbol in the "GENERAL - POINTS -UNDER SEA WARFARE -SEARCH" section. No other "search area" symbols are listed.
RESTRICTED	2	N/A		N/A	Restricted	2525 has no discrete "hookable" symbol but uses METOC.OCA.LMT.RSDARA to represent it on a digital map or chart. Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF instead.
EXERCISE	3	N/A		N/A	Exercise	2525 has no discrete "hookable" symbol but uses METOC.OCA.LMT.TRGARA to represent it on a digital map or chart. Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF instead.
SUBMARINE PATROL AREA	4	N/A		N/A	Submarine Patrol Area	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
FIGHTER ENGAGEMENT ZONE/FIGHTER AOR	5	N/A		N/A	Fighter Engagement Zone/ Fighter AOR	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
GROUND AREA OF RESPONSIBILITY	6	N/A		N/A	Ground Area of Responsibility	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
DEFENDED AREA	7	N/A		N/A	Defended Area	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
VITAL AREA CENTER	N/A	N/A		Vital Area Center	Vital Area Center	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
MILSTD 6016C - POINT TYPE AMPLIFICATION (DFI: 379) POINT TYPE AMPLIFICATION (DUI 002) ASW (7)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD 2525 SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
NO STATEMENT	0	N/A	N/A	N/A	General ASW	
SINKER	1	TACGRP.C2GM.GNL.PNT.USW.UH2.SNK		Radar Sinker	Sinker	
BRIEF CONTACT	2	TACGRP.C2GM.GNL.PNT.USW.UH2.BCON		Brief Contact	Brief Contact	
SEARCH CENTER (ASW)	3	TACGRP.C2GM.GNL.PNT.USW.SRH.CTR		ASW Search Center	Search Center	

Table A-6. MIL-STD-6016C Reference Points Statements Mapped Against MIL-STD-2525 (Continued)

ESTIMATED POSITION (EP)	4	N/A		Estimated Position	Estimated Position	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
FIX (ASW)	5	TACGRP.OTH.FIX ACU		Acoustic Fix	Fix	
NOTACK AREA	6	N/A		NOTACK Area Center	NOTACK Area	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
MOVING HAVEN	7	N/A		Moving Haven	Moving Haven	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
SONOBUOY POSITION	9	TACGRP.C2GM.GNL.PNT.USW.SNBY		Sonobuoy	Sonobuoy Position	
SONOBUOY PATTERN REFERENCE POSITION	10	TACGRP.C2GM.GNL.PNT.USW.SNBY.PTNCTR		Sonobuoy Reference Center	Sonobuoy Pattern Reference Position	
SONOBUOY EXPIRED	N/A	TBD		Sonobuoy Expired	Sonobuoy Expired	
LIMITING LINE OF APPROACH	11	N/A		N/A	Limited Line of Approach	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
AREA OF PROBABILITY (ASW)	12	N/A		N/A	Area of Probability	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
FRIENDLY WEAPON DANGER AREA (FWDA)	13	N/A		N/A	Friendly Weapon Danger Area	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
MADMAN	N/A	TACGRP.OTH.FIX.EM		MADMAN	MAD Contact	Recommend TACGRP.OTH.FIX.EM (electro-magnetic fix)
SONOBUOY PATTERN CENTER	N/A	TACGRP.C2GM.GNL.PNT.USW.SNBY.PTNCTR		Sonobuoy Pattern Center	N/A	
ASW SCREEN CENTER	N/A	N/A		ASW Screen Center	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
MILSTD 6016C - POINT TYPE AMPLIFICATION (DFI: 379) POINT TYPE AMPLIFICATION (DUI 002) ASW (8)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD 2525 SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
CHARTED WRECK	0	TACGRP.OTH.SSUBSR.BTM.RTN.WRKND		N/A	Charted Wreck	2525 list two types of wrecks. This is for the "non-dangerous wreck." See also TACGRP.OTH.SSUBSR.BTM.RTN.WRKND.WRKD for the "dangerous wreck" 
BOTTOMED NONSUBMARINE	1	TACGRP.OTH.SSUBSR.BTM.RTN		Bottomed non-sub	Bottomed Non-Sub	
ASW STATION	2	TBD		ASW Subsurface Station	ASW Station	Former 2525B symbol is  WAR.SBSUF.SUB.STN.ASWSUB
MILSTD 6016C - FIX OR BEARING TYPE (DFI: 382) FIX OR BEARING DESCRIPTOR (DUI 004)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD 2525 SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
EW FIX	0	TACGRP.OTH.FIX.EM		ESM fix	EW FIX	See "SSDS MK 2 MOD 12 HMI SRS" Section C.4.1 Fixes and Local LOB's Symbology
AREA OF PROBABILITY	1	N/A		N/A	EW AOP	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF
BEARING, TYPE NOT SPECIFIED	2	TACGRP.OTH.BE RLNE		EW Bearing - Other Than Missile or Missile Ctrl Unit	EW LOB	See "SSDS MK 2 MOD 12 HMI SRS" Section C.4.1 Fixes and Local LOB's Symbology
BEARING, ES	3	TACGRP.OTH.BE RLNE.ELC		EW Bearing - Other Than Missile or Missile Ctrl Unit	EW LOB	See "SSDS MK 2 MOD 12 HMI SRS" Section C.4.1 Fixes and Local LOB's Symbology
BEARING, ACOUSTIC	N/A	TACGRP.OTH.BE RLNE.ACU		Acoustic Bearing - Non-LAMPS	Acoustic Passive Bearing	
BEARING, TORPEDO	N/A	TACGRP.OTH.BE RLNE.TPD		Bearing - Torpedo	Torpedo Line of Bearing	
MILSTD 6016C - EMERGENCY TYPE (DFI: 1641) EMERGENCY TYPE (DUI 001)	**BIT CODE**	**MILSTD 2525 Hierarchy**	**MILSTD 2525 SYMBOL**	**ADS/NTDS NAME**	**SSDS NAME**	
NO STATEMENT	0	N/A	N/A	PHAST (special pt./Veh track)	General Emergency Point	
DOWN AIRCRAFT	1	TACGRP.OTH.ER.DTHAC		Downed Aircraft	Downed Aircraft	
MAN IN WATER	2	TACGRP.OTH.ER.PIW		Man in Water	Man in Water	
DITCHING	3	TACGRP.OTH.ER.DTHAC		Ditching	Ditching	
BAILOUT	4	TACGRP.OTH.ER.PIW		Bailout	Bailout	
DISTRESSED VESSEL	5	TACGRP.OTH.ER.DSTVES		Vessel in Distress	Distressed Vessel	
PDA (PERISCOPE DEPTH ATTACK) TORPEDO	N/A	WAR.SBSUF.UH2.WPN		PDA (Periscope Depth Attack) Torpedo	N/A	

Table A-6. MIL-STD-6016C Reference Points Statements Mapped Against MIL-STD-2525 (Continued)

ERRATA	BIT CODE	MILSTD 2525 Hierarchy	MILSTD 2525 SYMBOL	ADS/NTDS NAME	SSDS NAME	
SHORE BOMBARDMENT POINT	N/A	N/A		Shore Bombardment Point	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
SHORE STATION	N/A	N/A		Shore Station	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
FLY-TO-POINT (NORMAL)	N/A	N/A		Fly-to-Point (Normal)	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
ANCHORAGE	N/A	N/A		Anchorage	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
SONOBUOY FLY-TO-POINT	N/A	TACGRP.C2GM.GNL.PNT.USW.SNBY.KGP		Sonobuoy Fly-to-Point	N/A	
CTR. OF TARGET AREA OF UNCERTAINTY	N/A	N/A		Ctr. Of target area of uncertainty	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
PRE-LANDFALL WAYPOINT	N/A	N/A		Pre-Landfall waypoint	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
ENEMY POINT	N/A	N/A		Enemy Point	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
HOMEPLATE	N/A	N/A		Homeplate	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
TBM IMPACT POINT	N/A	TACGRP.C2GM.GNL.PNT.WPN.GRDZRO		TBM Impact Point	N/A	
TBM LAUNCH POINT	N/A	TACGRP.C2GM.GNL.PNT.WPN.MSLPNT		TBM Launch Point	N/A	
CRUISE MISSILE POINT	N/A	N/A		Cruise Missile Point	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
OBJECTIVE	N/A	N/A		Objective	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
WEAPON FLY-TO-POINT	N/A	N/A		Weapon Fly-to-Point	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
SHORE TARGET	N/A	N/A		Shore Target	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.
DEFENDED ZONE CENTER	N/A	N/A		Defended Zone Center	N/A	Recommend TACGRP.C2GM.GNL.PNT.REFPNT.NAVREF.

REFERENCES FOR APPENDIX A

A-1. Appendix I of WS-21366/7, "Color Definitions," *Aegis Display System (ADS) Mark 7 MOD 1 − Baseline 7 Phase 1C/1R*, 22 Dec 2003.

A-2. Appendix C of SSDS Mk 2 Mod 12, *Human-Machine Interface (HMI) Software Requirement Specification (SRS)*.

A-3. MIL-STD-6016C, *Tactical Data Link (TDL) 16 Message Standard*, 28 Mar 2005.

A-4. MIL-STD-2525B with Change 2, *Common Warfighting Symbology, DoD Interface Standard*, 7 Mar 2007.

A-5. Winters, J.; Hildebrand, G.; Jones, M.; and White, D., *Tactical Symbology Comparison: ADS/NTDS Symbology and MIL-STD-2525B Common Warfighting Symbology*, NSWCDD/TR-02/46, Jun 2002, Dahlgren, VA.

APPENDIX B—MAP BACKGROUND COLORS AND GRAPHICAL OVERLAYS

The following Red/Green/Blue (RGB) values represent the map colors and graphical overlays used to evaluate symbol colors: Map background colors conform to Aegis Baselines 6.1.7 and 7.1 (Table B-1). Graphical overlays conform to prior color use doctrine for 1/16 dot-fill tactical graphics (Table B-2). Tactical graphical overlays may be created using either dot-fill or transparent graphics. Refer to Reference B-1.

Table B-1. Map Background Colors

Area	RGB	HSL	Yu'v'
Land	85, 87, 71	48, 26, 79	0.33, -0.02, 0.00
Coastal Border*	136, 133, 112	37, 25, 124	0.51, -0.04, 0.02
Territorial Water	62, 62, 65	170, 6, 64	0.24, 0.01, 0.00
Deep Water	70, 70, 70	170, 0, 70	0.27, 0.00, 0.00
* Coastal border did not have an Aegis-specified RGB value.			

Table B-2. Graphical Overlays

Color	RGB	HSL	Yu'v'
Rust	161, 116, 107	7, 57, 134	0.50, -0.04, 0.12
Tan	160, 166, 107	47, 63, 137	0.61, -0.09, 0.07
Green	108, 171, 108	85, 70, 140	0.56, -0.07, -0.12
Aqua-Blue	51, 136, 136	127, 116, 94	0.43, 0.05, -0.20

REFERENCE FOR APPENDIX B

B-1. Appendix I of WS-21366/7, "Color Definitions," *Aegis Display System (ADS) Mark 7 MOD 1 − Baseline 7 Phase 1C/1R*, 22 Dec 2003.

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APPENDIX C—DEVIATIONS FROM MIL-STD-2525

The following list contains deviations between MIL-STD-2525B, with Change 1, and the present *Implementation Guide*. To note, the list contains only those modifications that directly contradict MIL-STD-2525 guidelines or deviate from recommended defaults. Appropriate sections from MIL-STD-2525 and the *Implementation Guide* are indicated.

1. Symbol Colors – Filled Symbols
    a. MIL-STD-2525 recommends default colors for filled symbols, as listed in Section 5.7.2, Table XIII.
    b. The *Implementation Guide* suggests the MIL-STD-2525 color set as the lighter set and recommends allowing the user to decrease the color luminosity levels (refer to Section 5.2.1 of this document) up until the darker set. While the color values suggested differ from those in Table XIII in the standard, they are approved by the provisions set aside by MIL-STD-2525, Section 5.7.2c, allowing for different levels of saturation for an affiliation color to be used, provided sufficient usability testing has been undertaken.

2. Symbol Colors – Dimmed Symbols
    a. MIL-STD-2525 makes no provision for dimming symbols colors.
    b. The *Implementation Guide* outlines specified means for creating dimmed filled symbols (refer to Section 5.2.1.1 of this document).

3. Frame Shape and Affiliation (official change to standard)
    a. MIL-STD-2525 outlines default frames for all symbols across affiliation and battle dimension in Section 5.1, Table 1, which denotes assumed friend, suspect, and pending tracks with a question mark (“?”) symbol affixed to its upper right-hand corner.
    b. The *Implementation Guide* instructs users to denote assumed friend, suspect, and pending tracks with alternating black and white dots for filled symbols and alternating white and ID-colored dots for unfilled symbols (refer to Sections 5.2.1 and 5.2.2 of this document).

4. Symbol Color and Commercial Aircraft (COMAIR)
    a. MIL-STD-2525 only uses four colors to denote affiliation and does not utilize color for platform amplification, but it does permit use of alternative colors for frame or color fill if further discrimination amongst tracks is needed (MIL-STD-2525, Section 5.4.6, paragraph b).
    b. The *Implementation Guide* suggests using the color purple to denote COMAIR tracks. The color purple will be used to fill either unknown-evaluated or assumed friend tracks depending on the watchstander’s OPTASKID Supplement (ID Matrix).

5. Modifier Placement – Text Tags
    a. MIL-STD-2525 (Section 5.4, Figure 3, "Field positions for tactical symbols") recommends text tags to be located at field points G, H, and M, located to the immediate right of the tactical symbol (refer to Figure C-1).
    b. The *Implementation Guide* recommends text tags to be left-justified and located to the immediate right side of the symbol occupying field points G, H, and M. However, in addition to text tags, information such as track numbers, altitude/depth, and Identification, Friend or Foe (IFF) modes will also be co-located at those field points. The placement and order (from top-to-bottom) is specified in Section 5.12.

6. Modifier Placement – Single-letter Modifiers
    a. MIL-STD-2525 makes no recommendation for placement of single-letter modifiers to indicate training tracks, non-real-time tracks, and tactically significant tracks.
    b. The *Implementation Guide* recommends placement of the single-letter modifiers at field position W in the upper left-hand corner of symbol (refer to Figure C-1). The placement of the single-letter modifier will replace the MIL-STD recommendation for Date/Time Group (DTG) information

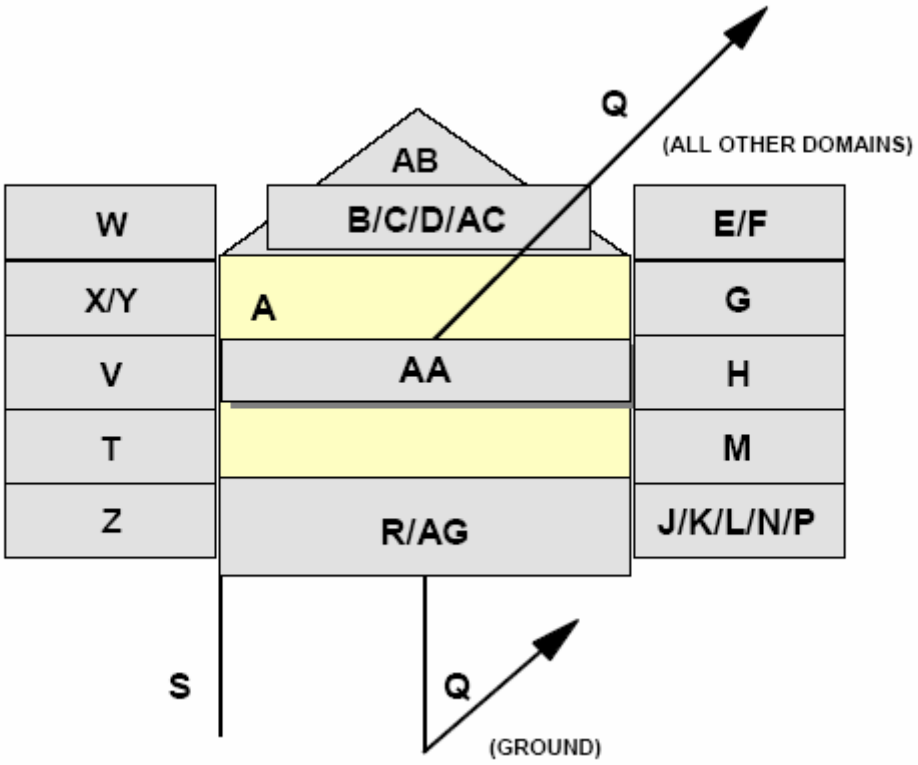


Figure C-1. Field Positions for Tactical Symbols (taken from MIL-STD-2525, 5.4, Figure 3)

APPENDIX D—LUMINANCE/CHROMINANCE VALUES (Yu'v') FOR COLOR DISPLAYS

Yu'v' color set values are derived from normalized Red/Green/Blue (RGB) values ranging from 0 (dark) to 1 (light). Yu'v' values are broken down into Luminance (Y) and Chrominance (u' and v') components. Chromatic blue is represented by u' and chromatic red is represented by v'. Other output color set measures include YCbCR, YPbPr, and YIQ, which are scaled representations of Yu'v'. YCbCR, YPbPr, and YIQ may be used if system specific. The following equations depict the transition from normalized RGB values into the Yu'v' components:

Luminance: $Y = (0.299)R + (0.577)G + (0.114)B$
[Y values range from 0 (dark) to 1 (light)]

Chromatic Blue: $u' = (0.492)*(B - Y)$
OR
$= (0.436)B – (0.147)R – (0.289)$
[u' values range from -0.44 to +0.44]

Chromatic Red: $v' = (0.877)*(R-Y)$
OR
$= (0.615)R – (0.515)G – (0.100)B$
[v' values range from -0.62 to +0.62]

Table D-1 represents corresponding Yu'v' values for filled dark, medium, and light symbols. Table D-2 represents corresponding Yu'v' values for unfilled symbols.

Table D-1. Luminance/Chrominance Values for Filled MIL-STD-2525 Symbols

Affiliation	Dark		Medium		Light*	
	RGB	Yu'v'	RGB	Yu'v'	RGB	Yu'v'
Hostile	200, 0, 0	0.23, -0.12, 0.48	255, 48, 49	0.43, -0.12, 0.50	255, 128, 128	0.65, -0.07, 0.31
Suspect	200, 0, 0	0.23, -0.12, 0.48	255, 48, 49	0.43, -0.12, 0.50	255, 128, 128	0.65, -0.07, 0.31
Friendly	0, 107, 140	0.31, 0.12, -0.27	0, 168, 220	0.49, 0.19, -0.43	128, 224, 255	0.78, 0.11, -0.24
Assumed Friend	0, 107, 140	0.31, 0.12, -0.27	0, 168, 220	0.49, 0.19, -0.43	128, 224, 255	0.78, 0.11, -0.24
Unknown	225, 220, 0	0.77, -0.38, 0.10	255, 255, 0	0.89, -0.44, 0.10	255, 255, 128	0.94, -0.22, 0.05
Neutral	0, 160, 0	0.37, -0.18, -0.32	0, 226, 0	0.52, -0.26, -.46	170, 255, 170	0.86, -0.10, -0.17
COMAIR	80, 0, 80	0.13, 0.09, 0.16	128, 0, 128	0.21, 0.14, 0.26	255, 161, 255	0.78, 0.11, 0.19
* All colors conform to MIL-STD-2525 except for COMAIR.						

Table D-2. Luminance/Chrominance Values for Unfilled MIL-STD-2525 Symbols

Affiliation	Unfilled Color Set	
	RGB	Yu'v'
Hostile	255, 0, 0	0.30, -0.15, 0.61
Suspect*	255, 48, 49	0.43, -0.12, 0.50
Friendly	0, 255, 255	0.70, 0.15, 0.61
Assumed Friend*	0, 168, 220	0.49, 0.19, -0.43
Unknown	255, 255, 0	0.89, -.044, 0.10
Neutral	0, 255, 0	0.59, -0.29, -0.51
COMAIR†	255, 0, 255	0.41, 0.29, 0.51

* Suspect and Assumed Friend Tracks utilize Medium Filled Color Sets (Sect. 5.2.1).
† All colors conform to MIL-STD-2525 except for COMAIR.

APPENDIX E—ALTERNATE UNFILLED COLOR SET

The following unfilled color set should be used as an alternative to the MIL-STD-2525 unfilled color set, as specified in Section 5.2.2 of this document, when full-color gun display options are not permitted. The alternate color unfilled color set has been validated in former studies against Aegis de-saturated backgrounds (refer to Appendix B for Aegis background specifications). Table E-1 depicts the unfilled air tracks across battle dimensions, using the alternate unfilled color set. Table E-2 depicts the alternate unfilled color set for these values: Red/Green/Blue (RGB); hue, saturation, and luminance (HSL); and luminance/chrominance values (Yu'v').

Table E-1. Unfilled Air Tracks (Alternate Color Set)

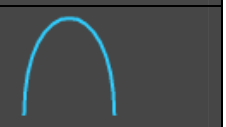
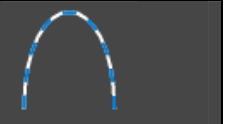
Affiliation	Unfilled Set
Hostile	
Unknown	
Friendly	
Neutral	
Assumed Friend	
Suspect	
COMAIR	

Table E-2. RGB, HSL, and Yu'v' Values for Alternate Unfilled Colors

Affiliation	Alternate Unfilled Color Set		
	RGB	HSL	Yu'v'
Hostile	255, 48, 49	0, 255, 152	0.43, -0.12, 0.50
Suspect*	255, 48, 49	0, 255, 152	0.43, -0.12, 0.50
Friendly	49, 206, 255	138, 255, 152	0.64, 0.18, -0.39
Assumed Friend*	0, 168, 220	138, 255, 110	0.49, 0.19, -0.43
Unknown	255, 255, 0	42, 255, 128	0.89, -.044, 0.10
Neutral	98, 255, 98	85, 255, 177	0.74, -0.17, -0.31
COMAIR†	255, 0, 255	213, 255, 128	0.41, 0.29, 0.51

* Suspect and Assumed Friend Tracks utilize Medium Filled Color Sets (Sect. 5.2.1).
† All colors conform to MIL-STD-2525 except for COMAIR.

APPENDIX F—RECOMMENDED FILTER SETTINGS

Based upon a series of empirical studies and expert usability feedback, using MIL-STD-2525 within an Open Architecture (OA) component symbology filter, the following filtering options are recommended. In total, the following filter setting capabilities are designed to optimize and take advantage of MIL-STD-2525 symbology. Differences between MIL-STD-2525 and current versions of Aegis Display System (ADS)/Naval Tactical Display System (NTDS) and the Ship Self-Defense System (SSDS) symbology sets should preclude merely back-fitting symbol rendering systems to accommodate MIL-STD-2525 symbology. Such measures obviate the advantages of using MIL-STD-2525. Table F-1 lists the suggested global filter settings that will apply to all tracks upon the tactical display. Table F-2 lists the local setting filters for battle dimension, affiliation, and battle dimension X affiliation as well as individual track filters.

Table F-1. Global Filter Settings

Track Characteristics	Filter Settings*	*Implementation Guide* (Section)
Symbol Size	Enlarged Default* Reduced Dot	5.3, 6.3
Frame Color	Black* White	5.2.3, 6.5
Symbol Fill	Filled* Unfilled	5.2.1 – 5.2.2, 6.2
Neutral Notch	Standard Fill* Notch Fill	5.5, 6.12
Symbol Color**	Lighter Set* ⇳ Darker Set	5.2.1, 6.4
Track Tags	On Off*	5.12, 6.7
Speed Leaders	On* Off	5.10, 6.6
Track History	On Off*	6.8
Deemphasized Symbols	Normal* Dim	5.2.1.1, 6.8
Symbol Framing	On* Off	6.9
Icon/Symbol Amplification	TBD	6.10

* Default setting
** Symbol Color may have either continuous or multiple intermittent settings.

Table F-2. Battle Dimension/Affiliation Filters and Individual Track Filter Settings

Track Characteristics	Filter Settings*	*Implementation Guide* (Section)
Symbol Size	Enlarged Default* Reduced Dot	5.3, 6.3
Symbol Fill	Filled* Unfilled	5.2.1 – 5.2.2, 6.2
Symbol Color**	Lighter Set* ⇳ Darker Set	5.2.1, 6.4
Track Tags	On Off*	5.12, 6.7
Speed Leaders	On* Off	5.10, 6.6
Track History	On Off*	6.11
Deemphasized Symbols	Normal* Dim	5.2.1.1, 6.8
Symbol Framing	On* Off	6.9
Icon/Symbol Amplification	TBD	6.10
* Default setting ** Symbol Color may have either continuous or multiple intermittent settings.		

Example screenshots of a prototypical filter's graphical user interface (GUI) are depicted in the figures that follow. Figure F-1 illustrates the top-level GUI, which provides the watchstander a means to make global changes to the symbology as well as make changes across battle dimensions, affiliations, or a combination of the two. Figure F-2 illustrates an example filter menu for rendering all air tracks. Finally, Figure F-3 represents potential tailored settings that may be incorporated into the symbol filter.

Figure F-1. Example Filter

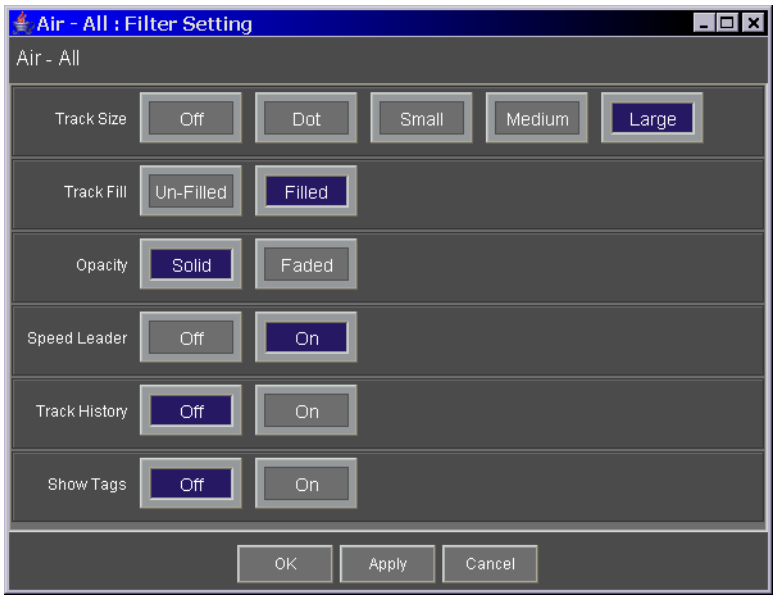


Figure F-2. Example Filter Options

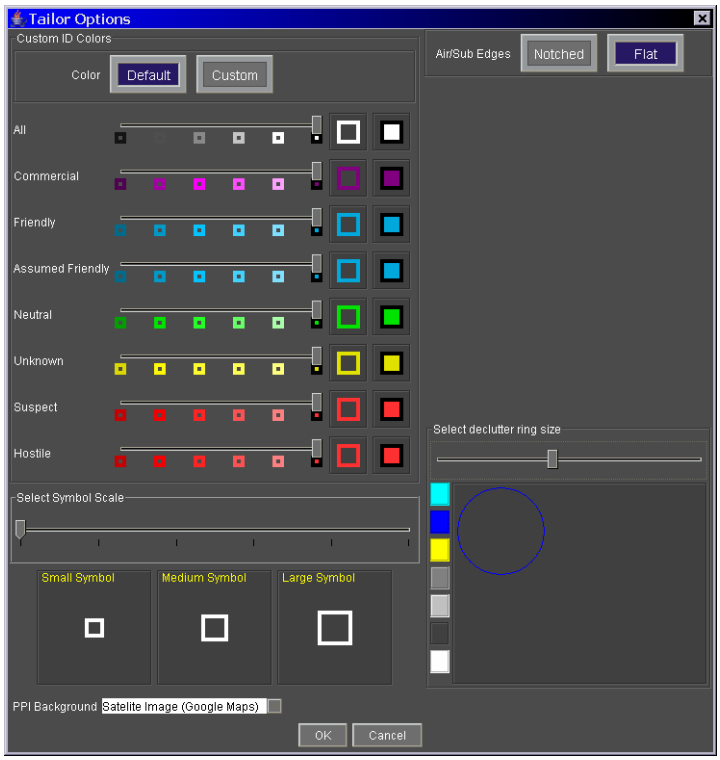


Figure F-3. Example Filter Tailoring Mechanisms

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APPENDIX G—*IMPLEMENTATION GUIDE* REQUIREMENTS TERMINOLOGY

The following requirements terms are hereby specified in order to clearly delineate items within the *Implementation Guide* that range from mandatory to optional.

Shall denotes a requirement that the implementer must provide to the operator.

Shall not denotes an item/method/tool that is prohibited for implementation.

Should denotes an item/method/tool that is to be implemented unless extenuating reasons or circumstances deem it inappropriate or unfeasible.

Should not denotes an item/method/tool whose incorporation is not recommended unless extenuating circumstances or needs dictate its implementation.

May denotes an item/method/tool that is optional for implementation. Items defined as MAY often provide nominal or modest benefit to the operator but are high in terms of implementation costs.

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