

WHITE PAPER

Tactical Display Framework: A Warfighter Benefit Perspective

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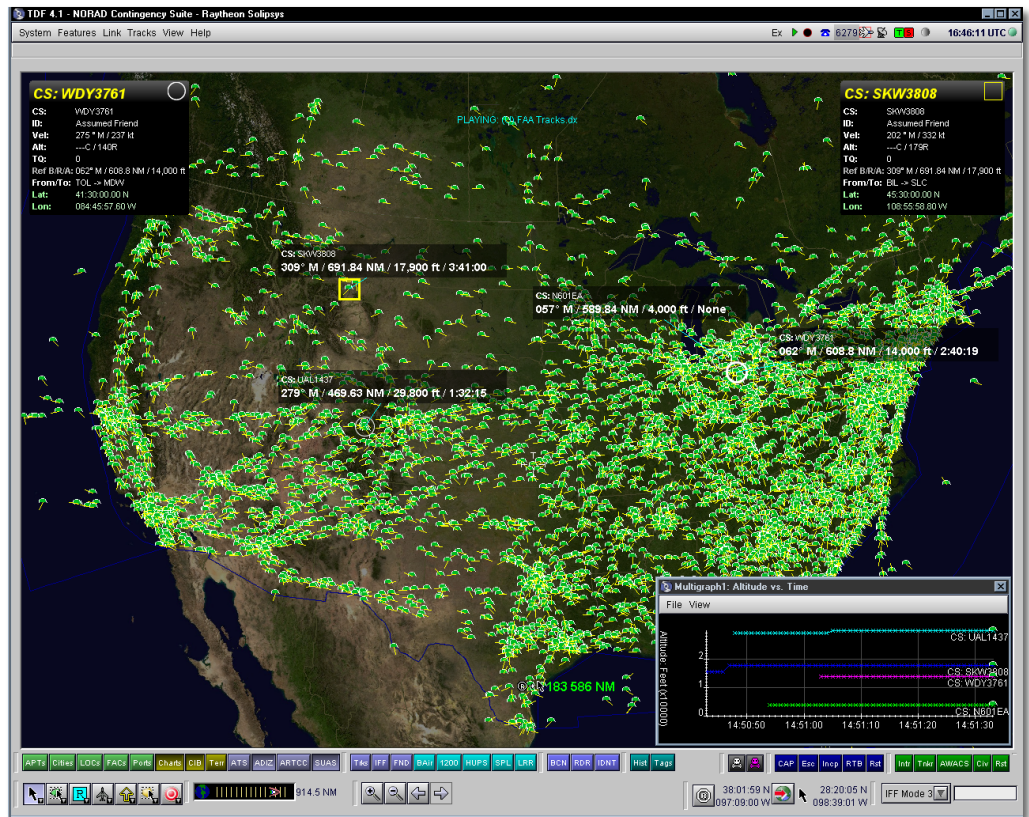
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Introduction

In days past, legacy Command and Control (C2) systems took months to learn, and were difficult to use. They were inflexible and could not be significantly tailored by the end user. They contained data and maps that could not be updated by the user in the field. Legacy C2 systems were not openly extensible by third party developers, and operated on expensive hardware that was often difficult to procure, transport, and maintain.

The good news is, those days are gone – the Raytheon Solipsys Tactical Display Framework (TDF) has revolutionized the way real-time battlespace visualization is performed, and in so doing, has eliminated these previous limitations. Initially employed by the US Marine Corps in

The NORAD Contingency Suite (NCS) TDF; initially fielded in November 2001. In round-the-clock operational use for US air defense by the US Northern Command Joint Operations Center, Cheyenne Mountain Operations Center, Continental NORAD Region, Eastern Air Defense Sector, Western Air Defense Sector, and the Joint Air Defense Operations Center.



1997, at that time TDF represented the first real-time tactical display system built using the Java object-oriented programming language.

Laboratory, Field, and Battle-Tested

Proven to be more efficient and effective than several of its competitors in head-to-head testing, the TDF is a rock-solid, mature application that has proven to be superior in the laboratory, the field, and in battle. Approaching its fifth major product release, the versatile and flexible nature of the TDF as a real-time visualization suite has been amply demonstrated during a decade of successfully developed systems for use in various domains.

With an ever-expanding base of domestic and international customers adding to this list, TDF continues to impress developers and operators alike with its performance, scalability, portability, and rich feature list. The designers of TDF are continually striving to achieve the highest levels of compatibility with widely accepted commercial off-the-shelf (COTS) standards as they emerge and mature in the industry. Extending compliance into the realm of usability engineering, the TDF human-machine interface (HMI) is fully compliant with published USAF Air Combat Command C2 system HMI style and usability guidelines ¹.

WarFighter Benefits

User-centered design and development. The greatest benefit to the warfighter provided by TDF may actually be the most difficult to quantify – the fact that the tool suite itself is the result of countless hours of close collaboration between our innovative engineers and actual users. While the effectiveness of this participative approach to system design and development is well known and documented², in practice it can be a rarity.

We realize that the success of our company is directly tied to the success of the users of our systems; for that reason, the underlying philosophy of development and operation of the TDF reflects the needs of command and control professionals. In short, the TDF is a tool that has been, and will continue to be, built around the warfighter.

Speed & Efficiency

Speed is life. This is true in military aviation, as well as military command and control. It is no longer sufficient to have a system that just performs a single function satisfactorily - it must perform that function swiftly and easily. Built from the ground up to be the most efficient battlespace visualization tool available, the TDF puts all required functionality at your fingertips.

Ease of operation. The TDF's interface is designed to strike a fine balance between power and simplicity, and employs the concept of Direct Manipulation, using the mouse to the fullest extent. This approach ensures that each system we develop has all the functions you need, right where you need them, and in a form that you can quickly understand. Whether available through shortcut toolbar buttons or via right-click context menus specific to the various on-screen objects, all actions are easily learned, readily accessible, and swiftly accomplished. In short, we get the tools out of your way, so you can get the mission done.

Robust filtering. The TDF has been tested with more than 20,000 tracks in the system. In high traffic density environments, it's imperative that you are able to swiftly filter out tracks that do not meet your interest criteria, which naturally varies with each mission. The TDF provides a wide variety of useful pre-built track filter toolbar buttons, and of course also allows you to build your own filters as well.

Lightning-fast search. We know that you need to be able to quickly search for tracks that

¹ Nelson, W.T., & Bolia, R.S. (2005). *Battle management / command and control human machine interface style guide*. Wright-Patterson AFB, Ohio: Air Force Research Laboratory, Human Effectiveness Directorate, Warfighter Interface Division.

² Williges, R.C., Williges, B.H., & Fainter, R.G. (1988). Software interfaces for aviation systems. In E.L. Wiener & D.C. Nagel (eds.), *Human factors in aviation* (pp. 463-494). San Diego, CA: Academic Press.

meet a wide variety of very specific criteria. The TDF's search function is built right into the main display, is simple to use, yet allows you to locate, hook, and offset the scope to display all tracks that meet your criteria, in less than one second after entering the search query.

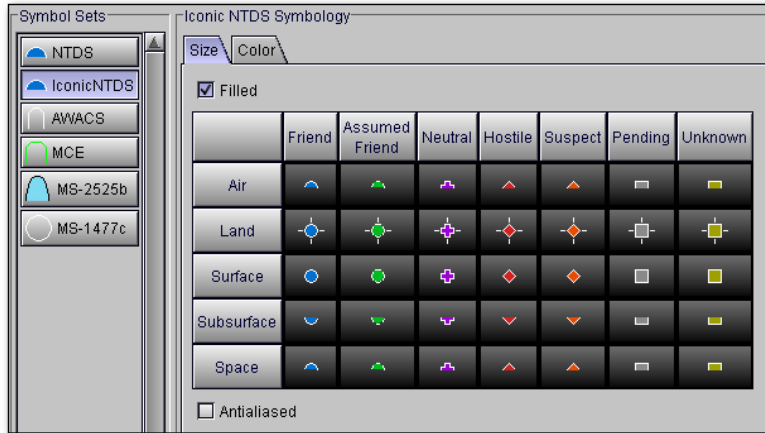
Automation & Customization

Even the most efficient warfighter does not always have time to complete all the preparations for a mission, nor can all mission needs be anticipated in advance. For these reasons, the TDF provides an unprecedented automation and customization capability designed to help you excel in even the most demanding and dynamic operational environments.

Automation support when you want it. When paired with the Raytheon Solipsys Multi-Source Correlator Tracker (MSCT), the system provides highly effective and reliable automated tracking of an entire area of operations. Automatic Identity by origin areas, non-auto tracking zones, data link receive and transmit filters, etc. are easily built, modified or deleted, and serve to reduce operator workload dramatically. Additionally, the TDF's unique Doctrine application provides you the ability to automate most actions that can be performed manually, when triggered by criteria you define; the nearly unlimited possibilities include customized alert messages, automated track actions, identifications, link pairings, etc.

Completely customizable text displays. An effective C2 interface just the information you need - nothing more, nothing less. The TDF stands alone in this area, as all text-based information displays are able to be customized by the end user; the order and type of information, number of lines used, colors, font sizes, number formatting, etc. are all able to be changed on the fly by the end-user to make sure their needs are met. And when mission needs change (as they always do), you can quickly adapt the tool to work in just the way you need it to, simply and quickly.

Flexible symbol sets. The subject of track symbol sets can always be relied upon to spark controversy, as personnel with varied backgrounds naturally prefer the symbology sets they are used to. The TDF eliminates the controversy, allowing the user to select between any of the major symbol sets, including MS-2525b, NTDS, Iconic NTDS, AWACS, MCE, or MS-1477c. Of course, symbols can be extensively customized, including the ability to scale to different sizes, display as filled in shapes vs. wireframe, drawn using anti-aliasing, etc.



Keyboard accelerators. Usability experts report that efficient and effective systems must support workflows for both the novice and the expert user; this process often involves the use of keyboard accelerators³, which allow users to perform actions more quickly as their skills and system knowledge improve. The TDF fully supports this need by allowing single or multiple actions to be accomplished with a single key press.

Robust Training Support

You fight the way you train. We understand the fundamental truth behind this tried and true military axiom. The TDF is Distributed Mission Operations (DMO) capable.

CHARTS & IMAGERY TYPES SUPPORTED BY TDF

- Controlled Image Base (CIB) Imagery
- Compressed ARC Digiitized Raster Graphics
- ARC Digitized Raster Graphic
- Digital Aeronautical Flight Information Files (DAFIF)
- National Geospatial Intelligence Agency (NGA) Vector maps, lines and points
- US Census Bureau Tiger mapping files
- ESRI Shapefile Geospatial Vector Maps
- Tagged Image File Format (TIFF) Georeferenced Raster Imagery
- ESRI ArcIMS Server-based dynamic map services

³ Nielsen, J. (1993). Usability engineering. San Francisco: Morgan Kaufman Publishers.

Accuracy, Coordinate Systems, Maps & Imagery

Ready to deploy. Out of the box, the TDF can be employed anywhere on the planet, since the display automatically models the earth in 3 dimensions, using up to date WGS-84 data, the most accurate model available. In addition, magnetic variation is calculated “on the fly”, and terrain elevation and slope is modeled for the entire globe using Digital Terrain Elevation (DTE) data. All this simply ensures that no matter where you operate, you can be sure you will have the most accurate information possible, with no hassles.

Selectable coordinate systems. We know that depending upon your branch of service, where you operate in the world, and who your coalition partners are, will determine what coordinate system you will need to use. As with all things TDF, you are not locked in to one option; you are free to choose between Latitude/Longitude, Universal Transverse Mercator (UTM), Military Grid Reference Systems (MGRS), and truncated Military Grid Reference Systems (Local MGRS).

Robust map & imagery support. The TDF supports all major map, chart, and imagery types, including all standard National Geospatial-Intelligence Agency (formerly NIMA) map and imagery products as well as ArcIMS server-based services. Even better, we provide you with a utility you can use to easily update or add new charts, imagery etc. in the field, without requiring technical support.

Summary

TDF consistently creates enthusiastic users anywhere it is employed. By now, the reasons for this should be abundantly clear – quite simply, it solves the problems real operators have.

- Where traditional C2 systems take months of training to learn, the TDF’s intuitive interface is easily learned in less than a week.
- Where traditional C2 systems provide access to preset bits of information that are hard coded, the TDF gives the operator the ability to adapt their display to meet changing mission needs. This means that user agencies can spend their development dollars on creating increased combat capabilities, rather than on changing text, colors, or other user preference items.
- Where traditional C2 systems often limit the area of operations to a pre-defined X/Y grid system, the TDF can be used accurately anywhere in the world, and it allows operators to update maps and imagery anytime they need to.
- Where traditional C2 systems operate only on expensive, obscure hardware and operating systems, Java programming allows the TDF to run on standard commercial hardware, and on nearly any operating system.
- Where traditional C2 systems are closed and proprietary, the TDF is engineered from the ground up with an open API, and is easily extended by third party developers for users who require new capabilities.