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BOSS® Capabilities Statement

TDL Testing and Platform Integration

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The BOSS Advantage

TCG BOSS is recognized worldwide as a standard Tactical Data Link (TDL) tool for multi-link certification testing and platform integration. Initially fielded in 2001, the BOSS is Curtiss-Wright's TDL testing and platform integration solution. It allows military end users and prime contractors to verify that the TDL implementations delivered on aircraft and other military platforms conform to Link 16, Link 11, Link 22, Variable Message Format (VMF), Joint Range Extension Applications Protocol (JREAP), Standard Interface for Multiple Platform Link Evaluation (SIMPLE), Situational Awareness Data Link (SADL), Distributed Interactive Simulation (DIS), and related TDL standards and interface definitions.

BOSS is a Microsoft® Windows®-based application suite that simulates and communicates with TDL networks. The BOSS scripts scenarios consisting of simulated tactical elements and then generates the TDL messages associated with the simulated elements. BOSS can interact with other network participants on a live TDL network when configured with a terminal or a radio. BOSS also emulates tactical communication terminals that enable host integrators to verify their application in a fully simulated tactical environment. The BOSS provides comprehensive message scripting and generation, network simulation, real-time and post-test monitoring, and analysis from a single hardware/software system.

Advanced Functionality

BOSS is a full-featured, complete package, including multiple simultaneous terminal/radio control and monitoring, comprehensive data link message processing, validation and management, multi-link routing and forwarding, classified message support, network-enabled weapons, complete command and control (C2) and non-C2 simulation and operational control, automatic message generation, country-wide wide area network (WAN) situational awareness, pilot, and ground training, certification testing and validation.

Robust Simulation and Scripting

This integrated multi-TDL network simulation capability provides industry-leading ease of use, creating complex test cases/scripts in minutes versus hours. The BOSS offers comprehensive online and offline message scripting and generation, network, track, and C2 simulation, real-time and post-test monitoring, and analysis from a single hardware/software system.

Intuitive Operations

The BOSS's familiar Windows-based user interface, combined with Curtiss-Wright's simplified approach to TDL interaction, provides the most intuitive user experience for TDL testing and minimizes training time. An integrated scenario generation and TDL network simulation capability allows a BOSS operator to create complex test environments quickly and easily.

Scripting Test Scenarios

BOSS provides a comprehensive set of functions for creating and managing test scenarios. Test scenarios can be generated online and offline, stored as a file, and executed when connected to a system under test or a live network. Scenarios can also be merged to provide added test environment flexibility. Pre-defined scenarios are modifiable while in real-time mode. Below are samples of some of the scripting features.

- **Simultaneous multi-link operation:** Script events for Link 16, Link 22, and VMF (for example) that can execute at the same time to test multi-network operations as well as single link operations.
- **Configurable TDL Transmission Parameters:** While TDL conventions are relatively standardized, the BOSS allows the user to override principles such as a track's recurrence rate, the Network Participation Group (NPG) on which a message is transmitted, and the packing limit of a message.
- **Comprehensive Message Standards:** BOSS supports both MIL-STD and STANAG specification standards including:
  - MIL-STD-6016 B, C, D, E, F, G (Link 16)
  - MIL-STD-6011 B, C, D (Link 11)
  - MIL-STD-6020 (Forwarding)
  - MIL-STD-3011 (JREAP-A and JREAP-C)
  - MIL-STD-6017 A, B (VMF)
  - MIL-STD-188-220 A, B, C, D Ch1
  - MIL-STD-2045-47001 A, B, C, D Ch1
  - MIL-STD-1553B (1553 Bus)
  - STANAG 5602 (SIMPLE)
  - STANAG 5516 (Ed 3 and 5)
  - STANAG 5522, ATDLP 5.22 (Link 22)
  - MTC v2
- **Track Templates:** This feature allows the operator to create a template object populated with user-specified values for most data fields. Once a template object has been defined, adding it to a scenario either offline or in run-time mode is very efficient.
- **Waypoints/Routes:** The BOSS provides the ability to establish an object's route, including orbits, based on user-defined waypoints in either offline or run-time mode. Operators can modify routes after their creation.
- **Scenario Preview:** Once a complex scenario has been created offline, it is helpful to execute the scenario to determine the location of objects at future scenario times and to synchronize status and command and control messages. The Scenario Preview feature allows the user to fast-forward, execute at faster speeds than real-time, and rewind and replay a scenario.
- **Scenario Summary:** A BOSS scenario can be displayed as a list of time-ordered events, graphically on a map, or both. The time-ordered events list can be commented on for ease of use and efficiency.
- **Scripted Message Interface:** The BOSS can create J-series, F-series, FJ-series, M-series, and K-series messages through Link 11, Link 26, Link 22, and VMF message definition windows. This interface allows the user to test unused message fields, out of out-of-range values, and bypass data link transaction rules to support very detailed testing and even negative testing.

Network Simulation and DIS/SIMPLE

BOSS offers the flexibility to create and transmit TDL messages in accordance with the message specifications (or that violate the specifications). It is a powerful network simulator that creates complete and very realistic test environments that can include virtual C2 assets, targets, threats, and simulated network participants. The BOSS provides a sense of realism without the reliance on low-density, high-demand assets such as airborne early warning (AEW) platforms, tanker aircraft, and intelligence, surveillance, and reconnaissance (ISR) participants.

BOSS can be configured to provide a gateway between an external source of simulated data and any supported live or simulated tactical data link. The BOSS supports the DIS and SIMPLE protocols for exchanging simulation data. The BOSS translates the information received from the simulation interface to the appropriate TDL message(s) and transmits them to the proper terminals and radios, following all applicable rules and protocols. The BOSS can also enhance the external simulation data by using its network simulation capability to provide additional information or test cases that are not available via DIS, such as mode codes and activity information.

Comprehensive Simulation & Scenario Management

BOSS provides a comprehensive set of functions for creating and managing test scenarios. The BOSS can accurately recreate the multi-tactical digital information link (TADIL) network traffic representing multiple C2 and non-C2 platforms, including network-enabled weapons and ballistic missiles. It also offers surveillance, command and control, and electronic warfare (EW) features. The BOSS contains a flexible test control mechanism and provides operator interaction for a wide variety of tactical transactions.

BOSS can define multiple discrete test cases to create complex scenarios. Data link messages may be spawned by the activity of simulated track objects or directly scripted via operator actions.

Detailed Test Scenarios

By allowing a BOSS operator to create and run realistic and detailed test scenarios containing virtual network entities and their associated message transactions that exhibit the same behavior as an actual live TDL network, the BOSS provides a high-fidelity test environment for the system or platform under test. The BOSS accomplishes this by allowing the user to define events that will result in the transmission of data link messages in accordance with the message and interface standards. This capability enables the BOSS to be used in several test capacities, such as laboratory platform integration, depot-level maintenance, training, development, and operational field testing or TDL system certification.

“Negative Testing”

In addition to creating scenarios that meet the rules of the various data links and interfaces, BOSS allows the tester to create erroneous and undefined message traffic to test a platform’s ability to handle unexpected or malformed data (“negative testing”).

Scenario Rehearsal

BOSS scenarios may be created before an exercise or test and saved to a file. A scenario consists of a series of time-ordered events. The BOSS provides a Preview Mode that allows scenarios to be tested and rehearsed before introduction to a formal test or exercise.

Data Injection

During scenario execution, as the events occur, a BOSS operator may also inject new data or modify data related to one or more of the scripted events. New objects that have a velocity component can be given a route or set of waypoints during the object’s definition on the BOSS’ tactical display. The operator then receives controls to start a scenario immediately or at an operator-specified future time. The operator can pause, restart, and stop the scenario at any point during its execution.

Scenario Construction

Scenarios are constructed in Design Mode, using the Map View or List View (or both simultaneously). To begin executing the scenario, the operator enters Run Mode. To perform the scenario without sending anything on the data link, they use Preview Mode. Preview Mode allows them to preview an entire scenario at any desired speed or only a portion of it.

Operator-Defined Tactical Objects

A tactical scenario contains operator-defined tactical objects. These objects may be any type (e.g., air, land, surface, subsurface, space, reference point, EW) defined in the Link 16, Link 22, Link 11, and VMF catalogs. The operator may define trajectories for moving objects consisting of flight segments and waypoints.

Track Management

The BOSS implements the MIL-STD-6016/MIL-STD-6011 surveillance track management rules to include reporting responsibility, drop track, difference reports, change data orders, emergency and force tell indicator changes, strength changes, and exercise status order functions. For Link 22, the BOSS implements STANAG 5522. For VMF, the BOSS implements MIL-STD-2045-47001 and MIL-STD-6017. Users may override reporting responsibility rules and stale out times to provide flexibility.

Configurable Transaction Processing

Many C2 to non-C2 message transfers require subsequent messages to be transmitted and states to be shifted. It is difficult for an operator to know the appropriate messages, associated fields, and conditions under which the state or new message should be generated, especially if required in real-time. Thus, the BOSS can generate these transactional messages according to both MIL-STD and STANAG specifications. Each message sequence is configurable to provide maximum flexibility.

Multi-Platform Emulation

BOSS simulates multiple TDL-enabled platforms and the TDL-related activities the platform may encounter during its operational missions. BOSS can create these network entities and pre-script their planned activities. During the test, the operator can allow these activities to occur as scripted or interactively activate some or all of the pre-scripted events. The platform can interact with other TDL network entities by engaging these techniques to ensure interoperation when fielded.

Tactical Display

The BOSS Tactical Display provides a robust, flexible, and realistic background that supports various map types and projections. Below are some of the tactical display features.

- **Imported Maps and Overlays:** The BOSS supports vector maps and digital raster map formats. The BOSS comes with a vector map and a raster image of the entire world. The user is encouraged to load additional maps in formats such as CADRG, JPEG/JPEG2000, TIFF/GeoTIFF, bitmap, and portable network graphics. The user can overlay maps on top of each other and vary each map's opacity to maximize the display characteristics of each map type.
- **Annotation Editor:** The tactical display includes a rich editing capability consistent with industry-standard drawing packages. Annotations can be saved, merged, or deleted and preserved by the BOSS installation application upon software installation updates.
- **Pairing Lines:** Generally referred to as pairing lines, mission status is reported by several data link messages, and all have unique meanings. In addition to tabular displays, the BOSS will display a unique colored and symbolized line for target sorting, engagement status, pairing, and associations reported on the data link.
- **Customizable Display:** The BOSS Tactical Display provides many options to display entity-related data. Customizable data blocks, standard or customizable color schemes, a track summary window, or one of several other methods can display track data.
- **Context Sensitive Help:** The BOSS directly links its software application user manuals to each application and dialog window. Upon selecting the Help control or accelerator, the applicable user manual opens to the exact section describing the context dialog.

Real-Time Monitoring/Scenario Control

BOSS provides many features and tools for efficient situational awareness, real-time message generation, and data analysis. Some of the most used features include:

- **C2 and non-C2 Control Panels:** This feature combines all the commands (control, handover, mission assignments, etc.) and mission status between a C2 and non-C2 participant on one window. As a result, the Control Panel provides a consolidated display illustrating the message communication between participants and their real-time status. The Control Panel layout is customized to the participant's function (C2 or non-C2).
- **Mission Assignments/Commands:** These standard C2 orders include many field restrictions derived from approximately 40 discrete values. The BOSS consists of a user interface that populates the required fields based on each discrete value and the entities addressed in the order. Once again, the BOSS gives the users greater flexibility by allowing them to override the data or even derive it in real time if the data link receives more recent target data.
- **Track History:** The BOSS allows the operator to denote an entity as a special interest object. Once denoted, the BOSS will record the time and events for significant changes to the entity, such as course, speed, altitude, and identity. For non-discrete parameters, the BOSS provides a user-configurable threshold value. The BOSS will display any of these events graphically if the user chooses.
- **Data Recording and Display:** The Data Extraction and Reduction Guide (DERG) is the standard by which the BOSS records and displays data link messages. The BOSS records all message traffic it transmits and receives in a DERG-formatted disk file. The Link Message Analyzer (LMA) is the BOSS tool that displays the recorded data in real-time or offline. Both modes offer numerous filtering and display options. Real-time mode provides additional message statistics.
- **Remote Track Status:** The BOSS provides a concise summary window detailing the status of all remote objects on the data link. The window is configurable and includes such fields as source track number (TN), reference TN, voice call sign, position/time/track quality, time since the last report, etc. This summary window helps monitor any participant's link status and the network's stability and quality.
- **Scenario Manipulation and Execution:** The BOSS offers flexible scenario execution options, including the ability to pause and resume a scenario execution, schedule the start of a scenario for a time in the future, and display real-time remote entities without executing the scenario. The BOSS also allows the user to add, delete, and modify scripted scenario events on the fly as test or training situations demand changes to execution plans.

Mission Playback

The BOSS provides a mission playback capability to support post-test analysis of mission debriefs. In this mode, the BOSS utilizes the recorded DERG file to replay the mission events and graphical display precisely as they occurred in real-time. The user is provided with controls to pause/resume, fast forward, rewind, and control the replay's speed (faster/slower).

Specialized Capabilities

Over the years, Curtiss-Wright has added many unique capabilities to TCG BOSS to meet evolving customer requirements. For example:

- **Imagery:** The Imagery option for the BOSS allows operators to transmit and receive imagery data over Link 16 using the J16.0 message. This option enables creating, modifying, and viewing National Imagery Transmission Format (NITF) files containing JPEG images. Further, the BOSS provides complete control over the transmission requirements, including the choice of one-way or two-way protocol transfer, a selection for the packet acknowledgment interval, and the recurrence rate for the data packet messages. As an advanced test capability, the BOSS provides a robust mechanism for users to exercise the dropped packet protocol processing of the system under test by allowing the user to skip up to 15 sets of data packets intentionally.
- **Link 16 Correlation:** Correlation processing consistent with the rules defined in the Link 16 standards has been implemented in the BOSS. All correlation parameters are configurable to meet the varied test needs, and the user can enable or disable the correlation algorithm.
- **Range Training Officer Display:** The BOSS provides a specialized display to aid in a Range Training Officer's (RTO) role in a "red/blue" fighter aircraft exercise to help make a "kill/no kill" determination from the data available on Link 16. At the time of a missile shot, the RTO display will provide data link information on the shooter and target, including aspect angle and bearing range, for a bullseye location.
- **Pseudo-local tracks:** The BOSS allows injecting a surveillance track on a "blue network" derived from a "red network" precise participant location and information (PPLI) or target sorting entity. In a red vs. blue training environment where the two networks are separated by net number, the BOSS provides a surveillance track on the red PPLI without having local sensor data. It dramatically enhances live training as the blue aircraft's sensors can correlate the target reported in the surveillance track provided by a BOSS with a physical object.

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External Interfaces

BOSS supports a wide range of external interfaces, extending the range of the data link. BOSS includes a graphical, dynamic routing capability supporting unidirectional and bidirectional routing between external interfaces, including filtering by message type and data source. BOSS also supports forwarding between networks, according to MIL-STD-6020. Some of the external interfaces include:

- **JREAP:** The BOSS supports the JREAP for the reception, generation, and forwarding of J-series messages to remote JREAP-capable processors over IP-based networks (MIL-STD-3011).
- **SIMPLE:** SIMPLE is a NATO Standardization Agreement (STANAG) specifying a standard for interfacing test rigs for TDL interoperability testing. The BOSS implementation can process Link 11, Link 16 messages, and Link 22 using a virtual network connection or operating as a terminal/DTS emulator. It supports SIMPLE packet types 1, 2, 61, 62, 63, and 65 over IP.
- **Socket J:** The BOSS can interface to an external Socket J-capable system over an Ethernet connection using TCP/IP. Operators can use this interface to exchange J-series messages using the MTDS/MTC protocol. The BOSS can establish and maintain a Socket J connection as either a client or server.
- **Serial J:** The BOSS can interface to a remote, Serial J-capable system over an asynchronous serial line via a null modem setup or attached to a Secure Terminal Equipment (STE) data modem connected to a Public Switched Telephone Network (PSTN) to exchange J-series messages.
- **DIS:** The BOSS allows participation in a DIS network. The BOSS supports entity, state, signal, and transmitter Protocol Data Units (PDUs). The BOSS routes locally simulated data to the DIS network, route live Link 16 data to the DIS network, and route received DIS data to the Link 16 network.
- **ADS-B:** The BOSS supports the Automatic Dependent Surveillance-Broadcast (ADS-B) data stream. The BOSS correlates ADS-B tracks with Link 16 tracks and can process the ADS-B data in a passive or active mode. In passive mode, the ADS-B data is received, processed, correlated, and displayed on the tactical display. In active mode, the track data is also transmitted onto the Link 16 network. ADS-B navigation integrity category data is also mapped to the Link 16 track quality.
- **AIS:** The BOSS supports reception and display of Automatic Identification System (AIS) surface tracks. AIS tracks can be translated into Link 16 tracks and transmitted on the Link 16 network. The BOSS correlates AIS tracks with received Link 16 tracks to eliminate the transmission of duplicate tracks.

Worldwide Deployment

More than 450 BOSS systems are deployed and in operation worldwide in the U.S. and more than 10 countries. Certification and testing agencies such as JITC, AFSIT, AF DT/OT (46th, 412th), and Navy (China Lake, SAIL, NELO) use the BOSS as the standard for simulation and testing of other platforms. Prime contractors like Boeing, Northrop, and Lockheed also use the BOSS for platform integration and simulation.

Constant Improvement

The BOSS will continue to improve and evolve as technologies, network architectures, U.S. and international TDL standards, and new applications emerge. The BOSS keeps pace with its infusion of interfaces supporting various protocols. LinkPRO®, BOSS's embedded data link processor, is constantly updated to incorporate the latest MIL-STD Interim Change Proposals (ICPs). User suggested enhancements are captured during annual user-group forums, site visits, exercises, and joint testing events.

Product Support

Curtiss-Wright provides full support options for TCG BOSS. On-site installation and training are available, and the BOSS User Manuals provide detailed instructions. The BOSS comes with a six-month warranty. A comprehensive maintenance package covering tech support, software updates, and site visits is also available.

Product Support Silver, Gold, and Platinum Plans

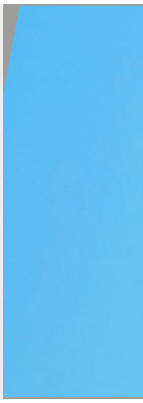
Each BOSS comes with an initial six-month hardware and software warranty. Additionally, the annually renewable product support plan is a fixed-price subscription plan and can cover all systems at the client's site. The plan provides for product support, extended hardware and software warranty, and one year of software updates. For example, the Gold Plan offers unlimited help desk support and one site visit for up to three days. The site visit can accomplish many things, including but not limited to software installation and refresher training. The plan can be modified to provide for increased support to suit custom requirements.

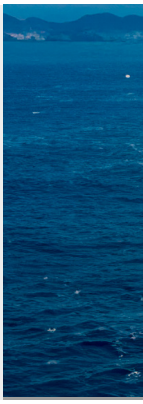
Technical Support Hotline

Unlimited technical hotline support for BOSS technical or troubleshooting issues is included in the maintenance support plan. Remote support for test and operations is available on request. The technical support team follows an established process to ensure timely resolution of customers' technical issues. Working with program managers, engineering, contracts, quality assurance, operational support, and senior management, the technical support team coordinates a response to customer support inquiries related to Curtiss-Wright systems and products, including software, hardware, training, application, network connectivity, and operations. Our technical support team prides itself on excellent customer relationships.

BOSS at a Glance

BOSS Capabilities and Features	Terminal and Interface Support
▪ Link 16, Link 11, Link 22, and VMF data links ▪ Multi-link message processing ▪ Tactical situational display ▪ Track & message simulation ▪ Offline & Sim-over-Live scenario generation ▪ Live-Virtual-Constructive (LVC) ▪ RF and IFF processing ▪ Range training officer support ▪ Record/playback ▪ Remote client/server support ▪ Real-time Pseudo Track support ▪ Terminal Control Wizard (TCW) ▪ Full terminal control & emulation ▪ Network monitoring ▪ Network Time Reference (NTR) ▪ Multi-terminal control ▪ Network Enabled Weapons ▪ Dynamic message routing ▪ Maintaining mission objects ▪ Desktop, laptop, or rack mount	▪ Link 16 MIDS LVT1 ▪ Link 16 MIDS LVT2 ▪ Link 16 MIDS LVT3/FDL ▪ Link 16 MIDS JTRS ▪ Small Tactical Terminal (STT) ▪ TacNet Tactical Radio (TTR) ▪ Link 22 SNC/LLC ▪ Link 11 ATDS/NTDS ▪ Combat Net Radio (CNR) ▪ JREAP-A & JREAP-C ▪ Socket-J & Serial-J ▪ Link 11 DTS ▪ SADL ▪ SIMPLE ▪ DIS ▪ ADS-B ▪ AIS





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