

Joint Tactical Radio System (JTRS) Network Enterprise Domain (NED) Network Managers

Executive Summary

- The Joint Tactical Radio System (JTRS) Wideband Networking Waveform (WNW) Network Managers (JWNM), the Soldier Radio Waveform (SRW) Network Managers (SRWNM), and the JTRS Enterprise Network Manager (JENM) allow signal personnel to manage the networks of JTRS software-defined radio sets.
- Of the JWNM management functions (planning, monitoring, controlling, and reporting), testing primarily examined the planning and monitoring functions.
- Review of JWNM and SRWNM training materials and observation of planning exercises indicate that certain planning tasks are burdensome and prone to errors. A highly skilled user with the intended military occupational specialty is able to develop the plan, enter it into the system, and correct errors. However, the available personnel within the unit for the test events often are not at the skill level designated in the training materials.
- The JWNM monitoring function tested in the Army Network Integration Evaluation (NIE) 11.2 did not meet the operational needs of the users, with software performance hindering system use. Software performance problems included user concerns with timeliness and accuracy of displayed information and system slowdowns and lockups requiring routine hard reboots.
- Without an independent means of determining the actual status of the radios (e.g. if the radio is on or off and where the radio is located) and how the WNW network is performing (e.g. what radios are currently connected), the accuracy of the JWNM monitoring function cannot be determined.
- The SRWNM IOT&E analysis is not complete. Initial observations are that unit signal personnel can load a communications plan on the SRWNM, create the mission data set file, and load it on the Rifleman Radios. This took several days longer than planned. Causes will be identified when the test data are available for analysis. Lessons learned from the testing conducted show the program manager and test community need to develop a better T&E methodology for JWNM, SRWNM, and JENM that clearly establishes the needed level of developmental test, trials, and scoring criteria. Additionally, results identify the data collection tools needed to assess the accuracy of all management functions and determine the readiness to enter operational test.

System

- JTRS Network Enterprise Domain (NED) software applications allow the JTRS software-defined radio sets to provide communications to tactical forces. The software applications include waveforms, enterprise networking



- services (route and retransmission among waveforms), and enterprise network management.
- The waveforms and enterprise networking services software are integrated into and are considered part of a JTRS radio set, and their performance is part of that reported for the JTRS Ground Mobile Radio (GMR); Handheld, Manpack, and Small Form Fit (HMS); and Airborne, Maritime, and Fixed Station (AMF) radio products.
- The enterprise network management software is separate from the JTRS radio sets and is deployed on designated commercial off-the-shelf laptop computers.
 - The current network manager products are: JWNM for managing WNW networks; and SRWNM for managing SRW networks of JTRS software-defined radio sets.
 - In FY12, the JENM is intended to integrate the JWNM and SRWNM onto a single laptop computer.
 - Enterprise network management functions include planning, monitoring, controlling, and reporting:
 - The planning function develops the network parameters and creates a Radio Mission Data Set file that loads into and configures the GMR, HMS, or AMF radio sets.
 - The monitoring function provides a near-real-time display of the WNW or SRW network status and the conditions of the radios.
 - The control function allows the signal officer to make changes to the network, to include sending commands to the radio operator, changing the configuration parameters of the radio sets, or conducting cryptographic functions (rekey, zeroize, and transfer).
 - The reporting function records all network management events and makes the data available for analysis.

Mission

- Forward-deployed military forces use JTRS radios to communicate and create networks to exchange voice, video, and data during all aspects of tactical military operations.
- Signal staffs use the JWNM and SRWNM to plan, monitor, control, and report on network operations involving JTRS GMR, HMS, and AMF software-defined radio sets running WNW and SRW.

Major Contractors

- The Boeing Company, Phantom Works Division – Huntington Beach, California (the JWNM and JENM developer)
- ITT Electronics Systems Division, Clifton – New Jersey (the SRWNM developer)

Activity

- DOT&E approved the JTRS NED Test and Evaluation Master Plan (TEMP) in July 2011. Shortly after the TEMP was signed, the Nunn-McCurdy actions related to GMR delayed the Milestone that the GMR test event was to support. The Rifleman Radio test events were accelerated from December 2011 to October 2011, and the HMS Manpack radio events were also accelerated.

JWNM

- JWNM developmental testing occurred during the following test events:
 - The JTRS GMR System Integration Test extension conducted by the Army's Electronic Proving Grounds in September and October 2010 at Fort Huachuca, Arizona.
 - The JTRS GMR Field Experiment 5 conducted by the Army's Electronic Proving Grounds in February and March 2011 at Fort Huachuca, Arizona.
- The JWNM also completed a Customer Test with the GMR during the Army NIE 11.2 event in June and July 2011 at White Sands Missile Range, New Mexico. Units participating in NIE 11.2 only monitored GMR/ WNW networks. There was no Soldier planning activity in support of the GMR Customer Test; the program office developed and loaded the Radio Mission Data Set files onto the radios.
- Following the GMR Customer Test, the NIE 11.2 Capstone event took place, which was not part of the formal test. Soldiers did develop a network plan for the Capstone event, entered it in the JWNM, and monitored the set-up of the GMR network.

SRWNM

- The SRWNM completed two government developmental tests in August and September 2011 at Fort Huachuca, Arizona, to examine technical readiness for OT&E, and had its IOT&E conducted during the JTRS Rifleman Radio IOT&E in October and November 2011.

JENM

- The JTRS NED Program Office continues development of the JENM, which will integrate the JWNM and SRWNM into a single network management product in FY12.

Assessment

- There are lessons learned from ongoing JTRS NED testing that need to be applied to future events. Without an independent

- means of registering the true status of JTRS radios using WNW or SRW, the accuracy of the JWNM monitoring function cannot be determined. In addition, the program manager and test community have not agreed on a deliberate, integrated test process to properly test and assess the myriad of capabilities provided by the JWNM, SRWNM, and JENM software. The TEMP outlines a general plan for test, but the reality of execution has not met the proper level of rigor.
- To date, the testing has been mostly demonstrations of various capabilities with very limited instrumented data collection. There is a close link between radio performance, waveform performance, and the network manager performance. More deliberate testing and data collection that can separate JWNM or SRWNM performance deficiencies from radio and waveform problems are needed.

JWNM

- JTRS Field Experiment 5 examined the JWNM planning and monitoring functions for WNW networks for GMR radios, as well as limited experimentation with control functions.
 - Planning: Subject Matter Experts from the Army Signal Center completed two of the three planning types during the pilot of the JWNM training. Planning software was considered intuitive, but not flexible enough to support changes to the plan.
 - Monitoring: The monitoring function exhibited latency of up to 15 minutes in displaying updates and differences between displayed status and radio properties. It is unclear what the cause is for the delay – breakdown of the network over time, waveform problems, and/or reporting parameters selected.
 - Control: Over-the-air zeroization (rendering the radios non-functional) met the 3-minute requirement. Other control functions, such as changing the frequency used by WNW subnets, updating the Simple Network Management Protocol, commanding a GMR to only receive messages, changing the presets on the GMRs, and disseminating revised Radio Mission Data Set files, demonstrated mixed performance results.
- JWNM training for Field Experiment 5 did not provide procedures to troubleshoot, determine, and inform the operators regarding appropriate WNW/GMR parameter changes. Sparing for JWNM components and maintenance

concepts for JWNM are unknown. Problems with loading the JWNM software caused the laptops to freeze up and required operators to restart the computer. This frustrated the operators and delayed completion of the network plan. The program office identified the root cause and a fix.

- The GMR Customer Test during NIE 11.2 examined JWNM monitoring of WNW networks of GMR radios. The program office ended up performing the planning activity instead of the units participating in the NIE.
 - Review of the JWNM training materials and observations of the planning exercises indicate that certain planning tasks are very burdensome, prone to errors, and may be beyond the anticipated skill and knowledge levels of available signal personnel in a unit. Personnel with the military occupational specialty and skill levels consistent with the intended audience of the training material performed much better. Procedures and possibly special aids have to be devised. Soldiers stated that understanding WNW and JWNM configuration information was critical to effectively manage the WNW network and that training must include practical hands-on exercises.
 - The monitoring function did not meet the operational needs of the users. Software performance problems with timeliness and accuracy of displayed information and the routine use of hard reboots to resolve system slowdowns and lockups hindered system use. Personnel were also distracted from using the JWNM during the event due to the need to operate other systems participating in the NIE.

SRWNM

- SRWNM developmental testing confirmed the capability to plan networks, create mission data sets, and then load mission data sets for the Rifleman Radios loaded with the SRW waveform. The Army has determined there is no requirement for SRWNM to monitor the Rifleman Radio/SRW network, so this function was not demonstrated in the Rifleman Radio IOT&E.
- Observation of SRWNM training for the SRWNM IOT&E indicates that aspects of the planning process are burdensome, prone to errors, and might be beyond the

anticipated skill and knowledge levels of typical signal personnel within a unit. Personnel with the intended military occupational specialty and skill levels as identified in the training package perform much better.

- The SRWNM IOT&E took place as part of the JTRS Rifleman Radio IOT&E. Analysis of the data is not complete. Initial observations are that unit signal personnel can load a communications plan on the SRWNM, create the Mission Data Set files, and load the Rifleman Radios. However, completing this process took several days longer than planned. Identifying causes for the process delays will be accomplished when the test data are available for full analysis.
- The original network structure for the SRWNM IOT&E focused on the Rifleman Radio architecture and did not include the Manpack radios. As a result, a new network plan had to be developed and loaded onto the radios highlighting the importance of network planning from both a detailed understanding of networking waveforms and operational needs.

Recommendations

- Status of Previous Recommendations. This is the first annual report for JTRS NED.
- FY11 Recommendations.
 1. The program manager should test all network management functions to include having representative users plan and manage networks of size and complexity commensurate with those envisioned for the WNW and the SRW.
 2. The program manager and test community should develop an integrated T&E methodology for JWNM, SRWNM, and JENM to establish the needed level of developmental test, trials and scoring criteria, and data collection tools needed to assess the accuracy of all management functions.
 3. The program manager should use lessons learned from JWNM and SRWNM testing to assess the skill levels needed to operate the systems, improve the training packages, and increase the flexibility of the system software.

DOD PROGRAMS