

# The navy multiband terminal



The Navy Multiband Terminal (NMT) Program is the next generation maritime military satellite communications terminal. The NMT Program is the required Navy component to the Advanced Extremely High Frequency (AEHF) Program for enhancing protected and survivable satellite communications to Naval forces. NMT multiband communication capabilities will communicate via two way Ka-Band on Wideband Global Satellite Communication (SATCOM) (WGS) and shipboard and submarine terminals to communicate with X-Band using the Defense Satellite Communications System (DSCS) and WGS.

NMT will operate in the Extremely High Frequency (EHF)/AEHF Low Data Rate (LDR), Medium Data Rate (MDR), and Extended Data Rate (XDR) communication modes and will sustain the Military Satellite Communication (MILSATCOM) architecture by providing connectivity across the spectrum of mission areas to include land, air and naval warfare, special operations, strategic nuclear operations, strategic defense, theater missile defense, and space operations and intelligence (1).

The NMT system will replenish and improve on the capabilities of both the Military Strategic and Tactical Relay (MILSTAR) system and WGS system by equipping the warfighters with assured, jam resistant, secure communications. The AEHF system will provide crosslinks within the constellation as well as between AEHF satellites and MILSTAR satellites in the backwards-compatible mode. Mission requirements specific to Navy operations, including threat levels and scenarios, are contained in the AEHF ORD. NMT will be a FORCEnet enabler by providing critical protected bandwidth for war fighter information services (3).

The NMT is the fourth iteration Navy EHF terminal being designed to communicate with the AEHF satellites, as well as existing EHF on-orbit capable satellites. The NMT is designed to replace existing submarine and shipboard SATCOM terminals with a single terminal, reducing the space and complexity of on-board antenna systems. The NMT system provides an increase in single service capability, increases the number of coverage areas and retains Anti-Jam/Low Probability of Intercept (AJ/LPI) protection characteristics.

During performance verification tests NMT capabilities demonstrated included both network and point-to-point communications at data rates up to 8.2 Mbit/sec; nanosecond timing of antenna handovers under harsh at-sea conditions; and the validation that the system operates on polar-inclined orbit satellites to provide full global connectivity for naval platforms (2). The system is capable of maintaining connectivity in weather conditions up to Sea State 6. There are three variants: terminals for shore stations, surface platforms and submarines.

The surface platform variant has either a 1.5 or a 3m dish antenna, depending on the size of the platform. The below-deck equipment fits in a single cabinet. For submarines the equipment will interface with existing mast and periscope antennas. Raytheon is also exploring the possibility of producing a non-EHF variant. NMT will provide deployed Naval Commanders with secure, protected, command, control and communications capabilities and will support the exchange of tactical data, imagery, real-time video, battlefield maps and targeting information.

The NMT will provide physical and electromagnetic survivability, resistance to jamming and Electromagnetic Interference (EMI), and Low Probability of Intercept (LPI)/Low Probability of Detection (LPD) capabilities against current and projected threats (1). NMT is an advanced software architecture that will allow the U. S. Navy to substantially increase bandwidth and data throughput of its satellite communications systems, and serve as a bridge to the next generation capabilities.

It is anticipated that the NMT, with minor modifications, will also be able to communicate with the future Transformational Satellites (TSAT), in support of Transformational Communications (TC). The Navy has a current requirement for the development/procurement of 44 Navy Multiband Terminal (NMT) -International Partner Variant (IPV) terminals, to satisfy signed Foreign Military Sales (FMS) cases for Canada, The Netherlands and the United Kingdom.

The prime equipment inventory at Full Operational Capability (FOC) will consist of 131 Ships, 74 Submarines, 32 Shores, eight Trainers and five Test systems, based on the JAN 2012 NCCA Cost Estimate results (3). NMT is an ACAT IC acquisition program. The Assistant Secretary of the Navy (Research, Development, and Acquisition), who is also the Navy Acquisition Executive, is the milestone decision authority for the development and procurement of this program. The Program Executive Office for Space and Naval Warfare Systems Command manages this program. The Navy uses a database called Dashboard to help manage the Navy programs.

Navy Multiband Terminal concept exploration contracts were awarded in FY 2001. Two System Development and Demonstration (SDD) contracts were competitively awarded in FY 2004 for the development and demonstration of four prototype terminals per vendor (eight total) to Raytheon and Harris. In FY 2007, a firm fixed price contract was awarded to Raytheon for the development, demonstration and procurement of 20 Engineering Development Models (EDMs) which incorporated integrated multi-band capabilities for Q/Ka band, Submarine X-Band, and Ship X/Ka frequency band communication requirements.

Overall program efforts include investigation of emerging technologies through study, development, and associated testing for feasibility of satellite communications-related program insertion. They also include first and second phases of Navy Multiband Terminal development for System Design and Development (SDD) for ship, shore, and submarine platforms. The NMT Acquisition Strategy (AS) was prepared for Milestone B and signed on July 21, 2003 by ASN (RD&A). Milestone B was approved by ASN (RD&A) on October 21, 2003. ASN (RD&A) approved a Milestone C in the Acquisition Decision Memorandum (ADM) on August 25, 2010.

With the initiation of its Low Rate Initial Production (LRIP), the Navy Multiband Terminal program began Production Year (PY)-1 procurements in the last quarter of FY 2010, with an authorization of 90 units (65 for the NMT program and 25 for other customers) (2). On March 14, 2011, Assistant Secretary of the Navy (Research, Development and Acquisition) (ASN (RD&A)) signed a revised Acquisition Decision Memorandum (ADM)

authorizing NMT to procure an additional 42 units (22 units for NMT and 20 units for other customers).

The program awarded contract modifications on March 31, April 7, May 19, and August 25, 2011, completing the PY-1 and PY-2 procurements, with 87 units for the Program of Record (POR) and 41 for other customers. ASN (RD&A) authorized this additional quantity to maintain a desirable and orderly production rate for FY 2012 and to avoid a break in production between LRIP and Full Rate Production (FRP). With respect to the other customers, this increase allowed execution of their acquisition programs without impairment from NMT.

Lastly, for all NMT users, this increase facilitated significant cost efficiencies. In addition, the NMT program completed Development Testing (DT) in July – August 2011 and conducted Initial Operational Test and Evaluation (IOT&E). Initial Operational Test and Evaluation (Start) date changed from APR 2012 to JUL 2011 in order to provide the Fleet with the NMT capability sooner (1). Additionally, the necessary platforms were available for a single Operational Test.

As a result of the IOT&E, NMT was assessed as operationally effective, but not operationally suitable, by the Office of the Director, Operational Test and Evaluation (DOT&E) and the Navy's Commander Operational Test and Evaluation Force (COMOPTEVFOR). COMOPTEVFOR did, however, recommend Fleet introduction for the NMT system as a replacement for the legacy Q-band, Ka-band, and X-band systems. The NMT program has taken

expedient action to address the deficiencies from IOT&E and, thus far, has significantly reduced programmatic and technical risk.

Final closure of deficiency risks will be conducted with COMOPTEVFOR and DOT&E via a Verification of Correction of Deficiencies and is expected in the fourth quarter of FY 2012. The current total Low Rate Initial Production (LRIP) quantity is more than 10% of the total production quantity due to the strong technical performance of NMT during Operational Assessment, the necessity to ensure a smooth and consistent establishment of production capacity, and significant operational benefits from providing the NMT capability aligned with the satellites with which it will operate (1).

The official NMT inventory objective remains at 276 systems. The President's Budget (PB) FY 2013 for NMT shows an inventory objective of 250 systems. The quantity decrease is from decommissioning 16 afloat systems and a reduction of 10 ashore systems. Based on an urgent Fleet need for NMT to operate in Anti-Access/Area Denial (A2AD) areas, the Office of the Chief of Naval Operations (OPNAV) added funds in FY 2013, which are Research, Development, Test, and Evaluation (RDT&E) funds prior to review/approval by the Navy's Configuration Steering Board (CSB).

The A2AD costs are not part of the NMT POR/Acquisition Program Baseline (APB) until review/approval by the CSB and completion of an Independent Cost Estimate (ICE) (3). The NMT program will continue to refine its Program Life Cycle Cost Estimate (PLCCE) and support a follow-up Service Cost Position (SCP) in preparation for an FRP-DR and then update the NMT APB as appropriate. RDTE, for FY2012, was budgeted \$18.8 million while FY2013

has a budget of \$31.7 million. Years 2014-2017 have proposed budgets of \$16.8, \$19.5, \$18.1, and \$14.3 million respectively for the development of future capabilities.

Procurement has scheduled budgets for current year through 2017. The respective budgets for the appropriate years starting with current year are \$107.3, \$184.8, \$217.1, \$289.0, \$117.1, and \$57.0 million. There is an additional \$91.7 million proposed for 2018-2020 to complete the procurement of all remaining systems and upgrades. The procurement contract for Raytheon is estimated at \$492.1 million. The total flyaway cost is currently estimated at \$1,270.8 million. This leads to a cost variance of \$49.1 million from the original procurement flyaway cost estimate.

The NMT program's two critical technologies—a multiband antenna feed and monolithic microwave integrated circuit power amplifiers for Q-band and Ka-band communication frequencies—are mature. Both of these technologies have been demonstrated in fully capable, production-representative engineering development models. The NMT's design is stable. The program has released all of its expected design drawings and placed the design under configuration control. At its May 2008 design review, program officials reported that about 70 percent of the expected drawings were releasable to manufacturing.

A difference between the initial contract price target (\$641.5 million) and the current contract price target (\$492.1 million) is due to the reduction in inventory objective from 276 to 250 units. However, in response to overall Navy financial initiatives, the Office of the Chief of Naval Operations (OPNAV)



has identified potential changes to the NMT inventory objective. For example, the Naval Center for Cost Analysis (NCCA) utilized a total reduction of 26 systems in their most recent Cost Review Board (CRB), to reflect up to 16 afloat systems decommissioning, as well as a reduction of 10 ashore systems.

The NMT program is dependent on AEHF satellites to test its full range of capabilities. The first AEHF satellite was launched in August 2010; however, a faulty satellite propulsion system delayed the satellite from reaching its planned orbit by about 7 to 9 months. Delays with AEHF capability directly affect the ability of the NMT program to test the new higher data rate communications capability. However, NMT officials stated that the new higher data rate can be tested with one AEHF satellite, should the Air Force configure it in that fashion.

Additional AEHF satellites provide more coverage and program officials noted that initial operational capability can be achieved with two installed systems that have successfully completed system operational verification test. In addition, the NMT program can provide value to the fleet when it is fielded by accessing existing satellite communication systems such as the Defense Satellite Communications System, Milstar, Wideband Global SATCOM, Interim Polar, and UFO satellite constellations. There are no significant software-related issues with this program at this time.

The NMT program's software lines of code have significantly increased since development start to accommodate software communications architecture requirements. Currently, software integration testing is over 80 percent

complete with over 95 percent of the defects resolved. According to NMT program officials, the NMT program is containing most of the defects that it finds within phase, which is a good indicator because it is more efficient to correct problems within the phase in which they occur (2).