

## DDG 1000 *Zumwalt* Class Destroyer

### Executive Summary

- The DDG 1000 program continued detailed design, systems integration, and technology risk reduction in FY09. Developmental testing and an operational assessment (OT-B1) examined a range of major warfare mission and ship support areas to identify potential ship design and performance risks.
- The Navy revised the Acquisition Strategy for DDG 1000. The revised acquisition strategy reduces production and delivery of the DDG 1000 ship class from seven to three ships.
- Although no Live Fire testing occurred in FY09, an active LFT&E program is in place to gain survivability insights.

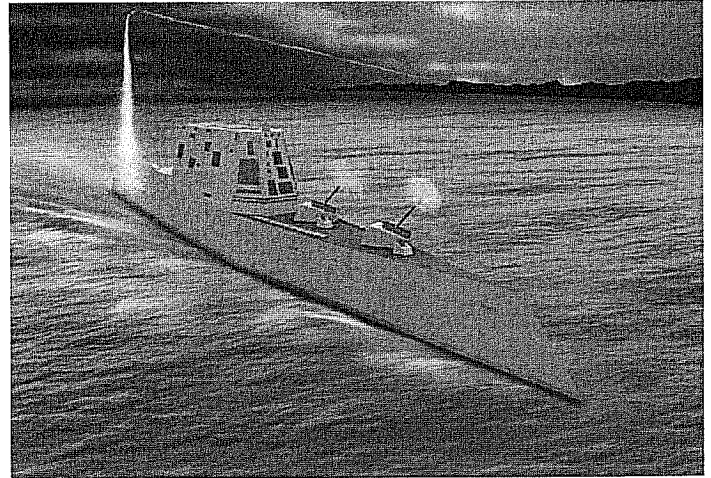
### System

DDG 1000 is a new combatant ship with a wave piercing hull form designed both for endurance and to be difficult to detect on radar. It is equipped with the following:

- Two 155 mm Advanced Gun Systems that fire the Long-Range Land Attack Projectiles
- Dual Band (X-Band and S-Band) Radar capable of performing all search and fire control functions for both air and surface
- Eighty vertical launch cells that can hold a mix of Tomahawk missiles, Standard Missiles, Vertical Launch Anti-Submarine Rockets, and Evolved SeaSparrow Missiles
- Integrated Undersea Warfare system with a dual frequency bow mounted sonar and multi-function towed array sonar to detect submarines and assist in avoiding mines
- An ability to embark and maintain MH-60R helicopters and vertical take-off unmanned aerial vehicles

### Mission

- The Joint Force Maritime Component Commander can employ DDG 1000 to accomplish the following:



- Land Attack Warfare - Joint Surface Strike and Joint Surface Fire Support
- Anti-Surface Warfare
- Anti-Air Warfare
- Undersea Warfare
- DDG 1000 can operate independently or in conjunction with an Expeditionary or Carrier Strike Group as well as with other joint or coalition partners in a Combined Expeditionary Force environment.

### Prime Contractors

- General Dynamics Marine Systems Bath Iron Works, Bath, Maine
- BAE Systems, Minneapolis, Minnesota
- Northrop Grumman Ship Systems, Pascagoula, Mississippi
- Raytheon, Waltham, Massachusetts

### Activity

- The Navy conducted significant developmental testing of the Dual Band Multi-function Radar, Total Ship Computing Environment/Infrastructure (TSCEI), and hull form in FY09.
- Commander, Operational Test and Evaluation Force conducted an operational assessment (OT-B1) of DDG 1000 from March 2008 to July 2009. OT-B1 test events examined hull mechanical, electrical, damage control, and mission system designs, and shore support and habitability/onboard support areas to identify any significant risks to DDG 1000 completing IOT&E. The Navy conducted testing in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP) and test plan.
- The Navy revised the Acquisition Strategy for DDG 1000. Production and delivery of DDG 1000 ship class was reduced from seven to three ships. The revision also includes a commitment by the Navy to construct the three ships at Bath Iron Works, with Northrop Grumman Ship Building retaining work share efforts. The scope of the testing defined by the DOT&E-approved TEMP remains adequate. The TEMP will be revised during FY10 to align the testing schedule with the program execution schedule cited in the Acquisition Strategy.
- The LFT&E program performed an in-depth review of mission essential systems to identify vulnerabilities in the Detail Design.

# NAVY PROGRAMS

- The Navy is developing a new shock qualification program based in part on the reduction of DDG 1000 to a three ship class. The options under consideration include no shock qualification, shock qualification for take home capability only, or shock qualification for take home and limited self-defense capability.
- The Integrated Production Team continues to assess the feasibility of the end-to-end test capability and the impact of that upon the previously-approved LFT&E lethality strategy.
- The LFT&E program's mission essential systems review identified survivability features in the Detail Design that will not be included in the first two ships. The first two ships of the class will be less survivable because of the Navy's decision to reduce cost by not implementing certain system redundancy features of the Detailed Design.

## Assessment

- Test results from operational assessment (OT-B1) identified the following:
  - When electrical power is disrupted causing a loss of chilled cooling water, affected TSCEI Data Centers will shut down within seconds due to thermal overload, despite being powered by uninterruptible power supplies. Electrical power casualties that cause the loss of both TSCEI Data Centers (Deadship Condition) will require manual restoration of electrical power and cooling. It will take a significant amount of time to recover and restore basic command and control operations placing the ship at risk.
  - The Close-in-Gun System gun mount will accumulate a significant amount of toxic fumes when the gun fires a fully loaded (120-round) magazine at the maximum rate of fire (about 220 rounds per minute). Personnel safety procedures require that the gun mount be purged of the toxic fumes before personnel may reenter the mount. This will preclude immediate reloading of the gun during extended engagements.
  - The Navy has not identified funding to purchase inert rounds for use in the Advanced Gun System. Operational readiness will be adversely impacted if inert rounds are not available to support operator and unit training and system maintenance.
  - The DDG 1000 program intends to defer a significant amount of preventative and corrective maintenance to shore-based contractors. Uncertain funding raises the real possibility that DDG 1000's minimally manned crews will be required to perform these maintenance actions in excess of their planned workload. The current Navy Training Plan and Projected Ship's Manning Document for DDG 1000 do not support this requirement.
- Planned testing on the Self-Defense Test Ship only includes Evolved SeaSparrow Missile engagements. Without advanced testing of Standard Missile (SM)-2 prior to lead ship delivery, the program risks potential cost and schedule delays.
- The Navy identified a potential land-based range for conducting operational end-to-end testing of Land Attack Warfare, one of the ship's major mission areas, using the Advanced Gun System against realistic targets.

- The OT-B1 assessment noted the delay in important software functionality. The LFT&E review of many ship systems suggested there may be a significant disconnect between intended system operation as designed and the software developers' understanding of system dependencies.
- The DDG 1000 has a requirement to maintain all mission essential functions when exposed to underwater explosive shock loading. The Navy is exploring possible changes to the existing DDG 1000 shock qualification program. These changes, if accepted, would reduce the adequacy of the DDG 1000 LFT&E program by eliminating important testing necessary to measure the shock hardness of the ship. This testing is vital to understanding the survivability characteristics of the DDG 1000.

## Recommendations

- Status of Previous Recommendations. The Navy has closed three of the four FY05 recommendations, one of the two FY07 recommendations, and one of the three FY08 recommendations.
- FY09 Recommendations. The Navy should:
  1. Develop solutions to eliminate or reduce the impact of loss of electrical power and associated loss of chilled water cooling casualties on TSCEI Data Centers.
  2. Develop procedures for manual electrical plant restoration during total loss of electrical power casualties that secure all TSCEI Data Centers.
  3. Develop tactics and training that optimize employment of the Close-in-Gun System against surface threats.
  4. Identify funding to purchase inert rounds for use in the Advanced Gun System.
  5. Develop contingencies in the Navy Training Plan and Projected Ship's Manning Document that address training and manning issues that may occur in the event of potential fluctuations in shore-based contractor maintenance funding.
  6. Maintain the current shock requirements and complete the shock qualification program prior to deploying DDG 1000.