DDG 1000 Class Destroyer

10 May 2016

American Society of Naval Engineers (ASNE) Flagship Section

DDG 1000 Overview

DDG 1000 Program Manager, PMS 500
RDML(s) Jim Downey
DDG 1000/1001/1002

DDG 1000

DDG 1001

DDG 1002 Pre-Fabrication Units
95 of 97 Under Construction

DDG 1000 Sea Trials
December 2015
DDG 1000 Sea Trials
April 2016
DDG 1000 Sea Trials
April 2016
Alpha Trials Highlights

- **Propulsion events executed**
  - Achieved full power multiple times
  - Executed full ahead, full astern, crashbacks, etc in multiple configurations
- **Anchoring events executed** – met Alpha Trials performance requirements
- **Boat launch and recovery executed** – met Alpha Trials performance requirements
- **Demonstrated ship handling performance characteristics**
- **Steering events executed** – met Alpha Trials performance requirements
  - Full rudder swings ahead, astern during ranging propulsion operations
  - Multiple sea & anchor / restricted maneuvering events executed; performed well
- **Integrated Fight Through Power (IFTP) – met Alpha Trials performance requirements**
- **Engineering Control System (ECS) / Total Ship Computing Environment (TSCE) – met Alpha Trials performance requirements**
- **Multiple additional events executed**
- **Logistics well coordinated**
  - Galley and berthing fully exercised
  - Refueling conducted per plan

**Successful Alpha Trials conducted 7-13 Dec 2015**
Builder’s Trials (BT) Highlights

- Completed all planned propulsion commissioning events
- Significant preparations completed for Acceptance Trials including successful completion of numerous demonstrations
- Additional demonstrations/testing completed on the Integrated Power System (IPS) and associated auxiliaries; IFTP; Boat Handling, Anchoring, Ballasting, Damage Control, Steering, Navigation and Engineering Control systems; and Interior Communications
- Special test event completed with the assistance of the Coast Guard to measure ship signatures
- Over 100 PCU ZUMWALT sailors participated in the Crew Day from 23-24 Mar, allowing extensive crew training to be conducted side-by-side with representatives from industry

Successful Builder’s Trials conducted 21-24 Mar 2016
Acceptance Trials (AT) Highlights

- DDG 1000 underway Acceptance Trials (AT) were conducted in the Gulf of Maine 20-21 Apr 2016
  - 100+ in-port INSURV demonstrations/inspections conducted for certification of the ship to commence at-sea trials 20 April
  - 25+ at-sea demonstrations/inspections conducted during the two-day underway
  - 30 hours of major INSURV demonstrations of the Hull, Mechanical, and Electrical (HM&E) ship systems including: boat handling system, anchor system, mooring systems
  - Major demonstrations of IFTP, ECS, damage control systems, ballast / deballast systems, navigation systems, internal and external communications systems, and auxiliary systems

DDG 1000 on track for Delivery, Sail Away and 15 Oct Commissioning in Baltimore, MD
DDG 1000 Sea Trials
Video
DDG 1000 Program Highlights

- **Started DDG 1000 fabrication February 2009** – 98% complete (as of 24 Apr 2016; ~200 of 340,000 work orders remain; test 95% complete)
  - Resulting in full ship (15,000 tons, 610 ft long)
  - Hangar arrived May 2012 at BIW and erected Jul 2012
  - Deckhouse arrived Nov 2012 at BIW and erected Dec 2012
  - Launch – 28 Oct 2013
  - Christening – 12 Apr 2014
  - Test and Activation underway (Alpha Trials conducted 7-13 Dec 2015, Builder’s Trials conducted 21-24 Mar 2016, Acceptance Trials conducted 20-21 Apr 2016)
  - Delivery Q3FY16

- **Started DDG 1001 fabrication March 2010** – 87% complete (as of 24 Apr 2016)
  - All units are on Land Level Transfer Facility (LLTF) at BIW
  - Keel Laying 23 May 2013
  - Hangar arrived Oct 2013 at BIW
  - Deckhouse arrived Sep 2014 at BIW and erected Nov 2014
  - Launch projected Q3FY16

- **Started DDG 1002 fabrication 4 April 2012** – 46% complete (as of 24 Apr 2016)
  - Fabrication underway – 42% complete; 95 of 97 units under construction
  - Material at 65% complete
  - Steel deckhouse / hangar design complete, production underway

- **Integrated Power System (IPS) provides complete electric plant integration**
  - Full Power (local control) completed May 2011
  - IPS with Engineering Control System (ECS) completed March 2012
  - Energized High Voltage Sep 2013
  - Risk reduction testing complete at Philadelphia Land Based Test Site (LBTS); transitioning final equipment to DDG 1002 in FY16
  - IPS thoroughly exercised at sea during trials; Integrated Fight Through Power (IFTP) very stable
DDG 1000 Program Highlights (Cont’)

- 100% of Mission Systems Equipment (MSE) delivery complete and installed on DDG 1000 and 1001
  - Equipment delivered in time to meet ship activation requirements
  - DDG 1002 MSE contract awarded 31 Dec 2015

- SPY-3 with integrated volume search
  - Testing of X-Band Mods for Volume Search at Wallops Island underway, then Self Defense Test Ship

- Software development progressing to support ship activation and delivery
  - Software Releases (SR) 1-8 completed
  - Release 7 supporting DDG 1000 trials, Release 8 development and test complete and ready for install in Q3FY16

- Advanced Gun System (AGS) manufacturing underway at 3 facilities (Cordova, AL; Fridley, MN; and Louisville, KY)
  - Testing of 1st AGS gun at Dugway Proving Grounds, UT completed
  - All 3 Ship sets under contract (DDG 1002’s to be delivered in FY16)

- Long Range Land Attack Projectile (LRLAP) development and testing
  - Guided flight tests (GFT) successfully completed Oct 2013
    - Demonstrated max range capability
    - Demonstrated outstanding accuracy
    - Demonstrated Height-of-Burst (HOB) operation with excellent lethality
  - Rocket motor redesign complete including hot/cold/ambient static fire tests
  - Transition to production in progress to support Low Rate Initial Production (LRIP) in FY16
DDG 1000 Requirements

- Carry the fight to the enemy through offensive operations and destroy enemy targets ashore with precision strike and volume fires
- Contribute to littoral dominance: surface, air, sub-surface
- Employ an open architecture total ship computing approach
- Be highly survivable
- Reduce crew size

Requirements Document

- DD(X) Operational Requirements Document, Change 1 approved, dated Jan 2006
- DD(X) will transition from a single step to full capability approach to a spiral acquisition
  - Spiral acquisition fields operationally and supportable capability in as short a time as possible, with the explicit intent of delivering improved or updated capability in the future
- Acquisition Risk Mitigated thru spiral development, modeling & simulation, and a combination of land-based / at-sea testing

### Key Performance Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Threshold</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interoperability</td>
<td>Top Level IERs</td>
<td>All IERs</td>
</tr>
<tr>
<td>Number of Guns</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Gun Magazine Capacity</td>
<td>600</td>
<td>1200</td>
</tr>
<tr>
<td>Vertical Launch Cells</td>
<td>80</td>
<td>128</td>
</tr>
<tr>
<td>Radar Cross Section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manning</td>
<td>175</td>
<td>125</td>
</tr>
<tr>
<td>Survivability (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force Protection (2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Designed to meet requirements; Evolutionary Acquisition – Spiral Development

PB16 +17 crew increase (total = 175)
# DDG 1000 Characteristics

## Hull
- Wave-Piercing Tumblehome

## Characteristics
- Overall Length: 610 ft
- Maximum Beam: 80.7 ft
- Navigational Draft: 27.6 ft
- Speed: 30 kts

## Sensors
- SPY-3 X-Band
- Multi-Function Radar (MFR)
- Volume Search Radar (VSR) (Space & Weight Reservation)
- HF & MF Bow Sonar Arrays
- Multi-Function Towed Array
- EO/IR System
- ES System
- EXCOMMS – Alternative Navy C4I POR

## Weapons
- (80) Advanced Vertical Launch (AVLS) cells for Tomahawk, ESSM, Standard Missile
- (2) Advanced Gun System (AGS) 155 mm guns
- (600) 155 mm rounds
- (2) MK 46 Close In Guns Systems (CIGS)
- Torpedo Defense (Space Reservation)
- Anti-Terrorism

## Integrated Power System (IPS)
- (2) Main Turbine Generators (MTG)
- (2) Auxiliary Turbine Generators (ATG)
- (2) 34.6 MW Advanced Induction Motors

## Superstructure
- Composite Structure
  - DDG 1000 / 1001
  - Steel
  - DDG 1002

## Aviotion
- (1) MH60R and (3) VTUAVs / (2) MH 60Rs

## Boats
- (2) RHIBs
  - sized for (2) 7m or (2) 11m RHIBs

---

DDG 1000 Critical Technologies

Engineering Development Models (EDMs) Used to Mitigate Production Risk Prior to Milestone B Decision

**Advanced Gun System (AGS)/Long Range Land Attack Projectile (LRLAP)***

- Full scale Gun and Magazine produced
- Automated Magazine and Gun rate of fire validated
- Tactical Rocket Motor design demonstrated at threshold 63 NM range
- LRLAP Tactical Guided Flight Tests completed Oct 2013
  - LRIP FY16

**Composite Deckhouse & Apertures Test Article***

- Composite production ability proven
- Tested for RCS and EMI
- Validated RCS KPP can be achieved

**Dual Band Radar (DBR)***

- MFR (X Band) at sea-based testing complete
- VSR (S Band) land based testing complete
- Leap ahead clutter rejection capability in the littorals
- MFR Volume Search modification complete
- MFR Testing underway
  - Wallops (2015-2016)
  - SDTS (2017)
  - DDG 1000 (2016-2018)

**Composite Deckhouse & Apertures Test Article***

- Software Releases 1-8 complete
- Open Architecture principles applied
  - Release 7 supporting DDG 1000 trials
  - Release 8 ready for install in FY16

**Total Ship Computing Environment (TSCE)***

- Sea keeping, stability and RCS performance validated by model testing
- Underwater explosion testing complete – hull whipping requirement validated
- Hull form certification underway
  - Cert / Guidance for Trials received in 2014
  - Heavy Weather Guidance received June 2015

**Integrated Power System (IPS)***

- Full scale testing of components
- Full rated power and torque validated
- Full Power testing completed
- ECS LBTS testing completed
- HM&E Activation Underway
  - Energized High Voltage Sep 2013
  - AIM light off Jul 2014
  - Generator light off Sep 2014
  - SAC Nov 2014
  - Alpha Trials Dec 2015

**Integrated Undersea Warfare (IUSW)***

- At-sea mine avoidance capability proven
- Reduced ASW Manning validated

**Integrated Vertical Launch System (PVLS) / Advanced VLS***

- Detonation tests and missile restrained firing testing complete
- Enhanced survivability design proven and ability to carry all current missiles (SM 2/3/6, ESSM, VLA with CEU mods)

**Autonomic Fire Suppression System (AFSS)***

- At-sea weapons effect autonomic fire suppression testing demonstrated
- Critical technology enables reduced manning

**Hull Form Scale Models***

- At-sea mine avoidance capability proven
- Reduced ASW Manning validated
Summary

• DDG 1000 will be a multi-mission surface combatant tailored for the littorals
  – Signature reduction, active and passive self-defense systems, and enhanced survivability features
  – Designed to fulfill volume firepower and precision strike requirements
  – Provides credible forward naval presence while operating independently or as an integral part of Naval, Joint, or Combined Expeditionary Strike Forces
  – Reduced Life Cycle Cost

• DDG 1000,1001,1002 under contract and significant production underway
  – DDG 1000/1001/1002 completion 98% / 87% / 46% as of Apr 2016