

FFG 62 *Constellation* Class – Guided Missile Frigate

Executive Summary

- In April 2020, DOT&E approved the Guided Missile Frigate (FFG 62 *Constellation* Class) LFT&E Alternate Plan. This allowed the waiver from full-up system-level testing to be approved, which supported the Milestone B decision.
- In June 2020, DOT&E approved the FFG 62 *Constellation* class Test and Evaluation Master Plan (TEMP) with the exception of the plan’s strategy for testing FFG 62 *Constellation* class anti-air warfare (AAW) mission capability, which was not approved and deferred until the next TEMP update, scheduled for FY24.

System

- The FFG 62 *Constellation* class is a new multi-mission, small surface combatant intended to operate in increasingly complex warfare environments requiring capability to conduct air warfare (AW); anti-submarine warfare (ASW); surface warfare (SUW); electronic warfare (EW)/information operations (IO); and intelligence, surveillance, and reconnaissance (ISR) missions.
- The ship is powered by a combined diesel-electric and gas system, which employs two electric propulsion motors and a single gas turbine engine.
- The key Navy standard warfare system elements to be fielded on board FFG 62 *Constellation* class include the following systems:
 - AN/SPY-6 (FFG 62 *Constellation* class variant) Air Surveillance Radar
 - Mk 41 Vertical Launch System with Evolved Sea Sparrow Missiles and Navy Standard Missiles
 - Rolling Airframe Missile (RAM) Guided Missile Launching System with RAM
 - AN/SQQ-89(V)16 Undersea Warfare/ASW Combat System
 - AN/SLQ-25 NIXIE
 - AN/SPS-73(V)18 Next Generation Surface Search Radar
 - Mk 110 57-mm Gun (with Advanced Low-Cost Munitions Ordnance)
 - Over-the-Horizon Weapon System
 - MH-60R Seahawk helicopter
 - MQ-8C Fire Scout Vertical Take-off and Landing Tactical Unmanned Aerial Vehicle with MD-4A Mission Control System



- The FFG 62 *Constellation* Class System Specification establishes requirements for survivability features to be incorporated into the ship. They include, but are not limited to, the following:
 - Shock resistance to underwater explosions for select systems
 - Armor and ballistic protection in designated areas
 - Blast and fire-resistant structure in designated areas
 - Vulnerability reduction features for vital hull, mechanical, and electrical systems to include redundancy, separation, and damage isolation
 - Chemical, biological, and radiological defense systems
 - Signature reduction (e.g. radar cross section (RCS), infrared (IR), underwater electromagnetic)

Mission

The Maritime Component Commander will employ FFG 62 *Constellation* class to conduct AW, ASW, SUW, EW/IO, and ISR missions to support the National Defense Strategy across the full range of military operations.

Major Contractor

Fincantieri Marinette Marine Corporation – Marinette, Wisconsin

Activity

- In June 2020, DOT&E approved the FFG 62 *Constellation* class TEMP with the exception of the plan’s strategy for testing FFG 62 *Constellation* class AAW mission capability.

DOT&E did not approve the AAW test strategy because it was not adequate to determine the operational effectiveness of the FFG 62 *Constellation* class combat system.

FY20 NAVY PROGRAMS

- In April 2020, DOT&E approved the FFG 62 *Constellation* class LFT&E Alternate Plan to allow the program to seek a waiver from full-up system-level testing and complete Milestone B requirements. The FFG 62 *Constellation* class LFT&E Alternate Plan includes Full Ship Shock Trials as a primary method to evaluate the FFG 62 *Constellation* class survivability to threat-induced shock. The approved plan retains the option to plan and execute an alternative to Full Ship Shock Trials should DOT&E, in coordination with the Navy, review and approve such an alternative as adequate prior to the next TEMP update, scheduled for FY24.
- The Navy established a working group to mature the Enhanced Testing supported by Modeling and Simulation (ET-M&S) approach proposed as an alternative to Full Ship Shock Trials.
- In September 2020, the FFG 62 *Constellation* class Program Office completed the first test series in the LFT&E program. Testing, executed at Aberdeen Test Center, Maryland, supplied the ballistic penetration data required for model verification and validation.
- The Navy expects to complete Aegis testing in 4QFY24. DOT&E will work with the Navy to evaluate those results to determine whether the FFG 62 *Constellation* class T&E Strategy will require unmanned ship testing. If the requisite data are not available and/or applicable to FFG 62 *Constellation* class, unmanned ship testing will need to be resourced and scheduled in the Navy's FY24 TEMP update.
- The FFG 62 *Constellation* class LFT&E program includes a number of M&S upgrades and surrogate tests to address long-standing limitations in the Navy's vulnerability assessment toolset. If successful, the FFG 62 *Constellation* class vulnerability assessments will include new blast loading, fragment penetration, near-contact underwater explosion shock prediction, and whipping analysis that will enable a more comprehensive and accurate assessment of the ship's survivability performance.
- The ET-M&S approach could potentially enable a more comprehensive assessment of the ship's response to shock and in a timeframe that would enable the findings to be efficiently implemented into the design. To effectively use this approach in lieu of Full Ship Shock Trials, a Navy-wide effort is required to adequately predict and validate the damage tolerance and likely failure modes of naval equipment and systems when exposed to underwater shock.

Assessment

- The Navy's proposed AAW strategy intends to leverage the results of future Aegis Destroyer (DDG 51 Flight III)-related test programs to evaluate FFG 62 *Constellation* class AAW capabilities. The Navy's justification for this approach depends on similarities between some elements of the FFG 62 *Constellation* class and DDG 51 Flight III combat system, but they do not address how end-to-end mission performance of the DDG 51 Flight III combat system can be extrapolated to evaluate the end-to-end mission performance of the FFG 62 *Constellation* class combat system.
- The successful execution of the Navy's approach is also predicated on successfully managing substantial test and schedule interdependencies of at least five distinct Navy acquisition programs that are not yet documented, resourced, or approved by the Navy or DOT&E in program TEMPs. These programs are Enterprise Air Surveillance Radar, Aegis Weapons System (as installed on DDG 51 Flight III), Standard Missile 2 Block IIIC, Enhanced Sea Sparrow Missile Block 2, and RAM Block 2A/2B. The Navy's proposed AAW approach is not adequate without strategies for managing these interdependencies and addressing end-to-end performance differences between combat systems, and without documentation of critical details on the test scope, assets, resources, and schedule required to support successful test execution.
- The Navy has committed to updating the FFG 62 *Constellation* class TEMP by the end of FY24. As the TEMP states, critical Aegis testing will not conclude until 4QFY24. DOT&E encouraged the Navy to complete the TEMP update with the subset of Aegis data that are available and have been evaluated for FFG 62 *Constellation* class applicability by that time.

Recommendations

The Navy should:

1. Start working on FFG 62 *Constellation* class TEMP updates as soon as possible to ensure the TEMP is completed by the end of FY24. The updated TEMP should identify the remaining data elements required to assess FFG 62 *Constellation* class AAW capabilities, and incorporate test events, test assets, and test resources required to complete the evaluation of FFG 62 *Constellation* class AAW mission capability. The updated TEMP should also include an overall integrated Master Test Schedule managing the remaining programmatic interdependencies required for the successful execution of the Navy's intended AAW operational test strategy.
2. Continue efforts to complete Aegis testing events intended to provide evaluation data necessary to determine whether the FFG 62 *Constellation* class T&E Strategy will require unmanned ship testing. If the requisite data are not available and/or applicable to FFG 62 *Constellation* class, the Navy should resource and schedule unmanned ship testing in the Navy's FY24 TEMP update.
3. Support the funding of ET-M&S to include development of a method of predicting principle unit failure due to underwater shock and demonstration of the validity of underwater shock M&S predictions.