Experimental Evaluation Vessel (EEV)

LT Bill Hentschel, USN; LCDR DP Johnsen, USN; LCDR William Taft, USN

Between laboratory testing and the installation of technologies aboard the U.S. Navy's warships lies Technology Readiness Levels five through seven, which entail testing in a relevant environment. Currently, the Navy does not have a dedicated seagoing asset that can test emerging technologies in this range of technology maturation. To satisfy this need, the Experimental Evaluation Vessel (EEV) provides a testbed to facilitate this technological progression using a low-cost, high-flexibility design. To account for the numerous developing technologies that will require rapid and frequent shipboard changes to support testing requirements, the vessel provides modular configurations through allocation of space margin in the test spaces and the associated transfer paths throughout the ship.

With sufficient space, weight, area, power, and cooling (SWAP-C) to test a range of systems, EEV was designed to be operated by civilian mariners, who will be accompanied by test teams for each at-sea evaluation period. Due to EEV's unconventional operational nature, reduced manning and the test environment provided an opportunity to apply practices not normally used in traditional U.S. warship design. Though prudent marine engineering practices still applied, U.S. Navy standards of survivability, habitability, and shock were relaxed when justified to improve affordability, flexibility, and modularity.

EEV's design portrays the priority placed on modular testing configurations and the rapid interchange of systems during in-port availabilities. The ship's Operations Deck (second deck) and Corridor Deck (seventh deck) are incorporated to facilitate rapid transfer of equipment throughout the ship and to distribute the primary and auxiliary services for test systems, respectively. The vessel provides multiple loading methods, including a stern ramp, removable decking, and pre-determined shipping paths. EEV's primary testing areas incorporate modular concepts, such as flexible infrastructure (FI) and common interfaces, to facilitate the rapid interchanging of test components.

The propulsion plant houses three Main Machinery Rooms (MMRs), which accommodate the ship's seven GE LM2500+ gas turbine generators and baseline propulsion equipment, and EEV's Engineering Test space, designed to allow interchanging test equipment and demonstrating modular engine room options provided for engineering plant testing. Due to the complexity of modular design for larger engine room components, additional focus was placed on equipment removal paths and the use of modular skids to facilitate the interchanging of test equipment.

Similarly, the Combat Systems Test area contains the Variable Payload Space, Modular Weapons Space, and Adaptable Testing Space, which provide SWAP-C to test various weapon system technologies and incorporate different types of modularity into the design. The ship's Railgun SWAP-C requirements drove the design team's sizing of EEV and provide the footprint for other combat systems during in-port weapon interchanges. Initial detection for at-sea test system engagements is provided by an AN/SPY-6 Air and Missile Defense Radar. Future opportunities for UxV stowage, handling, and launch-and-recovery operations ensure EEV's value for decades to come.

Connecting everything throughout EEV is its electric plant, a key enabler of the ship's testing flexibility. The electric plant was designed with three core principles: (i) capability to segregate

vital and test-system loads, (ii) allowance for ship-wide system-interaction characterizations through testing, and (iii) ship-service accommodation for increased reliability configurations during split-plant and restricted-maneuvering situations. With 168 MW installed capacity, the 13.8 kVAC, 60 Hz system is distributed via five ship service and five test system zones to supply power to EEV's baseline ship and test plant loads. Since the vessel's distribution system cannot provide power at every possible voltage, test system interfaces are standardized at 4160 VAC and 450 VAC three phase, 120 VAC single phase, and 1000 VDC.

A reduction to the three main cost-drivers for MSC vessels – personnel, fuel, and maintenance – were fundamental to EEV's cost-conscious design. Technical risks were mitigated through the use of fielded equipment and a modular infrastructure in the design of an asset that satisfies a Fleet need for testing in a relevant environment.

EEV Characteristics	
$\Delta_{Full\text{-}Load}$	39200 LT
$\Delta_{Lightship}$	25896 LT
LOA	783 ft
LBP	766 ft
Beam	105.36 ft
Draft	26.48 ft
Molded Depth	74.08 ft
KG	34.42 ft
GMT	19.45 ft

Sponsor Requirement	Value / Description
Endurance	30 days
Test System Capacity	SWAP-C for ≥ 40-MJ Railgun system
Navigation	existing fleet concentration areas

Ship Selection Process	Scope / Result
System-Level Evaluation	cargo-handling options, eng. plant architecture
Ship-Level Evaluation	parametric analysis of 20 vessels
Tradespace Analysis	3000 variants (eight baseline models, 375 each)
Selected Variant	shaft-driven, IPS, size ≈ MSC dry-cargo vessel