

## Evolved Sea Sparrow Missile (ESSM)

The Evolved Sea Sparrow Missile (ESSM) is a short-range missile intended to provide self-protection for surface ships. On Aegis ships, ESSM will be launched from the MK 41 Vertical Launch System. Four missiles are stored, with tail fins folded, in each launcher cell. (The number of cells is either 90 or 96 on an Aegis destroyer and either 122 or 128 on an Aegis cruiser.) Vertical launch requires a thrust vector control system on the ESSM rocket motor. Guidance will be by up-linked commands until the ESSM is near the target, at which time guidance will transition to semi-active homing on reflected radar signals from the target. ESSM may also be launched in a home-all-the-way mode (no up-linked commands). At this time, ESSM installation is funded for Aegis ships only. On non-Aegis ships (aircraft carriers, amphibious assault ships, other surface combatants), ESSM will be fired from other launch systems and guidance will be in homing all the way to intercept. ESSM uses an 8-inch diameter modified guidance section and a new warhead section. This forebody is attached to a new 10-inch diameter rocket motor, which provides higher thrust for longer duration than predecessor Sea Sparrow missiles. ESSM is a cooperative development effort by 13 participating governments.

The Milestone II review was conducted in November 1994. During 1998, the program was restructured to add an operational assessment (Operational Test-IIA) based on missile flights at White Sands Missile Range (WSMR), New Mexico, to support the first low-rate initial production (LRIP) decision. A second LRIP decision was added and will be supported by results of operational testing (Operational Test-IIC) with the Self Defense Test Ship (SDTS). The full-rate production decision will be supported by an operational evaluation (OPEVAL), planned for FY03, conducted with an Aegis destroyer. Subsequent to program restructuring, the Test and Evaluation Master Plan (TEMP) was revised and approved by the Office of the Secretary of Defense in March 2000. Live Fire Test and Evaluation (LFT&E) component/section level ground testing, conducted in FY96-98, included arena warhead tests against fragmentation mats and components of U.S. and foreign targets.

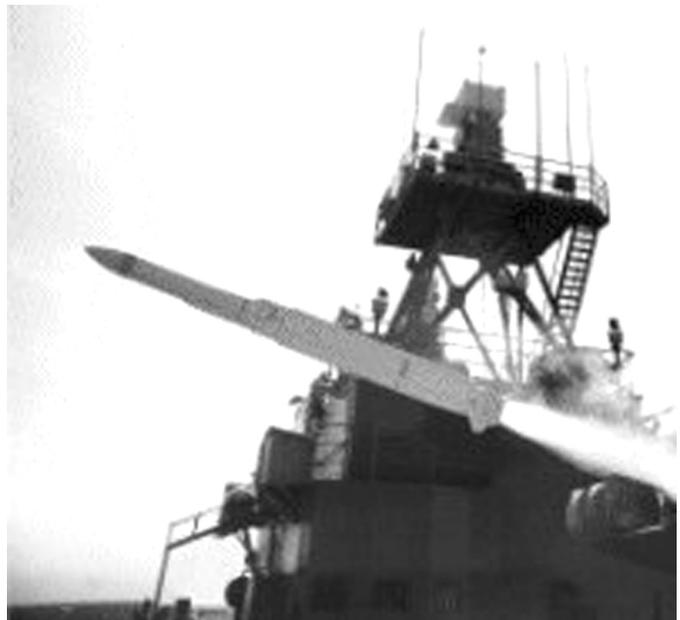
### TEST & EVALUATION ACTIVITY

FY02 activity included the final ESSM firing for the developmental Aegis S-Band testing at the WSMR to demonstrate ESSM guidance via Aegis up-link commands. Additionally, the remaining at-sea ESSM firings were conducted on the SDTS at the Naval Air Warfare Center Weapons Division sea range. Both the S-Band and SDTS tests were conducted in accordance with a DOT&E-approved TEMP and test plan. The TEMP is being revised in preparation for the FY03 OPEVAL.

### TEST & EVALUATION ASSESSMENT

S-Band Testing (Operational Test-IIB): The Aegis S-Band testing demonstrated missile launch from the MK 41 vertical launching system with mid-course guidance provided by up-linked S-Band commands from a simulated Aegis radar. Semi-active homing provided ESSM terminal guidance. The third and last missile flight test was conducted successfully against a subsonic, low altitude, non-maneuvering drone.

Self Defense Test Ship Phase (Operational Test-IIC): The combat system installed on the SDTS is intended to approximate that on non-Aegis ships that use the MK 29 rail launch system. However, the combat system on the SDTS has limitations that constrain ESSM capability against some operationally realistic



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threats. As a result of better understanding the impact of these limitations, certain missile firing scenarios planned for the SDTS phase are being modified and moved to the OPEVAL with an Aegis destroyer. The TEMP is being updated to reflect these modifications.

Fifteen ESSMs were launched at various targets for this phase of operational test and evaluation (OT&E) in FY02. Targets included maneuvering and non-maneuvering, subsonic, low altitude drones, as well as a supersonic high diving target and supersonic, low altitude, non-maneuvering targets. Problems were discovered during flight tests, solutions were implemented, and corrections were demonstrated. For example, the first two ESSM firings conducted from the SDTS experienced in-flight failures caused by failure of the locking pins that were designed to keep the unfolded tail fins erect. This resulted in redesign of the locking pins with successful operation demonstrated during later firings. Also observed during the initial ESSM firing from the SDTS was severe noise introduction into the signal processor as a result of rear reference signal modulation by the rocket motor exhaust plume. This resulted in relocation of the rear reference antenna, with successful operation demonstrated during subsequent firings.

·OPEVAL and Follow-on OT&E (FOT&E): Adequacy of the FY03 OPEVAL is dependent upon operational realism of the scenarios, particularly anti-ship cruise missile (ASCM) threat representation. Given the low and dwindling inventories of threat-representative targets (maneuvering supersonic sea-skimmers and supersonic high divers), such targets may not be available for the OPEVAL, and without them, the test plan will not be approved for adequacy. Since ESSM is a short-range air defense missile and the OPEVAL entails launches from a manned ship, there is a challenge in balancing Range Safety requirements against operationally realistic scenarios.

For FOT&E, a new ASCM threat has appeared for which there is no credible surrogate target. The time required to obtain such a surrogate is expected to be an issue for FOT&E. Additionally, limitations in the Aegis Weapon System Baseline 6.3 computer program and shipboard illuminator radars will preclude testing ESSM's capability against surface targets. Although this is not a requirement, it is a capability provided by predecessor Sea Sparrows on non-Aegis installations.

ESSMs are intended to provide close-in defense of Aegis ships against ASCMs, with Standard Missile providing interceptor capability at longer ranges (both self defense and defense for other ships.). There are circumstances in which the Aegis Weapon System could be controlling ESSMs and SM-2s simultaneously. This is primarily an Aegis Weapon System (Baseline 6.3) issue that requires operational testing under the DDG-51 program's FOT&E.

·LFT&E: The LFT&E strategy is structured around component/section level ground testing, actual missile firing results against ASCMs and surrogates, computer modeling and simulation analyses. Ground testing has been completed. Missile firing tests against ASCMs and surrogates have been conducted, but firings for the technical evaluation and OPEVAL remain.