

# Sting Ray Mod 1

## Advanced lightweight torpedo

Developed to meet the operational requirements of the UK MoD for its next generation of lightweight torpedo, Sting Ray Mod 1 simultaneously addresses two key user issues. First, to meet new and more arduous operational and threat requirements through a process of software-driven evolution. Second, to offer a maintenance free design which further reduces cost of ownership.

To achieve these goals, BAE Systems has developed the Sting Ray Mod 1 torpedo. Capitalising on the investment in the original Mod 0 variant of the torpedo and its supporting infrastructure, the enhanced Mod 1 weapon will sustain Sting Ray's position as the world's premier lightweight, autonomous underwater weapon for decades to come.

Sting Ray Mod 1 is currently in production for the United Kingdom Ministry of Defence and has been selected by the Norwegian Armed Forces to meet the requirements of their New Anti-submarine Torpedo programme.



A completely new weapon, Sting Ray set new and superior standards for software-controlled, autonomous underwater systems, being designed to defeat the dual threats of both fast, deep diving double-hulled submarines operating in the oceanic environment and the quiet conventional submarine in coastal waters.

The enhanced performance of Sting Ray Mod 1 is underpinned by the development of new acoustic and tactical software, drawing on knowledge gained from extensive in-water trials with the Mod 0 weapon.

The tactical and processing algorithms, which incorporate leading edge technology have been

optimised using real-time hardware-in-the-loop simulation prior to in-water testing.

The use of an object orientated approach to tactical software enhances flexibility in pursuing future developments to meet emerging threats.

Hardware improvements selected for Sting Ray Mod 1 include a substantially modified front-end array, digital signal processing, navigation and guidance computers, a new motor controller and an electro-mechanical actuation system for the control surfaces.

Other improvements, such as longer life seals and improved bearing lubrication, have been introduced in support of the maintenance free philosophy.

Sting Ray Mod 1 replaces all existing electronic units of the Mod 0 homing system with the signal processing, navigation and guidance subsystems based on the latest Commercial-Off-The-Shelf (COTS) hardware. These units, which will enable 'through-the-skin' insertion of future evolutions of software to extend functionality through the lifecycle, include:

- A modern digital signal processor offering the computational throughput to execute the most advanced classification algorithms and ample capacity for further software enhancements. This enables improved target classification and better discrimination of non-target returns.
- An autopilot, with much increased processing power and memory, which executes the far more complex tactical software routines demanded by operations in shallow water environments. It is also capable of using an increased amount of data supplied by the launch platform.
- A solid-state inertial measurement unit, its improved accuracy supporting the more complex tactical software modes being employed to overcome the latest acoustic countermeasures.

This new processing architecture retains 100 per cent spare capacity in terms of memory, processing throughput and bus traffic for the benefit of future performance enhancement.

Sting Ray Mod 1 features a new insensitive munition shaped charge warhead, ensuring high lethality against even the most hardened submarine targets. In addition to generating a significant isotropic blast effect, the shaped charge produces a highly directional jet of molten metal to penetrate the pressure hull of the submarine and inflict catastrophic damage.

The new Insensitive Munition Mod 1 warhead will meet NATO's current and foreseeable requirements for insensitive munitions.

Sting Ray Mod 1's main power source is a magnesium/silver chloride battery with a sea water electrolyte, essentially similar to that used in Mod 0 but featuring manufacture and installation improvements to the battery stack.

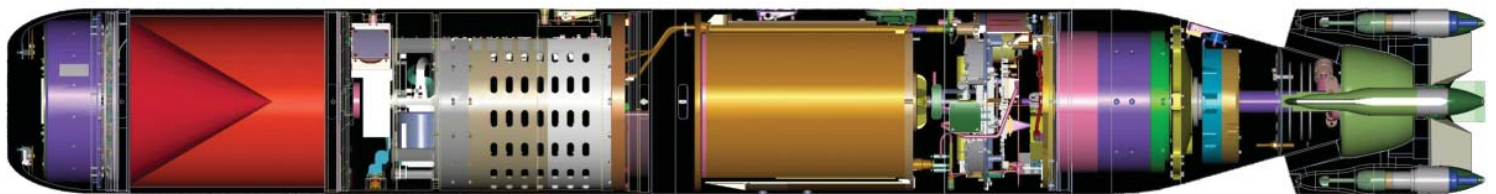
To maximise lethality, Sting Ray's guidance and homing system enables precise aimpoint selection for accurate placement of the warhead at near normal incidence to the submarine pressure hull.

The re-engineered nose section in Mod 1 provides optimum lethality as demonstrated by trials during which Sting Ray warheads produced levels of target penetration considerably in excess of that previously achieved. To maximise lethality, Sting Ray's guidance and homing system enables precise aimpoint selection for accurate placement of the warhead at near normal incidence to the submarine pressure hull.

The electro-hydraulic servo system used in the Mod 0 weapon is replaced in Mod 1 by an electromechanical actuation system. The removal of seals, pumps and fluids associated with the electro-hydraulic actuation significantly reduces support requirements.

Propulsion motor and driveshaft maintenance requirements are reduced through the incorporation of improved bearing lubrication. Longer life hull seals will also feature, removing the requirement to routinely replace seals during the life of the torpedo.

Sting Ray Mod 1 has been designed to meet the requirement for a 20-year shelf life without any planned maintenance beyond periodic 'through-the-skin' testing. Building on the findings of the Sting Ray Mod 0 warstock surveillance programme, the Mod 1 weapon will achieve this by introducing, at first build, a series of modifications designed to improve supportability and minimise cost of ownership through the lifecycle.



Sting Ray Mod 1 cut away

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