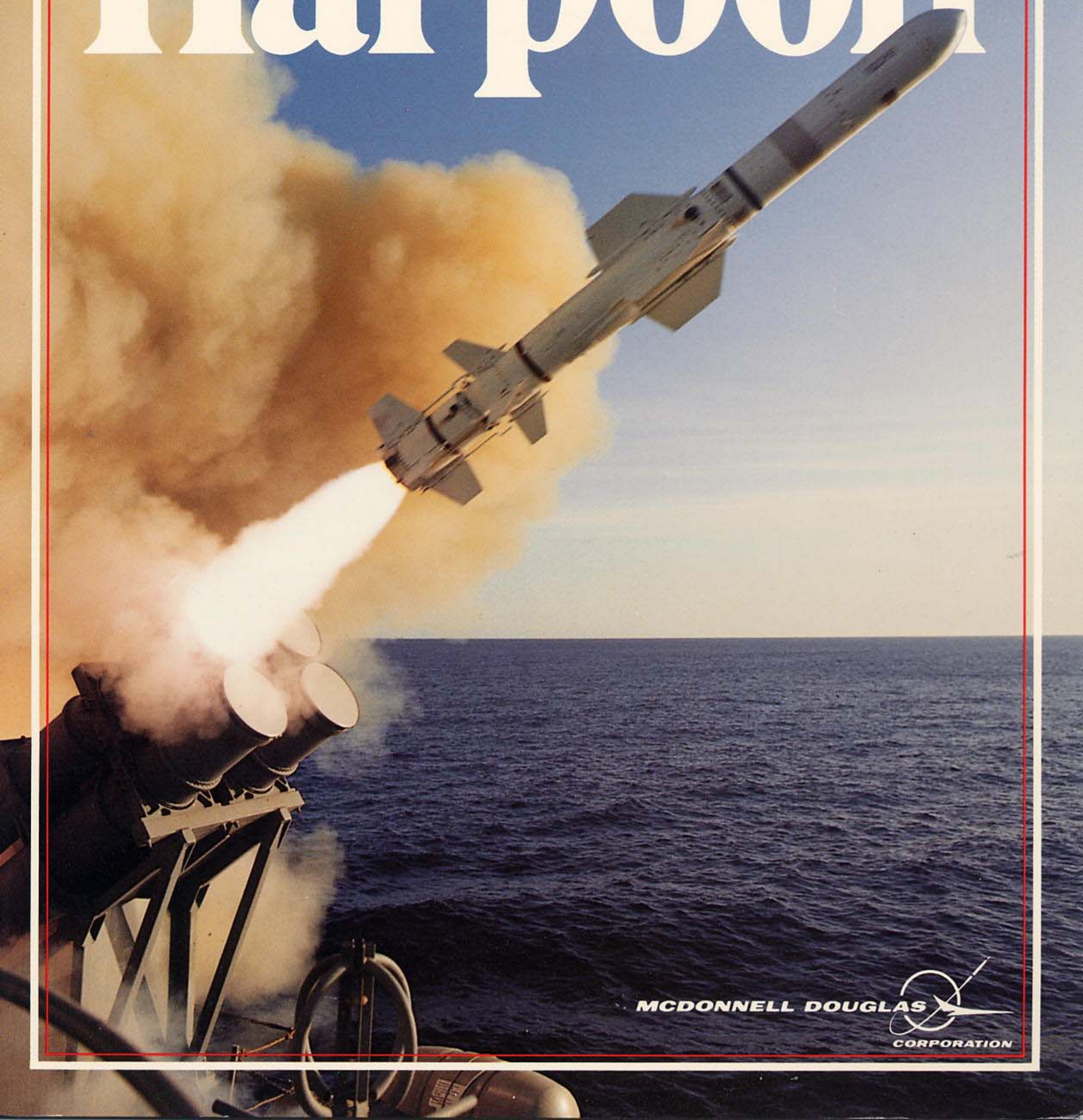


Harpoon



MCDONNELL DOUGLAS



CORPORATION

HARPOON



Introduction/Harpoon is an effective all-weather, anti-ship weapon system designed for use by aircraft, ships and submarines. Launched from standoff ranges, it provides new dimensions in accuracy and firepower for the modern Navy.

The missile employs a low-level cruise trajectory, active radar guidance with counter-countermeasures, and terminal maneuvering, to assure maximum weapon effectiveness from beyond the horizon ranges. Scheduled for deployment by a broad spectrum of naval sea and air forces, Harpoon is designed for ease of fleet integration and compatibility with standard onboard equipment. These objectives have been met and flight proven by the Harpoon team.



System Elements:

Missile — Common for ship, submarine and air launch

Booster — Added for ship and submarine launch

Launchers — TARTAR, ASROC, Mark 26, Canister

Command and Launch System — Common Data Processor permits integration with existing ship and aircraft launch systems.

Length: 180 in. ship and submarine launch,
151 in. air launch

Diameter: 13.5 in.

Weight: 1460 lb. ship and submarine launch,
1160 lb. air launch

Range: Over-the-horizon

Propulsion: Cruise: Airbreathing Turbojet Engine
Surface Launch: Solid Propellant Booster

Guidance: Terminal: Active radar
Midcourse: Integrated digital computer
and a strapdown attitude reference
system with a radar altimeter

Warhead: Penetrating, high explosive blast type

Initial Launch Platforms:

Aircraft:

P-3 ASW Patrol

A-6 Attack

Ships:

FF-1052 Class Frigates

DD and DDG Class Destroyers

CG and CGN Class Guided Missile Cruisers

FFG-7 Guided Missile Frigates

PHM Patrol Hydrofoils

SSN Attack Submarines

Launch Platform Flexibility/Harpoon is designed for broad applicability to airborne, surface, and submarine tactical operations.



AIR LAUNCH

Air Launch / In tactical operation, the Harpoon missile can be air-launched at flight conditions encompassing a broad envelope of altitude and speed. After release, the missile descends in a programmed dive until pullout is commanded by the radar altimeter. It then levels out and flies to the target at a low cruise altitude.



SHIP LAUNCH

Ship Launch / For ship-launch the booster-assisted Harpoon missile is launched at a low elevation angle and follows a ballistic trajectory through booster separation. After booster separation, the sustainer engine starts and the missile descends to cruise altitude, following the same trajectory used for air launch.



CANISTER LAUNCH

Canister Launch / The Harpoon Canister Launcher provides a lightweight means of adapting Harpoon to almost any surface launch application including land based shore defense systems. The launcher comprises a cluster of four Harpoon canisters and an associated support structure. The missile is the same as used for ship launch except that the aerodynamic surfaces are configured to permit folding within the canister diameter.

The canister also serves as a shipping container and provides a protective environment for the Harpoon in operational use.



SUBMARINE LAUNCH

Submarine Launch / The submarine-launch Harpoon configuration is the same as for the canister launcher except that the missile is installed in a buoyant capsule. The capsule is fired from the submarine's torpedo tubes. The capsule glides to the surface as aft mounted control fins unfold to maintain the required attitude. Upon breaching the surface, the capsule end sections separate automatically and the missile's solid propellant booster ignites, launching the missile into the same trajectory used in surface launches.

Harpoon operations / The Harpoon Command and Launch Subsystem interfaces with onboard data systems to initialize the missile and control launch. Missile readiness can be verified prior to launch by use of a Built-In-Test selected by the operator. After launch from an aircraft, ship, or submarine, Harpoon operation is totally independent of the launch platform. Missile guidance and control is provided by a mid-course guidance system consisting of a strapdown attitude reference assembly, a digital computer, and a radar altimeter. Flight control is maintained by four fin surfaces, each driven by an electromechanical actuator. Offset launch capabilities are provided for all launch platforms. On reaching the selected target search area, the high resolution active radar seeker detects and "locks-on" to the target. Seeker lock-on is maintained until target impact. A terminal maneuver counters close-in enemy defenses and maximizes warhead effectiveness.



HARPOON

Harpoon Support Subsystem / The Harpoon Weapon System maintenance and logistics are based on a "wooden round" concept. Initial missile checkout is performed at a Naval Weapon Station, and repeated periodically, depending on launch platform environments. In storage the missile has a 5 year shelf life before retest. The primary support subsystem equipment is:

- Standard Handling Equipment compatible with existing facilities, organization level operations and existing logistics systems.
- Missile Subsystem Test Set (MSTS) used at the Naval Weapon Station for automated missile test and fault isolation to replaceable sub-assemblies.
- Missile Test Set-Simulator (TSS) provided at the organizational level to simulate missile electrical interface for Command and Launch Subsystem Checkout.

System Features / Use of proven design concepts, validated subsystems and off-the-shelf components have allowed an orderly development program with minimum developmental risks. The Harpoon Weapon System features...

Adaptability / A common missile for ship, submarine or air launch. For ship or submarine launch, the missile is equipped with a solid propellant booster motor to accelerate to cruise velocity. Harpoon avionics permit a simple adaptation to existing launcher and fire control systems. The missile guidance system is autonomous after launch, requiring no inputs from the launch platform. A canister launcher system allows a dedicated Harpoon launch capability to be deployed on virtually any ship.

Extended Cruise Range / A low cost turbojet sustainer engine provides long range flight. The high subsonic cruise speed provides an optimum tradeoff among range, warhead size, maneuverability, and weapon effectiveness.

Low Level Flight / A low level cruise altitude maximizes target acquisition capability through reduction of clutter effects while enhancing capability of penetrating enemy defenses.

All-Weather Target Acquisition / An active, frequency-agile radar seeker provides effective target acquisition and terminal tracking against all targets in rain and high sea conditions.

Terminal Maneuver / Missile maneuvering during the last seconds of flight increases survivability. Capability to perform high-g maneuvers throughout flight permits hitting fast, maneuvering targets.

Counter-Countermeasures / The frequency agility of the terminal seeker, coupled with advanced computer logic circuitry, provides extensive counter-countermeasure capability.

Target Acquisition Flexibility / Operator selectable seeker search patterns and optional launch modes permit maximum flexibility for a wide range of tactical conditions. Beyond-the-horizon targeting is enhanced by compatibility with third party inputs.

"Wooden Round" Concept / Missile checkout is completed at a Naval Weapon Station. No further assembly, inspection or maintenance of the Harpoon is required in operational deployment. The missile is designed for a 5 year shelf life.





HARPOON STRIKING TARGET SHIP FROM ASTERN

Program Plan

Harpoon has employed the DoD Milestone Contracting Approach to Provide Progress Assessment at Specific Program Phases.

Phase I — Design — Demonstrated Missile and Subsystem Performance for Air, Ship and Submarine Applications.

Phase II — Weapon System Development — Design, Development, and Demonstration of the Complete Weapon System for U.S. Navy designated platforms.

Phase III — Pilot Production — Verification of Design Data Package in Pilot Production line; Operational Test and Evaluation of Pilot Line Missiles and equipment.

Phase IV — Production — Expanded Production Rate While Maintaining System Quality; Continuing Cost Reduction and Control Effort.

Status

Harpoon has entered full production for the U.S. Navy, leading to fleetwide deployment. In addition, a number of friendly nations have signed government to government orders for Harpoon in parallel with USN requirements.

Program Direction

PMA 258, Naval Air Systems Command supported by the Naval Sea Systems Command.

Support

- Naval Weapons Center
- Pacific Missile Test Center
- Naval Ship Weapons Systems Engineering Station
- Applied Physics Laboratory
- Naval Undersea Center
- Naval Ship Research and Development Center
- Naval Underwater Systems Center
- Naval Air Development Center
- Naval Air Test Center
- Naval Weapons Station, Concord



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