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Warship Upgrades to Utilize Modern Standard Missile

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Introduction

Introduction

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- The United States Navy deployed Standard Missile-1 (SM-1) on the Perry class FFGs; however, the missiles have since been removed
  - U.S. Navy FFGs still retain the capability to launch SM-1
  - The remaining FFGs will likely be sold/transferred over the next decade
- SM-1 continues to serve as the primary air defense missile system for Frigates (FFG) and Destroyers (DDG) of 11 International Navies
- Due to ship transfers and International Navy requirements, FFGs and DDGs that utilize SM-1 will remain in service beyond the lifespan of the missile

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What can Navies do to retain AAW capability?

SM-1 Shooters Today

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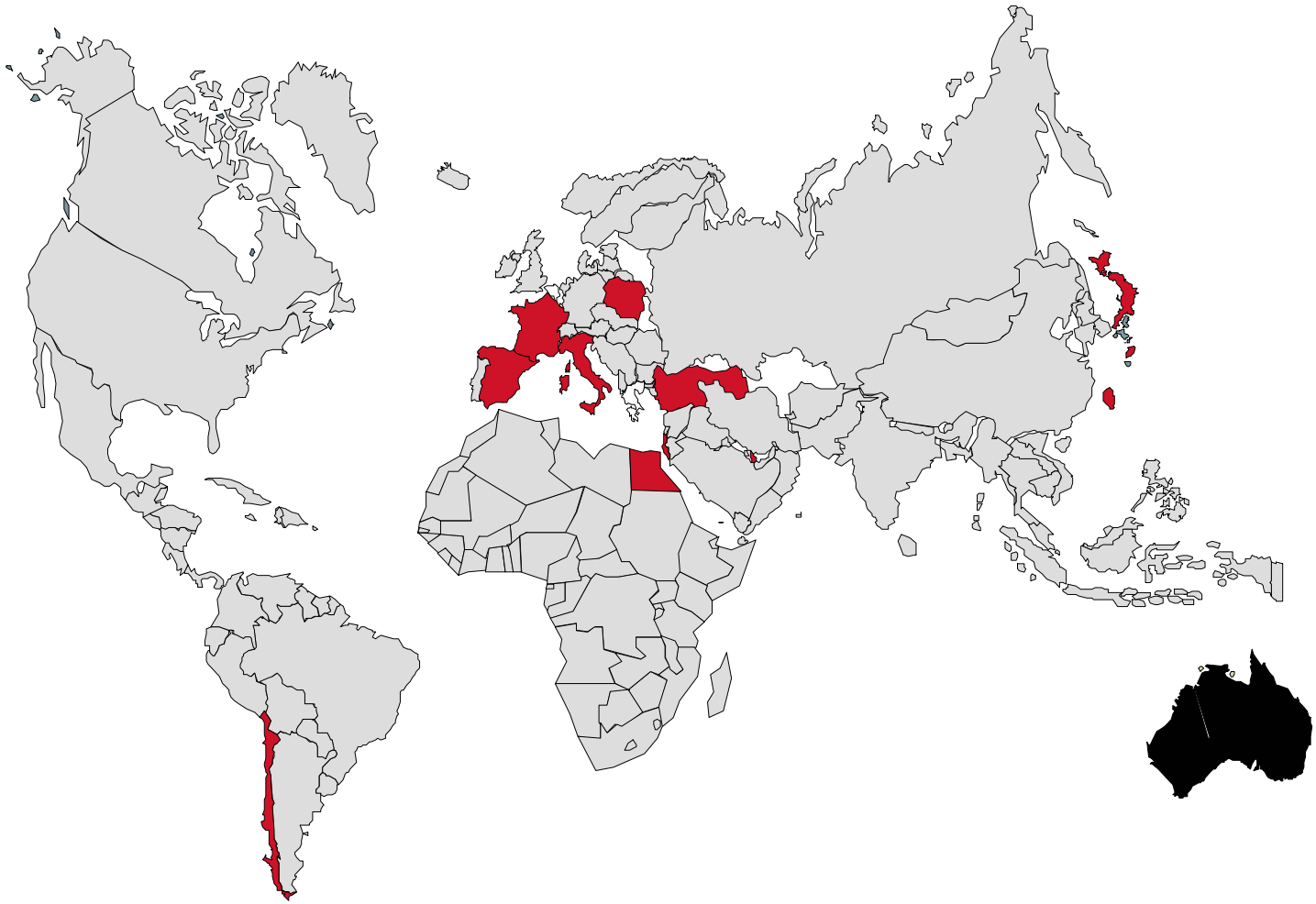
- DDG
  - Chile
  - France
  - Italy
  - Japan
- FFG
  - *Australia
  - Bahrain
  - Egypt
  - Poland
  - Spain
  - Taiwan
  - Turkey



*Australia is currently upgrading FFGs to SM-2

SM-1 Overview

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- All-weather, ship-launched, medium range, fleet air defense missile system
- Provides significant capability
  - Semi-active radar
  - Anti-ship cruise missiles
  - Aircraft
  - Helicopters
  - Rail launch (MK 13/26)
- Range > 46 km
- Altitude Up to 24 km
- Velocity > Mach 2.0

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SM-1 Shooters

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Provide these warships with enhanced air defense

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Steps to Upgrade the Ship

FFG Upgrade Approach

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- FFGs utilize several different Combat Management Systems (CMS)
  - MK 92 Mod 2
  - MK 92 Mod 6
  - MK 92 Mod 12
- Mod 2 Requirements:
  - Digital Initialization (Standard Missile Adjunct Processor)
  - Launcher Ordalt (ablative and electrical mods)
  - Employ in Home-All-The-Way (HAW)
  - Reliability and upgraded capabilities addressed
  - Improved SM-2 performance within the SM-1+ boundary (simplifies Weapon System modifications)

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FFG Mod 6/12 & DDG Upgrade Approach

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- MK 92 Mod 6/12 CMS offer greater capabilities than Mod 2
- DDGs have more powerful CMS and shipboard systems
- To upgrade MK 92 Mod 6/12 or DDG requires same minimum changes as Mod 2 and the following
  - MK 13 Launcher Ordalts (ablative)
  - Illuminator noise upgrade
  - SM-2 Adjunct Processor (SMAP)
  - Employ in HAW mode
  - Improved exploitation of ship system capability

- OR Same as Mod 2, Plus
  - Add improved INS
  - Add uplink capability (OT 134 or SSTx)
  - Procure new Block IIIA missile's
  - Employ in HAW and Midcourse (MCG)
  - Exploit SM-2 to its maximum capacity, constrained only by ship system capabilities

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System Upgrades for HAW

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- Minimum system upgrade for SM-2 limits modifications
  - AM/FM Open Architecture (OA) modifications to legacy Continuous Wave Illumination (CWI) transmitters
  - Full OA to MK 13
  - Standard Missile Adjunct Processor (SMAP) for SM-2 initialization minimizes impact on existing infrastructure and SM-2 Weapon Control Software (WCS)
    - Utilizes engageability and scheduling processes in WCS that are similar to SM-1
    - Detection, tracking and engagement is limited to SM-1 envelopment and ship capabilities (radars, CMS)
      - Enhanced performance within parameters
    - Minimum modifications to MK 92 or DDG FCS and command and control software

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System Approach for MCG

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- Basic upgrades for HAW are needed
- Additional modifications include
  - Improved Inertial Navigation System
  - OT-134 or solid state transmitter with uplink capability
  - Additional integration between SMAP and WCS to enable engagement at extended ranges

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Benefits of Upgrading the Ship

SM-2 Block III/IIIA

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- All-weather, ship-launched, medium-to-long range, fleet/area air defense missile system
- Provides significant capability
  - Monopulse, solid state, semi-active radar
  - Midcourse guidance
  - Extreme low altitude ASCM
  - High altitude cruise and diver
  - ECCM
  - Helo
  - Vertical (MK 41) or rail (MK 13)
- Range > 80 km
- Altitude > 65,000 ft (>20 km)
- Velocity > Mach 3

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SM-1 vs. SM-2 Engagement Envelope

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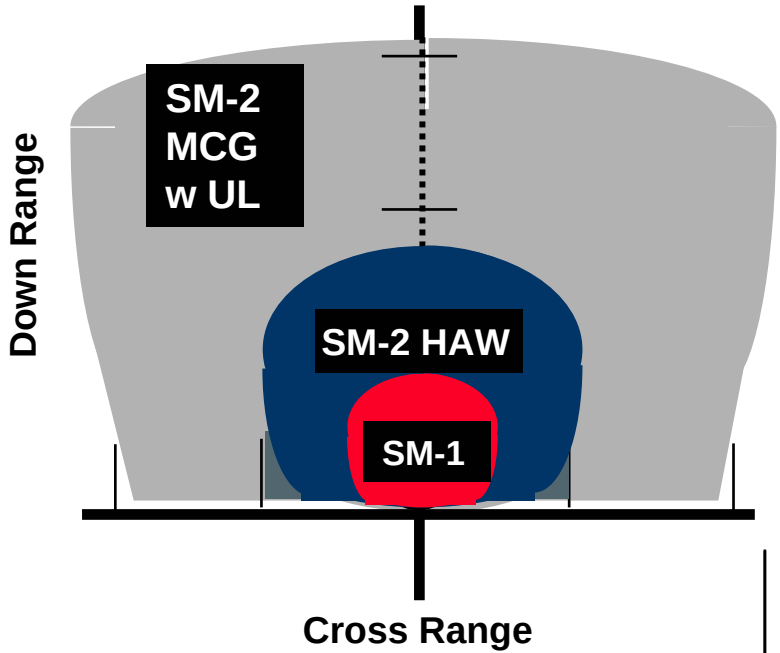
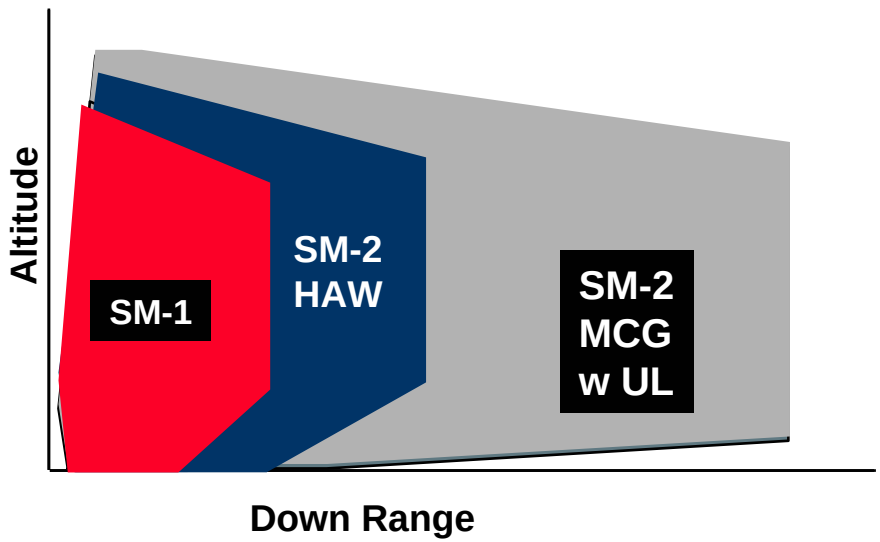


Notes:

- SM-2 HAW boundaries are notional
- SM-2 MCG boundaries are notional



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Key Benefits

- SM-2 has numerous improvements over SM-1
  - Greater target detection capability due to improved seeker and Target Detection Device
  - Increase kinematic capabilities and superior maneuverability
  - Greater engagement envelope and defended area
    - MCG provides greater footprint than HAW
  - SM-2 is in use by the U.S. Navy and 7 International Navies (Currently), which enables better logistics support for a longer period of time
- Upgraded ship performance
  - Improved detection, track and engagement capabilities resulting from radar and CMS modifications

Conclusion

Summary

- Some FFGs and DDGs will remain in service beyond the lifespan of SM-1
- Ships upgraded to SM-2 will have increased capability and performance
- Ship upgrades to enable the firing of SM-2 are a low-cost solution that keep the ship and crew defended against the threats of today and tomorrow