

LONG-RANGE STANDOFF WEAPONS

AGM-84H/K Standoff Land Attack Missile – Expanded Response

The Standoff Land Attack Missile – Expanded Response (SLAM-ER) is a long-range, highly precise, air-launched strike missile capable of attacking high-value fixed and mobile land targets as well as surface ships that are under way or in port. Terminal control of the weapon is accomplished when the pilot designates the impact point on the imaging infrared scene transmitted by the weapon to the cockpit display. Man-in-the-loop commands are sent to the SLAM-ER by way of a data-link pod carried by the launching (or secondary control) aircraft.

AGM/RGM-84D Harpoon Block 1C

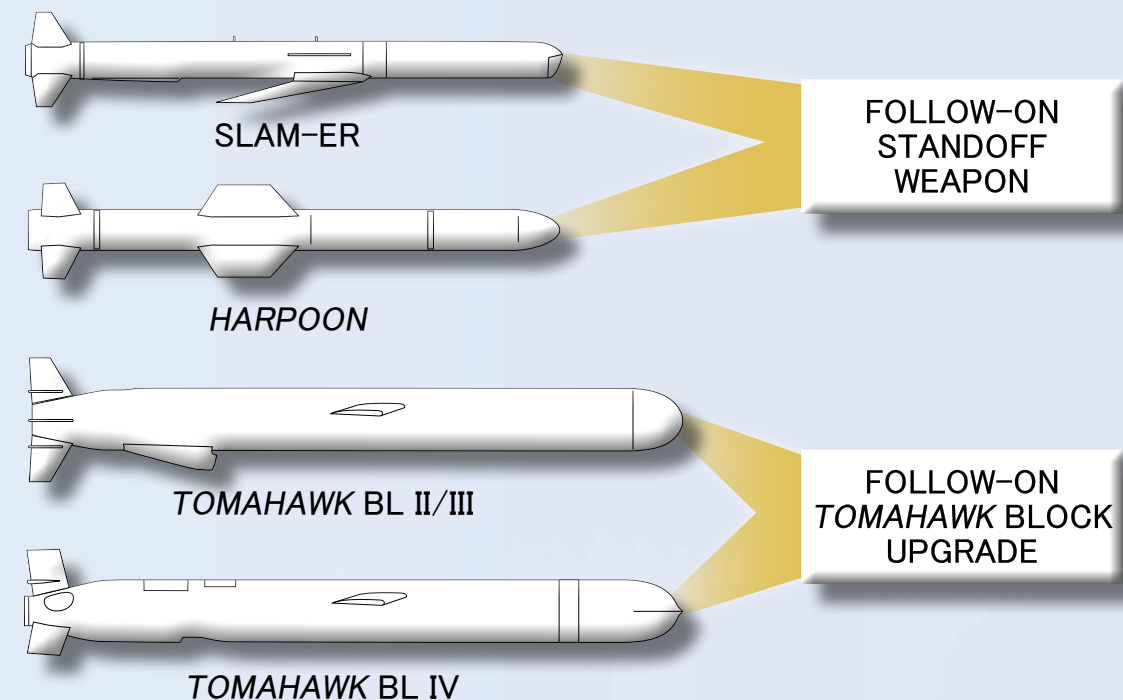
The *Harpoon* Block 1C is an air- or surface-launched, anti-ship, all-weather cruise missile that employs an autonomous active radar seeker to attack a wide variety of surface ship targets from standoff ranges. The *Harpoon*, which entered service in 1977, is currently carried by F/A-18 and P-3C aircraft as well as a portion of the Navy's DDG-51 and CG-47 surface ship classes. Numerous air, surface, and submarine platforms currently deploy *Harpoon* for 27 international customers.

An analysis of alternatives will be conducted to scope and define a follow-on weapon solution to meet the standoff strike mission areas currently addressed by SLAM-ER and *Harpoon* Block 1C.

Five-inch rockets, 1945

2010

2032



Tomahawk Land Attack Missile

The *Tomahawk* Land Attack Missile (TLAM) is a long-range, subsonic cruise missile used for deep land attack warfare that is launched from U. S. Navy surface ships and U.S. Navy and United Kingdom Royal Navy submarines. There are currently three main versions: the Block II nuclear variant, which contains the W80 warhead; the Block III conventional variant, which can carry either a 1000-pound unitary warhead or a submunition-dispensing warhead; and the Block IV, or Tactical *Tomahawk*, which is network-enabled and capable of changing targets while in flight. *Tomahawk* provides on-scene commanders with the flexibility to attack long-range fixed targets or to support special operations forces with a lethal, responsive, precise weapon system. Future capabilities for the *Tomahawk* Block IV include improvements to the warhead (the Joint Multiple Effects Warhead System [JMEWS]) and a maritime interdiction multimission capability (Multimission *Tomahawk* [MMT]). JMEWS will demonstrate the military utility of a programmable warhead with increased effects of penetration and blast against the full range of targets, from area to hardened targets. MMT adds a moving target seeker and upgraded data link to the existing Tactical *Tomahawk* missile. The *Tomahawk* program office is currently investigating industry seeker technologies for maritime interdiction that could potentially be integrated into the existing Block IV weapon system. Additional studies have been initiated to develop a next-generation supersonic cruise missile capability for *Tomahawk* that will increase responsiveness against time-critical targets.

MID-RANGE STANDOFF WEAPONS

AGM-88E Advanced Anti-Radiation Guided Missile

The Advanced Anti-Radiation Guided Missile (AARGM) upgrade program transforms a portion of the existing AGM-88 High-Speed Anti-Radiation Missile (HARM) inventory into lethal strike weapons with enhanced time-critical strike and precision attack capabilities. The AARGM upgrade includes: an advanced digital anti-radiation homing receiver for greater sensitivity and advanced air defense system capabilities; an active millimeter wave terminal radar to increase lethality against modern air defense units, such as surface-to-air missile radars that use radar shutdown and countermeasures designed to defeat anti-radiation missiles; an inertial navigation system (INS)/Global Positioning System (GPS) capability; a weapon impact assessment transmitter to aid and cue the battle damage assessment process; and an integrated broadcast service receiver for network-centric connectivity reception of off-board targeting information. AARGM correlates multiple sensors and geo-specific capabilities to locate and attack both stationary and fixed targets with precision while countering enemy tactics designed to defeat anti-radiation missiles. Initial operational capability for AARGM is the beginning of fiscal year 2011.

AGM-154 Joint Standoff Weapon

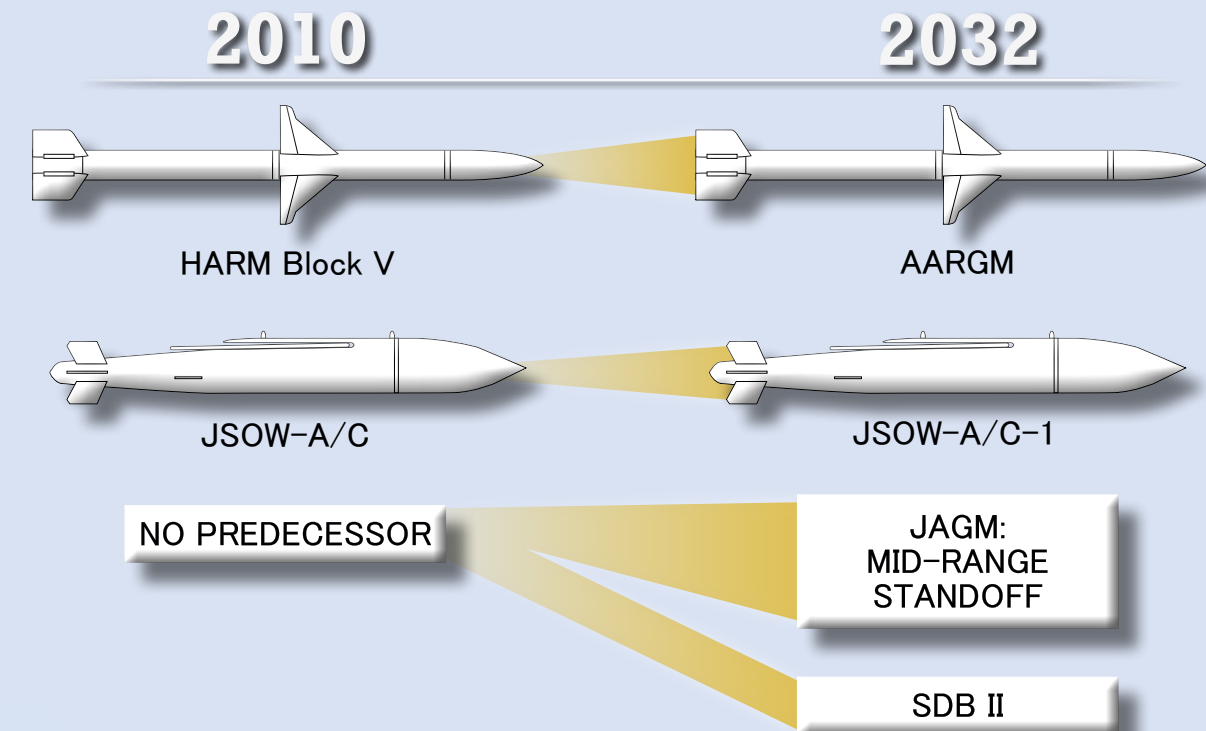
The Joint Standoff Weapon (JSOW) is a joint family of armaments that permits Navy and Air Force aircraft to attack targets at increased standoff distances. The weapons use INS and GPS for guidance. All JSOW variants share a common body but can be configured for use against area targets or bunker penetration. The JSOW-C unitary variant adds an imaging infrared seeker and an autonomous target acquisition capability to attack point targets with precision accuracy. The JSOW-C-1 will incorporate new target tracking algorithms into the seeker for moving targets, giving joint force commanders an affordable, air-delivered, standoff weapon that is effective against fixed and mobile land targets in addition to maritime targets. The JSOW-C-1 system will maintain legacy JSOW-C functionality to be effective against point targets in or through adverse weather conditions on both day and night missions. JSOW-C-1 will provide low- and high-altitude launch capabilities to enable launch platforms to remain outside the range of target point defenses, enhancing aircraft survivability. Used in conjunction with accurate targeting information and anti-radiation weapons, JSOW-C-1 will destroy enemy air defenses.

Joint Air-to-Ground Missile (Mid-Range Standoff)

The Joint Air-to-Ground Missile (JAGM) is a joint Army-Navy initiative with the Army designated as the lead service. It is an all-weather, extended range, 100-pound-class weapon system that will use a tri-mode seeker (semi-active laser, millimeter wave radar, and imaging infrared), multipurpose warhead, and single configuration rocket motor to destroy high-value hardened and non-armored stationary and moving targets. Threshold platforms for JAGM as a mid-range standoff capability include the F/A-18E/F *Super Hornet* and other joint service manned and unmanned aircraft. It is expected to reach initial operational capability in fiscal year 2015.

Small-Diameter Bomb Increment II

The Small-Diameter Bomb Increment II (SDB II) is a joint program that provides warfighters with the capability to attack mobile targets at standoff ranges in all types of weather. This 250-pound-class weapon addresses the following additional requirements: multiple ordnance



carriage; all-weather operations; precision munitions capability; reduced munitions footprint; increased weapon effectiveness; minimized potential for collateral damage; reduced susceptibility of munitions to countermeasures; and a migration path to a network-centric operations capability. Incremental development to pursue network-centric interoperability will continue. SDB II integration is planned for the F-35B/C *Lightning II*, with weapon system initial operational capability on the Marine Corps' F-35B scheduled for fiscal year 2016. Initial operational capability on the Navy's F-35C carrier variant will follow soon thereafter. There is a potential for future integration on the Navy's F/A-18E/F *Super Hornet*.



DIRECT ATTACK WEAPONS

General Purpose Bombs

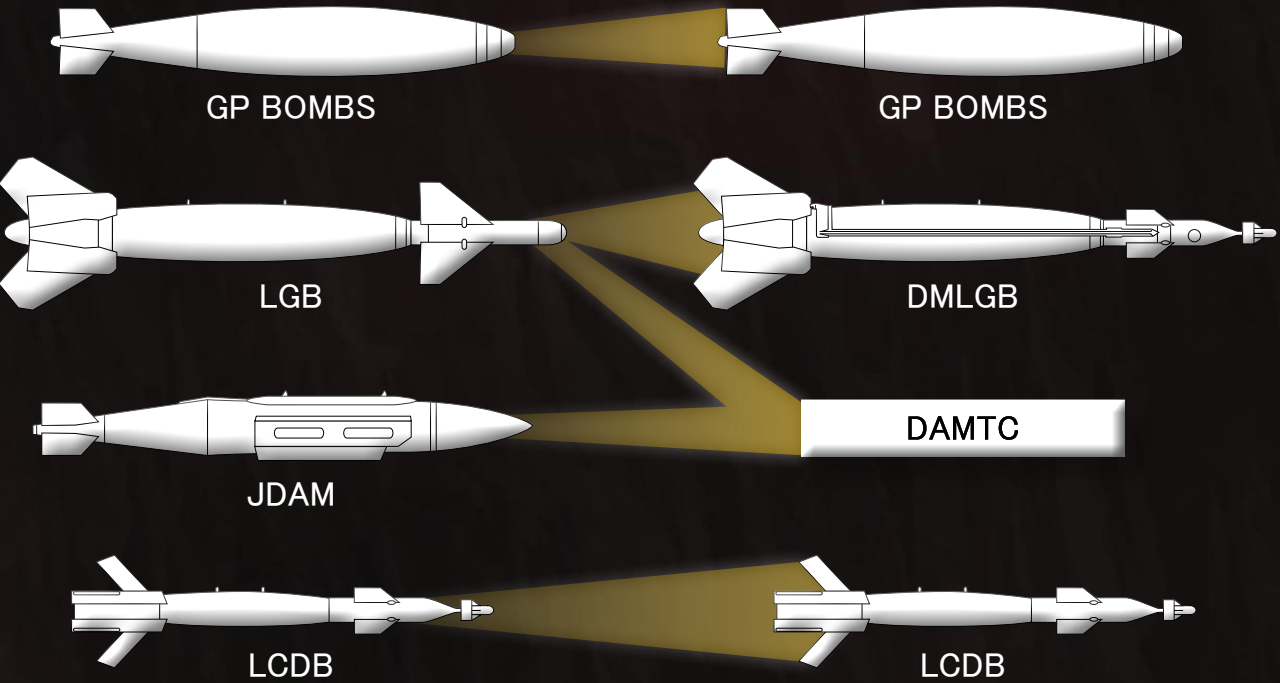
Mark 80/BLU series General Purpose 500-, 1,000-, and 2,000-pound bombs provide blast and fragmentation effects against a variety of non-hardened targets and are used extensively for direct attack, close air support, and suppression missions. The thermally protected warhead is used for Joint Direct Attack Munitions (JDAM), Laser JDAM, Dual Mode Laser-Guided Bombs (DMLGB), and Low Collateral Damage Bombs (LCDB). General Purpose bombs are expected to remain in the inventory through 2032.

Dual Mode Laser-Guided Bomb

The Dual Mode Laser-Guided Bomb (DMLGB) is a retrofit that converts Laser-Guided Bombs currently in the inventory to a dual mode configuration using common components. The retrofit replaces the existing computer control group with an INS and GPS that provides fire-and-forget, all-weather terminal guidance. The retrofit strategy streamlines qualification timelines, putting a new weapon in the hands of warfighters that much faster. Initial operational capability took place in October 2008 for both the AV-8B *Harrier* and F/A-18 *Hornet* aircraft. Future integration on the F-35 *Lightning II* is also planned.

2010

2032



Direct Attack Moving Target Capability

Threat targets are becoming more mobile and more capable, and the ability to neutralize them with legacy aircraft is critical. The Direct Attack Moving Target Capability (DAMTC) will be a level-of-effort weapon that is intended to provide naval and joint warfighters with a lethal, interoperable, and cost-effective precision strike weapon system that can engage moving, semi-mobile, and stationary targets. It is anticipated that DAMTC will be a retrofit kit for existing JDAM and/or LGB level-of-effort weapons, making it available to the fleet in the near future.

Low Collateral Damage Bomb

The Low Collateral Damage Bomb (LCDB), is a weapon that is combat-effective and adheres to the collateral damage rules of engagement dictated by U.S. Central Command. A precision strike weapon, LCDB is ideal for modern urban warfare, where target discrimination between friendly, neutral, and enemy forces requires exceptional blast control. LCDB can be used with the same guidance kits as those used for LGBs, DMLGBs, JDAM, and Laser JDAM. The modification of an existing weapon system reduced the design, production, and sustainment costs of the LCDB.

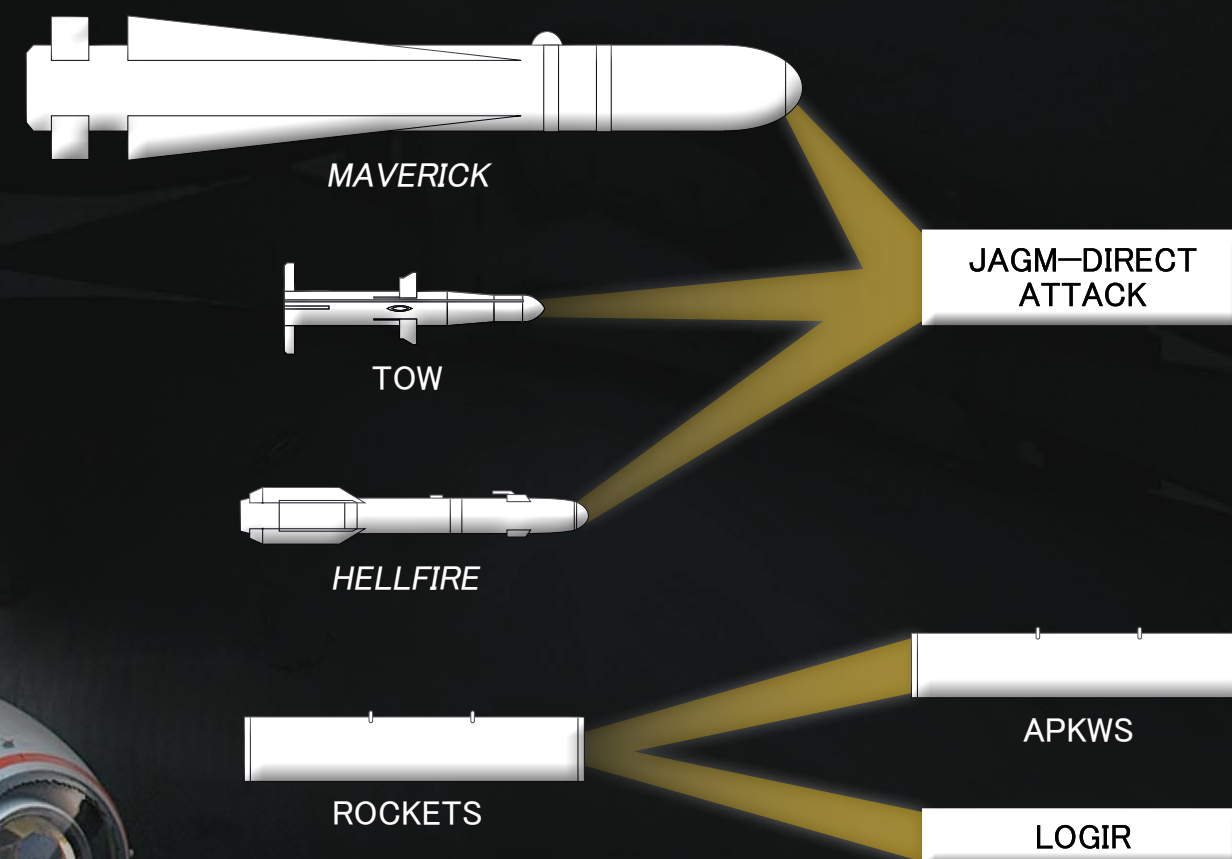
Joint Air-to-Ground Missile (Direct Attack)

The Joint Air-to-Ground Missile (JAGM) is a joint Army-Navy initiative with the Army designated as the lead service. It is an all-weather, direct attack, 100-pound class weapon system that will use a tri-mode seeker (semi-active laser, millimeter wave radar, and imaging infrared), multipurpose warhead, and single configuration rocket motor to destroy high-value hardened and non-armored stationary and moving targets. JAGM as a direct attack capability is envisioned as the eventual replacement for the AGM-114 *Hellfire*, AGM-65 *Maverick*, and tube-launched, optically tracked, wire-guided missile systems. Threshold platforms include the AH-1Z *Viper*, the MH-60R *Seahawk*, and other joint service manned and unmanned aircraft. It is expected to reach initial operational capability in fiscal 2015 for the AH-1Z and fiscal year 2016 for the MH-60R.



2010

2032



Advanced Precision Kill Weapon System

The Advanced Precision Kill Weapon System (APKWS) provides precision guidance to the existing *Hydra 70*, 2.75-inch rocket system (scalable to 5-inch) by placing a laser-guided seeker on existing rocket motors and warheads, providing an excellent low-cost, mid-range weapon that is well suited to the urban environment. Accurate to within 2 meters of the aim point, the weapon will destroy target sets consisting of personnel, unarmored vehicles, lightly-armored vehicles, armored personnel carriers, structures, and man-portable air defense systems at ranges from 1.5 to 5 kilometers. Initial operational capability is expected in fiscal year 2010.

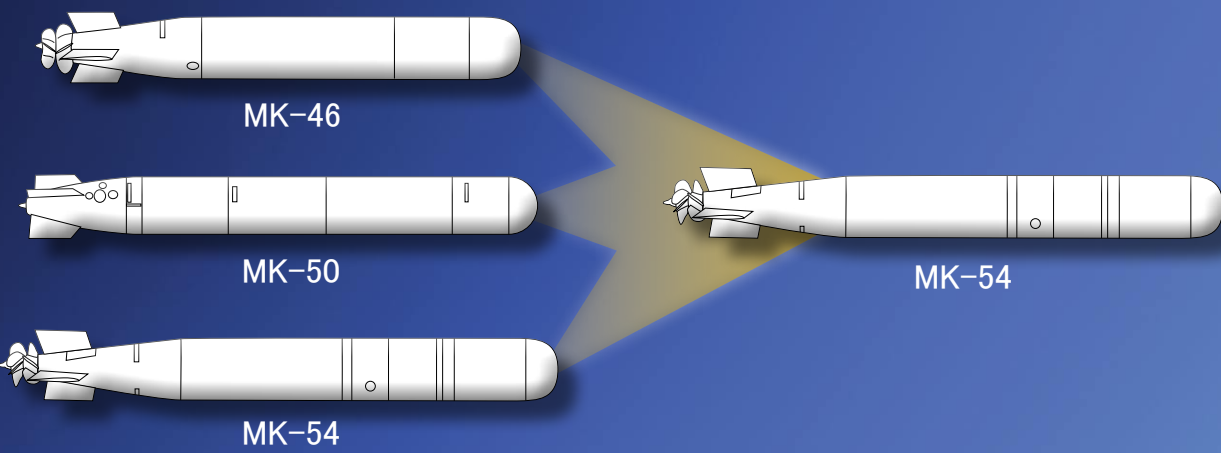
Low-Cost Guided Imaging Rocket

The Low-Cost Guided Imaging Rocket (LOGIR) is a *Hydra 70*, 2.75-inch rocket with a front-end inertial/infrared guidance kit. LOGIR technology is applicable to 5-inch rockets (such as *Zunis*) and bombs (such as JDAM). In 2006, the LOGIR team from the weapons division of the Naval Air Warfare Center completed final deployment testing and the results showed excellent functionality. In addition, researchers have made significant theoretical advances that will lead to the elimination of nearly all image processing thresholds, technologies that are now being incorporated into LOGIR.



2010

2032



By 2032, the MK-54 will have replaced the current inventory of MK-46 and MK-50 lightweight torpedoes. The MK-54 was created by combining the homing section of the MK-50 and the propulsion unit and warhead of the MK-46, improved for better performance in shallow water, and with the addition of commercial off-the-shelf technology. The MK-54 has both analog and digital fire control capabilities in addition to a software upgrade capability. Aircraft capable of employing the MK-54 are the SH-60F, MH-60R, P-3C, and P-8A (in 2013). Still in the design phase, a special variant of the MK-54—the High-Altitude Anti-Submarine Warfare Weapon—is an air-launch accessory that allows fixed-wing aircraft to employ the torpedo outside the current air-launch envelope. This variant will provide the P-8A *Poseidon* (starting in 2016) with the ability to engage undersea targets with precision at high altitude and long range without the need for dedicated attack runs. Future developments may include a data link allowing in-flight control and mid-course guidance to the weapon by 2018.

AIR-TO-AIR WEAPONS

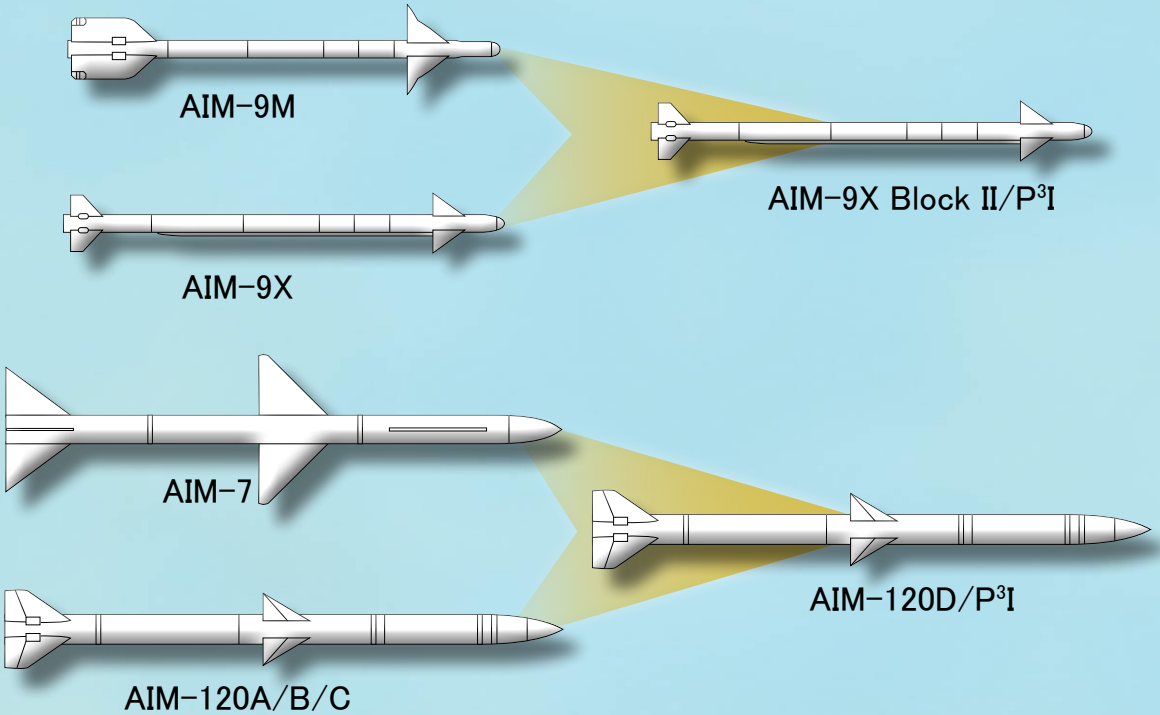
AIM-9X Block II/P³I *Sidewinder*

The AIM-9X *Sidewinder* is a major modification to the AIM-9M short-range, air-to-air missile and will provide U.S. fighters with the ability to defeat tomorrow's advanced threats. The AIM-9X is upgraded with a focal-plane-array guidance-control section, a highly maneuverable airframe, and signal processors that enhance kinematics and infrared countermeasure capabilities. The AIM-9X Block II/Pre-Planned Product Improvement (P³I) program will provide warfighters with increased lethality, high off-boresight capability, and a data link to take full advantage of increased kinematics and range. The Joint Helmet-Mounted Cueing System provides a "first-look, first-shoot" capability to naval aviators.



2010

2032



AIM-120D/P³I Advanced Medium-Range Air-to-Air Missile

The Advanced Medium-Range Air-to-Air Missile (AMRAAM) is deployed on the F/A-18A/B/C/D *Hornet* and the F/A-18E/F *Super Hornet* and will be deployed on the EA-18G, AV-8B, and F-35 aircraft. Joint Navy and Air Force procurement of the AMRAAM AIM-120C7 was completed in late 2008. The AIM-120D/P³I program modernizes this missile to maintain medium-range air superiority. This modernization plan includes an enhanced data link, a GPS system, improved high off-boresight capability, a program to enhance kinematics, and improved electronic counter-countermeasures capabilities through software upgrades. Initial acceptance of AIM-120Ds began in 2009. Ultimately, the AMRAAM will be the Department of the Navy's sole medium-range missile.