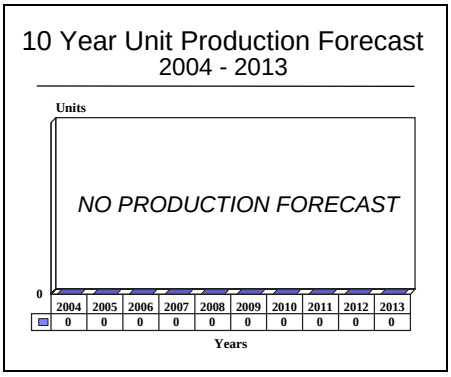
Predator - Archived 9/2005

Outlook

- Production run nearly complete
- Operation Iraqi Freedom emphasized need for direct fire Predator
- Existing Predators to be retrofitted with new multipurpose warhead
- Two LRIP contracts have been awarded to Lockheed Martin by the U.S. Marines



Orientation

Description. A man-portable anti-tank weapon.

Sponsor. The development of the Predator was sponsored by the United States Department of Defense through the U.S. Navy, Naval Surface Weapons Center, Dahlgren, Virginia. The U.S. Marine Corps initially procured the weapon. The U.S. Army has provided some funding for the development program. The Predator was developed under the Balanced Technology Initiative program.

Status. The full-scale development of the Predator has been completed. Low-rate serial production is under way.

Total Produced. As of the end of 2003, a total of 1,005 complete Predator munitions had been manufactured.

Application. A disposable, light anti-armor weapon for infantry on the move, the Predator is designed to be able to inflict a catastrophic kill on a T-80/Future Soviet Tank 2 when attacked from any aspect.

Price Range. Based on the originally projected procurement of 18,190 weapons, the unit price for a serially produced Predator is US$19,791 in Fiscal 2004 dollars. While denied by officials, the unit price figure will undoubtedly be affected by the reduction in procurement announced in mid-2000.

Contractors

Lockheed Martin Missiles and Fire Control - Orlando, http://www.missilesandfirecontrol.com, 5600 Sand Lake Road, MP 455, Orlando, FL 32819-8907 United States, Tel: + 1 (407) 356-2000, Fax: + 1 (407) 356-2080, Prime

Alliant Techsystems - ATK Tactical Systems, Allegany Ballistics Laboratory, http://www.atk.com, 210 State Route 956, Rocket Center, WV 26726-0210 United States, Tel: + 1 (304) 726-5000, Fax: + 1 (304) 726-5183, Email: gary_geiger@atk.com (Solid Rocket Motor)

Aerojet, http://www.aerojet.com, PO Box 13222, Sacramento, CA 95813-6000 United States, Tel: + 1 (916) 355-4000, Fax: + 1 (916) 351-8667, Email: comment@aerojet.com (Warhead)

General Dynamics Ordnance and Tactical Systems, http://www.gd-ots.com, 10101 Dr. M. L. King St North, St. Petersburg, FL 33716 United States, Tel: + 1 (727) 578-8100, Fax: + 1 (727) 578-8119 (Warhead)

BEI Systron Donner Inertial Division, http://www.systron.com, 2700 Systron Dr, Concord, CA 94518-1399 United States, Tel: + 1 (925) 671-6400, Fax: + 1 (925) 671-6590, Email: sales@systron.com (Sensors)

Technical Data

Design Features. The Predator is a disposable, fire-and-forget weapon designed to defeat T-80/Future Soviet Tank 2 threat armor when attacked from any aspect. This weapon uses top-attack (also called over-the-armor) technology to inflict the catastrophic kill. The Predator is a modular design that incorporates "soft launch" technology that allows it to be fired from small enclosed spaces.

	SI units	**U.S. units**
Dimensions		
Total length:	88.9 centimeters	35 inches
Diameter:	14 cm	5.51 inches
Total weight:	9.7 kilograms	21.3 pounds

Performance. The armor perforation data for the Predator weapon are unknown. As the exact design, composition, and diameter of the warhead are not known at this time (most sources state 14 cm, or 5.51 in), we are unable to apply our standardized formula to this weapon. However, reliable sources state that an "excellent" level of armor perforation has been fully demonstrated in the developmental test program to date.

	SI units	**U.S. units**
Speed:	300 meters per second	984,24 feet per second
Range (from shoulder):	600 meters	656.2 yards

Propulsion. The Predator projectile uses a solid-fuel rocket motor that is designated "Minimum Smoke." This motor is being supplied by Alliant Techsystems (formerly Hercules). The motor features low signatures and has a high degree of operator safety.

Control and Guidance. The Predator projectile is stabilized in flight by four spring-out fins that deploy after the projectile exits the launcher. This weapon is a fire-and-forget type with a high probability of a first-round hit. The manufacturer says that a "low cost inertial autopilot incorporating three axes sensors" is used; jet reaction control is used as well. There is evidence that the jet reaction system of the Predator's guidance and control system automatically corrects for crosswinds, motor thrust misalignment, control surface misalignment, and similar disturbances to the trajectory of the munition. The changes in target velocity are an automatic process, as is the overflight of the target. The target is first detected by a magnetic sensor; the front, then rear, of the target is detected by optical (laser beam-based) sensors. At the appropriate point over the target (which must be confirmed by the two sensor components), the downward firing warhead is activated.

Warhead. The Predator uses an advanced-design High Explosive Anti-Tank warhead employing top-attack technology. Aerojet is the contractor. The High Explosive Anti-Tank lethal mechanism is a flat cone-shaped charge, and is also referred to as an explosively formed penetrator.

Some sources state that the diameter of the warhead is 14 centimeters. If this is true, the application of our standardized formula for chemical (High Explosive Anti-Tank) warheads yields an armor perforation figure of 88.2 centimeters, among the best available today.

In 2004, Lockheed Martin received a contract to refit all Predators with a new multi-purpose blast-fragmentation warhead. This new version is known as the Predator SRAW-MPV (Multi-Purpose Variant). This will convert the missile from an anti-armor rocket to a direct-fire urban assault weapon, which better fulfills the needs of the USMC.

Variants/Upgrades

The modular design of the Predator facilitates the integration of alternate payloads. The Naval Surface Weapons Center and the U.S. Army have been developing a specialized warhead/fuze combination for the bunker defeat mission which is called the Multi-Purpose Individual Munition program. The specific weapon is called the Short Range Anti-Tank Weapon/ Multi-Purpose Individual Munition.

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In 1995, the Defense Science Board issued a report that praised the Predator and encouraged upgrades to the weapon. While no specific enhancements were mentioned, the upgrades would be necessary to address the need for weapons that can be used in urban combat.

Program Review

Background. In the past, the U.S. Marine Corps had to be content with whatever man-portable anti-armor the U.S. Army developed. This changed with the advent of the Mark 150 Shoulder Launched Multi-Purpose Assault Weapon in 1983. This weapon was developed by the Marine Corps with its own (U.S. Navy) funds. Although the weapon was not originally an anti-tank weapon, newer warheads have given this weapon a moderate anti-tank capability. The Mark 150 Shoulder Launched Multi-Purpose Assault Weapon is a derivative of the Israeli B-300 (see separate report).

During the 1980s, the U.S. Army conducted a series of tests for a new man-portable anti-armor weapon. This effort was aimed at fielding a definitive weapon for the U.S. armed forces. However, the Marines were somewhat dissatisfied with the weapon selected, the AT4/M136 (see separate report).

Short-Range Anti-Tank Program. The original requirement for an Improved Light Anti-Tank Weapon was written in 1982. The Marine Corps operational requirement specified an inexpensive, lightweight, man-portable anti-tank weapon that could defeat the latest threat armor, including explosive reactive armor. The Defense Advanced Research Projects Agency, which at the time had a number of anti-armor programs in development, joined with the U.S. Naval Surface Weapons Center in developing a weapon to meet the requirement. In October 1987, a Request for Proposals was prepared, and in April 1988 five firms were selected to define the concept, which was then known as the Short-Range Anti-Tank Weapon. The firms selected were each awarded US$500,000 contracts for Phase I development, which lasted five months. The firms were the Ford Aerospace and Communications Corporation – Aeronutronic Division (subsequently sold to Loral and called Loral Aeronutronic, and then acquired by Lockheed Martin), Hughes Missile Systems Group (now owned by Raytheon), McDonnell Douglas Missile Systems (now owned by Boeing), Honeywell Defense Systems (now Alliant Techsystems), and Physics International.

In July 1989, the development program was passed from DARPA to the Marine Corps under the auspices of Naval Surface Weapons Center. In February 1990, the downselection process resulted in (then) Ford Aerospace and Hughes Missile Systems entrants being selected for the second stage of development. Ford Aerospace received US$12.9 million and Hughes received US$13.9 million to develop competitive prototypes of their systems. In December 1990, a further downselection was made, resulting in Ford Aeronutronic (by then known as Loral Aeronutronic) continuing in a sole-source position. Negotiations on a sole-source contract with Loral Aeronutronic then began. In 1992, Loral Aeronutronic selected the name Predator for its Short-Range Anti-Tank Weapon. Loral Aeronutronic was subsequently acquired by Lockheed Martin and eventually become part of Lockheed Martin Missiles & Fire Control – Orlando.

Description. Originally, the Predator was designed as a light, man-portable anti-tank weapon designed to inflict a catastrophic kill on a T-80/Future Soviet Tank 2 when attacked from any aspect. The weapon has the same general appearance as other weapons of this type but is not an over-caliber weapon such as the Panzerfaust 3 or RPG-7.

The Predator has an inertial guidance system. While not a missile, this guidance system is sufficient to give it a high probability of a hit. The Predator is very close to what we define as a missile, but its low-cost guidance system is not equal to a true tactical missile such as MILAN, Javelin, or TOW.

Under its original design, the Predator projectile would fly *over* the target with the warhead detonating downward. This top-attack technology was chosen because the tops of tanks have thinner armor. The Predator was designed to be effective against explosive reactive armor (ERA).

The Predator has been designed as a modular system, with the aft module referred to by the manufacturer as the "Delivery System" and the front module as the "Payload." This concept was intended to dramatically reduce the development and procurement costs of man-portable weapons, and bring economies of scale to production of all variants. During the demonstration and validation phase of development, a number of component improvements were incorporated into the design. This served to reduce the number of parts used in the Predator from slightly over 1,500 to fewer than 300. For example, one circuit card was reduced from 121 components to a single 28-pin integrated circuit. Overall, these reductions are resulting in a lighter, more effective weapon that can be procured at a lower price.

Program Restructuring. In 1993, a move began in Congress to integrate the Marine Corps' Short-Range Anti-Tank Weapon program and the Army's M141 Bunker Defeat Munition and Multi-Purpose Individual Munition programs. Proponents of this plan cited the great similarity among the three programs. They envisioned the integration of the eventually selected Bunker Defeat Munition warhead with the Predator weapon. The modular design of the Predator aided this effort. The resulting weapon would also fill the Army's Multi-Purpose Individual Munition requirement.

By June 1994, the funding for the two programs had been integrated, but the contractors involved were less than enthusiastic, the general belief being that the programs could again be separated, which they subsequently were.

SRAW-MPV. In 2004, the Predator underwent another change. Lockheed Martin was awarded a contract to retrofit its Predator anti-tank weapon with a multi-purpose variant (MPV) blast fragmentation warhead. This new warhead enables the missile to defeat urban targets such as buildings and bunkers, as well as light-armored vehicles.

The U.S. Marine Corps gave Lockheed Martin the go-ahead to modify the Predator anti-tank weapon into a direct-attack urban assault weapon. The conversion of Predator from a top-attack anti-armor weapon to a direct-fire urban assault weapon was prompted by "the need for fire-from-enclosure assault weapons, which has become paramount to support Operation Iraqi Freedom," according to program officials.

The retrofit effort will run through the end of 2004 and include all Predator rounds already delivered under a low-rate initial production (LRIP) 1 contract as well as all rounds currently in production under LRIP 2.

The resulting new weapon system will be renamed the Short-Range Attack Weapon Multi-Purpose Variant (SRAW-MPV).

Funding

The U.S. is procuring the Predator, although in smaller numbers than once planned. In mid-2000, the U.S. Marine Corps slashed its planned procurement of the Predator from 18,190 to 5,700 weapons. The reason cited for the cut was that fewer Predator weapons were needed for training. Under the new guidelines, only 500 weapons were to be expended in training, with the rest of the training conducted on simulators. The reduction also freed up US$140 million for other programs.

No funding for research and development was requested after Fiscal 2001. For Fiscal 1999, US$18.2 million was originally requested for 289 Predator weapons. These weapons were never procured. The first procurement request was subsequently made in Fiscal 2001, when US$43 million was requested to procure 307 Predator weapons.

U.S. FUNDING

	FY2002		FY2003		FY2004		FY2005 (Req)	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
Procurement								
Predator (SRAW)	-	-	445	35.7	-	5.8	-	-
RDT&E								
PE#0603635M[a]								
Project C2113[b]	-	-	-	-	-	-	-	-
TOTAL	-	-	445	35.7	-	5.8	-	-

All US$ are in millions.

[a] Program Element number 0603635M – Marine Corps Ground Combat/Support Systems.

[b] Project number C2113 – Short-Range Anti-Tank Weapon. This project supports the full-scale engineering development of the Short-Range Anti-Tank Weapon. Project C1964B, Weaponry, supported the development program through Fiscal 1991.

Recent Contracts

The first procurement contract for the Predator – M67854-02-C-1003 – was issued on January 25, 2002. This contract, worth US$39 million and reportedly completed by March 2004, covers the procurement of 330 Predator weapons. This LRIP contract was followed by a second award for US$30.9 million in December 2002 (M67854-03-C-1084). The LRIP 2 contract, completed in January 2004, was for the production and delivery of 445 Predator weapons.

Timetable

Month	Year	Major Development
	1985	Concept formulated, and a requirement issued by Marine Corps
	1986	Development of program assumed by DARPA
August	1987	Request for Proposals
April	1988	Five firms selected for competitive development
July	1989	Development program passed to U.S. Marine Corps
February	1990	Downselection to two competitors
December	1990	Loral Aeronutronic (then Ford Aeronutronic) design selected for full-scale development
September	1991	Short-Range Anti-Tank Weapon operational capability approved
October	1991	First successful test of Short-Range Anti-Tank Weapon against a moving target
June	1994	Congress mandates the integration of the Short-Range Anti-Tank Weapon program and Bunker Defeat Munition program
January	2002	First production contract awarded
	2002-03	Low-rate production
	2004	Predator retrofitted with new multi-purpose warhead

Worldwide Distribution

Countries. **United States**.

Forecast Rationale

The fighting in Iraq has prompted the U.S. Marines to retrofit all Predators with a new multi-purpose blast-fragmentation warhead. This converts the Predator from an anti-armor rocket to a direct-fire urban assault weapon now known as the SRAW-MPV (Multi-Purpose Variant). All existing Predators will be converted to SRAW-MPV status. The SRAW-MPV will better fulfill the U.S. Marines' need for a weapon capable of being fired from enclosed areas.

Yet even as the fighting in Iraq raged, all procurement funding for the Predator was zeroed in the FY2004 U.S. defense budget. The Predator program was apparently shelved to save money. The U.S. Marines had planned to procure some 5,700 Predators – down from an original total of 18,190 units. During the initial phase of Operation Iraqi Freedom, sources were hopeful that the Predator would receive a boost in demand due to the experience gained during this conflict.

Some supporters of this program say there is still a chance Predator will receive new procurement funding in the future. The fighting in Iraq saw heavy use of man-portable rocket systems. While a good portion of these weapons were used against armored vehicles, the majority were expended in attacks on fixed targets such as fortifications and other structures. The Pentagon is reevaluating its urban assault weapon capabilities and examining options for upgrading them. The SRAW-MPV could be offered to meet part of this upgrade requirement.

For now, production of those Predators under contract has been completed. The retrofit of the new multi-purpose warhead is to be completed this year (2004). No further production of the Predator is anticipated.

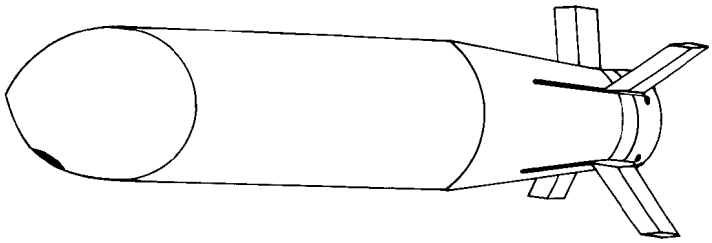
Note: The following forecast chart is for the Short-Range Anti-Tank Weapon/Predator weapon program in its original manifestation as described herein, and *does not* include the M141 Bunker Defeat Munition or the Multi-Purpose Individual Munition.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

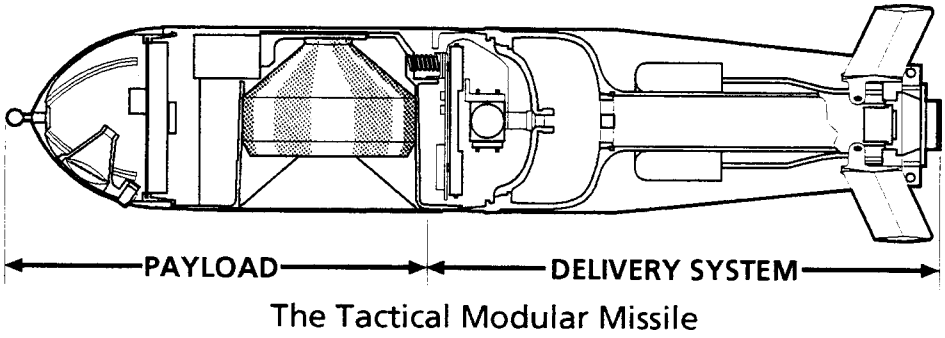
		High Confidence Level			Good Confidence Level			Speculative				
Munition	thru 03	04	05	06	07	08	09	10	11	12	13	Total 04-13
LOCKHEED MARTIN CORPORATION												
PREDATOR (a)	1005	0	0	0	0	0	0	0	0	0	0	0
Total Production	1005	0	0	0	0	0	0	0	0	0	0	0

(a) Production through 2001 is for the initial contractor developmental and test munitions, operational test munitions and contractor demonstration munitions. The production shown is for procurement by the United States Marine Corps only.



PREDATOR

Source: Forecast International



The Tactical Modular Missile

PREDATOR

Source: Lockheed Martin