

ARCHIVED REPORT

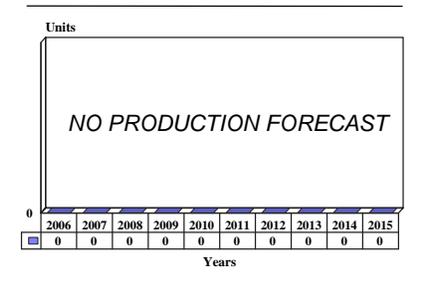
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LOSAT - Archived 9/2007

Outlook

- Program terminated and production concluded
- U.S. Army completed its demonstration effort but will not procure the LOSAT
- U.S. is continuing the Compact Kinetic Energy Missile (CKEM), which could offer an alternative to LOSAT
- LOSAT was to be deployed with units of the XVIII Airborne Corps

10 Year Unit Production Forecast
2006 - 2015



Orientation

Description. High-speed kinetic energy missile system.

Sponsor. The U.S. Department of Defense, through the U.S. Army's Aviation & Missile Command (AMCOM), Huntsville, Alabama.

Status. Program terminated. An Advanced Concept Technology Demonstration (ACTD) and System Demonstration and Development (SDD) efforts ran concurrently. Low-rate initial production will not take place.

Total Produced. Series production of the LOSAT did not take place. The first LOSAT fire units were

delivered to the U.S. Army in 2002 for testing. A company assigned to the 82nd Airborne Division was equipped with LOSAT fire units. The U.S. Army once planned to procure 345 LOSAT missiles and 24 fire units under its LRIP program.

Application. For the destruction of current and future generations of advanced main battle tanks.

Price Range. The LOSAT kinetic energy missile was to range in price from \$165,000 to \$200,000 each (depending on annual procurement rates).

Contractors

Prime

Lockheed Martin Missiles & Fire Control	http://www.lockheedmartin.com , PO Box 650003, Dallas, TX 75265-0003 United States, Tel: + 1 (972) 603-1000, Prime
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Subcontractor

Alliant Techsystems - Mission Systems Group, Tactical Systems Division, Allegany Ballistics Laboratory	http://www.atk.com , 210 State Rte 956, Rocket Center, WV 26726-0210 United States, Tel: + 1 (304) 726-5000, Fax: + 1 (304) 726-5183, Email: tactical.systems@atk.com (LOSAT Solid Rocket Motor)
BAE Systems Inc	http://www.na.baesystems.com , 1601 Research Blvd, Rockville, MD 20850-3173 United States, Tel: + 1 (301) 838-6000, Fax: + 1 (301) 838-6925,

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	Email: na.marketdevelopment@baesystems.com (Carbon Dioxide Gas Laser Rangefinder)
DRS Technologies Inc	http://www.drs.com, 5 Sylvan Way, Parsippany, NJ 07054 United States, Tel: + 1 (973) 898-1500, Fax: + 1 (973) 898-4730 (Fire Control System)
General Dynamics Armament and Technical Products, Camden Operations	1/2 Mile Hwy 203, Woodberry, AR 71744 United States, Tel: + 1 (870) 798-2031, Fax: + 1 (870) 798-2097 (Composite Canister)
Pacific Scientific Energetic Materials - Hollister Operation	http://www.mcselph.com, 3601 Union Rd, Hollister, CA 95023 United States, Tel: + 1 (831) 637-3731, Ext: 236, Fax: + 1 (831) 637-1376, Email: RWeiss@psemc.com (LOSAT Propulsion Igniter)
Raytheon Network Centric Systems	http://www.raytheon.com, 13532 N Central Expy, M/S 87, Dallas, TX 75243 United States, Tel: + 1 (972) 344-4901, Fax: + 1 (972) 344-4910 (Electro-Optical subsystem of the Fire Control System)
Sofradir	http://www.sofradir.com, 43-47 rue Camille Pelletan, Chatenay-Malabry, 92290 France, Tel: + 33 1 4113 4530, Fax: + 33 1 4661 5884, Email: felix.zutterman@sofradir.com (Focal Plane Array for Thermal Imager)
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Technical Data

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Length	287.02 cm	113 in
Diameter	16.18 cm	6.37 in
Weight	78.9 kg	174 lb
Performance		
Speed	>1,524 m/s	>5,000 ft/s
Range	500-5,000 m	546.80-5,468 yd
Armor Penetration ^(a)	16 cm	6.29 in

^(a)Estimated

Propulsion. For propulsion, the KEM uses a solid-fuel rocket produced by Alliant Techsystems Rocket Center.

Control & Guidance. The KEM uses a Raytheon forward-looking infrared (FLIR) sensor, together with a CO₂ laser beam, as its guidance system. BAE Systems provides the KEM laser-based target ranging system. The system uses the FLIR to acquire and track targets, and the laser to send guidance updates to the in-flight missiles. Several missiles could potentially be guided

simultaneously to different targets from a single launch platform. Introduction of a Sofradir 480x4 element focal plane array extended the FLIR's range.

Launcher Mode. The LOSAT can be mounted on M1114 heavy HMMWV 4x4 vehicles or a stretched version of the Bradley infantry-fighting vehicle.

Warhead. The KEM uses a high-density 3-kilogram rod penetrator to defeat its targets.

Variants/Upgrades

No specific LOSAT variants were being developed besides the initial system.

Over the years, various names have been attached to the U.S. effort to develop advanced anti-armor missile

systems. Some refer to the predecessors of the current LOSAT program. These names include the following:

Advanced Anti-Tank Weapon System-Heavy (AAWS-H) is an overall heading for a program that

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involved research into medium and heavy anti-armor missile systems.

Advanced Kinetic Energy Missile (ADKEM) is an advanced version of the KEM and a potential follow-on.

Advanced Missile System-Heavy (AMS-H) is a potential replacement for the BGM-71 TOW.

Hypervelocity Missile (HVM) is a previous joint U.S. Air Force/Army program replaced by the KEM.

Kinetic Energy Missile (KEM) is a candidate for the LOSAT requirement.

Line-of-Sight-Anti-Tank (LOSAT) is the U.S. Army program to replace the Improved TOW Vehicle (ITV) and provide early-entry forces with a light anti-armor system capable of defeating current and future

generation tanks. The LOSAT could arm the U.S. Army's Future Combat Systems (FCS).

Hypervelocity Anti-Tank Missile (HATM). Raytheon is offering the HATM to arm the FCS. Raytheon is teamed with Alliant Techsystems and NAMMO Noric Ammunition.

E-Strike (Extended Area Air Defense Short-Range Integrated Kinetic Energy) Program. Under this program, the U.S. Army could develop a LOSAT-like weapon to meet the FCS's organic air defense system need.



LOSAT

Source: Lockheed Martin

Program Review

Background. The best weapon against a tank is another tank. Even with the development of various man-portable and vehicle-mounted anti-armor weapon systems, this statement remains true today. Nevertheless, the U.S. has long desired a lightweight anti-armor weapon system that is capable of defeating tanks without requiring significant increases in the number of transport aircraft assigned to move these units with the early-entry forces they would accompany. Tanks can be transported by air, but only in small numbers (one or two per aircraft). To address this problem, the U.S. has been attempting to develop systems that have the firepower to defeat tanks but are light enough to be easily air transported in large numbers into a theater of operations.

High Velocity to Counter Heavy Armor

Line-of-Sight-Anti-Tank (LOSAT). This program is the latest incarnation of the U.S. effort to develop a vehicle-mounted, high-speed, anti-armor weapon system. Previous efforts included the Hypervelocity Missile (HVM), which was followed by the Kinetic Energy Missile (KEM). The latter was part of an overall missile development effort called the Advanced Anti-tank Weapon System – Heavy (AAWS-H). The KEM is an integral part of the LOSAT effort.

The Line-of-Sight-Anti-Tank (LOSAT) system was intended to provide the necessary overmatch capability to counter current and future tank designs (initially the Soviet Future Tank 2 and 3).

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The original LOSAT was to replace the Improved TOW Vehicle (ITV) as the dedicated anti-armor system in U.S. heavy divisions. The LOSAT was to have a weapons range capability greater than that of contemporary tanks' guns to allow it to engage an opponent's tanks with relative impunity. The vehicle was to be capable of speeds up to 61 kmph and have a maximum combat weight of 36 tons and a range of 481 kilometers. Some 907 LOSAT vehicles were to be procured starting in the fourth quarter of FY99.

At first, U.S. plans called for the fielding of this new anti-armor weapon system on a stretched Bradley Infantry Fighting Vehicle (IFV). Eventually, the Armored Gun System (AGS) chassis was designated as the LOSAT launch platform, which would enable it to be transported by C-130 aircraft and used by U.S. rapid intervention forces. However, the original AGS program was canceled, and the LOSAT, which was in its demonstration/validation phase, never transitioned to full-scale development due to funding shortfalls. The LOSAT was designated a technology demonstration program, located somewhere between technology base and demonstration/validation.

Deployment with Light Forces

Still, the LOSAT program needed a new launch platform. After weighing the merits of the Bradley, the M113 APC, the V-150 wheeled vehicle, and other potential carriers, the U.S. Army selected the M1114 "Heavy" HMMWV (High Mobility Multipurpose Wheeled Vehicle). Lockheed Martin was awarded a contract to integrate the LOSAT on an Enhanced Capacity HMMWV (ECH). The ECH LOSAT was to weigh 12,100 pounds, up from the standard vehicle's weight of 8,200 pounds.

The LOSAT project began to transition from a technology demonstration effort to an ACTD program in FY98 with the award of a \$180 million contract to Lockheed Martin. Under the ACTD contract, 12 fire units were built for testing and evaluations.

Flight tests of the LOSAT took place in FY02. A demonstration version was deployed in 2002-2003 and used for external user evaluation in 2003-2004. Funding cuts reduced the number of LOSAT battalions from five to one. This LOSAT unit was to be assigned to the 82nd Airborne Division. However, in late 2004, the U.S. Congress decided to terminate the LOSAT program altogether, its funding transferred to higher priority efforts.

Significant News

NetFires LLC Successfully Conducts Loitering Attack Missile Flight Test – Lockheed Martin conducted a successful Control Test Vehicle (CTV) flight test of its Loitering Attack Missile (LAM) recently at Eglin Air Force Base, Florida. This latest flight test of the new square body LAM airframe included a turbojet and demonstrated launch through transition to cruise.

A more extended cruise was hindered by fuel issues that were promptly identified, reported, and addressed. One more flight test remains in the series to demonstrate LAM end-to-end performance. During this flight, the LAM launched vertically from a container launch unit; maintained stability during rocket-powered ascent using a fin-control actuation system and a commercial IMU; maintained stability during wing deployment; started a micro turbojet engine with integral electrical generator; executed a high-G maneuver to limit altitude; transitioned to cruise; established a commercial GPS fix; and maneuvered and navigated to the initial waypoint.

The onboard telemetry subsystem provided real-time observation of all onboard operations including a nose-mounted color TV camera recording the missile view through a clear glass nose dome.

Building on a Defense Advanced Research Projects Agency's (DARPA) NetFires predecessor, this new, innovative square-body LAM airframe features more room for fuel, bigger wings and bigger fins for extended loiter time and improved control, a more fuel-efficient turbojet and an Aerojet annular rocket motor. The airframe, seeker, electronics, fuel system, and software suite were designed and integrated by Lockheed Martin Missiles and Fire Control in Dallas, Texas.

Key subsystems of LAM included a miniature turbojet from Technical Directions Inc., in Ortonville, Michigan, a motor that shares heritage with an air-launched predecessor; a control actuation system from Moog, Inc., in Buffalo, New York, with precision electromechanical actuators common with the Precision Attack Missile (PAM); and control surfaces made using advanced low-cost production technology at Lockheed Martin Aeronautics Company (Skunk Works), in Palmdale, California. The test flight's launcher was a collaborative Container Launch Unit (CLU), provided by the NLOS-LS Project Office and fabricated by its Prototype Integration Facility (PIF).

The remaining test in this five-flight series will be a Guided Test Vehicle (GTV) with a turbojet and LADAR seeker. The GTV will be a complete missile system and will be flown against a real target in an end-to-end demonstration from launch through search to target identification and attack.

The NetFires LLC, a limited liability company formed by Lockheed Martin and Raytheon, was established to develop the Non Line-Of-Sight – Launch System (NLOS-LS) consisting of the LAM, PAM, and the CLU. In operation, LAM is the loitering capability of NLOS-LS. It is projected to loiter, locate, identify, and destroy fleeting high-value mobile targets at extended range. Its range and unique ability to search large areas for moving or poorly located targets then decisively engage these targets will provide the Army an artillery solution virtually independent of target location error.

LAM is a responsive cruising artillery munition, ideal for hunter-killer missions where automatic target recognition finds and identifies precisely the target of interest. If the network is active, it can report these targets and be controlled by a man in the loop.

NLOS-LS is an integral part of the Army's Future Combat Forces and Modular Forces. Lockheed Martin-designed loitering munitions have achieved many successful flight tests with multiple airframe configurations. LAM's LADAR seeker has been successfully demonstrated under previous DARPA NetFires and U.S. Air Force Low-Cost Autonomous Attack System (LOCAAS) programs. Loitering munitions with ATR technology will provide early entry forces with responsive artillery to hold moving or stationary enemy forces at risk anytime anywhere in the area of interest. (Lockheed Martin, 5/06)

Taliban Wants Better Weapon to Defeat Armored Vehicles – Taliban commanders are looking for better anti-armor weapons to defeat the vehicles operated by Canadian troops in Afghanistan. Canadian troops in Afghanistan are equipped with Bison and LAV III armored troop carriers and Coyote reconnaissance vehicles. The Taliban militants are armed with RPG-7s, which have proven effective against these armored vehicles.

The Taliban wants to acquire better shoulder-launched weapons, such as ones similar to the German Armbrust, or the jeep-mounted, Russian-built AT-1 Snapper anti-armor missiles. Also, the Taliban wants to purchase additional anti-tank mines.

Meanwhile, there are rumors the Taliban has managed to reactivate a handful of U.S.-made FIM-92 Stinger shoulder-fired surface-to-air missiles (SAMs) through the purchase of new battery packs. Reportedly, a turncoat Taliban commander has offered to surrender two Stinger SAMs for the reward of \$100,000 per missile offered by the Afghan government.

In 2005, Pakistani forces along the Afghan border seized as many as six dilapidated Stinger SAMs. (*The Chronicle Herald*, 5/06)

U.S. Performs Another Test of Spike ATGW – The U.S. Navy has conducted another test of the lightweight Spike anti-armor missile system. The test was performed on April 12 at the Naval Air Warfare Center Weapons Division (NAWCWD).

The Spike is called the world's smallest tactical fire-and-forget precision-guided missile. This missile will be easily transported by a single soldier and light enough to be carried by unmanned air vehicles (UAVs). The Spike weighs only 5.3 pounds, is 25 inches long and 2.25 inches in diameter. Potential targets for this missile include small boats, helicopters, bunkers, machine gun nests, or small armored vehicles.

This low-cost weapon system uses commercial off-the-shelf components. The price of a Spike missile is to be \$5,000 or less.

The Spike has been under development for several years. Cooperating with the NAWCWD are the defense firms DRS Technology and ATK-Thiokol, a unit of Alliant Techsystems (ATK). Further tests of the Spike are planned for 2006 including firings against various stationary and mobile targets at a 2,000-meter range. (*DCMilitary*, 4/06)

BAE Systems Wins APKWS II Contract – BAE Systems has won the contract to provide the U.S. Army with a lightweight guided rocket. The U.S. Army has awarded a three-year contract, worth \$45.7 million, to BAE Systems to begin production of the Advanced Precision Kill Weapon System (APKWS) II. This weapon will be carried by U.S. Army and Marine Corps attack helicopters.

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The APKWS II combines a guidance system with a Hydra 70 rocket. This combination offers U.S. attack helicopters a less expensive weapon for engaging unarmored or lower value targets. The APKWS II will be used instead of the more expensive AGM-114 HELLFIRE anti-armor missile. This guided rocket has been referred to as HELLFIRE Jr.

The three-year contract includes missile development, testing, and two years of low-rate production. The total value of this contract could reach more than \$96 million.

BAE Systems defeated competing bids from Lockheed Martin and Raytheon. BAE Systems is located in Nashua, New Hampshire. (*Defense News*, 4/06)

Joint Common Missile May Be Back in Future – Termination of the Joint Common Missile (JCM) program has not killed all interest in this system. The JCM program was to have provided a replacement for the AGM-114 HELLFIRE and AGM-65 Maverick missiles. Now, Claude Bolton, assistant secretary of the Army, said at a conference that using a HELLFIRE with a new front end to meet future needs might not work. Consequently, the possibility exists that a new program could be launched in 2007. (*Defense Daily*, 4/06)

Turkey Could Award \$12 Billion in Defense Contracts in 2006 – Turkey may finally move ahead with certain key defense programs. These deals are worth a potential \$12 billion. The Turkish defense market experienced a serious downturn in the aftermath of the 2000-2001 financial crises.

Turkey's financial crises of 2000-2001 cut the country's national income by one-third. Ankara responded by indefinitely suspending 31 procurement programs worth nearly \$20 billion. Now, Turkey could decide in 2006 on a new combat fighter, fighter aircraft upgrades, attack helicopters, main battle tanks, tank upgrades, air defense systems, basic trainer aircraft, and a military satellite. The Turkish military is said to need desperately this new equipment.

Turkey could decide whether to join the production phase of the F-35 Joint Strike Fighter (JSF) as it is already participating in the program's development phase. Other options are to procure the Eurofighter Typhoon or a combination of both aircraft. This contract could be worth \$10 billion.

Turkey also wants to select a winner for its attack helicopter competition by the end of this summer. Contenders for this contract are: AgustaWestland's A129 Mangusta; Eurocopter's Tiger; Kamov's Ka-50/2 Black Shark; and Denel Aviation's CSH-2 Rooivalk. The attack helicopter contract involves an initial purchase of 50 platforms and is worth a potential \$2 billion.

To protect itself from ballistic missile attack, Turkey could finally purchase a defensive system. The main candidates to meet this requirement are the U.S. PAC 3 and Russia's S-300. This contract could be worth over \$1 billion.

Other contracts include: a military reconnaissance satellite worth \$250 million; upgrades for F-4 fighters worth \$480 million; procurement of 50-60 basic trainer aircraft worth \$450 million; and procurement of 1,000 indigenous tanks, developed with foreign assistance, a program that could be worth over \$10 billion. (*Turkish Daily News*, 4/06)

Spain Selects Israeli Missile Over Raytheon Offering – Spain has decided to purchase Israeli-built missiles to meet its manportable anti-armor requirements, with Rafael to supply some 2,600 SPIKE anti-armor missiles to the Spanish military. The deal is worth \$300 million.

Raytheon, along with its partner Lockheed Martin, had offered the Javelin anti-armor missile, which has been used during combat in Afghanistan and Iraq. The Javelin is in service with the United States armed forces and the militaries of 10 other nations.

While this loss is a blow to Raytheon, the company and Rafael plan to develop jointly a ballistic missile defense system for the Israeli government. Rafael and Raytheon will jointly bid to develop a short-range ballistic-missile defense system. This system is aimed at defeating attacks by Kassam rockets used by Palestinian terrorist groups.

Boeing and Israel Aircraft Industries (IAI) are also preparing a joint bid for the contract. This missile defense contract is valued between \$50 million and \$100 million. (*Boston Business Journal*, 2/06)

Brimstone Missile Ready for Fielding – The Brimstone anti-armor/strike missile is finally ready for fielding. Long in development, the Brimstone will arm British Royal Air Force fighters. During testing, the Brimstone hit 21 of 22 targets.

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Initially, the primary launch platform for the Brimstone will be the RAF's Tornado fighters. The missile is being integrated on the Harrier and the United States is considering placing the Brimstone among the weapon to be carried by the F/A-18E/F Super Hornet fighter, as well as the A-10 ground-support aircraft.

Boeing is the major subcontractor to MBDA for this missile's development and production. (*St. Louis Business Journal*, 11/05)

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Funding

The U.S. Congress cut funding for LOSAT during defense budget deliberations in 2004. Funding for the LOSAT's Advanced Concept Technology Demonstration (ACTD) effort is contained under PE#0603654A. Allocations for the LOSAT's System Development and Demonstration (SDD) program are included in PE#0604819A. No further funding for the LOSAT SDD effort is included in the budget after 2005. These two programs were running concurrently.

U.S. FUNDING

	FY03 QTY	FY03 AMT	FY04 QTY	FY04 AMT	FY05 QTY	FY05 AMT	FY06 (Req) QTY	FY06 (Req) AMT
Proc								
LOSAT	-	-	34	15.2	12	0.4	-	-
RDT&E								
Proj - 1	-	27	-	8.7	-	-	-	-
Proj - 2	-	13.6	-	29.4	-	21.7	-	-

All \$ are in millions.

Proj - 1 PE#0603654A LOSAT Technology Demonstration; Project 460, LOSAT Technology Demonstration.

Proj - 2 PE#0604819A LOSAT; Project 460, Line-of-Sight-Anti-Tank (LOSAT) missile.

Contracts / Orders & Options

In August 2002, Lockheed Martin Missile and Fire Control-Dallas, Grand Prairie, Texas, was awarded a \$9.3 million contract for the first production lot of 108 LOSAT missiles. Deliveries were completed by July 2004.

In December 2000, Lockheed Martin Missile and Fire Control-Dallas received a \$13 million increment of a \$40 million modification to a cost-plus-incentive-fee contract for the LOSAT Advanced Concept Technology Demonstration program enhancement effort, an added requirement to the LOSAT ACTD program. Work on this contract was completed by April 30, 2004. Contract Number DAAH01-98-C-0156

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1980s	U.S. Army explores heavy anti-tank replacement
Feb	1989	U.S. Army solicits information on Kinetic Energy Missile contractors
Mar	1989	U.S. Army awards contracts for AMS-H seeker technical demonstrations
	1990	Flight testing of LTV KEM begins
	1990	Testing of IR seekers (for possible use on AMS-H) begins
	1990-91	Development contract for KEM scheduled to be awarded
	1991	KEM program delayed/restructuring commences
	1992	KEM changed to Technology Demonstration program
Apr	1998	LOSAT ACTD contract awarded

LOSAT

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Jun-Aug	2003-2004 2004	U.S. Army cuts LOSAT funding U.S. Congress terminates program

Worldwide Distribution / Inventories

User Country. The first operator of the LOSAT was expected to be the **United States**.

Forecast Rationale

The United States has long expressed an interest in an anti-armor weapon that would not become obsolete by the development of new tanks. A solution to this need appeared to manifest itself in hypervelocity missiles.

Kinetic Energy to Defeat Tanks

Using the kinetic energy produced by the impact of its high-speed projectile, in theory, hypervelocity missile systems could penetrate the armor of any tank, no matter how thick. The Line-of-Sight-Anti-Tank (LOSAT) system was among the attempts by the U.S. Army to develop such a weapon.

Thought to be ideal for U.S. Army light forces, LOSAT production projections climbed rapidly. The optimism surrounding this program soon faded and delays became common. Although the LOSAT offered the overmatch capability long desired by the Army to defeat current and future tanks, the U.S. Congress terminated the program so that its funding could support higher priority efforts.

Critics of this decision say the Pentagon made the same mistake it did with the Armored Gun System (AGS).

The AGS was to provide the U.S. Army rapid intervention forces with an air-transportable armored vehicle capable of engaging tanks. Supporters of the LOSAT program vigorously protested this termination decision, but to no avail. Funding for the LOSAT is just another casualty in the U.S. Army's effort to transform itself.

Those units completed may service with the XVIII Airborne Corps and could see service in Iraq. Instead of destroying tanks, the primary purpose of the LOSATs would be mobile support.

Compact KEM Could Meet this Need

Instead of the LOSAT, the U.S. Army may put its resources into the Compact Kinetic Energy Missile (CKEM) program. The Compact KEM could act as a supplement or possible follow-on to the BGM-71 TOW. Yet the CKEM may not be available for service before 2012 or even 2018, leaving a possibly big hole in the U.S. Army's anti-armor capability.

Note: *Our LOSAT forecast represents the requirement for surface-to-surface missiles only.*

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Missile	(Engine)	High Confidence Level			Good Confidence Level			Speculative			Total 06-15		
		thru 05	06	07	08	09	10	11	12	13		14	15
LOCKHEED MARTIN CORPORATION													
LOSAT	UNSPECIFIED	196	0	0	0	0	0	0	0	0	0	0	0
Total Production		196	0	0	0	0	0	0	0	0	0	0	0