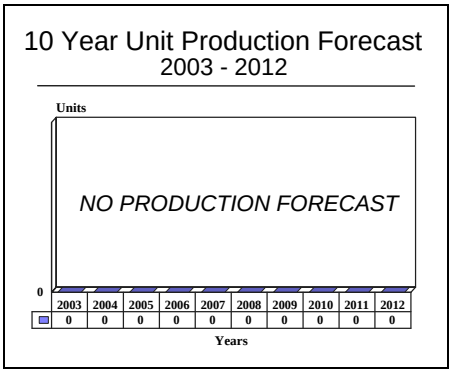
M8 Armored Gun System - Archived 3/2004

Outlook

- Procurement of this new light tank canceled by the United States Army in 1996
- Despite renewed interest and evaluations by US Army in 2000, tank was again rejected for new medium combat brigades
- While interest by several potential export customers evident, no sales to date
- No modernization or retrofit programs are forecast for this tank



Orientation

Description. A light tank.

Sponsor. The development and procurement of this light tank was sponsored by the United States Department of Defense through the United States Army Tank, Automotive, and Armaments Command. The United States Marine Corps has been following the program, although only as an interested observer. Following the January 1996 cancellation of the United States Army procurement, further development of the program has been funded by the contractor, including the costs of the 1999/2000 evaluations by the US Army.

Contractors. The FMC Corporation/Ground Systems Division developed the Close Combat Vehicle-Light which is the basis of the Armored Gun System. In 1994, FMC, along with BMY Combat Systems, merged its operations under a new firm called United Defense Limited Partnership; this organization is the prime contractor for the Armored Gun System. The major subcontractors include Computing Devices Corporation of Canada, Detroit Diesel Corporation, General Dynamics Defense Systems, General Motors Corporation/Hughes Aircraft Company, Textron Marine & Land Systems and Watervliet Arsenal.

Licensees. The Hwa Fong firm has teamed with United Defense for the Republic of China's requirement for a new light tank. If this program ever moves ahead and the M8 is selected to fill this requirement, the agreement may well involve the licensed assembly or manufacture of the vehicle or components in the Republic of China.

An agreement has been made between United Defense and the Rheinmetall Industrie subsidiary MaK System Gesellschaft to market the M8 Armored Gun System in the NATO nations.

For the potential Turkish procurement, FNSS Savunma Sistemleri, a firm jointly held by United Defense and Nurol, will manufacture the M8 Armored Gun System.

Status. Following years of effort, the program to introduce a new light tank to the United States Army was moving ahead under the Armored Gun System program. A Request for Proposals was issued in August 1991, and following a competitive evaluation, a modified version of the FMC Close Combat Vehicle-Light was selected in June 1992 for this requirement. Production approval was granted in October 1995, and a contract was expected by mid-1996. However, in January 1996, the US Army procurement program was canceled. The Armored Gun System *was not* a component of the United States Army's defunct Armored Systems Modernization program.

Since the US Army's 1996 cancellation of the program, the contractor, United Defense, has been marketing the M8 Armored Gun System on its own. In late 1999, the M8 Armored Gun System was evaluated at Fort Knox,

Kentucky, as part of a general evaluation of armored vehicles to outfit the US Army's new medium brigades. Following additional competitive evaluations running into 2000, the US Army again rejected the procurement of the M8 later that year.

Total Produced. As of January 1st, 2003, a single prototype of the Close Combat Vehicle-Light and six developmental prototypes of the Armored Gun System had been manufactured for the United States Army.

Application. A light tank especially designed for use with the light/airborne forces of the United States Army. Originally, the Armored Gun System was to replace the obsolescent M551 Sheridan armored reconnaissance vehicle (in actuality a light tank), which was finally retired (in its original role) from US Army service in early 1998. The M8 was again evaluated for use as the assault gun component of the new medium combat brigades created in late 1999.

Price Range. The Armored Gun System in its original configuration has a unit price of $4.502 million in FY03 dollars. An austere version offered to the Republic of China has a somewhat lower unit price.

Technical Data

Design Features. This vehicle features a three-man crew with a modular armor suite, an automatic loading system and 1553 databus technology.

Crew. Three: commander, gunner and driver.

Armor. The M8 Armored Gun System is available with three levels of armor protection. The vehicle is fabricated from steel and aluminum armor, with titanium armor in certain areas. Bolt-on ceramic and steel appliqué armor is offered, and additional spaced and "pre-stressed" appliqué armor can be fitted if desired.

Dimensions. The following data are for the M8 Armored Gun System as it exists in its latest prototype; the height figure is to the roof of the turret. The weight data are for the vehicle as equipped in the Level I armor configuration; in the Level III configuration, the weight is 23.13 tonnes (25.5 tons).

	SI units	**US units**
Length:	9.37 meters	30.74 feet
Width:	2.69 meters	8.83 feet
Height:	2.35 meters	7.71 feet
Combat weight:	16.78 tonnes	18.5 tons
Fuel capacity:	568 liters	151.06 gallons

Performance. The automotive performance is on a metaled road.

	SI units	**US units**
Maximum speed:	70.0 kilometers per hour	43.5 miles per hour
Maximum range:	480 kilometers	298.08 statute miles
Step:	76 centimeters	2.49 feet
Trench:	2.13 meters	6.99 feet
Slope:	40%	40%
Gradient:	61%	61%
Fording:	1.32 meters	4.33 feet

Engine. Detroit Diesel provides the 6V-92TA six-cylinder supercharged diesel engine rated 411.67 kilowatts (552 horsepower) at 40 revolutions per second (2,400 revolutions per minute). The power-to-weight ratio in the Level I armor configuration is 24.53 kilowatts per tonne (29.84 horsepower per ton). In the Level III armor configuration, the power-to-weight ratio is 17.8 kilowatts per tonne (21.64 horsepower per ton). A 24 volt electrical system with four 6TN batteries is the standard electrical fit.

Gearbox. General Dynamics Defense Systems supplies the HMPT-500-3 hydromechanical gearbox with one reverse and three forward gear ratios. This gearbox has integral service and parking brakes.

Suspension and Running Gear. This vehicle uses a torsion bar suspension system with six dual-tired roadwheels on each side with the idler forward and the drive sprocket at the rear. All roadwheel positions except the fifth are provided with hydropneumatic shock dampers. The new-design T-150 track assembly is the double pin type.

Armament. The specified main armament of the Armored Gun System is the M35 105 millimeter gun, a

lighter, low-recoil version of the M68. The M68 is a highly effective tank gun and is a United States version of the RO Defence L7. It is manufactured by Watervliet Arsenal, which also developed the M35 low-recoil version. All US/NATO standard 105 millimeter tank gun ammunition can be fired. The gun is fully stabilized in two axis; elevation is +20 degrees and depression is -10 degrees through 270-degree frontal arc, and the turret can traverse 360 degrees. An automatic loading system is incorporated with the M35; 21 rounds are stored in the system with 24 more in the hull. With this system, a rate of fire of 12 rounds per minute can be achieved. An emergency manual loading system is provided. The secondary armament is a 7.62 millimeter M240 machine gun coaxially mounted. Sixteen smoke grenade launchers are mounted on each side of the turret.

Fire Control. The Armored Gun System has a computer-based fire control system and gunner's position fitted with a Hughes Aircraft two-axis-stabilized day/night (infrared) sight with integral laser rangefinder. For a secondary sight, the gunner has a coaxially mounted fiber-optic auxiliary sight. The commander is provided with a cupola with eight periscopes providing 350-degree vision. The digital fire control computer, a slightly modified version of the same equipment used in the M1 tank, is provided by Computing Devices Corporation of Canada. A muzzle reference system is fitted. The commander is provided with a remote display of the fire control data and has an override capability. In order to save money as well as development time, the commander's independent thermal viewer was deleted from the Armored Gun System for the United States Army procurement.

Variants/Upgrades

Variants. Under an agreement between United Defense/ FMC and the former Vickers Defence Systems (now Alvis Vickers) of the United Kingdom, the British firm further developed the basic Close Combat Vehicle-Light as the VFM Mark 5. This now-dormant program is covered in the "Vickers Tanks" report in this tab.

A plan to integrate the Line-of-Sight Anti-Tank weapons system with the chassis of the Armored Gun System was announced in 1994. In October of 1994, Loral Vought Systems, then the prime contractor for the Line-of-Sight Anti-tank weapons system, was awarded a $42.5 million contract for the integration. A chassis for this requirement has been completed, but the cancellation of the M8 Armored Gun System procurement in 1996 rendered the future of this effort moot.

Because the Republic of China perceived the unit price of the M8 to be high, the contractor (United Defense) offered the vehicle to this nation without the automatic loading system. However, this new configuration had several shortcomings and was not pursued further.

Modernization and Retrofit Overview. In 1992 the decision was made to delete the commander's independent thermal viewer from the Armored Gun System, but this component could be required in the outyears should a market develop for the system. It is only with this technology that the "hunter-killer" concept so needed in modern dynamic combat can be exploited.

Program Review

Background. For many years, the United States Army has been attempting to develop and field a new light tank to replace the obsolescent M551 Sheridan. The M551, originally developed in the 1960s, was designed to be a light tank (even though the United States Army did not call it that) with heavy firepower suitable for light, particularly airborne, units. Weighing 15.83 tonnes (17.45 tons), the M551 featured the unique (and troublesome) M81 gun/missile launcher. This weapon fires a 152 millimeter, combustible-cased, High Explosive Anti-Tank round along with the MGM-51A Shillelagh Anti-Tank missile. The M551 was rushed into production too soon and sent to Vietnam, where the tropical humidity greatly affected the missile's accuracy and caused problems with the combustible cartridge cases. In addition, the caseless ammunition proved to be extremely fragile in use, often breaking up in the tank. Other problems included severe recoil, an ineffective bore scavenging system, and engine overheating. While most of these problems were eventually corrected, the Sheridan had a rather short mainstream service life, being retired from most front-line units by 1979. The Sheridan was last used in combat in the Second Gulf War and finally retired in its original role with the US Army in 1998.

Development. Since the shortcomings of the Sheridan were known fairly early on in the program, the United States Army soon began to look for a replacement for the troubled system. From the outset, the Army did not call the Sheridan what it really was – a light tank.

Instead, the M551 was designated the Armed Reconnaissance/Airborne Assault Vehicle. In any event, the Army viewed the M3 member of the Bradley Fighting Vehicle System as the definitive replacement for the M551. A review of the need for a true light tank was prompted by several factors, including United States operations in Grenada and Panama, other international operations, and the changing geopolitical situation.

In the ensuing years, a number of development programs for a light tank were funded by the Army. Among these were the Mobile Protected Gun, Mobile Protected Gun System, Close Assault Weapon System, Air-Transportable Protected Anti-Armor/Assault Capable System, High Survivability Test Vehicle-Light, Armor Protected Gun, Mobile Protected Weapon System, Close Combat Vehicle-Light, Rapid Deployment Force Light Tank, and XM4 (subsequently XM8 and now M8) Armored Gun System.

Several light tanks have also been developed by private companies: the Direct Fire Support Vehicle and Armored Gun System from Teledyne Continental Motors, the Close Combat Vehicle-Light from FMC Corporation, the Commando Stingray from Textron Marine & Land Systems (Cadillac Gage), and the 13.2 Tonne Light Tank from AAI Corporation. The above firms, as well as a number of others, have developed paper proposals for new light tanks, many of them based on the Bradley chassis.

Amidst all this, there have been intermittent calls for a wholesale modernization of the thousand-odd Sheridan tanks that remain in storage at Anniston Army Depot. However, because of the age of these tanks, plus the extensive modernization efforts that would be required to bring them up to standards, such a program would be too costly. Also, most observers believed (and rightfully so) that the Sheridan was still a 1960s design that would not be viable in the 1990s.

European Designs. Several European nations have developed and fielded the following new light tank designs:

- Infantrikanonvagn 91 – A rather successful Swedish light tank that was recently offered with a 105 millimeter cannon firing NATO standard ammunition. Hagglunds Vehicle, the manufacturer, was offering this light tank for the Armored Gun System program. However, with the advent of the new Stridsfordon 90 program for Sweden (under which a version armed with a 105 millimeter tank cannon has been developed), the entire Infantrikanonvagn 91 program has fallen by the wayside.
- FV101 Scorpion – A British light tank that is a member of a family of vehicles developed and manufactured by Alvis. The light tank, although mounting a 76 or 90 millimeter cannon and not suitable for the Armored Gun System, proved itself well in the harsh conditions of the Falklands (Malvinas) War. A newer vehicle, broadly based on the Scorpion technology, is the Stormer, the basis for a family of vehicles that includes a 105 millimeter canon armed light tank called Sagitar.
- Puma – A new family of armored vehicles with the light tank mounting a 105 millimeter cannon. Developed by Krauss-Maffei Wegmann and Diehl, the Puma underwent trials in the Federal Republic of Germany, but the program died in 1996.
- MARS 15 – A family of vehicles once being developed by Creusot-Loire Industrie of France. The light tank member mounted a 90 or 105 millimeter cannon. In 1993, the marketing effort associated with the MARS 15 program was terminated.
- Jagdpanzer SK 105 – A highly effective light tank from Steyr-Daimler-Puch of Austria. The proposed A3 version of this tank mounts the M68 105 millimeter cannon.

Of the above systems, the MARS 15 and Sagitar were considered as realistic candidates for the Armored Gun System.

Program Moves Ahead. Following Operation Just Cause in Panama in late 1989, calls were again heard for a new light tank. Despite reservations by some senior officers regarding the viability and survivability of a light tank in the modern battlefield, a greater number of senior staff believed that a new light tank was needed by the Army. By February 1990, several members of Congress were also voicing support for a new light tank to replace the Sheridan.

In April of 1990, the United States Army again began formulating plans to develop and field a new light tank. Senior officials told Congress that the Army expected a research and development effort to begin in FY92. The required operational capabilities were completed shortly thereafter and a rodeo was held in July at Fort Bragg, North Carolina. Cadillac Gage (modified Stingray), FMC (Close Combat Vehicle-Light), Teledyne Continental Motors (Direct Fire Support Vehicle), Hagglunds Vehicle (Infantrikanonvagn 105), and 20 other firms attended, but the only complete system was displayed by FMC Corporation.

In late 1990, following the deployment of the Third Battalion of 73d Armor (the last unit to operate the M551 Sheridan) to Saudi Arabia, the production of Armored Gun System program was accelerated. The Army decided to procure a non-developmental (off-

the-shelf) system to reduce the development time and unit cost of the vehicle.

The following vehicles were then represented in a competitive evaluation: the Commando Stingray, from the Cadillac Gage; a version of the Stridsfordon 90 (with a 105 millimeter turret from Giat Industries), from Hagglunds Vehicle of Sweden; the Direct Fire Support Vehicle, from Teledyne Continental Motors/General Dynamics Land Systems Division; and the Close Combat Vehicle-Light, from FMC Corporation. In June 1992, the latter system was selected as the winner of the competition. In 1994, FMC and BMY Combat Systems merged their operations under a new firm called United Defense Limited Partnership. The first prototype of the definitive Armored Gun System was rolled out on April 19, 1994; five additional prototype vehicles were subsequently manufactured for the United States Army. In addition, one contractor demonstration tank was completed in 1995.

Description. Many of the automotive, fire control, and other components of the M8 Armored Gun System are similar to or the same as those used in other United States Army vehicles. For example, the engine is 65 percent common with the engine used in the Heavy Expanded Mobility Tactical Truck, the gearbox is the same unit used in the M2/M3 Bradley fighting vehicles, and the ballistic computer is slightly modified from the unit used in the M1 Abrams tank.

The hull and turret of the M8 Armored Gun System are of all-welded aluminum and steel construction, and additional appliqué armor can be fitted as detailed below. The driving compartment is forward with the driver seated in the center. The driver is provided with a single-piece hatch cover and five periscopes; a night driving periscope can be fitted if required. The turret is mounted in the center of the vehicle with the automatic gun-loading mechanism to the left and the commander/ gunner seated on the right. The gunner is seated forward of the commander. A sealed bulkhead separates the automatic loading mechanism from the commander and gunner. Several blow-out panels are in the turret roof. Turret traverse and cannon elevation are hydraulic in operation with a manual backup. The gunner has two control handles and the commander has one.

The automatic loading mechanism was designed by FMC Corporation's Naval Systems Division in 1983, and has been continually refined since. The latest version of this system stores 21 rounds at the ready with 24 more in the hull. With the aid of this automatic loader, a firing rate of 12 rounds per minute can be achieved. The rounds are stored vertically, base down on a crescent-shaped pathway and are moved by a chain mechanism. Once the rounds are in position, a loading arm with integral ram tray assembly picks up the round and moves it forward and upward to ram it into the hydraulically operated breech assembly. After firing and return to battery, the cannon lowers to 0 degrees to eject the case through the loading port in the turret bustle.

The engine compartment is to the rear of the vehicle. A hydraulically operated ramp allows access to the engine and provides a working space for various maintenance operations.

Armor Protection. A major design feature of the M8 Armored Gun System is its modular protection system based on several types of appliqué armor. These armor suites, called "levels" by the contractor, can be easily changed to address different tactical situations. Our research indicates that the modular armor system used on the Armored Gun System may be that which was developed by the German firm ABD Diesenroth Engineering and marketed under the name Modular Expandable Armor System. The three levels are as follows:

- Level I – The basic level of protection, Level I is composed of ceramic tiles bolted to the exterior of the vehicle. These tiles, 102 millimeters (4.02 inches) square, are covered by a layer of urethane. The urethane helps to absorb and laterally displace kinetic energy. When damaged, new tiles are simply glued in place.
- Level II – This enhanced level of protection is composed of spaced and armor steel plate appliqué armor.
- Level III – Designed for enhanced protection from man-portable anti-armor weapons, this appliqué armor consists of special plates designed for a high degree of effectiveness against shaped-charge warheads.

Note: United Defense has considered combining Level I and Level II armor suites in a new basic armor suite for the Armored Gun System.

Air Transport. Five combat-ready M8 Armored Gun System vehicles can be carried in a C-5 aircraft; three can be transported in a C-17. In October of 1994, the United States Army made the first successful test drop of the new light tank from a C-130 aircraft.

Funding

The development of the M8 Armored Gun System was funded by the Tank, Automotive, and Armaments Command of the United States Army. The $37.9 million requested in the FY92 budget was deleted in April 1991 by the House Appropriations Committee. In July 1991, the Senate kept the program alive but introduced a requirement that the Armored Gun System use the turret developed for the Marine Corps' Light Armored Vehicle; the turret is manufactured by Textron Marine & Land Systems (Cadillac Gage). Shortly thereafter, the Senate Armed Services Committee directed the United States Army and Marine Corps to integrate their efforts to field a light vehicle armed with a 105 millimeter gun.

When the FMC Close Combat Vehicle-Light was selected in June 1992, $27.7 million was immediately awarded to FMC.

US FUNDING

	FY91		FY92		FY93		FY94	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
Research and Development								
PE#0604645A								
	-	0.0	-	0.0	-	67.2	-	81.8
Procurement								
M8	0	0.0	0	0.0	0	0.0	0	8.2
Total	0	0.0	0	0.0	0	67.2	0	90.0

	FY95		FY96		FY97		FY98	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
Research and Development								
PE#0604645A								
	-	41.8	-	15.5	-	23.1	-	0.5
Procurement								
M8	0	0.0	26	141.6	42	182.2	-	-
Total	-	41.8	26	157.1	42	205.3	-	0.5

Note: The above funding was allocated and projected before the program was canceled in January 1996.

All dollar amounts are in millions.

Program element number 0604645A, Project number D413 - Armored Gun System. This project funded the development of the Armored Gun System. Also provided under this program element was $2.9 million in Fiscal 1995 dollars for the operational testing of the Armored Gun System.

Program Canceled. The United States Army unexpectedly canceled the M8 Armored Gun System procurement in January 1996. While the details of the cancellation were not made available, sources close to the program claim that it was canceled to release funds for other programs.

Renewed Interest. On October 12, 1999, General Eric Shinseki, the Chief of Staff for the US Army at the time, made a speech at the Association of the US Army convention outlining his plan for the future US Army – a lighter, more deployable force that will still pack a heavy punch. The center of the General's plan was the creation of new medium brigades consisting of armored vehicles that are air transportable by C-130 aircraft. The General's plan quickly moved ahead with a December 1999 evaluation of off-the-shelf armored vehicles to meet the requirements of the new brigades. United Defense sent the M8 to the evaluation, which was held at Fort Knox, Kentucky. Several other evaluations were conducted through the summer of 2000. Between 30 and 42 mobile (or assault) gun systems will be required in each of the three envisioned brigades. However, in November of 2000, the US Army selected a version of the Piranha vehicle to fill the requirement. The impact of the decision is still being felt, with most of the opponents stating that even when armed with a 105 millimeter cannon, the wheeled Piranha is not a tank and cannot perform like a tank. As of early 2003, there are still proposals for the M8 to be included in the new brigades.

Recent Contracts

The United States Army has awarded numerous research and development contracts for a new light tank since 1978. Aside from the $27.7 that was awarded to FMC in June 1992, no other contract information is available.

Timetable

This timetable is for the Armored Gun System in its latest form only.

Month	Year	Major Development
	1983	FMC begins development of Close Combat Vehicle-Light
August	1985	First prototype of Close Combat Vehicle-Light completed
February	1990	Requirement for a new light tank redefined
April	1990	Plans for development and introduction developed
July	1990	Rodeo of potential candidates for Armored Gun System held
November	1990	Armored Gun System program accelerated
August	1991	Request for Proposals issued
June	1992	FMC Close Combat Vehicle-Light selected to fill Armored Gun System requirement
Early	1994	FMC and BMY Combat Systems merge to form United Defense Limited Partnership
April	1994	First prototype of Armored Gun System rolled out
Mid	1994	Potential sale to the Republic of China announced
October	1995	Armored Gun System type classified and approved for production
Late	1995	Program development ongoing
January	1996	United States procurement canceled
Late	1999	M8 evaluated as component of US Army's new brigade structure
November	2000	M8 again rejected
Early	2003	Program development and marketing ongoing

Worldwide Distribution

Export Potential. Although procurement of the M8 has twice been canceled by the United States Army, the international market has still shown interest in the M8. In 1994, the Republic of China made an official request for up to 700 vehicles. The Hwa Fong firm has teamed with United Defense for the program which, if it moves ahead, will probably involve the licensed assembly or manufacture of the vehicle in the Republic of China. The Federal Republic of Germany had once expressed interest in procuring up to 50 Armored Gun Systems, although such a procurement is now considered remote. In 1997, FMC-Nurol and United Defense teamed to offer the M8 for a potential Turkish requirement for at least 200 vehicles.

Countries. Six prototypes of the Armored Gun System and one Close Combat Vehicle-Light prototype are in the **United States**. In addition, one contractor demonstration Armored Gun System vehicle was manufactured for shipment to the **Republic of China**.

Forecast Rationale

As of early 2003, there is still a strong effort to procure the M8 Armored Gun System for the new Medium Combat Brigades. However, since the fielding of these new brigades is now well under way and the Army is now funding the expensive development of the Future Combat Systems, our research can not support any procurement of the M8 by the United States.

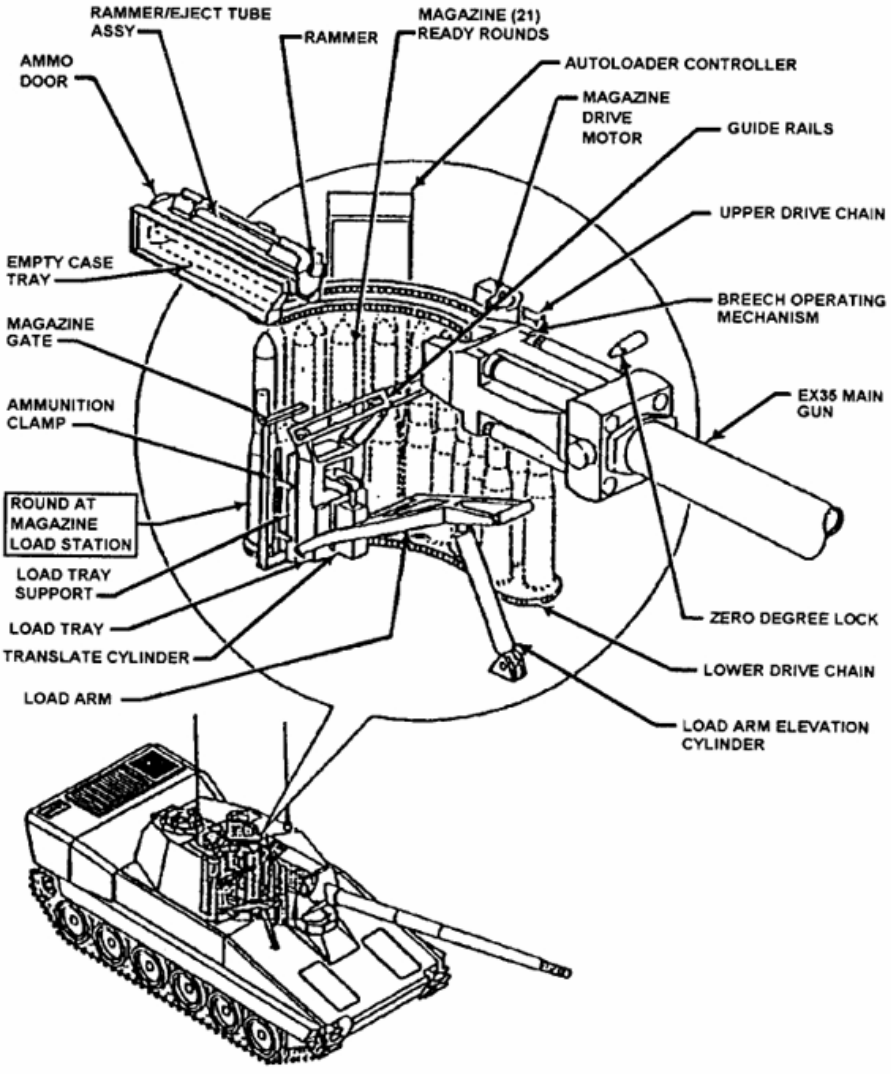
Regarding the export potential for the M8, our research still cannot find sufficient evidence to support a forecast for a sale to the Republic of China (probably the best opportunity), Turkey, or anyone else for that matter. However, United Defense's still strong promotion of the M8 and the recently concluded competition and evaluations have served to maintain interest for the M8 on the international market. Therefore, we will continue to monitor this program in relation to its international prospects and update this report accordingly.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

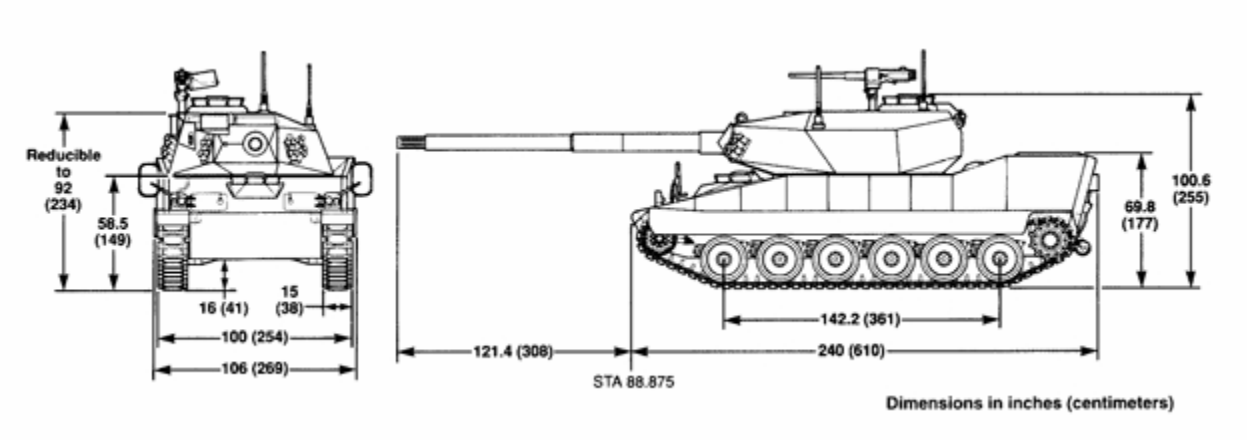
Vehicle	(Engine)	thru 02	High Confidence Level 03	04	05	Good Confidence Level 06	07	08	Speculative 09	10	11	12	Total 03-12
UNITED DEFENSE LIMITED PARTNER													
M8 ARMORED GUN SYSTEM (a)	6V-92TA	7	0	0	0	0	0	0	0	0	0	0	0
Subtotal - UNITED DEFENSE LIMITED PARTNER		7	0	0	0	0	0	0	0	0	0	0	0
UNITED DEFENSE/HWA FONG (Co-Product)													
M8 ARMORED GUN SYSTEM (b)	6V-92TA	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal - UNITED DEFENSE/HWA FONG (Co-Product)		0	0	0	0	0	0	0	0	0	0	0	0
Total Production		7	0	0	0	0	0	0	0	0	0	0	0

(a) The through 2002 figure is for the test and evaluation vehicles. The through 2002 production also includes the one Close Combat Vehicle-Light which was completed in August of 1985. The vehicle delivered in late 1995 is a company demonstrator vehicle for delivery to the Republic of China for evaluations. This program was canceled by the United States Army in late January of 1996 but reconsidered (and again rejected) for the US Army's new medium combat brigades.
(b) The production in this line is forecast for the Republic of China only. License or co-production will be involved.



Automatic Loading System

Source: United States Army



M8 Armored Gun System

Source: United Defense