

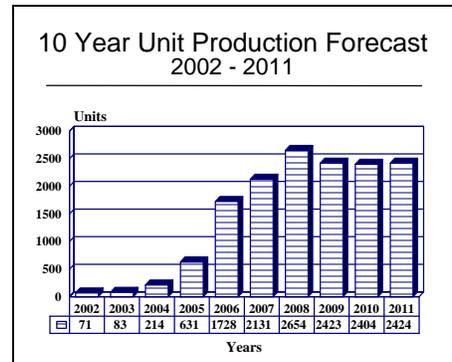
# ARCHIVED REPORT

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## M93 Hornet Wide Area Munition - Archived 12/2003

### Outlook

- Program terminated as of the FY 2003 Defense Appropriations bill
- Production of this new munition had started in order to meet an originally stated 15,259-unit United States Army procurement objective (hand emplaced only); but only 441 total were actually procured before program termination
- Technology applications with other programs, such as the Intelligent Munitions System, possible



### SPECIAL NOTE

Earlier in the program, the M93 was referred to as a mine; and indeed, the weapon was originally envisioned as a mine in the conventional sense and usage of the term. However, due to its advanced operational characteristics and high unit price, it soon became clear that the Hornet could not be considered a conventional anti-tank mine. In effect, the M93 was not meant to be deployed or sown as a conventional anti-tank land mine, and the US Army designated the M93 as a munition.

### Orientation

**Description.** A smart anti-armor munition.

**Sponsor.** The United States Department of Defense, through the United States Army, sponsored the M93 Hornet Wide Area Munition program. The program was being run by the United States Army Armament Research, Development and Engineering Center (Picatinny Arsenal, Dover, New Jersey). The Project Manager for Mines, Countermine and Demolitions was the executive office.

**Contractors.** Textron Systems (formerly known as Textron Defense Systems), Wilmington, Massachusetts, developed and produced this munition.

**Licensees.** In March 1998, Textron Systems teamed with Royal Ordnance (now RO Defence) and Hunting Engineering (now Insys) to offer the M93 Hornet Wide Area Munition to address a British Ministry of Defence requirement for what it calls an Area Denial Weapon. More recently, Israel Military Industries was qualified

as a second source and has a license to manufacture the Wide Area Munition; details have yet to be announced.

**Status.** The M93 Hornet Wide Area Munition program was terminated in October 2002, as part of the FY 2004-2009 Program Objective Memorandum (POM) long-term spending plan. Prior to termination, the full-scale engineering development phase of the M93 Hornet Wide Area Munition program was completed in 1997, and the initial version of the munition was in low-rate serial production. The first service deliveries were made in early 1999.

**Total Produced.** As of January 1, 2003, a total of 441 M93 Hornet Wide Area Munitions had been manufactured, including developmental prototypes and operational test units.

**Application.** A smart anti-armor munition that can be hand-emplaced or dispensed by a variety of platforms,

with the ability to detect and destroy hostile armored resources, including tanks.

**Price Range.** The initial production contract yielded a unit price of \$119,190 in Fiscal 1996 dollars. The Fiscal

2002 documents listed a unit price of \$335,087 based on the procurement of 57 munitions. There was no unit price breakout in the Fiscal 2003 documents.

## Technical Data

Some of the technical information related to the M93 Wide Area Munition is still sensitive. In its initial hand-emplaced version, the cylindrically shaped Wide Area Mine, weighing approximately 15.91 kilograms (35 pounds), can be man-packed. The mine employs three types of detectors, seismic, acoustic, and infrared, to detect and classify targets. The M93 is remotely operated by the M73 remote control unit (the man-in-the-loop criteria); and the munition self-neutralizes after

30 days, in compliance with the 1997 Ottawa Convention.

**Warhead.** The warhead used in the Wide Area Munition is quite similar to that used in the BLU-101/B and BLU-108/B submunitions of the defunct CBU-92/B Extended Range Anti-Armor Munition and the now-operational CBU-97/B Sensor Fuzed Weapon, respectively. The latter program is covered in the pertinent report in Tab F.

## Variants/Upgrades

**Variants.** No specific variants of the M93 Hornet Wide Area Munition have been developed; integration with different platforms is possible.

**Modernization and Retrofit Overview.** Although the M93 Hornet Wide Area Munition was declared operational in January 2001, a product improvement program had been funded and in place for the new munition for several years. On the date of the first production contract, another contract was awarded for the product improvement of the new munition. The four-year program was developing and integrating a new two-way command and control and remote arm/disarm component compatible with the Army's standard Single Channel Ground-Air Radio System (SINCGARS). This improvement enhanced the M93 Hornet Wide Area Munition flexibility by more fully integrating the Hornet into the coordinated

attack/defense plans of field commanders. The program also enhanced compliance with the 1997 Ottawa Convention. Also being pursued under the product improvement program was a cost reduction effort and the integration of commercial and non-developmental items. In addition to the prime contractor Textron Systems, Harris Corporation was also involved in the product improvement program.

Under the product improvement program, Textron was developing the Air Deliverable Acoustic Sensor for integration with the M93 Hornet Wide Area Mine. This passive acoustic sensor can detect, classify, and track targets at extended ranges. The Air Deliverable Acoustic Sensor was to be integrated with the M93 Hornet Wide Area Munition as part of the US Army's Intelligent Combat Outpost, named Raptor.

## Program Review

**Background.** In the early 1980s, a number of advanced smart munitions and submunitions were being developed under the "Assault Breaker" concept. This concept had its origin in the late 1970s as a wide-ranging effort to counter the numerical superiority in armor enjoyed by the old Warsaw Pact armies. The ambitious Assault Breaker effort envisioned countering this numerical advantage with advanced high-technology weapons. Textron Systems remains one of the world's leading firms in this area of military technology.

The Wide Area Mine Program. Textron Systems has long had a variety of ideas for applications of its

advanced-design warhead technology. The United States Air Force originally adopted the sensor fuzed warhead concept for the CBU-92/B Extended Range Anti-Armor Munition. This program integrated the sensor fuzed warhead concept into the BLU-101/B submunition (which uses the same BLU-108 submunition as the CBU-92/B-BLU-101/B weapon). After release of the FY 1985 budget, the US Air Force allowed the CBU-92/B program to effectively go dormant, to be superceded by the CBU-97/B Sensor Fuzed Weapon. However, in 1987 the United States Army Armament Research, Development and Engineering Center (Picatinny Arsenal) embraced the

sensor fuzed warhead concept and continued to develop submunitions as an “off-route” anti-tank mine system. This program, then called the Wide Area Mine, has been the major anti-tank mine development program in the United States for some years now.

Competition. In developing a “smart” anti-tank mine, the US Army Armament Research, Development and Engineering Center had two major technological options from which to choose. One was the integration of the Sense and Destroy Armor technology then being competitively developed by Alliant Techsystems (then the Defense Systems Division of Honeywell Corporation) and Aerojet ElectroSystems. The other option was the sensor fuzed warhead technology described above. The United States Army awarded competitive proof of principle contracts to Alliant Techsystems and then-Textron Defense Systems. In August 1987, Alliant was awarded a \$3,925,000 increment as part of a \$11,958,150 contract. Textron Defense Systems was also awarded \$3,925,000 as part of a \$12,939,107 contract. Both contracts were to run for 26 months. In April 1990, the U.S. Army selected the Textron Defense system proposal for full-scale engineering development. In a 1995 reorganization, Textron Defense Systems changed its name to Textron Systems.

Description. In the Wide Area Mine (now Wide Area Munition), Textron integrated its Skeet warhead technology (described below) with a smart anti-tank mine. The cylindrical munition contains sophisticated seismic, magnetic, and acoustic sensors; an autonomous arm-to-kill sequence is employed. Once in place, the mine’s sensors, which have a range of around 100 meters (109 yards) can detect a tank or other armored vehicle. The mine then analyzes the data and prioritizes the targets (the munition disregards any target with a less than 5 ton weight), and predicts the movement of the selected target. The munition then tilts itself in the direction of that target and fires the warhead toward the target, detonating above it.

The warhead is based on the Skeet submunition. As noted above, by the mid-1980s Textron Defense Systems had under development a number of programs applicable to the old Assault Breaker concept. Several of the weapons developed under these programs, especially the CBU-92/B Extended Range Anti-Armor Munition and the CBU-97/B Sensor Fuzed Weapon, employ a unique smart submunition called Skeet. As this technology is an integral component of the Wide Area Munition, it merits further discussion.

BLU-108/B Skeet. The Skeet is one of the most unique submunitions available today. It is capable of being dispensed as a submunition, or fired as a warhead, as in the former Extended Range Anti-Armor Munition

project. Skeet was also developed under the Assault Breaker/Wide Area Anti-Armor Munitions program.

Skeet uses state-of-the-art technology to yield an extremely smart submunition. For the first time, state-of-the-art dual-mode infrared sensor, logic, microcircuitry, dynamics, and warhead (a flat cone-shaped charge, often incorrectly called a self-forging fragment warhead) technology are brought together to result in a small, extremely affordable weapon capable of destroying the largest tank. The only problem with the original Skeet was that it was too sensitive. In September 1989, Textron Defense Systems was ordered to reduce the sensitivity of the Skeet, as it was “overreacting to the battlefield environment,” and should react only to tanks and other armored vehicles. It has long been believed that the Skeet has great potential as an anti-tank weapon.

This technology has been developed into a number of other munitions, among them the Extended Range Anti-Armor Munition, which has in turn been developed into the Wide Area Munition. However, the CBU-97/B Sensor Fuzed Weapon is the first weapon employing this advanced munitions technology (in the BLU-108/B submunition) to enter service.

Why a Flat Cone-Shaped Charge? Flat cone-shaped charge warheads (often erroneously called self-forging fragments) are based on a unique principle of applied physics, the Misne-Schardin effect. This principle states that certain metals, such as copper, and certain steel alloys, tantalum and uranium, can be explosively formed into ultra-high-speed masses capable of penetrating the heaviest armor. The Misne-Schardin effect is used in all conical-shaped charge (chemical) warheads designed to defeat armor. However, in order to apply the Misne-Schardin effect properly, extremely critical technology involving the geometry and manufacture of the metal liner and shaped charge must be mastered. The development of the flat cone-shaped charge was even more difficult as these parameters had to be even more exact. Textron Systems is among world leaders in the development of such technology.

A flat cone-shaped charge warhead functions in the following manner: a uniquely shaped (130-150 degree) explosive charge confined within a cylindrical casing is fired so as to create an explosive pressure wave which implosively forges a precisely shaped metal disc, frequently called a lens or liner, into an armor-piercing slug. The purity, thickness, diameter, contour, and curvature of the lens, as well as the shape of the explosive pressure wave, are critical in forging the final slug shape. The development of elastic-plastic dynamic finite difference models and their utilization in high-speed computers enabled Textron Defense

Systems Division to computationally model the so-called self-forging process. Sophisticated laboratory measurement devices have confirmed the validity of these models.

The lens-to-slug transition can occur in several ways, each of which results in a characteristically shaped final fragment – that is, spherical, long-rod, or co-linear. The transformation from lens to final slug shape typically occurs within 100-150 microseconds, with terminal velocities on the order of 2,743 meters (9,000 feet) per second. The Textron Systems long-rod flat cone-shaped charge warheads have demonstrated high effectiveness over long ranges and have successfully defeated advanced armor targets. In the future, flat cone-shaped charge technology will likely be incorporated into other weapons.

Development. In June 1992, the M93 Hornet Wide Area Munition scored its first hit against a moving target, a T-62 tank. A series of additional successful tests followed. By 1996, the engineering development of the weapon had essentially been completed with no major problems identified. However, troubles have subsequently developed, leading to changes in Congress's support of the program. These are detailed further on.

The initial development contract, awarded in April 1990, was for the hand-emplaced version of the M93 Wide Area Munition. The United States Army also envisioned deployment by other emplacement methods, especially the M139 Volcano mine dispensing system, the MGM-140 Army Tactical Missile System, a variant of the M270 Multiple Launch Rocket System's M269 rocket, and the Army's new Advanced Precision Air Drop System.

The potential value of the Army's procurement of the M93 Hornet Wide Area Munition program was originally estimated to be \$1.2 billion.

The Fiscal 1993 descriptive summary of the research and development effort for the Wide Area Munition added an unspecified missile delivery option to the program. The summary also noted that integration was to begin in 1998, with the system operational in the year 2000. That missile is now known as the MGM-140 Army Tactical Missile.

Procurement Objective. In the late 1980s, the initial requirement of the United States Army for the M93 Hornet Wide Area Munition was to be 10,000 mines. Most observers believed that 85,000 to 100,000 mines would eventually be required. The dramatic geopolitical changes in the world have altered the US threat scenario. Consequently, the inventory objective for the hand-emplaced version of the Wide Area Munition was revised to a maximum of 15,289 units, with the remainder of the 34,000-unit procurement total being for the product improved version.

In 1995, as the final development and operational test phase was ongoing, the United States Navy began investigating the use of the BGM and UGM-109 models of the Tomahawk cruise missile as a delivery platform for the M93 Hornet Wide Area Munition. The planned integration would include a datalink capability through Joint STARS, unmanned aerial vehicles, and other means in order to strike a variety of static and mobile armored targets. The program, run by Hughes Missile Systems, is called Tomahawk Stops Attacking Regiments. With the termination of the M93 Hornet program, this Hughes program is now effectively dormant. If this program can be revived and fully implemented, perhaps with another munition component, it could be worth more than a billion dollars.

Congressional Support Vanishes. In late 1991, the Pentagon's Inspector General issued a report highly critical of the M93 Wide Area Munition program. Criticizing the program for poor management, a 330 percent increase in costs, a five-year program slippage, and failure in addressing mission requirements, the report called for a complete review of the program. While US Army officials disagreed with the findings of the report and cited evidence to support its position, members of Congress soon heard of the report, and Congressional support began to falter. First the House Appropriations Committee and then the Senate Appropriations Committee called for the termination of the program. In October 2002, House and Senate Appropriations Committee conferees agreed to terminate the M93 Hornet Wide Area Munition program.

## Funding

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With the FY 2003 and FY 2004 budget requests, the United States Department of Defense has terminated funding for the Wide Area Munition program. Prior to this, the Department of Defense, through the United States Army Armament Research, Development and Engineering Center, provided developmental funding for the Wide Area Munition. The United States Air Force, under the old Extended Range Anti-Armor Munition development effort, also provided some technology base support.

US FUNDING

	<u>FY91</u>		<u>FY92</u>		<u>FY93</u>		<u>FY94</u>	
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>
<u>Research and Development</u>								
PE#0604619A(a)								
Project #D088(b)	-	35.1	-	34.6	-	22.8	-	21.2
PE#0604808A(c)	-	-	-	-	-	-	-	-
Project #D016(d)	-	-	-	-	-	-	-	-
<u>Procurement</u>								
US Army	-	-	-	-	-	-	-	-
Total	-	35.1	-	34.6	-	22.8	-	21.2

	<u>FY95</u>		<u>FY96</u>		<u>FY97</u>		<u>FY98</u>	
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>
<u>Research and Development</u>								
PE#0604619A(a)								
Project #D088(b)	-	33.8	-	29.5	-	23.4	-	21.5
PE#0604808A(c)								
Project #D016(d)	-	6.6	-	0.0	-	0.0	-	0.0
<u>Procurement</u>								
US Army								
M93 Wide Area Mine	-	-	106	14.6	70	10.0	74	14.7
M93 Individual								
Trainer	-	-	NL	1.2	-	-	-	-
M93 Collective								
Trainer	-	-	-	-	NL	1.9	-	-
Total	-	40.4	106	50.3	70	42.5	74	36.2

	<u>FY99</u>		<u>FY00</u>		<u>FY01</u>		<u>FY02</u>	
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>
<u>Research and Development</u>								
PE#0604619A(a)								
Project #D088(b)	-	23.0	-	13.3	-	0.0	-	0.0
PE#0604808A(c)								
Project #D016(d)	-	25.8	-	18.4	-	12.6	-	9.0
<u>Procurement</u>								
US Army								
M93 Wide Area Munition	65	9.5	70	15.2	23	19.1	-	2.0
M93 Remote Control Unit	-	-	-	-	-	-	274*	3.3
M93 Individual								
Trainer	-	-	-	-	-	-	-	-
M93 Collective								
Trainer	-	-	-	-	-	-	-	-
Total	65	58.3	70	48.7	57	21.4	-	TBD

All funding amounts are in millions of dollars. NL = not listed, TBD = to be determined.

\*Information in the Fiscal 2002 documents but not in the Fiscal 2003 documents.

For Fiscal 2003, a total of \$12.5 million is requested for procurement of an undisclosed number of M93 munitions.

(a)Program Element 0604619A - Landmine Warfare.

(b)Project D088 - Wide Area Munition. This project funds full-scale engineering development of the Wide Area Mine and funds the integration

with the Volcano and other dispensers. Total program cost was listed as \$250.386 million in the Fiscal 1999 documents.

- (c) Program Element 0604808A - Landmine Warfare/Barrier - Engineering Development.
- (d) Project D016 - Mine Systems Engineering Development. A new start for the M93 Hornet Wide Area Munition in Fiscal 1995, this project funded the product improvement program for the new mine. In 1998, this effort was transitioned to the procurement line item.

In the Fiscal 2001 supporting documents, procurement of the M93 Individual Trainer is listed at 1,840 units in Fiscal 2000 and 1,543 units in Fiscal 2001; the procurement objective is listed at 8,826 units. The same documents listed a procurement of 1,957 M93 collective trainer units in Fiscal 2002; this is the total procurement objective. The procurement objective for the remote control unit is put at 37,273 units.

## Recent Contracts

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Aside from the initial proof of principle contracts, the U.S. Department of Defense awarded a \$69.4 million contract for the full-scale engineering development of the M93 Hornet Wide Area Munition to Textron Systems on April 9, 1990. The following are the subsequent contracts.

<u>Date</u>	<u>Contract</u>	<u>Amount</u>	<u>Procurement</u>
1996/06/19	DAAE30-96C-0015	\$15,161,425	Initial production contract for 97 M93 Hornet Wide Area Munitions plus related test equipment and procedures and supporting data.
1996/06/19	DAAE30-96C-0019	\$55,234,838	For the product improvement program for the M93 Hornet; Harris Corporation is also involved.
2002/05/30	DAAE30-96C-0019	\$7,059,649	For the product improvement and program restructure for the M93 Hornet.

## Timetable

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The following timetable is for the M93 Hornet Wide Area Munition program only and for no other application of the Skeet warhead technology.

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Mid	1970s	Assault Breaker concept formulated and technology development begun
	1977	CBU-92/B and BLU-101/B Extended Range Anti-armor Munition program conceived
	1981	CBU-92/B and BLU-101/B Sensor Fuzed Weapon concept development begun
January	1985	CBU-92/B and BLU-101/B program goes dormant
July	1987	US Army embraces sensor fuzed warhead technology for new smart mine
August	1987	Competitive proof of principle contracts awarded
April	1990	Full-scale engineering development contract awarded
June	1992	First kill against a moving tank
June	1996	Initial production contract awarded
October	2001	Pentagon Inspector General report criticizing M93 program issued
Late	2002	Development and testing continues; low-rate serial production and product improvement program ongoing

## Worldwide Distribution

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Export Potential. Due to the termination of the program by the US Department of Defense, as well as the sensitive nature of the technology involved, we expect no export for several years.

In March 1998, Textron Systems teamed with RO Defence (then Royal Ordnance) and then Hunting Engineering (now Insys) to offer the M93 Hornet Wide Area Munition to address a British Ministry of Defence requirement for what it calls an Area Denial Weapon. Around 3,000 systems were expected to be procured beginning in 2003. Israel Military Industries also has a license for the marketing and production of the Wide Area Mine.

Country. **United States of America** (developmental and operational test munitions, some low-rate production munitions).

### Forecast Rationale

The M93 Wide Area Munition program has yet to really get going. Indeed, congressional support has been waning of late, with the program’s future being debated as this report is being written. For the past several years, the annual budget submissions of the Department of Defense have raised eyebrows in connection with the M93 Hornet Wide Area Munition program; the last straw was the highly critical October 2001 report released by the Pentagon’s Inspector General.

Despite the fact that first service deliveries of the hand-emplaced version of the M93 were made several years ago, the annual requests have still been at low-rate initial production levels, and the levels remained low in the 2002 budget submission and were only moderately higher for the 2003 request.

Although the low-rate serial production of the mine is ongoing, development and testing of the product-improved version of the new munition continues. The product improvement program for the new mine is well in place and funded as part of the further development

of the new mine, and is indicated by our research as being the bulk of the forecast production.

Despite the increased disenchantment of Congress, the research still supports the M93 program moving ahead, but our forecast is greatly reduced from previous ones. Of course, the total procurement and rate of production could well increase over what we show if the Navy or Air Force decides to integrate the new mine with the Tomahawk cruise missile or some other delivery system.

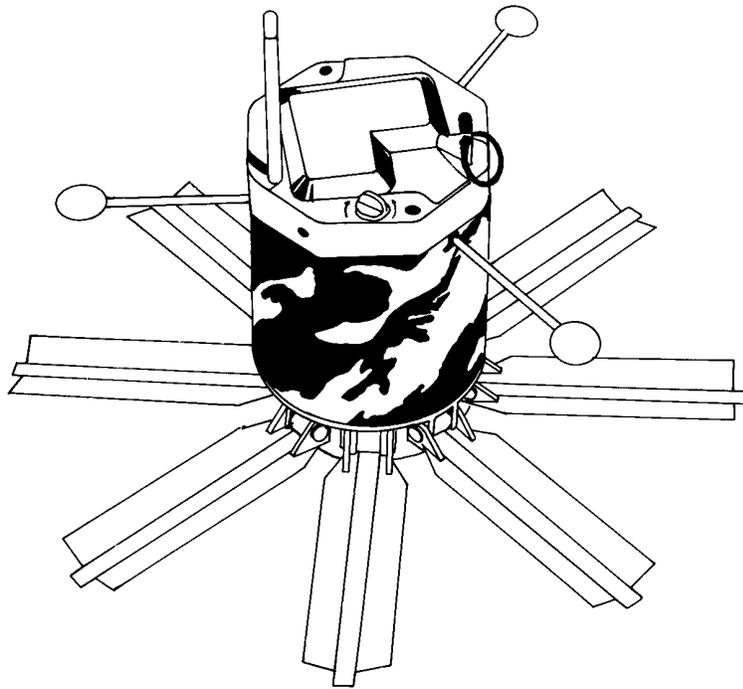
Regarding the potential export of this new smart mine, probably the best near-term prospect is the United Kingdom. However, as of this writing, there is still no formal requirement and, in any event, the competition from Rheinmetall DeTec is expected to be intense. In addition, Israel was once expected to order this new smart mine. However, information on Israel’s intentions is hard to come by, so we are not forecasting any export sales at this time.

### Ten-Year Outlook

#### ESTIMATED CALENDAR YEAR PRODUCTION

Munition	through 01	High Confidence Level				Good Confidence Level			Speculative		Total 02-11	
		02	03	04	05	06	07	08	09	10		11
TEXTRON SYSTEMS												
M93 HORNET WIDE AREA MUNITION (a)	441	71	83	214	631	1728	2131	2654	2423	2404	2424	14763
Total Production	441	71	83	214	631	1728	2131	2654	2423	2404	2424	14763

(a) Production through 2001 includes the full-scale engineering development prototype munitions, contractor and operational test prototype munitions and service test munitions; low-rate production of the M93 munition for service deliveries began in late 1997. The forecast production is for the United States Army only for all dispensing applications. Also included in the forecast production are additional M93 developmental and operational test munitions for the product improved version expected to enter serial production in 2004.



M93 Wide Area Munition

Source: Forecast International