

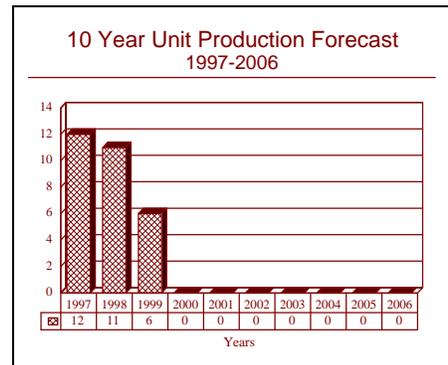
ARCHIVED REPORT

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Terminally Guided Submunition (Phase III Warhead) and Infrared Terminally Guided Submunition - Archived 12/98

Outlook

- Terminally Guided Submunition and Infrared Terminally Guided Submunition programs are dead in US
- Except for France (where serial production is not forecast), there is no longer any international interest in Terminally Guided Submunition program
- Bar graph for the Terminally Guided Submunition



Orientation

Description. Guided anti-armor submunitions

Sponsor. The Terminally Guided Submunition for the M269 227 millimeter Multiple Launch Rocket System rocket Phase III warhead was sponsored by the United States Department of Defense through the United States Army with support from the United Kingdom's Ministry of Defence, the Ministries of Defense of France and the Federal Republic of Germany. This program is presently being sponsored by the French Ministry of Defense through the Délégation Général pour l'Armement, Direction des Armements Terrestres and the Direction Centrale du Matériel de l'Armée de Terre.

The Infrared Terminally Guided Submunition was being sponsored by the United States Department of Defense through the United States Army.

Contractors. During its full scale development, the Terminally Guided Submunition for the M269 227 millimeter Multiple Launch Rocket System rocket Phase III warhead was being developed by MDTT Incorporated; Orlando, Florida. Lockheed Martin, also of Orlando, was the principal member of this

consortium. Other members of MDTT were Diehl GmbH, Electronics Division; Rothenbach, Federal Republic of Germany; Thomson-DASA Armements (then Thomson CSF); Paris, France; and Thorn EMI Electronics Limited; Hayes, Middlesex, England, United Kingdom. Following the early 1994 withdrawal of the United States of America, Federal Republic of Germany and the United Kingdom from the program, the MDTT organization has been broken up. The present contractor is Thomson-DASA Armements (which subsequently absorbed the munitions portion of Thorn EMI Electronics).

The Infrared Terminally Guided Submunition was being competitively developed by Raytheon Company/Missile Systems Division, Manchester, New Hampshire and (the then) General Dynamics/Valley Systems Division, Ontario, California.

Licensee. None

Status. The Terminally Guided Submunition for the 227 millimeter M269 Multiple Launch Rocket System Phase III rocket warhead is in continued engineering development in France.

In early 1991, the United States funding support for these programs were terminated in favor of the Brilliant Anti-Tank weapon which is described in a separate report in this section. Subsequently, the Germans and British both withdrew their funding support for this weapon, leaving only France. In early 1994, the then Thomson-CSF made an unsolicited proposal to the French Ministry of Defense to continue the program on its own as the prime contractor with the French government to provide the remaining developmental funding. However, as of mid-1997, no official announcements to this effect had been made either by the French government or the contractor although the development and integration of the submunition continues.

The funding for the Infrared Terminally Guided Submunition program was terminated in early 1991, also in favor of the Brilliant Anti-Tank weapon.

Total Produced. For the Terminally Guided Submunition for the M269 227 millimeter Multiple Launch Rocket System rocket Phase III warhead, a total of 129 developmental submunitions had been manufactured as of January 1, 1996. By the same date, a total of 14

Infrared Terminally Guided Submunition prototypes had been manufactured.

Application. Smart submunitions for the mass destruction of hostile armor. The Terminally Guided Submunition was originally being developed specifically for the Terminally Guided (Phase III) Warhead program for the M270 227 millimeter Multiple Launch Rocket System, but other applications have subsequently been investigated and at least one brought to prototype status. The Infrared Terminally Guided Submunition was being developed for the Block II version of the MGM-140 Army Tactical Missile System with other applications, including the M270 227 millimeter Multiple Launch Rocket System.

Price Range. Although difficult to determine due to the status of the programs, the unit price of a serially produced Terminally Guided Submunition for the M269 227 millimeter Multiple Launch Rocket System rocket (not the complete warhead) was tentatively put at \$28,000 in equivalent 1993 United States dollars; this figure is essentially the same in late 1996. The unit price of the Infrared Terminally Guided Submunition was similar.

Technical Data

The following data are for the Terminally Guided Submunition for the M269 227 millimeter Multiple Launch Rocket System rocket Phase III warhead application; the data are essentially the same for the other dispensing platform applications.

Launch/Carrier Vehicle. Designed for the terminally guided (Phase III) warhead for the M269 227 millimeter Multiple Launch Rocket System rocket; this submunition has subsequently been integrated with the BL755 cluster bomb case.

Submunitions Per Carrier. In the M269 227 millimeter Multiple Launch Rocket System rocket Phase III warhead, six terminally guided submunitions are carried. In the BL755 application, four Terminally Guided Submunition munitions are carried.

	<u>SI units</u>	<u>US units</u>
Warhead length	2.001 meters	6.56 feet
Warhead diameter	22.7 centimeters	8.94 inches
Warhead weight	107 kilograms	235.4 pounds
Submunition length	63.5 centimeters	2.08 feet
Submunition diameter	10.0 centimeters	3.94 inches
Submunition weight	11.0 kilograms	24.2 pounds

Dimensions. The following data are for the latest prototype of the Terminally Guided Submunition for the M269 227 millimeter Multiple Launch Rocket System rocket Phase III warhead. The data are the same for the unpowered version as dispensed from the BL755 cluster bomb. The data for the powered version are not available.

The detailed technical data for the Infrared Terminally Guided Submunition are not known but the munition was broadly similar (albeit somewhat larger) to the Terminally Guided Submunition for the M269 227 millimeter Multiple Launch Rocket System rocket Phase III warhead.

Control & Guidance. The Terminally Guided Submunition employs active millimeter wave (94 gigahertz) radar for guidance following ejection from

the Phase III warhead. Four spring-out fins at the rear of the submunition provide aerodynamic control and effect course changes as directed by the guidance system. The

Infrared Terminally Guided Submunition operation is essentially the same except that the seeker system was based on infrared seeker technology.

Warhead. The Terminally Guided Submunition employs a tandem-shaped charge warhead of advanced design and cone geometry. When applied to a warhead of this diameter, our standardized formula for shaped

charges yields an armor perforation figure of 63.076 centimeters (24.83 inches). However, the performance of this formula is probably deficient with this type of advanced precursor type warhead which is effective against explosive reactive armor. The warhead for the Infrared Terminally Guided Submunition operation was essentially the same.

Variants/Upgrades

Variants. While it was being run as an international program, no variants were developed for the Terminally Guided Submunition. Since the program was taken over by Thomson-CSF (now Thomson-DASA Armements), a powered version of the submunition has been developed on paper. This was in connection with a

proposal to integrate the submunition with the BL755 cluster bomb.

No variants of the Infrared Terminally Guided Submunition were developed.

Modernization and Retrofit Overview. Not applicable at this time

Program Review

Background. The M270 227 millimeter Multiple Launch Rocket System is a highly effective barrage weapon equipped with the Phase I (M42/77) and Phase II (AT 2) submunition warheads on the M269 rocket. However, during the weapon system's early development, it became apparent that it would be an excellent carrier for "smart" submunitions. The advent of this effort, which occurred in late 1970, built upon the effort of the then Defense Advanced Research Projects Agency to develop a terminally guided submunition under the old Assault Breaker concept. In fact, the terminally guided submunition developed by the Defense Advanced Research Projects Agency was designed to fit the M269 227 millimeter Multiple Launch Rocket System rocket. In July 1981, the then 227 millimeter Multiple Launch Rocket System partner nations (United States, France, United Kingdom, and Federal Republic of Germany) decided to fund the definition phase for what is designated the Phase III warhead for the weapon. The competing development teams (as they were then known) were Raytheon/AEG Telefunken/GEC-Marconi/Engins Matra; Hughes/Euromissile (Aerospatiale, British Aerospace and Messerschmitt-Bölkow-Blohm) and the MDTT team headed by Lockheed Martin as outlined above. On November 29, 1984, the contract award was made to MDTT.

Program Description. Development of the Phase III warhead and submunition has proven to be a difficult proposition, both technically and politically. However, this program was originally felt to offer the greatest promise for the multinational 227 millimeter Multiple

Launch Rocket System program. The M269 Multiple Launch Rocket System rocket's Terminally Guided Warhead ejects by a gas generator/bladder system six terminally guided submunitions. These six submunitions then deploy four aerodynamic stabilization fins at the rear of the submunition; shortly thereafter, the aerodynamic control surfaces are deployed and the submunition performs a pull-up maneuver to establish a roughly horizontal glide path. Originally, several different technical standards for the millimetric radar seeker were examined. By all indications, selection of the much more efficient 94 gigahertz seeker instead of the originally favored 35 gigahertz unit did not cause any major difficulty. The 94 gigahertz millimetric radar is then activated to search an area of about 2,000 by 1,000 meters for armored targets. The submunition can detect if one target is already under attack and switch to another target. Once a valid target is acquired, the appropriate commands are generated and transmitted to the aerodynamic control surfaces which then guide the submunition to the target. The top of the target is then attacked via a contact-fuzed tandem shaped charge warhead. Our standardized formula for the armor perforation performance of High Explosive Anti-Tank warheads gives 63.076 centimeters (24.83 inches) when applied to this warhead; the actual performance is almost certainly somewhat better.

Schedule. The late 1984 developmental contract award covered a 28-month definition phase. This was followed by a full-scale development phase scheduled to last from February of 1987 to July of 1989. The maturation

phase, which included pre-serial production, was to have run from July of 1989 to November of 1992. However, political and technical questions delayed this schedule. In equivalent 1987 United States dollars, the total development cost for the Terminally Guided Submunition was put at \$350.5 million, of which each European partner nation (except Italy) was to contribute 22 percent and the United States 34 percent. However, as of early 1996, a Thomson-DASA Armements official stated that the development costs had been the equivalent of around US\$600 million, about half of which was attributable to the design and validation of the millimeter-wave radar.

The overall management of the Phase III Warhead program was by MDTT Incorporated, which is owned 34 percent by Lockheed Martin and 22 percent by each European partner except Italy. The breakdown of responsibilities was as follows:

Lockheed Martin - system integration, development of algorithms, seeker software, radio frequency transmitter and system test and evaluation.

Thorn EMI - development of telemetry, fuze, gyroscope, seeker antenna, guidance components and gimbal assembly.

Diehl GmbH - safe/arm system, seeker signal processor, control actuation system and internal power system.

Thomson CSF - seeker receiver, lethal mechanism, airframe and internal structure, and submunition ejection system.

Other Applications. By the late eighties, the Terminally Guided Submunition was being groomed for integration with any number of launch platforms as well as submunition dispensers launched from various platforms. Major candidates mentioned were the APACHE modular dispenser system, the SUU-64/65 Tactical Munitions Dispenser, the Block II version of the MGM-140 Army Tactical Missile System and the Mehrzweckwaffe-1 dispenser as well as its derivatives. More recently, other dispenser applications have been investigated; these are described further on.

Troubles In The Program. In 1986, several members of Congress, along with the General Accounting Office, began to question the wisdom of continuing the United States of America's participation in the Terminally Guided Submunition program. The reasons cited were the fact that the Sense And Destroy Armor submunition, also planned for integration with the M270 227 millimeter Multiple Launch Rocket System, does essentially the same job. At that time, the Sense And Destroy Armor program was also much more mature; it was expected by most observers to be in service up to three years earlier than the Terminally Guided

Submunition. Finally, for several reasons, the Sense And Destroy Armor program was expected to be cheaper. However, the passage of time has brought several major problems in the Sense And Destroy Armor program. For a complete description of the Sense And Destroy Armor submunition, we refer the reader to the pertinent report in this section.

In late 1990, Congress mandated in the Fiscal 1991 Appropriations bill that the United States Army select one submunition from the several it then had in development for its deep strike mission area. The contenders were the Terminally Guided Submunition for the Phase III 227 millimeter Multiple Launch Rocket System warhead, the Infrared Terminally Guided Submunition (described below) and a then "black" program which was subsequently revealed as the Brilliant Anti-Tank Weapon. The Army selected the latter program, cutting off funding for both the Terminally Guided Submunition for the Phase III 227 millimeter Multiple Launch Rocket System warhead and the Infrared Terminally Guided Submunition program. While there were a number of efforts to save the Terminally Guided Submunition for the Phase III 227 millimeter Multiple Launch Rocket System warhead, as of mid-1997, none of these had been successful and they were abandoned. The United States' funding for the program ran out in early 1994.

Seeing the writing on the wall, the United Kingdom and the Federal Republic of Germany also withdrew from the program in 1993; after early 1994, this left only the French supporting the program. The MDTT consortium was broken up.

Resurrection? In early-1994, the then-Thomson-CSF, the French firm involved in the developmental program, expressed a desire to finish the then almost complete development of the Terminally Guided Submunition for the Phase III 227 millimeter Multiple Launch Rocket System warhead. The firm, citing its already heavy involvement in the program, also noted that the submunition has possibilities for integration with other platforms and dispensers, most notably the APACHE missile, already funded by France. The firm further stated that the development could be funded for completion by France for only a little more than the country would have had to pay under its 20-percent share under the original development plan. While the French government has committed itself to procure the system, no quantity has been mentioned. The French have noted that they have excellent sales potentials for the Phase III Warhead in the numerous countries that operate the M270 Multiple Launch Rocket System. In a more recent proposal to address a Royal Air Force requirement, the submunition was integrated with the Hunting Engineering BL755 cluster bomb instead of the

original submunition; four Terminally Guided Submunitions would be carried; however, with the selection of a competing missile-based system for this requirement, this program has gone dormant. Most recently, Thomson-DASA Armements has proposed the integration of a solid-fuel rocket motor with the Terminally Guided Submunition, again for dispensing from the BL755 cluster bomb; in this latest proposal, three Terminally Guided Submunitions would be carried.

Infrared Terminally Guided Submunition. This was a very similar program to develop a terminally guided submunition for the MGM-140 Army Tactical Missile System missile. However, this submunition was to use an advanced infrared seeker as the main component of its guidance system. Initiated in 1988, the contractors for the competitive development were Raytheon and General Dynamics. In August and October of 1989, the two firms were awarded competitive proof of principle contracts for this program. However, the entire Infrared Terminally Guided Submunition program was terminated in early 1991 as described above.

Funding

The United States' funding for the Terminally Guided Submunition and Infrared Terminally Guided Submunition was terminated effective with the Fiscal 1991 budget. While the other member nations' funding profiles for the Terminally Guided Submunition and Phase III warhead have not been released, the general profile parallels that below, albeit in reduced form. No funding for the Infrared Terminally Guided Submunition program is shown.

US FUNDING

	FY88		FY89		FY90		FY91	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
PE#0603303A	-	23.6	-	35.3	-	28.4	-	47.2

All dollar amounts are in millions.

Note: Program element number 0603303A, Surface to Surface Missile Rocket System. This program element was listed as 633303A in the initial Fiscal 1988/1989 documents. There was only one project, D216 - MLRS Terminally Guided Warhead. The funding for development of the Infrared Terminally Guided Submunition (the Block II warhead) was under Program Element 064324A - Army Tactical Missile System.

Recent Contracts

None; both the Terminally Guided Submunition and Infrared Terminally Guided Submunition programs were terminated by the United States in early 1991. No contract information was released from the European member nations involved in development of the Terminally Guided Submunition for the Phase III 227 millimeter Multiple Launch Rocket System warhead. No contract information has been released by the French government or Thomson-DASA Armements since the program was assumed by the latter firm.

Timetable

The following timetable relates to both the Terminally Guided Submunition and Infrared Terminally Guided Submunition programs.

Late	1970	Concept development began
Jul	1979	Memorandum of Understanding signed among the four nations involved
May	1980	Requirement for a terminally guided warhead for the 227 mm Multiple Launch Rocket System issued by United Kingdom, France, Federal Republic of Germany and United States
Jul	1981	Terminally Guided Warhead/Submunition program began

Jun	1982	Concept studies completed, competitive evaluations began
Sep	1984	Defense Systems Acquisition Review Council milestone 1
Nov	1984	Contract award made to MDTT
Feb	1986	Captive flight tests of components began
Early	1988	Infrared Terminally Guided submunition program for the Block II Army Tactical Missile System began
Summer	1989	Dispensed flight tests of complete Terminally Guided Submunition began
Aug	1989	Competitive development contracts for Infrared Terminally Guided Submunition program awarded
Early	1991	United States Army terminates funding for Terminally Guided Submunition and Infrared Terminally Guided Submunition programs
Mid-Late	1993	Several successful tests of the Terminally Guided Submunition
Early	1994	Except for France, all governmental funding support for the Terminally Guided Submunition terminated
	1995	Terminally Guided Submunition integrated with BL755 cluster bomb
Late	1997	Development of the Terminally Guided Submunition continues in France

Worldwide Distribution

Export Potential. Since the Terminally Guided Submunition and the Phase III warhead was an integral component of the multinational 227 millimeter Multiple Launch Rocket System program, its future was expected to be assured. Now that the United States, Germany and the United Kingdom have pulled the rug out from under the funding effort, it is increasingly doubtful if the program will ever be brought to production status. The caveat here is in relation to the French desire for the weapon and their noting of the export potential for the submunition in relation to the M270 Multiple Launch Rocket System. The contractor also continues to push the Terminally Guided Submunition in the BL755. The Infrared Terminally Guided Submunition was also expected to eventually gain some export sales, but such a prospect is now considered impossible.

Countries. None (developmental prototypes of the Terminally Guided Submunition and Infrared Terminally Guided Submunition in France)

Forecast Rationale

Our latest review of the Terminally Guided Submunition program finds that, as of late 1997, the munition remains in development. The development and testing of the submunition in relation to the Phase III Warhead for the M270 Multiple Launch Rocket System is nearly complete, although no information on any proposed procurement has yet been released. While the contractor has continued the promotion of the submunition integrated with the BL755 cluster bomb, this program has been and is expected to remain dormant. No new information related to the status of the development of the powered version of the submunition has come forth since early 1996.

Our latest research still does not support any serial production of the Terminally Guided Submunition for the Phase III 227 millimeter Multiple Launch Rocket System warhead program. This is despite the French commitment to procure the submunition. France is going whole hog for the APACHE program, which,

although a bi-national (with Germany) program was originally and is still considered to be French. Also hindering the future of the Terminally Guided Submunition is the fact that there are already several indigenous submunition loadings in final development for the APACHE. The evidence also indicates that the available funding does not support the French procuring the Terminally Guided Submunition, although the available funds could be prioritized. Based on these facts plus our other research, we forecast that only a minimal amount of additional developmental work will be directed to this program. However, we will continue to maintain this report on the still possible chance that it will be procured by France or by some other nation.

The Infrared Terminally Guided Submunition program in the US is dead and is not expected to be revived, although again we will continue to monitor the program.

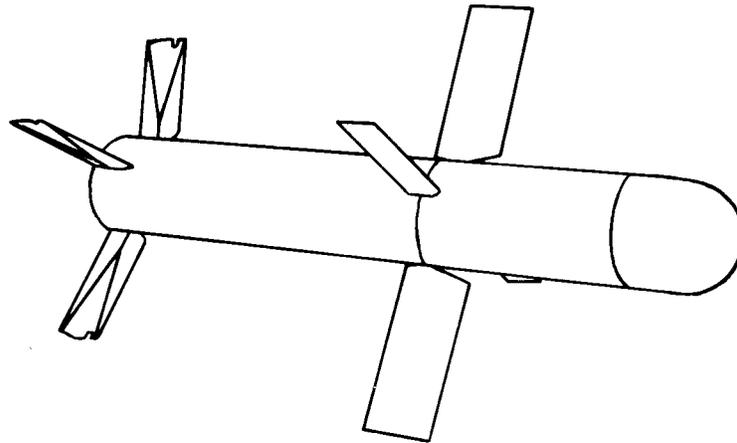
Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION												
Munition	through 96	High Confidence Level			Good Confidence Level			Speculative			Total 97-06	
		97	98	99	00	01	02	03	04	05		06
THOMSON-DASA ARMEMENTS												
TERMINALLY GUIDED												
SUBMUNITION (a)	129	12	11	6	0	0	0	0	0	0	0	29
Total Production	129	12	11	6	0	0	0	0	0	0	0	29

(a) Production is for complete developmental submunitions for function and integration tests as well as dispensing tests which began in 1989.

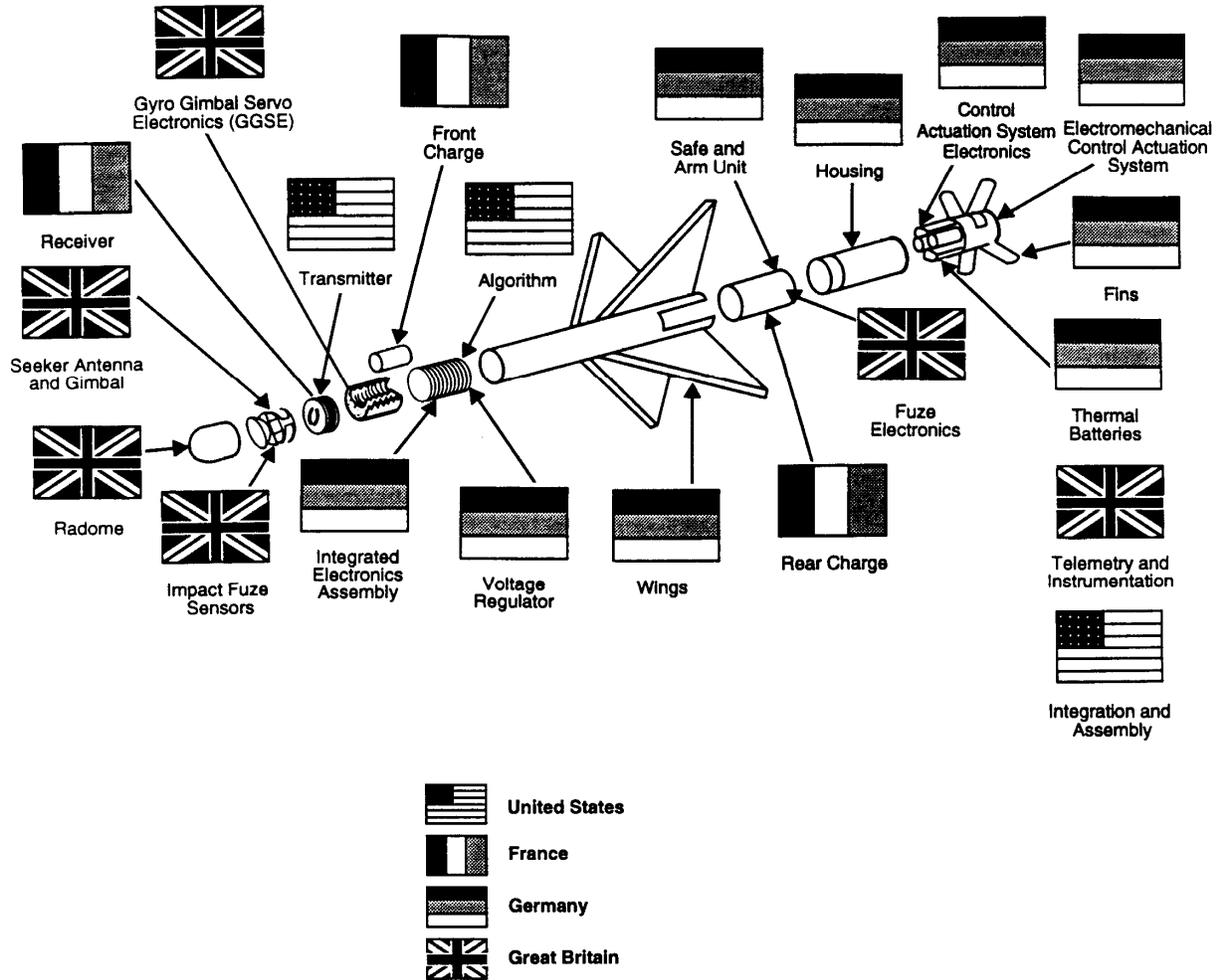
ESTIMATED CALENDAR YEAR PRODUCTION												
Munition	through 96	High Confidence Level			Good Confidence Level			Speculative			Total 97-06	
		97	98	99	00	01	02	03	04	05		06
GENERAL DYNAMICS/RAYTHEON												
INFRARED TERMINALLY												
GUIDED SUBMUNITION (a)	14	0	0	0	0	0	0	0	0	0	0	0
Total Production	14	0	0	0	0	0	0	0	0	0	0	0

(a) The production is for the initial developmental prototypes.



INFRARED TERMINALLY GUIDED SUBMUNITION

Source: Forecast International



TERMINALLY GUIDED SUBMUNITION (PHASE III WARHEAD)

Source: MDTT Incorporated