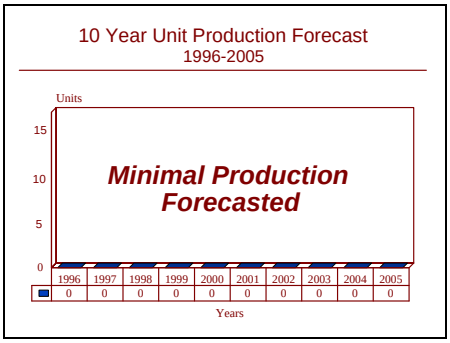
Merlin Guided Anti-Armor Projectile - Archived 10/97

Outlook

- Due to no sales interest, development of program terminated in September of 1996
- British Aerospace looking for international funding to complete development
- Components (especially guidance) of Merlin could find use in other weapons



Orientation

Description. A guided mortar projectile.

Sponsor. The United Kingdom Ministry of Defence, Ordnance Board through the Ministry of Defence Army Department provided some of the development funding for Merlin; to date, the remainder of the development funding is being provided by the contractor. Following its termination in September of 1996, British Aerospace is looking for international funding to complete the development of the Merlin.

Contractors. The Merlin was being developed and would have been manufactured by British Aerospace plc, Dynamics Division; Stevenage, Hertfordshire, United Kingdom. The production of Merlin would have taken place at Lostock. Royal Ordnance acts as a subcontractor.

Licensees. Alliant Techsystems has the marketing and manufacturing license for Merlin in the United States of America. More recently, Rockwell International entered the a projected version of the Merlin for the United States Army's Precision Guided Mortar Munition program.

Status. Before British Aerospace termionated the program in September of 1996, the Merlin program was in full-scale engineering development with the contractor's and operational firing trials phase ongoing; development of the basic Merlin as well as a 120 millimeter version (originally for the United States Army's Precision Guided Mortar Munition program), was being continued.

Total Produced. As of January 1, 1996, a total of 124 Merlin projectiles had been manufactured.

Application. Designed for use by infantry units, the Merlin guided mortar projectile was to be used for the long range destruction of tanks and other armored vehicles in all types of weather in day or night by the use of 81 millimeter mortars.

Price Range. In late 1989, British Aerospace projected the unit price for the Merlin in then equivalent United States dollars at $12,400. The unit price for serially produced Merlin rounds is now projected by us as being $17,808 in equivalent 1996 United States dollars.

Technical Data

Launch/Carrier Vehicle. Any 81 millimeter mortar; 82 millimeter mortars can also fire Merlin with the aid of an obturator ring.

Dimensions. The following data is for the latest prototype Merlin munitions.

	SI units	US units
Munition diameter	81 millimeters	3.19 inches
Munition length	90.0 centimeters	35.43 inches
Munition weight	6.0 kilograms	13.2 pounds

Performance. The armor perforation figure is the result of a standardized formula for High Explosive Anti-Tank warheads; since the Merlin is a top attack weapon, its performance should be more than adequate against any known tank for many years.

Maximum range	4,000 meters	4,374.4 yards
Armor perforation	51.0 centimeters	20.1 inches

Warhead. Merlin uses a high explosive shaped charge (High Explosive Anti-Tank) warhead of advanced design.

Control & Guidance. Six fins are deployed as the projectile leaves the tube; these fins provide the initial aerodynamic stabilization of the projectile. Two canard control surfaces are deployed shortly after the active millimeter wave seeker is activated at the top of the projectile's trajectory. These canard control surfaces are activated in the appropriate manner by signals from the millimeter wave guidance system and the associated control electronics. Electrical actuators are used to activate the aerodynamic control surfaces.

Variants/Upgrades

Variants. No variants of Merlin have been developed at this time. However, as a result of the United States Army's evaluations of several guided mortar round options conducted under the Precision Guided Mortar Munition program, British Aerospace, Alliant Techsystems and Rockwell International were developing a 120 millimeter version of the Merlin projectile fitted with the original millimeter wave guidance system of the Merlin integrated with the semi-active laser guidance system and lethal mechanism of the AGM-114 HELLFIRE missile. Further details are found in the relevant report in this tab.

Modernization and Retrofit Overview. Not applicable as the Merlin has yet to enter production.

Program Review

Background. For some time, the infantry arm of the British Army has been considered deficient in long range anti-armor capability. In 1979, the Ministry of Defence began the study of a smart mortar projectile to fill this need. In September of 1981, British Aerospace, which had been following the official feasibility program, began funding the internal development of the new guided mortar projectile. In April of 1983, a General Staff Target for a terminally guided mortar projectile was issued under the term MORAT. This coincided with an agreement made between British Aerospace and the Ministry of Defence for the equal sharing of funding to complete the project definition phase as well as to fund the pre-development phase. This later phase was completed in December of 1984. By that time, the MORAT program had become known by the name Merlin. Due to financial considerations, the Ministry of Defence did not enter into a contract for the full scale engineering development of Merlin, leaving British Aerospace to continue to fund the program on a private basis. As of mid 1996, the developmental test program is on schedule with the test firings continuing. Although as of this writing the Ministry of Defence is still not funding the Merlin program, it is still cooperating and supporting the development program through the British Army.

Description. The Merlin is supplied and stored as any other type of mortar round; the shelf life is stated by the contractor to be at least ten years. The diameter of the projectile is 81 millimeters (3.1 inches); it can be fired from any Western pattern 81 millimeter mortar. In addition, the Merlin projectile can be fired from Russian pattern 82 millimeter mortars by the addition of a simple obturating ring. The Merlin can be fired as rapidly as any other type of mortar round, allowing for fires against massed formations of armor.

The Merlin has an appearance similar to any other mortar projectile, albeit longer. The forward portion of the projectile contains the millimeter wave guidance and control components including the canard control surfaces. The middle of the projectile houses the electronics, batteries and shaped charge warhead to the rear. The rear portion of the projectile mounts the stabilizing fins and contains the safe/arm mechanism.

After the projectile is fired, six spring-out fins at the rear of the projectile stabilize it during the initial stages of flight. At the top of the trajectory, the millimeter wave sensor is switched on. From a "normal" range the footprint of search is 90,000 square meters (107,636.5 square yards). Once a target is acquired, the appropriate guidance and control inputs are generated and the projectile homes in on the target, striking it on the top. Merlin is optimized to hit moving targets.

The Merlin uses a chemical (High Explosive Anti-Tank) warhead to defeat armor. The application of our standardized formula for chemical warheads of this type yields a perforation figure of 51.0 centimeters (20.1 inches), more than sufficient to perforate the top armor of any tank presently in service or projected. Even if the tank is fitted with explosive reactive armor on top, the detonation of the Merlin projectile will almost certainly destroy or severely disrupt the tank's fire control optics, rendering it almost impotent.

Merlin Program Terminated. Even though the United Kingdom Ministry of Defence supported a portion of the development of the Merlin, the British Army never made a commitment to procure the guided mortar round. In addition, despite a good deal of interest from the United States of America (especially the Marine Corps), when the time came for the selection of a guided mortar round, the Merlin fell by the wayside in favor of competing technology. The final blow was probably the fact that the Merlin was deleted from the British Army's Long Term Costs program in mid-1996. The announcement that the Merlin program would be terminated came in September of 1996; the program reportedly cost British Aerospace about a hundred million pounds (155 million United States dollars). At the time of the announcement, our research into the program revealed that British Aerospace was engaged in an effort to find funding to complete the development of the Merlin, which is about 95% complete.

Funding

Other than the fact that the United Kingdom Ministry of Defence provided some of the development funding for Merlin and that the remainder of the development funding is being provided by the contractor, no information is available.

In the United States of America, under the Foreign Comparative Testing program, the United States Army evaluated guided mortar technology in its Precision Guided Mortar Munition program; a half million dollars was authorized in the Fiscal 1994 defense budget for this effort. For a complete description of the Merlin's role in this program, we refer the reader to the Mortar Ammunition (United States) report in this tab.

Recent Contracts

No information is available as contractual information is not released.

Timetable

This timetable is for the Merlin program only; it does not relate in any manner to the Strix or any other guided mortar projectile program.

Early	1979	Concept exploration and initial development
Sept	1981	British Aerospace began the private development of the MORAT concept
Apr	1983	General Staff Target for a guided mortar projectile issued; initial funding agreement between British Aerospace and Ministry of Defence made
Dec	1984	Concept development and pre-development phase completed, Ministry of Defence funding terminated
Early	1985	Full scale engineering development phase began with private funding
	1985-1990	Full scale engineering development/test firing phase ongoing
	1994	Comparative testing in the United States
Oct	1994	Modified version of Merlin accepted for further development in the United States

Sept 1996 Development of Merlin terminated by contractor

Worldwide Distribution

Export Potential. British Aerospace had developed an estimate that 30 to 40 percent of the 62,000-odd 81 millimeter mortars in the world would be candidates for the Merlin. The closest competition comes from the Swedish Strix program, which is a 120 millimeter system which uses infrared guidance. Because of the fact that the Merlin uses the much more sophisticated millimeter wave guidance, by the late-nineties, British Aerospace expected that Merlin would be the standard by which all guided mortar projectiles are judged. Now that the program has been terminated, the point is moot.

Countries. **United Kingdom** (prototypes with the contractor)

Forecast Rationale

Now that the Merlin program has been terminated by the contractor British Aerospace, no additional production is forecast. However, our research related to the potential for guided mortar projectiles in general is still bullish; even so, the chances of an 81 millimeter guided mortar projectile becoming available are now a somewhat more remote.

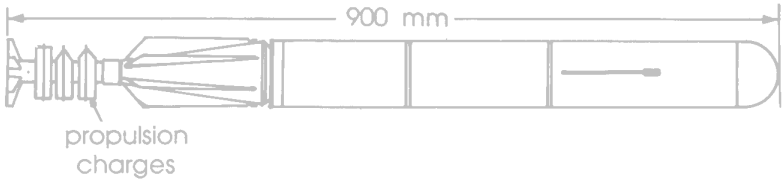
Our latest review of the Merlin program prompts us to zero the forecast production of this munition. However, the contractor British Aerospace is striving to find funding on the international market to complete the development of the Merlin, which is about 95% complete. There is also one report circulating that British Aerospace is offering the complete technical data package for sale although this can not be confirmed as of the time of this research. Therefore, we will continue to monitor this still potentially important program in the closest manner, and update this report on an interim basis if warranted.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

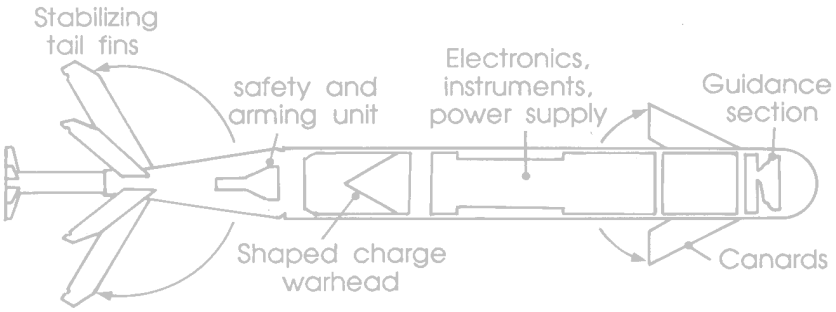
		High Confidence Level			Good Confidence Level			Speculative				
Munition	through 95	96	97	98	99	00	01	02	03	04	05	Total 96-05
BRITISH AEROSPACE/ARMY WEAPONS												
MERLIN (a)	124	6	0	0	0	0	0	0	0	0	0	6
Total Production	124	6	0	0	0	0	0	0	0	0	0	6

a Production through 1996 is for the initial pre-prototype test rounds, component integration test rounds, unguided test rounds, guided test rounds, all up test rounds and contractor/operational test rounds.



MERLIN IN LAUNCH CONDITION (6kg)

Source: Forecast International



MERLIN IN HOMING CONDITION