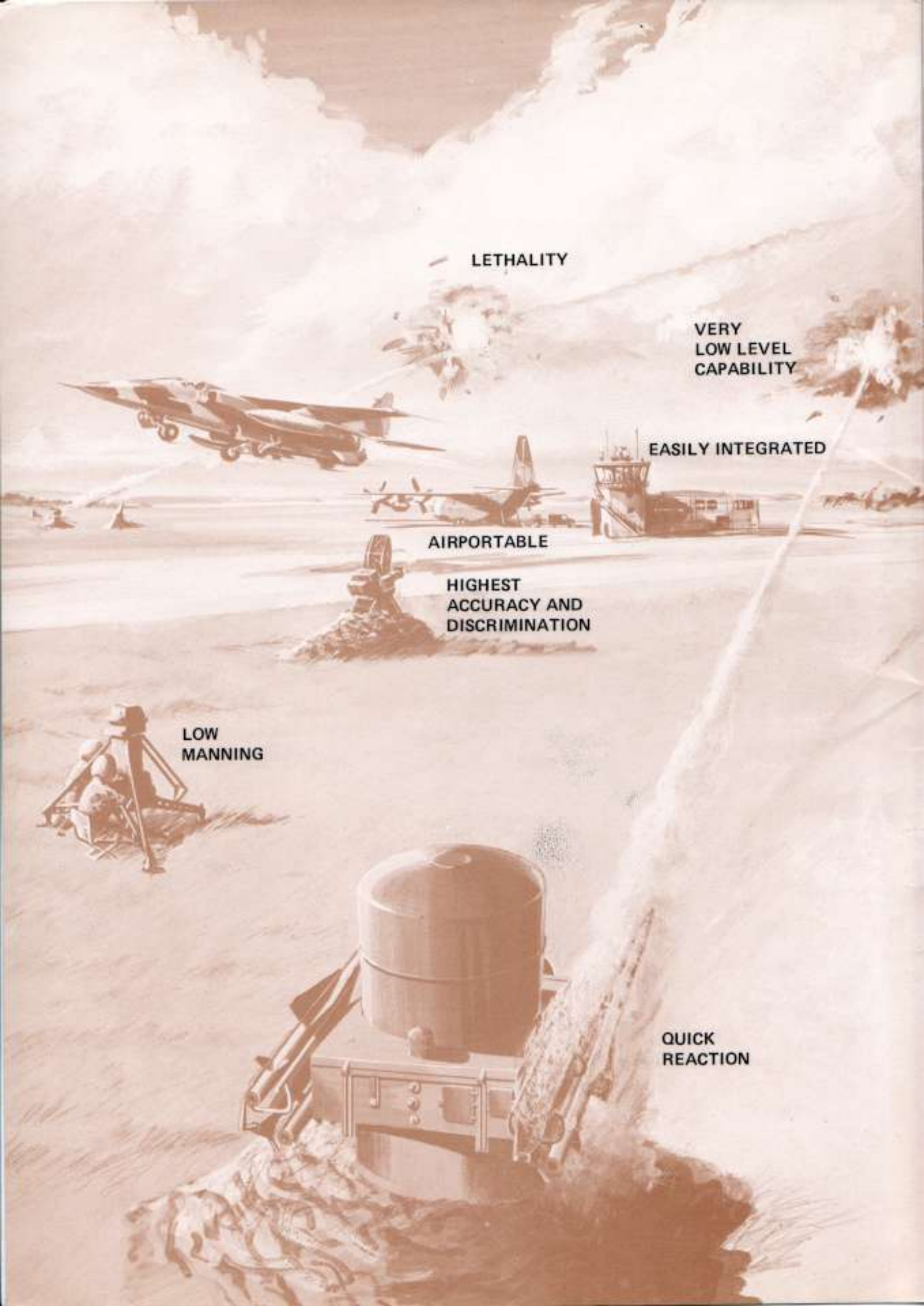


RAPIER

***BRITISH
AEROSPACE
DYNAMICS
GROUP***





LETHALITY

VERY
LOW LEVEL
CAPABILITY

EASILY INTEGRATED

AIRPORTABLE

HIGHEST
ACCURACY AND
DISCRIMINATION

LOW
MANNING

QUICK
REACTION

Introduction

RAPIER is a low-level anti-aircraft guided weapon specifically designed to combat modern low flying aircraft. It is equally suited to the defence of Army and Air Force installations, both fixed and mobile.

RAPIER is a lightweight, highly mobile system built with a modular construction to allow the greatest flexibility to the user at a minimum cost. A direct hitting missile or "hittile" is used to ensure a high overall kill probability.

RAPIER was developed to a requirement laid down by the British Ministry of Defence for use by the British Army and Royal Air Force.

The system is in service with the British Army and Royal Air Force and is operationally deployed by both services in Germany with NATO forces and is the only weapon of its type to have achieved this status.

The add-on Blindfire Radar is in full production and also operationally deployed in NATO.

TRACKED RAPIER is being developed to meet the requirement for the defence of armoured formation of the Field Army in certain operational theatres where battlefield mobility and armour protection, for both crew and equipment, are essential.

Over 340 RAPIER Fire Units and 12,500 missiles have been produced. An equipment availability of about 90% is currently being achieved in NATO.

MODES OF OPERATION

There are two modes of operation in the RAPIER system, the Optical Mode for daylight and good visibility use and the Blindfire Mode for night and poor visibility conditions.

OPTICAL GUIDANCE MODE

The Optical Mode employs an Optical Tracker with which the operator uses a "joystick" for target tracking and which employs an automatic TV missile tracking system. The main items of equipment required are as follows:—

- Launcher
- Optical Tracker
- Selector Engagement Zone Generator

BLINDFIRE GUIDANCE MODE

The Blindfire Mode employs a Blindfire Radar Tracker which automatically tracks both the target and the missile. The Blindfire Mode uses the optical equipment with the addition of:—

- Blindfire Radar Generator

Rapier Into Action



Major Equipment Items

LAUNCHER

The Launcher is the centre of the RAPIER system. The surveillance radar aerial, on which the IFF aerials and interrogator are mounted, is housed under the radome and rotates once every second. The Radar transmitter receiver is mounted in the lower part of the Launcher. The radar, together with the IFF, is thus able to provide the necessary early detection and alarm of approaching enemy aircraft required to effect interceptions at the maximum range.

The Launcher turntable which rotates through 360° , carries four missiles in their firing position and the command transmitter and aerial which provide the link between the computer, in the base of the launcher, and missiles in flight. When deployed the road wheels and mudguards are removed and the launcher is levelled on four corner jacks.

OPTICAL TRACKER

The Optical Tracker stands on a tripod, which has a levelling jack on each leg, and consists of a static column with a rotating head providing 360° coverage in azimuth. Elevation coverage between -5° and $+60^{\circ}$ is provided by movable prisms in the rotating head. There are two tracking systems, one an optical system, through which the operator tracks the target under joy-stick control and the other a TV tracking system which automatically gathers and then tracks the missile in flight.

The operator is provided with a biocular sight for target tracking and has the few simple controls required to operate the system at the control station. A monocular sight is provided at the rear of the static column which an instructor can use to monitor students' performances during training in the field.

The excellent performance of the Optical Tracker has been produced as the result of extensive trials and field experimentation conducted during the early stages of development to ensure the best possible interface between man and machine.

The accuracy with which an average soldier can track target aircraft has been shown on numerous occasions demonstrating the benefit gained from the extensive ergonomic work incorporated at the design stage.

THE SELECTOR ENGAGEMENT ZONE UNIT

The Selector Engagement Zone (SEZ) provides tactical control facilities and is connected by cable between the Launcher and Optical Tracker. The SEZ is divided into 32 sectors in azimuth, each sector thus covering $11\frac{1}{4}^{\circ}$. By operating sector switches blind arcs can be built up as required to provide "safe" channels for friendly aircraft or to set in priority arcs of fire for the Fire Unit, should this be desired.

MISSILE

The RAPIER missile has a streamlined monocoque body of circular cross-section and consists of four main sections:—

- Warhead
- Guidance
- Propulsion Unit
- Control

The Warhead Section contains the semi-armour piercing warhead, safety and arming unit, and crush fuze.

A frangible plastic nose cone is fitted to the penetrating head to provide the optimum aero-dynamic shape.

The Guidance Section is in two parts, the Electronic Pack and the Instrument Pack.

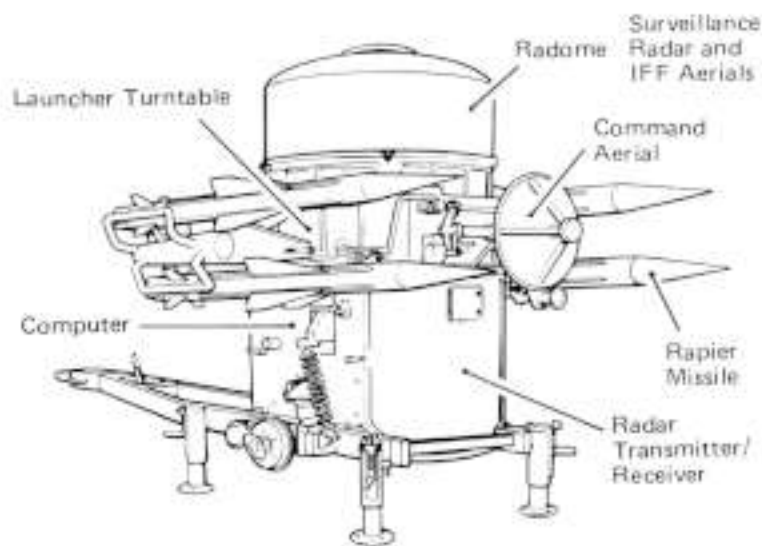
The Propulsion Unit is an integral two stage boost motor and gives the missile a maximum speed in excess of Mach 2.

The Control Section contains the hot gas driven control surface actuation mechanism which controls the missile in flight and pyrotechnic flares to facilitate TV gathering and tracking.

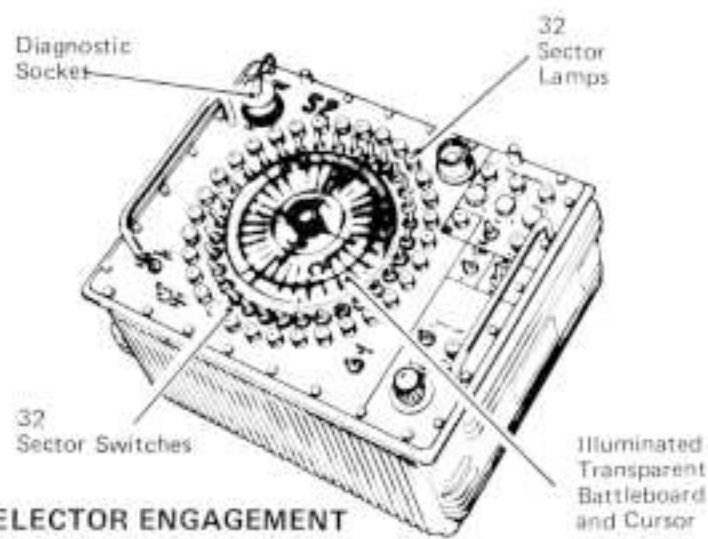
The missile is 7ft 4 in (2.24m) long, has a body diameter of 5.25in (13.3cm), a wingspan of 15in (38.1cm) and weighs only 94lb (42.6kg).

The same missile is used for both the Optical and Blindfire Guidance modes and for TRACKED RAPIER.

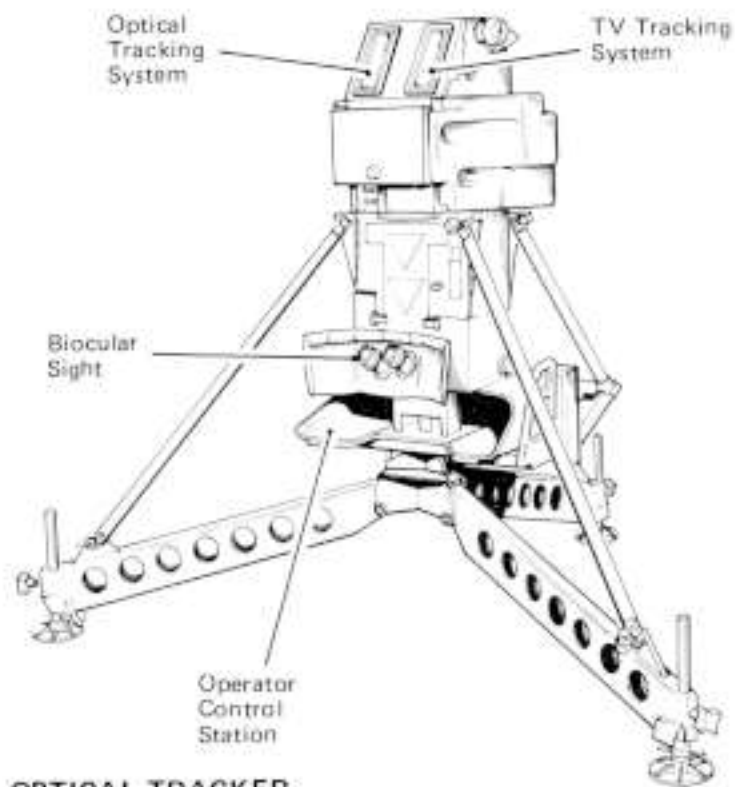
The missile is manufactured as a round of ammunition and requires no maintenance, testing or servicing once it has left the ordnance depot except for the routine changing of desiccators. When stored in controlled conditions the missile has a shelf-life well in excess of seven years.



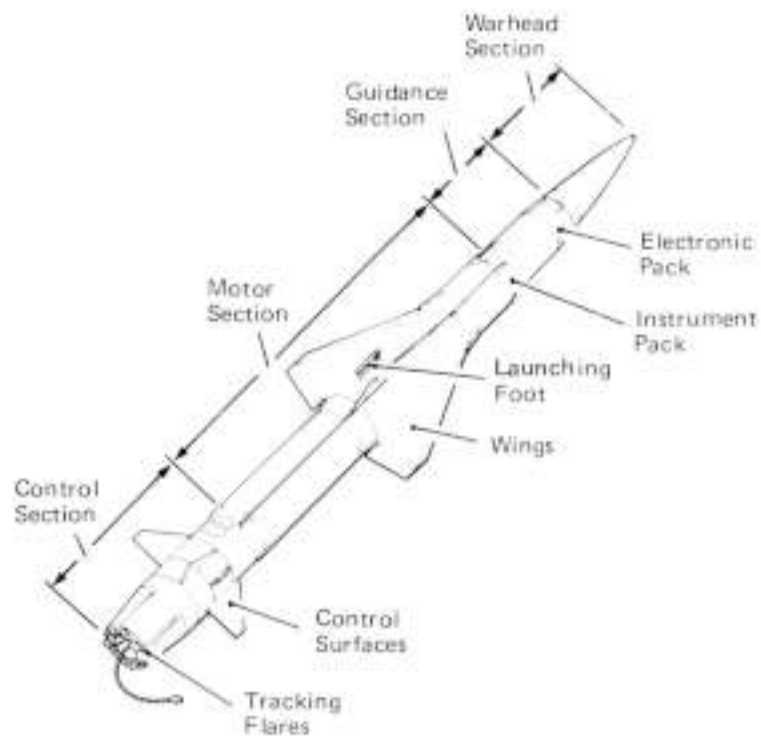
LAUNCHER



SELECTOR ENGAGEMENT ZONE UNIT

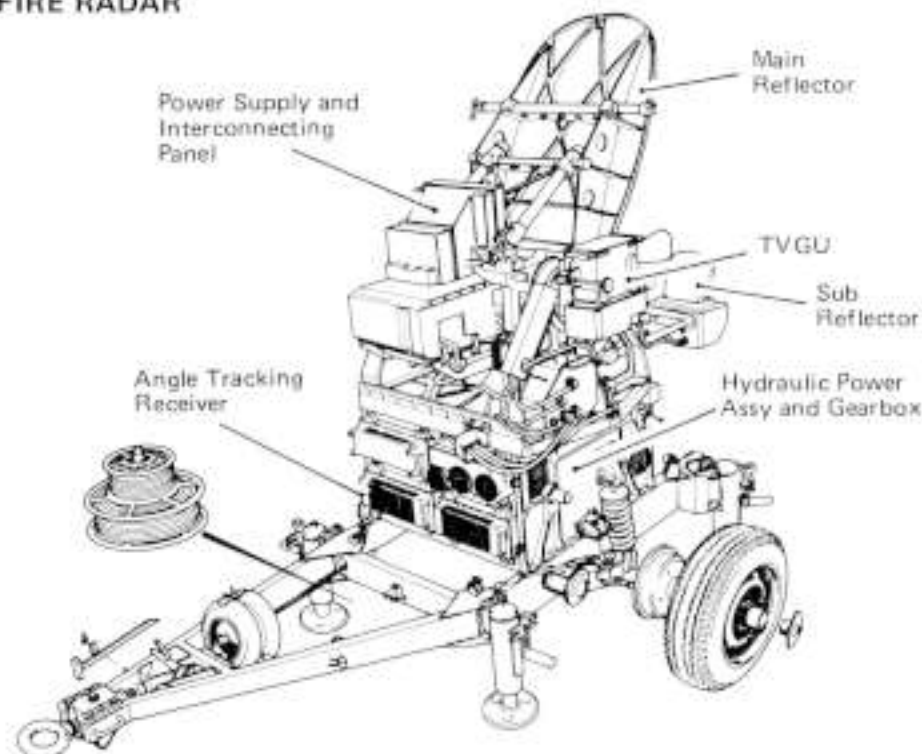


OPTICAL TRACKER



MISSILE

BLINDFIRE RADAR



BLINDFIRE RADAR

The Blindfire Tracking Radar is a plug-in unit which provides RAPIER with a night/poor visibility capability. In operation the monopulse radar employs differential tracking of both the missile and the target using a very narrow pencil beam in order to achieve the accuracy required.

The Radar is mounted onto a chassis which is similar to the launcher. The base housing contains the electrical electronic and hydraulic power assemblies and is static during operation.

The upper assembly carries the main reflector, the sub-reflector assembly, the TV gathering unit with its power supply and the RF unit. This assembly rotates in azimuth and the aerial system in elevation.

Fire Units

OPTICAL FIRE UNIT

A mobile Optical Fire Unit consists of two Land-Rover (or similar) vehicles, the launcher and a light trailer. The first Land-Rover carries two men, the Optical Tracker, four missiles in their travelling boxes and tows the Launcher with its generator set rear mounted. The second Land-Rover carries three men, stores and supplies for the fire unit and tows the missile resupply trailer carrying a further nine missiles in their travelling boxes. The fire unit is highly mobile, airportable by fixed wing aircraft and helicopters and can operate autonomously in the field or integrated as part of an overall air defence system. The fire unit can be deployed and brought into action in under 15 minutes; out of action time is the same. The reaction time of the system between detection by the surveillance radar and the launching of a missile, is dependent on many factors but typically averages between 6 and 8 seconds.

BLINDFIRE FIRE UNIT

An Optical Fire Unit can be converted into a Blindfire Fire Unit simply by the addition of a Blindfire Radar towed by a third Land-Rover. This Land-Rover is very similar to that which tows the Launcher. It carries two men, four missiles in their travelling boxes and tows the Blindfire Radar with its generator set rear mounted. A fully mobile Blindfire Fire Unit thus consists of three light vehicles, three light trailers, a complement of 7 men, a total of 17 missiles and has its own surveillance radar, IFF, guidance computer, day and night tracking systems, resupply missiles and power supply units. It is thus able to operate autonomously or integrated, with the necessary communications system, as part of an air defence network. The Blindfire fire unit can be brought into and out of action in about 20 minutes.

Defence of Vital Installations





Electronic Repair Vehicle (ERV)

Rapier Trainer



MAINTENANCE

Ease and speed of maintenance and repair of front line defence equipment is of the utmost importance to the armed services. From its initial concept RAPIER was designed so that military service personnel could operate, maintain and repair the system in the field.

All RAPIER equipments are built up from a number of assemblies and subassemblies in sealed containers which are easily removed from or replaced in the main equipment. The repair philosophy is based on the use of Manual Test Equipment which can rapidly locate a fault to a particular assembly. Repair is then effected by replacement of that faulty assembly by a serviceable spare assembly. Daily Tests and Adjustments are then used to check that the fault has been cleared and that the equipment is once more serviceable.

In addition Automatic Test Equipment (ATE) is used to carry out routine performance testing to maintain the system at full battle readiness. RAPIER, like any other technically advanced equipment can suffer a gradual deterioration in performance which may remain unnoticed by the operators. If not corrected, this loss of performance could eventually lead to a significant loss of coverage and operational effectiveness. The Automatic Test Equipment carried at First and Second Line is equipped to carry out routine performance tests.

TRAINING

Operational efficiency of any weapon system depends on competent handling, repair and maintenance. The training described here is aimed at producing this efficiency. The Training School at British Aerospace Dynamics Group, Stevenage has extensive experience gained from other training schemes at the School over many years. Training can be divided into three categories: Operational, Maintenance and Staff Training. In all cases, on-the-job training subsequent to formal training provides the trainee with practical experience. Usually, a Training School in the user's country is established to undertake training of battery personnel.

Rapier Capabilities

RAPIER has been designed to engage and destroy fast, low flying and manoeuvring aircraft and has demonstrated its unparalleled ability to do so with a high kill probability both in the Optical and Blindfire modes.

SURVEILLANCE RADAR

Most engagements commence with an alarm following detection of a target by the surveillance radar and the failure of the aircraft to provide the correct IFF response. The surveillance radar operates in F-Band and can detect moving targets in the presence of strong fixed echoes. It is thus able to provide bearing range and velocity information.

Rapier Blindfire Deployed



SYSTEM REACTION TIME

The average reaction time from target detection to missile launch is between 6 and 8 seconds in both Optical and Blindfire modes.

This very short reaction time allows missile/target intercept at maximum range even when target detection is delayed by terrain screening. The re-engagement time against the same or another aircraft in the operator's field-of-view is only about 2 to 3 seconds. One of the features of RAPIER which greatly enhances this short reaction time is the absence of a complex fire control system.

Because of the effects of terrain screening a central surveillance radar and fire control display will seldom be able to show all low level enemy aircraft which could be engaged by RAPIER. This is one of the reasons why each RAPIER launcher has its own surveillance radar.

Rapier Firing



MISSILE VELOCITY

The RAPIER missile is accelerated after launch to a maximum speed in excess of Mach 2. Even at maximum range the missile maintains its ability to out-maneuvre any target.



Hit sequence

SINGLE SHOT KILL PROBABILITY

The RAPIER system employs a direct hitting missile carrying a warhead designed to penetrate the relatively thick skin of modern combat aircraft even at high angles of obliquity. A crush fuze is mounted behind the warhead thereby ensuring that the warhead detonates inside the aircraft.

Extensive trials have shown that with the highly accurate guidance system the likelihood of a kill is extremely high. The guidance system of RAPIER has been progressively refined so that the chance of a hit is very high over the whole of the missile coverage irrespective of whether the target is being tracked optically or by radar. As a result the lethality, or Single Shot Kill Probability (SSKP), of RAPIER is very high and averaged over the whole coverage, exceeds 70%.

Rapier Firing



FIRINGS

A large number of RAPIER missiles have been fired to date. For economic reasons the majority of firings have been against towed targets, such as the Rushton; however, many missiles have been fired at target aircraft and drones with devastating results which have confirmed the predicted overall kill probability. Firings have been conducted in the U.K., Canada, U.S.A., Iran, Australia and Oman.

It is this experience of firings, backed by the other extensive tests and trials that ensures that RAPIER will be in operational service into the 1990's, providing effective low-level air defence to ground installations and equipments.

Rapier Characteristics

Lethal System — RAPIER has a Single Shot Kill Probability in excess of 70%, both by day and by night/poor visibility.



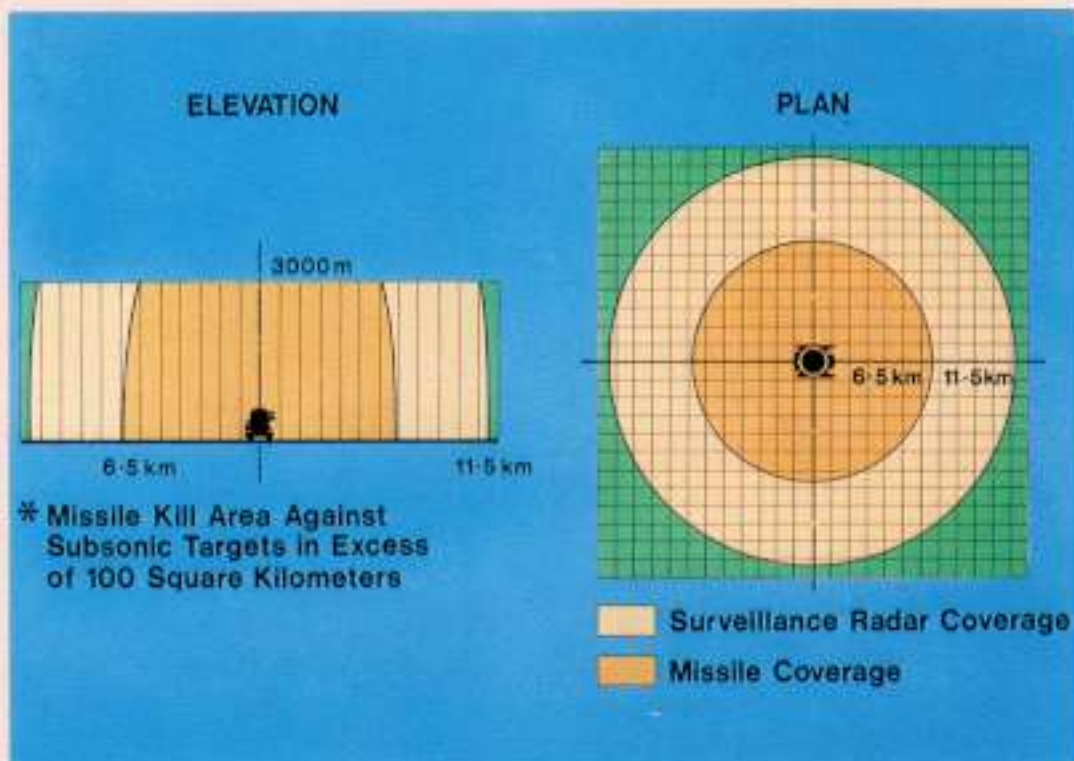
Mobility — RAPIER is a light-weight system which has excellent mobility when towed by a Land-Rover. The system can be airlifted by medium helicopters, carried internally in an H-53 and four optical systems can be carried in a C-130.



Easy Manual Reload



Firepower — With a fast reaction time, four missiles ready-to-fire and quick reload RAPIER is able to attain a high attrition rate against low level air attack, even against saturation raids.



Intercept Coverage –
 RAPIER can kill targets over an area in excess of 100 sq.km and up to a height of 3000m. In both Optical and Blindfire modes of operation aircraft can be tracked and engaged at the lowest aircraft operating height.

Coverage Diagram



Flexibility – With each Fire Unit being self contained, and with the facility for adding a Blindfire Radar to each unit as required RAPIER offers a very high degree of operational flexibility in the field.

Rapier Blindfire Radar



Proven in Service – Over 300 RAPIER Fire Units are already in operational service in three Continents. RAPIER is therefore fully proven and is combat ready now. In NATO a Fire Unit availability in excess of 90% is currently being achieved.

Airbase Defence

Rapier Variants

TRACKED RAPIER

Recent wars in the Middle East have clearly illustrated the effect that unopposed air attacks can have upon the activities of ground forces. Likewise, the ability of the surface-to-air missile (SAM) to blunt such attacks and severely restrict their effectiveness has been clearly illustrated. The anti-aircraft weapons, both guns and missiles, used in hostilities so far have, however, suffered from severe restrictions in terms of lethality, fire power, mobility and maintainability particularly against high speed, low flying and manoeuvring enemy aircraft attacking elements of the Field Army. The British Aerospace Dynamics Group highly effective RAPIER low level guided weapon system on a tracked vehicle provides air defence against the low level threat to the Field Army. Members of the M113 family of vehicles have been chosen for TRACKED RAPIER; in particular an armoured version of the M548 Cargo Carrier the RCM 748 is used for both the Launcher Vehicle and the TRACKED BLINDFIRE Tracking Radar Vehicle. Thus a proven weapon system has been combined with a proven vehicle to ensure a cost effective solution.

TRACKED RAPIER is highly mobile and can accompany tanks and other armoured vehicles over the most difficult terrain and being amphibious, can cross inland waterways.

The crew and all RAPIER equipment (except radars) are armour protected.

Chemical and Biological collective protection for the crew can be provided and the cab is temperature controlled to provide a comfortable working environment.

TRACKED RAPIER is yet another example of how the well proven and highly flexible RAPIER system can be adapted to effectively fight and survive in any battlefield environment.

TRACKED RAPIER CHARACTERISTICS

High Battlefield Survivability —
Mobility
Armour Protection
Inconspicuousness
All Round Surveillance and Coverage
High Degree of Firepower
Fast Into and Out of Action
High Lethality and SSKP
Day/Night Capability
Crew Comfort
Combines Proven Weapon with Proven Vehicle

TRACKED BLINDFIRE

The Blindfire Radar manufactured by Marconi Space and Defence Systems Limited can also be mounted on an RCM 748 vehicle and will thus have a similar cross country performance and be fully compatible with the Launcher Vehicle.



Tracked Rapier unloading from C130 Hercules.



Tracked Blindfire. An engineering mock-up.

Tracked Rapier Firing



Physical Data

MISSILE

Span	0.381m	Body Diameter	0.133m
Length	2.235m	Weight	42.6kg



LAUNCHER

Height	2.134m	Width	1.77m
Length	4.064m	Weight	1,227kg



OPTICAL TRACKER

Height	1.549m	Tripod Diameter	1.828m
Weight (Deployed)	119kg		



BLINDFIRE TRACKER

Height (Deployed)	3.378m	Width	1.753m
(Travelling)	2.032m	Weight	1,186kg
Length	4.140m		



GENERATOR

Height	0.914m	Width	0.832m
Length	0.991m	Weight	243kg



AIR TRANSPORTABILITY



LETHALITY

**VERY LOW
LEVEL
PERFORMANCE**



**EASILY
MAINTAINED
IN THE FIELD**

HIGH MOBILITY

**EASILY CONCEALED
BATTLE SURVIVABILITY**



**EASILY
RELOADED**



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