

BAE SYSTEMS

INSPIRED WORK



105mm Light Gun

Introduction

The 105mm Light Gun offers an **ideal solution** to the diverse and challenging demands placed on rapid deployment forces worldwide. **Effective deployment** of Artillery in the 21st Century, with the increased need for speed and mobility, is more challenging than at any time in the past.





The BAE Systems 105mm Light Gun forms the benchmark against which all similar weapons are judged with over 1100 systems currently in service, operated by 20 countries worldwide. Available as the L118 and L119 versions, both Light Gun variants are undergoing mid-life upgrades, which are available as retrofit to existing systems.

The light gun offers versatility in range, ammunition type and mobility in the field. For enhanced operational effectiveness, the Light Gun can be provided with Digital Fire Control and extended range ammunition.

These combine to give unparalleled levels of readiness, accuracy, firepower and range. ILS packages available, range from the provision of basic documentation through to full contractorised logistic support. Full manufacturing support is also available to facilitate partial or total build in-country.

The 105mm Light Gun from BAE Systems offers the **ideal solution** to the diverse and challenging demands placed on Rapid Deployment forces worldwide; **surpassing all requirements** for operational capability, reliability and maintenance.

Today's user buys into the benefits and unique advantages of extensive in-service experience and technological development. 130 Light Guns were employed in combat by the US and UK forces in the 2003 Iraq war. The Royal Marines were crucial in rapidly deploying guns, ammunition and troops by helicopter in support of US forces outside Baghdad. The group giving essential indirect fire support to armoured columns.



System description

The Light Gun comprises the following sub-assemblies:

- Ordnance
- Cradle
- Recoil System
- Balancing Gear
- Saddle, incorporating Elevating and Traversing Mechanisms
- Trail Assembly
- Wheels and Suspension

The ordnance, cradle, recoil systems, balancing gear and saddle form the upper gun structure, whilst the trail assembly, platform, wheels and suspension collectively form lower gun structure.



Ordnance

The ordnance comprises a one-piece, forged, autofrettaged barrel of 30 calibre (3.2m) length and a manually operated breech. The breech operates using a vertically sliding breech block. Gas obturation is provided by the brass cartridge case of the ammunition system.

The ammunition system for the UK variant L118 Light Gun uses an electrical primer and the L119 uses a percussion primer in the base of the cartridge case. To fire the gun, a firing handle located on the left hand side of the breech is pulled. The firing gear is fully waterproofed. At the muzzle end of the ordnance is a forged steel multi-baffle muzzle brake that reduces the firing impulse to the gun carriage. It can easily be removed for cleaning.

Cradle

The cradle is manufactured as a very stiff, lightweight, open structure, constructed from corrosion resistant steel which has a very good strength-to-weight ratio. The cradle has a pair of rails that support the ordnance during recoil. The cradle also supports the recoil system.



Recoil System

The recoil system comprises a hydraulic recoil brake and hydro-pneumatic recuperator. The recoil brake brings the recoiling mass to rest by throttling oil through a variable orifice in a rotating valve arrangement. A pair of compensating tubes allow for volume changes in the system during the recoil and run-out stroke and allow the oil to expand under the influence of heat. The recuperator returns the gun to the fully run-out position after firing from any angle of elevation. The recoil system uses a cut off gear to decrease the length of recoil at higher angles of elevation. Consequently, there is no requirement to dig a recoil pit for the gun.

Balancing Gear

The balancing gear maintains the balance of the gun's elevating parts throughout all angles of elevation. This ensures that the elevating handwheel loads are kept at a manageable level. The system uses a pair of springs on each side of the gun. This system is extremely reliable and does not require any adjustment during ambient temperature changes.



Saddle Elevating and Traversing Mechanisms

The saddle is a closed box structure that supports the elevating mass in a pair of trunnions and provides the structure upon which the gun can traverse. Like the cradle, the saddle is manufactured from high-strength corrosion-resistant steel. The saddle also supports the controls for elevating the gun through - 100 mils to + 1,244 mils.

Gun elevation is by a manual hand-wheel mounted on the left side of the gun, driving through a reduction gearbox with safety clutch. The on-board fine traverse of the gun is 200 mils (100 mils to left and right). The traverse mechanism is a compact ball-screw drive operated from the left-hand side of the gun.

Trail Assembly

The trail assembly is manufactured from corrosion-resistant steel, formed into curved tubes giving the gun its characteristic bow configuration. This extremely stiff structure enables very quick deployment in comparison with a traditional trail comprising a pair of open legs hinged about a lower carriage and forms a natural boundary within which the breech operator and loader stand, maintaining a high rate of fire at all elevations. At the rear of the trail is a set of trail end gear comprising the spade, towing eye, brake mechanism and

electrical sockets for vehicle connection. Spades are available for various firing and ground conditions - a combined rock/digger spade normally used with the platform, on rock and firm ground; a field spade for use on very soft ground or when firing without the platform; and a snow spade. The front of the trail provides mounting points for the suspension and wheel system. The track of the gun is the same as most towing vehicles of around 1 tonne.

Wheels and Suspension

The wheels have large-section tyres. Over-run braking is provided by a pair of hydraulically operated drum brakes that can be applied independently by lever when manhandling the gun onto its firing point and during firing.

The suspension is of a trailing arm design, employing low maintenance torsion springs and sealed hydraulic dampers. It remains in operation during firing, assisting in maintaining stability of the equipment and reducing carriage stresses.

Sighting System

The indirect and direct sight system and controls are operated by the layer while seated. A direct fire night sight is also available. Trilux light sources illuminate the scales and graticules, obviating the need for batteries.

Platform

The platform is manufactured from aluminium and steel and provides a firm but lightweight base for firing the gun. It enables smoother firing of the gun. It enables smoother and faster traverse for all-round fire coverage whilst providing significant ground adhesion. The tyre runs on the outer-edge of the platform which is connected to the underside of the gun by four wire stays.

The gun can also be fired directly off its wheels without the platform where ground conditions permit.

Basic Issue Items and Battery Stores

The Light Gun is provided with all Basic Issue Items necessary for the complete equipment to function. To assist in the effective maintenance of the system, Maintenance Computers with an interactive CD-ROM can also be provided.

In addition to the Basic Issue Items supplied with each weapon, Battery Stores are provided, sufficient to support a battery of either six or eight weapons. They include equipment to facilitate lifting by helicopter, fuze setters and additional parts that assist the operational and maintenance roles of the Light Guns.

Fire Control

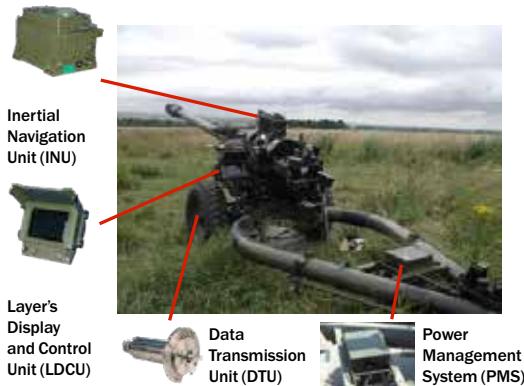


The overall effectiveness of any artillery system is only as good as the command and control inputs that are applied. The Light Gun System can be fitted with direct and indirect digital fire control, where a number of Fire Control Options are available.

LIGHT GUN FIRE CONTROL - OPTIONS

Digital Fire Control dramatically improves coming into action times, where conventional firing and sighting systems typically take 11 minutes for gun readiness. With Fire Control the gun is ready to fire within 2 minutes. BAE Systems will be pleased to discuss Digital Fire Control options to meet specific customer requirements.

Selex LINAPS Fire Control System



Artillery Sighting System

The Hall & Watts Artillery Sighting System with proven reliability and ease of operation is in service on the L118/L119 105mm Light Gun. The Artillery Sighting System is a highly accurate, battle proven Sighting System designed for use with field guns.



Kearfott ATACS

The Automated Tactical Artillery Control System provides automated computerised fire support for Light Gun, with a modular, lightweight accurate navigation and pointing system. Using the Kearfott Monolithic Ring Laser Gyro the system calculates velocity, position, heading and attitude.

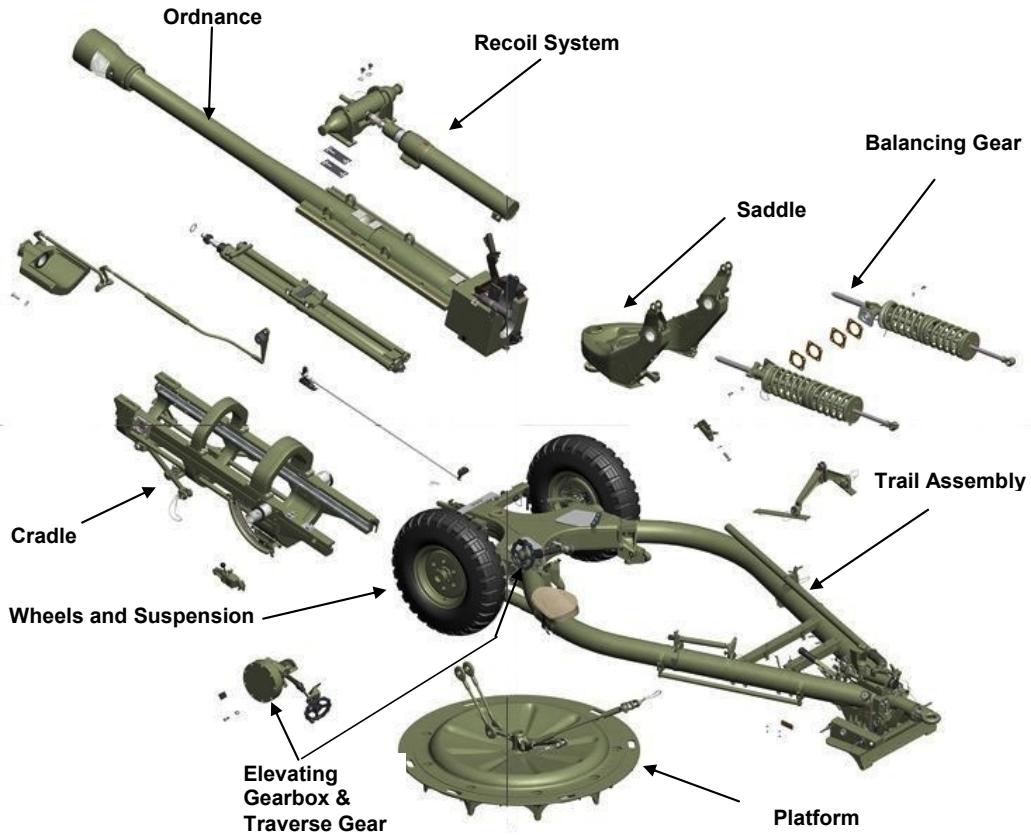


Sagem CM3 LR Long-range Compact Military 3-sensor Sight

- Cooled thermal, day and LRF sensors in a single unit
- Advanced image processing functions
- Improved awareness and engagement range
- High-performance integrated solution for direct firing (RWS, AFV, Howitzers)



KEY SYSTEM ATTRIBUTES



Deployment

The 105mm Light Gun is compact, helicopter portable, towable behind light vehicles at high speed over rough ground and capable of being emplaced within 1 minute on soft or hard ground.

Mobility

The gun is towable on primary roads and across rough terrain. The gun travels in the unfolded mode by securing the barrel rigidly to the trail. The platform is carried on top of the trail during travel.

For long distances, the upper structure can be fully rotated 180° to give a compact travelling configuration for high-speed towing on primary roads, or for palletisation and aerial delivery from transport aircraft. The complete conversion takes less than 1 minute. Any light utility vehicle or light truck, including Land Rover, Pinzgauer, Supacat and HMMWV can tow the Light Gun.

Emplacement Versatility

Flexibility to cope with a wide variety of ground conditions is provided by unique interchangeable spades allowing the gun to be fired off soft ground, rock, and hard emplacements.

There is no necessity to dig recoil pits or fire 'bedding in' rounds, enabling an emplacement time of less than 1 minute.

The gun is provided with a platform, enabling fast rotation through 180° when the operational need arises. Guns with a split trail design cannot provide the same level of response. For firing off hard surfaces, the Light Gun can be fired directly off its wheels, with no platform attached.

Transportability

The Light Gun can be lifted in a ready-to-fire position by a range of medium-lift helicopters. For lighter helicopters such as the Bell, it can be dismantled into two parts and lifted as a split load.

Both the UK and US authorities have extensively approved the Light Gun for all altitude drops, including Low Altitude Parachute Extraction System (LAPES). No other artillery system of its kind can offer Operational Commanders this degree of flexibility for tactical movements.

Combat Reliability

Reliability is of paramount importance. The 105mm Light Gun has proven itself in the most demanding of tests and combat situations. In US Type Classification Testing, six Light Guns fired a total of 15,819 rounds and exceeded the US reliability requirement by 163%.

In Combat with the British Army, five batteries of 105mm Light Guns fired in excess of 17,000 rounds in support of infantry and commando brigades, with 6000 rounds fired in the last 24 hours of the assault. During this intense period, only one gun went out of action and that was repaired in the field and became fully operational again. The Light Gun can also operate in mountainous conditions as demonstrated recently by 45 Cdo at 10,000ft in Afghanistan.

Manning

Normal manning for the Light Gun is with a crew of six but it can be adequately operated by a crew of just three.



Ammunition



BAE Systems Munitions has a family of **fully compliant** 105mm ammunition, including High Explosive, High Extended Range and other natures. The greatest damage inflicted in an artillery bombardment is achieved in the first minute before the enemy has time to take cover or disperse. A Light Gun battery of six guns is capable of delivering 90 rounds (nearly 1.3 tonnes) of ammunition on to an enemy position in that first minute of engagement, giving unrivalled terminal effect.

L118 AMMUNITION

105mm HE L31

The 105mm High Explosive L31 round is designed for the L118 Light Gun and has a high finish steel body, filled with RDX/TNT. The lethality is approximately 25% greater than the US M1 shell, with higher consistency of range and accuracy. A maximum range of 17.2 km using L36 charge super. The shell is compatible with all existing and future fuses.

105mm HE IM L53

This is a development round which will optimise explosive effects and give increased performance.

105mm L35 (Cartridge Propelling)

Designed for use with the Light Gun, this round comprises a brass cartridge case, electric igniter and five incremental charges, with a range of 15.3km at increment five.

105mm L52 Smoke RP

The new 105mm Red Phosphorus (Bi-Spectral Screening) Smoke shell has a new IM Exploder and is environmentally friendly.

Cost Effectiveness

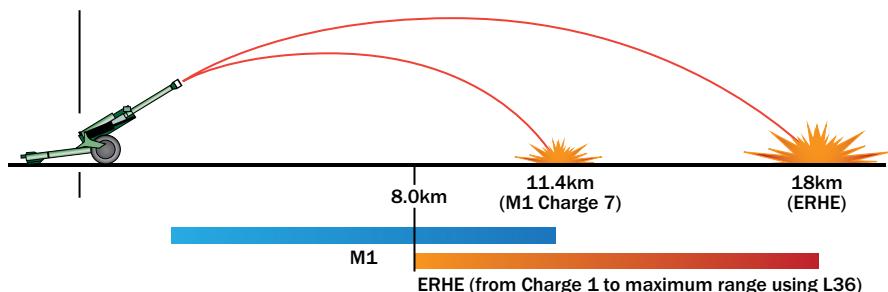
The L31 HE round fired from the Light Gun has a range 65% greater than the M1 HE round. Thus fewer assets are required on the battlefield for the same area coverage and fewer rounds of ammunition are required to achieve the desired target effect; thereby reducing the costs of ammunition procurement, storage, transportation and management than with any other 105mm artillery system of its type.

L119 AMMUNITION

The L119 Light Gun is designed to use M1 ammunition. All projectiles are of the semi-fixed type being a free fit to the cartridge case. The arrangement facilitates the adjustment of the flexible multi-stage charge system just prior to loading, enabling ranges of between 1.8km and 11.4km for the M1 family to be achieved.

The charges are contained in a brass cartridge case, which also provides the obturation. A wide variety of fuzes are also available. The existing range of M1 ammunition is both cost-effective and readily available from many sources worldwide. The full range of M1 ammunition can also be used by the L119 for both operational and training purposes. In addition, the US has both Rocket Assisted and Bomblet rounds specifically designed for the L119.

The 105mm Light Gun can **shoot further** than any other 105mm artillery gun available in-service today.



Refurbishment



BAE Systems being the Design Authority (DA) for the Light Gun recognise that with over 1000 Light Guns in service worldwide over a number of decades, that some of these guns will require refurbishment and increased maintenance. This has become evident due to the increasing number of spares enquiries.

BAE Systems will be pleased to survey the installed base of guns with a **bespoke solution** in terms of spares and maintenance based on service usage. A part or full refurbishment service will be provided, along with a catalogue of spares along with options to improve and upgrade the in-service guns.

Also on offer is the opportunity for 'new' Reset guns at discounted prices, where these guns would be stripped, inspected, upgraded, refurbished and tested under warranty. Also the Tools and Test equipment for these guns would be refurbished and calibrated.

Final Assembly and Test

- Sub-Assemblies and critical components are inspected against criteria defined by original manufacture.
- Process is fully defined with inspection procedures and documentation at every level of assembly.
- Fully documented test procedures with certification required at final inspection, functional test and functional firing.
- Defined customer test and acceptance strategy agreed with customer prior to final handover.
- Measuring equipment and Lifting Equipment is returned to the OEM for calibration and certification.

- Each weapon comes with its own basic toolkit to enable maintenance and adjustment of the system.

- Each battery comes with its own Special Tools and Test Equipment. This enables greater tasks to be carried out in the field by the user, without the need for each weapon carrying excess equipment.

The remanufactured guns will be totally reworked and certified as new weapons and in addition will have all the latest build-standard improvements incorporated. There are a number of standard improvements from the original design and range from improved braking to replacing asbestos linings in the elevation gearboxes. Also, depending on requirements, upgrades can include new pointing and navigational systems (LINAPS) and new fire control systems (LACS) making the operational performance of the system second to none.



Maintenance & Logistics



To guarantee continual operational availability, a complete Integrated Logistic Support (ILS) package is available. This includes Special Tools and Test Equipment (STTE), Operator/Maintainer/Officer Training, full documentation, and comprehensive spares.

Special Tools and Test Equipment (STTE)

A comprehensive set of Special Tools and Test Equipment can be provided for undertaking all levels of maintenance and repair.

Operator and Maintainer Training

Operator and maintainer training courses can be arranged, taking place in the United Kingdom and/or in-country. Operational training usually commences during the commissioning of the weapons in-country and is ongoing through to final deliveries. The primary source of our training expertise is the British Army who have unique experience of operating and maintaining the Light Gun in a variety of service conditions.

Strategic and Tactical Training

To fully exploit the capabilities of the Light Gun BAE Systems offers Tactical Development training, focused on the optimum deployment of the Light Gun.

Operation and Maintenance Manuals

BAE Systems can supply a comprehensive set of documentation for the Light Gun, comprising:

- User Handbooks - covering all operator instruction

- Drill Book - a small pocket book for gun crew covering gun drill

- Maintenance Manuals - covering 1st to 3rd line maintenance

- Range Tables

- Illustrated Parts Catalogues (IPC)

- Catalogue of Ancillaries and Tools

- Base Repair Standards

Wall Charts

The documentation set for the 105mm Light Gun can be supplemented by a full set of wall charts, illustrating the internal construction of all major assemblies. These views are in full colour and are an invaluable aid for training.

Maintenance Computers and Interactive CD-ROM

This system permits Maintenance and Support Engineers to follow maintenance schedules on 'user-friendly' interactive software.

A CD-ROM holds the software, which includes a fully integrated parts catalogue with NATO and BAE Systems part numbers. Using exploded diagrams, the software enables the engineers to view assembly and disassembly, item by item.

Spares

The range of spares varies according to number of guns deployed. The scales include exchange assemblies held by a Field Workshop. Removed assemblies are returned to the Workshop for overhaul or repair, using the parts held in stores.

The spares scale is based on routine maintenance tasks being carried out and is sufficient to ensure that the weapons are only out of operational role for the minimum amount of time.

Manufacture

Although the Light Gun is no longer in main stream production, BAE Systems can offer build-under licence opportunities, which include a full set of work instructions and drawings of the build process and supports the initial build with expert presence in-country.



Upgrades

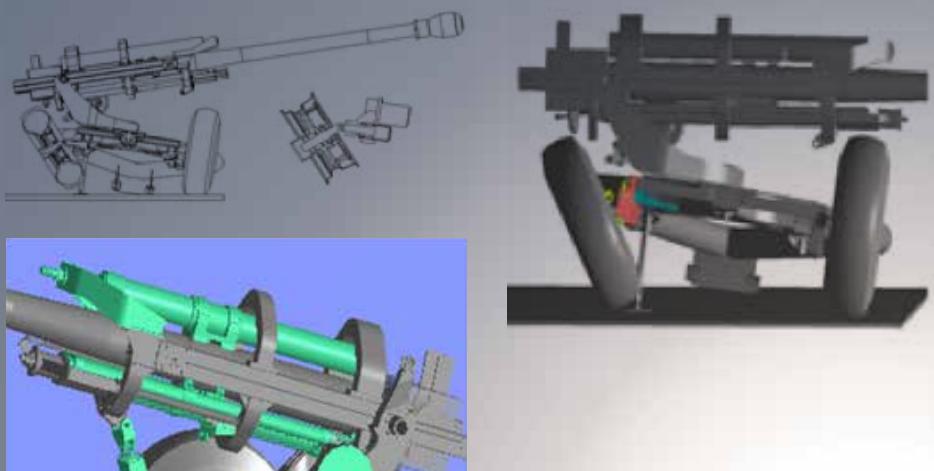


An upgrade programme of the L118 and L119 guns in the UK and USA has been initiated to improve performance, maintainability and safety. The Howitzer has received several upgrades incorporated into the current configuration; which include digital fire control; increased low temperature capability from -25 to -51 degrees Fahrenheit; the M20 breech, a new titanium base and a modified recoil system.

The system consists of approximately 124 total parts. A redesign will reduce that number by approximately 40%, resulting in a system that **is more reliable and meets all requirements.**

Upgrade options can include:

- Improved Recoil System
- Travelling Stay Latching
- Wheel Modification
- Improved Brakes
- Gearbox Redesign
- Platform and 'A' Frame Modifications
- Suspension Lock Out System
- Weight Reduction



Technical data

HOWITZER TYPE	L119 LIGHT GUN	L118 LIGHT GUN		
Bore Diameter	105mm	105mm		
Barrel Length	3.2m	3.9m		
Effective Chamber Capacity	2.5 l	5.3 l		
Firing Mechanism	Percussion	Electric		
Muzzle Brake Efficiency	30%	37%		
Maximum Range	M1	11.4km	L31	17.2km
Overall Length (folded)	4.87m	4.87m		
Overall Length (in A frame)	6.13m	6.62m		
Overall Width	1.78m	1.78m		
Overall Height (folded)	1.37m	1.37m		
Overall Height (in A frame)	2.21m	2.63m		
Track Width	1.4m	1.4m		
Weight	1942g	1982g		
Maximum Elevation	1,244 mils	1,244 mils		
Minimum Elevation	-100 mils	-100 mils		
Fine Traverse	200 mils total	200 mils total		
Full Traverse	6,400 mils	6,400 mils		
Full Traverse Rate	< 20 seconds	< 20 seconds		
Loading Angles	-100 mils to 1,244 mils	-100 mils to 1,244 mils		
Recoil Pit	None Required	None Required		
Spade Pits	None Required	None Required		
Detachment Size (Normal)	6 (3 minimum)	6 (3 minimum)		
Time into Action	< 1 min (from unfolded)	< 1 min (from unfolded)		
Rate of Fire (Normal)	6 rounds for 3 mins	6 rounds for 3 mins		
Rate of Fire (Sustained)	3 rounds per min	3 rounds per min		
Rate of Fire (Burst)	15 rounds for 1 min	15 rounds for 1 min		
Barrel Life	7,500 EFC	3,250 EFC		
Carriage Life	20,000 average rounds	20,000 average rounds		
Certified for Air Drop	Yes	Yes		

BARREL LIFE

L119 is good for 20,000 rounds or 7500 EFC's with conventional rounds

L118 is good for 8000 rounds or 3250 EFC's with conventional rounds

Dependent on ammunition type

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