Illumination is still a critical mortar task and has not diminished even with the advent of night vision systems.

LIGHT MORTARS, HEAVY EFFECT

Ian Kemp

70 years after the British Army introduced the 2-inch light mortar an after action report from a US Army infantry battalion following the first phase of Operation Iraqi Freedom stated the "60mm hand-held was devastating in the close fight and excellent for marking targets. 60 mm is still the best option for a rifle company." Following experience in both Afghanistan and Iraq the army's 75th Ranger Regiment has reported that "based on the situations that have been encountered during the Global War on Terrorism we always have a 60mm handheld as convoy security.

Operations in Afghan mountains and Iraqi cities have shown the versatility of the 60mm mortar. During the 2003 invasion of Iraq Task Force Tarawa (TFT), the name given to the 2nd Marine Expeditionary Brigade, fought an intense action against Iraqi forces in and around the city of An Nasiriyah. During the offensive phase of the battle on 23 March the company mortar teams of the 1st Battalion, 2nd Marine Regiment used their M224 60mm Lightweight Company Mortar System (LWCMS) in both the handheld and bipod configurations to fire high explosive (HE) ammunition against Iraqi infantry and light vehicles and to fire smoke to obscure the movement of friendly forces. During the following 10-day defensive phase of operations around An Nasiriyah marines used the M224 in the both the handheld and bipod configurations to fire HE and illumination rounds generally at ranges of less than 1,000 m. During the battle one mortar was destroyed by enemy fire and another damaged.

UNMATCHED

The 60mm mortar is just as responsive as a machine gun and creates a unique psychological effect that is unmatched. During all of the ambushes we have encountered over the past few years the 60mm has been the deciding factor for gaining fire superiority. It is the counter to

The RUAG 60mm MAPAM round.

the rocket propelled grenade and can suppress places that the M2 [.50 cal heavy machine gun] MK 19 [40mm automatic grenade launcher] cannot."

Handheld, or 'commando', light mortars generally consist of a barrel with a small integral base plate and weigh somewhere between 4.3 and 10kg depending upon the model. One soldier carries the weapon and a few rounds of ammunition, and another soldier carries additional ammunition. At the most basic level the 'sight' may consist only of white line painted down the barrel or it may have an optical sight integrated into a carrying handle or 'bubble' level. It is exceptional for these weapons to have an effective range of 1,000m and their accuracy depends entirely on the skill of the user. In the 'classic' or standard configuration light mortars consist of four major components - barrel, base plate, bipod and sight - are able to fire accurately beyond 2,000m and in some cases as far as 4,000m. Some armies use the same sight unit on both their 60mm light and 81mm medium mortars. The weight tradeoff to achieve this additional range and accuracy means the standard classic light mortar is usually carried and operated by a crew of three. A combination of factors - weight, range, accuracy, crew numbers and tactical doctrine - means commando mortars are usually found at the platoon level while the standard mortars are usually deployed at the company level.

The British Army's L10A1 51mm light mortar, fielded between 1982 and 1988 as a replacement for the Second World War vintage 2 inch mortar, has recently been withdrawn from service following the exhaustion of ammunition stocks during operations in Afghanistan and Iraq. The handheld weapon was employed by a two-man team within each infantry platoon primarily to provide illumination for other platoon weapons at night. The last major order for 51mm mortar ammunition, a £50 million contract placed with BAE Systems Royal Ordnance in 1996, covered 200,000 illuminating, 100,000 smoke and 100,000 HE bombs. To replace the 51mm mortar the army planned to field a medium velocity family of ammunition for its recently acquired Heckler and Koch AG36 40mm under barrel grenade launchers and new fire control system to double the weapon's range to 800 metres. However, with withdrawal of the light mortar and the in service date for the 40mm medium velocity 'uplift' now set for 2012 the army is considering alternatives to plugging this capability

gap. Options include buying 51mm mortar ammunition from overseas manufacturers, fielding low velocity 40mm illumination and smoke rounds, expediting the procurement of medium velocity ammunition or acquiring a limited number of 60mm mortars. British special forces already use the M224 60mm mortar and an urgent operational requirement for approximately 20 handheld 60mm mortars was released earlier this year.

US SYSTEMS

The US Army and US Marine Corps have used the US-designed and manufactured M224 60mm LWCMS since 1978 when it was introduced as a replacement for the M19 60mm mortar. More than 2,000 M224s are in US service and this number is set to expand. The US Army employs its light mortars as company weapons in all light infantry battalions including airborne, air assault and ranger. Under the new modular brigade structure the service will continue to field 60mm, 81mm and 120mm mortars. Infantry brigade combat teams - light, airborne and air assault - will have two 60 mm mortars in each rifle company while battalion mortar platoons will be equipped with four towed 120mm and four 81mm mortars. Infantry battalions with thus operate four 120mm, four 81 mm and six 60 mm mortars. In mid-2005 General Dynamics Land System delivered the first of 241 Stryker Mortar Carrier Vehicle version B (MCV-B vehicles to equip the army's seven new Stryker Brigade Combat Teams. The MCV-B mounts a 120 mm mortar at the battalion level or an 81 mm mortar at the company level and each vehicle also carries a second mortar to provide dismounted fire. The four MCV-B vehicles of the battalion mortar platoon each carry an 81 mm mortar while the two vehicles in each rifle company mortar section carry the M224. A Stryker battalion thus has four M120, 10 M252 and six M224 mortars available to provide a formidable indirect fire capability. The M224 is also used by the 75th Ranger Regiment for special operations; under the 'arms room' concept each ranger battalion has four 120mm, four 81mm and six 60mm mortars available enabling commanders to select the weapons best suited for a particular mission. The US Marine Corps also employs the M224 as a company level weapon with each rifle company having a section of three mortars.

70% more lethal. The effect of the MAPAM fragmentation can be clearly seen on this helmet.

The M224 can be used in the handheld mode and also with a base plate and bipod to achieve greater accuracy and a sustained rate of fire. The 21.11 kg weapon is broken down into two loads for carrying. The weapon has a minimum range of 70 m and a maximum range of 3,500 m using the bipod and a maximum range of 1,340 m in the handheld mode. When the weapon is used with its bipod a skilled three-man team can achieve a rate of fire of up to 30 rounds per minute.

In December 2005 the army awarded General Dynamics Ordnance and Tactical Systems a $19.4 million base contract, with four one year options, covering the production of mortar weapon systems in 60mm, 81mm and 120mm calibre. Although the company can purchase other components competitively the contract stipulates that barrels for the M224 must be supplied by the army's Watervliet Arsenal. During the first year the contract covered the purchase of 79 mortars for the army and 59 for the USMC.

Product Manager (PM) Mortars within the US Army's Armament Research, Development and Engineering Center (ARDEC) is developing new ammunition, and command and control systems to enhance the effectiveness of its mortars in all calibres. Alongside traditional white light illumination rounds US forces have been using M767 60mm infrared illumination rounds since 2001. The M767, M816 81mm and M983 120mm IR illumination rounds are filled with a 'candle composition' which illuminates targets in the near IR wavelengths of the electromagnetic spectrum and is thus only visible to soldiers wearing passive night vision equipment. As there is no light to illuminate friendly troops the round is ideally suited for special operations and users report that a much clearer target image is achieved with IR rounds than is usual with white light. The rounds are produced at the army's Pine Bluff Arsenal in Arkansas.

ARDEC is evaluating new electronic timed (ET) fuzes that will offer better timing accuracy and safety than the mechanical fuzes now in use. The ET fuzes will allow the time to be set in 0.1 second increments from 5 to 99.9 seconds. The time can be set by hand without special equipment or fuze setters and the display will be backlit to eliminate the need for external light.

A 'focus area' for 2007 for the US Army's Product Manager Combat Ammunition Systems is to obtain material release and field XM1061 (with multi-option fuze) and XM1046 (with point detonating fuze) 60mm Mortar Anti-Personnel Anti-Materiel (MAPAM) ammunition to the USMC. Swiss company RUAG developed the MAPAM concept to provide a better fragmentation effect for high explosive ammunition. The detonation of a standard mortar bomb produces different numbers of irregular fragments that fly at different speeds. The 60mm MAPAM round features a unique warhead body made of a matrix of 2,400 ball bearings and epoxy that provides increased lethality with a predictable dispersion pattern. The US Army states "this improved ammunition provides the soldier with

as much as a 70% increase in lethality over conventional US ammunition" now in service. RUAG demonstrated the 60mm MAPAM in 2002, and an 81 mm MAPAM round in 2005 and is developing a 120 mm MAPAM round. ARDEC began product qualification testing of the XM1046 in December 2005 and the 60mm MAPAM was Type Classified in spring 2007. Product Manager Mortars is also seeking to field 81mm MAPAM ammunition. With effect from 1 July 2007 Saab Bofors Dynamics acquired the former RUAG Land Systems Warhead Division and formed the new company Saab Bofors Dynamics Switzerland Ltd.

The new M32 Light Weight Hand Held Mortar Ballistic Computer (LHMBC) is being fielded to 60mm, 81mm and 120mm mortar teams. This consists of the Talla-Tech Rugged Personal Data Assistant-55 (RPDA-55) and fire control software that uses a Windows Graphical User Interface to make its operation more intuitive to soldiers. Weighing less than 1 kg the M32 is about one-quarter the weight of the M23 system that it replaces and includes a tactical modem and an embedded global positioning system (GPS) receiver.

US Marines man an M224 60mm mortar in the indirect fire role, using the base plate and bipod.

The service is fielding the M95/M96 Mortar Fire Control System to its heavy forces that, according to PM Mortars, "provides Paladin-like (M109A6) fire control capability that greatly improves mortar lethality, responsiveness, and crew survivability. MFCS links mortar fires with the digital battlefield. It integrates a fire control computer with an inertial navigation and pointing system, allowing crews to fire in less than one minute." In a second increment the army plans to field a Mortar Fire Control System - Light (MFCS-L), using the M32 as the computer, that can be used by dismounted mortar teams equipped with 81 mm mortars and possibly 60mm mortars.

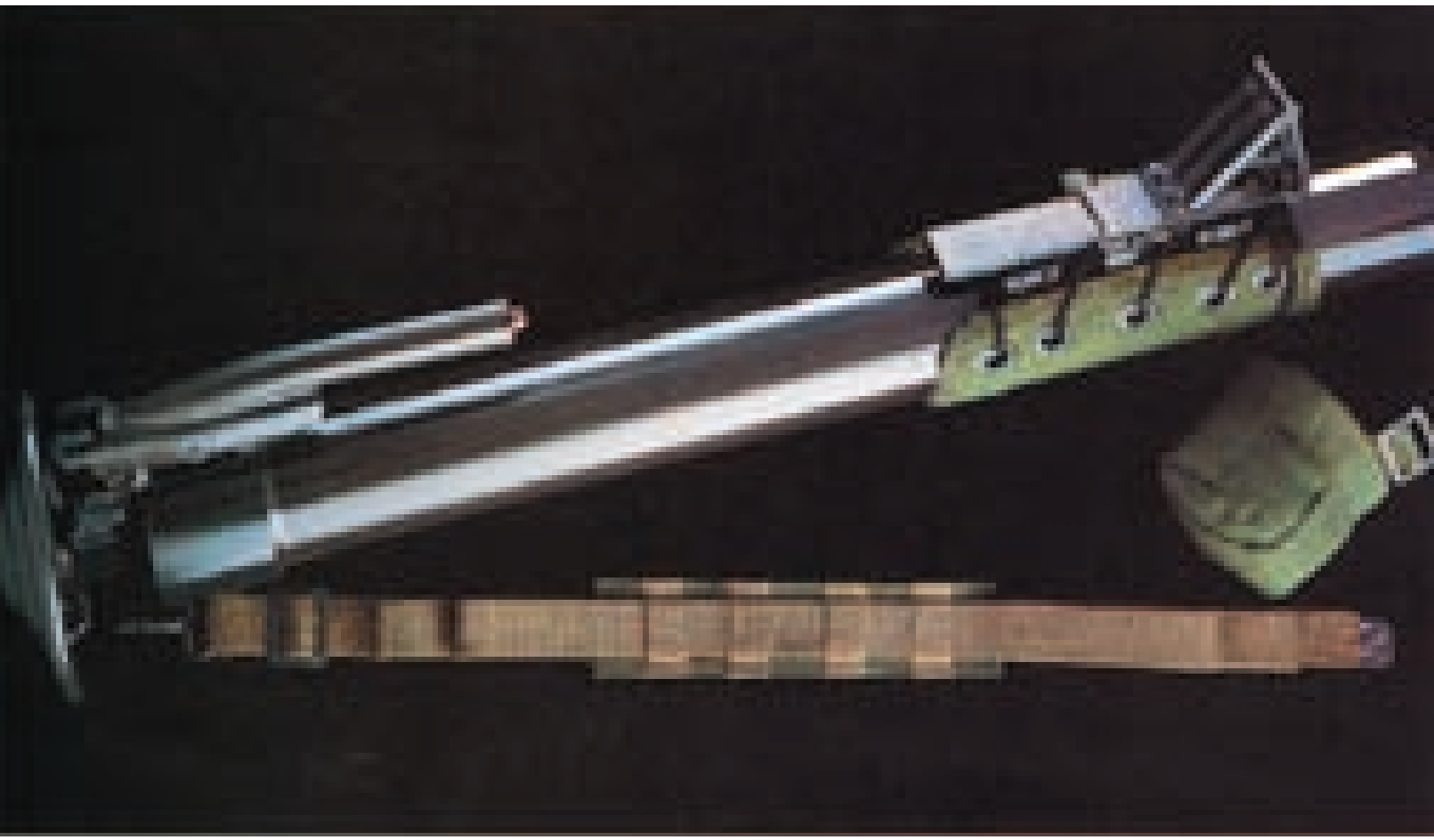
OTHER OPTIONS

Most companies that develop 60mm mortars produce both - handheld and standard models. Hirtenberger of Austria produces its M6 60mm Commando mortar in two models: the 4.3 kg M6C-640 model with a fixed firing pin and the 5.1kg M6C-640T with a self-cocking firing pin controlled by a trigger in the handgrip. Both have a maximum range of 1,921m using Hirtenberger Mk2 HE ammunition with Charge 3. In service with several armies, the M6C is also produced in Bulgaria and Greece. The company also produces its M6 'classic' mortar in two configurations: the M6-640 standard version with a 4.5 kg barrel which can achieve a maximum range of 3,000 m and the M6-1000 long range model with a 5.8 kg barrel and a maximum range of 4,000 m.

US Army soldiers employing the M224 in the direct fire hand held role.

TDA Armements, a French subsidiary of Thales, produces four 60mm mortars:

- The 60mm TDA Commando mortar is available in the drop fired 8.1kg MO 60 CV variant while the 10kg MO 60 CA is fired by a lanyard-controlled firing pin. Both models have a minimum range of 100m and a maximum range of 1,050m. The TDA Commando is in service in more than 20 countries.
- The TDA 60mm Proximity mortar is designed to be used in the commando role and features a simple bipod. The complete weapon weighs 6 kg and has a maximum range of 900m firing illumination rounds. A modified version is produced under license by RUAG for the Swiss Army which uses the weapon with RUAG's MAPAM



The Singapore Technologies hand held 60mm light mortar.

ammunition.

- In production since 1963 the TDA MO 60L light mortar is a classic design with a 3.8 kg barrel, 6 kg base plate and 5 kg bipod. It has a range of 100 - 2,060 m. In service with the French and other armies.
- The TDA MO60 LP long range mortar achieves a maximum range of 4,800 m although this requires a heavier barrel (10.1 kg), base plate (14 kg) and bipod (9.5 kg).

Soltam, the Israeli manufacturer of mortars and artillery, produces several 60mm mortars to meet different tactical requirements. The C 03 Commando mortar is designed for use for ranges between 100 and 1,000 m and can also be fired on a flat-trajectory in urban and other close environments. The weapons weigh 7.1kg and a simple sight displaying elevation angles can be fitted. The C 576 lightweight mortar is designed for use in the handheld role out to a maximum range of 1,600m. The weapon consists of a barrel/sight unit and a small circular base plate. The C 576 is in service with the Israel Defence Force while the C 03 Commando has been sold to several Latin American armies.

Soltam's C 08 mortar can be used without a bipod in the assault role, with a bipod as a company support weapon and also mounted on the roof of tanks and other armoured vehicles. When fitted with the bipod and base plate the complete weapon weighs 16.3 kg and can achieve a maximum range of 2,550 m. The bipod and sight unit are removed for the assault role that reduces the weapon's maximum range to 1,600m. The weapon is in service in Israel, Singapore, Colombia and Mexico. For longer-range fire support Soltam produces the C 06 which weighs 18.2 kg ready to fire and achieves a maximum range of 4,000 m and the C 06A1 which weighs 27 kg and reaches a maximum range of 6,000 m. These weapons are in service in Israel, Singapore, Colombia, Mexico and Venezuela.

Singapore Technologies Kinetics Ltd markets both a 60mm Commando and a 60mm Standard mortar system. The Commando mortar weighs 6kg and has a minimum range of 150m and a maximum range of 1,080m. The weapon can be either dropped fired or fired manually using a handle at the base of the barrel. A collapsible indexed leaf sight, which is illuminated for night use, is fitted as standard and a leveling sight can be fitted if a customer requires. The standard ST Kinetics 60mm mortar weighs 15.5kg in fired position and can reach a maximum range of 2,555 m.

Denel Land Systems developed the M4 60mm Commando mortar series to meet the requirements of the South African Army. The 7.6 kg M4 and the 7 kg M4 Mk1 are identical apart from the breech. Whereas the later has a fixed firing pin the M4 is equipped with a trigger mechanism which enables the user to move with a round

The 60mm mortar is a viable option for dismounted operations. Here Soldiers dig in, having made the mortar ready for action.

in the barrel. A clamp on sight unit, with an integral handle, incorporates bubbles for elevation and horizontal aiming. Both versions have a minimum range of 100m and a maximum range of 2,050 m. The 7.5kg M4L3 has a simplified base plate and lacks the handgrip sight unit of the other models thus reducing the maximum range to 1,200m.

The army's battalions generally have three 60mm mortars in each rifle company and up to 12 81mm mortars in the battalion's support company. Denel use its M3 81mm mortar as the start point for M6 long-range 60mm mortar, which is offered as a simple conversion for the M3, or as a complete weapon system. The 10 kg barrel of the M6 is manufactured using carbon-fire composite material and can either be mounted on the standard 14.9 kg base plate of the M3 or on a 6.7kg patrol base plate. The M3 can fire the older M61 series ammunition used by the South African Army's M1 60mm mortars (a licence-built TDA design) but to achieve the full benefits of the mortar design Denel has developed a new family of ammunition which can be fired at ranges from 175 to 6,180 m. CSIR designed a palletised modular mortar mount for its 4 x 4 G BAT Mk 2 air droppable light utility vehicle, which is used by South African airborne units, to accommodate either the M6 60mm or the M8 81mm mortar. Denel is the prime contactor to supply the Patria Vehicles 8 x 8 Armoured Module Vehicle for the army's Program Hoefyster and the M6 will arm the dedicated mortar variant. Indeed, some sources say the service intends to replace its 81mm weapons with the M6.

Denel markets both the M6 and the M8 as part of an Integrated Mortar System which can include Denel Eloptro's LH40C laser rangefinder and Denel's recently developed Eagle Eye target location binoculars, the Marine Air Systems Morfire fire control system and a CSIR-designed digital mortar sight as well as Denel's new ammunition families.

Should the British Army decide to return its 51mm mortars to service one possible source of ammunition is India's Ordnance Factory Board which produce the 51mm E1 mortar and ammunition for the Indian Army. The weapon is a copy of the 2 inch light mortar used by British and Commonwealth forces during the Second World War. The E1 weighs 4.88 kg and can fire from 200 to 850 m in range.