

Howitzers on Wheels



The fully automatic, internally operated Archer

The past decade has seen the development of several truck-mounted self-propelled artillery systems intended to combine firepower and mobility while keeping costs down. The choice of systems is now widening to meet very differing requirements.

Ian Kemp, inputs from Eric H. Biass

Wheeled self-propelled artillery systems combine the same firepower as their tracked counterparts with significant tactical advantages of greater road speeds and travelling ranges at reduced fuel consumption. In comparison with their towed counterparts self-propelled guns offer quicker into and out of action times thus improving survivability by their ability to 'shoot and scoot'. Another attraction for many armies is that their acquisition and life cycle costs are significantly lower than the track-carried variety.

Zuzana

The 152-mm Dana developed by Slovakia's ZTS for the Czechoslovakian Army in the late 1970s was the first modern wheeled SP artillery system to enter service in Europe and more than 750 weapons were produced for the home and export markets before production ceased in 1994. The design is unique with the ordnance mounted in a fully enclosed turret in the centre of the vehicle with an armoured driver's cab at the front and an armoured engine compartment at the rear. The chassis is based on the Tatra 815 8 × 8 truck. In recent years ZTS has focused its development and marketing

efforts on the Zuzana, which is basically a Dana upgraded to fire Nato standard 155-mm ammunition. The Zuzana mounts a 155-mm/45-calibre ordnance and an automatic loading system reduces the crew from five to four. It carries 40 rounds. The Slovakian Army, the first former Warsaw Pact member to convert to 155 mm calibres, has bought 16 systems and has stated its aspiration to convert 78 of its fleet of about 130 Danas to the new configuration. ZTS has also sold twelve Zuzanas to the Cypriot National Guard. The manufacturer has developed an ammunition re-supply vehicle on a Tatra chassis that carries 120 complete rounds. ZTS completed the prototype of a Zuzana armed with a 155-mm/52-calibre ordnance on an upgraded Tatra 815 chassis in 2004.

Caesar

Nexter's Caesar, publicly shown for the first time in 1994, is set to enter service with the French Army later this year as the company ramps up production for both domestic and export customers. The Caesar mounts the upgraded 155-mm/52-calibre ordnance of Nexter's TRF1 towed gun on a 6 × 6 chassis. Prototypes were based on the Mercedes-Benz Unimog 6 × 6 truck while production systems for the French Army will be based on the Renault Trucks Defense 6 × 6 Sherpa 5 chassis. The Caesar has a crew of five,

three less than the crew of the TRF1. An automatic projectile loader increases the rate of fire and reduces crew fatigue. French Army crews have demonstrated Caesar's ability to fire six projectiles in less than a minute and a burst rate of three rounds in 18 seconds can be achieved. A maximum range of 42 km can be reached using extended-range full-bore – base bleed (ERFB-BB) projectiles. When travelling the crew is seated within a fully enclosed armoured cab that provides protection against 7.62 mm ammunition and shell splinters. The Caesar has a combat weight of less than 18 tonnes, including a full load of 18 projectiles, enabling it to be airlifted by the C-130 Hercules and C-160 Transall tactical transport aircraft. There are provisions for the possible development of an ammunition re-supply vehicle that carries six containers with 72 projectiles and charges which can be loaded and offloaded using the vehicle's onboard crane. In terms of mobility, a film shot during trials in Thailand showed the Caesar being driven on an open road at a speed of 110 km/hour.

In September 2000 the French Délégation Générale pour l'Armement procurement agency bought five prototype Caesars (Unimog-based) which were delivered in 2002-03 for evaluation. Successful trials led to a \$ 358 million production contract in December 2004 for 72 Caesars (Renault-based) to equip eight batteries each of eight guns (plus a few spare units for training). Nexter will also upgrade the five evaluation systems to the production standard. The army now has five tracked and three towed 155 mm artillery regiments. Its goal is to field five wheeled regiments with 120 Caesars and three tracked regiments equipped with



The ZTS Zuzana 155-mm/45-calibre SP artillery system is in service in Slovakia and Cyprus. (ZTS)

Auf1s which may be upgraded to the 155-mm/52-calibre Auf2 configuration in the future. The first prototype of a Caesar in production configuration was delivered to the DGA on 3 April 2007, two months ahead of the contractual schedule, and it is being subjected to an intensive three-month test programme which includes firing more than 800 rounds. Deliveries will begin in early 2008 and are scheduled to be completed in 2011, although additional Caesars have been included in the 2009 mid-term procurement planning.

Thailand became the first export customer for the Caesar when it ordered six weapons in April 2006, first deliveries of which are slated for July 2008 (these will be Renault-based). Then in July the same year Nexter received a contract of undisclosed origin and value for 76 systems, although the fact that the order came from the Saudi Arabian National Guard quickly became an open secret. This was followed a few months later by an order for another four, bringing the total to 80. These particular Caesars, oddly enough, will all be based on a Mercedes-Benz chassis adapted by Soframe with deliveries to commence in 2009.

The Caesar has undergone extensive trials in Britain as a possible solution for the British Army's Lightweight Mobile Artillery Weapon System - Gun requirement, also known as the Limaws (Gun) project. The other contender is the BAE Systems Land Systems M777 Portee System which combines the 155-mm/39-calibre M777 lightweight towed howitzer unloaded to the ground by the 8 x 6 version of the HMT Supacat high mobility cross-country vehicle. Industry sources indicate the army, faced with budget pressure, is reconsidering the programme.

Archer

Bofors, before coming into the fold of BAE Systems, began the development of a truck-mounted howitzer in the mid-1990s when it received a contract from the Swedish Defence Materiel Administration (FMV) to conduct a technology demon-

stration programme. This involved fitting the 155-mm/45-calibre ordnance of the Bofors FH-77B towed howitzer (the Swedish Army has 52 weapons in service) on a modified Volvo VME A25C 6 x 6 all-terrain chassis fitted with a fully armoured cab to protect both the crew and engine compartment. After conducting extensive trials with the test rig in 1996 the Swedish Army stipulated that the crew should be able to halt, conduct a fire mission and move off again without having to leave the protection of the cab. The rebuilt FH-77BD L/45 test rig, with a 24-round magazine, was returned to the Swedish artillery school for a new battery of testing in 1999. In parallel with this development effort the army also conducted extensive trials of two tracked 155 mm weapons, the Krauss-Maffei Wegmann PzH 2000 and the BAE Systems AS90 Braveheart, before deciding to proceed with a wheeled solution. BAE Systems Bofors calculates that the cost of converting the army's FH-77Bs to what is now known as the Archer (see our title picture) is about one-third that of buying a new tracked 155 mm SPH. In late 2003 Bofors received a contract from the FMV to build two prototype Archer Artillery System 08 155-mm/52-calibre weapons, the first of which began trials in June 2005. The FMV awarded the company a SEK 40

million contract in June 2006 to complete detailed design work on the gun and in January 2007 awarded a SEK 100 million contract for continued work on the gun and the product definition phases for an ammunition supply vehicle and modular charges. The company will produce 24 guns to equip two battalions with initial deliveries scheduled to start in 2009 and finish in 2011. One artillery battalion will continue to operate towed FH-77Bs upgraded to the latest FH-77 BO5 L52 configuration. The final element of the artillery modernisation project will be the introduction of the BAE Systems Bofors Excalibur guided projectile. The Danish Defence Materiel Administration participated as a junior partner in the Archer project, and only few years ago, project officials stated the two armies would each order 36 weapons but Denmark's commitment is now uncertain.

Based on the latest generation Volvo A30D 6 x 6 articulated all-terrain chassis the Archer can obtain a top speed of 70 km/h on roads and has a range of about 500 km. The crew consists of a driver and three operators carried in a fully armoured cab which provides protection equivalent to 'at least Stanag 4569 Level 3'. The design also protects against a six-kg mine detonated under one of the wheels. The three operators' computer workstations are identical and, in extremis, the Archer can be operated by a driver and one crewmember. The driver has more basic computer equipment that is optimised for vehicle operation, including navigation. The 20-round magazine can handle all 155 mm projectiles which do not exceed 1000 mm in length and 50 kg in weight. A further 20 rounds of ammunition are carried on the vehicle to replenish the magazine manually. The Archer can fire 20 rounds in 2.5 minutes with a rate of nine rounds/min. The Archer can fire ERFB-BB projectiles to a range of about 40 km and the Excalibur to approximately 60 km. For close protection the Archer will be fitted with the Lemur remote weapon station, likely armed with a 12.7-mm heavy machine gun, which is also designed and produced by BAE Systems Bofors in Karlskoga. This will feature the Thales UK Celt2



Nexter's Caesar 155-mm/52-calibre self-propelled artillery system can fire extended range full-bore - base bleed (ERFB-BB) projectiles to a maximum range of 42 km. This is the Unimog-based version seen rolling out of a Hercules. (Nexter)



The G6-52 has a maximum speed of 80 km/h on roads and an operating range of 700 km. Air transportability was not a significant consideration in the design of the G6-52, which has a combat weigh of 49,000 kg. (Denel)

compact eye-safe laser rangefinder. With a weight of about 30 tonnes the Archer is (unlike the Caesar) too heavy and bulky to be carried by a C-130 but can be lifted by an Airbus Military A400M transport. An ammunition re-supply vehicle is being developed on a similar chassis that is intended to carry about 100 rounds and also a support vehicle.

Bofors is aiming at the protracted Indian Army requirement for 155 mm weapons in three configurations: wheeled and tracked self-propelled and towed weapons. In April the Indian Ministry of Defence released another request for tender for an initial purchase of 180 wheeled types (the army has stated that it requires 600 to equip 30 artillery regiments). India is evaluating the Bofors FH-77 B05 L52 for a separate towed artillery requirement to augment its 410 39 calibre FH-77Bs. The Swedish firm is proposing that if the Archer and the FH-77 B05 L52 are chosen it could upgrade the army's FH-77Bs to the latest standard with obvious logistical advantages across India's artillery force. Canada, Malaysia and Norway have also expressed an interest in the Archer.

Bofors is teamed with Australia's Tenix Defence to offer the Archer and the towed FH77B05 for the Australian Land 17 Artillery Replacement Project. A Request for Tender is scheduled to be released in mid 2007 for not less than 18 SPHs to equip two batteries, not more than 35 towed weapons to equip four batteries, precision guided munitions and a digitised, networked battle management system. In-service delivery is anticipated from 2011. Thales Australia and Nexter were partnered to offer the Caesar for Land 17 and a prototype was flown to the Australian Army's 2005 Land Warfare Conference. However, the Functional Performance Specification Version 2.0 (FPS 2.0), which received 'First Pass' approval from government in February 2006, stipulated that only weapons that offered complete protection for the crew while firing would be considered. FPS 2.0 also specified that candidates must meet the Nato Joint Ballistics Memorandum of Understanding for calibre (155 mm), chamber (23 litres) and length (L52), be able to fire the Excalibur, have a rate-of-fire of at least six rounds in 60 seconds and fire a multiple-round simultaneous



The Condor mounts the ordnance of Denel's G5-2000 towed artillery system on the Tatra 8 x 8 chassis, which is produced under license by India's Bharat Earth Movers. (Denel)

impact mission of at least five rounds. The Archer is competing against the two tracked systems – the Samsung Techwin K9 Thunder and the Krauss-Maffei Wegmann PzH 2000 being offered by the Dutch government – and another wheeled system, the Denel Ordnance G6-52 which the South African company is offering in partnership with General Dynamics Land Systems Australia.

G6

The G6 was developed by Denel Ordnance to meet the South African Army requirement for a weapon that would combine the ballistic performance of Denel's battle-proven G5 155 mm towed howitzer with the cross-country mobility needed to keep pace with its Ratel 6 x 6 armoured personnel carriers.

The first of 43 production G6 155-mm/45-calibre SPHs was completed for



The most recent version of the Caesar, seen here during trials in April 2007, is based on a Renault chassis. It is the definitive version for the French Army. (Nexter)

South Africa in 1988 and the company built a further 78 for the United Arab Emirates and 24 for Oman. At IDEX 2003 Denel unveiled its new G6-52 155/52 system. The layout remained unchanged with the driver at the front of the 6 x 6 chassis, powerpack in the middle and the turret at the rear (unlike the howitzers seen above, the G6 rests on a purpose-designed chassis, not a production lorry chassis). The all-welded steel armour of the hull and turret protects against 7.62 mm armour-piercing attack through a full 360° and 14.5 mm over the frontal arc while the vehicle can withstand the detonation of a Russian TN-46 anti-tank mine. Denel offers two versions of the G6-52: one with a 23-litre chamber enabling the weapon to fire an extended-



This demonstrator combines a Denel 105 Leo (originally developed as a towed gun) and a General Dynamics LAV III. (Denel)

range full-bore (ERFB) projectile to 33 km and the High Explosive Velocity enhanced Long range Artillery Projectile (HE-Vlap) to 53 km and a second with a 25-litre chamber able to fire ERFB to 38.4 km and HE-Vlap to 67 km.

Denel also developed the 155 mm T5 Condor in 2001-02 for the Indian Army requirement but has since been barred from the competition.

Two prototypes have been built: the T5 with a 45-calibre ordnance and the T5-2000 with a 52-calibre ordnance. While the T5 achieves a rate-of-fire of four



The Israel Defense Force began trials of the Atmos 2000 in late 2004 and, according to local press reports, an initial order for 18 could be placed this year. (Soltam)

rounds/min using a push rammer system the T5-2000's semi-automatic loading system increases the rate to eight rounds. Both models can fire Vlaps to a maximum range of 54 km. The prototypes have the standard non-armoured Tatra cab that has seating for three although an add-on armour kit can be fitted to meet the customer's requirements.

Efec

Working with General Dynamics Land Systems, Denel has developed a turreted Leo self-propelled howitzer using the South African company's 105 mm Light Experimental Ordnance mounted on the American company's 8 x 8 LAV III. Under the auspices of the Defense Acquisition Challenge Program the US Army is using this configuration to demonstrate

the ability of a candidate Enhanced Force Entry Cannon (Efec) to fire both US semi-fixed ammunition as well as projectiles and the modular charge system which Denel in partnership with General Dynamics Ordnance and Tactical Systems is supplying for the army's 105 mm and 155 mm Advanced Cannon Artillery Ammunition Program (Acaap). Fitted with a 52-calibre ordnance, or a 57-calibre ordnance with a special muzzle break, the weapon has a maximum range of 24,000 metres firing standard ammunition or 30,000 firing base bleed ammunition. Although the Efec requirement was written with a towed weapon in mind it remains to be seen whether the army, or other customers, are attracted by the potential of the Denel/GDLS system. Planned development of the Leo will see the weapon mounted on the back of a 6 x 6 chassis.

Atmos 2000

Israel's Soltam Systems is producing the 155 mm Atmos 2000 system for an undisclosed export customer. Based on a 6 x 6 cross-country truck chassis the Atmos 2000 uses the upper part of Soltam's 155 mm/52 calibre towed Tig 2000 system but 39 and 45-calibre barrels can be fitted if the customer desires. Another option is to use the Russian 130-mm M-46 gun. Using ERFB-BB projectiles the 155-mm/

52-calibre barrel can achieve a maximum range of 41 km.

The Tatra 6 x 6 truck has been selected as the platform for the first production weapons. As the Tatra is built under licence in India this could give Soltam an advantage in the continuing Indian project to acquire and eventually produce locally a wheeled SPH. Romania's Aerostar unveiled the prototype of its Atrom 155-mm/52-calibre SP gun at Expomil 2003. This mounts the Soltam Atmos on a Romanian-developed Roman 26.360 DFAEG 6 x 6 truck.

Size Matters

Quite clearly, the systems reviewed here show that one cannot have one's cake and eat it. In other words, one cannot expect to have a comprehensive armour protection and fully automatic loader and drive the vehicle into a C-130. The choice really boils down to the customer's way of seeing things and the kind of battlefield he's looking at. The lighter types' protection is extremely high mobility and speed of deployment (standard civilian truck size), which enables them to get out of counter-battery fire's harm. It also goes without saying that the efficiency of all types highly depends on navigation, command, communication and information systems. □

Main Features (in order of appearance in the article)

Designation	Manufacturer	Ordnance	Max Range [km]	Weight [tonnes]	C-130
Zuzana	ZTS	155/45	18	29	no
Caesar	Nexter	155/52	42	<18	yes
Archer	Bofors	155/52	~40 ¹	~30	no ²
G6-52	Denel	155/52	53	49	no
		[23-litre chamber]	[HE-Vlap]		
G6-52	Denel	155/52	67	49	no
		[25-litre chamber]	[HE-Vlap]		
Leo-Efec	Denel + GD	105/52	30 ³	in dev. ⁴	yes
Atmos 2000	Soltam	155/52	41 ⁺	22	yes

¹60 km with Excalibur ² but A400M-compatible ³with base bleed ⁴design not frozen