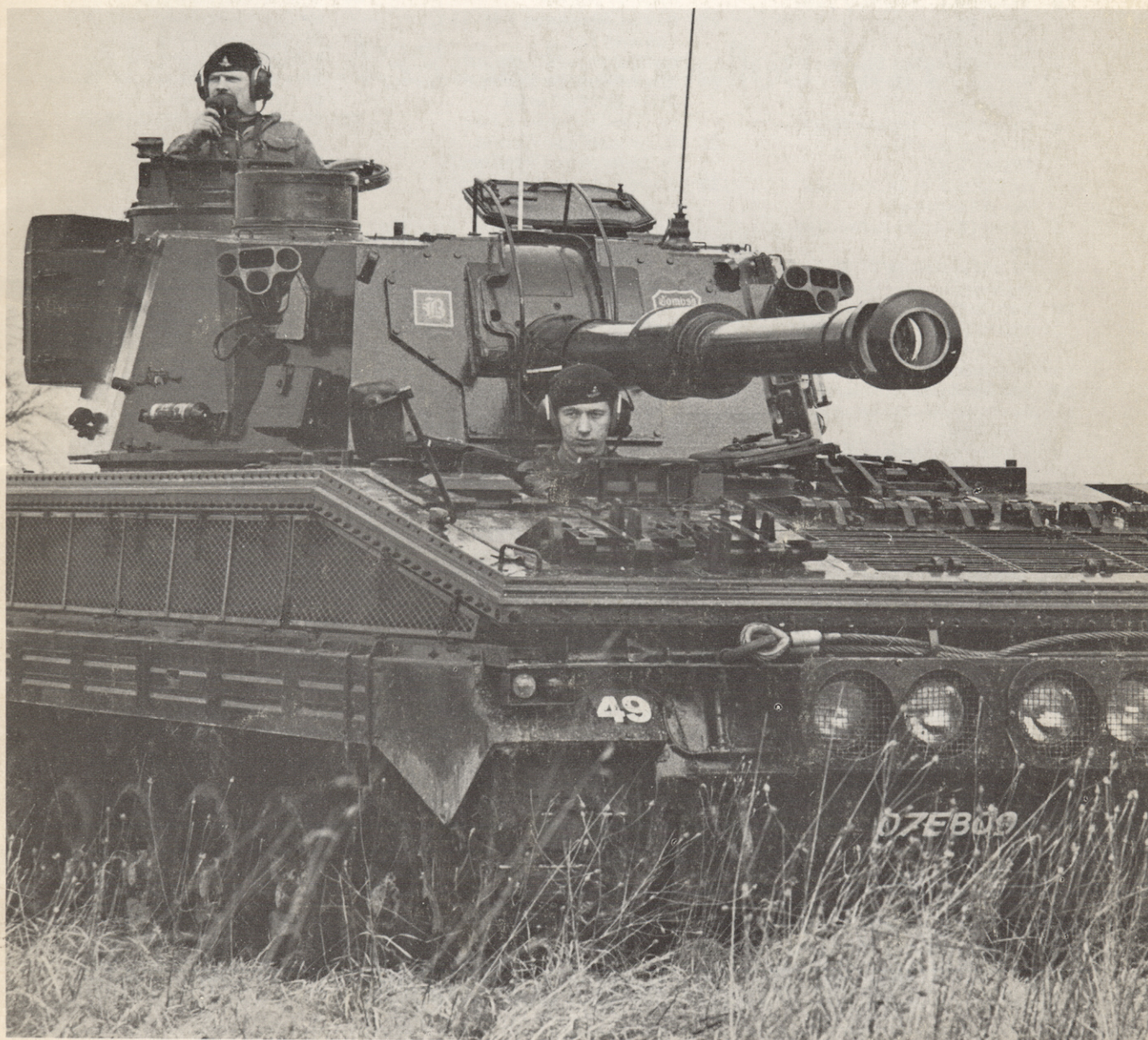


40p

Abbot FV433 Self-Propelled Gun

by Christopher F. Foss



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Abbots firing on the ranges.

(Vickers Limited)

Abbot FV 433 Self-propelled Gun

by Christopher F. Foss

DEVELOPMENT

THE Abbot, full designation FV 433 105mm Field Artillery Self-Propelled, was developed by the Fighting Vehicles Research and Development Establishment (now the Military Vehicles and Engineering Establishment) between 1958 and 1960. Abbot is the first British gun designed specifically for the self-propelled rôle. It was designed to replace the 25 pdr field gun which was still in service with the Royal Artillery. Although the 25 pdr Sexton SPG was used by the Royal Artillery until the 1950s, and other self-propelled 25 pdr guns were projected or built (for example the FV 3802 Centurion with a 25 pdr gun, and the Saracen project) the Royal Artillery in the late 1950s was still essentially using towed artillery—for example the 25 pdr and 5.5 in guns were towed—although some American SP 155mm M 44 guns were also in service.

Obviously a new self-propelled gun was required, so it was decided that the vehicle would use the same suspension and engine as the new range of armoured personnel carriers that was being developed, the FV 432 series. Vickers were appointed as the design parents for the new self-propelled gun, called Abbot. They built a series of 12 prototypes, the first of which was completed in 1961. Six of these were powered by the Rolls-Royce B 81 petrol engine and the other six by the new Rolls-Royce K 60 multi-fuel engine. These prototypes were distinguishable from the production Abbots in a number of ways, the most noticeable being that their flotation screen, when stowed, sloped towards the front of the vehicle; also they had only two head lamps*. Some of these prototype vehicles were later re-built with production type flotation screens and four headlamps. Basic data of these prototype vehicles was as follows:

Weight laden:	36,000 lbs
Length:	19 ft 2 in
Height:	8 ft 9 in
Weight unladen:	33,000 lbs
Width:	8 ft 8 in
Track centres:	7 ft 2 in

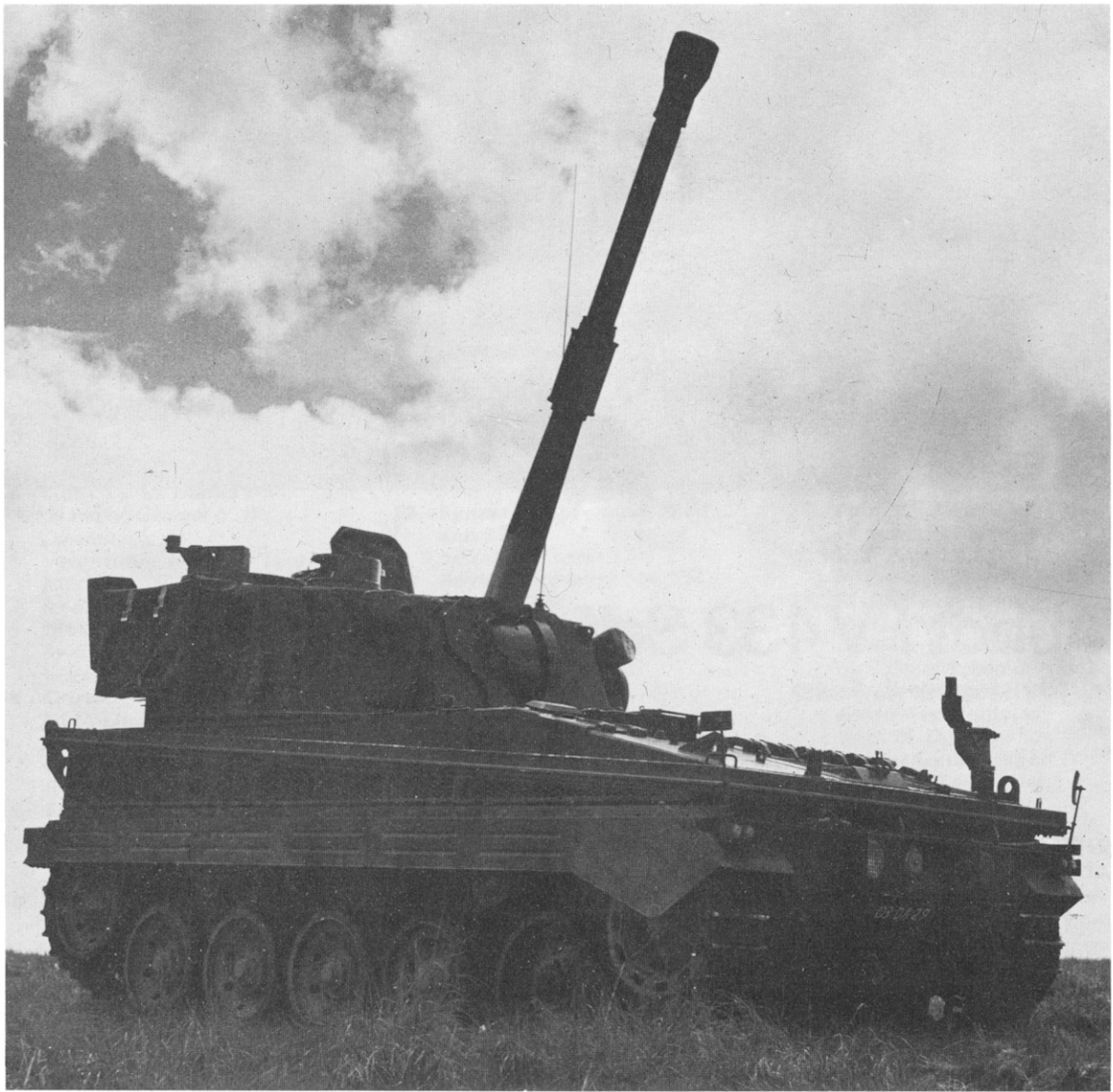
Vickers undertook production of the Abbot at their Elswick factory at Newcastle-upon-Tyne, and the vehicle was in production at the factory between 1964 and 1967.

DESCRIPTION

The Abbot is divided into two parts. The forward part of the vehicle contains the engine, gearbox, transmission, fuel and driving compartment, which is on the right side of the vehicle. The rear part of the vehicle contains the fighting compartment, turret and gun, and the other three crew members. Insulation panels are fitted to the fighting and driver's compartments. The hull and the turret are of welded plate which provides protection from shell splinters, mines and small arms fire.

The driver is provided with twin hatch covers which open either side, and he has a single wide-angle periscope with twin wiper blades for closed-down vision. The commander has a rotating cupola with three fixed periscopes and a single hatch cover. The gun layer is provided

*Also, on the prototypes the exhaust pipe was on the left hand side of the hull above the flotation screen, on the production models and prototype re-builds the exhaust pipe was moved (with the silencer) and positioned between the flotation screen and the top of the running gear.



One of the prototype Abbots with only two headlights, different screen top, and gun lock on left front of vehicle.

(Vickers Limited)

with a single hatch that opens towards the rear of the vehicle. There is a door at the rear of the hull which is the normal means of entry for the loader, layer and commander; this door is also used for re-supplying ammunition when the Abbot is used in a static position for longer periods. The vehicle carries sufficient rations and water for four days. External stowage space is provided on the turret and between the hull top and the flotation screen.

ARMAMENT AND AMMUNITION

The gun (made by the Royal Ordnance Factory at Nottingham) and its ammunition have been especially developed for the Abbot. The calibre of 105mm was chosen after detailed examination of projectile weight/lethality and of gun range considerations. In addition, it enables the gun to fire the American M1 projectile with a special cartridge with which it has achieved the un-

precedented range of 15,000 metres.

The gun is provided with a fume extractor and a semi-automatic vertical sliding breech. It is mounted in a ring-type cradle with twin hydraulic buffers and a single hydro-pneumatic recuperator. A brass-cased cartridge is used with an electrically-fired primer. The gun is laid for azimuth using a periscopic dial sight which protrudes through the roof and is protected by a rotating cupola. A spool-type gun rule is provided with scales for all charges. This enables map ranges to be converted to tangent elevations in mils.

The two elements of the ammunition are loaded separately—the projectile with an electrically-operated rammer, and the cartridge by hand. The following projectiles have been developed:-

HE (High Explosive), Fuzed Percussion Direct Action or Air Burst Time, Mechanical or CVT (Proximity Fuze). Smoke—Base Ejection, Fuzed Time Mechanical. Target Indicating, Fuzed Time Mechanical Direct



One of the prototype Abbots entering the water at the FVRDE exhibition in 1962. (CCR BIS)

Action or CVT.

Illuminating, Fuzed Time Mechanical.
High Explosive Squash Head.
Squash Head Practice.

There are eight charges in the cartridge system. These are fired from two separate cartridges: supercharged cartridge containing supercharge only; normal cartridge containing charges 1-5.

In addition to supercharge and charges 1-5, two sub-zone charges (A and B) are provided. These are fired from a normal cartridge case, emptied of its original charge bags.

The 105mm gun is mounted in a turret with power traverse through 360 degrees, elevation is plus 70 degrees and depression minus 5 degrees, elevation and depression being by hand. When travelling the gun is trained forward to the left of the centre line where it is held in position by a lock.

A total of 40 rounds of ammunition can be carried (34 HE and 6 HESH), although in normal circumstances 38 rounds are carried (32 HE and 6 HESH). These are stowed around the turret and fighting compartment.

A 7.62mm light machine-gun is pintle-mounted on the commander's cupola, and 1200 rounds of 7.62mm ammunition are carried. Three smoke dischargers are mounted either side of the turret front; 12 smoke grenades are carried for these dischargers. The crew also have their personal weapons.

The 105mm gun as fitted to the Abbot has also been developed in the towed rôle to replace the Italian 105mm Pack Howitzer currently used by the light regiments.

WEAPON PERFORMANCE

Abbot is the most advanced field gun of its time in its primary rôle of close support of infantry and armoured formations. A half battery of three Abbots can deliver more than half a ton of shells per minute for sustained periods. This concentration of fire is delivered with great accuracy and consistency from 2500 metres to over 17,300 metres in any direction day or night under any conditions to be met in nuclear or conventional war. Abbot's formidable firepower, range cover, accuracy and mobility are without parallel in any known weapon of

comparable size and versatility.

The lethality of the Abbot shell is from one-and-a-half times to twice that of the 25 pdr shell, resulting principally from its increased HE capacity. Its regularity of muzzle velocity provides outstanding consistency and accuracy better by a factor also of one-and-a-half times to twice that of the 25 pdr. The gun has a very long barrel life, at least 10,000 rounds (in fact no barrels have yet been worn out), and a sustained rate of fire of 12 rounds per minute can be achieved with a well drilled crew.

A high angle firing arrangement that requires no change in laying techniques makes it possible for the gun to search behind the steepest cover, offering great flexibility for engaging targets in what was previously considered to be dead ground. Although Abbot is primarily not an anti-tank gun it has a good anti-tank capability using HESH ammunition. In the Royal Artillery the Abbot is used in conjunction with the Field Artillery Computer Equipment.

Indirect Fire: The ability to engage targets at a high rate of fire and over prolonged periods, without undue crew fatigue, has been attained by:

- (1) mounting the gun and stations for the commander, layer and loader in a turret with a 360 degree traverse. Targets in any direction may thus be engaged rapidly without moving the vehicle or marring its camouflage arrangements. The turret has power traverse with a hand-operated fire control. The commander has an over-riding power traverse control. Emergency two-speed hand traverse is fitted.
- (2) providing the gun with a semi-automatic breech which opens on run-out, ejecting the used cartridge case. The breech automatically closes when a fresh cartridge is loaded.
- (3) providing an electrically-powered rammer which automatically rams the projectile on operation by the loader.

Orders from the observation post for the engagement of a target are received in the command post (for example a FV 432, FV 604 or FV 610), where they are edited and sent to the guns, either by radio or, when the guns are in an established position, by line. Each member of the detachment hears orders from the command post or from the gun commander through transistorized headset receivers from the induction loop. The range is ordered to the gun in metres and is converted on the gun rule to mils of elevation by the commander. The gun rule automatically compensates for any variation in muzzle

Abbot prototype after being fitted with production type flotation screen. (CCR BIS)





Abbot prototype, note that the outer headlamps are infra-red.

(Vickers Limited)



The fifth Abbot prototype, note the original position of the exhaust pipe on left hull top (centre). (RAC Tank Museum)

velocity of the gun. The layer sets this data directly on to the sights and lays the gun for elevation. The gun is laid for azimuth using the periscope dial sight. Ammunition is passed to the loader in the turret by the two ammunition members working outside the vehicle. Further supplies of ammunition are brought up by a Stalwart, which also carries the two ammunition members (the Abbot driver can also assist in handling the ammunition).

Direct Fire: Targets may be engaged by direct fire with HESH or HE ammunition. The commander has over-riding power traverse which enables him to direct the gun on to the target and so to indicate it to the layer. A telescopic sight is provided for the engagement of tanks or other targets by direct fire.

ENGINE AND TRANSFER DRIVE

The Rolls-Royce K 60 Mark 4G multifuel engine is an in-line, six-cylinder vertically-opposed piston two-stroke compression-ignition engine especially designed as a military power unit capable of operating on a variety of fuels. The engine and gearbox are mounted in a power-pack and can be removed for replacement or maintenance as a complete unit; the power pack is not interchangeable with those fitted to the FV 432 series. Two crankshafts are geared together at the rear of the engine, and the output is taken from the gear above the lower crankshaft to give an output speed of 3750 rpm at a crankshaft speed of approximately 2400 rpm. At this speed the engine delivers 240 bhp (gross), which allows the use of a lightweight transmission, similar to that used with the Rolls-Royce eight-cylinder military petrol engine. The drive from the engine is taken through a Rolls-Royce transfer drive to an Allison TX.200 six-speed (six forward and one reverse) automatic gearbox.

The K 60 offers an outstanding weight-to-power ratio of 6.9 lb/bhp and a specific power of 36.5 hp per litre. The basic unit measures 46 in (116.8 cm) in length, 27 in (68.6 cm) in width and 30 in (76.2 cm) in height. The two-stroke diesel principle used in the "K" engine is known to have low sensitivity to variations of fuel. The engine can operate on a range of fuels, including diesel oil, aviation kerosene, JP4 petroleum, and MT80 petrol. Adjustments to suit the fuel used are made by a manually operated device on the injection pump; an automatic

advance and retard mechanism is being developed further to improve multifuel operation. Many thousands of hours' testing of prototypes and of production vehicles has demonstrated an improvement of up to 70% in vehicle range over existing military petrol engines.

An inherent advantage of the opposed piston two-stroke design is that the conventional valves, valve gear, cylinder head and gaskets are eliminated, greatly reducing routine maintenance requirements. The marked reduction of moving parts, combined with the interchangeability of certain components such as pistons, connecting rods, cylinder liners, injectors, gears and certain accessories, keeps to a minimum the number of spare parts which will be required when other versions of the "K" engine come into operation.

The K 60 engine has been designed to have a considerable development potential. The mean piston speed of 1440 feet per minute (730 cm/sec) at 2400 rpm, and the brake effective pressure of 111 psi (7.8 kg/sq cm) are both low, and it is known that both can be increased. Provision has been made for piston cooling if required when the power output is increased. More use of light alloys is possible, and it is certain that with further development over 300 hp can be achieved from the engine without appreciable increase in size or weight.

Transfer Drive: The unit was designed by Rolls-Royce to provide the drive which couples the engine output shaft to the input of the Allison automatic gearbox. Rigorous testing in military vehicles has proved its thorough reliability. The unit comprises a train of four helical gears having splined bores so that the power take-off shafts can be incorporated to take up to the full power of the engine. The engine has been designed to meet the British Army's requirement for starting at very low temperatures.

TRANSMISSION, SUSPENSION AND TRACKS

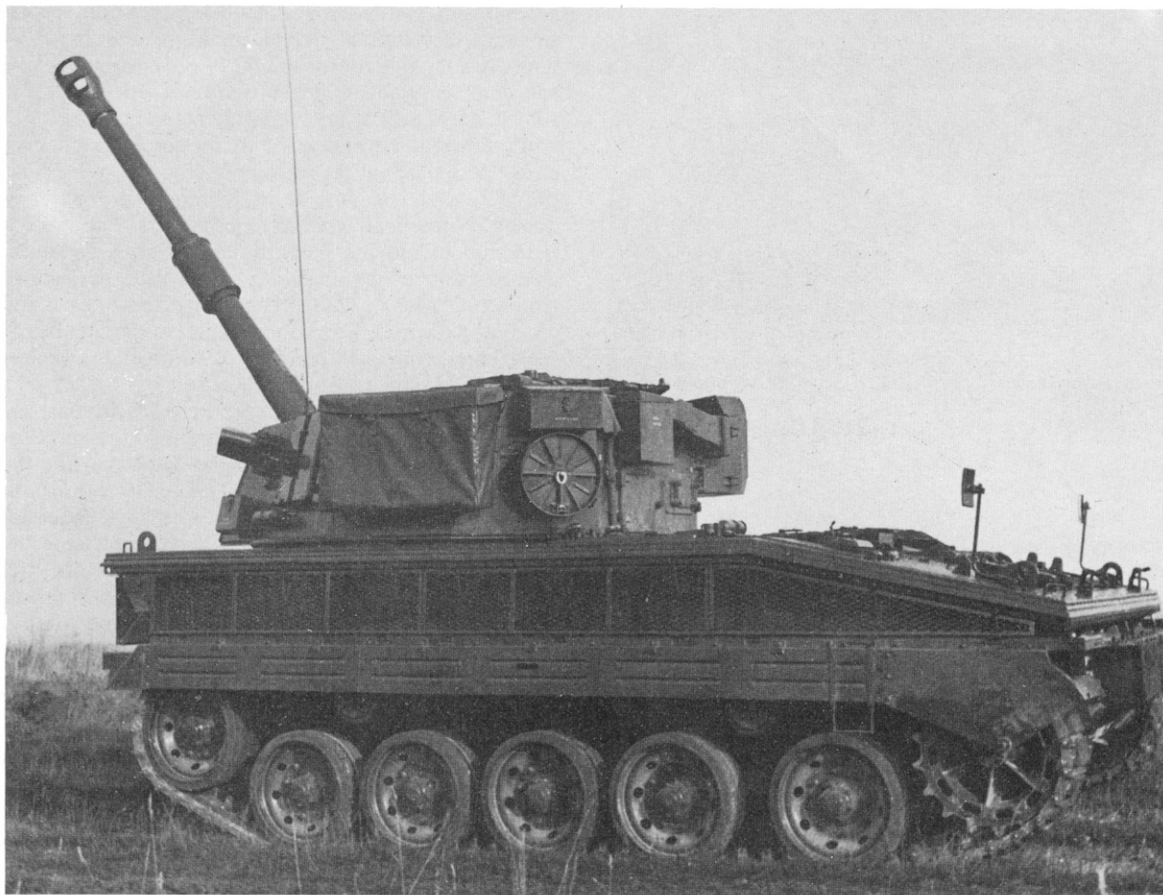
The Abbot is equipped with the Allison "Torqmatic" TX.200 automatic gearbox, which is a hydraulically operated automatic transmission and torque converter with lock-up clutch. It was chosen because of its proven reliability in military, off-highway and conventional heavy vehicles. Over the past few years many millions of hours of operation in thousands of vehicles have backed up development of this unit. Extensive experience was accumulated at the FVRDE (now MVEE) during development of the FV 430 series of tracked vehicles.

The Allison gearbox has the twin features of hydraulic torque converter and lock-up clutch in front of the planetary gear trains, enabling suitable drive ratios to be achieved under all conditions of operations. The maxi-

Abbots on the move.

(Vickers Limited)





Abbot with turret traversed to the rear.

(Vickers Limited)

mum output-to-input torque ratio is 14.8 to 1; the torque converter provides a 2.8 to 1 torque ratio in the lower gears and reverse. All the usual shock-damping characteristics of hydraulic systems are incorporated in the transmission. Engine life is prolonged because lugging and overspeeding are almost impossible. Hydraulic power losses sometimes associated with this type of equipment are eliminated by an automatic provision of a direct drive under appropriate conditions. Very little maintenance is required.

With this transmission, the engine power is automatically balanced to load and speed, through a hydraulic control system, by selecting the gear ratio or torque multiplication appropriate to any operating condition (ie, the speeds at which the changes occur depend on power and accelerator demands). A six position quadrant, to the left of the driver, enables him to select the gearing range to suit his particular need. Neutral gear must be engaged before the engine can be started. In an emergency, the engine can be started by towing the vehicle in neutral and engaging the transmission control lever in the high range when a speed of about 10 mph (16 kmph) is reached. The gearbox is manufactured by Rolls-Royce, under licence from the American General Motors Corporation, specifically for the British Ministry of Defence.

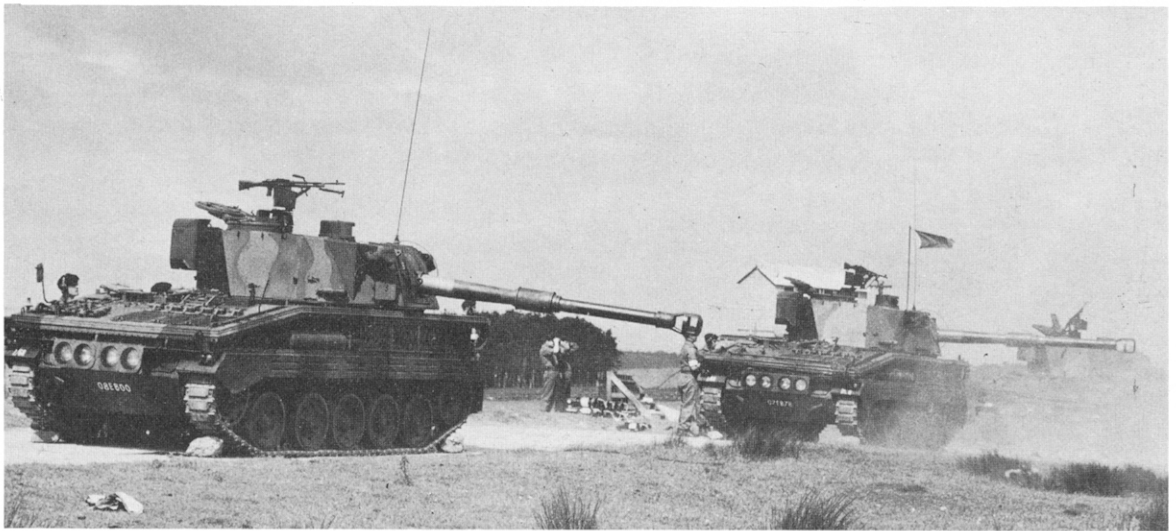
A short propeller shaft transmits the drive from the gearbox to a Cletrac type steering unit and thence to the sprockets. Self-wrapping type band brakes in the steering unit function as both main and steering brakes.

The torsion bar suspension has a single torsion bar at each wheel station and friction-type dampers on front and rear stations. The wheels are of 24 in diameter, rubber-tired double wheels. The manganese steel tracks, which have an exceptionally long life of about 3000 miles, are fitted with replaceable rubber pads; these pads last about 1500 miles.

ELECTRICAL AND GENERATING EQUIPMENT

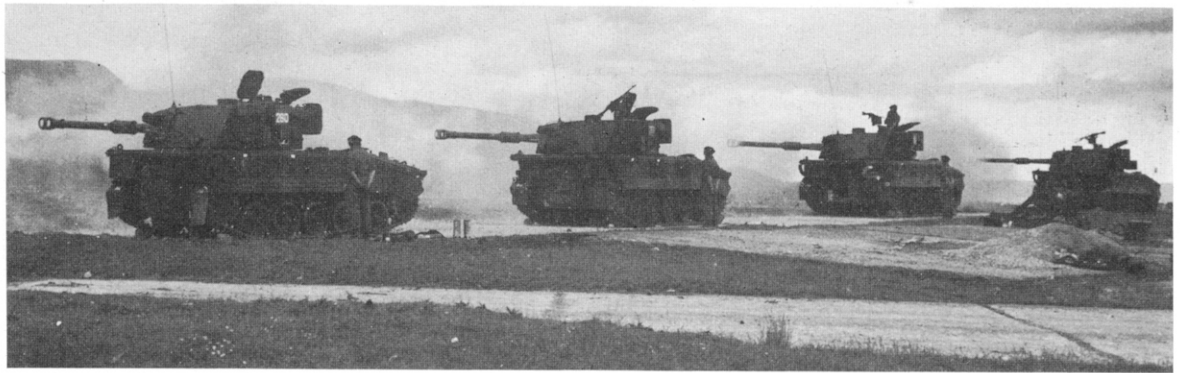
The electrical system is nominal 24-volt DC with all devices suppressed to prevent interference with radio equipment installed in the vehicle. One set of batteries, giving a capacity of 100 amp/hours, is located in the hull for supplying the hull electrical needs (for engine starting and lighting etc). An additional set of the same capacity is carried in the turret under the commander's seat to supply the radio during silent-watch periods. For starting under cold conditions, provision is made to parallel the hull and turret batteries by using the inter-vehicle starting cable, an inter-vehicle starting socket being provided in the turret for this purpose.

The vehicle has four headlamps (of which two can be infra-red) at the front, as well as a side light and an indicator light on each front mudguard. An indicator and stop light are mounted either side on the rear hull. A spotlight is sometimes mounted externally on the turret roof.



Three-quarter left front view of Abbots firing on the ranges. Note Bren LMGs on turret tops and blocks under front and rear of tracks.

(Vickers Limited)



Three-quarter right rear view of Abbots at target practice with turrets traversed to nine o'clock.

(Vickers Limited)



Abbot of the Royal Artillery Wing, Royal Armoured Corps Centre, Bovington, Dorset. (C.F. Foss)

Charging is carried out by means of two oil-cooled alternators driven by the engine. Full output is given from an engine speed of 700 rpm upwards. When the engine is running, both sets of batteries are parallel-charged and voltage regulation is achieved by transistorized regulator units. Rectification is performed by an oil-cooled diode unit fitted in the oil tank.

A 208V 8kVA power tool outlet can be provided when required by a slight rearrangement of cable harness in the driver's compartment. A B48 VHF radio set is fitted in the turret for external communication. Communication with the gun crew is by means of an induction loop in conjunction with fixed microphones and special headsets. The driver's induction loop provides communication with the loading members.

OTHER FEATURES

The Abbot is fitted with an air-filtration unit which provides protection against fall-out and radio-active dust in contaminated areas and against chemical and bacteriological agents; it is mounted on the rear right hand side of the turret.

The vehicle has fire warning equipment and internal fire extinguishers are fitted.

A collapsible screen is carried around the top of the hull; this can be erected by the crew in about 13 minutes. When erected it is held in place by stays. The vehicle is then capable of crossing rivers and streams at a speed of about 3 knots. It is propelled by its tracks, steering whilst waterborne being accomplished in the same way as on land. The gun is elevated before the screen is raised, and



A section of Abbots, Stalwarts, FV 432 (command), and Ferret of 143 (Tombs's Troop) Field Battery, 2nd Royal Horse Artillery. (CCR BIS)



Abbot in drive past at Larkhill, 1970.

(CCR BIS)



Close up showing Abbot gun lock.

(CCR BIS)

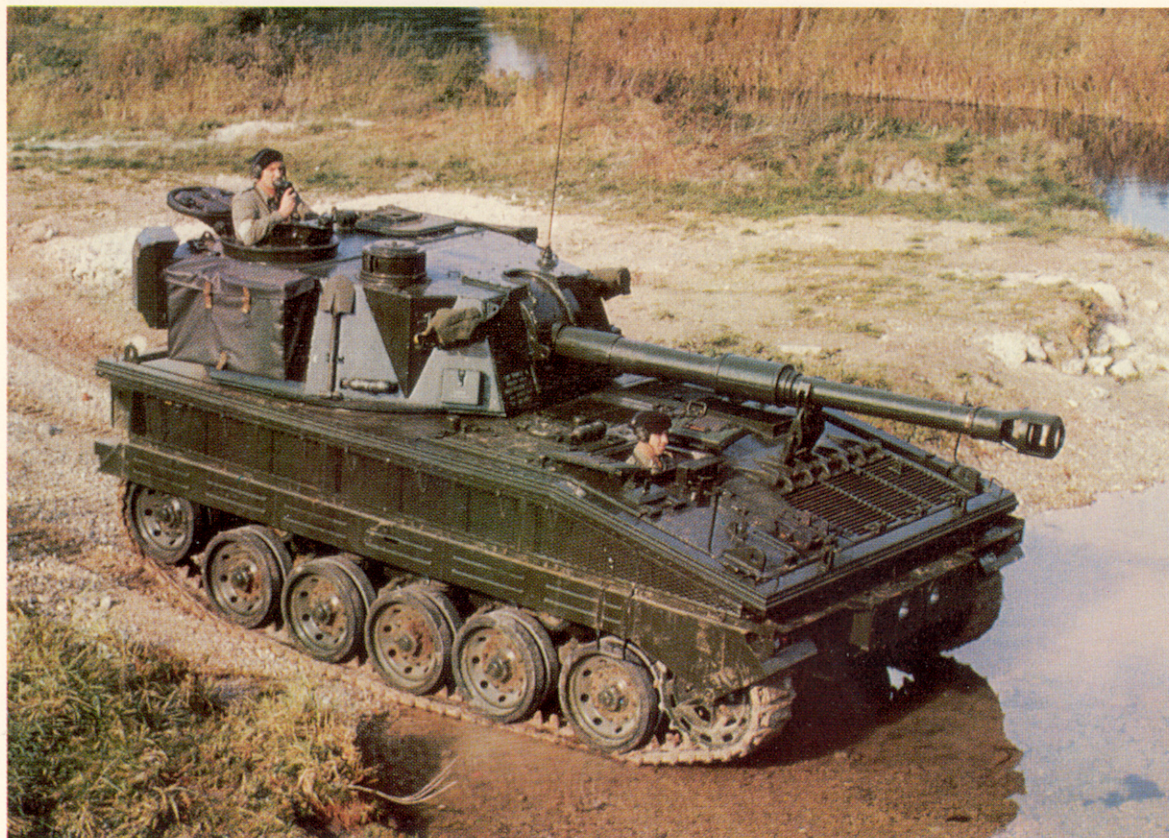
an extension tube is fitted to the end of the exhaust pipe at the rear of the vehicle (on the left hand side), so that the exhaust gases escape above the water level.

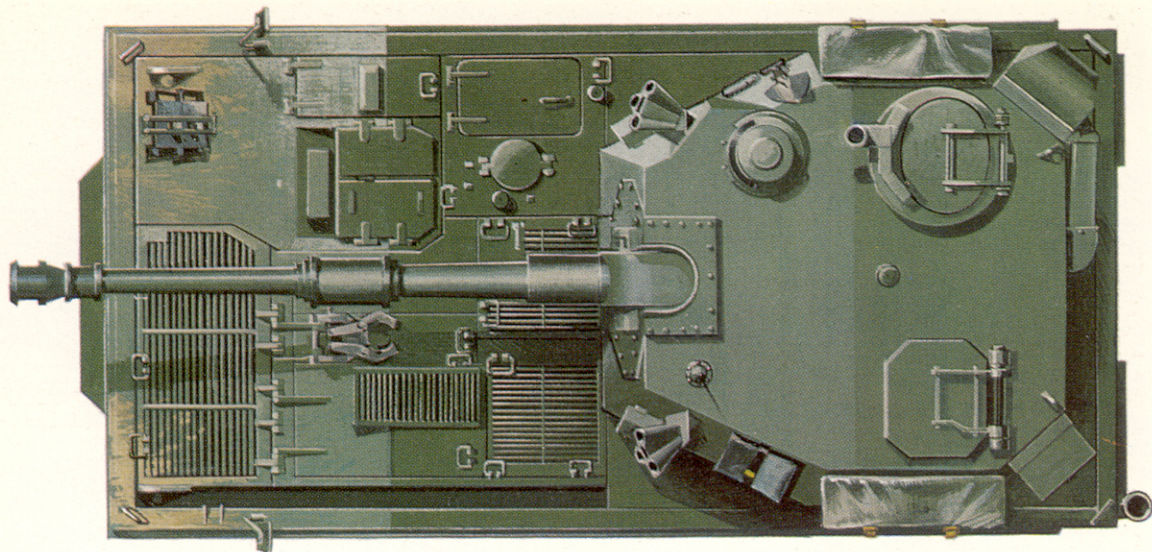
PERFORMANCE AND EMPLOYMENT

The Abbot has a maximum speed on the road of 30 mph and a range of about 300 miles on roads, depending on the type of fuel used. The vehicle can cross ditches up to 6 ft 9 in wide, go up a maximum gradient of 30 degrees, and climb a vertical obstacle of 24 in (hard shoulder). It can deep ford to a depth of 4 ft.

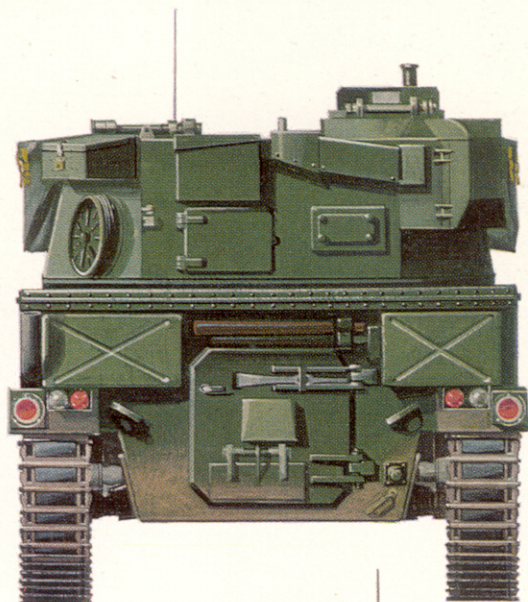
The first regiment to be equipped with Abbots was the 3rd Royal Horse Artillery in 1965. An Abbot regiment normally has four batteries each of six guns. Each battery has two sections of three Abbots, three Stalwart support vehicles, an FV 432 command vehicle (fitted with FACE), and a Ferret or Land Rover for the section commander. Abbot is employed by the British Army in the United Kingdom and in the British Army of the Rhine.

After initial troubles with the suspension and radiators, the Abbot has established itself as a reliable vehicle with an excellent gun, and will remain in service with the Royal Artillery for some years to come.



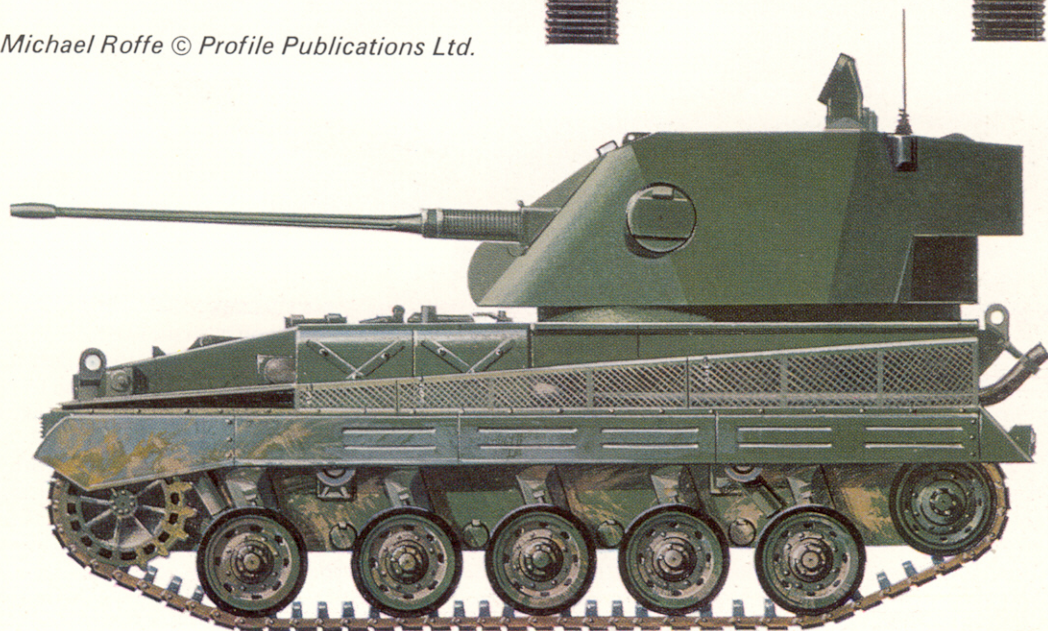


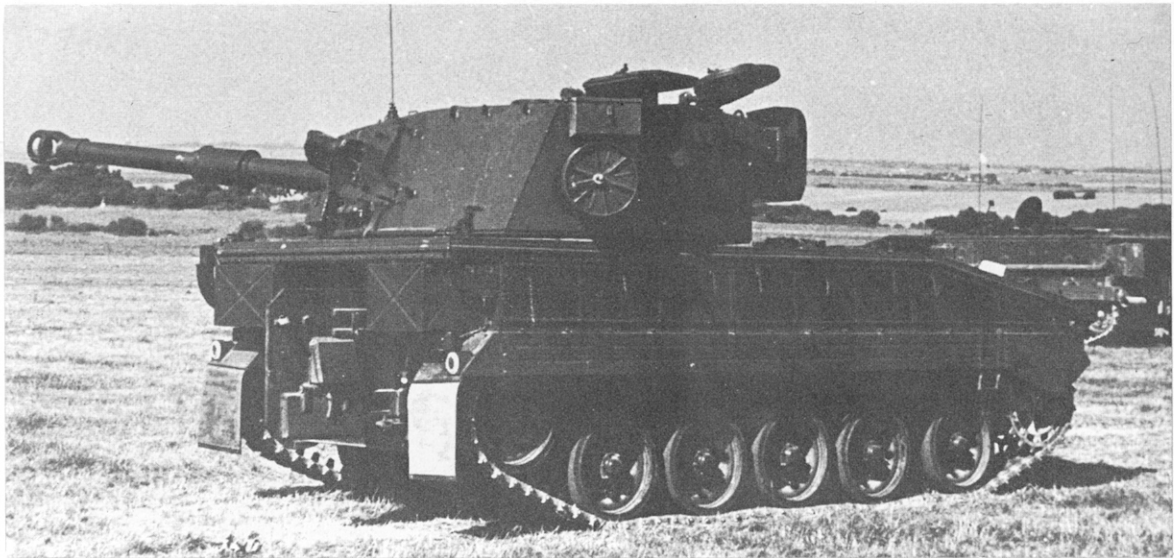
Above and right: Top and rear views of Abbot FV433 105mm Field Artillery Self-propelled.



Below: Side view of Falcon anti-aircraft system mounting two Hispano Suiza HSS B31L 30mm guns.

Michael Roffe © Profile Publications Ltd.





Abbot with turret traversed to left. Photograph taken at the Royal School of Artillery, Larkhill, 1971.

(C.F. Foss)



Abbot of Tombs's Troop, 2nd Royal Horse Artillery, Larkhill, 1969.

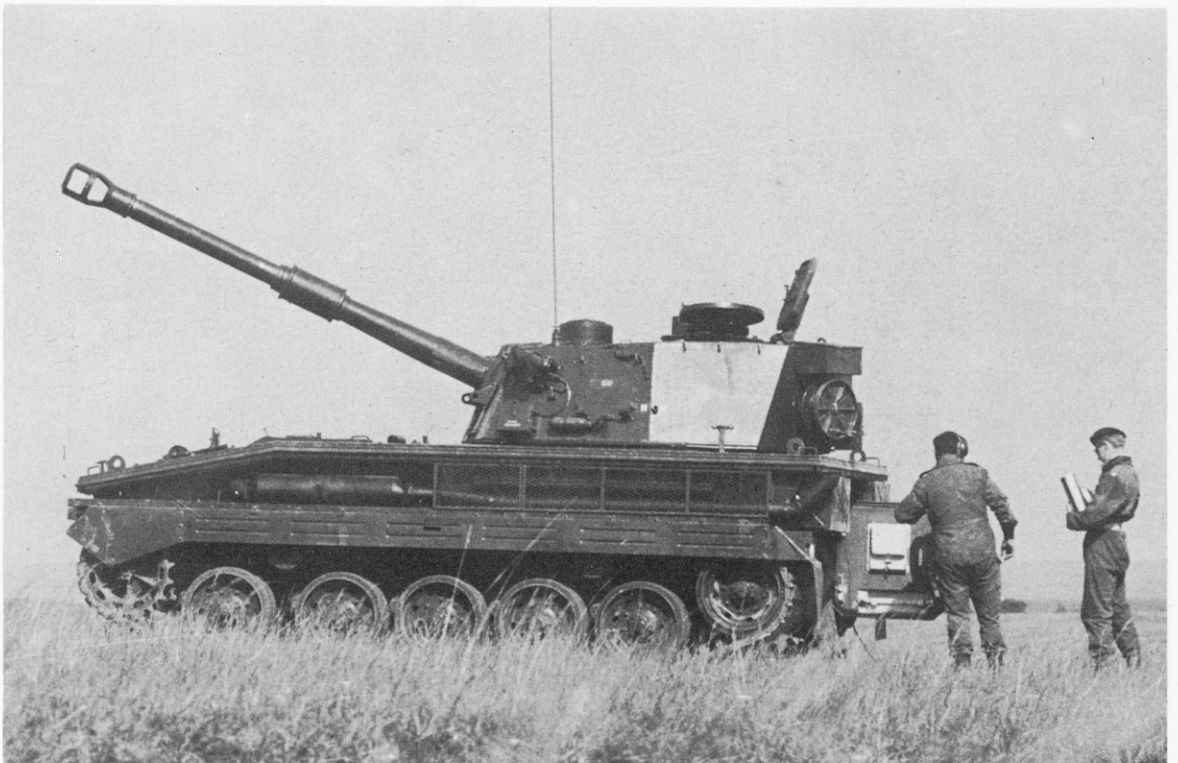
(CCR BIS)

DRIVING THE ABBOT

Thanks to the Royal Artillery Wing of the Royal Armoured Corps Centre at Bovington, Dorset, the author was able to drive an Abbot for a few hours. The Abbot was the first tracked vehicle the author had driven, and he was able to drive the vehicle with ease after only a few minutes instruction. After starting the engine, which, although alongside the driver, is very quiet, you select whichever gear range you require according to the type of country you are crossing. The brakes are then released by pushing down the tops of each steering lever with your

thumbs. To go ahead you push the two levers to the front, keeping them parallel, the accelerator is then depressed with your right foot. A foot rest is provided for your left foot. To turn left you pull the left lever back, and the right lever back to turn right.

The Abbot's suspension gave a very comfortable ride on dirt roads and across country. Streams should be entered slowly or the bow wave will swamp the driver's compartment. When climbing a slope the vehicle will automatically change down in gear if the slope becomes too steep; the driver can change up or down in gear without taking his foot off the accelerator.



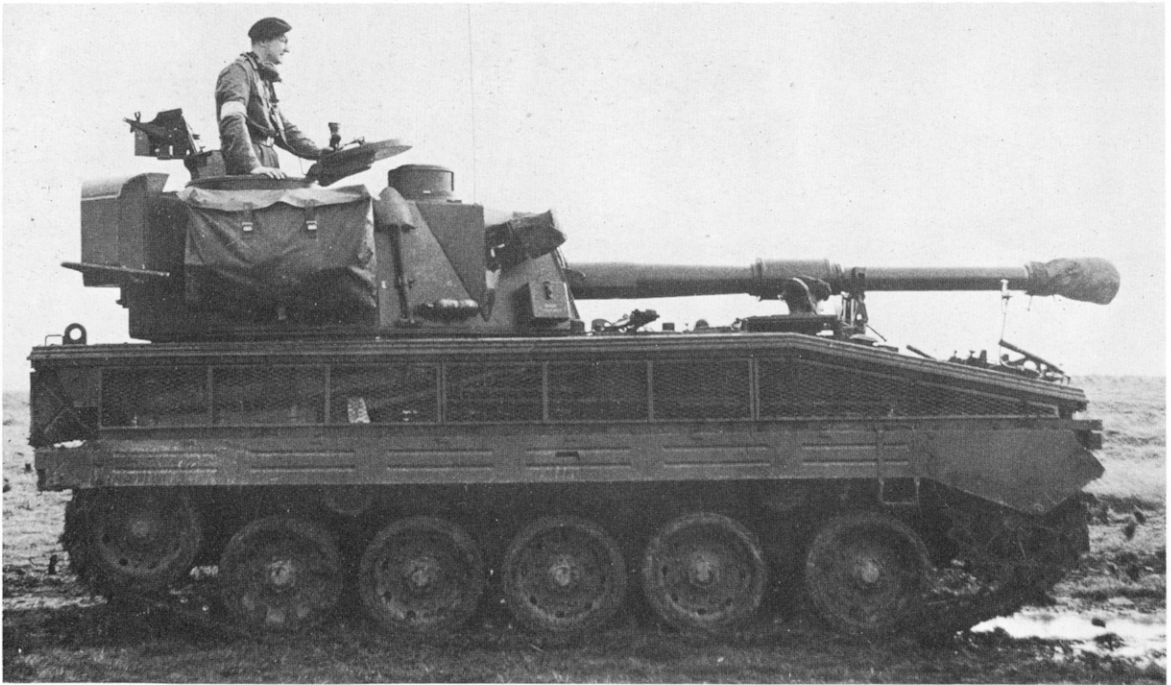
Abbot in firing position with rear doors open. Note brass-cased cartridges carried by ammunition member.

(CCR BIS)

Abbots firing at Larkhill, 1970. Note Bren LMG on turret top.

(CCR BIS)



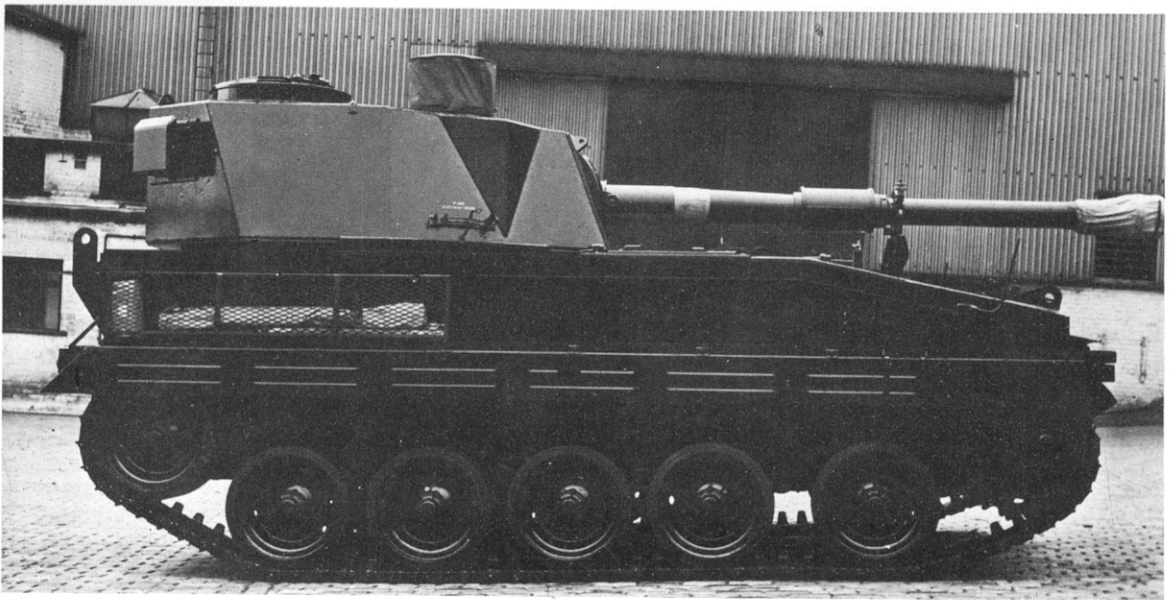


Note stowage over tracks in this picture of an Abbot travelling across country. Compare the side view of this Standard Abbot with that of the Value Engineered Abbot on the opposite page.

Front view of Value Engineered Abbot.

(Vickers Limited)





Right side view of Value Engineered Abbot. Note lack of flotation screen.

(Vickers Limited)

VARIANTS: VALUE ENGINEERED ABBOT

In 1965 Vickers made a presentation of a standard Abbot in India. The Indians found the Abbot an excellent hard-hitting vehicle, but were rather concerned at the cost of the vehicle. As a result a full scale investigation was undertaken by the Value Engineering Department of the Vickers Armament Division. Value Engineering is the application of a number of highly sophisticated techniques in a way which produces the required performance from a product at a lower cost.

In applying Value Engineering to Abbot it was decided that there should be no degradation of materials, standard of design, or the proved durability of the vehicle. The prototype Value Engineered Abbot was in fact the last Abbot for the British Army; it was bought back from the Army whilst still on the production line. The vehicle was completed as the Value Engineered Abbot in 1967 and was taken to India for a demonstration.

The Value Engineered Abbot differs from the British Army Abbot in a number of ways including:

Flotation screen—this is not fitted.

Engine—fitted with a Rolls-Royce K 60 Mark 60G/1 engine which runs on diesel fuel only and incorporates barometric altitude fuel compensating device.

Transmission and transfer drive are the same as the Abbot.

Suspension and tracks—the suspension is the same as that fitted to the Abbot, but the manganese steel tracks are not fitted with rubber pads.

Batteries—one set of batteries, 24 volt DC, is located in the hull for engine starting and lighting etc., capacity 100 amp/hours.

Generator—charging is carried out by means of an air-cooled alternator mounted on the hull bulkhead and driven from the engine. Full output is given from an engine speed of 1500 rpm upwards.

Communication—one-way powered sound communication from commander to driver is provided.

Turret traverse—two-speed hand traverse, elevation and depression are also by hand.

Power operated rammer—not fitted.

Fire warning equipment—not fitted.

Dial Sight—this is in an unarmoured hood, a German sight (as fitted to the German M-109G SPG) has replaced the British one.

Commander's cupola is non-rotating and has one periscope; commander has twin hatch covers which open either side.

The loader has a split hatch cover that opens fore and aft. *No smoke dischargers* or light machine are fitted.

Infra-red equipment is not fitted.

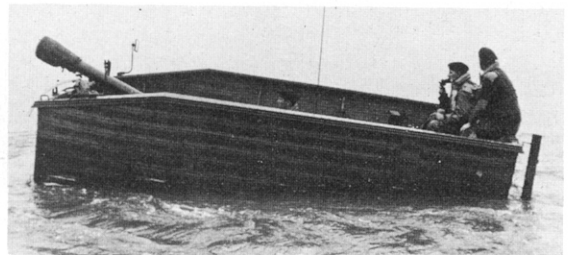
Fan-assisted filtered ventilation is provided for the fighting and driving compartments.

External stowage is reduced to a minimum.

Any of the above modifications could be added during production, or at a later date, if required. The Value Engineered Abbot is currently in large scale production at Vickers Elswick works for the Indian Government.

Abbot swimming with screen erected. Note exhaust extension on rear of vehicle.

(Vickers Limited)



FALCON ANTI-AIRCRAFT GUN SYSTEM

Although there are many mobile and expensive anti-aircraft systems available, for example the 2 × 35mm Oerlikon guns on a Leopard chassis and the twin 30mm guns on an AMX-13 or AMX-30 chassis, complete with radar, there is obviously a need for a cheap and reliable weapons system that can operate both in the anti-aircraft and ground rôles. The Falcon anti-aircraft system was developed by Vickers Limited and British Marc Limited (a subsidiary of Oerlikon). The prototype Falcon was completed in 1970, and in fact the chassis of the prototype Falcon (only one Falcon has been built so far) was the second prototype Abbot chassis.

Basically the system is a Value Engineered Abbot chassis with a turret mounting two Hispano Suiza HSS 831L 30mm guns. The 30mm ammunition is the same as that used in the British Rarden 30mm cannon as fitted to the Scimitar and Fox*.

The turret is fabricated in steel armour plate and gives protection against shell splinters and small arms fire. The crew consists of commander, gunner and driver; access to the crew compartment is through two hatches in the roof, above the commander's and gunner's seating positions. The commander and gunner sit side by side on adjustable seats. The commander's seat is designed to allow him to sit in the "head out" position. The crew compartment is sealed from the gun and ammunition compartment, thereby ensuring an atmosphere free from fumes and reducing the noise threshold when firing the weapons. Standard British Army VHF radio communication equipment with internal crew communications facilities is fitted. The Falcon can be fitted with additional equipment, such as flotation screen and infra-red driving equipment, to bring the vehicle up to full Abbot standard.

The guns are mounted in coupled gun cradles which are externally of armoured steel. Access for mounting and dismounting the guns for maintenance is simplified by the provision of a front cover on each cradle and the fact that the gun barrel is bayonet-fitted into its gun body.

Ammunition is fed to the guns from boxes located in the base of the turret through chutes into belt feed mechanisms operated by gun recoil. Empty cartridge cases and the belt links are ejected sideways through the elevation trunnion bearings. The guns are cocked and fired electrically, single shot and automatic fire from both or either gun being selectable. The guns fire at a rate of 650 rounds from each barrel per minute. Each ammunition box contains 310 rounds. The boxes are loaded and removed by traversing the turret to the rear of the vehicle and thereby gaining access through the rear hull door. The types of ammunition available are:

- Practice
- (1) HE-P An inert practice shell with the same ballistic properties as a live shell.
 - (2) HET-P An inert shell with tracer.
- High Explosive
- (1) HEI-HE incendiary shell with high blast effect.
 - (2) HEIT-HE incendiary shell with high blast effect and tracer.

*The power pack includes two 400 cps alternators which, together with two regulators and a diode rectifier unit cooled in the engine oil tank, provide 200 amperes at 28.5 V DC for all vehicle electrical requirements. Hull mounted batteries of 24V, 300 ampère hour capacity are also included in the electrical system. The tracks are the same as those fitted to the standard Abbot vehicle.

Armour Piercing (1) APICT—armour piercing incendiary with hard metal core and tracer.

(2) APHEI—armour piercing incendiary with self-destruction base fuse.

Armour Penetration:

Type APICT

Firing range in metres	1000			
Thickness of armour plate mm	10	20	30	40
Angle of plate to horizontal	23°	36°	50°	61°

Type APHEI

Firing range in metres	600	1000	1400
Thickness of armour plate in mm	24 30	25 30	14 25 30
Angle of plate relative to horizontal	45° 55°	55° 62°	35° 64° 73°

The Falcon system would be highly effective against lightly armoured vehicles such as armoured personnel carriers as well as trucks and other soft skinned vehicles.

The power control system controls and drives the turret in traverse and the twin guns in elevation, providing high speed slewing and maintaining accuracy of aim, even with one gun firing. The gun is also stabilised against vehicle movement. This system is similar to that used in the Centurion, Chieftain and Vickers MBTs and was developed by GEC-AEI (Electronics) Limited. The gunner tracks the target by operating a two-motion joystick which is energized when a foot pedal is depressed. The commander has a similar joy-stick which can override the gunner's. The power control system is all-electric. Signals from the joy-sticks are compared with the outputs from rate gyro units mounted on the gun cradle, the resultant error signal being processed in amplifier channels to optimise the response and convert it into a suitable signal for controlling rotating amplifiers (metadynes). The metadyne outputs control servo motors which drive the turret and twin guns through gearboxes. The metadyne system has been proved in service to be both reliable and easy to maintain. In an emergency, the turret can be power traversed at a fixed low speed in either direction using the joy-stick control, or hand driven by the gunner in elevation and by the commander in traverse. Suspension lock-outs are necessary when using emergency control and these are provided. Radar could be fitted to the turret if required.

The gunner is provided with a periscopic gunsight with dual optical system, one of X1 magnification and 50 degree field of view for anti-aircraft use and the other of X6 magnification with 10 degree field of view for accurate lay on to ground targets.

Anti-Aircraft Mode Superimposed on the anti-aircraft field of view is a moving circle; the displacement from the optical centre line of the moving circle is the lead angle for ensuring a high probability that the shells will hit the target.

The lead angle is computed by automatically feeding the rate of tracking speed into a simple computer and multiplying this by a factor representing the present range of the target. In practice the guns would be intentionally

fired at a range longer than the manually set range, and firing continued until the actual range is shorter than the manual range. In this way it can be ensured that any normal error in estimating the range of the target is covered by the bracketed range of fire. In short, the use of the sight will be identical to the gyroscopic gunsights used for many years, but the periscopic gunsight as installed enables the turret to be used with complete cover for the crew. The commander has a similar periscopic gunsight, but without the moving lead angle display. Both the gunner's and commander's sights have emergency fixed graticules. The guns have a maximum range in the anti-aircraft rôle of 3,300 yards (3000 metres).

Ground Target Mode Both the gunner's and commander's sights are provided with a ground target ballistic graticule which has the following features:

- (1) It gives the variation in tangent elevation (gravity drop) for different ranges.
- (2) The length of the graticule marks at each range are calculated to be identical to the width of a typical armoured personnel carrier. This feature gives a form of stadiametric ranging.
- (3) Lateral deflection is possible by graticule marking at 5 millirad intervals.

The above facilities in the X6 magnification periscopic sight, and the provision of additional observation peri-



Three-quarter left front view of Falcon Anti-Aircraft System with turret traversed to left.
(Vickers Limited)

scopes for the commander, ensure quick and accurate engagement of all ground targets.

Stabilisation of the weapon system permits firing while on the move. The guns have a total traverse of 360 degrees, elevation of plus 85 degrees and a depression of minus 5 degrees. The 620 rounds of ammunition, belt fed and all available for immediate use, provide the equivalent of 30 one second bursts (20 rounds). Single shot operation is available for use in the ground target

Falcon Anti-Aircraft System.

(Vickers Limited)





Falcon firing its two 30mm Hispano Suiza HSS 831L guns with turret traversed to rear.

(Vickers Limited)

Three-quarter left front view of Falcon Anti-Aircraft System with turret traversed to right.

(Vickers Limited)





rôle. Turret performance is:

Elevation tracking velocity	40 degrees/second max.
Traverse Velocity (slew)	80 degrees/second max.
Traverse Velocity (track)	45 degrees/second max.
Elevation Acceleration	120 degrees/second ² max.
Traverse Acceleration	120 degrees/second ² max.

The Falcon weapons system is fully developed and ready for production. Firing trials were carried out at the Royal School of Artillery at Larkhill and at Manorbier. These were very successful; on one occasion the Falcon succeeded not only in riddling the drogue but also in cutting the line of the towing Canberra aircraft.

VICKERS 13 TON TANK

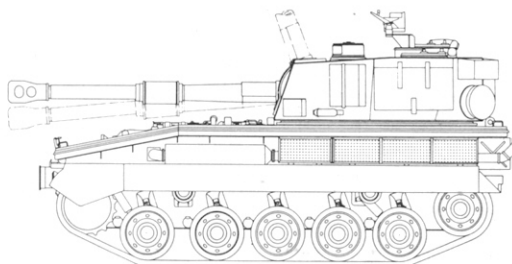
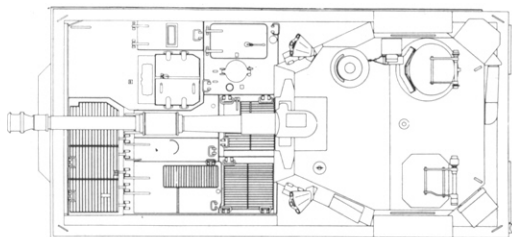
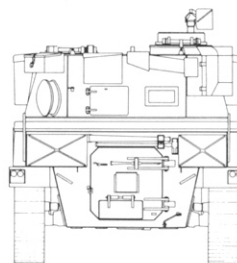
This did not progress beyond the drawing stage and used adapted Abbot suspension, transmission and steering units. The engine was to be a Leyland 680. Armament was to be the 76mm gun of the Saladin Armoured Car, a 12.5mm ranging machine-gun, 7.62mm co-axial and a 7.62mm anti-aircraft machine-guns. Two Vigilant anti-tank missiles were to have been mounted either side of the turret.

AVR (ARMOURD VEHICLE, RECONNAISSANCE)

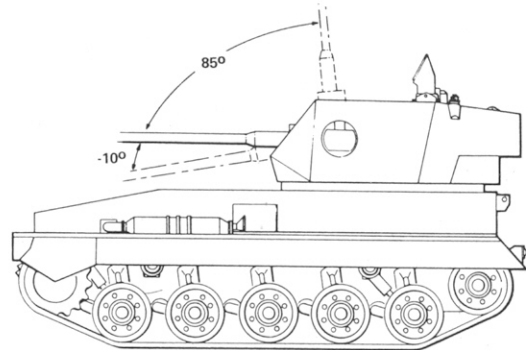
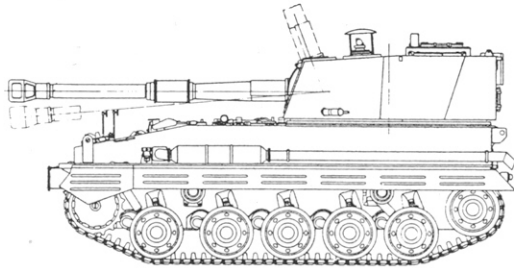
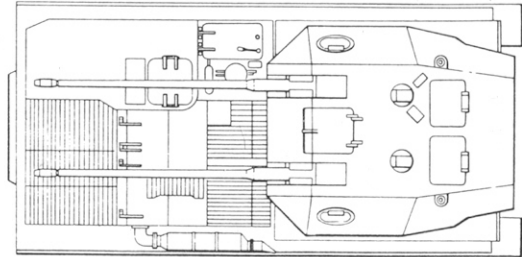
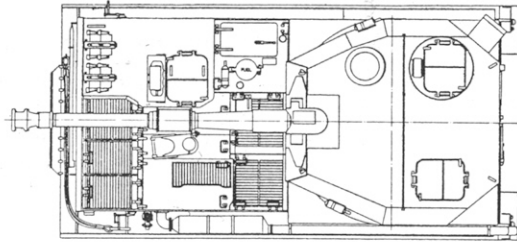
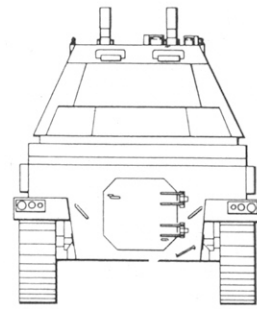
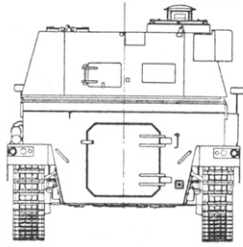
This was projected in 1960 by FVRDE (now MVEE) and had a 76mm or 105mm gun and Swingfire guided missiles. It would have used Abbot components including the engine and transmission. For details of this project see Scorpion Reconnaissance Tank *Profile*.



Standard Abbot



Four views of an Abbot of the Royal Artillery Wing, Royal Armoured Corps Centre, Bovington. (C.F. Foss)



Value Engineered Abbot

Falcon Anti-Aircraft System

	Abbot	Value Engineered Abbot	Falcon
Crew	4	4	3
Nominal weight laden (less crew)	38,500 lbs	35,000 lbs	35,000 lbs
Nominal weight unladen	34,000 lbs	31,300 lbs	31,300 lbs
Nominal ground pressure (loaded)	12.7 psi	11.6 psi	11.6 psi
Gross power/weight ratio BHP/ton	16.05	13.7	13.7
Overall length (vehicle)	16' 8"	17' 6"	17' 6"
Length (gun forward)	19' 2"	18' 9"	17' 6"
Overall height (top of cupola)	8' 2"	8' 2"	8' 3" (roof)
Overall width	8' 8"	8' 8"	8' 8"
Ground clearance	1' 4"	1' 4"	1' 4"
Maximum speed (road) mph	30	30	30
Vertical obstacle (hard shoulder)	24"	22"	22"
Gradient	30°	30°	30°
Trench	6' 9"	6' 9"	6' 9"
Fording	4'	3' 8"	3' 8"
Range road (miles)	300	240	240
Main armament	105mm	105mm	2 x 30mm
Secondary armament	7.62mm MG	—	—
Smoke dischargers	2 x 3	—	—
Ammunition capacity (main)	40	36	620
Ammunition MG	1200	—	—
Engine (all Rolls-Royce)	K 60	K 60 Mk.60G/1	K 60 Mk.60G/1
BHP gross/RPM	240/3750	213/3750	213/3750
Cubic capacity (cubic inches)	400.9	400.9	400.9
Fuel (gallons)	85	85	85
Oil capacity (gallons)	5	8	8
Wheels	all have 5 x 24" rubber tyred double wheels		
Track width	1' 1 1/2"	1' 1 1/2"	1' 1 1/2"
Pitch	4.59"	4.59"	4.59"
Length of track on ground	9' 4"	9' 4"	9' 4"
Track centres	7' 2"	7' 2"	7' 2"

Armour:	Abbot	Value Engineered Abbot	Falcon
Hull side	12mm	12mm	12mm
Hull nose	12mm	12mm	12mm
Hull bottom	6mm	6mm	6mm
Hull top	10mm	10mm	10mm
Hull rear	10mm	10mm	10mm
Turret front	10mm	10mm	10mm
Turret sides	10mm	10mm	10mm
Turret top	12mm	12mm	12mm
Turret rear	10mm	10mm	10mm

12 in = 1 ft: to change in to m multiply by .0254
to change ft to m multiply by .3048

2,204 lb = 1 kg.
2,204 lb = 1 tonne (metric)
2,000 lb = 1 short ton (U.S.)
2,240 lb = 1 long ton (English)

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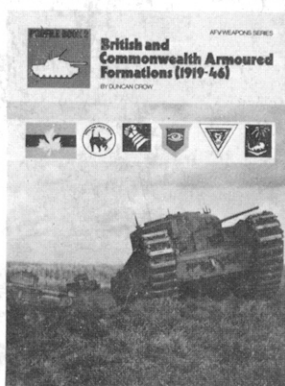
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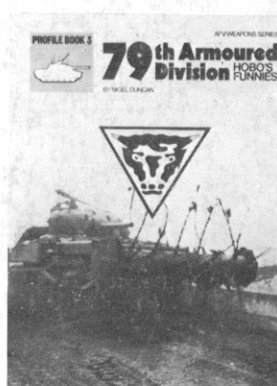
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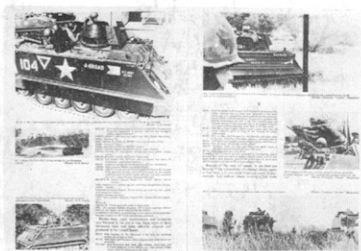
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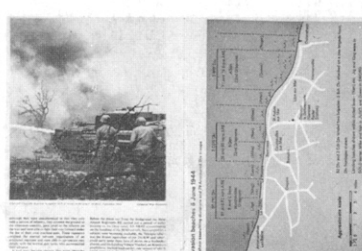
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