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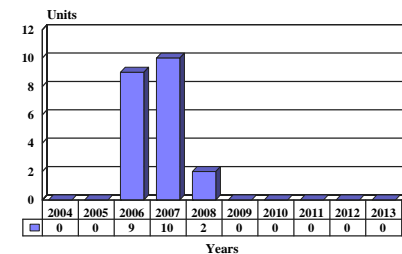
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Vickers Tanks - Archived 1/2005

Outlook

- Serial production of the Mark 3 remains dormant
- Mark 3(I) program is dormant; the Mark 5 and Mark 7 programs never advanced beyond the demonstrator stage
- Apart from the Vijayanta, there are no major modernization or retrofit programs for this series
- Production forecast (at right) is for the Mark 3M model only

10 Year Unit Production Forecast
2004 - 2013



Orientation

Description. Tanks

Sponsor. The primary contractor, Vickers Defence Systems, privately funded development of this tank series. FMC Corporation (now United Defense Limited Partnership) provided some support for the Mark 5 development program.

Contractors

Primary Contractor. Vickers Defence Systems Division (Elswick, Newcastle-upon-Tyne, United Kingdom) – since 2002, a component of Alvis-Vickers.

Major Subcontractors. Avimo, Boeing (formerly McDonnell Douglas Helicopters), British Leyland Motors, Curtis-Wright Antriebsstechnik, General Dynamics Armament Systems, David Brown Defence Equipment (formerly Self-Changing Gears), Detroit Diesel Corporation, Graviner, Horstman Defence Systems, Marconi Command and Control Systems, NANOQUEST, Officine Galileo, Perkins Engines, Philips, Raytheon Systems, Renk AG, RO Defence (Royal Ordnance), Societe de Fabrication d'Instruments de Mesure, Thales Optronics (formerly Pilkington PE), and Vickers Instruments.

Licensees. The Avadi Company of India had a license to produce the Mark 1.

Status. In 1994, Vickers completed the latest Mark 3 production run, filling a 1990 Nigerian order. Since then, the production line has remained dormant. The basic Mark 3, Mark 3(I), and Mark 3M models are available for further production orders. The Mark 1 (also as the Vijayanta) and Mark 3 are currently in service.

Total Produced. Vickers has produced the following total quantities of tanks covered in this report: 162 Mark 1s (including the first 90 tanks configured as the Vijayanta, delivered to India); 2,187 Vijayantas; 222 Mark 3s; two Mark 3(I)s; two Mark 4s; two Mark 5s; and two Mark 7s.

Application. Armored mobile weapon systems, optimized for high-speed offensive and break-through operations, as well as for defensive fire support.

Price Range. In equivalent 2003 U.S. dollars, the Mark 3M carries a unit price of \$5.006 million; the price of the Mark 3(I) was \$4.107 million in equivalent 1996 U.S. dollars.

Technical Data

Mark 1

Design Features. Vickers designed the Mark 1 as a cost-effective tank with a good level of firepower for the export market.

Armor. The Mark 1 has conventional armor with a maximum thickness of 80 millimeters (3.15 in) on the turret face and front of the hull.

Crew. Four: commander, gunner, loader, driver.

Dimensions. The following data are for the last production standard of the Mark 1:

	<u>SI units</u>	<u>U.S. units</u>
Length:	9.73 m	31.92 ft
Width:	3.17 m	10.4 ft
Height:	2.64 m	8.66 ft
Combat weight:	38.6 tonnes	42.55 tons
Fuel capacity:	1,000 liters	265.96 gallons

Performance. The maximum speed and range figures represent use on a paved road.

	<u>SI units</u>	<u>U.S. units</u>
Maximum speed:	48.3 kph	30.0 mph
Maximum range:	480 km	298 statute miles
Step:	91.4 cm	2.99 ft
Trench:	2.44 m	8.0 ft
Slope:	30%	30%
Gradient:	60%	60%
Fording:	1.14 m	3.74 ft

Engine. Leyland L60 Mark 4B six-cylinder, liquid-cooled, multi-fuel engine. This engine generates 484.71 kilowatts (650 hp) at 44.5 revolutions per second (2,670 rpm), with a power-to-weight ratio of 12.56 kilowatts per tonne (15.28 hpt). The Mark 1 24-volt electrical system consists of four six-volt, 115-ampere-hour batteries.

fume extractor and (usually) a thermal sleeve. Elevation (+20°), depression (-7°), and turret traverse are electrically powered, with manual backup provided. The Mark 1 carries 44 rounds of 105mm ammunition.

Gearbox. David Brown (then Self-Changing Gears Ltd) TN12 semi-automatic gearbox. This gearbox has six forward and two reverse gear ratios; it also incorporates the Merritt steering system.

Secondary Armament. One 12.7x99mm (.50 caliber) ranging machine gun; one 7.62x51mm NATO (.308 Winchester) L8A2 coaxially mounted machine gun; one 7.62x51mm NATO (.308 Winchester) L8A2 pintle-mounted machine gun on the turret roof. Each side of the turret features six electrically operated smoke grenade launchers.

Suspension and Running Gear. Torsion-bar suspension system with six dual-tired roadwheels and three track return rollers on each side. The first, second, and sixth suspension units mount secondary torsion bars and hydraulic shock dampers.

Fire Control. The fire control suite of the Mark 1 is rather austere. The gunner uses a sighting telescope with an integral ballistic reticle, as well as a GEC-Marconi gun control system; this can operate in non-stabilized, stabilized, and emergency modes. The commander uses a 10-power sight and six periscopes. Periscopes and vision blocks are available for all crew stations.

Armament

Main Armament. RO Defence (Royal Ordnance) L7A1 105mm rifled tank gun. This 51 caliber gun features a

Vijayanta

Design Features. The Vijayanta is essentially a Mark 1, modified to meet Indian Army requirements.

Crew. Four: commander, gunner, loader, driver.

Armor. Same as the Mark 1.

Dimensions. The following data are for the basic production standard Vijayanta:

	<u>SI units</u>	<u>U.S. units</u>
Length:	9.79 m	32.11 ft
Width:	3.17 m	10.4 ft
Height:	2.71 m	8.89 ft
Combat weight:	40.39 tonnes	44.52 tons
Fuel capacity:	1,000 liters	265.96 gallons

Performance. The maximum speed and range figures represent use on a paved road.

	<u>SI units</u>	<u>U.S. units</u>
Maximum speed:	48.3 kph	30.0 mph
Maximum range:	412 km	255.9 statute miles
Step:	91.4 cm	2.99 ft
Trench:	2.44 m	8.0 ft
Slope:	30%	30%
Gradient:	60%	60%
Fording:	1.3 m	4.27 ft

Engine. Same as the Mark 1, with the addition of an auxiliary power unit based on a three-cylinder diesel engine, providing electrical power when the main engine is shut down.

The gunner uses a single Number 30 Mark 1 sighting telescope with an integral ballistic reticle for day use. The gunner's night sight is the IR 102C infrared periscope. The commander uses a periscope-binocular for day use and an IR 101A infrared periscope for night use. The loader has a Number 23 Mark 1 periscope. The driver uses an AFV101A periscope for day use and an IR 101A infrared binocular for night use. The Vijayanta features the same GEC-Marconi gun control system as the Mark 1.

Gearbox. Same as the Mark 1.

Suspension and Running Gear. Same as the Mark 1.

Armament. Same as the Mark 1.

Fire Control. Like the Mark 1, the fire control suite of the Vijayanta as originally supplied is rather austere.

Mark 3

Design Features. Vickers designed the Mark 3 to offer a high degree of firepower and protection in a tank optimized for the export market. The latest version, the Mark 3M, incorporates fire control and survivability improvements designed to keep the tank competitive in the market.

Armor. The Mark 3 conventional armor protection is the same as the Mark 1's. In addition, the Mark 3M places explosive reactive armor (the Royal Ordnance ROMAR A or Vickers Defence Systems Varma series 2) on the forward portion of the turret, the forward half of the hull and glacis plate, and the side skirts.

Crew. Four: commander, gunner, loader and driver.

Dimensions. The following data are for the Mark 3M, which has essentially the same dimensions as the original Mark 3. The height figure is with a machine gun mounted on the turret roof; the height to the turret roof is 2.47 meters (8.10 ft).

	<u>SI units</u>	<u>U.S. units</u>
Length:	9.78 m	32.08 ft
Width:	3.17 m	10.4 ft
Height:	3.10 m	10.17 ft
Combat weight:	40.0 tonnes	44.09 tons
Fuel capacity:	1,000 liters	265.96 gallons

Performance. The maximum speed and range figures represent use on a paved road.

	<u>SI units</u>	<u>U.S. units</u>
Maximum speed:	50 kph	31.1 mph
Maximum range:	530 km	329 statute miles
Step:	83 cm	2.72 ft
Trench:	3.0 m	9.8 ft
Slope:	30%	30%
Gradient:	60%	60%
Forcing:	1.14 m	3.74 ft

Engine

Early-Production Mark 3. VR750 powerpack, which is based on the Perkins (Rolls-Royce) Condor CV12 TCE diesel engine. This engine generates 559.3 kilowatts (750 hp) at 38.33 revolutions per second (2,300 rpm).

Late-Production Mark 3. Detroit Diesel Corporation 12V-71T supercharged diesel engine. This engine generates 536.9 kilowatts (720 hp) at 41.67 revolutions per second (2,500 rpm), with a power-to-weight ratio of 13.42 kilowatts per tonne (16.33 hpt).

The Mark 3 24-volt electrical system consists of four 12 volt, 200-ampere-hour batteries.

Gearbox. David Brown V5 version of the TN12 semi-automatic gearbox. This gearbox has six forward and two reverse gear ratios; it also incorporates the Merritt steering system.

Suspension and Running Gear. Same as the Mark 1. The Mark 3 track is 52.1 centimeters (20.5 in) in width.

Armament. Same as the Mark 1, except the Mark 3 carries 50 main armament rounds.

Fire Control. The Mark 3 fire control suite is somewhat more sophisticated than that of the Mark 1 series, featuring all-electric gun stabilization and control systems and a two-axis gyroscope. A Vickers Instruments neodymium yttrium-aluminum garnet laser rangefinder is integral to the gunner's NANOQUEST L23 dual magnification (1x and 10x) periscope sight; the range setting is automatic. The commander's primary sight is the Thales (formerly Pilkington PE) one-to-ten-power (day)/four-power (night) Condor. The driver's night sight is the Thales Badger. Periscopes and vision blocks are available for all crew stations.

The Mark 3M variant retains the Marconi SFCS-600 fire control suite and the Condor sight. In addition, the Mark 3M gunner's station features a day/thermal sight (the Avimo NVL 3200 or Thales Optronics Falcon), with a remote display for the commander. In April 1997, Vickers selected the Officine Galileo modular day/night panoramic periscopic for installation on the Mark 3M. A Global Positioning System receiver and the Avimo LIRD-2 laser warning system (linked to the smoke grenade launcher system) are also part of the Mark 3M package.

Mark 3(I)

Design Features. Vickers designed the Mark 3(I) to offer an improved version of the Mark 3, optimized for the export market.

Crew. Four: commander, gunner, loader, and driver.

Dimensions. The following data are for the latest example of the Mark 3(I):

	<u>SI units</u>	<u>U.S. units</u>
Length:	9.50 m	31.16 ft
Width:	3.24 m	10.63 ft
Height:	3.02 m	9.91 ft
Combat weight:	42.1 tonnes	46.41 tons
Fuel capacity:	1,000 liters	265.96 gallons

Armor. Same as the Mark 1 and Mark 3, except the front of the chassis is cast rather than welded. The Mark 3(I) does not feature the Mark 3M reactive armor package.

Performance. The maximum speed and range figures represent use on a paved road.

	<u>SI units</u>	<u>U.S. units</u>
Maximum speed:	59 kph	36.6 mph
Maximum range:	530 km	329 statute miles
Step:	83 cm	2.72 ft
Trench:	3.0 m	9.8 ft
Slope:	30%	30%
Gradient:	60%	60%
Fording:	1.14 m	3.74 ft

Engine. Perkins Engines CV 12 TCE supercharged diesel engine. This engine generates 633.8 kilowatts (850 hp) at 41.67 revolutions per second (2,500 rpm), with a power-to-weight ratio of 13.42 kilowatts per tonne (16.33 hpt). Engine cooling components are improved over the original Mark 3; the engine compartment also features a Graviner automatic fire extinguishing system. The electrical system is the same as the basic Mark 3.

Gearbox. David Brown T1200 semi-automatic gearbox. This gearbox has six forward and two reverse gear ratios; it also incorporates the Merritt steering system.

Suspension and Running Gear. The Mark 3(I) retains the torsion bar suspension system of the earlier Mark 3, but with lengthened bars. The Mark 3(I)

mounts six dual-tired roadwheels (wider than those of the original Mark 3) and three track return rollers on each side of the tank. The first, second, and sixth suspension units feature Horstman Defence Systems rotary shock dampers. The Mark 3(I) track is 55.9 centimeters (22 in) wide, as opposed to the 52.1 centimeter (20.51 inch) track of the original Mark 3. The Mark 3(I) also features a powered steering system, new brake components, and upgraded final drive components.

Armament. Same as the basic Mark 3, with the addition of a muzzle reference system.

Fire Control. Same as the basic Mark 3 except for the driver's station, which features a Badger night sight and three periscopes instead of the one periscope of the Mark 3.

Mark 5

Design Features. Vickers designed the Mark 5 as a light, cost-effective tank with high firepower and a good fire control suite, suited for less affluent nations.

Crew. Four: commander, gunner, loader, and driver.

Armor. The Mark 5 features welded aluminum armor, with additional hard steel armor in vital areas.

	<u>SI units</u>	<u>U.S. units</u>
Length:	8.61 m	28.24 ft
Width:	2.69 m	8.82 ft
Height:	2.62 m	8.59 ft
Combat weight:	19.75 tonnes	21.77 tons
Fuel capacity:	570 liters	151.59 gallons

Performance. The maximum speed and range figures represent use on a paved road.

	<u>SI units</u>	<u>U.S. units</u>
Maximum speed:	70.0 kph	43.5 mph
Maximum range:	481 km	298.7 statute miles
Step:	76 cm	2.49 ft
Trench:	2.13 m	6.98 ft
Slope:	40%	40%
Gradient:	60%	60%
Fording:	1.32 m	4.33 ft

Engine. Detroit Diesel 6V-92TA supercharged diesel engine. This engine generates 412 kilowatts (552.28 hp), with a power-to-weight ratio of 20.86 kilowatts per tonne (25.37 hpt). The 24-volt electrical system

consists of four 12-volt maintenance-free batteries in the hull and two more in the turret.

Gearbox. General Dynamics Armament Systems HMPT-500-3 hydromechanical gearbox with three

speed ranges and infinitely variable output within each range.

Suspension and Running Gear. Torsion bar suspension with six dual-tired roadwheels mounted on independent trailing-type road arms. Five of the six roadwheel stations feature linear-type hydraulic shock dampers.

Armament. Same as the Mark 3, except the Mark 5 carries 41 main armament rounds. Also, each side of the turret mounts only four (instead of six) 66mm electrically operated smoke grenade launchers.

Fire Control. The Mark 5 fire control suite is based on an integrated two-axis stabilization system for the main armament and a Marconi computerized fire control system. The gun control system is all-electric, with a muzzle reference system. The system features a Thales Raven day/night sight and five periscopes for the commander, a Vickers Instruments 10-power telescopic laser sight, a GS10 auxiliary sight and a NANOQUEST wide-angle periscope for the gunner, and an AFV Number 30 Mark 1 roof-mounted periscope for the loader. The Mark 5 can fire on the move with a high degree of hit probability.

Mark 7

Design Features. Vickers designed the Mark 7 as a more sophisticated yet still cost-effective tank with a 120mm main armament and a good fire control suite. Vickers intended the Mark 7 as a lower cost alternative to the Challenger, Leopard 2, or M1 Abrams main battle tanks for less affluent nations.

Crew. Four: commander, gunner, loader, and driver.

Armor. The Mark 7 features Chobham armor fitted over conventional steel armor.

Dimensions. The following data are for the last prototype of the Mark 7:

	<u>SI units</u>	<u>U.S. units</u>
Length:	10.95 m	35.92 ft
Width:	3.42 m	11.22 ft
Height:	2.99 m	9.81 ft
Combat weight:	54.64 tonnes	60.23 tons
Fuel capacity:	1,200 liters	319.15 gallons

Performance. The maximum speed and range figures represent use on a paved road.

	<u>SI units</u>	<u>U.S. units</u>
Maximum speed:	80.0 kph	49.7 miles per hour
Maximum range:	550 km	341.8 statute miles
Step:	110 cm	3.61 ft
Trench:	3.0 m	9.84 ft
Slope:	30%	30%
Gradient:	60%	60%
Fording:	1.70 m	5.57 ft

Engine. Motoren- und Turbinen-Union (MTU) MB 873 Ka 501 supercharged diesel engine. This engine generates 1,119 kilowatts (1,500 hp) at 43.34 revolutions per second (2,600 revolutions per minute), with a power-to-weight ratio of 20.48 kilowatts per tonne (24.90 hpt). The 24-volt electrical system consists of eight 12-volt, 125-ampere-hour batteries.

Gearbox. Renk HSWL 354/3 epicyclic automatic gearbox with four forward and two reverse gear ratios.

Suspension and Running Gear. Torsion bar suspension with seven dual-tired roadwheels and four track return rollers on each side. The first, second, third, sixth, and seventh roadwheel stations feature rotary shock dampers.

Armament

Main Armament. RO Defence (Royal Ordnance) L11A5 120mm rifled tank gun. This 55 caliber gun features a thermal sleeve. Elevation (+20°), depression (-10°), and turret traverse are electrically operated, with manual backup provided. The Mark 7 carries 55 rounds for the L11A5 gun. The Mark 7 can also mount the 120mm Rheinmetall Rh 120 smoothbore tank gun as an option, though this reduces ammunition capacity to 38 main gun rounds.

Secondary Armament. One coaxially mounted Alliant Techsystems EX-34 7.62x51mm NATO (.308 Winchester) Chain Gun®, manufactured under license by RO Defence. A 12.7x99mm (.50 caliber) M2 or 7.62x51mm NATO (.308 Winchester) L8A2 pintle-

mounted machine gun on the turret roof is optional. Each side of the turret also mounts ten 66mm electrically operated smoke grenade launchers.

Fire Control. The Mark 7 fire control suite is much more advanced than those of the other original-production Vickers tanks covered in this report. The Mark 7 suite features full stabilization and a muzzle reference system for the main armament, as well as the Marconi Centaur integrated fire and gun control system, including the EC600 ballistic computer.

The commander uses a Societe de Fabrication d'Instruments de Mesure VS580-10 second-generation

gyroscope-stabilized panoramic sight. A Philips model UA9090 gyroscope-stabilized thermal imaging system (produced by Raytheon), with dual displays for the commander and gunner, is mounted on the turret roof. The gunner's primary sight is the NANOQUEST L30 with integral laser module; this monocular sight mounts coaxially with the main gun. The gunner also uses a turret roof-mounted NANOQUEST GS10 periscope sight with wide-angle capability. The driver uses a Philips night sight. The loader uses an AFV Number 30 Mark 1 periscope, which can rotate through 360°. Periscopes and/or vision blocks are available for all crew stations.

Variants/Upgrades

Variants. Vickers has not developed any variants of the Mark 3(I), Mark 5, or Mark 7.

Mark 1 Variants. The Mark 1, produced under license in India as the Vijayanta, is available in two variants:

Catapult. The Catapult 130mm self-propelled artillery system integrates the Russian M-46 130mm field gun with a lengthened Vijayanta chassis. The main changes in the lengthened chassis are the removal of the turret and the fitting of an additional roadwheel on each side. The vehicle carries a total of 32 130mm projectiles and charges. India has produced 100 Catapult systems.

Kartik. The Kartik armored-vehicle-launched bridge (AVLB) uses the same lengthened Vijayanta chassis as the Catapult. Introduced in 1989, the Kartik features a scissors-type bridge that is deployed and recovered from the front of the vehicle. As of 2003, India had produced 34 Kartik AVLBs.

Mark 3 Variants. The Mark 3 is available in three variants:

Vickers Armored Bridgelayer. In 1977, Vickers developed an armored bridgelayer with a 13.41 meter military load class 60/70 bridge. Vickers used the basic Mark 3 chassis; a crew of three operates the system. In addition to the integration of the bridge, the principal change is the incorporation of a different engine. The vehicle is available with the 596.6 kilowatt (800 hp) Perkins CV12 800E or the 536.9 kilowatt (720 hp) Detroit Diesel 12V-71T engine. Nigeria ordered six in 1981, and a further six in 1985.

Vickers Armored Repair and Recovery Vehicle. In 1973, Vickers began the development of an armored recovery vehicle. Manned by a crew of four, this vehicle is available with or without a four-tonne hydraulically operated crane. Engine options are the same as for the armored bridgelayer (see above). Kenya ordered three in 1977, and placed a follow-on order for

four in 1978. Nigeria ordered five in 1981, and Tanzania has at least two.

Vickers Anti-Aircraft Tank. For use in trials, Vickers integrated a Mark 3 chassis with the Marconi Marksman turret, mounting twin 35mm guns. Vickers has yet to secure any sales of this variant.

Retrofit and Modernization Program Overview. Aside from potential retrofits of the Mark 3(I) improvements to the original Mark 3, Vickers has not developed any significant modernization or retrofit programs specifically for the Mark 3 tank.

Since the early 1980s, India has investigated and implemented several modernization and retrofit programs for the Vijayanta, in addition to the variants described above. The overall program, called Bison, effectively superseded India's Arjun tank program in 1993. The main features of the program include the retrofit of the V-84 engine (as used in the T-72), a new fire control suite, and additional armor protection, and the installation of a land navigation system and passive (including thermal) night vision equipment. Despite some indications that 1,100 Vijayanta tanks could be upgraded under the Bison program, our latest research puts the highest figure at 700. India has yet to fully implement the Bison program; the estimated Bison unit cost is around US\$330,000 per tank.

Hull and Turret. The hull-related program involves retrofitting advanced Kanchan appliqué armor, developed by the Indian Defence Metallurgical Laboratory at Hyderabad. Another indigenous product, the Jackal armored skirt system, is also part of this retrofit program. While India reportedly has no plans to retrofit explosive reactive armor, it cannot be entirely ruled out.

Turret retrofits include a new semi-automatic loading system and a nuclear, biological, and chemical (NBC) protection system. The driver's station has been retrofitted with passive night vision equipment. For the

L7 tank gun, India is developed a new Armor Piercing Fin Stabilized Discarding Sabot round.

Propulsion and Drivetrain

The propulsion and drivetrain programs mainly involve the retrofit of a new diesel engine to replace the L60 powerplant. The TN12 gearbox remains in all cases. In 1983, India began investigating several engine options for the Vijayanta, before finally selecting the Indian license-produced V-84 diesel engine, as used in the Indian license-produced T-72 tank. The Indian Defence Research and Development Organization has reportedly developed an improved version of the Russian engine.

Electronics

An integral part of the Bison program is a new fire control system for the Vijayanta. India is installing the Bharat Dynamics Tank Fire Control System Mark 1B (AL-4421); this system is reportedly a slightly modified SUV-T55A, developed in the former Yugoslavia. This upgrade package includes a new ballistic computer, improved gun control components, a muzzle reference system, and a laser rangefinder. The program also includes a land navigation system from Hindustan Aeronautics and passive (including thermal) night vision equipment.

Opportunities. The greatest potential through the mid-term for retrofit and modernization of the existing Mark 3 inventory appears to be the integration of the Mark 3(I) or, more likely, the Mark 3M enhancements described above. Vickers is offering these enhancements (without the modified hull) as a complete package, with a total unit price equivalent to US\$387,000. Vickers is also offering individual upgrade components.

The only major hull-related retrofit and modernization potential for the Mark 3 appears to lie in the retrofitting of the RO Defence (Royal Ordnance) ROMAR A or Vickers VARMA Series 2 explosive reactive armor to the tank. Another option is appliqué armor such as that offered by the German firm Diesenho. Explosive reactive armor, in the form of boxes bolted to the exterior of the tank, is available from a number of other sources, including Giat Industries, Israel Military

Industries (IMI), and various sources in the Russian Federation. The weight added by this type of armor is about 1.7 tonnes (1.87 tons). Another hull-related enhancement, standard in the new Mark 3M, is the installation of air conditioning in the crew compartment.

Fire Control. The new EFCS 600 fire control system and the EC 620 gun control system represent a great enhancement to the fighting capability of the Mark 3. As noted above, these are part of the present 3(I) and 3M packages; the components are also available for sale separately. A fire control suite is usually the greatest single cost driver in any modernization/retrofit program for tanks; the Mark 3 is no different. While the installation of such technology can be accomplished in-house by a number of nations, we expect that the current users of the Mark 3 would most likely leave programs of this type to the prime contractor or one of the modernization and retrofit centers specializing in such work.

Advanced Sight System/Laser Sight/Rangefinder. An advanced thermal sighting system or combined optic-electronic sight/laser rangefinder is virtually a necessity for any tank to be competitive with new-production tank designs. Numerous firms worldwide offer such equipment.

Passive Vision Devices. A wide variety of passive vision equipment for the commander, gunner, and driver is currently available on the open market. As the development of such technology is proceeding at a rapid pace, the integration of the next generation of these devices is fairly certain; this process should continue through the near term.

Vehicle Navigation System. The need to closely coordinate land forces on the modern battlefield in all conditions has driven the installation of vehicle navigation units. The premier system of this type is the U.S. Navstar Global Positioning System (GPS) program; GPS receivers are fast becoming standard equipment on a wide variety of vehicles, including the Mark 3M. Numerous other vehicle navigation systems are available from manufacturers worldwide.

Program Review

Background. Realizing that the high weight and high unit price of the then-current Chieftain tank would place it out of the reach of many potential customers, Vickers developed a smaller, cheaper tank. Started in the late 1950s, this program accelerated with India's selection of the Vickers design for indigenous licensed production. Following production of the first 90 tanks in the United Kingdom, the Vijayanta entered licensed production in India at the Avadi facility near Madras, beginning in

January 1965. Avadi subsequently produced a total of 2,187 Vijayanta tanks for India.

Shortly after the Indian program began, Vickers modified the original design and began offering it on the open market as the Mark 1. Kuwait purchased 70 Mark 1 tanks from Vickers; deliveries were made between 1970 and 1977.

Mark 1. The Mark 1 is of conventional design, with the driver's compartment to the front of the tank, the

fighting compartment in the center, and the powerpack to the rear. The hull and the turret consist of welded, rolled steel. The all-welded turret features an ammunition reload hatch on the left side and a storage basket at the rear. The driver's station includes a single-piece hatch cover and an AFV Number 44 Mark 2 wide-angle periscope. To the left of the driver is a storage area for 25 rounds of ammunition. The turret seats the commander to the left, with the gunner and loader to the right. The commander's station includes a single-piece hatch cover opening to the rear, a 10-power sight, and six periscopes. The loader's station includes a two-piece hatch cover and an observation periscope.

Standard equipment on the Mark 1 includes a fire detection and suppression system and removable rubber track pads. Optional equipment includes a flotation screen, night vision equipment, and a nuclear, biological, and chemical (NBC) defense system.

Although the Mark 1 is essentially the same as the Vijayanta, there are some minor differences in equipment and internal layout, accounting for the 1.4 tonne increased weight of the Vijayanta over the standard Mark 1.

Mark 3. In 1974, Vickers began the development of an enhanced Mark 1 tank, designated Mark 3. This tank follows the conventional interior layout of the Mark 1. Unlike the Mark 1, however, the loader sits to the left in the turret, with the commander and gunner seated to the right. We discuss the powerpack, armament, and fire control fits for the Mark 3 in the **Technical Data** section.

Mark 3(I). In 1984, Vickers began the development of an improved version of the Mark 3, based on an extensive evaluation of the original design in operational conditions. Vickers found the original Mark 3 power-to-weight ratio to be inadequate and a definite hindrance to marketing the tank. The integration of the Perkins CV12 TCE engine has remedied the power-to-weight ratio problem; a new chassis with a cast front and a new suspension with a rotary damping system provide a higher level of protection. While at least two nations had investigated the Mark 3(I) for possible procurement, Vickers failed to secure any orders; Vickers terminated its Mark 3(I) marketing effort in 1994.

Mark 3M. In response to a stated requirement from Malaysia, Vickers sent a standard Mark 3 tank to that Southeast Asian nation for evaluations in 1995. While these initial evaluations were highly successful, Vickers has attempted to improve its chances of securing the Malaysian contract by offering a further-improved Mark 3(I) design. The resulting tank, the Mark 3M,

features explosive reactive armor; an enhanced fire control suite with a thermal sight and GPS receiver; and air conditioning. We discuss these enhancements in **Technical Data**. In 1996, Vickers sent the Mark 3M to Malaysia for a further demonstration. Despite the Mark 3M enhancements, Malaysia ultimately selected the Polish PT-91 main battle tank, a T-72M1 derivative.

Mark 5. At the 1986 British Army Equipment Exhibition, Vickers – along with what was then FMC Corporation (now a component of United Defense Limited Partnership) of the United States – unveiled a new tank based on FMC's Close Combat Vehicle-Light. Actually more of a light tank due to its 19.75 tonne (21.77 ton) weight, the Mark 5 integrated an FMC hull with an all-new Vickers turret. We discuss the engine, gearbox, ordnance, and fire control in the **Technical Data** section. The tank followed the generally accepted tank layout, with the driver in the hull and commander, gunner, and loader in the turret. The turret was somewhat unusual in that it was tilted 3° forward to allow for a greater depression. In early 1994, Vickers and FMC suspended the marketing effort for the Mark 5 due to lack of interest.

Mark 7. Aside from the Challenger program, the Mark 7, represents the latest in the Vickers tank line. Although the 1982-1983 tests of the Mark 4 (Valiant) in the Middle East indicated that the Valiant tank had excellent firepower and fire control components, the mobility characteristics were deficient, leading to termination of the Mark 4 program. Further, the relatively light structure of the Valiant did not lend itself to the full potential of Chobham armor protection.

Therefore, in 1983, Vickers, in conjunction with Krauss Maffei, began the development of another new tank – the Mark 7 – incorporating the universal turret of the Valiant and the chassis and running gear of the Leopard 2. The Leopard 2 powerpack, described in the **Technical Data** section, gave the Mark 7 a power-to-weight ratio comparable to that of the Leopard 2. The Mark 7 armor protection was probably not quite up to that of the Leopard 2, Challenger 2, or M1 Abrams. The most recent version, the Mark 7/2 prototype, mounts a new turret with improved fire control components, enabling an enhanced fire-on-the-move.

However, politics, and not technology, killed the Mark 7 program. In July 1989, the Federal Republic of Germany effectively halted the Mark 7 trials in Abu Dhabi by refusing to release the Leopard 2 chassis. The official reason for this refusal was that the Federal Republic of Germany would not release military equipment to areas of possible tension. Since that time, the Mark 7 program has been dormant.

Funding

The contractor, Vickers Defence Systems, funded the development of all the Vickers tanks covered in this report.

Recent Contracts

Vickers Defence Systems has not released any contract information since the 1990 Nigerian contract for an unspecified number of Mark 3 tanks.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Late	1950s	Concept development
August	1961	Mark 1 accepted for production in India
January	1965	Mark 1 (Vijayanta) serial production begun
Late	1968	Sale of Mark 1 to Kuwait
	1974	Mark 3 development begun
May	1977	Vickers provided with details of Chobham armor
July	1977	First order for Mark 3 (Kenya)
August	1977	Design of Mark 4 (Valiant) initiated
June	1980	Mark 4 (Valiant) unveiled
June	1982	Mark 4 (Valiant) with "universal" 120-millimeter turret exhibited
Early	1983	Mark 4 (Valiant) tested in Middle East
October	1983	Mark 7 development begun
January	1984	Mark 4 (Valiant) development completed, Mark 3 (I) development begun
Early	1985	Development of Mark 5 begun
July	1985	Mark 4 (Valiant) marketing effort terminated
October	1990	Additional export order for Mark 3
Mid	1994	Production of Mark 3 dormant
	1995	Mark 3 demonstrated in Malaysia
March	1996	Mark 3M revealed
Early	2003	Mark 3 and 3M available for new orders

Worldwide Distribution

Export Potential. British armored vehicles, especially tanks, enjoy a great deal of respect worldwide. Vickers Defence Systems – as the only remaining tank producer in the United Kingdom – can offer a wide range of models to suit any desired level of sophistication and any price range. While Alvis Vickers will continue to aggressively market the more sophisticated (and more expensive) Challenger 2 on the international market, we expect only a moderate level of export sales for this tank. The more moderately priced Vickers tanks discussed in this report clearly offer more opportunities for sales on the export market.

Countries. **India** (2,277 Vijayanta); **Kenya** (76 Mark 3); **Kuwait** (70 Mark 1s in the inventory before the 1991 Gulf War); **Nigeria** (144 Mark 3).

Forecast Rationale

Our latest review of the Vickers Mark 1, Vijayanta, Mark 3, Mark 3(I), Mark 3M, Mark 5, and Mark 7 tank programs has uncovered few noteworthy developments over the last year. The Mark 3M tank lost out to the PT-91 for the Malaysian contract; Vickers is continuing the marketing effort elsewhere in the world.

The Mark 3(I), Mark 5, and Mark 7 programs remain dormant. The Mark 3M has effectively superseded the Mark 3(I). The advent of the FMC (now United Defense) M8 Armored Gun System effectively killed the Mark 5 effort, despite the U.S. Army's rejection of the M8. United Defense continues, albeit unsuccessfully, to market the M8 on the international

market. The Mark 4 (Valiant) program never went anywhere. Its follow-on program, the Mark 7, died at the hands of strict German export laws; we do not expect Vickers to revive the Mark 7.

The Mark 3, while never taking the market by storm, has been a good income source for Vickers. Despite the recent loss to the Polish PT-91 in Malaysia, the Mark 3 is still a viable, cost-effective tank for the export market. Vickers continues to improve upon its marketability with enhancements, as evidenced by the 3(I) and, more recently, the 3M versions. These factors, plus the tank's other well-known attributes, should ensure its continued presence in the market for some time to come.

Balancing the expected marketability of the Vickers Mark 3 series is the reality that Vickers has not been able to sell any Mark 3 tanks since the 1990 Nigerian contract. While the Mark 3 clearly has the potential to do well on the international market, the current glut of tanks on the market has precluded any sales.

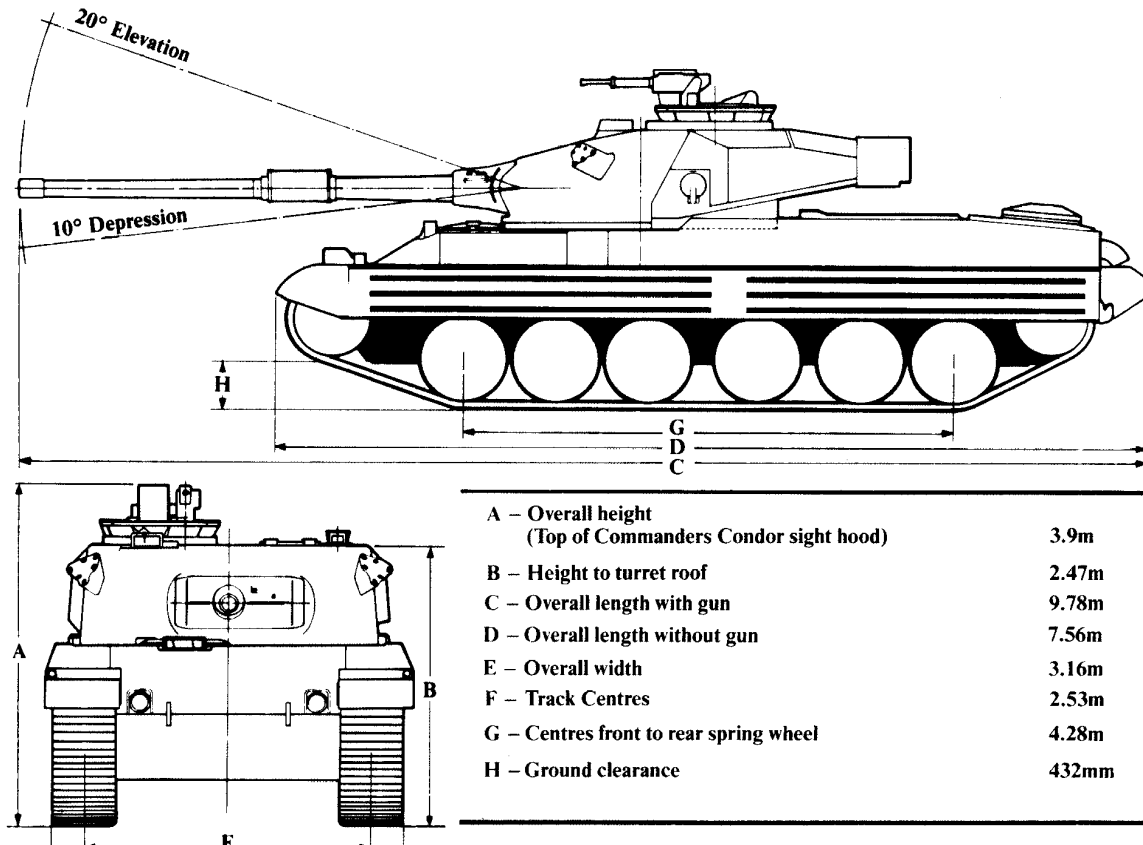
We base our ten-year outlook (below) on procurement information which still indicates that at least some Mark 3M export sales are possible within the forecast period. If we uncover indications that such sales are, in fact, unlikely, we will consider the entire Vickers tank program (excluding, of course, the Challenger 2) to be dormant. In that event, we will then drop this report from our annual supplement, but the report would remain archived for future research.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

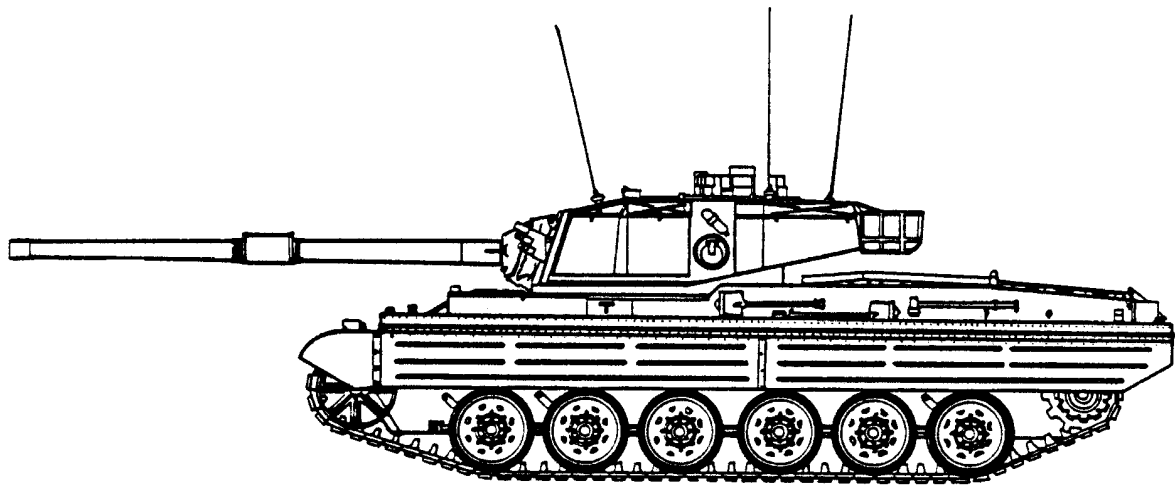
Vehicle	(Engine)	thru 03	High Confidence Level				Good Confidence Level				Speculative		Total 04-13	
			04	05	06	07	08	09	10	11	12	13		
ALVIS VICKERS LIMITED														
MARK 1 (a)	L60 MK4B	162	0	0	0	0	0	0	0	0	0	0	0	0
MARK 3 (b)	12V-71T	222	0	0	9	10	2	0	0	0	0	0	0	21
MARK 3I (c)	CONDOR V12-TCE	2	0	0	0	0	0	0	0	0	0	0	0	0
MARK 4 (d)	CONDOR V12-TCA	2	0	0	0	0	0	0	0	0	0	0	0	0
MARK 5 (e)	6V-92TA	2	0	0	0	0	0	0	0	0	0	0	0	0
MARK 7 (f)	MB 873 KA 501	2	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal - ALVIS VICKERS LIMITED		392	0	0	9	10	2	0	0	0	0	0	0	21
AVADI COMPANY (Licensee)														
VIJAYANTA (g)	L60 MK4B	2187	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal - AVADI COMPANY (Licensee)		2187	0	0	0	0	0	0	0	0	0	0	0	0
Total Production		2579	0	0	9	10	2	0	0	0	0	0	0	21

- (a) Production includes two prototypes, one of which was sent to India, plus 90 Mark 1 tanks configured as the Vijayanta for India.
- (b) Production includes two prototype/development tanks. It does not include any specialized variants. The forecast production is for unidentified export.
- (c) Production through 2003 consists of the prototype/developmental tanks that were used for contractor demonstrations. Vickers no longer markets this tank.
- (d) Production is for the initial prototype/developmental tanks.
- (e) Production through 2003 is for the initial developmental prototype tanks that are were used for contractor demonstrations.
- (f) The historical production is for the initial two prototype and developmental tanks.
- (g) Production includes two prototype/developmental tanks but does not include the 90 tanks supplied by Vickers at the beginning of the program.



Mark 3

Source: Vickers Defence Systems



Mark 1/Vijayanta

Source: Forecast International