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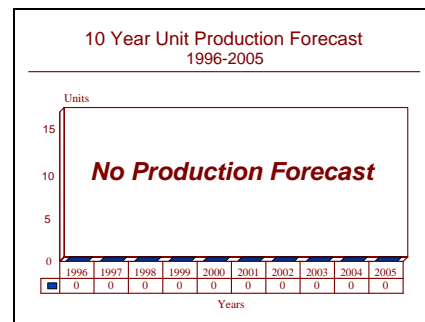
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EE-9 Cascavel - Archived 8/98

Outlook

- Program is no longer in production.
- Due to the demise of Engenheiros Especializados, no additional production is forecast .
- The technical data package is being offered by the creditors.
- This vehicle was widely sold on the international market.



Orientation

Description. A wheeled vehicle.

Sponsor. The Cascavel is a private development program funded by Engenheiros Especializados SA.

Contractors. The EE-9 was developed and manufactured by Engenheiros Especializados SA (ENGESA); Sao Paulo, Brazil. Major subcontractors include Cockerill Mechanical Industries, Detroit Diesel Corporation, Allison Transmission Division of General Motors Corporation, Mercedes-Benz do Brazil and Zahnradfabrik Friedrichshafen.

Licensees. None

Status. Production of the Cascavel is dormant as a result of Engenheiros Especializados ceasing operations in late 1993 due to bankruptcy.

Total Produced. As of January 1, 1995, a total of 2,709 EE-9 vehicles had been manufactured.

Application. A highly mobile and fast scout/reconnaissance vehicle to neutralize heavier armored vehicles, including some older tanks.

Price Range. In equivalent 1993 United States dollars, the unit price of the Cascavel was \$154,800 for the basic Mark V vehicle armed with the EC-90 cannon.

Technical Data

Crew. Three: commander, gunner, driver

Configuration. 6x6

Dimensions. The following data are for the Cascavel Mark VII, the latest production standard.

	<u>SI units</u>	<u>US units</u>
Length	6.22 m	20.40 ft
Width	2.64 m	8.66 ft
Height	2.68 m	8.79 ft
Combat weight	13.4 tonnes	14.77 tons
Fuel capacity	390 liters	103.72 gal

Performance. The maximum speed and range data are on surfaced roads.

Maximum speed	103 km/h	63.9 mph
Maximum range	880 km	546.48 statute miles

	<u>SI units</u>	<u>US units</u>
Step	60 cm	1.96 ft
Trench	73 cm	2.40 ft
Slope	30%	30%
Gradient	60%	60%
Fording	1.1 m	3.61 ft

Engine. The Mark I version of the Cascavel is powered by a Perkins model 6357 diesel engine. The Marks II, III, V, VI, and VII are powered by the Mercedes Benz do Brazil OM 352 A six cylinder in-line liquid cooled diesel engine, rated at 141.74 kilowatts (190 horsepower) at 46.67 revolutions per second (2,800 revolutions per minute). With this engine, the power-to-weight ratio is 10.58 kilowatts per tonne (12.86 horsepower per ton). The alternate standard, used in the Mark IV, is the Detroit Diesel Corporation 6V-53N liquid cooled diesel rated at 158.15 kilowatts (212 horsepower). With this engine, the power-to-weight ratio is 11.8 kilowatts per tonne (14.35 horsepower per ton). A dual 24 volt electrical system (12 volt in the hull and 24 volt in the turret) with four batteries is fitted to all versions except the Cascavel Mark I.

Gearbox. For the Mark IV version of the Cascavel, the Allison Transmission Division of General Motors Corporation provides the MT-643 automatic gearbox with four forward and one reverse gear ratios integrated with a two-speed ENGESA transfer case. The same firm provides the AT-540 or AT-545 automatic gearbox for the Mark III and Mark V vehicles. The Mark I and II versions of the vehicle are fitted with a Clark manual gearbox with five forward and one reverse gear ratios. Steering is of integral hydraulic type supplied by Zahnradfabrik Friedrichshafen.

Suspension and Running Gear. The 6x6 Cascavel uses the ENGESA designed boomerang suspension system consists of a rigid axle that is attached to the chassis by a double leaf spring assembly and two hydro-pneumatic dampers which are attached to two laterally mounted walking beams. The 12.00x20 run flat tires are linked to a central tire pressure regulation system.

Armament. Early models of the Cascavel were equipped with a 37 millimeter cannon taken from M3 Stuart light tanks. All the later production models are equipped with a 90 millimeter cannon; a few with the Giat Industries D921A but the majority with the Cockerill 90 millimeter cannon which is manufactured under license by Engenheiros Especializados as the EC90. For complete details of the Cockerill 90 millimeter cannon, we suggest review of the pertinent report in the Munitions and Ordnance book that is a companion service to this. The turret is designated ET-90 and is produced by the prime contractor. The EC90 cannon employs the latest high-strength, Electro Slag Refined steel construction for the barrel, breech block and the triple-baffle muzzle brake. The Electro Slag Refined castings are provided by Electrometal-Acos Finos SA, Campinas, Sao Paulo, Brazil. Secondary armament is a coaxial 7.62 millimeter machine gun. A M2HB 12.7 millimeter anti-aircraft machine gun is optional. Forty-four rounds of Armor Piercing Fin Stabilized Discarding Sabot, High Explosive Anti-Tank, High Explosive Squash Head, High Explosive or White Phosphorous 90 millimeter ammunition can be carried, while up to 2,000 rounds of 7.62 millimeter ammunition can be stored. Six smoke dischargers are mounted on the turret, three per side.

Fire Control. The gunner's sight is a Rank Pullin SS 123 periscopic sight with an integral image intensifier; this sight has a ten power magnification. The laser rangefinder is provided by Ferranti; the Model 520 unit is a neodymium/yttrium-aluminum garnet type. The commander's station is provided with a Rank Pullin SS 141 periscopic sight with integral range finder; magnification is 2.7 power.

Variants/Upgrades

As of mid-1995, no significant modernization or retrofit programs had yet been developed for the EE-9. For the near to mid term, the best potential for the modernization and retrofit of the Cascavel are related to the upgrading of the early model engines and armament suites to the latest standard.

Variants. As of late 1993, the time production went dormant; there had been no distinct variants of the EE-9 developed to production status.

Anti-aircraft Variant. In mid-1986, there were reports that Iraq was concluding a 250 unit deal with Engenheiros Especializados for a new Cascavel variant. Other than the fact that the new variant was to be equipped with a 25 millimeter cannon optimized for anti-aircraft (specifically helicopter) use, no other details are known and as of mid-1991, it was almost certainly dead.

A specialized vehicle was developed in the mid-eighties that used some Cascavel components.

Uruvel. In 1985, the first news was heard of a new joint Engenheiros Especializados SA/FMC Corporation program called Uruvel. The Uruvel was an integration of the turret of the EE-9 Cascavel with the hull and chassis of the EE-11 Urutu. An expected agreement between the then FMC Corporation and Engenheiros Especializados was supposed to give FMC 51 percent of the production and

Engenheiros Especializados the remainder, if the United States Army would procure the vehicle. The United States Army was examining the possibility of procuring up to 600 vehicles of this type for low intensity conflicts. As of early 1987, nothing additional had been heard of this program and if it existed in the form just described, it has been dead for some time.

Program Review

Background. In July of 1970, Engenheiros Especializados started design work on a new reconnaissance and patrol vehicle designated Cascavel. The design of the new vehicle was based on the EE-11 Urutu armored personnel carrier; the first prototype was completed in November of 1970. For a full description of the EE-11 Urutu, please refer to the separate report in this section. The rapid time schedule from design to first prototype fabrication demonstrates that the Cascavel shares many common features and characteristics with the Urutu armored personnel carrier; for example, both vehicles share a common engine and gearbox. However, the Cascavel has heavier armor and mounts the 90 millimeter cannon for its primary mission as a fast assault vehicle.

By late 1989, Brazil's Army and Marine Corps needs had been filled; slightly over 300 vehicles were delivered for Brazil's four mechanized infantry brigades and six armored battalions within eight divisions as well as the marine units. Brazil calls the vehicle the Carro de Reconhecimento sobre Rodas.

Vehicle Description. The EE-9 shares many of the components of the EE-11 armored personnel carrier. Both vehicles use many standard automotive components which are available worldwide.

The hull is of all welded construction using a contractor developed dual hardness armor. The armor is 8.5 to 16 millimeters in thickness. The driver is seated in the front on the left side. A hatch is provided the driver, as are three periscopes providing a 120° field of view. The engine is to the rear and is accessed via two hatches. The ENGESA-developed Boomerang walking beam suspension allows a maximum of 90 centimeters travel vertically, which ensures that all four rear wheels remain in contact with the ground over difficult terrain. A dual 24 volt battery/electrical system is provided: one for vehicle operations and turret drive and the other solely for starting the engine. The pneumatic over hydraulic brakes are disc type and an automatic tire inflation system is standard. Optional equipment includes air conditioning, heater, other types of laser rangefinder, night vision equipment and an automatic fire extinguisher.

The ET-90/500 turret has the commander and gunner seated on each side; both crew members are provided a hatch. Turret specifications follow:

Turret weight	1.8 tonnes
Turret length (with cannon)	4.8 meters
Turret width	0.8 meters
Turret height	58.5 centimeters
Cannon elevation/depression	+15°/-8°
Traverse	360°

A total of 44 main armament and 2,000 secondary armament rounds can be carried. The gunner is provided with a telescopic sight linked to the main armament for fire control. The EE-9 vehicles supplied to Tunisia are reported to be fitted with the OIP LRS-5 fire control system.

Production Models. The EE-9 has proven to be easily developed and offered with various options in the following production models:

Mark I. This first prototypes and initial ten pre-production vehicles had a Perkins model 6357 engine, a manually operated gearbox and no central tire inflation system. These vehicles mounted a single 37 millimeter cannon and did not have the dual electrical system. Most of these vehicles have been rebuilt with the ET-90 turret. This model did not enter serial production.

Mark II. This was the first serially produced model; it was fitted with the Mercedes-Benz engine, a manually operated gearbox and no central tire inflation system. The dual 24 volt electrical system (12 volt in the hull and 24 volt in the turret) was first fitted to the Mark II. This model had 37 millimeter cannon but most have been rebuilt with the ET-90 turret and EC-90 cannon. By the early eighties, the Mark II model was no longer produced; the Brazilian Army was the only customer.

Mark III. The first model designed for the export market, fitted with the dual electrical system, Mercedes-Benz engine and the AT-540 automatic gearbox. A centrally controlled tire air pressure system for increased ability to cross difficult stretches of soft terrain became a standard feature with the Mark III. This model had the Hispano-Suiza H-90 turret with the D921A cannon. Introduced in

1979, by the late eighties, the Mark III model was no longer produced.

Mark IV. Major firepower and automotive improvements characterize the Cascavel Mark IV which was introduced in 1976. Chief among the automotive improvements is the fitting of the uprated Detroit Diesel 6V-53N diesel engine. An Allison MT-643 automatic gearbox is fitted to handle the higher engine capacity. Drum brakes have been replaced by disc systems. The ET-90 turret with the EC-90 cannon was introduced with this model. The Mark IV incorporates enhanced vision equipment within the ET-90 turret to include night sighting ability for both commander and gunner. The externally mounted 7.62 millimeter ma-

chine gun is able to be fired from within the turret by remote control. These changes reflect an ability to enhance mobility and night fighting capabilities.

Mark V. This is the same as the Mark IV but equipped with the Mercedes-Benz diesel engine linked to either the AT-540 or AT-545 automatic gearbox.

Mark VI. This model is essentially the same as the Mark V but powered by the OM 352A engine and incorporating other minor automotive improvements.

Mark VII. This is the Mark VI fitted with the MT-643 gearbox.

Funding

The EE-9 was developed with the contractor's private funds.

Analysis. Libya did much for the success of Engenheiros Especializados in general and the EE-9 in particular. The available evidence is that a good number of EE-9 vehicles were sold or distributed through Libya to other nations, particularly Chad and Iran, as well as revolutionary movements friendly to those nations. Most of these transfers have gone unrecorded, as have some sales to nations wishing to remain unidentified. The only way they

are confirmed is when the vehicles turn up in the service of previously unidentified users. Some of these nations are almost certainly in sub-Saharan Africa; the recent addition of Burkina Faso to our list of users is indicative of this. Of course, sales of this type, essentially with no strings attached, are a main factor in ENGESA's meteoric rise in the armored fighting vehicle market.

Recent Contracts

Not available, as contractual information is not released.

Timetable

This timetable relates to the EE-9 only.

Jul	1970	Design started based on EE-11 Urutu
Nov	1970	First prototype completed
	1971-72	Test and evaluation of prototype vehicles took place
Sep	1973	First 10 production models delivered to Brazilian Army
	1974	New production facilities started up
	1978	New Brazilian-designed turret integrated with Cockerill 90 millimeter cannon
Mar	1979	First export order announced
Aug	1985	Uruvel program revealed
Late	1993	Production went dormant as Engenheiros Especializados ceased operations
Mid	1995	EE-9 remains in service

Worldwide Distribution

Export Potential. Prior to the financial difficulties experienced by the contractor, the export market for Cascavel had been brisk. Regardless of the competitive statements, Brazil is known for manufacturing quality products at cost-effective prices without government subsidy or political pressure. Before its production went dormant, research indicated that Jordan and Mozambique were to be the next probable customers for the EE-9.

Countries. The identified customers with their early 1995 inventories of the Cascavel include: Bolivia (24), Brazil (302), Burkina Faso (24), Chad (29 - captured), Chile (197), Colombia (120), Cyprus (126), Ecuador (22), Gabon (16), Ghana (3), Guyana (1), Iran (130), Iraq (232), Libya (380), Morocco (7), Nigeria (75), Paraguay (30), Polisario Front - Morocco (29), Qatar (20), Suriname (6), Togo (36), Tunisia (24), Uruguay (15), Venezuela (9) and Zimbabwe (90). Numerous other customers, mostly of the internal security type, remain unidentified.

Forecast Rationale

As of early 1995, production at Engenheiros Especializados remains dormant as a result of the firm ceasing operations due to bankruptcy in late 1993.

All of the evidence related to the Cascavel still indicates that many of the sales of the vehicle have been to internal security or similar organizations. These sales are of such a level that they pass unnoticed by most military journals; such an occurrence is common in this class vehicle.

While we are presently forecasting no additional production of the Cascavel, there are consistent rumors

circulating in industry that the company will come out of its financial problems, probably through the aid of some other firm. In relation to the latter, Vickers Defense Systems has been mentioned. Therefore, we will continue to monitor both the vehicle as well as the firm for events which could affect this forecast.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Vehicle	(Engine)	through 94	<u>High Confidence</u> <u>Level</u>				<u>Good Confidence</u> <u>Level</u>				<u>Speculative</u>		Total 95-04
			95	96	97	98	99	00	01	02	03	04	
ENGESA													
EE-9(a)	6V-53T	2709	0	0	0	0	0	0	0	0	0	0	0
Total Production		2709	0	0	0	0	0	0	0	0	0	0	0

(a) The historical production includes five prototype/developmental vehicles.