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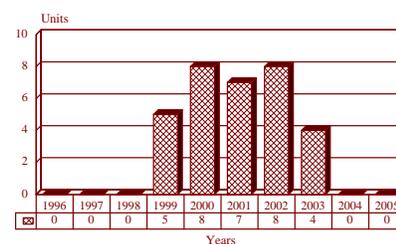
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ZA-35 Twin 35 mm Self-Propelled Anti-Aircraft Artillery System - Archived 6/97

Outlook

- System available for production orders.
- Being developed in several different configurations to enhance marketability.

10 Year Unit Production Forecast
1996 - 2005



Orientation

Description. A wheeled anti-aircraft artillery system.

Sponsor. This mobile air defense system was developed with the private funds of Denel Limited (and, prior to 1991, ARMSCOR), although these firms are owned by the government of the Republic of South Africa. The Ministry of Defence of the Republic of South Africa developed the requirement for this weapon system and has been present throughout its development.

Contractors. The ZA-35 is being developed and will be manufactured by Kentron, a subsidiary of Denel Limited (formerly ARMSCOR), Hennopsmeer, Republic of South Africa. The principal subcontractors are ESD, Lyttleton Engineering Works and Synertech. The contractors related to the Rooikat vehicle are described in Military Vehicles Forecast, a companion volume to this.

Licensees. None

Status. The first prototype of the ZA-35 is in the initial contractor test phase; this test program is being supported by various agencies of the South Africa Defence Force.

Total Produced. As of January 1, 1996, one developmental prototype of the ZA-35 had been manufactured.

Application. A highly cost-effective mobile air defense system effective against both fixed- and rotary-wing aircraft.

Price Range. In equivalent 1996 United States dollars, the unit price of the ZA-35 as described below is approximately \$4.848 million.

Technical Data

Crew. Three: commander, gunner, driver.
Configuration. 8x8 on the Rooikat chassis.

Cannon type and number. Two x GA-35 (also called M-35)
Cannon caliber. 35 millimeters

Ammunition. The GA-35/M-35 cannon of the ZA-35 system is chambered for the 35x228 standard ammunition in High Explosive, High Explosive Incendiary, High Explosive Incendiary-Tracer, Semi-Armor Piercing High

Explosive Incendiary, Armor Piercing Core Incendiary, Target Practice and Target Practice Tracer. Pretoria Metal Pressings, another component of Denel, has developed an improved range of ammunition in the same types.

Dimensions. All the following data are based on ZA-35 integrated with the Rooikat chassis (as the first prototype is) and are provisional, and, in some instances, estimated. The height of the ZA-35 system (which is estimated) is with the EDR 110 radar assembly retracted; with the radar elevated for operation, the height is 6.09 meters (19.98 feet).

	<u>SI units</u>	<u>US units</u>
Length	7.21 m	23.65 ft
Width	2.92 m	9.57 ft
Height	3.10 m	10.17 ft
Combat weight	32.03 tonnes	35.31 tons
Fuel capacity	510 liters	135.64 gal

Performance. The following data is for the automotive performance only; the cannon performance parameters are detailed in the Armament and Program Review sections below. The maximum speed and range data are on a metalled road or hard earth surfaces.

Maximum speed	96 km/h	59.62 mph
Maximum range	965 km	599.3 statute miles
Step	90 cm	2.95 ft
Trench	2.10 m	6.89 ft
Slope	29%	29%
Gradient	60%	60%
Fording	1.5 m	4.92 ft
Cannon elevation	81°	81°
Cannon depression	-8°	-8°
Traverse	360°	360°
Rate of fire	1,100 rounds per minute	1,100 rounds per minute

Engine. The ZA-35 uses an unspecified V-10 liquid cooled diesel engine which is rated at 420 kilowatts (563 horsepower). The manufacturer is undetermined. The power-to-weight ratio is 13.11 kilowatts per tonne (15.94 horsepower per ton). A 24 volt generator and six 12 volt 100 Ah batteries comprise the electrical fit of the vehicle. In addition, an auxiliary power unit consisting of an unspecified supercharged diesel engine-driven generator is mounted on the rear of the turret. The auxiliary power unit provides 40 kilowatts of electrical power to operate the vehicle's air conditioning, electronics and other fire control components as well as turret and armament operations. An emergency backup system can operate these components from the vehicle's electrical system through a slip ring assembly.

Gearbox. The ZA-35 uses an unspecified automatic unit with six forward and one reverse gear ratios and a hydrodynamic torque converter. Steering is mechanical with hydraulic assistance.

Suspension and Running Gear. The suspension system of the 8x8 vehicle consists of each road wheel station being equipped with an internally driven trailing arm, coil spring assembly and a hydraulic shock damper. The tires are 14.00x20 radial run-flat type.

Armament. The ZA-35 has a fully rotating turret fitted with two GA-35 (also called M-35) 35 millimeter automatic cannon; the cannon was developed by Lyttleton Engineering Works. The cyclic rate of fire per cannon is 550 rounds per minute, the muzzle velocity is 1,175 meters per second (3,854.9 feet per second) with the High Explosive Incendiary round. The GA-35 weighs 435 kilograms (957 pounds) and is cocked by a hydraulically activated mechanism. The maximum effective range is around 3,000 meters (3,280.8 yards). The elevation and depression limits are +81° and -8° respectively, and the electrically operated turret rotates 360°. A total of 460 rounds of 35 millimeter ammunition (230 rounds per cannon) is stored in the turret and vehicle. The reloading of the ammunition bins takes about eight minutes per side.

Fire Control. The surveillance and target designation system is the EDR 110 radar, which is mounted on the roof of the ZA-35. Provided by ESD, the EDR 110 operates in the L band and can be operated whether the vehicle is static or moving. When not in operation, the EDR-110 unit folds down for storage. The range capability of this radar is 12 kilometers (13,123 yards) against fixed-wing aircraft and 6,000 meters (6,561.6 yards) against hovering rotary-wing aircraft. The turret crew monitor the radar via a flatscreen plasma display.

The principal fire control sensor is the AA-EOT electro-optic two axis stabilized tracker, which is positioned on the front of the turret. This modular device, provided by Kentron, incorporates a charge coupled device electro-optic viewing device with zoom capability for daylight use and a forward looking infrared channel for night use; primary fire control data is displayed in this sight. Also included in the AA-EOT sensor is an integral 20 pulse per second neodymium yttrium-aluminum garnet laser rangefinder. The gunner is provided with a dual display that is switchable between the daylight electro-optic viewer and the forward looking infrared device. The gunner tracks targets manually using a hand control device or automatically by means of a centroid automatic tracking device. As an option to the AA-EOT, the even

newer ETS-2000 radar/optronic tracking system can be fitted. This system, still in development, has a KA band tracking radar integrated with a forward looking infrared device, electro-optic viewer and a laser rangefinder. This sensor mix greatly enhances the performance of the system, which has an effective range of 12 kilometers (13,123 yards). The commander is provided with the AA-CS-300D one axis stabilized panoramic day sight from Kentron with dual (x3 or x10) magnification. With this sight, the commander can independently search for targets and then cue the gunner or optionally aim the twin 35 millimeter cannon himself. The ZA-35 is designed to be a component of an air defense system with fire control data transmitted by radio data link; it can also operate autonomously.

Variants/Upgrades

Not applicable to this system at this time.

Program Review

Background. In late 1991, the Republic of South Africa revealed two new self-propelled anti-aircraft systems, one missile based and the other cannon based. The new systems were developed in response to the increasingly sophisticated aircraft, including helicopters, that were expected to be encountered in the 1990s. The need for new technology of this type was demonstrated in the closing stages of the campaign in Angola, where the South African Defence Force encountered increasingly sophisticated and lethal aircraft. It was also found that the existing air defense systems lacked mobility sufficient to engage in the dynamic type of warfare that has long characterized the region. The maturation of attack helicopter technology was also viewed as especially significant. Several projections had a number of nations in the southern portion of Africa acquiring this technology in the 1990s.

The program to develop the new self-propelled anti-aircraft systems began in the early 1980s. The cannon based system, the ZA-35 (also called the ZA-SPADS) has had the lead in the development. The development of the missile-based system, the ZA-HVM, exists only in mock-up form as of late 1991. The concept development of the ZA-35 began in 1983 with the full scale development phase beginning in early 1986. The turret and hull of the

first prototype were fabricated in 1990 and the first prototype completed in May of 1991.

Vehicle Description. The hull of the prototype ZA-35 is mounted on the chassis of the Rooikat infantry fighting vehicle. The hull is of all welded steel construction designed to provide protection from 23 millimeter Armor Piercing projectiles over the frontal arc and 7.62 millimeter projectiles over the rest of the vehicle. The vehicle is divided into three sections with the driving compartment forward, the fighting compartment with the turret in the center and the engine and gearbox to the rear. The powerpack can be quickly removed for service or replacement as all connections are of a simple quick-release type. An escape hatch is standard as are bilge pumps, bullet-proof windscreens, episcopes, fording equipment, fire detection systems with fire extinguishers and extra sound insulation.

While the ZA-35 turret has initially been integrated with the chassis of the Rooikat armored vehicle, like other systems of this type, the ZA-35 turret can also be integrated with other platforms. The most immediate candidates are the unmodified Centurion tank chassis, the T.72 tank chassis and the chassis of the G6 155 millimeter self-propelled howitzer.

Funding

The development of the ZA-35 has been privately funded by the contractor, which is a component of the government-owned Denel Limited (and formerly, the ARMSCOR) firms.

Recent Contracts

None as contractual information is not released.

Timetable

This Timetable relates to the development of the ZA-35 system only and not to the MC 601 or Shark vehicles.

	1983	Concept development of a new self-propelled anti-aircraft artillery system began
Early	1986	Development of ZA-35 system began
	1990	Hull and turret fabricated
May	1991	First ZA-35 system completed
Mid	1991	ZA-35 testing program began
Sep	1991	ZA-35 program revealed
Mid	1996	Initial prototype testing ongoing, development continues

Worldwide Distribution

Export Potential. Even though the Republic of South Africa's geopolitical position has improved somewhat in the last year or so, it should still be some time before the country's weapons are more fully accepted on the international market. While the ZA-35 is generating a good deal of interest on the market, it is still far too early to forecast the export potential of this system.

Countries. One developmental prototype with the contractor in the Republic of South Africa.

Forecast Rationale

The 1991 public revealing of the ZA-35 program generated a good deal of interest in the international weapons community. However, due to the recent changes in South Africa's geo-political situation, it should not be until the late 1990s at the earliest that the system's characteristics and weaknesses (if any) are able to be fully judged. However, sources indicate that the ZA-35 appears to be an especially rugged and effective system designed for the harsh and somewhat unique characteristics of the southern region of Africa. The available technical data indicates that the ZA-35 is sufficiently advanced in terms of technology to operate in almost any sophisticated environment. Once the general distaste for weapons from the Republic of South Africa is gone, the ZA-35, as well as other weapons from this nation, can be more accurately appraised.

Due to the changed threat scenario as perceived by the Republic of South Africa, the changing internal politics of

the nation and the reduced funding available for the defense forces, the funding for an additional two developmental systems is not expected to be forthcoming. We still forecast a moderate serial production run for the domestic requirement; this should get underway in 1998 and total 21 systems. A few additional systems are expected to be sold on the international market.

Despite the major changes that have taken place in the Republic of South Africa as well as the region, it should still be some time before the general distaste for weapons from the Republic of South Africa wears off in the international community. However, some nation could always decide that the ZA-35 is just what it wants and the development program could be accelerated. In any event, we will continue to monitor this potentially significant program and update this report on an interim basis if warranted.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Ordnance	(Engine)	through 95	High Confidence Level				Good Confidence Level			Speculative			Total 96-05	
			96	97	98	99	00	01	02	03	04	05		
DENEL LIMITED/KENTRON														
ZA-35(a)	UNSPECIFIED		1	0	0	0	5	8	7	8	4	0	0	32
Total Production			1	0	0	0	5	8	7	8	4	0	0	32

(a) Production through 1995 is for the developmental prototype.