

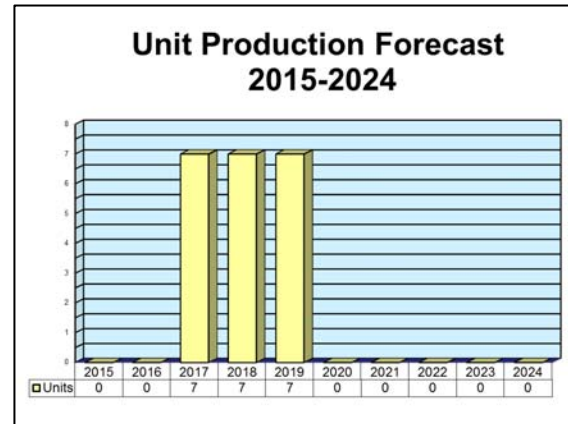
ARCHIVED REPORT

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G5 155mm Howitzer

Outlook

- G5 production line remains dormant; marketing continues
- Loss of Indian contracts in October 2005 over corruption scandal continues to severely impact export potential
- Forecast reflects only Denel's persistent hopes for possible export sales during the forecast period



Orientation

Description. A towed 155mm artillery system.

Sponsor. The South African National Defence Force (SANDF) sponsored the development and procurement of the G5.

Licensees. None. The Metalnor Ltd (formerly Industrias Cardoen) license lapsed around 1990.

Status. Development through serial production. The G5 production line remains dormant.

Total Produced. Through 2014, we estimate Denel produced 520 G5-series artillery pieces. In addition, Metalnor assembled one G5 under license.

Application. Indirect fire artillery support for maneuver forces at the battalion through division levels.

Price Range. In 2015 U.S. dollars, the basic G5 towed howitzer reportedly maintains a unit price of \$576,700.

Contractors

Prime

Denel SOC Ltd	http://www.denel.co.za , Nellmapius Dr, Irene, 0046 South Africa, Tel: + 27 12 671 2700, Fax: + 27 12 671 2751, Email: marketing@denel.co.za , Prime
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Technical Data

Crew. Eight.

Muzzle Brake. Single-baffle.

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Recoil System. Hydro-pneumatic.

Breech Mechanism. Interrupted screw stepped-thread.

APU. The G5 employs an air-cooled diesel engine for auxiliary power/propulsion. This engine generates 59 kilowatts (79.06 hp), with a power-to-weight ratio of 4.29 kilowatts per tonne (5.21 hp/ton) in the basic G5 application and 3.37 kW/tonne (4.09 hp/ton) in the G5-52 application.

Carriage Type. Split trail.

Shield. None.

Ammunition. In addition to all NATO-standard 155mm separate-bag ammunition types, Denel designed the G5 to fire Extended Range Full Bore (ERFB) ammunition in the following types:

- M1-series High Explosive ERFB
- Target Practice (TP)
- Target Practice-Tracer (TP-T)

The G5 is also compatible with the M90 and other modular charge systems. The ordnance can also fire the Velocity Enhanced Long-Range Artillery Projectile (VLAP) and the developmental PRO-RAM munitions.

Dimensions. The following data reflect the production-standard 45-caliber G5 Mark 3; data for the 52-caliber G5-52 is in parentheses where different.

	<u>SI Units</u>	<u>U.S. Units</u>
Caliber	155 mm	6.10 in
Length overall	11.1 (14.5) m	36.42 (47.57) ft
Towing length	9.5 (10.53) m	31.17 (34.55) ft
Barrel length (G5)	45 cal/6.98 m	45 cal/22.90 ft
Barrel length (G5-52)	52 cal/8.06 m	52 cal/26.44 ft
Traveling weight	13.75 (17.5) tonnes	15.15 (19.29) tons
Firing weight	13.75 (17.5) tonnes	15.15 (19.29) tons

Performance. The range and muzzle velocity data reflect Charge 3 Zone 6, firing ERFB/base-bleed projectiles. The traverse figure is above 15 degrees elevation; up to 15 degrees elevation, the piece can traverse 82 degrees (41 degrees left and right). The VLAP rocket assist/base-bleed projectile yields a maximum range of 50,000 meters (54,680 yd) from the 45-caliber G5 and 55,000 meters (60,148 yd) from the 52-caliber G5-52.

	<u>SI Units</u>	<u>U.S. Units</u>
Elevation	75°	75°
Depression	-3°	-3°
Traverse (total)	65°	65°
Maximum range	39,600 (42,500) m	43,307 (46,478) yd
Maximum rate of fire	3 (6) rds/min	3 (6) rds/min
Sustained rate of fire	2 (6) rds/min	2 (6) rds/min



155mm G5 Towed Howitzer

G5 155mm Howitzer

Source: Denel SOC Ltd

Variants/Upgrades

Variants. Denel assigns product-improved models of the G5 new Mark designations, the latest being the Mark 3. In addition, the contractor has developed the following variants of the basic G5 design:

<u>Designation</u>	<u>Description</u>
G5-52	Formerly known as G5-2000. Basic G5 carriage, mounting a 52-caliber barrel and the Kentron WMS 205 weapon management system. See Technical Data , above.
T5 Condor	45-caliber G5, mounted on a Tatra 8x8 truck chassis. In development.
T5-2000 Condor	52-caliber G5-52, mounted on a Tatra 8x8 truck chassis. In development.

Modernization and Retrofit Overview. Denel integrated a number of improvements to the basic G5 design as production cut-ins and retrofits. The Mark 2 and Mark 3 configurations integrate the following improvements:

Ordnance. To improve the performance of the 45-caliber ordnance, Denel integrated the G6 breech assembly. Other improvements include an improved recoil system, an improved traverse and elevation mechanism, a new muzzle brake, and a barrel temperature sensor with warning device.

Chassis. The chassis now features a new tow bar, allowing a wider range of tow-vehicle options. Denel also improved the lubrication and electrical distribution systems.

Ammunition. Continuing improvements in 155mm ammunition enhance G5 performance, as we note in the **Technical Data** section of this report.

52-Caliber Ordnance. In October 1992, information surfaced that Denel was developing and testing a 52-caliber version of the G5 ordnance, conforming to the NATO Quadrilateral Ballistics Agreement. Firing ERFB ammunition, the 52-caliber G5-52 (formerly G5-2000) features a maximum firing range of 42.5 kilometers (46,478 yd). The Velocity Enhanced Long-Range Artillery Projectile (VLAP) pushes the range out to 55,000 meters (60,148 yd).

Program Review

Background. The experience of the civil war in Angola and the subsequent military occupation of Namibia (formerly South West Africa) clearly demonstrated to the South African General Staff the deficiencies of the tube artillery then employed by South Africa.

Adapting a Foreign Design

In response, the South African Armaments Corporation (ARMSCOR) contracted with Space Research Corporation (Canada) for the purchase of a number of its GC-45 artillery systems and ERFB ammunition. Despite the United Nations-imposed arms embargo on the Republic of South Africa (which ultimately led to the demise of SRC in 1980), an unknown number of GC-45 cannon (or components thereof) found their way into South Africa during the 1970s.

During the period 1976 through 1979, the South Africans experimented with integrating the GC-45 ordnance with various carriages and ancillary equipment, yielding the G3 and G4 configurations. South Africa publicly revealed the 155mm G5 in late

1979. The G5 design is so different from the original GC-45 that it is essentially a distinct new piece.

In 1992, Denel (Pty) Ltd assumed the management of the G5 production program for the new South African National Defence Force (SANDF). The prime contractor currently operates as Denel SOC Ltd.

Description. Despite SANDF security restrictions, a fair amount of technical data concerning the G5 program have emerged in recent years.

Conventional Design

The carriage exhibits a conventional design, with the ordnance hinging through 180 degrees for travel. A walking-beam suspension and four large rubber-tired wheels provide superior cross-country mobility compared to other systems of this type. Although the APU can propel the piece distances up to 100 kilometers (62.5 mi), its primary function is to assist the piece into firing position.

Early models of the G5 featured a multi-baffle muzzle brake; the production models feature a single-baffle type.

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Sighting equipment consists of the standard British Number 9 dial sight (converted to metric measures) and a direct fire telescope for use out to 5,000 meters. The G5 fire control suite includes the EMVA Mark 10B muzzle velocity analyzer, S700 meteorological station, and AS 80 artillery fire control system. More recently, Denel integrated the AS 2000 fire control component with the G5.

Condor: Picking Up the Pieces

In 2002, Denel unveiled the T5 Condor as a contender for the Indian Army's much-delayed 155mm self-propelled howitzer procurement program. Denel had worked closely with Indian officials on the Condor design; Bharat Earth Movers (Bilaspur, India) was to act as subcontractor for the T5 Condor vehicular platform.

With the G5 and the T5 Condor, Denel hoped to capture both the towed and self-propelled segments of the Indian Army 155mm artillery requirement.

However, in October 2005, the Indian government canceled all business dealings with Denel over allegations of corrupt business practices by the South African contractor. This action by the Indian government was a body blow to Denel's export potential. Further, several countries in the Middle East are now reportedly pulling back from deals with South Africa in the wake of the scandal.

Denel continues to develop the Condor as a wholly indigenous project. The contractor is already offering the Condor on the international market.

Related News

G6 Renoster: Clinging to Hope – The G6 Renoster has yet to score any new sales since Denel completed an export order for Oman in 1999. Modernization and retrofit of the 43 systems remaining in active South African National Defence Force service constitute the only significant activity for this weapon system program.

Denel continues to promote the G6 Renoster as relevant to the modern battlefield. In 2012, Denel partnered with Raytheon for a live-fire demonstration of Raytheon's Excalibur 155mm precision-guided artillery projectile from a G6. Despite the successful firing demonstration, the effort garnered little more than yawns from the international market.

Denel still clings to hopes for export of complete G6 Renoster systems, despite the lack of any firm commitments for export sales of the G6 or the T6 turret system. Without export sales, the G6 Renoster production line will remain limited to the production of components and spares in support of sporadic modernization and retrofit work. (FI, 3/15)

South African Government Clears Denel, BAE Systems Land Systems Merger – South Africa's Competition Commission has approved the acquisition of BAE Systems' Land Systems South Africa (LSSA) by state-owned Denel.

Back in August 2014, BAE Systems had made the decision to sell off its LSSA division. An agreement was signed to proceed with the sale, which was valued at ZAR855 million (\$79.85 million) and was anticipated to conclude during the fourth quarter of 2014 after receiving regulatory and other approvals.

The transaction includes sale by BAE Systems of its 75 percent interest in LSSA, as well as sale by DGD Technologies (2001) Proprietary Limited of its 25 percent stake in LSSA, as LSSA is a joint venture between the two companies.

LSSA has comprised three business segments employing approximately 500 people. The LSSA business specializes in the design and manufacture of military tactical-wheeled vehicles, mechanical driveline products, precision-machined components and gears, fire directing systems, and remote weapon launching platforms, subsystems and products.

While Denel has not yet announced its intentions for LSSA, it seems probable that it will be grouped with Denel Land Systems (DLS), which is the group's weapons and turret systems house and which has the contract to manufacture the Badger infantry combat vehicle (ICV) for the South African Army. (Defenceweb.co.za, 12/14)

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Funding

The Department of Defence of the Republic of South Africa, through the South African National Defence Force, funded the development and SANDF procurement of the G5.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1976	South Africa begins talks with Space Research Corporation Canada regarding GC-45 procurement
	1979	South Africa acquires GC-45 components and technology
Mid-	1980s	Iraq acquires the G5
	1986	Industrias Cardoen secures license to produce the G5
	1989	Industrias Cardoen produces and test-fires its first prototype of the G5
	1991	Qatar places export order
Dec	2000	Malaysia places export order
	2004	Malaysian order complete
Oct	2005	India cancels all business dealings with Denel over corruption allegations
	2015	G5 production line remains dormant; development and marketing continue

Worldwide Distribution/Inventories

Export Potential. While the G5 offers an advanced design at a relatively low unit price, the increasingly glutted international market simply will not support significant sales at this time. The international trend toward 52-caliber artillery is quickly overtaking any advantages ERFB technology may have offered. Still, the contractor clings to hope that the G5 might still score some export sales during the forecast period as nations retire obsolete systems. Nevertheless, the apparent loss of a supply contract to fulfill India's requirement for some 400 to 700 new 155mm artillery pieces will severely limit Denel's sales prospects.

Countries. **Chile** (one GC-45 prototype; in negotiation for 28 new-production pieces); **Iran** (200); **Iraq** (possibly 200 prior to Operation Desert Storm; status unknown); **Malaysia** (28); **Qatar** (12); **South Africa** (72); and **Uganda** (6).

Forecast Rationale

The G5 production line remains dormant. No production of complete G5 artillery pieces has occurred since completion of the Malaysian follow-up order in 2004.

Denel SOC Ltd continues to offer the 45-caliber G5 and 52-caliber G5-52 howitzers on the international market, albeit without any new sales. The South African contractor also continues to develop the 45-caliber T5 Condor and 52-caliber T5-2000 Condor truck-mounted howitzers for possible export.

Minimal Export Potential

Denel SOC Ltd maintains persistent hopes for at least some export sales of the G5, G5-52, or T5 Condor as

nations replace obsolete systems. However, the export potential for Denel products continues to diminish rapidly. As with the self-propelled G6 Renoster program, the G5 production line will likely be limited to the production of components and spares in support of modernization and retrofit of existing tubes.

While the G5 offers an advanced design at a relatively low unit price, the increasingly glutted international market simply will not support significant G5 sales at this time.

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Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence				Good Confidence			Speculative			Total	
	Thru 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		2024
Denel SOC Ltd												
G5/52 (-2000)												
	520	0	0	7	7	7	0	0	0	0	0	21
Total	520	0	0	7	7	7	0	0	0	0	0	21