

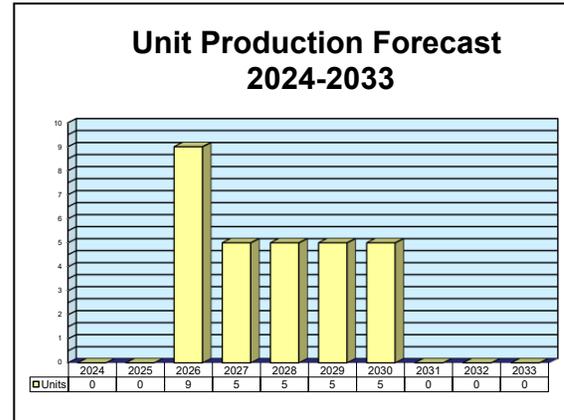
ARCHIVED REPORT

For data and forecasts on current programs please visit forecastinternational.com or call +1 203.426.0800

Cockerill and MECAR 90mm Guns

Outlook

- Serial production of KEnerga Mark 8 occurs on an as-needed basis only, with all earlier Marks still available
- MECAR 90 series remains out of production; used MECAR ordnance is still available on the secondary and tertiary markets
- Forecast reflects as-needed production of KEnerga Mark 8 for possible export sales only



Orientation

Description. Medium-caliber ordnance systems, optimized for light armored vehicle applications.

Sponsor. Cockerill Mechanical Industries (now CMI Defence) developed the Mark series as a private venture. MECAR SA likewise developed the 90/28 and 90/46 ordnance as private ventures.

Licensee. None.

Status. Development through serial production.

Total Produced. Through 2023, FI estimates Cockerill produced 2,383 Mark series and 329 KEnerga Mark 8 guns.

Before production ceased, MECAR produced 1,361 90/28 light guns, 117 90/28 towed guns, and three 90/46 (KEnerga Mark 8) 90mm guns.

Prior to its demise, Engenheiros Especializados produced 967 EC-90 guns under license.

Application. Main armament for light armored vehicles, providing fire support to infantry units during both offensive and defensive operations.

Price Range. In 2024 U.S. dollars, the Cockerill Mark III MA1 carries an estimated unit price of \$338,000.

The KEnerga Mark 8 carries a 2024 estimated unit price of \$385,000.

Contractors

Prime

CMI Defence, Cockerill Mechanical Industries	http://johncockerill.com/en/defense , Avenue Greiner 1, Seraing, Belgium, Tel: + 32 4 330 2444, Fax: + 32 4 330 2582, Prime
MECAR	http://www.mecar.be , Rue Grinfaux 50, Petit-Roeulx-lez-Nivelles, Belgium, Tel: + 32 67 876 411, Fax: + 32 67 211 823, Email: marketing@mecar.be , Second Prime

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 75 Glen Road, Suite 302, Sandy Hook, CT 06482, USA; rich.pettibone@forecast1.com

Cockerill and MECAR 90mm Guns

Technical Data

Cockerill Mark I through Mark VII

Crew. Per vehicle application.

Muzzle Brake. Single-baffle.

Recoil System. Hydromechanical (concentric springs).

Breech Mechanism. Vertical sliding block.

Bore Evacuator. None.

Ammunition. Specific 90mm ammunition types per Mark are as follows:

Mark I/II/III. The Cockerill Mark I through Mark III fire the following NATO-standard 90mm ammunition types:

- NR 125 Canister
- NR 501 High Explosive-Tracer (HE-T)
- NR 478 High Explosive Anti-Tank-Tracer (HEAT-T)
- NR 479 High Explosive Anti-Tank-Target Practice-Tracer (HEAT-TP-T)
- NR 220 High Explosive Anti-Tank-Tracer-Heavy (HEAT-T-H)
- NR 503 High Explosive Squash Head-Tracer (HESH-T)
- NR 502 Smoke White Phosphorous Tracer (S-WP-T)

- NR 219 High Explosive-Anti-Personnel-Fragmentation (HE-AP-Frag)

The HEAT and HESH rounds are fin stabilized. In addition, the NR 232 Armor Piercing Fin Stabilized Discarding Sabot-Tracer (APFSDS-T) round is available for the Mark III MA1.

Mark IV. The Cockerill Mark IV fires the following types of NATO-standard 90mm ammunition:

- NR 185 HE-T
- NR 181 HEAT-T
- NR 182 HESH-T

These rounds are fixed-fin stabilized. The Mark IV also fires the NR 232 APFSDS-T round.

Mark VII. The Cockerill Mark VII fires the following types of NATO-standard 90mm ammunition:

- NR 320 APFSDS-T
- NR 299 HEAT-T
- NR 300 HESH-T
- NR 321 HE-AP

The Mark VII can also fire standard NR 125 Canister, NR 479 HEAT-TP-T, NR 219 HE-AP-Frag, and NR 232 APFSDS-T rounds.

Dimensions. The following data reflect the Mark III MA1.

	<u>SI Units</u>	<u>U.S. Units</u>
Caliber	90 mm	3.54 in
Gun length	3.506 m	11.50 ft
Barrel length	36 cal/3.24 m	36 cal/10.63 ft
Gun weight	456 kg	1,003.2 lb

Performance. The range data reflect firing HE-T ammunition.

	<u>SI Units</u>	<u>U.S. Units</u>
Maximum effective range	1,500 m	1,640.42 yd
Maximum rate of fire	11 rds/min	11 rds/min
Sustained rate of fire	8 rds/min	8 rds/min
Recoil stroke	30 cm	11.81 in
Trunnion pull	8.5 tonnes	9.37 tons

Cockerill and MECAR 90mm Guns

KEnerga Mark 8

Note: Because the KEnerga Mark 8 is essentially a development of the MECAR 90/46, the following technical data also apply to the MECAR 90/46.

Crew. Per vehicle application.

Muzzle Brake. Double-baffle.

Recoil System. Hydropneumatic.

Breech Mechanism. Cam-operated, semiautomatic, horizontally sliding block.

Bore Evacuator. None.

Ammunition. The KEnerga Mark 8 is compatible with the following types of NATO-standard 90mm ammunition:

- APFSDS-T
- S-WP-T, TP
- Canister

- HE
- HEAT-T

In addition, MECAR developed the following ammunition types specifically for the 90/46 and KEnerga Mark 8 applications:

- M652 APFSDS-T
- M616 HE-T
- M624 HE-AP-Frag
- M617 HEAT-T-H
- M620 HEAT-T
- M618 Smoke-T
- M621 Canister
- M625 HESH-T

Dimensions. The following data reflect the KEnerga Mark 8.

	<u>SI Units</u>	<u>U.S. Units</u>
Caliber	90 mm	3.54 in
Gun length	4.67 m	15.34 ft
Barrel length	46 cal/4.14 m	46 cal/13.58 ft
Gun weight	610 kg	1,342 lb

Performance. The range data reflect firing HE ammunition.

	<u>SI Units</u>	<u>U.S. Units</u>
Maximum effective range	2,000 m	2,187.2 yd
Maximum rate of fire	10 rds/min	10 rds/min
Sustained rate of fire	7 rds/min	7 rds/min
Recoil stroke (max)	40 cm	1.31 ft

MECAR 90/28

Crew. Per vehicle application.

Muzzle Brake. Double-baffle.

Recoil System. Hydropneumatic.

Breech Mechanism. Cam-operated, semiautomatic, horizontally sliding block.

Bore Evacuator. None.

Ammunition. The 90/28 is compatible with the following types of NATO-standard 90mm ammunition:

- Smoke-WP-T
- HE
- HEAT
- TP
- Canister

Dimensions. The following data reflect the 90/28 ordnance, as mounted on armored vehicles.

	<u>SI Units</u>	<u>U.S. Units</u>
Caliber	90 mm	3.54 in
Gun length	3.13 m	10.27 ft
Barrel length	28 cal/2.90 m	28 cal/9.51 ft
Gun weight	274 kg	602.8 lb

Cockerill and MECAR 90mm Guns

Performance. The range data reflect firing HE ammunition.

	<u>SI Units</u>	<u>U.S. Units</u>
Maximum range	4,000 m	4,374.44 yd
Maximum rate of fire	10 rds/min	10 rds/min
Sustained rate of fire	7 rds/min	7 rds/min
Recoil stroke	40 cm	1.31 ft
Trunnion pull	2.5 tonnes	2.76 tons

MECAR 90/28 Towed Gun

Note: *The MECAR 90/28 towed gun is optimized for the anti-tank mission. Due to its relatively low weight, this piece is also an effective mountain and jungle warfare weapon. Germany, Italy, and Switzerland have employed it as a mountain gun.*

Muzzle Brake. Double-baffle.

Carriage Type. Tripod.

Shield. None.

Ammunition. The 90/28 towed gun is compatible with the following types of 90mm ammunition:

- HEAT-CAN 90 (High Explosive Anti-Tank)
- HE-CAN 90 (High Explosive)
- CNT-CAN 90 (Canister)
- SMK-CAN 90 (White Phosphorous Smoke)

Dimensions. The following data reflect the latest production version of this towed ordnance.

	<u>SI Units</u>	<u>U.S. Units</u>
Length	3.50 m	11.48 ft
Traveling width	136 cm	4.46 ft
Traveling height	125 cm	4.10 ft
Weight	880 kg	1,936 lb
Elevation	+12°	+12°
Depression	-10°	-10°
Traverse	360°	360°

Performance. Essentially the same as the basic 90/28 ordnance.



Scorpion 90 CVR(T) Mounting Cockerill 90mm Mk 3MA1 Cannon

Source: BAE Systems plc

Cockerill and MECAR 90mm Guns

Variants/Upgrades

Variants. Not generally applicable.

Modernization and Retrofit Overview. There is essentially no modernization or retrofit potential for these guns. Enhancements have thus far been limited to the development of more modern ammunition to enhance performance.

In the late 1980s, MECAR (the original developer and producer of the 90/28 and 90/46 ordnance) began investigating ways to increase the anti-armor performance of the Cockerill series. The result was the M652 APFSDS round and a new single-baffle muzzle brake. The new muzzle brake still accommodates other ammunition types. The M652 round and the new muzzle brake entered production in 1990.

Program Review

Background. A Scotsman, John Cockerill, established the Cockerill ordnance firm in 1817. Through the Second World War, the high quality of Cockerill products made the firm one of the best known developers and producers of heavy armament for both vehicle and ship applications. For three decades following the war, the company limited itself to the licensed production of other designs. In 1973, Cockerill re-entered the field of weapons design with its Cockerill 90mm ordnance.

Description. All Cockerill 90mm guns exhibit an electro-slag refined steel composition.

Unique Steel Composition

This unique Cockerill manufacturing process consists of purifying, through two successive melting processes, special alloy steels. This progressive melting and solidification, combined with successive passages through a slag pool of special composition, enhances the steel's unique homogeneity and cleanliness. The process results in significantly lower sulfur and oxygen content, as well as the elimination of shrinkage cavities and other defects.

Guns of the Resurgent Cockerill

Cockerill test-fired the first new gun (the Mark I) in 1974; the design entered production as the improved Mark II (with a modified recoil mechanism) in 1976.

Common Basic Design

All production models of the Cockerill Mark series employ a semiautomatic vertical-sliding breech assembly, with manual backup. The triple baffle muzzle brake, which is on all versions except those firing APFSDS ammunition, absorbs 70 percent of the propellant gas force and 40 percent of the recoil energy.

That same year, Cockerill sold license-production rights for the Mark II to Engenheiros Especializados SA of Brazil, which produced the ordnance as the EC-90. ENGESA subsequently acquired a license for the Mark III, the last production standard of Engenheiros Especializados before it ceased operations in 1993.

The recoil mechanism is a hydro-concentric design, integrating a hydraulic buffer/recuperator with two concentric springs.

At least 31 combat vehicle types worldwide mount Cockerill 90mm ordnance.

The following table summarizes the Cockerill 90mm ordnance line:

<u>Designation</u>	<u>Description</u>
Mark I	Initial 1974 prototype model.
Mark II	Initial production standard.
Mark III	Main production standard.
Mark IV	Specifically for 20-tonne (22.04-ton) class tanks. Production began in 1979 for integration with AMX-13 (Mark IVA3) and M41 (Mark IVA1/2) tanks. By the end of 1993, Cockerill had produced approximately 32 Mark IV pieces; Uruguay accepted 22 pieces for its M41 tanks.
Mark V	Developmental piece, used to test technology to reduce trunnion pull and enhance barrel life.
Mark VI	Developmental piece, used to test technology to reduce trunnion pull and enhance barrel life.
Mark VII	Last Cockerill-designed member of the series; a high-pressure weapon, essentially a more robust version of the Mark III. The Mark VII underwent initial test-firing in 1983.

Cockerill and MECAR 90mm Guns

Scorpion 90. In 1974, Cockerill successfully integrated its 90mm ordnance with the Alvis (now BAE Systems Land Systems) Scorpion light tracked vehicle. The Scorpion 90 CVR(T), featuring the Alvis-Cockerill 90 turret, is a standard variant of the FV101 Scorpion line.

CM 90 Turret. This system – designed specifically for Malaysia's 162 SIBMAS AFSV 90 vehicles – features a turret-mounted Cockerill 90mm ordnance, designated CM 90 (Cockerill-Malaysia 90). The turret has been test-fitted with at least 17 other combat vehicle types.

MECAR 90mm Cannon Line

MECAR 90/28. The 90/28 gun dates to the late 1950s, when MECAR began developing a light but powerful gun suitable for mounting on wheeled vehicles in the 7- to 14-tonne (7.72- to 15.43-ton) class. Despite its relatively limited range, the 90/28 has only about half the weight of most comparable systems.

The sliding breech mechanism is semiautomatic; case ejection is automatic. User satisfaction with the 90/28 has been high; barrel wear is reportedly very low.

MECAR 90/46. To deal with the heavier armored threats of the 1980s and beyond, MECAR began to develop a greatly enhanced 90mm system in 1977. As a 90mm weapon system could deal with modern heavy armor only by firing APFSDS ammunition, MECAR

concurrently developed the M603 series APFSDS round specifically for the new ordnance.

MECAR derived much of the 90/46 design from the earlier 90/28. The 90/46 is distinguishable from the 90/28 by its longer barrel (46 cal versus 28 cal), greater weight, and a generally more robust construction to accommodate firing the APFSDS ammunition. The 90/46 also features a high-efficiency, two-stage muzzle brake.

However, the 90/46 never experienced any significant sales, owing to the following agreement between Cockerill and MECAR.

Cockerill-MECAR Collaboration

In 1992, Cockerill and MECAR (Cockerill's longtime main competitor) finalized an agreement whereby Cockerill would acquire the production rights to the MECAR 90/28 and the new 90/46 gun. MECAR would then concentrate its development efforts on a new line of 90mm ammunition for the 90/46.

Cockerill further refined the 90/46 design, marketing it as the KEnerga Mark 8. The KEnerga (kinetic energy) portion of the name comes from the MECAR side; the Mark 8 retains the Cockerill nomenclature system. The switch from a Roman numeral in the designation further differentiates the Mark 8 from the previous Cockerill product line.

Funding

The respective contractors (CMI Defence and MECAR) funded the development of the Cockerill Mark series and the MECAR 90mm ordnance as private ventures. The single licensee, ENGESA, funded some additional development on its own prior to its demise.

Worldwide Distribution/Inventories

Export Potential. Outside of France, Belgium is the only source for new-production 90mm ordnance in Europe today. The Cockerill and MECAR products have been a major factor in Belgium's leadership in the 90mm field.

The first major success for the KEnerga Mark 8 resulted from its integration with the Cockerill LCTS 90 turret. Qatar selected the Piranha 8x8 vehicle with this turret package; Kuwait subsequently selected the turret package for its Pandur vehicle order. In addition, Saudi Arabia specified the KEnerga Mark 8 for its 130-unit Piranha order.

Countries

Cockerill 90mm Ordnance (including the KEnerga Mark 8). **Bolivia, Botswana, Brazil, Burkina Faso, Canada, Chile, Colombia, Cyprus, Ecuador, Gabon, Indonesia, Iran, Iraq, Italy, Kuwait (KEnerga Mark 8), Libya, Malaysia, Morocco, Nigeria, Panama, Paraguay, Philippines, Qatar (KEnerga Mark 8), Saudi Arabia (KEnerga Mark 8), Singapore, Spain, Suriname, Thailand, Togo, Tunisia, Uruguay, Venezuela, and Zimbabwe.** In addition, at least nine other nations using this ordnance remain unidentified.

MECAR 90/28 Ordnance. **Angola, Belgium, Cameroon, Gabon, Germany (towed piece for the Bundeswehr; vehicle-mounted ordnance for the national police), Haiti, Indonesia, Italy (both vehicle and towed versions), Malaysia, Portugal, Singapore, and Switzerland (towed).**

Cockerill and MECAR 90mm Guns

Forecast Rationale

Outside of France, Belgium is the only source for new-production 90mm ordnance today. The Cockerill and MECAR products have been a major factor in Belgium's leadership in the 90mm ordnance market.

The popularity of armored vehicles in the under-20-tonne (22.05-ton) class, along with the growing trend toward mounting heavier armament on these vehicles, could continue to support low-rate production of the KEnega Mark 8 through the next decade.

In October 2013, Textron unveiled its Commando Select 90mm Direct Fire vehicle, mounting a CMI Defence Cockerill CSE 90LP weapon system that features the proven Cockerill Mk 3 90mm low-pressure gun.

Sales of Belgian 90mm ordnance occurs at moderate, albeit somewhat uneven, levels. However, much new

production goes unreported, emerging only as new or retrofit vehicles roll out somewhere sporting Cockerill ordnance.

Scorpion 90 CVR(T) for Ukraine?

In March 2023, the Serhiy Prytula Charity Foundation reportedly launched an international crowdfunding campaign to purchase British Army-surplus Scorpion 90 Combat Vehicles Reconnaissance (Tracked) for the Ukrainian Army. The Scorpion 90 CVR(T) mounts the Cockerill 90mm Mk 3MA1 cannon.

The crowdfunding campaign reportedly raised in excess of \$6.4 million. However, the Forecast International Weapons Group has yet to confirm any actual Scorpion 90 CVR(T) purchases or deliveries to Ukraine directly related to this initiative.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION													
Designation or Program	Thru 2023	High Confidence					Good Confidence			Speculative			Total
		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033		
CMI Defence													
KEnega Mk 8													
	329	0	0	9	5	5	5	5	0	0	0	29	
Total	329	0	0	9	5	5	5	5	0	0	0	29	