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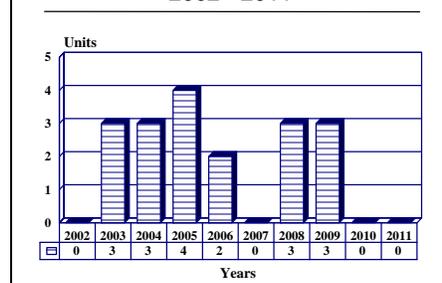
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Rayo 160 mm Multiple Launch Rocket System - Archived 8/2003

Outlook

- Production of the Rayo system is forecast for Chile
- No orders from export market are expected until later in the forecast period
- The Rayo has only a minimal modernization or retrofit potential, and then in the outyears

10 Year Unit Production Forecast
2002 - 2011



Orientation

Description. A wheeled multiple launch rocket system.

Sponsor. The Rayo is a private development of the contractor Fabricas y Maestranzas del Ejercito through the Chile Ministry of National Defense, War Materiel Department.

Contractors. The Rayo multiple launch rocket system is being developed and is to be manufactured by Fabricas y Maestranzas del Ejercito, Santiago de Chile, Chile. BAE Systems/RO Defence (Royal Ordnance), London, England, United Kingdom, is the principal subcontractor. Air Log, Computing Devices of Canada, MAN, and SOMCHEM are the known subcontractors. Fabricas y Maestranzas del Ejercito and RO Defence have established the firm FAMAE Ordnance Limitada in Santiago in order to market the Rayo outside Chile.

Licensees. None

Status. Two lightweight towed launchers have been fabricated for contractor and operational testing. Testing of the first prototype on a 6x6 truck chassis is ongoing. A production contract for the Rayo has yet to be awarded.

Total Produced. As of January 1, 2002, one prototype wheeled Rayo system had been manufactured.

Application. A mobile rocket-based fire support system for the destruction of a variety of targets by means of multiple barrages.

Price Range. In equivalent 2002 United States dollars, the projected unit price of a fully loaded 12-round Rayo truck-mounted system is \$1,424,200.

Technical Data

Crew. Three

Training & Elevation Mechanism. Electrohydraulic with manual backup.

Vehicle. The Rayo prototype is mounted on a MAN SX 2000 6x6 truck chassis; other heavy wheeled vehicles as well as tracked vehicles can also mount the Rayo system.

Dimensions. As detailed dimensional data for the SX 2000 chassis mounting the Rayo System are not known except for the number of launch tubes, the following data are for the Rayo High Explosive rocket only.

	<u>SI units</u>	<u>US units</u>
Launcher vehicle		
Launch tubes:	24	24
Rocket		
Length:	3.19 meters	10.47 feet
Diameter:	160 millimeters	6.29 inches
Weight:	122 kilograms	268.4 pounds

Performance. The following data are provisional and are for the High Explosive version of the Rayo rocket only. During the year 2000 firing tests of the rocket, a range of 52,000 meters (56,867 yards) was achieved.

	<u>SI units</u>	<u>US units</u>
Launcher elevation:	60°	60°
Launcher depression:	0°	0°
Launcher traverse (left and right):	105°	105°
Maximum rocket range:	45,000 meters	49,212 yards

Propulsion. The Rayo rocket uses an aluminized hydroxyl terminated polybutadiene solid-propellant motor of an unknown weight. RO Defence has been involved with the development of this motor and its aluminum casing, which meets the requirements of an insensitive munition.

Warhead. Two types of warheads have been developed for the Rayo rocket; these warheads, the High Explosive Fragmentation warhead (RDX-TNT filling) and submunition dispensing warhead, were developed by RO Defence. The High Explosive warhead weighs 40 kilograms (88 pounds). No information has yet been released on the submunition dispensing warhead.

Launcher Mode. The truck-mounted Rayo system uses two 12-tube launcher packs (rocket pod containers) for a total of 24 rounds. The rocket pod container is supplied as a loaded environmentally protected unit. The proposed tracked system would have a similar configuration mounted on a modified tank or light tracked vehicle chassis. The launch tube has a groove

that imparts a spin to the rocket as it travels down the tube. The firing is accomplished electrically. The SOMCHEM component of Denel Limited provides some of the components of the launcher.

Control & Guidance. Three wrap-around fins pop out after the rocket exits the launch tube; these fins, plus the spin imparted by the launch tube, provide aerodynamic stabilization. Various ranges are achieved by varying the elevation of the launcher.

Fire Control. The fire control of this truck-mounted system, unlike many others, is rather sophisticated and allows for fire missions to be conducted autonomously or through orders coming from a forward observer or central command vehicle. As the truck-mounted Rayo has an onboard global positioning system-based fire control suite, it can also operate autonomously. Firing is automatic after programming or manual. Computing Devices of Canada provides the fire control computer. The launch vehicle is equipped with a radio or land-line link to the fire control officer.

Variants/Upgrades

Variants. The Rayo system is also planned for integration with a tracked vehicle; most light tracked vehicle and tank chassis are able to be integrated with the Rayo 12-tube launcher. In most cases, two 12-round rocket packs can be fitted. The trailer-mounted towed version of the Rayo has already

been tested. This version mounts a single 12-round pack and is not fitted with a reloading crane.

Modernization and Retrofit. None at the present or through the midterm, as the Rayo system has yet to enter production.

Program Review

Background. In 1988, the Chilean Ministry of National Defense developed a requirement for a new multiple launch rocket system. Fabricas y Maestranzas del Ejercito, the state-owned weapons development and production firm, began the concept development of the new system in late 1988. The firm's senior staff subsequently determined that some international expertise would be required to develop the system, especially the rockets. Solicitations were extended to a number of international firms, including Israel Military Industries and the then Royal Ordnance. In early 1990, Royal Ordnance was selected to develop the rocket warheads and propulsion components.

The first complete prototype of the Rayo was assembled in 1997, and the system was publicly unveiled in September of that year in a military parade. Contractor and operational trials began in 1998, and the first phase was completed in March 1999. A second series of trials was followed by the formal qualification trials, which were completed in early 2000. A contract award is expected in the immediate future, certainly by 2003. The procurement objective for Chile has not been disclosed, but our research indicates that it should be for 12 systems, sufficient for two batteries; six will be ordered, at least initially. When full-scale serial production gets under way, the filling and final integration of the rockets will take place at a new

production facility located at Talagante, approximately 40 kilometers southwest of Santiago.

Description. The Rayo system was designed from the outset to be able to be integrated with a variety of wheeled and tracked vehicles. In addition, a lightweight trailer-mounted system was developed so that the widest range of customer requirements could be addressed. The trailer-mounted system is designed for rapid aerial transport. Other than the fact that the MAN SX 2000 6x6 truck is the lead launch platform, little else is known about the launcher. Originally, other launch packs of 16 and 20 rounds were investigated. The self-propelled systems use two 12-round launch packs, and a crane is mounted for reload purposes.

As with the launcher, little is known about the Rayo 160 millimeter rockets. One rocket will mount a High Explosive fragmentation-type warhead that is optimized for soft targets and thin-skinned vehicles. This rocket will be fitted with a fuze that can be set to detonate at various heights or with a point-detonating fuze. The second type of rocket is fitted with a submunition-dispensing warhead; this version is fitted with a time fuze and approximately 100 submunitions. RO Defence has been developing both warheads as well as other components of the rocket, such as the aluminum motor casing; the rocket qualifies as an insensitive munition.

Funding

Funding for the development of the Rayo program has been provided by Fabricas y Maestranzas del Ejercito through the government of Chile.

Recent Contracts

Not available, as contractual information is not released.

Timetable

The following timetable should be considered provisional.

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Late	1988	Chile developed a requirement for a new multiple launch rocket system
	1988	Development of Rayo program begun
	1989	Solicitations for development assistance issued
February	1990	Royal Ordnance selected to assist in rocket development
March	1990	Rayo program announced at FIDAE 1990 weapons fair
Late	1996	First complete Rayo system mounted on SX 2000 chassis completed
September	1997	Rayo system unveiled at Santiago parade
March	1999	First operational trials completed
Mid	2002	Final development and testing continuing

Worldwide Distribution

Export Potential. Chile is still a relatively new and unknown player in the world’s weapons market. Despite the fact that Fabricas y Maestranzas del Ejercito has exported some small arms and ammunition, it will take some time for its offerings to be evaluated by the market. However, our research confirms that several countries have already expressed an interest in the Rayo.

Country. **Chile** (one wheeled prototype)

Forecast Rationale

As of mid-2002, the developmental portion of the Rayo program is essentially complete, and a contract award can now be expected by late 2002 or early 2003. The evidence indicates that the developmental and operational testing of the first prototype, mounted on a MAN SX 2000 chassis, has proceeded with no real problems; in point of fact, the rocket has exceeded the 45,000 meter range requirement by 7,000 meters.

Based on the almost certain order from Chile, we are forecasting that the serial production of the Rayo will

get under way almost immediately after the order is received. A total of six Rayo systems are forecast to be procured by Chile under the initial order, with six more following. By 2007 or possibly earlier, an order from the export market should also be addressed. Malaysia, Sweden, and Venezuela have all expressed interest in the Rayo, as have several unidentified nations.

Approximately 32 loads of rockets (768) should be procured for each Rayo vehicle.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Ordnance	(Engine)	High Confidence Level			Good Confidence Level			Speculative			Total 02-11		
		through 01	02	03	04	05	06	07	08	09		10	11
FAMAE/RO DEFENCE													
RAYO (a)	SOLID ROCKET	1	0	3	3	4	2	0	3	3	0	0	18
Total Production		1	0	3	3	4	2	0	3	3	0	0	18

(a) Production forecast is for the wheeled version of the Rayo only as a complete system. The through 2001 production is for the developmental and contractor demonstration system.