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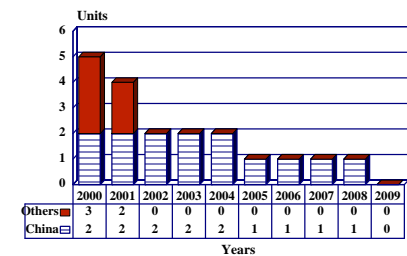
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Giat 100 mm L55 Compact Gun - Archived 5/2001

Outlook

- Standard French Navy medium-caliber gun
- Export potential relatively limited
- Competition tough against 76 mm and 5-inch guns
- Saudi Arabia important for current applications; maybe Horizon
- Chinese production of unknown quantity believed to continue

10 Year Unit Production Forecast
2000 - 2009



Orientation

Description. General-purpose, medium-caliber automatic gun mount.

Sponsor

Delegation Generale pour l'Armement (DGA)
19/21 Rue du Colonel Pierre Avia
F-75015 Paris
France
Tel: +331 41087171
Fax: +331 41080027

Contractors

Giat Industries
13 Route de la Minière
F-78034 Versailles cedex
France
Tel: +33 1 30 97 37 37
Fax: +33 1 30 97 39 00
Marketing Department
Tel: +33 1 30 97 39 91
Fax: +33 1 30 97 39 67
URL: <http://www.giat-industries.fr>
(gun and live ammunition)

Delegation Generale pour l'Armement (DGA)
19/21 Rue du Colonel Pierre Avia
F-75015 Paris
France
Tel: +331 41087171
Fax: +331 41080027
(training munitions)

Licensee. The gun is being produced in China for the Jiangwei, Luhui and Luhai class frigates.

Status. Production and service.

Total Produced

Model 53: 58 remain in service
Model 68: 65 are in service or on order
Compact: 8 guns in service

Large numbers of Model 53 and some Model 68 guns have been withdrawn from service. The latter have probably been refurbished and used for new construction ships.

Application. The gun is said to be equally effective against missiles, aircraft and surface ships.

Platform. The 100 mm L55 is the French Navy's standard medium-caliber, dual-purpose gun. It is suitable for deployment on corvettes, frigates and larger warships.

Price Range. Based on a comparison of similar systems, it is estimated to cost between US\$2 million and US\$2.5 million.

Technical Data

Specifications	Metric	US
<i>Caliber:</i>	100 mm	3.9 in
<i>Weight Gun Mount:</i>	13.400 kg	13.2 tons
<i>Weight Below Decks:</i>	3.600 kg	3.54 tons
<i>Effective Range/Surface:</i>	15.000 m (PFHE, HE: 17,5 km)	13,700 yd
<i>Effective Range/Air:</i>	4.500 m (Compact: 6 km)	4,144 yd
<i>Round Weight:</i>	23,59 kg	52 lb
<i>Projectile Weight:</i>	13,5 kg	29.7 lb
<i>Muzzle Velocity:</i>	870 m/sec	2,854 ft/sec
<i>Elevation Limits:</i>	-15/+80 deg	
<i>Elevation Velocity:</i>	33 deg/sec	
<i>Elevation Acceleration:</i>	95 deg/sec ²	
<i>Train Limits:</i>	350 deg	
<i>Train Velocity:</i>	50 deg/sec	
<i>Train Acceleration:</i>	57 deg/sec ²	
<i>Maximum Rate of Fire:</i>	90 rpm	

Design Features. The Compact system is a lighter-weight derivative of the standard 10 mm L55 Model 1953 or Model 1968 naval gun mount. The Compact mount achieves its small size by the use of micro-electronic chips and plastic components. The ammunition supply consists of a main magazine below the gun with a 12-round secondary magazine. Both magazines are modular with 24-round palletized units.

Ammunition is carried up from the magazines in a duct to an intermediate 18-round magazine that elevates with the gun. Maximum capacity for the secondary and intermediate magazines combined is 24 rounds

(conforming with the palletizing arrangements). The shells are paired with a space between pairs. The gun barrels are water-cooled and have a service life of 3,000 rounds.

Operational Characteristics. The Compact model is entirely automatic, requiring no on-mount crews. The gun is remotely controlled and operated by a single man in the CIC. Only two men are needed to operate the magazine. The intermediate magazine, which is more typical of smaller caliber guns, makes the gun ready for operation more rapidly and allows for quick availability of alternative types of ammunition.

Variants/Upgrades

100TR. This is the designation for a modernization program developed by Creusot-Loire, intended to offer reduced radar cross-section. Serviceability of the system is expected to be so high that maintenance intervals could be raised to seven years, according to the manufacturer. This should be achievable by locking all movable components when not in use. The components unlock automatically when the turret is started up. The upgrade's current status is not known.

Compact. A lighter weight version for export markets was developed from the original design. Also unmanned, the mount can fire preselected 1-, 2-, 3- or 6-round bursts.

Compact Mark 2. This was introduced at the Bourget Navale exhibition in 1990. The mount stores 66

ready-use rounds of three types, with a magazine extension option available to increase storage up to 114 rounds. Instant selection between the different ammunition types is provided. Firing speed is selectable between 90/85, 45 and 20 rpm.

The automated ammunition replenishment system, first introduced for the Mark 2, is available as a retrofit for other 100 mm gun mounts of previous generations as well.

Barrel life is increased from the base model to 6,000 rounds, or is rated as 3,000 rounds under heavy use. The weapon is designed to remain functional after seven years without servicing. The gun mount also features reduced radar cross-section. Its proximity-fuzed

pre-fragmented round, with tungsten ball bearings, is considered highly effective against missiles and aircraft.

ENG-2. The Chinese license-build the Giat 100 mm gun for the latest version of the Luda frigates. A Chinese 100 mm twin mount is also available. One report suggests this use of the French gun in a Chinese mounting.

Model 1953. The original version of the gun uses an analog fire-control system (CTA) with electro-mechanical computer. The director can operate either in optronic or radar modes. The gun has a rate of fire of 60 rounds per minute and weighs 22,000 kilograms. A Model 1964 exists as well, also featuring an electro-mechanical computer.

Model 1968. This version is slightly lighter in weight than the 1953, with a training speed of 40 deg/sec vertically and an elevation speed of 25 deg/sec. Model 1968, as well as its further variant 1968-II, uses a digital fire-control system (CTD) which in some cases is integrated with the ship's SENIT CDSs. The system features either a magnet or disk memory. It is normally outfitted with a light radar director but can be outfitted with an optical director.

The gun's rate of fire was increased from 60 to 78 rpm, thanks to the upgrade program CADAM (Cadence de tir Ameliore).

Program Review

Background. Immediately after World War II, the French Navy introduced a twin 5-inch mount and a twin 57 mm gun. These were both based on imported weapons: the 5-inch used US 5 inch L38 ammunition, while the 57 mm system was a license-built version of the Bofors 57 mm L60. These were interim systems, intended to equip ships started prior to the war and suspended during the German occupation. When financial conditions permitted the restart of the French naval industry, it was decided to replace both systems with a single dual-purpose gun.

Design studies were begun in 1953 on a new mount that would have faster firing, train and elevation rates. The French warship design teams had made a conscious decision to restrict the size of their hulls, to reduce initial costs and also to enhance the export prospects of their ships. This precluded the installation of separate anti-aircraft and anti-surface guns. The new gun would have to fulfill both roles, so an intermediate caliber was accepted. Initially, a 105 mm caliber was selected so that supplies of German 105 mm ammunition could be used; this was quickly discarded in favor of a 100 mm weapon. This lacked the rate of fire of smaller guns (90 rpm for the contemporary US 3 inch L70) and the hitting power of larger weapons (30 pounds, as opposed to 70 on the US 5 inch L54 Mk 42, which had a similar rate of fire).

The new mount, Model 53, was introduced to the fleet in 1959. A slightly modified version was introduced in 1964, while a greatly improved version was introduced in 1968/69. The 1968 version used digital fire-control systems instead of the analog systems used by the earlier models. The first exports of the system were made to Germany in 1962, with an order for eight guns for its Hamburg class destroyers and Köln class frigates.

Portugal was the next foreign nation to order the system, with an order for four guns in 1966 for the Commandante Joao Belo class frigates.

Creusot-Loire's designers began developing a faster, lightweight design in 1977. The prototypes were tested in 1981, and production of this model known as the Compact began in 1983. The first models were sold that same year to Malaysia and Saudi Arabia, which ordered four guns each. The La Fayette class frigates ordered in 1994 by Saudi Arabia carry 55 Compact Mk 2 models. That new Compact version was intended for export use, this platform being presumably the first client (the Malaysian orders were prior to the availability of the Mk 2 model, in the early 1980s).

In 1992, the 100 mm L55 started to appear on new-construction Chinese warships amid rumors that a license for production had been granted. Although these were countered by suggestions that Chinese acquisition had been restricted to two guns and that a Russian weapon had been chosen for future construction, it is understood that the license had been granted. Installation on new-construction Chinese ships continued through 1993, and some aspects of 100 mm L55 technology were subsequently applied to older guns in Chinese service.

A new version of this gun, the Compact Mark 2, was introduced in 1990. The main difference between this weapon and the earlier mark is its significantly improved reliability compared to the previous versions. This was achieved through improved voice communications from the operator's console and new software in the ammunition supply system. The first export sale was apparently that for the Saudi La Fayettes. The mounts on the Malaysian Musytari and Kasturi classes may have been upgraded as retrofits to Mk 2 level since

their original installation. Retrofit activity is expected to continue with other customers as well.

Giat took over full responsibility for the 100 mm L55 in 1993 and initiated plans to add two new extended-range rounds to the ammunition types available. These would use base bleed to extend range and comprise a unitary and a carrier round as munitions. Funding for these new rounds would depend on the selection of the 100 mm L55 as the main armament for the Project Horizon Common New Generation Frigate (lately a bi-national program between Italy and France only).

It appears more likely that at least Italy and possibly also Britain (for its substitute Type 45 class), would be leaning more toward the 127 mm Otobreda gun for the Horizon. If the UK Royal Navy does opt for the Italian gun, the weapon would be built locally on license in Britain.

The Model 1968 will continue to be a significant part of the French naval systems package for both the domestic and international market. Recent contracts for the La Fayette class frigates for Taiwan will see production carried through the forecast period.

However, it is puzzling why the export-oriented lightweight 100 mm Compact has failed to achieve any significant market penetration thus far, despite the weapon's obvious advantages. Part of the problem may lie in the age of the system. The gun was conceived at a time when medium-caliber guns were still the primary armament of frigates and destroyers. Consequently, the design team concentrated on developing a high-performance weapon at a cost of substantial mounting weight, trunnion load and ship impact.

The choice of 100 mm caliber was probably a mistake since the original Model 53 is deficient in rate of fire for anti-air warfare (AAW) use and in shell weight for anti-submarine warfare (ASuW). US and Italian warships both adopted more generous hull dimensions and a combination of 5-inch and 3-inch guns, rather

than a compromised intermediate caliber. When guns became relegated to a secondary, relatively insignificant, part of the ship's battery during the 1960s and 1970s, and with the emergence of missiles, the 100 mm gun became an obvious anomaly.

The development of the Compact mount was an attempt to produce a lightweight derivative of Model 68 to compete with the US 5-inch L54 Mark 45, the British 4.5-inch L55 Mark 8, and the Italian 76 mm L62 Compatto. The combination of a large shell (by 76 mm standards) and a high rate of fire (by 5-inch standards) with a very lightweight mounting provided serious engineering challenges, and there is much cause to suspect that the mounting is unreliable and suffers from excessive shot dispersion. The French Navy has thus far not adopted it, and continues to procure the heavier Model 68 mount. The retention of 100 mm caliber has made the gun too large for the FAC and corvette markets, while most frigate designs today use either the 76 mm OTO Melara due to its AAW efficiency, or the 5-inch L54 Mk 45 for its ASuW effectiveness. The French La Fayette class is one exception to that pattern, but that is obviously because of ship carrying domestically-built weapons systems onboard as a package solution.

It remains to be seen how long the Compact Mk 2 remains in production; new sales of the entire unit are not being publicized by the manufacturer, but apparently a great deal of upgrade activity continues with the older versions already in use.

In the future, only the Model 68 will be offered, with the Model 53 being long out of production. France has a long tradition of marketing weapons even after any serious hopes of major sales are gone. This involves producing small batches of equipment at irregular intervals, to support the marketing and to meet specific orders. Consequently, the Compact line will remain available for orders in the foreseeable future, even though no major successes are foreseen.

Funding

This program is funded by the Delegation Generale pour l'Armement (DGA) for the French Navy and exports.

Recent Contracts

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Creusot-Loire	N/A	1992 — Malaysian contract to upgrade its existing 100 mm guns to the Mk 2 standard, including new software in the ammunition supply.

Timetable

<u>Year</u>	<u>Major Development</u>
1953	Design studies began
1959	Model 1953 entered service
1964	Modified version of Model 1953 introduced
1968	Model 1968 entered service
1977	Design work for Compact version began
1981	Production model of Compact version tested
1983	Compact version entered service
1990	Compact Mark 2 introduced
1992	Malaysia upgraded to Mk 2 specifications

Worldwide Distribution

Model 53

France. 8 on Foch aircraft carriers, 4 on Jeanne d'Arc helicopter carrier, 7 on Commandante Riviere corvettes
Germany. 9 on Hamburg frigates, 8 on Rhein depot ships
Portugal. 12 on Commandante Riviere corvettes
Turkey. 4 on Gelibou frigates
Uruguay. 6 on Commandante Riviere frigates

Model 68

Argentina. 3 on A-69 corvettes
Belgium. 4 on Wielingen corvettes
China. 1 on Luda III frigate, 1 on Jianghu IV frigate, 2 on Type 25T frigates
France. 2 on Cassard destroyers, 4 on Suffren destroyers, 7 on George Leygues frigates, 3 on Tourville frigates, 2 on Aconit frigate, 6 planned for La Fayette frigates, 6 on Floreal corvettes, 17 on D'Estienne d'Orves corvettes
Portugal. 3 on MEKO-200 frigates, 4 on Baptiste de Andrade corvettes

Compact

Malaysia. 2 on FS1500 frigates, 2 on Musytari OPV
Saudi Arabia. 4 on Madina class, 3 Mk 2s going on La Fayettees

Forecast Rationale

Any domestic procurement by the French for the 100 mm Giat gun will depend on the selection of the gun for what is left over from the Common New Generation Frigate (CNGF) Project Horizon, which is now being developed with Italy only. This seems to be a very unlikely platform, however, since the design team preference is for a substantially larger and heavier gun, either 127 mm or 155 mm in caliber. With this program excluded, there appears to be no other European requirement for the 100 mm L55. Any French procurement will be for the remaining portions of existing programs (including the La Fayette class as well as sample models to support export efforts, plus occasional single unit sales).

A separate line is provided for Chinese licensed production, since ships equipped with the 100 mm gun

are likely to feature prominently in the naval market during the forecast period. China also has obtained the first of the Russian Sovremenny class destroyers, with AK-130 130-mm L70 twin mounts onboard. Although a good weapon, that one is too large and heavy for installation on the smaller Chinese-built hulls. Production of the 100 mm L55 will therefore continue for the lighter-duty indigenous ships, including frigates and destroyers.

It appears that the 100 mm French design is being implemented across a wide spectrum of surface combatants in the People's Liberation Army-Navy

(PLAN), almost making this marketplace a renewed “lease on life” for this particular weapon. Meanwhile, production for European platforms has virtually dried

out. The competition from Otobreda, with its 76 mm and 127 mm weapons, plus from Bofors for the lower end of the spectrum, is simply too formidable.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Designation	Application	Thru 99	<u>High Confidence Level</u>					<u>Good Confidence Level</u>				<u>Speculative</u>		Total 00-09
			00	01	02	03	04	05	06	07	08	09		
100 MM L55	DD/FF (CHINESE NAVY)	25	2	2	2	2	2	1	1	1	1	0	14	
100 MM L55	DD/FF (FRENCH NAVY)	51	2	1	0	0	0	0	0	0	0	0	3	
100 MM L55	DD/FF (VARIOUS)	18	1	1	0	0	0	0	0	0	0	0	2	
Total Production		94	5	4	2	2	2	1	1	1	1	0	19	