

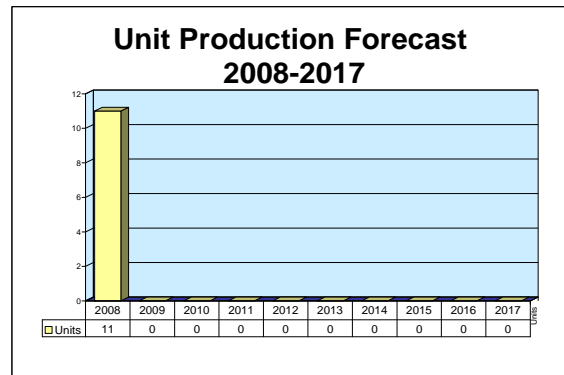
ARCHIVED REPORT

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AU-F1 (155 GCT) 155mm Self-Propelled Howitzer

Outlook

- Serial production complete for French Army procurement
- AU-F1TA upgrades ongoing for French Army; AU-F2 upgrade program remains unfunded
- Aggressive international marketing continues, especially among potential customers in the Middle East
- Forecast reflects contractor's expectations of new production for possible export



Orientation

Description. A tracked 155mm self-propelled artillery system.

Sponsor. The French Ministry of Defense, through the French Army, sponsored the development and procurement of the AU-F1.

Licensees. None

Status. Development through serial production. The production line is available for further orders.

Total Produced. Through 2007, we estimate the prime contractor produced 457 AU-F1 systems.

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

Price Range. In 2008 U.S. dollars, a new-production AU-F2 would carry a unit price of \$4.728 million.

Contractors

Prime

Nexter	http://www.nexter-group.fr , 13, rue de la Minière, Versailles, 78034 France, Tel: + 33 1 30 97 37 37, Fax: + 33 1 30 97 39 78, Email: presse@nexter-group.fr , Prime
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Subcontractor

Renault Trucks	http://www.renault-trucks.com , 99 Rte de Lyon, Saint-Priest Cedex, 69802 France, Fax: + 33 4 72 96 27 63 (HS 110-2 Diesel Engine)
Sagem Défense Sécurité SA	http://www.sagem-ds.com , Le Ponant de Paris, 27, rue Leblanc, Paris, 75512 France, Tel: + 33 1 40 70 63 63, Fax: + 33 1 40 70 66 40 (CITA 20 Inertial Fire Control System)

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Societe D'Equipements Systemes Et Mecanismes (SESM)	http://www.renk.biz , 67 rue d'Epluches, ZI D'Epluches, Saint Ouen-L'Aumone, 95315 France, Tel: + 33 1 34 48 37 00, Fax: + 33 1 34 64 55 43, Email: d.sepfonds.sesm@renk.biz (ENC 200 Automatic Transmission)
Thales Land & Joint Systems	http://www.thaleson-line.com/landjoint/ , 160, Blvd de Valmy, BP 82, Colombes, 92704 France, Tel: + 33 1 41 30 30 00, Fax: + 33 1 41 30 33 57, Email: supportline@fr.thalesgroup.com (ATLAS Fire Control System)
Volvo Powertrain North America (Mack Powertrain Hagerstown Operations)	http://www.macktrucks.com , 13302 Pennsylvania Ave, Hagerstown, PA 21742 United States, Tel: + 1 (301) 790-5400, Email: govt.comm.relations@macktrucks.com (Mack Truck E9 Diesel Engine)

Comprehensive information on Contractors can be found in Forecast International's "International Contractors" series. For a detailed description, go to www.forecastinternational.com (see Products & Samples/Governments & Industries) or call + 1 (203) 426-0800.

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

Design Features. An advanced-design artillery system, featuring an automatic loading system. The AU-F2 version mounts a 52-caliber barrel.

Crew. Four: commander, gunner, loader, driver.

Muzzle Brake. Modified double-baffle.

Recoil System. Hydro-pneumatic.

Breech Mechanism. Hermetically sealed vertical sliding wedge.

Ammunition. The AU-F1 fires all NATO-standard 155mm artillery rounds.

Dimensions. The following data reflect the current production-standard AU-F1 with the 39-caliber barrel.

	<u>SI Units</u>	<u>U.S. Units</u>
Length overall	10.25 m	33.62 ft
Width	3.15 m	10.33 ft
Height	3.25 m	10.66 ft
Combat weight	42.02 tonnes	46.32 tons
Fuel capacity	900 liters	239.36 gal
Ordnance caliber	155 mm	6.10 in
Ordnance length	39 cal/6.05 m	39 cal/19.83 ft

Performance. The maximum speed and range data reflect use on a paved road. The maximum range of the 39-caliber AU-F1 is 23.5 kilometers (25,699.86 yd) with non-assisted ammunition; with assisted ammunition, the range increases to 30.5 kilometers (33,355 yd).

	<u>SI Units</u>	<u>U.S. Units</u>
Maximum speed	60 km/h	37.26 mph
Maximum range	450 km	279.45 stat mi
Step	93 cm	3.05 ft
Trench	1.9 m	6.23 ft
Slope	30%	30%
Gradient	60%	60%
Fording	2.1 m	6.89 ft
Elevation	+66 deg	+66 deg
Depression	-4 deg	-4 deg
Traverse	360 deg	360 deg
AU-F2 maximum range	40.3 km	44,072.08 yd
Maximum rate of fire	8 rpm	8 rpm
Sustained rate of fire	2 rpm	2 rpm
AU-F2 Muzzle velocity	810 mps	2,647.47 fps

Engine

AU-F1. Hispano-Suiza HS 110-2 supercharged, multi-fuel, liquid-cooled, 12-cylinder diesel engine. This

powerplant generates 536.9 kilowatts (720 hp), with a power-to-weight ratio of 12.76 kilowatts per tonne (15.52 hp/ton). Renault Trucks (formerly Renault

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Véhicules Industriels SA, now a component of the Volvo Group) produces this powerplant on behalf of Hispano-Suiza.

AU-F1TA. Mack E9 two-stage supercharged V-8 diesel engine. This powerplant generates 559.3 kilowatts (750 hp), with a power-to-weight ratio of 13.31 kilowatts per tonne (16.19 hp/ton) in the AU-F1TA application. Mack Trucks (a U.S. subsidiary of the Volvo Group) produces the engines; integration with existing AU-F1 platforms takes place at French Army repair shops.

The 28-volt electrical system consists of a 5-kilowatt generator and eight 12-volt/100-ampere-hour batteries.

Gearbox

AU-F1. An unspecified manually operated unit, with five forward and five reverse gear ratios. The unit features an automatic centrifugal clutch, a hydraulically operated steering unit, and electric brakes, with manual backup.

AU-F1TA. ENC 200 automatic transmission, with five forward and two reverse gear ratios. This transmission is a product of Societe d'Equipements Systemes et Mecanismes (SESM), a component of Renk AG (Augsburg, Germany).

Suspension and Running Gear. Torsion bar suspension, with five dual-tired roadwheels and five track return rollers on each side of the hull. The first, second, fourth, and fifth roadwheels mount on bogies; the first and last wheel stations feature shock dampers.

Fire Control. As the AU-F1 is an indirect fire system, targeting data originate with the forward observer, passing through a fire direction center command post before reaching the individual AU-F1 platform. The AU-F1 fire control suite features a conventional M589 optical sight and an inertial optic-electronic goniometer, mounted on a gimballed platform. An azimuth plate, a counter-rotation device, and a direct fire telescope are also standard equipment.

The French Army selected the Sagem CITA 20 inertial fire control system for the AU-F1. The CITA 20 system enables automatic, immediate orientation of the AU-F1 without the traditional site survey. The digital system is modular in concept, allowing integration with the ATILA fire control network.

The upgraded AU-F1TA and AU-F2 configurations feature the Thales Automatisation du Tir et de Liaisons de l'Artillerie Sol-sol (ATLAS) fire control system, integrated with the existing CITA 20 navigation system.

Variants/Upgrades

Variants. None. In the late 1990s, the prime contractor introduced the improved AU-F1TA and AU-F2 configurations (see below) as potential production cut-ins and retrofit packages.

Modernization and Retrofit Overview. In 1997, the French Army initiated a program to retrofit a new powerpack into the AU-F1 platform. The Mack Truck E9 is a two-stage supercharged V-8 diesel engine that generates 559.3 kilowatts (750 hp) with a power-to-weight ratio of 13.31 kilowatts per tonne (16.19 hp/ton) in the AU-F1 application. Mack Trucks produces the engines; integration with existing AU-F1 platforms takes place at French Army repair shops.

AU-F1TA and AU-F2 Upgrades

In 1999, the French Ministry of Defense sponsored the replacement of the standard 39-caliber barrel with a new 52-caliber upgrade package, conforming to the latest

NATO ballistic standards. The new ordnance features a new screw-breech assembly, cradle, and muzzle brake. The upgrade also integrates a modified recoil system and the Thales ATLAS fire control system.

The French MoD originally expected Giat Industries (now operating as Nexter) to upgrade 174 systems for the French Army. Of these, 104 AU-F1TA systems would receive the new fire control system, the E9 engine, and the ENC 200 automatic transmission. The remaining 70 AU-F2 systems would receive a more extensive retrofit, featuring the ATLAS fire control system, the E9 engine, the ENC 200 transmission, and the new 52-caliber ordnance.

However, the French MoD has since scaled back the upgrade program. The AU-F2 upgrade program remains on hold for lack of funding. Through 2007, the AU-F1TA program reportedly involved upgrading 94 pieces.

Program Review

Background. In 1969, the Grande Cadence de Tir began to replace the 105mm Mark 61 and 155mm Mark F3 self-propelled artillery systems in French service.

The AU-F1 was an immediate hit on the export market; Saudi Arabia purchased the initial serial production run in 1978. The French Army selected the AU-F1 in 1979,

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deploying the system in six-gun batteries, three batteries per regiment.

Corporate Evolution

In October 2006, Giat Industries approved a reorganization and an associated name change to Nexter. Under the restructuring, the group maintains four core operations:

- Nexter Systems
- Nexter Munitions
- Nexter Electronics
- Nexter Mechanics

The move reportedly better prepares the firm for consolidation in the near future, possibly with Thales or EADS.

Description. The AU-F1 system consists of a new 155mm gun turret, integrated with a slightly modified AMX 30 tank chassis. Replacing the heavily armored AMX 30 tank turret with the AU-F1 turret results in a net weight reduction of about 2 tonnes (2.2 tons).

AMX 30 Tank Chassis

The driver sits in the left-front of the hull. The driver's station features a single-piece hatch cover and day/night vision equipment. The all-welded steel turret occupies the center of the vehicle. The commander and gunner sit to the right of the ordnance; the loader sits to the left.

The commander's station features periscopes for 360° observation and a cupola with a single-piece hatch. The

loader's station also features a single-piece roof hatch, with either a 7.62x51mm NATO (.308 Winchester) machine gun or a 12.7x99mm (.50 caliber) machine gun in a pintle-mount on the turret roof. Electrically operated smoke grenade launchers mount on either side of the turret.

The AU-F1 turret features two large rear doors for ammunition resupply; the turret also has access doors on each side. The AU-F1 turret normally carries a total of 42 projectiles and 42 cartridge cases for the 155mm ordnance. Turret power control is hydraulic, with manual backup.

Automatic Loading

A metal blanking plate hermetically seals the hydraulically operated breech of the 39-caliber ordnance. Loading is automatic, with manual backup. The AU-F1 gunner can fire single shots or six-round bursts. The crew can bring the system into action in about two minutes; it takes about one minute to bring it out of action.

Available Options. The prime contractor offers an opto-electronic goniometer with a digital display as an option, along with a course indicator, muzzle velocity-measuring datalink equipment, and a full nuclear, biological, and chemical (NBC) protection suite.

Related News

Nexter Earnings Drop as Programs Are Completed – Nexter Systems held a board meeting on February 26, 2008, and closed the Nexter Group consolidated accounts for the 2007 financial year. Those accounts were closed in compliance with IFRS rules.

Nexter Group 2007 orders intake amounted to EUR495 million, compared with EUR780 million in 2006. The drop is explained by the lack of a large export order during 2007, whereas in 2006 a contract was obtained for 76 CAESAR artillery systems for the Middle East. Export orders thus reached EUR67 million in 2007. The 2007 domestic orders were slightly higher than the 2006 level.

Nexter Group turnover in 2007 (EUR587 million) was less than that in 2006 (EUR715 million). This was expected and is related to the end of the Leclerc MBT deliveries to the French Army (14 vehicles against 47 in 2006), whereas the initial VBCI and CAESAR deliveries will only start in the second half of 2008.

The main element of the 2007 financial year is the continuing improvement of the group's profitability. The Nexter Group operating profits were EUR69.9 million. "Current operating profits" (not including non-recurring elements) reached EUR44 million in 2007 versus EUR42 million in 2006. The current operating margin was up to 7.4 percent, against 5.8 percent in 2006.

The Nexter Group's consolidated net profits were EUR151.1 million in 2007. This includes a considerable non-recurring part, due notably to the incorporation, for the first time, of future benefits related to carry-forward tax deficits that have been transferred from Giat Industries to Nexter Systems. These profits also take into account the

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high level of expenditures dedicated to research and development of new products (17 percent of turnover against 13 percent in 2006). Nexter Group orders in hand amount to EUR1.825 million and represent about three years of activity. (Nexter, 2/08)

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Funding

The French Ministry of Defense, through the French Army, funded the development and French procurement of the AU-F1.

Contracts/Orders & Options

Not available, as the French Ministry of Defense and the prime contractor have not released contractual information regarding this program.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1969	Development begins
May	1972	First prototype rolled out
Jun	1973	AU-F1 debuts at Satory arms fair
	1974-1975	Ten pre-production systems rolled out
Early	1977	Serial production begins
	1978	First production deliveries to Saudi Arabia
Jul	1979	French Army selects AU-F1
	1991-1992	Giat integrates AU-F1 turret with T-72 tank chassis
Jan	1996	Production restarts for French Army follow-on order
	1999	52-caliber upgrade program begins
	2004	Deliveries of upgraded AU-F1TA howitzers begin
Oct	2006	Giat Industries reorganizes under the name Nexter.
	2008	Modernization of and retrofit to AU-F1TA configuration ongoing; marketing and development continue

Worldwide Distribution/Inventories

Export Potential. The AU-F1 saw action with Iraqi forces during the Iran-Iraq War (1980-88), with both sides during Operation Desert Storm (1991), and with French peacekeeping forces in the Balkans. However, no reports of AU-F1 combat performance have emerged from any of these engagements. This lack of reporting has become a limiting factor in marketing the AU-F1 in an already glutted market. For potential customers, this lack of reporting can be, to say the least, ominous.

While integration of the 52-caliber ordnance and ATLAS fire control system can enhance AU-F1 marketability, the fact remains that the weapon system suffers under a self-imposed cloud of doubt. Not helping matters is the fact that the AU-F1 unit price places it at the high end of the international 155mm self-propelled artillery market, with only Japan's Type 99 (\$9.021 million) and Germany's Panzerhaubitze 2000 (\$5.0-\$5.6 million) carrying higher unit prices.

Countries. France (273), Iraq (85; current status unknown), Kuwait (18), and Saudi Arabia (51).

Forecast Rationale

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The AU-F1 production line for new systems remains available for export. The new-production program for the French Army is complete; there are reportedly no firm export orders pending. Nevertheless, Nexter continues to maintain the production line for French Army modernization and retrofit work, as well as for possible export.

Corporate Evolution

In October 2006, Giat Industries approved a reorganization and an associated name change to Nexter. Under the restructuring, the group maintains four core operations:

- Nexter Systems
- Nexter Munitions
- Nexter Electronics
- Nexter Mechanics

The move reportedly better prepares the firm for consolidation in the near future, possibly with either Thales or EADS.

Dwindling Export Prospects

Nexter continues to aggressively promote the AU-F1 series on the international market, albeit with no new orders. While the enhanced AU-F2, which the contractor promotes as among the better systems of its type available today, has generated additional market interest, it has yet to generate any new sales.

Oman, Bahrain, and the United Arab Emirates remain the best prospects for export sales of this weapon system during the forecast period. Each country could potentially procure 20 to 25 units; the UAE could potentially make a substantially larger purchase. However, the high unit price of the AU-F1, combined with the ready availability of comparable 155mm self-propelled howitzers at substantially lower prices on the international market, continues to hinder AU-F1 export sales.

AU-F1TA Upgrades Complete?

In 2004, (then) Giat Industries began deliveries of the upgraded AU-F1TA howitzers to the French Army. Under the revised schedule, Giat delivered 18 upgraded howitzers in 2004 and 33 in 2005. The contractor was scheduled to deliver another 33 systems in 2006, with delivery of the final 10 upgraded AU-F1TAs to be complete by the end of last year. The AU-F2 upgrade program, including integration of the 52-caliber ordnance, reportedly remains unfunded.

Our 10-year production outlook reflects Nexter's lingering expectation of production for at least one potential export sale. Without new export sales, the AU-F1 production line will likely shut down permanently by the end of this year. As we limit our production forecast to complete AU-F1 systems, the production of components and spares for the French Army's modernization and retrofit programs is transparent to this forecast.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Nexter												
AU-F1												
	177	11	0	0	0	0	0	0	0	0	0	11
Total	177	11	0	0	0	0	0	0	0	0	0	11

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AU-F1 (155 GCT) 155mm Self-Propelled Howitzers on the Firing Line

Source: army-technology.com