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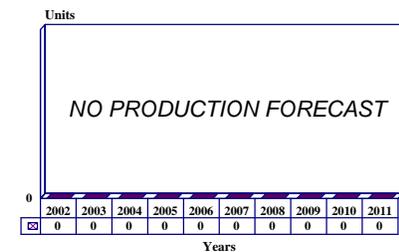
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R.530/Super 530F/Super 530D - Archived 12/2003

Outlook

- No longer in production
- The R.530 is still on active duty with the French and other foreign air forces
- No further production orders for this missile are anticipated
- Those combat aircraft offered for export by France will be armed with the MICA-EM
- MBDA has switched its marketing focus to the MICA-EM

10 Year Unit Production Forecast
2002 - 2011



Orientation

Description. All-weather, medium-range air-to-air missiles.

Sponsor. French Ministry of Defense through the French Air Force.

Contractors. Developed and produced by Matra-Hachette SA, Matra Defense, Velizy-Villacoublay, France. Missiles produced at Salbris, France. Matra is now part of MBDA.

Major Subcontractors. ADI of Australia (for new solid-propellant binder), Crouzet (arming/safety fuze), Electronique Serge Dassault (AD26 semi-active radar seeker head and RDI radar with Thomson-CSF), Hotchkiss-Brandt, SOGEA (electrical power supply), Thomson Brandt Armaments (fragmentation warhead), PROTAC (power supply), Thomson-CSF DSE (proximity fuze and RDM/RDI radars) and SAFT (batteries).

Status. Fabrication of the R.530, Super 530F, and Super 530D gas concluded. The Super 530F entered service with the French Air Force in December 1979 and was specifically designed for the Mirage F1s. However, the missile can be fitted to Mirage 2000s.

The development of the Super 530D was complete in mid-1987. Full-scale production followed one year later. Initial deliveries were made to the French Air Force in mid-1988. Escadron de Chasse I/5, the first operational unit equipped with RDI-fitted Mirage 2000s and armed with the new missile, began working toward its Initial Operational Capability in July 1988. This missile is designed with the Mirage 2000 specifically in mind.

Total Produced. Approximately 4,857 R.530, 1,486 R.530F, and 1,371 R.530D missiles were completed or in production as of the end of 1998. By 1988, a total of 1,770 Super 530 missiles had been ordered by at least six countries, of which more than 50 percent were export orders. Two hundred and twenty missiles were ordered during 1987. By early 1990, some 2,000 R.530F/R.530D missiles had been ordered.

Application. Medium-range air-to-air missiles for a variety of tactical aircraft.

Price Range. The unit price of the Super 530F is put at \$114,000 in FY88 dollars. The Super 530D costs approximately \$262,500 in FY99 dollars.

Technical Data

Design Features. The missile has a ceramic radome that houses the antenna of the ESD AD26 homing head. Behind the homing head are the proximity fuze, warhead, safety and arming unit, and rocket motor. Clustered around the rocket motor at the rear of the

missile are rate gyros, primable battery, static converter, voltage generator, junction box, and control surface actuators. The missile is fitted with cruciform long-chord steel honeycomb wings, which provide lift and smooth airflow over the rear control fins.

	<u>Metric</u> R.530	<u>Metric</u> Super 530F	<u>Metric</u> Super 530D	<u>US</u> R.530	<u>US</u> Super 530F	<u>US</u> Super 530D
Dimensions^(a)						
Missile length:	328 (319.8) cm	354 cm	380 cm	10.76 (10.49) ft	11.61 ft	12.48 ft
Missile diameter:	26.3 cm	26.3 cm	26.3 cm	10.35/10.35 in	10.35 in	10.35 in
Missile weight:	192 (193.5) kg	250 kg	270 kg	422.4 (425.7) lb	550 lb	594 lb
Missile finspan:	110 cm	88 cm	88 cm	43.33 in	34.65 in	34.65 in
Performance						
Speed:	Mach 2.7	Mach 4.6	Mach 5	Mach 2.7	Mach 4.6	Mach 5
Altitude (min):	Sea Level	See Note	See Note	Sea level	See Note	See Note
Altitude (max):	21,350 m	25,000 m	25,000 m	70,028 ft	82,000 ft	82,000 ft
Range:	18 km	30-35 km	40+ km	11.18 mi	18-21.7 mi	25+ mi
Max load factor:	+15 g	+20 g	+30 g	+15 g	+20 g	+30 g

Note: The Super 530F and Super 530D can attack targets flying some 9,000 meters (29,527.5 feet) above or below the launch aircraft. The minimum safe launch distance for the Super 530D is approximately 1,000 meters.

(a) Information for the infrared version is given in parentheses.

Propulsion. The R.530 is powered by the Marie Antoinette dual-thrust, solid-propellant rocket motor of 83.36kN (18,740 lbt), produced by PROTAC. The Super 530F uses an Angele butalane PBCT composite material propellant motor. This powerplant provides much higher specific impulse, more than doubling the speed of the Super 530 over that of its predecessor. The Super 530D uses an improved version of this motor for enhanced snap-down performance.

Control & Guidance. The R.530 uses interchangeable AD26 or RDM semi-active radar or AD3501 infrared homing heads produced by Electronique Serge Dassault. The Super 530F uses the Super AD26 semi-active radar-homing head, supplied by the same firm. The new Super 530D employs an active pulse Doppler (RDI) radar. All three missiles employ electric actuators for the aerodynamic control surfaces.

The target is detected and illuminated by the launch aircraft's radar. On the Mirage F1, this is the Thomson-CSF Cyrano IV monopulse, I/J-band radar. The Mirage 2000 uses the Thomson-CSF I/J-band multimission RDM radar for export customers, or the Thomson-CSF/Electronique Serge Dassault RDI I/J-band, pulse Doppler intercept radar for the French Air Force. Due to delays in RDI radar development, early Mirage 2000 aircraft for the French Air Force were fitted with RDM radar and Super 530F missiles, which are being retrofitted with the new radar and Super 530D missiles with RDI radar (deliveries commenced in 1986/87).

The missile homes-in on the energy reflected by the target from the launch aircraft's radar, following a trajectory based on proportional navigation – a lateral acceleration which is proportional to the missile/target sightline rotation rate and closing speed. Pitch and yaw maneuvers are carried out by movement of the rear control surfaces, with lateral acceleration of up to 20g possible at up to 17,000 to 18,000 meters (55,777 to 59,058 ft), reducing to 6g at 27,000 meters (88,560 ft). Snap-up maneuvers also can be carried out, with a height gain of around 9,000 meters (29,520 ft) up to a ceiling of 25,000 meters (82,000 ft). These figures are for the Super 530F and Super 530D missiles.

Launcher Mode. Launched from underwing or centerline pylons of the Mirage III, 5, 50, F1, 2000, and F-8E aircraft. Currently, the Super 530D is compatible only with the Mirage 2000.

The missile is normally carried in pairs, one with an infrared (IR) homing head and the other with a semi-active radar homing head. The infrared head is capable of lock-on throughout a wide envelope, including head-on engagements, while the semi-active radar homing head uses the launch aircraft's radar for target illumination. A fragmentation or continuous rod warhead is fitted, detonated by an electromagnetic proximity fuze.

Warhead. The R.530 uses two types of high-explosive warheads, each weighing 27 kilograms (59.4 lb) and fitted with proximity and contact fuzes supplied by

Hotchkiss-Brandt. The Super 530F/D uses a Thomson-Brandt high-explosive warhead with an electromagnetic proximity fuze produced by Thomson-CSF. This warhead has a weight of greater than 30 kilograms

(66 lb) and incorporates advanced electronic countermeasures anti-jamming circuitry. The explosive is of the casted-bond, low-vulnerability composite material type manufactured by SNPE.



Super 530D

Source: French Air Force

Variants/Upgrades

Matra has developed three medium-range air-to-air missiles: the R.530, its original production medium-range missile; the Super 530F (also called the R.530F), which offers improved aerodynamics, electronics (including an all-weather/all-sector), and propulsion;

and the Super 530D, also known as the R.530D, which operates with the Mirage 2000 and 4000 aircraft via a pulse Doppler radar. For additional information, see the pertinent entries under the **Program Review** section.

Program Review

Background. Since 1963, when serial production of the R.530 family of air-to-air missiles began, this missile has equipped the air arms of over 14 countries. Two versions are in service: a radar-homing and an infrared-homing type. Changes of the guidance to fit the tactical situation are accomplished through the use of interchangeable guidance components. The R.530 equips the Mirage 2000, Mirage III, and Mirage F1 aircraft of the French Air Force, as well as Mirages operated by South Africa, Israel, Australia, Brazil, and other countries.

Development of the R.530 was begun in 1958, and the system entered service with the French Air Force in 1963. Production ended in 1980 with over 4,800 missiles built. The missile remains in service with several countries including France, Argentina, Brazil, Colombia, Egypt, Morocco, Pakistan, and South Africa. It was also in use with Australia and Israel, but has since been withdrawn from active service.

Missile Models. Matra has developed three separate versions of the R.530 basic missile: the original R.530, the R.530F (Super 530F), and the R.530D (Super 530D). Design of the Super 530 began in 1968, with the start of development in 1971. The first firing of a controlled mock-up missile took place in February 1973, following ramp tests in 1971 and flight trials of the AD26 homing head in 1972. In July 1973, drop trials were carried out, followed by aircraft carriage and aerodynamic trials in the first half of 1974. Development and evaluation trials by the Centre d'Experience Aeriennes Militaires (CEAM) continued from 1974 through 1977 and included live firings. The first fully guided firing took place in 1975, when a missile fired from a Vautour flying at Mach 0.7 at a height of 11,000 meters (roughly 36,000 ft) successfully intercepted a target drone flying at Mach 1.6 at a height of 18,000 meters (approximately 59,000 ft). The first firing from a Mirage F1 took place in 1976; following the successful conclusion of the trials, a production contract was signed in late 1977. The first firing from a

Mirage 2000 took place in July 1981, following carriage trials initiated in November 1979.

Super 530F. Although alphabetically reversed, Matra produced the Super 530F for the French Air Force, as well as for export requirements, prior to Super 530D. The Super 530F was initially delivered in late 1979 to the Commandment Air des Forces de Defense Aerieenne (CAFDA), and arms Mirage F1-C and Mirage 2000 squadrons at Reims, Cambrai, and Orange.

The Super 530F offers improved aerodynamics, electronics, and propulsion over the basic R.530. An all-weather/all-sector weapon, the missile can attack targets flying at altitudes to almost 30 kilometers (98,425 ft). The Super 530F performed very successfully through initial and final operational trials, and is apparently living up to its conceptual mission. The missile possesses a look-down/shoot-down potential when integrated with the Cyrano IV radar-based fire-control system of the Mirage 2000.

Matra has stressed commonality on the Super 530F to maintain compatibility on the Mirage F1. However, the Super 530F is a completely new missile that greatly outperforms the earlier R.530. The Super 530F has a maximum speed of Mach 4.6, which allows an airborne intercept to occur more quickly and at a much higher altitude. It possesses an automatic launch mode, in which the aircraft's main computer calculates the best launch point during an intercept and fires the missile into the center of the firing envelope. It appears, though, that the preferred mode of launch is semi-automatic, whereby the pilot tracks the target continuously by radar until missile impact.

Super 530D. This greatly enhanced version of the Super 530, designated the Super 530D (the D stands for the pulse Doppler radar employed by this version), is intended for the new Mirage 2000 aircraft. The Super 530D is a further-enhanced version of the Super 530F; in addition to the pulse Doppler radar, a more powerful motor is used, as well as greatly improved electronics and flight controls. The basic aerodynamic design was also modified to result in a missile of significantly greater performance (especially at extreme altitudes) and operational capability. A new Doppler semi-active homing head permits the interception of targets at very low altitudes, and digital data processing systems permit a very short reaction time. The Super 530D is capable of intercepting aircraft to heights of up to 80,000 feet at speeds of up to Mach 3. The Super 530D is now operational with the French Air Force.

The following provides information of the Super 530D's sequence of engagement:

The target can be approached along all its bearings. However, operational advantage is in favor of a head-on attack to profit by a longer range, resulting from the relative speeds and to engage the target at the earliest time.

The speed of the firing aircraft can be much lower than the target's, and the same goes for altitude. It is up to the missile to bridge the difference. Missile firing can be performed within the whole fighter operational envelope – from very low altitude up to 16,000 meters. The minimum firing distance of less than 1,000 meters is basically laid by safety requirements for the firing aircraft. The maximum distance varies, depending on the sector of approach and on the relative aircraft altitudes and speeds. At low altitude the distance could be as great as 20 kilometers. At high altitude it can reach 40 kilometers despite a vertical separation of 10,000 meters (30,000 ft) in favor of the opponent.

When the alert is sounded, whether on the ground or in flight, the interceptor is guided toward the opponent by an air-defense radar station. Often the situation involves proceeding toward the threat at such altitude and distance as to be able to acquire it on the airborne radar. From then on, the pilot takes over the interception assignment, and the following operations take place:

- *Radar lock-on to target:* The interception computer works out instructions and transmits them to the pilot through the head-up display in order to enter the launch zone. At the same time, the missile antenna is pre-positioned toward the target.
- *Missile lock-on to target:* The signal sent by the airborne radar and reflected by the target is picked up by the missile. This depends on the size of the target and how far it is. From then on, the missile's active radar homing head tracks the target permanently.
- *Entering firing range:* This is figured by the airborne computer, and the pilot is advised thereof.
- *Firing the missile:* Firing can be under automatic or pilot control. The harmonization of the auto-director and radar is then performed just before the missile is launched.

Funding

No recent funding figures have been provided for the R.530/Super 530 procurement line. Previous procurement totals are as follows:

- 1981 – French Air Force funding included FRF273 million for procurement of 110 additional missiles for an additional 21 Mirage F1 aircraft and initial Mirage 2000s, with FRF125 million for R&D on Super 530D for Mirage 2000s.
- 1982 – French Air Force funding included FRF292 million for procurement of 110 missiles, FRF153 million for Super 530D development, and FRF13 million for Super 530F development.
- 1983 – French Air Force funding included FRF215 million for Super 530F, and FRF154 million for Super 530D.
- 1986-1987 – French Air Force funding included FRF75 million for Super 530D arm RDI radar-equipped Mirage 2000 aircraft.
- 1988 – French Air Force funding included FRF606 million for Super 530D, and FRF30.5 for the Super 530F.

The French military has now completed procurement of these missiles. Some units may be available for export from the French military inventory.

Recent Contracts

No specific information is available concerning production contract awards for this missile system.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1958	Design and development starts
	1960	Engins Matra selected as main contractor
	1960	Full-scale engineering development begins
	1963	Initial entry into service
	1964	Full production of R.530
	1968	Start of Super 530 design
Jan	1971	Super 530 project initiated
Sep	1972	Homing head flight test
Feb	1973	First prototype launch
	1974	Initial flight testing initiated
Late	1977	Production contract signed with French Air Force
	1977	Initial operational tests terminated
	1978	Technical flight evaluation initiated
	1979	Flight testing complete; initial prototype production
Late	1979	Production of R.530 halts
	1980	Super 530 production continues; Initial Operational Capability with Mirage F1s
	1981	Full production of Super 530 begins
	1982	R & D work on Super 530D begins
	1984	Flight testing Super 530D begins
Oct	1984	Firing trials of Super 530D/RDI radar
Mid	1985	Iraq deployed Super 530 in the Gulf
Late	1985	Low-rate production of Super 530D for operational tests begins
Late	1987	Initial operating capability for Super 530D
	2000	Production of Super 530D concluded

Worldwide Distribution

User Countries. While MBDA has not identified all the overseas customers, the following nations are known to have ordered or operated one or more variants of the R.530: **Argentina, Australia, Brazil, Colombia, Ecuador** (Mirage F1), **Egypt** (Mirage 2000), **France** (Mirage F1/Mirage 2000), **India** (Mirage 2000), **Iraq** (Mirage F1), **Jordan** (for the Mirage 2000; order may be canceled), **Kuwait** (Mirage F1), **Lebanon, Libya** (Mirage F1), **Morocco, Pakistan, Saudi Arabia, Republic of South Africa, United Arab Emirates, and Venezuela.** These countries are all potential customers for the Super 530D, along with the other nations that already possess the R.550 short-range air-to-air missile, or operate or have on order the Mirage 2000. (See separate report.)

Forecast Rationale

No further production orders for the Super 530D missile are anticipated. Manufacture of this missile has been concluded and will not be restarted. Instead of the Super 530D, MBDA is offering the newer MICA-EM on its Mirage 2000 and Rafale fighters. Eventually, the MICA-EM could be superseded by the Meteor beyond-visual-range air-to-air missile (BVRAAM).

Although production has been ceased, the Super 530D will likely remain in service throughout the decade. Certain countries may even keep this missile in service beyond this point. In the unlikely event that further orders are placed for the Super 530D, they will likely be fulfilled with units from French Air Force stocks.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Missile	(Engine)	thru 01	High Confidence Level				Good Confidence Level			Speculative		Total 02-11	
			02	03	04	05	06	07	08	09	10		11
MBDA													
R.530	MARIE ANTOINETTE	4857	0	0	0	0	0	0	0	0	0	0	0
R.530D	ANGELE	1371	0	0	0	0	0	0	0	0	0	0	0
R.530F	ANGELE	1486	0	0	0	0	0	0	0	0	0	0	0
Total Production		7714	0	0	0	0	0	0	0	0	0	0	0