RAFALE INTERNATIONAL

FOX THREE

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Flottille **12F**

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AESA

THE FIRST RAFALE UNIT IS NOW FULLY OPERATIONAL

In a ceremony headed by Admiral Jean-Louis Battet, the French Chief of the Naval Staff, Flottille 12F - the first Rafale unit - was officially declared combat ready, a major step forward for the Rafale programme.

After months of intense operational testing, the Rafale has now reached full operational capability. On Friday 25 June 2004, Flottille 12F was officially granted approval to conduct offensive and defensive missions with its Standard F1 Rafales. From then on, the French Navy Rafales became fully capable of carrying out the whole spectrum of air-superiority and air-defence missions, either from the *Charles de Gaulle* nuclear carrier or from any land base. In fact, the Rafale could have been engaged in combat two years ago. In 2002, at the peak of Operation Enduring Freedom - the international effort against terrorism - in the Indian Ocean, Flottille 12F flew operationally and could have fired air-to-air missiles to protect the French carrier battle group if needed. To this day, nearly 5,000 flying hours and 2,000 carrier landings have been recorded by the unit.

A successful process

Flottille 12F, previously flying the F-8E(FN) Crusader, was recommissioned in May 2001, and has been a key asset and player for the tactical evaluation of the new fighter. This evaluation phase is now completed, and, from now on, the pilots will be able to devote their time to tactical training. Thanks to a remarkable collaboration between the French Navy, the DGA and all the companies involved in the programme, the Rafale's entry into service was undoubtedly a major success. The fighter has been operationally tested in severe environments - extreme temperatures and high ambient humidity levels - in the Indian Ocean and the Red Sea, and it is fully compliant with the extremely stringent French Navy requirements. According to Flottille 12F pilots, the Rafale has already demonstrated its exceptional qualities during numerous engagements against other fighters such as US Navy F/A-18 Hornets and F-14 Tomcats, Royal Saudi Air Force F-15 Eagles, and Belgian Air Force F-16 Fighting Falcons. The required level of reliability has been demonstrated and the Thales RBE2 radar and the Thales/MBDA Spectra electronic warfare suite have proved extremely successful, allowing the fighter to efficiently perform all the missions it was envisioned for. The Snecma M88-2 turbofan is also highly praised by pilots and maintainers alike. Its thrust, responsiveness, reliability and maintainability have set new standards: the excess power available and the immediate power response give the aircraft exceptional wave-off characteristics, a decisive factor for demanding carrier operations.

A new configuration tested operationally

During the tactical evaluation phase, Dassault Aviation and the Marine Nationale have gone even further than initially planned, and the Rafale Standard F1 can now be used for buddy-buddy in-flight refuelling, a capability not envisioned until the delivery of the Standard F2 Rafales. What is even more significant is the fact that the first three aircraft adapted for the in-flight refuelling mission were all modified, at sea, onboard the *Charles de Gaulle* in the Indian Ocean with minimal assistance from France. Only three Dassault personnel and three Navy specialists had to be flown to the area. The first aircraft, Rafale M6, was modified in only eight days by this dedicated team. The other two fighters, M4 and M9, were both directly retrofitted by Flottille 12F specialists and their validation flights were conducted by two pilots of the unit. A batch of five 2,000 litre drop tanks was lent by Dassault to supplant the 1,250 litre variant in use with Flottille 12F, considerably boosting the off-load capability of the aircraft. It is worth noting that switching from an air-defence configuration to a tanker fit takes only about 1 h 30 min.

The modified Rafales were engaged operationally over Afghanistan to support the effort against terrorism, co-operating with reconnaissance Super Etendard Modernisés from Flottille 17F. Two Rafales fitted with in-flight refuelling pods were capable of significantly increasing Super Etendard Modernisés radius of action. Although there was no real airborne threat in the theatre of operations, the Rafales were also utilised to escort the reconnaissance jets with their long-range, active radar Mica missiles. The ability to carry out missions as a refuelling tanker is a welcome boost to operational flexibility: the Rafale can keep up with any strike package since it can match the speed and altitude performance of other fighters, providing great flexibility in planning and executing long-range missions.

The comprehensive operational test programme set up by the French Navy has resulted in the Rafale being a mature programme. Indeed, the omnirole fighter was successfully flown in complex air-defence missions as part of a coalition, the latest operations over Afghanistan clearly marking the beginning of the Rafale's operational career.

The future is definitively on track :
Rafale Standard F3 development contract signed

In February 2004, the Délégation Générale pour l'Armement (the French Procurement Agency) announced that the contract to develop the F3 Omnirole Standard for the Rafale had been signed. Due to enter service in 2008, the Standard F3 will offer new, expanded capabilities for both French Air Force and French Navy units. New functionalities for the radar include a high-resolution synthetic aperture radar (SAR) mode. With its high-quality digital images, the New Generation Reconnaissance Pod will offer unmatched capabilities for real-time stand-off reconnaissance. The new Gerfaut Helmet-Mounted Sight/Display produced by Sagem will also be adopted for Standard F3 Rafales, remarkably enhancing the lethality of the agile Mica IR missile. With the advent of Standard F3 Rafales, new weapons such as the ASMP-A nuclear missile and the latest variant of the acclaimed Exocet anti-ship missile will find their way into the Rafale's already impressive armament inventory, thus enhancing the firepower of the new omnirole fighter.

AESA RADAR
TEST FLOWN ON RAFALE

In April 2002, the DGA, the French defence procurement agency, appointed Thales to develop an active array radar demonstrator optimised for the Rafale omnirole fighter. Called DRAA (Démonstrateur Radar à Antenne Active, or Active Array Radar Demonstrator), the programme culminated in a series of demanding flight tests to validate its detection performance. Although the development schedule was extremely tight, the DRAA met all programme milestones on time. This Active Electronically Scanned Array (AESA) demonstrator will pave the way to a production equipment for the Rafale.

An extremely fast programme

Today, the Rafale is the only European fighter fitted with an electronic scanning radar. Its remarkable RBE2 radar is already in full operational service with the French Navy and will soon enter service with the French Air Force. It is far more advanced than legacy mechanically-steered radars used by most of the Rafale's competitors. Their flexibility and performance are clearly limited by the complex hydraulic drives associated with moving their radar dish around.

With the adoption of an active antenna, RBE2 radar performance will be even further increased : detection and tracking ranges will be significantly improved, angular coverage will be considerably expanded and reliability will be boosted to unprecedented levels. The state-of-the-art DRAA active array is composed of numerous solid-state transmit and receive GaAs modules. They are used to point and move the radar beam at an extremely high speed. Aircrews will also benefit from improved situational awareness while observability of the aircraft will be reduced. Additionally, the introduction of the active array paves the way for the development of new radar functions in such areas as counter-countermeasures.

The numerous T/R modules also virtually eliminate mechanical breakdowns and reliability has been dramatically improved thanks to an increased redundancy: a number of modules can fail without affecting overall radar performance. Antenna status can be established in real-time, and maintenance operations programmed accordingly, leading to considerably lower operating costs for operators. As a result, active array technology offers significantly greater operational readiness than previous antenna technologies.

To develop the DRAA, Thales has taken advantage of its long experience in solid-state technology which dates back to the early 90s when the Cobra battlefield radar was conceived. Since then, other radar applications have benefited from solid-state advances, and numerous surface warships and ground-based defence systems are equipped with such radar systems. *"The first development studies for the airborne AESA array for the Rafale had been carried out in 1999*, explains Philippe Ramstein, Thales Director for the Rafale Programme. *The RBE2 variant currently in front-line service is already an electronic scanning radar, and changes to adapt the new AESA array are kept to a strict minimum. The DRAA fully complies with the plug-and-play concept, and the passive and active arrays are thus totally interchangeable. This clearly facilitates upgrades, so all French Rafales will have the capability to be equipped with an AESA."*

Test-flying the DRAA

In December 2002, the first flight of the AESA system was carried out in a Mystere XX flying test bed belonging to the French MoD located in the Flight Test Centre at Cazaux (South-West of France). Subsequently, the DRAA demonstrator was fitted to two-seat production Rafale B301. *"For us, it was essential to prove to our customers that we could easily fit a new array to the existing RBE2 hardware*, stresses Jean-Marc Goujon, Rafale Radar Programme Manager. *As such, one of the main goals of the DRAA programme was to demonstrate that the new array could easily be fitted to the B301's current RBE2 electronic scanning radar without any modifications of the whole radar architecture. This modification was a total success, Thales and Dassault engineers being able to complete the task in less than three hours! This is a considerable achievement that proves impossible for our competitors who would have to completely redesign and rebuild their radar sets to accommodate an AESA."*

The first flight in Rafale B301 was recorded from Istres in May 2003. During the comprehensive flight test programme, the fully integrated Band X DRAA radar successfully transmitted, received and collected radar data, confirming all Thales prediction, a clear indication that the company totally masters AESA technology.

DRAAMA towards the serial production AESA RBE2

For Thales, the next stage of the ongoing development process for the Rafale fighter is the DRAAMA (Démonstrateur Radar à Antenne Active Modes Avancés, or Advanced Modes Active Array Radar Demonstrator) programme which was officially launched by the DGA in July 2004. Optimised to prepare full-scale production, the DRAAMA array will be entirely new and will benefit from the latest developments in radar/solid-state technology. It is worth noting that all components of the DRAAMA antenna will be built in Europe, a key factor for total autonomy and independence. By the end of 2007/early 2008, DRAAMA development and test flying programme will have been completed, and qualification should have been granted by the DGA.

The advent of the DRAA and DRAAMA programmes will allow engineers to shortly equip production Rafales with cutting edge radar technology. Developed in a record time, the DRAA radar already proved that Thales is fully capable of meeting stringent requirements with state-of-the-art solutions. With the AESA, the Rafale Omnirole fighter will undoubtedly become more lethal, more survivable, more reliable and more affordable, key advantages for operators in search of the ultimate fighter.

RAFALE INTERNATIONAL

GIE - Rafale International
78, quai Marcel Dassault 92552 Saint-Cloud cedex 300 - France

www.dassault-aviation.com
www.snecma.com
www.thalesgroup.com