RAFALE INTERNATIONAL

DASSAULT AVIATION • SAFRAN • THALES

FOX THREE

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Editorial

In the 19th issue of Fox Three,
we are proud to present the latest progress made in the trials of the F3R Standard which will enter operational service with the French Air Force and French Navy in early 2019: the last of five test Meteor ramjet-propelled missiles was fired in April 2017, scoring a direct hit, and the TALIOS targeting pod is now being tested on the Rafale. We are also extremely pleased to announce the launch of the new Standard F4 which will significantly increase the omnirole fighter's already impressive lethality on the battlefield. Standard F4 Rafales will be fitted with an improved radar, a new datalink, improved electronic warfare / electronic attack systems, new air-to-air missiles, new air-to-surface guided weapons…
In the Middle East, combat operations against the Daesh terror group have intensified and the Rafale fighter remains at the forefront of the French effort in the region. Both Air Force and Navy Rafales are actively supporting from the air troops engaged against the terrorists, using an extremely wide array of sensors and precisions weapons to defeat the enemy.

The 'FOX THREE' Team

Summary

DEVELOPMENT OF
NEW STANDARD F4 APPROVED

Dassault Aviation, the French Ministry of Defence and their partners have launched the development of the Standard F4 set to enter service in the 2024/2025 timeframe.

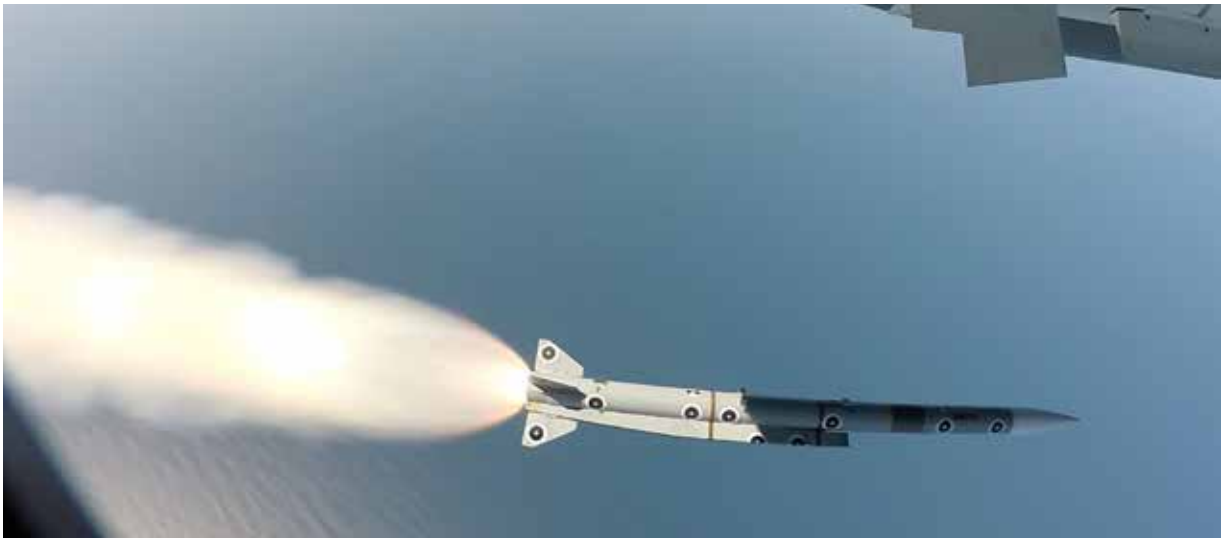
The Rafale has been conceived as a modular aircraft, with an easily upgradable, open architecture avionics suite designed to readily accept new systems and weapons. Taking advantage of this plug and play concept, spiral evolutions are introduced every three years on average to boost the fighter's offensive and defensive capabilities. Rafales were successively delivered in the F1, F2, F3 standards, with F3R soon to enter service. In between those standards, software increments are regularly added to facilitate interoperability with allied air, land and naval forces and improve sensor performance and survivability on the battlefield while reducing aircrew workload even further. Increment F3.4+ is currently operational with the French Armed Forces, paving the way for the arrival of F3R.

Standard F3R

The Standard F3R will be qualified in 2018 and is scheduled to enter operational testing with the Air Force and Navy operational evaluation centres early in 2019. F3R will bring significantly increased capabilities to the combat-proven Rafale, including the Meteor air-to-air missile, the TALIOS (TArgerting Long-range Identification Optronic System) multifunction targeting pod, a Mode S transponder, a Mode 5 interrogator and various improvements to the RBE2 electronic scanning radar, to the Spectra electronic warfare suite and to the L16 datalink. With all these new systems, the fighter's connectivity and lethality on the battlefield will be further enhanced. Trials of the Standard F3R are progressing at an unabated pace, with major milestones recorded over the last few months.

Successful TALIOS trials

The first flight of the Thales TALIOS on a Rafale was performed in early 2017. Development trials of the TALIOS on Mirage 2000D flying test benches had proved entirely successful, with performance exceeding specifications, allowing engineers to focus on the integration of the TALIOS onto the Rafale. The new pod is optimised for operational use in challenging environments and tactical situations, offering unrivalled image quality, extremely accurate coordinates extraction, and long stand-off target designation ranges. It is fitted with cutting-edge systems, including a new generation IR sensor and a powerful, high-resolution TV sensor, allowing targets to be localised, identified, tracked and engaged at extreme ranges, day and night. The TALIOS will prove ideal in the close air support, deep strike, air interdiction and convoy escort roles as well as for non-traditional intelligence, surveillance and reconnaissance (NTISR) and battle damage assessment missions.



Final Meteor test

With the Meteor missile and its RBE2 radar, the Rafale will shortly be in a class of its own, the only fighter in the world equipped with both an AESA (Active Electronically Scanned Array) and with a fire-and-forget, ramjet-propelled, hypersonic, air-to-air missile. Conceived to meet the most stringent requirements, the 190-kg Meteor is cleared to operate from the deck of carrier Charles de Gaulle, a severe environment in terms of electromagnetic compatibility and resistance to shocks during catapult shots and carrier landings. The solid fuel ramjet is designed to propel the missile all the way to target interception, providing the pilot with the largest No-Escape Zone of any air-to-air missile. Its advanced active radar seeker offers excellent resistance to jamming and countermeasures. the last of five test Meteor ramjet-propelled missiles was fired in April 2017 from Cazaux air base. As part of that qualification test, a Rafale launched a Meteor at a distant air threat, then reassigned the missile to another target using the Rafale's fighter-to-missile encrypted datalink, scoring a direct hit.

Standard F4

The Standard F4 will include a whole new generation of sensors and weapons helping boost the fighter's already fearsome air-to-air and air-to-surface capabilities. The Rafale's communication suite will be improved thanks to the adoption of Thales Contact software radios, of a robust Satcom system, and of a secure fighter datalink to supplement the L16.
Additional radar functionalities will be introduced for the detection of threats in challenging environments, notably a Ground Moving Target Indicator (GMTI) mode. The Spectra electronic warfare/self-protection suite will also be updated, with enhanced emitter geolocation capabilities and a faster and more accurate jamming response.

With the advent of the Standard F4, French aircrews will be equipped with a Helmet-Mounted Display System (HMDS) allowing off-boresight target designation to be performed while improving aircrew situational awareness in the air-to-air and air-to-surface roles. The Rafale cockpit will also be progressively modernised, with new, larger lateral multifunction displays to be introduced.

Adopting the latest sensor technology

Thales is heavily investing on the promising Gallium Nitride (GaN) technology that will shape the future of the Rafale's sensors from 2025. Compared to current AESA modules, GaN transmitters/receivers will prove even more powerful, but with reduced electric and cooling requirements, allowing the RBE2 radar's already impressive performance to be significantly increased and additional functionalities to be performed via the radar antenna. New multifunction GaN arrays are likely to find their way onto the Rafale, thus multiplying the number of sensor apertures to enlarge the radar's field of view. GaN antennas will also be adopted for the Spectra jammers. Various new weapons are due to be introduced for the Rafale over the coming years, either as part of spiral upgrades or as part of the future Standard F4, including upgraded Scalp stealth cruise missiles of the Scalp / Storm Shadow family and improved and heavier Hammer (Highly Agile, Modular Munition Extended Range) precision weapons. The Mica family of air-to-air missiles will be upgraded too, to guarantee operational relevance against a whole range of emerging threats. With all these improvements on the horizon, the battle-hardened Rafale will remain a lethal combat tool for the foreseeable future. Thanks to constant investment, to the unconditional support of the French Defence Procurement Agency and to the recent successes on the export market, the Rafale is set to stay in production for years to come, with an additional batch of Rafales likely to be procured by the French MoD around 2020.

RAFALES IN COMBAT IN THE MIDDLE EAST

There are now eight French air force and naval units equipped with Rafale omnirole fighters. They form a powerful, combat-proven force that stands ready to deploy at short notice to any hot spot in the world.

French Air Force and French Navy Rafales have been engaged in Afghanistan, Libya, Mali, Iraq and Syria, successfully logging tens of thousands of flying hours in sustained combat operations. They are currently supporting the fight against Daesh, in Iraq and Syria.

Operation Chammal was launched in September 2014 as the French contribution to Operation Inherent Resolve, the international effort in the fight against Daesh, with the dual aim of restoring stability in the area and of defeating the terror group to curtail its ability to conduct offensive operations throughout the region and further afield.

In the Middle East

As part of operation Chammal, French Air Force Rafales stationed in Al Dhafra, in the United Arab Emirates, and in Jordan are taking an active role in the global fight against terrorism. The first operational missions in Iraq by French forces were flown from Al Dhafra in August 2014, after the United Nations had voted Resolution 2170: Rafales took off to photograph multiple targets of interest with their sharp-sighted Pod Reco NG (new generation reconnaissance pod, known on the export market as AREOS, for Airborne Recce Observation System). From November 2014, French Rafales started bombing Daesh combatants. In September 2015, France decided to extend into Syria operations against terror groups. As it had been previously the case in Iraq, reconnaissance missions were flown first, but Rafales soon switched to kinetic engagements to disrupt Daesh activities in Syria and to support Syrian democratic forces.

Until September 2016, the Rafales based in Al Dhafra belonged to Escadron de Chasse 3/30 'Lorraine' but that unit was moved back to Mont-de-Marsan, in southern France, that very same month. It was simultaneously replaced in the UAE by Escadron de Chasse 1/7 'Provence'. Today, EC 1/7 is equipped with six Rafales. About half of its aircrews are permanently based in Al Dhafra, with the rest provided on a rotational basis by Rafale units in France. Air interdiction, close air support, armed overwatch and ISR (intelligence, surveillance and reconnaissance) missions are flown in Iraq and Syria from Al Dhafra. With its sharp-sighted long-range sensors, the Pod Reco NG has become a key enabler that is constantly in high demand from the combined intelligence cell for wide area mapping and for high-resolution imagery of pinpoint targets.

Forward operating base

France rapidly stepped up the rhythm of combat operations and a forward operating base – a Base Aérienne Projetée, BAP, or deployed air base in Armée de l'Air parlance – was opened in Jordan in late November 2014. The first missions were flown from the BAP in early December 2014, initially by Mirage 2000D and 2000N strike fighters. After the successive terrorist attacks in Paris and in Nice, the BAP was progressively reinforced and the number of offensive sorties increased. In late 2016, a massive reshuffle of deployed French assets led to the repositioning of Mirages to Africa, in support of combat operations in Mali. Simultaneously, the Rafales that were based in Chad left N'Djamena to take over their missions from the BAP. Depending on operational requirements, the number of Rafales based in Jordan fluctuates between six and eight aircraft, usually a mix of single-seat Rafale C and two-seat Rafale B variants.

Missions flown from Jordan include air interdiction, ground-assisted air interdiction, close air support and armed overwatch. The BAP is significantly closer to the theatre of operation than Al Dhafra, thus reducing the duration of transits to and from the operating areas, while increasing time on station. Missions typically last anything between three and five hours, with support from a wide range of French, Australian, German, Italian and US tankers. Previous operational experience in Afghanistan, Abu Dhabi and Chad had proved that the Rafale had no difficulty operating in a hot and sandy environment, and Jordan is no exception, with availability rates close to 100%.

Navy Rafales in action

Like their Air Force counterparts, Marine Nationale Rafale pilots have been engaged in combat on countless occasions, in Afghanistan, Libya, Iraq and Syria. They have amassed considerable combat experience, flying their omnirole Rafale M fighters from the deck of nuclear carrier Charles de Gaulle in the Indian Ocean, in the Persian Gulf and in the Mediterranean Sea. Since early 2014, the 42,000-tonne flagship has deployed to the Middle East no less than four times in quick succession during missions Belleau Wood and Arromanches I, II and III, setting an enviable operational record.

Since February 2015, the French carrier air group has been extremely active against Daesh. Initial combat operations against the caliphate were flown from the Persian Gulf. During Arromanches III, however, the Charles de Gaulle remained in the Mediterranean, thus shortening the supply chain from France. Arromanches III was also significant in that it was the first time that the two naval fighter squadrons on board the vessel, Flottilles 11F and 12F, were equipped with a combined force of 24 Rafale M omnirole single-seat fighters. The withdrawal of the last Super Etendard Modernisé (SEM), in July 2016, had signalled the end of a major modernisation process that will be completed in September 2018 when Flottille 17F, the last SEM operator, is declared fully operational on the Rafale. During Arromanches III, the two Rafale Flottilles closely co-operated, taking advantage of the presence of 24 Rafales on board to generate a huge number of sorties, each unit indifferently performing air interdiction, deep strike, close air support, buddy-buddy refuelling or reconnaissance missions.

In late 2016, when the Charles de Gaulle and her carrier air group were operating off Syria, the overall number of deployed Air Force and Navy Rafales peaked at around forty airframes, offering a major increase in fire power to the local air commander. Rafales were flying offensive sorties at a sustained rate at a crucial moment which coincided with the beginning of the coalition offensive to retake Mosul, the largest city in northern Iraq, at a time when Daesh was constantly being driven back.

Powerful punch

For combat operations in the theatre, each Air Force or Navy Rafale is typically armed with four to six GBU-12 Paveway II laser-guided bombs or four to six Hammer (Highly Agile, Modular Munition Extended Range) stand-off precision weapons of the acclaimed AASM (Armement Air-Sol Modulaire) family. Aircrews can choose from a wide variety of bomb bodies and fuse options to obtain the best military effect on the battlefield, including low collateral damage warheads that can be used reliably in close proximity to friendly forces in urban areas, such as Mosul. Alternatively, a 1,000-kg GBU-24 Paveway III can be fitted under the Rafale's centreline pylon. The GBU-24 is equipped with an earth and concrete penetrator to attack reinforced underground facilities. Infrared and radar-guided Mica air-to-air missiles are carried as standard for self-protection. Rafales also carry a full load of 30-mm ammunition for their 30M791 internal cannon and a full allocation of flares and chaffs. To destroy specific, hardened or deeply buried targets such as tunnels, command posts, ammunition storage caches and improvised explosive device (IED) assembly facilities as part of a wider counter-IED effort, Air Force Mirage 2000s and Rafales and Navy Rafales have launched a significant number of Scalp stealth cruise missiles from stand-off ranges. The first Scalps were launched by Rafales from Al Dhafra in December 2015.

Superb fighter

Armée de l'Air and Marine Nationale pilots all agree that the Rafale is ideal for combat operations in the Middle East. Its huge load-carrying capability is a key enabler in such a vast theatre: the Rafale can be fitted with up to three 2,000-litre external fuel tanks and can carry up to six precision weapons, quite an achievement for such a compact fighter. With its side stick controller, its Martin-Baker Mk 16F zero-zero ejection-seat reclined at 29 degrees, its perfectly well laid-out instrument panel, its state-of-the-art man-machine interface and its powerful data fusion system, the Rafale's cockpit environment proves extremely comfortable and intuitive to operate, a decisive advantage for combat missions which can exceed six hours. The Rafale's comprehensive suite of sensors – RBE2 radar with Active Electronically Scanned Array (AESA), Front Sector Optronics, Spectra electronic warfare suite and Damoclès targeting pod – contributes to an excellent understanding of the tactical environment surrounding the aircraft. The Rafale's exceptional reliability, maintainability and serviceability are also crucial advantages, allowing a large number of missions to be performed with a small number of aircraft supported by a limited number of personnel.
Since entering service, the Rafale has become a battle-hardened combat tool which has proved incredibly efficient in all types of combat situations (supporting troops in contact in Afghanistan, as an entry-force asset against a dense network of air-defences in Libya, tracking well hidden terrorists in rocky mountains in northern Mali and hunting vehicle-borne improvised explosive devices in Iraq and Syria), in all sorts of environments, from the snowy peaks of the Hindu Kush, in Afghanistan, to the sands to the Sahara, from the jungle of the Central African Republic to the city centre of Mosul, from their austere forward operating base in Chad to the pitching and rolling deck of the Charles de Gaulle.

Network centric warfare

Nowadays, no modern combat operation can be carried out without the extensive use of tactical datalinks by warfighters in order for them to share a common tactical picture. Interoperability is the name of the game for interventions as part of a wide coalition and Rafale fighters, designed from day one for combat operations within NATO, is fully interoperable with all the allied assets in the theatre. From their cockpit, Rafale aircrews have permanently at their disposal a huge amount of information, allowing them to gather, process and disseminate data on the battlefield. In the Middle East, Rafale fighters routinely use their Link 16 to seamlessly plug into allied command and control networks. In addition to the L16, Rafales are equipped with the ROVER (Remotely Operated Video Enhanced Receiver) system to exchange in real time a video stream with forward air controllers / joint tactical air controllers on the ground. Rafales routinely cooperate with US and British Reaper Unmanned Aerial Vehicles (UAVs) which are in force in the Middle East, the Reapers acting as airborne forward air controllers.

Navy in Jordan

In early 2017, the Charles de Gaulle entered dry dock for a major refit / nuclear reactor refuelling that will keep her unavailable for 18 months. Rafales will not stand still, however, and it was decided they would support French combat operations against Daesh. Accordingly, four Marine Nationale Rafales deployed to Jordan in late March 2017, allowing the number of Air Force Rafales based there to be reduced. French Air Force and French Navy pilots are totally interoperable and interchangeable as they all train in exactly the same way, with the same tactics and with the same systems, thus considerably improving the operational flexibility of the French armed forces, allowing planners to freely allocate a mission to any one of them.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