

# **RAFALE - M**

## **FRENCH NAVAL GENIUS**

### **RAFALE-M - FRENCH NAVAL GENIUS**

As a successor for the old Crusader the Rafale-M offers the French Aeronavale nowadays complete air-defence capacity and in what form? Very advanced technology en flying characteristics makes this aircraft capable for every challenge.

### **REPLACEMENT OF THE 'CROUZE'**

Since the naval authorities set there choice for the Rafale things went different as planned. The Rafale came much later in service caused by delays in reaching the operational phase. This is why the Crusader had to soldier on for a longer time resulting in much more workload for the maintenance group. However very loved by the pilots, giving it the nickname "La Crouze" the F-8E (FN) had despite some updates several operational shortcomings with its designing technology from the fifties and sixties. There was no BVR (Beyond Visual Range) capacity and no possibility to take radar homing rockets, just only two infra-red homing Matra Magic 2 air-to-air missiles. ECM or other self defence equipment was missing and the range of the radar was very modest. Eventually to create accurate self defence for the fleet in an interim period the Super Etendard was tasked in this role being in the avionics more advanced but as a fighter not designed for this role and therefore not real suitable. This was not a glamorous situation for the new French aircraft carrier "Charles de Gaulle" and even could influence the operational ability of the ship and so was decided to deliver a first batch aircraft for the air defence task only (Standard Fox 1). Our team had the opportunity to visit 12 Flotille at Landivisiau where already 10 examples of the Rafale are yet operational.

### **STRONG MODEL**

When looking at the Rafale one get impressed from this robust fighter with its high and strong landing gear. The attractive aerodynamic shape is highly advanced and not only for beauty. The special position of the engine air intakes combined with the fuselage design with radar emission absorbing materials makes a very low radar cross section for such a big fighter. Characteristics are considered semi-stealth. Performances and agility are equal or exceeding the F-16, Mig-29 or Eurofighter with very promising aircraft handling characteristics for the pilot.

### **NEW IN EUROPE**

Dassault has created a new fusion for the most modern sensors, flying management instruments and weapon systems. The mission computer with powerful data processors forming the heart of the system. Next to this are an advanced synthetic aperture radar (Phased Array Radar) and a Spectra ECM-unit fitted with also in the next versions (Fox 2 and 3) an optical/infrared seeking search system (FSO) and a

helmet mounted cue sight. The Thales RBE-2 (Radar a Balayage Electronique 2) has 2 electronic scanning radars with a passive system scanning the surrounding of the aircraft and a electronic scanning in the look down/look up mode with missile guiding in the shoot-down mode. A phased array radar is more accurate and reliable and reduces radar waves from the enemy by minimizing. The concept is known already for some time in the United States, Israel and Russia and has in the RBE-2 product from Thales Airborne Systems ( ex-Thomson CSF) its first European design. During a typical interception mission the system is looking for high, middle and low frequency pulses above and under the horizon.

Possible targets are first questioned by the IFF and the computer automatically changes in “dog fight” module when the target is not identified. In the “track while scan” mode up to 40 targets can be locked. The eight most threatening targets are automatically selected by the computer and the pilot only has to authorise this before letting go his Mica rockets. Targets can be recognized from great distances and under all weather circumstances including jamming conditions. Search and weapon guiding modes can work simultaneously giving the possibility of finding new targets while others are already engaged.

### **STATE OF THE ART AVIONICS**

Next to the RBE-2 a second very important role is for the Spectra unit. Spectra coordinates the radar warning receiver (RWR) and missile approach warning receiver on the tail and laser warning receiver (LWR) on the nose. The Spectra detects radar waves of hostile radars and incoming rockets and send this information to the computer. The Rafale has electronic counter measures (ECM), flare and chaff dispensers and electro optical decoys. The Fox-1 series will be delivered as soon as possible responding at Aeronavales most urgent needs but has no FSO which will be the case in the Fox-2 series. The FSO is a product of Thales too (in cooperation with SAGEM) and is fitted with two modules with one containing the infrared sensors (IRST and FLIR) and the other a TV/laser system with laser range finder.

Surveillance in different infrared frequencies in a wide range is possible while the system acts totally passive and providing stealth characteristics when replacing the radar. The TV/laser system can track targets but also visually identify the type of aircraft from great distance providing in this way essential information. The laser gives the distance of the target, The own position is very precise measured by the Sagem Spark inertial navigation system with GPS hybrid.

### **FLIGHT CONTROL IS OPTIMAL**

You may say that the man-machine interface is very optimized. The Rafale has HOTAS controls with approximately 30 buttons on stick and throttle, and the fly-by-wire capacity provides several pre-programmed modes. Essential data are combined displayed on a big multifunctional colour display (MFCD) situated central in the cockpit (Head Level Main Display). The tactical data from the radar, ECM and in the fox 2 the FSO and data-link are displayed vertically in regions. Two multifunctional colour touch screens displaying system functions, radar images or fuel levels and a

Head Up Display (HUD) completing the cockpit. Everything has been designed to provide maximum situational awareness in a simple way. To win time in air battle essential information is needed without complex methods to acquire this.

To improve tactical awareness the Fox 2 version will receive the Multifunctional Information Distribution System (MIDS) which receives information acquired by the Nato compatible link 16 data-link system. External data from the tower, AWACS/Hawkeye or friendly fighters are directly displayed in the cockpit. In the Fox 3 version this data will be projected directly on the Thales Topsight helmet mounted cue sight. With the Topsight you can aim your arms by looking at the target and shots over the shoulder will be possible.

### **MODERN ARMAMENT**

The rockets primarily used on the Rafale will be the Matra/BAe Dynamics Mica in both radar homing EM (Electromagnetic) and infrared homing IR versions.

The EM-version is acting autonomously and attacking several targets in the same time with more rockets is possible. A radar missile data-link can activate the warheads at the very last moment. Totally fourteen hardpoints are available fully Nato compatible. Besides Mica's other "smart weapons" like Laser Guided Bombs (LGB's), modular air-to-ground weapons, Scalp-EG or Matra-BAe dynamics Apache cruise missiles or external fuel tanks can be taken at the hardpoints. Other systems like the AASM gets there coordinates and go there own way by GPS like the American JDAM munitions with a precision of decametres. The Fox-3 version will be able to carry nuclear arms or the Exocet anti-ship missile.

### **TRAINING COURSE WITH AMERICAN FRIENDS**

The pre course for flying the Rafale (and Super Etendard) is at Meridian, Mississippi on the T-45 Goshawk. Next phase is carrier deck landings at US aircraft carriers. Then the cadet can immediately practice his skills on the Rafale or Super Etendard. Conversion is not an issue at Landivisiau where you cannot find a trainer version. The navy is used to this and cadets receive training in simulators first. You only find a tactical trainer at Landivisiau at this moment so the air force trainer is shared in use. By the way a Super Etendard is harder to learn as the Rafale. The autothrottle is more advanced as traditional systems.

The thrust/drag control mode enables the Rafale to fly in with ideal angle and speed to the flightdeck. By taking of the computer automatically selects the catapult mode and enables the pilot to go in the air "hands free" with full afterburner. The first 10-15 seconds are under control of the computer before it is handing over to the pilot. On the Charles de Gaulle is a combat simulator with different simulating scenarios like catapult take offs, carrier on board landings and BVR-combat.

### **FUTURE PROSPECTS**

Totally 60 Rafale's-M are on order and after delivering of the first batch Fox 1 it will switch to Fox 2 series being at this moment in the pre- implementation phase

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resulting in operational status within two years with complete simulator. Within 4-5 years the Fox 3 production will be started.

When the Fox 3 is operational the Fox 1 and 2 will be upgraded to Fox 3 during regular maintenance with plug and play avionic systems. In the beginning of the next decade a new aircraft carrier is planned named Richelieu and this is why Aeronavale is scheduling to operate a big pool of fighters the coming years. The Rafale project stays interesting to observe while design of avionics and new high tech inventions will develop in short time and may change the versions in some unpredictable ways.

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