Rafale Aircraft—the Untold Story—Part III

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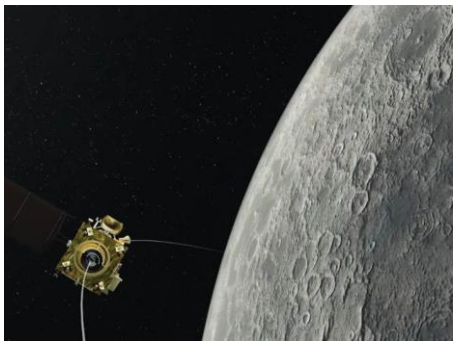
The exchange of vital information across dedicated captive network would facilitate tactical decision making at the appropriate level. Network centric operations play a major role in the present day military warfare. Mapping of the movement of space craft 'Chandrayan II' all the way to the Moon shows how we can monitor and control remote operations. Armed forces conduct similar operations by controlling their weapon platforms from their respective war rooms.



Electronic Warfare (EW) has a major role in the present day military operations. The tactical situation presented by aircraft sensors gives real-time pictures of the battle field. Exchange of information to the right element at the right time makes the difference in modern day warfare. Self-protection of fighting platform is very important for sustenance.

In this part, we will see how sensor suits are integrated on board Rafale aircraft. M/s Thales has played a major role in making the Man Machine Interface (MMI) of Rafale near perfect.

State-of-the-Art Systems

The avionic embedded systems on board Rafale is listed below:

Sr	System	Remarks
a	Smart Cockpit/HOTAS	Glass cockpit with user friendly MMI
b	RBE2 AESA Multimode Radar	Manufactured by Thales
c	SPECTRA EW Suite	Integrated protection suit by MBDA
d	Front Sector Optronics (FSO)	Developed and manufactured by M/s Thales in collaboration with M/s Dassault Aviation
e	AREOS Reconnaissance Pod	
f	TALIOS Laser Designation Pod	
h	DAMOCLES Laser Designator	
i	SB25A IFF (Identification Friend and Foe)	
j	MDPU Mission Computer	For data fusion and exchange
k	MIL-STD-1760/1553 interface back borne	Data Bus for communication control of distributed weapon system
l	Link 16 Data Link	For network centric operations

Smart Cockpit

Dassault Aviation has developed a very easy to use MMI combining the “Hands on Throttle and Stick” (HOTAS) control concept with touch screens and a large tactical display inside the glass cockpit. The comprehensive design of cockpit provides a wide field of view at the front and on both sides with an array of integrated equipment. The cockpit provides superior agility, increased G-protection with 29° tilted seats and an efficient air conditioning/heat exchange system suiting to different altitudes.

Management of mission system resources is done via two lateral displays with their touch screens. The wide angle (30°x22°) holographic head-up display (HUD) shows flight parameters and tactical cues for immediate head-up work.

The tactical situation display is done on a 20°x20° head level display which shows the 'big picture' and facilitates pilots to take right decision during combat. The multiple sensor information is 'fused' into a single colour-coded view. Display is presented at the same optical distance as the HUD for a faster transition between head-down and head-up work.

All the information obtained from various sensors is compiled and projected onto the pilot's HUD in front of the cockpit canopy. The pilot can comprehend the tactical situation without looking down through the canopy glass.

RBE2 AESA Multimode Radar

The AESA (Active Electronically Scanned Array) radar brings superior detection and tracking range, electronic scanning agility and the ability to track targets in or out of the search domain with high resolution ground mapping in Synthetic Aperture Radar (SAR) and Inverse SAR modes.

The radar also allows very low altitude flying above uncharted terrain in autopilot-coupled modes under blind conditions. Electronically scanned array radars which are designed to track all groups of targets, can "track while search", when mechanically scanned array radars can only track some targets inside the search volume and update them as per scanning rate.


AESA RBE2 radar will provide a wide range of functions like look-up and look-down detection, tracking of multiple air targets for close combat and long-range interception. It can function in a cluttered all weather and jammed environment. Radar can do real time generation of three-dimensional maps for uncharted terrain. It also generates high resolution 2D ground maps for navigation updates and detection, identification and designation of ground targets as well as tracking of multiple naval targets.

SPECTRA EW Suite

SPECTRA (Self-Protection Equipment to Counter Threats for RAFALE Aircraft) has been jointly developed by M/s MBDA and M/s Thales to provide an integrated self-protection system for Rafale. The SPECTRA integrated EW suite provides long-range detection, identification and accurate localisation of infrared, electromagnetic and laser threats. The system incorporates radar warning, laser warning and missile warning receivers for threat detection plus a phased array radar jammer and a decoy dispenser for threat countering. It also includes a dedicated management unit for data fusion and reaction decision.


SPECTRA comprises Infrared (IR) Missile Warning System, a dedicated management unit for threat level assessment and multi-threat decoy dispensers with a smart dispensing facility. System facilitates Rafale a high survivability against a range of airborne and ground-based threats.

Front Sector Optronics

The internal FSO provides a tele-lens picture of the target (ground or airborne) with the range measured by the incorporated laser detection system. The covert approach

capability of the FSO is especially valuable in air policing and intercepts. The system can provide early visual identification and detection of suspect manoeuvres.

The FSO is developed by M/s Thales. The system operates in the optronic wavelengths and hence immune to radar jamming/ECM. It also provides covert long-range detection and identification, high resolution multi-target angular tracking and laser range-finding for air, sea and ground targets.

FSO can carry out Air-to-Air and Air-to-Surface tracking using IR search and track. It can also do automatic search and track, access situation awareness, ranging, 3D tracking, wide angle tracking and threat identification.

AREOS Recce Pod

AREOS (Airborne Recce Observation System) reconnaissance system is available as an attachment pod for both strategic and tactical reconnaissance missions. Pods are external attachments carried by aircraft for specific missions. This pod is connected to one of the 14 hot points located at the belly of fuselage. This is an all-weather day and night equipment which can be used in a wide range of altitude and speed. The AREOS pod is fitted with a data link which allows high resolution images to be transmitted back to war rooms in real time.

TALIOS Laser Designation Pod

TALIOS (Targeting Long-Range Identification Optronic System) is the latest addition to the Thales family. TALIOS is the first optronic pod to cover the entire critical decision chain from intelligence gathering to weapon delivery. Its capabilities range from deep strike with long-range missiles, bombs, air-to-air target identification and close air support. It is also capable of handling the rapidly emerging requirement of Non-Traditional Information, Surveillance and Reconnaissance (NTISR).

TALIOS has high-resolution sensors and high-precision line-of-sight stabilisation with wide-angle vision providing critical contextual information and making the pod a key component of the pilot's visual environment throughout the mission. It was developed in an open architecture conceived as a 'plug & fight' system with a high level of functional integration.

DAMOCLES Laser Designator

The DAMOCLES Laser Designator pod by M/s Thales brings day-night laser designation capability to Rafale with metric precision. Damocles is interoperable with all existing laser-guided weapons. It permits laser-guided weapons to be delivered at stand-off range and altitude. The IR sensor of the Damocles pod operates in the mid-wave IR band, allowing it to retain its effectiveness in warm and humid conditions. Damocles features a long-range laser designator, an integrated navigation FLIR and high-resolution imagery. It is compatible with laser-guided bombs and guided

weapons. It has reconnaissance capability with instant transmission of imagery to ground stations.

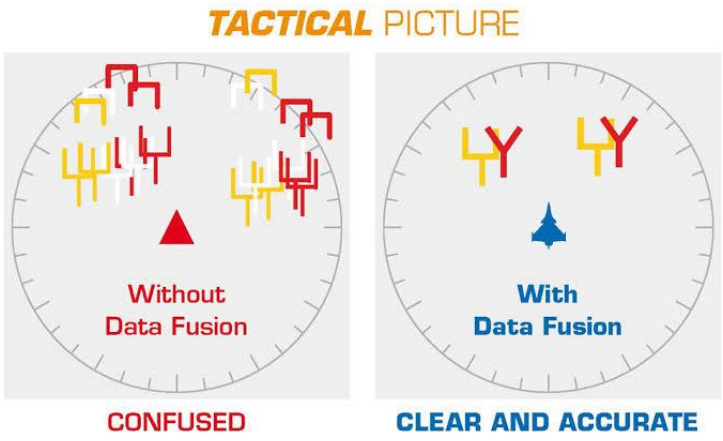
SB25A IFF

The Rafale has an SB25A combined interrogator-transponder developed by M/s Thales. The SB25A has a unique electronic scanning technology unlike other conventional IFF.

MDPU—Data Fusion

The Modular Data Processing Unit (MDPU) is the main mission computer which performs data fusion and processing of the data provided by the AESA radar, the FSO optronic system, the SPECTRA EW system, the data links, the IFF interrogator and the IR missile seekers.

The data fusion yields a simplified and consolidated tactical picture, showing correlated system tracks rather than separate sensor and data link tracks. Workload alleviation, clarification of the tactical situation and fratricide risk reduction are the most immediate benefits for the pilot.



Implementation of the “multi-sensor data fusion” in Rafale facilitates accurate, reliable tracks, uncluttered displays, reduced pilot workload, quicker pilot response and a clear situational awareness. The automated process is carried out in three steps with advanced signal processing coupled with in-built library.

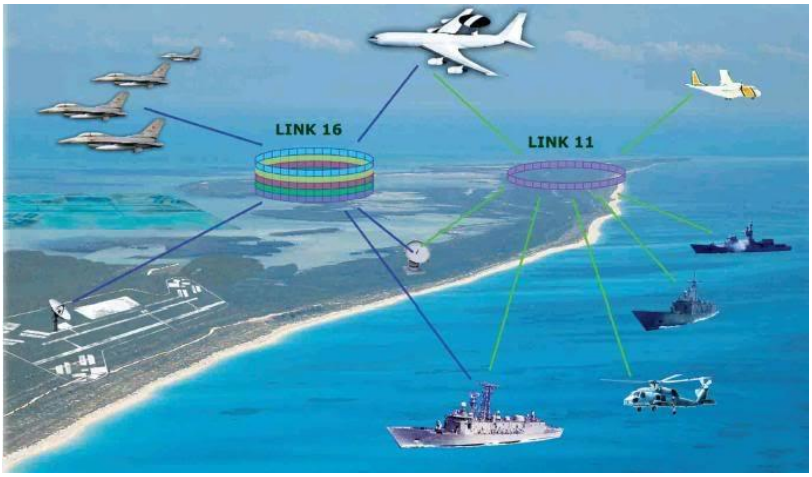
(a) Establishing consolidated track files and refining primary information provided by the sensors.
(b) Overcoming individual sensor limitations related to wavelength/frequency, field of regard, angular and distance resolution, etc. by sharing track information received from all the sensors.
(c) Assessing the confidence level of consolidated tracks, suppressing redundant track symbols and de-cluttering the displays.

MIL-STD-1760 Interface Backbone

MIL STD 1760 is the military standard electrical interface between a military aircraft and its weapon systems/on board avionic systems. This standard has a fibre optic backbone and can facilitate high speed data communication. Rafale's avionics are integrated through four MIL STD-1553B data buses and two MILSTD-1760 data buses.

Link 16—Data Link

Link 16 is a military tactical data link for network centric operations. The network is currently used by NATO nations. This tactical data link is used across the board in Army as well as in Navy. Tactical situation data is exchanged between ships and ground forces on near-real time. It facilitates exchange of text messages, imagery data and digital voice. The link can transmit data up to 1 Mbit/s speed.



Conclusion

It is apparent that the Rafale has every feature comparable with leading fighter aircraft in the world. The reservation shown by the US government to sell new generation fighters to India has left us with no choice other than exploring the European market. Rafale may be no match for the leading US stealth fighters, but many aspects like its manoeuvrability, dog fight capability, weapon package, avionics systems, ease of operation and maintenance, cost of aircraft, operational cost and after sales support are considered by the Indian Air Force for opting Rafale. Though we cannot claim of getting the best fighter, we can say with authority that we are going to have one among the best fighters. In fact, man behind the machine matters the most and our airmen are second to none in the world.

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Views expressed are personal and need not reflect or represent the views of Centre for Public Policy Research

The reference sources for research, photos and tables are given below.

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