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Reviewing Dassault-Rafale And Its Technology For Indonesian Defense

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Abstract – The production of defense equipment, especially combat aircraft, is currently the focus of various countries in the world. Dassault Aviation as one of the influential manufacturers in the air defense industry, offers its flagship product Rafale with qualified specifications such as the SPECTRA electronic defense system which is capable of 360° detection and action as well as its AESA Radar specification which is capable of detecting and searching for all aspects, tracking various targets. air in close combat, in all weather conditions. Indonesia's geographical conditions are vast and are in a tropical climate with quite dynamic hydrometeorological conditions. The AESA Radar system on the Rafale is capable of all-round detection, tracking various air targets in close combat, in all weather conditions.

Keywords – Alutsista; Rafales;AESA; SPECTRA

I. INTRODUCTION

The sovereign territory of the Unitary State of the Republic of Indonesia which stretches very wide also makes Indonesia have a very large air space. In addition, Indonesia's territory which is the main trade crossing makes Indonesia vulnerable in terms of airspace sovereignty. Every country in the world continues to produce and develop defense equipment to support its national defense, including Indonesia. This is a problem for Indonesia because Indonesia's air defense system is still minimal. This causes the vulnerability of violations in Indonesian airspace.

Airspace violations that occurred in Indonesia are quite high. The Bawean intercept incident in 2003 became a wake-up call for Indonesia to properly and sustainably prepare for Air Superiority. This is bearing in mind that the control of airspace is a determining factor in the course of a war. Based on the data, in 2021 there will be 500 cases of violations committed by foreign aircraft. A case of airspace violation occurred recently, namely a Malaysian-owned aircraft was detected by Satrad 213 Tanjung Pinang making an unauthorized flight over the Tanjung Pinang area. The plane was then forced to land at Hang Nadim Air Force Base, Batam by deploying an F-16 fighter jet. The breach occurred on May 14, 2022,

One way to solve this problem is to increase the number of Indonesian air defense systems. In February 2022 it was discovered that Indonesian Minister of Defense Prabowo Subianto entered into a cooperation contract to purchase Rafale Fighter Jets with Dassault Aviation. The purpose of the purchase is to improve defense in Indonesia's territory. Rafale fighter jets have modern and sophisticated technology which is very useful for air defense. This study discusses the analysis of technology in Rafale fighter jets to support Indonesia's territorial defense.

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II. LITERATURE REVIEW

2.1. Dassault Aviation

Dassault Aviation is a French aerospace company that makes military and civil aircraft. Dassault develops control systems for business purposes in accordance with consumer desires. Dassault works not only in France but all over the world with the help of digital aspects. Some of Dassault Aviation's locations are France, India and the United States. Dassault Aviation makes offers to partnerships to be developed covering Governance, ethics, CSR, Digital drivers, Transformation plan, Program in partnership and Customer first.

In its partnership, Dassault has a variety of partnership experiences such as partnerships in the industry aiming to develop products that best meet the criteria of consumer needs such as modern aircraft concentrating on advanced technology such as the RAFALE Fighter Jet with the main industry partner namely Dassault Aviation as the Rafale design authority, airframe manufacturer, design and system integration and flight control systems, Thales as developer of RBE2 and AESA Radar, SPECTRA EW SUITE and optronic systems, and Safran as developer of M88 Engines.

Dassault also establishes partnerships in Science and R&D to maintain leadership in technology, as well as partnerships through the development of polarization in anticipating civil and military needs by mastering the most promising technologies in the long term which consists of 3 pillars namely the future Business Jet, Air Collaborative Military Combat future by developing an Autonomous Platform, as well as a key framework technology consisting of 2 pillars, namely people and technology. International cooperation in Research and Development, Dassault Aviation involves universities, start-ups, companies, student exchanges, bilateral projects and multi-partner projects to develop technological innovation.

Partnership in education to capture the potential of talented and skilled people. PointsThe main goal of this partnership is to find people who are capable of innovating in the future so that they can design new technologies for Dassault Aviation. Dassault Aviation Preparing skills for the future is carried out by collaborating with educational institutions and assisting career promotion in aeronautics. In addition, Dassault Aviation is able to anticipate needs by hiring the best talent, training employees to maintain technology leadership, and supporting change.

2.2. RAFALE

Rafale is a French fighter aircraft made by Dassault Aviation. The Rafale's maiden flight was on 4 July 1986, then it continued to be developed with various trials so that the Rafale was finally introduced on 4 December 2000 with the French Air Force as its main user. The launch of the Rafale duplicated the types of combat aircraft that were in operation at that time, namely the Air Force's SEPECAT Jaguar and the Navy's F-8 Crusader.

The Rafale aircraft program has 3 versions, namely Rafale type C (1 seater), Rafale type B with 2 seats and Rafale type M for the benefit of the Navy on aircraft carriers. Rafale type C has a navigation system that is fully integrated with the latest technology which has extraordinary capabilities on target air-to-air and ground-to-air missions. While the Rafal type B has the same system features and capabilities as the Rafale Type C equipped with 2 seats so it can carry out any mission with 1 pilot or 2 crew members. Meanwhile, the Rafale type M, with the same system features and capabilities as the other two types, is devoted to the needs of aircraft carrier operations for the Navy.

2.3. The National Defense

As stated in the Law of the Republic of Indonesia No. 3 of 2002 Chapter I Article 1 concerning National Defence, National Defense is all efforts to defend state sovereignty, territorial integrity of the Unitary State of the Republic of Indonesia, and all the safety of the entire nation from threats and disturbances to the integrity of the nation and state. Threats that will be faced, can be in the form of military threats such as military attacks from other countries, as well as non-military threats such as pandemic threats, natural disasters and others.

The Indonesian defense system is a universal defense system, the implementation of which is based on awareness of the matters and obligations of all citizens in achieving national goals as stated in the 1945 Constitution. The area of the State of Indonesia reaches 1,919 million km2 and of which around 17,504 islands demand the existence of a system. maximum and comprehensive national defense from all components, namely land, sea and air.

The national defense component that will be discussed in this study is specifically air defense. In Law no. 34 of 2004 Article 10, the TNI Air Force is tasked with carrying out the duties of the TNI in the field of defense, enforcing the law and

maintaining security in the airspace of national jurisdiction in accordance with the provisions of national law and ratified international law, carrying out the TNI's duties in the development and development of force air force, as well as carry out the empowerment of air defense areas.

2.4. Indonesian Air Force Air Power Capability

In supporting its duties in protecting the airspace of the Unitary State of the Republic of Indonesia, the Indonesian Air Force is equipped with all sophisticated facilities and technology. The capabilities of the Indonesian Air Force in this case are in the form of air control capabilities, air strike capabilities to carry out air strikes against enemies that endanger the sovereignty of the Republic of Indonesia in the air, as well as ISR (Intelligence, Surveillance, and Reconnaissance) capabilities.

In supporting air control and air strike capabilities, several facilities are in the form of surcafe-to-air, control facilities, and air-to-air facilities. The surface-to-air facility owned by the Indonesian Air Force is the Oerlikon Skyshield Air Assault Counter (PSU), which is capable of fending off various air threats that have the potential to damage vital objects. The Control Facility owned by the Indonesian Air Force is Radar, be it radar active or passive radar. Air-to-air facilities owned by the Indonesian Air Force are in the form of combat aircraft and missiles. The strength of fighter aircraft owned by the Indonesian Air Force includes the F-16 Falcon Star eMLU, SU-27/30, HAWK 100/200 and T-50i.

In addition, in supporting ISR capabilities, the Air Surveillance strength of the Indonesian Air Force includes short range ISR and long range ISR, while land-based surveillance includes the GCI Radar and Passive Radar.

III. Research Methods

The method used in this research is to use descriptive analysis method and literature review (literature review) which the author collects from various sources related to this paper. This method aims to provide a comprehensive and analytical explanation based on data from literature. The author utilizes several search engines including Google Scholar, OpenKnowledge using related keywords such as: Rafale, AESA Radar, Dassault Aviation, and so on to then obtain sources such as previous research journals to assist the author in writing this article.

IV. Discussion

4.1. The Need for Combat Aircraft for Indonesian Air Defense

Airspace as stated in the 1944 Chicago Convention Article 1, Signing countries recognize that each country has full and exclusive sovereignty over the airspace above its territory. Air space is the territory above the land and sea of a country with land and sea areas as crucial point areas that need attention and supervision as a form of national sovereignty and defense. Indonesia's vast territory, which is shaped like an archipelago, demands extra patrols and reconnaissance. This is hampered by limitations in the number of defense equipment and technology so that threats tend to enter Indonesia through airspace, such as violations of territorial boundaries. Therefore, control of air space is an important component in Indonesian territorial air defense.

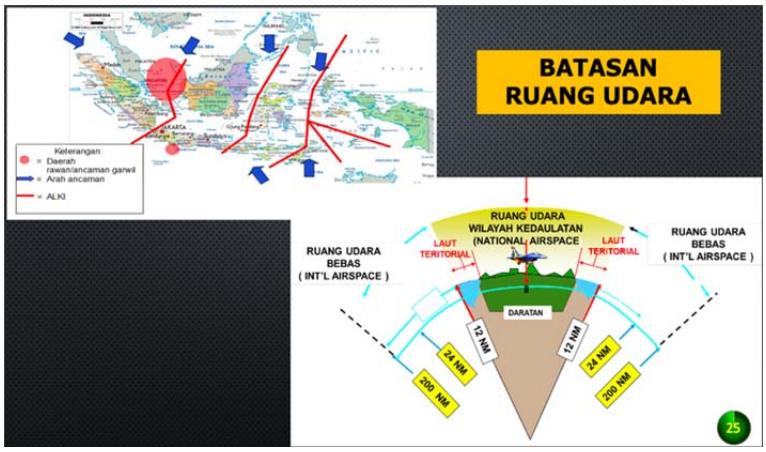

Fig. 1. Indonesian Air Space Limitations and Potential Threats

Air Force Titles belonging to the Indonesian Air Force in Indonesia total 49 air bases, consisting of 17 Type A air bases,

19 Type B air bases and 13 Type C air bases

Fig. 2. The title of Indonesian Air Base

The Indonesian Air Force's current defense radar strength is 20 radars spread throughout Indonesia. With the current conditions, compared to the entire area and islands, Indonesia still needs the procurement of air defense radars. Until now, air defense radar is assisted by the existence of civil radar which can be utilized to support air defense covering its entire territory.

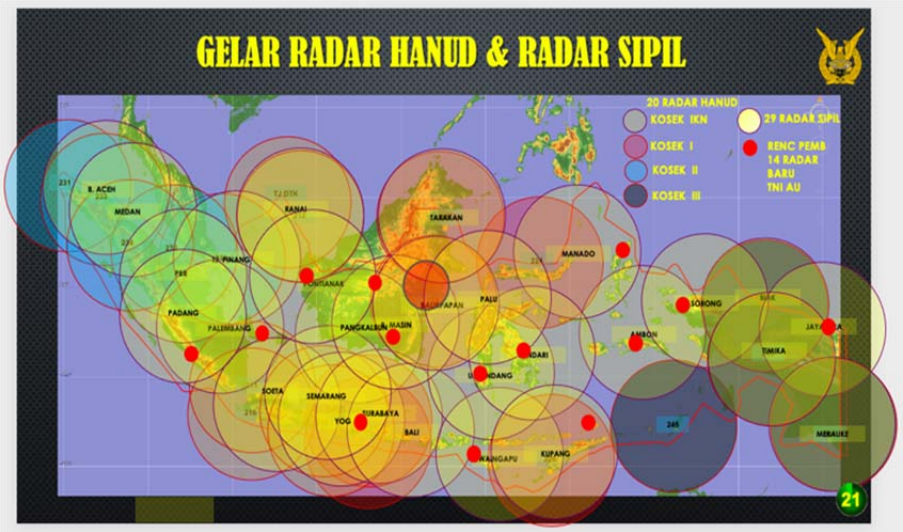

Fig. 3. Air Defense Radar and Civil Radar Deployments

There are several types of fighter aircraft owned by the Indonesian Air Force. One of them is the F-16 Falcon. The Fighting Falcon is a fighter jet developed by the United States which has excellent air combat capabilities, has a side control handle for easy control at high speeds. The F-16 is equipped with air-to-air missiles, air-to-ground missiles and anti-ship missiles. In addition, the F-16 also has an An/APG radar which mandates the X-band which is capable of covering high-flying and low-flying targets. This system can detect and track aircraft and small high-speed targets at ranges beyond visual range to near range, the Radar then transmits target information to the aircraft's central computer to engage using effective delivery of attack weapons.

Fig. 4. Indonesian Air Force's F-16 Fighter Falcon

Another type of fighter aircraft owned by Indonesia is the HAWK 100/200 fighter. The HAWK fighter jet is produced by a BAE HAWK company which is a company from Great Britain, England. This type of aircraft has been operational in Indonesia since 1997, and uses the APG-66 modern radar and AIM-9 Slidewinder missiles.

The T-50i type fighter owned by the Indonesian Air Force has a configuration similar to the KF-16. This type of aircraft was developed by the United States-South Korea which is also equipped with the AIM-9 Slidewinder missile mounted on each cell at the tip of its wing and has an APG-67 type radar. In its use, this aircraft functions as a LIFT (Lead In Fighter Trainer) aircraft.

The vast territory owned by Indonesia needs to be supported by fighter aircraft that have a long range. The fighter aircraft that Indonesia already has is the Russian-made Sukhoi SU-30. This aircraft has a maximum speed of 2,120 km per hour with a cruising range of up to 3,000 km. Sukhoi SU-30 is equipped with a radiolocation system that has the ability to track 10 targets simultaneously. This aircraft is claimed to be effective and precise in attacks on the ground. Armament is equipped with anti-radar missiles and guided bombs that are adapted to the existing weapons. The armament of the Sukhoi SU-30 is equipped with 30 mm caliber rifle armament, 12 missiles to the ground with a range of 30 km, 20 air missiles with a range of 20 km and can load 45 aerial bombs of various types.

4.2. Rafale and its Technology

The Dassault Rafale is a form of standardization of the French military in achieving the 2025-2030 vision which is equipped with nuclear weapons. Development of the Rafale since its inaugural flight on July 4 1986 continued to be developed until it was finally declared to meet standard requirements in 2008. The aerodynamics of the Rafale have a delta wing feature that is able to maximize maneuverability while maintaining flight stability. One of the superior features of the Rafale is that it can be operated on a runway with a length of only about 400 meters. With the ability to carry many types of weapons and a sophisticated mission system, the Rafale is said to be able to carry out air-to-ground attacks, as well as air-to-air attacks and intercept enemy aircraft in one mission (Herindra, 2022).

In its combat system, the Rafale is equipped with an integrated electronic defense system commonly known as SPECTRA (Self-Protection Equipment Countering Threats to Rafale Aircraft) which is capable of 360-degree detection and action, sophisticated human-machine interface with display in the cockpit, missile electronics allows the pilot instantly selects the most effective defensive measure based on a combination of radar jamming, infrared or radar decoying and evasive maneuvers. With SPECTRA, threats can be easily defined, then integrated and updated in no time by users with complete autonomy. In addition, SPECTRA also includes a new generation missile warning system capable of enhancing the detection performance of the latest threats.

Another key to the Rafale's performance is in the RBE AESA Radar specification. The AESA Radar is developed by the Thales Group. Compared to conventional radar antennas, the RBE2 offers Active Electronically Scanned Array (AESA)

performance that provides a wide range of functions. AESA is capable of performing all-aspect search detection and tracking of various air targets for close combat in all weather conditions. AESA also has the ability to track targets going in and out of search range making it very advantageous in situations air combat. AESA also allows the creation of real-time three-dimensional maps to follow the terrain on a blind map. In addition, AESA is capable of loading high-resolution 2D ground maps in real-time for navigation detection updates, identification and designation ground targets, as well as AESA capable of detecting and tracking various targets in the sea. This technology makes the Rafale the only new generation fighter aircraft that proposes fully compatible functions in the range and detection of upcoming air-to-air missiles.

4.3. Composition of Rafale, F-16 Fighting Falcon & Sukhoi SU-30

A comparison of the composition and performance of the three types of fighter aircraft owned by Indonesia is described in the table below.

Table 1. Indonesian Combat Aircraft Specifications

Specification	TYPES OF INDONESIAN FIGHTER AIRCRAFT		
	Rafale	**F-16 Fighting Falcons**	**Sukhoi Su-30**
Maximum speed	1,384 km/hour	1470 km/h	2120 km/h
Fighter Jet Size	15.27m x 10.80m	15.1m x 9.9m	21.9m x 14.7m
Cruising range	3700 km	3900 km	3000 km
Weapon capacity	9 tons	11 tons	24 tons
Radar	RBE2 AESA with 200 km detection	APG Pulse-Doppler radar	NIIP N001VEP Fire Control Radar for
Electronic defense system	SPECTRA with 360o detection	Internal FLIR Targeting System (IFTS)	Radiolocation with the ability to track 10 targets simultaneously
Missiles	Mica, Magic, Sidewinder, ASRAAM, and AMRAAM, AS30L, ALARM, HARM, Maverick, and PGM100, Exocet anti-ship missile	Air-to-air: AIM-7 Sparrow, AIM-9 Sidewinder, IRIS-T, AIM-120 AMRAAM, Python-4 Air-to-ground: AGM-45 Shrike, AGM-65 Maverick, AGM-99 HARM Anti-ship: AGM-84 Harpoon, AGM-119 Penguin	Air to Air: R-73 Short range infrared missile, R-77E Missile combined with radar Air to ground: KH-31p anti-radiation, KH-29T & KH-59 ME TV

V. CONCLUSION

Indonesia's vast territory, as well as the defense power of the Indonesian Air Force which until now has not yet reached all

parts of Indonesia, makes the need for fighter aircraft with the best and most sophisticated specifications to support Indonesia's air defense at this time a vital necessity. The existence of Dassault Aviation with its Rafale product which offers all sophisticated systems from SPECTRA to AESA Radar can be the best choice for Indonesia in meeting the needs of fighter aircraft to support national defense, especially airspace defense.

By looking at the different composition of the various variables and types of fighter aircraft owned by Indonesia, with their respective technological sophistication and advantages, it can be used as a benchmark for the need for fighter aircraft that must be owned by Indonesia. In the future, it is hoped that the study in this paper can be continued by conducting research related to the specific number of Rafales needed based on Indonesia's geographical conditions by utilizing a geographic information system.

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