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Development Of Sıxth Generatıon Combat Aırcraft

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ABSTRACT: *The sixth-generation fighter is a conceptualized class of fighter aircraft that is more advanced than the fifth-generation jet fighters under development. The sixth-generation fighter will represent a fighter aircraft design category that is anticipated to be far superior to the technological capabilities of the fifth-generation fighters under development. Countries, including the USA, Russia and China, announced their sixth generation aircraft production plans to the world public. A consortium of countries including Japan, Italy, the United Kingdom, France, Germany, Spain and Sweden has launched multinational initiatives aimed at developing a sixth-generation fighter jet.*

Since sixth-generation warplanes will be able to read pilots' minds thanks to artificial intelligence in the 2030s, information will be exchanged between pilots and planes. Sensors in pilots' helmets will be able to monitor the pilot's brain signals and other health data and provide information about the pilot to relevant authorities.

Key Words: *Sixth Generation Fighter Aircraft, Sensors in Helmets, Advanced Stealth, Hypersonic Speed, Advanced Sensors, AI and Autonomous Systems, Directed Energy Weapon.*

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I. INTRODUCTION

Several countries, including the United States, Russia and China, have announced the development of sixth-generation aircraft programs, while Japan, Italy, the United Kingdom, France, Germany, Spain and Sweden have also joined joint multilateral programs to spread development costs. The first 6th generation fighter is expected to enter service in the 2030s[1]. The United States and several European nations are pursuing next-generation fighters. While many details are closely held or are still being fleshed out, a picture is starting to emerge of the capabilities they will possess[2]. Generations are by no means universally accepted. There are numerous different definitions of what precisely a generation entails, where the start and stop points are, and what design characteristics they have[3]. Overall it fits nicely to what we know and expect, China's 6th generation fighter will be most likely be a tailless flying wing design like several other 6th gen fighter concepts under study in other countries too[4]. The US Air Force has formally begun the competition for its highly-classified Next Generation Air Dominance (NGAD) fighter aircraft. The NGAD is a next-generation tactical combat aircraft that will be capable of performing missions alongside drones[5]. Several countries have announced the development of a national sixth-generation aircraft program, including the United States, India, Russia and China, while Japan, Italy, the United Kingdom, France, Germany, Spain, and Sweden have joined together in collaborative multinational programs in an effort to spread development costs[6]. The first sixth-generation fighters are expected to enter service in the 2030s[7].

Tempest aircraft, developed by UK's BAE (British Aerospace Electronic) Systems, Rolls-Royce, European missile company MDBA (Matra, BAe Dynamics and Alenia) and Italian aerospace and defense company Leonardo, will help pilots with artificial intelligence when they are under pressure. After successive flights, the artificial intelligence will have collected a huge amount of biometric and psychometric data[8].

II. Studies on the development of sixth generation warplanes

II.I. TEMPEST Project

Figure 1. Tempest Project Visual: BAE Systems

The Tempest will be a sixth-generation jet fighter incorporating several new technologies including deep learning AI, ability to fly unmanned, swarming drones, directed-energy weapons,[9] virtual cockpit in helmet[10][11] and hypersonic weapons.[12] £2 billion was earmarked until 2025.[13][9] It was developed by a group called Team Tempest, consisting of the BAE Systems, project leader and systems integrator; Rolls-Royce, working on power and propulsion; Leonardo S.p.A., working on sensors, electronics and avionics; MBDA, working on weapons;[9][14][11] and the Royal Air Force (RAF) Rapid Capabilities Office.[10] The maiden flight is anticipated to occur by 2025 ahead of entry into service by 2035.[10][15] Tempest will replace the Eurofighter Typhoon in RAF service.[9] The RAF's Second World War Hawker Tempest fighter also followed a Typhoon.[16] Some technology developed for Tempest will be implemented in Typhoon.[13]

II.II) The Future Combat Air System (FCAS)

The FCAS will consist of a Next-Generation Weapon System (NGWS) as well as other air assets in the future operational battlespace.[17][18] The NGWS's components will be remote carrier vehicles (swarming drones) as well as a New Generation Fighter (NGF) - a sixth-generation jet fighter[19] that by around 2040 will replace current France's Rafales, Germany's Typhoons and Spain's EF-18 Hornets[20][21]. A test flight of a demonstrator is expected around 2027 and entry into service around 2040[22].

Figure 2. Combat Air System

II.III) F-X Project

The Mitsubishi F-X (unofficially called F-3) is a sixth-generation stealth fighter in development for the Japan Air Self-Defense Force (JASDF). It is Japan's first domestically developed stealth fighter jet and will replace the Mitsubishi F-2 by the mid 2030s.[23] Its development is to also bolster the nation's defense industry and potentially enter the international arms market amid Japan's change in defense posture[24]. To improve detection against stealth aircraft, the F-X utilizes integrated sensors. The sensors include: an active electronically scanned array (AESA) radar, passive radio frequency (RF) sensor, and an infrared camera.To minimize its radar cross section, F-X physical design features serpentine air-ducts and an internal weapons bay.[25] Electromagnetic wave absorbers are applied to the air-ducts and engines to reduce the amount of radar reflection.

Figure 3. F-X Project

II.IV) MIG-41 (PAK-DP) Project

The Mikoyan PAK DP Prospective air complex for long-range interception is a Russian programme to develop a stealth interceptor aircraft/heavy fighter under development by Mikoyan to replace the Mikoyan MiG-31 in the Russian Aerospace Forces in mid-2030sIt is often referred to as the Mikoyan MiG-41, because its project code is izdeliye 41 (product 41), but an official designation has not been given, as Russian planes only receive an official designation when they are about to enter service. According to Russian defence analyst Vasily Kashin, the MiG-41 would be considered a 5++ or 6th generation Project[26].

Figure 4. MIG-41 Project

II.V) ADF Project

Taiwan to accelerate plans for a next-generation indigenous fighter, the first flight of which is now estimated for 2025. The Taiwanese Ministry of Defense indicated that the ADF (Advanced Defense Fighter) project will be officially launched in 2023, bringing forward the evaluation and development phase by at least one year. Taiwan expects the first flight of the fighter, if all goes well, to occur in 2025. The pre-series aircraft initially intended as 9 for 2029, will be 6 and will join the test program in 2026[27].

Figure 5. ADF (Advanced Defense Fighter)

II.VI) PCA Project

PCA is meant to replace the current fleet of F-22s and F-15s, taking its place as the service's dedicated air-to-air fighter when it enters service in 2030. Unlike the Air Force's F-35A, which is meant to carry out both

air-to-air and air-to-ground missions, PCA will be focused solely on the skies, optimized to fight and win against current and future aerial threats including the Russian Sukhoi Su-57 and China's J-20 fighter.
PCA will also need greater stealth, particularly against low frequency radars. One design characteristic that might make PCA more stealthy than her predecessors could be the lack of a vertical stabilizer, like the B-2 Spirit bomber. Another feature of the new fighter will be optimized to penetrate enemy airspace. Weapons and fuel must be stored within the airframe, increasing internal volüme[28].

Figure 6. PCA Project Air Forces[28].

II.VII) F/A-XX Project

F/A-XX is a development and acquisition program for a future sixth-generation air superiority fighter to replace the United States Navy's F/A-18E/F Super Hornet and complement the F-35C beginning in the 2030s.[29] A requirement was first identified in June 2008[30]. The F/A-XX is expected to be the manned fighter component and centerpiece of the Navy's Next Generation Air Dominance (NGAD) family of systems. Although identically named and sharing some technology developments, this program is distinct from the U.S. Air Force's NGAD sixth-generation fighter program.[31] In May 2015, Secretary of the Navy Ray Mabus stated that the F/A-XX should be a platform with the capability of optional unmanned autonomous operation.[32]

Figure 7. F/A-XX Project

II.VIII) J-XX Project

Shenyang J-XX[33] (or J-X33][34] or XXJ[1]) is China's next-generation fighter aircraft project with stealth aircraft features. There is no clear information about the project yet disclosed to the world public. Information obtained by the intelligence agencies of Western countries claims that the aircraft will be a twin-engine vehicle with wings, carrying its weapons in closed compartments, such as the Lockheed Martin F-22. Due to China's close ties with Russia, it is estimated that this aircraft will use Russian design and technology.

In 2002, Jane's Defense Weekly magazine claimed that Shenyang Aerospace Company had been selected as head of research and development on the J-XX project[34] (New Scientist magazine made similar claims the same week[35]).

Figure 8. J-XX Chinese Next Generation Fighter[36].

III. Features of Sixty Generation Figter Aircraft

1. It will have a manned and/or unmanned design.
2. It will have more effective maneuverability than fifth generation warplanes.
3. It will have network and satellite-centered operations and cyber warfare capability using artificial intelligence.
4. It will be able to move 5-6 times faster than the speed of sound.
5. Thanks to the modular structure, the replacement time for any part will be very short.
6. It will be able to establish strong sensor connections with air, land and naval units.
7. Advanced Stealth: Enhanced stealth capabilities to evade detection.
8. Hypersonic Speed: Ability to reach speeds beyond Mach 5.
9. Directed Energy Weapons: Integration of high-energy lasers.
10. Advanced Sensors: State-of-the-art sensor suites for enhanced situational awareness.
11. AI and Autonomous Systems: Utilization of artificial intelligence for decision-making.
12. Network-Centric Warfare: Seamless integration into broader military networks.
13. Multirole Capability: Versatility for diverse mission profiles.
14. Extended Range: Increased operational range for greater flexibility.
15. Improved Survivability: Enhanced defensive systems.
16. Sustainability and Efficiency: Focus on fuel efficiency and reduced environmental impact[37].

IV. CONCLUSION

Sixth-generation fighter jets include advanced technologies such as stealth, hypersonic speed, directed energy weapons, artificial intelligence and network-centric warfare. The purposes of developing these aircraft are designed to provide superior capabilities, versatility and survivability depending on the environment. Little information is available on progress in the development of sixth-generation fighter jets. Delays in the production of fifth-generation warplanes will mean that 2030-2035 will be a realistic time frame for the production of sixth-generation warplanes.

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