



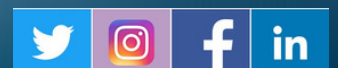
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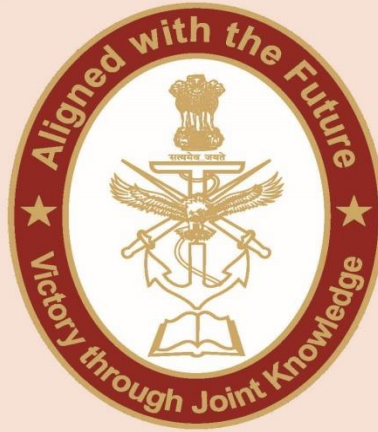
ANALYSIS OF GLOBAL COMBAT AIR PROGRAM

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ANALYSIS OF GLOBAL COMBAT AIR PROGRAM



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Abstract

The 'Global Combat Air Program' (GCAP) seeks to build long-lasting defence relationships, accelerate advanced military capability and technological advantage, deepen science and technology collaboration, integrated supply chains, and further strengthen the defence industrial base among the three nations. While the GCAP is a highly ambitious program and is a great policy of joint security architecture, we need to keep in mind that such fighter jet projects all over the world have faced various issues, closer home being the Fifth Generation Fighter Aircraft (FGFA) Program of India-Russia or the Future Combat Air System (FCAS) of France, Germany and Spain. This article briefly analyzes the scope and challenges of GCAP and whether it can be a successful program, rather than turning into a failure.

Introduction

On 9th December 2022 the PM of UK Rishi Sunak announced an unprecedented international aerospace coalition called GCAP to adapt and respond to the security

threats of the future. The GCAP is a new partnership and ambitious endeavour between the governments of UK, Japan and Italy to deliver the next generation of combat fighter jets by 2035. Britain and Italy have previously collaborated in early development work on their own future combat aircraft project, known as the 'Tempest', while Japan has been pursuing its next-generation F-X fighter jet program. The GCAP will merge the UK-led Tempest with the Japanese F-X program.¹

Reasons for launching GCAP

The GCAP is a trilateral aircraft development program. The three countries have their own unique security concerns and requirements as well as foreign policy goals. Japan wants joint collaborations with countries that have program timeframes matching Japan's timeframe for deploying the fighter jets. Hence Japan chose UK's BAE Systems as a collaborative partner over Lockheed Martin of the US because the developmental timeframes of both the F-X and Tempest programs are aligned with each other. The GCAP program is expected to replace the existing F-2 fighters of Japanese Air Self- Defence Forces (JASDF) by the year 2035.²

Japan wants to develop a more superior aircraft at lesser cost that can be comparable to the US F-35, with advanced sensor and networking capabilities. In order to maintain air superiority, it wants to acquire a large multi-role stealth fighter with a long cruising range and twin engines with excellent missile loading capacity. Next, the cost of developing new fighter planes is so huge that it can hardly be covered by a single country alone. Hence it makes sense to reduce development and technological costs by working with the UK and Italy.³

Additionally, Japan is seeking a degree of freedom in future modifications. Hence it wanted access to the source codes to introduce localized and independent upgrades of weapons, controls etc. This would also assist in its future plans to export this jet in South East Asian countries according to their requirements.⁴ Japan's decision comes in addition to three key policies that it adopted namely the National Security Strategy (NSS), the National Defense Program Guidelines (NDPG) and the Mid-Term Defense Program (MTDP), which covers defense spending for a five-year period. It also comes as Prime Minister Fumio Kishida and his government has vowed to increase defense spending and capabilities, including acquisition of counter-attack capabilities enabling

Japan to retaliate against bases and installations in the territory of countries attacking Japan, in light of what they see as threats from Russia, China and North Korea.⁵

On the European side, the Tempest is being developed by the UK and Italy jointly as part of the Future Combat Air System (FCAS), which includes plans to work with a fleet of unmanned aerial vehicles (UAVs) and innovative data systems. As a maritime nation, the UK wants similar performance capabilities as required by Japan including the capability of firing hypersonic missiles and Directed Energy Weapons (DEW). GCAP is expected to replace the existing Eurofighter Typhoon fleets of both UK and Italy beyond 2040.⁶

The UK PM said "*The security of the United Kingdom, both today and for future generations, will always be of paramount importance to this Government. That's why we need to stay at the cutting-edge of advancements in defence technology – outpacing and out-maneuvering those who seek to do us harm. The international partnership we have announced today with Italy and Japan aims to do just that, underlining that the security of the Euro-Atlantic and Indo-Pacific regions are indivisible. The next-generation of combat aircraft we design will protect us and our allies around the world by harnessing the strength of our world-beating defence industry – creating jobs while saving lives.*"⁷ This statement points to the fact that the UK seeks to occupy a more assertive role in the near future in the Indo-Pacific and European continent, clearly pointing towards the combined threats from Russia and China.

Scope of GCAP

The GCAP program is unprecedented in many ways. It's the first time that Japan has chosen a partner other than the US, which is extremely rare since after World War II, Japan has chosen to be totally a pacifist nation with security arrangements with the US. It didn't have any credible experience in developing any fixed wing fighter aircraft previously because it depended on the US for its overall security. As the US contractor Lockheed Martin was earlier collaborating with Japan on its F-X fighter program, there was an issue of delays which was compromising the security of Japan. This delay was based on the fact that Lockheed Martin was not sharing the source codes and the usual US policy of denying technology transfer. This has already affected Japan's

earlier F-2s and F-15s fleets.⁸ The timeline for the development of the F-X fighter was virtually off. Hence this program will try to replenish those fighter strength.

As was seen before in 2011, Japan opted for the US F-35 instead of the British Eurofighter. So in 2017 Japan got a better offer of co-developing an advanced fighter jet with the UK. The agreement stipulated that both countries will exchange information about advanced aviation technology. To counter the US, the UK is also helping Japan in areas of ramjet powered Beyond Visual Range (BVR) air-to-air missiles. Further, the UK is also offering to help integrate the Japanese Radio Frequency (RF) seeker technologies into the European Meteor BVR air-to-air Missile. This project is called the Joint New Air-To-Air Missile (JNAAM).⁹ This will help the indigenous Japanese industries. The main Japanese contractors are Mitsubishi Heavy Industries (MHI), Mitsubishi Electric and Ishikawajima-Harima Heavy Industries (IHI) Corporation. They are expected to heavily gain technical expertise from this project.¹⁰

From the UK point of view, this program is planned from an economic, diplomatic and security point of view. Right after Brexit, and due to the political turmoil, the economy of Britain has been affected to a large part. There have been issues of unemployment, inflation, slower industrial output etc. A report by PricewaterhouseCoopers in previous years, suggested the UK taking a core role in a combat air system could support an average of 21,000 jobs a year and contribute an estimated £26.2bn to the economy by 2050.¹¹ As stated by Defence Secretary Ben Wallace "*This international partnership with Italy and Japan to create and design the next-generation of Combat Aircraft, represents the best collaboration of cutting edge defence technology and expertise shared across our nations, providing highly skilled jobs across the sector and long-term security for Britain and our allies.*"¹² This view has also been echoed by the UK PM. The UK defence industry is already leading the world in advanced aerospace engineering. At BAE Systems' new 'factory of the future' in Lancashire, for example, the company is pioneering the use of advanced 3D printing and autonomous robotics in military aircraft. The other contractors involved in GCAP are Rolls-Royce and MBDA.¹³

On the foreign policy front, this program allows the UK to engage with new partners apart from the traditional NATO Ally US. The UK currently due to economic issues has funding problems for any type of combat fighter projects. During the term of President

Donald Trump, the US reminded the UK and other NATO countries to spend at least 4 percent of GDP on their own security needs.¹⁴ Hence this funding problem can be solved if the UK joins hands with another middle power and Japan seems to be the right choice. The UK also seems eager to showcase to the world that it's still a relevant power in the defence sector and specially the EU since Russia has attacked Ukraine and UK has been supporting Ukraine right from the start. In the Indo-Pacific, the support for Taiwan is the UK's core idea in case of any conflict with China. This project will signal to the NATO allies that the NATO can opt for partners other than the US if the need arises in future. As per UK government, GCAP sits alongside their other defence cooperation with international allies, including the AUKUS partnership and NATO – to which the UK remains the leading European contributor.¹⁵

As far as Italy is concerned, Japan and the UK are its important key strategic partners. It's already engaged with the UK in the Tempest program. Along with the UK and Japan, Italy is committed to upholding the free and open rules-based international order. Japan is the president of the G7 during 2023 and Italy has supported Ukraine against Russian aggression. The current President of Italy, Giorgia Meloni, is showing serious concern with regards to Chinese behaviour in the Indo-Pacific and North Korea's belligerent missile launch activities. President Meloni will henceforth look at GCAP as an initiative to secure both Europe and its Japanese ally.¹⁶ This will boost the image of President Meloni since she is being looked too feminine to guarantee Italy's security from her opposition parties. The main contractors from Italy are Leonardo, Avio Aero and Elettronica which is known for developing advanced communication systems for the Tempest program.¹⁷

On the technology front, Italy is expected to lead the GCAP by developing advanced on-board electronics, referred to as the Integrated Sensing and Non Kinetic Effects (ISANKE) and Integrated Communications Systems (ICS). As per a press release, *"ISANKE will comprise a fully integrated sensing, fusion and self-protection capability that draws on a spider's web of sensing and effecting nodes across each platform. ICS will enable ISANKE to operate as a network across formations of crewed and uncrewed aircraft, as part of each nation's wider, multi-domain system-of-systems."*¹⁸ As per Maj. Gen. Masaki Oyama, Japan's Acquisition, Technology & Logistics Agency's Director Development Division GCAP *"For pilots, ISANKE/ICS will be ideal if the aircraft moves like part of their body. ISANKE and ICS can deliver integrated*

*information of sensors situated across an aircraft ensuring freedom of maneuver while maintaining excellent situational awareness."*¹⁹ Masahiko Arai, Senior General Manager, Defense Systems Division, Mitsubishi Electric explained that *"ISANKE and ICS are GCAP's advanced electronics, designed to deliver substantially better situation awareness to the pilot, telling them what is going on around them and turning that into information that they can exploit much, much quicker than the adversary."*²⁰

In March this year, during the Defence And Security Equipment International (DSEI) conference the overall distribution and collaboration of work was highlighted. BAE Systems, MHI and Leonardo will continue to work closely together on the next steps in the GCAP with a shared ambition for a joint industrial arrangement. Rolls-Royce, IHI and Avio Aero will set out the terms under which they will pool their expertise to design, manufacture and test a full-scale future combat engine demonstrator. Mitsubishi Electric, Leonardo UK; & Leonardo and Elettronica will form a special domain to develop advanced on-board electronics which will provide aircrew with information advantage and advanced self-protection capabilities.²¹

Challenges of GCAP

(i) Separate Assembly

The GCAP can face various challenges. One is that the assembly of the final aircraft may not be consolidated in one location, i.e, it will be assembled across the three nations.²² This is due to the fact that all three countries want equal employment generation from this project. Out of the three, only the UK has state of the art facilities for indigenous assembly of 6th generation fighter jets.²³ Whereas Japan just has only experience of developing it's 3rd generation F-2 jets which has been unsuccessful. Hence if the parts are assembled in different locations, they can have problems in logistics, design perfection or assembly errors. Earlier the F-2 program of Japan was shelved because the domestic industry struggled to produce the carbon fiber structures needed for the F-2's wings and cracks proved a persistent problem.²⁴ If the various parts like fuselage, wings, etc have different dimensions then assembly can be complex and delayed.

(ii) Indigenous Stealth Development

GCAP is expected to have stealth features. It's not a secret that earlier Europe missed the 5th generation era of fighters and hadn't built any operational 5th generation jet.²⁵ The closest is the French Rafale jets which are only 4.5 generation aircrafts. Only the US is said to have built a complete 5th generation fighter like the F-22 or F-35. In any stealth fighter, the design, material and external stealth coating is a highly secret technology. Since the UK, Italy and Japan don't have the know-how of developing 5th generation fighters, then it will be difficult to switch from 4th to 6th generation in such a short time as envisaged. Moreover every stealth fighter requires extensive stealth coatings after every operational flight mission, so whether the composite material planned for GCAP will be compatible with the stealth coating will be a challenging task, it's also been a major challenge for the USAF F-35. Apart from that, the maintenance of such stealth fighters is a highly costly affair.

(iii) Different Operational Requirements

The prospective use of these fighter jets will be an important parameter for the design and weapon development of GCAP. For example, the needs of the three nations can be different based on what missions they intend to prioritize for their future fighters via GCAP. This will have far-reaching implications for system requirements, design, and cost. For example, how stealthy does a future fighter need to be to accomplish its missions? How far does it need to fly without refueling, and at what speed and altitude? How many weapons does it need to carry, and of what type? Japan will mostly want a large, long-range fighter that could protect Japan's airspace from threats of China, Russia and North Korea. They may need a more stealth feature as it will be useful in launching counter attacks in enemy territory and air-to-air dogfights. On the other hand, the U.K. and Italy, which frequently deploy out of their respective countries, want a similar fighter, but prize long-range for expeditionary and anti-terror missions, for example carrying out combat missions against the Islamic State or patrolling NATO's long border with Russia.²⁶ They can compromise on the stealth part but would need supercruise. Hence the Japanese version of GCAP may end up being a little more optimized for air-to-air combat, while the European version might split the air-to-air and air-to-ground missions more evenly.

(iv) Workshare Allocation

It's quite obvious that this GCAP program will require a large skilled manpower. It's unclear exactly how the three partner nations will divide up the workshare of GCAP.²⁷ Italy has raised a precondition for the functioning of the GCAP. Minister of Defense Guido Crosetto said that Italy must be treated equally in cooperation with Britain and Japan to produce the new fighter. He said that Rome would decide how much to invest in the multi-billion dollar project after further specifics were established. According to him, "*Italy can only continue along this path if it has the same weight as Japan and Britain on technology, research and later, if it comes to that, on the results,*" while adding that he wanted a "33%-33%-33%" breakdown.²⁸ On the contrary, the Joint Press release of the GCAP by three leaders remained silent about workshare allocation.²⁹ While for Japan the urgent need of fighter fleets is important, for the UK job creation has long been billed by the British government as a central pillar of the Tempest and now GCAP. As the country faces a major economic downturn, defense programs have already taken a hit, so the economic advantages of a big-ticket — and hugely costly — initiative such as Tempest/GCAS will need to be promoted for the taxpayer.³⁰ So how much workshare pie the UK is willing to share with Italy or Japan is yet to be seen.

(v) Budget Allocation

The GCAP joint leaders statement states that "*By working together in a spirit of equal partnership, we share the costs and benefits of this investment*".³¹ A UK minister from the Labour party asked how much has been invested into the Global Combat Air Programme by the three countries. For that a reply came from the minister of conservative party that "*The March 2021 Defence Command Paper reaffirmed that that we will invest more than £2 billion in FCAS out to 2025, and we have spent over £1.4 billion so far. This is part of a budget of over £10 billion over the next 10 years. The amount that we ultimately invest will be determined by future decision points. The amount that our international partners are investing is for them to comment on. Nevertheless, all three countries are making significant investments in our combat air sectors to pursue shared goals for a combat air programme in a spirit of equal*

partnership. We will determine the cost-sharing arrangements ahead of the next phase, based on joint assessment of costs and national budgets."³² This statement reveals the fact that both Italy and Japan have not decided how much investment they intend to make in GCAP.

On the other hand some sources have speculated that Italy is set to pay around only a fifth of the overall development cost. "*The cost of the project will likely be around 40% each for Japan and Britain,*" said one source at the DSEI event in Japan.³³ Earlier Italy had planned on investing at least EUR 2 billion (\$2.1 billion) in the Tempest development program between 2021 and 2035.³⁴ This can create issues for Italy because if that happens, Japan and the UK won't be able to give 33% of workshare as demanded by Italy. UK and Japan are already set to dominate the program because UK and Japan are likely to work more aggressively on design of the aircraft as the F-X and Tempest Jets have almost similar designs. Moreover, Japanese investment in GCAP is likely to be buoyed by the recent decision to increase the defense budget to two percent of GDP, roughly double what Tokyo has invested in its armed forces in the past. Japanese estimates for F-X have ranged as high as \$40 billion.³⁵ The increase in the defence budget is planned to be met by increasing the tax rate, which may not be liked by the Japanese citizens.

(vi) Technological Challenges

The GCAP is expected to have special features, like hypersonic weapons, unmanned cockpit and loyal wingman etc. But how realistic is it in present times ? During a roundtable in October 2022 conducted by Royal Aeronautical Society, partner members of Team Tempest discussed various issues. Air Cdre Jonny Moreton, FCAS Portfolio Director said "*As it stands, we currently plan to have a pilot in the cockpit in 2035*". This implies that the GCAP will not be unmanned. Instead, he suggested that it can happen by the year 2050 with arrival of AI.³⁶

In terms of any futuristic fighter jet project, sustainability will also be a key factor. So any aircraft contributing to lesser environmental emissions or fuel consumption will be attractive in future. In this regard, Rolls- Royce's Sustainability Executive, Andrew Eady said "*We're looking at enabling supply chains around green hydrogen fuels and the future role that synthetic fuels can play in the FCAS programme. If you have access to*

water, and you can suck carbon out of the air and use Fischer–Tropsch to create a synthetic hydrocarbon that really starts to move the conversation away from sustainability just being decarbonization into something that improves your energy resilience and introduces fuel sovereignty".³⁷ These newer sustainable technologies need time and research which are just beginning.

Next is the concept of Loyal Wingman/UCAV in GCAP which will support the main fighter jet or mother ship during any mission. It's a new concept and lots of major military powers are doing R&D in this. In that vein, Air Cdre Moreton raised the question of loyal wingmen: *"Is it loyal in that it has the same characteristics as the core platform and, therefore, must go at the same speed to operate? Or is it just a contributing capability that acts independently in that I, as a pilot, either wait for it to arrive or it is there waiting for me?"* He further added *"If we're asking it to be survivable in a highly congested, contested, complex environment then we're just describing an F-35A. In essence, you can keep adding capability until you get to a price point that is no longer attractive. Personally, from a true systems perspective, we should not limit system thinking to air vehicles. I am interested in how the core air vehicle interacts with the other domains, including land, maritime and space, because that really allows me to look beyond the horizon and provides me with a layer of capability required to deliver a kinetic or non-kinetic effect at a time of my choosing, no matter how challenging the battlespace."*³⁸ This points to the fact that it's still not clear how Loyal Wingman can be compatible with modern fighters. Plus, if GCAP is to be developed keeping in mind the manned unmanned teaming, then how many drones or UCAV to be developed doesn't really emerge in budget allocation or the overall plan.

The R&D of hypersonic missiles in the UK, Italy or Japan at present is absent or maybe in a nascent stage. The hypersonic weapons require huge amounts of research specially in terms of building a carbon outer material which can protect the missile from atmospheric friction while reentering the atmosphere. This friction can cause the warhead to burn while the missile cruises at mach speed. The cost of developing such carbon material is very high and costly process as we have seen in the case of Russia.³⁹ In case of GCAP, it's not clear whether the missiles will be of air-to-air type or air-to-ground type because most of the hypersonic missiles being developed are air-to-surface or anti-ship type.

(vii) Skilled Manpower & Crew

The GCAP has a tight schedule with development to begin from 2025 and first flight demonstration to begin in 2035. Japan MOD says starting the ground and flight tests around 2029 is being considered as a possible scenario. So at such a lesser time, finding skilled workers is a tough job. Air Cdre David Tait, Defence Suppliers Forum Lead for People and Skills, MoD, observed that aerospace and defence still struggles to recruit the best talent.⁴⁰ Rolls-Royce Systems Designer James Davies pointed out that many of the roles needed to design, build, operate and maintain Tempest might not even be known yet, such is the pace at which the technology and ideas are advancing. However, he admitted that awareness is still a challenge. Also, the fighter pilot training will be a challenging task, since it requires lots of skills to fly a 5th generation fighter, and GCAP will be a 6th generation jet.⁴¹

(viii) Other Misc. Issues & Conclusion

Apart from above other critical issues like export potential, supply chain flow, manufacturers validation, security clearance of contractors to prevent espionage, political issues like Italian government's aim to ban English language while GCAP aims to have English as common language, potential US interference as previously seen in AUKUS deal,⁴² etc can cause friction between GCAP partners.

Hence overall it can be observed that GCAP has more challenges to conquer to achieve its stated goals and future visions.

DISCLAIMER

The paper is author's individual scholastic articulation and does not necessarily reflect the views of CENJOWS. The author certifies that the article is original in content, unpublished and it has not been submitted for publication/ web upload elsewhere and that the facts and figures quoted are duly referenced, as needed and are believed to be correct.

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