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The New Partnership among Italy, Japan and the UK on the Global Combat Air Programme (GCAP)

edited by Alessandro Marrone

ABSTRACT

The Global Combat Air Programme (GCAP) launched by Italy, Japan and the UK in 2022 represents a novel partnership among the three countries for the development and production of a next-generation crewed fighter aircraft. A partnership based on equality of rights for and investments by the founding partners, as well as on the principles of Freedom of Action and Freedom of Modification at national level – that means full operational and technological sovereignty on the core platform, differently from the F-35 experience. As such, GCAP presents new challenges and opportunities in political, military and industrial terms, in addition to the programme's tight schedule and high level of technological ambitions. The cooperation accelerated in 2024 with the establishment of a dedicated international governmental organisation to manage the programme, and the agreement on a joint venture among the three major companies involved on equal foot from the respective countries. This study provides an in-depth and comprehensive analysis of the specific British, Italian and Japanese ways to GCAP, of the programme's politico-institutional governance and industrial architecture, as well as of training issue and the cross-sectorial implications for Italy. Moreover, a dedicated chapter focuses on the Franco-German-Spanish Future Combat Air System (FCAS) and the US Next-Generation Air Dominance (NGAD) programmes in a comparative perspective. The conclusions outline 15 policy recommendations for Italy concerning GCAP.

keywords

Italy | UK | Japan | Defence industry | Technology | GCAP | Eurofighter | F-35

The New Partnership among Italy, Japan and the UK on the Global Combat Air Programme (GCAP)

edited by Alessandro Marrone*

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Executive summary

From Tempest to GCAP, from bilateral relations to a trilateral partnership

The UK initiated its efforts toward a next-generation air combat system in the mid-2010s, driven by concerns that without substantial investment, its defence industry would struggle to deliver advanced air capabilities. The 2015 Strategic Defence and Security Review launched the Future Combat Air Systems Technology Initiative (FCAS TI) with a 2 billion pounds investment. Team Tempest was subsequently established to develop new technologies and ensure the UK maintained a leading role in combat air capabilities. The 2018 Combat Air Strategy emphasised the importance of a sovereign next-generation aircraft but acknowledged potential compromises, including reliance on foreign suppliers.

By 2018, Tempest had evolved from a technology initiative into a full-fledged sixth-generation combat aircraft programme. Announced at the Farnborough International Airshow, it was envisioned as a crewed platform with integration of unmanned systems and advanced effectors. The UK recognised early on that international partnerships were necessary for securing funding and enhancing technological development. Sweden became the first partner in 2019, bringing Saab's expertise in fighter aircraft. A Memorandum of Understanding (MoU) was signed between the UK and Sweden, but by 2022, Sweden took on a more passive role due to concerns over costs and strategic fit, as it remained focused on its Gripen programme.

Italy's involvement in Tempest was facilitated by longstanding military and industrial cooperation with the UK, including shared programmes such as Eurofighter Typhoon and Tornado. While Italian industry supported the initiative early on, political commitment was delayed. In 2019, after initial exploration of the Franco-German Future Combat Air System (FCAS) project, Italy formally joined Tempest with the signing of a bilateral statement of intents (SOI).

By December 2022, Tempest had expanded into a trilateral effort, incorporating Japan alongside the UK and Italy, forming the Global Combat Air Programme (GCAP). Japan's entry was significant due to its financial capacity, technological alignment and shared experience with the F-35 programme. In contrast, Sweden's exit was influenced by its preference for developing complementary uncrewed systems rather than committing to an entirely new manned platform with the related costs. The emergence of GCAP as a UK-Italy-Japan initiative effectively ruled out any future merger with the Franco-German-Spanish FCAS, given diverging requirements, governance structures and industrial priorities.

The Eurofighter Typhoon programme serves as an important reference for GCAP, highlighting both the benefits and challenges of multinational cooperation. This fourth-generation multirole fighter was developed jointly by Germany, Italy, Spain and the UK. While it successfully strengthened European airpower and

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industrial ties, it also revealed governance inefficiencies. The NATO Eurofighter Typhoon and Tornado Management Agency (NETMA) was created to coordinate the programme, but limited authority and divergent national procurement strategies led to inefficiencies. The juste retour principle, which tied workshare to initial procurement commitments, further complicated long-term industrial returns. These lessons are informing GCAP's governance structure, with a focus on avoiding overly rigid workshare agreements and fostering greater flexibility.

GCAP also carries broader geopolitical implications, particularly in shaping the trilateral dynamics among the UK, Italy and Japan. While the UK and Italy share NATO membership, Japan's growing alignment with NATO and deepening bilateral ties with both countries reflect the increasing significance of Indo-Pacific security cooperation. The programme necessitates compatibility with NATO standards while integrating the distinct requirements of its partners, adding complexity to its management.

Cultural and geographical differences also pose challenges. Unlike previous European collaborations, GCAP spans two continents, requiring effective coordination despite different industrial practices and strategic outlooks. One possible solution is decentralising production across multiple sites to enhance resilience and mitigate supply-chain vulnerabilities, a lesson drawn from disruptions caused by the Russia-Ukraine conflict.

GCAP has catalysed stronger bilateral relationships, particularly between Italy and Japan, which had limited defence cooperation before this initiative. Italy and the UK have a long history of joint projects, supported by companies with footprint in both countries like Leonardo and MBDA, while Japan's participation marks a strategic shift in its approach to international defence collaboration. These deepening ties underscore the broader significance of GCAP beyond the development of a next-generation fighter, positioning the UK, Italy and Japan as key players in shaping the future of air combat capabilities.

The Italian way to GCAP

Italy's commitment to the GCAP is strong, spanning government, military and industry. Despite public scepticism about military spending, the Giorgia Meloni government has invested significant political capital in the initiative. Defence Minister Guido Crosetto has been a vocal advocate, and both the Italian Air Force (*Aeronautica Militare*, AM) and the defence industry have actively promoted GCAP.

Official documents emphasise GCAP's importance. The 2022 Strategic Direction of the Chief of Air Force highlights next-generation air combat capabilities as crucial for multi-domain operations. The Ministry of Defence's (MoD) 2025-2027 Strategic Direction views GCAP as an opportunity to drive investment in research and technology. The 2024-2026 Multiannual Planning Document (*Documento programmatico pluriennale*, DPP) underscoring Italy's strategic priorities allocates 8.9 billion euros to GCAP up to 2050 and stresses its role to enhance Italian military

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capabilities.

Unlike the divisive F-35 programme, GCAP has seen so far minimal political opposition in Italy, partly due to its lack of US involvement that enables greater operational and technological autonomy. Italy has secured an equal 33.3 per cent partnership in GCAP alongside the UK and Japan, ensuring industrial benefits far beyond what was achieved with the F-35. Minister Crosetto has made equal partnership a priority, reinforcing Italy's standing in the programme.

Rome continues to consider London as a key European defence partner, building on decades of military and industrial cooperation which is currently enhanced by British government more positive view of the EU. GCAP's inclusion of Japan marks an additional novelty in Italy's defence partnerships. Italian primary geopolitical focus remains the Enlarged Mediterranean, but Tokyo's involvement in GCAP broadens its strategic perspective to the Indo-Pacific. This has been reinforced through increased cross-regional military cooperation, including Italy's participation in the Rising Sun 2024 exercise in Japan. The tripartite nature of GCAP also indirectly supports NATO's growing interest in Indo-Pacific cooperation, and contributes to bring Tokyo closer to Europe in the defence field – as underlined by Japan's new status of observer the Eurodrone project.

From a military perspective, the DPP underscores the need for Italy to sustain high-intensity conflicts autonomously. The war in Ukraine has heightened the need for a high-low mix of military assets, with GCAP forming the high-end component. AM envisions GCAP as the centrepiece of a system of systems, integrating various networked assets, including adjuncts – that is uncrewed combat air systems (UCAS) – and effectors to enhance operational capabilities. The programme is a leap forward in disruptive technologies, requiring close collaboration between all military, industrial and research stakeholders.

GCAP will complement for a while in-service platforms like the Eurofighter Typhoon and F-35, while replacing the former in the long-term. Indeed, Italy purchased a total of 118 Eurofighter Typhoon, including newly ordered Tranche 4 variants, which will remain in service into the 2060s and be interoperable with GCAP. The F-35 fleet is expanding, with plans to operate a total of 115 aircraft, enhancing Italy's proficiency in low-observability tactics. By the 2040s, AM will likely operate over 180 F-35s and upgraded Eurofighter Typhoon alongside phasing-in GCAP, solidifying its position as one of Europe's most advanced air forces. However, Italy lags behind in terms of UCAS, a gap that GCAP could help address through the development of its adjuncts.

On the industrial front, GCAP presents major opportunities for Italy's defence industry, particularly for Leonardo (Lead Systems Integrator), for Avio Aero and ELT Group (Lead Sub-Systems Integrators), but also for MBDA Italy and the whole supply chain including SMEs, research institutes and universities. Structural challenges persist, including limited investment in key sectors and hesitance from some civilian stakeholders to engage in a high-end, highly-classified project such

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as GCAP. The programme could drive significant technological advancements across the board and necessitates wide industrial mobilisation. The Italian MoD launched the GCAP Acceleration Initiative in April 2023 to foster innovation, leveraging collaboration between industry, academia and research bodies.

Italy's aerospace sector has maintained competencies in military aircraft design over decades, but GCAP represents a significant leap. While the Eurofighter Typhoon programme provided significant experience in terms of design authority, Italy had a secondary role compared to Germany and the UK. Then, the limited technology transfer and presence of 'black box' in the F-35 programme frustrated Italian stakeholders. In contrast, GCAP's commitment to equal technology access aligns with Italy's insistence on operational sovereignty. Ensuring a fully open system and sharing critical technologies will be key to the programme's success. By securing a balanced workshare in both quality and quantity terms, Italy aims to maximise its strategic and industrial benefits from GCAP. Against this backdrop, the principles of Freedom of Action/Freedom of Modification (FoA/FoM) are vital for each of the three founding countries to maintain technological and operational sovereignty.

The British way to GCAP

Nearly two decades after the UK declared it did not foresee developing a next-generation crewed combat aircraft, a British demonstrator is now in final assembly as part of the GCAP. Set to fly by 2027, the aircraft, known as Tempest, represents the UK's commitment to advanced air combat capabilities.

In 2025, the Conservative government Strategic Defence and Security Review (SDSR) funded the FCAS TI to sustain the UK's aerospace industrial base. Under Defence Secretary Ben Wallace, the UK joined forces with Italy and Japan in December 2022 in the GCAP programme. After Labour's return to power, financial constraints and a strategic review left the programme's future uncertain, yet by late 2024 Prime Minister Keir Starmer reaffirmed the UK's commitment to GCAP.

Initially, the UK explored partnerships with Italy and Sweden for future combat air technologies. As mentioned before, Rome emerged as a natural ally, given past collaborations on the Tornado and Eurofighter Typhoon. Meanwhile, UK-Japan ties strengthened contributing to the tripartite launch of GCAP. Beyond these core partners, the UK also engaged with Saudi Arabia, which has longstanding defence ties with London. While Saudi participation in GCAP remains sensitive, discussions continue.

The UK's defence needs have changed significantly over the last two decades. By 2014, Russia had annexed Crimea and invaded eastern Ukraine, and by 2022 Europe faced a full-scale state-on-state war. These events, along with China's growing military power, reinforced the necessity of a next-generation fighter. British need for air power had shifted from that of an expeditionary capability to one shaped by the needs of a peer-to-peer or near-peer war.

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The RAF plans to replace its Eurofighter Typhoon squadrons by 2040, necessitating GCAP readiness by 2035. Unlike other Eurofighter Typhoon partners, the UK shows little interest in extending its production, favouring autonomous collaborative platforms to enhance air combat mass. The GCAP is designed to operate in highly contested airspace against advanced threats, replacing the Eurofighter Typhoon as the RAF's primary air superiority aircraft. It will counter peer threats, particularly from China and Russia, which are rapidly developing next-generation aircraft and missile systems. China's J-20 and emerging J-35A fighters, alongside advanced air-to-air missiles like the PL-15 and PL-16, pose significant challenges. While Russia's Su-57 and Su-35 may not match China's pace, they still influence UK defence planning.

Without a follow-up to the Eurofighter Typhoon or sustained involvement in the F-35 programme, the UK's combat aircraft industry faced decline. To prevent this, Team Tempest – comprising BAE Systems, Rolls-Royce, Leonardo UK and MBDA UK – was formed in 2018. The UK government pledged 2 billion pounds for the project through 2025. While only formally established in 2018, the partners in the team had already, to a greater or lesser extent, been working on the technologies related to a future crewed combat aircraft design and the systems required to support this.

The UK demonstrator aircraft will test manufacturing techniques, stealth features and weapon release at supersonic speed. Rolls-Royce and Japan's IHI are jointly developing the propulsion system, while Leonardo UK leads efforts on advanced electronic systems. The ambitious GCAP timeline requires efficient collaboration to avoid delays and cost overruns, a challenge highlighted by past multinational projects like the Eurofighter Typhoon.

The Japanese way to GCAP

Japan adopted the new National Security and National Defence Strategies in December 2022 to counter growing security threats, particularly from China, North Korea and Russia. These strategies emphasise strengthening Japan's defence capabilities, including counterstrike operations, integrated air and missile defence and multi-domain operations. The Japan Air Self-Defence Force (JASDF) is crucial in securing air superiority and conducting offensive counterair operations, requiring modernisation efforts such as procuring 147 F-35s, upgrading 200 F-15s and renewing the ageing F-2 fleet. The GCAP is central to achieving these capabilities, with a budget allocation for research on man-unmanned collaborative combat networks.

GCAP is Japan's most significant defence project, involving massive development costs and international collaboration with the UK and Italy. It is critical for air superiority and revitalising Japan's aviation and defence industries. Politically and diplomatically, it marks Japan's first joint fighter aircraft development project with non-US partners.

Japan's next-generation fighter development dates back to 2010, with research on advanced demonstrators and engines. Lockheed Martin's 2018 proposal of a hybrid F-22/F-35 aircraft was rejected due to limited technology disclosure. Washington was focused on its Next-Generation Air Dominance (NGAD) programme, which did not align with Japan's timeline. Given past experiences with F-2 development dependency on the US, Japan prioritised autonomy in its new fighter programme while maintaining interoperability with allies. In 2020, Tokyo selected Lockheed Martin for integration support, ensuring continued collaboration with the US while negotiating interoperability measures.

Simultaneously, Japan engaged with the UK on GCAP. Tokyo and London had strengthened defence ties since 2013, culminating in agreements on joint research and arms transfers. The feasibility study for a Joint New Air-to-Air Missile (JNAAM) further reinforced cooperation. The UK vision aligned with Japan's next-generation fighter goals, facilitating a mutually beneficial partnership. Cost-sharing and risk reduction made the collaboration attractive, ultimately leading to the GCAP launch as a trilateral project with Italy.

Two key challenges for Japan in GCAP's implementation were export regulations and industrial participation. Exporting GCAP-developed fighters was essential, but Japan's restrictive defence export principles required revision. In 2023, a working team from the ruling parties clarified permissible transfers, leading to a partial revision. By March 2024, Japan's Cabinet approved a mechanism for direct transfers.

Japanese industry participation was another hurdle. Mitsubishi Heavy Industries (MHI) was designated as the prime contractor for aircraft integration, by collaborating with BAE Systems and Leonardo on common platform development. Japanese firms like IHI and Mitsubishi Electric took leading roles in engine and avionics development. While international joint development mitigates costs and technological risks, conflicting interests regarding operational requirements, cost-sharing and intellectual property remain. Japan's defence industry, lacking extensive experience in multinational projects, required a dedicated entity to manage negotiations and implementation.

Japan has steadily advanced GCAP, allocating 112.7 billion yen (about 800 million dollars) in the 2025 defence budget. The programme aligns with Japan's broader defence cooperation with NATO, countering China and Russia's growing military assertiveness. If successful, GCAP will deepen security ties among Japan, the UK and Italy, fostering structured long-term cooperation.

Beyond military advantages, GCAP presents economic and strategic benefits. Exporting the next-generation crewed aircraft will lower costs, enhance domestic defence capabilities and create resilient supply chains for allies. GCAP demands full commitment from all partners to maintain an edge over authoritarian rivals and secure a leading role in next-generation combat aircraft.

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The GCAP politico-institutional governance

The GCAP governance presents both challenges and opportunities. The trilateral partnership benefits from the long-standing defence cooperation between Rome and London, particularly in aerospace projects such as the Tornado and Eurofighter Typhoon. These past collaborations provide valuable lessons for structuring GCAP's governance effectively. However, Japan's limited experience in international defence procurement projects, aside from its cooperation with the US on the F-2, introduces complexities in trilateral agreements, particularly concerning export controls and legal frameworks.

GCAP governance is reinforced by parallel diplomatic and economic collaborations among the three nations. Defence and security ties have strengthened alongside agreements in technology, trade and energy. The programme has also catalysed high-level political engagements, as demonstrated by frequent meetings involving defence and foreign ministers, as well as heads of state and government.

Programme key milestones include the December 2022 Joint Statement launching GCAP and the December 2023 signing of the legally binding GCAP International Government Organisation (GIGO) treaty, which was ratified in 2024 by all three nations. GCAP's governance structure is designed to be innovative and resilient. The programme emphasises principles such as FoA/FoM, moving away from the rigid work-share approach of the Eurofighter Typhoon.

GIGO is established as an autonomous international agency with delegated decision-making power, in order to ensure efficiency and adherence to the ambitious programme schedule. The fact GIGO's governance is formalised through a treaty highlights the programme's high level of institutionalisation. This status makes it politically and legally challenging for partners to withdraw, although financial obligations are not currently embedded in the treaty.

The GIGO governance structure consists of a Steering Committee (SC) and the GCAP Agency. The SC, composed of representatives from each country with rotating leadership, provides oversight and strategic direction. The GCAP Agency, headquartered in Reading, UK, manages the programme's execution, coordinates industrial activities and oversees compliance with regulations. Its co-location with the aforementioned Joint Venture (JV) made up by British, Italian and Japanese companies and is expected to facilitate synergy between political and industrial dynamics.

The GCAP Agency is led by a Chief Executive (CE) which rotates every three years among the founding countries. Oka Masami from Japan will be the first GIGO CE, while the JV's first Chief Executive Officer (CEO) will come from Leonardo. Staffing GIGO poses challenges, as approximately 500 personnel are required, with an initial operational capacity of 150 employees. Italy, leveraging its expertise in fourth- and fifth-generation fighter procurement, is mobilising qualified personnel to meet these needs.

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Export facilitation is another key function of the GCAP governance. A dedicated mechanism within the Agency will oversee technology transfers, ensuring compliance with national and international regulations.

The potential expansion of GCAP to additional partners such as Saudi Arabia is under consideration. Any new member would require unanimous SC approval and would likely enter as a junior partner with limited decision-making power.

As a whole, the politico-institutional governance aims to strike a balance between efficiency, autonomy and cooperative decision-making, providing a strong foundation also for the industrial architecture of GCAP.

The GCAP industrial architecture

The most critical component of GCAP's industrial structure is the establishment of a JV among the three Lead Systems Integrators (LSIs): BAE Systems (UK), Leonardo (Italy) and Japan Aircraft Industrial Enhancement Co. (JAIEC) established by the Mitsubishi Heavy Industry. This JV serves as the industrial counterpart to the GIGO. The JV founding agreement, signed in December 2024, is the first legally binding document undersigned by the CEOs of the LSIs in GCAP's development. Its activities will be launched through contracts determined by GIGO.

The JV headquarters will be supported by three local offices in each partner country. To ensure balance among founding countries, as mentioned before the first CEO will be Italian, serving a three-year term before rotating to Japan and then the UK. This structure fosters multinational cooperation, transparency and visibility for all three nations.

Given GCAP's unprecedented security classification, significantly higher than previous projects like the Eurofighter Typhoon, security measures impact industry infrastructure, costs and work organisation. At the same time, the programme's global nature introduces logistical challenges but also enables continuous development across time zones. Against this backdrop, the JV will oversee key R&D and core technological developments, while some technologies will be handled separately by partner industries to maintain national FoA/FoM. To uphold these principles, Italy requires extensive sharing of GCAP's technological advancements.

Importantly, only LSIs will be part of the JV, while partner companies (e.g., Avio Aero, ELT Group or MBDA) will operate under a separate framework without forming a dedicated joint venture. The JV aims to avoid traditional industrial silos, encouraging an integrated and collaborative workflow with tri-national teams to meet ambitious deadlines and requirements.

Italy has committed to an equal role in GCAP, marking a significant shift from its previous partnerships in the air combat sector. Unlike past projects where Rome had a lesser share (e.g., 15 per cent in Tornado and 21 per cent in Eurofighter

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Typhoon), as mentioned before GCAP is structured as an even three-way split between Italy, the UK and Japan.

The GCAP industrial ecosystem is very diverse, with each LSI forming specialised teams dedicated to the project. The UK's BAE Systems builds on investments made through the Team Tempest, which employs 3,500 people and engages 600 suppliers. Italy's Leonardo involves personnel across multiple divisions and is investing in new resources, with the Aircraft Division alone hiring over 500 additional employees in 2024. Japan's MHI contributes expertise from its national F-X fighter programme, focusing on aerospace manufacturing and systems integration.

Lead Sub-Systems Integrators (LSSIs) include Avio Aero (Italy), ELT Group (Italy), IHI (Japan), Leonardo Electronics (UK & Italy), MBDA (UK & Italy), Mitsubishi Electric (Japan) and Rolls-Royce (UK). These companies work on key components such as propulsion (Rolls-Royce, IHI and Avio Aero), integrated sensing and communications (Leonardo Electronics, Mitsubishi Electric, ELT Group) and weapons systems (MBDA UK, MBDA Italy, Mitsubishi Electric). GCAP also features the collaboration with high-tech SMEs and academia to accelerate innovation and expand its technological base.

Leonardo, as LSI, is undertaking internal restructuring, reallocating personnel and training new hires. Addressing the shortage of science, technology, engineering and mathematics (STEM) graduates for engineering and project management roles is a growing concern. Key Italian industrial hubs for GCAP include the Torino Caselle site, alongside locations in Rome, Pomezia, Florence and Nerviano.

Coordination along the supply chain is critical, as acceleration by LSIs must be matched by second-tier partners to prevent delays. Effective communication, timely funding allocation and secure infrastructure development are essential for meeting the ambitious 2035 timeline for the first aircraft.

GCAP's high-security requirements necessitate substantial investments in cybersecurity, classified information management and secure work environments. Addressing the risks of industrial espionage and foreign interference is crucial, requiring stringent security measures across an international supply chain. Yet many SMEs may struggle to meet these standards without financial incentives.

The leap to next-generation aircraft: A katana tale

As GCAP takes shape, the US is working on two separate next-generation air combat programmes, while France, Germany and Spain have joined forces on the aforementioned FCAS.

The developments in the US have been characterised by an unusual amount of uncertainty over a period of several years since the announcements of the Air Force's NGAD and the Navy's F/A-XX. In December 2024 the Biden Administration concluded a review of NGAD, which had originally been launched to ensure the

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initiative was still an adequate counter to changing threats and technology. While the review was ultimately in favour of developing a crewed next-generation combat aircraft, then-Air Force Secretary Frank Kendall continued to raise questions over the affordability of the programme – with costs estimated at 300 million US dollars per airframe. The funding request for FY 2025 was 2.74 billion US dollars for the NGAD platform and 557 million for the Collaborative Combat Aircraft (CCA) and at the time of writing has still not been approved by Congress. The Biden Administration ultimately left the final say on NGAD to its successor, who is still to take a definitive decision, despite the Air Force awarding new contracts to GE Aerospace and Pratt & Whitney as part of the Next-Generation Adaptive Propulsion (NGAP) programme for the related engine.

The Navy's F/A-XX is conceived as a replacement for the F/A-18E/D and the EA-18G carrier-borne aircraft. Affordability of the new platform appears to be a key requirement, while the Navy is pursuing a separate path also when it comes to engines, preferring a derivative of existing solutions rather than the new concepts that the Air Force is funding for NGAD. Until recently the Navy still aimed at an entry into service in the 2030s. Three companies are rumoured to be competing for the contract: Boeing, Lockheed Martin and Northrop Grumman, with a winner originally expected to be announced in 2025.

Meanwhile in Europe, back in 2017 President Emmanuel Macron and Chancellor Angela Merkel launched a bilateral cooperative effort on FCAS. It was part of a broader, shared political vision of a renewed Franco-German cooperation intended to become the heart of European defence. Cooperation between the two camps has been far from smooth, however, and seven years later, the Head of French MoD Direction Générale de l'Armement (DGA) Emmanuel Chiva declared at the National Assembly that "Today, FCAS is an object that has yet to be defined".[1]

The Franco-German cooperation became trilateral when Spain formally joined FCAS in 2019. Madrid made an unprecedented effort to acquire a role as an equal partner with respect to Paris and Berlin. Interestingly, the three countries tasked the French DGA to act as procurement agency for the whole programme, rather than relying on existing multinational agencies or creating a new one. On the industrial side, the FCAS consortium includes Airbus – mainly the German leg of the European company – Dassault Aviation, Indra and Thales, as well as the European Military Engine Team (EUMET) joint venture made up by MTU and Safran to work on the FCAS engine with the support of Spanish ITP Aero. When compared to GCAP, another major point of difference is that no joint venture has been established among the main companies involved in the programme.

[1] Rudy Ruitenberg, "France, Germany to Hammer Out Next Steps for Delay-Prone FCAS Warplane", in *Defense News*, 25 October 2024, https://www.defensenews.com/global/europe/2024/10/25/france-germany-to-hammer-out-next-steps-for-delay-prone-fcas-warplane.

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FCAS is set to encompass a core, crewed combat aircraft, also referred to as Next-Generation Weapon System (NGWS), a range of armed drones labelled as remote carriers, and a combat cloud as a framework to bring together all these platforms in a system-of-systems. In 2022, Phase 1B has been launched with a contract of 3.85 billion euros awarded by DGA to the FCAS consortium, to fund activities until 2026. This first investment aims to define and develop FCAS-related technologies to be tested in the demonstrator. The DGA expects Phase 2 and a second contract to follow in early 2026, to fund the development of a demonstrator with around 4.5 billion euros. Ultimately, FCAS' entry into service is expected around 2040, five years after the deadline set by GCAP countries for their core platform. These plans and schedule have to be taken with caution, in light of previous delays and hurdles experienced by the programme thus far. Some friction is unsurprising, considering that France and Germany, including their air forces and industries, have no relevant experience about working on combat aircraft joint procurement programmes.

The US uncertainties on the NGAD and the FCAS' difficulties to take off hint toward a more general reflection that concerns GCAP too. The F-35 represented a generational leap with respect to fourth-generation fighter aircraft in many ways, including low observability and net-centric data fusion. Metaphorically, like the Japanese katana, an F-35 can be used in different ways and for different purposes, including defensive and offensive ones, going beyond the traditional Western dualism between spear and shield, armor and cannon. The same will apply even more to the next generation of air combat systems. But the ability to fully and proficiently use a katana for its multiple purposes depends mainly on its mastery by the warrior. Indeed, those air forces and navies that have right now more than a decade of experience deploying, operating, maintaining, as well as exercising and training with the F-35 will have a unique, structural advantage over the others as they think about what their future katana should be able to do. This is the case of GCAP countries with respect to FCAS ones. As for other generational jumps in the aeronautic sector, it is less difficult to move from fifth to sixth generation systems than from fourth to sixth. Obviously, this does not mean that such a leap will be easy for Italy, Japan and the UK, but at the very least they are better-positioned than France, Germany and Spain to start the journey towards their new katana.

Common training: Best praxes from the past, guidelines for the future

The training pipeline for fast-jet pilots is a critical component of any air force, ensuring that pilots are trained efficiently and proficiently. It consists of five key pillars: academies, flight schools, trainer aircraft, instructors and ground-based training systems (GBTS), including simulators. NATO typically divides pilot training into four phases: Basic (Phase I), Primary (Phase II), Specialised (Phase III) and Lead-in to Fighter Training (LIFT, Phase IV). The latter phases are increasingly complex and costly, with Phase IV focusing on transitioning pilots to operational aircraft while minimising the use of expensive combat platforms like the F-35 and F-22.

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With the introduction of next-generation systems such as GCAP, significant revisions in training methodologies, particularly in Phases III and IV, will be necessary. The evolution of air combat towards system-of-systems, including adjuncts, will drive changes in tactics and training requirements. Countries like Italy, Japan and the UK, which already operate fifth-generation platforms, have begun adapting their training pipelines to accommodate these developments.

Trainer aircraft play a crucial role in preparing pilots before they transition to their Operational Conversion Units (OCU). These aircraft must replicate modern combat aircraft features while remaining cost-effective. The rising operational costs of advanced fighters make it imperative to shift more training activities to earlier phases. Developing and maintaining effective trainers, however, is complex. The US Air Force has faced challenges with the Boeing-Saab T-7A Red Hawk, and the UK's Hawk T2 fleet has struggled with availability, causing delays in pilot training. The RAF is now considering replacing the Hawk T2 to ensure pilot training continuity.

Italy's training pipeline, by contrast, has been notably successful due to the acquisition of Leonardo's M-346 advanced jet trainers. The Italian Air Force, in partnership with Leonardo, established the International Flight Training School (IFTS) in Decimomannu, Sardinia. This facility has attracted international pilots from Austria, Canada, Germany, Japan, Qatar, Saudi Arabia, Singapore and the UK. The M-346's export success underscores Italy's growing role as a provider of advanced training solutions.

Joint training offers several benefits beyond cost-efficiency. It enhances interoperability through common doctrines, tactics, techniques and procedures (TTPs). It also fosters collaboration and trust among air forces with different strategic cultures. Historical examples, such as the Tornado's Tri-National Training Establishment (TTTE) and the F-35 training programme at Luke Air Force Base, highlight the effectiveness of multinational training initiatives. A similar approach for GCAP could enhance standardisation while optimising resources across partner nations. However, integrating training assets across Italy, Japan and the UK will require addressing security and classification challenges.

GCAP's training pipeline will need to address pilot shortages and ensure optimal preparation levels. Advanced simulation and augmented reality can help bridge the gap between early training phases and next-generation operational demands. While developing new trainers specifically for GCAP may not be necessary, adapting existing platforms like the M-346 with relevant capabilities can optimise costs. Additionally, employing jet-powered drones for training could introduce pilots to manned-unmanned teaming (MUM-T) before they enter operational service.

The cross-sectorial implications for Italy: Technologies, innovation and skills

GCAP is more than just an aircraft; it represents a System of Systems (SoS) designed with an open architecture, ensuring seamless integration of crewed and uncrewed

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systems. This technological leap is expected to enhance situational awareness, communication, decision-making through artificial intelligence (AI) and big data, as well as low observability. GCAP's technological advancements will extend beyond air combat, benefiting land and naval platforms as well.

GCAP prioritises emerging disruptive technologies (EDTs) such as AI, machine learning, hypersonics, quantum systems and advanced materials. These align with the European Defence Agency (EDA), European Commission and NATO priorities, particularly in terms of cybersecurity, next-generation communications and space.

The programme's AI-driven data fusion aims to dramatically enhance combat efficiency by processing information six times faster than current platforms. However, managing the resulting power and cooling demands poses a significant technical challenge. A critical focus is placed on integrating space-based capabilities, including secure satellite communications and advanced positioning, navigation and timing (PNT) systems. Additionally, the programme incorporates cutting-edge innovations such as quantum gyroscopes, high-powered lasers, advanced thermal management to maintain low observability, and enhanced man-machine interfaces (MMI) to reduce pilot workload and improve mission effectiveness.

To ensure long-term effectiveness, GCAP follows a "cyber-secure by design" approach, while its flexible architecture will allow for continuous upgrades and adaptation to evolving threats. Actually, one of the primary challenges of GCAP is balancing innovation with operational reliability and cost-effectiveness. Unlike previous European fighter projects, GCAP has a compressed development timeline of just ten years. This necessitates selecting technologies that are mature enough to meet performance requirements while minimising the risk of obsolescence.

Despite these challenges, the programme benefits from existing national expertise in EDTs, including in propulsion systems and dual-use technologies. This prior experience reduces risks and accelerates implementation. Additionally, the programme's cross-sectoral synergies – spanning aerospace, digitalisation and manufacturing – will drive innovation beyond the military domain.

The Russia-Ukraine war has underscored the geopolitical risks associated with supply chain dependencies. For Italy, ensuring supply chain resilience is a strategic priority, which can be achieved by managing Italian and European supply chains and diversifying among G7 nations. Italy's unique position as the only EU country in GCAP provides an opportunity to prioritise European-sourced components, enhancing security while maintaining compatibility within a global programme. Close collaboration between the Ministry of Defence and industrial partners will be essential to safeguard critical supplies and technologies.

As mentioned before, the GCAP programme faces a significant challenge in securing sufficient STEM talent to meet its long-term needs. Demand for skilled

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engineers and technicians is expected to surpass current supply levels across all partner nations. To address this, companies such as Leonardo are actively recruiting and training new personnel while collaborating with universities and technical institutes to tailor educational programmes to GCAP requirements. Cultural and ethical concerns in Italy have led some young professionals to avoid defence-related careers. Against this backdrop, fostering a "GCAP generation of engineers" is necessary to ensure the programme's long-term sustainability while avoiding the diversion of skilled personnel from other critical defence projects.

As a whole, the Italian government views GCAP as a catalyst for technological advancement, industrial growth and competitiveness across the national defence technological industrial base (DTIB) and beyond.

Conclusions

The GCAP is by all means an extraordinary programme for Italy: in terms of across the board technology leaps, new model of governance, novel international partners, wide-ranging involvement of national DTIB, significant and long-term financial commitment, high level of classification, tight schedule, etc. Suffice it to say, concerning the timeline, that 2035 represents a target much more challenging and ambitious, *mutatis mutandis*, than the previous experience of both F-35 and Eurofighter Typhoon. As such, GCAP presents daunting challenges, but also precious opportunities. Italy can and shall better face the former and grasp the latter by implementing the following 15 recommendations:

1. A whole-of-country approach from short- to long-term
2. A mindset change on technological innovation
3. A realistic investment in classified infrastructures and info-structures
4. An advanced collaborative working environment
5. A special effort towards the supply chain
6. A GCAP generation of STEM personnel
7. Qualified and stable personnel for GIGO, JV and national stakeholders
8. An ad hoc law for GCAP exchange of components
9. A smart approach to training
10. A relaunch of Italian UCAS
11. A certain, timely and proportionate budget
12. A pragmatic attitude to possible additional partners
13. 1An early agreement on export
14. A GCAP model and driver for better Italian defence industrial policy
15. An enabler for Italian foreign and defence policies

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1. From Tempest to GCAP, from bilateral relations to a trilateral partnership

by Elio Calcagno and Gaia Ravazzolo[1]

1.1 The UK's early moves on Tempest

The UK took its first concrete steps toward a next-generation air combat system programme in the mid-2010s. In the absence of a successor programme to the Eurofighter Typhoon (also known as European Fighter Aircraft, EFA), UK MoD and industrial stakeholders shared serious concerns that without substantial investment the British defence industry would become unable to deliver next-generation capabilities in the air domain. The 2015 Strategic Defence and Security Review, which established the Future Combat Air Systems Technology Initiative (FCAS TI), announced an investment package of 2 billion pounds, including investments of both the MoD and the industries involved. As part of FCAS TI, the MoD and industry partners instituted Team Tempest in order to act as a catalyst for developing new technologies.[2]

The MoD's 2018 Combat Air Strategy clearly stated that Team Tempest's primary goal was to help prove that the UK industry "[was] in a strong position to lead in delivering affordable next generation capability".[3] On the other hand, the document seemed to implicitly suggest that, should Team Tempest and the wider Initiative prove to be incapable of meeting expectations, the UK would have to accept a higher degree of flexibility in terms of national requirements going forward. Presumably, therefore, such flexibility could be interpreted as having to rely heavily on foreign suppliers or off-the-shelf solutions, or indeed find an uncomfortable compromise with France in a European collaborative programme; both options would have likely been perceived as spelling the decline of the British defence-aerospace sector and of the British strategic autonomy in terms of air combat. From this perspective, the UK's initial push was by all accounts highly ambitious, yet the potential rewards of a sovereign next-generation combat air capability more than justified the 2 billion pounds initially earmarked for the first decade. How much this early impetus has placed the UK industry in an advantageous position vis-à-vis its Italian and Japanese counterparts in the context of GCAP-related qualitative work share remains to be seen.

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[2] UK Ministry of Defence, *Combat Air Strategy: An Ambitious Vision for the Future*, July 2018, p. 19, https://www.gov.uk/government/publications/combat-air-strategy-an-ambitious-vision-for-the-future.

[3] Ibid. See also Douglas Barrie and Bastian Giegerich, "The United Kingdom", in Alessandro Marrone and Michele Nones (eds), "Europe and the Future Combat Air System", in *Documenti IAI*, No. 19|02 (March 2019), p. 41-53, https://www.iai.it/en/node/10115.

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Back in 2005, when the topic of next-generation combat air capabilities started gaining traction, the then government's Defence Industrial Strategy did not foresee the need to "design and build a future generation of manned fast jet aircraft beyond [the Eurofighter and F-35]".[4] The following open-source documentation from successive UK governments was rather vague as to what exactly the next-generation combat air capabilities would entail – for instance whether they would be crewed or uncrewed. However, relative disinterest and stagnating investment into UCAS at a European level, despite promising results initially,[5] meant that the UK's efforts under FCAS TI gradually drifted toward a platform-oriented programme rather than just focusing on the component technological bricks.

By 2018, the metamorphosis from catalyst to sixth-generation combat aircraft was complete when at Farnborough International Airshow, the then-Defence Secretary Gavin Williamson announced the UK's next-generation "fighter jet" programme, named Tempest, as a continuation to FCAS TI.[6] The full-size mock-up used to present the new programme revealed a crewed platform, though rumours at the time spoke of an 'optionally-manned' aircraft:[7] clearly, this platform was meant to be integrated with unmanned systems of different sizes and complexity as well as new generation effectors. Concurrently, the 2018 Combat Air Strategy made no secret of the unavoidable necessity of involving international partners in Tempest in order to tap into a wider pool of capabilities and, especially, secure the required budget.[8]

1.2 The temporary involvement of Sweden and enduring intra-European competition

Sweden joined Tempest as its first international partner in July 2019,[9] bringing with it a capable and competitive industrial player in Saab, strengthened by decades of experience in the production of advanced fighter aircraft, like Gripen.[10] In July 2019, the UK Defence Secretary, Penny Mordaunt, and Swedish Defence Minister, Peter Hultqvist, signed a MoU to collaborate on future combat air development. This agreement committed both governments to the joint development and acquisition

[4] Douglas Barrie and Bastian Giegerich, "The United Kingdom", cit., p. 45.

[5] Elio Calcagno and Alessandro Marrone (eds), "Above and Beyond: State of the Art of Uncrewed Combat Aerial Systems and Future Perspectives", in *Documenti IAI*, No. 23|24 (December 2023), https://www.iai.it/en/node/17889.

[6] @GavinWilliamson, "Today it's my pleasure to announce Britain's next generation and world beating fighter jet Tempest", *X post*, 16 July 2018, https://x.com/GavinWilliamson/status/1018814556834074624.

[7] Justin Bronk, "Enter the Tempest", in *RUSI Defence Systems*, 16 July 2018, https://rusi.org/explore-our-research/publications/rusi-defence-systems/enter-tempest.

[8] UK Ministry of Defence, Combat Air Strategy, cit.

[9] Sylvia Pfeifer, "Sweden Poised to Join Britain's Tempest Fighter Programme", in *Financial Times*, 7 July 2019, https://www.ft.com/content/b87f47e4-9e53-11e9-9c06-a4640c9feebb.

[10] Andrew Chuter, "Sweden to Join British 'Tempest' Next-Gen Fighter Push", in *Defense News*, 7 July 2019, https://www.defensenews.com/global/europe/2019/07/07/sweden-to-join-british-tempest-next-gen-fighter-push.

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of advanced combat air capabilities, including new concepts to meet their future operational needs.[11] Saab took steps to engage with the programme, establishing a radar innovation hub with the Imperial College in 2019 and announcing a 50 million pounds FCAS centre in the UK in 2020. Despite early progress, however, by 2022 Sweden and Saab had transitioned to a more passive observer role, possibly due to concerns about its contributions, costs, and whether the programme aligned with its strategic needs – which to this day continue to revolve around the Gripen.[12]

A UK-Italy partnership was facilitated by the level of industrial integration between the two DTIBs, thanks to shared programmes like Eurofighter and Tornado, but also the Leonardo Group's presence in the British market through its Leonardo UK subsidiary. Indeed, in 2018 Norman Bone, then head of Leonardo UK revealed that briefings with Italian stakeholders had already taken place.[13] Meanwhile, however, the possibility of joining FCAS instead was never formally discarded, with then-Defence Minister Elisabetta Trenta opting not to rule this option out, citing the added value of undertaking such a project with EU partners.[14] An official explanation of why Italy ended up joining the UK's efforts was never provided, but the decision was likely motivated by the perceived difference in potential industrial gains and the less flexible French approach to workshare. In any case, no formal request by the FCAS countries has ever been reported.[15]

Italy's approach to the Tempest camp was nevertheless characterised by limited and sometimes contradicting official communications. In September 2018, political support for Italian involvement was expressed by the then-Italian Undersecretary of Defence, Angelo Tofalo, who despite hailing from the same party as the Defence Minister, argued that "it [was] imperative for Italy to immediately join" Tempest in order to attain a leadership position in the Initiative.[16] At the end of 2018, the Spanish MoD considered Italy's participation in the Tempest project a certainty, though such a decision was yet to be made formally made in Italy. However, a formal commitment from Rome was still lacking.[17] All the while, the Italian DTIB

[11] UK Ministry of Defence, *UK and Sweden Partner on Future Combat Air*, 19 July 2019, https://www.gov.uk/government/news/uk-and-sweden-partner-on-future-combat-air.

[12] Trevor Taylor and Isabella Antinozzi, "The Tempest Programme. Assessing Advances and Risks Across Multiple Fronts", in *RUSI Occasional Papers*, November 2022, https://rusi.org/explore-our-research/publications/occasional-papers/tempest-programme-assessing-advances-and-risks-across-multiple-fronts.

[13] Silvio Lora Lamia, "Tempest, riscatto (anche) europeo", in *Analisi Difesa*, 14 September 2018, https://www.analisidifesa.it/?p=118447.

[14] Lorenzo Cladi and Andrea Locatelli, "Weapon of Choice: A Neoliberal Institutional Perspective on Italy's Decision to Procure a Sixth Generation Fighter Aircraft", in *Contemporary Italian Politics*, Vol. 17, No. 1 (2025), p. 81-97, https://doi.org/10.1080/23248823.2023.2287328.

[15] Stefano Pioppi, "La Difesa (da Trenta a Guerini) con Tempest. Oltre l'asse franco-tedesco", in *Formiche*, 5 September 2019, https://formiche.net/?p=1188457.

[16] "Difesa: sottosegretario Tofalo, 'doveroso' entrare nel programma Tempest", in *Agenzia Nova*, 26 September 2018, https://www.agenzianova.com/a/0/2084972/2018-09-26/difesa-sottosegretario-tofalo-doveroso-entrare-nel-programma-tempest.

[17] Spanish Ministry of Defence, *España insta su participación como socio de pleno derecho en el*

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rather strongly supported Italy's entry into the Tempest programme, as made evident by statements by Guido Crosetto, now Italy's Defence Minister but at the time President of the Italian Industries Federation for Aerospace, Defence and Security (AIAD). In February 2019, referring to the Franco-German FCAS project, Crosetto asserted that "a rejected partner has the right to explore other options, and the UK has invited us to join the Tempest", no doubt in reference to FCAS' rumoured rejection of Italian interest.[18]

Nonetheless, delays in Italy's formal accession accumulated. By the summer of 2019, the then-Italian Defence Minister, Elisabetta Trenta, while acknowledging the interest of Italian industry and the armed forces in the Tempest project, was still exploring the details of the Franco-German FCAS initiative.[19] By September 2019 even Minister Trenta dropped any remaining doubts and agreed to join Tempest during a bilateral meeting with her UK counterpart, just days before the end of her term in office.[20] The decision to join Tempest was formalised only on 10 September 2019 by the newly-appointed Defence Minister, Lorenzo Guerini, just days after assuming office with a bilateral statement of intents (SOI).[21] As later explained in UK government statements, this agreement was the result of a process that had already begun the previous year and spawned a joint government feasibility study originally launched following the publication of the UK's Combat Air Strategy at the Farnborough Airshow in July 2018.[22]

Despite Italy's hesitation, Rome's accession to the Tempest ultimately appears to be a natural development, given decades of successful collaboration with the UK in the defence field, and aircraft in particular.[23] Crucially, the fact that both the Italian and Royal Air Forces operate F-35 Lightning II aircraft was deemed to be important, along with a common history of cooperation in the combat air field, leading to common experiences and doctrinal approaches.[24]

futuro caza europeo, 3 December 2018, https://www.defensa.gob.es/gabinete/notasPrensa/2018/12/DGC-181203-caza-europeo-ngws.html; Franco Iacch, "L'Italia ha scelto il caccia Tempest come velivolo di sesta generazione", in *Il Giornale*, 5 December 2018, https://www.ilgiornale.it/news/mondo/litalia-ha-scelto-suo-caccia-sesta-generazione-1611754.html.

[18] "Caccia europeo del futuro: è ora di scegliere!", in *Airpress*, No. 99 (April 2019).

[19] Andrea Mottola, "Difesa, quali scelte strategiche?", in *Portale Difesa*, 1 August 2019, https://www.rid.it/shownews/3149/difesa-quali-scelte-strategiche.

[20] Francesco Bussoletti, "Difesa a 5 Stelle: Italia nel progetto Tempest, il caccia che sostituirà Eurofighter", in *La Stampa*, 5 September 2019, https://www.lastampa.it/esteri/2019/09/04/news/difesa-a-5-stelle-l-italia-aderisce-al-progetto-tempest-il-caccia-che-sostituira-eurofighter-1.37413809.

[21] "L'Italia aderisce al programma britannico per il caccia Tempest", in *Analisi Difesa*, 10 September 2019, https://www.analisidifesa.it/?p=127420.

[22] UK Ministry of Defence, *Italy Partners with the UK on Tempest*, 11 September 2019, https://www.gov.uk/government/news/italy-partners-with-the-uk-on-tempest.

[23] David Cenciotti, "Italy Joins Tempest Becoming Third Nation to Partner on the Program to Develop a 6th Generation Fighter", in *The Aviationist*, 10 September 2019, https://theaviationist.com/?p=67167. In February 2019 a IAI study presented to Air Force Chief of Staff and Leonardo CEO also recommended to join Tempest despite the uncertainties of Brexit negotiations: Alessandro Marrone and Michele Nones (eds), "Europe and the Future Combat Air System", cit.

[24] UK Ministry of Defence, *Italy Partners with the UK on Tempest*, cit.

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Tempest, which had transitioned from a UK-only Initiative to two bilateral frameworks involving Rome and Stockholm, then evolved into a fully trilateral Initiative following the signing of an MoU between the three nations in December 2020. This agreement covered cooperation on research, development, and the joint conceptualisation of the Tempest sixth-generation fighter aircraft.[25]

With Italy on board, Tempest briefly took the role of a fully European competitor to the Franco-German-led FCAS programme. Yet, as Japan emerged first as a potential partner, and then officially as a full-fledged party to the newly-forged GCAP, Sweden and Saab began taking an increasingly ambiguous position.[26] Eventually, Stockholm quietly slipped out of this partnership, preferring instead to upgrade its Saab JAS 39 C/D Gripen and procure further tranches of the new and larger Gripen E over the next decades, leaving little spare resources for any other large-scale efforts in the short-to-medium term.[27] Indeed, Sweden has opted to focus on updating the Gripen and developing adjunct uncrewed capabilities to complement it; an approach that was incompatible with GCAP's focus on a new core platform first and foremost.[28] Nevertheless, recent concepts by Saab known as the F-Series feature the Gripen E alongside two UCAS and, interestingly, a sixth-generation "Manned Future Fighter", though no further details have been shared as to whether the latter would be an off-the-shelf acquisition or the result of Sweden and Saab joining an existing programme at a later stage.[29]

The significance of Sweden's GCAP departure and Japan's entry represent cannot be overstated. Firstly, the size of Japan's GDP and defence budget fit the scale of GCAP's budgetary challenge much better than Sweden's. Secondly, Tokyo's timeline for a next-generation air combat capability aligned more closely with British and Italian ones in terms of sheer urgency. Third, Japan shares with the other two partners the F-35 experience, accumulating expertise in stealth fighter operation and complex maintenance and logistics.

From the early stages, the coexistence of Tempest and FCAS prompted some stakeholders – especially in Italy – to voice their concerns regarding the risk of running two competing sixth-generation combat aircraft programmes in Europe, especially considering the limited economy of scale for each that such an arrangement would lead to. However, the addition of Japan upon the

[25] Stefano D'Urso, "Italy, United Kingdom and Sweden Sign Tempest FCAS Cooperation Memorandum of Understanding", in *The Aviationist*, 5 January 2021, https://theaviationist.com/?p=73760.

[26] Andrew White, "Sweden Joining UK-Japan-Italy Fighter Effort Seen as Unlikely by Industry Partners", in *Breaking Defense*, 22 March 2023, https://breakingdefense.com/?p=276306.

[27] IAI interview, 25 November 2024; Fabrice Wolf, "Can Sweden Rejoin the SCAF Program after Leaving the UK GCAP?", in *Meta-Defense*, 9 November 2023, https://meta-defense.fr/en/2023/11/09/programme-scaf-suede-quitte-gcap.

[28] IAI interview, 25 November 2024.

[29] Thomas Newdick, "These Are Saab's Concepts for Its Next Generation Fighter, Drones", in *TWZ*, 18 December 2024, https://www.twz.com/?p=6412463.

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announcement of GCAP has significantly complicated any prospects for a merger with FCAS, which is going to be almost impossible as time goes by because of four main reasons.

Firstly, as the two programmes progress, technical and operational requirements by the end users are bound to mature up to a point where they are simply too far removed from one another and consolidated. Secondly, GCAP is rapidly reaching a high level of institutionalisation, including a treaty-based international organisation and a fully-fledged joint venture. These constructs will be extremely difficult to reshape in order to accommodate partners like France or Germany as peer partners. Thirdly, Japan has never undertaken a cooperative programme at this scale with two European partners, let alone all five of Europe's leading DTIBs, and may not be interested in cooperation at this scale of complexity. At the same time the FCAS partners may not wish to undertake a cooperation programme of this importance with a non-European country, which would bring more complexity in terms of requirements, workshare and export controls. Fourthly, based on previous cooperative programmes of comparable magnitude, such as the Panavia Tornado and the Eurofighter, there exists an ideal middle ground between two hypothetical scenarios where: (a) is characterised by too few partners, whereby costs can soar for each country, but greater individual worksharesand industrial returns divided among fewer industries are seen as worth the expense; and (b) features too many partners with inevitably conflicting requirements, which drift toward the lowest common denominator or multiple versions of the platform, with each partner having to settle for a smaller share of the work, but jointly reaching better economy of scale. A multinational programme uniting France, Germany, Italy, Japan, Spain and the UK – along with their industries – will err too far on the side of the second option, with all its hurdles and complexities, potential financial advantages notwithstanding.[30]

1.3 The Eurofighter experience for Italy and UK

While there have been other multi-national collaborative programmes for the development of combat aircraft in the past which are worthy to bear in mind when analysing GCAP, the Eurofighter is both the most recent (with the personal involvement of many in the military and the industry who are now working on GCAP) and the closest comparison.

Eurofighter is a fourth-generation advanced multirole fighter developed through collaboration among Italy, Germany, the United Kingdom and Spain.[31] The programme began in the late 1980s, with the first test flights in 1994 and operational service starting between 2003 and 2005. In particular, Italy's Air Force currently operates 94 Typhoons (to be complemented by a further 24 recently

[30] As for the FCAS and its relations with GCAP, see Chapter 7 of this study.

[31] Italian Air Force website: *Eurofighter Typhoon*, https://www.aeronautica.difesa.it/en-home/aircrafts.

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ordered units).[32] A total of 680 aircraft have been ordered, with 529 for the partner nations and 151 exported to Saudi Arabia (72), Austria (15), Oman (12), Kuwait (28) and Qatar (24).[33] Eurofighter is a key programme even when analysing GCAP not only because it has been a binding element between the UK and Italian DTIBs, but because it continues to foster close cooperation between the two countries. In fact, when the Italian and UK governments signed the first SOI in 2019, Eurofighter featured prominently among the shared commitments for instance with regard to closer government alignment on future enhancements and integrating advanced technologies into Tempest.[34] Furthermore, given the returning emphasis among NATO air forces on achieving not only technological superiority, but also sheer mass, the Eurofighter is set to remain the backbone of Italian and British air superiority capabilities in the next two decades.

The complexity of the programme and the existence of four nations as main partners required the institution of an ad hoc governance, structured to more efficiently manage requirements and contracts. The NATO Eurofighter and Tornado Management Agency (NETMA) was thus created out of two pre-existing agencies as a NATO subsidiary to represent the nations and act as the prime customer, while Eurofighter Jadflugzeug GmbH was established in parallel by the industry's prime contractors (then-Finmeccanica, and BAE Systems and Airbus) to coordinate design, upgrades and production.[35] EUROJET, a third entity comprising Rolls-Royce, MTU Aero Engines, Avio and Industria de Turbo Propulsiones, was built up to manage the development, production, maintenance and sales of the EJ200 engine.[36]

Despite its central role as a forum for international coordination between the four partner nations, NETMA continues to face criticism for a number of unsolved weaknesses that are due to the limited authority governments have granted it. This has had enduring effects on general efficiency, procurement processes, and particularly the consortium's ability to formulate long term strategy for the platform's evolution, while governments have diverged in their procurement and platform evolution plans, resulting in increasing fragmentation among operators.[37]

[32] Leonardo, *Italy Places Order for up to 24 Eurofighter Typhoon Jets*, 23 December 2024, https://www.leonardo.com/en/press-release-detail/-/detail/23-12-2024-italy-places-order-for-up-to-24-eurofighter-typhoon-jets.

[33] Leonardo website: *Eurofighter Typhoon*, https://aircraft.leonardo.com/en/products/eurofighter-typhoon.

[34] UK Ministry of Defence, *Italy Partners with the UK on Tempest*, cit.

[35] Ron Matthews and Rashid Al-Saadi, "Organisational Complexity of the Eurofighter Typhoon Collaborative Supply Chain", in *Defence and Peace Economics*, Vol. 34, No. 2 (2023), p. 228-243, https://doi.org/10.1080/10242694.2021.1987022.

[36] Bae Systems website: *The People behind Typhoon*, https://www.baesystems.com/en-be/campaign-typhoon-for-belgium/the-people-behind-typhoon.

[37] Ron Matthews and Rashid Al-Saadi, "Organisational Complexity of the Eurofighter Typhoon Collaborative Supply Chain", cit.

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The Eurofighter's production process is distributed across the four partner nations[38] based on agreed workshare percentages, which were based on the projected numbers of purchased units.[39] Thus the UK and Germany were allocated 33 per cent each, Italy 21 per cent, and Spain 13 per cent.[40] This type of workshare allocation, based on the principle of *juste retour* (fair return), fails to take into account the very long shelf-life of systems like the Eurofighter and cannot accurately reflect actual orders decades down the line. In fact, while all Eurofighter partners cut their original orders, the UK in particular has strayed the furthest from its original plans, from an original commitment of 232 down to a total of 160 orders as of the time of writing.[41] It is worth noting that the UK MoD is evaluating an additional order both to better fill the gap until GCAP will be in service and to allow continued production of the aircraft in the BAE industrial facility at Warton.

The programme's management model has resulted in a high-quality product, with over 603 aircraft delivered and 850,000 flight hours logged, which remains a cornerstone of European defence.[42] Nevertheless, the convoluted *juste retour* dynamics as well as NETMA's weak governance have likely affected its success on the export market, while failing to cut costs to the desired extent. GCAP partners will undoubtedly keep the Eurofighter's lessons learned in mind while designing its own governance structure.

1.4 Triangular dynamics and bilateral relations

An analysis of the GCAP trilateral partnership should consider each party's own outside connections and how each relates to other alliances and frameworks. Italy is the only EU member and, alongside the UK, is part of NATO, whereas Japan holds a formal partnership status with both Rome and London. It should be noted in this context that Italy and the UK have signed a memorandum after bilateral talks on strategic collaboration in April 2023, with a strong focus on defence.[43] Interestingly, likely because there was little in the way of defence industrial cooperation with Rome and London before GCAP, Tokyo and its two European counterparts initiated bilateral strategic partnerships in 2023.[44] In this context, Japan's growing

[38] With final assembly lines in Warton (UK), Manching (Germany), Turin (Italy) and Getafe (Spain).

[39] Ron Matthews and Rashid Al-Saadi, "Organisational Complexity of the Eurofighter Typhoon Collaborative Supply Chain", cit.

[40] Eurofighter Typhoon website: *The Programme*, https://www.eurofighter.com/the-programme.

[41] Michael Evans, "The Sad Death of the Eurofighter Typhoon", in *The Spectator*,14 November 2024, https://www.spectator.co.uk/?p=526382.

[42] Raoul De Forcade, "Tecnologia made in Italy vincente per lo sviluppo del consorzio Eurofighter", in *Il Sole 24 Ore*, 30 July 2024, https://www.ilsole24ore.com/art/tecnologia-made-italy-vincente-lo-sviluppo-consorzio-eurofighter-AFlJ0vwC.

[43] Italy and UK, *Memorandum of Understanding on Bilateral Cooperation between the President of the Council of the Ministers of the Italian Republic and the Prime Minister of the United Kingdom of Great Britain and Northern Ireland*, 27 April 2023, https://www.gov.uk/government/publications/memorandum-of-understanding-between-the-uk-and-italy.

[44] UK and Japan, *The Hiroshima Accord: An Enhanced UK-Japan Global Strategic Partnership*, 18 May 2023, https://www.gov.uk/government/publications/the-hiroshima-accord/the-hiroshima-

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alignment with NATO and the Indo-Pacific's increasing strategic significance for the Alliance, highlighted in the recent Washington Summit Declaration,[45] are strengthening ties between the three nations.[46] GCAP's architecture will of course need to be compatible with NATO standards (STANAG) and integrate as much as possible with the legacy aircraft in service in each nation. This may not be such a daunting challenge for Tokyo, given the existing levels of integration between its armed forces and their US counterparts, yet it may represent a further layer of complexity.[47]

Cultural differences and geographic distance add other complexities. The shift from a bilateral to a trilateral partnership, spanning two continents, involves bridging distinct cultural perspectives that influence daily interactions, even though Japan is often seen as one of the Far East countries most aligned with Western practices. To optimise the trilateral partnership and overcome the geographical issue, the GCAP partners will have to draw some valuable lessons from previous cooperation programmes, chief among which the Eurofighter. The Eurofighter, despite a history of relatively smooth cooperation, has been greatly hampered by a highly complex workshare framework resulting in a convoluted and inefficient supply chain.[48] Workshare concerns have been, and will necessarily continue to be, a key aspect of defence industrial cooperation, but GCAP's geographical limitations mean that in this instance a more flexible and de-centralised approach may make the difference between success and failure. In this context, the creation of multiple production lines could present a partial solution, transforming redundancy – formerly seen as a vulnerability – into a potential asset with a view to industrial resilience, especially considering supply-chain challenges exacerbated by the Russia-Ukraine conflict.[49]

It is important to highlight the role that GCAP is playing in accelerating bilateral relationships that were previously less ambitious in the defence field. Italy's longstanding partnership with the UK has set a foundation for collaboration on advanced defence projects, exemplified by joint work on the Tornado and Eurofighter, which reflect a shared technological and strategic legacy. Both countries also share successful industrial defence collaborations, such as through Leonardo UK and MBDA, and Italy's established presence in the UK market is an

accord; "Italian, Japanese Leaders Agree to Form 'Strategic Partnership'", in *Reuters*, 10 January 2023, https://www.reuters.com/markets/deals/italian-japanese-leaders-agree-form-strategic-partnership-2023-01-10.

[45] NATO, *Washington Summit Declaration*, 10 July 2024, https://www.nato.int/cps/en/natohq/official_texts_227678.htm.

[46] Jack Detsch and Robbie Gramer, "NATO Wants to Plant Its Flag in Asia", in *Foreign Policy*, 9 July 2024, https://foreignpolicy.com/?p=1149970.

[47] Jeffrey W. Hornung and Zack Cooper, "Shifting the U.S.-Japan Alliance from Coordination to Integration", in *War on the Rocks*, 2 August 2024, https://warontherocks.com/?p=31987.

[48] Ron Matthews and Rashid Al-Saadi, "Organisational Complexity of the Eurofighter Typhoon Collaborative Supply Chain", cit.

[49] IAI interview with defence stakeholders, 3 September 2024.

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important and positive factor for the GCAP programme.[50]

At the same time, Italy-Japan relations have experienced a great push in recent years in the field of defence, especially following the signing of the GCAP agreement and subsequent meetings between Prime Minister Meloni and Prime Minister Kishida. These ties encompass joint efforts in various programmes, including the International Flight Training School (IFTS) and shared platforms like the F-35 and the KC767 tanker.[51] Defence cooperation between the two countries extends to the helicopter sector, as shown by the 2023 agreement between Leonardo and Kawasaki Heavy Industries (KHI) for additional MCH-101 naval helicopters and the Mid-Life Update (MLU) programme of the MCH-101 (a variant of Leonardo's AW101, produced under licence in Japan), marking 20 years of collaboration in the field.[52] Italy's recent naval diplomacy in the Indo-Pacific reflects its growing strategic alignment with Japan, too. In fact, the deployment of Cavour Carrier Strike Group to Japan in the Summer of 2024 was unprecedented in its scale and distance from Italy's usual area of naval operations.[53] Meanwhile, the Air Force also dispatched a number of F-35 and Eurofighter aircraft, together with E-55 CAEW, KC767 and a C-130J, to the Far East, taking part in the Rising Sun 2024 exercise organised by the Japan Air Self-Defence Force (JASDF).[54] The importance of these efforts, as well as joint participation to the 2024 Pitch Black exercise, in building new bridges for Italian cooperation with Japan's industry, armed forces and government cannot be overstated. In this rapidly evolving relationship, a programme as complex and significant as GCAP with the two countries will be wholly transformative in terms of moving Italy-Japan cooperation to the next stage.

Finally, the UK-Japan relationship has strengthened through joint exercises, training exchanges and security arrangements.[55] The landmark January 2023 defence treaty between the UK and Japan is the most substantial agreement of its kind between the two partners in over a century, formalising an "increasingly

[50] Ibid.

[51] Marco Battaglia, "In volo da un secolo. Il futuro dell'Aeronautica militare secondo Goretti", in *Formiche*, 28 March 2023, https://formiche.net/?p=1543434.

[52] Leonardo, *Leonardo and Kawasaki Heavy Industries Sign Contract for Additional MCH-101 Helicopters and the Start of a Mid-Life Update Programme for the Type in Japan*, 20 June 2023, https://www.leonardo.com/en/press-release-detail/-/detail/20-06-2023-leonardo-and-kawasaki-heavy-industries-sign-contract-for-additional-mch-101-helicopters-and-the-start-of-a-mid-life-update-programme-for-the-type-in-japan.

[53] "Italian Navy Aircraft Carrier Cavour Makes First Port Call in Japan", in *Kyodo News*, 23 August 2024, https://english.kyodonews.net/news/2024/08/512ec985ed25-italian-navy-aircraft-carrier-cavour-makes-first-port-call-in-japan.html.

[54] Davide Tortora and Giulio Finotti, "Rising Sun 2024: l'Aeronautica Militare conclude la missione addestrativa in Giappone", in Italian Air Force website, 8 August 2024, https://www.aeronautica.difesa.it/news/rising-sun-2024-laeronautica-militare-conclude-la-missione-addestrativa-in-giappone.

[55] UK Ministry of Defence, *Defence in a Competitive Age*, March 2021, https://www.gov.uk/government/publications/defence-in-a-competitive-age.

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close relationship".[56] Against this backdrop, it is no coincidence that the agreement was signed after the announcement of the GCAP programme. However, as early as in February 2021, the UK and Japan had already declared each other as "closest security partners" in Europe and Asia, respectively,[57] and the UK's 2021 Integrated Review further emphasised London's "tilt to the Indo-Pacific", with Japan as a key regional partner.[58]

The GCAP is clearly an ambitious tripartite programme which will have to balance itself on top of a complex web of existing and novel bilateral relations encompassing the civilian, military and industrial levels. Like other programmes in the combat aircraft domain, this is a multi-decade undertaking, and as such the relations between the three countries will simultaneously adapt to GCAP while greatly benefitting from it.

[56] Louisa Brooke-Holland, "UK-Japan Defence Agreement 2023", in *House of Commons Library Research Briefings*, No. 9704 (13 January 2023), https://commonslibrary.parliament.uk/research-briefings/cbp-9704.

[57] UK and Japan, *Japan-UK Foreign and Defence Ministerial Meeting 2021: Joint Statement*, 3 February 2021, point 2, https://www.gov.uk/government/publications/japan-uk-foreign-and-defence-ministerial-meeting-2021-joint-statement.

[58] UK Government, *Global Britain in a Competitive Age. The Integrated Review of Security, Defence, Development and Foreign Policy*, 16 March 2021, p. 60, https://www.gov.uk/government/publications/global-britain-in-a-competitive-age-the-integrated-review-of-security-defence-development-and-foreign-policy.

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2. The Italian way to GCAP

by Elio Calcagno and Nicolò Murgia[1]

2.1 Politico-strategic perspectives

Italy's commitment to GCAP is remarkably strong and cuts across government, military and private sectors. As public opinion remains on balance sceptical about military spending,[2] the political capital the Meloni government is going to invest in the programme reveals its importance for the country as a whole. In the public sphere, Defence Minister Guido Crosetto has been the most outspoken proponent of GCAP and the transformational defence partnership with the UK and Japan resulting from it. The Italian Air Force (*Aeronautica Militare*, AM) and the industry are fully committed to GCAP and have made considerable efforts in order to substantiate such commitment, with a multitude of events and speeches as well as public and media appearances.

The most recent official documents outline the centrality of GCAP to the capability planning of the Air Force and the MoD. The 2022 Strategic Direction of the Chief of Air Force (*Linee di Indirizzo del Capo di Stato Maggiore*)[3] takes a very broad and high-level approach to capability development but still argues for the centrality of next-generation air combat capabilities as the only viable option for properly managing multi-domain operations in contested environments. The MoD's 2025-2027 Strategic Direction document (*Atto di Indirizzo*)[4] takes a similar approach and describes GCAP as a key opportunity to direct funding toward research and technology (R&T) as well as R&D. Out of all public documents, however, it is the 2024-2026 Multiannual Planning Document (*Documento programmatico pluriennale*, DPP), published in the fall of 2024,[5] that provides the most detail as to Italy's commitment to the programme. In the absence of a national security strategy, this document *de facto* takes up the role of a yearly assessment of Italian defence capability gaps and planning priorities at the strategic and procurement levels. As such, in addition to the 8.9 billion euros in funding the programme is currently predicted to receive up to 2050, the DPP partially spells out the MoD's views on the development, role and mission of this system.

[1] Nicolò Murgia is Junior Researcher in IAI's "Defence, Security and Space" programme.

[2] "Sondaggio ECFR: solo il 9 per cento degli italiani approva maggiori spese militari", in *Analisi Difesa*, 5 July 2024, https://www.analisidifesa.it/?p=176724.

[3] Italian Air Force, *Sic Itur ad Astra. Linee di indirizzo del Capo di Stato Maggiore 2022*, https://www.assoaeronautica.it/indirizzodelcapodistatomaggiore.

[4] Italian Ministry of Defence, *Atto di indirizzo per l'avvio del ciclo integrato di programmazione della performance e di formazione del bilancio di previsione per l'E.F. 2025 e la programmazione pluriennale 2026-2027*, 2024, https://www.difesa.it/assets/allegati/26763/attoindirizzoed2024finalfirmato.2024.06.20.09.27.43.894.pdf.

[5] Italian Ministry of Defence, *Documento programmatico pluriennale della difesa per il triennio 2024-2026*, September 2024, https://www.difesa.it/assets/allegati/30714/dpp_2024-2026_final_firmato.pdf.

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While Italy's main geographical focus remains the Enlarged Mediterranean (*Mediterraneo allargato*), the DPP recognises that increasing strategic competition in the Indo-Pacific region requires a new level of attention. Meanwhile, Japan's entry into GCAP, and the subsequent strengthening of the bilateral relationship with Italy further enhances this perspective.[6] This has been amply demonstrated in recent years, with significant Air Force and Navy deployments to the region and Japan in particular,[7] culminating in their joint participation in the Rising Sun 2024 military exercise organised in Japan.[8]

At the political level, GCAP seems to enjoy broad support across party lines, or at the very least it has encountered a degree of political and public opposition that is much more limited than the F-35. Indeed, the F-35 was particularly divisive and harshly criticised by some political parties and media outlets. Such criticism usually focused on the per-unit costs of the F-35 and its supposed inadequacy as a fighting platform, but also on it being a US product mostly powered by US technology and the limited technology transfers to Italy.[9] The fact that GCAP has no US involvement seems to offer a partial explanation for the little opposition the programme has endured so far, despite the predicted high costs and the openness with which the government has promoted it publicly.

As an equal partner, Italy is also set to play an important part in the GCAP R&D and industrial efforts. In practice, the country is therefore destined to enjoy industrial returns that were simply not achievable in the F-35 programme. This last aspect was particularly stressed by Minister Crosetto and represents a significant development when compared with the F-35.[10] Indeed, Rome has pushed hard to gain and defend its role as an equal partner to London and Tokyo both in terms of funding and ownership of the programme,[11] with some indications that the UK in particular initially pushed for a leading position – and thus a smaller Italian role. In this regard, the signing of the GCAP joint venture agreement on 13th December 2024 that gives equal 33.3 per cent ownership to Leonardo, BAE Systems and Japan Aircraft Industrial Enhancement Co. Ltd (JAIEC), is a positive sign that Italy's

[6] Japan and Italy, *Japan-Italy Action Plan (2024-2027)*, 14 June 2024, https://www.governo.it/sites/governo.it/files/Japan-Italy_Action_Plan_2024-2027_0.pdf.

[7] "Pitch Black 2024 and Italy's Growing Role in the Indo-Pacific", in *Decode39*, 6 August 2024, https://decode39.com/?p=9447; "Italian Navy Aircraft Carrier Cavour Makes First Port Call in Japan", cit.

[8] "Italian Wings in Flight to Japan", in *ItaMilRadar*, 5 August 2024, https://wp.me/paXVH2-3lg.

[9] Michele Nones, Giovanni Gasparini and Alessandro Marrone, "Europe and the F-35 Joint Strike Fighter (JSF) Program", in *IAI Quaderni English Series*, No. 16 (July 2009), https://www.iai.it/en/node/2560.

[10] Italian Ministry of Defence, *Difesa: Italia, Giappone e Regno Unito investono sulla tecnologia del futuro*, 14 December 2023, https://www.difesa.it/il-ministro/comunicati/difesa-italia-giappone-e-regno-unito-investono-sulla-tecnologia-del-futuro-n-145/31972.html.

[11] Rhyannon Barlett-Imadegawa, "Italy Must Take Same Split as Japan, U.K. in Defense Pact: Leonardo CEO", in *Nikkei Asia*, 23 May 2024, https://asia.nikkei.com/Politics/Defense/Italy-must-take-same-split-as-Japan-U.K.-in-defense-pact-Leonardo-CEO.

strong commitment to an equal partnership is bearing its fruits.[12] Indeed, as far as Italian stakeholders are concerned, an equal role to the other partners is a non-negotiable based not only on the willingness to contribute to the programme's funding in line with its counterparts, but also on the Italian DTIB's capabilities.[13] In particular, Minister Crosetto has made GCAP a top priority of his tenure, and equal rights based on a 33 per cent share for each partner a pre-condition for Italy's participation in the programme.

Rome's decision to take part in GCAP on the one hand represents a novel approach insofar as the project involves Japan, a non-European, non-NATO country. Yet the programme still fits into Italy's traditional approach as a sort of bridge between the EU and the UK. Multilateral cooperation has become a core tenet of Italy's broader approach to international affairs and defence industrial policy is no exception. The strong commitment to achieving an equal partner status is however unprecedented as compared with other cooperative programmes in the same field such as Eurofighter or the Panavia Tornado, where Italy was not on an equal footing compared to the most important partners. This achievement is largely the result of a combination of national efforts and extensive experience within cooperative programmes. For Italy and its defence ecosystem, this newly gained position of equal leadership represents a significant challenge and a watershed moment. Whether this tripartite arrangement will lead to a workshare that is equal not only quantitively but also qualitatively will depend largely on the Italian stakeholders' ability to formulate and maintain a long-term, systematic approach to obtaining and defending prominent roles for the national industry throughout the programme's duration, while at the same time supporting the Air Force's operational sovereignty.

European integration and transatlantic cooperation have constituted the two main pillars of Italy's strategic positioning and are shared to varying degrees by the whole mainstream political spectrum, though rhetoric occasionally strays away from practice. Although the UK has exited the EU, it is still viewed in Rome as a crucial component of European security and an important defence partner. Such perspective is further strengthened by the Labour government's willingness to work more closely with the Union, including through some form of agreement on security and defence to be reached in the short- to mid-term.[14] Moreover, it could be argued that a partnership uniting two important European NATO allies and the leading American ally in the Far East, fits within a trend of expanding horizons of the NATO alliance toward closer cooperation with like-minded states in the Indo-

[12] Leonardo, *Global Combat Air Programme Industry Partners Reach Landmark Agreement to Deliver Next Generation Combat Aircraft*, 13 December 2024, https://www.leonardo.com/en/press-release-detail/-/detail/13-12-2024-global-combat-air-programme-industry-partners-reach-landmark-agreement-to-deliver-next-generation-combat-aircraft.

[13] IAI interview, 20 November 2024.

[14] Luigi Scazzieri, "Towards a UK-EU Security Pact", in *CER Insights*, 6 August 2024, https://www.cer.eu/node/11057.

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Pacific.[15] It also shows growing cooperation among European and Asian allies of the US, which indirectly enhances the Western camp in the Indo-Pacific.[16] It is notable in this regard that in 2024 Japan acquired observer status in the Eurodrone project involving France, Germany, Italy and Spain.[17]

2.2 Military perspectives

The DPP emphasises the necessity for Italy to be able to fight high-intensity conflicts, with a high level of autonomy, for a limited period of time. Such language is rather novel in Rome for open-source MoD documentation, but it is indicative of the paradigm shift ushered in by the conflict in Ukraine and its implication for European and transatlantic security.[18] This type of conflict requires both mass, to sustain a high level of attrition, and high-tech systems, resulting in the need for a high-low mix. As far as the Air Force is concerned, GCAP is located at the highest end of the mix, as it is seen in Rome as a crucial tool to maintain the technological edge with the aim of safeguarding the operational advantage over potential adversaries. Russian and Chinese threats are clear priorities in London, Rome and Tokyo, albeit with different prioritisation in each country.

The AM conceives GCAP as the core platform of a much wider system of networked assets combining into what it still named Future Combat Air System (FCAS). This open architecture will allow the integration of effectors, various types of adjuncts, satellites as well as surface-based assets.[19] In this function GCAP is not intended to merely replace a single platform in the Air Force's fleet in terms of role, but will instead take up a new role, unique to what next-generation air system can offer.[20] In other words, GCAP has become the primary means to propel the Air Force toward the adoption of new and disruptive technologies. Indeed, the programme is so important for the service that it has already made a significant investment in terms of highly qualified personnel at the Air Chief of Staff level, closely working with the Chief of the Air Force, the National Armament Directorate and the cabinet of the Defence Minister.

The Italian Air Force currently has purchased a total of 118 Eurofighters, with 94 currently in service and an additional 24 (Tranche 4) have been ordered at the end of 2024.[21] The Eurofighter has evolved significantly since its entry into service, with

[15] IAI interview, 11 December 2024.

[16] IAI interview, 29 October 2024.

[17] OCCAR, *First Meeting with Japan as Observer to the MALE RPAS Programme (aka Eurodrone)*, 14 March 2024, https://www.occar.int/news/first-meeting-with-japan-as-observer-to-the-male-rpas-programme-aka-eurodrone.

[18] See, for instance: Alessandro Marrone (ed.), *Russia-Ukraine War's Strategic Implications*, Rome, IAI, 20 February 2024, https://www.iai.it/en/node/18118.

[19] IAI interview, 2 September 2024.

[20] IAI interview, 11 December 2024.

[21] Italian Chamber of Deputies-Research Department, "Programma pluriennale di A/R n. SMD 1/2024, relativo all'acquisizione di 24 velivoli F-2000 e al supporto tecnico logistico dell'intera

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successive tranches expanding its range of capabilities. For Instance, Tranche 1 (27 aircraft) is slated for retirement by 2029 in Italy and was designed mostly for an air defence role.[22] To this day, the AM uses the Eurofighter primarily for the defence of the national and NATO air spaces. Nevertheless, later tranches gradually adapted the EFA into a more multi-role (swing role) platform, including substantial ground attack capabilities. The ongoing acquisition of Tranche 4 aircraft, likely in the Next-Generation (NG) configuration, may allow new and upgraded Eurofighters to carry out MUM-T tasks as well as electronic attack thanks to the new CAPTOR-E MK2 Radar.[23] The most recent Eurofighters (as well as older upgraded airframes) are expected to be in service up to the 2060s,[24] therefore meaning that they will not only temporarily coexist with GCAP, but will have to be interoperable for a long time.

The F-35 is part of the same equation, as its low-observability characteristics make it particularly well-suited to a different role than the Eurofighter, mainly to do with A2/AD bubble penetration and strike missions, though it can take up an air superiority role too. Indeed, currently F-35 is also employed by the Air Force in its NATO Air Policing commitments.[25] Up until recently, Italy had ordered a total of 90 F-35s, including 30 F-35Bs evenly split between Air Force and Navy,[26] though the Russian invasion of Ukraine has led Rome to seek the purchase of another 15 F-35As and 10 F-35Bs – the latter again equally allocated to the two services.[27] As a whole, Italy will therefore operate 115 F-35s, including 95 used by the Air Force and 20 by the Navy. This upcoming acquisition will bring the total orders to 75 F-35As and 20 F-35Bs, meaning that the first Italian GCAP airframes will enter service in an air force already accustomed to operating around one hundred fifth-generation aircraft. As the GCAP enters service in more significant numbers in the 2040s, it will likely operate alongside a total of over 180 F-35s and upgraded Eurofighters, making the AM one of the most well-equipped air forces in Europe – even if the total number of combat aircraft is still well below Cold War levels. Indeed, as one of the early adopters of the fifth generation F-35, by then the AM will be highly

flotta", in *Dossier*, No. 320 (15 July 2024), https://documenti.camera.it/leg19/dossier/pdf/DI0111.pdf; Pietro Tabacchi, "Via all'acquisizione di 24 nuovi Eurofighter Typhoon per l'Aeronautica Militare", in *Portale Difesa*, 5 July 2024, https://www.rid.it/shownews/6666/via-all-acquisizione-di-24-nuovi-eurofighter-typhoon-per-l-rsquo-aeronautica-militare.

[22] Italian Ministry of Defence, *Documento programmatico pluriennale della difesa per il triennio 2024-2026*, cit.

[23] Gabriele Molinelli, "Leonardo consegna il primo radar Captor-E MK2 per i Typhoon della RAF", in *Portale Difesa*, 28 April 2023, https://www.rid.it/shownews/5687/leonardo-consegna-il-primo-radar-captor-e-mk2-per-i-typhoon-della-raf.

[24] Leonardo UK, *Revealed: The Next Generation Electronic Warfare System for Eurofighter Typhoon that Won't Require Updates to Its Airframe*, 20 November 2024, https://uk.leonardo.com/en/news-and-stories-detail/-/detail/next-generation-ew-system-for-eurofighter-typhoon-revealed.

[25] NATO Allied Air Command, *Italy Demonstrates Fifth Generation Integration in NATO Air Policing in Poland*, 15 February 2024, https://ac.nato.int/archive/2024/ITA_EF_replace_F35_eAP.

[26] Elia Silvestris and David Cenciotti, "Italian Air Force Eyes F-35 Fleet Expansion", in *The Aviationist*, 26 July 2024, https://theaviationist.com/?p=88008.

[27] Italian Ministry of Defence, *Documento programmatico pluriennale della difesa per il triennio 2024-2026*, cit.

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proficient in the use of low observability tactics thanks to decades of accumulated experience. In other words, while revolutionary from so many points of view, GCAP should not require Italian pilots, training and doctrine to account for this crucial characteristic for the very first time. Furthermore, Italy is also among the first countries outside of the US to manage a mixed fourth-fifth-generation fleet, which will provide some useful lessons on how to integrate next-generation platforms into existing ones.

While the picture concerning crewed combat aircraft is rather clear in Italy, uncrewed combat air systems (UCAS) are still a significant question mark, with very little progress made in recent years or at least shared with the public domain.[28] While it is early to speculate as to GCAP's exact capabilities, it is likely that several types of adjunct systems will be an integral part of the FCAS as envisaged by the Air Force, which may extend to existing fourth and fifth-generation platforms should at least some of the future adjunct system be cross-compatible. The principle of FoA/FoM will be key in light of a diverse fleet of uncrewed combat platforms which will be required to operate together. Accordingly, significant investment by both industry and government will be crucial if Italy is to catch up on UCAS development in coming decades and develop adjuncts able to operate with the whole Italian fleet of combat aircraft, including F-35 and Eurofighter. In fact, GCAP could represent a significant opportunity to develop cutting-edge national technological know-how in this field.

2.3 Industrial perspectives

From a technology point of view, GCAP represents a set of significant opportunities and challenges for the four main companies that represent Italy in the programme: Leonardo as a Lead Systems Integrator (LSI) and Avio Aero, ELT Group, MBDA Italia as Lead Sub-Systems Integrators (LSSI).[29] In addition to the main industrial players, GCAP will require a concerted effort involving all R&D and R&T actors, including SMEs, research institutes and universities.[30] This will undoubtedly represent a significant challenge for the country, mainly because of structural difficulties in maximising investment in the relevant technological sector and the occasional unwillingness by some entities to work on defence-related projects.[31] Nevertheless, the prospect of taking a significant step forward in terms of skills and capabilities, including the security dimension, more than ever essential to work on projects of this nature, should be sufficient to call for an overall industrial mobilisation.

[28] Elio Calcagno and Alessandro Marrone (eds), "Above and Beyond", cit.

[29] Leonardo, *Global Combat Air Programme Partners Unveil New Concept Model of Next Generation Combat Aircraft*, 22 July 2024, https://www.leonardo.com/en/press-release-detail/-/detail/22-07-2024-global-combat-air-programme-partners-unveil-new-concept-model-of-next-generation-combat-aircraft.

[30] IAI interviews, 20-21 November 2024.

[31] IAI interviews, November 2024.

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Like its two GCAP counterparts, the Italian industrial base has not undertaken new air superiority aircraft programmes in decades (from R&D to actual production), beyond the cooperative production and upgrade of Eurofighter for the Italians and British, or the F-16-derived F-2 for the Japanese. Through Leonardo, however, the Italian industry has maintained its capability to independently design military aircraft like the M-346 advanced trainer, the M-346 Fighter Attack (FA) – a sovereign light fighter, the C-27J Spartan tactical transport and the M345 jet trainer. Moreover, the aforementioned successive Eurofighter tranches and upgrades have allowed the Italian industry to continue the development and integration of on-board systems, to cultivate the ability to market, export and carry out maintenance and upgrades on nationally-designed platforms – which represent a significant asset.[32] While such products have helped the domestic DTIB maintain a large array of capabilities, GCAP represents a huge step forward that requires a strong and crosscutting effort to stimulate innovation at all levels. To this end the Italian MoD launched in April 2023 the GCAP Acceleration Initiative in partnership with the Milan Polytechnic University's Centre for Digital Innovation (CEFRIEL), the Federation of Italian Companies for Aerospace, Defence and Security (AIAD), Leonardo, Avio Aero, ELT Group and MBDA Italia. The initiative intends to accelerate technological innovation by involving startups, research centres, companies and universities to come up with solutions related to the GCAP system of systems.[33]

A crucial aspect of the programme's early negotiations and definition of work allocation, however, is the previous experience, and technical and technological know-how that each of the three national partners' DTIBs are able to prove. From an Italian perspective, Eurofighter is still the single most important programme for the national DTIB in terms of high-end air combat capabilities, though the Italian share was smaller than those of Germany and the UK. Leonardo's equal ownership of the GCAP joint venture will not by itself guarantee the Italian DTIB a fair workshare allocation, neither quantitatively nor qualitatively: the government, the military and the industry will have to continue working so that this arrangement can cascade down the entire value chain. Moreover, the involvement of Leonardo UK presents the opportunity to multiply synergies with the parent company.

The F-35 has also been rather transformative in industrial terms, albeit to a different extent. Italy hosts in Cameri (Piemonte) the only Final Assembly and Check Out/Maintenance Repair Overhaul Upgrade (FACO/MROU) facility in Europe for the F-35 for a number of European users. The Italian defence industry, and Leonardo in particular, can therefore benefit from valuable lessons learned from the management of the Cameri facility, in terms of process, security of such an advanced line, as well as specific components and technologies provided by Italian companies. Yet the sheer scale of GCAP and the technological advancements it

[32] IAI interview, 20 November 2024.

[33] Leonardo, *'GCAP Acceleration Initiative' an Open Innovation Project Launched to Support Development of Future System of Systems*, 12 April 2023, https://www.leonardo.com/en/news-and-stories-detail/-/detail/leonardo_gcap_acceleration_initiative.

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entails require levels of security rarely seen by a significant share of the national DTIB, and hardly if ever by civilian R&T and R&D actors like universities.[34] Cameri has represented a useful proving ground for Leonardo, but GCAP will require a cascading effect that can seep through the entire value chain.

The F-35 did nevertheless cause some frustration at the industrial level in Italy with regard to the control that US firms retained over the key technologies, and Italy's role as second-tier partner with limited access to those technologies because of several 'black boxes'.[35] Against this backdrop, Italian stakeholders agree that one of the main challenges when it comes to GCAP will be to ensure sovereignty over all involved technologies relevant to operational sovereignty.[36] Indeed, both MoD and industry share a strong conviction that GCAP should do away entirely with a black box approach to system integration and be based on a completely open structure where all nations have access to all necessary technologies.[37] The absolute, three-way sharing of technology in particular is seen as a pre-condition for the success of the programme in Italy,[38] also as a way to make it resilient to future developments that may see partner nations going their separate way to develop new or updated variants.[39] Such an approach would be perfectly in line with the GCAP principles of FoA/FoM which are seen as crucial by Italian stakeholders.[40]

2.4 The Italian aerospace industry involved in GCAP

GCAP is set to involve Italy's aerospace industry at an unprecedented level. The latter is well developed and able to offer a number of cutting-edge solutions to the national armed forces as well as export clients. Leonardo stands out as the country's main prime, complemented by an array of other actors like Avio Aero, ELT Group and MBDA Italia, whose core business is respectively propulsion, electronic warfare and missile systems. These companies and their predecessors, along with a rich fabric of suppliers including SMEs and companies specialised in dual-use technologies, have built a strong portfolio over decades, while cooperating extensively on air platforms with the UK DTIB from the Panavia Tornado to the Eurofighter, which represent the baseline for their involvement in GCAP. Specialised studies suggest that Eurofighter alone may contribute to over 90,000 jobs in the partner countries, with 400 suppliers involved. In Italy alone, estimates indicate that as many as 24,000 jobs depend on the Eurofighter programme.[41]

[34] IAI interviews, November 2024.

[35] Michele Nones, Giovanni Gasparini and Alessandro Marrone, "Europe and the F-35 Joint Strike Fighter (JSF) Program", in *IAI Quaderni English Series*, No. 16 (July 2009), https://www.iai.it/en/node/2560.

[36] IAI interviews with stakeholders, September-November 2024.

[37] Ibid.

[38] IAI interview, 20 November 2024.

[39] IAI interview, 7 November 2024.

[40] IAI interviews with stakeholders, September-November 2024.

[41] Gabriele Capomasi, "Da Eurofighter una spinta a crescita e occupazione", in *Il Sole 24 Ore*, 30 July 2024, https://www.ilsole24ore.com/art/da-eurofighter-spinta-crescita-e-occupazione-AFlEypwC.

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In addition to the industrial capacities previously mentioned with regard to Eurofighter and F-35, Leonardo has made important investments in technologies crucial for the design and development of future combat aircraft, including next-generation platforms. For instance, the Product Capability and Concept Laboratory (PC2Lab), located in Turin, has been updated to allow pilots and engineers to formulate, test and develop new operational concepts for the next-generation combat air systems, including both crewed and uncrewed assets and the interaction between the two.[42] Crucially, PC2Lab is also being used to test pilots' ability to effectively manage their own aircraft as a core platform and a number of adjuncts simultaneously. Leonardo's aircraft division is also headquartered in Turin, with the company's resources dedicated to the GCAP effort mostly based in the city. Leonardo's Electronics and Cyber Security divisions are also key players in the programme, which underlines GCAP's crosscutting potential for the LSIs. Moreover, Leonardo has established the *Polo di competenza nazionale per la digitalizzazione industriale del Paese* (National Competence Hub for the industrial digitalisation of the Country) in Genoa, serving as the centre for high-performance computing (HPC) activities, particularly in the development of the Digital Twin. The latter, relevant not only in the context of the GCAP, is essential for facilitating and optimising testing activities, as well as for enhancing aircraft maintenance systems and training operational and maintenance personnel. A key asset of the HPC Lab, is the Davinci-1 supercomputer, one of the most powerful in the defence sector and crucial for research and development in the following areas: enhancing data analysis processes; running simulations and creating digital twins of real-world devices; and developing proprietary artificial intelligence algorithms for the company.[43] Davinci-1 will be a crucial asset for Italy's role in GCAP as more and more development work requires a mastery of HPC activities.

Avio Aero, the Italian LSSI for GCAP's propulsion aspects, is a subsidiary of General Electric (GE) Aerospace which specialises in designing and manufacturing components and propulsion systems for civil and military aviation.[44] The company employs over 5,800 people and operates multiple facilities around Italy. Avio Aero already plays a key role in the development of engines for military aircraft, such as the EJ200, which powers the Eurofighter Typhoon, and the TP400-D6, used in the Airbus A400M transport plane. Avio Aero is also a supplier for components for aircraft such as the F-35 and the F-16.[45] It is also responsible for the engine of the medium-altitude, long-endurance Eurodrone procured by Czechia, France, Germany, Italy and Spain through the EU Permanent Structured Cooperation

[42] Leonardo, *Battle Lab, Home to the Sixth-Generation Air Combat System*, 18 August 2021, https://www.leonardo.com/en/news-and-stories-detail/-/detail/battle-lab-home-to-the-sixth-generation-air-combat-system-1.

[43] Leonardo, *The Italian Industrial Digitalisation Hub*, 15 December 2021, https://www.leonardo.com/en/focus-detail/-/detail/polo-genova.

[44] AIAD website: *Avio Aero 2025*, https://aiad.it/aziende-federate/avio-aero-2025.

[45] Avio Aero website: *Military Aviation: Modules and Components*, https://avioaero.com/en/military-aviation/modules-components.

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(PESCO) project.

ELT Group, formerly known as Elettronica, specialises in electronic warfare solutions, and increasingly in cyber warfare also thanks to its subsidiary Cy4Gate. Therefore, its work encompasses a range of systems designed to enhance defence capabilities across various domains. Accordingly, this LSSI will mainly deal with GCAP's Integrated Sensing and Non-Kinetic Effects & Integrated Communications Systems (ISANKE & ICS) pillar. Other than its portfolio relating to programmes with an Italian role, the company is making important steps abroad. For instance, on top of many existing international activities, in late 2024 ELT Group and Qatar signed a contract for the supply of a Unified EW Centre with the role of Prime Contractor and Lead Systems Integrator.[46]

MBDA Italia develops and manufactures missile systems tailored for both air-to-air and air-to-ground combat applications. In its LSSI role within GCAP, the company will work with its UK and Japanese counterparts on the weapons and effectors pillar of the programme.[47] Being part of a pan-European company, thanks to cooperation with its French, German or British counterparts, MBDA Italy is involved in a number of relevant programmes. They include ASRAAM, an air-to-air missile designed for short-range engagements, the METEOR and its newly evolved variant, a long-range system capable of beyond-visual-range operations, and the MICA family, which offers flexibility for short- and medium-range scenarios. Recent advancements include the VSHORAD missile, aimed at countering aircraft and UCAS, and the Aster B1 NT, an upgraded missile with meaningful BMD/Hypersonic engagement capabilities and extended operational relevance into the 2060s. Notably, MBDA Italia profiles itself as provider of effectors for different platforms, including both GCAP and the Franco-German-Spanish FCAS.

[46] ELT Group, *ELT Group and the Qatar Armed Forces Signed a Contract for the Delivery of a Unified EW Center in Qatar*, 18 December 2024, https://www.eltgroup.net/media/press-release/elt-group-and-the-qatar-armed-forces-signed-a-contract-for-the-delivery-of-a-unified-ew-center-in-qatar.

[47] AIAD website: *MBDA Italia 2023*, https://aiad.it/aziende-federate/mbda-italia-2023; Gareth Jennings, "DSEI 2023: MBDA Partners with Mitsubishi Electric Corporation for GCAP Effects", in *Janes*, 13 September 2023, https://www.janes.com/osint-insights/defence-news/weapons/dsei-2023-mbda-partners-with-mitsubishi-electric-corporation-for-gcap-effects.

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3. The British way to GCAP

by Douglas Barrie[1]

Near two decades after the UK said it did not envisage building a next generation of crewed combat aircraft, a British demonstrator for just such a project is now in final assembly. The demonstrator, to be flown by 2027, is part of the UK's involvement in the Global Combat Air Programme (GCAP), with the GCAP combat aircraft known in London as the Tempest.

Then, Secretary of State for Defence Gavin Williamson announced the Tempest name for the aircraft at the 2018 Farnborough International Air Show when launching the Ministry of Defence's Combat Air Strategy. Standing in front of a mock-up of the broad design, Williamson's naming of aircraft may have been impromptu, but the event also marked the culmination of at least three years of planning and analysis.

3.1 The politics from Conservative to Labour governments

The Conservative Government's 2015 Strategic Defence and Security Review (SDSR) had included funding for what was dubbed the Future Combat Air Systems Technology Initiative (FCAS TI).[2] The programme of work covered national technology development as well as elements of cooperation with France and the US. Central to the political rationale, however, was the aim of sustaining the key design elements of UK's defence aerospace industrial base, at least until fundamental choices were made.

Policy decisions taken a decade before the 2015 SDSR by the then Labour Government in its 2005 Defence Industrial Strategy (DIS) had already had clear long-term implications for, and impact on, the sector.[3] The 2005 DIS also signalled the apparent end of a string of Defence Ministry and Royal Air Force research projects and procurement plans aimed at pursuing a future generation of crewed combat aircraft. These had begun with the early 1990s Air Staff Target 425 for a Future Offensive Aircraft and had gone through numerous iterations. The 2005 DIS indicated that the defence aerospace industry's national focus going forward should be on the support and upgrade of the Eurofighter Typhoon and Lockheed Martin F-35B Lighting II. The former entered service with the RAF in 2007, while the first F-35Bs were delivered to an operational squadron in 2018.

[1] Douglas Barrie is Senior Fellow for Military Aerospace at the International Institute for Strategic Studies (IISS).

[2] UK Government, *National Security Strategy and Strategic Defence and Security Review 2015*, November 2015, https://www.gov.uk/government/publications/national-security-strategy-and-strategic-defence-and-security-review-2015.

[3] UK Ministry of Defence, *Defence Industrial Strategy: Defence White Paper*, December 2005, https://www.gov.uk/government/publications/defence-industrial-strategy-defence-white-paper.

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In terms of technology development, the 2005 DIS identified uncrewed air systems (UAS) in general and particularly uncrewed combat air systems (UCAS) as a means of sustaining engineering and design skills in the absence of a future crewed combat aircraft programme. Implicit with this approach was in effect the further decline over time, if managed, of elements of the UK's traditional defence aerospace industrial base. For some this was simply a recognition of the inevitable, for others it leant an unnecessary hostage to fortune. The implications of the 2005 DIS were explored in a 2010 RAND Europe report, *Sustaining Key Skills in the UK Military Aircraft Industry*, commissioned by the Ministry of Defence.[4] The study found that, without a UK UCAS or crewed combat aircraft programme beginning around 2015, key skills in the sector would be eroded and then lost beyond 2020.

Cooperation with Paris on uncrewed air platforms did not succeed. Meanwhile, in 2018 France and Germany also announced partnering on their Future Combat Air System, which included both crewed and uncrewed platforms. After two generations of combat aircraft development with Germany on the Panavia Tornado and Eurofighter, Berlin and London were now in rival camps.

Discussing the Combat Air Strategy in the House of Commons in 2018 Williamson said: "The future of the UK's combat air sector [...] is not assured. There has been a gap between major combat air development programmes, and a clear indication of future UK military requirements is required to stimulate and deliver the research and development investment that is needed. The strategy defines a clear way ahead to preserve our national advantage and maintain choice in how it is delivered."[5]

It was under Minister Ben Wallace that the tri-national GCAP programme was announced in the UK in December 2022, with London joining Italy and Japan to cooperate on the development of a next-generation crewed combat aircraft.

Then, a snap election in July 2024 let the Labour Party return to Power for the first time in 14 years. It had been supportive of the Combat Air Strategy, the Tempest, and GCAP in opposition, but opposition is a vehicle for vicarious gratification without commitment. When in opposition, Labour Secretary of State for Defence John Healey had welcomed the signing of the GCAP treaty in December 2023. Now in power, the party was confronted with substantial funding shortfalls left by the previous government and a relatively weak economic outlook. While the launch of a Strategic Defence Review was understandable, and indeed laudable, it also tacitly left a question regarding the UK's future intention concerning GCAP. The government's terms of reference for the SDR appeared to ring-fence only two areas, neither of which was GCAP. One was to a "total commitment to the independent

[4] Matt Bassford et al., *Sustaining Key Skills in the UK Military Aircraft Industry*, Santa Monica, RAND, 2010, https://www.rand.org/pubs/monographs/MG1023.html.

[5] UK House of Commons, *Combat Air Strategy*, 17 July 2018, https://hansard.parliament.uk/Commons/2018-07-17/debates/17B8168C-254D-4725-BBEF-B869DD7FD037/CombatAirStrategy.

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UK nuclear deterrent" and the other was a commitment to the Australia, United Kingdom, United States (AUKUS) partnership to develop a new class of nuclear-powered submarine.[6]

The SDR was announced only days before the 2024 Farnborough International Air Show. The absence of any mention of GCAP in the terms of reference, combined with some unfortunate language from a junior minister at the RAF's Air and Space Chiefs conference on 18 July 2024, served only to fuel speculation in the UK press, not that much accelerant was required. Prime Minister Keir Starmer, attending the opening day of the air show, had to underline the importance of the GCAP programme, but his comments fell short still of a guarantee of its long-term continuation pending the outcome of the SDR, due to be published in the first half of 2025.

In November 2024, however, the *Financial Times* ran a story saying that following a high-level meeting Starmer had given the go-ahead to the project within the context of the SDR.[7] The intent was to reassure the UK's two partners in the programme regarding London's commitment. While as of mid-December 2024, the government had not publicly declared this to be the case. Industry partners BAE Systems, Leonardo and JAIEC, however, were also confident enough to announce the 13 December 2024 agreement to establish a joint venture company to manage the GCAP.[8]

3.2 The quest for partners

London held exploratory discussions with multiple potential partners, with Italy and Sweden initially emerging for possible cooperation on future combat air technologies. Rome had been a partner on the Panavia Tornado and Eurofighter Typhoon, while Italy's Leonardo had a key industrial presence in the UK. As such, it made an obvious choice of candidate as a partner for London in any future combat aircraft project. Ties between the UK and Japan had also been developing in the air combat realm, with BAE Systems seen as possibly supporting a domestic Japanese combat aircraft programme. In the event, Tokyo picked Lockheed Martin but the collaboration unravelled. Subsequent talks between the British and Japanese governments proved more productive and the two agreed to partner with Italy with the launch of the Global Combat Air Programme in December 2022. The UK had also indicated an 'Indo-Pacific tilt' in its 2021 Integrated Review, with HMS Queen Elizabeth's 2021 deployment to the region emblematic of the shift. A second carrier

[6] UK Ministry of Defence, *Strategic Defence Review 2024-2025: Terms of Reference*, 17 July 2024, https://www.gov.uk/government/publications/strategic-defence-review-2024-2025-terms-of-reference/strategic-defence-review-2024-2025-terms-of-reference.

[7] Sylvia Pfeifer, Jim Pickard and George Parker, "Keir Starmer Green-Lights Multibillion-Pound Fighter Jet with Italy and Japan", in *Financial Times*, 8 November 2024, https://www.ft.com/content/aab8c68b-eb7e-4305-989c-d107cb931f4b.

[8] Leonardo, *Global Combat Air Programme Industry Partners Reach Landmark Agreement to Deliver Next Generation Combat Aircraft*, cit.

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strike group deployment is planned to take place during 2025, but the four-year gap in between also served to underscore London's limited capacity to commit military resources to the region on a regular basis. Instead, the AUKUS nuclear-powered submarine programme and GCAP have become the most credible elements of any shift. Closer to home, BAE Systems had also provided engineering support to Turkey's TF-X (now Kaan) combat aircraft programme starting in 2017.

The UK has for decades also had a close defence relationship with the Kingdom of Saudi Arabia, and Saudi officials were present when Williamson 'unveiled' the design. There may well also have been differing expectations between London and Riyadh as to what would be possible in the near term. The issue of any full-blown Saudi participation in GCAP was initially particularly sensitive for Japan. Saudi Arabia's future combat air needs have continued to be explored bilaterally with the UK.

Aside from the question marks, real or imagined, on a possible involvement of Saudi Arabia which would eventually share the GCAP financial burden by reducing its cost for London and other partners, UK government has made bridging funding available to ensure the continuity of the programme and to avoid any delay in the development of UK elements of the project.

3.3 The military requirement

The 2005 DIS was predicated on the lack of "an imminent and existential threat from a hostile superpower".[9] By the 2015 SDSR Russia had annexed Crimea and had invaded eastern Ukraine, and from February 2022 Europe has faced a state-on-state war on its eastern fringe. Concomitantly, the UK's need for air power had shifted from that of an expeditionary capability to one shaped by the needs of a peer-peer or near-peer war within the context of the NATO alliance. Russia was identified in the 2021 Integrated Defence and Security Review as the "most acute threat" to UK security.[10] The 2023 Refresh of that document then identified China's "deepening partnership with Russia" and Beijing's foreign policy goals as further concerns.[11] Military aerospace developments in both countries have, and continue to shape, the UK's requirements for combat air power.

London's Combat Air Strategy was predicated on the aim of ensuring what was termed operational advantage, while also maintaining freedom of action. Ambitions which underpin the GCAP programme too.

[9] UK Ministry of Defence, *Defence Industrial Strategy: Defence White Paper*, cit., p. 15.

[10] UK Government, *Global Britain in a Competitive Age*, cit., p. 18.

[11] UK Government, *Integrated Review Refresh 2023: Responding to a More Contested and Volatile World*, March 2023, p. 8, https://www.gov.uk/government/publications/integrated-review-refresh-2023-responding-to-a-more-contested-and-volatile-world.

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The RAF plans to start to replace the first of its Typhoon operational squadrons in 2040, requiring that the Tempest begin to be available as soon after 2035 as possible. While the other Eurofighter partners have committed to a further purchase of the aircraft, there is no indication that this is a favoured option within the RAF. Industry unions have lobbied for such a purchase to support continuing final assembly of the aircraft in the UK. There is a recognition within the SDR work that greater combat air mass is required, but autonomous collaborative platforms (ACP) are favoured to provide this in the near term. There also remains interest within the RAF in the possibility of acquiring at least a squadron's worth of the F-35A model.

ACP development is being pursued at the national level within the UK at least for the moment. There remains, however, the possibility of cooperative development at least for some of the types of uncrewed systems the RAF is now considering. Cooperation among the GCAP partners for some classes of system would be one option.

The aircraft will be introduced into a demanding operational environment with the requirement of being able to be operated within highly contested air space against advanced threat systems. The Tempest will replace the Typhoon as the RAF's primary air superiority aircraft while the F-35B will continue to meet the carrier strike requirement and some air-to-surface tasks. The Tempest is planned to be used to contest the air domain if faced with advanced Chinese or Russian combat aircraft and their associated weapons.

Chinese and Russian developments are the main threat drivers for the UK and its partners' GCAP requirements. Both China and Russia are now fielding a new generation of combat aircraft, though at differing paces, and associated air-to-air weapons. Beijing and Moscow are also continuing to develop surface-to-air missile systems across a broad range of categories.

While Russia's Aerospace Forces have underperformed in Moscow's war on Ukraine, and the Sukhoi Su-57 Felon is only now, over a decade, beginning to enter the inventory, its development should not be discounted. Complementing the Felon are upgraded and new AAMs, notably the K-77M (RS-AA-X-12c ADDER) and the Item 810 (RS-AA-X-14 ARSON) medium and long-range missiles respectively. The Su-35 FLANKER M may also benefit from further upgrades during its service life.

However, Moscow's combat aircraft developments pale in comparison to those of Beijing. Described as the "pacing threat" by the US, the People's Liberation Army Air Force has and continues to be the beneficiary of sustained investment. As of late 2024, it likely had built nearly 250 of the Chengdu J-20, its first combat aircraft designed from the outset with significant radar signature management features. The aircraft's AAM inventory is in broad terms at least as good as the best the US and its allies now field. The PL-15 (CH-AA-10 ABADDON) AAM is fitted with an active electronically scanned array seeker and combines very long range with a

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high fly-out speed. In the near future, the PL-16 (CH-AA-X-13) is intended to offer the same performance characteristics but is sized to allow six rather than the four PL-15s that can be accommodated in the J-20s main internal bay. Both the PL-15 and PL-16 may be fielded in upgraded form from the 2030s and beyond. The People's Liberation Army Air Force (PLAAF) also now looks likely to take the Shenyang J-35A medium multi-role fighter into its inventory. This low-observable design would complement the larger J-20. The Shenyang design initially did not appear to garner air force support and seemed intended only for the navy as a carrier-borne aircraft.

Complementing its growing inventory of advanced combat aircraft, China also continues to develop and field an array of increasingly capable surface-to-air missile systems. These are intended to provide layered ground-based air defence from very long-range to point defence supported by a network of radars and command and control.

3.4 The industrial outlook

The UK has a long and proud history of combat aircraft development. Without a research, development and production programme to follow Typhoon and its involvement in the F-35, the future offered likely only a process of managed decline. Against this backdrop, Team Tempest was formed in 2018 consisting of BAE Systems, Rolls-Royce, Leonardo UK and MBDA UK. BAE is the UK lead on aircraft design, Rolls-Royce on propulsion, Leonardo on sensors and electronic attack, and MBDA on the associated weapons programme. The Government's 2018 launch of the programme included a commitment to provide 2 billion pounds for support through 2025.

While only formally established in 2018, the partners in the team had already, to a greater or lesser extent, been working on the technologies related to a future crewed combat aircraft design and the systems required to support this. The work on the demonstrator project began within BAE sometime in advance of the defence ministry's July 2022 formal announcement. This included a commitment to provide 2 billion pounds to support the programme through 2025.

The UK demonstrator aircraft is intended to be flown in 2027, providing a technology-proving platform for the GCAP. It will allow for the exploration of manufacturing and assembly techniques that could be adopted for GCAP, as well as examining signature management performance, including the design of the inlet ducts. The demonstrator will also be used to release weapons from the main internal bay while at supersonic speed. Weapon release at high speed is of importance for extended-range air-to-air engagements against a peer threat. Launching at supersonic speed imparts considerable energy to the missile, increasing the average speed of its fly-out to the target, and at engagement ranges, reducing the likelihood of detection of the launch aircraft.

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Meanwhile, Rolls-Royce is teamed with IHI on the propulsion system for the aircraft. The two agreed in December 2021 – in advance of the GCAP tie-up – to pursue joint-development of a next-generation propulsion system for future combat aircraft. A further testbed is known as Excalibur, a modified Boeing 757 that will be used for the development of what is dubbed the integrated sensing and non-kinetic effects and integrated communications system, the development of which is led by Leonardo UK.

The development timeline for the GCAP, is by the partners' own admission, demanding. Multilateral programmes can too often be hit by domestic issues in one or more of the partner countries, which then delays the programme and increases costs. Perhaps the poster child for this was Germany's review of the then European Fighter Aircraft project in 1991. The UK is keen, as are its GCAP partners, to avoid such a risk. At the industry level the national demonstrator programme is aimed in part at examining, along with the basic design, some of the manufacturing approaches that could be adopted for the production of aircraft.

Conclusion

While the UK has a Strategic Defence Review underway little can be taken for granted, but continued support for GCAP now appears assured. Unilateral withdrawal would have been damaging to the UK's standing as a reliable partner and represented a severe blow to core elements of the country's defence aerospace manufacturers. The UK needs a successor to the Typhoon, and GCAP continues to be the answer.

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4. The Japanese way to GCAP

by Sadamasa Oue[1]

4.1 Japan's strategic outlook and military needs

Japan adopted the new National Security/Defence Strategies and Defence Buildup Plan in December 2022, to face a security environment as severe and complex as it has ever been since the end of World War II.[2] China has intensified its attempts to unilaterally change the status quo by force in the maritime and air domains, while strengthening its strategic ties with Russia and attempting to challenge the international order. North Korea, armed with various types of missiles, including nuclear-capable and hypersonic, intensifies hostile military provocations against South Korea, the US and Japan. Against these existential threats, Japan has to fundamentally reinforce defence capabilities, including counterstrike in adversary's territory, integrated air and missile defence and multi-domain operations. The strategies also emphasise that Japan's defence capabilities must be able to respond to new ways of warfare as a result of advances in science and technology while focusing on the adversary's capabilities. To implement these strategies and plans, Japan declared to double its defence budget to two per cent of GDP by 2027.

Japan Air Self-Defence Force (JASDF) plays a major role from the early stage of an eventual conflict to defend Japan, which is an island nation surrounded by the sea. In fact, JASDF has long conducted anti-airspace intrusion measures as its peacetime primary mission, whereas training and doctrine are oriented to defensive counterair based on the exclusively defence-oriented policy. In wartime, JASDF is expected to secure air superiority as an extension of this peacetime mission. However, new strategies demand JASDF to conduct offensive counterair operations in addition to defensive in cross-domain environment. As potential opponents are developing next-generation fighters to meet future operational requirements, JASDF must expedite the ongoing procurement of 147 F-35s in total and upgrade some of the 200 F-15s. To further enhance the Japanese air combat fleet in the long run, it is more needed to modernise the aging F-2 fleet which was developed together with the US based on the F-16. Global Combat Air Programme (GCAP) is a way to achieve JASDF future capabilities envisioned in the recently approved strategies. Moreover, 3.8 billion yen (25 million US dollars) are requested for the JFY 2025 draft budget to conduct research for man-unmanned collaborative combat network.

4.2 What the GCAP means for Japan

Japan's GCAP is characterised by many of 'the most', such as: the most important to ensure air superiority in advantageously fighting a future war; the most massive

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[2] Japan's Ministry of Defence website: *Defence Policy*, https://www.mod.go.jp/en/d_policy/index.html.

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project involving trillions of yen just in development costs and hundreds of personnel engaged; the most effective as the centrepiece of the efforts to boost Japanese domestic aviation and defence industries; the most significant politically and diplomatically since it is the first joint fighter aircraft development project with countries other than the US, and therefore challenging to manage the project, including its costs and schedule as well as securing interoperability between Japan and the US.

4.3 The road to the decision in relation to the US

On 9 December 2022, the leaders of Japan, UK and Italy issued a joint statement on the GCAP, stating "we share ambition for this aircraft to be the centrepiece of a wider combat air system that will function across multiple domains".[3] With it, the project was launched for Japan to jointly develop a next-generation fighter aircraft for deployment beginning in 2035 to replace F-2s.

Japan's development of a next-generation platform started when the Defence Ministry released in 2010 a research and development vision for a future fighter jet. Since then, the Ministry has continued research and development on an advanced technological demonstrator and its engines, while gathering and analysing information by issuing requests for information (RFI) to companies at home and abroad. In response to an RFI issued in 2018, US defence contractor Lockheed Martin pitched a hybrid aircraft de facto combining an F-22 body with F-35 avionics, but disclosure of the core F-35 technology was not guaranteed. Consequently, during a briefing on the fiscal 2020 defence draft budget held in December 2019, the Defence Ministry announced that no derivative aircraft met its conditions, and Lockheed Martin's hybrid aircraft plan fell through.

The US military was at the time secretly pushing forward its Next-Generation Air Dominance (NGAD) programme to develop a successor to F-22s, and in September 2020 announced that it had already built and flown a full-scale flight demonstrator. Japan's next-generation fighter development project was small in size, and the timing of development did not match with the American one. There was no chance of the two countries jointly developing an aircraft based on the NGAD programme, of which details remain scarce even as of 2024, and which is also under review in the US.

Tokyo has bitter experiences in terms of dependency largely on the US to develop the F-2 jet,[4] as well as importing F-35s through the Foreign Military Sales (FMS)

[3] Italy, Japan and UK, *Joint Leaders' Statement*, 9 December 2022, https://www.gov.uk/government/publications/joint-leaders-statement-uk-italy-japan-9-december-2022.

[4] Japan advocated production of an indigenous fighter jet under the FS-X program in the 1980s but was politically pressured by Washington to jointly develop it with the US based on the F-16 aircraft. It still failed to get critical technologies like flight control disclosed. However, Japan managed to independently develop the F-2, which can be regarded as "nearly indigenous", in the 1990s despite bearing ballooning costs, enabling the country to build domestic production technology

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programme instead of conducting licensed production.[5] Therefore, in developing a next-generation fighter, Japan set a number of conditions: securing sufficient scalability to be able to respond flexibly to future threats and technological advances; freedom of modification to make repairs and updates with independent judgment; and domestic defence infrastructure enabling timely and appropriate maintenance and updates to ensure high responsiveness and operational relevance. In other words, Japan sought autonomy in fighter jets, a core tenet to pursue air superiority in its own judgement.

On the other hand, securing interoperability with allies is indispensable. In 2020, Japan selected Lockheed Martin as a candidate for an integration support company to leave any development options open while ensuring American supports. In 2021, the Ministry of Defence said it will continue negotiations with Lockheed Martin over what kind of support it will offer, and that it started discussions with the US Air Force on the future network to secure interoperability among combat platforms including GCAP as well as F-35.

At the same time as the joint statement issued by the leaders of Japan, the UK and Italy in December 2022, the Defence Ministry and the US Defence Department released a statement saying that the US supports the GCAP. The statement also said, "Together, we have begun important collaboration through a series of discussions on autonomous systems capabilities, which could complement Japan's next fighter program among other platforms".[6]

Indeed, through Japan's sincere and careful negotiations with the US, the matured Japan- US alliance made it possible for Tokyo to find a balance between autonomy and interoperability.

4.4 The road to the decision in relation to the UK

When in 2021 Tokyo started discussion with the US Air Force on interoperability, the Japanese MoD simultaneously announced that defence authorities of Japan and the UK would have conducted a joint analysis on the degree of standardisation. Such moves indicate the government's cautious attitude as it attempted to win

infrastructure and conduct improvements and repair work while the aircraft is in operation.

[5] Japan could not join the F-35 multilateral development programme that began in the 2000s because of its three principles on arms exports, so it initially considered the F-22 fighter as a candidate to replace decades-old F-4s. But it abandoned the idea as the US Congress had barred the exports of F-22s and instead purchased F-35s through the FMS. Nevertheless, Japan, which has not taken part in the development, does not have access to technologies and is also forced to unilaterally keep up with the frequent and highly costly technological improvements and software updates being made. Taking such experiences into account, Japan set out to secure both autonomy in manufacturing and deploying fighter jets through the GCAP programme and interoperability with the US.

[6] US Department of Defence and Japan Ministry of Defence, *Joint Statement on Cooperation for Japan's Next Fighter Aircraft*, 8 December 2022, https://www.defense.gov/News/Releases/Release/Article/3241016/us-department-of-defense-and-japan-ministry-of-defense-joint-statement-on-coope.

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Washington's understanding of Japan's shift to joint development with the UK while securing interoperability with the US.

The GCAP was launched against the backdrop of Japan and the UK's renewed focus on bilateral security ties. In June 2013, Prime Minister Shinzo Abe and British Prime Minister David Cameron reached an agreement on a framework for defence equipment cooperation, the first time for Japan to do so with a country other than the US. In the following month, the two governments signed an agreement concerning the transfer of arms and military technologies necessary to implement joint research, development and production of defence equipment.

In January 2015, at the two-plus-two meeting of foreign and defence ministers, London and Tokyo welcomed the launch of a project on the feasibility of a Joint New Air-to-Air Missile (JNAAM). A trial production of the prototype was completed during fiscal 2022 and the project was concluded in 2023.

Meanwhile, the UK signed a memorandum of understanding with Sweden and Italy in 2019 to work on a joint combat air development and acquisition programme for the planned Tempest fighter which will eventually replace the Eurofighter Typhoon. Tempest and Japan's next-generation fighter aircraft that will replace F-2s have a lot in common, with both aiming for greater range and missile payload than F-35s and for deployment in 2035, which means a joint development will lead to a win-win relationship.

Japan and the UK can also benefit from being able to reduce massive development costs and technological risks, and the accumulated achievements of technological cooperation in the JNAAM project pushed them to launch the joint aircraft development programme. "The UK sees this as a once-in-a-generation opportunity for an equal partnership that will allow both our nations the freedom of modifications we both need, while ensuring any future platforms and systems are interoperable with our key security partners, such as the US", Richard Berthon, the UK Ministry of Defence's director of future air combat programmes, wrote in an article in the *Sankei Shimbun* in September 2020.[7] Then the GCAP started as a trilateral project and Japan welcomed Italy as a legitimate, capable and reliable partner.

4.5 Issues that must be resolved

Japan had to resolve two major issues for implementing the GCAP: the so-called three principles on the transfer of defence equipment and technology (The Principles) and mobilising industry participation.

[7] "British Ministry of Defence Calls for Cooperation with Japan in Developing Next-Generation Fighter Jets" [in Japanese], in *The Sankei Shimbun*, 23 September 2020, https://www.sankei.com/article/20200923-VGP457QUZVPLRDXIBK775ZO7DQ.

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From a Japanese perspective, the export of the fighters to be developed via GCAP is a prerequisite of the programme. As the leaders' joint statement says, "This programme has been designed with our Allies and partners at its very heart",[8] indicating that it is intended for exports. Recognising this issue, the ruling parties, the Liberal Democratic Party and the Komeito Party, organised a Working Team (WT) in April 2023 to clarify permissible transfer cases and procedures. In December 2023 WT submitted its recommendations, leading to the partial revision of The Principles, but the direct transfer from Japan to the third countries was left for further deliberation due to Komeito's hesitation. Concerns with this situation amounted among partners, including British Ambassador to Japan Julia Longbottom, urging Japan to swiftly revise The Principles to avoid negative impacts on an already ongoing project.[9] The Japanese Government, through a coordination of the ruling parties, provided explanations to the Diet to appease Komeito, and finally the Cabinet decided the mechanism to allow direct transfer of the future GCAP aircraft from Japan to third countries in March 2024.[10]

Notably, GCAP is the first international joint development for Japanese institutions and defence industry. Having the Japan-led part of the joint development in sight, MoD signed a contract with Mitsubishi Heavy Industries (MHI) in 2020 as a prime company to be in charge of the holistic integration of the fighter and the development began. MHI played a major role in a joint analysis including on the extent of commonality of the aircraft, leading to the agreement on developing a common platform. MHI announced the Collaboration Agreement between BAE Systems (UK), MHI (Japan) and Leonardo (Italy) on 12 September 2023, which supports ongoing discussions to set out long-term working arrangements and maturity of the concept and capability requirements for the GCAP.[11]

Having suffered from a long-term decrease in domestic military demands, Japanese defence industries are eager to participate in the GCAP. This is the case, for example, with IHI and Mitsubishi Electronic Company being designated as a leader for the development of engine and mission avionics respectively. Multilateral development collaboration has become a major trend among Western countries, as it offers the merit of bringing together the technological prowess of participating states to share and reduce development costs and technological risks. Yet, there are also many conflicts of interest, including differences in operational requirements, cost sharing, manufacturing workshare and the attribution of intellectual property. In order to encourage the participation of the Japanese

[8] Italy, Japan and UK, *Joint Leaders' Statement*, cit.

[9] "British Ambassador Urges Japan to Change Rules on Fighter Jet Exports" [in Japanese], in *The Sankei Shimbun*, 13 February 2024, https://www.sankei.com/article/20240213-AQETNX5ZPFPH7GJZJZSEAQLC7I.

[10] Japan's Ministry of Defence, *Defense of Japan 2024*, p. 475, https://www.mod.go.jp/en/publ/w_paper/index.html.

[11] MHI, *Global Combat Air Programme Industry Partners Agree Next Steps on Collaboration to Deliver Next Generation Combat Aircraft*, 12 September 2023, https://www.mhi.com/news/23091202.html.

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defence companies, big and small alike, who lack experience and expertise for international joint development, it should be established an appropriate entity to manage negotiations among participants, oversee programme implementation and ensure profits for each company.

Japanese government also needs such entity not only to expedite collaboration among institutions, militaries and private sectors of three countries, but also to ensure final products export in accordance with The Principles. In December 2023, defence ministers from Italy, Japan and the UK met in Tokyo to sign the Convention on the establishment of the GCAP International Government Organisation (GIGO)[12] to lay a solid basis not only for delivering a next-generation fighter aircraft by 2035 but also for further enhancing the defence industrial base of each country.[13] The convention on the establishment of GIGO was approved by the Diet on 5 June, and Oka Masami, former Vice Minister of Defence for International Affairs, was named as the head of GIGO settled in London.[14] It is also reported that Saudi Arabia may join the programme as a partner outside the framework of the treaty.[15]

Japan is steadily moving forward with the GCAP: MoD requested 112.7 billion yen (about 800 million US dollars) for the GCAP in the FY2025 defence budget,[16] as well as tens of personnel increase to dispatch GIGO despite very tight manpower shortage and difficult recruitment. Moreover, they must be highly qualified to play important roles in successful development.

4.6 A new alliance

In recent years, defence cooperation, such as joint training between NATO and Japan, has been rapidly enhanced because of shared concerns against China, Russia and their cooperation. As the leaders' joint statement on the GCAP affirms that the three countries share the ambition for this aircraft to be the centrepiece of a wider combat air system that will function across multiple domains, GCAP is expected to provide the capability to cope with common threats in the future.

[12] Italy, Japan and UK, *Convention on the Establishment of the "Global Combat Air Programme - GCAP International Government Organisation"*, Tokyo, 14 December 2023, https://www.gov.uk/government/publications/convention-on-the-establishment-of-the-global-combat-air-programme-gcap-international-government-organisation-ts-no982024.

[13] Italy, Japan and UK Ministries of Defence, *GCAP Trilateral Defence Ministerial Joint Statement*, 14 December 2023, https://www.gov.uk/government/publications/convention-on-the-establishment-of-the-global-combat-air-programme-gcap-international-government-organisation/gcap-trilateral-defence-ministerial-joint-statement.

[14] "Masami Oka Named First Head of Fighter Jet International Body", in *The Japan Times*, 20 October 2024, https://www.japantimes.co.jp/news/2024/10/20/japan/politics/oka-fighter-jet-international-body.

[15] "Next-gen Fighter Being Developed by Japan, U.K., Italy Could See Saudis Sign on as 'Partner'", in *The Japan News*, 1 December 2024, https://japannews.yomiuri.co.jp/world/wider-world/20241201-225435.

[16] Japan spent 530 billion yen from 2020 to 2023 for R&D of the next fighter jet. Defence Buildup Plan from 2023 to 2027 may allocate 700 billion yen for the GCAP. Total cost for the development is unknown.

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The three countries' governments, militaries and numerous companies will work together and cooperate in various fields in a multilayered manner for decades to come for the development, deployment and operation of the aircraft through the GCAP. If the programme proves successful, the security and defence ties among the three countries will certainly grow even stronger. While joint drills and military operations can be described as a flow of temporary military cooperation, joint development is a stock or a structured cooperation. In that sense, the GCAP is a symbol of what the UK calls a "new alliance".

Moreover, the benefits of exporting finished aircraft are enormous for Japan and its defence industry. It will lead not only to price reductions due to increased production and maintenance work to be allocated to national manufacturing and technological basis, but also to deepened mutual dependence with importing countries. Indeed, GCAP could offer a competitive edge and resilient supply chain to allies and partners of Japan, UK and Italy.

Accordingly, three countries must push ahead with the GCAP programme without insisting too much on their narrow national interests and peculiar circumstances in order to be at an advantage over the authoritarian regimes of China and Russia, which are also each developing their own sixth-generation fighter jets. Meanwhile, Germany, France and Spain are jointly developing the Future Combat Air System (FCAS) that would become the rival of the GCAP in terms of export markets. How these development projects turn out could determine not only who will have an operational advantage in future wars but also the future of the aviation and defence industries' supply chains and exports, as well as alliance relationships among countries within an unstable international environment. As such, GCAP deserves the full commitment of all participants from three countries.

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5. The GCAP politico-institutional governance

by Karolina Muti and Nicolò Murgia[1]

5.1 Challenges and opportunities of a GCAP governance in the making

The challenges and opportunities of establishing an adequate and fit-for-purpose GCAP politico-military governance point in two opposite directions. On the one hand, the partnership between Japan, Italy and the UK can count on the consolidated and long-lasting political and industrial ties between Rome and London in the field of aviation and aerospace. The legacy of jointly developed combat aircraft programmes, such as Tornado and Eurofighter Typhoon, together with their dedicated institutional and industrial bodies, leave both countries with a detailed list of what worked well and what did not: therefore, they have a good understanding of what should be done differently to establish an effective governance structure.[2] Such understanding relates to the cooperation with the US on the F-35 programme as well. The latter was designed with the UK as the only Tier 1 partner, and Italy as a Tier 2 one, which resulted in a strong asymmetry, especially in terms of information sharing. Such previous common experiences are expected to benefit the GCAP institutional governance through lessons learned from past processes. However, it is already clear that the GCAP institutional and organisational structure will be deeply innovative in its form, functioning and principles, with respect to previous programmes.

On the other hand, the opposite applies to cooperation with Japan, which is new to international collaborative and long-term procurement projects, with the exception of cooperation with the United States on F-2.[3] Such a lack of experience entails a higher level of complexity in establishing trilateral agreements. While Italy and UK can rely on a consolidated background on this matter, including on issues like export control, the involvement of Japan in defining such agreements is novel. This relates especially to Japan, which needs to set up some of its own national regulations to participate in GCAP, which is unprecedented for Tokyo, and notably to the bilateral legal and political framework between Japan and Italy that, compared to UK-Italy and UK-Japan frameworks, is less developed.[4]

The GCAP governance has the opportunity to benefit from collaborative relationships that, in some cases, precede the programme itself but gain traction and reach a higher political and strategic level in parallel with GCAP, and, in some cases, because of GCAP. Cooperation extends across various sectors, such as defence, security, or technological innovation e.g., the British-Japanese

[1] Karolina Muti is Senior Fellow in IAI's "Defence, Security and Space" programme.
[2] IAI interviews, 2 September, 7 November, 12 November 2024.
[3] IAI interviews, 2 September, 3 September, 7 November 2024.
[4] IAI interview, 7 November 2024.

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digital partnership[5] or the Italo-Japanese industrial partnership on advanced technologies, semiconductors and AI.[6] In the trade sector, Rome and London have established an export and investment partnership,[7] while London and Tokyo signed an agreement for a comprehensive economic partnership.[8] In the energy field, Italy and Japan rely on an agreement focusing on strategic areas of gas distribution networks,[9] whereas the UK and Japan formalised a renewable energy partnership.[10] It is clear that the GCAP has been crucial in reinforcing high-level political-institutional ties, as underlined by the frequent bilateral and trilateral meetings centred on the programme, and involving Defence Ministers, Foreign Ministers and Prime Ministers. As a result, the programme not only leverages existing strong cooperation but also serves as a catalyst, enhancing and consolidating politico-institutional collaboration among the three nations.

The launch of GCAP was marked by a number of high-level political and institutional milestones reached by top representatives of the partner countries. Notably, the 1st Joint Statement of the GCAP project on 9 December 2022 and the signature of the Memorandum of Cooperation between Italy, Japan and the UK on 16 December 2022 was the first step to institutionalise the partnership. On 14 December 2023, the signature of the Convention on the Establishment of "Global Combat Air Programme GCAP International Government Organisation" – an international and legally binding treaty – by the Ministers of Defence of the three countries represented a quality leap for the partnership. This step represents a crucial development for the programme since it leads to a higher level of institutionalisation. The international agreement has been ratified by the Parliaments of the three countries, officially establishing the coming into force of the treaty. In particular, on 12 November 2024, the lower chamber of the Italian Parliament voted to approve the convention on the institution of the GIGO,[11] after

[5] *UK-Japan Digital Partnership*, 22 January 2025, https://www.gov.uk/government/publications/uk-japan-digital-partnership.

[6] Japan and Italy, *Joint Statement between the Minister of Economy, Trade, and Industry of Japan and the Minister of Enterprises and Made in Italy of the Italian Republic*, 12 December 2023, https://www.meti.go.jp/press/2023/12/20231212003/20231212003-1.pdf; Italian Ministry of Enterprises and Made in Italy, *Italia e Giappone firmano Joint-Statement su partnership industriali*, 12 December 2023, https://www.mimit.gov.it/it/notizie-stampa/italia-e-giappone-firmano-joint-statement-su-partnership-industriali.

[7] UK and Italy, *UK-Italy Ministerial Dialogue on Export and Investment Promotion*, 11 September 2023, https://www.gov.uk/government/publications/ministerial-dialogue-on-export-and-investment-promotion-between-the-uk-and-italy/uk-italy-ministerial-dialogue-on-export-and-investment-promotion.

[8] UK and Japan, *UK/Japan: Agreement for a Comprehensive Economic Partnership*, Tokyo, 23 October 2020, https://www.gov.uk/government/publications/ukjapan-agreement-for-a-comprehensive-economic-partnership-cs-japan-no12020.

[9] Italgas, *Italgas and Tokyo Gas Network Agreement to Develop the Future Gas Distribution Network*, 4 December 2023, https://www.italgas.it/en/press-release/italgas-and-tokyo-gas-network-agreement-to-develop-the-future-gas-distribution-network.

[10] UK and Japan, *UK-Japan Renewable Energy Partnership: Joint Statement*, 18 May 2023, https://www.gov.uk/government/publications/uk-japan-renewable-energy-partnership-joint-statement.

[11] Italian Chamber of Deputies, "Verifica delle quantificazioni A.C. 2010. Ratifica ed esecuzione della

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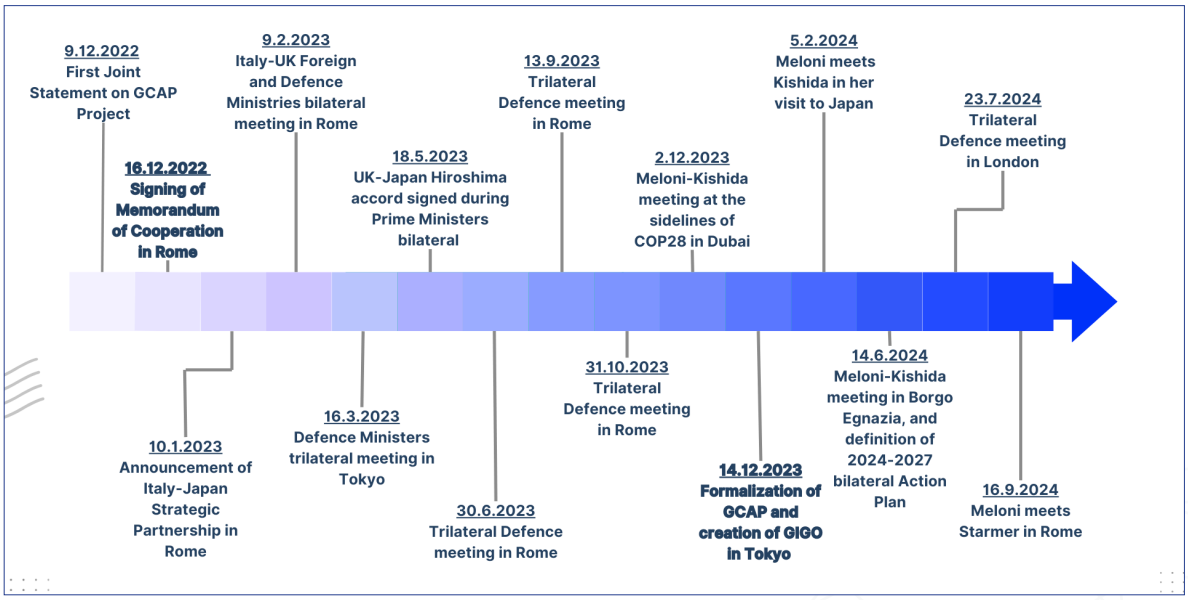
it had already been approved by the Senate.[12]

The subsequent key milestone achieved was the creation of the industrial Joint Venture (JV) among the three Lead Systems Integrators (LSI), which was formalised on 13 December 2024 and added the industrial layer to the partnership.[13] Since the first joint statement on GCAP, representatives of Japan, Italy and the UK kept a high-frequency rate of bilateral and trilateral meetings at the highest political level. Prime Ministers and Foreign Affairs and Defence Ministers met regularly since December 2022 as reported in the timeline, reinforcing the sense of relevance that the three partner countries link to GCAP. Such a political commitment has been necessary to overcome the challenges of a novel trilateral cooperation spanning across two continents and including both NATO and non-NATO members.

Figure 1 | The road to GCAP: Key high-level meetings



5.2 Building a more innovative and resilient governance organisation

Key principles on which the GCAP institutional governance is supposed to build include FoA/FoM, along with tenets of autonomy, flexibility, transparency, and truly joint development through the "responsibility to agree" concept.[14] This

Convenzione sull'istituzione dell'organizzazione governativa internazionale GCAP, fatta a Tokyo il 14 Dicembre 2023", in *Dossier*, No. 273 (6 November 2024), https://documenti.camera.it/leg19/dossier/pdf/VQ2100.pdf.

[12] Italian Chamber of Deputies, *Ratifica convenzione GCAP, approvazione definitiva*, 12 November 2024, https://comunicazione.camera.it/archivio-prima-pagina/19-44418.

[13] Riccardo Leoni, "Firmato a Londra l'accordo per la joint venture sul Gcap. Tutti i dettagli", in *Formiche*, 13 December 2024, https://formiche.net/?p=1666714.

[14] John Hill, "Future Proof: GCAP to Learn from Lessons of the Past", in *Airforce Technology*, 7 February 2024, https://www.airforce-technology.com/?p=246724.

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approach purposely differs from the "*juste retour*" principle embedded in the Eurofighter Typhoon, which resulted in strictly separated work shares among industrial players, as well as to delays by the designated bodies due to the lack of a proper transfer of responsibilities.[15] The GIGO is supposed to avoid such setbacks in several ways, through innovative processes and new organisational solutions. First, through a more agile and flexible organisation and structure. Secondly, thanks to a proper delegation of decision-making power from national governments directly to GIGO, rendering it a truly autonomous international agency. This approach should enhance the programme's effectiveness and adherence to a strict and very ambitious timetable. Thirdly, avoiding institutional and industrial silos through an underlying concept of joint design and system development, and considering, where possible, the establishment of joint institutional and industrial teams composed of personnel from all three countries and from the LSI. Such an approach was conceived as a direct lesson from, and in contrast with, the Eurofighter Typhoon cooperation model.[16]

In particular, autonomy should make the Agency and the programme resilient to the volatility and unpredictability of the political landscape and more resistant to changing governments, and their different priorities, over the mid and long-term. Since the signature of the Joint Declaration launching GCAP, the UK changed two governments in less than two years.[17] Japan experienced a similar situation, with the government of Shigeru Ishiba succeeding Fumio Kishida's government on 1 October 2024. Despite a previous track record of short-lasting governments, Italy is the only partner to have experienced continuity of government since the GCAP official start. This situation presents some advantages for Rome, notably helping to cope with the challenging time schedule and to bring a continuity of vision, compared to Tokyo and London. Government changes in partner countries came with temporary political challenges regarding the programme. In July 2024, in the aftermath of the Farnborough International Airshow, the Minister of the Armed Forces elected with the new Labour government declared that "it [was] not right for [him] to prejudge what might happen in the defence review",[18] referring to a possible modification in the UK's commitment to the GCAP. This created some concerns among the stakeholders with regard to the continuation of the programme on the terms previously agreed. Such worries did not have any practical consequence, and the cooperation continued with the same pace and quality. Nevertheless, the situation showcased well the risks of a changing political landscape in the three partner countries that could well appear in the future, considering also the decades-long duration of the programme. The GIGO should

[15] Douglas Barrie and Ben Thornley, "GCAP Treaty Seeks to Avoid Past Development Missteps", in *Military Balance Blog*, 2 January 2024, https://www.iiss.org/online-analysis/military-balance/2024/01/gcap-treaty-seeks-to-avoid-past-development-missteps.

[16] IAI interviews, 3 September, 7 November, 12 November 2024.

[17] Conservatives' Rishi Sunak Government (2022-2024) and Labours' Keith Starmer Government.

[18] Deborah Haynes, "New UK Fighter Jet Could Be Axed in Defence Review", in *Sky News*, 19 July 2024, https://news.sky.com/story/article-13180864.

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be designed to mitigate and manage such risks. Tim Rowntree, former director of OCCAR, suggested implementing in GCAP governance elements typical of OCCAR agreements, notably the principle that if a partner nation changes the offtake, it has to financially compensate the remaining ones, this way discouraging partners from withdrawals and from reducing their engagement.[19]

5.3 GIGO's structure and pillars

The fact the convention establishing GIGO has the legal status of an international treaty highlights the strong level of institutionalisation of the governance in the making. This is somehow unprecedented for such type of programme and signals the great political and strategic value that the three partners attach to GCAP. The status of an international treaty makes it more difficult politically and legally for the parties to withdraw from the programme, even if, in its current form, the treaty does not contain any financial obligation.[20]

The GIGO, an independent entity with legal capacity, was established to achieve the "most efficient coordination between the parties" and "to pursue the guidance, direction, control, supervision and management of the GCAP on behalf of the parties".[21] In accordance with the goal of maximising the synergies and the cooperation between the three partners, the GIGO strongly encourages the import, export and transfer of knowledge and materials developed within the programme among the partners, as the GCAP has a stated objective of pushing the growth of partners' DTIBs and fostering technology innovation.

According to the treaty, the GIGO structure is composed of the Steering Committee (SC) and the GCAP Agency, which will function under the guidance, direction, oversight and supervision of the SC.[22]

The SC is composed of representatives from each party on an equal basis, including a Head of Delegation (HoD), and the leadership rotating among the parties. As the highest governance body, the SC oversees the GIGO, providing guidance, direction and supervision. Its responsibilities and decision-making processes will be further defined via agreements between the parties, and it may establish subordinate committees to support its functions when necessary.[23]

The GCAP Agency is responsible for managing, coordinating and executing all phases of the programme under the oversight of the SC. The GIGO headquarters

[19] John Hill, "Future Proof", cit.

[20] Trevor Taylor, "The Damage from Doubt: Labour's Clumsy Handling of the GCAP Programme", in *RUSI Commentaries*, September 2024, https://www.rusi.org/explore-our-research/publications/commentary/damage-doubt-labours-clumsy-handling-gcap-programme.

[21] Italy, Japan and UK, *Convention on the Establishment of the "Global Combat Air Programme - GCAP International Government Organisation"*, cit.

[22] Ibid.

[23] Ibid.

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are located in the UK in the city of Reading, east of London, whereas possible branches will be located in Japan and Italy as well. It is particularly relevant that the GIGO and the Joint venture will be both located in the UK and, possibly, in the same place and structure. The proximity of the two organisations may have a positive impact on respecting the strict security standards and on adhering to the tight timeline, by allowing for quick information sharing and a more efficient decision-making process. The co-location of the two entities should allow for a stronger synergy between the political and industrial dynamics, facilitating a more consistent and cohesive management of the programme.

The Agency oversees GCAP contracts, manages technical and programme requirements, and ensures compliance with national regulations. The fact that GIGO will be a fully-fledged international organisation entails that personnel seconded from partner countries will be hired directly by the organisation itself. The Agency is also meant to submit annual budgets to the SC.

The GCAP Agency is led by a Chief Executive (CE), appointed by the SC, who is supported by Directors overseeing key departments. The first CE should be from Japan, while the first Chief Executive Officer (CEO) of the Joint Venture, the industrial counterpart of GIGO, will be from Italy, to maintain a balance between the three countries' responsibilities and competencies.[24] The Agency CE will be accountable to the SC. The GIGO personnel will include government officials and specialised staff selected to ensure both balance between the parties and efficiency. Key roles are reserved for government officials. For what concerns the selection of adequate personnel for GIGO, Italy is mobilising staff with know-how and expertise in fourth-fifth-generation fighters in operational and procurement areas. However, involving a sufficient number of personnel with the right skills to staff GIGO is likely to be an issue for all involved partners, as GIGO is planned to hire approximately 500 people – even if the initial operational capacity will consist of approximately 150 employees.[25]

The accession of additional parties to the GCAP requires unanimous consent from the SC to start negotiations and from all parties for final approval. In other words, the Agency must seek SC direction before engaging in discussions with non-parties interested in the GCAP. Saudi Arabia has appeared in international media as an interested candidate partner.[26] In case the three partners were to agree on the enlargement of the programme, Saudi Arabia would be admitted as a junior partner, with limited decisional power, access to information and share of work. This would therefore result in just a partial alteration of the current decisional and

[24] UK Ministry of Defence, *UK, Japan, and Italy Sign International Stealth Fighter Jet Programme Treaty*, 14 December 2023, https://www.gov.uk/government/news/uk-japan-and-italy-sign-international-stealth-fighter-jet-programme-treaty.

[25] IAI interview, 7 November 2024.

[26] "Saudi Arabia Likely to Join GCAP Jet Fighter Project, Italy Says", in *Reuters*, 27 November 2024, https://www.reuters.com/world/saudi-arabia-likely-join-gcap-jet-fighter-project-italy-says-2024-11-27.

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management structure. The main reason to include another partner, especially one with the financial and industrial profile of Saudi Arabia, is a larger distribution of costs that would ease the burden currently borne by Japan, Italy and the UK, and make the programme financially more sustainable. In addition, it would expand the export perspectives, also considering that Saudi Arabia's defence spending to GDP rate is estimated at 7.1 per cent.[27] In addition, it does not have to this moment operational experience of the F-35 like the GCAP countries, or of any other fifth-generation fighter jet.[28] In addition, the absence of previous defence cooperation between Saudi Arabia and any of the three GCAP partners would add a significant layer of complexity to the management of the programme, even if, as already mentioned, it would not obtain the same partner status of the other three countries.

The parties will also cooperate to facilitate exports to non-parties, with a common mechanism in place, administered by the Agency, to manage technology and systems transfers in compliance with national laws and international agreements. Indeed, the Agency mandate encompasses support for export, and its structure foresees specific offices to deal with that dossier.

To conclude, the GCAP political-institutional governance should strike the right balance in enabling common, effective and timely processes and decision-making, by creating a solid counterpart for the establishment of an industrial governance.

[27] Nan Tian et al., "Trends in World Military Expenditure, 2023", in *SIPRI Fact Sheets*, April 2024, https://doi.org/10.55163/BQGA2180.

[28] "Saudi Arabia Shows Interest in Turkish Kaan Fighter, Kizilelma Drone", in *Defense Mirror*, 4 July 2024, https://www.defensemirror.com/news/37199.

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6. The GCAP industrial architecture

by Karolina Muti and Gaia Ravazzolo

The emerging GCAP industrial architecture is intertwined with the institutional architecture (see Chapter 5) of the programme and reflects the same highly innovative concept and structure. Still, at the moment of writing, less information is available regarding industrial architecture developments compared with institutional ones.

6.1 The GCAP Joint Venture

The most important element of the future GCAP industrial architecture is the planned establishment of a joint venture (JV) among the three Lead Systems Integrators (LSI), namely BAE Systems (UK), Leonardo (Italy) and JAIEC (Japan). The GCAP JV is supposed to be the industrial counterpart of the GIGO (see Chapter 5), and the signature for the establishment of the JV that took place on 13 December 2024 represents the first legally binding document signed by the CEOs of the LSIs for the programme's development.[1] The first contract (whose exact form has yet to be determined) to launch JV's activities will be determined by GIGO itself.[2]

The JV's Headquarters (HQ) will be based in the UK, similarly to GIGO. Three local offices distributed throughout the partner countries will support the HQ's activities. To guarantee an adequate counterbalance to the fact that both GIGO and JV HQ will be located in the UK, the first Director/Chief Executive of the JV will be Italian and will be chosen by Leonardo.[3] His/her assignment will last three years, handing over to Japan, and only from the 7th year will the rotation also involve the British counterparts.[4] The JV is planned to be an agile organisational body in which multinational teams from Italy, Japan and the UK are supposed to work jointly, in order to ensure maximum levels of cooperation, transparency and full visibility on the programme and its advancement for London, Rome and Tokyo.[5] The unprecedented security classification level of GCAP, considerably higher than those applied to previous similar programmes such as the Eurofighter, has a direct impact on infrastructures (including IT and cyber) and costs, on the work organisation and on the "in-person vs. virtual" balance in the day-by-day work, adding an additional layer of complexity to the industrial organisation and

[1] IAI interview, 12 November 2024; Tim Martin, "GCAP Partners Form Joint Venture to Deliver Next-gen Fighter for UK, Japan and Italy", in *Breaking Defense*, 13 December 2024, https://breakingdefense.com/?p=377109.

[2] IAI interview, 20 November 2024.

[3] Andrea Carli and Celestina Dominelli, "Gcap, arriva la joint venture paritetica: quote del 33% dell'Italia con Leonardo, UK e Giappone", in *Il Sole 24 Ore*, 13 December 2024, https://www.ilsole24ore.com/art/gcap-arriva-joint-venture-paritetica-quote-33percento-dell-italia-leonardo-uk-e-giappone-AG4CCHkB.

[4] IAI interview, 7 November 2024.

[5] Ibid.

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structure. The distribution of partners across three continents further complicates the picture but also enhances the speed of process if leveraged properly, as teams are working in some cases almost around the clock through different time zones, making the most out of their geographical distribution.[6]

The most valuable research and development (R&D) elements and the key programme's technologies will be at the centre of the JV agreement, whereas other technologies and components will be developed outside the JV framework by partner industries.[7] Such emerging division and framework should be functional to guarantee, in the long run, the FoA/FoM principles to each participating nation, that implies the ability to autonomously modify the system/platform and adapt it based on national operational needs, in the preferred time, pace and place.[8] Freedom of Action and Freedom of Modification are very important for Italy's Armed Forces, as they guarantee operational autonomy and technological sovereignty.[9] Even if the concrete effects of this principle will be visible later during the more advanced phases of the programme, it must be adequately planned and ensured since the beginning, as it mostly regards the national industrial complex capacity to enforce FoA/FoM through national technological competencies. Actually, those principles can only be ensured if the national industry will have the capacity to adapt the system to national needs, thus requiring Italy, and particularly Leonardo, an unprecedented level of visibility over the technological progress and access to the know-how throughout the whole process of system's development. It is worth noting that the JV will include only the LSIs, whereas partner companies (in the Italian case Avio Aero, ELT Group and MBDA Italy) involved in the programme will manage their activities under a separate framework.[10] While they will work as second-tier partners of the GCAP JV, no joint venture is planned to be established among them. The concept, design and structure behind the JV are planned to be innovative, and intentionally different from previous models that the UK and Italy experienced together, such as the Eurofighter consortium.[11] The aim is to avoid an industrial organisation where each involved company works and delivers its outputs in rigidly divided silos, fostering a more integrated and collaborative process from the outset, where close cooperation is imperative to comply with the ambitious timeline and system requirements. For this reason, tri-national working groups have been established to lay the foundations of a common working culture underpinning the programme.[12] However, as mentioned before, such a new JV model will not apply to industries that are non-LSIs and that are planned to be

[6] IAI interview, 20 November 2024.

[7] Namely, not by the Lead Systems Integrators. IAI interview, 12 November 2024.

[8] IAI interview, 12 November 2024; Gabriel Dominguez, "Japan Joint Fighter Program Gains Steam as Firms Zero in on Conceptual Design", in *The Japan Times*, 26 February 2024, https://www.japantimes.co.jp/news/2024/02/26/japan/japan-joint-fighter-interviews.

[9] Ibid.

[10] IAI interview, 20 November 2024.

[11] Eurofighter Typhoon website: *The Programme*, https://www.eurofighter.com/the-programme#consortium.

[12] IAI interview, 20 November 2024.

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organised in a more traditional way.

6.2 An equal industrial partnership

Italy has decided to participate in GCAP only on an equal basis: this is quite significant considering that Rome has never been an equal industrial partner in similar types of cooperation in the air combat sector in the past.[13] In concrete terms, being an even partner would mean Italy has a 33.3 per cent share of the programme, with 33.3 per cent for Japan and another 33.3 per cent for the UK. Italy's Minister of Defence, Guido Crosetto, has shown strong political will to realise an equal partnership, and the intent is to maintain equality throughout the whole programme, from the research and technology to the development and procurement phases.[14] If Italy wants to deliver on such an ambitious goal, continuity, full commitment and unity of vision are necessary at institutional, political and industrial levels. Robust funding from the Italian MoD will be necessary too, in order to match words with deeds.

Table 1 | Industrial partnership: A comparison of workshare (%) between Tornado, Eurofighter and GCAP

	Tornado*	Eurofighter**	GCAP
Germany	42,5	33	/
Italy	15	21	33.3
Japan	/	/	33.3
Spain	/	13	/
UK	42,5	33	33.3

Sources: (*) Roberto Manzo, "Panavia Tornado: il caccia multiruolo da combattimento italiano", in *Geopop*, 9 May 2023, https://www.geopop.it/?p=57235; (**) Eurofighter Typhoon website.

6.3 GCAP industrial landscape: Roles and expertise

The industrial landscape behind the GCAP project is very diverse. Against this backdrop, the three LSI have established ad hoc teams dedicated to the GCAP, sharing responsibility for coordinating the development of the core platform. In this context, a strong approach to sharing and co-producing information, to support the Freedom of Modification principle, will be settled.[15] The programme builds on the investment already made in the UK by BAE Systems, Leonardo UK, MBDA UK, Rolls-Royce and the UK Ministry of Defence through the Team Tempest partnership. As of October 2024, the Tempest programme employs 3,500 people in the UK and involves around 600 suppliers, including SMEs and academic

[13] IAI interview, 2 September 2024.

[14] Peter Felstead, "Italy Says It Will Assume Equal Role in the GCAP Programme", in *European Security & Defence*, 29 September 2023, https://euro-sd.com/?p=34293.

[15] IAI interview, 19 September 2024.

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institutions. Since its launch, more than 1,000 apprentices and graduates have started careers within the programme and its supply chain.[16]

Leonardo Italy instead directly involves in the programme more than 750 people distributed in the Aircraft, Electronics, Cyber & Security Solutions, and Aerostructures business units.[17] In 2024, Leonardo Aircraft Division alone hired more than 500 people specifically for GCAP, growing from 6,300 employees to over 6,800,[18] and this trend is set to continue in the next years.

Mitsubishi Heavy Industries leverages its expertise in aerospace manufacturing and systems integration, including in the national F-X project in advanced electronics and weapon systems, and plays a pivotal role in driving the engineering and manufacturing aspects of GCAP, contributing to aerospace technology and systems integration.

Lead Sub-Systems Integrators (LSSIs) encompass Avio Aero (Italy),[19] ELT Group (Italy), IHI (Japan), Leonardo Electronics UK, Leonardo Electronics Italy, MBDA Italy, MBDA UK, Mitsubishi Electric (Japan) and Rolls-Royce (UK). Rolls-Royce, IHI and Avio Aero are collaborating on the engine, particularly on the design of advanced power and propulsion systems and energy generation systems, including a joint effort on an engine demonstrator.[20] The GCAP's "propulsion team"[21] wants to deliver superior fuel efficiency, endurance and power generation, management and distribution. The engine demonstrator aims at achieving higher turbine operational temperatures.

Leonardo Electronics, Mitsubishi Electric and ELT Group are focusing on the Integrated Sensing and Non-Kinetic Effects (ISANKE) & Integrated Communications Systems (ICS). These capabilities are responsible for the advanced onboard electronics that provide crews with mission-critical information and advanced self-protection capabilities,[22] by delivering comprehensive situational awareness

[16] Bae Systems, *UK Industry to Play Key Role in New Global Combat Air Programme, Delivering Next Phase of Combat Air Fighter Jet Development*, 9 December 2022, https://www.baesystems.com/en/article/uk-japan-italy-global-combat-air-programme-delivering-next-phase-of-combat-air-fighter-jet-development.

[17] Leonardo website: *Global Combat Air Programme (GCAP)*, https://www.leonardo.com/en/business/gcap.

[18] IAI interview, 21 November 2024.

[19] Avio Aero is a General Electric Aerospace company: https://avioaero.com/en/our-company/who-we-are.

[20] Bae Systems website: *GCAP brochure*, https://www.baesystems.com/en/product/global-combat-air-programme.

[21] Tom Kington, "UK, Italy, Japan Companies Eye Novel Sensor Mix for GCAP Warplane", in *Defense News*, 11 September 2023, https://www.defensenews.com/global/europe/2023/09/11/uk-italy-japan-companies-eye-novel-sensor-mix-for-gcap-warplane.

[22] Leonardo, *Global Combat Air Programme (GCAP): Advanced Electronics Partners Zero in on Joint Project Delivery Set-Up*, 12 September 2023, https://www.leonardo.com/en/press-release-detail/-/detail/global-combat-air-programme-gcap-advanced-electronics-partners-zero-in-on-joint-

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and maximising aircraft survivability.[23]

Leonardo UK's effort consists of integrating advanced sensing, data fusion and communication systems essential for the aircraft's mission effectiveness. The company contributes significantly to advancing sensor technologies. Leonardo UK has collaborated with Mitsubishi Electric on the JAGUAR radar technology since 2018, which could facilitate work within the GCAP framework. ELT Group is focusing on fully integrated sensing and non-kinetic effects systems and advanced communication technologies. It is also deeply involved in developing radar and sensor technologies, contributing to ensuring these systems are ready for integration into the GCAP platform.

MBDA UK, MBDA Italy and Mitsubishi Electric are responsible for weapon systems (effectors) and for their integration on the platform.[24] The three industries aim to harmonise the effector integration strategies across the GCAP nations, but the national room of manoeuvre with regard to weapon systems is still to be defined. Notably, MBDA is a pan-European company which traditionally provides weapons for different platforms. Mitsubishi Electric has gained experience in previous international defence collaborations, including its role in the multi-role, single-engine fighter aircraft F-2 programme, jointly developed by Japan and the US for the Japan Air Self-Defence Force (JASDF).

GCAP will also work with various suppliers, including high-tech SMEs beyond the defence sector, to speed up technological advancement and bring in specialised expertise.[25] The programme's investments are expected to drive economic benefits across multiple sectors, involving over 1,000 suppliers in partner countries.[26] At the time of writing, however, it is too early to give a clear idea of the SMEs and start-ups involved in the GCAP project. Several innovative calls are still underway in the three countries. In Italy, the MoD has launched the GCAP Acceleration Initiative.[27] The intentions outlined in various press releases suggest that the GCAP ecosystem will encompass organisations of all sizes, with LSIs expected to play a supportive role for smaller companies, but also research centres and Academia, and the whole supply chain.[28] Timely coordination and effective work structure will be key, as smaller entities, despite possessing technological expertise, may

project-delivery-set-up.

[23] Bae Systems website: *GCAP brochure*, cit.

[24] "MBDA e Mitsubishi Electric: accordo di collaborazione per il GCAP", in *Portale Difesa*, 13 September 2023, https://www.rid.it/shownews/5990/mbda-e-mitsubishi-electric-accordo-di-collaborazione-per-il-gcap.

[25] Last but not least, the academic world and research centres will also be actively involved in the GCAP project; Leonardo Italy itself, for example, has planned to set up 100 doctoral programmes with leading Italian universities contributing to the programme.

[26] Bae Systems website: *Global Combat Air Programme*, https://www.baesystems.com/en/product/global-combat-air-programme.

[27] Foresight Acceleration Platform website: https://www.foresightap.it.

[28] Formiche Conference, 24 October 2024.

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lack the resources, personnel and adequate security infrastructures necessary to contribute effectively to a project of this scale. In particular, compliance with higher security standards compared to previous programmes will be a challenge for a large part of the supply chain, which lacks the necessary security clearances and infrastructure to work at higher secret level, and may consider the required investments not worthy of shouldering without adequate financial incentives. On the other hand, SMEs agility and reactivity should complement the reliability and accountability of LSI and LSSI.[29]

Figure 2 | GCAP industrial partners

[29] IAI interview, 19 September 2024.

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6.4 Challenges and opportunities of a transformative programme

In Italy, GCAP is widely regarded as a growth and innovation opportunity for the whole of the country (*sistema-Paese*) and its military, industrial and technological complex (see Chapter 9). The programme is believed to be transformative for a large part of the Italian DTIB, to have transversal, cross-sector spillover effects benefiting non-defence sectors and technologies, and to accelerate innovation. Some observers even argue that the innovative processes, organisational and cultural change that GCAP will set in motion are as important as the platform itself in terms of wide-ranging innovation.[30] As a flagship, long-term programme that will extensively involve Italy and its DTIB for at least the next three decades, the idea is to involve as much national know-how as possible, from prime contractors to universities, research institutes and SMEs.[31] GCAP presents itself with an opportunity to map national capabilities in relevant technology sectors, create connections and synergies which may spill-over in other programmes and build up the competitiveness of a large part of Italian DTIB.[32]

Indeed, GCAP entails and requires deep changes within the industrial sector in terms of building a new cooperative culture with Japan, investing in the necessary infrastructures (e.g. for access to classified information), adapting the internal organisation of work, as well as legal, procedural and security approaches, including on issues such as certifications or export control agreements. For some stakeholders, the size of change and adaptation required by GCAP is a sort of technological, organisational and cultural revolution that the defence ecosystem – including public and private sectors – has to go through.

For instance, the internal adaptation of Leonardo as LSI envisages an internal transfer of human capital from other departments and projects to work on GCAP, which likely means cuts to secondary activities to prioritise resources for GCAP. Moreover, the integration of a vast amount of new personnel for GCAP necessitates further personnel able to form, train and integrate new employees. For about 500 new employees in the Aircraft Division, Leonardo needs to task 150 personnel already in place for the training of the newcomers.[33] The systemic gap in the number of STEM (science, technology, engineering and mathematics) graduates to be employed for engineering and project management tasks, risk to be a recurrent problem in the next years (see Chapter 9). For Leonardo's GCAP activities, the key hub will be at the Torino Caselle site – the plant where the Eurofighter assembly line is located. Other sites significantly involved include those in Rome, Pomezia, Florence and Nerviano.[34]

[30] IAI interview, 21 November 2024.
[31] IAI interview, 2 September 2024.
[32] Ibid.
[33] IAI interview, 21 November 2024.
[34] Paolo Valpolini, "GCAP Moves on, the Italian View", in *European Defence Review*, 17 December 2024, https://www.edrmagazine.eu/?p=41104.

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Furthermore, while the strict time schedule is crystal clear to LSIs and LSSIs directly involved with the three MoD planning and requirements, the same does not apply to the supply chain that will need to support the GCAP effort. The acceleration by the main industrial players will have to come alongside an acceleration throughout the entire GCAP supply chain in order to avoid delays. Smooth coordination and communication along the supply chain, timely allocation of financial resources, including avoiding delays in payments and adapting infrastructures and facilities, will all be key. The extremely ambitious timeline of the programme that envisions the first aircraft flying in 2035, and the size and continuity of the national investment to be made throughout the next decade, are the most significant challenges for GCAP also from an industrial perspective and for the supply chain.

Finally, as mentioned before, security becomes a true prerequisite of the programme, with its own challenges. The GCAP will feature extremely high security requirements, necessitating significant investments from the companies involved to secure products, information, communications and the complex supply chain. The need to manage highly classified information will have to translate into an effective and still dynamic structure of work, including a virtual but secure working environment, despite the security level connected with the programme will likely slow down the overall process. In parallel, the risk of industrial espionage and foreign interference, considering the vast number of actors that need to be involved in such a programme, is an additional risk to be managed and mitigated by fully implementing the security by design principle across the whole supply chain. The recruitment of a high number of adequate personnel across the supply chain coped with the unprecedented level of security classification of the programme required to strike a difficult balance between workability and security. In this sense, an adaptation of the current security vetting procedures cannot be ruled out.

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7. The leap to next-generation aircraft: A katana tale

by Elio Calcagno and Alessandro Marrone

As GCAP takes shape, the US are working on two separate next-generation air combat programmes, while France, Germany and Spain have joined forces on the Future Combat Air System (FCAS). Although these initiatives currently sit at different stages of development, analysing them helps put GCAP in the right global context and to understand the challenges of the leap to next-generation air combat platforms.

7.1 The US Next-Generation Air Dominance (NGAD)

The development of sixth-generation combat air programmes in the US has been characterised by an unusual amount of uncertainty over a period of several years since the announcements of the Air Force's NGAD and the Navy's F/A-XX. Much of the ambiguity must be attributed to the level of classification of each programme, which is unprecedented among mainstream aircraft programmes since the late stages of the Cold War.[1] At the same time, the US armed forces are emerging from an era of flagship procurement programmes frequently characterised by extensive media coverage over rising costs, delays, order cuts or in some cases outright failures. Perhaps partially as a result of this, the Senate's Appropriations Committee has voiced some concerns over some aspects of NGAD in particular, including estimated procurement costs and transparency issues.[2] In addition, recent developments in uncrewed aerial technologies and Chinese advancements in air defence technology have led to some, including in the US Air Force, casting doubt over the very need for an NGAD-like system.[3] After putting the programme on hold in July 2024,[4] in December of the same year, the Biden Administration concluded a review of NGAD, which had originally been launched to ensure the initiative was still an adequate counter to changing threats and technology.[5]

In 2024, the Air Force's Vice Chief of Staff eloquently described the dilemma the service was facing: "You get two different answers if you frame the question as, 'How do we achieve air superiority' [versus] 'How do we build a 6th-gen manned

[1] Bill Sweetman, "NGAD - A Generational Divide?", in *Aerospace Insight blog*, 12 December 2023, https://www.aerosociety.com/news/ngad-a-generational-divide.

[2] Jennifer DiMascio, "U.S. Air Force Next-Generation Air Dominance (NGAD) Fighter", in *CRS In Focus*, 17 January 2025, https://crsreports.congress.gov/product/details?prodcode=IF12805.

[3] Brandon J. Weichert, "NGAD: The 6th Generation Fighter America Doesn't Need", in *The Buzz*, 28 June 2024, https://www.airandspaceforces.com/kendall-new-chinese-aircraft-reveal-usaf-plans; John A. Tirpak, "Kendall: Reveal of New Chinese Aircraft 'Hasn't Really Changed' USAF Plans", in *Air & Space Forces Magazine*, 7 January 2025, https://www.airandspaceforces.com/?p=238435.

[4] Michael Marrow, "Air Force 'Taking a Pause' on NGAD Next-gen Fighter: Kendall", in *Breaking Defense*, 30 July 2024, https://breakingdefense.com/?p=364308.

[5] John A. Tirpak, "Kendall: Reveal of New Chinese Aircraft 'Hasn't Really Changed' USAF Plans", cit.

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fighter platform?'".[6] Indeed, the main goal of the review was to determine whether a crewed fighter was still necessary, or alternatively distributing capabilities across a spectrum of uncrewed systems would be more cost-effective and useful in the current threat scenario. While the review was ultimately in favour of developing a crewed next-generation combat aircraft, then-Air Force Secretary Frank Kendall continued to raise questions over the affordability of the programme (with costs estimated at 300 million US dollars per airframe) when inevitably weighed up against other impending priorities.[7]

Table 2 | NGAD programme funding request (in million US dollars) – not yet approved

	FY2025	FY2026	FY2027	FY2028	FY2029
NGAD Platform	2,749.2	3,189.3	3,741.9	4,201.4	5,723.1
CCA	557.2	494.9	1,654.6	3,046.3	3,106.3
Total	3,306.4	3,684.2	5,396.5	7,247.7	8,829.4

Source: Jennifer DiMascio, "U.S. Air Force Collaborative Combat Aircraft (CCA)", in *CRS In Focus*, 22 January 2025, https://crsreports.congress.gov/product/details?prodcode=IF12740.

The funding request for FY 2025 was 2.74 billion US dollars for the NGAD platform and 557 million for the CCA, and has still not been approved by Congress and it could yet be subjected to modification requests or rejected outright. In practice, the Biden Administration ultimately left the final say on NGAD to its successor, who is still to take a definitive decision as of the time of publication, despite the Air Force awarding new contracts to GE Aerospace and Pratt & Whitney as part of the Next-Generation Adaptive Propulsion (NGAP) programme for a next-generation fighter engine, which is tied to NGAD.[8] The updated Air Force contracts' funding for the two competing engine development project tops 7 billion. Questions remain, however, on how work on developing the two prototypes could be affected by evolving requirements for the NGAD platform, including in terms of size/weight or whether it will a single- or twin-engine aircraft.[9]

NGAD is still thought of first and foremost as a replacement for the F-22 Raptors, although it transcends the simple platform, encompassing instead the entire system of systems (SoS) that will include crewed aircraft and uncrewed CCAs with a variety of purposes.[10] As a result, funding for CCAs, as well as development

[6] Stephen Losey, "Air Force's NGAD Revamp Could Open Up More Business to Smaller Firms", in *Defense News*, 5 September 2024, https://www.defensenews.com/air/2024/09/05/air-forces-ngad-revamp-could-open-up-more-business-to-smaller-firms.

[7] John A. Tirpak, "Kendall: Reveal of New Chinese Aircraft 'Hasn't Really Changed' USAF Plans", cit.

[8] Michael Marrow, "Air Force Moves Forward with Next-gen Engine Work, Raises GE, Pratt Contracts to $3.5 billion each", in *Breaking Defense*, 28 January 2025, https://breakingdefense.com/?p=380026.

[9] John A. Tirpak, "Faced with New and Growing Demands, Military Propulsion Needs More Support: Experts", in *Air & Space Forces Magazine*, 25 September 2024, https://www.airandspaceforces.com/?p=233293.

[10] For more on UCAS and US planning in this regard, see: Elio Calcagno and Alessandro Marrone

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efforts, are occurring in parallel with the core platform. Review notwithstanding, details are scarce as to where exactly the programme currently stands in practice, though at least an undisclosed demonstrator was already flown as early as 2020,[11] with Northrop Grumman, Boeing and Lockheed Martin all reportedly having developed demonstrators as of 2023 after Northrop Grumman withdrew from the competition.[12]

The US is unique among NATO countries in that it is carrying out two separate sixth-generation programmes simultaneously. The Navy's F/A-XX is conceived as a replacement for the F/A-18E/D and the EA-18G carrier-borne aircraft, though the service has been even more secretive than the Air Force in recent years.[13] Affordability of the new platform appears to be a key requirement, while the Navy is pursuing a separate path also when it comes to engine, preferring a derivative of existing solutions rather than the new concepts that the Air Force is funding for NGAD.[14] The Navy's requirements are obviously shaped by the constraints imposed by carrier operations, yet the two programmes are also looking at different roles for the respective systems: while NGAD is more focused on air superiority, while the F/A-XX will have a multirole character in order to carry out long-range air-to-surface and fleet defence air-to-air missions.[15] Like NGAD, however, the Navy's programme is set to include uncrewed CCAs, although any development in this regard (and in relation to the core platform itself) may be strictly tied to the Navy's future doctrines and CONOPS involving its carrier strike groups.

When looking at the two programmes, the timelines are rather mismatched. Throughout 2024 the Navy appeared to be proceeding steadily even if 1 billion had been withdrawn from its funding request for 2025 in order to meet more urgent needs.[16] Indeed, until recently the Navy still aimed at an entry into service in the 2030s, though it is unclear how the dismissal of Chief of Naval Operations Adm. Lisa Franchetti and her replacement will affect the programme. Three companies are rumoured to be competing for the contract: Boeing, Lockheed Martin and Northrop Grumman, with a winner originally expected to be announced in 2025.[17]

Meanwhile, NGAD's timeline not only depends on how long the ongoing "pause" under the Trump administration lasts, but also on whether radical changes will be made the requirements. Should such changes be deemed necessary, the delays

(eds), "Above and Beyond", cit.

11 Jennifer DiMascio, "U.S. Air Force Next-Generation Air Dominance (NGAD) Fighter", cit.

12 Ibid.

13 Stefano D'Urso, "U.S. Navy to Develop F/A-XX Next-Generation Fighter Independently of Air Force NGAD", in *The Aviationist*, 16 November 2024, https://theaviationist.com/?p=92790.

14 Ibid.

15 Ibid.

16 Chris Gordon, "Navy Will Pick a 6th-gen Fighter as Air Force Pauses NGAD", in *Air & Space Forces Magazine*, 2 October 2024, https://www.airandspaceforces.com/?p=233772.

17 Stefano D'Urso, "U.S. Navy to Develop F/A-XX Next-Generation Fighter Independently of Air Force NGAD", cit.

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could last several years, during which the Air Force's tip of the spear will consist mostly of a shrinking number of updated F-22s and the latest F-35s production lots, possibly complemented by a growing number of CCAs. In fact, in this scenario CCA development and acquisitions may become even more crucial and further procurement of F-15s may be evaluated in order to achieve the required levels of mass.

7.2 The Franco-German-Spanish Future Combat Air System (FCAS)

Back in 2017 President Emmanuel Macron and Chancellor Angela Merkel launched a bilateral cooperation effort for a sixth-generation air combat system known as FCAS. It was part of a broader, shared political vision of a renewed Franco-German cooperation intended to become the heart of European defence,[18] involving also other major programmes, such as the Main Ground Combat System. Cooperation between the two camps has been far from smooth, however, and seven years later, the Head of French MoD Direction Générale de l'Armement (DGA) Emmanuel Chiva declared at the National Assembly that "Today, FCAS is an object that has yet to be defined".[19]

The Franco-German bilateral cooperation became trilateral when it opened to Madrid, with Spain formally joining FCAS in 2019.[20] Madrid selected Indra as its national industrial leader (rather than Airbus Spain) and made an unprecedented effort to acquire a role as an equal partner with respect to Paris and Berlin. Interestingly, the three countries tasked the French DGA to act as a procurement agency for the whole programme. The choice not to establish an ad hoc project management agency – differently from GCAP – nor to use OCCAR or other multilateral bodies, underlines how sensitive and critical this endeavour is perceived to be in Paris. On the industrial side, the FCAS consortium includes Airbus – mainly the German leg of the European company – Dassault Aviation and Indra, as well as Thales and the European Military Engine Team (EUMET) joint venture made up by MTU and Safran to work on the FCAS engine with the support of Spanish ITP Aero. When compared to GCAP, another major point of difference is that no joint venture has been established among the main companies involved in the programme.

Notably, the Spanish government took the strategic decision to negotiate hard to obtain an equal role in FCAS. Yet it will not be easy for Madrid to sustain this ambition during all the programme's phases: the required financial effort could be a significant challenge for Spain, as well as the necessary mobilisation of national technological and industrial competences in order to keep up with its partners.

[18] See in this regards Jean-Pierre Maulny and Christian Mölling chapters in the IAI study: Alessandro Marrone and Michele Nones (eds), "Europe and the Future Combat Air System", cit.

[19] Rudy Ruitenberg, "France, Germany to hammer Out Next Steps for Delay-Prone FCAS Warplane", cit.

[20] Michel Rose, "Spain Joins France and Germany in Race to Build Europe's Next Combat Jet", in *Reuters*, 17 June 2019, https://www.reuters.com/article/idUSKCN1TI0Z6.

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FCAS is set to encompass a core, piloted crewed combat aircraft, also referred to as Next-Generation Weapon System (NGWS), a range of armed drones labelled as remote carriers and a combat cloud as a framework to bring together all these platforms in a system-of-systems.[21] France sees the remote carriers as important to generate combat mass, in particular to: (i) serve as decoys to protect the core platform from ground-based air defences and jammers; (ii) act as flying weapon bay in order to reduce the fighter's load and therefore size/weight or eliminate the need for it to carry external weapons; and (iii) to operate as distributed sensors detached from the fighter.[22] While more detail on the requirements has not yet been disclosed, it seems clear that the main rationale for the French Air and Space Force has three main elements: FCAS must be the air component of the national nuclear deterrence triad; it has to be a successor of the Raphale 5F in terms of air superiority and attack capabilities and it should be able to operate from the Marine Nationale's new aircraft carrier.[23] Meanwhile, few details have transpired from the German and Spanish sides regarding requirements, except the obvious need for both Berlin and Madrid to replace Eurofighter in the future.

A significant question mark remains on whether all partners share a common view on future exports, as the French MoD has made clear that FCAS should have an export potential – traditionally a sensitive issue for Germany. Indeed, since the Cold War, France has been a major exporter of combat aircraft, which has helped its industry to develop independently of cooperative programmes and maintain a much larger degree of autonomy than any other European country. Meanwhile, while Spain and Germany are focused on acquiring new batches of Eurofighter,[24] and Germany is also acquiring the F-35 France has kicked off the development of the Raphale fighter's F5 standard, which should include a purely national collaborative combat aircraft as well as the ability to carry the future hypersonic nuclear missile SNA4G.[25]

On the industrial side, the workshare is organised in the current phase in different pillars, also in order to maintain a certain balance among the three participating countries, which can be summarised as follows:

- Dassault: development of the Fighter Demonstrator
- EUMET: engine work
- Airbus in Germany: remote carrier, crewed-uncrewed teaming and combat cloud

[21] Airbus website: *Future Combat Air System (FCAS)*, https://www.airbus.com/en/products-services/defence/future-combat-air-system-fcas.

[22] Robert Wall and Tony Osborne, "Europe's Future Combat Aircraft Advances toward Demonstrator Flights", in *Aviation Week Network*, 10 July 2024, https://aviationweek.com/shownews/gascc-riat/europes-future-combat-aircraft-advances-toward-demonstrator-flights.

[23] Rudy Ruitenberg, "France, Germany to hammer Out Next Steps for Delay-Prone FCAS Warplane", cit.

[24] See in this regards chapter 7 of this study.

[25] Rudy Ruitenberg, "France Kicks Off Development of Wingman Drone for Rafale Fighter Jet", in *Defense News*, 9 October 2024, https://www.defensenews.com/global/europe/2024/10/09/france-kicks-off-development-of-wingman-drone-for-rafale-fighter-jet.

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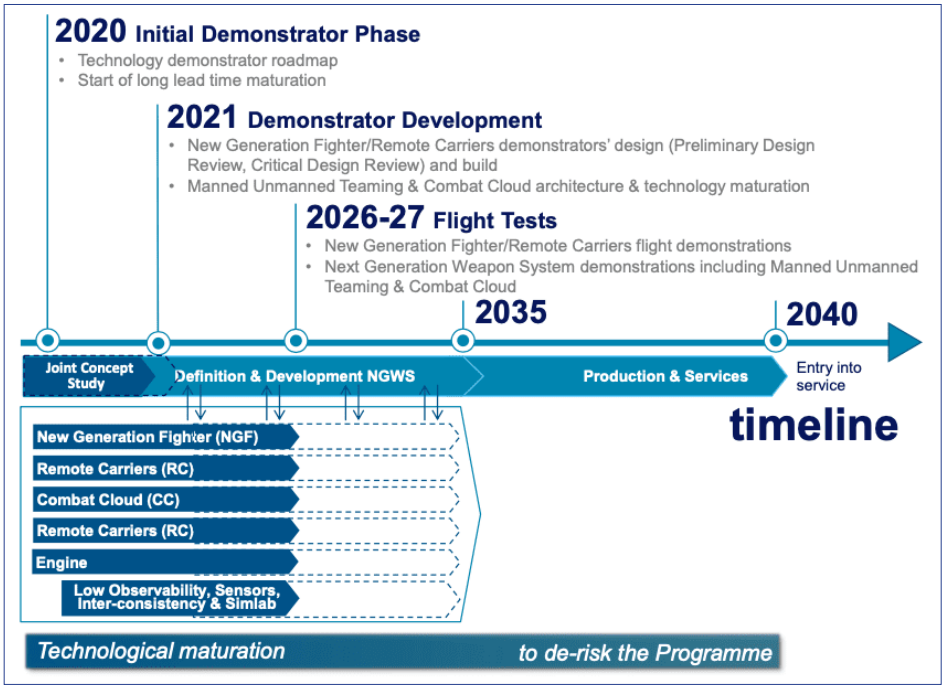
- Dassault: simulation laboratory work
- Indra: sensors
- Airbus in Spain: low-observable technologies[26]

Figure 3 | GCAP timeline



Source: FCAS and NGWS timeline displayed by Airbus during its 2020 Trade Media Briefing.

In December 2022, Phase 1B was launched with a contract of 3.85 billion euros awarded by DGA to the FCAS consortium, to fund activities until 2026. This first investment aims to define and develop FCAS-related technologies to be tested in the demonstrator. The DGA expects Phase 2 and a second contract to follow in early 2026, to fund the development of a demonstrator with around 4.5 billion euros. Reportedly, many of the high-level ground and flight tests will not start before the launch of Phase 2. In particular, the sensor package is likely to be tested onboard a DGA-owned Fokker 100 around 2028, while the true demonstrator is planned to fly in 2029, powered by Safran M88 engines already used on the Raphale.[27] Flight demonstration will involve the remote carrier too, as they are considered to be a key component of the programme. At the time of writing, however, the picture regarding remote carriers remains unclear, with France already developing its own national adjunct to team up with the Raphale, and Spain and Germany possibly having similar national ambitions. Against this backdrop, it is possible that the FCAS core platform will have to operate with a variety of national adjuncts.

[26] Robert Wall and Tony Osborne, "Europe's Future Combat Aircraft Advances toward Demonstrator Flights", cit.
[27] Ibid.

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Ultimately, FCAS' entry into service is expected around 2040, five years after the deadline set by GCAP countries for their core platform.[28]

These plans and schedule have to be taken with caution, in light of previous delays and hurdles experienced by the programme thus far. Some friction is unsurprising, considering that France and Germany, including their air forces and industries, have no relevant experience working on joint combat aircraft procurement programmes. From the Panavia Tornado to Eurofighter, Germany has worked mainly with the UK and Italy, whereas France has had no experience seeing a cooperative fighter programme through since the Jaguar. In practice, this has already translated into significant tensions over work-share arrangements, with Airbus and Dassault Aviation struggling to find agreement regarding the core platform elements.[29] In 2023, rumours emerged on the possibility that Germany had reconsidered its participation in FCAS to join GCAP instead, which was then denied by Berlin.[30] German long-delayed decision to acquire 35 F-35 to renew its tactical nuclear strike-capable Tornado fleet had angered some French stakeholders, and led many observers to speculate that operating the F-35 would eventually re-orient German requirements toward Italy and the UK, who operate sizeable F-35 fleets. There is little doubt that this acquisition will drive the Luftwaffe's posture, doctrine, tactics, techniques and procedures – as well as training and logistics – away from French ones, and closer to British and Italian air forces, who also operate the Eurofighter and F-35. One of the latest quarrels regards the involvement of Belgium as programme observer, with a view to its inclusion as a partner in 2025, which has been criticised by Dassault's CEO on the grounds that he saw "[no point] in putting more F-35 countries into the programme".[31]

7.3 A katana tale

The US uncertainties on the NGAD and the FCAS' difficulties to take off hint toward a more general reflection that inevitably concerns GCAP too. The F-35 and its capabilities represented a generational leap with respect to fourth-generation fighter aircraft in many ways, including low observability and net-centric data fusion. The F-35 therefore sparked profound changes in the air forces keen to exploit the opportunities of this new, and in many ways revolutionary, platform. This obviously happened *in primis* in the US, but also in Italy which is the second major buyer of F-35A, has decades-long operational experience and has been the first European country to deploy F-35 in a NATO operation, as well as in UK and

[28] Robert Wall and Tony Osborne, "Europe's Future Combat Aircraft Advances toward Demonstrator Flights", cit.

[29] Clément Charpentreau "Will Germany Leave the FCAS Program to Join the British GCAP Tempest?", in *AeroTime*, 2 November 2023, https://www.aerotime.aero/?p=84490.

[30] Sebastian Sprenger, "Germany Clinches $8 Billion Purchase of 35 F-35 Aircraft from the US", in *Defense News*, 14 December 2022, https://www.defensenews.com/global/europe/2022/12/14/germany-clinches-8-billion-purchase-of-35-f-35-aircraft-from-the-us.

[31] Joe Saballa, "Belgium to Join European FCAS Next-Gen Fighter Program", in *The Defense Post*, 28 November 2023, https://thedefensepost.com/?p=67235.

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Japan. In triggering such changes, the F-35 had the advantage of a rather clear rationale, which can be summarised as follows: equipping US – Air Force, Navy and Marines – as well as NATO allies and partners with a multi-role combat aircraft fit for the post-Cold War era heavily influenced by ICT.

Metaphorically, like the Japanese katana, an F-35 can be used in different ways and for different purposes, including defensive and offensive ones, going beyond the traditional Western dualism between spear and shield, armor and cannon. The same will apply to next-generation of air combat systems, and even more considering that crewed aircraft will exploit a family of adjuncts and effectors in a SoS framework. But the ability to fully and proficiently use a katana for its multiple purposes depends mainly on its mastery by the warrior. Indeed, those air forces and navies that have right now more than a decade of experience deploying, operating, maintaining, as well as exercising and training with the F-35 will have a unique, structural advantage as they think about what their future katana should be able to do. Furthermore, these forces will be better placed to guide their industries toward developing these systems accordingly, at least when compared with those that lack relevant fifth-generation experience. This is a major difference between GCAP and FCAS even if Germany will start acquiring F-35 in the next years, because it will take time to get up to speed with those services dealing with this platform since the 2000s. Moreover, the GCAP industries' involvement in F-35 procurement, albeit with a rather limited role, enables them to grasp some key elements of fifth-generation aircraft and have more solid foundations from which to work on the next generation. Despite so much of all sixth-generation programmes' developments being highly classified, it appears clear that, as for other generational jumps in the aeronautic sector, it is less difficult to move from fifth to sixth-generation systems than from fourth to sixth. Obviously, this does not mean that such a leap will be easy for Italy, Japan and the UK, but at the very least they may be better positioned than most to start the journey towards their new katana.

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8. Common training: Best praxes from the past, guidelines for the future

by Elio Calcagno

8.1 The training pipeline

Pilot and support personnel training is a crucial enabler for any air force and a key aspect of any aircraft procurement programme. Air forces must be able to plan and carry out pilot training at a rate commensurate to operational requirements while ensuring that pilots achieve the desired quality and proficiency with the platform they are assigned to. The training process, known as the 'training pipeline', must be carefully managed in all its phases in order to adequately feed an air force.[1] It can be argued that such a pipeline is constituted at its core of five pillars: academies, flight schools, trainer aircraft, instructors and ground-based training systems (GBTS), including simulators. A nation lacking any one of these elements must by definition rely on allies or partners to fulfil all training requirements. These pillars all interact as they contribute to a fast-jet pilot's training, which NATO generally splits into four phases: Phase I: Basic pilot training; Phase II: Primary pilot training; Phase III: Specialised pilot training; Phase IV: Lead-in to fighter training (LIFT).[2]

Starting from Phase II, the training activities become more complex and increasingly expensive. Phase IV in particular requires advanced jet trainers and simulator systems in order to better prepare pilots for their transition into an Operational Conversion Unit (OCU) back in their respective air forces, where they are trained to operate specific combat aircraft.[3] In practice, Phase IV aims to download training activities from operational aircraft, which are few and very expensive to operate. This is an even more crucial requirement when the operational aircraft in question is only produced in single-seat versions as is the case with the F-35 or F-22.

While it is too early to speculate in detail as to what the training pipeline for GCAP pilots might look like, an overview of trends pertaining to fast-jet pilot training in NATO countries may be a useful starting point for future considerations. The advent of next-generation systems like GCAP will require substantial revisions in the training praxes, especially in Phase III and IV of the pipeline, given the former's focus on basic fighter tactics and manoeuvres and the latter's on more advanced tactical flying. The state of the art in fast-jet combat aircraft is set to move towards systems of systems involving also adjuncts. Therefore, tactics, and consequently training, are going to evolve considerably in view of these changes. The very concept of GCAP as first and foremost a core platform at the centre of a

[1] Trevor Nash, "Fast Track to Fast Jet?", in *European Security & Defence*, 23 July 2024, https://euro-sd.com/?p=39449.

[2] Ibid.

[3] "How Does the Italian Air Force Train Its Pilots?", in *KeyAero*, 11 May 2023, https://www.key.aero/node/176969.

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wider system of systems highlights the need for an evolution in how training is conceived and carried out at the later stages of the pipeline.

In countries like Italy, the UK and Japan, which all operate a fifth-generation platform, the training pipeline has already started adapting to account for very low observability (VLO) characteristics and the unique tactics the F-35 requires.[4] The concerted operation of adjuncts side-by-side with crewed assets is in all likelihood going to precede the entry into service of GCAP and begin with fourth and fifth-generation aircraft like Eurofighters and F-35. Therefore, the challenge of integrating this revolutionary development in air combat will occupy, and dictate the evolution of, training schools in the very near future.

8.2 Trainer aircraft

While much less complex than modern fighter aircraft, the jet trainers needed for adequately preparing pilots to enter in their OCU are a crucial piece of equipment. They must possess avionics and flight characteristics close enough to those present in combat aircraft, so as to make training as realistic as possible, while at the same time maintaining much lower acquisition, operation and maintenance costs. A successful fast-jet trainer must also have high availability rates so as to ensure that training pilots meet flying hour targets. The entry into service of more advanced platforms like the F-35 or later tranches of fourth-generation aircraft also requires that trainers replicate new ways to manage and display information in the cockpit and duly replicate the pilot workload.[5] In this regard, the role of trainers is made all the more central in the pipeline by the ever-increasing operating costs of high-end platforms like the F-35. Faced with the greater financial burden of operating VLO combat aircraft and the likely lack of training-capable twin seaters in future programmes, air forces are compelled to transfer as much of the pilot's advanced training as possible to the training phases before OCU in order to cut costs.[6]

On the surface, the development of an advanced two-seater jet trainer may seem a rather trivial endeavour for advanced DTIBs that already develop high-end combat aircraft, but reality suggests otherwise. The US Air Force's Boeing-Saab T-7A Red Hawk trainer has experienced significant problems, cost overruns and delays,[7] while the US Navy is struggling to quickly settle on the requirements for a replacement of the ageing T-45.[8]

[4] "F-35 Stealth Tactics Focus for Italy's Biggest Air Exercise of 2022", in *KeyAero*, 22 January 2023, https://www.key.aero/node/175182.

[5] David Cenciotti and Stefano D'Urso, "The M-346N Is the Only 'Low Risk, No Drama' Solution for the U.S. Navy, Textron and Leonardo Say", in *The Aviationist*, 4 June 2024, https://theaviationist.com/?p=86600.

[6] Ibid.

[7] Stephen Losey, "Boeing Pushes Back T-7 Plans Due to Faulty Parts", in *Defense News*, 5 February 2024, https://www.defensenews.com/air/2024/02/05/boeing-pushes-back-t-7-plans-due-to-faulty-parts.

[8] Stefano D'Urso, "U.S. Navy Releases New T-45 Replacement's Request for Information, Pushing

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The UK provides the most severe example of how a training pipeline can be negatively affected by trainer aircraft availability problems. Serious reliability issues have meant that the RAF's Hawk T2 fleet has suffered from a very low availability rate, sometimes descending under 50 per cent, causing significant delays in UK pilot training.[9] While the Hawk T2 was officially set to retire in 2040, the RAF's chief, Air Chief Marshal Sir Rich Knighton, has argued for its early retirement while some British pilots have already had to rely on allies' flight school programmes in Italy and the US.[10] The importance of training pilots domestically along foreign pilots was highlighted in November 2024 by Knighton, who cited it as an "integral part" of why the UK must quickly find a replacement to the Hawk T2.[11]

International pilot training

The Italian Air Force's current training pipeline situation stands in stark context to the UK's – in no small part thanks to the timely acquisition of a high number of M-346 advanced jet trainers made by Leonardo. In the framework of a partnership between AM and Leonardo, the International Flight Training School (IFTS) in Decimomannu, Sardinia, was created in 2018.[12] The IFTS, now counting over 40 military and civilian instructors,[13] has been so successful that it has become a hub for NATO and partner countries wishing to outsource their Phase II-to-IV training. Phase IV training, in particular, has pushed many nations to send their pilots to Decimomannu, including Canada, Germany, Austria, Saudi Arabia, Qatar and Singapore, as well as – with particular relevance to GCAP – the UK and Japan.[14] While it is too early to speculate as to how GCAP training will take place and will be structured, Italy's Air Force and industry have built for themselves a prominent position within NATO as a training solutions provider, while also making a strong case for the M-346 as a competitive export product. Indeed, the M-346 (in its trainer or FA light combat configurations) is one of the most advanced aircraft in its class and is already in service with the Greek, Israeli, Nigerian, Polish, Qatari, Singaporean and Turkmen air forces, with more countries considering its purchase.

Program to 2028", in *The Aviationist*, 1 July 2024, https://theaviationist.com/?p=87436.

[9] Richard Thomas, "RAF Investigation into Hawk T2 Replacement to Deliver in 2024", in *Airforce Technology*, 25 March 2024, https://www.airforce-technology.com/?p=248466.

[10] "Chief of the Air Staff Calls for Early Replacement of RAF's Hawk T2 Jet Trainer", in *Forces News*, 27 November 2024, https://www.forcesnews.com/node/141890.

[11] Ibid.

[12] Stefano D'Urso, "IFTS: A Deep Dive into the Joint Italian Air Force – Leonardo Training Centre", in *The Aviationist*, 6 December 2022, https://theaviationist.com/?p=81370.

[13] Craig Hoyle, "How Leonardo's M-346 Helped Italy to Become a Training Master", in *Flight Global*, 17 November 2022, https://www.flightglobal.com/151014.article.

[14] David Cenciotti and Stefano D'Urso, "Deep Dive into the International Flight Training School, 'World's Leading 5th Gen. Training System'", in *The Aviationist*, 15 May 2023, https://theaviationist.com/?p=82395.

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8.3 Simulation as an enabler

The M-346 was designed to emulate features that are present in the most advanced fourth-generation platforms, as well as the F-35, for instance by utilising a Helmet Mounted Display (HMD) that can help pilots get accustomed to similar systems present in modern combat aircraft. The aircraft can also simulate other systems that are present on combat aircraft, including radar, datalinks, targeting pods, self-protection suite and weapons' employment.[15] The M-346's upcoming Block 20 configuration is going to further evolve the M-346 with two new Large Area Displays (LAD), including with a new HMD and other updates to avionics and the GBTS featuring also artificial intelligence applications.[16] These capabilities are not only a convenient way to help minimise the need for more expensive flying hours in the OCU stage of pilot training, but a way to ensure future pilots are natively trained as fifth generation pilots. Such an approach will be crucial with a view to next-generation training, which is by all accounts going to be even more complex and expensive.

The success of a trainer like the M-346, also in a future perspective, does not depend only on the platform itself and its onboard systems. Ground-based systems and simulators are just as key in turning the whole training process (especially at Phase IV) into a next-generation pipeline. For instance, the M-346 is enhanced by an Integrated Training System Solution, which includes the Embedded Tactical Training System (ETTS) data link that allows the aircraft to connect to a ground monitoring station and take part, while flying in real life, to generated tactical scenarios complete with simulated threats.[17] This system also allows trainers to integrate a real aircraft with a synthetic one operated by another pilot in a ground-based simulator.[18] This solution is ground-breaking and can significantly cut costs while still ensuring pilots are accumulating real flying hours in the cockpit and responding to complex scenarios that would be difficult to replicate if only physical aircraft were employed. As GBTS continue to evolve, they are set to provide better live virtual and constructive training and will integrate more and more with the overall training syllabus.

As air forces gradually begin moving toward operating combat aircraft as a component of wider air combat systems that include UCAS and adjuncts,[19] the role of simulators and their integration into a wider training system encompassing physical aircraft flying in real life, along with AI- or human-controlled simulated aircraft and UAS, becomes ever more central to a pilot's training. Air forces are

[15] Elia Silvestris, "Leonardo M-346: Two Decades of Cutting-Edge Training Excellence", in *The Aviationist*, 8 August 2024, https://theaviationist.com/?p=88301.

[16] Leonardo, *Block 20, the New Digital Face of the M-346*, 22 July 2024, https://www.leonardo.com/en/focus-detail/-/detail/m-346-block-20.

[17] Elia Silvestris, "Leonardo M-346: Two Decades of Cutting-Edge Training Excellence", cit.

[18] Ibid.

[19] Elio Calcagno and Alessandro Marrone (eds), "Above and Beyond", cit.

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thus presented with an opportunity not only to maintain financially sustainable advanced training pipelines amid rising costs, but also to enhance the training itself by including elements that would be highly cost-ineffective without digital support. At the same time, a careful balance will have to be struck as trainers find the right compromise between simulation and actual flying, considering that only the stress and workload of real-life flying and high-G manoeuvres can prepare pilots for actual combat operations. Therefore, flying is going to remain a crucial element in all training phases, though technological opportunities mean that ground-based training inevitably becomes more prominent.[20]

8.4 Advantages of joint training

Joint training presents a number of important advantages for involved air forces other than efficiency and cost-optimisation. First, it fosters deeper and wider interoperability by benefitting the development and implementation of common doctrines, tactics, techniques and procedures (TTP). Second, it leverages complementarity and cross-fertilisation among armed forces with partly different strategic cultures, threat assessment and operational track records. Last but not least, it builds networks and trust among air forces' elites, who may become future leaders in their own forces. Past air combat procurement programmes developed good praxes in terms of joint training. For instance, in order to maximise efficiency and cost-effectiveness, the three Panavia Tornado partner countries (Italy, UK and Germany) agreed to create a joint training unit based in the UK known as the Tri-National Training Establishment (TTTE).[21] The TTTE was comprised of four squadrons, including one dedicated to standardisation which was tasked with ensuring that the training methods and quality were maintained throughout courses despite pilot and instructor rotations. This common training initiative lasted from 1981 until 1999, and ended as a result of the growing divergence between each nation's Tornado aircraft.[22] It is also worth noting that the vast majority of F-35A pilots from around the world perform the basic operational conversion in the US at Luke Air Force Base in Arizona with the 56 Fighter Wing, which is planning to expand to seven F-35 squadrons and 32 full simulators.[23] The effectiveness of such an arrangement may represent a useful blueprint for a GCAP equivalent, with a view to interoperability, standardisation and cost saving. The complexity of such an endeavour requires that the GCAP partners start considering various options well ahead of the planned entry into service. For instance, the decision to base F-35 training at Luke was taken in 2012, with the first sorties being flown in 2014.[24]

[20] IAI interview, 3 September 2024.

[21] "Revealing Insights from the Days of the Tri-National Tornado Training Establishment (TTTE) at RAF Cottesmore", in *KeyAero*, 21 October 2022, https://www.key.aero/node/179181.

[22] Ibid.

[23] Belinda Guachun-Chichay, "Flying Forward: U.S. Pilot Training Mission at Luke Air Force Base Transitions to F-35 Exclusively", in *Air Force News*, 2 October 2024, https://www.af.mil/News/Article-Display/Article/3924749.

[24] Tristan Hinderliter, "Luke AFB Selected for F-35 Pilot Training", in *Air Force News*, 2 August 2012, https://www.af.mil/News/Article-Display/Article/110707; "F-35 Flies First Training Sortie at Luke

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Looking ahead, any degree of common training in the context of GCAP would benefit from a strong commonality of the core platform across the programme's participating nations. At the same time, cost-effective training can and should be performed by building on the existing high-quality assets and know-how – including in terms of trainers, simulators, schools and infrastructures – in Italy, Japan and the UK, in order to maintain the aforementioned affordability of the training pipeline vis-à-vis what is going to be an expensive core platform. Against this backdrop, a key challenge will be to bring these assets to a higher level of classification compatible with GCAP's high security standards, which in many regards already represent a new era of working in a highly-classified environment outside of a US-led framework for the participating nations.

8.5 GCAP training needs

GCAP core platform is still taking shape, but lessons learned in the present day can meaningfully inform future decisions. At a time when pilot shortages become more widespread in advanced air forces, optimising training in order to ensure the highest possible preparation from a limited pool of pilots becomes paramount.[25] Training, therefore, is a key component amid a range of possible solutions or mitigation measures. The integration of advanced system emulation in simulators and trainer aircraft, combined with augmented reality, can ensure a smoother and more gradual transition for pilots from the early stages of the training pipeline to the type of tasks required from a pilot in next-generation air combat systems. GCAP's success as a system of systems will certainly also depend on the quality and adaptability of the partner countries' training pipelines, including all the necessary physical and digital infrastructure.

Against this backdrop, despite the rise of ever more powerful simulation, the availability of modern advanced jet trainers remains crucial for any air force. In light of this, developing new trainers to cater for GCAP training requirements is probably unnecessary in the short and medium terms, given that the unique properties of sixth-generation aircraft, beyond VLO, are set to mostly relate to onboard systems and their interaction with other assets, rather than avionics and flight characteristics.[26] In most cases, therefore, much can be achieved by replicating specific features onto existing trainer platforms and GBTS, as is being done with the M-346 in order to train future F-35 pilots. Such an approach could help free up precious resources that can instead be invested in the enhancement of existing trainer systems, including by developing training-specific jet-powered UCASs in order to get pilots acquainted with manned-unmanned teaming (MUM-T) activities before joining their OCU or even their operational squadron.

AFB", in *Air Force News*, 13 May 2014, https://www.af.mil/News/Article-Display/Article/484733.

[25] Mike Holmes, "Rebuilding the forge: Reshaping How the Air Force Trains Fighter Aviators", in *War on the Rocks*, 28 January 2019, https://warontherocks.com/?p=19154.

[26] IAI interview, 7 January 2025.

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As GCAP partner air forces begin to rethink training practices, a reflection should also take place on the role of aggressors in pilot training, which must start replicating current threats including low or very low observability characteristics. Even though the US Air Force already employs F-35A as aggressors through the 65th Aggressor Squadron, other air forces may struggle to sustain the costs of employing such an advanced system in aggressor roles, given its limited availability and high operation costs. In light of this, the development of advanced VLO UCASs specialised in this role would offer significant opportunities, especially for already-qualified pilots. Crucially, efforts on this work stream would result in technologies and solutions strictly linked with the development of adjunct systems, opening up a new avenue for cooperation among GCAP partners beyond the core platform, which is still the main focus of current agreements.

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9. The cross-sectorial implications for Italy: Technologies, innovation and skills

by Michele Nones and Gaia Ravazzolo[1]

9.1 Overview of the technologies involved in the programme development

The GCAP is often described as "more than an aircraft" because it will be a proper System of Systems (SoS) with an open system architecture, bringing a shift in conceptual and operational approach and a technological leap compared to traditional aircraft. The programme's scope, as mentioned in previous chapters, focuses on the crewed core platform, sensors and effectors (including networking aspects), while adjuncts are developed in parallel by Italy and other partner nations. Accordingly, the whole GCAP envelope will push the development of a broad range of essential base technologies, which will subsequently be made available for equivalent technological advancements benefiting land and naval systems,[2] extending even to propulsion and electronic components.

To meet the different challenges, GCAP requires not only advanced communication capabilities, but also enhanced situational awareness and rapid decision-making cycles, leveraging very low observability and AI to gain a strategic advantage.

As a central component within a global defence SoS, GCAP will have to integrate both crewed and uncrewed systems and to support secure, high-volume air-to-air and air-to-ground communications across all distances. It will have to function as a versatile node with low observability to ensure seamless connections across multiple domains, while maintaining stealth – a crucial feature given the sophistication of modern threats. This requirement for seamless and secure communication necessitates a significant technological leap.

As specified in the Italian bill for the ratification and implementation of the Convention establishing the GIGO,[3] the GCAP will enable the enhancement and protection of the expertise previously developed by the national industrial base, while also facilitating the identification and management of a range of emerging disruptive technologies (EDTs). The main EDTs that are concerned will include AI, big data analysis, machine learning, autonomy, quantum-enabled systems, hypersonics and new materials.

[1] Michele Nones is Vice President and Scientific Advisor of the Istituto Affari Internazionali (IAI).

[2] Italian Ministry of Defence, *Documento programmatico pluriennale della Difesa per il triennio 2022-2024*, 2022, https://www.difesa.it/assets/allegati/30714/dpp_2022_2024.pdf.

[3] Law No. 184 of 18 November 2024: *Ratifica ed esecuzione della Convenzione sull'istituzione dell'organizzazione governativa internazionale GCAP, fatta a Tokyo il 14 dicembre 2023*, https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2024;184; Italian Senate: *Atto Senato 1225*, 16 October 2024, https://www.senato.it/leg/19/BGT/Schede/Ddliter/testi/58483_testi.htm.

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In a European comparative perspective (see table below), and concerning technologies considered essential for the military capabilities of the future, it is noteworthy that most of the technologies to be integrated into the GCAP align with the nine main EDTs identified by the EDA:[4] AI; Internet of Things (IoT); biotechnology and human enhancement; advanced materials and manufacturing; hypersonic weapon systems; new space technologies; quantum technologies; blockchain; and robotics and autonomous systems. Also, the latest version of the Coordinated Annual Review on Defence (CARD), published in November 2024, identifies technological priorities that align closely with those emphasised by the GCAP. Among these are investments in secure and resilient cyber defence, command-and-control systems, cyber and space situational awareness and satellite communications, all of which are deemed equally critical. Furthermore, Annex 1 of the most recent CARD reiterates the importance of EDTs prioritised by GCAP, including AI, quantum technologies and space technologies.

Moreover, the European Commission 2023 "Recommendation on critical technology areas for the EU's economic security"[5] identified four critical technology areas: advanced semiconductors (including microelectronics, photonics, high-frequency chips and semiconductor manufacturing equipment); artificial intelligence (covering high-performance computing, cloud and edge computing, data analytics, computer vision, language processing and object recognition); quantum technologies (such as quantum computing, quantum cryptography, quantum communications, and quantum sensing and radar); and biotechnologies (techniques of genetic modification, new genomic techniques, gene-drive, synthetic biology).[6] The GCAP overlap with this list concerning AI and quantum further underscores that the programme will be at the forefront of technological innovation.

Finally, within NATO, the primary focus regarding EDTs includes artificial intelligence, autonomous systems, quantum technologies, biotechnology and human enhancement technologies, space, hypersonic systems, novel materials and manufacturing, energy and propulsion, and next-generation communications networks.[7] The table below summarises the overlaps between NATO, European Commission, EDA and GCAP technology agendas.

[4] European Defence Agency, *Enhancing EU Military Capabilities beyond 2040*, September 2023, https://eda.europa.eu/publications-and-data/brochures/enhancing-eu-military-capabilities-beyond-2040-brochure.

[5] European Commission, *Commission Recommendation of 03 October 2023 on Critical Technology Areas for the EU's Economic Security for Further Risk Assessment with Member States*, https://defence-industry-space.ec.europa.eu/node/505_en.

[6] European Commission, *Commission Recommends Carrying Out Risk Assessments on Four Critical Technology Areas: Advanced Semiconductors, Artificial Intelligence, Quantum, Biotechnologies*, 3 October 2023, https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4735.

[7] NATO, *Emerging and Disruptive Technologies*, 8 August 2024, https://www.nato.int/cps/en/natohq/topics_184303.htm.

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Table 3 | Overlaps between technology agendas

Technologies	GCAP	EDA	Commission	NATO
Artificial intelligence	X	X	X	X
Big data analysis	X		X	
Machine learning	X			
Autonomy/Robotics and autonomous systems	X	X		X
Quantum-enabled	X	X	X	X
Hypersonic	X	X		X
New/advanced materials	X	X		X
Internet of Things		X		
Biotechnology and human enhancement		X	X	X
New space technologies		X		X
Blockchain				
Energy and propulsion	X			X
Next-generation communications networks				X

A key innovation within GCAP is its future use of AI and big data, which aims to revolutionise the speed and accuracy of decision-making cycles. This integration of AI directly within sensors allows for rapid data collection, assessment, and deployment in combat, by accelerating the data-to-action pipeline and the kill chain. Additionally, GCAP's data fusion capabilities consolidate information from advanced sensors with a bandwidth six times greater than that of the Eurofighter, facilitating real-time, high-bandwidth data processing across its core platform. This extensive data environment, though powerful, introduces technical challenges related to power supply and cooling – key areas currently under active development.

It is also fundamental to underline the significance of the space domain within the GCAP, which encompasses key areas such as communications, positioning, navigation and timing (PNT), as well as the direct transmission and reception of data from space-based systems and sensors. These aspects highlight the critical role of space capabilities in supporting the programme's objectives and ensuring effective integration of its technological and operational components.

GCAP indeed aspires to achieve a major technological leap, pushing boundaries in aerospace innovation in various ways. For instance, the core platform cockpit aims to offer performance levels up to 10,000 times greater than those of current aircraft. The GCAP will see a central role of the electronic dimension, underscoring the shift towards advanced digitalisation (already in the development stages). With the high level of digitalisation the GCAP seeks to pursue, the man-machine interface (MMI) is expected to play a crucial role in reducing the pilots' workload, even as their tasks are set to become even more complex than those of current pilots. The future "GCAP pilot" will likely take on a more managerial and decision-

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making role, focusing on analysing and exploiting the extensive data collected quickly. For this reason, Leonardo is conducting studies to evaluate and reduce the psychological impact of technologies and this expansion of responsibilities on pilots during military operations.

The GCAP will adopt a "cyber-secure by design" approach, emphasising cyber security and ensuring robust protection from the beginning. Other key technological elements include a sophisticated thermal management system designed to handle the extreme heat generated by the engine, electronics and advanced radar systems. The radars, which will be highly powerful, are expected to produce substantial heat that must be managed effectively – partly dissipated and partly recovered – an aspect that will be particularly critical for maintaining the aircraft's stealth capabilities. Additionally, sensor integration will be essential for optimising situational awareness, further supported by the aircraft's planned capacity to operate within a combat cloud. Cutting-edge capabilities such as quantum gyroscopes, high-powered lasers, advanced computing capabilities and software updates are meant to enhance its adaptability for diverse mission profiles, including ultra-long-range operations. In any case, a clear focus will be on technologies that enable acceleration and that are evolvable. With an integration process defined "by design", the GCAP bets on a forward-thinking convergence of innovation, durability and technological resilience.

9.2 The challenging balance between innovation, timeline and reliability

Considering the programme's overall value and the range of systems to be developed, GCAP represents a significant challenge, particularly in innovating within the military sector while balancing technological advancement, availability, reliability and safeguarding FoA/FoM. Added to this is the challenge of managing *a priori* the obsolescence of the technologies that will be on board the future fighter, which is going to stay in service for decades.

In this context, innovation entails not only the introduction of the aforementioned new technologies but also a careful selection of proven technologies that can be exploited to ensure superior performance and survivability for the system and its crew. In major defence programmes such as GCAP, it is often complicated to adopt everywhere cutting-edge technological solutions which offer potential technical superiority but may also introduce an unacceptable level of risk for a system that must guarantee reliability, availability and affordable operational costs (cost for flying hour) and maintenance costs. This reliability not only translates into operational effectiveness but also in survivability. For instance, a self-protection system must be functional in all circumstances, whereas a secondary weapon's malfunction might be more tolerable. Thus, a hierarchy exists in assessing acceptable risk levels for specific components over others.

This issue becomes particularly significant given the strict development time constraints imposed by the programme itself: the goal is to make a next-generation aircraft, with an open system architecture, operational within a decade from the

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GCAP inception, a shorter timeframe than that experienced by previous European air combat cooperative projects such as Eurofighter or Tornado.

Developing, testing, refining, and achieving reliability for a number of major technologies in just ten years is challenging for traditional aerospace and defence industries. This time limitation necessitates a careful selection of technologies to adopt, prioritising those already close to readiness, thereby reducing the risks associated with large-scale implementation. The GCAP in fact, cannot afford long-term experimentation but must find a balance between established solutions – compatible with the required pace of development and production – and the technological ambitions it aims to achieve. The time constraint will, therefore, weigh heavily in the choice of technologies to be adopted, but also foster new, faster and more efficient ways to bring innovation to the floor. Nonetheless, it is relevant to note that the development of innovative technologies has not started from scratch at the national level. Several EDTs have already been under development for years, such as those related to engine systems, as well as technologies from other sectors with potential dual-use applications. These cutting-edge technologies will represent the "contribution" or "assets" each partner brings to the joint programme, where they will be thoroughly evaluated and valued.

Against this backdrop, another innovative aspect of the programme is noteworthy: the large-scale integration of technologies and related cross-sectoral synergies, an advantage that only such major programmes hold over smaller ones focused on individual components. The ability to bring together diverse industrial and technological expertise – a hallmark of the aerospace sector – enables wide-ranging growth beyond the single aircraft, with benefits across multiple defence areas, thanks to the broad technological advancements GCAP aims to achieve. The scope of this programme serves not only as a driver for product innovation but also as an opportunity for process innovation. The latter often remains less apparent than the product itself but is crucial for enabling efficient and scalable production of the aircraft, and its components in the future, and meeting large-scale manufacturing goals. It will be necessary to establish an industrial capacity that is able to produce numerous units within a limited timeframe, while avoiding delays arising from integration processes.

As outlined in the 2024 Multiannual Planning Document (*Documento programmatico pluriennale*, DPP), Rome's participation in the GCAP "will grant access to a project destined to have implications not only in military technology but also in the area of digitalisation".[8] Therefore, it will be essential for Italy to harness the benefits that GCAP will bring to the national industry beyond just technological advancements.

[8] Italian Ministry of Defence, *Documento programmatico pluriennale della difesa per il triennio 2024-2026*, September 2024, p. 83, https://www.difesa.it/assets/allegati/30714/dpp_2024-2026_final_firmato.pdf.

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Notably, the advanced integration of systems and sensors within the GCAP programme will enable the management of billions of data points, opening up application possibilities well beyond the defence sector. Effectively managing and leveraging data could generate significant advantages across various domains, offering enhanced informational capacity. However, to achieve this leap, it will be crucial to develop specific skills, such as: identifying data, ensuring its integrity, protecting it (e.g., through electronic and cyber warfare techniques), and, most importantly, learning to exploit it fully.

9.3 Supply chain: Implications and opportunities for Italy

The international shock caused by the Russia-Ukraine war has also revealed how much the political risks associated with the supply chain were underestimated. Ensuring its resilience in an international and highly complex programme such as the GCAP represents a central and strategic element for the entire programme's success, as well as a crucial factor from an industrial perspective.

For Italy, exercising strengthened control over the supply chain, with the support of the Ministry of Defence, and taking responsibility for managing supplies from other European firms could provide an additional opportunity to consolidate its role within the programme. Specifically, beyond clearly defining supply chain-related objectives, continuous and in-depth monitoring of the supply chain, would be essential. This approach would help mitigate risks associated with dependency on extra-European supplies, which may present political and technological challenges. At the same time, diversifying the supply chain among trusted G7 countries could provide further resilience, considering for example different GCAP final assembly lines in different continents.

Given Italy's position as the only EU member in the project, it could be considered to prioritise European-sourced components to secure an additional level of protection compared to partners such as the United Kingdom and Japan, who do not benefit from the "protection" provided by EU membership. Therefore, the European-origin products and technologies utilised within the GCAP should be protected as much as possible by Italy precisely because it is the only EU country participating in the programme – provided there is no obstacle in their use within a global programme like GCAP.

9.4 Skills and human factor

The process innovation to be introduced by the GCAP will also likely impact business processes themselves. The GCAP programme presents significant challenges regarding workforce management, not only during the design phase, but also in the industrialisation phase – namely, the transition from prototype to large-scale production and then the constant upgrade and support of the system. Technology plays a crucial role in this process, such as: (i) using 3D printing and lasers to build components; or (ii) leveraging advanced manufacturing technologies and processes, which integrate propulsion innovations. These methods will enable the

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programme to overcome constraints that would be difficult to address by relying only on traditional techniques, allowing for shorter production times.

The demand for STEM personnel, both during the current design phase and later in production and long-term support and evolution, will thus become a critical issue, as the current supply from all partners risks falling short of the programme's requirements. Companies from the three partner countries involved in the project must implement bespoke strategies and targeted measures to tackle this issue effectively.

Leonardo, for example, is addressing this problem in different and complementary ways. The aircraft division has been hiring around 500 new STEM workers per year over the last two years, while tasking about 150 current employees to train them.[9] Italian industries are reaching out to universities such as Politecnico di Torino to establish or refine current curricula to match with their GCAP needs. In some cases, Leonardo has established partnerships with secondary technical institutes aimed at STEM roles that do not require university-level qualifications. The hub "Città dell'aerospazio" planned in Torino represents a promising reality in terms of cross-fertilisation and development of an industrial, technological and academic ecosystems aimed also to increase the number of young STEM graduates willing and able to work on projects such as GCAP. The demand for STEM personnel is not confined to entry-level graduates but extends to more senior roles as well. Experienced professionals are required not only to contribute directly to programme development but also to train and mentor newly hired staff. Addressing this need in the short term proves challenging, often necessitating the transfer of senior resources from other programmes within the same company. This solution offers immediate expertise but risks disrupting existing projects. Otherwise, alongside developing and advancing national talent, further opportunities could also be explored to recruit external personnel, for instance, by drawing from individuals with dual nationality or those from Commonwealth countries for its UK subsidiaries.

However, it remains crucial to support the inclusion of Italian personnel within the programme by working with industry to make the defence-related aerospace sector more attractive. In Italy, particularly in the public opinion, there are deep-rooted cultural, political and ethical obstacles that may prevent many young engineers from working on defence projects like GCAP. These individuals often choose to work in other industrial sectors rather than in defence, partly because of economic and/or professional incentives, partly due to reputational concerns and a lack of widespread awareness of the GCAP as a strategic national objective. To address this problem, efforts should be made both in the short and mid- to long-term to enhance the sector's attractiveness by promoting a positive perception of this project – including among universities – as an opportunity to contribute to the country's security over the coming decades. Promoting the programme and

[9] IAI interview, 22 November 2024.

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its innovative and employment impacts at the university level could therefore prove decisive, with the Ministry of University and Research potentially acting as an advocate for this vision. Emphasis should also be placed on the fact that the programme is a major technological breakthrough that will significantly contribute to safeguarding peace in Europe by making deterrence more solid.

Accordingly, the DPP considers GCAP as a driver for a sort of whole-of-country approach, to introduce new technologies in the aerospace sector and as well as to bring to this sector a "GCAP generation of engineers".[10] To make it real and safeguard the programme from a detrimental shortage of human resources, it is thus crucial for Italy to take actions to bridge the gap in available terms of engineers, while avoiding the diversion of resources from other ongoing projects.

[10] Italian Ministry of Defence, *Documento programmatico pluriennale della difesa per il triennio 2024-2026*, cit., p. 83; Italian Ministry of Defence, *Documento programmatico pluriennale per la difesa per il triennio 2023-2025*, October 2023, p. 75, https://www.difesa.it/assets/allegati/30714/dpp_2023-2025.pdf.

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Conclusions

by Alessandro Marrone and Michele Nones

The GCAP is by all means an extraordinary programme for Italy: in terms of across the board technology leaps, new model of governance, novel international partners, wide-ranging involvement of national DTIB, significant and long-term financial commitment, high level of classification, tight schedule, etc. Suffice it to say, concerning the timeline, that 2035 represents a target much more challenging and ambitious, mutatis mutandis, than the previous experience of both F-35 and Eurofighter. As such, GCAP presents daunting challenges, but also precious opportunities. Italy can and shall better face the former and grasp the latter by implementing the following 15 recommendations:

1. A whole-of-country approach from short- to long-term
2. A mindset change on technological innovation
3. A realistic investment in classified infrastructures and info-structures
4. An advanced collaborative working environment
5. A special effort towards the supply chain
6. A GCAP generation of STEM personnel
7. Qualified and stable personnel for GIGO, JV and national stakeholders
8. An ad hoc law for GCAP exchange of components
9. A smart approach to training
10. A relaunch of Italian UCAS
11. A certain, timely and proportionate budget
12. A pragmatic attitude to possible additional partners
13. An early agreement on export
14. A GCAP model and driver for better Italian defence industrial policy
15. An enabler for Italian foreign and defence policies

1. A whole-of-country approach from short- to long-term

Rome's defence policy often suffers from the polycentric nature of the Italian institutional system and the weakness of public-private partnership. In the GCAP case, the need for a whole-of-country approach ("*sistema Paese*") is greater than ever because of the extraordinary challenges presented by the programme itself. Italy should establish and maintain a high level of intra-MoD, inter-agency and public-private coordination in order to:

- negotiate adequate GCAP military requirements and industrial workshare in the short-term with strong partners such as Japan and UK – also considering London's attitude as primus inter pares and a strong British-Japanese relation: the next few years will be crucial for the positioning of Italy;
- ensure timely and effective technology development in Italy through the programme lifespan: innovation will continue for decades, and the DTIB will have to remain competitive;
- fully implement the Freedom of Action/Freedom of Modification principles enshrined in GCAP, including with regards to intellectual property rights,

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exports, etc;
- ensure GCAP full interoperability with both Eurofighter and F-35, also through negotiations with the US which will not be easy.

More than other multinational procurement programmes, GCAP is crucial for a large part of Italian DTIB to learn, develop technologies and cultivate industrial capacities in an array of key areas – particularly where Italian strengths lie. Such a whole-of-country approach should be implemented in the long run, and should involve also improved cooperation among major and mid Italian industrial players to achieve an industry wide quantum leap in know-how.

2. A mindset change on technological innovation

GCAP technology's level of ambition is unprecedented and the risk of failure lies on an equal basis on Italian, British and Japanese shoulders. This combination makes the programme different from both the F-35 and Eurofighter, and requires Italy a change of mindset when it comes to technology innovation. The MoD should be crystal-clear in its requirements, also by prioritising tasks of the core platform with respect to the broader system of systems and open to the possibility some of them will not be met in the R&D phase and will have to be dropped. The private sector should take the risk of investing on its own and move beyond the comfort zone of previous platforms and components development programme, by designing and testing a number of new solutions – which in turn may lead to the establishment of new standards – creating new laboratories and undertake internal reorganisations to become more agile.

Notably, the envelope of Integrated Sensing and Non-Kinetic Effects (ISANKE) represents a key technological frontier to explore through investments in the capacity to develop and produce both hardware and software to be updated and/or replaced in the core platform over a long GCAP in-service timespan. ISANKE in turn should provide seamless communications through the Integrated Communication Systems (ICS) between the core platform and adjunct. Being a system of systems, electronic integration will be crucial. As such, GCAP will bring together air, space and cyber domains, also via new datalink with satellites, and feature a central role for both cyber and electromagnetic spectrum operations. In this context, artificial intelligence will be key across the board, from sensors and radars to mission control and effectors.

Against this backdrop, the Italian MoD should dramatically improve and speed up its certification process, whose lengthy timing hampers technological innovation in the armed forces and represents a tremendous obstacle to GCAP implementation by Italy. In the private sector, better coordination and cooperation should be established among Leonardo, Avio Aero, ELT Group and MBDA Italia. Public-private partnerships should make a quality leap in terms of information sharing, coordination and accountability, to create a favourable environment for timely technological innovation.

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All of this is particularly important as GCAP should really implement an open architecture, to enable constant upgrade and update of its components over the core platform's operational life by involving a wider supply chain in a more competitive and integrated manner than in previous programmes. The bottom line is that the Italian defence ecosystem should not only develop new technologies, but it should also embrace the process, organisational, governance and cultural innovation that GCAP requires to succeed – a mindset change.

3. A realistic investment in classified infrastructures and info-structures

The GCAP potential benefits for Italian DTIB are huge, and a genuine effort is going on to reach out to SMEs, start-ups, research centres and universities. But most of them are not able, nor sometimes willing, to comply with the high level of classification envisaged by the programme because this entails cumbersome security clearance procedures and expensive investments in both info-structures and infrastructures.

Realism and pragmatism are needed by the GCAP MoDs on the management of classification and the balance to strike with the necessary innovation achievable via the supply chain. At the same time the Italian MoD, the LSI and the lead sub-systems integrators will have to invest in an info-structure which can be used by the suppliers to work together on GCAP technology bricks in an effective and secure manner. Italian institutions should also staff, improve and accelerate the vetting process for GCAP personnel in order to move forward with an unprecedented number of high-level security clearances.

Concerning infrastructures, the protection of sensitive information on product and process technologies will require significant investments in new dedicated facilities, often separate from those currently used. In the case of the much more limited Italian participation in the F-35 programme, the solution was to build the Final Assembly and Check Out facility at the Cameri military airport. In the GCAP case, the number of industrial sites involved will be much larger and thus a distributed solution across Italy will have to be found. In any case, significant public support will be necessary to cope with the extra costs related to the protection of technological and industrial information.

4. An advanced collaborative working environment

The GCAP features MoD and industries working together across two continents and different time zones on sensitive database to perform high-tech engineering. This will require the creation of a cybersecure and classified digital infrastructure to design, share and test technology components of the core platform – and the aircraft itself – also through digital twins. GCAP will produce a huge amount of precious data, to be managed through governance and software which work for the stakeholders in Italy, Japan and UK. And the highest level of cybersecurity will have to be guaranteed. Italy should invest in such Advanced Collaborative Working Environment (ACWE), where both Leonardo and ELT Group can and should play a

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leading role. The ACWE would represent a quantum leap in terms of ICT for the Italian DTB, and could be an enabler for other collaborative procurement in the future.

5. A special effort towards the supply chain

GCAP has the potential not only to involve a large part of Italian DTIB but to move beyond it, towards SMEs and start-ups working on AI, big data, cryptography, and broadly speaking information communication technology. Italy should grasp the opportunity to broaden and innovate the supply chain, by looking at leading SMEs in their niche of the market. Accordingly, it should be carried on a systematic activity to reach out to innovative private partners, monitor the supply chain, and put in place the necessary mechanism to ensure security of supply as well as security by design of the technology bricks to be part of GCAP. This entails, among other things, supporting supply chain's structural investments while screening FDI. The scope of such activity is unprecedented, given the fact GCAP is the first digital-native aircraft to be designed in Italy, UK and Japan, but its benefits for Italian high-tech companies are worth the effort. Above all, GCAP technological challenges require each of the three participating countries to leverage all the knowledge and know-how suitable for their respective industrial sector. Once again, a whole-of-country approach will be crucial in this regard.

6. A GCAP generation of STEM personnel

GCAP presents the challenge and opportunity to recruit, train and retain a new generation of STEM graduates, including – but not only – a variety of engineers (bachelor and master) and technicians from aerodynamics to materials, from software to mechanics. New partnerships should be established with universities across Italy in order to set up curricula fit for the programme, while the establishment of "Aerospace City" (*Città dell'aerospazio*) in Turin can represent a driver and a model for university-industry collaboration, including with regards to technological districts (distretti industriali) and technological clusters across Italy. Technical high schools should also be involved recruiting for example younger software engineers for certain tasks.[1] The aforementioned whole-of-country approach here is crucial to involve the Ministry of University and Research as well as the ensemble of Italian academia and education system. An effort should be made also to attract Italian STEM professionals currently living abroad and let them to return to work in the country. These actions entail different timing, and most of them bear fruit in the mid-to-long-term and, therefore should be undertaken as soon as possible and simultaneously. Meanwhile, the private sector, and particularly LSI and SSI, should move internal resources from less strategic activities to GCAP in order to fill the gap in the short term.

[1] See in this regards Chapter 9 of this study.

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7. Qualified and stable personnel for GIGO, JV and national stakeholders

Another recurrent weakness of Italy's defence policy regards the ability to adequately staff international organisations and institutions with personnel holding a tailored CV and a coherent experience, as well as the linkage with those professionals once they work abroad.[2] Once again, GCAP presents unique challenges and opportunities.

The GIGO will play a crucial role in the procurement programme and needs to be timely staffed by qualified and committed Italian military and civilian personnel from day one to decades of activities, including high-, medium- and low-level positions. The same applies to the JV concerning private sector professionals, including managers and engineers, from the upcoming first Italian CEO[3] downwards and with appropriate succession planning for the short-, mid- and long-term.

Italian institutions will have to keep pace with GCAP too according to the whole-of-country approach mentioned before. First and foremost, the Air Force carrying on the bulk of military efforts on this programme, but also the National Armament Directorate and the Cabinet of Defence Ministers in their respective roles, should adequately staff the related offices and ensure continuity of personnel and expertise over the mid- to long-term. Second, the Ministry of Foreign Affairs and International Cooperation (MAECI) should both support the programme and exploit the opportunities for a wider partnership with UK, Japan and eventual further GCAP partners, by enhancing the diplomatic staff in these countries – as the British diplomats have done in Italy and elsewhere. Similarly, the Ministry of Enterprises and Made in Italy (*Ministero delle Imprese e del Made in Italy*, MIMiT) should both provide financial support and exploit the GCAP opportunities for the development of the Italian DTIB. Finally, as this programme is strategic for national security, the intelligence services should keep a close eye on it.

8. An ad hoc law for GCAP exchange of components

The GCAP development phase involves an intense share of information between the companies involved in the three participating countries, as well as an increasing exchange of parts and equipment to be built both to allow testing and for processing needs. For the first time, Italy has included in the Law of ratification of the Convention on the establishment of the GIGO[4] the provision for the use of the Global Project License foreseen by the national regulation on exports.

[2] See in this regards, mutatis mutandis: Elio Calcagno, Alessandro Marrone and Michele Nones, "La Bussola strategica Ue e dodici sfide per l'Italia", in *Documenti IAI*, No. 22|06 (June 2022), p. 9, https://www.iai.it/en/node/15558.

[3] See in this regards Chapter 6 of this study.

[4] Law No. 184 of 18 November 2024, cit.

This particular form of authorisation aimed at facilitating the implementation of cooperative programmes was introduced into Italian legislation following the ratification of the 2000 Framework Agreement between the then six major EU member states.[5] Unfortunately, however, its possible extension to other EU or NATO countries was tied to compliance with "provisions similar to those in Article 13 of the Framework Agreement", which require the definition of a list of permitted destinations. This provision has never been implemented in the FA. The GCAP involves also Japan which does not fall in the category of NATO/EU members. Above all, the GIGO Convention in Article 51 assigns the definition of the management of exports to third countries to a subsequent agreement between the three countries. As a result, the current Italian legal provision for the Global Project Authorisation is not enough to enable smooth and effective cooperation within GCAP concerning the crucial exchange of parts and components. Italy has to solve this problem by introducing a new, ad hoc law for GCAP-related transfers. This would also favour any new cooperative international programme that could present similar problems.

9. A smart approach to training

While it is too early to elaborate in-depth on the training of core platform training, some preliminary considerations can be made. First, in light of the GCAP's likely high costs, a smart approach should leverage existing training capability for the first stages of the training pipeline, including advanced trainer aircraft such as the Italian M-346, infrastructures such as the International Flight Training School at Decimomannu (Italy) now rightly to be considered as the benchmark – as confirmed by the fact that both RAF and USAF pilots are being trained there – and the future ground-based training system, including simulators' role, as enabler. No necessity seems to appear for a new-gen advanced trainer for future GCAP pilots, even if obviously electronics, cockpits, interfaces and communications have to evolve – together with the need to train with various categories of adjuncts. Second, when it comes to pilots who have already completed their first phases of the training syllabus and need to move onto their operational squadrons, through an operational conversion unit, the best praxes of Tornado joint approach should inspire training as common as possible for future GCAP pilots – while much can be learned from F-35 training too when it comes for example to very low observability and netcentric capabilities. Third, new thinking on training will have to be developed also on the basis of the ratio and interaction between each core platform and its adjunct, in order to make the management of collaborative combat aircraft manageable by aircrews: being the core platform at the centre of a wider system of systems, it is necessary an evolution in how training is conceived and carried out

[5] Law No. 148 of 17 June 2003: *Ratifica ed esecuzione dell'Accordo quadro tra la Repubblica francese, la Repubblica federale di Germania, la Repubblica italiana, il Regno di Spagna, il Regno di Svezia e il Regno Unito della Gran Bretagna e dell'Irlanda del Nord relativo alle misure per facilitare la ristrutturazione e le attività dell'industria europea per la difesa, con allegato, fatto a Farnborough il 27 luglio 2000, nonché modifiche alla legge 9 luglio 1990, n. 185*, https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2003-06-17;148.

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at the later stages of the pipeline.[6] Fourth, the GIGO should establish an effective training office in order to plan joint GCAP training well in advance, in synergy with the development and production of the core platform.

10. A re-launch for Italian UCAS

The GCAP core platform will work with a family of uncrewed adjuncts as a system-of-system, in order to increase range, effects and combat mass, and these adjuncts may well vary in terms of performance, expendability and costs. While Italy, Japan and the UK are working together on the crewed aircraft, it is likely that each one will develop one or more national adjuncts, also with a view to export markets. Italy should grasp this unique opportunity to re-launch its position on UCAS,[7] by using GCAP as a catalyst with respect to previous efforts in this field by combining research, development and procurement of national adjuncts. Those new UCAS, or at least some of them, will have to cooperate seamlessly with GCAP core platform, F-35 and Eurofighter, with full operational sovereignty as well as technological and industrial one.

Moreover, integrating the core platform and adjuncts should be a driver for the development of a combat cloud able to leverage distributed sensors and computing capacity, once again with positive, cross-cutting technological spillover within and beyond the air domain. Last but not least, from a military perspective the integration of crewed and uncrewed platforms driven by GCAP will require an innovation in terms of doctrine, tactics, techniques and procedures.

11. A certain, timely and proportionate budget

Chronic budgetary constraints are traditionally a negative factor influencing Italian procurement.[8] Against this backdrop, GCAP poses additional challenges because of the characters and pace of cooperation with UK and Japan. First, the MoD and MIMiT budget for this programme has to be certain for each and every year from the short- to mid-term, in order to enable a number of Italian industries, from LSI to SME, to plan and implement the aforementioned private investments in terms of qualified personnel, classified infrastructures and info-structures, etc.

Second, GCAP funding has to be timely with a greater effort on research and development activities in the short term, from 2025 onwards: this is the window of opportunity where national industries position themselves on key technologies and they need immediate, robust investments as their counterparts in UK and

[6] See in this regards Chapter 8 of this study.

[7] For an in-depth analysis of UCAS and Italy's position, see: Elio Calcagno and Alessandro Marrone (eds), "Above and Beyond", cit.

[8] See, among others: Alessandro Marrone, "What Are the Main Drivers of Member States' Defence Procurement Practices? The Italian Case", in *Ares Comments*, No. 101 (September 2024), https://www.iris-france.org/wp-content/uploads/2024/09/ARES_2024_09_101_Defence_Procurement_Practises_Italy_Comment.pdf.

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Japan are receiving in order to stay ahead. Otherwise, the risk is to have in the end a shallow 33 per cent of workshare, whereby the percentage of high-quality technologies developed, designed and owned by Italian industries is well below that threshold. The current budgetary timespan, with 8 billion euros for R&D spread up to 2050 and very limited investments in the 2025-2027 timeframe, is not adequate for the GCAP speed of relevance.

Last but not least, the budget has to be proportionate to the GCAP level of ambition, as defined by the military requirements for the core platform and by the political commitment to a programme deemed strategic for Italy. To put it simply, the whole government – including the Treasury – has to walk the talk on GCAP. This applies first and foremost to the R&D investment, which should be increased already in the short term. In the mid-to-long-term, proportionate funding is necessary also for national off-take of the core platforms. Italy should not repeat the mistake made on the F-35, when the 2011 decision to announce a reduction in the very long-term of the planned off-take from 132 to 92 aircraft immediately and severely damaged the industrial return for Italian industries, including the Cameri facility, while as of 2024 Italy is procuring much more than 100 aircraft – and more than a Tier-1 partner of F-35 such as UK. The lesson from the F-35 experience is that when it comes to long-term procurement programmes, in light of the rapid evolution of the international security environment, is nonsense to anticipate cuts to the planned acquisition. In contrast, after robust investment in R&D, certain and proportionate planning with regard to off-take is crucial for the return of investment as a country in a programme like GCAP.

12. A pragmatic attitude to possible additional partners

GCAP financial sustainability would obviously benefit from additional partners willing and able to invest in robust acquisition of the core platforms to be produced, such as Saudi Arabia, without altering the institutional and industrial governance established on an equal basis among the three founding parties. Broadly speaking, enlarging the GCAP partnership is likely to bring to the programme different strengths – i.e. political, military, technological and industrial – depending on who is joining the club, when and how. At the same time, by default an enlargement increases complexity and transaction costs, while negatively affecting the procurement timeline – as regularly happened in many other international programmes. Therefore, an evaluation of possible additional partners should be made on a case-by-case basis by the three founding parties.

Italy should maintain a pragmatic approach in this regard, by supporting the inclusion of countries which overall would benefit the programme from an Italian perspective, including but not limited to financial sustainability. This position as a decision-maker in a dynamic programme is a relative novelty for Rome's defence industrial policy, after a rather stable consortium like Eurofighter and the junior role played in the F-35. As such, it requires strong and timely politico-military leadership as well as constant public-private partnership in the short, mid and long term.

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13. An early agreement on export

In light of previous, mixed experience with Eurofighter export, Italy should push for an early agreement with Japan and UK on the rules and guidelines for a joint effort to promote the core on third countries marked beyond partners of the programme. A dedicated office in the GIGO is a positive step towards a common approach to export. Such an approach should implement the Freedom of Action/ Freedom of Modification principles in order to avoid national authorisation hurdles as those experienced with Germany in the Eurofighter programme. At the same time, common guidelines and a degree of coordination are necessary to establish a win-win logic among the founding partners, so that any bilateral export deal benefits to some extent all parties and therefore enjoy their support. Once again, past negative examples of intra-consortium competition should be avoided by reaching an agreement ex ante, before concrete opportunities for export arise. This is crucial to enhance the marketability of the core platform and therefore its financial sustainability through production rates higher than those necessary for the domestic markets of Italy, Japan and UK. The GIGO has a crucial role to play in this regard.

14. A GCAP model and driver for better Italian defence industrial policy

To some extent, GCAP may represent a model for Italian defence industrial policy, based on three complementary pillars: an equal basis partnership; a strong commitment by the political leadership; and the creation of a joint venture as an incubator for industrial cooperation and integration. Some of these elements are not new in the recent history of the Italian defence industry, by looking at AgustaWestland and MBDA examples. Still, for the first time these three pillars are simultaneously in place in GCAP.

At the same time, this programme may represent a driver for positive changes in the Italian defence industrial policy, thanks to the innovative processes, organisational and cultural change that GCAP will set in motion.[9] For instance, if transfers and export regulations are streamlined, or better cooperation between STEM universities and the private sector are implemented, or any other systemic improvement is pushed by GCAP, that would trigger cascade effects to the benefit of other procurement programmes, the wider DTIB and in the end the Italian defence ecosystem. Achieving such cascade effects would require, once again, a whole-of-country approach to grasp the GCAP opportunity as a model and driver for a better national defence industrial policy.

15. An enabler for Italian foreign and defence policies

Last but not least, Italy should consider GCAP as an enabler for both its defence and foreign policies. Concerning the former, the programme keeps the military,

[9] See in this regards Chapter 6 of this study.

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particularly the air force, at the top level in terms of air combat capabilities for the next decades. This in turn enables effective deterrence and defence of both national and NATO territories, as well as worldwide reach through the air domain. At the same time, GCAP drives the Italian aerospace and defence industry at the forefront of key technologies by providing also a format for global industrial cooperation and integration through the JV. Italian defence policy should leverage such enabler on a number of dossiers, *in primis* Italy's contribution to NATO capability targets, collective defence and transatlantic burden sharing.

At the same time, Italy should avoid any GCAP negative effect on its position concerning intra-EU cooperation by making a clear case in this regard. As a matter of fact, Rome is committed on a number of cooperative initiatives within the EU, from the European Patrol Corvette with France to the Leonardo-Rheinmetall cooperation on main battle tanks, to the Eurodrone programme involving France, Germany, Spain and Cekia to mini-lateral formats for European air and missile defence, up to EU dual-use space capabilities, including via PESCO and the European Defence Fund. Pragmatism is the hallmark of the Italian approach to European defence cooperation and integration. As Berlin decided to not continue the long-standing partnership with London and Rome experienced on Tornado and Eurofighter by rather choosing FCAS,[10] Italy and UK made the right choice to set up GCAP in order to preserve together their air combat capabilities, which benefit Europe's security and NATO collective deterrence and defence. The reduction from three different European models of fourth-generation aircraft – Eurofighter, Gripen and Rafale – to two programmes for next-generation air combat platforms is already a form of consolidation and economy of scale. GCAP in principle is open to other European and international partners who may consider joining the programme in the mid-term should it succeed in meeting requirements and timeline.

Italian foreign policy should also consider GCAP as an enabler. First, as mentioned before, it further profiles Italy as a security producer at European, transatlantic and global levels. Second, it is a unique partnership among three G7 countries, fully in line with the greater attention on international security pushed by Italy during its 2024 presidency of the forum when the first-ever defence G7 ministerial meeting took place. Third, GCAP includes two NATO countries and one of the Alliance's most important partners, aligning very well with the greater attention to China and the Indo-Pacific as laid down by allies in the 2022 Strategic Concept. Fourth, the programme upgrades relations with Japan to an unprecedented level. Indeed, GCAP is such a long-term, wide-ranging and intense partnership among both the armed forces and the industry of these countries that anchors together Rome and Tokyo by bringing institutions and policy communities closer across the continents. Accordingly, it presents synergies with ongoing Italo-Japanese cooperation on semiconductors, AI or space,[11] as well as with new bilateral cooperative initiatives across the board that may leverage such convergence and

[10] See in this regards Chapter 8 of this study.

[11] See in this regards Chapter 5 of this study.

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proximity driven by GCAP. Last but not least, thanks to this programme Italy will be more present and visible in the Indo-Pacific, deemed by many observers as a key region in terms of both economic growth and geopolitical confrontation, with a potential benefit for other Italian bilateral relations in that area.

All these opportunities in NATO, G7, the Indo-Pacific and at the global level can be exploited only if the various levels and directorates general of the Italian Ministry of Foreign Affairs and International Cooperation will fully recognise defence, including GCAP, as an asset for Italy's foreign policy, to be understood and leveraged by diplomats. A whole-of-government mindset and a top-down political mandate will be crucial in this regard, also to enhance inter-ministerial cooperation between MoD and MAECI, MIMiT and the Ministry of Economy and Finance. GCAP is "just" a powerful enabler, which will require politico, diplomatic, economic and military actions to bear fruits for Italy's international standing and national interests.

In conclusion, these multifaced recommendations further underline that GCAP stands out as an extraordinary project for Italy and should be managed and exploited as such through a whole-of-country approach.

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Acronyms

AAM	Air-to-air missile
ACP	Autonomous collaborative platform
ACWE	Advanced Collaborative Working Environment
AI	Artificial intelligence
AIAD	Federazione aziende italiane per l'aerospazio, la difesa e la sicurezza (Italian Industries Federation for Aerospace, Defence and Security)
AM	Aeronautica Militare (Italian Air Force)
AUKUS	Australia, United Kingdom, United States
CARD	Coordinated Annual Review on Defence
CCA	Collaborative Combat Aircraft
CE	Chief Executive
CEO	Chief Executive Officer
CONOPS	Concept of Operations
DGA	Direction Générale de l'Armement (France's defence procurement agency)
DIS	Defence Industrial Strategy
DPP	Documento programmatico pluriennale (Multiannual Planning Document)
DTIB	Defence technological and industrial base
EDA	European Defence Agency
EDT	Emerging disruptive technology
EFA	European Fighter Aircraft
ETTS	Embedded Tactical Training System
EU	European Union
EUMET	European Military Engine Team
EW	Electronic warfare
FA	Fighter Attack
FA	Framework agreement
FACO/ MROU	Final Assembly and Check Out/Maintenance Repair Overhaul Upgrade
FCAS	Future Combat Air System
FCAS TI	Future Combat Air Systems Technology Initiative
FMS	Foreign Military Sales
FoA	Freedom of Action
FoM	Freedom of Modification
FY	Fiscal year
GBTS	Ground-based training system

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GCAP	Global Combat Air Programme
GE	General Electric
GIGO	GCAP International Government Organisation
HMD	Helmet Mounted Display
HoD	Head of Delegation
HPC	High performance computing
HQ	Headquarters
ICS	Integrated Communications Systems
ICT	Information and communication technologies
IFTS	International Flight Training School
IoT	Internet of Things
ISANKE	Integrated Sensing and Non-Kinetic Effects
JAIEC	Japan Aircraft Industrial Enhancement Co
JASDF	Japan Air Self-Defence Force
JNAAM	Joint New Air-to-Air Missile
JV	Joint Venture
KHI	Kawasaki Heavy Industries
LAD	Large Area Display
LIFT	Lead-in to Fighter Training
LSI	Lead Systems Integrator
LSSI	Lead Sub-Systems Integrator
MAECI	Italian Ministry of Foreign Affairs and International Cooperation
MHI	Mitsubishi Heavy Industries
MIMiT	Italian Ministry of Enterprises and Made in Italy
MLU	Mid-Life Update
MMI	Man-machine interface
MoD	Ministry of Defence
MoU	Memorandum of Understanding
MUM-T	Manned-unmanned teaming
NATO	North Atlantic Treaty Organisation
NETMA	NATO Eurofighter Typhoon and Tornado Management Agency
NG	Next Generation
NGAD	Next-Generation Air Dominance
NGAP	Next-Generation Adaptive Propulsion
NGWS	Next-Generation Weapon System
OCCAR	Organisation for Joint Armament Co-operation
OCU	Operational Conversion Unit
PC2Lab	Product Capability and Concept Laboratory
PESCO	Permanent Structured Cooperation
PLAAF	People's Liberation Army Air Force

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PNT	Positioning, navigation and timing
R&D	Research and development
R&T	Research and technology
RAF	Royal Air Force
RFI	Request for information
SC	Steering Committee
SDSR	Strategic Defence and Security Review
SME	Small and medium-size enterprise
SOI	Statement of intents
SoS	System of Systems
STANAG	NATO standards
STEM	Science, technology, engineering and mathematics
TTP	Tactic, technique and procedure
TTTE	Tornado's Tri-National Training Establishment
UAS	Uncrewed air systems
UCAS	Uncrewed combat air systems
UK	United Kingdom
US	United States
USAF	US Air Force
VLO	Very low observability
WT	Working Team

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