European Fighter Programs: A Preliminary Assessment

Two European consortia, FCAS and Tempest, have recently set out to develop and manufacture 6th-generation fighter jets. Both projects are motivated by the same basic rationale: regaining European autonomy in a strategic technology cluster. However, they differ not only in their approaches and ambition levels towards this end, but also in key military and politico-industrial parameters.

By Amos Dossi and Niklas Masuhr

By the 2030s, European fleets of combat aircraft will have to be modernized by introducing 6th-generation platforms characterized by advanced network-embedded avionics, the potential for unmanned deployment, and a degree of stealth capabilities. As in any major defense-industrial undertaking, the recently launched procurement programs are structured by two basic dimensions of decision-making, each informed by distinct benchmarks. The military dimension is about matching specific operational requirements with technical solutions. Some of those may already exist while others are yet to be developed. The politico-industrial dimension, in turn, is about aligning project setups with foreign and industrial policy objectives.

A British F-35B Lightning II, an American F-15E Strike Eagle, and a French Rafale fly over the English Channel during the "Point Blank" exercise in November 2018. *Eddie Keogh / Reuters*

In the upcoming procurement cycle, several large Western European states seek to allot domestic manufacturers as active a role as possible. This preference for autonomy – that is, to reduce foreign dependency – is motivated by both military and politico-industrial considerations. European decision-makers question whether foreign products – primarily those supplied by US market leaders – can effectively and efficiently cater to the future operational needs of their air forces. Moreover, a tense security environment, the unclear future of the transatlantic alliance, and the experience of the current pandemic all accentuate the insight that states must retain some control over their critical supply chains.

Two consortia aiming to develop and manufacture the next generation of European combat aircraft have formed. Germany, France, and Spain constitute the Future Combat Air System (FCAS) project; Britain and Italy, likely supplemented by Sweden, join forces within the Tempest framework. Scheduled to commence serial production by the 2030s, both undertakings currently are in their concept stages, with FCAS being further along the process. Notably, FCAS and Tempest are overarching project titles, relating to a broad array of interconnected platforms, sensors, and munitions. The centerpieces of these "systems of systems", the actual combat aircraft, are called the New Generation Fighter (NGF) and, respectively, Tempest.

While changes are likely, the basic program setups of FCAS and, to a lesser extent, Tempest, have already become tangible. It is therefore possible to provide a preliminary assessment of both projects – and their relevance for European autonomy in military aerospace – by evaluating the military requirements they set out to address, the overall political approaches they pursue, and the industrial capabilities they seek to utilize.

Military Dimension of FCAS

In terms of military requirements, FCAS is a complex balancing act. Its centerpiece, NGF, is expected to replace combat aircraft currently in use by four military services in three European nations. These are primarily French Rafale multirole fighters, including their carrier-capable "M" version, German Eurofighter Typhoons, focused on air-to-air missions, and Spanish Typhoons, which also fulfil a ground attack role. Notably, France – and, at a later stage, potentially also Germany – will require the aircraft to be nuclear capable, which necessitates a distinct set of datalinks to guarantee a secure command and control architecture. In other words, NGF is expected to fulfill virtually the entire spectrum of modern combat air missions over both land and sea.

This raises the timeless issue of choosing between multirole and specialized design philosophies. It relates to the question of whether a single technological solution will be able to strike a sustainable balance between different performance benchmarks that are partly conflicting. Assuming that Germany and Spain stick to their current mission profiles only, qualitatively enhanced by leveraging next-generation technology, the main drivers of complexity are the French requirements. The resulting trade-offs are further aggravated by the still unresolved issue regarding the degree of stealth capabilities that NGF will have to feature. Design options favoring low radar signatures tend to compromise other important aircraft properties, especially regarding aerodynamics and payload.

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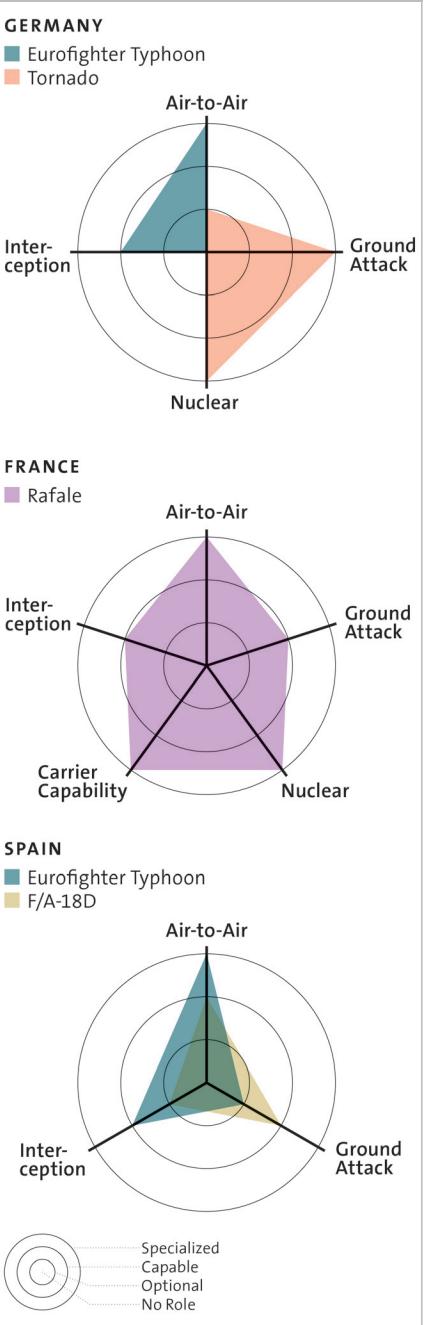
Another risk for FCAS is the decision to conceive NGF, from the outset, in conjunction with unmanned combat aerial vehicles (UCAVs) – that is, drones. UCAVs are here to stay due to the increasing costs of manned platforms, their vulnerability to integrated air defense systems and electronic warfare, and the improving performance of autonomous systems. Air force planners have little choice but to seek higher degrees of automation, thus shifting not only tactical functions but also exposure to the enemy from manned to unmanned systems. Furthermore, UCAVs will likely become more intelligent and autonomous than most observers currently feel comfortable with. A narrow understanding of autonomy – for example, forcing an armed UCAV to return to base if communication with the mother platform is disrupted – will not always make sense, especially in high-intensity combat settings. At the same time, however, there is a range of options between "full human control" and "automatized killing". Finding sustainable compromises in this complex field involves not only considerable technical challenges, but also the necessity of winning over the European – especially German – public, which tends to be very skeptical, in normative terms, of such considerations.

Politico-Industrial Dimension

Three key politico-industrial issues must be resolved to render the FCAS project successful. In essence, all of them relate to the significantly different ways in which FCAS' central actors, France and Germany, approach defense-industrial autonomy. From the French standpoint, national security ultimately hinges on sovereign control over domestic capabilities. The upside of this emphasis on national self-responsibility is a considerable willingness and capability to act, both politically and industrially. The implicit downside, however, is a limited willingness to share. The opposite is the case for Germany, which is considered by many as a champion of European solidarity while also being notoriously passive when it comes to security and defense.

The first issue is export policy. Weapons exports are, *per se,* a double-edged sword. On the one hand, they can render production more efficient by enabling the exploitation of scale economies while also serving as a powerful tool of international diplomacy. On the other hand, even if carried out in a cautious manner, exporting weapons always carries risk, both morally and strategically. French and German decision-makers navigate this trade-off based on different calculations. Whereas France focuses on the opportunities of exports, Germany tends to emphasize the liabilities. The 1972 Schmidt-Debré Treaty, stipulating uniform export regulations for weapon systems co-developed by France and Germany, is still valid. Nevertheless, past decisions on foreign sales were made on a case-by-case basis, with Germany having vetoed French initiatives several times. Against this backdrop and considering FCAS' costs, interdependencies, and range of potentially export-worthy

Roles within Current Inventories



Sources: The Military Balance, Air University

A Generational Question

The technical and tactical innovation dynamics relevant in military aerospace do not necessarily unfold linearly and at an equal pace. While it is difficult to classify specific systems into development generations, the following broad-brush categorization is generally accepted:

The **4th generation** is defined by mid-1980s advances relating to **digitalization and miniaturization** that particularly enhanced manoeuvrability and target acquisition. Examples include the American F-15, F-16 and F/A-18 series, as well as the Russian Su-27 and MiG-29.

The **5th generation**, accessible to non-US users only since the 2010s, is characterized by incremental improvements along 4th-generation criteria, as well as the incorporation of then-radical innovations such as **stealth technology and high-speed data links**. Representative 5th-generation aircraft include the American F-22 Raptor and the F-35 Lightning II.

The **future 6th generation envisions a high degree of decentralization and automation** of tactical functions, implying a further shift from human-controlled, platform-centric concepts to intelligent "systems of systems". It also is likely that manning will be optional from the outset. The US' take on this development step will be the recently announced Next Generation Air Dominance system.

The current **European-designed combat aircraft** – the Eurofighter Typhoon, Rafale, and Swedish Gripen – are often labelled **"generation 4.5"** because they are comparable to 5th-generation aircraft in electronic and handling characteristics while lacking stealth features.

While work on advanced combat aircraft is not limited to the US and Europe, other states will in the medium term remain focused on catching up on current Western capabilities. **Russia**'s 5th-generation Su-57 has recently entered service, eventually to be supplemented by the Su-75. **China**, similarly, has started to modernize its fleet with the J-20 air superiority fighter.

sub-products, Paris is likely to insist on Berlin renewing its commitment to "pragmatic" export rules. This request is likely to be met with significant resistance from the German public, parliament, and government.

The second issue is industrial policy. The French *raison d'état* to maintain national control over strategic industrial capabilities has bred an institutionally ingrained tradition of state-industry interaction, active steering, and direct ownership. By contrast, in German – and, equally, Spanish – politics and administration, the willingness and ability to constructively influence the domestic defense industry appears much less developed. In terms of clarity of mandate and high-level backing, this inevitably reflects onto the ministerial negotiating parties who broker the modalities according to which the workload and profit of FCAS are to be shared. This is likely to prove a disadvantage to German and Spanish manufacturers.

The third issue is the specific character of defense-industrial capabilities. For France, the cooperative defense-industrial rationale promoted by the EU has remained up to this day an optional supplement to a strictly national mainstay. With companies such as Dassault (systems integration in aerospace) and Safran (jet engines), it has maintained a national industrial base capable of autonomously developing and manufacturing systems across a broad spectrum of military applications. Germany and Spain, by contrast, have long shifted most of their ambitions for autonomy from the national to the European level. Especially in the field of military aerospace, they have restructured and subsequently amalgamated most of their industrial capabilities within the Franco-German-Spanish conglomerate Airbus. As not only Airbus, but also Dassault and Safran are key industrial actors of FCAS; many capabilities that Germany and Spain can contribute are already covered, in principle, by French-based companies. This tendency towards duplication instead of complementarity is likely to afflict both the workshare and hierarchy of actors within the project.

Current State of Tempest

Considering all these caveats, how does the Tempest program fare along the same two dimensions? At first glance, the assessment is positive. Overall, there seems to be a relatively high degree of compatibility. Britain, Italy, and Sweden appear to be looking for weapon systems of similar operational properties. Their approaches towards defense-industrial cooperation are also similar in their basic pragmatism, while the manufacturing capabilities they can contribute to a joint development and production effort display a notable degree of potential complementarity.

Crucially, the military requirements informing the design of the Tempest fighter and its subsystems appear to be relatively compatible. Especially among British and Italian fleets, there is significant similarity – not only in current setups, but also regarding the directions and timelines according to which defense planners intend to develop them. Both countries have recently acquired the widely-sold US F-35 multirole fighter. This aircraft covers both nations' carrier aviation requirements. In addition, by being compatible with US nuclear weapons, it enables Italy to participate in the nuclear sharing framework of NATO. Meanwhile, Britain's nuclear deterrent continues to rest on strategic submarines. Hence, Tempest can primarily be considered a replacement for the Eurofighter Typhoon, which in turn is comparable in many ways to the Swedish Gripen. In terms of the capability gaps to be filled, this suggests a relatively clear air-to-air focus, significantly simplifying the engineering challenges Tempest will have to address.

Furthermore, the setup of the Tempest consortium displays a number of potential advantages in politico-industrial terms. Overall, security-related cooperation among these countries appears largely unencumbered by political symbolism and lock-in effects. Despite significant differences in overall national strategy, Britain, Italy, and Sweden are similar in their "selective" notions of defense-industrial autonomy as well as in their sober, synergy-driven approaches towards that end. Respective ties are close, with the UK-based multinational BAE Systems acting as the hinge. BAE Systems has cooperated on a high level for many years with the Swedish firm SAAB as part of the Gripen project. Similarly, BAE System is involved with the Italian Leonardo conglomerate not only regarding the further development of both nations' Eurofighter Typhoon fleets, but also in the F-35 program. The latter is likely to have resulted in valuable knowledge transfer.

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Preliminary Assessment

Compared to FCAS, the overall ambitions and setup of Tempest appear more straightforward, which is clearly an advantage. The set of operational requirements is narrower,

Further Reading

Justin Bronk, "FCAS: Is the Franco-German-Spanish Combat Air Programme Really in Trouble?", *RUSI Commentary* 01.03.2021.

Ronan Le Gleu / Hélène Conway-Mouret, Information Report on behalf of the Foreign Affairs, Defence and Armed Forces Committee (1) on the Future Combat Air System (FCAS), *French Senate,* 15.07.2020.

Dominic Vogel, *Future Combat Air System: Too Big to Fail* (Berlin: SWP, 2021).

mainly because both the British and Italian F-35s already cover many mission profiles that would otherwise be complexity drivers. Furthermore, the political authorities and industrial actors involved have successfully cooperated in the past and are increasingly geared towards this end. Even Sweden, which until now has pursued a policy of industrial autonomy in military aerospace, is likely to accept that success in this field increasingly depends on coordinated efforts of friendly nations.

Taking into account the broader context of the Tempest program, however, its slightly lower overall ambitions can also be disadvantageous because they imply lower political salience. Unlike the countries constituting FCAS, Britain and Italy – the actors thus far most committed to Tempest – have not placed all their eggs in the basket of a single, overarching military aerospace project. This means that a possible failure of Tempest would be less problematic for them. Militarily, they will possess sizable F-35 fleets by the 2030s. Politically, symbolic aspects of European cooperation are not of great concern to them. Furthermore, in terms of industrial considerations, they have already filled parts of their order books as partners of the F-35 program. Given the overall pressure to perform is therefore lower, minor disagreements within the consortium or politico-economic shifts in either country may significantly endanger the future of Tempest.

The opposite is the case regarding FCAS, whose particularly high ambition implies high political salience. Broadly speaking, the project appears "too big to fail" for the involved nations. Militarily, for the lack of alternative strategies, a possible default of FCAS would likely leave the French, German, and Spanish air forces with no other option than to purchase US aircraft – or even Tempests – in order to remain operational. Politically, it would be a symbolic blow to Franco-German efforts to strengthen "European" defense capabilities. For the already-struggling military aerospace industries of the involved countries, FCAS is an issue of "now or never". If the project were to break down, this would likely mean the end of their independent (above sub-contractor level) combat aircraft activities. Against this backdrop, and considering that ambition levels may become more humble as the project evolves, FCAS has a good chance to be dragged over the line despite the significant obstacles it is likely to encounter.

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An obvious question is whether a re-configuration of the project structures of FCAS and Tempest is conceivable, especially with the uncertain strategic terrain ahead. From the political standpoint, the probability of an official, far-reaching consolidation appears low, especially considering the French unwillingness to cede influence over FCAS. That being said, technological and budgetary realities might force actors to seek synergies at the subsystem level. This particularly relates to the key component of any combat aircraft, the jet engine. Both FCAS and Tempest will require highly sophisticated, highly expensive, and likely similar turbines, which, in the Western world, are manufactured by closely intertwined multinational corporations. In this context, an informal agreement to seek commonality on such technologies – as well as regarding more loosely affiliated systems such as UCAVs – while maintaining formally separate project structures appears feasible.

For more on military doctrine and arms procurement, see CSS core theme page.

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