



Combat Air Systems for the 21st Century: A Shared Stake for Europe

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Air dominance was the strength of Western military powers from the early 1990s until the mid-2010s. The proliferation of air defence systems, notably Russian S300 and S400 missile systems, has created a major challenge. This is the reason why acquiring an up-to-date combat air system is crucial to restore the level playing field. Europeans seem to have become aware of the stakes, but they respond in a scattered manner.

The states of Europe appear unable to converge towards a single project for the future combat air system. The United Kingdom, Italy, and Sweden collaborate on Tempest (and the next generation of the Gripen), while France, Germany, and Spain work together on the Future Combat Air System (FCAS). Meanwhile, the F-35 community is growing in Europe, and could constitute a third option if and when the United States launches the development of a sixth-generation aircraft. One has to ask whether this fragmentation is sustainable at both the domestic and the European level.

Combat air systems are one of the most symbolic defence capabilities, especially for arms-producing countries. However, the acquisition of these capabilities appears less and less affordable on a purely national basis. Pooling efforts between the largest possible number of allies is the obvious solution. Yet France, Germany, Italy, Spain, and the UK already failed to develop a new generation of fighter aircraft together in the past, when France opted out of the Eurofighter project and eventually developed the Rafale aircraft alone in the 1980s.¹ Should we fear history repeating itself? Or could the transformation of technology and manufacturing favour another way of cooperating, which would avoid the traditional limitations of armament cooperation?

THE ECONOMIC FUNDAMENTALS OF COOPERATIVE PROGRAMMES

European arms-producing countries are confronted with a paradox. Maintaining a domestic defence industrial base constitutes a prerequisite to achieve sovereignty, but since the end of the Cold War a purely domestic industry has become less and less sustainable. Limited budgets combined with the rising cost of advanced defence systems should push the states

of Europe to enlarge the market for any major defence capability by pooling their efforts, so that between them they can reach the required critical mass.

In any case, the cost of future combat air systems appears prohibitive for almost all arms-producing countries. Beyond the United States, China, and maybe Russia, no country can afford such a programme on a purely domestic basis. The Rafale programme cost €43 billion, while the trilateral FCAS should require up to €80 billion, and that is a conservative estimate.² Tempest similarly would require core funding of more than £25 billion (€28 billion).³

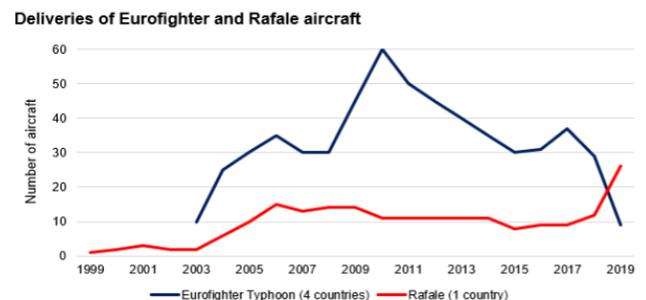
This cost escalation reflects significant technological improvements. However, the resulting operational advantages come with higher and higher unit costs, because outstanding performance relies on expensive inputs, complex architectures, and challenging systems engineering. This trend creates a vicious circle: higher unit costs result in smaller fleets, which further raises the unit cost as economies of scale vanish. Cost escalation is not specific to combat aircraft, but a global trend for major capabilities, ranging from 5 to 12 percent per year on average over the last half century.⁴

Furthermore, acquiring a new capability constitutes just one part of the equation. Armed forces can secure their strategic autonomy only if the domestic industrial base is sustainable in the long run. Indeed, providing air forces with the capabilities they need goes far beyond the initial delivery. Defence industry must be able to support combat air systems throughout their decades-long lifecycle by maintaining, upgrading, or renewing in-service fleets. For instance, early studies for the Rafale took place in the mid-1970s, while the French Air Force will decommission the last aircraft in the late 2060s.

Eurofighter, F-35, or any other combat aircraft has a similar lifecycle.

A sustainable and innovative industrial base is a condition sine qua non for guaranteeing strategic autonomy. This requires maintaining a sufficient flow of activities over time to preserve the arms-producing countries' competences and skills in design and manufacturing. This was already difficult to achieve for the generation of Eurofighter and Rafale, with an average annual production rate of just above ten for each participating country. Exports can complement this, but such complementary orders are unpredictable, and often insufficient to reach the appropriate level of production evenly throughout a platform's lifecycle.

DELIVERIES OF EUROFIGHTER AND RAFALE AIRCRAFT



Source: Author's analysis of the annual reports of participating companies

A cooperative programme seems the only way of maintaining an effective and comprehensive defence-industrial base on European soil, the UK included. Otherwise, there is no guarantee that domestic industry can deliver effective and affordable capabilities and related support. Europeans would be well advised to resolve this challenge between them, since any project shared with the US will very likely be structurally unbalanced, in view of the huge asymmetry in needs and resources.⁵

EUROPE AS THE RIGHT LEVEL FOR A SUSTAINABLE INDUSTRY

Since the 1970s, Europeans have increasingly resorted to cooperative programmes to fulfil their capability needs as well as to preserve a domestic technological and industrial base. Various schemes have revealed different shortfalls, however: higher R&D and procurement costs than expected, delays, unsatisfactory compromises on requirements, limited industrial consolidation or specialisation between participating countries, etc.

Cooperative programmes can disappoint because states are likely to pursue contradictory goals. They cooperate to make defence investment affordable but, simultaneously, they expect to maintain as many activities inside their domestic industrial base as possible (through the rule of *juste retour*). While making it easier to gather a large number of participating countries, *juste retour* contradicts the reasons for cooperating, and results in redundancies that increase the cost of programmes and induce weaknesses within the European defence technological and industrial base.

Nevertheless, cooperative programmes can be truly advantageous for all participating states, independently from the size of their contribution – if they are well conceived and managed effectively. R&D costs represent a large share of any major programme. Cooperating countries could share these sunk costs. In addition, pooling orders can increase production series and reduce unit costs through economies of scale and higher productivity. The cooperation on armoured vehicles between Germany and the Netherlands (Boxer) and between Belgium and France (CaMo) provides a perfect illustration of these benefits. Thus, disappointment with past cooperative programmes should not prevent Europeans from exploring innovative ways for future cooperation.

This certainly applies to future combat air systems. There simply is not enough room for two or more competing programmes in Europe. Meanwhile, it is also very unlikely that the two existing projects could merge, and recruit other European countries. However, a third way is possible, pooling efforts between both projects to a certain extent. Brexit should not be allowed to stand in the way of such cooperation, nor should other countries that would be interested in joining a collective dynamic, like Poland or Belgium, be excluded.

The institutional tools to make this possible exist. Even though a single programme is unlikely, the creation of the European Defence Fund constitutes an opportunity to develop a shared technological and industrial base in Europe. The fact is that the ecosystem of defence has undergone deep changes, which opens up the way for a more creative approach to European cooperation – more flexible and more scalable to the potential contribution of each participating country. It may not be necessary, therefore, as it was the case before, to unite all interested states in a single programme.

INDUSTRY 4.0: NEW WAYS OF COOPERATION?

Two technological evolutions also provide fruitful ground for cooperation on future combat air systems in Europe: on the one hand, such systems are much more than just another aircraft; on the other hand, the fourth industrial revolution (Industry 4.0) creates a world of opportunities to imagine new modes of cooperation.

First, a future combat air system is not merely a new combat aircraft, but a system of systems, composed of various types of manned and unmanned aircraft as well as flying objects, including remote carriers and missiles. Such configuration opens room for a contribution by

any interested country, which was more difficult before, when cooperative programmes used to concern a single large complex weapon system.

Historically, the increased complexity of advanced combat aircraft was the main driver of cost escalation. In order to keep this trend under control, armed forces have conceived multi-mission platforms. This “one fits all” approach led to the replacement of several platforms by just one. The Rafale, for example, is able to perform the tasks of 5 to 7 earlier types of aircraft. However, a platform that performs more and more tasks becomes very expensive to develop, produce and support. Rather than stop cost escalation, this strategy ended up nurturing it, thus confirming “Augustine’s Law”.⁶

The concept of a system of systems makes an alternative strategy possible, since it is no longer necessary to integrate all capacities into one platform. Different components of the combat air system can be developed separately from a technical, industrial and geographical point of view. It is not necessary for all countries to agree on a single product, but only on a shared base. Each country and its industry can then participate according to its own competences and expectations in the field of design and production. This change of concept is an opportunity to invent new modalities for cooperation.

Second, Industry 4.0 provides the technological means to implement such a disruptive approach to cooperation. Manufacturing has greatly evolved since the late 1990s when the F-35, the most recent combat aircraft, was conceived. It is now possible to go beyond the logics of the third industrial revolution (Fordism), which required large volumes of a standardised production to minimise unit costs.

Thanks to the digital transformation and “additive manufacturing”,⁷ it is now possible to produce short series at an affordable cost, and to abandon a logic of verticalised and centralised production for cooperative programmes. Different countries can therefore work together on a programme while keeping a significant part of the production on their national territory, which would make it possible to combine cooperation and strategic autonomy. The Tempest and FCAS projects offer limited opportunities for industrial participation from countries with a more limited defence industrial base. Nevertheless, this new technological ecosystem can keep programmes open for eventual contributions from countries that do not position themselves as system integrators, such as Belgium, the Netherlands, or Poland.

Finally, these new tools also offer the means to maintain or even develop long-term strategic autonomy for European countries. Thanks to the reduction in production series, it is possible to introduce innovations more regularly and to implement a logic of upward spiral development. This creates an opportunity to adapt in-service fleets as best as possible to a given country’s defence requirements as well as to the evolving geostrategic challenges.

CONCLUSION

Today’s technological and manufacturing ecosystem provides opportunities to combine national strategic autonomy and European cooperation without painful compromises. Countries could share R&D costs for a joint project while managing production domestically, focusing on economics of scope rather than of scale, helping to overcome the contradictions experienced in previous cooperative programmes. European countries have a major opportunity to both reinvent cooperative programmes and improve their domestic and

collective strategy autonomy by working together to develop the next generation of combat air systems.

This possible new configuration constitutes a chance to really move forward a true European defence technological and industrial base, in which each country can define a niche position, without requiring a constraining “big programme” frame or industrial consolidation detrimental to its domestic industrial interests. Such configuration could represent a game-changer in the field of cooperative programmes, in particular for countries like Belgium that focus on specific niches.

As Karl Marx noted in *The Eighteenth Brumaire of Louis Napoleon* (1852), “Hegel remarks somewhere that all great world-historic facts and personages appear, so to speak, twice. He forgot to add: the first time as tragedy, the second time as farce”. We could hope that the United Kingdom, France and their European partners will this time prove Marx wrong regarding the ability of Europeans to develop together the next generation of combat air systems.

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ENDNOTES

- ¹ Faure S.B.H. (2020) Quitter la défense européenne, Le choix de la France pour l'avion de combat Rafale. *Politique européenne* (67-68): 84-113.
- ² Le Gleut R., Conway-Mouret H. (2020) *2040, l'odyssée du SCAF - Le système de combat aérien du futur*. Information report 642. Paris: Senate, 15 July 2020.
- ³ Bronk J. (2020) *Combat Air Choices for the UK Government*. Occasional Paper. London: RUSI, July.
- ⁴ Arena M.V., Blickstein, I., Younossi O., Grammich C.A. (2006) *Why has the cost of navy ships risen?* Santa Monica: RAND Corporation; Davies, N., Eager A., Maier M., Penfold L. (2012) *Intergenerational equipment cost escalation*. Defence Economic Research Paper 1, London: Ministry of Defence.
- ⁵ Bellais R. (2020) Royaume-Uni et Union européenne, un mariage de raison dans l'armement. *Revue Défense Nationale* (832): 73-78.
- ⁶ "Law Number XVI: In the year 2054, the entire defense budget will purchase just one aircraft. This aircraft will have to be shared by the Air Force and Navy 3-1/2 days each per week except for leap year, when it will be made available to the Marines for the extra day." (Norman Augustine, *Augustine's Laws*. Reston, Virginia: American Institute of Aeronautics and Astronautics, 1997).
- ⁷ Bellais R., Fiott D. (2017) Disruptive innovation, market de-stabilization and Europe's defence market. *The Economics of Peace and Security Journal* 12(1): 37-45.