



HAL
open science

MBDA's Industrial Model and European Defence

Renaud Bellais

► **To cite this version:**

Renaud Bellais. MBDA's Industrial Model and European Defence. Defence and Peace Economics, 2021, pp.876-893. 10.1080/10242694.2021.1926176 . hal-03271365

HAL Id: hal-03271365

<https://ensta-bretagne.hal.science/hal-03271365>

Submitted on 1 Jul 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

MBDA's industrial model and European defence

Renaud Bellais

ENSTA Bretagne, Brest, France, and CESICE, Université Grenoble Alpes, Grenoble, France

ENSTA Bretagne 2 rue François Verny 29806 BREST cedex 9, France,
renaud.bellais@gmail.com, +33 607 656 776 (mobile phone)

Graduated from Institut d'Études Politiques de Lille (1994), PhD in economics from Université du Littoral (1998) and accredited research director ("HDR") from Université Grenoble-Alpes (2004), Renaud Bellais is an associate researcher in economics at ENSTA Bretagne and at CESICE, Université Grenoble Alpes. He has been working in the defence industry since 2004. Renaud Bellais has also teaching commitments in defence economics (University Paris 2, French Army Academy), innovation economics (University Paris 1, ENSTA Bretagne) and international economics (IRIS). He is also Institutional advisor to the CEO of MBDA since 2017.

MBDA's industrial model and European defence

Among European arms producers, MBDA represents the most advanced example of industrial integration and cross-border specialisation, thanks to a unique model of French-British centres of competences. However, it constitutes an exception inside the European defence technological and industrial base. It is therefore relevant to analyse why MBDA was able to achieve such consolidation process from fragmented competences of the European missile industry and to merge once competing companies despite the lack of a unique regulatory framework at the European level.

This article presents the main features of MBDA today. It analyses the consolidation process in the European missile industry that created MBDA. It underlines how cooperative programmes provided a critical impulse in favour of industrial consolidation and the specialisation of MBDA sites across Europe. It explains how technological and industrial assets were reshuffled across European borders. It focuses on exports as a key dimension for MBDA's model. Finally, it concludes by exploring the limits that result from the lack of a unified regulatory framework in Europe.

Keywords: arms production, missiles, integration, specialisation, Europeanisation, cooperative programmes, exports.

Subject classification codes: G34, L22, L51, N44.

Introduction

Can an arms-producing company implement a European defence industrial model¹ despite the lack of a European defence? This could represent a paradox, even though some trans-European defence companies exist and even constitute the largest industrial players in Europe (e.g. Airbus, Thales, BAE Systems or Leonardo). However, being a European company owning assets across Europe does not mean that these groups form truly European companies, that is, with an integrated industrial model beyond an

¹ This article is part of Company Survey series number 2.

industrial footprint in different European countries. The persistence of national regulations and markets has prevented domestic companies from engaging in “mega mergers” that the defence industrial base experienced in the United States and in China in the 1990s or in Russia in the 2000s.

Nevertheless, when stakes and political support are sufficient, stakeholders are able to overcome the complex institutional setting in Europe and promote the creation of Europe-wide champions. In the field of missile systems, MBDA represents a good example of such transformation inside the European technological and industrial base. It is not unique, since Airbus Helicopters or Thales Alenia Space have also resulted from such integrative dynamics at the European level. However, these examples appear as the exception rather than the rule in Europe (Bellais and Jackson 2014), and MBDA has taken the integration process through consolidation and specialisation further than any other European defence company.

This article aims at explaining why MBDA was created, how the merger of legacy activities was able to engender an integrated industrial model and what are the limits resulting from the lack of a unique regulatory framework at the European level. Part 1 presents the main features of MBDA today. Part 2 analyses the consolidation process in the European missile industry that led to the creation of MBDA. Part 3 underlines how cooperative programmes provided a critical impulse in favour of the industrial consolidation and the specialisation of MBDA sites across Europe. Part 4 explains how technological and industrial assets were reshuffled across European borders. Part 5 focuses on exports as a key dimension for MBDA’s model. Part 6 concludes by exploring the limits that result from the lack of a unified regulatory framework in Europe.

Main characteristics of MBDA in 2020

MBDA is quite a young company, for it was created only two decades ago.

Nevertheless, it has been a key player since the beginning of the European missile industry because it resulted from the consolidation of major players in its field.

Indeed, it consists primarily in the merger of missile divisions or subsidiaries of EADS (now Airbus), Finmeccanica (now Leonardo), and BAE Systems in December 2001. It benefits from the stability of its shareholders, which have not changed since its creation. Shareholding reflects the assets provided initially by each founding company: 37.5 percent for Airbus and BAE Systems respectively, and 25 percent for Leonardo.

Among the largest European defence companies, MBDA stands out since it is a pure player in both defence and missile systems. Most arms-producing groups present a diversified portfolio in defence activities and, most of the time, commercial ones. Since its creation, MBDA did not depart from this market segment even though it has enlarged its scope from missile to missile systems.

It is not surprising that MBDA is positioned as a leading industrial player in the field of missile systems not only in Europe, where it has remained the most important domestic supplier. On open export markets, it competes head to head with American, Russian or Israeli leaders (Chinese companies are newcomers on international markets and exports only represent a small share of their revenues). It benefits from quite stable revenues as underlined in Graph 1. Over the past two decades, MBDA was able to maintain a market share globally and to preserve or develop a products portfolio that makes it capable of competing over the whole scope of missile systems.

[Insert here Graph 1]

Estimating the turnover of missile producers or markets is not easy, for most major companies are not specialised into missiles but have large and diverse portfolios.

Even though data are available regarding the global defence revenues of major arms-producing companies through their annual reports or the analysis of SIPRI and *Defense News* (Top 100 arms companies), it is not easy to compare mono-product companies with multi-product groups. Most of the time, for these groups, missile activities belong to a larger division. Their annual reports do not provide detailed information on each market segment. In addition, Russian and Chinese companies are key players but their turnover is far from being transparent, especially when we are looking for information on specific defence systems.² Nevertheless, it is possible to make a benchmark with MBDA's main competitors at least on international markets.

At first sight, MBDA's revenues appear small compared to the largest arms-producing companies for which military revenues reach tens of billions of dollars. However, a relevant comparison should be based on the same market segment. Lockheed Martin's missile business represented \$8.4 billion per year on average between 2010 and 2019, which is very close to Boeing (\$8.1bn). Even though MBDA's revenues only represent half of their revenues (\$4.7bn), they are much larger than other competitors like Boeing, IAI, Kongsberg or Rafael whose revenues range from \$500m. to \$1bn. A similar comparison with large Russian and Chinese companies is almost impossible due to the lack of detailed information, as demonstrated by Nan and Su (2020)'s seminal research.

[Insert here Graph 2]

Despite fluctuations in revenues over the past two decades, MBDA was able to preserve its workforce and even increase it in the late 2010s, as the missile industry

² Nan and Su (2020) published a seminal research on the arms sales of Chinese companies. However, they were not able to estimate their revenues on each market segment. Symmetrically, they achieved a thorough estimate of China's military expenditure in 2021, but without being able to provide data on missile expenditure.

entered a new cycle of procurement domestically and abroad. As the present article will demonstrate, this stability of MBDA workforce is intrinsically linked to the consolidation of a large share of the European missile industry and the possibility to specialise in sites.

The geographical distribution of its 12,000 employees still reflects the distribution of jobs that pre-existed in 2001. As described in Table 1, employees are mainly located in France and the United Kingdom, which represented the initial nucleus of MBDA, followed by Italy and Germany that joined the group a few years later (see Part 2). Table 1 also underlines that MBDA has specialised its sites through a progressive integration process to be discussed throughout this article.

[Insert here Table 1]

Besides being a pure player in defence systems, MBDA is especially positioned because many of its products are strongly linked to major platforms. This constitutes a specific feature among major systems integrators. Indeed, missile and missile systems can be stand-alone capabilities but MBDA estimates that only 25 percent of its order intakes in value are not related to platforms. Most missile systems are intrinsically associated primarily with aircraft (40 percent) or naval capabilities (20 percent). This feature has strong implications in terms of conception but also market access, since missiles go along with the sale of corresponding platforms.

Such configuration is quite unusual at the integrator tier. It creates a complex situation. MBDA benefits from the promotion of platforms, which facilitates its order intakes. The interaction goes also the other way round, as specific missiles can increase the value of a given platform especially in export markets. For instance, Dassault Aviation leveraged on Scalp EG/Storm Shadow missile to sell Rafale aircraft to Egypt in 2015. However, such virtuous interaction goes with side effects when the fate of a

given missile is associated to a specific platform. Integration engineering is usually expensive, and it requires the authorisation from both the platform integrator and launch state(s). Excluding a missile system from a platform could constitute a strategic move for both the platform integrator that benefits from it, as a competitive advantage, and the platform integrator that promotes another missile system through a global offer. This lock-in/lock-out phenomenon engenders specific relations between missile and platform integrators. This is the reason why, explained the then CEO Antoine Bouvier, MBDA tried to develop missile systems that are “platform neutral”³.

Consolidating the European missile industry

European arms-producing countries are confronted with a paradox. Maintaining a domestic defence industrial base constitutes a prerequisite to achieve sovereignty or at least strategic autonomy, but a purely domestic industry has become less and less sustainable since the end of the Cold War (Hartley et al. 2008). Limited budgets combined with the rising cost of advanced defence systems are likely to push European states to enlarge the market for major defence capabilities by pooling their efforts in order to reach the required critical mass (Bellais and Oudot 2019).

Throughout the 1990s, the missile industry experienced major post-Cold War adjustments. More than other categories of procurement, missile systems faced a dramatic fall of orders. While budget cuts were impressive for defence budgets globally, the budget for munitions, including missiles, suffered from cuts twice or thrice higher than other budget lines. Graph 3 illustrates this disruption in the domain of anti-tank missiles: MBDA saw its orders collapse in a few years and never recovered to the 1980s

³ Antoine Bouvier, MBDA CEO, “The French-British couple and the European strategic autonomy”, Brown Bags Seminar Series, Ifri, Paris, 17 April 2018.

level. This resulted in a crisis for missile companies in Europe: they had to consolidate an oversized industrial base to preserve competences as well as to access other European markets in order to maintain their orders intake.

[Insert here Graph 3]

In addition, like most major capabilities, missile programmes experience a cost escalation that has accelerated since the 1980s. This cost escalation reflects significant technological improvements. A comparison between successive generations of major capabilities makes obvious that the most recent systems offer higher performances while implementing a wider range of missions. For instance, in the 1980s, Stinger missiles helped Afghan Mujahidin acquire a clear, while temporary, tactical advantage since Soviet platforms were only adapted to counter missiles of the previous generation (Bellais 2021). Similarly, Rafale aircraft were conceived as a multi-mission platform, able to replace 5 to 7 pre-existing aircraft.

However, 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 volumes of orders, which further raises the unit cost as economies of scale vanish, thus confirming "Augustine's Law"⁴. Cost escalation constitutes a global trend for major capabilities, ranging from 5 to 12 percent per year on average over the last half century (Kirkpatrick 2004; Arena et al. 2006; Davies et al. 2012; Hartley 2020). Missiles follow the same trend in cost escalation, even though these capabilities remain affordable compared to submarines, combat aircraft or tanks.

⁴“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).

While European states had been able to launch purely domestic programmes for previous generations, such a choice appeared more and more difficult in the 1990s. This is why they eventually considered to launch the development of major missile projects as cooperative programmes (Aster, Scalp EG/Storm Shadow, Taurus, etc.). Simultaneously, missile companies were no longer able to survive alone as their domestic and export markets had shrunk. Cross-border consolidation became the sine qua non condition for both their survival and the preservation of a sustainable and innovative industrial base as a guarantee for the strategic autonomy of their home countries.

However, the European consolidation process was quite complex because of political constraints, domestic military requirements, and companies' strategies. As Faure et al. (2019, 136) note: "Twenty years after the restructuring upheavals experienced by the defence industry in the 1990s, the homogenisation process of integration of European firms predicted at the time has clearly not happened." In Europe, national borders hindered the possibility of a merger mania that occurred in the United States. This process was particularly intense in the field of missiles. From 1990 to 1998, the number of companies reduced from 13 to 3 in tactical missiles: Lockheed Martin, Raytheon, and Boeing (GAO 1998). Creating cross-border joint ventures quickly appeared as a second best solution in Europe. This kind of consolidation favoured a first round of consolidation, at the beginning of the 1990s, to overcome political barriers in order to enlarge accessible market size and to share development and production costs in a context of decreasing military spending (Hébert 1995, 2006).

As illustrated in Graph 4, the consolidation began in 1996 when the missile division of Matra Defence and BAe Dynamics, the missile subsidiary of British Aerospace, merged to form a French-British joint venture, Matra BAe Dynamics

(MBD). GEC and Finmeccanica followed and merged their own missile activities into a British-Italian joint venture, Alenia Marconi Systems in 1998. In both cases, this consolidation consisted of gathering assets into a specialised company but this financial reshuffle had limited impacts on pre-existing sites or programmes in each country. Industrial integration was limited, since each domestic subsidiary remained organised on the ex-ante basis.

These joint ventures had two main objectives. First, each company looked for a mate that provided a complementary portfolio of missile systems (as a means to become more competitive) and access to each other's domestic market (to counterbalance decreasing domestic demand). Second, newly created joint ventures were more able to maintain and increase their market share on export markets thanks to a more competitive and comprehensive portfolio as well as political support from their different home countries. However, industrial and technological synergies were difficult to implement since national states prevented companies from engaging a cross-border industrial rationalisation. Therefore, such environment restricted the depth of consolidation beyond the merger of company stocks, which could be defined as a purely financial consolidation since this latter does not lead to an in-depth reorganisation of manufacturing and intangible assets between merged companies and across borders (Bellais and Jackson 2014).

[Insert here Graph 4]

The fate of European missile industry was then influenced by the reshuffle of arms-producing groups in the late 1990s. While Matra and Aerospatiale were rivals in France for ages in the field of missiles, the French state eventually decided to create an aeronautical and space champion by merging Matra Défense and Aerospatiale in 1999 (Hébert 2006; Hartley 2012). The new company, Aerospatiale-Matra, inherited from

Matra's participation into Matra BAe Dynamics and from Aerospatiale's missile business unit. The same year, a consolidation took place in the United Kingdom when British Aerospace and Marconi, the defence division of GEC, merged to create BAE Systems. Similarly, the new company inherited from participations into the two rival British missile leaders, Matra BAe Dynamics and Alenia Marconi Space.

This new portfolio and strategy of both BAE Systems and Aerospatiale-Matra favoured the gathering of all their missile assets into a new company, MBDA. This latter naturally associated the Italian defence group Finmeccanica as the co-owner of Alenia Marconi Space. While Matra BAe Dynamics already owned 30 percent of LFK, the missile subsidiary of DASA, in Germany since 1997, the decision to create MBDA was taken before the EADS existed (July 2000). Therefore, the full takeover of LFK was delayed until 2006, after MBDA achieved its own integration and that EADS and MBDA agreed on the valuation of LFK. This last move achieved the creation of an "Airbus of missiles" with hopes for a comparable destiny.

MBDA looked to increase its international footprint by setting up a subsidiary established in Spain in 2010 and by acquiring the Viper Strike activity of Northrop Grumman in Huntsville, Alabama, in 2011.

The consolidation of the European missile industry goes beyond the creation of an integrated company. MBDA fully owns subsidiaries that are critical for its supply chain, namely:

- Bayern Chemie (propulsion systems) and TDW (warheads) in Germany;
- Matra Électronique (electronic components) and GDI Simulation (training systems) in France;
- 50 percent of Roxel (propulsion systems), on par with Safran, in France and the United Kingdom.

An industrial transformation through cooperative programmes

MBDA differs from most European defence companies, since it has achieved a unique level of cross-border industrial integration (Faure et al. 2019). While it was born in December 2001, it is possible to speak about a 25-year transformation. Its history began in 1996 with initial discussions between France and the United Kingdom to jointly develop cruise missiles, leading to the Scalp EG/Storm Shadow programme. Even though missile producers created British-French and British-Italian joint ventures, these companies led to very limited industrial consolidation and even less specialisation between their sites. This latter was possible only when the launch of common programmes legitimated a reshuffle of pre-existing industrial competences.

Europeans have been cooperating for capability programmes since the 1960s, and the field of missile was very active with many bilateral programmes notably between France and Germany (e.g. Roland, HOT, Milan) or the United Kingdom and France (e.g. Martel, Milan, FAM anti-air system). Even though this dynamics ramped up in the 1990s, state cooperation hardly succeeded in creating truly European integrated companies. Most of the time each country and each participating company tried to preserve its own domestic competences or even increase them through these cooperative programmes. MBDA appears as an exception since cooperative programmes were truly transformative thanks to the combination of political will, capability development and industrial vision – sharing many features with the creation of Eurocopter.

European countries have increasingly looked at cooperative programs since the 1970s to fulfil their capability needs. Nevertheless, the ways through which most European cooperative programs have been managed appear unsatisfactory. Different schemes have been tested but they all revealed major shortfalls (Bellais 2017): higher R&D and procurement costs than expected, delays, unsatisfactory compromises on

requirements, limited industrial consolidation or specialisation between participating countries, etc. Cooperative programmes are usually disappointing because participating states tend 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”.

This was not the case with the key cooperative programme on cruise missiles, a very strategic capability, which gave birth to MBDA: Scalp EG/Storm Shadow. This French-British programme was not a “one shot” cooperation but conceived so as to foster an integration of participating companies and create a unique and sustainable missile provider for both countries. France and the United Kingdom agreed on a mutual dependency, because this programme constituted the opportunity for both countries to master the conception and production of cruise missiles (in a field historically dominated by the United States). The bilateral industrial strategy pursued several objectives: “to preserve the defence industry, to make savings in production costs, and to organize interdependence.” (Pannier 2018, 433) Contrary to many previous European cooperative programmes, the French and British states created the appropriate environment (described in the next part) that allowed the missile industry to achieve empirically the theoretical benefits of such bilateral programme, giving it its full transformative potential.

As such, Scalp EG/Storm Shadow was not a cooperative programme, since there were no formal MoU or programme ad hoc agency. France and the United signed two separate contracts with then Matra BAe Dynamics, the precursor of today’s MBDA, but contracts incentivised industry to maximise commonality and favoured industry-led choices (Devaux and Ford 2018). This supply-push approach departs from the traditional demand-pull approach that characterises most cooperative programmes. With

the absence of “juste retour” requirements and reduced state interferences, the industrial integrator was able to specialise its sites and select subcontractors on a “best athlete” principle. This governance favoured industrially based decisions to minimise specifications, promote cross-border specialisation, maximise economies of scale, and promote an exportability-by-design. These features are quite exceptional for cooperative programmes.

Scalp EG/Storm Shadow was transformative by combining political and industrial dynamics aligned towards creating a sustainable and autonomous industrial base. As Devaux and Ford (2018, 11) underline, “the more or less simultaneous signature of the French and British contracts became the *sine qua non* condition for the definitive merger of Matra Défense and BAe Dynamics into the new firm Matra-BAe Dynamics or MBD.” Reciprocally, the industrial consolidation represented the cornerstone of this programme. As we will detail in the next part, political and industrial decisions taken for the Scalp EG/Storm Shadow resulted in an in depth industrial consolidation. Consequently, on the demand side, France and the United Kingdom became mutually dependent on each other's industrial base for critical components. On the supply side, the creation of centres of excellence has made a demerger of MBDA quite difficult contrary to many joint venture or special purpose companies.

Meteor constituted another dimensional cooperative programme in the industrial integration of MBDA (Devaux and Ford 2021). It contributed to deepen the consolidation of assets between national entities inside MBDA beyond the French-British geographical area. Germany, Italy, Spain and Sweden joined France and the United Kingdom for developing this beyond-visual-range air-to-air missile. Gathering a large volume of domestic orders and several industrial competences throughout Europe was the means to develop this capability between Europeans.

It is remarkable that, in this programme too, states' objectives aligned strongly with industry's wider technological and manufacturing strategy. Devaux and Ford (2021) demonstrate that the complexity and scale of challenge of the Meteor programme, like Scalp EG/Storm Shadow, required a strong industrial lead with, above all, an effective industrial structure. This included a more extensive consolidation of the European missile industrial base, as we underlined in the previous part.

Meteor programme gave a decisive push for integrating Alenia Marconi Systems and Aerospatiale Matra Missiles into MBD, creating MBDA in 2001. The consolidation was even larger due to the dynamics of the Meteor programme. MBDA took the full control of LFK (then owned at 81 percent by EADS⁵), with its subsidiary TDW, in 2006. It also acquired Bayern-Chemie/Protac (owned by EADS Deutschland and Thales at 50 percent respectively) in 2007. This horizontal and vertical integration of key actors of the Meteor value chain into a single company, capable of autonomous decision-making, was critical to the programme's success. Reciprocally, the Meteor programme gave essential additional momentum to the creation of MBDA when this process faced a challenging phase, according to Devaux and Ford (2021).

MBDA is not the only company that has resulted from cooperative programmes in Europe. For instance, Eurocopter (now Airbus Helicopters) was created in 1992 after France and Germany had launched the Tiger helicopter programme. Merging the helicopter divisions of Aerospatiale and DASA (MBB) appeared as the natural outcome of such cooperation, which intrinsically linked the French and German entities. However, no other European company has experienced the same level of industrial and technological integration and specialisation across national borders.

⁵ The shareholding of LKF evolved between 1997 and 2006 due to asset reshuffles.

From financial merger to industrial assets consolidation

While launching Scalp EG/Storm Shadow and then Meteor contributed to preserve and even strengthen the missile industrial bases in participating countries, these cooperative programmes were not sufficient to guarantee the sustainability of such bases. Indeed, cooperation does not lead automatically to consolidation, which was inevitable due the evolutions of defence markets in the 1990s. France and the United Kingdom became aware of the necessity to push industrial consolidation further. This move was also nurtured by the “Spirit of Saint Malo”, that is, the French-British summit in December 1998 where Tony Blair, Jacques Chirac and Lionel Jospin gave a decisive impulse to the deepening of European defence (Pannier 2018, 426).

After the launch of Scalp EG/Storm Shadow programme and the creation of MBDA, the equation was still missing a significant dimension: a political blessing on the cross-border consolidation of technological and industrial assets. At the turn of the century, MBDA benefitted from the convergence between France and the United Kingdom on defence stakes and ambitions. As Béranger (2020, 139) underlines: “This industrial and political momentum resulted from a shared desire to strengthen strategic autonomy in order to provide the best capabilities possible for the armed forces. This was achievable since both countries have accepted, step by step, a mutual interdependency as the sine qua non condition to access unrivalled missile systems in Europe.”

The Lancaster House arrangements constituted a critical milestone in November 2010, since they provided the ground for a bilateral consolidation of industrial assets inside MBDA. With the Defence and Security Treaty specifically, France and the United Kingdom undertook to preserve a robust and competitive industrial and technological base for defence. This Treaty gave a strong political impulse at the

highest level: “The Defence and Security Treaty designated the French President and the UK Prime Minister as heads of the bilateral defence regime. Together with their security and diplomatic advisors, they form the Senior Level Group, which defines cooperation priorities and oversees their implementation.” (Pannier 2018, 430) The new institutional environment induced by the Lancaster House arrangements provided new grounds for industrial consolidation far beyond what trans-European companies were able to implement in domains like helicopters, radar systems or satellites.

Both countries have accepted to implement a binational regulation of the missile industrial base, which represents a true change with regard to the national boundaries of traditional arms-production regulation. Indeed this regulation is intertwined with sovereignty stakes, which explains why it is excluded from the mandate of the World Trade Organisation or the European Union. Many issues and stalemates that cooperative programmes have encountered historically come from the lack of shared regulation, each state remaining sovereign in its decisions regarding any dimension of these programmes.

A Summit Declaration went along with the Treaties, listing a number of projects that the United Kingdom and France should undertake. Moreover, the two defence ministers signed a Letter of Intent setting out the provisions for the governance and supervision of cooperation. Thus, the Lancaster House agreements gave a major political impetus and provided a legal and institutional framework to deepen bilateral cooperation in defence capabilities. All these arrangements aimed at incentivising joint procurement and industrial integration. Complex weapons or missiles were clearly identified as a top-priority sector for such cooperation through the “One Complex Weapons” initiative, also known as “One MBDA”.

While the Lancaster House arrangements provided a political framework, the United Kingdom and France went further by creating a new, bilateral regulatory framework that made industrial and technological consolidation possible. Indeed, both states signed an intergovernmental agreement in September 2015 enabling MBDA to implement “Centres of Excellence” between its British and French sites in specific technologies and sub-systems. This agreement favours the specialisation of sites inside MBDA between both countries. It facilitates cross-border activities in terms of transfers, employees’ mobility or exports, notably thanks to reciprocal global licences. It limits to some extent the sovereign decisions of each state, unless their sovereignty and security are at stake, but as the *sine qua non* condition – paradoxically – for a higher sovereignty together thanks to a greater strategic autonomy (Païtard and Bellais 2019).

There was a large room for consolidation, and this latter was a strong incentive to merge missile industrial bases between the United Kingdom and France in the late 1990s. Moreover, due to the contraction of domestic orders since the end of the Cold War, both domestic bases and industrial assets were oversized. The required consolidation was coupled with a specialisation that aimed at achieving critical mass for each Centre, which was necessary to preserve technological capabilities and industrial capacities.

However, such consolidation had already faced difficulties even at domestic level, as domestic customers had tried to maintain a certain level of competition between domestic suppliers throughout the 1990s (Hébert 1995). In addition, they had resisted any attempt at the creation of cross-border specialised companies, limiting such mergers and acquisitions to joint ventures or direct investment short of any true industrial consolidation. This resistance resulted from fears regarding the security of supply once the newly created groups would transfer some activities abroad while

closing sites domestically. This is the reason why states remain attached to national regulation of arms production even inside the European Union after passing the grounds for a common regulatory framework in 2009 (Maulny et al. 2020).

Blessed by the Defence and Security Treaty and the intergovernmental agreement, MBDA was able to overcome such reluctance and create bilateral centres of competences, called “Centres of Excellence”, between its British and French national companies. These Centres aim at suppressing in-house duplications and developing synergies. Indeed, MBDA had to deal with legacy activities organised on national grounds as well as by competing companies both domestically and internationally. The intergovernmental agreement covers two categories of Centres.

First, Predominant Specialised Centres of Excellence consolidate the skills and expertise relating to a given technology in either the United Kingdom or France, leaving only a residual capability in the other country to deal with legacy programmes and nationally sensitive requirements⁶. Specialised Centres were chosen to achieve a balanced organisation of common competences between both countries. MBDA set up four Specialised Centres:

- Missile Actuators (United Kingdom)
- Missile Data-Links (United Kingdom)
- Test Equipment (France)
- Weapons Controllers (France)

Second, Federated Centres combine technological expertise and skills located in the United Kingdom and France on a complementary basis. These Centres aim at

⁶ Actually, the other country keeps circa 20 percent of competences domestically.

securing increased efficiencies and synergies thanks to a more effective allocation of MBDA's resources. While each country keeps a global competence in the given technology, Federated Centres favour specialisation at subsystem level. These Centres also ease the sharing of information and experience across relevant French and British teams. MBDA set up four Federated Centres:

- Algorithms
- Complex Warheads
- Navigation Systems
- Software

In fact, Specialised and Federated Centres reflect the ex-ante specialisation between British and French sites. Such specialisation strategy aimed at consolidating and reinforcing pre-existing domains of excellence, and overcoming the historical tendency to create duplications through cooperative programmes. In other words, this specialisation process succeeded in achieving the cross-border consolidation of a defence industry in Europe that had failed in most previous cooperative schemes (with the exception of Eurocopter between Germany and France). As Béranger (2020, 141) notes, “these Centres of Excellence ensure an affordable comprehensive missile industry in full sovereignty for both the United Kingdom and France.”

In addition, both countries decided to define a common technological roadmap. This jointly funded R&T is original because it goes beyond on-going cooperative programmes and aims at developing knowledge components for future capabilities. The “Materials and Components for Missiles, Innovation and Technology Partnership”

(MCM-ITP, now CW-ITP⁷) was launched in 2007. This bilateral programme constitutes a model of cooperative research and technology. It is unparalleled in the field of defence in terms of scope and pooling of efforts⁸, since CW ITP gathers industrial integrators but also universities, SMEs and start-ups on both sides of the English Channel.

However, we should keep in mind that Centres of Excellence and CW ITP do not cover all aspects of in-house activities. For instance, Centres do not include key dimensions like system design and integration or airframe design. The industrial and technological consolidation focused on critical domains, for which purely domestic turnover was incompatible with sustainable industrial base. However, both countries did not choose to go further and accept complete interdependence. This explains why, since the setting-up of these Centres, each country has nevertheless engaged in purely domestic programmes (e.g. MMP or MICA NG in France or SPEAR or Fire Shadow in the United Kingdom) or cooperative ones that do not involve both countries (e.g. CAMM-ER between the United Kingdom and Italy).

Accepting such mutual dependence beyond a given capability programme constitutes the first time that two countries agree with loosening their domestic regulation in order to secure the sustainability of their defence technological and industrial bases. Contrary to many previous projects, the integration of industrial bases inside MBDA and along with MBDA's supply chain is truly operational. For instance, MBDA UK's production facility delivers Fin Actuation Systems for the French MMP programme. MBDA France delivered test equipment for the latest evolution of the British Brimstone programme. MBDA France also provided weapon controllers for the British ASRAAM and SPEAR programmes. MBDA UK provides datalinks for the

⁷ It was renamed Complex Weapons Innovation & Technology Partnership in 2019.

⁸ The French-German Research Institute Saint Louis constitutes another example, but its domain of expertise is more limited and ISL carries on state-sponsored R&T.

bilateral ANL/Sea Venom programme while it has been developing the datalink for the French MICA NG programme.

MBDA provides the first experiment of an in-depth integration between two defence industrial bases in such sensitive capability domain in Europe. Even when France and Germany decided to merge their helicopter industrial base in 1992, each national company of Eurocopter (now Airbus Helicopter) had to maintain mirror activities for a large range of competencies. Both states opposed Eurocopter's proposal in the late 2010s to deepen the technological and industrial specialisation, even for the equivalent of a federated centre of excellence in the field of blades for instance. Trans-European defence companies outside the field of missiles, like satellites or radar systems for instance, have experienced similar restrictions from national states that limited the benefits of creating cross-border groups (Bellais and Jackson 2014). In the field of land systems, KNDS could be an exception granted that Germany and France launch the bilateral programme for the next-generation of main ground combat systems.

Cooperative programmes and intergovernmental partnerships are challenging, but they can achieved sustainable benefits if they are able to induce industrial consolidation. A cross-border industrial specialisation, thanks to cooperative programmes like Scalp EG/Strom Shadow or Meteor, enables lasting cost-saving by sharing sunk costs, reducing the unit price of defence capabilities through economies of scale and scope and benefitting from a larger domestic market in the long term that reduces the necessity to export. Eventually, thanks to this true integration and resulting specialisation MBDA was able to organise a shared and more efficient industrial base between France and the United Kingdom. This latter provided the grounds for launching the development of French-British anti-ship missile, ANL/Sea Venom, in 2014.

Exports, affordability and sustainability of the missile European missile industry

Exports become a major feature of missile industry since the 1970s, as Graph 5 underlines. Nevertheless, their role has clearly evolved since the end of the Cold War. While missile exports aimed at supporting allies politically or represented mainly business opportunities during the East-West confrontation and post-colonial conflicts, the fall of domestic defence spending made exports a survival criterion at the turn of the century. Exports have become a determining dimension in the business model for most missile producers as they help balance domestic orders.

In the field of missiles, competition is therefore tough for export markets. In arms-producing countries, platform integrators depend mainly on their domestic markets, and they do not rely on export sales for preserving their business or competencies. This is less and less the case regarding the missile industry. Exports represent a major stake for all main missile producers. This is indeed the case for small arms-producing countries like Israel or Norway because of their limited domestic market. However, like MBDA, American leaders Lockheed Martin, Raytheon and Boeing are dependent on export contracts. They represented from 45 to 50 percent of their revenues in the field of missiles on average between 2010 and 2019. Similarly, MBDA's turnover is equally distributed between domestic deliveries and exports. Therefore, exporting constitutes a key dimension of the missile industry in most producing countries, China being maybe the only exception among large missile producers (for the time being).

[Insert here Graph 5]

Such export dependency results from decreasing domestic spending, a major downsizing of missile stocks compared to the 1980s, and the consequences of cost

escalation. In the 1990s, as previously explained, missile industries had to enlarge their market to avoid losing industrial capacities and competencies. Exports have then become a sine qua non condition to balance insufficient domestic orders in order to preserve a sustainable and innovative defence base, able to provide the capabilities that domestic armed forces need without disruption.

In defence economics, most of the literature explains that, in arms-producing countries, exports can be explained by profit motives on the supply side (Smith 2009) or the need to lengthen production series to reduce unit costs on the demand side (Anderton 1995). These analyses in fact focus mainly on a supply-based perspective. Indeed, such incentives to export exist but they represent only one side of the coin. We should also take into consideration a complementary demand-side perspective. States want to keep procurement costs under control but, in addition, securing exports aims at preserving a missile industry capable of meeting the needs of domestic armed forces.

First, exports are necessary to guarantee that producers will be able to provide missiles beyond initial deliveries of a given programme. These deliveries often take place in the early years of the lifecycle of a programme. This continuity requirement is important, as armed forces need to replenish military stocks or increase procurement in response to higher international tensions. Relying on domestic orders only may not be sufficient to secure a minimal level of activities throughout a programme's lifecycle. Consequently, a limited domestic market could jeopardise some competencies, weaken the industrial base, and make any production surge improbable. The missile industry seems particularly sensitive to such risk, which explains its high dependency on exports.

Second, a certain level of strategic autonomy constitutes an objective for arms-producing countries. Thus, the missile industry must remain viable in the medium and long term to fulfil this objective. Armed forces expect that their domestic industry will

be capable of developing and producing the next generation of missiles, which is likely to occur 15 to 25 years after the launch of today's generation (depending on missile categories). Export orders contribute to this objective, since they help sustain a design and manufacturing base between two generations of missile systems. Then, exports can prevent domestic companies from losing specific knowledge and expertise. They help them to maintain R&D and production competencies and keep R&D and production costs under control for future systems.

Combining domestic and export deliveries contributes to keep the manufacturing base in condition to support continuously the national defence posture, which cannot allow any disruption by definition. This is also essential to guarantee the through-life support of defence systems in any circumstance, which includes both design and manufacturing activities. This is the reason why, as illustrated by Graph 6, export deliveries has always represented a major part of MBDA's revenues since its creation. They clearly smooth its revenues by acting as a counter-cyclical mechanism with regard to uneven domestic orders.

[Insert here Graph 6]

The critical balance between domestic and export orders can be illustrated with MBDA's cruise missile activities, presented in Graph 7. Considering current budget constraints and operational requirements, domestic orders from European launch countries, even for cooperative programmes, are not sufficient to achieve the sustainability of corresponding competences. Initial deliveries to launch countries occur in the first years of a programme while there is about two decades between two generations of cruise missiles. For instance, MBDA launched Scalp EG/Storm Shadow

programme in the late 1990s and the next generation capability, FC/AW-FMAN/FMC⁹, is under development since the late 2010s. Without exports, a loss of competencies is expected once the initial provision is achieved since there is a gap in design and manufacturing activities related to launch countries for a few years.

International orders contribute, albeit imperfectly as Graph 7 shows, to the continuity of activities by complementing domestic or launching orders. They help extend the production of components and subsystems, which are usually specific to a given programme. The support and retrofit of missiles for the benefit of both launch countries and international customers contribute, albeit imperfectly, to the sustainability of the manufacturing base too. In addition, new requirements from international customers contribute to ensure a sufficient level of workload for design offices, which are critical assets to develop the next generation of missiles. Such export-related activities give the opportunity to continue working on missiles concepts and related technologies. Such R&D can also favour a dynamics of economies of scope resulting from a family of missiles. Then, launch countries benefit from such workload in return when their acquired missiles are retrofitted or when they can access upgraded versions of these capabilities for additional orders. This example shows that export orders contribute to the preparation of the conception and development for the next generation of missiles to the benefit of the domestic customer and/or launch countries.

[Insert here Graph 7]

Critical mass is required to achieve an affordable capability programme. However, most of the literature focuses on the demand side of this issue, that, how to minimise the total cost of a given programme as well as the unit cost of the

⁹ Future Cruise and Anti-Ship Weapon or Futur Missile Antinavires / Futur Missile de Croisière.

corresponding capability. This is indeed necessary but not sufficient. In fact, there is a supply-side dimension, which is as important as the demand-side one. The defence industry has to deliver affordable capabilities not only at a specific moment but also in the medium and long term. The affordability issue is therefore intrinsically linked to the sustainability of the industrial base. This latter requires gathering three intertwined dimensions: volume (critical mass), geography (enough customers to smooth workflow) and timescale (in order to preserve competencies).

The challenge of integrating European markets

This portrait of MBDA underlines the limits induced by the lack of a unique defence market in Europe. Even though it was able to push industrial consolidation across borders to an extent never achieved before, MBDA remains dependent on political goodwill since any new European project relies on a cooperative programme between European countries. Launching such programme is not guaranteed and requires achieving complex negotiations between all stakeholders. For instance, the light anti-ship ANL/Sea Venom programme was announced in 2008, but it took six years before France and the United Kingdom finalised its launch despite the spirit of Lancaster House. If we do not take into consideration MBDA's internal cross-European organisation, a missile cooperative programme does not differ today from an equivalent cooperative programme for any other defence capability in terms of industry regulation. This complex situation reflects the unachieved transformation of European defence market from a purely national market to an integrated European market, that is, a seamless market with a homogenised demand side and a fluid cross-border functioning of the demand side.

While MBDA appears as a true success in building European defence, the limits of the integration of both demand and supply sides at the EU level prevents MBDA

from fully implementing its industrial model contrary to its non-European competitors (notably in the United States), which benefit from a unique domestic market and seamless industrial base. Thanks to the Lancaster House Treaty and the 2015 intergovernmental agreement, MBDA was able to move quicker and farther in the Europeanisation process on supply side than the European regulatory environment on demand side. Indeed, European arms markets remain fragmented despite the “defence package” adopted by the European Commission in 2009. Analysing the implementation of EC directives on intra-community transfers (2009/43) and defence and security markets (2009/81), Maulny et al. (2020) demonstrate that the European Union has a long way before it is able to create a unique market for defence capabilities. Indeed, the European Defence Action Plan raised high expectations in 2016, but these expectations remain to be confirmed once the European Defence Fund is fully implemented.¹⁰ Consequently, the European Union still lacks a truly European defence technological and industrial base: industrial competencies remain spread over several national bases mainly characterised by domestic dynamics rather than European ones.

Moreover, the lack of a unified regulatory framework and market in Europe favours centrifugal trends. Despite the creation of the European Defence Agency in 2004 and several defence-related initiatives since then, EU states have launched many purely domestic capability projects (frigates, submarines, armoured vehicles, satellites, etc.) while they share capability needs with other EU countries. This lack of coordination and pooling results in a high opportunity cost, duplications and eventually intra-European competition inside the European Union as well as for export markets for

¹⁰ The EDF implementation started only in 2021. The preliminary programmes (PADR and EDIDP) had a very limited budget and only served to test and calibrate EDF rules and governance. Therefore, it seems necessary to wait for the results of first EDF projects to be able to assess the benefits and limits of the European Defence Action Plan.

preserving the industrial and technological assets engendered by competing capability projects.

European arms-producing countries, at least in capabilities considered as critical for their sovereignty, still look for purely domestic programmes when they are affordable in the field of missiles (and elsewhere). Indeed, not all European countries were able or willing to master a full independence in terms of defence technologies, but they expected to increase their autonomy by acquiring specific competencies. This is another reason why a European defence industrial base remains an aim. Today, the European landscape is characterised by a juxtaposition of several industrial bases organised on a domestic basis, with limited interconnections. Consequently, it is not really surprising that there exist several programmes for each kind of major systems in Europe, as underlined in Table 2. While European countries spend only half of what the United States invests in its defence, according to Briani (2013) there are 71 programmes for major defence systems in Europe when the United States operates only 23.

[Insert here Table 2]

Even though military requirements could converge towards a shared capability (notably among NATO nations), the quest for security of supply on the demand side and the desire to sustain a domestic industry on the supply side encourages the launching of domestically based programmes. However, such a policy comes with several costs: “The ‘national preference’ for defence procurement, which still exists today, necessarily implies a duplication of platforms and funds for research and development, assembly lines and, in short, all production factors.” (Briani 2013, 15). The European Commission recently stated that “today, defence markets are highly fragmented, creating a lack of interoperability and at least €30 billion worth of opportunity cost” (European Commission 2017, 8). The only solution to overcome such limits consist in

deepening the integration of defence markets inside the European Union towards a single armament market on the demand side and a truly European defence technological and industrial base on the supply side.

This persistent fragmentation limits the implementation of industrial consolidation and specialisation that are necessary to reach critical mass at the European level due to the limited size of different domestic markets. This does not require that all missile producers merge into one company, since a monopolistic market configuration is not desirable. Other missile companies still exist in Europe (Diehl, Saab, Thales, Kongsberg or other small players) and they are likely to remain independent. In addition, the optimal size and structure of European missile industry varies according to the complexity of missiles. For instance, advanced, high-end missiles like Scalp EG/Storm Shadow and Meteor requires that European players gather their resources to deliver an effective and affordable solution. This is not imperative concerning less complex and expensive capabilities (e.g. MMP, Enforcer or ANL/Sea Venom), for which the domestic market of one large country could still suffice to launch and sustain a domestic industrial base. The consolidation of companies or industrial competencies depends on the stakes regarding the sustainability of the industrial base and the desired degree of strategic autonomy for a given category of missiles.

Nevertheless, considering the current technology and European demand level, it would be possible to avoid some duplications and the under-utilisation of industrial capacities. Moreover, without a further integration between missile industrial bases inside Europe, MBDA and other missile producers are likely to remain highly dependent on third-country revenues to achieve a sustainable industrial model. However, these revenues comes from few large customers mainly concentrated in the Middle East (Bellais and Boulanger 2017). Such demand remains unpredictable and

beyond control, which places MBDA as well as many other European defence companies at risk.

Finally, the past success of MBDA should not hide the fact that competition has become stronger and stronger at international level in the field of missile systems. For instance, MBDA faced 16 competitors in 2000 proposing about 250 missile systems. In 2020, it has to compete with 26 companies that propose more than 600 missile systems. Competition has been intensifying because of the rebound of legacy companies (notably in Russia and China), technology transfers that nurture new competitors, and a technological level playing field resulting from three decades of globalisation. Thus, MBDA must, at the same time, develop advanced systems to match American or Russian advanced systems and keep its cost under control to sustain the very affordable solutions coming from emerging countries (e.g. Turkey).

Therefore, MBDA could benefit from the European Defence Fund in order to maintain and to improve its competitiveness if new missile programmes are launched or, at least, if the EDF serves to develop technological bricks (knowledge components) that will help improve existing missiles. Even though it is too soon to anticipate its impacts on the European missile industry, the creation of the EDF represents an opportunity to open a new chapter in the history of MBDA as a European missile company.

Declaration of interest statement

All views expressed in this article are those of the author. They do not purport to reflect the opinions or views of any entity whatsoever with which he has been, is currently or will be affiliated.

References

- Anderton, Charles H. 1995. "Economics of arms trade." In *Handbook of defence economics*, edited by Keith Hartley and Todd Sandler, 523-561. Amsterdam: Elsevier.
- Arena, Mark V., Irv Blickstein, Obaid Younossi, and Clifford A. Grammich. 2006. *Why has the cost of navy ships risen?* Santa Monica, CA: RAND Corporation.
- Bellais, Renaud. 2017. "The Economic Imperative of Europeanizing Defense Innovation." In *The Emergence of EU Defense Research Policy, From Innovation to Militarization*, edited by Nikolaos Karampekios, Iraklis Oikonomou, Elias G. Carayannis, 93-109. Cham: Springer.
- Bellais, Renaud. 2021. "Une économie permanente d'armement" [A permanent arms economy]. In *Mondes en guerre IV. Guerre sans frontières*, edited by Louis Gautier et Hervé Drévillon, 449-513. Paris: Passés Composés.
- Bellais, Renaud, and Philippe Boulanger. 2017. "Les pays arabes, meilleurs amis de la France et de son industrie d'armement ?" [Arabic countries, the best friends of France and its arms industry?]. *Moyen-Orient* 34: 24-29.
- Bellais, Renaud, and Susan Jackson. 2014. "Defence firms beyond national borders: Internationalisation or multi-domestic approach?" In *The evolving boundaries of defence: An assessment of recent shifts in defence activities*, edited by Renaud Bellais, 233-251. Bingley: Emerald Publishing.
- Bellais, Renaud, and Jean-Michel Oudot. 2019. "Defence companies in the age of globalisation? The French defence industry as a case study." In *The Political Economy of Defence*, edited by Ron Matthews, 169-194. Cambridge: Cambridge University Press.
- Béranger, Eric. 2020. "MBDA and the missile industry at the heart of the defence partnership between France and the United Kingdom." *Revue Défense Nationale* 834: 139-143.
- Briani, Valerio. 2013. *The costs of non-Europe in the defence field*. Moncalieri: Centre for Studies on Federalism, and Rome: Istituto Affari Internazionali.
- Davies, N., A. Eager, M. Maier, and L. Penfold. 2012. *Intergenerational equipment cost escalation*. London: Ministry of Defence.
- Devaux, Jean-Pierre., and Richard Ford. 2018. *Scalp EG/Storm Shadow: Lessons from a successful cooperation*. Paris: Fondation pour la Recherche Stratégique.
- Devaux, Jean-Pierre., and Richard Ford. 2021. *Meteor: General lessons from a singular cooperation*. Paris: Fondation pour la Recherche Stratégique.

- European Commission. 2017. *Reflection paper on the future of European defence*. Brussels, https://ec.europa.eu/commission/sites/beta-political/files/reflection-paper-defence_en_1.pdf. Accessed on 8 June 2017.
- Faure, Samuel, Thibaut Joltreau, and Andy Smith. 2019. "The differentiated integration of defence companies in Europe: A sociology of (trans) national economic elites." *European Review of International Studies* 6: 135-162.
- GAO. 1998. *Defense industry consolidation, Competitive effects of mergers and acquisitions*. GAO/T-NSIAD-98-112. Washington, DC: United States General Accounting Office.
- Hartley, Keith. 2012. "Company survey series: I: BAE Systems PLC." *Defence and Peace Economics* 23(4), 331-342.
- Hartley, Keith. 2020. "Rising costs: Augustine revised." *Defence and Peace Economics* 31(4): 434-442.
- Hartley, Keith, Renaud Bellais, and Jean-Paul Hébert. 2008. "The evolution and future of European defence firms." In *War, peace and security*, edited by Manas Chatterji and Jacques Fontanel, 83-104. New York: Emerald Publishing.
- Hébert, Jean-Paul 1995. *Production d'armement, Mutation du système français* [Arms production, Changes of the French system]. Paris: La Documentation Française.
- Hébert, Jean-Paul. 2006. *Le débat stratégique sur l'armement 1992-2005* [Strategic debate on arms production 1992-2005]. Cahiers d'études stratégiques 38-39. Paris: CIRPES.
- Kirkpatrick, David. 2004. "Trends in the costs of weapon systems and the consequences." *Defence and Peace Economics* 15(3): 259-273.
- Maulny, Jean-Pierre., Edouard Simon, and Alessandro Marrone. 2020. *EU Defence Package: Defence Procurement and Intra-Community Transfers Directives European Implementation Assessment*. External study for the European Parliamentary Research Service. Brussels: European Parliament.
- Nan, Tian, and Fei Su. 2020. Estimating the arms sales of Chinese companies. SIPRI Insights on Peace and Security 2020/2. Solna: Stockholm International Peace Research Institute.
- Païtard, Xavier, and Renaud Bellais. 2019. "Un modèle industriel gagnant pour la défense européenne" [A successful industrial model for European defence]. *Champs de Mars* 32: 139-148.

- Pannier, Alice. 2018. "UK–French Defence and Security Cooperation." In *The Handbook of European Defence Policies and Armed Forces*, edited by Hugo Meijer and Marco Wyss, 424-440. Oxford: Oxford University Press.
- Smith, Ron. 2009. *Military economics, The interaction of power and money*. Basingstoke: Palgrave Macmillan.

Table 1. MBDA's employees, locations and site specialisation (2020)

Country	Jobs	Sites	Activities
France	5,000	Le Plessis	Management, R&D, simulation,
		Robinson	training systems
		Bourges	R&D, production, integration
		Compiègne	Electronics, manufacturing
United Kingdom	4,000	Stevenage	Management, R&D, integration
		Bristol	R&D, software, systems
		Bolton	Production
		London	Management
Italy	1,400	Rome	Management, R&D
		Fusaro	R&D, production, integration
		La Spezia	R&D, integration
Germany	1,260	Schrobenhausen	Management, R&D, production, integration
		Aschau	R&D, production
		Ulm	R&D
United States	50	Huntsville	R&D, production
Spain	20	Madrid	Management, R&D

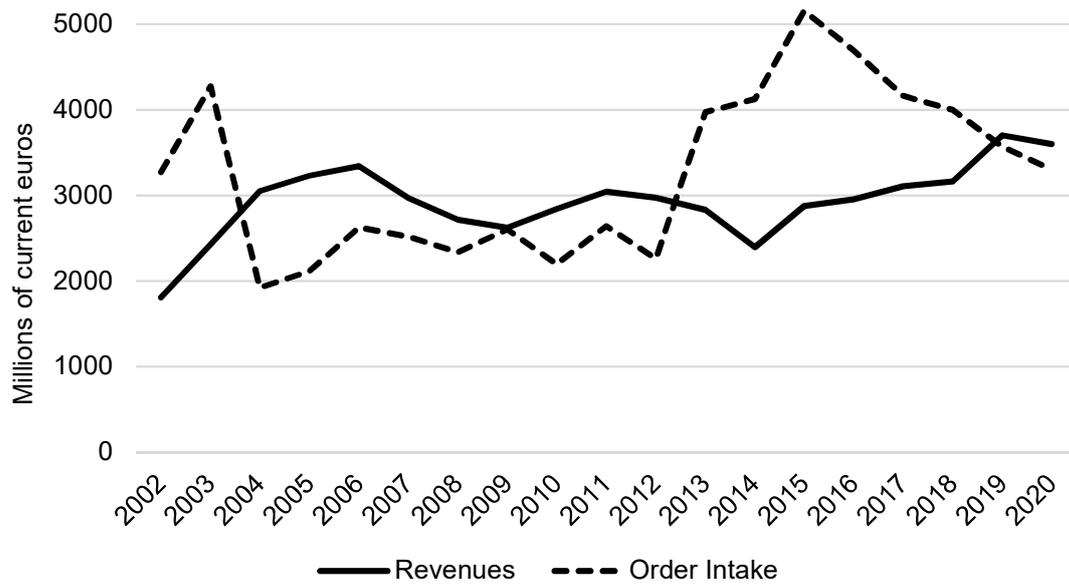
Source: MBDA Human Resources, April 2021.

Table 2. Duplications of defence programs in Europe

Systems and platforms	Europe	United States
Tanks	4	1
155mm howitzer	3	1
Fighter/ground attack aircraft	7	5
Attack helicopters	7	5
Anti-ship missiles	9	3
Air-to-air missiles	8	4
Frigates	11	1
Diesel submarines	7	0
Nuclear submarines	2	1

Source: V. Briani. 2013. The costs of non-Europe in the defence field. Centre for Studies on Federalism, Moncalieri, and Istituto Affari Internazionali, Rome, 15-16.

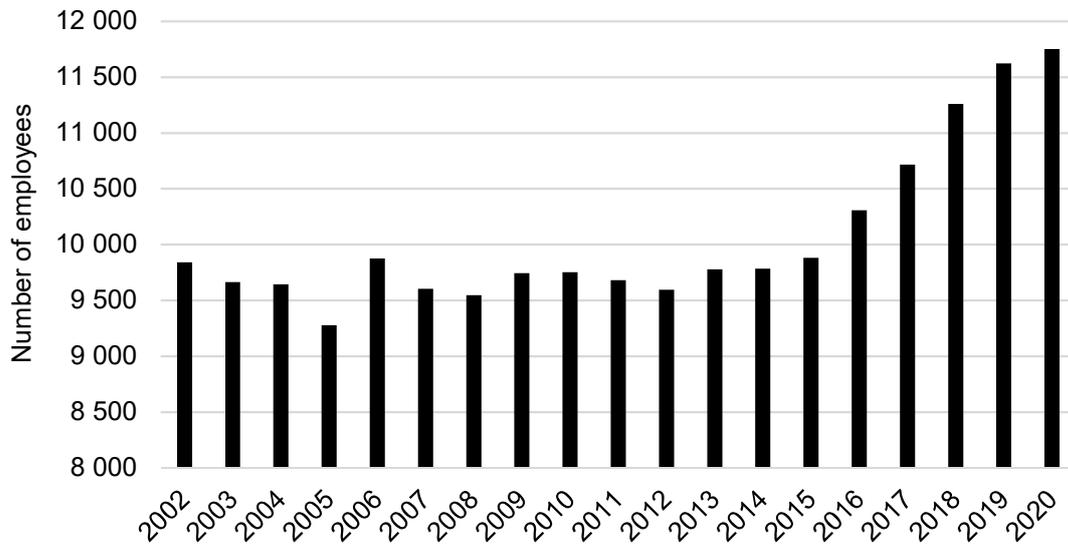
Figure 1. Revenues and order intakes of MBDA (2002-2020)



Source: MBDA¹¹, March 2021.

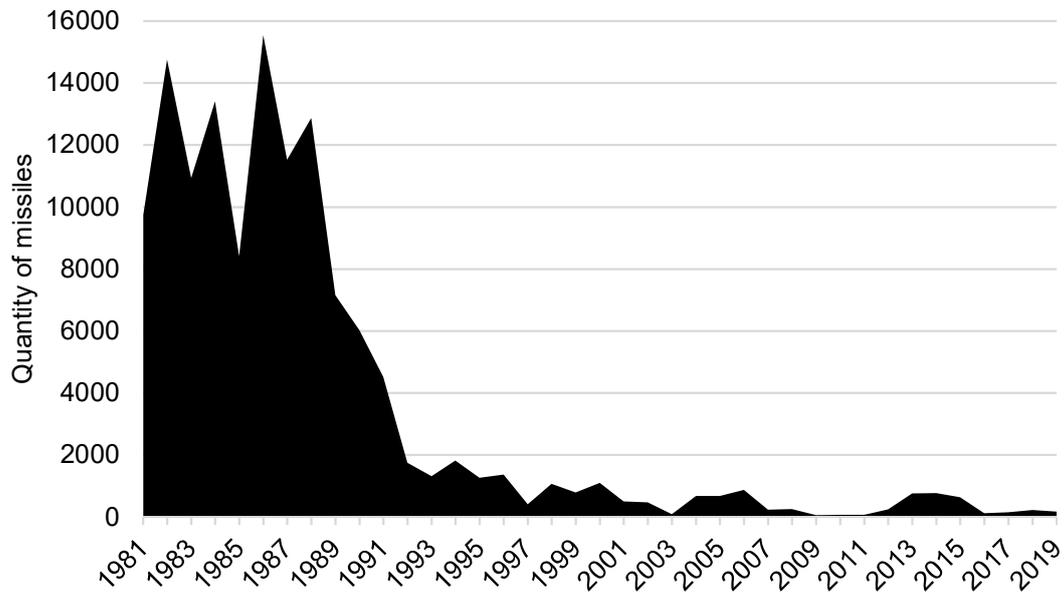
¹¹ Since MBDA is a private company, most of the data displayed in this article come from internal sources. The author is grateful to the kindness of MBDA teams, which supported the preparation of this article.

Figure 2. Evolution of MBDA employees (2002-2020)



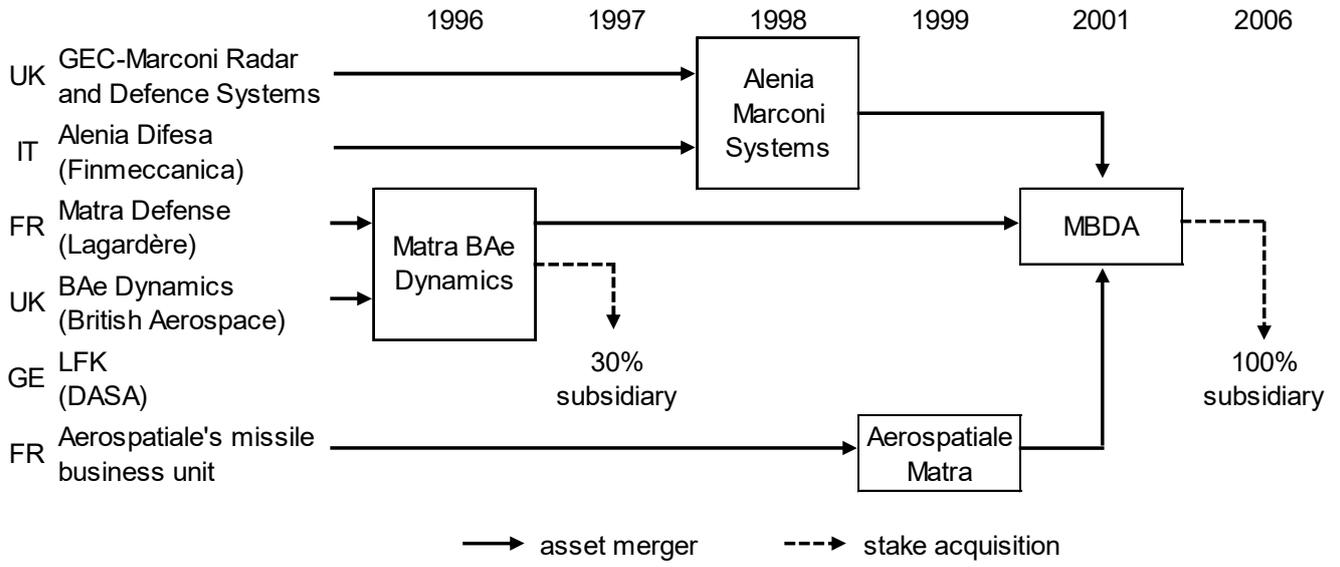
Source: MBDA, April 2021.

Figure 3. Evolution of MBDA's anti-tank missile order intakes



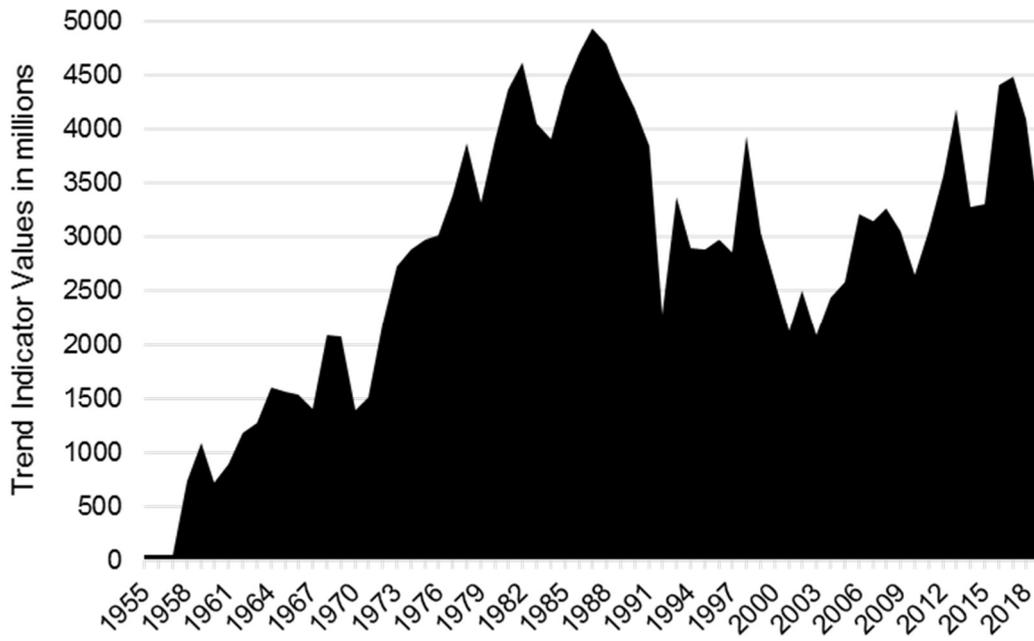
Source: MBDA, December 2020.

Figure 4. Mergers and acquisitions giving birth to MBDA



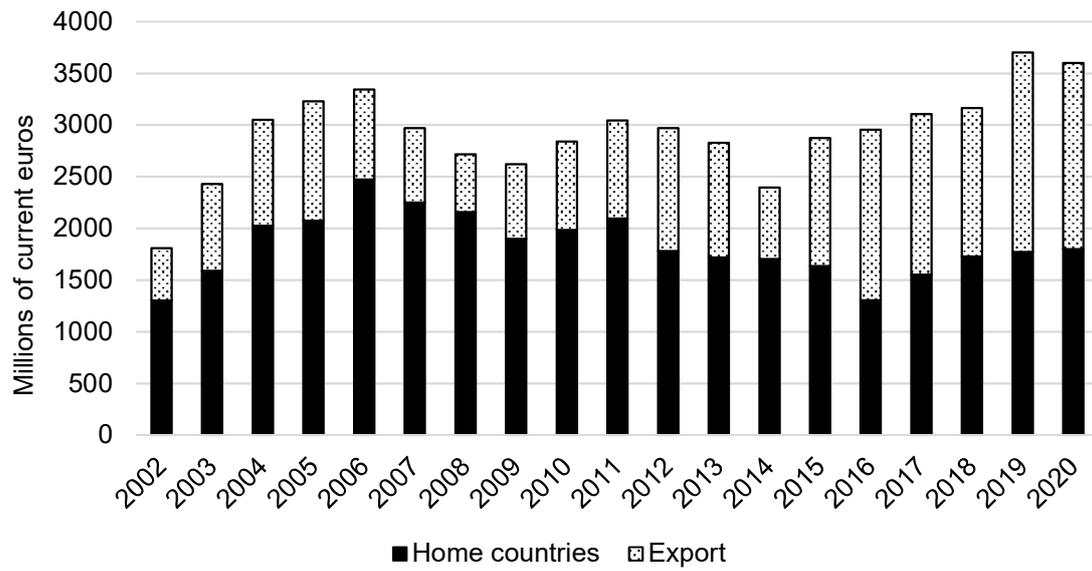
Sources: author; press releases.

Figure 5. Missile exports worldwide since the 1950s



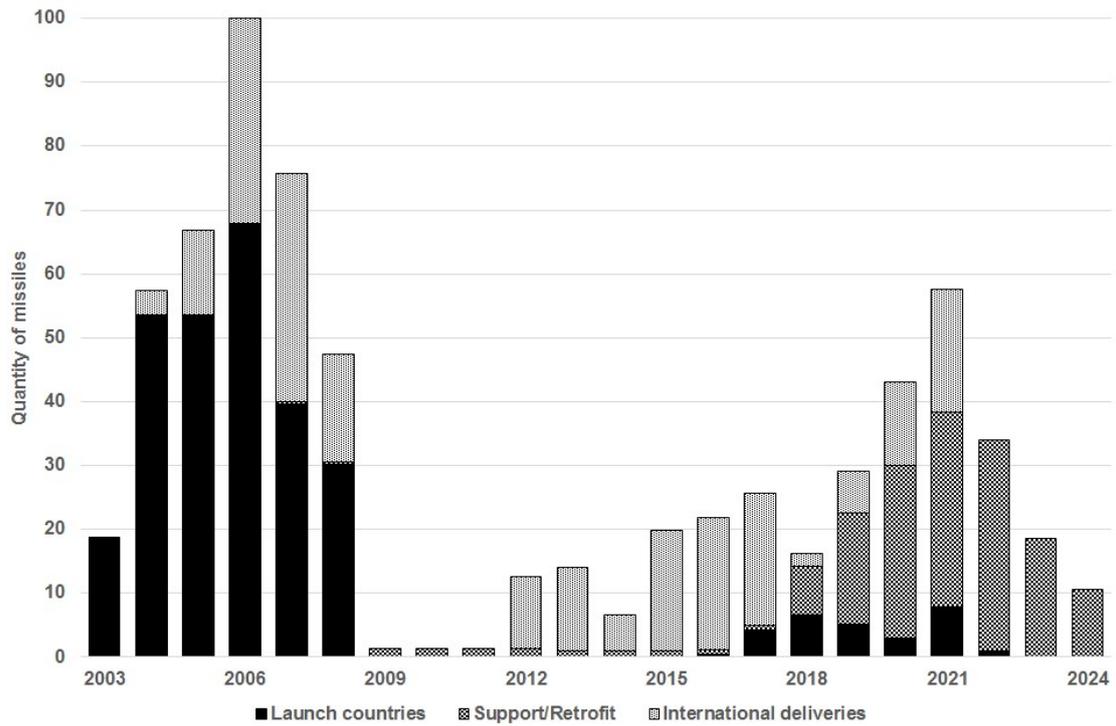
Source: SIPRI Arms Transfers Database, generated on 25 January 2021.

Figure 6. MBDA's revenues from domestic and export deliveries



Source: MBDA, April 2021.

Figure 7. Domestic and export deliveries of MBDA's cruise missiles



Source: MBDA, January 2021. Due to the sensitiveness of data, the graph does not use real numbers of missiles. However, scale and proportion fully reflects undisclosed data.