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**DEFENCE INNOVATION: NEW MODELS AND
PROCUREMENT IMPLICATIONS**

The French Case

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Policy Paper

ABSTRACT

This article describes the innovation and procurement policy of the French Ministry of Defence. It focuses on recent evolutions in defence-related innovation management as well as its reorganisation towards a greater integration of open innovation and a more user-centric approach. It addresses key issues such as the integration of open innovation in weapon system programmes, the regulation and organisation of innovation and procurement in France, the evolution of mindsets and risk acceptance, or the adjustment of innovation support mechanisms, ending with a reflection on the future European coordination.

Keywords: *Programmed innovation, Open innovation, Internal innovation, Programme management, Incremental approach, User-centric approach, Risk acceptance.*

INTRODUCTION

In France, as in other Western countries, the end of the Cold War was marked by a reduction of the budget allocated to defence and a reform of the Directorate General for Armaments (DGA) in charge of the procurement and development of future defence systems. Therefore, the DGA was reoriented towards incremental research, research funding was reduced by 30%, and the Direction for Research and Technical Studies (DRET) - in charge of disruptive innovation – was abolished.¹ In the aftermath, support to innovation was characterised by a profusion of instruments addressing different aspects of defence innovation support through experimentations. However, in the face of evolving threats and fast-growing digital development, the recent years have seen innovation put back at the heart of the French MoD's top priorities (*Revue stratégique de défense, LPM 2019-2025, Document d'orientation de l'innovation de défense...*).

Whereas defence innovation used to be state-organised, backed by powerful industries investing massively in R&D and producing equipment over several decades before irrigating the civilian sector, today's innovation responds essentially to civilian stimulation and is produced by numerous and agile actors on a much shorter time scale.² This paradigm shift, as well as the blurring of boundaries between civilian and military stakeholders, is not without consequences regarding the way innovation, and especially open innovation, is driven and captured by the MoD. Although major transformations have taken place (or are in progress) in the management of defence innovation and in the field of procurement, there is still a long way to reach the set level of ambition.

FRANCE IS HEAVILY INVESTING FOR YEARS IN DEFENCE INNOVATION

France is the first defence R&T investor in Europe with about € 1.3 billion spent in 2020 in this domain.³ A major part of this amount (around € 1 billion) is directly awarded to

¹ Perrin C. et Guérini J.-N. (2019). "L'innovation et la défense", *Rapport d'information* n°655, Sénat, France.
https://www.senat.fr/rap/r18-655/r18-655_mono.html

² Ibid.

³ French official 2020 budget: € 1.1 billion in payment and € 1.3 billion in contract authorization. These numbers do not take the evolution linked to COVID-19 recovery plans that have added and will add additional money. France is also the

the industry or to research laboratories through contracts. 85% is oriented to future programmes and 15% aimed at supporting open innovation. A significant amount is reserved for operational innovation such as experimentations and “battle labs”. In addition to this amount of money, around 400 people of the French MoD are directly working on innovation to identify trends and solutions, drive the needs, choose solutions, and evaluate innovation.

Emphasising a 15-year trend, both the *French Strategic Review* published on 11 October 2017 and the Military Planning Act (LPM) 2019-2025 give a decisive place to innovation. Whereas the first emphasises the need to mainstream innovation, recommending that the aim should be to integrate civil technologies and promote the use of digital technologies, the latter identifies “innovating to meet future challenges” among its four main priorities.

Before going into the details of the French defence innovation model, it is important to distinguish what is being considered as “innovation” in the French context. In a common understanding, innovation is mostly linked to technological breakthroughs, sometimes extended to processes. In the defence sector, innovation is mostly driven by a vision of the needs and emerges slowly from long-term studies financed by R&T to match the goals of the future programmes. In France, Defence R&T (part of the budget programme 144) is focused on scientific development, innovation and the experimentation of new concepts and potential dual products, whereas Defence R&D (budget programme 146) is focused on developing the desired products and services, integrating innovation from R&T or from the civil sector. Therefore, innovation is transverse through fundamental research, R&T, R&D, and experimentations. R&T (from TRL 2 to 5-6) corresponds to the perimeter of the newly created Defence Innovation Agency (AID).

The French effort is split into three main pillars:

- **Programmed innovation:** with medium long-term roadmaps identifying goals to be reached, this innovation is driven by forward-looking analyses and visions, linked to the main requirements of the armament systems programme, and reviewed regularly with the industry to integrate the self-financed effort made by the industry for other sectors. It aims at feeding the programmes with mature technologies in their development phases. This does not only concern the industry: research centres such

first R&D defence investor in Europe with nearly 14% of its budget allocated to it. Both R&T and R&D budgets are supposed to rise in the coming years.

as the CEA, CNES, INRIA, ISL or ONERA⁴ are participating to this scheduled effort. Research is also part of this through the 500 university theses and postdoctoral programmes financed by the DGA, some of them (CIFRE mechanism) being financed jointly by the industry. A dedicated programme directly supports defence-oriented research in laboratories: the ASTRID⁵ programme is a national open research programme on defence dual topics from the ANR⁶, financed by defence. This research is transferred to the industry as rapidly as possible through complementary funding (ASTRID maturation).

- **Dual innovation:** For twenty years, the DGA has been interested in identifying and supporting innovations found in the civil sector that can have defence applications. For this, the DGA has worked with innovation clusters linked to defence technologies (Pôle Mer, SAFE, Systematic, Laser Road, etc.) and has developed dedicated programmes to test and support innovation coming from start-ups and SMEs. For instance, in 4 months the RAPID⁷ support mechanism will allocate a grant to SMEs providing interesting innovative topics: the grant covers around 70% to 80% of the eligible R&D expenses. Experimentation programmes of existing solutions are also helping the forces to identify the innovations that could be useful to them.
- **Internal innovation:** This innovation is essential to integrate operational innovation and offers the advantage to allow an amazingly fast coupling between job concept and equipment, which others have a harder time achieving. It uses dedicated grants awarded to defence personnel, most of them using SMEs or start-ups to implement their solutions. Dedicated to internal innovation, the *Mission Innovation Participative* (MIP), founded in 1988 and now renamed *Cellule Innovation Participative* (CIP) within the AID, has supported more than 1,400 innovation projects carried out by MoD

⁴ CEA (Commissariat à l'énergie atomique et aux énergies alternatives), CNES (Centre national d'études spatiales), INRIA (Institut national de recherche en informatique et automatique), ISL (Institut franco-allemand de recherche de Saint Louis), ONERA (Office national d'études et de recherches aérospatiales). All those centres, which include an important part of the MoD's technical and scientific expertise, have a significant part of their research funded directly by a yearly grant and by competitive research contracts.

⁵ ASTRID (Accompagnement Spécifique des Travaux de Recherches et d'Innovation Défense): launched in 2012, this support mechanism allocates funding to dual use research projects up to € 300,000, for a period of 18-36 months. In a second step, ASTRID Maturation supports the maturation and development of ASTRID projects by allocating up to € 500,000, for a period of 2-3 years.

⁶ ANR (Agence nationale de la recherche) is a governmental agency devoted to competitive scientific and technological research programmes.

⁷ RAPID (Régime d'appui à l'innovation duale): launched in 2009, this support mechanism is also available to intermediate-sized enterprise (ETI) up to 2,000 employees since 2011. It has had an annual budget of € 50 million since 2015.

civilian or military personnel.⁸ Selected projects may be granted up to € 120,000, in order to realise a first prototype. Once the prototypes have been presented to the CIP (in charge of assessing their potential), high-stakes projects can be transferred to the *Innovation Défense Lab*. Finally, the DGA's *Laboratoire Technico-Opérationnel* (LTO) is building a federation of forces, and furnishes tools in order to support experimentations but also to develop new concepts of use of current or future equipment and capabilities.

THE RESULTS ARE GLOBALLY SATISFACTORY BUT IMPROVABLE

N.B. To judge whether innovation is successful or not, the authors used the following metrics: the integration into programmes of the innovation funded at R&T level, the level of performance reached by the weapon system compared to others, and the industrial and technological competencies maintained at the needed level.

Planned innovation allows France to maintain its expertise in most essential areas, but also to offer particularly "smart" solutions for its armaments (i.e. AESA radar and missile solutions for Rafale jets, air defence systems, FELIN system for infantry). However, due to budget priorities, some technological areas suffer from a lack of defence funding that deeply impacts the required level of technological skills: if the technology is partly supported by the civil domain as in aeronautics or electronics, the gap can be managed, provided that dedicated military technologies are identified and supported by regular demonstration programmes. Unfortunately, this process is merely fully applied, which generates progressive technological gaps. For pure military players, export can provide the needed resources to feed self-financed R&T: although the CIR⁹ helps reduce the impact of this spending, it can have short-term positive cash impacts.

Being chosen to be part of the targeted programmes is a clear advantage for a technology, but not a guarantee to integrate a weapon system programme: the risk of using the technology (finance, R&T maturation, ethics problems, etc.) is permanently assessed by future capabilities teams in the DGA and Joint Staff, creating a link between research and

⁸<https://www.defense.gouv.fr/aid/actualites/la-cellule-innovation-participative-un-soutien-cle-aux-porteurs-d-innovation-du-ministere-des-armees-et-de-la-gendarmerie-nationale>

⁹ The CIR (Credit innovation recherche) is a fiscal process that reduces the taxes supported by the industry, thanks to a reimbursement of R&T spending up to 30% (i.e. mainly R&T people's salaries, if working on self-financed programmes, but also the expenses linked to prototypes). This measure is not limited to defence.

programmes, at least for programmes about to be launched. The technology support will integrate in its roadmap the scheduled incremental steps of the possible use in a weapon system (including in life support). For the Rafale fighters, AESA technology was able to join one of the aircraft standards, but in the case of the FREMM frigates the same technology arrived too late to be put on the vessels design and was finally put on the next generation design.

In this context, cooperation has emerged in France as an imperative to ensure a better coverage of the total R&T needs, but finally the concerned amount remains weak. In bilateral cooperation, France's first partner is the UK with a targeted € 50 million spending in common programmes, then come the US, Singapore, and Germany (cooperative R&T programmes outside ISL's R&T programmes¹⁰). In multilateral cooperation, the French participation to EDA programmes is significant but limited by the programme's ambition. About 25% of the defence equipment credits in payment (€ 2 billion per year) are allocated to joint programmes, a share that is expected to increase by 36% according to the 2019-2025 military planning act (LPM).¹¹ The main problem is the difficulty to finance inside Europe, in a bilateral or multilateral way, significant medium long-term R&T programmes matching our national goals. Three game changers have clearly emerged: first of all, the Franco-British Lancaster House Treaty has provided interesting R&T and R&D processes in the missile and maritime countermeasure at sea; secondly, the Franco-German cooperation for SCAF and MGCS programmes is structuring innovation in the field of air and land warfare; and finally, the European Defence Fund is offering an efficient cooperative platform connected to clearer cooperative programme goals.

The unscheduled innovation, both internal and external, has been a real success: it has proposed very innovative and disruptive solutions, some of them helping their company to reach a new business level (MC2 and Earthcube are good examples of such successes)¹². But most solutions are struggling to find a place in the programmes: if about 30% of

¹⁰ The Saint Louis Institute (ISL) was established in 1958 and aimed at implementing close cooperation between France and Germany in scientific and technical research and studies in the field of armaments.

¹¹ *La coopération européenne en matière d'armement : un renforcement nécessaire, soumis à des conditions exigeantes*, Rapport public, Cour des Comptes, April 2018, p. 9 and 19.

<https://www.ccomptes.fr/sites/default/files/2018-04/20180417-rapport-cooperation-europeenne-armement.pdf>

¹² In percentage of the R&D effort, the level of innovation effort made in France (11.1% in 2018) is close to the effort made by the US (10.9%). It is also more focused.

RAPID-supported solutions have found their defence market (and most of the time also a civil market), the success of the clusters' programmes projects supported by defence funds is much lower.¹³

In this later case, the forces, DGA and industrial prime contractors' culture in programme management, is a clear showstopper. The French MOD's support to innovation imposes a real change in the management of weapon system programmes, particularly when considering the risks and the programme's architecture and organisation. This change of mindset and procedures is moving slowly due to financial habits (defence processes do not include investment return considerations), promotion processes (major programme management is the key to high-level positions) and regulation constraints (aeronautics norms, nuclear regulations, etc.).

One domain, however, is poorly supported: France has focused its R&T mainly on technology building blocks to ensure the largest coverage of the technology needs. Demonstrators and prototypes are only linked to decided programmes: there is clearly a lack of integration platforms that could help experiment in agile mode the innovations provided by industry. The result is a TRL¹⁴ limitation for those promising technologies that are not able to join a programme rapidly. The French MoD has decided to launch in 2017 a special fund dedicated to innovative industry support, DEFINVEST: this fund (€ 50 million) piloted by the BPI¹⁵ and the DGA is acting on equity to ensure a durable support to SMEs. This helps dual technologies by attracting to the fundraising other investors more confident in the possible defence commercial outlets. In January 2020, French Defence Minister Florence Parly announced the forthcoming creation of a new sovereign investment fund (DEFINNOV) dedicated to innovative start-ups and SMEs.¹⁶

THE FRENCH MOD'S INNOVATION AND PROCUREMENT REFORM

In 2017, the new elected government has asked for a reform of the innovation processes and organisation inside the French MoD. The main problems to be solved were the

¹³ Perrin C. et Guérini J.-N. (2019). *L'innovation et la Défense*, Rapport d'information n°655, Sénat, France.

¹⁴ *Technology Readiness Levels* (TRL) are used to estimate the maturity of technologies during the acquisition phase of a programme. TRL are based on a scale from 1 to 9 (with 9 being the most mature technology).

¹⁵ BPI (Banque publique d'investissement): French Investment Bank.

¹⁶ Florence PARLY, *Présentation des vœux aux Armées*, 22 January 2020.

<https://www.defense.gouv.fr/salle-de-presse/discours/discours-de-florence-parly/discours-voeux-aux-armees-de-florence-parly-ministre-des-armees>

multiplication of the innovation structures and tools, the lack of concertation inside the MoD on the priorities, the poor opening to civil innovation, and the difficulty encountered by innovations to successfully integrate armament programmes.

The creation of the Defence Innovation Agency (AID) in September 2018 is one of its consequences, as well as the adoption of the Defence Innovation Guidance Document (DOID¹⁷) in July 2019.

The AID is an independent agency in charge of collecting and developing all types of innovations (technological, organisational, conceptual) inside the French MoD. Responsible for the R&D budgets (programme 144), it is linked to the DGA but acts as an autonomous body with its own vision elaborated with only French defence stakeholders. It issues the orientations guidelines in coordination with the other bodies of the ministry. Since its purpose is to be very responsive, it is a light agile organisation (100 people), with an annual budget of € 1.2 billion (2019)¹⁸, that pilots all innovation structures working inside or within the French MoD (defence cluster, technolabs, techlabs, etc.¹⁹) in order to capture “opportunity innovations”. For instance, the AID has recently signed two partnership agreements with the GICAT and the GICAN (French trade organisations for land defence industry and for shipbuilding) and their respective start-up acceleration programmes: GENERATE and SEAstart.²⁰ The AID acts on all French territory through points of contact designated among all the DGA and forces’ tests and experimentation centres.

At the same time, a programme management reform has been put in place, and the 2008 ministerial instruction on armament operations IM 1516 was replaced by the IM 1618²¹ in February 2019. This organisational instruction has “shifted the organisation of innovation-related activities from programmes to capabilities and introduced more agility”, especially in the management of complex military programmes.²²

¹⁷ Document d'orientation de l'innovation de défense, Ministère des Armées, 11 July 2019.

<https://www.defense.gouv.fr/actualites/articles/document-d-orientation-de-l-innovation-de-defense-doid-2019-les-nouvelles-ambitions-du-ministere-en-matiere-d-innovation>

¹⁸ This budget will increase gradually to reach € 1.5 billion by 2022.

¹⁹ For instance, the French Navy launched the *NavyLab* (2018) and the *FuscoLab* (2019) dedicated to special forces, whereas the French Army launched its *Battle Lab* (2019).

²⁰ <https://www.defense.gouv.fr/aid/actualites/signature-d-un-partenariat-entre-l-agence-de-l-innovation-de-defense-et-les-groupements-industriels-gican-et-gicat>

²¹ Instruction N° 1618/ARM/CAB sur le déroulement des opérations d'armement du 15 février 2019

²² V. MERINDOL D. W. VERSAILLES, *The (R)evolution of Defence Innovation Models: Rationales and Consequences*, ARES, July 2020, p.15.

Among the main developments the following changes should be noted:²³

- a programme management process driven by a capability vision and simplified to reduce the administrative phases in programme decisions from 6 to 3 phases (initiation, realisation, in service);
- a strong emphasis on incremental deliveries of capacities to accelerate capabilities delivery to forces and regularly put innovation into programmes²⁴;
- a joint vision of the specification shared between the Joint Staff and the DGA, joined when put in place by the industrial prime contractor;
- a reinforcement of the collaborative plateau between operational users, Forces Staff, DGA and industry engineers using system of system approaches and covering all capability aspects (equipment, training, concept, support, etc.);
- a better integration of the export requirements constraints into the initial design of a weapon system (provided that the industry will take part in financing the programme).

This reform intended to propose management guidelines for innovation but failed to provide them rapidly, the reason of the delay being the need to experiment new structures and new procedures to verify their efficiency.

Many experiments are currently in progress:

- CENTURION is a programme preparation phase started in January 2020, aimed at providing the next generation of infantry soldier equipment. Innovative solutions from all horizons are collected in a continuous flow and challenged by the integrated programme management team within clear goals: the soldier's efficiency and the equipment's weight reduction. The interest is confirmed in 3 months and development or experimentation contracts placed rapidly after. Results will be seen in one or two years.

²³ DEVAUX Jean-Pierre, *L'évolution de la conduite des programmes d'armement*, Défense & industries n°14, FRS, June 2020, p. 7-10.

<https://www.frstrategie.org/sites/default/files/documents/publications/defense-et-industries/2020/14.pdf>

²⁴ It is not the only the changes made in this reform that simplifies the processes and focus on a better teaming between industry, DGA and the Joint Staff to enhance programme management efficiency, it also emphasized by the capability management, the European cooperation, and the need to integrate as early as possible the export dimension into the programmes.

- Innovation clusters specialised in dedicated defence domains have been created in regions where the industry is already focused on this domain. In Toulon, France's largest naval base, a maritime cluster oversees the innovation for naval programmes in all phases. MRO solutions and new concepts are presented and evaluated through guided challenges or on a continuous flow basis. In the regions of Occitanie and Nouvelle Aquitaine, cradle of the French aeronautics industry, mainly around the cities of Toulouse and Bordeaux, the Aerospace Valley²⁵ cluster gathers over 500 companies, schools (ENAC, INSAE) and research centres (ONERA, CNRS, CNES, INRIA) in the field of aviation and space flight. In that regard, Aliénor, a regional aerospace innovation cluster, was launched in 2019. It brings together the DGA, Aerospace Valley, and the French Air Force and Army, and aims at "detecting, guiding and testing innovations brought by regional players (especially SMEs, VSEs and start-ups), in order to develop new technological solutions for aerospace defence, in conjunction with the Defence Innovation Agency".²⁶ A variety of other clusters have emerged, such as for army equipment, CBRN or intelligence, so as to cover the territory with defence-specialised innovation structures and contact points.
- The AID is performing regular thematic calls for proposals and challenges often resulting in the award of a contract to the winner. These kinds of challenges have already proven that they can be very good accelerators for forces' equipment if the topic is limited and wellfocused. The CAROTTE challenge for instance, is a good example of the value of such practices: launched in 2012, it has been able to provide within two years an operation solution for small ground exploratory robots that have been procured and immediately deployed in operation (2014).²⁷ Recent challenges, such as the SYNAPSE challenge²⁸ (July 2019) or the drone swarm challenge²⁹ (May

²⁵ <https://www.aerospace-valley.com/>

²⁶ <https://www.defense.gouv.fr/dga/actualite/la-dga-inaugure-alienor-cluster-d-innovation-technique-de-defense-dans-le-domaine-aerospacial>

²⁷ CARTographie par ROboT d'un TErritoire": the challenge is to create an autonomous robotic system, capable of orienting itself in an enclosed space and of recognising objects within this space in order to map it. <https://anr.fr/en/call-for-proposals-details/call/programme-contenus-et-interactions-defi-robotique-cartographie-par-robot-dun-territoire-carott/>

²⁸ Carried out by *Intelligence campus* (the structure in charge of innovation within the Directorate of Military Intelligence) with the AID's Innovation défense lab, this challenge aimed at exploring the logical and physical mapping of cyberspace. <https://www.defense.gouv.fr/aid/actualites/challenge-synapse>

²⁹ Carried out in collaboration with the schools under the supervision of the DGA (ENSTA Paris, ENSTA Bretagne, ISAE-SUPAERO and the Ecole Polytechnique), the goal of this challenge was to reflect on the concept of a "guardian angel" UAV swarm, which could ensure the safety of a section on the ground.

<https://www.defense.gouv.fr/aid/actualites/challenge-essaim-de-drones-quand-les-etudiants-imaginent-les-drones-autonomes-de-demain>

2020), pursue this logic by addressing very precise topics for which solutions are expected in a noticeably short time: cyber, robotics, digital applications, etc. More recently, a large challenge has been launched to provide solution for the COVID-19 crisis: thousands of answers have been collected in a few weeks, rapidly analysed, selected, and some were financed.³⁰

- A purchasing unit dedicated to innovation acquisition has been set up within the AID to explore new procurement approaches by making an extensive use of the provisions of the public procurement code (*Code de la commande publique*) and relying on simplified market models (i.e. *Décret n°2018-1225*)³¹. Thus, the establishment of a “contract factory” within the AID, based on systematised purchasing, should allow to reduce the delay between the choice of the operators and the contract notification, with a 3-week notification target.³² This idea is strongly inspired by American DoD’s DIUx capacity to contract within 60 days, thanks to the Commercial Solutions Openings (CSO) and Other Transaction Agreements (OTA) mechanisms.³³
- Finally, the AID is attempting to renew defence prospective vision by assembling a group of science fiction authors and futurologists (the Red Team) to develop their vision on the possible futures. After its launch in December 2019, over 500 people have positively answered, and this experience has started earlier in 2020.³⁴

The return of those experiments is expected in a few years’ time.

FRENCH DEFENCE TECHNOLOGY PRIORITIES

French defence technology priorities have been presented in the previously mentioned R&T orientation document (DOID, 2019). This document aims at giving information outside of the MoD, particularly on the main priorities issued from the capability analysis

³⁰ Emmanuel CHIVA, Assemblée Nationale, *Audition devant la Commission de la défense nationale et des forces armées*, 3 June 2020.

http://www.assemblee-nationale.fr/dyn/15/comptes-rendus/cion_def/115cion_def1920057_compte-rendu

³¹ <https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000037852355&categorieLien=id>

³² *Document d’orientation de l’innovation de défense*, Ministère des Armées, 11 July 2019, p. 17.

³³ CHIVA Emmanuel, “Capturer l’innovation de défense : à la découverte de DIUx”, *Défense & Industries* n°11, FRS, June 2018, p. 12.

³⁴ “Les auteurs de science-fiction, dernières recrues de l’armée française”, *L’express*, 18 February 2020.

at system level, identifying the field where innovation is awaited. According to this document, the MoD's main targets for innovation are:

- autonomous vehicles in all environments. This includes the control of connected objects and resilience, unmanned fleet control, swarm technologies and geolocation;
- data collection, processing, and analysis: data fusion, multisource data acquisition, massive data collection and analysis. This includes the detection of abnormal behaviours, the development of smart sensors;
- corporate social responsibility and environment, human resources, training, environmental footprint, including energy in theatres of operations;
- human (mental load, health, wearable technologies) and man-machine interfaces with expected progress in voice and brain-machine control interface as well as in telemedicine;
- transverse themes such as quantum calculator, artificial intelligence (defence is one of the big players in the national AI challenge), telecoms (5G, IoT, Wi-Fi, etc.), cybersecurity in all its forms, NewSpace, biotechnology, etc.

These priorities include programmes and programme support. For example, studies are under way for the FCAS (Future Combat Air System) and the MGCS (Main Ground Combat System) in a multilateral cooperative process, the next intelligence platform ARTEMIS, the future aircraft carrier (PANG), the future submarines and submarine warfare (partly also with Germany), complex missiles new generation (partly with the UK, partly with Germany), space intelligence (edge sensors and space surveillance in European cooperation), GEODE 4D (dynamic geographic data referendum), etc. In addition, deterrence efforts must be considered as a support to many key technologies (laser, simulation, transmissions, ballistic and super or hypersonic missiles, reliability of systems, submarines, etc.).

N.B. An update of the defence innovation guidance document (DOID) has been announced by the director of the AID and should be released shortly.³⁵ This updated version should

³⁵ Emmanuel CHIVA, *Audition devant la Commission de la défense nationale et des forces armées*, Assemblée Nationale, 3 June 2020.

specify the European cooperation priorities and place the emphasis on operational superiority and strategic autonomy.

LIMITS OF THE REFORM

The engaged innovation and procurement reform expected the following results:

- be more effective in identifying innovations of all kind and in bringing them into programmes as soon as they are available and mature;
- deeply change mindsets, favouring risk takers and limiting the financial impact in the early phases of programmes;
- involve the whole industrial base in the innovation process by opening the defence market to SMEs, start-ups, and laboratories, as well as connecting them to main defence system providers.

However, some difficulties have already emerged:

- Innovation generates financial risk: despite a cultural change, budget pressure can limit innovation dissemination, and although defence budget is ensured until 2022, the uncertainty on what could happen after the current period discourages risk taking attitudes for future programmes. Moreover, it is difficult for defence companies to access private funding, especially for start-ups which suffer from recurring funding refusals by banks arguing compliance reasons.³⁶
- The links between innovation and industrial policy are not simple: defence industry must ensure that the autonomy of supply is reached for most critical domains, not only for the most mediatic ones. Through its Defence Innovation Orientation Document (DOID), the AID is focusing on very innovative technologies (AI, quantum computing, biotech, smart sensors, robots, etc.) but puts aside “old technologies” support (e.g. material for armoured vehicles or submarines, engine technologies, electronic components, etc.) although they are essential to our current and future systems. A compromise must be built to manage both aspects in future programmes, also taking the European industry dimension into account.

³⁶ ALLIZARD Pascal, BOUTANT Michel, *L'industrie de défense dans l'œil du cyclone*, Rapport d'information n°605, Sénat, 8 July 2020, p.18-19. <https://www.senat.fr/notice-rapport/2019/r19-605-notice.html>

- The current vision remains fundamentally French-minded with little reflection on European coordination, even if as usual Europe's mantra appears everywhere. Experimentations for innovation integration are waited for FCAS and MGCS as they are in phases where innovation should be considered with limited risks. The European Defence Fund should also consider that current calls are remarkably interesting but poorly linked to real major programmes.
- The multiplication of innovation support mechanisms in France, but also in Europe, makes them hard to understand for small companies with limited human resources and especially for non-defence actors. The competition is also increasing, limiting the chances of success which impacts the investors' enthusiasm in the defence process.
- The AID is still struggling to find its place in the innovation and procurement processes, in particular regarding the DGA. The AID is progressively acquiring the needed tools such as procurement (a structure dedicated to innovation has been created) but still depends on the DGA's technical expertise and the operational knowledge of the forces. Moreover, despite some efforts, the agency remains too centralised and therefore has difficulties to capture innovation resulting from regional actors such as DGA clusters, army innovation centres, research centres, or technology parks.
- Time is a key factor to judge the possible success of such a structure, and the constant MoD transformation over more than 30 years is putting the AID under the pressure of immediate results, tampering with a process that needs years to be verified and corrected. The AID is therefore pushed to short-term results focusing on mediatic topics rather than on long-term evolutions or more discrete operational matters. At the same time, the AID is expected to be highly reactive and to be able to adapt itself to any new situation as quickly as the situation evolves. The COVID-19 crisis and the support brought by the AID³⁷ to the emergence of innovative solutions to fight the pandemic is a clear marker of

³⁷ The AID has launched in early March a call for project proposal with € 10 million: thousands of various projects (protection, COVID detectors, medical equipment, but also human resources optimization, mask-wearing surveillance systems, etc.): the first projects were chosen in April and finally around 37 are now allocated.

those two tendencies. It has been an incontestable success, but in some cases the velocity clearly deserved the industrial strategy.³⁸

THE REFORMS' IMPACT ON PROCUREMENT POLICIES REMAINS UNCERTAIN

Although the impact of the current reform is not easy to identify because it has just started and programmes have a long lifespan, some impacts on the innovation tools developed over the last 10 years have already been identified:

- The RAPID process allows SMEs to develop their own products with credible offers within 3/5 years after the grant allocation. It has also helped the DGA identify the companies that wanted to change their position inside the supply chain or had an innovative product approach. **The relations with main system providers are still difficult:** many of them have innovation policies that help innovative industry go beyond the DGA's first support. The property gained through the DGA's innovation grant is still a major item: it is often captured afterwards by the supply chain through defence contracts.
- **It takes time to change mindsets.** Most of the time, risks are eliminated early and at every level of the hierarchy. Innovation is a major risk that needs dedicated management structures and budget procedures within a dedicated envelope. If the AID has provided such an environment in the MoD, they were very few in the past and not so well considered in a waterfall programme management environment. Innovation management must evolve from a technology-driven approach to an end-user-centric approach, in a context where regulations are strongly limiting the acceptable risks of many weapon systems. The programme manager profile (and evaluation process) should integrate this new management dimension favouring more than before the risk takers.
- **The contract awarding velocity is a major challenge** for the years to come. Innovation will have to be rapidly fed with contracts. The public contracting procedures are offering a large panel of possibility explored today by the AID and the

³⁸ NG Biotech choice for instance (the first project to be chosen) was announced as a pure French homemade detection system, which was not really the case since the key elements of the system came from foreign countries. France Inter, 10 July 2020. <https://www.franceinter.fr/ng-biotech-un-test-covid-19-francais-en-realite-essentiellement-chinois>

DGA (competitive challenges for instance), but the transition from scientific discovery to market launch is still too slow compared to civilian processes. One of the main causes is the weight of regulations and standards in the military world, often added to civilian regulations that create specific product lines for niche markets. Those regulations evolve too slowly. Paragliding capacities for mountain infantry are a good example of such difficulties; acquired very rapidly and successfully experimented, they have been retired from service due to a lack of a military standards. The need for defence to anticipate those standards evolutions is increasing, as well as the methodology to ensure that standards are demonstrated in more complex contexts, generating a new field for defence innovation.

Finally, defence buyers must be more willing to take risks, and defence users must reconsider all regulations and norms that could limit the innovation process.

THE EUROPEAN DEFENCE FUND (EDF) IS ESSENTIAL TO DEVELOP INNOVATION AT A EUROPEAN LEVEL

For years, NATO has been the place where European innovative projects could find their way. AGARD³⁹ and ACT⁴⁰ are places where those innovations were presented, sometimes experimented, but seldom voluntarily financed to accelerate their development. In Europe, the European Defence Agency (EDA) has tried to develop a European ambition in this field but focused mainly on scheduled innovation.

Launched in 2018, the European Defence Fund (EDF) intends to support the development of innovation at a European scale between 2021 and 2027, offering innovative companies to collaborate on large projects linked to future programmes and supporting their breakthrough innovative ideas in dedicated programmes: they will be able to join forces to reach greater goals. It should come in addition with the national efforts aimed at identifying the potential innovations and should support Europe's quest for autonomy and industrial development. Between 2017 and 2020, the PADR and the EDIDP preparatory experimentations to the EDF have shown that investing in building a consortium and a proposal is constraining the SMEs' ambitions to join a consortium

³⁹ The Advisory Group for Aerospace Research and Development was a NATO agency from 1952 to 1996.

⁴⁰ NATO's Allied Command Transformation.

managed by current European prime contractors. This will probably change progressively, both structuring the supply chain around prime contractors and the market opportunities for innovative SMEs, allowing innovation to spread around Europe more easily.

Finally, the question arises as to whether we should develop some kind of European DARPA, in line with Europe's defence priorities, fostering Europe's strategic autonomy and anticipating its future needs? It would have to promote innovative European technological developments and European future operational concepts through real experimentation capacities around Europe, focus on risky advanced technological topics, be very reactive both for contracting and diffusing results, be sufficiently independent to take major risks and to support failures, and be able to collaborate closely with national forces. It could be partly financed by the EDF, but technology is only one possible way to innovate in military affairs. The other part of the budget should come from other sources managed by representatives of European forces. Following the example of the French AID, a future European defence innovation agency should also mix defence experienced personnel with personnel coming from other economic sectors and scientists from every horizon (including social sciences). ■

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Policy Paper

DEFENCE INNOVATION: NEW MODELS AND PROCUREMENT IMPLICATIONS The French Case

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ARES GROUP

The Armament Industry European Research Group (Ares Group) was created in 2016 by The French Institute for International and Strategic Affairs (Iris), who coordinates the Group. The aim of the Ares Group, a high-level network of security and defence specialists across Europe, is to provide a forum to the European armament community, bringing together top defence industrial policy specialists, to encourage fresh strategic thinking in the field, develop innovative policy proposals and conduct studies for public and private actors.

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