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AFFAIRES ÉTRANGÈRES
ET DE LA DÉFENSE

SÉNAT

THE DRONE WAR: THE URGENT NEED FOR A FRENCH STRATEGIC RESET

Nearly five years have passed since the Commission's last report on the 'drone war'. **In a prophetic warning, issued just a few months before the outbreak of the war in Ukraine, it cautioned against *'the leading role that drones could play on the battlefield in the future, against the backdrop of a return to high-intensity warfare***'.

At the time, the Commission recommended equipping our armed forces with a new fleet of 'low-cost' and 'disposable' drones, providing greater support to the national defence industry, promoting more agile procurement processes, simplifying procedures and relaxing regulations to improve efficiency. Clearly, events since then have proved the Commission right.

Both the war in Ukraine and the conflicts in the Middle East are characterised by the widespread use of drones. No longer confined to the air, drones are now also used at sea and, increasingly, on land. The robotisation of the battlefield is no longer the stuff of fiction: it is now a reality. In this new sword-and-shield dynamic, counter-drone capabilities have become a central issue.

Since 2021, a new factor has entered the picture: the growing use of artificial intelligence. This technology significantly reduces decision-making loops and promotes ever-greater system autonomy. In this regard, Ukrainian President Volodymyr Zelensky announced in April 2026 that, for the first time, a battle had been won solely through the use of robotic systems.

Having completed their work, the rapporteurs – **Ronan Le Gleut** (representing French nationals living abroad), **Hélène Conway-Mouret** (SER, representing French nationals living abroad) and **Étienne Blanc** (LR – Rhône) – **are now sounding the alarm: France is not ready for a robot war**. **They are therefore calling for a strategic reset to make robotisation the backbone of the French armed forces**.

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I. THE DRONE WAR: NO LONGER THE STUFF OF FICTION

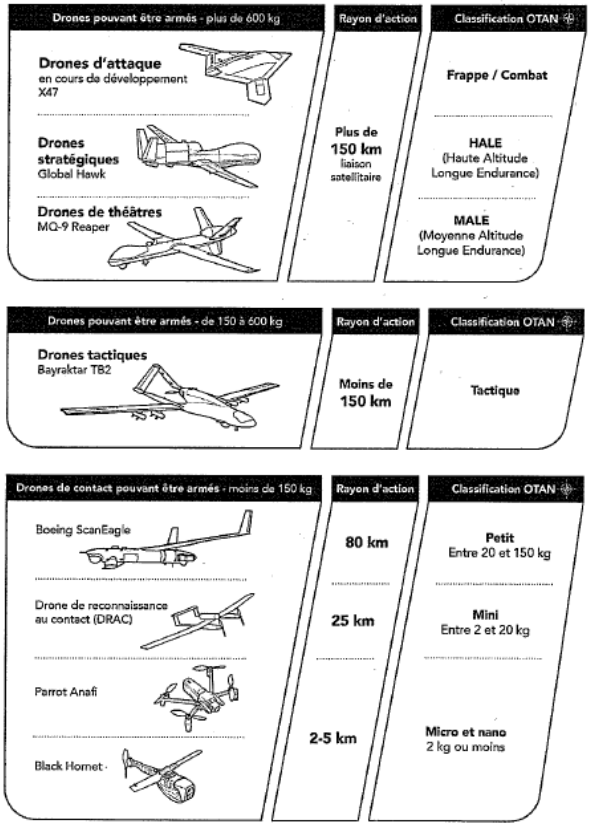
A. A multifaceted reality unfolding across four dimensions

The term 'drone' covers a **very diverse range of systems**: from *Prox Dynamics' Black Hornet,* which is 16 cm long and weighs 33 grams, to *Northrop Grumman's RQ-4 Global Hawk*, which is nearly 40 m long, 14.5 m high and weighs over 14.5 tonnes.

These increasingly diverse systems have also seen a transformation in uses. **Long confined to surveillance and intelligence missions, drones are now fully integrated into combat operations (attack, counter-drone operations, and overwhelming enemy defences)**. Mass-produced, loitering munitions (LMs) and *FPV (First-Person View)*[1] drones enable low-cost precision strikes. **Guidance technologies have also undergone significant developments**. Traditional radio links are now combined with wired systems, satellite communications and increasing autonomous capabilities based on artificial intelligence.

The proliferation of drones now extends to all theatres of conflict. Alongside aerial drones**,** there are now uncrewed surface vessels (USVs), such as Ukraine's Magura and Sea Baby, uncrewed underwater vehicles (UUVs), as well as ground robots, particularly for logistical operations.

Les différentes catégories de drones aériens



Source : Olivier Dujardin et Lauraline Maniglier, Drones et lutte anti-drones, Ellipses, octobre 2025.

B. From niche to mass adoption: lessons from the war in Ukraine and conflicts in the Middle East

The war in Ukraine has marked a shift in scale: drones have become mass-produced, much like ammunition. They are used at every phase of operations and play a major role in wearing down enemy forces.

Ukraine **uses nearly 15,000 drones daily and produced 4.5 million in 2025. Production could exceed 10 million units in 2026**.

[1] These drones are equipped with cameras that transmit video in real time, offering the pilot an immersive experience via specialised goggles.

15,000 drones are used every day on the Ukrainian battlefield; **4.5 million** drones were produced by Ukraine in 2025. This figure could exceed **10 million in 2026**.

Furthermore, it is also adapting its capabilities in line with extremely rapid innovation cycles. **The average time between the emergence of a new technology and the development of a countermeasure by the adversary is estimated at just 6 weeks**.

Recent crises in the Middle East have confirmed the now central role of drones on the battlefield.

Operations conducted in the Red Sea since 2023, followed by the hostilities that erupted in 2026 in the wake of Israeli and American strikes on Iranian targets, have highlighted the growing use of drones and loitering munitions in saturation attacks.

6 weeks

This is the average time between the emergence of a new technology and the development, by the adversary, of a countermeasure designed to counter it.

They have also demonstrated **the ability of actors with limited resources to challenge advanced defence systems by forcing them to incur interception costs that are disproportionate to the cost of the attacking systems deployed.**

C. The conflict in Ukraine: the first drone war

Beyond the widespread deployment of unmanned systems, the conflict in Ukraine highlights a more fundamental shift: **the onset of the first 'drone war'**.

Drones are no longer used solely for surveillance or strike missions. **They are themselves becoming targets and active participants in the conflict**.

On certain sections of the front line, the density of sensors and drones is such that any movement detected can be struck within an extremely short timeframe, greatly reducing the 'fog of war'. **This has led to the emergence of 'kill zones' along the front line, where combatants' freedom of manoeuvre is severely restricted and where only drones or robotic systems can operate**. **In these environments, subject to near-total jamming of radio communications and GNSS signals, these systems must be capable of operating with an ever-increasing degree of autonomy**.

D. France still has a long way to go to close the gap

Faced with this transformation, France remains in an intermediate position.

Efforts undertaken over the past few years have helped to reduce its initial capability gap, but **the number of systems currently available – just a few thousand – remains insufficient to achieve a genuine critical mass**.

Furthermore, capability shortfalls remain, particularly in the areas of tactical drones, loitering munitions, deep-rear support capabilities and counter-drone capabilities.

Beyond equipment alone, **the armed forces must also address the challenge of training and retaining drone pilots**, a skill set that will be critical in future conflicts.

II. COUNTER-DRONE DEFENCE (C-UAS): IN THE FACE OF A PROVEN THREAT, FRENCH CAPABILITIES REMAIN INSUFFICIENT

A. In this new dynamic of sword and shield, counter-drone capabilities have become indispensable

The ability to defend against enemy drones has become as essential as protection against conventional aerial threats.

Counter-drone capabilities (often referred to as Counter Uncrewed Aerial Systems or C-UAS) are structured around **four core functions: detection, classification, identification and neutralisation**. The effectiveness of this chain depends on an integrated command-and-control (C2) architecture, responsible for fusing data from multiple sensors, sharing the tactical situation and coordinating response systems.

There is currently no single solution capable of addressing the full range of threats posed by drones. **Instead, C-UAS relies on a combination of successive layers of protection**, the overall effectiveness of which depends on how well they are coordinated.

B. French capabilities remain limited

French counter-drone capabilities are based on **two broad categories of complementary systems**.

So-called 'heavy' or long-range systems (the *MILAD*, *BASSALT* and *PARADE* systems) provide protection for critical infrastructure, military installations and deployment areas. They combine multiple sensors, a C2 system and various means of neutralisation, including jamming, decoys, interceptor drones, nets, missile-type effectors, guns, rockets and small arms. Other neutralisation systems, such as laser or electromagnetic directed-energy weapons, or even system takeover, are currently under development or being evaluated.

So-called 'light' or short-range systems are designed for close protection of critical sites, events or deployed units. They generally combine compact detection equipment with portable jamming devices. For example, the armed forces use the *Murin* surveillance radar from *Thales* and the *HADDES* detector from *MC2 Technologies* for detection; they also have *NEROD* jamming rifles and *BLAST* jammers developed by *MC2 Technologies*, as well as the *PROTEUS* and *ARLAD* systems for neutralisation.

Despite the diverse range of solutions deployed, the capabilities currently fielded by the armed forces remain limited. According to the report appended to the updated Military Programming Law, **at the end of 2024, the armed forces had only 31 counter-drone systems, 150 jamming rifles, 3 naval counter-drone systems and 8 SAMP-T systems**.

In particular, protection capabilities for mobile units remain insufficient. Whilst several manufacturers are currently developing onboard protection and self-protection systems, the armed forces still mainly rely on interim solutions, such as the *ARLAD armoured personnel carriers* or vehicles equipped with the *Proteus Standard 1* system. The future *Serval LADs*, which will significantly bolster this capability, are only due for delivery in 2027.

Similarly, **protection of naval facilities, particularly against the emerging threats posed by uncrewed surface and underwater systems, is set to be strengthened**.

III. ARTIFICIAL INTELLIGENCE: A REVOLUTION SET TO TRANSFORM EVERY COMPONENT OF THE ARMED FORCES

A. A technology permeating all aspects of military activity

Artificial intelligence (AI) is gradually establishing itself as a major driver of transformation in military capabilities. The Ministerial Agency for Defence Artificial Intelligence (AMIAD) identifies **three main categories of use**:

- **'organic' or management applications**. These are the most widespread applications: conversational assistants, automated document processing, data analysis support, and forecasting logistics requirements and stock levels;
- **decision-support systems**. Faced with the ever-increasing volume of available information, human operators can no longer analyse all the data produced by sensors, intelligence systems or open sources on their own. AI can prioritise the available information, highlight relevant elements or suggest several courses of action to inform the operator's decision;
- **embedded systems**. AI is gradually being integrated into drones, airborne sensors, land vehicles and naval vessels. However, this integration remains constrained by several factors, including onboard computing power, energy requirements, heat dissipation issues and the rapid pace at which the underlying technologies are evolving.

The major operational benefit of AI lies in its ability to accelerate the OODA loop ('observe, orient, decide, act'). In this respect, it is a key component of future collaborative combat systems and '*kill web*'-type architectures (such as Ukraine's *Delta*, *Palantir's* US-based *Maven*, or the French *Arcadia* project), designed to network sensors, effectors and command systems.

Although the French armed forces have begun to overhaul this area, the transformation has yet to reach the required scale. The publication of the ministerial strategy on defence AI in March 2024 marked an important milestone, swiftly followed by **the creation of the Ministerial Agency for Defence Artificial Intelligence (AMIAD)**. This effort was accompanied **by investment in sovereign computing capabilities, notably including the commissioning of the ASGARD supercomputer in September 2025.**

This momentum is also part of preparations for future methods of warfare. **The PENDRAGON project is intended to trial an initial robotic combat unit by 2027, based in particular on the coordinated use of aerial drones and ground robots**. This initiative is a necessary step, yet its scale remains insufficient in light of the transformation required.

France must therefore continue to scale up its defence AI capabilities.

B. Towards ever-greater automation of weapons systems

France has historically opposed the use of Lethal Autonomous Weapons Systems (LAWS). Whilst this stance is shared by several European partners, **some of France's allies and competitors continue to pursue research aimed at increasing the level of automation of such systems**.

Maintaining meaningful human control must not result in constraints that are incompatible with operational realities or that risk leaving France at a technological disadvantage compared with less restrictive competitors.

France must be able to respond to changes on the battlefield and to counter threats – notably drones – whose speed or scale of operation could exceed the capabilities of a purely human response. **The rapporteurs therefore consider that no area of research should be ruled out from a defensive perspective.**

The use of the term 'Lethal Weapon Systems Incorporating Autonomy' already reflects this development. These systems remain under the authority of a human chain of command, and their autonomous functions operate within a framework previously defined by human decision-makers. In this model, **the operator is no longer necessarily 'in the loop' –** that is to say, directly involved in every engagement decision – **but** remains **'on the loop',** defining *in advance* the conditions under which autonomy is exercised. In practice, Lethal Weapon Systems Incorporating Autonomy already exist**: once launched, 'fire-and-forget' missiles can no longer be redirected or assigned to a different target.**

This doctrinal update is all the more necessary given that, in the event of clashes between autonomous systems, the concept of lethality itself becomes meaningless.

IV. FRANCE MUST BE READY FOR THE WAR OF THE FUTURE

A. Preparations still largely geared towards the conflicts of the past

According to the French Army General Staff, while the 20th century was the era of mechanised warfare, the 21st will be the age of robotic systems. This transformation is driven by the widespread deployment of drones and robots with increasing autonomy, alongside the emergence of increasingly automated defence systems and countermeasures.

> *While the 20th century was the century of mechanised warfare, the 21st will be the age of robotic systems.*

However, this transformation is not yet seen as a priority within France's military model. **Initiatives undertaken in the fields of drones, counter-drone defence and AI continue to be pursued largely on a sector-by-sector basis**.

This fragmentation gives the impression **of a jumble of disconnected technological building blocks, rather than a clearly defined, overarching vision**. **These investments should not, however, be viewed in isolation, but as part of a coherent programme to prepare the French armed forces for future conflicts, where robotic systems and greater autonomy will play a central role**.

Furthermore, **of the €15.1 billion secured by France under the European SAFE instrument, only €490 million will be allocated to drones, with no funding earmarked for counter-drone defence or AI**.

Only **3.2 per cent** of the €15.1 billion secured by France under the SAFE instrument will be allocated to drones.

B. The 2024–2030 Military Programming Law and its update reflect this lack of foresight and vision

The 2024–2030 Military Programming Law initially allocated **€5 billion to drones, representing 1.25 per cent of total defence funding**. **This level of investment appears modest given the role drones now play in conflicts**.

> Only **1.25 per cent** of the funding under the 2024–2030 Military Programming Law is allocated to drones (rising to 1.92 per cent after the update), even though drones are responsible for **80 per cent** of Russian losses in Ukraine.

Furthermore, nearly **90 per cent of the funding earmarked for drones was intended for a handful of major programmes –** including the European MALE (medium-altitude, long-endurance) drone, the combat drone, the future maritime mine countermeasures system and the tactical drone system (TDS) – **rather than for the development of consumable or mass-deployable capabilities**.

The pace at which this programme is being implemented also appears slow: only 28 per cent of the allocated funds were utilised between 2024 and 2026.

> Only **28 per cent** of the payment appropriations allocated to the 'drone' programme have been spent

The update to the Military Programming Law has brought the total budget to €8.4 billion, representing 1.92 per cent of defence appropriations for the period. This revision provides, in particular, for enhanced tactical drone capabilities, the development of unmanned naval capabilities, the fitting out of French Navy vessels with embarked drones, and preparations to replace the *MQ-9 Reapers* with a sovereign MALE drone capability.

In view of what it considered to be a still insufficient level of investment, **the Senate adopted several provisions aimed at strengthening French capabilities in this field**. These include:

- the development of long-endurance underwater drones;
- the recognition of interceptor drones as a fully-fledged capability category, to ensure they are not treated as conventional air defence systems or munitions;
- the development of 'loyal wingman' drones to accompany the *Rafale*;
- the creation of a catalogue of trusted drones to simplify the procurement of such equipment;
- doubling the procurement targets for tactical and light tactical drones by 2035.

Despite the progress secured by the Senate during the update of the Military Programming Law, **the necessary shift in scale has yet to materialise**. The rapporteurs therefore believe that **the next military planning cycle must place robotics, drones and AI at the heart of the armed forces' transformation**.

C. Yet France has considerable strengths

The French defence industry is well placed to rise to this challenge.

In the field of counter-drone defence, the rapporteurs have noted a wide range of initiatives led both by major contractors (including *MBDA*, *KNDS*, *Arquus*, *Thales* and *Safran*) and start-ups such as *Harmattan AI* and *Alta Ares*. These players have fully embraced the need to develop innovative, cost-effective solutions.

The same momentum can be seen in the field of AI, where France is home to internationally recognised players. The development of partnerships with companies such as *Mistral AI* illustrates the potential to draw on world-class national capabilities to meet the needs of the Ministry of the Armed Forces.

Similar dynamics are evident in the field of drones and loitering munitions, with projects such as *Damocles*, led by *KNDS* and *Delair*, and *Chorus*, developed by *Turgis & Gaillard* and *Renault*. At the other end of the capability spectrum are programmes for 'loyal wingman' drones to accompany the *Rafale*, as well as the future stealth combat drone, whose development has, for the time being, been delayed due to a lack of funding.

In addition to its defence technological and industrial base (DTIB), France benefits from a deep pool of engineers, researchers, IT specialists and technicians, whose expertise constitutes a significant comparative advantage.

The challenge now lies in the ability to turn these strengths into operational capabilities. This will require:

- **an increase in real-world testing**, which **requires the creation of new centres to test emerging capabilities;**
- **speeding up innovation cycles** and, consequently, **further streamlining the** Ministry of the Armed Forces' **procurement procedures**;
- **providing greater support for innovative SMEs and mid-sized companies through public procurement,** particularly once the war in Ukraine comes to an end, to help France's DTIB to adapt to the new competitive environment as Ukraine's industrial capacity and technologies increasingly shift towards export markets;
- **adapting the regulatory framework**;
- **playing an active role in European initiatives in the fields of drones, counter-drone defence and AI in order to take full advantage of them**.

Main recommendations

1. Make the use of drones, robotics and artificial intelligence the cornerstone of France's conventional armed forces model, as part of a 'robotic deterrence' strategy.

2. In the short term, modelled on the UK's *Asgard* programme, launch a programme with a budget of at least €1 billion to build a comprehensive robotic warfare ecosystem combining C2, artificial intelligence, cloud computing, satellite communications, robotic systems, and related capabilities.

3. Pursue the development of increasingly autonomous systems as part of a defensive approach, without introducing a proliferation of new standards that would lead to a technological disadvantage, particularly in the field of counter-drone defence.

4. Establish, without delay, new test centres to enable the testing of drones, counter-drone systems and artificial intelligence solutions under real-world conditions.

5. Launch work, without delay, on Collaborative Combat Aircraft (CCA) to ensure France remains competitive on the international stage.

6. Make better use of data by systematically collecting, analysing and sharing information from the various sensors deployed during missions. Put in place specific arrangements for processing and managing protected data.

7. Adopt a multilayered, multi-effector approach to counter-drone defence, particularly in the case of mobile systems, to avoid developing capabilities in silos.

8. Strengthen the security of naval facilities, particularly against uncrewed surface and underwater systems.

9. Establish a specialist reserve dedicated to drones, counter-drone defence and artificial intelligence in order to rapidly mobilise the expertise available within civil society.

10. Radically speed up procurement procedures and, wherever possible, prioritise off-the-shelf European solutions – provided they are available and meet the required technical and operational specifications – in order to shorten decision-making and delivery cycles. Provide manufacturers with multi-year visibility to prevent the weakening of France's defence and security industrial base. Reassess the threshold for innovative defence and security contracts so that it is aligned with the threshold applicable to defence and security procurement at European level.

11. Streamline maintenance, repair and overhaul (MRO) specifications, particularly for low-cost capabilities and consumables.

12. Given the rapid obsolescence of drone and loitering munition technologies, prioritise a strategy of reserving production capacity that can be mobilised at any time rather than a stockpiling approach, in accordance with the provisions adopted by the Senate as part of the update to the Military Programming Law (LPM).

13. Increase the use of procurement contracts, including low-volume ones, to benefit SMEs, mid-sized companies and innovative start-ups, to foster the emergence of new capabilities and the consolidation of a robotic warfare ecosystem.

14. Support increased production by SMEs, mid-sized companies and start-ups through public procurement for the benefit of allied countries that request or require such capabilities, so as to avoid drawing on national stocks.

15. Explore the use of leasing arrangements for certain counter-drone capabilities to keep up with the rapid pace of innovation.

16. Secure sovereignty over critical components (communications, navigation, defence cloud, data and software) required to deploy robotic systems. Capitalise on France's strengths in the fields of defence, artificial intelligence – including the European flagship *Mistral AI* – and access to low-cost electricity, etc.

17. Make full use of the opportunities offered by new European initiatives to accelerate the development of French capabilities in the fields of drones, robotics, counter-drone defence and artificial intelligence, while forging new partnerships with European countries.

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FURTHER INFORMATION

Preparing for the 'drone war': a strategic challenge, information report, 23 June 2021

Surveillance drones and armed drones: a matter of sovereignty, information report, 23 May 2017

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