Next Generation Combat Aircraft Technologies - NGCAT

HIBOU

HIghly automated airBOrne fUnctions

Duration of the project: 01/05/2025 – 01/02/2028

Key words: UAV Robotics, UAV data orchestration, Secure Communication, Multispectral DRI, Hybrid physics & Gen based software, synthetic and real images generation

Budget: 4.604.179 €

of which RHID contribution: 4.321.000 €

PROJECT DESCRIPTION

Next-generation combat air systems will be ever-more based on collaborative combat doctrine involving autonomous flying assets. This collaborative combat doctrine is made possible thanks to the integration of several advanced technological blocks. Artificial intelligence is certainly the enabler of collaborative combat, since it allows for enhancing the coordination, decision-making and effectiveness of operations. Indeed, AI systems can analyze vast amounts of data in real-time, providing strategic insights and optimizing decision-making processes. This will bring a significant advantage to air combat systems. In addition, each flying asset will need to have resilient automated functions in order to perform the operations required for its part of the mission. In order to form a resilient combat air system, each flying asset needs to be based on autonomous operations during mission fulfilment. These future flying assets may also take the benefit of novel sensors, such as multispectral cameras.

The project aims at developing the following innovative technological building blocks:

1. Hybrid physics and GenAI-driven generation of synthetic and real images according to different scenarios
2. Novel DRI & data fusion algorithms based on multispectral images
3. Development of flight function algorithms, such as landing, based on RGB and multispectral sensing
4. Development of data orchestration and mission functions for increased autonomy of drones

5. Development of a cyber security solution for cyber anomalies detection and response
6. Development of algorithms to measure sensor's quality and reliability
7. Development of anti-tampering strategies for communication module

Those technological blocks will bring significant advances to the Belgian Defence Technology and Industrial Base (BDTIB) and the Next Generation Combat Aircraft Technologies (NGCAT). In addition, these technological blocks should constitute a firm basis for an inclusion of future products into the FCAS system.

The project will be executed in three phases:

1. a system engineering phase, where customer needs and required functionalities will be fully defined
2. a design, development, testing & validation phase will translate the requirements into technical specifications of system components that will be built, integrated and tested, following an agile methodology
3. a demonstration phase, during which all developed technological blocks are integrated within a platform, allowing to validate their interworking according to various scenarios:

    a. automatic landing
    b. automatic take-off
    c. threat detection and identification
    d. mission reconfiguration after corrupted data detection
    e. detections' quality & reliability

The creation of a blueprint for a synthetic data generation tool will reduce the costs of obtaining data to craft data-driven autonomous functions for avionics on one hand, and enhance the robustness of autonomous functions on the other. While the proposed concept will be trained specifically for synthetic training data generation in the context of autonomous avionics functions, it is generic by design and can be retrained to generate other sensor spectra and applied to other remote sensing applications. Also, by enhancing data orchestration capabilities, UAVs achieve greater autonomy and efficiency, particularly in complex missions requiring real-time processing and decision-making. Improved data management frameworks will lead to more effective use of AI for tasks like object detection and navigation, reducing reliance on ground control and enabling more scalable and flexible UAV operations. This implies a broader adoption of UAVs apart from military applications, across industries, including defense and logistics. Ultimately, the proposal will push the boundaries of what UAVs can achieve, contributing to innovations in swarm intelligence, where multiple UAVs collaborate seamlessly, enhancing mission effectiveness and operational safety.

The final expected results are multiple. The strategy encompasses commercializing solutions to enhance UAV capabilities with advanced AI for flight functions and context awareness ensuring superior detection, tracking and identification sensitivity while minimizing false alarms. Follow-up R&D projects aim to generalize the tool to a wide range of drone/airborne applications (infrastructure monitoring, terrain mapping, disaster response, surveillance, etc.) and sensor types.

The proposed technologies will significantly improve man-machine collaboration and autonomous decision-making. In addition, the cyber security solution developed will enhance the security of the data exchanges.

The demonstrator will facilitate seamless integration through the offering of products, solutions and software licenses enhancing overall next-generation jetfighters functionalities. In addition, this platform will serve also to validate new concepts and scenarios and thus facilitate a technological step-up in the context of FCAS program.

Up to three patents filed to protect the generated IP are also envisaged.

Scientific publications will play a crucial role in the dissemination of the findings effectively, e.g. at conferences like ICRA and in prestigious journals such as IEEE Transactions on Robotics. The publication plan aims for two conference papers and one journal article, prioritizing open access to maximize visibility and impact.

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LINK(S)

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We are delighted to announce that Thales Belgium, leading a consortium of six Belgian partners, Apixa, dotOcean , FCC.Aero, FN Herstal , the Royal Military Academy, Belgium, and VITO , has been… | Alain Quevrin