Next Generation Combat Aircraft Technologies - NGCAT

ACE4ACES

Advanced Cockpit Enhancements for Air Combat Efficiency and Success

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

Key words: cockpit, human machine interface, artificial intelligence, eye tracking, displays, holography

Budget: 6 433 400 €

of which RHID contribution: 5 985 000 €

PROJECT DESCRIPTION

Context

The ACE4ACES project aims to address the increasing workload and information overload faced by pilots in modern combat scenarios and pave the way for new efficient Human-Machine Interfaces (HMIs) to support the evolving role of the pilot in the modern battlefield. The future battlefield is envisioned as a highly dynamic and interconnected space, reshaped by innovations like the combat cloud—a seamless network facilitating real-time data sharing and coordinated operations. In this context, manned fighter jets will work alongside unmanned loyal wingmen performing various tasks. This integration of manned and unmanned systems enhances operational effectiveness but increases the pilot's workload and information processing demands.

General objectives

The ACE4ACES project focuses on developing a new and more efficient multi-modal HMI (MM-HMI) within the cockpit to help pilots manage increased workload and information flow. This advanced HMI combines visual, auditory, tactile, and gesture-based interfaces to provide pilots with intuitive and manageable ways to process information and execute commands.

The project aims to deliver several key technologies impacting Belgian Defense Technology and Industrial Base (BDTIB) and Next Generation Combat Aircraft Technologies (NGCAT), including

improved situational awareness, more intuitive cockpit interactions, seamless integration with unmanned assets, optimized communication flows, and increased availability.

Methodology

Key technological developments will include:

- A helmet-mounted augmented reality (AR) holographic display system featuring gaze-supported gesture-based interaction modalities.
- A Large Area Display (LAD) systems featuring touch, keyboard, and gaze- and gesture-supported interaction modalities.
- Advanced audio and data communications systems featuring natural language processing and data stream prioritization.

The LAD will provide a large seamless display surface, high resolution, and high reliability even in case of a major failure. The helmet-mounted AR system will offer multiple focal depth planes, wide field of view, high brightness levels, and gesture recognition capabilities with minimal latency. The audio and data communications systems will improve the quality, prioritization, and transcription of audio and data streams for better decision-making.

The ACE4ACES project aims to demonstrate and evaluate these technologies at TRL-4, supporting various interaction modes between the human operator and system-of-systems, including visual (advanced displays), touch (keyboard and touchscreen), AI-assisted audio, and non-contact gestures (hand and gaze tracking).

Potential impact on Defence

The ACE4ACES project aims to bring several key advances compared to the current state of the art:

- Developing a single fault-tolerant LAD made in Europe that meets or exceeds current standards in terms of power consumption, touch capabilities and safety requirements.
- Advancing holographic display technology for helmet-mounted display systems, offering adjustable focal depth planes, wide field of view, large eye box and high brightness levels.
- Improving eye tracking technology in terms of optical power, sample rate, compute needs, measurement accuracy, calibration simplicity, robustness, and ambient light performance.
- Enhancing head tracking and gesture recognition using event-based sensors.
- Leveraging natural language processing for better data streams processing and manned/unmanned teaming with special attention to military semantics and ontologies.
- Reducing pilot workload and improving decision-making through automatic context-aware audio source selection and quality improvements.

The project satisfies the objectives of the NGCAT call by deepening technological knowledge, fostering cross-fertilization, and developing game-changing technologies for future HMIs of the Next Generation Fighter (NGF). The project will deliver substantial reductions in the total cost of ownership of key components of the NGF cockpit and increase the market share for established Aerospace & Defence entities, leading new entrants into the A&D market. All techno-bricks delivered will be ITAR-free, ensuring export and end-use under BE/EU sovereignty.

Description of the expected final research results and valorisation perspectives

Expected final research results include:

- Prototypes for helmet-mounted AR display systems and large area display systems.
- Demonstrators that showcase improved situational awareness and pilot workload reduction.
- Faster readiness for production: e.g. from mid-2026, Scioteq will use the TRL6 LAD demonstrator for product development, aiming for TRL9 by the end of 2027.
- Workshops and publications disseminating the research findings and technological advancements.

The project's technologies will be promoted globally, accelerating connections in the A&D market and potentially leading to follow-up projects. All partners will pursue international projects to integrate the techno-bricks into cockpit designs and explore opportunities within follow-up projects in EDF and EDA Captech AIR.

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LINK(S)

NOT YET APPLICABLE