Next Generation Combat Aircraft Technologies - NGCAT

ACRONYM: PFC-REA

Title: Rotary Electro-Mechanical Actuator for Primary Flight Controls

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

Key words: EMA, rotary actuator, primary flight control, fighter aircraft, loyal wingman

Budget: 5.591.280 €

of which RHID contribution: 5.042.000 €

PROJECT DESCRIPTION

Next-generation fighter aircraft and their loyal wingmen will demand exceptionally high-performance flight control systems that surpass the functional capabilities of today's solutions. These systems must not only deliver superior responsiveness and reliability but also be compact enough to integrate into increasingly thinner wing profiles. This additional constraint on the available envelope necessitates a significant reduction in maintenance requirements, pushing the boundaries of current actuation technologies.

To address these challenges, the consortium will leverage SABCA's proven expertise in space-grade Electro-Mechanical Actuators (EMAs), now transitioning into the commercial aviation sector. Building on this foundation, the consortium will design and develop a prototype rotary EMA tailored to the stringent demands of next-generation combat aircraft and their remote carriers. The rotary architecture is particularly well-suited to meet the tight integration constraints imposed by modern airframe designs. As such, the consortium will focus on optimising the actuator's topology to achieve the required high-performance metrics while targeting a maintenance-free operational profile. The prototype will be tested in selected environmental conditions and subjected to an endurance campaign representative of a fighter aircraft's full operational life cycle.

The project will follow a structured and rigorous methodology. The Preliminary Design Phase will aim to freeze the system architecture and define high-level functional and performance requirements. Trade-off studies will be conducted to evaluate different design options. Then a material coupon testing phase will be performed to assess the long-life potential of various candidate materials, particularly for critical components such as the gearbox. These tests will inform material selection and

durability modelling. In parallel with material testing, the detailed design phase will focus on optimising the gearbox and electric motor to meet key performance targets. This phase will culminate in the final definition of the prototype. This will allow the manufacturing of the prototype and its testing platform. A comprehensive test campaign will finally be conducted, including performance validation under representative environmental conditions and long-duration endurance testing to simulate the operational life of a fighter aircraft.

The project aligns directly with Theme #1 (Structures and Associated Subsystems) of the NGCAT initiative. It contributes to the electrification of actuation systems for control surfaces, a key enabler for future air combat platforms. The prototype will be optimised for high performance, reduced weight, and enhanced reliability—three critical metrics for next-generation systems. Damage tolerance will be addressed through the development of passivation systems tailored to rotary EMAs, as well as the exploration of tandem control strategies for single control surfaces. Furthermore, the project will ensure strategic autonomy by enabling the complete development and manufacturing of the EMA and all critical components within Europe, with a strong emphasis on Belgian industrial capabilities.

Beyond the delivery of a functional prototype, the project will mature several enabling technologies with broader applicability across defence platforms. These include long-life gearboxes for highly dynamic and demanding applications, advanced material selection methodologies for extended durability, high-fidelity modelling and simulation of EMA behaviour under dynamic loads, integrated multi-material optimisation techniques, and robust dynamic testing protocols for actuation systems.

The stand-alone test platform developed as part of this project will serve as a valuable asset for future defence-related research. It will provide a basis for defining specifications, evaluating performance, and assessing lifetime characteristics of flight control systems for combat aircraft, loyal wingmen, and other military platforms—including air defence systems and land-based vehicles.

Importantly, this project marks the first collaboration between key Belgian institutions and companies in the actuation domain. It will serve as a blueprint for future research initiatives, not only in defence but also in civilian aerospace applications. The consortium's collaborative model will foster innovation, knowledge sharing, and industrial growth within Belgium and across Europe.

To maximise the impact of the project, explicit valorisation activities will be undertaken in parallel with technical development. These efforts, in addition to the individual initiatives of the participating companies, will target aircraft Original Equipment Manufacturers to ensure that the project outcomes are aligned with industry needs. This will reinforce Belgium's position as a strategic partner in future defence programmes and contribute to the country's long-term technological sovereignty.

CONTACT INFORMATION

Coordinator
Mathieu Claeys
SABCA
mathieu.claeys@sabca.be

Partners
Ewald Goosens
BMT Aerospace International BV
ewald.goossens@bmtaerospace.com

Erin Kuci
CENAERO
erin.kuci@cenaero.be

Xavier Vanden Eynde
Centre de Recherches Métallurgiques ASBL
xavier.vandeneynde@crmgroup.be

Clément Pire
Haute Ecole Bruxelles-Brabant
cpire@he2b.be

Sébastien Hoffait
V2i S.A.
s.hoffait@v2i.be

LINK(S)

No links available.