

AIR COMBAT

SYSTEM OF SYSTEMS TITANS



As part of its missions for the French Defence Procurement Agency (DGA), ONERA is continuing its multidisciplinary activities dedicated to combat aviation, building upon its rich heritage of research to foster innovation. TITANS, our system of systems mock-up, offers an illustration of the work conducted within the scope of an internal project dubbed PHOBOS, combined with results from previous projects, amongst which the SUPERMAN programme.

PHOBOS seeks to develop a suite of methodologies for the rapid conception of unmanned, Collaborative Combat Aircraft (CCA), destined to operate alongside today's piloted fighter jets and those of tomorrow, all within the operational framework of a future air force system as envisioned by the Future Combat Air System (FCAS) programme. PHOBOS aims at developing new modular and synergistic configurations, favouring connectivity between combat drones and with other systems integrated within a « combat cloud ». Numerous methodological and algorithmic development activities are underway to design fleets of collaborative combat aircraft, maximising operational success in tactical situations inspired by the requirements stemming from the FCAS programme.



WHAT'S TITANS?

The **TITANS system-of-systems concept** is composed of modular platforms designed to accompany manned fighter aircraft and to transform conventional air combat capabilities. These innovative unmanned aircraft, featuring varying levels of autonomy, sitting halfway between a cruise missile and an unmanned fighter jet, open up a significant range of prospects in terms of operational capabilities. They could be employed for a wide range of missions, including Air Combat, Suppression and Destruction of Enemy Air Defences (SEAD/DEAD), Electronic Warfare, and Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR).

TITANS ASSETS

ONERA is establishing a novel Multidisciplinary Design and Optimisation (MDO) framework to explore a diverse set of Collaborative Combat Aircraft (CCA) concepts, accounting for the inherent complexities of « systems of systems », and defining robust Concepts of Operations (CONOPS) for a fleet of heterogeneous entities, while also incorporating new decision criteria such as platform acquisition cost. This framework also includes disciplines not usually considered during early design phases, such as radar and infrared signature analysis. Thanks to this approach, ONERA is able to:

- Develop numerical optimisation algorithms for the design of complementary platforms,
- Perform multidisciplinary modelling of a fleet of unmanned aircraft,
- Conduct mathematical modelling of the design characteristics of collaborative combat aircraft in order to optimize their key capabilities such as survivability, manoeuvrability, agility, modularity, versatility, adaptability, etc.

This work, primarily supported by the in-house **PHOBOS** project, builds on the expertise developed at ONERA in the field of MDO through numerous in-house projects, and its progress directly feeds into the work carried out for external partners, supporting the design of systems, and more recently, systems of systems.

In-depth understanding of aerodynamic phenomena:

ONERA benefits from its expertise acquired in previous projects, such as the SUPERMAN programme, devoted to the study of vortex flows and their impact on flight dynamics for super-maneuvrability. This project, which ran from 2021 to 2024, helped to define a generic fighter aircraft shape, representing the challenges identified on modern fighter aircraft. SUPERMAN has enabled us to refine our understanding of the physical phenomena behind the appearance and development of vortices on the upper surface of modern fighter aircraft wings. The comparison of results obtained during tests carried out in the Lille wind tunnels (weighing, PIV, etc.) and CFD simulations has helped to increase confidence in the methods used in the numerical modelling.

Simulation carried out as part of the COBRA project.

