

## The Background

In order to increase the defensive capability of aircrafts, countermeasures are used to decoy enemy tracking system. Two commonly used countermeasures are chaff and flares. Chaff is a radar countermeasure consisting of small pieces or threads of metal or metalized glass fibre. The chaff interacts with the electromagnetic radar wave and can thereby decoy or distract enemy radar. Chaff are dispensed in very large numbers from specific dispenser devices, for an aircraft typically located on the fuselage or under the wing. Flares are used against IR-seeking missiles. They are a few decimetres in length and can have built in propulsions systems. The aerodynamic behaviours of these two countermeasures differ significantly. Chaff dispensed from an aircraft propagate through the wake of the aircraft with the motion induced by trailing vortices. When simulating chaff dispersion it is consequently of major importance to obtain an accurate description of the flow in the wake. Flares, on the other hand, are "solid bodies" for which the burning constantly changes their aerodynamic and mechanical properties.



Lacroix high speed track.

## The Programme

### Objectives of AD/AG-55

The main objectives of the proposed activities are improved understanding of the underlying physics and improved modelling tools for chaff dispersion and flare trajectory simulation. The project consists of two work packages: WP1 for chaff and WP2 for flares. The main focus of WP1 is to compare and investigate differences in various numerical approaches for modelling transport of chaff clouds. For WP2, primary concern is to investigate the requirements on the model of the flare in order to be able to predict the flare trajectories sufficiently accurate.

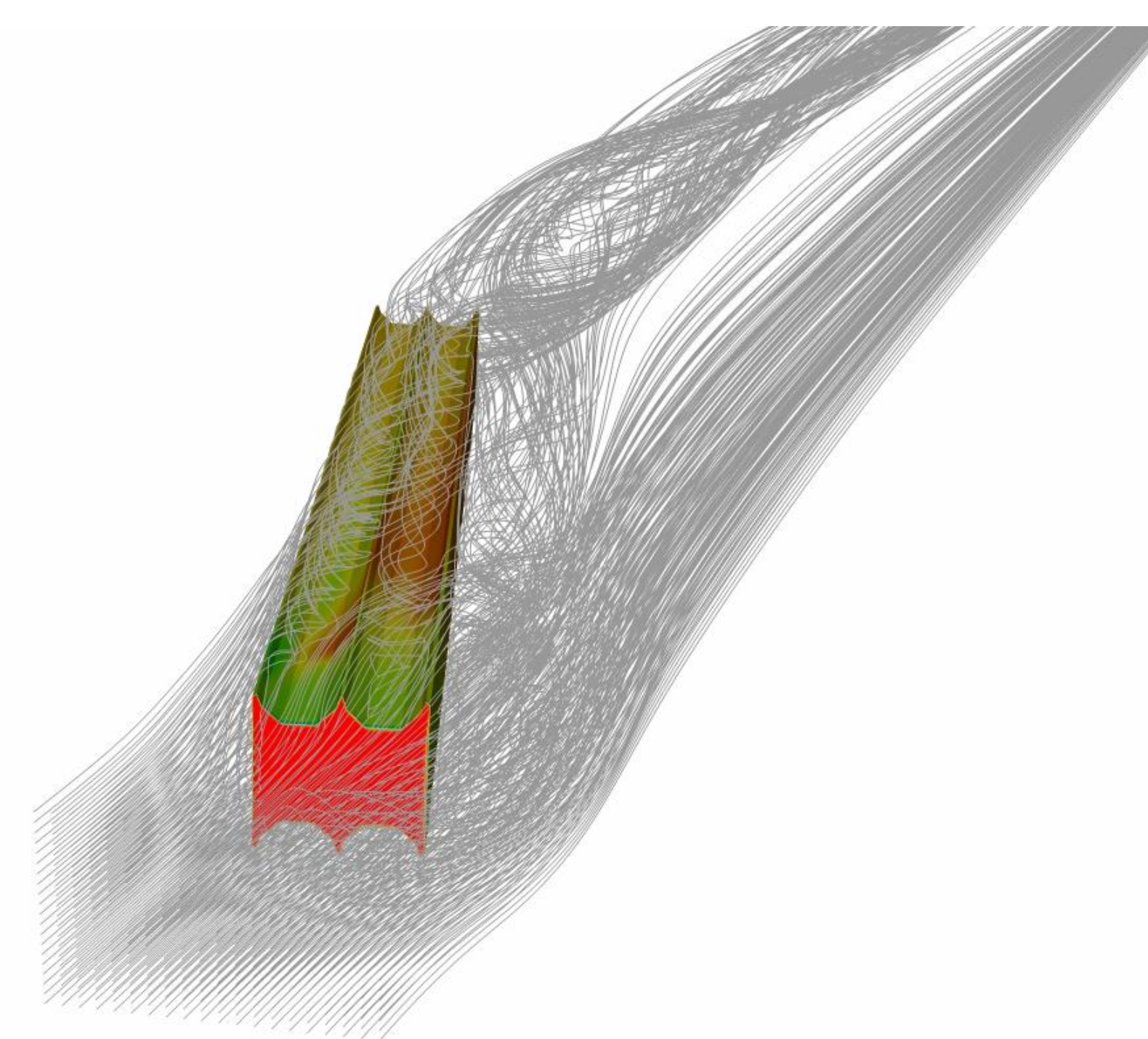
### Approach

For WP1 two methods of predicting chaff dispersion, Eulerian and Lagrangian, is be considered. The principle behind the Eulerian method is that chaff is traced as a concentration instead of individual specimen. The aim is to include directional information for both approaches. In addition to this, parametric studies such as chaff dispenser position, dispenser mechanism, will be performed. In WP2 first an aerodynamic database for the flare with shape changes is going to be generated. In the next step the procedure is going to be repeated for a model for which the real surface temperature and the exhaust gases is modelled. The latter requires that a special boundary condition is developed.

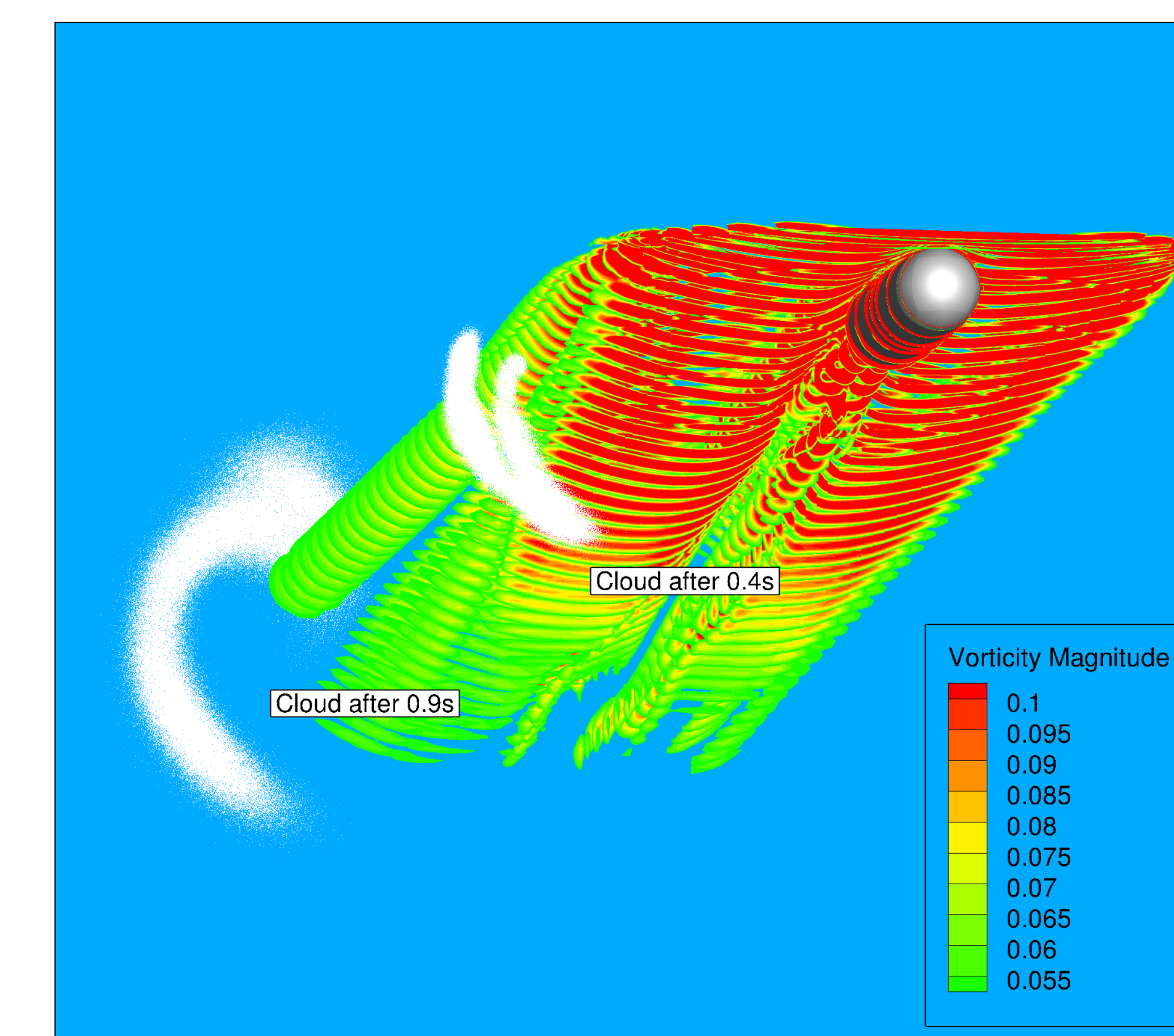
### Partners

Airbus Defence & Space, Etienne Lacroix, FOI, MBDA, NLR

**Project duration: January 2015 – December 2017**



Visualisation of flow around the flare at 20° incidence.



Simulation of chaff dispensed from a generic helicopter.

## The Outcomes

### Expected results/benefits

The action group is expected to yield increased understanding of how simulation of chaff dispersion and flare trajectory modelling should be performed. A natural outcome is also that the concerned partners obtain improved simulation tools, as the work packages are finalized.

### Main achievements

A meeting was held at MBDA le Plessis in Paris June 16th. In the WP1 for chaff it was decided that the test case should be chaff dispensed from a helicopter. NLR delivered a computational grid with 14.6 million nodes around a generic helicopter in the beginning of October. The main part of the work in WP2 is to generate aerodynamic databases for the flare with and without exhaust gases. Lacroix computed maps of the flare profile at various time stages with the program VULCAD. Work to compute the aerodynamic database was split between Airbus, FOI and MBDA. Grids were generated around the flare geometry after 0 sec (Airbus), 1 sec (FOI), 2 and 3 secs (MBDA). The database will be used to simulate 6DoF-trajectories for the flare with varying mass and moments of inertia. This database is expected to be completed early next year. Thereafter 6DoF-simulations of flare trajectories for the ground test case will start.

