



Case study

Airflow modelling to improve flight deck safety

THE CHALLENGE

The UK's future 'Queen Elizabeth Class' carrier is designed to launch and recover aircraft according to mission requirements. However, when a jet aircraft launches from the flight deck, it generates a large volume of high-velocity jet efflux which creates a hazardous working environment for onboard service personnel working on parked aircraft.

Without a safe flight deck, the carrier would not be able to launch enough aircraft to support the desired missions, rendering it unsuitable for its intended purpose. Frazer-Nash was therefore asked to suggest design and layout improvements to overcome this problem.

OUR SOLUTION

Understanding and managing the behaviour of this efflux is key to providing a safe working environment for the flight deck personnel. We therefore used Computational Fluid Dynamics (CFD) to model a full aircraft launch run along the flight deck, and predict the time-dependent growth of the efflux wake. We then simulated a number of potential design solutions, and compared the benefits and associated costs of each option.

Not only did this technology help us visualise the flow of the jet efflux during take-off (See Fig 1), but it also enabled the design to evolve intelligently and with confidence. This study also made use of related experimental data which provided further confidence in the predictions.

BENEFITS

This transient simulation technique allowed us to identify and quantify potential areas of danger and inform operational changes, together with a range of possible layouts to the flight deck to improve safety.

Transient and unsteady flow simulation represents a significant advance in modelling and has only been made possible because of increases in computational power. Real air and fluid flows are typically unsteady and this relatively new capability provides clarity where traditional experimental and steady-state CFD techniques can fall short.

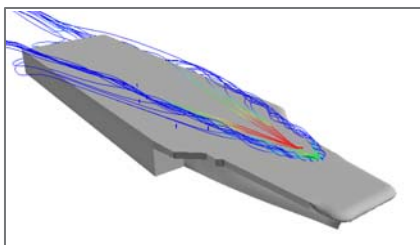


Figure 1: Aircraft Jet Efflux 'Pathlines' during Take-Off

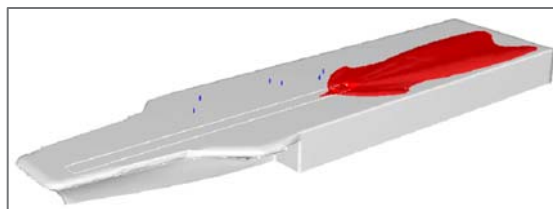


Figure 2: Aircraft Jet Efflux 'Footprint' During Take-Off

Client
Ministry of Defence

Business need
Accurately model the wake of launched aircraft to provide a safer working environment

Why Frazer-Nash?
Frazer-Nash Consultancy possesses one of the largest independent aerodynamic, hydrodynamic, and thermal analysis teams in the UK

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