Case study

Development of bespoke wind tunnel

THE CHALLENGE

Although wind tunnel simulations have been used for many years to assess aerodynamic performance, large amplitude aircraft manoeuvres are difficult and time consuming to realistically replicate in these situations. Motions are typically simplified into a series of tests where the angle of attack is adjusted between each test to obtain a set of performance figures. With this in mind, Frazer-Nash was challenged to design a solution that could dynamically simulate a complete manoeuvre or range or manoeuvres in one test.

OUR SOLUTION

In theory, it was possible to provide large amplitude, six degree of freedom control of the aircraft in an existing wind tunnel structure.

We developed a design utilising a hydraulically actuated “Stewart Platform” approach to manoeuvre the model dynamically during test. It was necessary to initially undertake various geometry analyses in order to determine the extents and limitations of the possible motions. From this, we identified geometric positional singularities, not previously identified in existing research.

Our final design *(Figure 1)* provides a particularly large range of motion (*up to 60^{o} from vertical*) and is used to simulate full dynamic manoeuvres, capturing the transient performance of aircraft in one test. The working section of the tunnel is fairly large (4m x 3m) and therefore required large actuators and a great deal of reserve hydraulic power to ensure smooth operation over the expected range of manoeuvre.

BENEFITS

The results from our research at this stage were positive, and the submission of our detailed drawings led to a specific phase for the production and fitting of mechanical and control hardware.

Client

Confidential

Business need

Design a bespoke wind tunnel with dynamic actuation capability.

Why Frazer-Nash?

Frazer-Nash has extensive expertise in applying a variety of mathematical modelling techniques to produce innovative and bespoke mechanical and structural design solutions.

Figure 1: Large amplitude motion platform

For more information please contact **Andy Gill** on **0117 9226242** or email **a.gill@fnc.co.uk**

FRAZER-NASH CONSULTANCY