

# Improving aircraft design simulations with HPC



Hartree Centre  
Science & Technology Facilities Council



**Advanced computing facilities at the STFC Hartree Centre have enabled a team lead by Dr Neil Ashton from the University of Manchester to develop better aerodynamic models, which are now being presented to industry stakeholders including Boeing and NASA.**

## Challenge

Reducing emissions is an increasingly important factor for aircraft manufacturers, whether through aspirations to reduce environmental damage or due to tightening EU and US regulations. Many companies also put emphasis on design for noise reduction, driven by customer desire and noise pollution concerns. Obtaining accurate estimates of aerodynamic forces is key to understanding and tackling both issues. Computational Fluid Dynamics (CFD) is an important design tool for the aerospace industry, used to supplement experimental studies by providing virtual simulations. This means engineers can predict the aerodynamic effects of different aerofoil and fuselage configurations before they turn to physical wind tunnel experiments, saving time and resources.

Researchers at the University of Manchester are developing and applying advanced CFD models that represent more accurate physics, better emulating real-life scenarios and offering advantages over ones used in industry. Due to a greater complexity and number of elements in the models, the computational requirements exceeded the University of Manchester's computing cluster.

## Solution

The research team took their project to the Hartree Centre, home to one of the top 30 most powerful supercomputers in the world. The advanced computation and visualisation facilities enabled them to begin to use their models on full complex geometries, taking the first step toward being able to simulate a full aircraft instead of the "piece by piece" approach previously necessary.

## Benefits

Intense computing capabilities at the Hartree Centre enabled the team to develop and run models to more reasonable timescales than on their own infrastructure – turning hours into minutes and months into days. The project results were so promising that team has presented its work to industry leaders at a variety of conferences, garnering attention from both Boeing and NASA. Ultimately, the goal is to develop a model that can be used in industry to model aircraft designs more accurately, resulting in greater fuel efficiency, R&D cost-savings and a variety of environmental benefits.

*"To study an entire aircraft using CFD you really need a big computing facility. The Hartree centre's HPC facilities allow you to use the most advanced CFD models, which on standard HPC facilities may take many months to compute. On the Hartree machines it only takes a matter of days. That speed up is invaluable for academics and industry."*

– Dr Neil Ashton, Research Engineer, University of Manchester

## Work with us

We collaborate with industrial clients and research partners on projects that create insights and value using high performance computing, big data analytics, simulation and modelling.

By combining our world-class facilities with access to our specialists and computational scientists, we can enable your organisation to produce better outcomes, products and services more quickly and cost-effectively than through conventional R&D workflows.

With our partners we are developing the next generation of supercomputing architectures and software, combining existing best practice with innovation to deliver faster, cooler and more sustainable solutions capable of meeting the challenges of data intensive computing.

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