

Code optimisation for aero-engine innovation



Hartree Centre
Science & Technology Facilities Council



The Hartree Centre's high performance computing (HPC) capabilities are helping Rolls-Royce plc to model and improve component design in its world-renowned jet engines more quickly and cost-effectively.

Challenge

As a global leader in aero-engine provision, Rolls-Royce strives to make constant improvements in crucial areas such as fuel efficiency, noise reduction and emissions performance. Computer simulations offer a rapid, cost-effective method of creating and testing new and modified designs against these key criteria, with the company's PRECISE software playing a vital role by simulating airflow through the combustor and modelling the chemistry taking place within. Rolls-Royce wanted PRECISE to run faster so these simulations could be completed more quickly – enhancing the company's ability to explore and accommodate innovations and further sharpening its competitive edge.

Solution

The Hartree Centre is home to cutting-edge expertise in code development and optimisation plus the UK's biggest dedicated industrial-access HPC platform; this includes Blue Joule, an IBM Blue Gene/Q facility comprising around 100,000 compute cores. Rolls-Royce commissioned the Hartree team to optimise their PRECISE code, enabling it to run faster on the company's HPC platforms. Working within broad guidelines that set out what Rolls-Royce needed the code to do and which parts of it to target, the team generated a range of recommendations for removing bottlenecks in performance, as well as proposing a way forward for scaling the code to more cores to run bigger models with higher fidelity.

Benefits

This first collaboration between Rolls-Royce and the Hartree Centre has proved very successful, already speeding up the running of PRECISE by around 20% and pointing the way to an ongoing, mutually beneficial relationship between the organisations. Once validated, the faster-running code will enable Rolls-Royce engineers to carry out a greater number of simulations and so iterate a greater number of design options. The optimised software will also deliver new insights into fuel-burn processes and soot accretion, for example, and help the company make its aero-engines even more efficient, cleaner and greener – and maintain its position at the leading edge of innovation. With growing global air traffic set to require 35,000 new aircraft by 2030, this will be key to sustaining success in a highly competitive sector.

"Simulation using HPC is critical to Rolls-Royce engine programmes and having efficient code is a key component of this. Working with the Hartree Centre, we have quickly made significant improvements to our code, delivering faster turnaround and more capability to our engineers."

– Matthew Street, High Performance Computing Specialist, Rolls Royce plc

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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