



Centre for Aerospace Manufacturing

Research partner of choice for aerospace manufacturing



Introduction

The Centre for Aerospace Manufacturing is an international research hub with a mission to conduct translational, industry focused research into future aerospace systems and the digital factory.

The Centre for Aerospace Manufacturing (CAM) was established in 2010. Since then it has rapidly expanded its project portfolio which is currently in excess of £10 million. This is built on our strong Engineering and Physical Sciences Research Council (EPSRC) and European Union 'Factories of the Future' research record. Industrial partnerships now include Airbus Operations UK, Airbus Helicopters, BAE Systems, GE Aviation, GKN Aerospace, and Leonardo.

CAM has recently moved into its new home in the Advanced Manufacturing Building (AMB) at the University of Nottingham.

The AMB is the centerpiece of a £100 million investment in manufacturing research and training; co-funded by the University, UK research councils, industrial partnerships and the EU. This facility provides the platform to develop, test and demonstrate new research concepts and support their accelerated translation into future production technologies, alongside our industrial partners.

To deliver high quality, industrial research we follow PRINCE2 project management practices and are accredited to ISO 9001:2015. This makes us a unique, academic research environment.

Professor Svetan Ratchev
Director, Centre for Aerospace Manufacturing



Innovate UK Projects

Innovate UK is a public body with the aim of supporting businesses realise growth through development and exploitation of new ideas. WingLIFT (Lean Innovative Future Technology) and SMARTER (Space Manufacturing, Assembly and Repair Technology, Exploitation and Realisation) are two Innovate UK projects that CAM are currently working on.

The WingLIFT project, led by Airbus with Spirit AeroSystems and LÜBBERING, aims to develop intelligent robot control for positional accuracies greater than 0.1mm in aerospace assemblies. The technology will integrate with assembly systems to monitor key parameters of the process, support quality assurance and provide data feedback for real-time improvement. CAM will be delivering a physical demonstrator of the WingLIFT system.

The SMARTER project, led by BAE Systems with a consortium of other industrial partners including Reaction Engines and Magna Parva, intends to explore the feasibility of conducting manufacturing, repair and overhaul operations in space. The focus is on autonomous systems using artificial intelligence and data fusion analytics. CAM will be studying the potential opportunities, proving concepts and delivering roadmaps to successfully manufacture in space.

Our research themes

CAM research initially focused on innovative tooling for aerospace assembly processes. This has evolved as CAM has grown and our five key areas of research are:

- **Advanced tooling and fixturing**
- **Assembly processes and metrology**
- **Automated systems and robotics**
- **Digital factory**
- **Aerostructures and design**

Clean Sky 2 Joint Technology Initiative

Our team of engineers and researchers are helping to shape the future through the 'Clean Sky 2' Joint Technology Initiative (JTI). This is a major programme, co-funded by the European Union and industrial partners, to develop technology that will reduce aircraft energy usage and incorporate these technologies into everyday life.

CAM are working with GE Aviation and Airbus Helicopters on a Clean Sky 2, 'Advanced wing Structure for Rotorcraft Additional Lift demonstrator' project, known as ASTRAL.

The objective of ASTRAL is to design, develop and manufacture a new wing concept, capable of increasing the rotorcraft cruising speed whilst reducing fuel consumption. The ASTRAL project forms part of the Rapid and Cost Effective Rotorcraft (RACER) demonstrator programme that Airbus are developing.

The ASTRAL consortium is completing the wing design, stress analysis, cost modelling and assembly of the novel wing architecture. The project will specifically focus on novel digital design and simulation techniques that can be combined with highly efficient, quality driven and cost effective manufacturing technology. The design will be rigorously tested and validated to support the world leading RACER project. The ASTRAL project is planned to span five years, with a completion date in June 2020.

The Aircraft Division of Leonardo Company S.p.A. has partnered with CAM on a project known as VADIS (Variance Aware Determinate assembly Integrated System) which is funded by the Clean Sky 2 JTI.

The aim of the VADIS project is to develop innovative assembly solutions for cost-effective wing manufacturing. CAM will optimise part-to-part wing box assembly processes by including an advanced metrology philosophy, predictive shimming, computer aided tolerance optimisation, self-adaptive fixturing and auto-updating of the adaptive digital twin model.

CAM engineers will demonstrate and validate the new assembly methods, making use of the assembly cell facilities available at Nottingham. Lasting three years, the project is due to be completed in July 2020.



Facilities

The Centre for Aerospace Manufacturing offers the full spectrum of capability; delivering solutions from early research to industrial application.

The University of Nottingham invested £1.2 million in a multi-function, final assembly cell to enable CAM to demonstrate innovative processes and systems. Known as the 'Future Automated Aircraft Assembly Demonstrator' (FA3D), the cell features spreadsheet driven process selection, RFID part identification, dual collaborative robots, automated conveyor systems, barrier-less safety systems and integrated vision systems for adaptive processes. The cell has been used to demonstrate a variety of projects for industrial partners.

CAM has a sub-assembly cell which has recently been successfully utilised to mature the Technology Readiness Level of automated processes for a project involving GKN and GE Aviation. The project CAM completed used the cell to demonstrate automated processes for the assembly of composite panels and metallic ribs.

CAM has now secured funding from the Industrial Strategy Challenge Fund of £3.8 million, through the Aerospace Technology Institute (ATI); a collaboration between the UK government and the aerospace industry. This funding is to setup a new demonstrator platform called FA3D Phase 2 (FA3D2). This new platform will become a national, experimental testbed and technology demonstrator in digital and informatics enabled manufacturing. FA3D2 is the result of pull from international aerospace companies already benefitting from the FA3D cell and provides a unique opportunity for UK based aerospace companies to test, demonstrate and accelerate the application of break-through technologies.

Capabilities

- Human – Robot collaboration for control, optimisation and safety
- Metrology for accurate positioning and product quality verification
- End effector development including design, simulation, manufacture trials and commissioning
- Design for manufacture and assembly processes
- Virtual reality tools for process visualisation
- Aerostructures design and analysis



Our locations

Centre for Aerospace Manufacturing
Advanced Manufacturing Building
Jubilee Campus
Nottingham
NG7 2GX

Centre for Aerospace Manufacturing
Unit 4, Easter Park
Lenton Lane
Nottingham
NG7 2PX

Contact us

Svetan.Ratchev@nottingham.ac.uk
Alison.Turner@nottingham.ac.uk