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School of Engineering

**Contact:**

Professor Konstantinos Kontis  
Mechan Chair of Engineering  
Professor of Aerospace Engineering  
School of Engineering  
University of Glasgow  
Glasgow, G12 8QQ

Email: [kostas.kontis@glasgow.ac.uk](mailto:kostas.kontis@glasgow.ac.uk)  
Tel: +44 (0) 141 330 4337

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## Driving innovation in aerospace research

*The University of Glasgow has been a home to aerospace research for over 70 years, and today our researchers are tackling the multidisciplinary challenges faced by the aerospace industry in the 21<sup>st</sup> century.*

*The University’s extensive research and technology programmes are closely aligned to national and international aerospace priorities, such as Clean Sky, Flightpath 2050 and the Aerospace and Defence Growth Partnerships. We nurture a strong, diverse research portfolio and have established major initiatives to deliver capability and technologies that contribute to the global aims of greener, faster and safer travel. The University offers world-class research expertise and has established diverse and successful links with the aerospace industry. Our interdisciplinary approach enables the provision of innovative, integrated solutions.*

## Facilities for aerospace research and development

The University’s drive to maintain existing, and develop new, world leading activities is demonstrated by its ongoing commitment to people, facilities and infrastructure. These include: major investments in wind tunnels and shock tubes, covering both subsonic and hypersonic flow regimes, and a new directed energy systems laboratory for plasma related research. The University of Glasgow is a hub in the UK’s National Wind Tunnel Facility and we are part of the Vertical-Lift Network Consortium. Our autonomous systems research is supported by a well-equipped micro-UAV lab with indoor flying area, an autonomous underwater vehicle development lab and a sight-line control lab. In addition, flight dynamics research is underpinned by a fully-instrumented autogyro aircraft and a flight simulator.

The University addresses the wider needs of the aerospace sector through the James Watt Nanofabrication Centre, which delivers integrated processes for the production of components, from devices up to total solutions. Our Sensors and Imaging initiatives deliver broad expertise from sensor element design, through the flow of data storage, analysis and processing to the provision of tailored information, allowing the end user to make informed decisions. Our expansive capabilities in modelling and simulation can be brought to bear on many aerospace challenges. Building on extensive expertise in big data, we are at the forefront of the emergent field of Smart Cities research.

*A key aim of our aerospace research is to advance the frontiers of transportation technologies. We achieve this through a range of research themes:*

### Fluid dynamics and flow diagnostics

Our fundamental and applied research into complex flow problems benefits a range of engineering sectors, including aerospace, automotive, nuclear, naval and power generation. This work relies on our excellent experimental facilities and computational capabilities. We develop and apply advanced CFD tools and novel flow diagnostics that produce comprehensive and high accuracy flow and thermal data. By investigating reactive flows and combustion-generated noise, we are working towards cleaner and quieter propulsion technologies.



### Autonomous systems

Autonomous systems have been identified worldwide as a critical future technology, with demand stemming from the defence and civil sectors. Our research advances the state-of-the-art in Unmanned Aerial Vehicles (UAVs), Autonomous Underwater Vehicles (AUVs), biologically-inspired vehicles and rovers. Research activities encompass simulation, control and navigation system design to hardware implementation and practical vehicle trials. Additionally, our research covers the coordinated guidance and control of multi-vehicle and multi-platform systems.

### Rotorcraft dynamics

We have particular expertise in fundamental and applied research into rotorcraft flight mechanics. Well-validated simulation and control tools have been developed in-house, these support high quality research in areas such as advanced rotorcraft configurations and pilot/rotorcraft coupling. Our research is supported by a fully instrumented autogyro aircraft, a flight simulator and the University’s wind tunnels.

### Aircraft design

We are advancing the design of aircraft configurations and propulsion concepts, including aircraft-engine integration and prediction of vehicle performance through improved understanding of flight physics. We are developing novel design support tools and methodologies (e.g. multidisciplinary design optimization) to sustain evolutionary improvement of aircraft design, as well as to support the investigation of new unconventional concepts. This is linked to our research on fluid structure interaction and optimal control.

### Advanced materials and structural mechanics

There is an urgent demand for lightweight, strong, flexible and responsive materials and we are addressing this through multi-scale materials simulation, design-oriented analysis, structural optimisation, stability and vibration analysis. Our researchers work on a range of materials including metals, composites, shape memory alloys and self-healing materials for automotive and aerospace applications.

### Advanced manufacturing

The need to manufacture high quality products at low cost is crucial for the UK economy. To address this, automated high rate production technologies and Computer Aided Engineering tools are required to reduce costs and reduce or eliminate trial and error approaches to design and manufacture. Our research aims to predict the complex relationship between the manufacturing process and final product quality and properties.

### Space systems

Our orbital mechanics and space systems engineering research is recognised internationally. We have developed technology for ultrasonic planetary drilling, which has been trialled for future missions to Mars, and our CubeSat deorbiting system has been adopted by industry. Other research includes: near-Earth object missions, orbital dynamics, formation flying, spacecraft attitude and control, and surface robotics.

*The University of Glasgow is committed to creating growth in aerospace research and we welcome approaches from potential partners in research and industry.*