



**QUEEN'S
UNIVERSITY
BELFAST**

SPIRIT
AEROSYSTEMS



**ADVANCED COMPOSITES
RESEARCH**



Ultra-lightweight smart composites aerostructures for high altitude long endurance aircraft

Design and Materials



Project aim:

Spirit AeroSystems is interested in developing the capability for the design, analysis and manufacture of ultra-lightweight composite aerostructures to enable high altitude long endurance flight of large unmanned aerial vehicles with a wingspan approaching that of a large widebody passenger aircraft (50m – 70m). These UAVs will serve the function of high-altitude 5G communication platforms with the aim of providing 5G capability in remote areas. They are likely to be powered by hydrogen fuel cells where the hydrogen will be stored cryogenically in liquid form. The scale of this research programme requires two PhD students at a minimum and both will further contribute to the development of a digital twin.

Objectives:

- Identify and further develop candidate materials and associated technologies for ultra-thin and ultra-light carbon-fibre composites which may include nanoscale enhancements.
- Undertake extensive material characterisation and structural testing to ensure that an airframe can withstand the turbulent aerodynamic forces acting on it whilst climbing through the troposphere until it reaches a cruising altitude in the stratosphere where more stable conditions prevail.
- Explore radical structural design with the help of machine learning algorithms
- Build a scaled wing demonstrator for physical testing.
- Use CNT web as embedded sensors for in-situ structural health monitoring.
- Develop a digital twin of the demonstrator to permit virtual testing, further enabling survivability assessments of the asset when encountering off-design conditions.

Advanced Composites Research Group



Key skills required for the post:

Candidate should demonstrate knowledge/experience/skills in at least one of the following areas:

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| <ul style="list-style-type: none"> • Finite element modelling • Basic material characterisation/testing | <ul style="list-style-type: none"> • Basic material selection • Structural design |
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Key transferable skills that will be developed during the PhD:

These will include an ability to effectively communicate research outcomes to academic peers and industry, independent analytical thinking and problem solving, time management, and leadership.

Lead supervisor:

Prof Brian G. Falzon CEng FRAeS
Professor of Composite Materials and Aerostructures
Head of School, b.falzon@qub.ac.uk

Other supervisors:

Dr Zafer Kazanci
z.kazanci@qub.ac.uk

Funding mechanism:

UK nationals only.

Application closing date:

31st July 2021

Guaranteed stipend

£15,285 tax free.

PhD students in the School may have the opportunity to apply to be demonstrators on undergraduate modules. Compensation for this can amount to in excess of £2,400 per year.

Queens University Belfast is a diverse and international institution which is strongly committed to equality and diversity, and to selection on merit. Currently women are under-represented in research positions in the School and accordingly applications from women are particularly welcome.