Department for Transport

Transport Research and Innovation Grants
ZERO EMISSION FLIGHT
Department for Transport

Transport Research and Innovation Grants: Zero Emission Flight Programme (TRIG: Zero Emission Flight) 2021

Cohort Brochure

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Connected Places Catapult is proud to be delivering the Department for Transport's 2021 Transport Research and Innovation Grants: Zero Emission Flight Programme (TRIG: Zero Emission Flight).

This programme is part of the wider Zero Emission Flight Infrastructure (ZEFI) project in collaboration with the Department for Transport, which examines the introduction of hydrogen and electric aircraft into airports, complemented by demonstrations of technology that will enable the UK's phased transition towards zero emission flight. Under TRIG: Zero Emission Flight, 15 projects have received funding to undertake innovative science, engineering, or technology projects focused on solving the challenge of introducing zero emission aircraft to airports.

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Transport Research and Innovation Grants Programme 2021 Recipients

Cranfield University
www.cranfield.ac.uk

WARWICK
THE UNIVERSITY OF WARWICK
www.warwick.ac.uk

PROTIUM
www.protium.green

HIVE
www.hivecomposites.com

STRATOSPHERIC PLATFORMS
www.stratosphericplatforms.com

EGB
www.egb-eng.com

ZEROAVIA
www.zeroavia.com

THE UNIVERSITY OF STRATHCLYDE
GRADUATE SCHOOL OF BUSINESS
www.strath.ac.uk

Ultima Forma
www.ultima-forma.com

AMPAIRE
www.ampaire.com

QUEEN'S UNIVERSITY BELFAST
www.qub.ac.uk

cdo2
www.cdo2.com

Cranfield University	LOCESA: Low Carbon Energy demand Scenarios for Aviation	LOCESA aims to model the additional energy demands that may emerge from the use of hydrogen and electricity for airside operations through a programme of novel empirical research, developing and evaluating a number of socio-technical scenarios with particular consideration of key transition points and spatial differences in the nature, scope and pace of decarbonisation of airports in alternative possible scenarios, from now to 2050.
University of Warwick	Creation of Full Airport Energy Model to Simulate/ Understand Infrastructure Impacts of Electric and Hydrogen Aircraft and Support Vehicles on Airports – A Warwick Manufacturing Group (WMG) Case Study with Leeds Bradford Airport (LBA)	This project will use current data from Leeds Bradford Airport (LBA) and growth rate predictions for electrification within the aviation sector to generate a prediction for electrical and hydrogen demands for a range of future scenarios. The project outcomes will be a scalable airport modelling tool initially based on LBA and created by WMG.
Protium Green Solutions Limited	Developing a Digital Twin for the Fast Refuelling Process and Procedure for Gaseous Hydrogen Aircraft	A digital twin (DT) will be developed to simulate and optimise the refuelling process for hydrogen aircraft. The DT will use complex computational analysis to review the complete process of refuelling within the boundary of the airport. The simulation will initially evaluate the performance at each part of the process, enabling critical analysis. The main aim is to establish if the aircraft refuelling can be achieved without violating the process limits defined by standards.
Cranfield University	Wireless opportunity charging of electric aircraft	The aim of this project is to assess the feasibility of wireless battery charging technologies for increasing autonomy within airport environments. The proposal does not investigate wireless charging as replacement to conventional battery charging methods, but rather, as a complementary technology to utilise new charging opportunities during ground manoeuvres, to improve efficiency, autonomy and safety of power delivery
Hive Composites Limited	Next-Generation Thermoplastic Composite Pipe for Hydrogen Distribution in Airports	Hydrogen causes embrittlement in steel pipes; specialist steel pipelines for hydrogen are expensive and are supplied in relatively short lengths with numerous pipe joints or welds. Thermoplastic Composite Pipes (TCPs) are resistant to hydrogen, have low transport and operating/inspection costs and minimal joints for reduced leakage points and improved safety. This project will investigate the feasibility of next-generation spoolable TCP optimised for the airport environment. The pipes will be manufactured using pre-treated tapes to provide performance close to traditional thermoplastic pipes at a lower cost, lower energy input and faster production rate that traditional TCP.
Cranfield University	Hydrogen Safety in Aviation: an immersive XR training scenario for airport personnel	Using immersive 360 video and XR (Extended Reality) technologies, the project will develop and deliver an interactive training programme for airport personnel covering an 'awareness level' overview of hydrogen safety in aviation. The programme will consist of various live demonstrations and immersive scenarios covering possible hydrogen related safety incidents at an airport, for example, hydrogen spillages or leaks. The training programme will then be made freely available for practitioners.
Stratospheric Platforms Ltd	Development of a safety zonal tool for the operation of liquid hydrogen powered aircraft at airfields	Working with Warwick FIRE, SPL proposes to develop a conceptual analytical tool for specifying the size and contents of airfield safety zones on the runway, taxiway and apron areas, needed for the operation of liquid hydrogen-powered aircraft. SPL will use its High Altitude Remotely Piloted aircraft, carrying up to 1,200kg of liquid hydrogen, as a study aircraft to develop the tool. The resulting tool will also examine the spread of both liquid and gaseous hydrogen in the event of a controlled or uncontrolled vent, leak or spillage.
EGB Engineering Consultants Ltd	MEHSAD: Modelling of Electricity and Green Hydrogen Scenarios to meet future Airport Demand	The aim of the project is to develop a high-fidelity modelling toolset. The toolset will analyse the impact of future demand on energy systems. The purpose will be to determine the most economically advantageous scenario(s) for electricity and green hydrogen, understand the gaps and subsequent emissions in order to aid decision-making and influence policy, determine development paths for cost-effective low to zero emission technologies, and direct investments for R&D.

ZeroAvia Limited	LHARE: Liquid Hydrogen Airport Refuelling Ecosystem	As part of this project, ZeroAvia will first conduct research to understand the challenges facing design of a liquid hydrogen mobile refuelling unit. Following this, the project will look to detail the path to first physical demonstration, assess the feasibility of the system, explore the concept design and culminate in a report that paves the way for the first generation of liquid hydrogen refuelling vehicles.
University of Strathclyde	Solutions Pathway Evaluation Toolkit for Airside Infrastructure to Power Zero Emissions Flight	This project will further develop an existing software platform capable of assessing power infrastructure requirements with respect to different future demand scenarios, minimising the risk for future capital infrastructure investment decisions for airport operators. To enable the platform to be capable of this, a set of transition pathways will be concurrently developed representing the phased transition period to net-zero flight.
Ultima Forma Ltd	Flexible electroformed twin-walled hydrogen fuel hoses	This project will design and manufacture a new kind of twin-walled liquid hydrogen fuelling hose using a proprietary electroforming process that is highly suitable for building non-permeable and flexible pipes where one pipe is grown outside another, allowing for a vacuum gap between. The project will deliver a new type of hydrogen transmission pipe offering very low thermal losses, providing flexibility in use and accommodating expansion and thermal fatigue.
University of Warwick	Evaluation of safety zones and mitigation measures for hydrogen refuelling infrastructure at airports	This project aims to formulate recommendations for Regulations, Codes and Standards, as well as mitigation measures, to address safety challenges of liquid hydrogen, including leaks, fire and explosion through: - Establishing the extents of the flammable cloud following release during aircraft refuelling and during catastrophic failure of storage tanks, and; - Quantifying the fire and explosion hazards associated with accidental releases during refuelling and with catastrophic failure of LH2 storage tanks.

Ampaire Ltd	Modelling demand of electric aviation and airport infrastructure	A study into the whole eco-system from energy generation to distribution and end-user considering the economics of infrastructure for electric aviation. The project will model the energy demands of electric aviation, calculate investment needed to implement electric and charging infrastructure and potential economic savings of operating hybrid as opposed to conventional aircraft.
School of Mechanical & Aerospace Engineering, Queen's University Belfast	UltraCompHy: Ultra-lightweight composite pressure vessels for safe and cost-effective hydrogen storage	This project is aiming to develop ultra-lightweight composite overwrapped pressure vessels (COPV) for hydrogen storage. The project will look at the design, liner manufacturing, deposition of variable-angle carbon fibre composite layers by filament winding (VAFW), liner-to-composite interface improvement, and advanced morphological and structural modelling. These ultra-lightweight VAFW COPVs will positively influence airport infrastructure such as expansible mobile fuel storage modules, refuelling stations and logistics vehicles.
CDO2 Ltd	SafeBatt: swappable aircraft battery packs for safe ground handling and charging	This project will consider and evaluate options for safe DC charging of fully electrified aircraft using both on-board charging and removable battery packs. It will investigate the practical viability of configuring the battery pack to run at high voltage during operation but be handled and charged with safety extra low voltage limits for handling by existing ground crew without specialist high voltage training.

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If you are interested in finding out more information about the grants or have any queries, please contact us by emailing:

Info@cp.catapult.org.uk

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