



ICAO

ENVIRONMENT



2023 ICAO STOCKTAKING



SAF-LAB Exhibition



11 to 13 JULY 2023

Montréal, ICAO Headquarters



Cranfield
**Aerospace
Solutions**

**James Angus, Commercial Director of
the Integrated Vehicle Health
Management (IVHM Centre)**

**Professor Sir Iain Gray, Director of
Aerospace, SATM, Cranfield University**

**Aviation Sustainability at
Cranfield**





Cranfield University

creating leaders in technology (focused on Aerospace and Defence) and management exclusively postgraduate university with 50% of our students from outside UK.

internationally recognised

unique facilities (inc. Global Research Airport)

transitioning blue sky concepts into operational environments

research capabilities in aviation and the environment



Digital Aviation Research & Technology Centre (DARTeC)

Cranfield's capabilities in aviation and the environment

[Link to brochure \(cranfield.ac.uk\)](https://www.cranfield.ac.uk/themes/aerospace/aviation-and-the-environment)



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Hydrogen and Sustainable Fuels Research

Related research facilities

- Airside facilities for H₂ storage, medium.
- Carbon capture storage.
- Economics and certification of H₂ and SAF.
- Waste to fuel.
- Materials and structures research for hydrogen applications.

Bulk Hydrogen Production by Sorbent Enhanced Steam Reforming (H₂ SEPR)
Research facility producing up to 700 kg/day of clean H₂.

Digital Aviation Research and Technology Centre (DARTec)
Research into SAF and H₂ refuelling of aircraft, facilities, fuel certification and fuel cell apron vehicles.

Cranfield Aerospace Solutions Ltd
Fuel cell light-aircraft (FRESSION).

Electrified aircraft propulsion systems
Emissions and contrails of H₂ and SAF.

Fuel production research
• Electrolysis.
• Methane cracking.
• Sustainable aviation fuel.

SAF storage on airfield fuel farm
(Coming soon).

Ground operations laboratory to simulate airside operations for aircraft turnaround and maintenance, repair and operation.

H₂ fuel cell vehicle test track

H₂-powered whole aircraft design research

Advanced gas-turbine thermal management rig

H₂ and SAF supply chain

H₂ and SAF fuelled internal combustion engine research

Storage vessels for compressed and liquified H₂

Mobile refuelling truck to refuel airside ground support equipment and aircraft at up to 700bar

40kg/day green hydrogen electrolyser

Anaerobic digestion feedstocks for H₂ and SAF production

LH₂ fuel system demonstrator, systems integration and ultra-low NO_x H₂ combustion

Key

Feedstocks and fuel production.

Transport, storage, economics, supply chain.

End users – aerospace and road vehicles.

• H₂ = Hydrogen

• LH₂ = Liquid hydrogen

• SAF = Sustainable aviation fuels

For more information, please contact:
Jon Horsley,
Transport Systems Development Manager
E: j.horsley@cranfield.ac.uk



Hydrogen and Sustainable Fuels Research

Developments since the last Stocktaking event:

- Major new development of Cranfield's Global Research Airport – over £3m (Research England RPIF*) investment to enhance our airport's net zero research capabilities with: *low/zero emission vehicles, fuel-cell grade hydrogen production & re-fuelling and growth of our site-wide Living Lab environment monitoring network*
- Propulsion - Cranfield's work in low NOx and Hydrogen combustion technologies is nationally recognised and world-leading. Current total research budget excess of £4m**.
- Cranfield Hydrogen Gateway (www.cranfield.ac.uk/hydrogen)
- Last September we delivered our 2022 Global Aviation Summit – Raising Ambition to address Climate Change & Biodiversity (in partnership with Air Transport Action Group). Starting in Oceania, this event followed the sun, lasted 13 hours and covered 6 global regions.
- This year we are launching Global Sustainable Aviation Forum – bringing together industry and academia globally to focus on the biggest challenges* that must be addressed before 2030 if we are to achieve aviation's 2050 targets (contact: L.H.Rice@cranfield.ac.uk)

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• H₂ = Hydrogen

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• SAF = Sustainable aviation fuels

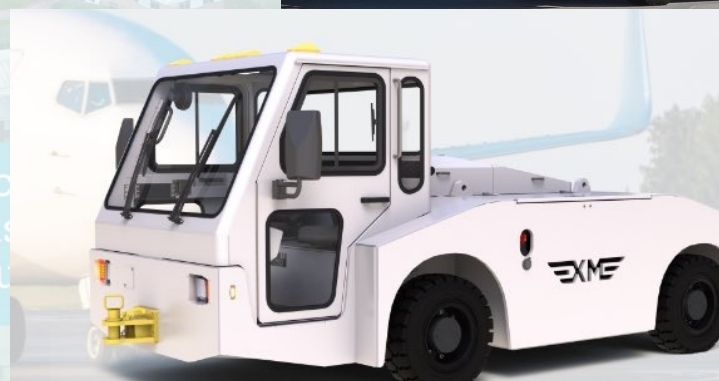
*Research England's Research Partnership Investment Fund

** Projects include: ATI Fly Zero programme; EU Horizon MINIMAL & ENABLE H₂; UKRI/ATI HYEST & LH₂GT; Clean Aviation HEAVEN

Bulk Hydrogen Production by Sorbent Enhanced Steam Reforming (H₂SD) Research facility producing up to 700 kg/day of clean H₂.

Digital Aviation Research and Technology Centre (DART)

Research into SAF and H₂ refuelling of aircraft, facilities, fuel certification and fuel cell apron vehicles.



For more information, please contact:
Images courtesy of Fuel Cell Systems, Ziegler, and Eagle Tugs, and may not be indicative of suppliers or products chosen

Cranfield Aerospace Solutions

B N
Britten-Norman

Cranfield
Aerospace
Solutions

1989

CAeS
established

25

years
Modification
experience

£26m

Investment
raised to
date⁽¹⁾

100+

Highly skilled
employees

- CAeS is a world leader in complex aircraft modifications and new aircraft design
 - Delivered cutting-edge products for Airbus, Boeing, Rolls-Royce, Raytheon and others
 - Holds critical Design Organisation (DOA), Production Organisation (POA) and Maintenance Organisation (MOA) approvals
 - Track record of securing regulatory certifications from UK CAA, EASA, US FAA & others
- Three business activities
 - Development of zero emissions propulsion systems for commercial aircraft
 - Aircraft Maintenance, Repair & Overhaul (MRO)
 - Design and manufacture of flight and motorsport simulators
- Access to unique aviation expertise, research and resources
 - CAeS is located at Cranfield Airport, a commercial and research facility
 - Cranfield University, an academic world leader in aerospace, is a shareholder



Designed & manufactured sub-scale
blended wing flight test vehicle



Designed & certified modifications to
convert BAE 146 to atmospheric
research aircraft

THE HYDROGEN ISLANDER (Fresson Project)

A ZERO-CARBON FUTURE FOR SUB REGIONAL TRAVEL



Cranfield
Aerospace
Solutions



Zero CO₂ emissions
& less air pollution



6 to 8 passengers



60 minutes
endurance
(45 minute reserve)



200km + reserve



Noise reduction
and less vibration



Lower operating costs
Reduced by up to 50%



Entry into
service by 2026

The conversion of a Britten-Norman Islander 9-seat aircraft from conventional fossil fuel to that of gaseous hydrogen propulsion is set to deliver the world's first fully certified, truly green, passenger-carrying aircraft.

For recipient use only

	CO ₂ reductions	100%
	Level of finance required	£30M
	Timeframe (EiS)	2026
	Main challenges	A. Fuel tanks B. Thermal Mngt C. Infrastructure

THE HYDROGEN ISLANDER (Fresson Project)

A ZERO-CARBON FUTURE FOR SUB REGIONAL TRAVEL

B N
Britten-Norman

Cranfield
Aerospace
Solutions

Developments since the last Stocktaking event:

- Project progress:
 - Detailed preliminary and critical design reviews largely complete.
 - Baseline flight testing of the demonstrator aircraft underway
 - Component testing is underway
 - Iron bird testing to start soon.
- Working with Cranfield University and Cranfield Airport on electrolyser-mobile refueller + growing engagement with the UK CAA.
- Heads of Terms (HoT) signed for a proposed merger with Britten-Norman. Est completion this August*
- On-going discussions with advisory groups to support the development of standards for zero emissions flight



The co
aircraft
hydrog
certified



*(<https://www.aviationbusinessnews.com/low-cost/new-uk-green-aircraft-business-formed-to-accelerate-transition-to-zero-emissions-flight/>)

Thank You



Cranfield
**Aerospace
Solutions**

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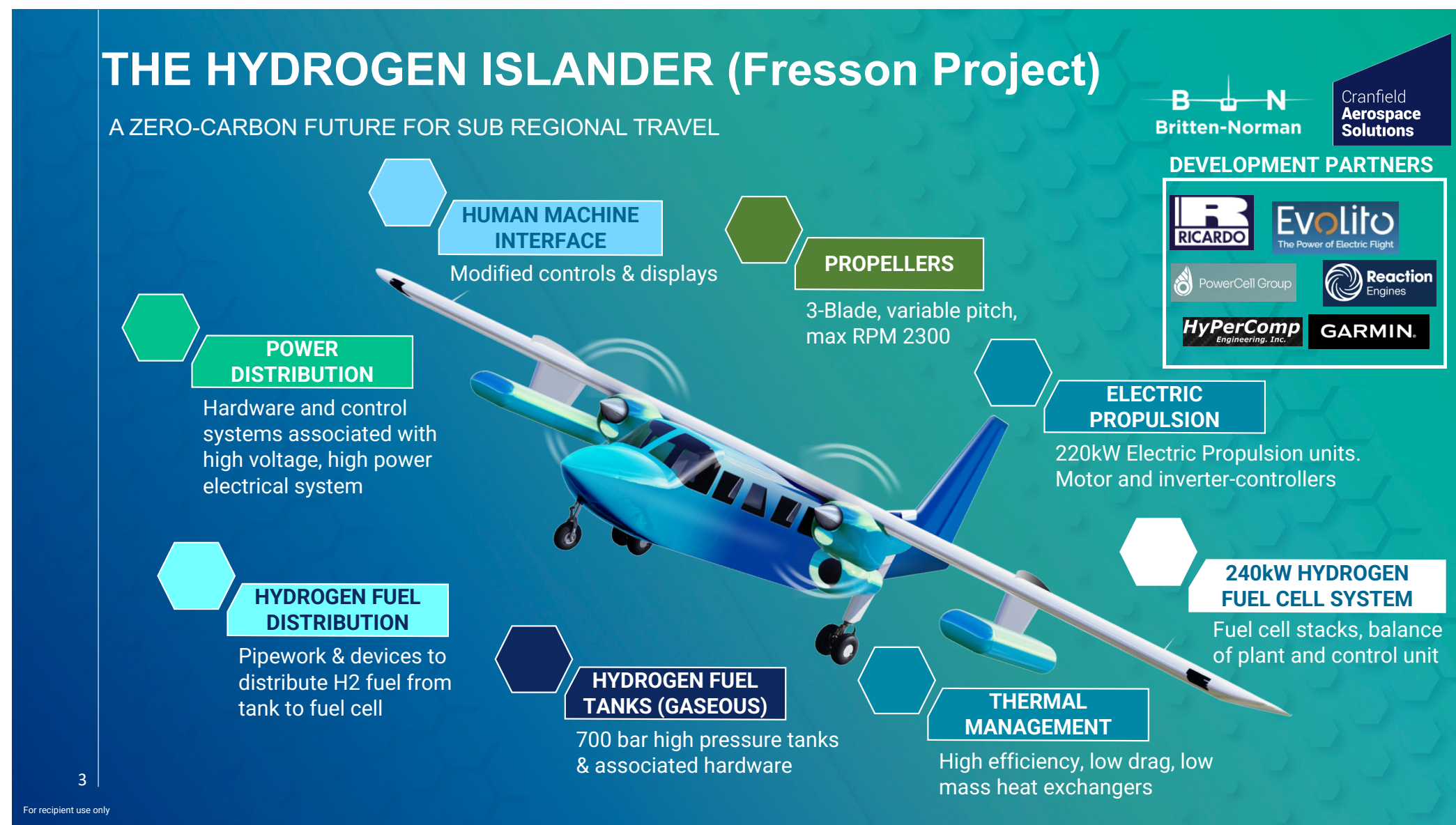
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Hydrogen Islander (Project Fresson)

Technology



	CO ₂ reductions (propulsion)	100%
	Level of finance required	£30M
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	Main challenges	A. Fuel tanks B. Thermal Mngt C. Infrastructure