
PROJECT
FRESSON
Islander
Zero carbon emissions aircraft development
to deliver the world's first truly green passenger carrying
airline services using hydrogen fuel cell technology

Cranfield Aerospace Solutions

FRESSON Hydrogen Fuel Cell Propulsion

Why is this difficult?

Design Challenges

- Mass
- System efficiency and power budget
- System responsiveness and stability
- Thermal management
- Drag
- Power electrics
- Reprovisioning of conventional systems
- Packaging
- System safety
- Certification

Only meaningful when solved at aircraft-level
Only optimized at aircraft-level
Only certifiable when qualified at aircraft-level (currently)

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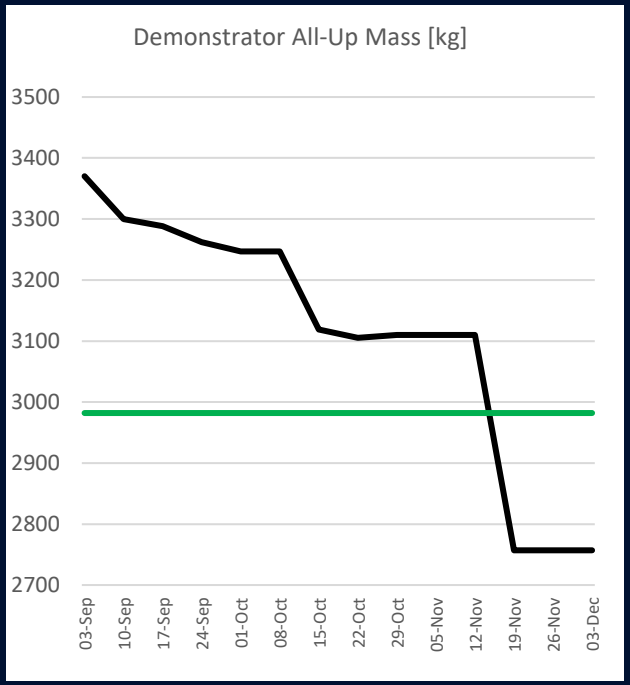
FRESSON Hydrogen Fuel Cell Propulsion

What are we learning?

- **Value of tackling the challenges of hydrogen fuel cell powered, electrical propulsion in a real aeroplane:**
  - **Thermal Management**
    - Key practical challenge for hydrogen fuel cell powered aircraft
    - Conventional radiators not flyable
    - Win-win collaboration with Reaction Engines
    - FRESSON problem solved
    - Technology will be demonstrated and certifiable
  - **Electrical Architecture**
    - For a practical aeroplane, mass drives search for elegant solutions
    - Novel solution will be demonstrated and certifiable
    - Signposts key electrical architectures and technologies
  - **Development road maps**
    - System design optimization
    - Basic aircraft mass reductions
    - Specific power increases
    - Thermal optimization
    - Mass-efficient fuel tanks



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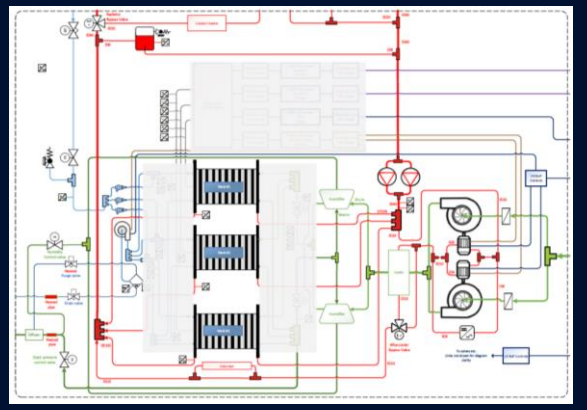
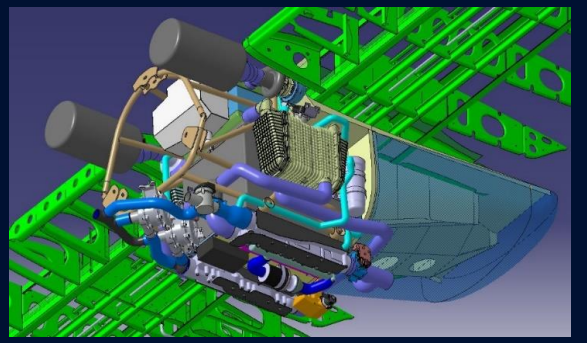
FRESSON Hydrogen Fuel Cell Propulsion

Foundation for zero carbon emissions aircraft design

- FRESSON delivers applicable and scalable hydrogen fuel cell powered, electric propulsion for 9- to 19-passenger commercial aircraft (and larger)
- By starting now (whilst LH2 is immature), supports a viable GH2 product, whilst the viability and availability of LH2 catch up, to support future 9-passenger iterations and 19-passenger applications
- Builds foundation for CAeS whole-aircraft design, for new, zero-emissions aeroplanes:
  - Experts in zero-emissions propulsion system architecture and integration
  - Intelligent customer for zero-emissions propulsion sub-systems and components
  - IP in novel electrical architecture
  - IP in zero-emissions propulsion installation design
  - IP in modular and scalable and zero-emissions propulsion system designs that work at aircraft-level
  - Able to exploit the technology to the full, by designing an aeroplane around it





Needs airport infrastructure that can support:

- Gaseous hydrogen now
  - 350 and 700 bar
  - 20 to 50kg per aircraft flying hour
  - At departure, destination and diversion airfields
- Liquid hydrogen ASAP in the future

Size matters


STANDARD
POLICIES
AKBANK
H_2