Cranfield Hydrogen Integration Incubator (CH2i)

- a summary technical guide

Background

The Cranfield Hydrogen Integration Incubator (CH2i) is a co-funded research infrastructure project by UK Government (Research England) and industry to support world-leading technology innovation in energy and transportation decarbonisation.

In parallel with the upgrading of the Cranfield Global Research Airport, a unique resource supporting the development of zero carbon aviation, the new CH2i technical facilities will enable research to be undertaken on the production, transportation and use of zero carbon fuels, such as hydrogen, across all transportation sectors.

CH2i will be available to academia and industry as part of future co-funded collaborative research programmes.

CH2i will provide the opportunity for rapid innovation in a regulated and safety-focused environment, the facilities consist of:

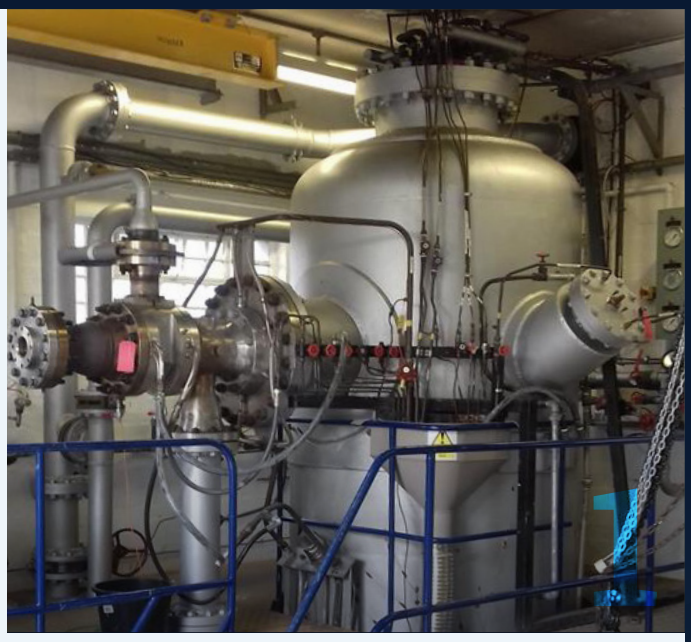
1. Large Experimental Test Area.
2. Cranfield Power and Propulsion Laboratory (CPPL).
3. Hydrogen Integration Research Centre (HIRC).

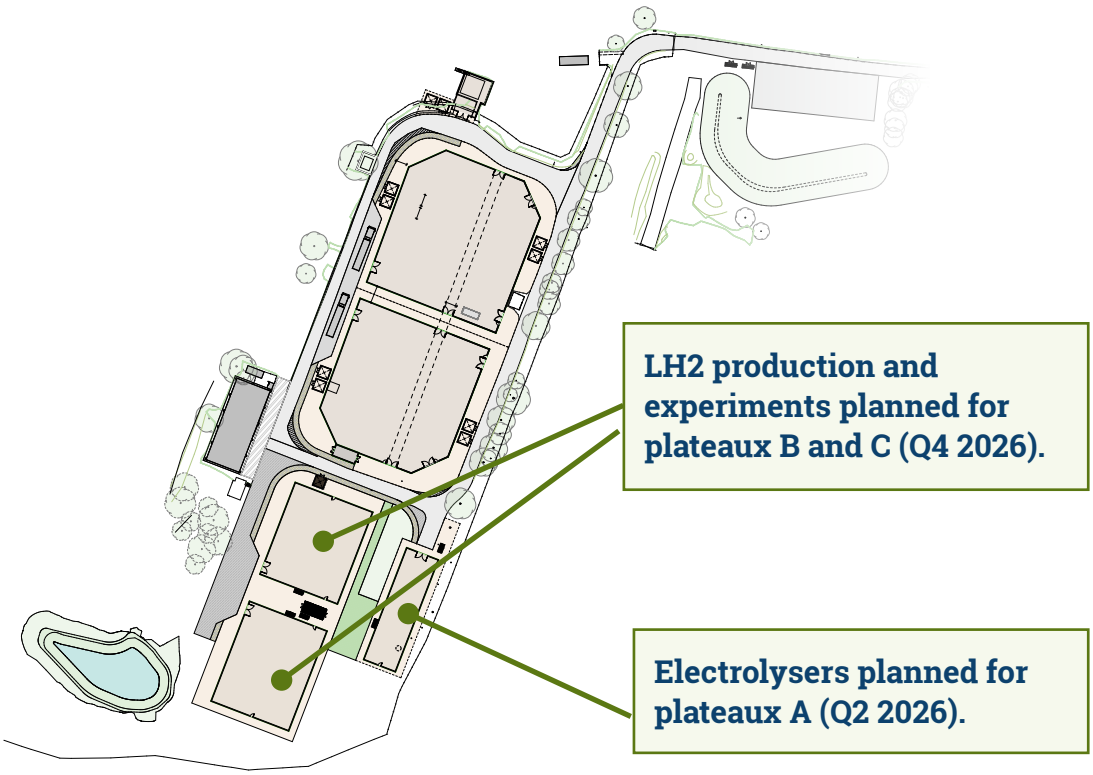
This guide provides technical summaries and use case examples of the new laboratories and experimental areas, including large-scale hydrogen production and experimental facilities, that are included in CH2i.

The incubator facilities

Large experimental test area

Fully serviced liquid hydrogen and ammonia research and development plateaux providing over 2,000m² of at-scale rig testing across three plateaux and experimental enclosures with remote monitoring and control.





Plateaux	A	B	C
Area (m²)	492	1093	1075
Services at the plateaux	Mains tap water 3-ph electricity	GH2 up to 30bar LH_2 ~5bar	GH2 up to 30bar LH_2 ~5bar
Typical applications	Hydrogen electrolysers, GH_2 buffer tank, HyTruck.	General LH_2 and GH_2 system experiments, materials coupon LH_2 testing plus other cryogenic test environments.	
In service date	Q3 - 2026	Q4 - 2026	Q4 - 2026

Cranfield Power and Propulsion Laboratories (CPPL)

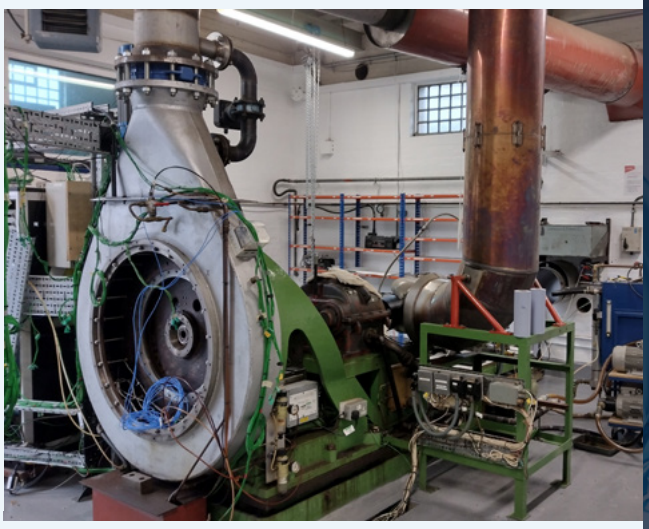
Located towards the south of the Cranfield campus the Cranfield Power and Propulsion Laboratories (CPPL) consist of nine separate reconfigurable cells that support advanced propulsion system development and test.

CPPL use case examples

Low Speed Turbomachinery (L3):

Compressor, fan and pump development.

Dynamic and static intake and exit flow, pressure and temperature measurement.



Super Critical CO_2 (L5):

Waste heat recovery and environmental control systems for transport, nuclear and space sectors.

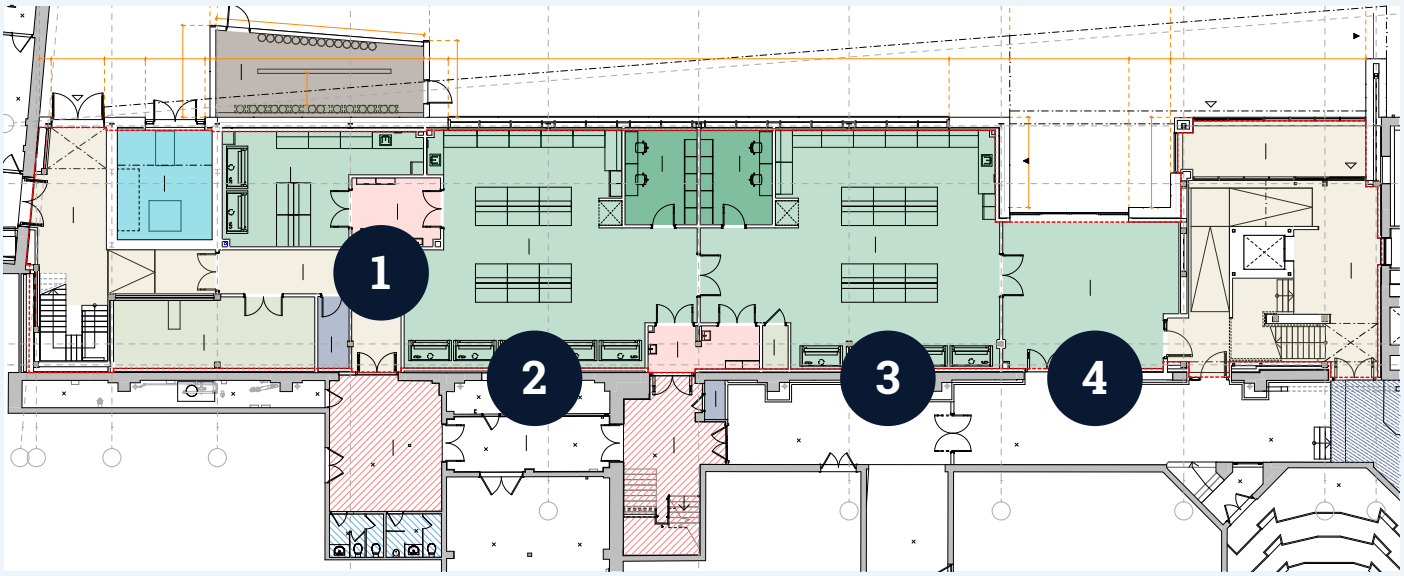
The Laboratories are fully-equipped with controllable ambient heating, 4.4MW of thermal load absorption, plus both 32A 3-phase plus 13A and 16A 1-phase AC supplies. Each test cell, typically 67m^2 floor area, is equipped with bespoke equipment and services that support propulsion research. If required, adjoining cells can be combined to create experimentation areas of over 120m^2.

L1	**Strip and build**	Workshop room hosting three Gnomes engines and diverse engine components disassembled for educational purposes for groups of up to ten students. Portable gantry for 1000kg lifting. Various tools and safety PPE for students' use.
L2	**Low speed aerodynamics**	AMT Netherlands Olympus Micro Gas Turbine Test Rig enabling sub-idle inlet flow conditions testing.
L3	**Low speed turbomachinery**	Load range to 1.24MW, speed range 0.8 to 0.9 Mach, steady and dynamic measurements.
L4	**Low temperature thermofluids**	FM50 – Centrifugal Pump Demonstration Unit.
L5	**Super-critical CO_2 waste heat recovery and environmental control system**	Pressure range 50 to 120 bar. Temperature range 0 to 45^{o}C. Compressor 90kW. Evaporator load 90kW. Gas cooler load 125kW.
L6	**Rocket propulsion**	Incorporates a mobile trailer platform for the development and testing of solid-, hybrid- and liquid-fuelled rocket motors up to 10kN thrust.
L7	**Electrical systems**	DC Motor 750kW @ 2750rpm, 1318Nm. Gearbox ratios 2.2:1 to 5.9:1. Max torque 2658Nm.
L8	**Hybrid electric gas turbine**	Rolls-Royce Artouste APU test rig - generic turbomachinery and rotating component testing.
L9	**Applied optical methods**	Centrifugal suction fan 160kW, 9kg/s, and electric ducted fan 24kW, 2kg/s, for atmospheric rigs for internal flow aerodynamics.

The Hydrogen Integration Research Centre (HIRC)

Designed as a set of new laboratories, collaborative workspaces, meeting rooms and office space, the two-storey Hydrogen Integration Research Centre (HIRC) provides low TRL research capacity for zero carbon fuels.

The key functional areas on the ground floor of the HIRC building include: **(1)** Clean laboratory, **(2)** Characterisation and testing laboratory, **(3)** Wet preparation laboratory and **(4)** Collaborative workshop.



1 Clean laboratory (39m^2)

The clean laboratory is a controlled environment designed to minimise contamination from particles, dust and other impurities.

Typically, this laboratory would be used for:

- Catalyst performance evaluation under clean conditions.
- Adsorption/desorption studies.
- Water/sea-water electrolysis studies.
- Electrochemical impedance spectroscopic studies.
- Electroplating characterisation.
- Long-term stability testing for catalysts, coatings, materials etc.
- Methane cracking lab reactors.
- Ammonia combustion studies under clean conditions.
- Optical characterisation (e.g. UV-Vis spectroscopy).

2 Characterisation and testing laboratory (123m^2)

The characterisation and testing laboratory enables researchers to evaluate the performance, efficiency and safety of zero carbon fuel systems including electrolysers, fuel-cells and hydrogen storage solutions.

Typically, this laboratory would be used for:

- Electrocatalyst performance testing (both anodic and cathodic performance testing).
- SE-SMR catalyst durability testing.
- Methane cracking catalyst durability testing.
- Methane cracking catalyst regeneration studies.
- Gas adsorption/desorption studies.
- Water/sea-water electrolysis: electrode screening and long-term stability testing.
- Electrochemical impedance studies.
- Ammonia combustion testing.

3 Wet preparation laboratory (130m^2)

The wet preparation laboratory serves as a workspace for sample/materials preparation and preliminary experiments supporting the clean plus characterisation and testing laboratories.

Typically, this laboratory would be used for:

- Solvent-based processes.
- Catalyst synthesis (catalysts for SE-SMR, methane cracking, ammonia cracking).
- Sorption materials synthesis.
- Water splitting electrode preparation (substrate cleaning, multilayer coating, pre-conditioning etc.).
- Ammonia cracking electrode preparation (substrate cleaning, multilayer coating, pre-conditioning etc.).
- Electro-deposition (galvanostatic deposition, potentiostatic deposition and pulse deposition).
- Spin coating.
- Drop casting.
- Doctor blade coating.

4 Collaborative workshop

The collaborative workshop, at the main HIRC entrance foyer, is a multipurpose space, designed to cultivate creativity, interdisciplinary collaboration, innovation and entrepreneurship.

Accessing the Cranfield Hydrogen Integration Incubator

Industrial and academic organisations are invited to enquire about collaborative research opportunities that could potentially take advantage of the CH2i facilities and Cranfield's expertise.

Please contact Jon Horsley,
CH2i Programme Director.

E: H2@cranfield.ac.uk
www.cranfield.ac.uk/ch2i

Partnering with:

Airbus
Cranfield Aerospace Solutions
Element 2
Energy Research Accelerator
Equilibrion
GKN Aerospace
GTI Energy
Heathrow Airport
HyWaves
Imperial College London
Modular Clinton Global Ltd
National Centre for Atmospheric Science
National Physical Laboratory
Siemens Energy
Toyota (GB) Plc

CH2i is supported by Research England under the UK Research Partnership Investment Fund (RPIF).

March 2026