

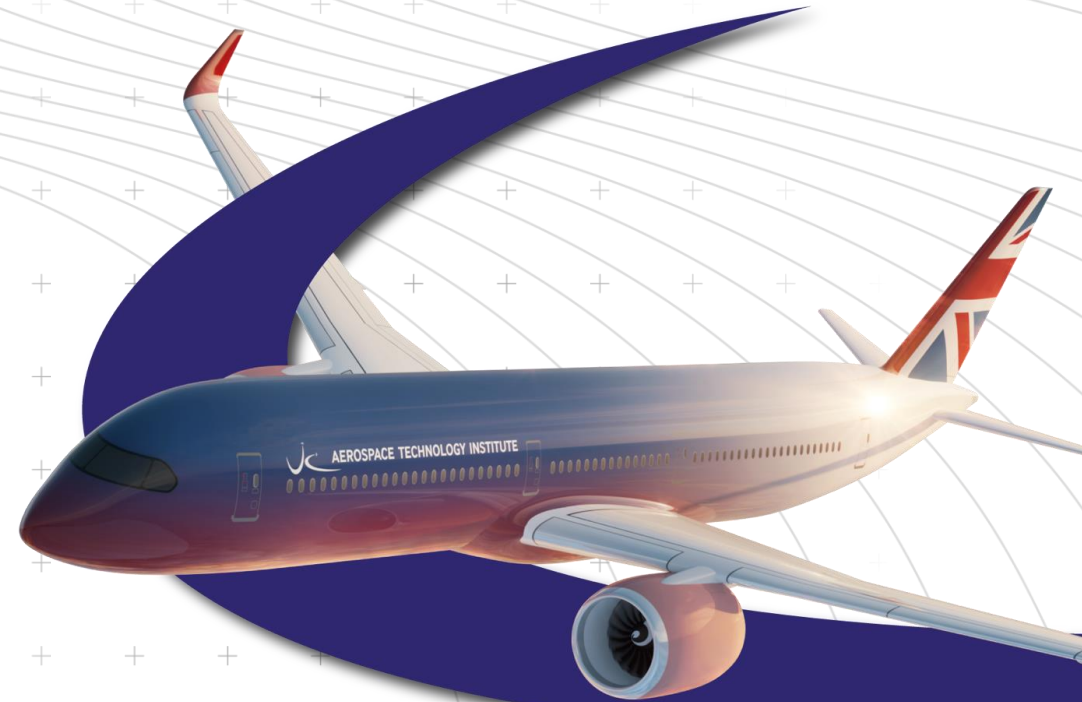


Hydrogen Capability Network

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Webinar

December 2023





AEROSPACE
TECHNOLOGY
INSTITUTE

Hydrogen Capability Network

Agenda

Introduction

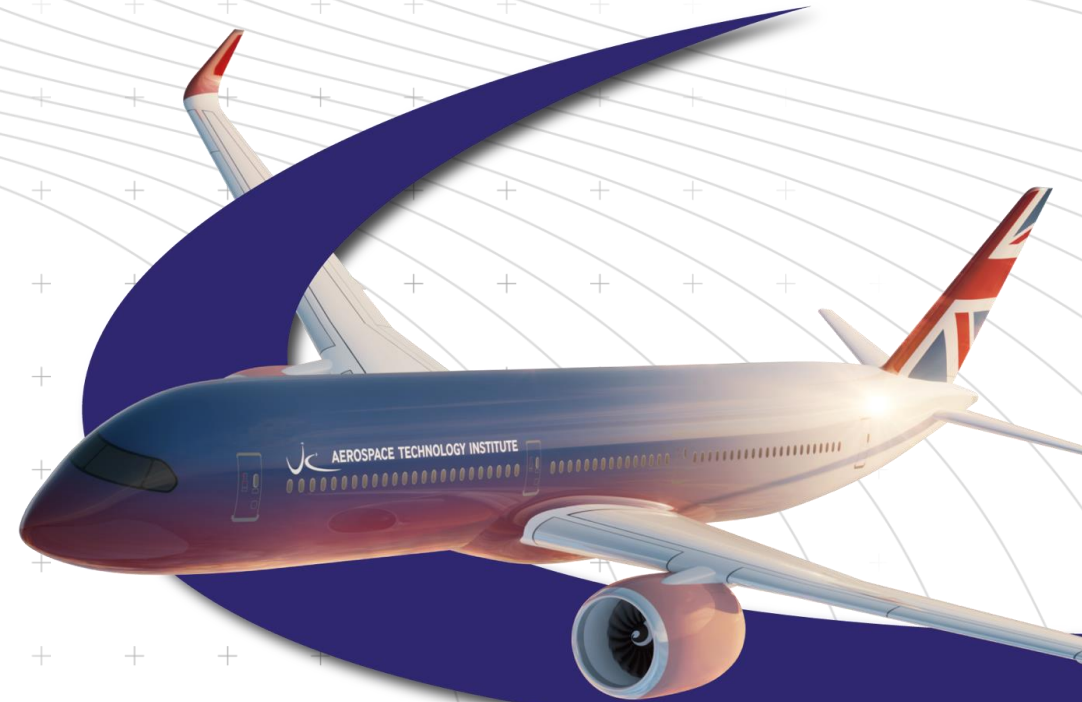
Context & Progress to Date

HCN Interventions

1. Research
2. Materials Testing & Standards
3. LH2 Test Hubs
4. LH2 Supply
5. Skills & Training

Conclusions

Q&A



Vision: Securing competitive advantage for UK aerospace through a world leading collaborative network. Delivering a coherent approach to skills development, infrastructure and hydrogen supply to secure long-term UK capability.

Why?

The strategic need
& case for the UK

HCN acts on key recommendations from FlyZero to become an essential enabler of UK technology development. With other nations acting quickly and other sectors competing for hydrogen, the UK must act to consolidate the aerospace sector's approach to hydrogen and ensure that testing and development remains in the UK.

What?

Our core activities



**Coordinating a
secure LH2 supply for the UK
aerospace sector's test &
development needs**



**Coordinating the approach
to skills & research to increase LH2
talent in the UK**



**Coordinating the approach to test
infrastructure & demonstration
through an open access network
and greater collaboration**

How?

Our approach

Collaborative – A network of stakeholders with a common aims, aligning aerospace with cross-sector initiatives

Agile business model – Allowing for growth and reacting to market opportunities

Common vision – Securing UK capability, and driving the aerospace industry to its shared net-zero aims

Phase 0 of the Hydrogen Capability Network is an initial 12-month project backed by a government investment of £1.29m. This will see the ATI develop the concept of a Hydrogen Capability Network through to the point of launch

Aim

Coordinated approach to aligning the aerospace sector requirements for the Hydrogen future. Detailed planning & preparation for launch of an entity to deliver the future Hydrogen Capability Network and vision

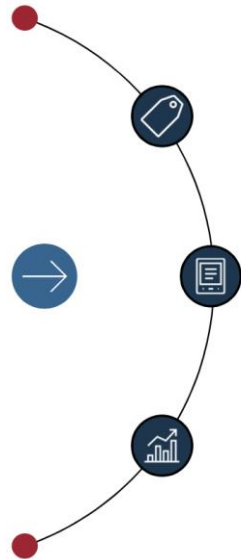
The deliverables of Phase 0 include:

- Defined test infrastructure requirements for the UK aerospace sector
- Agreed supply of liquid hydrogen for UK aerospace test & research activities
- An LH2 academy to accelerate skills development and research
- Financial commitment to establish initial operating capability for the Hydrogen Capability Network



Hydrogen Capability Network: First 6 months

Evaluating the sector's needs



We have engaged the sector through multiple touchpoints:

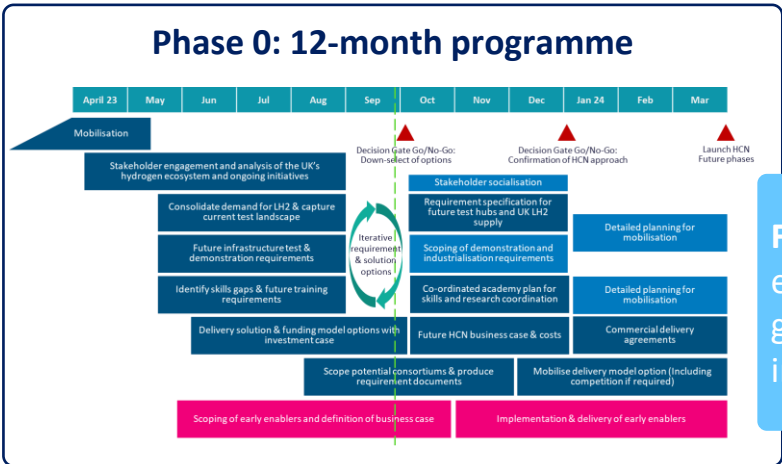
Pre-Market Engagement – multiple workshops convened with industry and academia to collate and identify the sector's requirements

Surveys - surveys issued to understand the detailed testing, supply and skills needs and identify gaps in current landscape.

Industry Secondees – Secondees in the HCN team have been able to provide valuable subject matter expertise and organisational knowledge

Coordination with other groups – The HCN has engaged with other adjacent organisations such as HII, AGP, ZEFI, ARC and others to ensure actions and delivery are aligned

- 200+ organisations engaged via a HCN Survey
- 80+ face to face discussions & site visits
- 50+ Testing workshop attendees
- 40+ Skills workshop attendees
- 50+ research workshop attendees
- Publication of current landscape, expertise and facilities



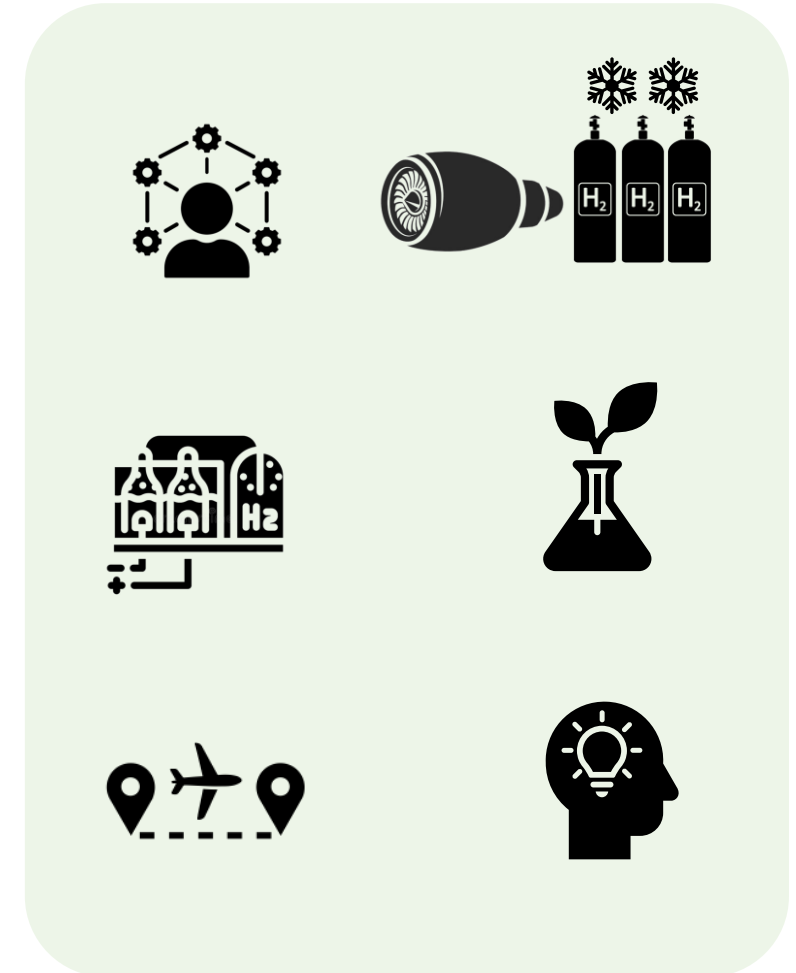
First 6 months – sector engagement, requirements gathering and scoping interventions

Next 3 months – socialise solution, detailed requirement capture, develop operating/commercial model and develop business case

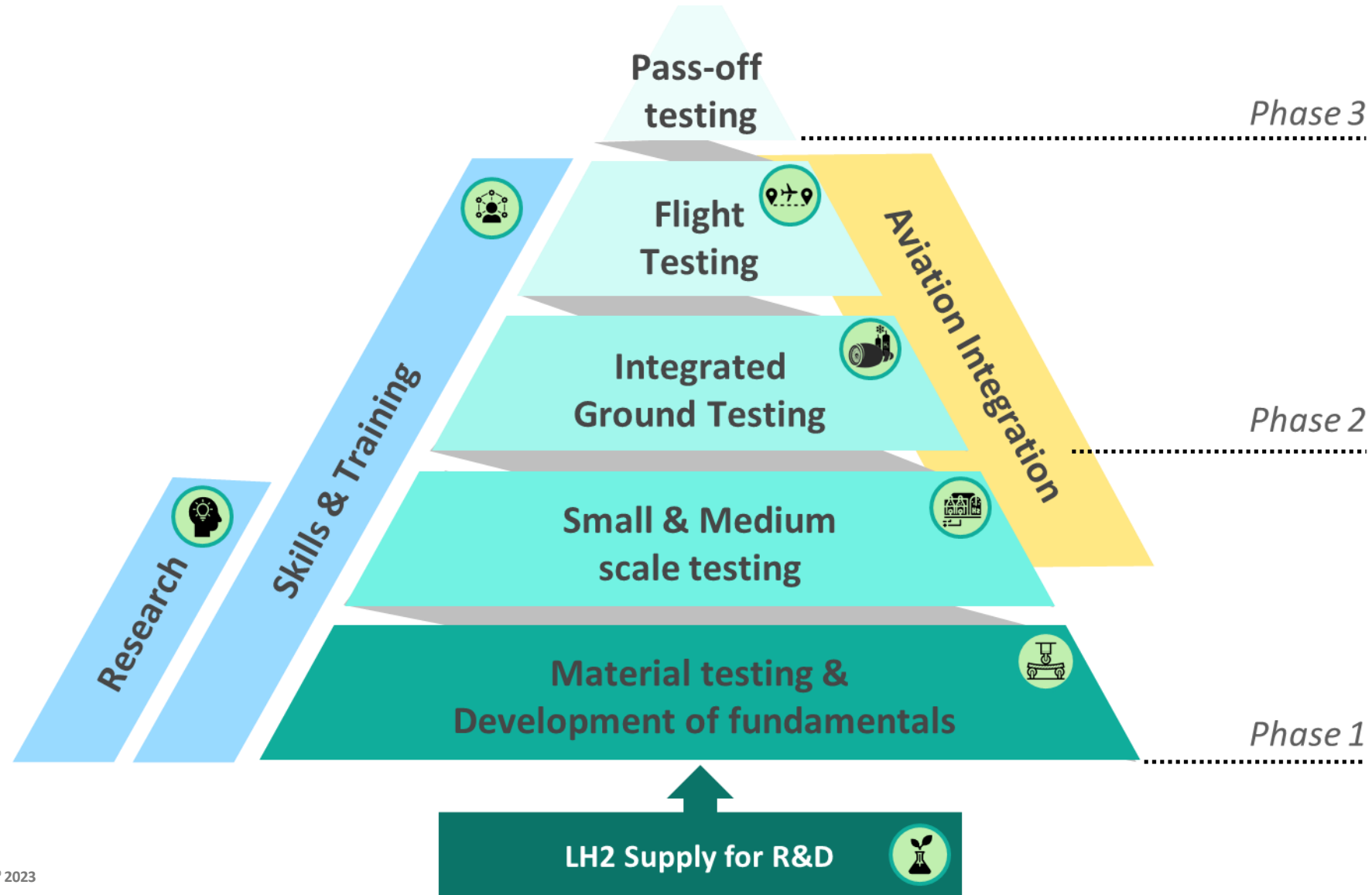
Final 3 months – socialise business case, secure funding sources, plan for mobilisation and determine commercial agreements

Hydrogen Capability Network: Context of Opportunity

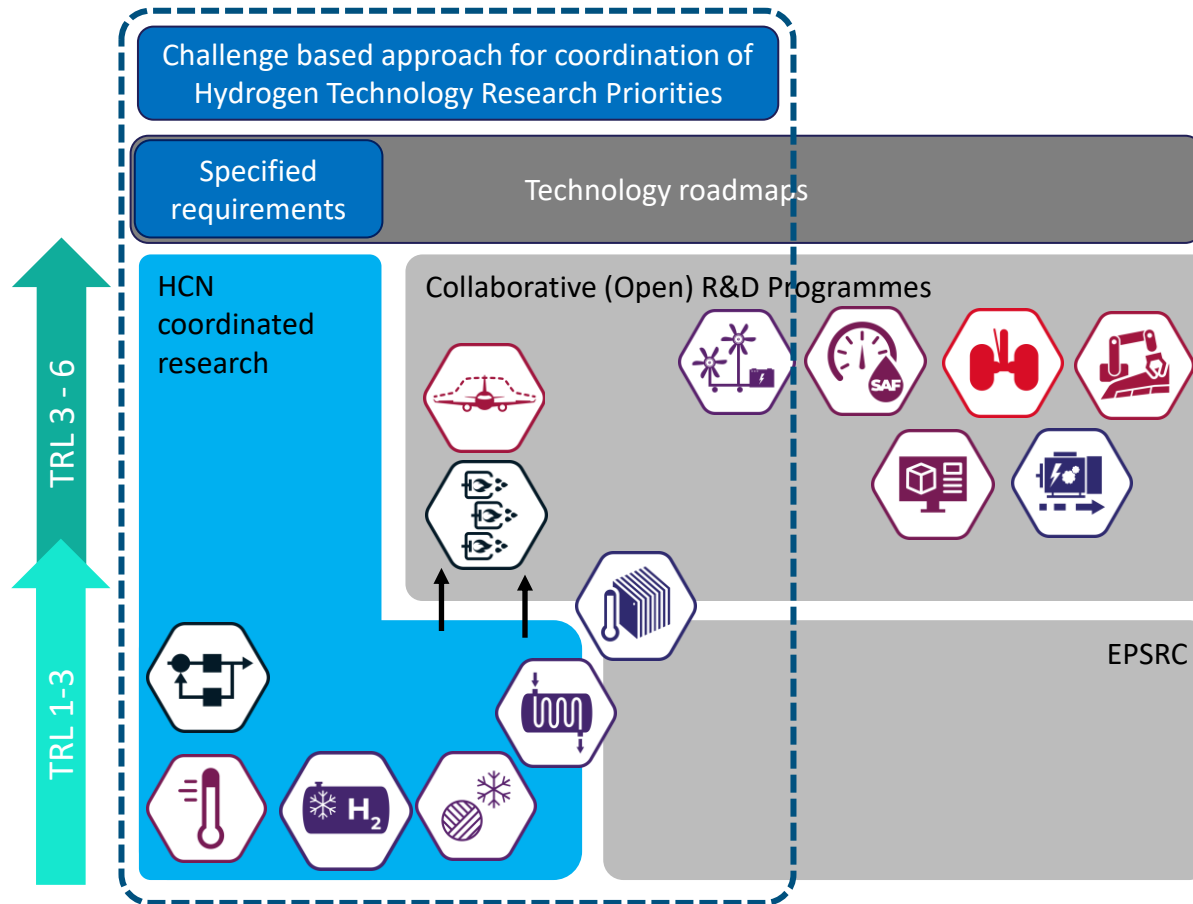
- Increase UK visibility of action in hydrogen for aerospace
- A team focused on driving forward the priorities for hydrogen for aerospace
 - Core research
 - Liquid hydrogen, demand and supply
- Drive efficiency and reduce duplication in capital infrastructure and facilities
- Bring together aerospace with aviation for demonstration
- Increase opportunities for the supply chain
 - Providing cross-sector opportunities for cryogenic components
 - Increase open access facilities and data
- Accelerate UK's wider energy skills, expertise and capability



HCN Focus areas across test pyramid



Intervention 1: Research Landscape



- Mid TRL research underway already
- Stakeholder engagement has identified a need for low TRL pre-competitive research
- Initial focus on disruptive topics
- Drive rapid flow of technology from low to mid TRL
- Need to support knowledge transfer into supply chain
- Certification support
- Strong links to skills development

Intervention 2: Materials Testing & Standards

Activities

Benchmarking of existing equipment and early materials performance data

Development of 77K (LN2) testing methods and limited trials at sub 77K (LHe) temperatures

Mature 77K (LN2) testing, development of sub 77K (LHe) testing, Initial LH2 testing

New equipment enables initial LH2 testing and increased capacity for developing all other testing; Standardisation of all types of testing underway

Continuous improvement of methods and greater confidence in data uncertainties.

Y1

Y2

Y3

Y4

Outputs

Existing equipment is validated with reference materials. Initial data indicates potential impact of temperature, and steers testing guidance and influence of test variables.

New equipment is developed further and commissioned. Increased amount of data confirms impact of temperature and indicates impact of environment. Testing guidance and influence of parameters is more concrete.

Significant knowledge now exists on impact of temperature and environment for materials of interests and across all methods. Testing guidance is being formalised.

Validated test methods are documented and published (Good Practice Guides) and standardisation process underway

Intervention 3: Testing Infrastructure

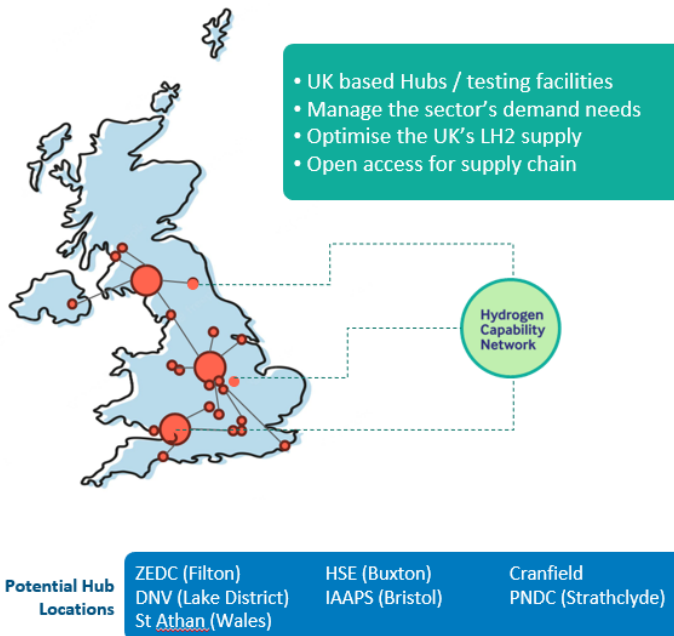
HCN has undertaken a focussed effort to understand where the UK might build testing capability to support the development of LH2 for UK aerospace.

This focussed effort has results in an **industry validated view** of UK capability/ needs:

- **Wide network of test nodes that are capable of GH2 testing/ very small volume LH2 testing.**
Ongoing Support needed from ATI/HCN.
- **LH2 Testing capability – at rates/ volumes signalled by UK Aerospace – does not exist today in UK.**
Intervention proposed from ATI/HCN.
- **Ongoing links to HII/ZEFI/etc** – to ensure downstream testing aerospace requirements are strategically considered (eg very high volume pass off testing infrastructure for Engines/ Pumps)

ATI/HCN (industry validated) propose the following Intervention:

- Invest in testing infrastructure – to ensure UK skills/ capability are secured.
 - 2 Hubs are proposed, with ZEDC and HSE judged as preferred hubs (rationale available).
- Ensure UK test ambition is signalled towards Hubs – to satisfy utilisation assumptions.
- Ensure investment occurs in time, to give confidence to Tier1/OEMs that test programmes do not need to move overseas.

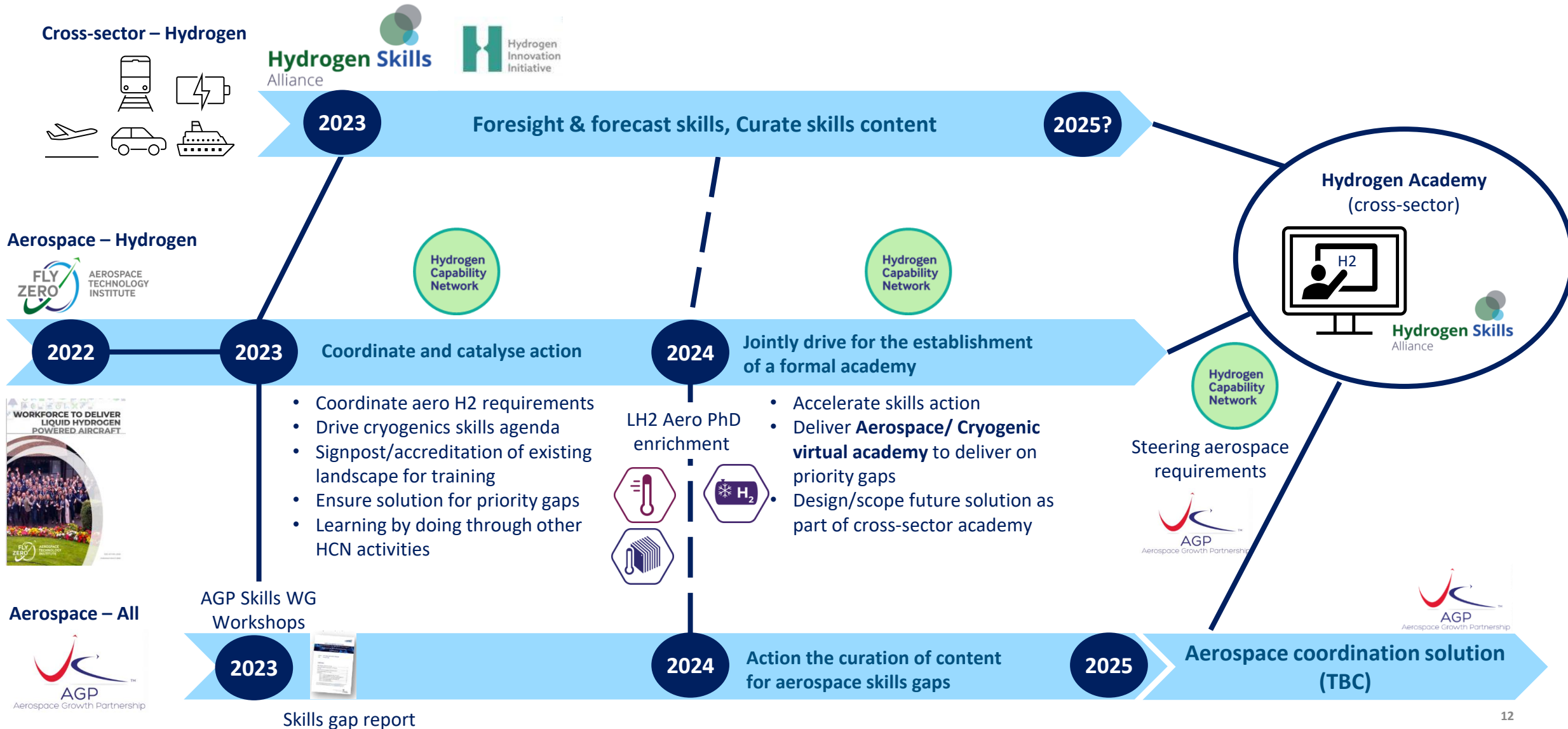


- **Phase 0 success** - HCN/ATI has an industry validated view of what is desirable from a Hydrogen UK Testing network perspective.
- **Next Step** – can our industry (with ATI/HCN support) deliver this ambition (finance/ governance/ etc)?

Intervention 4: Liquid Hydrogen Demand



Intervention 5: Skills & Training



Summary of HCN Interventions

We must act fast on priorities & maximise ambition to secure LH2 technology in the UK

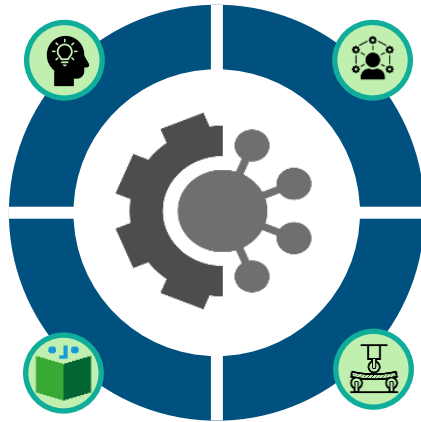


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Phase 1 – enable critical priorities

Phase 2 – accelerate sector ambition

Priority Research

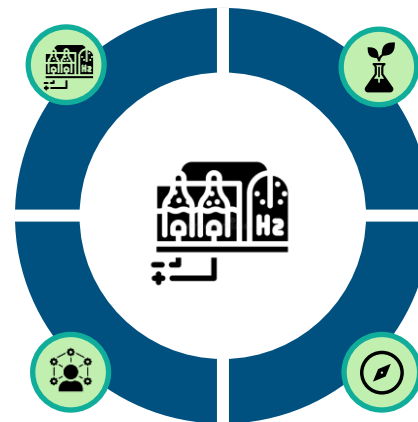


Progressing critical LH2 technologies, equipping the UK with critical research and skills

- Research Challenges
- Coordinated ecosystem
- Leading fundamental research (e.g. materials)
- Skills development

Interventions 1 & 2

R&T Test Hubs

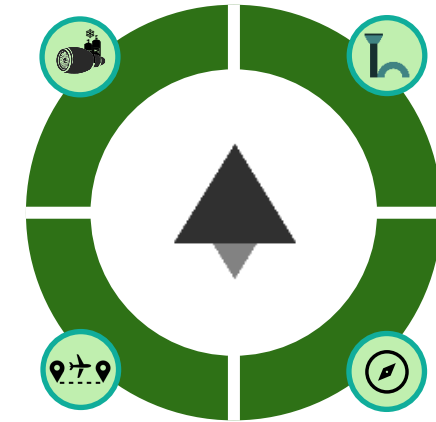


Enabling LH2 test hubs and access to LH2, balancing test capacity for whole supply chain

- Centralised LH2 Hubs
- Coordinated LH2 Supply
- Safety & Standards
- Skills Learning by Doing

Interventions 3 & 4

Integrated Demonstration



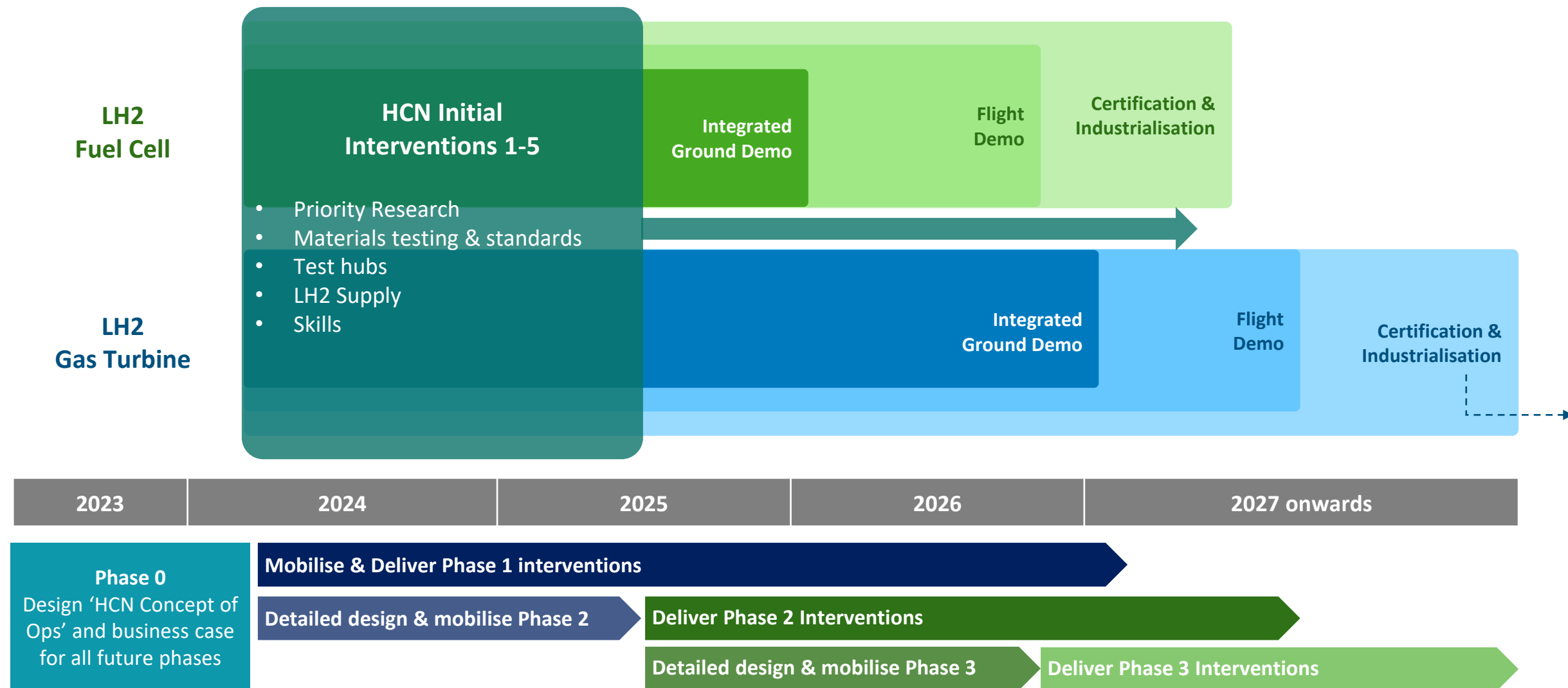
Building the ambition for the UK, engaging with the wider aviation ecosystem

- Integrated ground test
- Interface with airport
- Flying demonstration
- Safety & Certification

Intervention 5

The scope of HCN interventions is broken down into phases

The timing for future phases is driven by technology architecture and aircraft type





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Q&A

Facilitated by Nour Eid

