UK Civil Aviation Authority

Regulatory Sandbox for Hydrogen as an Aviation Fuel.

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Civil Aviation Authority
Aviation House
Beehive Ring Road
Crawley
West Sussex
RH6 0YR

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Enquiries regarding the content of this publication should be addressed to: hydrogenchallenge@caa.co.uk

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The Civil Aviation Authority is inviting industry, academia, and organisations to join its Regulatory Sandbox to test hydrogen technologies that support the use of hydrogen as an aviation fuel. The tests will identify hazards, risks, safety challenges and gaps in current CAA regulations and evaluate the proposed mitigations through verification and validation.

Our intention is that the hydrogen sandbox will enable appropriate stakeholders to test hydrogen technologies and show how the proposed mitigations will either comply with or close gaps in current CAA regulations. This outcome of testing will enable the proposal of recommendations to create new hydrogen policies.

The call is open to individual organisations or consortia working on developing and using hydrogen as an aviation fuel.

Context

To reach Net Zero flying by 2050, the aviation industry has been investing in developing hydrogen propulsion solutions that offer the potential for zero-carbon emission flights. However, hydrogen as an aviation fuel is at an early stage of development.

As a result, industry and the CAA do not yet have a comprehensive understanding of the risks to aviation safety; industry has not yet developed hydrogen-related standards; and the CAA has not yet published policies (e.g., acceptable means of compliance and guidance material) to certify aircraft and license aerodrome operations.

For industry, uncertainties about regulations are:

- A barrier to developing hydrogen as an aviation fuel.
- Attracting further funds for R&D.
- Setting up a business model.

The hydrogen sandbox proposes the testing of hydrogen technologies to gain test data to support the validation of proposed mitigations. This will enable the creation of required policies to facilitate the introduction of hydrogen in the aviation environment.

Objectives of the Sandbox

Our intention is that the Hydrogen Sandbox will be used by appropriate stakeholders to test their hydrogen technologies to propose policy recommendations.

The objectives of the sandbox are:

- To demonstrate and validate specific hydrogen technologies to manage the safe integration of hydrogen as an aviation fuel.
- Enable participants to progress their technologies towards certification, integration, and compliance with new policies.
- Enable the CAA to assess new hydrogen technologies and understand the hazards and safety risks associated with their introduction.
- Enable the CAA to understand industry's mitigations and demonstrating an acceptable level of safety.

The Hydrogen Sandbox will be delivered using the Regulatory Sandbox methodology. The Regulatory Sandbox allows the CAA to develop policies that better meet the needs of the industry, and to shorten the lifecycle for developing these policies.

This is achieved by following **cycles of hypothesis-driven experimentation in a controlled and safe environment** to accelerate learnings, eliminate unknowns and uncertainties, and rapidly converge towards the design of a policy. These cycles are called Build-Test-Learn cycles, Figure 1.

The Hydrogen Sandbox is managed by the CAA Technical Strategy Lead Zero Emissions Flight as part of the wider Hydrogen Challenge project in collaboration with Innovation Advisory Services team, Design and Certification Department, Continuing Airworthiness Department, Airspace, Air Traffic Management & Aerodromes (AAA) Department and Sustainability Department

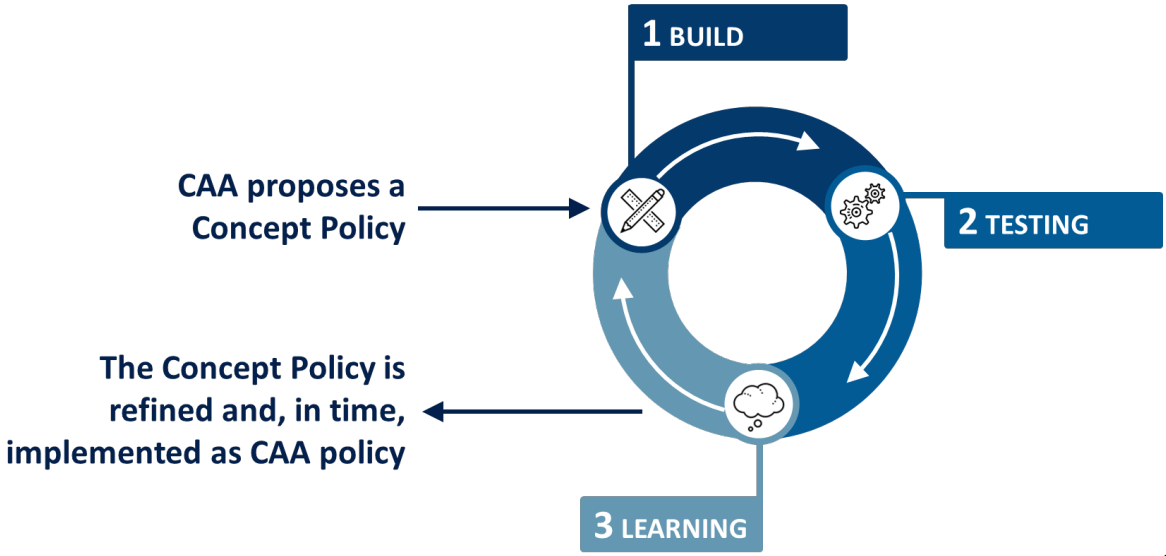

Figure 1

Functional aspects of the Sandbox

We offer Sandbox services prior to an application for regulatory approval being started.

The Sandbox service is an advisory service offered prior to an application for regulatory approval being started. Sandbox services stop as soon as a regulatory application process starts. The CAA individuals involved in the Sandbox services cannot process the regulatory approval. The separation between Sandbox services and regulatory approvals mitigates risks with conflicts of interest, Figure 2

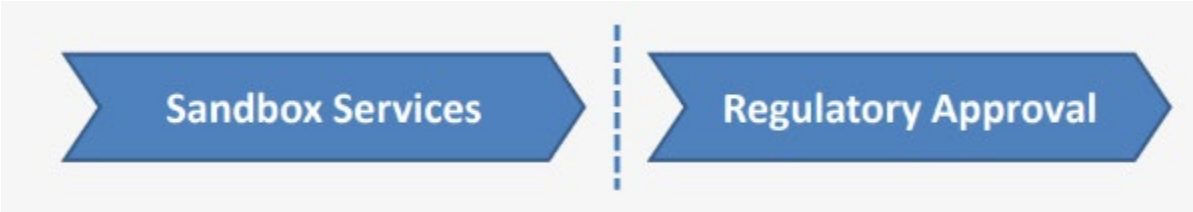

Figure 2 Regulatory separation from Sandbox services

Sandbox Services do not predispose regulatory decision making:

Sandbox services do not, in any way, predispose regulatory decision-making. Regulatory decision making is made by the CAA's core regulatory teams that sit in another part of the CAA. Such outcomes remain the sole discretion of the relevant regulatory teams with reference to our statutory duties.

What are we looking for?

We are looking for organisations planning to conduct flight or ground testing of technologies for the use of hydrogen as an aviation fuel. This can include but is not limited to the following technology/operating areas:

Technology Areas			
Hydrogen gas turbines	Fuel cells & electrical propulsion	Liquid hydrogen tanks	Hydrogen distribution
Thermal management	Aircraft design	Aircraft systems	Airports
Ground operations	Safety & reliability	Fuelling	Hydrogen storage

This call is open to individual organisations or consortia working on the development of hydrogen technologies for use in aviation.

Sandbox applicants must be working on a test programme that works towards testing their hydrogen technologies (ground test or flight test) by being able to demonstrate the following conditions:

- The applicant must be able to explain how their participation in the sandbox will support the introduction of hydrogen as an aviation fuel.
- The application must be able to demonstrate the TRL of their technology where applicable.
- The applicant must be ready to start testing in the sandbox and support the full duration of the test plan developed.
- A test plan must be available and clearly outline that testing can be completed by March 2028, including the key milestones and outputs of these activities. The test plan must also show clear deliverables for each calendar year throughout the length of the project.
- The applicants must be competent and experienced in developing new technologies in the above technology areas.
- Building on previous projects developing hydrogen technology (Please list the projects).

NB: Any regulatory approvals will be separate from the Hydrogen Sandbox E.g., Permit to Fly (PtF).

What you will get from us

The organisation(s) which enter the CAA Regulatory Sandbox will receive support from a dedicated hydrogen challenge team member and regulatory subject matter experts, who will:

- Collaborate on identifying hazards, risks, and safety challenges associated with the use of hydrogen.
- Provide feedback on the safety argument for hydrogen operations in the aviation environment.
- Review gaps in current CAA regulations that apply to hydrogen as an aviation fuel.
- Review of the trial plan for testing in the hydrogen sandbox to ensure both the CAA and participant objectives are realized.
- Provide a critical review of the test data obtained through operations in the hydrogen sandbox and associated final reports.
- Ensure lessons learnt through testing are captured to support the development of the policy.

All CAA support and access to subject matter experts for the sandbox activity will be free of charge to the selected participant(s).

How to apply

To apply, you will need to:

- Complete the provided application form (available by emailing hydrogenchallenge@caa.co.uk), ensuring you provide details of your proposed test plan including all key milestones, aims, objectives and anticipated outcomes.
- This should detail how you intend to test hydrogen related technologies/operations and applicable regulations within the sandbox environment.
- Complete a ConOps in as much detail as possible on how you intend to test within the sandbox.

NOTE: Successful applicants/consortia will be required to enter into a memorandum of understanding (MoU) and non-disclosure agreement (NDA) with the CAA. Please review the provisions of these documents as there will be no scope to negotiate them.

If you have any questions about the application process, please contact us through our email address: hydrogenchallenge@caa.co.uk

Timelines

An overview of the timelines.

- The application period for this sandbox will close on **Wednesday, 4 December 2024 at 12:00 hrs GMT.** Applications received after this time will not be accepted.
- Applications will be reviewed and assessed for inclusion in the sandbox and all bidders will be notified within **7 working days** of the outcome.
- Successful bidders will be onboarded to the sandbox.
- A virtual kick-off meeting will be arranged within **10 working days** of notification of onboarding to the sandbox to explain the next steps to all parties.
- Individual one-to-one meetings will be held to provide feedback on the proposed ConOps and establish a project timelines.

The sandbox will only be opened once, and once the application phase has closed, no other applications for this sandbox will be accepted.

Management

Governance

Weekly meetings to update on progress, issues, and new developments to be conducted via MS Teams.

Monthly reports are required by the last Friday of each month and can be presented in MS Word or MS PowerPoint format.

Any safety issues that are identified must be reported immediately.

Planning

The participant will provide a plan showing all the critical activities of the test plan. This plan will be maintained and updated throughout the sandbox.

Communications

Review meetings and presentations can be held remotely via MS Teams or in person.

All communications must be through the hydrogen challenge email: hydrogenchallenge@caa.co.uk