



**Introduction to CAA Sandbox & Hydrogen
Challenge**
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Authority**

About The Civil Aviation Authority



We constantly challenge ourselves and our stakeholders to improve safety, security and consumer protection outcomes.

- Aerodromes
- Airworthiness
- Flight Operations
- Airspace Regulation
- Airspace Change
- Air Traffic Management
- Rapid Capabilities
- **Design and Certification**
- General Aviation
- Remotely Piloted Aircraft

Safety and Airspace Group



- Airline Licensing
- Consumer Protection
- Airline Credit and risk
- ATOL
- Airport and NATS Economic Regulation
- Competition

Consumers and Markets Group



- **Innovation Services**
- Airfield Advisory Team
- Environmental Research & Consultancy (ERCD)
- CAA International
- State Safety Partnerships
- Air Safety Unit

International Group



- Sustainability
- **Innovation Futures**
- Airspace Modernisation
- Space
- Strategy and EU Exit
- Network Resilience

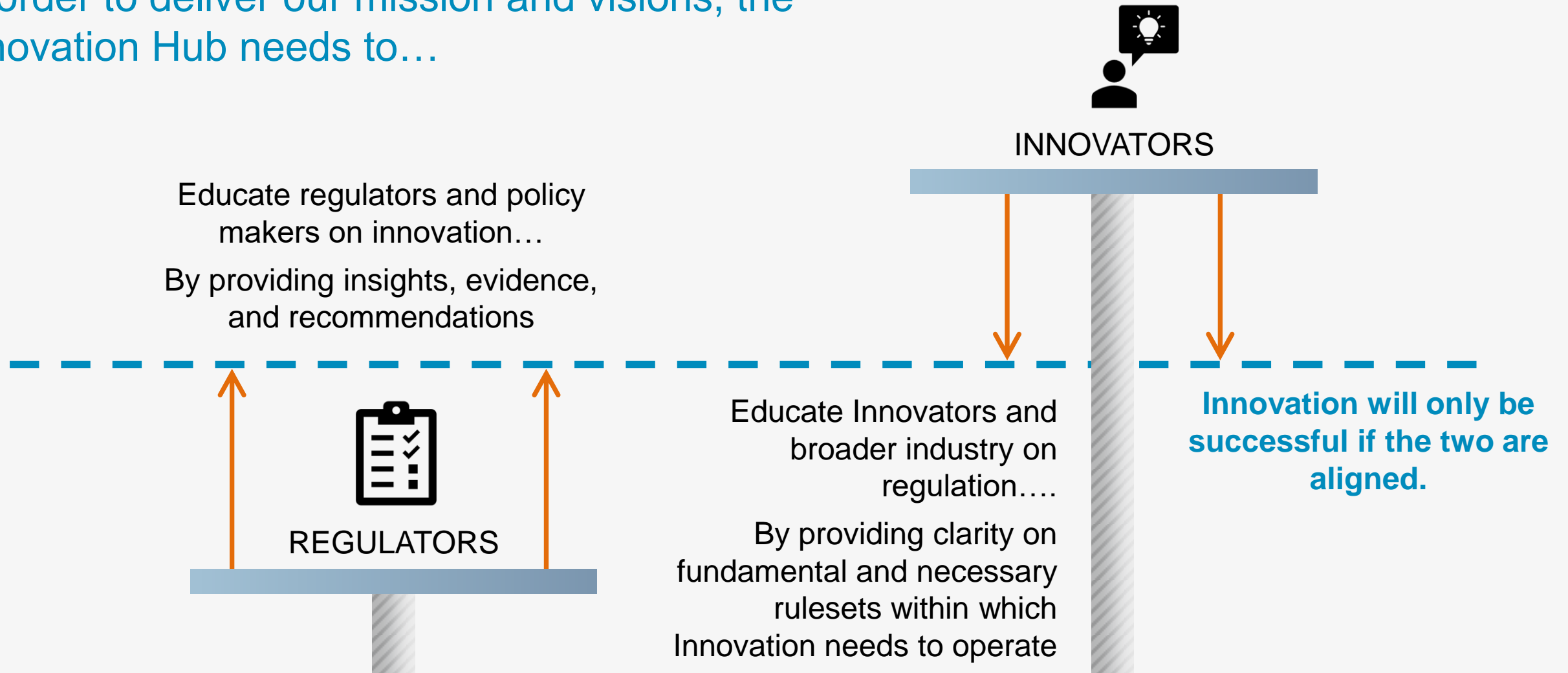
CAA Strategy and Policy Department



The Innovation Hub's Challenge



In order to deliver our mission and visions, the Innovation Hub needs to...



Introducing the CAA's 'Challenge' Approach



Coordinate & accelerate
development of policies and
regulations



Responding to
strategic risks to
the CAA



Hydrogen & Net Zero Propulsion Challenge

an initial commercial operation of a passenger
carrying service aircraft by 2030



Enable and coalesce
around a "**one CAA**"
approach



Provide CAA with the
necessary
resource capacity

Develop
CAA strategies for
what needs to be
achieved



Bringing together
Innovation and core CAA
methodologies in a **single**
programme of work



Zero Emissions Flight: Programme Outline



Mandate

UK Jet Zero Strategy:

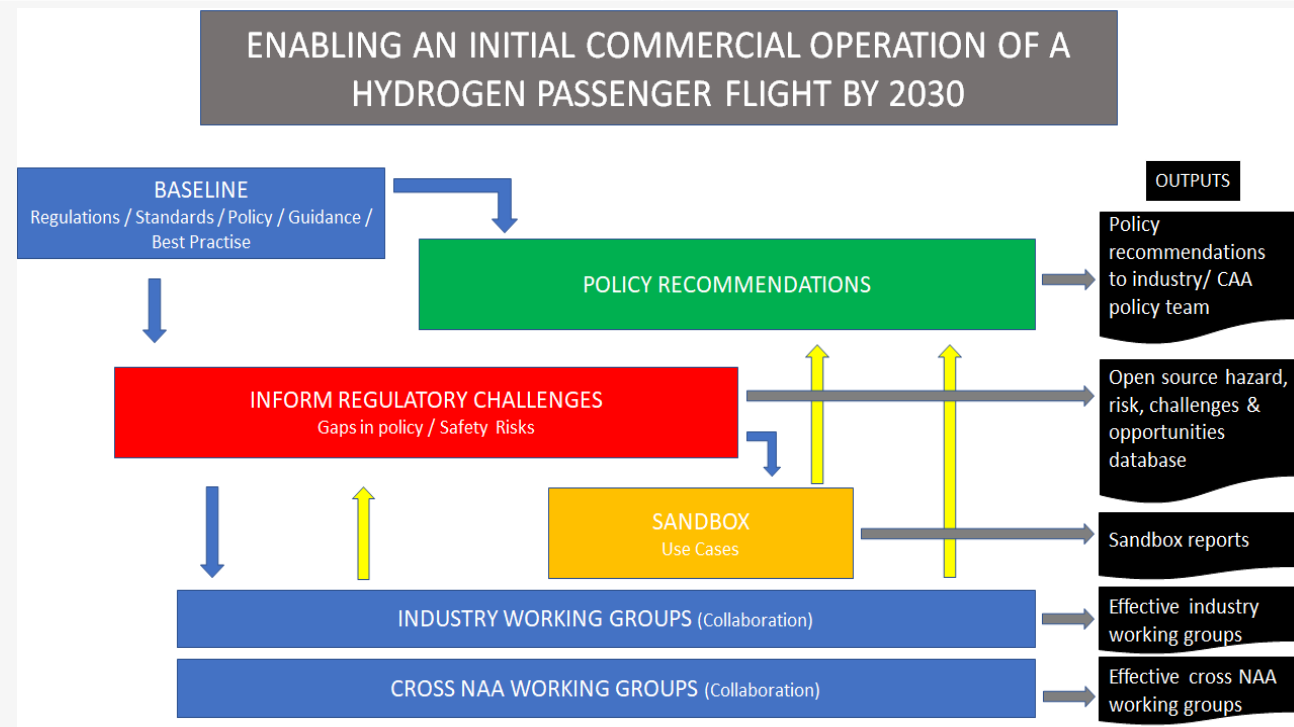
- 10% SAF in the UK aviation fuel mix by 2030
- Zero emission routes connecting different parts of the UK by 2030
- All airport operations in England to be zero emission by 2040
- All UK domestic flights net zero by 2040
- Net zero aviation in 2050

Objectives

1. Create a regulatory strategy
2. Support aviation Industry to meeting Net Zero
3. Provide a clear regulatory pathway
4. Enhance engagement with all relevant stakeholders
5. Understand impact of novel net zero solutions

Areas of interest

1. Hydrogen	6. Environmental Impact.
2. Battery-Electric	7. Human Factors
3. Sustainable Aviation Fuel	8. Pilot Licencing
4. Aerodromes, Ground Infrastructure & Operations	9. Maintenance & Continuing Airworthiness
5. Airspace	10. Design & Certification



Safety Regulation Considerations for new Hydrogen & Battery Technologies



GROUND OPERATIONS

Weight & Balance of Aircraft - Turnaround Times – ATEX certified equipment - Fuel dormancy support equipment – Leak detection systems – Automated ground equipment



AIRCRAFT

Initial Airworthiness – Continuing Airworthiness – Crashworthiness – Pressurised Fuel Systems – Hydrogen Explosion Prevention – Tanks – Propulsion Systems – Safety – Battery Storage & Safety



HUMAN FACTORS

-Training – Licencing for manufactures, crew, ground handlers, ATCOs



INFRASTRUCTURE

Hydrogen generation – Storage – Pipelines – Liquefaction – Electrolysis – Venting – Energy Supplies



ENVIROMENTAL ISSUES

CO2 Monitoring – Non CO2 Impacts – Noise – Whole Life Cycle



AIRSPACE CHANGE

Different take-off / approach profiles & speed
- Noise



FUELLING

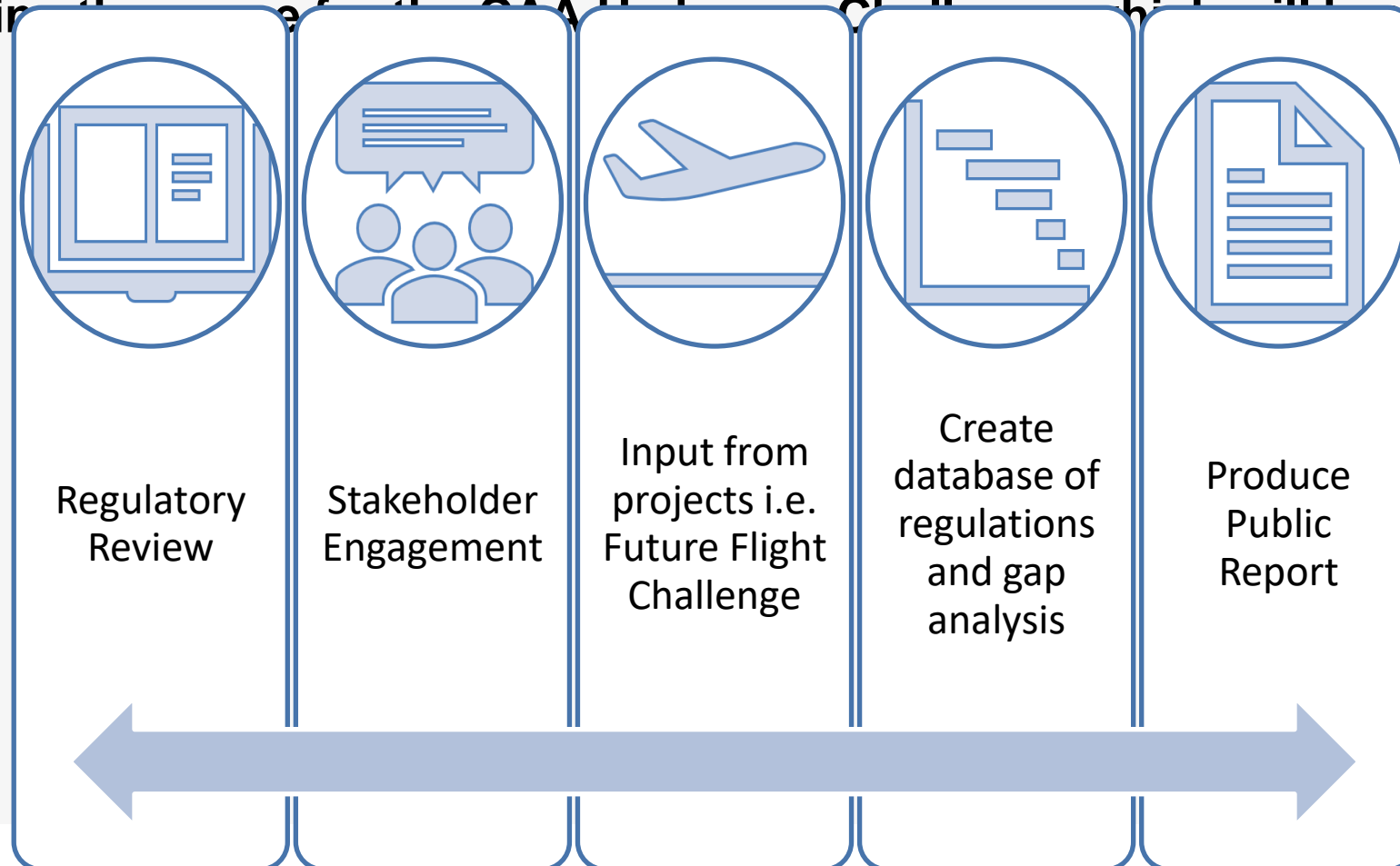
Fuel Safety Zone – Location of tanks – Refuelling with passengers onboard – Fuel Regulations – Location of recharging stations – Jettison of water – Emergency Response

Zero Emissions Flight Programme Outline



Current work we are conducting with the Zero Emissions Flight Regulation Sub Group:

This work is setting the stage for the "CAMU" (Climate Action Model Update) which will begin in September



Regulatory Capture & Review

Review of legislation, regulations, standards, policies, guidance material, AMC

Type of Document	Title of Document	URL	Applicable Publishing Organisation i.e. CAA, FAA, EASA	Applicable Document Sub Section Reference i.e. CS25.1
54	Certification Specification CS-23	https://www.caa.co.uk/media/125ftryp/caa-cs-23-amendment-5-ams-gm-issue-3-initial-airworthiness.pdf?catid=1&pageType=65&appid=11&mode=detail&id=9901		
55	Certification Specification CS-25	https://www.caa.co.uk/media/vkdl44xb/caa-cs-25-amendment-26-initial-airworthiness.pdf	European Union Aviation Safety Agency (EASA)	CS 25.561 Emergency landing conditions CS 25.562 Emergency landing dynamic conditions CS 25.563 Structural ditching provisions CS 25.721 Landing gear CS 25.801 Emergency provisions – ditching CS 25.963(d) Fuel tanks – emergency landing conditions CS 25.994 Fuel system components in a nacelle – wheels CS 25.903(d)(1) Engines (turbine engine installations) CS 25.979(d) Pressure fuelling system CS 25.863 Flammable fluid fire protection CS 25.981(a) Ignition source prevention CS 25.981(b) Flammability reduction CS 25.981(d) Critical Design Configuration Control Limit CS Appendix M Fuel tank flammability reduction means CS Appendix N Fuel tank flammability exposure CS 25.593 Fuel Systems Independence
56	Certification Specification CS-E	https://www.caa.co.uk/media/bdovcttp/caa-cs-e-amendment-6-initial-airworthiness.pdf	European Union Aviation Safety Agency (EASA)	
57	Certification Specification CS-P	https://www.caa.co.uk/media/dpchsxeg/caa-cs-p-amendment-2-initial-airworthiness.pdf	European Union Aviation Safety Agency (EASA)	
58	SC E-19 Electric/Hybrid Propulsion System	https://www.easa.europa.eu/sites/default/files/dfu/sc_e-19_issue_1_electric_hybrid_propulsion_system_-_2021-04-07.pdf	European Union Aviation Safety Agency (EASA)	
59	CAP482 - British Civil Airworthiness Requirements Section 5 - Small Light Aeroplanes	https://publicapps.caa.co.uk/docs/33/CAP482_BCARS_Issue7_19Dec_2018.pdf	UK Civil Aviation Authority	
60	Legislation	The Air Navigation Order 2005 - Section 137	UK Government	Aviation fuel at aerodromes 137.—(1) Subject to paragraph (2), a person who

Working with industry to capture current gaps

Initial Airworthiness

Large Aeroplanes

CS-25 – Amendment 26

Warning

This document contains links to pages containing EU law and/or to pages on the EASA website. You should not click on those links as those destination pages will not contain up to date and accurate descriptions of your rights and obligations.

NFPA

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Hydrogen Technologies Code

2023

	Special Condition	Doc. No.: SC E 19
		Issue: 1
		Date: 27/05/2020
		Proposed by: Final
		Qualified for comments: 04/03/2020

SUBJECT: Electric / Hybrid Propulsion System

REQUIREMENTS vs. AMCs:

ASSOCIATED M/AMC:

ADVISORY MATERIAL: / No

INTRODUCTORY NOTE:

The following Special Condition has been classified as important and as such shall be subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 13 September 2007, Article 3 (2) which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with them 2), as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

IDENTIFICATION OF ISSUE:

This Special Condition has been developed to support applications received by the Agency for the certification of Electric and / or Hybrid Propulsion Systems.

The certification specifications that are usually applicable to aircraft engines are contained in CS-E amendment 5 or CS-22 subject H, however none of these certification specifications consider Electric and / or Hybrid Propulsion Systems.

The purpose of this special conditions is to provide the certification requirements for an Electric and / or Hybrid Propulsion System.

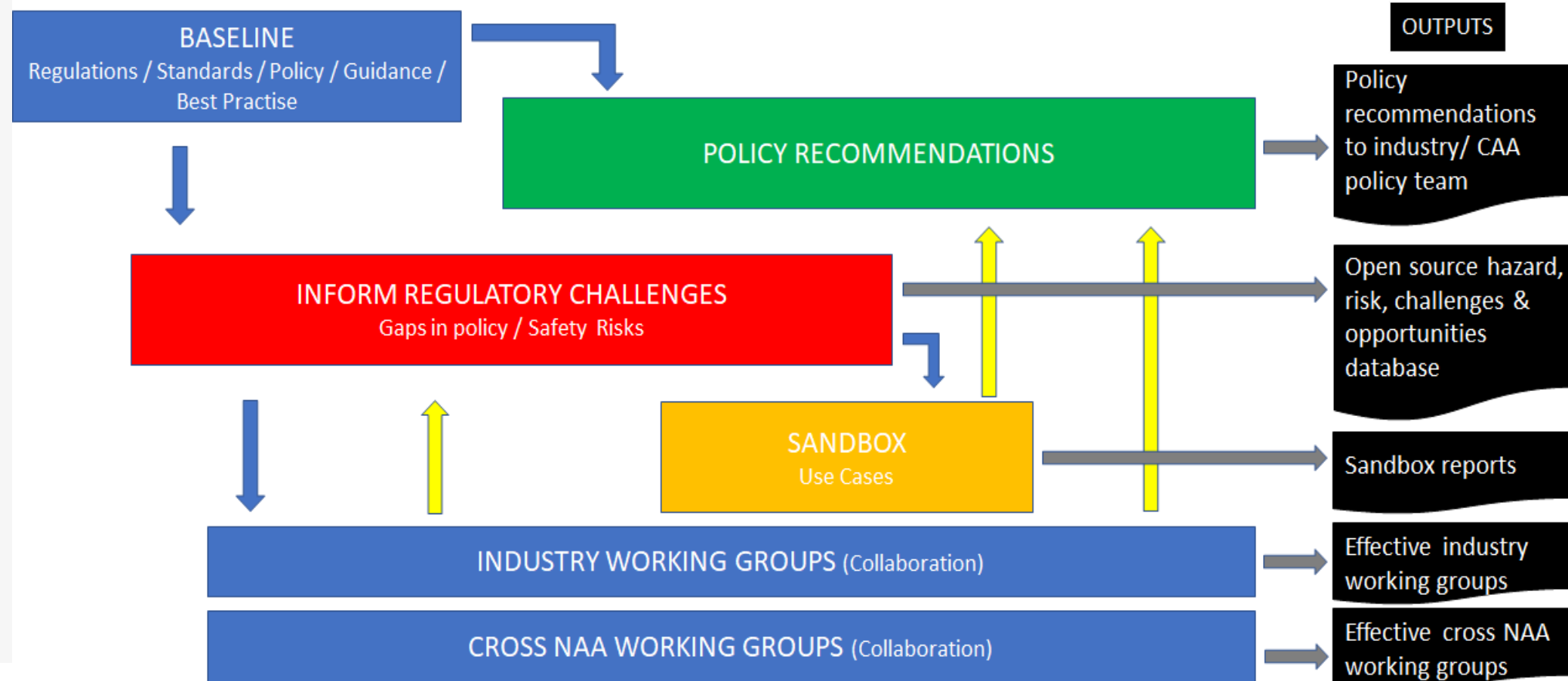
This Special Condition is articulated so as to provide objective based certification requirements which are independent of the propulsion system design or architecture. The type of technology used in the propulsion system will be addressed in the Acceptable Means of Compliance. Acceptable Means of Compliance will depend on the type of EPRs that is considered and on the type of aircraft on which the EPRs is intended to be integrated.

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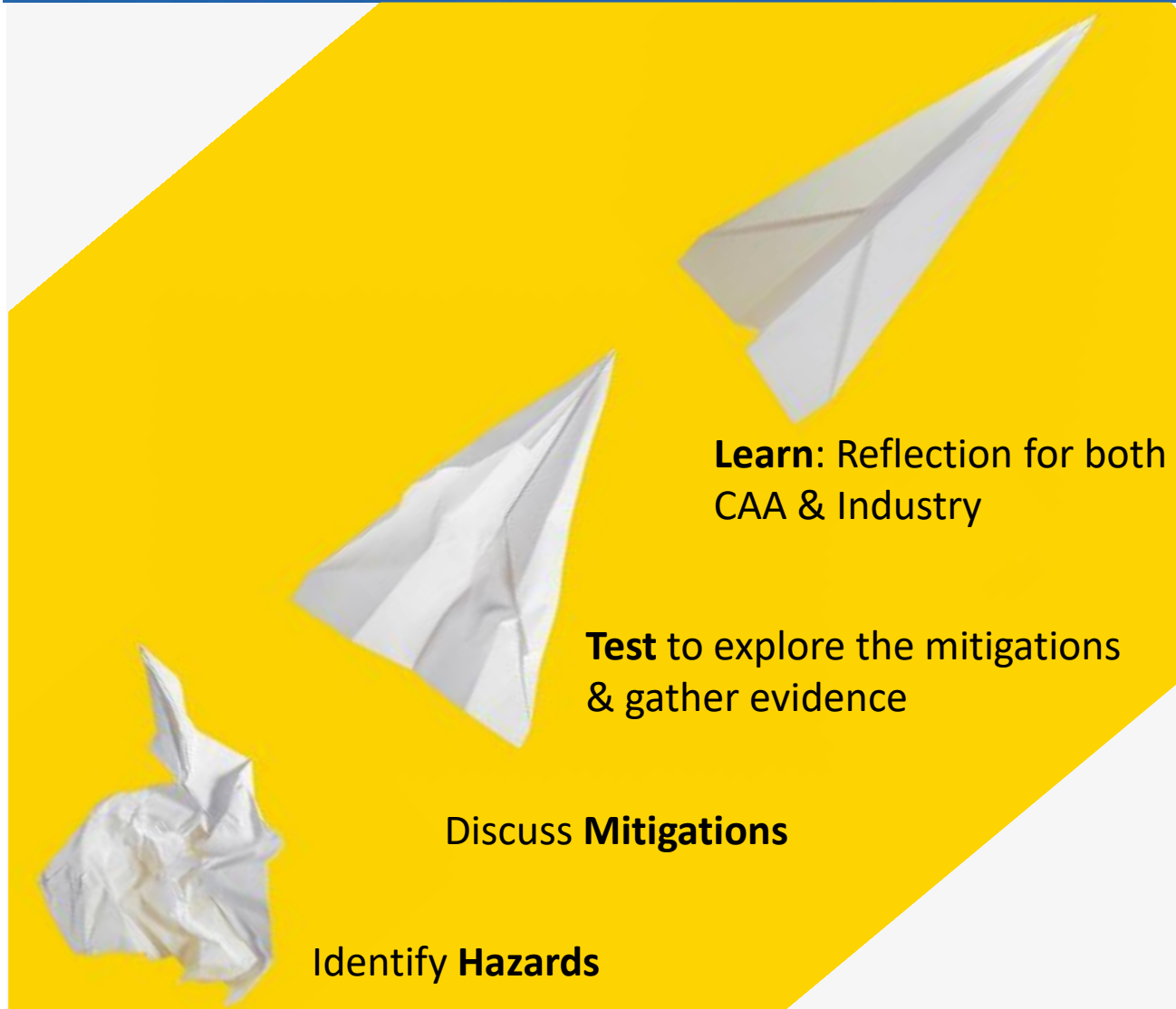
Zero Emissions Flight Programme Outline



ENABLING AN INITIAL COMMERCIAL OPERATION OF A
HYDROGEN PASSENGER FLIGHT BY 2030



What is the Regulatory Sandbox



Helping Industry to Overcome Regulatory Challenges

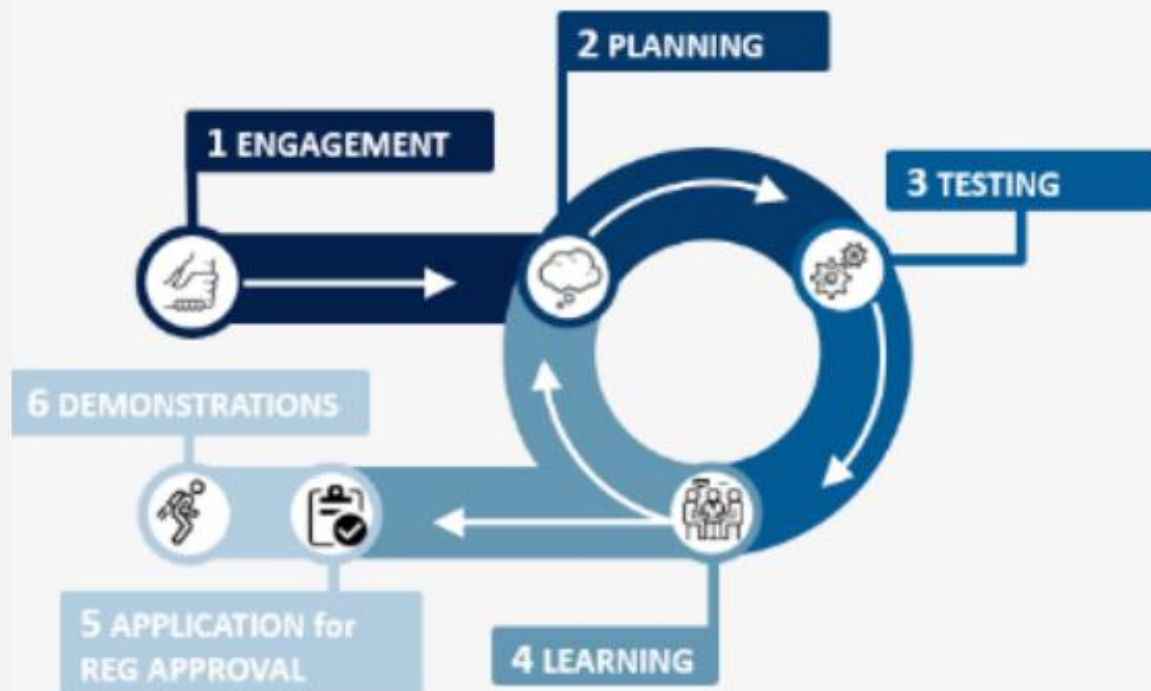
The Sandbox helps industry to maximise the regulatory readiness of their innovation by ensuring development activities address the risks that their innovation brings in terms of safety, security and consumer protection

The Innovation team will work with industry to:

- identify the regulations applicable to the innovation.
- identify the regulatory challenges i.e. the gaps between the innovative design or intended operations and what is permissible under existing regulations.
- discuss the associated safety (and also security and consumer protection) hazards.
- industry proposes mitigations for the hazards identified (Planning). These are then explored through tests and simulations in safe environments (Testing) to encourage learnings for both the industry and CAA (Learning).

By providing clarity on the new challenges and emerging risks we help to increase the CAA regulatory team's awareness of these aspects so that future regulation can be developed to support in the areas required.

The Sandbox Approach



1. Develop a common understanding of the innovation and the regulations that apply to it, and where there are gaps in regulations.

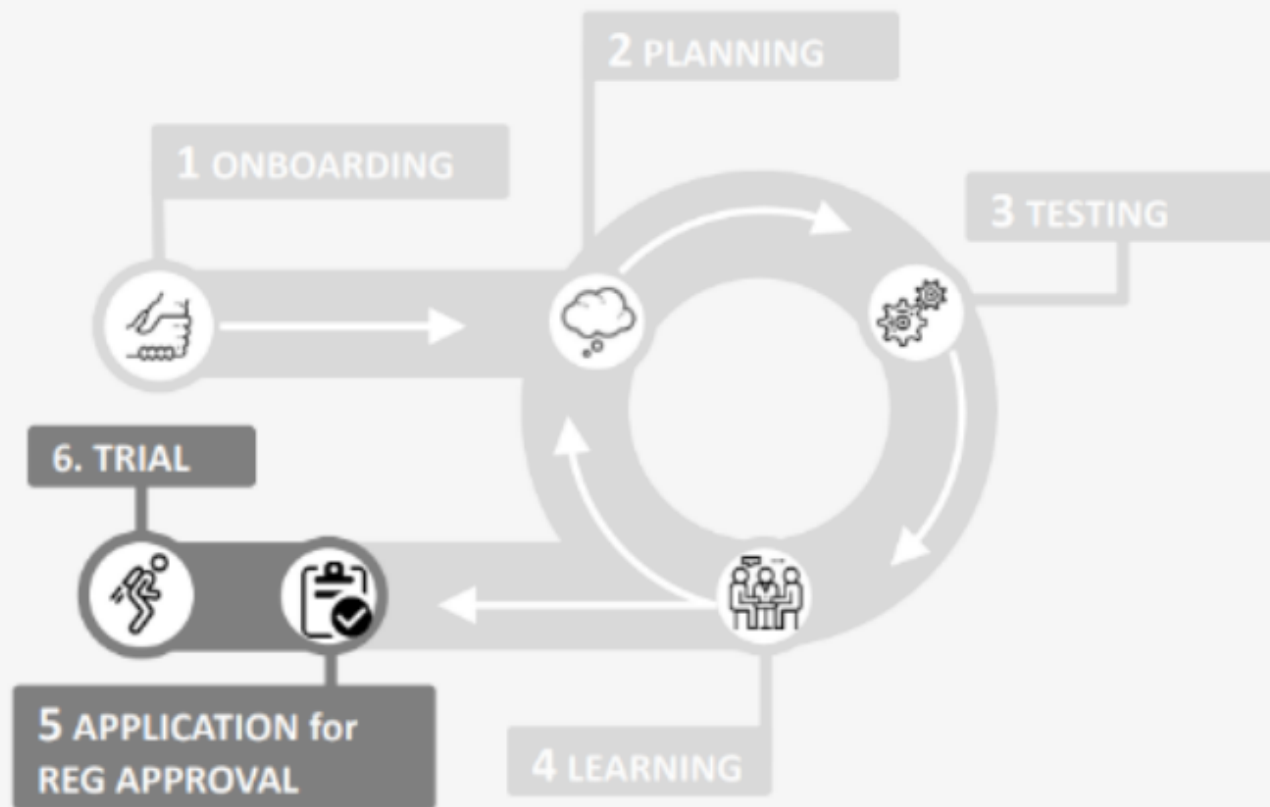
Where there are gaps in regulations, the CAA clarifies the unknowns and risks that innovation brings with regards to safety, security and consumer protection.

2. At the Planning stage, the industry propose design mitigations for the unknowns and risks.

3. These are then explored through tests and simulations in safe environments (Testing stage)

4. Encourage learnings (Learning Stage). Short iterative cycles of 'Planning, Testing and Learning' are favoured to eliminate unknowns and risks,

The Sandbox Methodology – Application for Regulatory Approvals & Trial Demonstarions



The organisation applies for the regulatory approvals applicable to the trial.

The organisation regularly will report about findings regarding the success (or otherwise) of trials.

The Innovation Hub will share these with other CAA colleagues for the purposes of informing future decision making, wider policy making, guidance and regulations.

Approvals for Demonstrations

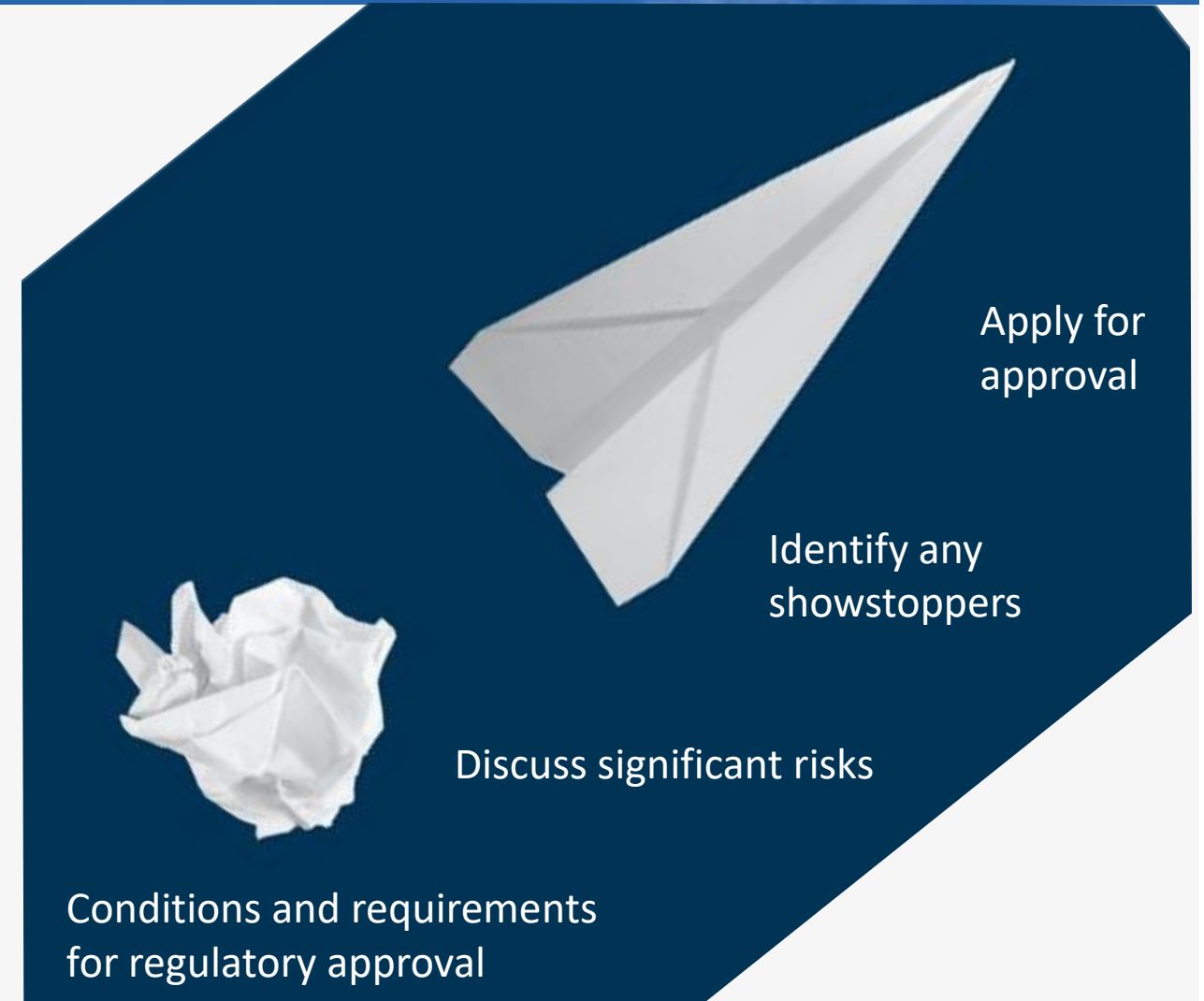


Helping to conduct demonstrations under existing rules

When industry wish to test technical feasibility and conduct other forms of testing in live environments but require support in navigating existing regulations the Innovation team can help by supporting industry in determining which regulatory approvals are required.

The CAA clarifies:

- The conditions and requirements to obtain the regulatory approvals for conducting the testing and demonstrations and what approval pathway may be best suited;
- Aspects of the test operations that present significant risks to third parties. The greater the risks, the more comprehensive the safety case must be. Applications may take longer to assess, and the Consortium may not be able to conduct the tests within the timescales of the project.
- Showstoppers, i.e. aspects of the testing operations that the CAA would not authorise.



Contact us...
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