



The importance of research in hydrogen and other new technology aircraft development

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Hydrogen aircraft – what changes from a regulatory viewpoint?

Crew training

Take off performance
Cruise performance

Fire / Evacuation / Rescue
ETOPS clearances

Characterising emissions

Fuel gauging

Engines
Fuel system
Fuel tanks

+ Hybridisation?

Materials in contact with hydrogen

+ Ground infrastructure standardisation & safety, ground staff training, fuel quality control

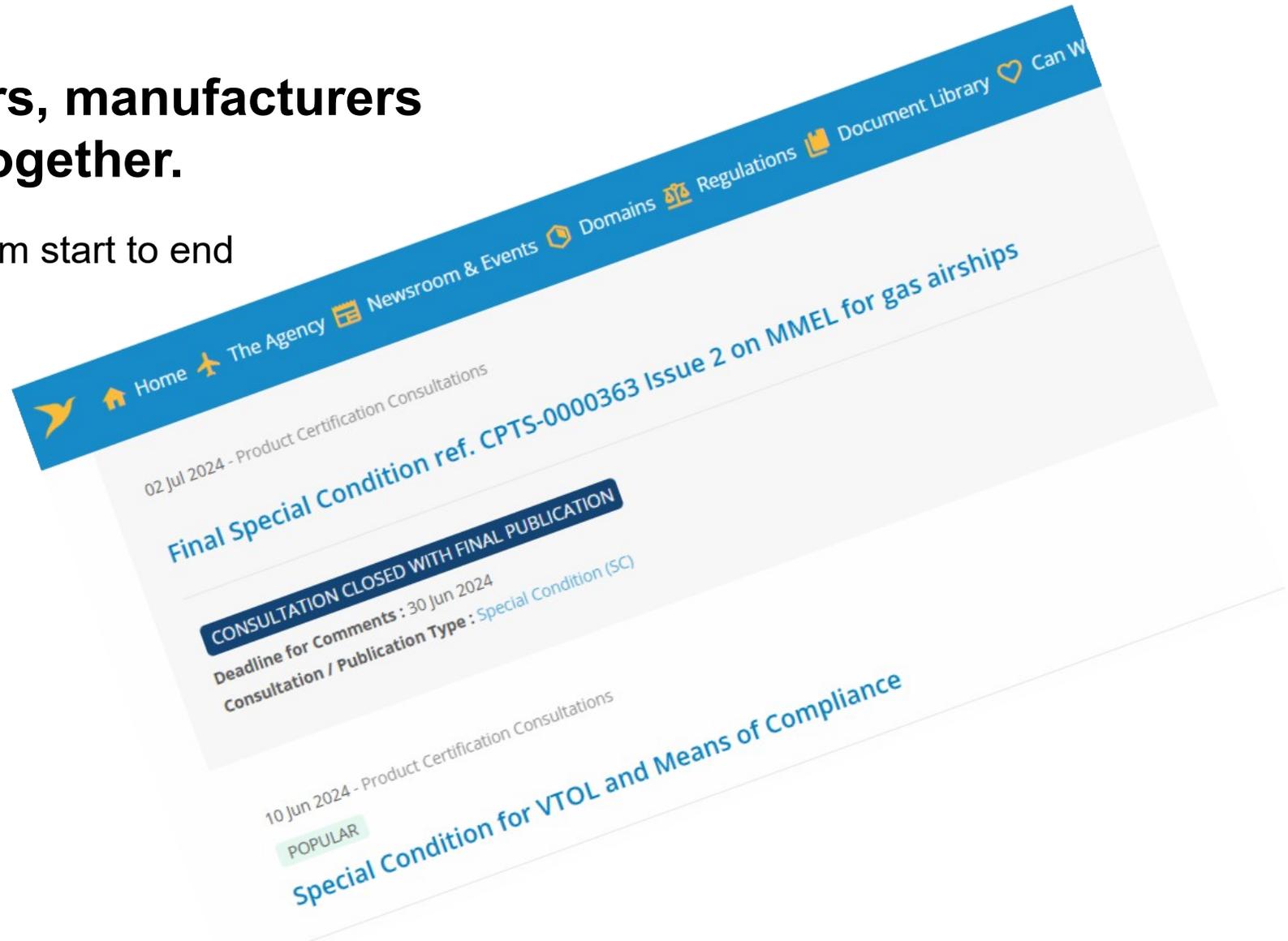




So the technology programmes, need regulatory programmes

Which must bring designers, manufacturers and authorities together.

And throughout every programme – from start to end





Work in stages

Certification activity needs to shadow the aircraft and/or engine development.



Regulatory Readiness Level

Publish requirements

Fully freeze certification requirements

Requirements NPA process

Internally freeze certification requirements

In-house trial certification on prototypes

Chill Special Conditions structure

Start evaluating against testbeds and models

Initial draft Special Conditions

Literature Review

TRL9

TRL8

TRL7

TRL6

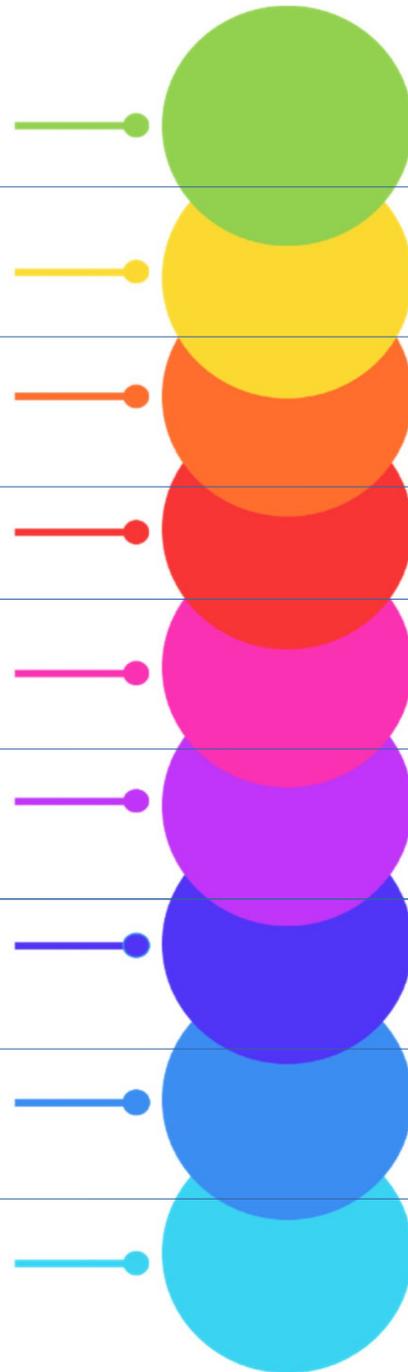
TRL5

TRL4

TRL3

TRL2

TRL1



Actual system proven in operational environment

System complete and qualified

System prototype demonstration in operational environment

Technology demonstrated in relevant environment

Technology validated in relevant environment

Technology validated in laboratory

Experimental proof of concept

Technology concept formulated

Basic principles observed

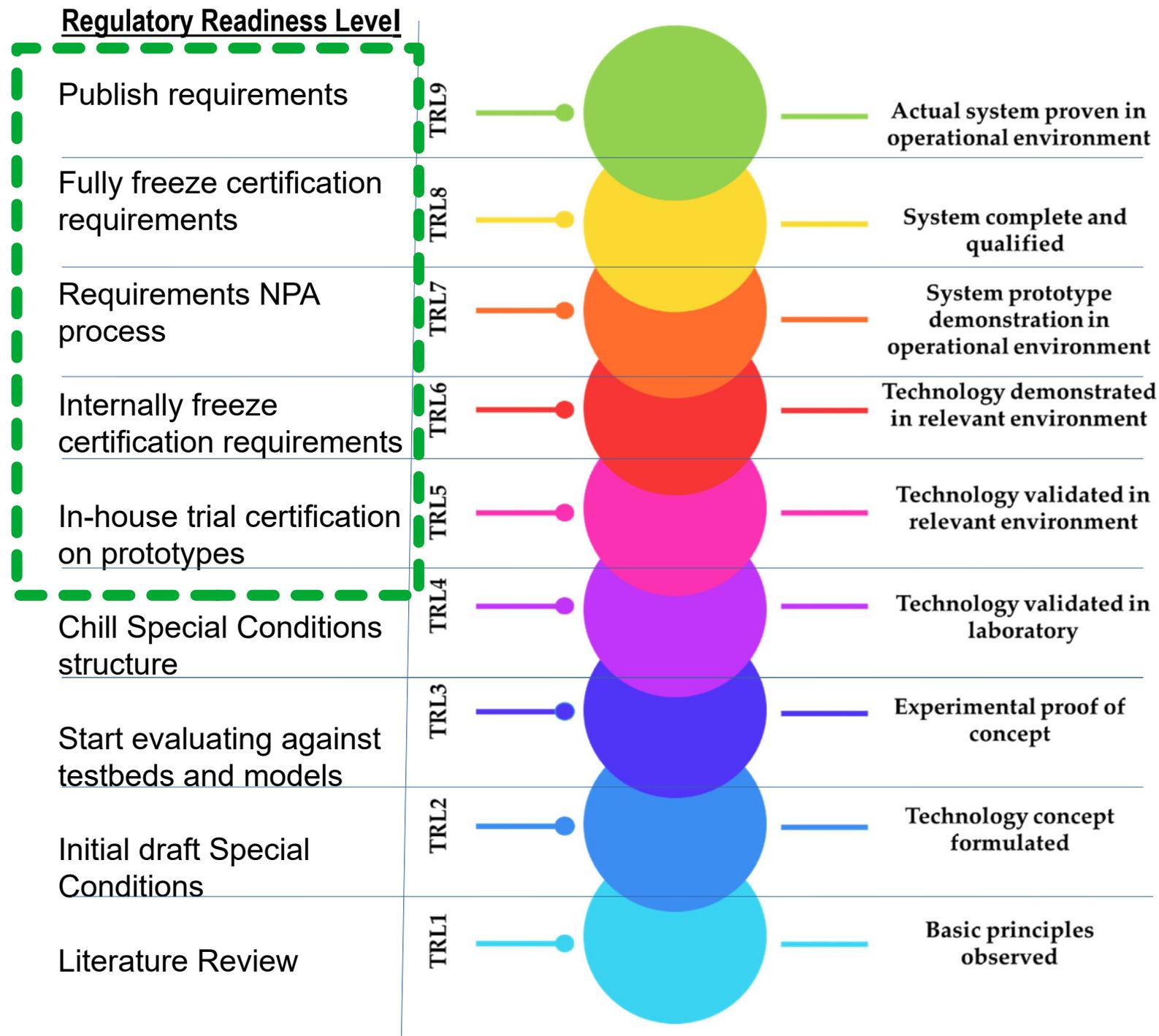
TRL here is standard
 RRL is our proposal
 EASA use CRL - Certification Readiness Level



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Main authority involvement



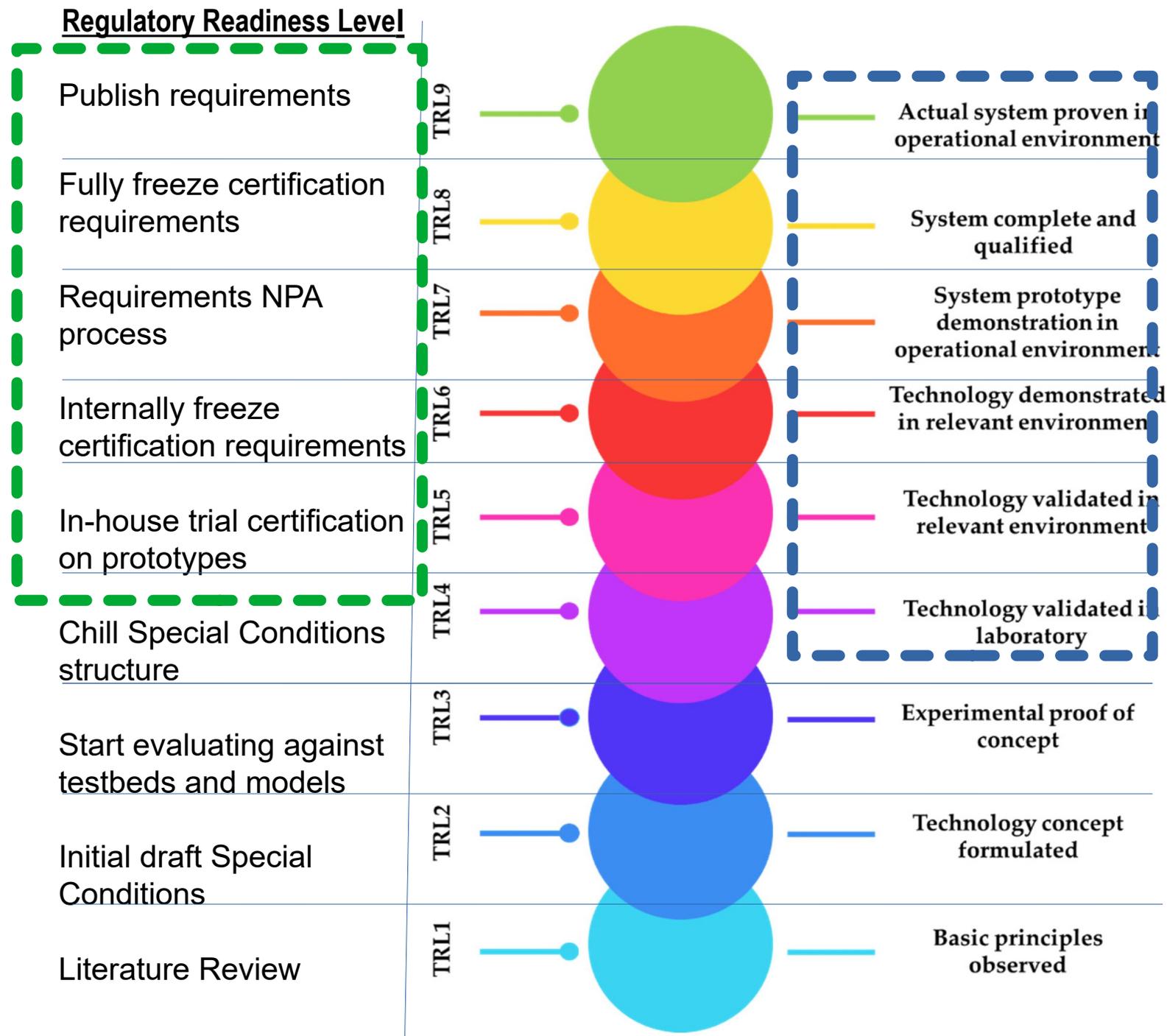


Work in stages

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Main authority involvement

Manufacturer leadership





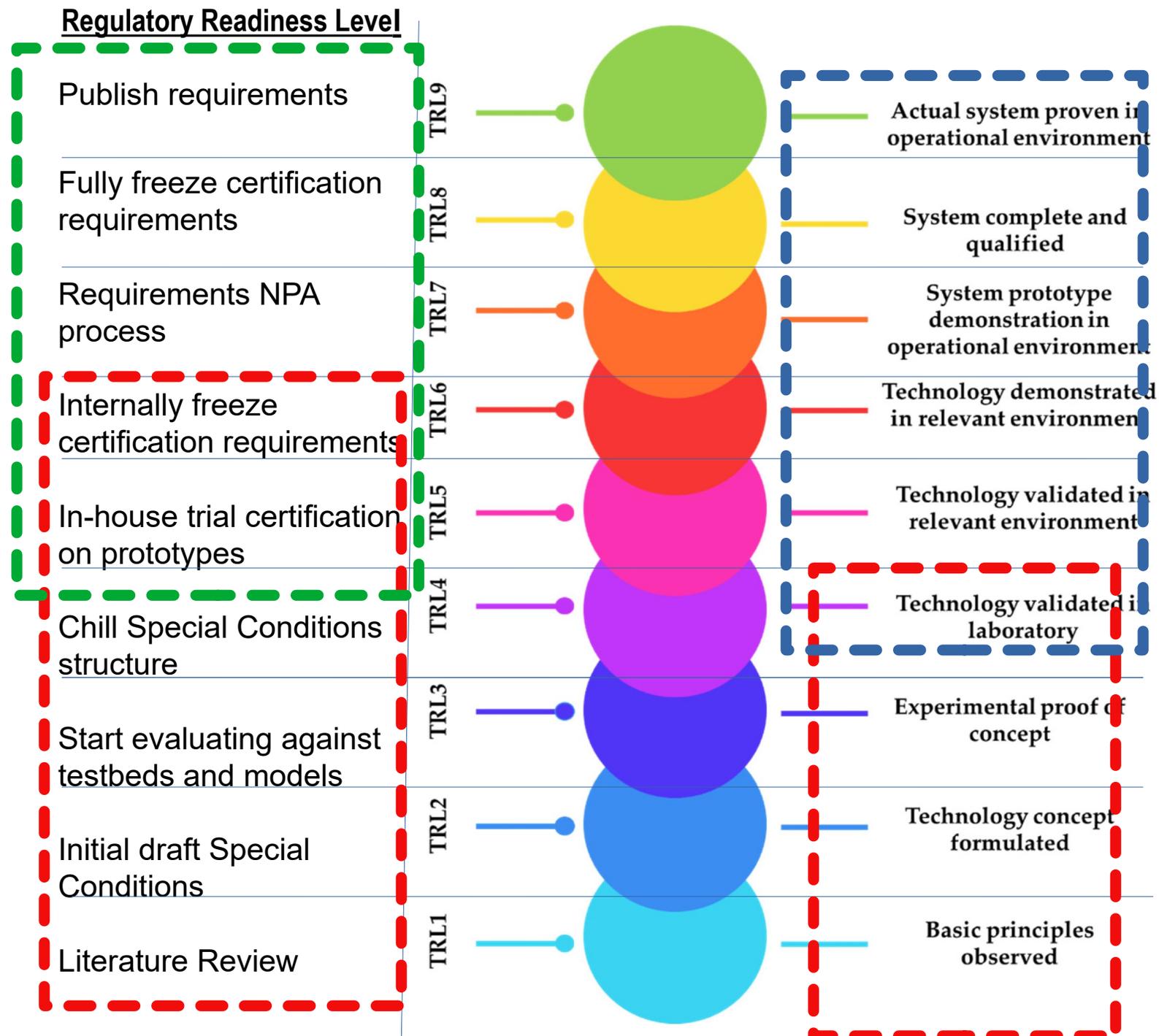
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**Research organisations
Greatest added value**





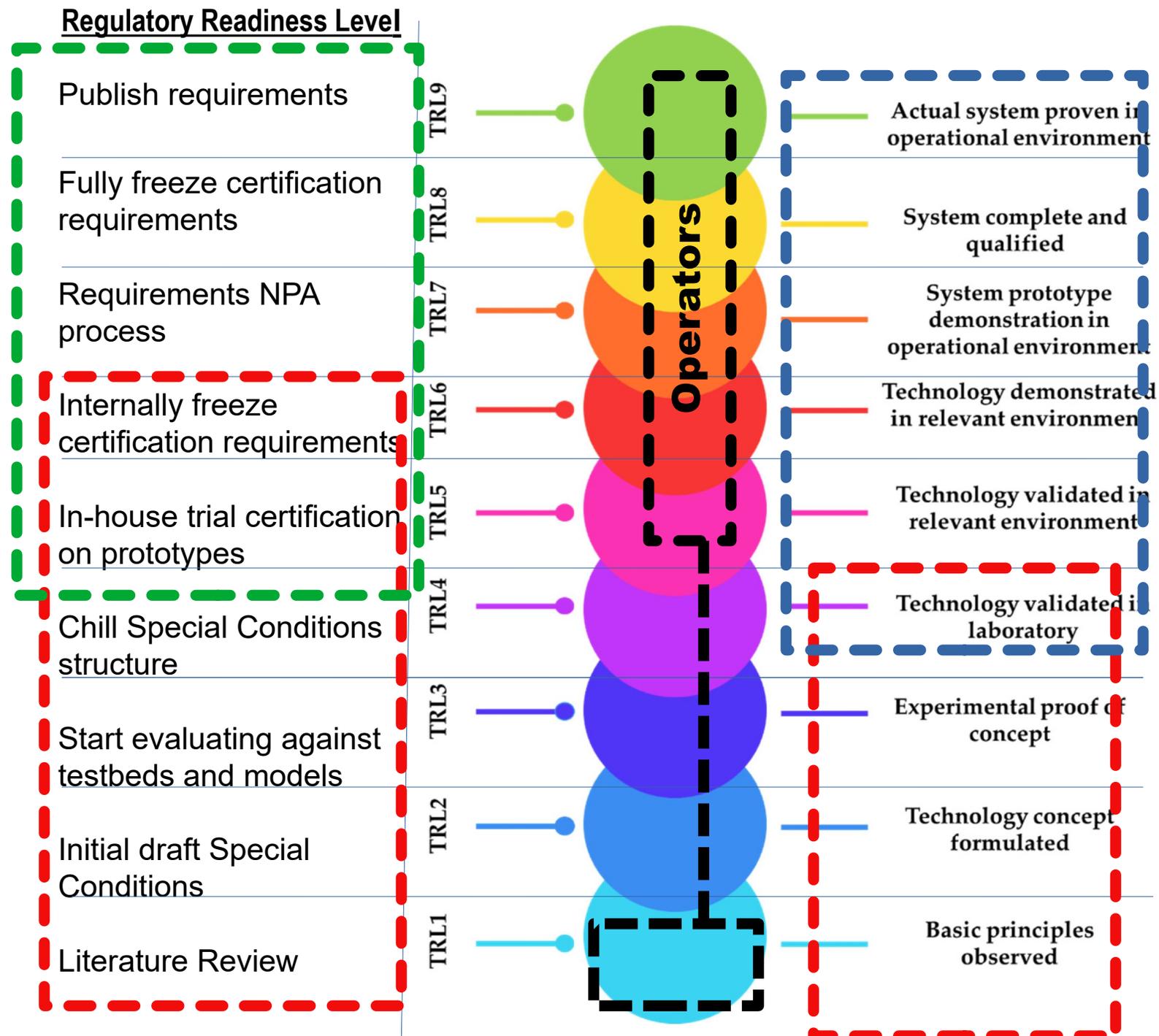
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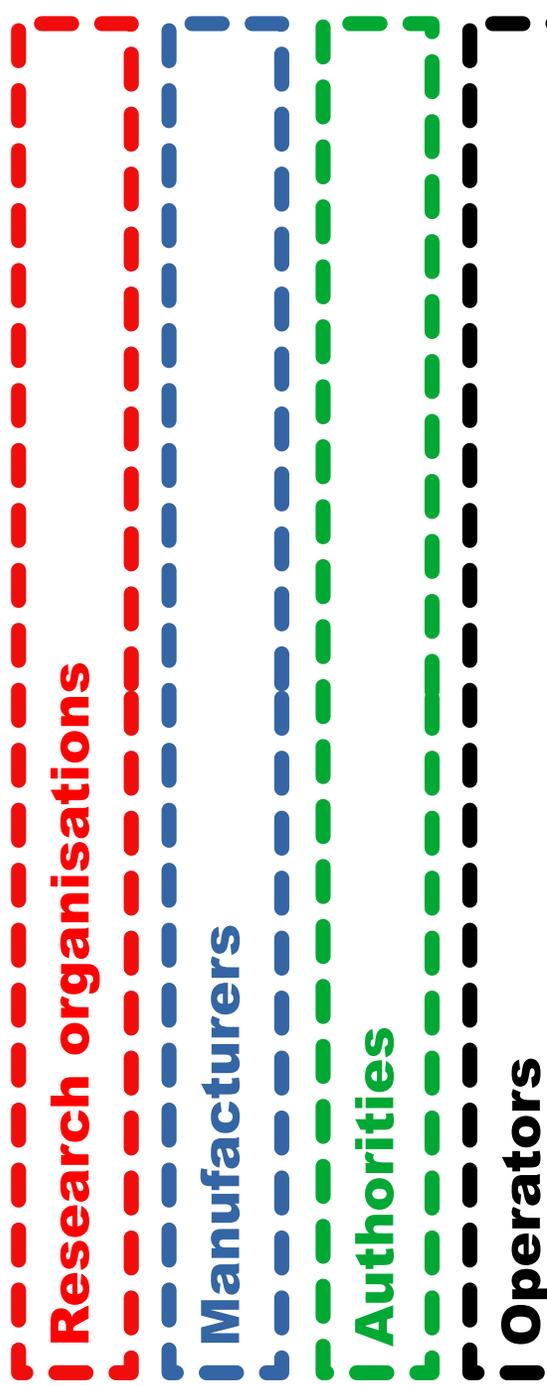
Integrating designers, authorities, operators and researchers



Everybody in the same tent..... but not equally all at the same time



But don't compromise visibility



Research organisations

Manufacturers

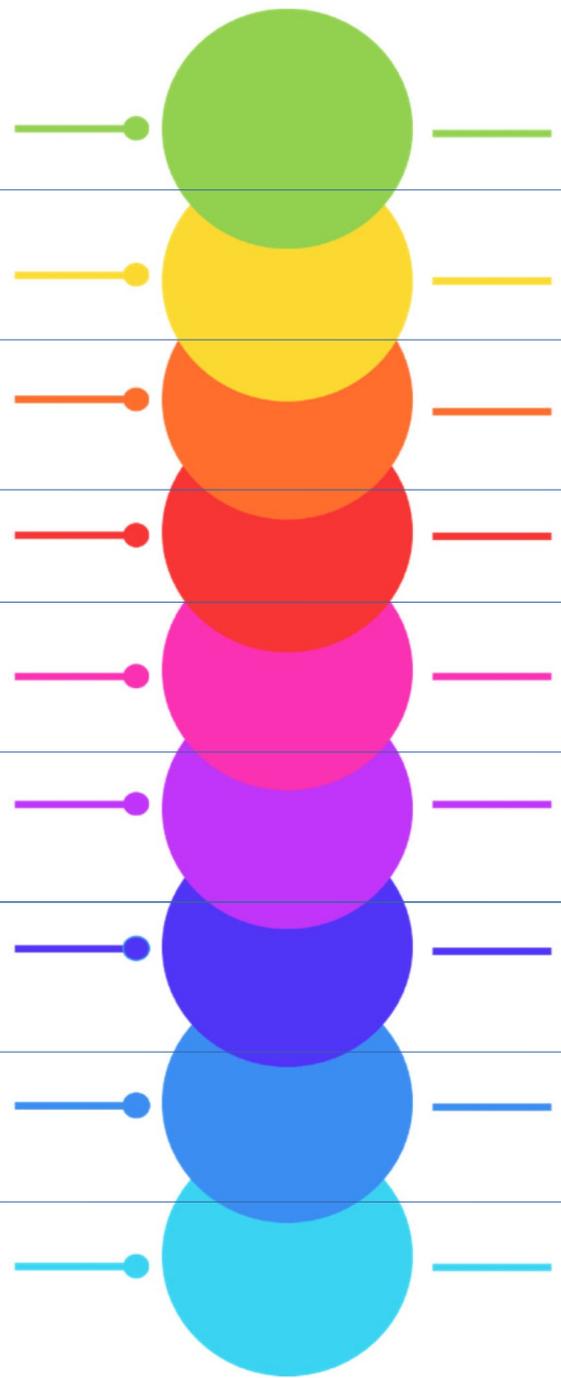
Authorities

Operators

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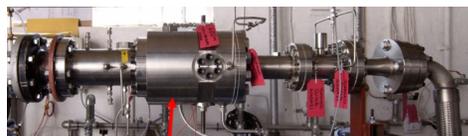
A few Cranfield Examples

Centre for Doctoral Training
in Net Zero Aviation

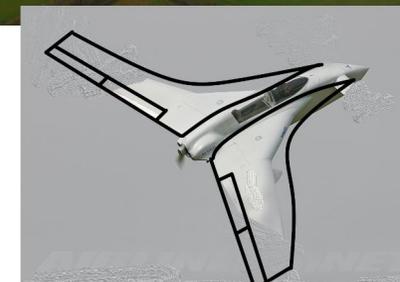
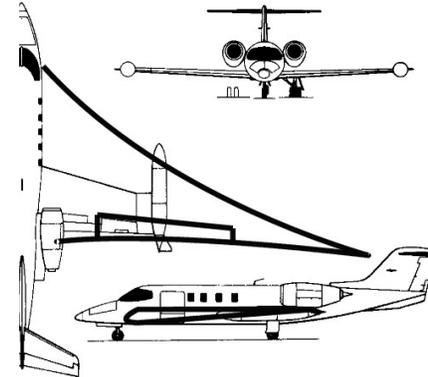


Engineering and
Physical Sciences
Research Council

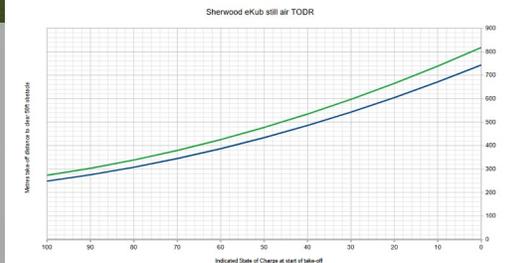
**Cranfield Hydrogen
Integration Incubator
(CH2i)**



EXAELIA



EnabEI





Hydrogen and sustainable fuels research at Cranfield

From 2024: £69 million Cranfield Hydrogen Integration Incubator (CH2i), delivering:

- Hydrogen labs for research in energy production and end-uses.
- Large-scale test cells for hydrogen in civil aviation.
- Configurable test area for LH2.
- Upgrades to Cranfield Airport for larger and hydrogen-fuelled aircraft.



Key Feedstocks and fuel production. Transport, storage, economics, supply chain. End users – aerospace and road vehicles. Policies, economics and markets. • H2 = Hydrogen • LH2 = Liquid hydrogen • SAF = Sustainable aviation fuel

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