ATI Non-CO$_2$ Technologies Roadmap and Non-CO$_2$ Programme webinar

Thursday 18th April 2024

Introduction

› In March 2024 the ATI launched the Non-CO_2 Technologies Roadmap and announced the introduction of a Non-CO_2 Programme in partnership with the Department for Business and Trade and Innovate UK to open in May 2024.

› The Non-CO_2 Technologies Roadmap is the first of its kind. It reflects the UK aerospace sector's collective view of the research actions needed to improve understanding and reduce broader atmospheric emissions from aircraft. While the sector rightly remains steadfast in its commitment to tackle carbon emissions, we must also take steps to address non-CO_2 emissions.

› As understanding of aviation's non-CO_2 impacts grows, so too does the market opportunity and the UK is ideally positioned to unlock the technologies which will maintain global connectivity while meeting environmental commitments and delivering economic benefit across the UK.

› The following slides are from the Non-CO_2 Programme webinar recorded on Thursday 18th April 2024. For more information, visit ati.org.uk/funding/non-co2programme/

Non-CO$_2$ Technologies Roadmap

Adam Morton

Head of Technology – Sustainability & Strategy

April 2024
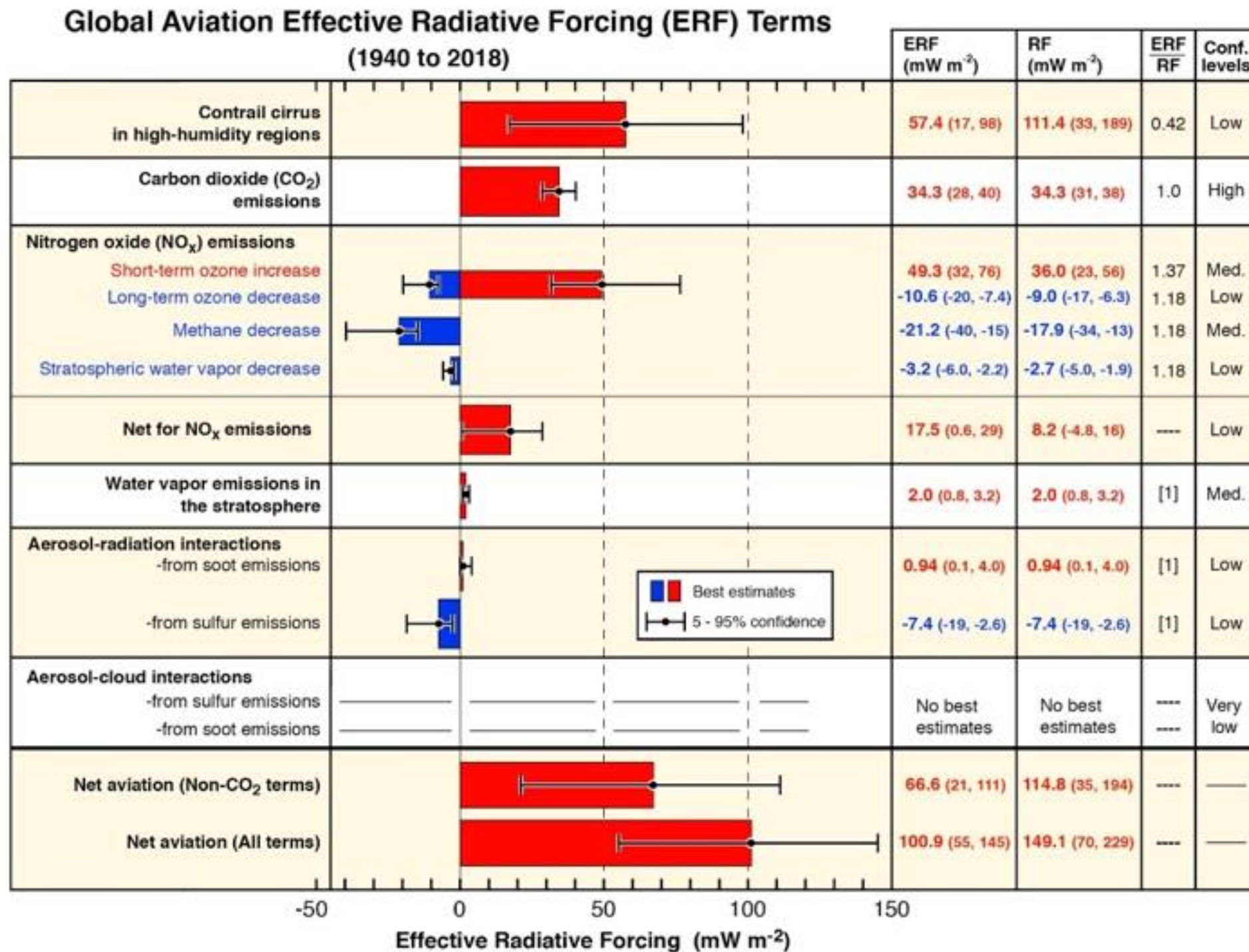
Background to development of Non-CO$_2$ Technologies Roadmap

Figure 1.1: Climate forcing terms from global aviation from 1940 to 2018. From Lee et al. (2021).

› Recent research by UK and international researchers concluded aircraft non-CO$_2$ emissions could potentially have a greater climate impact than aircraft carbon emissions.

› The research also concludes our current understanding of contrail formation, and the effects of other non-CO$_2$ emissions, is incomplete with this uncertainty likely to increase with the introduction of new fuels and novel technologies.

› In October 2023, the UK launched a research programme to support Fundamental and Applied work on non-CO$_2$.

› Now, the ATI has introduced the Non-CO2 Technologies Roadmap and associated funding programme.

NON-CO$_2$ EMISSIONS COMPARISON

AEROSPACE TECHNOLOGY INSTITUTE

Emission	Current understanding of climate impact	Level of confidence on warming impact	Duration of impact
Carbon Dioxide (CO$_2$)	CO$_2$ makes up around 80% of greenhouse gas emissions from human activity but some research suggests it accounts for less of aviation's warming contribution than non-CO$_2$ impacts.	High	Hundreds of years
Non-CO$_2$			
Oxides of Nitrogen (NO$_x$)	NO$_x$ comprises several different gases containing nitrogen and oxygen. These interact with other gases including ozone, methane and water vapour in complex ways. The net effect is currently thought to be warming but without further work this is uncertain.	Low-Medium	Days
Water Vapour (H$_2$O)	Water as water vapour has a small direct greenhouse gas effect, although in high humidity regions where it can form of persistent contrails, the impact is much larger (see 'Contrails' below).	Medium	Days to years before water vapour falls as precipitation
Contrails	Contrails can form when water vapour in the warm aircraft engine exhaust meets cold humid ambient air, condenses and then forms ice crystals. Whilst persistent contrails can be both cooling and warming, the net effect is currently believed to be strongly warming.	Low	Minutes to hours
Soot & Particulates	Aircraft emit soot and particulates from incomplete combustion of fuel in the engines. The direct warming effects from absorption, scattering and reflection of radiation are currently estimated to be small. There are no widely accepted estimates of the climate effect of aircraft soot-cloud interactions.	Very Low-Low	Days to months
Sulphur	Sulphur in aircraft fuels is released in the form of sulphur oxides (SO$_x$) or aerosols. The direct effects of sulphur emissions are thought to be mildly cooling. There are no widely accepted estimates of warming or cooling from sulphur interacting with clouds. Sulphur potentially plays a role in contrail formation.	Very Low-Low	Hours to weeks depending on form
Unburnt Hydrocarbons	With modern efficient aero engines, the quantity of unburnt hydrocarbons is small.	Medium	Days to months

The Non-CO$_2$ Technology Roadmap Process

> Process started with attendance at the JZC Non-CO$_2$ T&F Group workshop on 6 November 2023

> Participation in Non-CO$_2$ panel debate at the ATI Annual Conference in Birmingham on 15 November

> 10 ATI driven external stakeholder meetings including 6 roundtable events across academia, aerospace, airline, airport and air navigation service providers

  > 90+ participants joined ATI led workshops or meetings
  > 36 companies from across the aviation industry consulted
  > 14 aerospace, 9 airlines, 7 airports, 5 sustainable fuel providers, and NATS
  > Over 20 universities consulted – mainly in the UK but also Europe and the US

Over 250+ hours of project design, delivery and output consolidation meetings, analysis and drafting

Priority non-CO$_2$ areas for research

Projects should broadly align with the ATI Non-CO$_2$ Technologies Roadmap, which is split into these areas:

› **Fuel characteristics** – Research supporting the development and adoption of fuels with the potential for reduced non-CO2 emissions, including SAFs and hydrogen. This may include research into how to deploy these different fuels most effectively to minimise overall climate impact. Fossil-derived fuels are potentially in scope where there is potential to reduce their non-carbon impact, for instance through changes to the aromatic or sulphur content.

› **Aircraft Technologies** – Research focussed on technologies designed to mitigate non-CO2 impacts which will be deployed onboard aircraft. These technologies may include components of fuel or propulsion systems or sensors for control or monitoring systems.

› **Knowledge, Data and Operations** – Research related to understanding the climate impact of non-CO2 emissions from aircraft and how new technologies can mitigate them. This is expected to include modelling, and activities to support the validation or deployment of models and tools.

Potential projects based on priorities identified
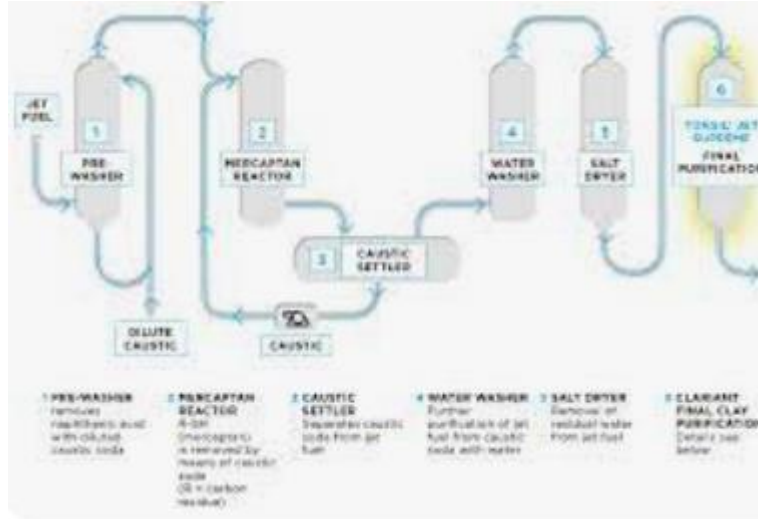
Hydro treatment of jet fuel

Optimisation of fuel use
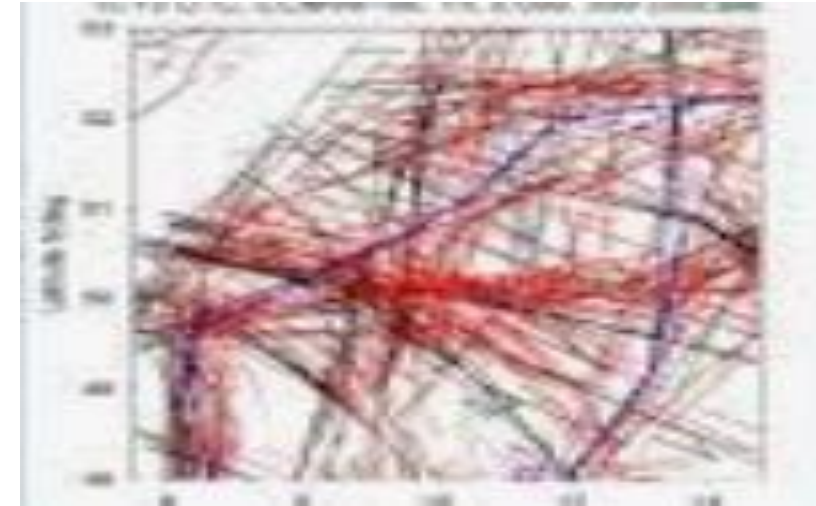
Contrail modelling

Role of exogenous aerosols in contrails

Sensor technology

Water vapour management
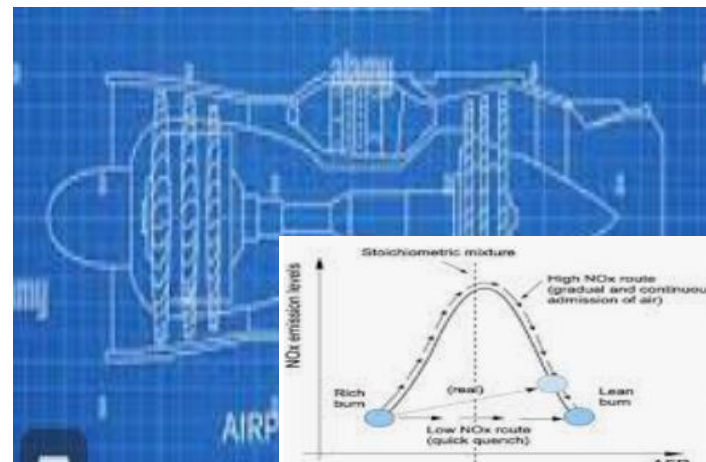
'Non drop-in' engine design
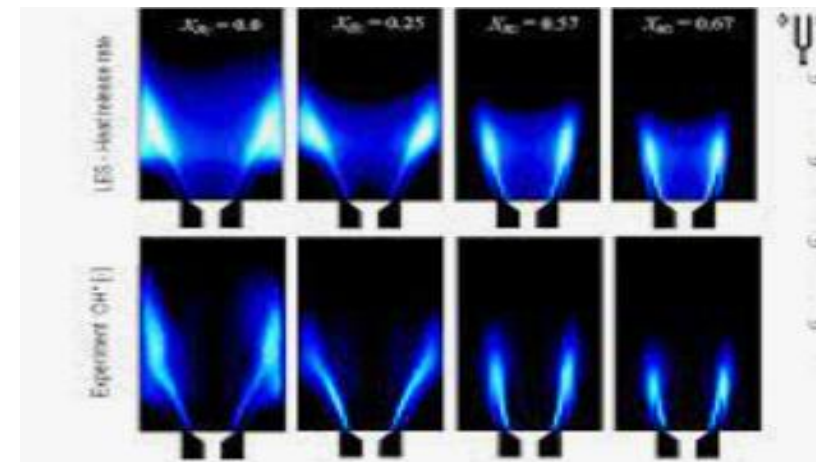
Hydrogen combustion
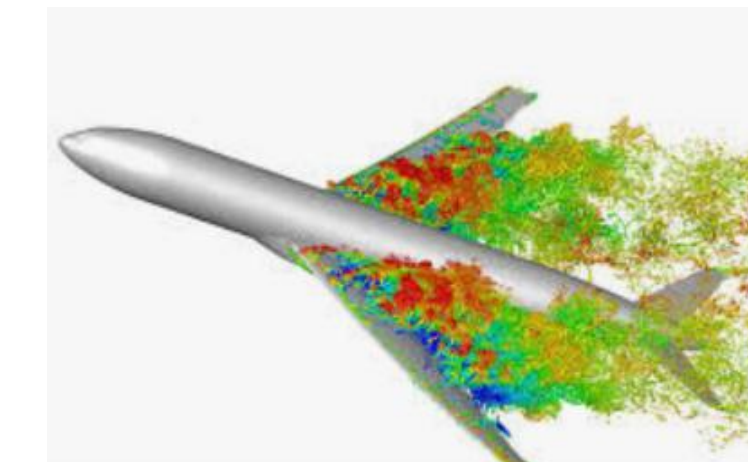
Aircraft model development/validation
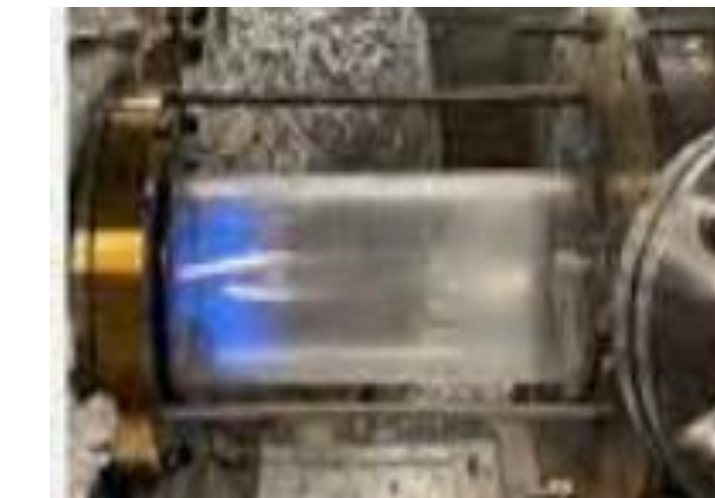
Combustion test rig design/development

Non-CO2 Technologies Roadmap
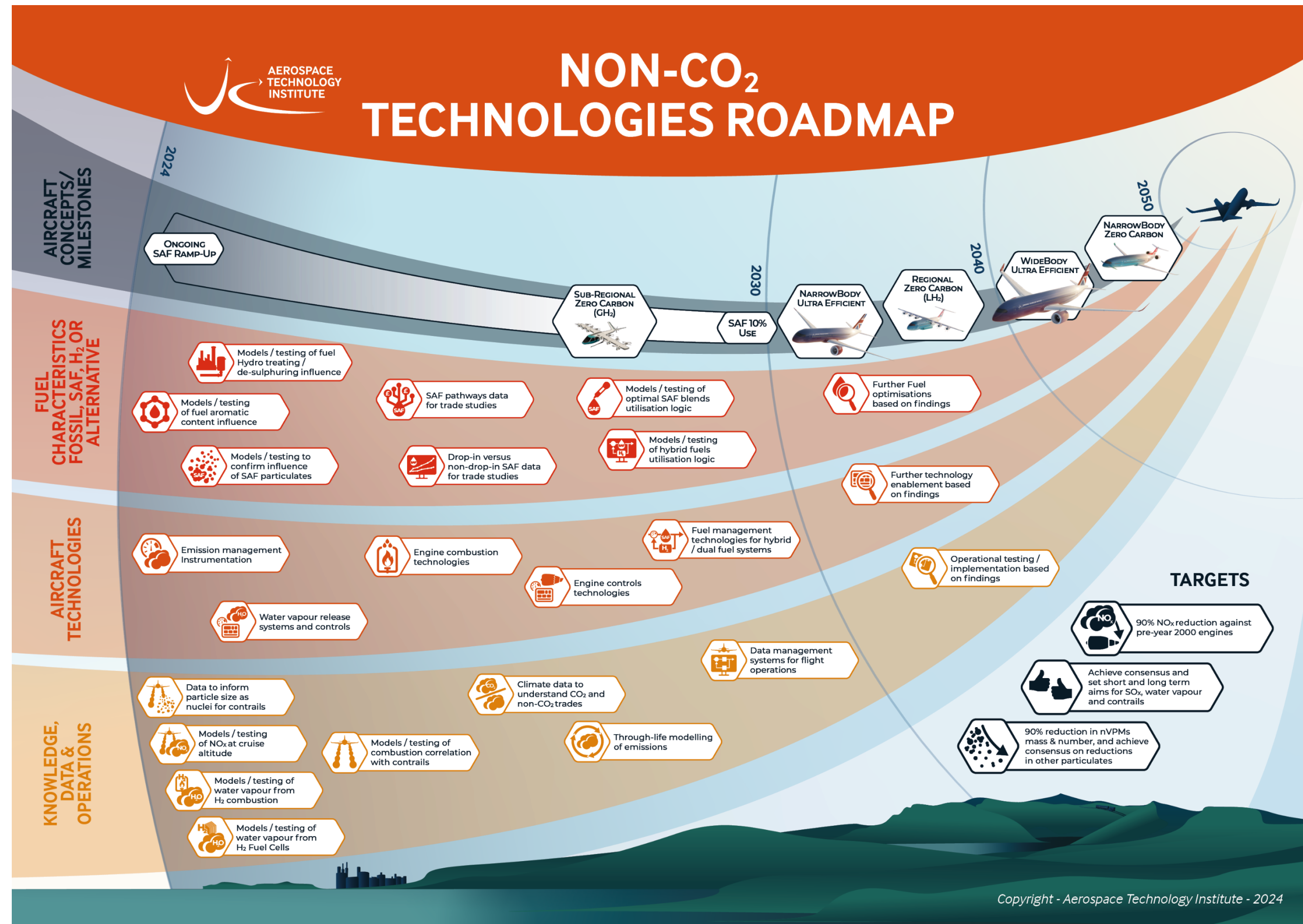
- The ATI's Non-CO$_2$ Technologies Roadmap aims to consolidate industry and academia views on non-CO$_2$

- Help supports evaluation of relevant technologies coming through the non-CO$_2$ technology programme

- Complimentary to guidance and work streams of other stakeholders including NERC, DfT and the JZC T&F DG

Summary

‣ Roadmap fully recognises importance of non-CO_2, current gaps in understanding and need to address changing technology/fuel mixes.

‣ Helps ensure UK work in applied technology and fundamental science is fully joined up.

‣ Includes all the recognised non-CO_2 atmospheric emissions arising from current and future mainstream fuel/technology combinations.

‣ Considers first and second-order effects in the atmosphere and aims to capture interaction of aircraft emissions with those from other sources.

‣ Based on wide consultation across UK aerospace industry and academia, with additional input from other aviation and non-aviation stakeholders.

‣ Considers work underway internationally to avoid gaps or excessive overlap, whilst playing to UK strengths.

‣ Follows Destination Zero format for other technology roadmaps recognising these are complementary.

‣ Should provide flexibility and resilience as our understanding of the subject develops.

ATI Non-CO$_2$ Programme

Romina Davoudi

Strategic Portfolio Manager

18 April 2024

Programme overview

Priority

- Reduce non-CO_2 emissions in line with aviation sector's target of Net Zero 2050

Focus

- Address challenges with reducing non-CO_2 emissions from the aerospace sector

Non-CO_2 Programme

Overview

- Linked to Jet Zero Non-CO_2 Fundamental Research Competition by NERC and DfT
- New roadmap complimenting Destination Zero roadmaps

Key Message

- Close collaboration and linkage between fundamental research and industrial projects to reduce non-CO_2 emissions in aviation

Competition process, dates and funding rules

Competition process

Stage 1- Outline Stage (OS)

ATI assessment only

- Competition opens three times a year
- Submission via ATI website
- Opportunity to submit draft OS application to ATI for feedback
- Submission of a PowerPoint presentation (no written application)
- Eligible applications will be invited to present their project to a Pitch Panel
- Successful projects must submit to one of the two upcoming Full Stage Application (FSA) batches and inform ATI of their intention to do so

Stage 2- Full Stage Application (FSA)

DBT, ATI, IUK Assessment

- Competition opens three times a year
- Submission by invitation only
- Successful projects at OS stage will be invited to submit on IFS
- Written application format, i.e. questions. Details will be published soon
- Opportunity to submit draft FSA to ATI for feedback

Competition process

Engagement with the ATI Hub

Outline Stage

01 Draft Outline Stage Application
Complete a draft application to receive feedback from the ATI.

02 Outline Stage Application Submission
Submit required information on your project and a PDF presentation.

03 Pitch Panel Presentation
If your application is in scope, you will be invited to present your project to a virtual assessment panel.

04 Outline Stage Notification
If successful, applicants will be invited to proceed to Full Stage Application.

If unsuccessful, the Outline Stage application can be resubmitted up to a further two times for the same project.

Full Stage Application

05 Draft Full Stage Application
Complete a draft Full Stage Application (FSA) for feedback from the ATI.

06 Full Stage Application
Submit Full Stage Application. A link will be provided by Innovate UK.

07 FSA Notification
Applicants receive notification of the funding decision.

08 Proceed to Contracting
Successful applicants proceed to Innovate UK's contracting stage.

If unsuccessful, the FSA can be resubmitted to one of the next two batches.

STEP 1 — STEP 2 — STEP 3 — STEP 4 — STEP 5 — STEP 6 — STEP 7 — STEP 8

All applicants (including project partners) must read and sign the ATI Framework Agreement.

ATI Framework Agreement →

Competition dates

Non-CO2 Programme

Outline Stage (OS) 2024

	May	November
Opening Date	Monday 13th May	Monday 4th November
Closing Date	Wednesday 29th May	Wednesday 20th November
Eligibility & Pitch Panel Notifications	Friday 31st May	Friday 22nd November
Pitch Panel Dates	Monday 10th June Tuesday 11th June Wednesday 12th June	Monday 2nd December Tuesday 3rd December Wednesday 4th December
Notifications	Tuesday 18th June	Tuesday 10th December

No funding will be awarded at this stage

Full Stage Application (FSA) 2024

	Batch 01 (Aligns with Strategic Programme Batch 44)
Opening Date	Monday 2nd September
Closing Date	Wednesday 9th October
Notifications	Tuesday 17th December

* Closing time for all competitions is 11 am on the day of the deadline. Dates and times are subject to change.

Programme Investment Board will make funding decisions

Non-CO2 Programme - Aerospace Technology Institute (ati.org.uk)

Funding and competition rules (identical to Strategic Programme)

Eligibility

- Eligible projects must align with the Non-CO_2 Technologies Roadmap
- Some projects may span across one or more of the existing roadmaps
- Individual or consortium applications are accepted
- Primary application in civil aerospace

Project Team

- Business of any size
- Academic institution
- Charity
- Not for profit
- Public sector organisation
- Research and technology organisation (RTO)

Grant and Project Duration

- Grants up to £18m
- Project duration ~ 3 years

Lead Organisation

- Be a UK registered business of any size for research projects
- Be a UK registered business of any size, a research and technology organisation (RTO), research organisation or academic institution for capital infrastructure projects
- Carry out the research or capital infrastructure project work in the UK
- Exploit the results from or in the UK
- Projects will be subject to 2.5% industrial contribution to ATI

Projects We Will NOT Fund

- Solely defence, space. We will recognise dual use
- Fundamental research, feasibility study, experimental development

Funding Rules (total eligible project costs)

- 60/40 funding ratio
- 70% for small or micro-organisation
- 60% for medium-sized organisations
- 50% for large organiations
- 30% research organisations

Budget

- Planning assumption of grants totaling up to £17m over the next 4 years (starting in 2024)
- This is not a limit or target and will depend on the number and the quality of applications received for all competition streams funded through the ATI Programme

Pitch panel presentations

Virtual pitch panel format

Welcome and introductions	All	5 mins
Project presentation	All	25 mins
Questions and answers	All	15 mins
Panel feedback and assessment	Panel only	15 mins

- Presentations will be assessed by ATI assessors during the Pitch Panel.

- Maximum of three representatives from the project are permitted to attend. Name of the attendees from the project must be communicated to ATI at least three working days prior to the date of the Panel.

- The project lead must attend the Panel and lead the presentation.

- Maximum of ten slides (including cover slide) can be submitted by projects. If more than ten slides are submitted, they will not form part of the assessment.

- The presentation duration is strictly 25 minutes and additional time will not be allocated.

- Applicants must not bring any additional materials to the interview to share with the Panel.

Outline Stage Presentation Guidance

Technology and Innovation

Project alignment to Non-CO$_2$ Technologies Roadmap
How does the project help to deliver the Non-CO$_2$ Technologies Roadmap? How does the project compare to the current technologies available? What are the non-CO$_2$ emissions benefits?

Technology ambition
The extent to which the proposed project can demonstrate innovation, outputs from the project, what challenges it addresses and what key technology and knowledge base is being developed.

Exploitation and Market

Business and market opportunity
Does the project deliver benefit to the UK? Who are the customers for the project output? What is the current market size? What is the route to the market and how it will be implemented?

Exploitation and route to market
Have end-users for the technology been identified or engaged? What is the timeline for exploitation of the technology or knowledge base?

Thank you for listening

Further information is available on the ATI website

ati.org.uk/funding/non-co2programme/

Contact: competitions@ati.org.uk