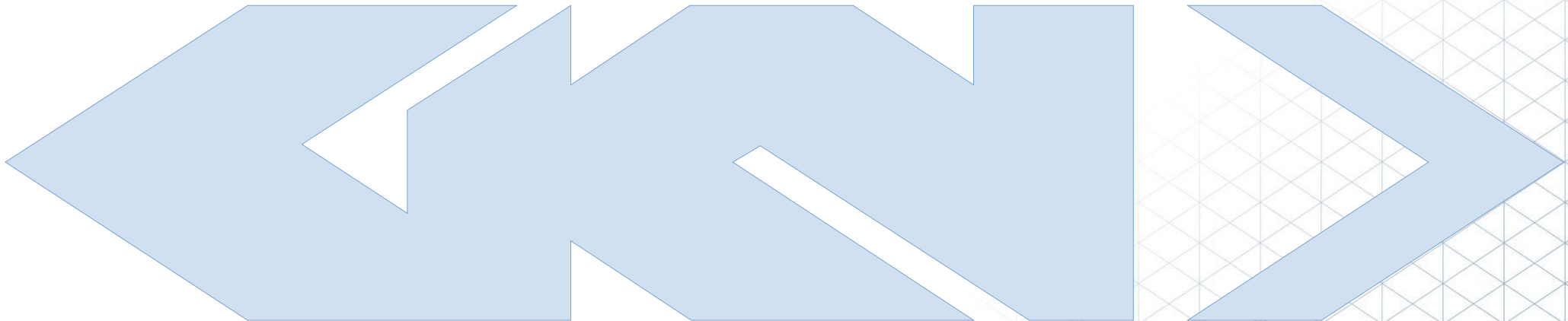


Aerospace Cluster Sweden

Sustainable aviation

Karl-David Pettersson, 2020-12-10



Export Control

This document contains technical data not subject to
Council Regulation (EC) No 428/2009 and its amendments.

Export Classification: Not Subject to Regulations (NSR)



GKN Aerospace Engine



Agenda

- **Company – Where and What**
- **Market and “The challenge”**
- **How do we do it, and how can you contribute?**
- **Where to play**
- **Collaboration makes the difference**
- **Can Sweden contribute to the big picture**

GKN Aerospace: A leading global tier 1 Aerospace supplier

Strong focused businesses, sales £3.85 billion (2019)

Civil Airframe
47%



Engines
32%

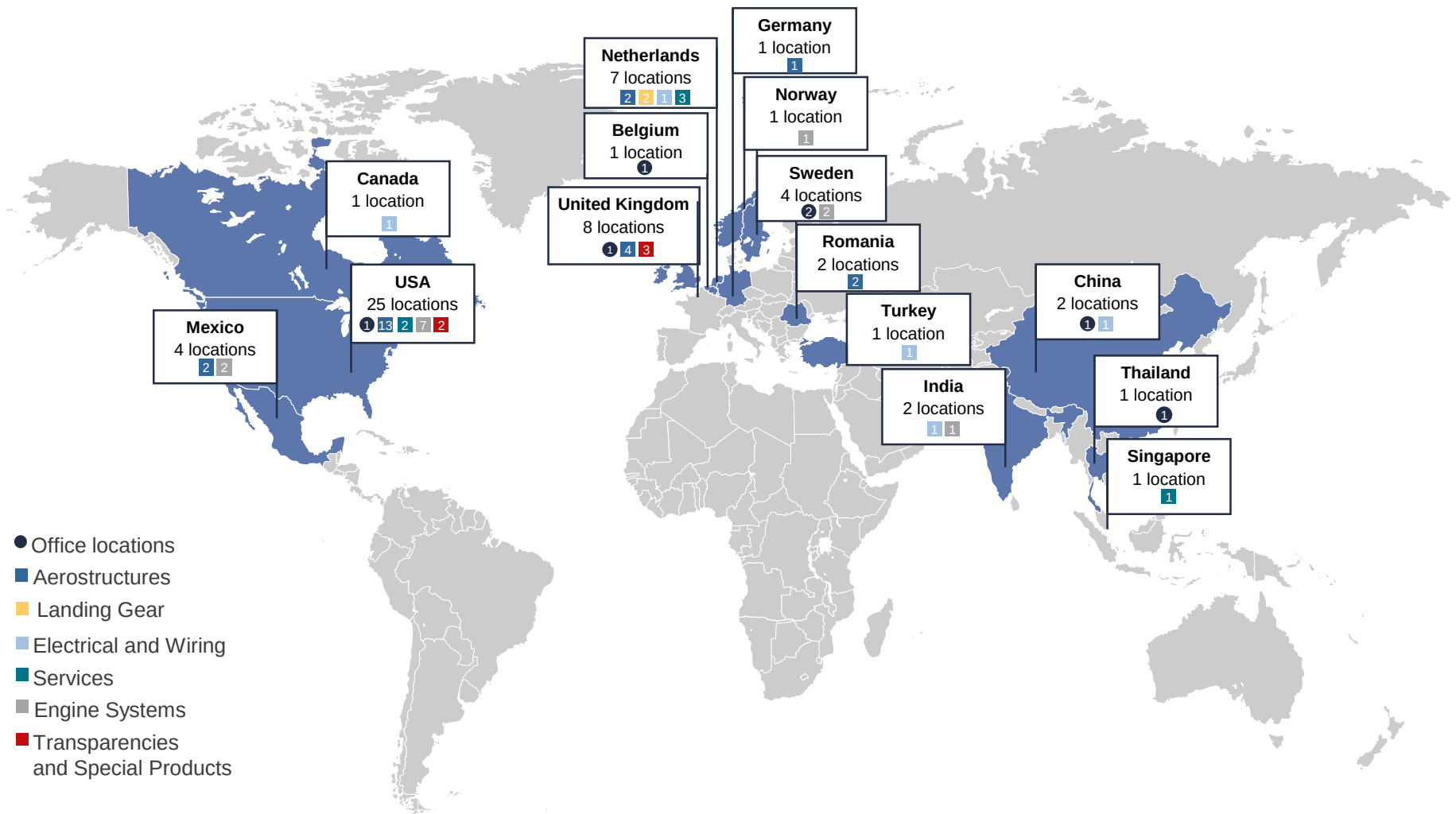


Defence
21%



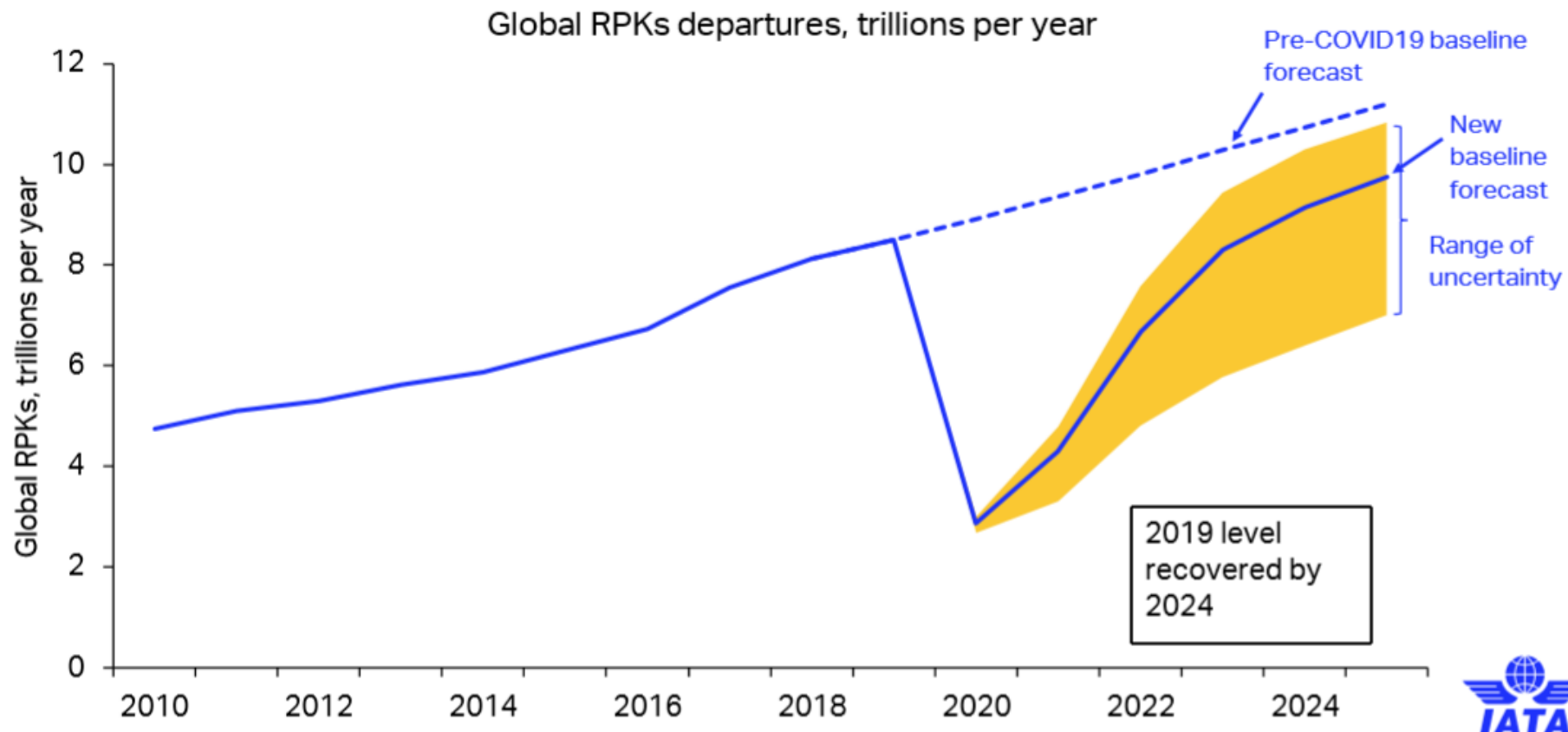


The leading global Tier 1 aerospace supplier



Återhämtningen kommer att ta tid

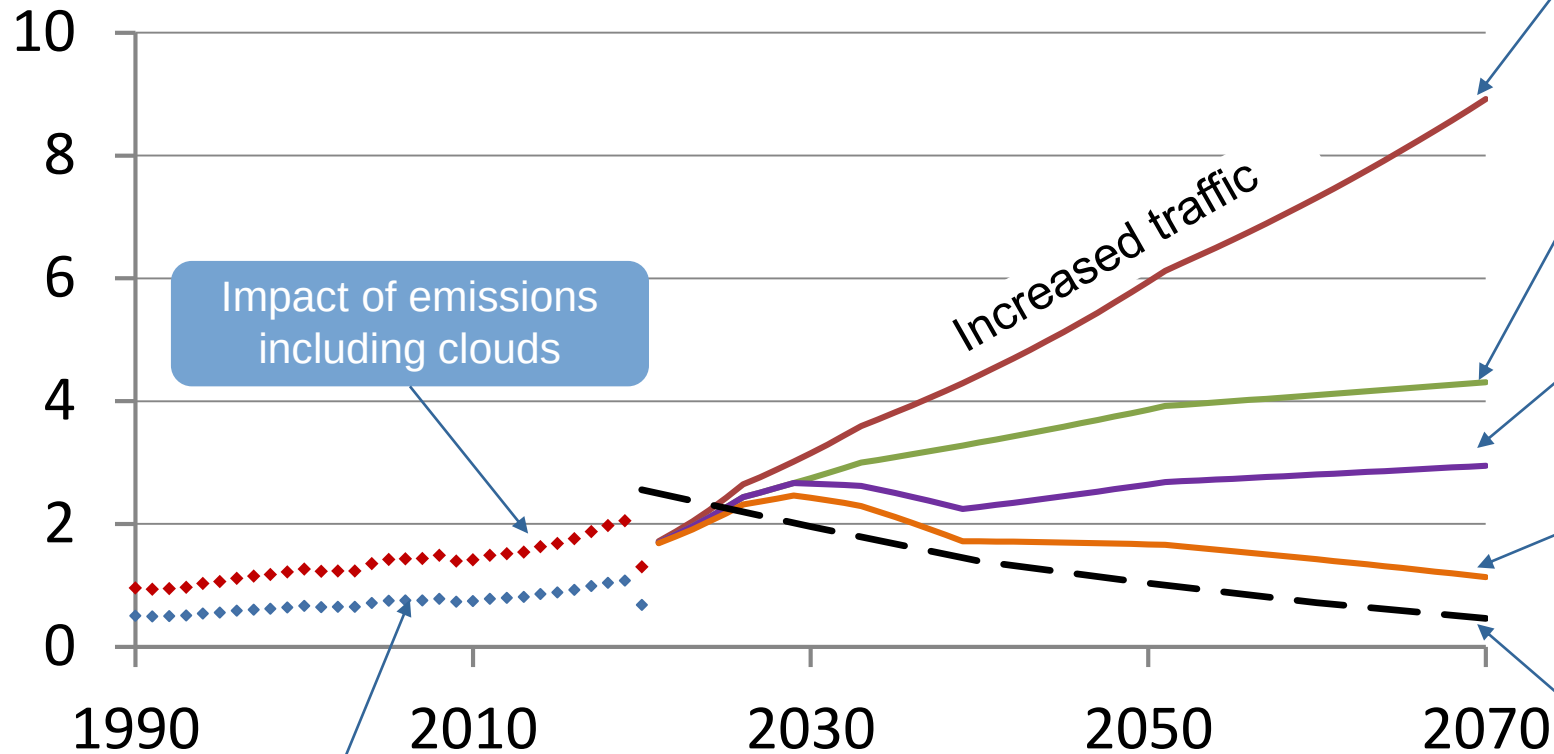
Vaccine news positive but recovery will still take time Issues with vaccine implementation and the impact of economic damage



Source: IATA/Tourism Economics 'Air Passenger Forecasts' October 2020

Sustainability challenge to commercial aviation

Billion tonnes carbon dioxide equivalent
(GWP₁₀₀)



Flying with current
fleet mix

More efficient
aircraft, engines,
usage

Reduced cloud
Adaptive altitude

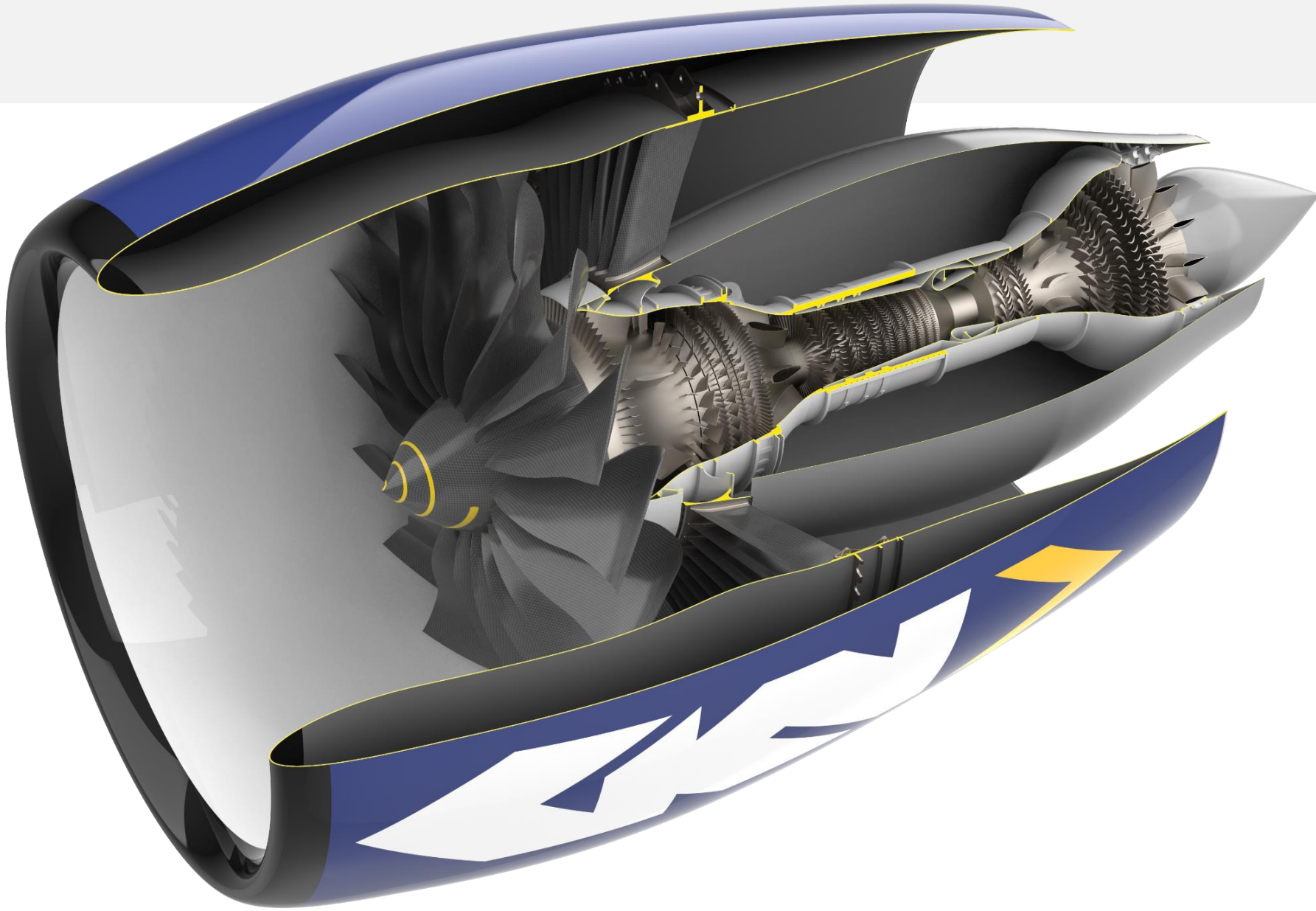
Hydrogen &
synthetic fuels

Aspirational goal
aviation <5% of the
Paris accord target
(RCP 2.6)

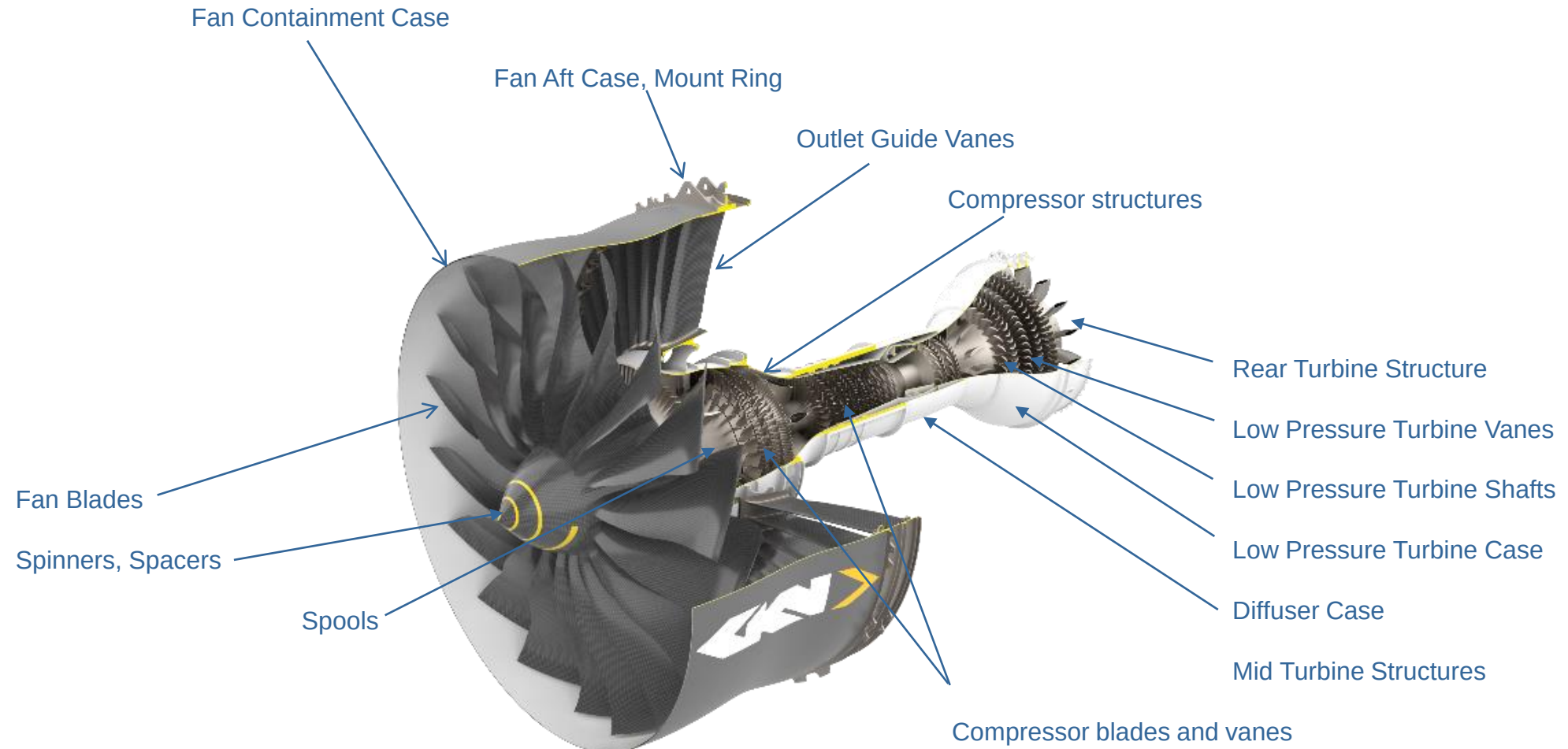
Emitted CO2

Impact of emissions
including clouds

Increased traffic

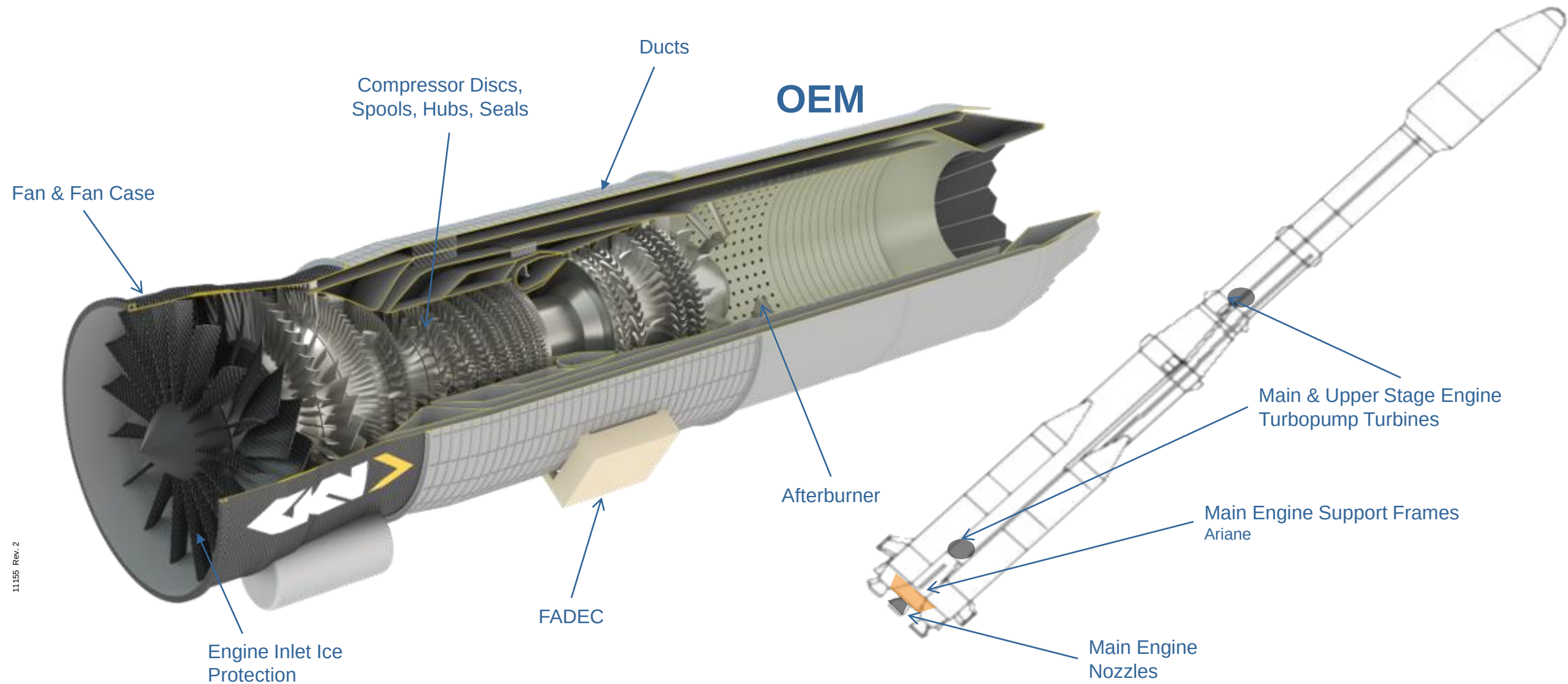


Major Aerospace Engine Products - Commercial Turbofans

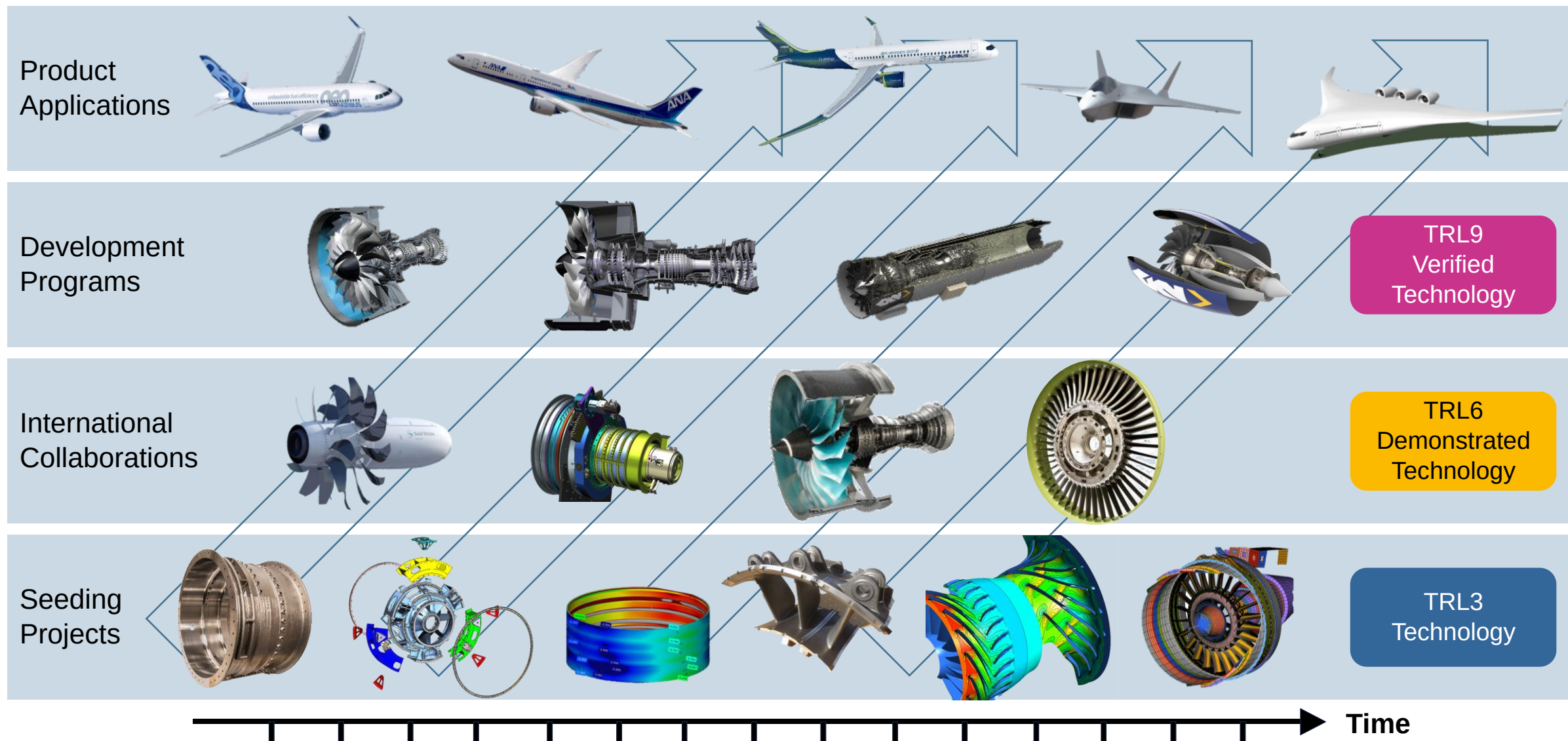




Major Aerospace Engine Products - Military Turbofans and Space



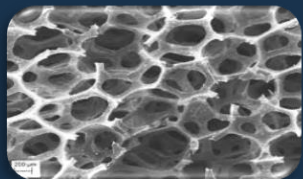
The inclined wave principle





The Widest Range of Technologies

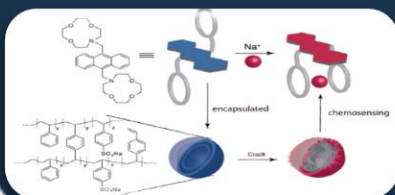
Chemistry & Materials



Erosion Coatings



Anti-Ice Coatings

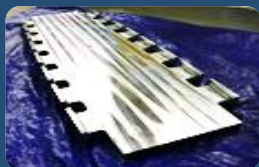


Damage Detection Coatings



High temperature Materials

Processes



Near Nett Joining



Additive Manufacturing



Forming & Welding

Major Components



Co-Cured Wing Covers



Cutting edge canopies



Composite Automation



Automated Polishing

Major assemblies



Composite Fuselages



Trailing Edge Assemblies



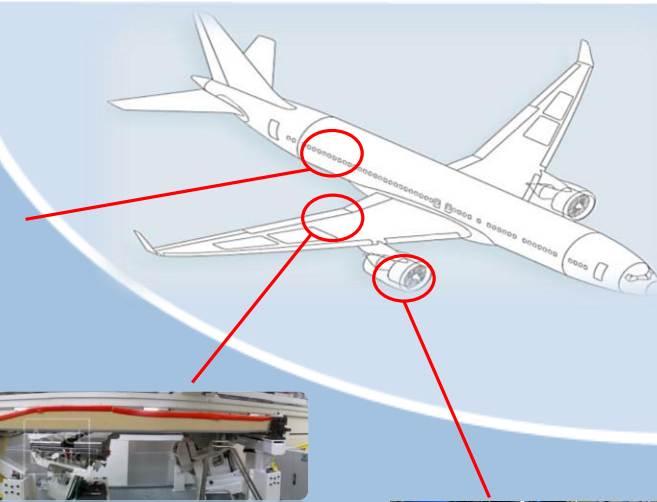
Composite Fan Cases



Laser Welded Structures



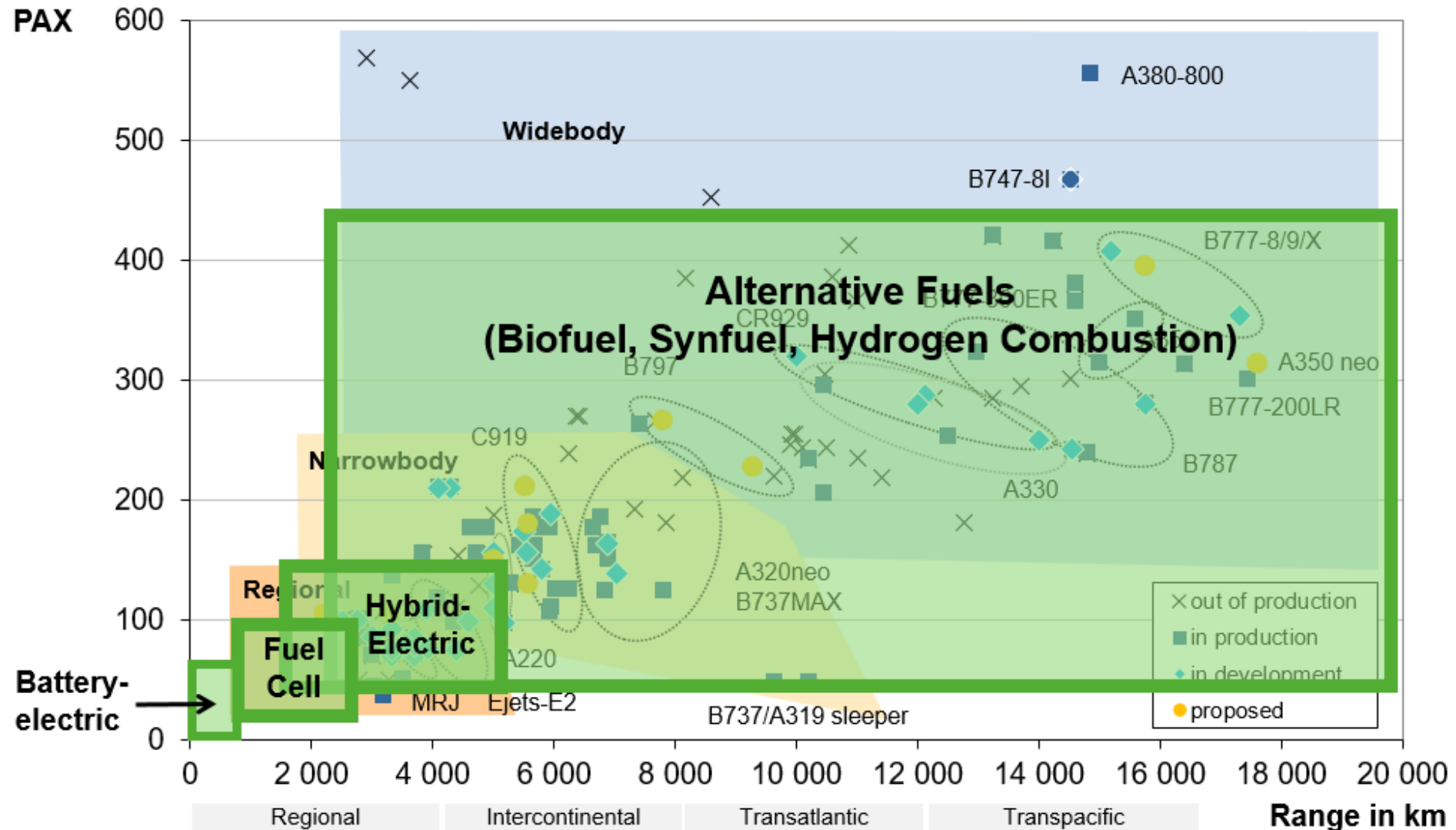
Space Propulsion Structures



Engine certification

GKN Aerospace combining technologies to offer unique products

Contribute to the sustainability of aviation



Clean Sky 2 major engine demonstrators

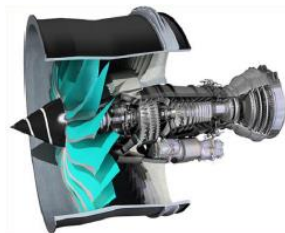


Ultra-high Bypass & High Propulsive Geared Fans



VHBR Turbofan Middle of the Market

Very High Bypass Ratio (VHBR)
Large Turbofan demonstrator for long range introducing advanced low weight structures



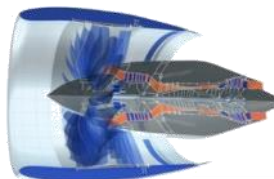
UHPE Demonstrator

(Ultra High Propulsive Efficiency)
Short/Medium range passenger aircraft developing advanced turbine structures and ICD solutions

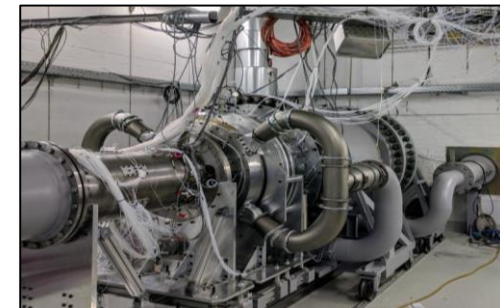


Advanced Geared Engine Configuration

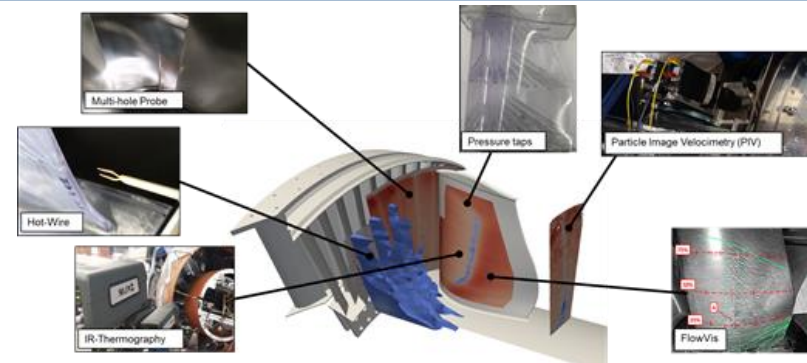
LPC and IMC technology demonstration for future regional GTF applications



Full scale testing



Validation of methods



Advanced manufacturing



Meeting the challenges

Vision: develop and enable the introduction of safe, reliable, efficient and affordable climate-neutral air transport

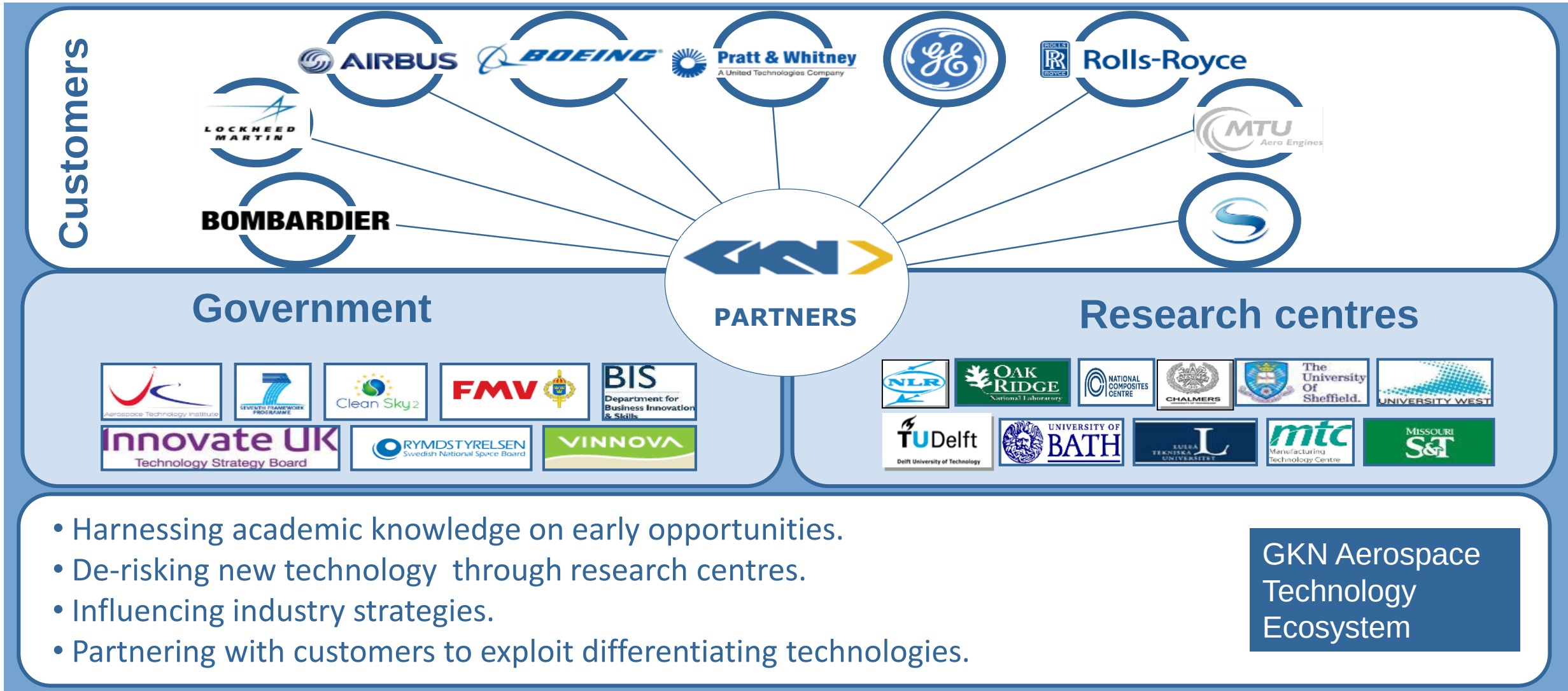
The Clean Aviation trajectory defines two clear horizons towards climate neutrality by 2050:

- 2035: low-emissions aircraft exploiting the research results of Clean Aviation
- 2050: climate-neutral aviation

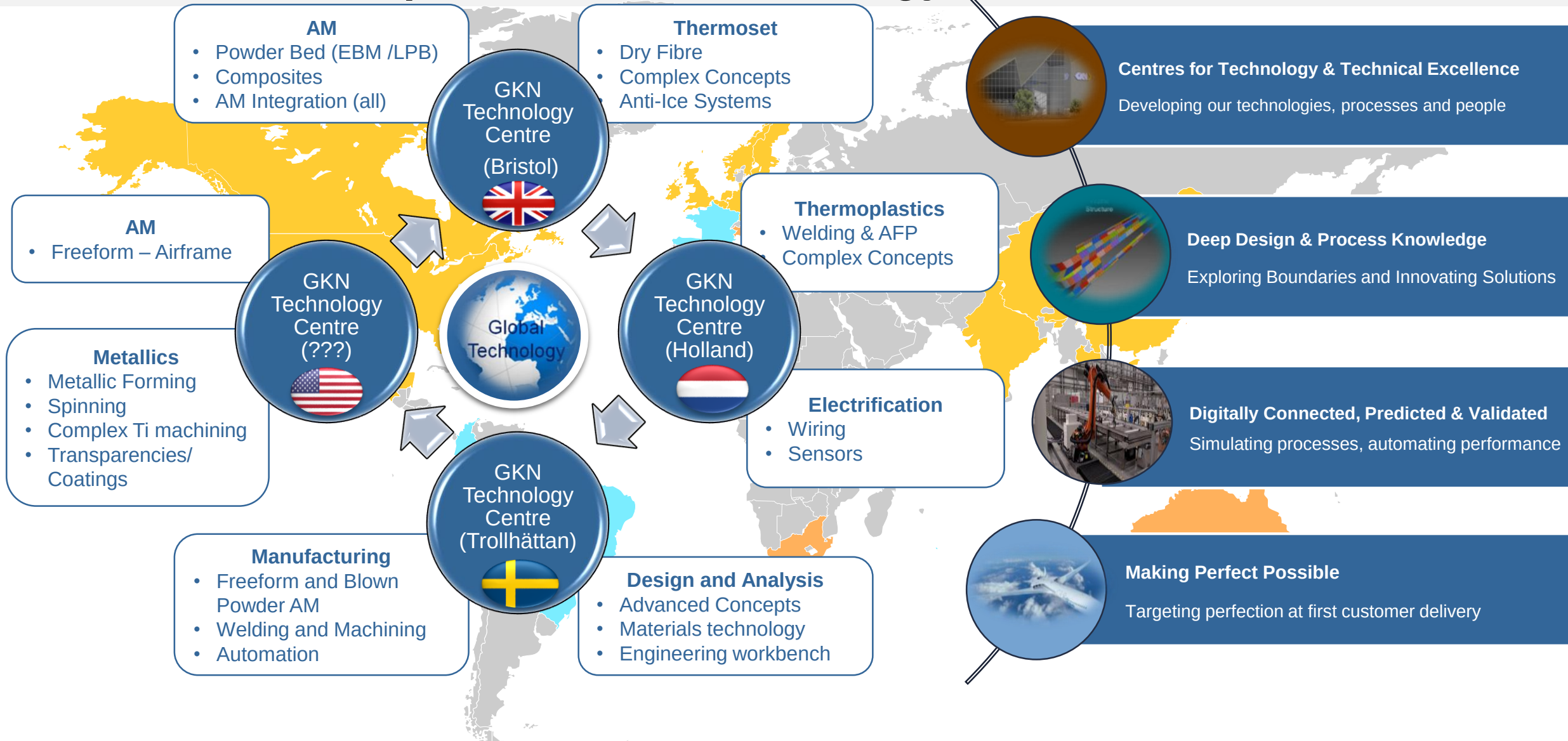




Partnering to Deliver Customer Value



GKN Aerospace Global Technology Centres



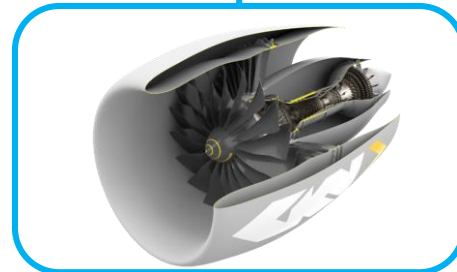
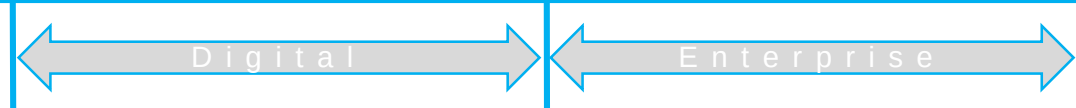
GTC and Eco System

> GTC Sweden

- 13 years of GKN operation at dedicated site
- GKN ~100 employees
- **Product design**
 - Advanced propulsion concepts
- **Material**
 - New material and new applications
- **Manufacturing**
 - New manufacturing processes and automation
 - Demo production

> Collaborative workspace

- >60 PhD projects ongoing
- SME's and Institutes



Airbus presenterar konceptflygplan (september 2020)



- Flytande H2
- Kryotankar
- Gasturbinmotorer

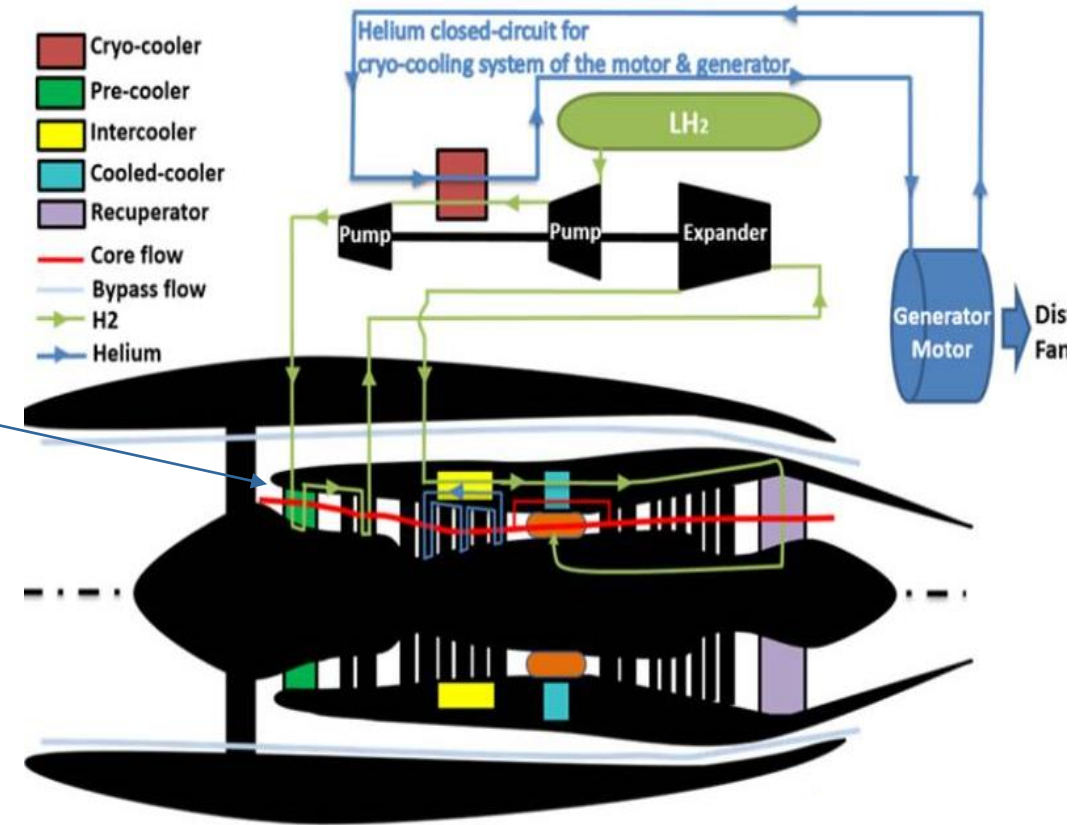
Teknologibidrag från Sverige?

Teknologier GKN Trollhättan/Chalmers/Lund

- > Systemanalys, motor/flygplan
- > Funktionella motorstrukturer
- > Integrerade värmeväxlare för system-optimering och uppvärmning av bränslet
- > Låg-NOx-förbränning av H₂
- > Väteförsprödning av metaller (rymderfarenhet)

Dessutom

- > Fordonsindustrin
- > Ståindustrin
- > Regioner



Från EU-projektet ENABLEH2 där GKN och Chalmers deltar

Är framtidens noll-CO₂-flyg vätgasflyg?

- > Frankrike satsar
- > Tyskland satsar
- > EU satsar
 - > Clean Aviation 6 B€ (hälften från industrin)
- > Sverige?



DN Debatt

DN Debatt. "Vätgas är flygets framtid – nu måste Sverige satsa"



PUBLICERAD 2020-10-24



Det europeiska flygföretaget Airbus har utvecklat konceptet Zeroe för vätgasdrivna flygplan. Den här modellen är tänkt att drivas av två motorer. Vätgastankarna finns



Tank you for your attention



Source: Rolls Royce