

The graphic features a green and blue background with a stylized globe on the left and a smaller globe on the right. An airplane is shown flying over the globe on the left, with yellow wavy arrows indicating emissions. Another airplane is shown flying over the globe on the right. The sun is visible in the top left corner. The text is centered in white.

# ICAO Symposium on Non-CO<sub>2</sub> Aviation Emissions

16 — 18 September 2024  
Montréal, Canada

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## David Ostdiek

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GE Aerospace

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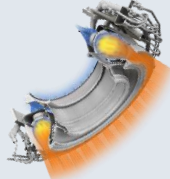



Speaker

Session 3: Mitigating Non-CO<sub>2</sub> Aviation Emissions –  
What is possible  
Part I – Innovative Technologies

# GE Aerospace legacy of innovation

A history of reducing emissions for CO<sub>2</sub> ...

... and non-CO<sub>2</sub>

 <p>Up to <b>15% better fuel efficiency</b> from the twin aisle CF6-80C2 to GEnx™ engine</p>		 <p><b>GEnx:</b> 1<sup>st</sup> generation TAPS combustor</p>
 <p><b>15% better fuel efficiency</b> from the single aisle CFM56-7B to LEAP engine*</p>		 <p><b>LEAP:</b> 2<sup>nd</sup> generation TAPS combustor</p>
 <p>Up to <b>10% better fuel efficiency</b> from the large twin aisle GE90-115B to GE9X™ engine</p>		 <p><b>GE9X:</b> 3<sup>rd</sup> generation TAPS combustor</p>

**NO<sub>x</sub> and nvPM reductions through lean burn Twin Annular Pre-Mixing Swirler (TAPS) combustion technology**

\*LEAP engines are products of CFM International, a 50-50 joint company between GE and Safran Aircraft Engines.

# CFM RISE program: a more sustainable future of flight for customers

## Technology pillars



### Open Fan

Enables maximum fuel efficiency gain ... targeting >20% better fuel efficiency vs. today's engines



### Compact core

Compressor, combustor, and high-pressure turbine technologies to improve thermal efficiency and emissions



### Hybrid electric

Integrating propulsion and power systems for flight, including battery and fuel cell sources



### Alternative fuels

100% sustainable aviation fuel (SAF) compatibility, advancing hydrogen combustion

## Technology developments across pillars

Today

2030s



### >250 baseline and part-level tests completed

First tests of Open Fan blade ingestion, high-pressure turbine blades and nozzles, >200 hours of wind tunnel and acoustic testing<sup>a)</sup>

### Ongoing baseline, part-level, and module-level tests

Moving from part-level to module and rig tests

### Engine and system-level ground tests

Includes Open Fan, hybrid electric, and compact core technologies

### Flight tests

Announced plans to test Open Fan integration with Airbus

(a – Completed by CFM)

# Actively collaborating on non-CO2 research across industry

## Fundamentals



- Exploring the impact of fuel chemistry on contrail formation in a sub-scale altitude combustion chamber at the NASA Glenn Research Center Particulate Aerosol Laboratory

## Flight tests



- LEAP engines powered Boeing ecoDemonstrator Explorer and Airbus VOLCAN studies of how Sustainable Aviation Fuel (SAF) impacts emissions, including contrails

## Fleet Operations



- EPIC-Trails: Engine-informed Prediction of aviation Induced Cirrus trails ... ARPA-E and U.S. DOE project
- Develop, demonstrate engine-informed real-time prediction system for long-lived Aviation-Induced-Cirrus clouds

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# Thank You

