16 November 2022

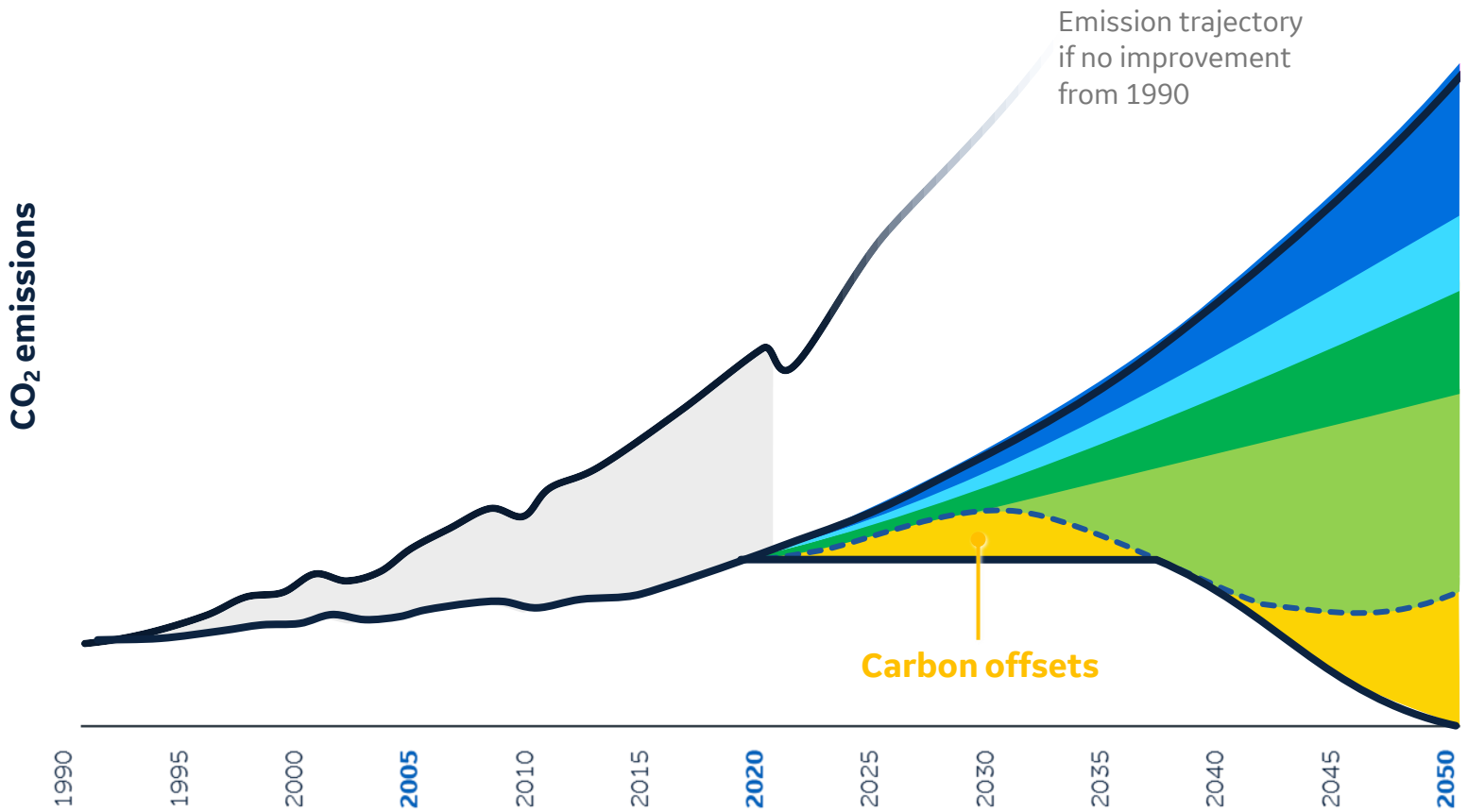
GE Aerospace

FAA CLEEN III Consortium

Industry Day

Industry goals to decarbonize through 2050

Decarbonization will drive faster technology adoption



CO_2 trajectory if no improvement from today

Technology improvements

Traffic management & infrastructure

Alternative fuels (blended)

100% Alternative fuels

CO_2 goal: Net zero

SOURCE: IATA, ATAG, GE Marketing Analysis. Reference: Beginner's Guide to Sustainable Aviation Fuel page 8

GE Aerospace: Building a world that works for the future of flight

Landmark Technologies

Developing and maturing technology solutions to reduce aircraft and engine emissions with ambition to be net zero by 2050

Industry Collaboration

Partnering globally to shape and guide industry dialogue and actions

Operational Commitment

Accelerating efforts to achieve carbon neutrality in our facilities by 2030

RISE Program Overview

RISE PROGRAM

REVOLUTIONARY INNOVATION FOR SUSTAINABLE ENGINES

TARGETING MORE THAN **20%** LOWER CO_2 EMISSIONS

Advancing **open fan** architectures

Advanced materials

100% SAF, hydrogen capability

Step change in **propulsive efficiency**

Hybrid-electric

Build on **proven technologies**

Technology Maturation | Ground & flight tests | EIS by the mid-2030s

Airbus and CFM International launch open fan flight demonstrator

Through CFM's RISE program:

- Collaboration to flight test CFM's open fan engine architecture with A380 testbed
- Evaluate open fan propulsive efficiency and performance
- Assess aircraft engine integration and aerodynamics
- Understand hybrid electric capabilities
- Assess internal and external noise sources

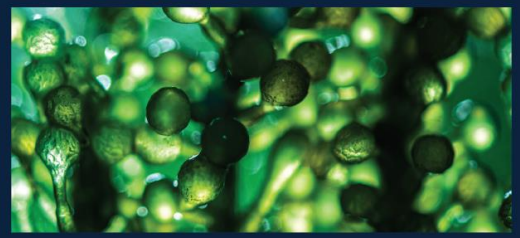
RISE is a registered trademark of CFM International, a 50-50 joint company between GE and Safran Aircraft Engines

GE has been actively involved in assessing and qualifying Sustainable Aviation Fuel (SAF) since 2007

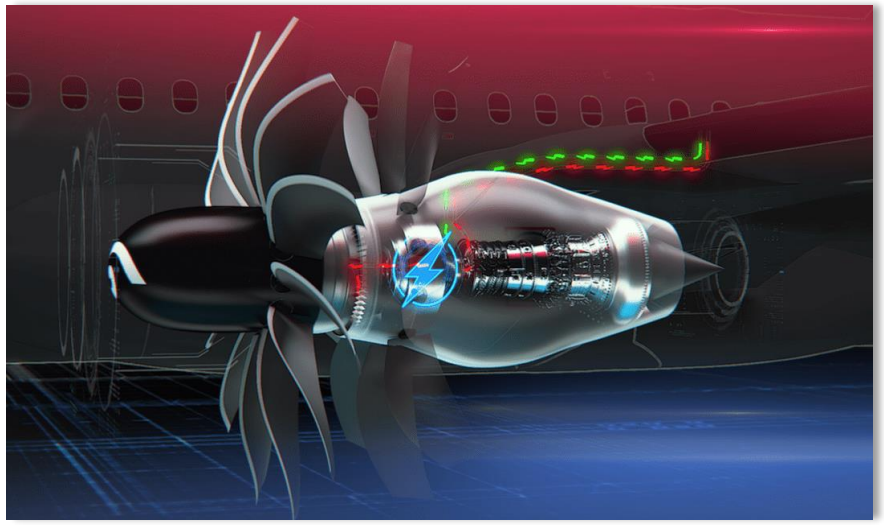
Evaluating and qualifying SAF pathways

Supporting airline customer SAF test and demonstration flights

Leading industry developments of 100% SAF standards



CFM RISE Technologies



Anticipated Benefits

- Noise: 13 EPNdB cum margin relative to Stage 5
- Combined Fuel Burn: 20+% reduction relative to current CFM LEAP* engine
- Targeting NOx reduction for a future high overall pressure ratio engine cycle, equivalent to 70% margin to the CAEP/8 standard at 30 OPR

Objectives

- **Open Fan**: develop unducted single fan architecture
- **Low emissions combustor**: develop low NOx and nvPM combustor and enable compact, high OPR core to achieve 20% fuel burn
- Develop **Advanced Thermal Management System** and waste heat recovery system
- **Hybrid Electric Generator**: develop integrated electric-power generation system within the engine

High Level Schedule

	2021	2022	2023	2024
Design				
Fabrication, Procurement, Assembly				
Technology Demonstration				

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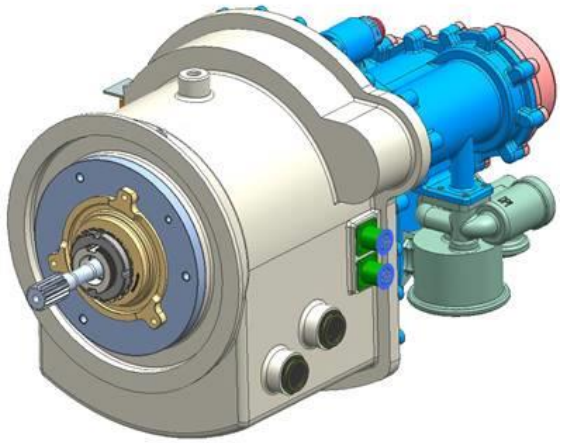


Anticipated Benefits

- More Efficient +/- 270Vdc generator with high power density and increased fuel savings
- New cooling method for increased thermal performance
- Self contained oil system

Risk/Mitigation Plans:

- Risk : Oil Pump performance fails to meet requirements
  Mitigation : Lab test with dummy generator

Objectives

Mature a +/- 270Vdc electric generator development as part of an integrated more-electric primary power system

Work Statement

- Design and develop a 90 kW, +/- 270Vdc generator to address requirements of mid-size aircraft, business jets.
- Improved power generation system design with increased power density at lower cost.

High Level Schedule

	2021	2022	2023
Design			
Fabrication, Procurement, Assembly			
Technology Demonstration			

Sustainable Aviation Fuel

Anticipated Benefits

- Advance the approval of a practical candidate SAF with perceived benefits over nominal drop-in SAF
- Accelerate the standardization and therefore the introduction of 100% SAF

Objectives

- Support qualification of candidate SAF – test/demo
- Advance standardization of 100% SAF

Work Statement

- Evaluate 100% & 50% (if needed) of CPK-0 SAF for combustor (FAR*) operability/emissions
- Help develop ASTM standard for 100% SAF

High Level Schedule

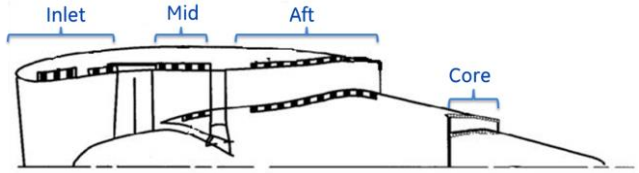
	2021	2022	2023	2024
Fuel Testing				
Development of Fuel Specification for 100% SAF				

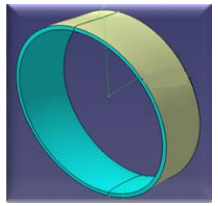
* Delayed due to fuel availability

*Full Annular Combustor Rig

CLEEN III Advanced Acoustics

Novel Liners





Fan Source Strength Reduction

Anticipated Benefits

- Novel Liners:
  2 EPNdB cumulative noise reduction relative to conventional liner w/ neutral performance impact

- Fan Source Strength Reduction:
  1 EPNdB cumulative noise reduction w/ performance neutral impact

Objectives

- Develop Novel Acoustic Liners.
- Develop Fan Source Strength Reduction Concepts

Work Statement

- Execute subscale acoustic test
- Down-select most promising technology
- Complete design of full-scale down-selected technology
- Manufacture full-scale hardware suitable for testing

High Level Schedule

	2021	2022	2023	2024	2025
Rig Scale Technology Demonstration*					
Full-Scale Design					
Full-Scale Fabrication, Procurement, Assembly					

* Delayed due to facility availability


GE Aerospace
Thank You!