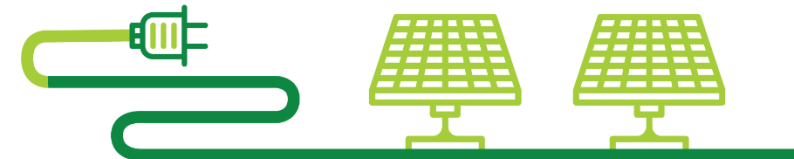


AVIATION CO₂ REDUCTIONS



STOCKTAKING SEMINAR
TECHNOLOGY · OPERATIONS · SUSTAINABLE AVIATION FUELS



Advanced Aircraft Technologies

Greg Steinmetz,

Consulting Engineer – Advanced Systems &
Preliminary/New Engine Design – GE
Aviation





GE Aviation: Completing a significant commercial portfolio refresh

Single-Aisle Aircraft



15%
DECREASE

*in fuel burn from the single aisle, CFM56-7B to LEAP engine**



Small Twin-Aisle Aircraft



Up to:

15%
DECREASE

in fuel burn from the small twin aisle, CF6-80C2 to GENx™ engine



Large Twin-Aisle Aircraft



10%
DECREASE

in fuel burn from the large twin aisle, GE90-115B to GE9X™ engine



**+ All SAF
Compatible**

Fuel burn reductions consistent with historical steps



GE Aviation: 20% fuel burn efficiency technology engine demonstrator

Entitlement propulsive efficiency

1988

2009-12

2012-15

2016

2017-18

2017

Advancing open rotor for >15% fuel burn improvement while solving noise

Next generation thermal efficiency

Additive for novel designs

CMCs

1/3 WEIGHT

2x STRENGTH

50% LESS COOLING

Low emissions combustion

GENx TAPS I

LEAP TAPS II

GE9x TAPS III

Next gen thermal management

Evolving existing technologies and adding new, to raise operating pressures and temperatures in hi-tech core

New systems - hybrid

2013

Hybrid laboratory

2016

F110 dual-spool demo

2017

Electric motor/generator

2019

Altitude testing NASA NEAT

Advancing high power hybrid and controls for technology engine demo



You must prove it in flight!



GE9X on GE Aviation flying test bed



Entitlement Propulsive Efficiency + Improved Thermal Efficiency + Advanced Systems Demonstrator

Technology

GE Aviation: Elements of bypass ratio maximization with open rotor, higher thermal efficiency via materials + thermal management + components, new advanced systems such as hybrid-electric



Entitlement propulsive efficiency

1988: Boeing 747-400

2009-12: GE90 engine

2012-15: LEAP engine

2016: GE9X engine

2017-18: LEAP engine

2017: SAFRAN AFD2000

Advancing open rotor for >15% fuel burn improvement while solving noise

Next generation thermal efficiency

Additive for novel designs

CMCs: 1/3 WEIGHT, 2x STRENGTH, 50% LESS COOLING

Low emissions combustion: GENx TAPS I, LEAP TAPS II, GE9x TAPS III

Next gen thermal management

Evolving existing technologies and adding new, to raise operating pressures and temperatures in hi-tech core

New systems - hybrid

2013: Hybrid laboratory

2016: F110 dual-spool demo

2017: Electric motor/generator

2019: Altitude testing NASA NEAT

Advancing high power hybrid and controls for technology engine demo

- CO₂ reductions per flight** **~20%**
- Level of finance required** **TBD**
- Timeframe** **Market Driven**
- Main challenges** **Engine-aircraft integration**



Thank You



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Montréal

European and
North Atlantic
(EUR/NAT) Office
Paris

Asia and Pacific
(APAC) Sub-office
Beijing

Middle East
(MID) Office
Cairo

Western and
Central African
(WACAF) Office
Dakar

North American
Central American
and Caribbean
(NACC) Office
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