Current and Future Aircraft Technologies

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ICAQ HQ, Montréal, Canada  9 – 10 SEPTEMBER 2014
Our challenges

CO₂ Emissions = 3.16 X Fuel (Combustion Only)

Baseline Including Fleet Renewal
Contribution of Technology Improvements
Contribution of Improved ATM and Infrastructure Use

Range of 2020 CO₂

Extrapolation beyond 2040

CO₂ Gap

Minimum

1,039 Mt

GHG

Noise

NOx

S1: (Sensitivity case) maintain current operational efficiency and no new aircraft technology
S2: AC: Low, Oil: Moderate
S3: AC: Moderate, Oil: Moderate
S4: AC: Advanced, Oil: Moderate

Scenario
AC: Aircraft technology
Oil: Operational Improvement

S1: (Sensitivity case) maintain current operational efficiency and no new aircraft technology
S3: AC: Moderate, Oil: Moderate
S4: AC: Advanced, Oil: Moderate

Scenario
AC: Aircraft technology
Oil: Operational Improvement

Total Global Population Exposed to Aircraft Noise Above 55 DNL

Total Global Aircraft NOx below 3,000 feet AGL

Source: ICAO Environmental Report 2013 - Environmental Trends in Aviation to 2050

Fuelling Aviation with Green Technology, ICAO HQ, Montreal, Canada, 9 and 10 September 2014
Industry Targets

Carbon Neutral Growth (CNG) Means:

- Capping Net Emissions at 2020 Levels
- Using a combination of the “four pillars”
  - Technology (inc. biofuels)
  - Operational Efficiencies
  - Infrastructure Improvements
  - Economic Measures
Embraer is committed to minimize the environmental impacts of our products during the complete life cycle.

DIPAS brings environmental requirements to product requirements through all the supply chain (contract enforced) and is built with environmentally-friendly, REACH*-compliant materials.

*REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals
New generation aircraft and future design concepts

A generational step led by new technology, not just a re-engine

- New Higher Aspect Ratio Wing
- New High By-Pass Ratio Engines
- 4th Generation Full Fly-by-Wire
- Improved Avionics
- Improved Systems Reliability and DMC
- New Interior
- e-Enabled
New generation aircraft and future design concepts

Fuel burn and weight savings:

- Horizontal stabilizer of a Closed Loop Fly-by-Wire aircraft: reduced in size, resulting in lower weights and drags

1.5% reduction in Fuel Burn
More composite materials

E-Jets E2 Composite Rudder

LEGACY 500 Composite Empennage
New generation aircraft and future design concepts

- **Noise**: stage 4 minus 15 dB margin to future regulations
- **CO₂**: Double digit reduction, ~3,600 tonnes per aircraft/year
- **NOₓ**: CAEP/8 minus 35%
- **Fuel Burn**: Double digit improvement
New generation aircraft and future design concepts

**E190-E2 Fuel Burn Efficiency: 16%**

- **Full Fly By Wire:** 1.5%
- **Wing and Aerodynamics Improvements:** 3.5%
- **Engine:** 11%
New generation aircraft and future design concepts

- Opportunity for additional 2-3% reduction in aircraft cash operating cost via lower noise fees, direct flight tracks and curfew extensions

- 65% Reduction in Noise Contour
Future green aviation technologies

Green and efficient propulsion
• Ultra high bypass ration engines
• More electric aircraft

Aerodynamic improvements
• Laminar flow control
• New aircraft configurations
Future green aviation technologies

**Lightweight aerostructures**
- Long, thin and precise surfaces
- 2nd generation composites
- Advanced manufacturing

**Aircraft Health Management**
- Accelerated diagnosis
- Systems Prognostics
- Structural health monitoring
Future green aviation technologies

Advanced ATM
• Reduced vertical distance
• Highly efficient pathways
• Communication aircraft-aircraft

Fleet Management System
• Advanced decision making system
• Spare parts management
Future green aviation technologies: Biofuels

- Engine: CF34-8E fueled with biofuel
- Biomass: Cameline (50% “drop-in” blend)
- Prototype flight: Aug-Sep, 2011

- Engine: CF34-10E fueled with biofuel
- Biomass: Sugarcane (50% “potential drop in” blend). Not ethanol, but biokerosene
- Demo flight: Jun 2012 (in “Rio +20 UN Conference”)
Future green aviation technologies: Biofuels

- EC FP7 collaborative project, aimed to produce sustainable renewable aviation fuel and to test its use in existing logistic systems and in normal flight operations in Europe;
- Nov/2012 to Out/2015;
- KLM Cityhopper’s E190 revenue flights forecasted for 2015 using HEFA biojet fuel.
SAFUG associates represent approximately 32% of commercial aviation fuel demand.

“Jet fuel plant sources should be developed in a manner which is non-competitive with food and where biodiversity impacts are minimized; in addition, the cultivation of those plant sources should not jeopardize drinking water supplies.”
Thank you!