Dr. Lourdes Maurice
Chief Scientific and Technical Advisor for Environment
Federal Aviation Administration

Environmental Team Lead, Commercial Aviation Alternative Fuels Initiative (CAAFI)

Presented to: ICAO Colloquium on Aviation and Climate Change
May 14, 2010
**The Challenge:**

- *Enable increased mobility while reducing environmental impacts in absolute terms*

**The Solution - U.S. five-pillar approach**

- Mature New Aircraft Technology
- Accelerate Operational Changes
- **Develop Alternative Fuels**
- Examine Policies and Market Based Measures
- Advance Scientific Understanding, Improve Environmental Analysis Capability

**Our Plans**

- Aggressive efficiency improvements of at least 2% per year
- Carbon neutral growth by 2020, absolute reductions by 2050
- Aircraft and engine CO$_2$ and other emissions standards
Can alternative fuels provide aviation with a sustainable source of energy to power both the fleet of today and that of tomorrow?
WHY AVIATION ALTERNATIVE FUELS?

- Aviation assured market for hydrocarbon liquid fuels
- Environmental need
- Concentrated airport distribution
- Aviation systems engineering/risk management experience
- Single ICAO regulatory environmental framework to ensure Global standards
- Committed industry and government investments to test and qualify viable alternative fuels candidates
- Strong leadership from the industry
WHAT HAVE WE ACHIEVED RECENTLY?

• Developed advanced biofuels that are safe for aviation and could be grown in a sustainable manner
• Approval of a new synthetic jet fuel specification (ASTM D7566) —
  • Fisher-Tropsch alternatives now approved
  • hydroprocessed renewable jet (HRJ) expected soon
• Multiple flights on these fuels

Commercial Aviation Alternative Fuels Initiative (CAAFI)
• Coalition of airlines, aircraft and engine manufacturers, energy producers, researchers, international participant, and U.S. government agencies
• Leading development and deployment of alternative jet fuels for commercial aviation
Structure addresses challenges to adoption

- Environmental Team: GHG Life Cycle Analyses, Emissions Quantification
- R&D Team: Multiple “Drop-in” Solutions
- Certification-Qualification Team: ASTM D7566
- Business & Economics Team: Facilitating Deployment, Investment
WHAT ARE WE DOING NOW?

- Researchers measuring “well-to-wake” lifecycle GHG emissions
- Purchasing of fuels from camelina and algae for more extensive testing
- Properties testing for early R&D fuels
- Considerable capital devoted to developing new biofuels
- Airline fuel purchasing agreements for renewable diesel, and alternative jet fuels
LIFE CYCLE ANALYSES
RESOLUTION LEVELS

Level 3
Screening

Conducted in support of a preliminary assessment of a technology alternative, to inform policy makers about research funding.

Level 2
Standard

All major operations examined, but with a lower degree of completeness and data quality than comprehensive LCA.

Level 1
Comprehensive

Conducted to meet regulation.

Increasing data quality, effort, and confidence in analysis results
Life cycle analyses also includes air quality benefits (1).

Differences in emissions greatest at idle, less at higher engine powers.

Number emissions 98% lower at idle, 40% at takeoff power.

Emission reduction:

LIFE CYCLE ANALYSES ALSO INCLUDES AIR QUALITY BENEFITS (2)

- Mass emissions 90% lower when burning FT fuel
- Number emissions ~70% lower when burning FT fuel

** FT2 = Sasol (coal)

Recent Air Quality Results: APU Emissions
• Establishes standardized specifications for control of aviation fuel properties and composition.
• Industry uses specifications for quality control of aviation fuel as it travels through the distribution system.
• Civil Airworthiness Authorities (CAAs) use fuel specifications to ensure the safety of aircraft operations.
TARGETED QUALIFICATION TIMING

- **100% HRJ Fuel Approved**: Approved 2013
- **HRJ 50% Blend in D7566**: 2011
- **HRJ Research Rpt**: 2009
- **100% FT Fuel Approved**: Approved 2012
- **D7566 Issued Sept 1**
CURRENT ALTERNATIVE JET FUEL PROCESSING

Petroleum

Fischer-Tropsch (FT)
- Coal
- Natural Gas
- Biomass

Syn Gas (CO, H₂)
Gasify
FT Process

Conventional Refinery Processes

Hydroprocessed Renewable Jet (HRJ) from Bio-Oils
- Plant/Algae Oils
- Oil Extraction

Hydroprocessing
Crude Oil
Syn-Crude
Bio-Crude
Jet Fuel
WHAT IS COMING NEXT?

- Sustainable biofuels avoid competition for food and fresh water
- Advanced bio-based jet fuels from camelina, jatropha pave the way
- Bio-based synthetic fuels with coal and carbon capture and sequestration could reduce GHG emissions and be cost-competitive
- Salicornia to synthetic fuel could be grown in the desert with sea water
- Sugars/cellulose to synthetic fuels via advanced fermentation
- Algae holds tremendous potential

Technology exists to create alternative jet fuels compatible with today’s aircraft; Fuel feedstocks being evaluated to determine their environmental sustainability.
ALTERNATIVE FUELS GLOBAL POTENTIAL

For starter in Latin America via Inter-American Development Bank

- USA: camelina
- Caribbean: jatropha
- Brazil: Macauba, babassu, sugarcane
- Mexico: salicornia, jatropha
- Ecuador: Target +10 projects globally
A NEW SUSTAINABLE FUEL
DYNAMIC

...EMERGING, GROWING