Quest for Bio-fuels in the Aviation Industry

Bob Sturtz
Managing Director Strategic Sourcing – Fuel
United Airlines
Vice-Chairman - ATA Energy Council
Aviation is a Ready Made Market for Bio-Fuels.

- Highly concentrated demand nodes
- Highly concentrated users
- Aviation has no alternative source of energy
- Economic benefits
- No changes needed for airplanes/airports/pipelines
- Environmental benefits
Concentrated Demand – 85% of Fuel at 35 Largest Airports

35 Largest U.S. Airports by CY 2008 Jet Fuel Requirements (Million Gallons)
Jet Fuel Distribution Infrastructure Already in Place
Approximately 90% of Jet Fuel Uplifted at U.S. Airports Moves Via Pipeline
Aviation Taking Action on CO₂

- United worldwide – global sectoral approach
- Sustainable bio-fuels a key part of the solution
Airline Criteria for Alternative Fuels

- Reliable (Must meet ASTM Fuel Specifications)
- “Drop-In” Fuel
- Cost Competitive
- Environmentally better than conventional jet on an LCA basis
Technical Viability Proven

- Numerous flight tests Feb. 2008 through present
  - Extensive laboratory and ground tests
- Results met or exceeded expectations
- Excellent fuel properties
  - Lower freeze point
  - Higher thermal stability
- Jet fuel specification approvals (by ASTM)
  - Fisher-Tropsch ("F-T") approved 2009
  - Approval of hydrotreated renewable jet ("HRJ") anticipated by 2011
  - Additional technologies/processes underway
  - 100% bio solutions (no blending) in development
- Sustainability criteria evolving

Commercial Off-Take Agreements Key to Progress
Started with Ground Fuel (Diesel)

Eight U.S. airlines* signed 5-year contract with Rentech and ASIG

- Contract with Rentech and ASIG
- Feedstock will be urban woody waste
- Operational by end of 2012
- Diesel for use in LAX ground equipment
- Small volume
- Price was competitive with market

Opportunity to test industry approach
- Less complex than a jet fuel deal

* Alaska, American, Continental, Delta, Southwest, United, UPS, US Airways
Commercial Off-Take Agreements Key to Progress Proceeding to Aviation Jet Fuel

14 airlines* from 4 countries signed multi-year MOU with AltAir Fuels

- Pursuing multi-year agreement with AltAir to purchase jet fuel and diesel
- Feedstock will be camelina or other non-food crops (e.g., algae, jatropha)
- Crop oils will be refined at a facility located on the West Coast
- Estimated to be operational by 2013
- Up to 75 million gallons per year
- Viability depends on multi-year biofuel tax credits and value of RFS2 RINs

Utilized industry approach

- Much more complexity

* Air Canada, Alaska, American, Atlas, Delta, FedEx, Hawaiian, JetBlue, Lufthansa, Mexicana, Polar, United, UPS, US Airways
Commercial Off-take Agreements

Key to Progress

• United Airlines signed MOU with GEVO for future supply of biofuels to Chicago – July 2010
  – Multi year agreement
  – Feedstock corn/cellulose
  – Fermentation process produces isobutyronol in conventional ethanol plants
  – Isobutynol becomes feedstock for conventional refinery.

• Discussion ongoing with; AltAir, Amyris, BioPure Fuels, Byogy, GEVO, Jet E, NextStep, Rentch, Sapphire, Sasol, Solazyme, Solena and others...
Partnerships & Progress

• Airlines/Airports/Manufacturers/FAA Co-founded CAAFI in 2006
  – Universities, think-tanks, government labs and agencies, energy start-ups, major oil companies, bankers
  – Three task teams; Business Development/Commercial, R&D and Environmental.
Partnerships

• Farm-To-Fly Program
  – Coalition of Airlines, Boeing and USDA
  – Determines regulations and policy changes necessary to future development of bio-energy feedstocks.

• Commercial/Military Strategic Alliance
  – ATA/DLA-Energy create a unified effort to pursue bio-fuels opportunities
  – Steering Committee with 3 working groups
Progress

• ASTM approval of Fischer-Tropsch fuels
  • Sept 2009
• United flew first commercial flight using domestically produced synthetic jet fuel
  • April 2010
• HRJ fuels expected to be approved by ASTM by 1st Quarter of 2011
• Development of Regional working groups to identify and pursue regional solutions
• Sustainable Aviation Fuels Northwest
• U.S. Pacific Command Green Initiative - Hawaii
Key Challenges
Key Challenges

• Price Stability and Affordability
  – Getting facilities built and financed
  – Competitive with conventional fuel
  – Multi-year financial incentives critical

• Certification of New Processes
  – HRJ not yet approved (est. 1Q 2011)
  – Additional pathway
    • Hydrolysis/Fermentation (FRJ)
    • Lignocellulosic bio conversion
    • Pyrolysis/liquefaction
Key Challenges

• Feedstock Readiness
• Crediting of Environmental Benefits
• Compatibility of International & Domestic Acceptance Criteria
  – Lack of consistent environmental criteria could hamper deployment