

# CAAFI Progress Update



31Jul'13

**An Aviation Industry Coalition Established to Facilitate and Promote the Introduction of Alternative Aviation Fuel**

**Goal is development of non-petroleum jet fuel production with:**

- \* **Equivalent safety & performance (drop-in)**
- \* **Comparable cost**
- \* **Environmental improvement**
- \* **Security of energy supply for aviation**

**Synthetic kerosene,  
primarily from  
renewable sources**

**Enables its diverse stakeholders to build relationships, share and collect data, identify resources, and direct research, development and deployment of alternative jet fuels**

# CAAFI Sponsors

From across the industry



**Airlines for America™**  
We Connect the World

# How CAAFI works

Bringing interested parties together\*

15 Aircraft,  
Engine, Subsystem  
OEM's



20 Airlines,  
Military,  
Airport orgs.



15 U.S. States /  
State Univ's



19 Countries /  
5 Continents



CAAFI®



Airlines for America™  
We Connect the World

30 U.S.  
Government  
Offices

54 fuel  
producers

**300 Global Sponsor/Stakeholder Attendees**  
**180 Different Organizations, 32 EXPO Participants**



# CAAFI Work Teams

Building the foundation to enable commercialization

## Research & Development

*Enabling  
Multiple “Drop-in”  
Solutions*

## Certification / Qualification

*Fostering  
ASTM D7566  
Approval*

## Environmental

*GHG LCA, PM2.5  
Quantification,  
Sustainability*

## Business

*Facilitating  
Deployment,  
Investment*

# Aviation RJF Overview

- \* **Industry making progress on all fronts:**
  - \* **R&D:** Public/Private work and progress continues, DOE intent to engage with additional cost reduction efforts, FAA CoE pending, academia, ...
  - \* **Demonstration:** multiple DOE projects, DPA, private efforts ...
  - \* **Cert/Qual:** 2 paths approved, 4 more in-process (research reports drafted), 3 more in development, others to follow
  - \* **Environment:** working to harmonize GHG methodologies, and evaluating methodologies for broader sustainability guidance
  - \* **Business:** recent announcement of commercial agreement (UAL and AltAir), others in works, published engagement guidelines, ...
- \* **Key issues remaining for US goal achievement:**
  - \* **Feedstock supply-chain development – led to F2F2 discussions**
  - \* **Bridging valley-of-death on investment & deployment**



... “THEREFORE, AS OUR GOAL, we the undersigned, jointly signify our intent to continue working together over the next five years in an expanded collaboration entitled “Farm to Fly 2.0”, to enable commercially viable, sustainable bio-Jet Fuel supply chains in the U.S. that are able to support the goal of one billion gallons of bio-Jet Fuel production capacity and use for the Aviation Enterprise by 2018

## FARM to FLY 2.0 – Work

WHEREAS, the previous FARM to FLY program of 2010 public-private focus on the development of sustainable bio *Agriculture and Aviation: Partners in Prosperity*, Parts I and for progress, and; the USDA and the Aviation Enterprise act potential to increase domestic energy security and improve s both USDA’s goals to support rural economic development a regionalized biomass supply chains for the production of sust

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WE AGREE, to consider and pursue actions that can be taken wi identify those that may require rulemaking or statutory changes, c reauthorization considerations. This resolution constitutes a stron intentions; it shall not, however, constitute a legally binding agree

WE COMMIT to designating personnel for a “FARM to FLY 2.0” following:

- (1) Work together, and with other public and private partners, to ass mutual Goal. Efforts will include the following types of activities:
  - a. A systematic evaluation of current and prospective feedstock p gaps and needs using the previously developed feedstock read resources.
  - b. A systematic development of public/private teams at the state an coordinate regional efforts to reach the Goal.
- (2) Work with associated teams, through USDA’s range of applicable R Enablement, and Policy Support programs, as well as all other availa multiple feedstock supply chains that demonstrate promise. Efforts w intended supply chain development that include the following: feedsto and transportation infrastructure; grower acceptance, education, and ex and sustainable production.
- (3) To communicate results and make recommendations for needed strategi regional pilot programs, implementation enhancement, and fast-track ap issue periodic progress reports and a final report by year-end 2018.

# F2F2 Commitments

... and work has commenced

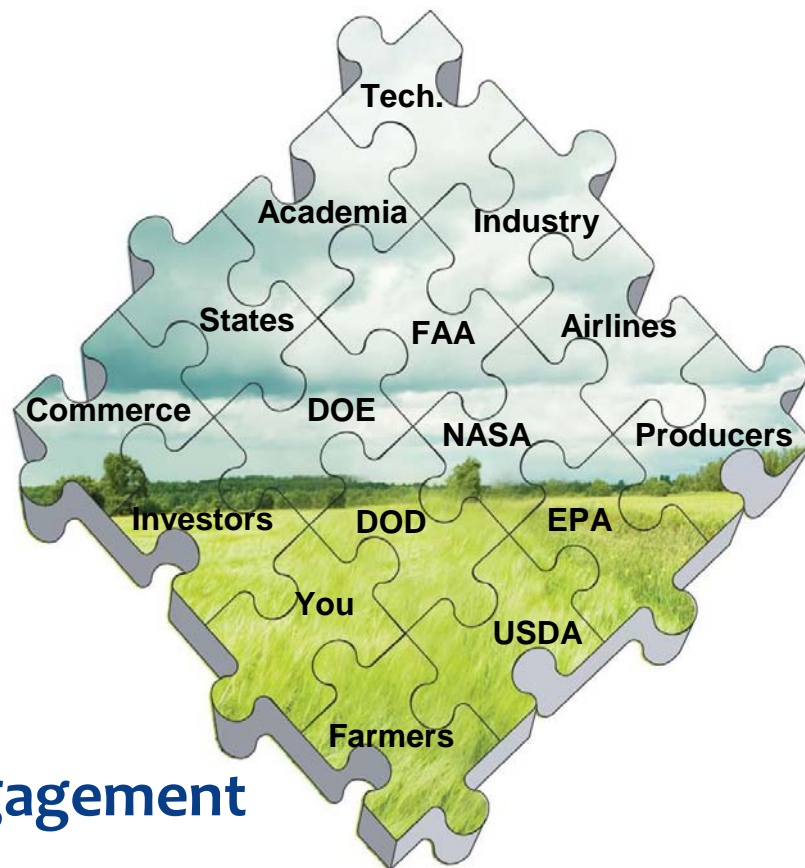
- 1) Define/execute multi-year programs aimed at enabling the agri-related elements of an integrated national strategy**
  - a) Forecasts, road-mapping, gaps, needs, projects
  - b) Define and engage local agents for execution
- 2) Address requirements needed for sustainable scale-up of promising feedstocks, addressing risk and risk abatement in key areas**
  - a) Feedstock and Infrastructure development
  - b) Grower Acceptance/Approval – Education – Adaptability - Risk
  - c) Accessibility Risk: Sustainability: Feedstock / Conversion Overall Acceptability:
- 3) Serve as a vehicle for enhanced communication and coordination**



# Progress Update

CAAFI facilitation leading to engagements ...

- \* Pathway Development
- \* Price Point
- \* Sustainability
- \* Political Alignment
- \* Airport Engagement
- \* Feedstock Development
- \* Analysis / Tools
- \* Int'l, Regional, State, Local Engagement
- \* Initiatives



# State Initiative Progress

Activities in 20 states – advancing to all 50+

- \* **VT: Successful RBEG award**

- \* New England Fuels Institute Branch, Vermont Fuels, and NEFI
- \* Heterotrophic algae production of jet and fuel oil using waste streams from beer breweries & dairies

- \* **CT: Successful RBEG award**

- \* CCAT, CAAFI, MSW handler and 2 fuel companies – central region development
- \* Potential for MSW & wood waste-to-liquid facility to support fuel needs at BDL

- \* **NC: Significant state development at BCNC**

- \* Next steps include potential communication summit and RFI

- \* **OH: OAI/OBIC/OFBF applied for USDA Foundational Grant**

- \* To establish an OBBWG (Ohio Biofuels and Bioproducts Working Group)

- \* **KY, CO, FL, CA, ... communicating interest in advancing**

# MASBI

## Midwest Aviation Sustainable Biofuels Initiative

- \* Year-long study of potential commercialization elements and options, “...to accelerate the commercialization of advanced biofuels in the Midwest”, with a 3+B usg annual Jet-Fuel demand
  - \* Targeting demand solutions for ORD, MDW, DTW, MSP
  - \* Led by UAL, Boeing, Honeywell/UOP, Chicago Dept. of Aviation, and Clean Energy Trust, with participation of 40 other organizations
- \* Study concluded with summit in Chicago on 27Jun
- \* Key findings and 14 recommended actions in 5 areas
  - \* R&D
  - \* Production
  - \* Financing
  - \* Policy
  - \* Sustainability



# Doing business with airlines

- \* Addresses CAAFI recognition, and one of the MASBI recommendations – communicate engagement guidelines
- \* On 17 Jun, CAAFI released “ Guidance for Selling Alternative Fuels to Airlines”
  - \* [http://www.caafi.org/files/CAAFI\\_Business\\_Team\\_Guidance\\_Paper\\_060413.pdf](http://www.caafi.org/files/CAAFI_Business_Team_Guidance_Paper_060413.pdf)
- \* Ties with other CAAFI guidance <http://www.caafi.org/information/fuelreadinesstools.html>
  - \* Path to Fuel Readiness (RJF-101)
  - \* Fuel Readiness Level Tool (or FRL)
  - \* FRL Exit Criteria
  - \* Feedstock Readiness Level Tool (FSRL)
  - \* Environmental Progression & Sustainability Overview guidance
- \* Intent is to augment with appendices of actual D.P.A. lessons-learned

# Airlines moving forward

## e.g. UAL D.P.A. with AltAir Fuels – 2014 Production

- \* “...cost-competitive, commercial-scale, sustainable aviation biofuel”
- \* 5M usg/yr targeted for LAX
- \* AltAir to produce HEFA-SPK Jet Fuel from plant and animal triglycerides at 30M usg/yr renewables refinery
- \* UOP instrumental in working for “bolt-on” refinery solution
- \* Numerous opportunities for replication

**United Airlines and AltAir Fuels to Bring Commercial-Scale, Cost-Competitive Biofuels to Aviation Industry**

United executes definitive purchase agreement for 15 million gallons of cost-competitive, commercial-scale, sustainable aviation biofuel to be used on flights departing LAX in 2014

AltAir Fuels' renewable jet fuel expected to achieve at least a 50 percent reduction in greenhouse gas emissions on a lifecycle basis

CHICAGO, June 4, 2013 /PRNewswire/ -- United Airlines today executed a definitive purchase agreement with AltAir Fuels for cost-competitive, sustainable, advanced biofuels at commercial scale, representing a historic milestone for aviation. With United's strategic partnership, AltAir Fuels will retrofit part of an existing petroleum refinery to become a 30 million gallon, advanced biofuel refinery near Los Angeles, Calif. AltAir will produce low-carbon, renewable jet fuel and other renewable products. United has collaborated with AltAir Fuels since 2009 and has agreed to buy 15 million gallons of lower-carbon, renewable jet fuel over a three-year period, with the option to purchase more. The airline is purchasing the advanced biofuel at a price competitive with traditional, petroleum-based jet fuel, and AltAir expects to begin delivering five million gallons of renewable jet fuel per year to United starting in 2014. United will use the biofuel on flights operating out of its Los Angeles hub (LAX).

"This is a great day for United and the aviation biofuels industry. This agreement underscores United's efforts to be a leader in alternative fuels as well as our efforts to lead commercial aviation as an environmentally responsible company," said United's Managing Director for Global Environmental Affairs and Sustainability Jimmy Samartzis. "We're excited about what this strategic partnership with AltAir means for United, the industry, the environment, and for our customers."

"United Airlines has been a strategic partner for several years as we work to establish our biofuel facility," said AltAir's Chief Executive Officer Tom Todaro. "We cannot overestimate how important this milestone is for the commercialization of sustainable aviation biofuels, and we at AltAir are proud that United is our first customer."

**Using the Locally Developed Fuel at United's LAX Hub**

AltAir has partnered with an existing oil refiner for the operation of its first commercial facility and use of the refiner's existing refinery near Los Angeles, Calif. This partnership is taking idled refining equipment and retrofitting it to increase the nation's energy supply -- positively impacting the southern California economy and providing the opportunity to sustainably power LAX flights.

Through process technology developed by Honeywell's UOP, AltAir is retrofitting the existing refinery to produce renewable biofuel. AltAir has worked extensively with Honeywell's UOP to demonstrate the commercial viability of the Honeywell Green Jet process. Utilizing this technology, licensed from UOP, the AltAir facility will be the first refinery internationally to be capable of in-line production of both renewable jet and diesel fuels. The facility will convert non-edible natural oils and agricultural wastes into approximately 30 million gallons of low-carbon, advanced biofuels and chemicals per year.

These advanced biofuels are drop-in replacements for petroleum-based fuel, requiring no modification to factory-standard engines or aircraft, with which they are fully compatible. This fuel provides the same performance as conventional, petroleum-based jet fuel. AltAir Fuels' renewable jet fuel is expected to achieve at least a 50 percent reduction in greenhouse gas emissions on a lifecycle basis.

"This refinery is important for two timely and significant reasons," said AltAir's President and COO Bryan Sherbakov. "First, the industry is delivering on the promise of commercial production of advanced biofuels that move beyond additives, like ethanol and biodiesel, to drop-in, replacement low-carbon fuels. Second, this project demonstrates the practical efficiencies these fuels allow by fully integrating into an operating petroleum refinery."

United will support AltAir Fuels' efforts to incorporate internationally recognized sustainability standards, such as those being developed by the Roundtable on Sustainable Biomaterials (RSB). RSB is an international, multi-stakeholder initiative that brings together farmers, companies, non-governmental organizations, experts, governments and inter-governmental agencies concerned with ensuring the sustainability of biomass production and processing.

**United and Sustainable Aviation Biofuels**

# Summary:

- \* Advancing use of alternative jet fuels is key for meeting industry's commitments
- \* Industry is working in concert to catalyze promising, renewable jet fuel technologies
  - \* Making progress with a broad range of topics / issues / challenges across the supply chain
- \* Regional and Global engagement vital to achieving broad success
  - \* Public private coordination and interagency collaboration vital (e.g. via CAAFI, airline efforts)
- \* CAAFI seeking additional opportunities and collaborators – coming to an initiative near you!





# Join us at our next BGM

28-29 Jan'14, Washington, DC

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