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Sustainable Alternative Jet Fuels

Update on U.S. Activities

ICAO HQ, Montréal, Canada

9 – 10 SEPTEMBER 2014



Outline

- U.S. Vision & Approach
- U.S. Activities
- Alt Fuel Developments
- Summary



Aviation Environmental Challenges

- Impacts on community noise, air quality, water quality, energy usage, and climate
- Environmental impacts could pose a critical constraint on capacity growth
- Alternative jet fuels could reduce the environmental impact of aviation:
 - Carbon neutral growth by 2020 compared to 2005
 - Absolute reduction of significant air quality impacts, notwithstanding aviation growth
 - 1 billion gallons of renewable jet fuel in use by aviation by 2018

NOISE



AIR QUALITY



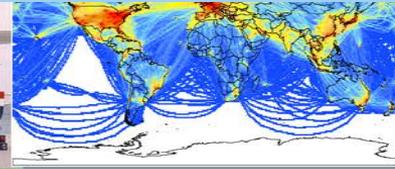
WATER QUALITY



ENERGY



GLOBAL CLIMATE





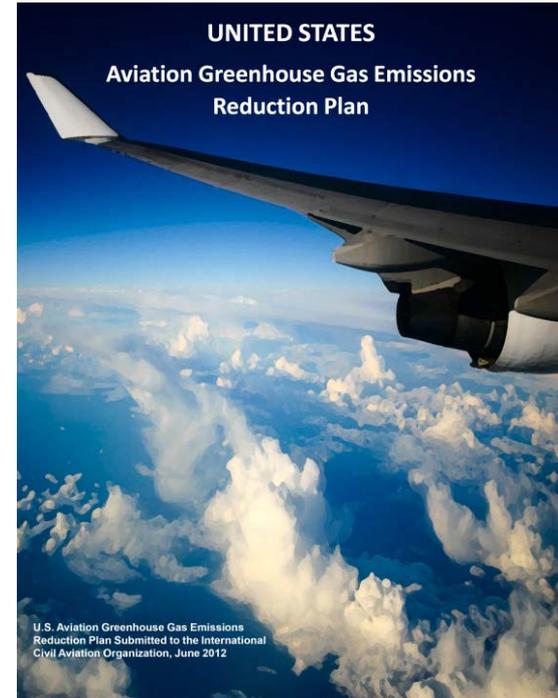
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U.S. Climate Action Plan for Aviation

- Aircraft and engine technology improvement
- Operational improvements
- Alternative fuels development and deployment
- Policies, environmental standards, and market based measures
- Scientific understanding through research, modeling and analysis





Alternative Fuels Principles – U.S. Vision

- Alternative Jet Fuels must be drop in, have equivalent safety and better environmental performance than petroleum Jet fuel
- Enable all possible fuels that meet criteria
- Government role to address key barriers
- Work through Public-Private Partnerships
- Address the whole supply chain
- Leverage expertise and resources of other government agencies and other countries
- Aviation should be a lead user of alternative fuels



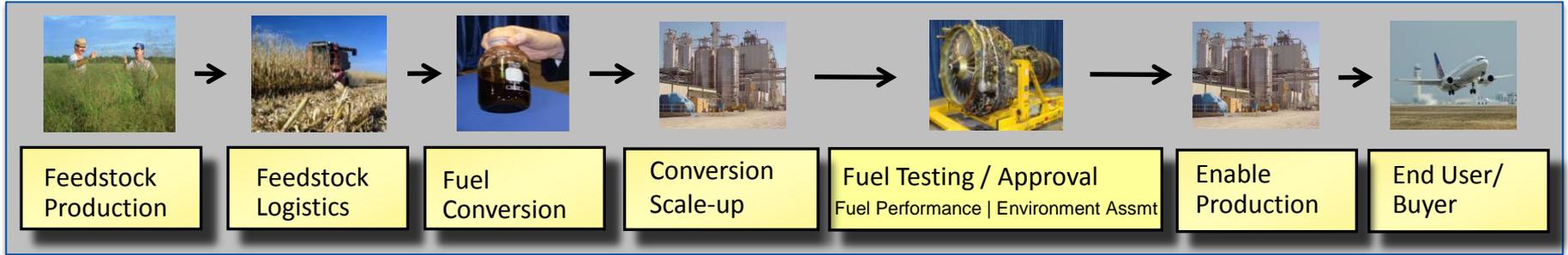
Challenges for Alternative Jet Fuels

- Feedstock Availability
- Competitive cost for alternative fuel
- Approved for performance/safety
- Environmentally sustainable
- Commercially produced





USG Efforts Across Alternative Jet Fuel Supply Chain



Agriculture: Biomass Crop Assistance Program & Crop Insurance Program

Agriculture: Feedstock Development Center Grants

Energy: R&D

Energy & Defense: R&D grants

Agriculture & Energy: R&D grants

FAA & Defense: C/Q Fuel testing

FAA, Defense, & NASA: Enviro Analysis

Agriculture, Navy, & Energy: Defense Production Act and Biorefinery

EPA: Renewable Fuel Standard

Defense & Airlines: fuel purchase

FAA: Guidance for Airports





FAA Alternative Jet Fuel Activities

- Testing
 - Support Cert/Qual testing
 - Improve Cert/Qual process
 - Emissions measurements
- Analysis
 - Environmental sustainability
 - Techno-economic analysis
 - Future scenarios & supply chain
- Coordination
 - Interagency
 - Public-Private
 - State & Regional
 - International





Continuous Lower Energy, Emissions and Noise (CLEEN)

- FAA R&D Program:
 - Reduce aircraft fuel burn, emissions and noise through technology & advance alternative jet fuels
 - 1:1 minimum cost share requirement
- CLEEN I: 2010-2015 (\$125M FAA Funding)
 - Alternative Jet Fuel Projects with Boeing, Rolls Royce, Pratt & Whitney, Honeywell & GE.
- CLEEN II: 2015-2020 (\$100M FAA Funding)
 - Industry Day - December 3, 2013 in Washington DC
 - Solicitation expected in 2014
 - More information available at:



http://www.faa.gov/about/office_org/headquarters_offices/apl/research/aircraft_technology/cleen/



FAA Center of Excellence for Alternative Jet Fuels & Environment

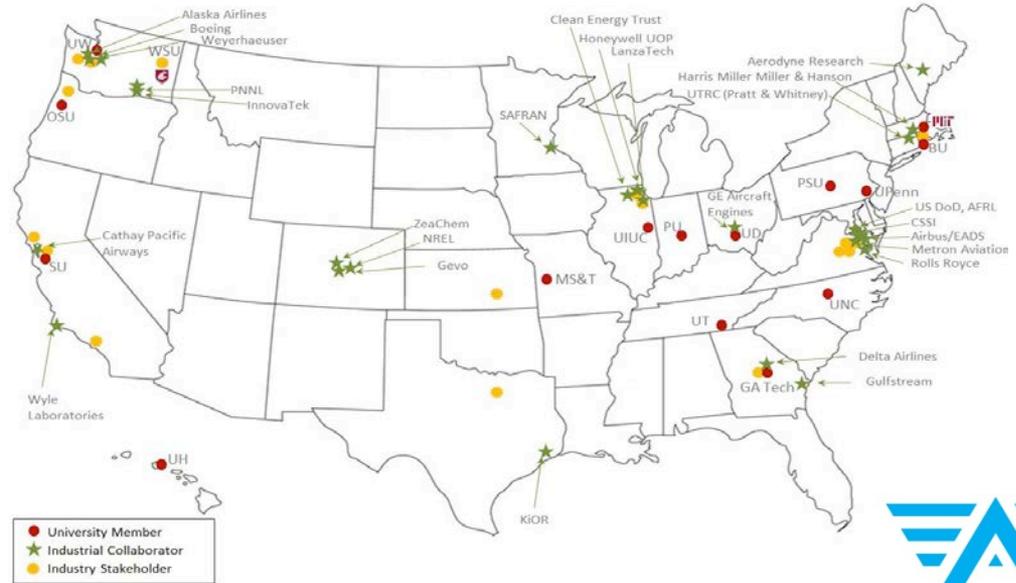
Lead Universities:

- Washington State University (WSU)*
- Massachusetts Institute of Technology (MIT)

Associated Universities:

- Boston University (BU)
- Georgia Institute of Technology (Ga Tech)
- Missouri University of Science and Technology (MS&T)
- Oregon State University (OSU)*
- Pennsylvania State University (PSU)*
- Purdue University (PU)*
- Stanford University (SU)
- University of Dayton (UD)
- University of Hawaii (UH)*
- University of Illinois at Urbana-Champaign (UIUC)*
- University of North Carolina at Chapel Hill (UNC)
- University of Pennsylvania (UPenn)
- University of Tennessee (UT)*
- University of Washington (UW)*

FAA CENTER OF EXCELLENCE FOR ALTERNATIVE JET FUELS & ENVIRONMENT



* Denotes USDA NIFA AFRI-CAP Leads and Participants & Sun Grant Schools



Commercial Aviation Alternative Fuels Initiative (CAAFI)

- Public-Private coalition for commercial aviation to engage the emerging alternative fuels industry
- Enable development of alt jet fuels:
 - Equivalent safety/performance (drop-in)
 - Comparable cost
 - Environmental improvement
 - Security of Energy supply
- Four teams for key issues:
 - Environment Team
 - Certification-Qualification Team
 - R&D Team
 - Business Team
- State and Regional Support
- International Cooperation





Farm to Fly 2.0

... “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”





Defense Production Act Update

- \$510 million commitment by USDA, DOE and U.S. Navy
- In 2013 4 Phase 1 awards made to Emerald Biofuels; Nature's Bioreserve; Fulcrum Bioenergy; Red Rock Biofuels
- Potential for 170 million gallons of drop-in diesel and jet fuel to start production by 2016
- Cost competitive -- weighted average price in 2013 dollars <<\$4/gal
- Phase 2 awards later in 2014
- Farm to Fleet fuel purchases in 2014 and 2015





International Engagement

- Bilateral Cooperation Agreements
- Informal coordination with counterpart organizations
- International Civil Aviation Organization





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Alt Fuels Development Progress 2014

- ASTM approval of SIP fuels (June 2014), additional ballots under preparation
- Engine tests of novel fuels continue
- ASCENT analysis projects established
- Continued domestic and international engagement



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Alt Fuels Progress Anticipated in 2015

- Continue support to ASTM approval of additional fuel pathways
- Continue Certification / Qualification testing of fuels with current methods (D4054) to support ASTM approval
- Continue work to improve testing methods to reduce cost and time of Certification / Qualification over longer term
- Continue analysis in support of deployment
- Continue domestic and international engagement



Summary

- Alternative jet fuels are a key component of U.S. strategy for meeting aviation environmental goals
- FAA efforts are directed to overcoming key challenges via testing, analysis and coordination
- Multiple programs and activities focus on different aspects of the challenge
- Partnerships across technical areas are a key focus
- Strong domestic and international coordination necessary for success



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