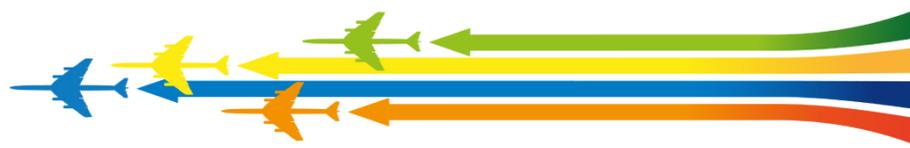




ICAO

UNITING AVIATION

**E-GAP**

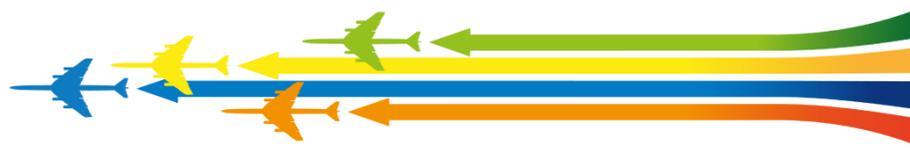


# ICAO Global Aviation Partnerships on Emissions Reductions (E-GAP)

## Sustainable Alternative Fuels for Aviation

**Angela Foster-Rice**

**United Airlines**



# United continues to increase our fuel efficiency through aircraft replacement, technology investment and process improvements

## 250+

new fuel efficient aircraft on order through 2022



## Winglets

Installed on 330+ aircraft with 5% reduction in emissions; launch partner “split scimitar” winglet

## >25%

of ground service equipment electric or alternatively fueled



## 34%

improvement in fuel efficiency compared to 1994



# United engagement to advance aviation biofuels

## 2009

First U.S. test flight  
biofuels

## 2011

First U.S. Commercial  
alternative fuel flight



## 2012

MASBI Biofuels  
Collaborative

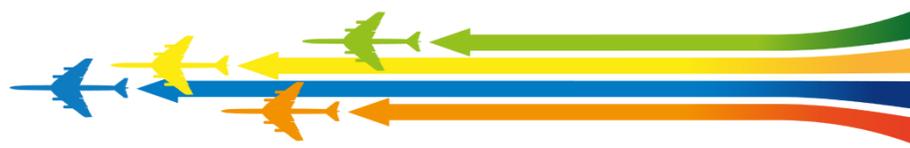
## 2013

First to sign definitive fuel  
supply agreement for  
sustainable aviation  
biofuel -AltAir Fuel



## 2015

\$30M Equity  
investment  
in Fulcrum BioEnergy



# Alternative fuels can reduce carbon emissions while creating other significant benefits

## Lifecycle CO2 Reduction



## Economic & Community Benefits

- Feedstock producers
- Bio-refining industry

## Fuel Diversification

- Reduce long term price volatility
- Improve energy security

## Protect natural resources

- Reduce impacts from extraction process
- Wastes as feedstocks; reduce landfill needs



# Alt Air Fuels – Los Angeles, CA

<b>Technology</b>	<ul style="list-style-type: none"> <li>• Honeywell UOP’s Green Jet HEFA process</li> <li>• Feedstocks can include non-edible, second-generation plant oils and animal fats</li> </ul>
<b>Fuel</b>	<ul style="list-style-type: none"> <li>• Up to 15 million gallons over 3 years</li> <li>• Seeking RSB sustainability certification</li> </ul>
<b>Location</b>	<ul style="list-style-type: none"> <li>• Repurposed idled portion of refinery in Paramount, CA</li> <li>• United purchasing the biofuel for flights out of LAX</li> </ul>
<b>Lifecycle Impacts</b>	<ul style="list-style-type: none"> <li>• Fuel will achieve a 50 percent reduction in CO<sub>2</sub> emissions as compared to traditional jet fuel</li> </ul>
<b>Timeframe</b>	<ul style="list-style-type: none"> <li>• Delivery planned for Q4 2015</li> </ul>
<b>Blend</b>	<ul style="list-style-type: none"> <li>• Fuel will be blended (30/70 ratio) at the Paramount refinery</li> </ul>
<b>Community</b>	<ul style="list-style-type: none"> <li>• The AltAir refinery will create &gt;100 full time jobs</li> </ul>





## In June 2015, United announced a \$30 million equity investment in U.S.-based alternative fuels developer Fulcrum Bioenergy



- Co-develop up to 5 facilities; 90 Million gallons/year
- Greater than 80% reduction in carbon emissions (lifecycle basis)
- Divert landfill waste, capture recyclables
- Create jobs, generate renewable electricity credits



# From trash to take off

Instead of household waste going to a landfill, it will now be delivered to a Fulcrum facility and converted into sustainable aviation biofuel.



Fulcrum's thermochemical process reduces greenhouse gas emissions by 80% compared to traditional jet fuel.



Trash is collected and delivered to a Fulcrum facility.



The drop-in fuel meets United's technical requirements.

Clean >> Scalable >> Efficient >> Reliable



Total trash placed in U.S. landfills in one year



Energy equivalent of 10 billion gallons of oil (3 times United's total annual fuel use)



The average American produces nearly 1 ton of garbage a year



That's 65 gallons of biofuels processed by Fulcrum

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# Challenges Remain for Commercialization of Sustainable Aviation Fuels

**Midwest Aviation Sustainable Biofuels Initiative** - collaborative effort by 40+ public, private, universities, NGOs to develop recommendations to advance commercialization of aviation biofuels



- Need continued R&D to improve feedstock innovation
- Need continued R&D to support scale-up of production technologies
- Need acceleration of jet fuel certification for new fuels
- Need acceleration of U.S. EPA approval under Renewable Fuels Standard
- Need stable governmental policies, funding, and incentives for aviation biofuels

***For more information go to [MASBI.org](http://MASBI.org)***



# Working Together for the success of sustainable aviation biofuels



Airlines for America  
We Connect the World

