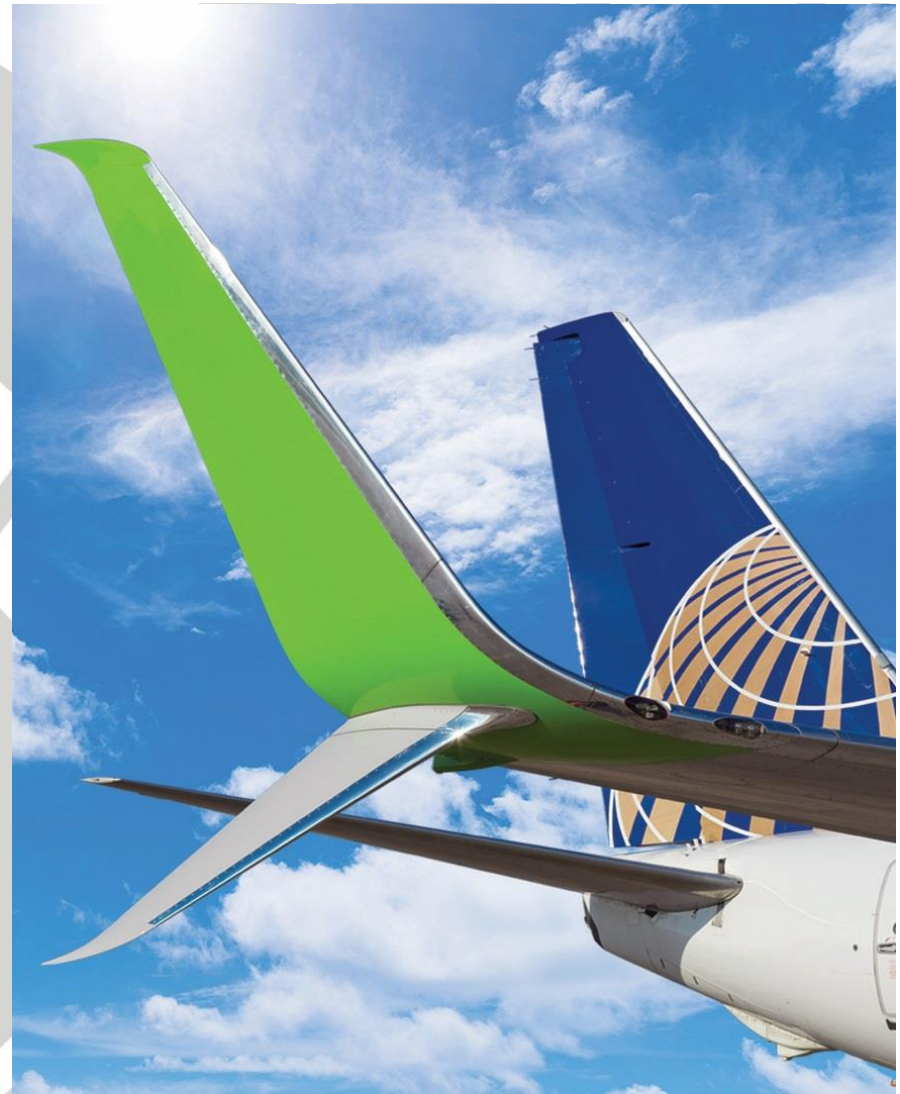


# United Airlines' Eco-Skies Program

**Aaron Stash**

Environmental Strategy & Sustainability

**GBENN Summit**  
Chicago, Illinois  
November 8, 2018



A STAR ALLIANCE MEMBER 

UNITED   
**eco-skies** 

# Newsweek names United among the world's top-ranked green companies

## GREEN RANKING 2017

ONE OF THE MOST RECOGNIZED  
ENVIRONMENTAL PERFORMANCE  
ASSESSMENTS OF THE WORLD'S  
LARGEST PUBLICLY TRADED  
COMPANIES

### United Airlines:

- #1 airline globally
- #59 among top 500 US
- #100 among top 500 globally

**Newsweek** IN PARTNERSHIP WITH **Corporate Knights**

## BEST IN INDUSTRY GLOBAL

LARGEST PUBLICLY  
TRADED COMPANIES IN  
THE U.S. + GLOBALLY BY  
MARKET  
CAPITALIZATION



Source: Newsweek Green Rankings 2017 (<http://www.newsweek.com/green-rankings-2017-18>) published 1/10/2018

UNITED   
eco-skies 



## From our CEO

**Innovation and sustainability are twin engines that drive our progress as the most environmentally conscious airline in the world.**

**United is committed to innovating solutions that we hope will become the expectation for our industry, not the exception.**

**The measure of our success is the opinion of our children and grandchildren who will look back on our efforts and say that we lived up to our obligations to them in protecting the planet for future generations.**



**Oscar Munoz**

# Aviation's global impact – Catalyst of economic and social progress

**3.5** BILLION

Passengers carried  
by airlines (2015)

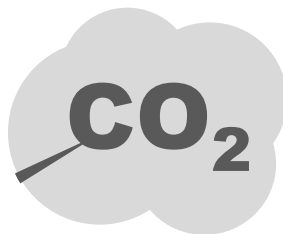
**62.7** MILLION

Jobs supported  
by aviation worldwide

**3.5%**

of Global GDP  
supported by aviation

- Aviation stimulates the economy, trade and tourism, generates business opportunities and enhances quality of life in both developed and developing regions.
- With 54% of international tourists travel by air, aviation remains one of the most efficient ways of traveling.
  - Optimizing distance between points and minimizing land use
  - Occupancy rates exceeding 75%; compared to:
    - 40-50% for trains and 30% for cars.
  - 80% of aviation emissions are from passenger flights exceeding 1,500 km or 900 miles, for which there is no practical alternative



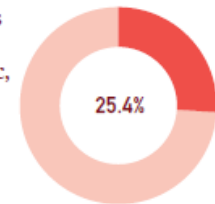
But aviation does  
produce around  
**2.0%**  
of human-induced  
CO<sub>2</sub> emissions

## NORTH AMERICA



Air transport supports 7.6 million jobs and \$791 billion in GDP in North America

North America's  
share of global  
passenger traffic,  
2014



Total jobs and GDP supported by air  
transport, 2014

JOB TOTAL		GDP TOTAL
7.6 million	Tourism catalytic	\$791 billion
1,400,000		\$136.8 bn
1,200,000	Induced	\$131 bn
2,500,000	Indirect	\$271.1 bn
2,400,000	Aviation direct	\$252 bn

# Climate change has many potential impacts on aviation

- **Increased fuel costs**

- Fuel and taxes
- Refining shortages

- **Higher temperatures**

- Increased fuel use during takeoff and cruise
- Lower aircraft performance (payload / range)

- **Airport impacts**

- More frequent runway maintenance
- Sea level rise

- **Increase in weather intensity**

- Number of weather events
- En route turbulence
- Stronger headwinds

- **Unexpected weather impacts**

- Different prevailing winds
- New weather modeling

- **Demand changes**

- Population relocation



# Airport impacts

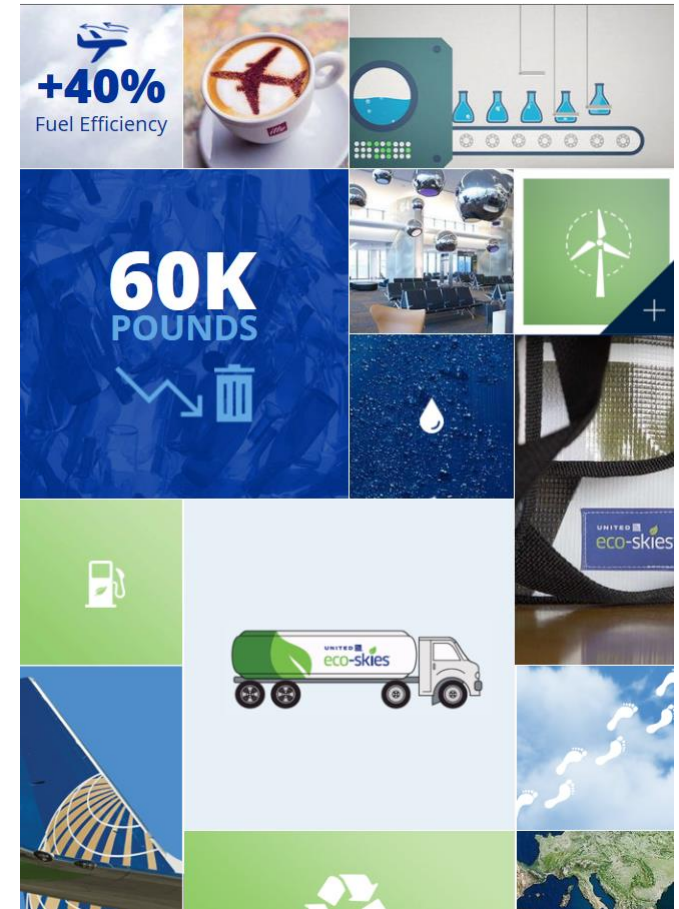
Thirteen of the 47 largest airports in the United States – have at least one runway with an elevation within the reach of moderate to high storm surge. Sea level rise will pose a threat to low-lying infrastructure. (Data from Federal Aviation Administration 2012 ).

Superstorm Sandy led to the cancellation of nearly 17,000 flights, costing airlines \$500 million in revenues and disrupting operations around the world, according to a 2017 presentation by Eurocontrol on climate change risk.

New York, LaGuardia (LGA)

# Our Environmental Affairs team serves as the steward of United's corporate environmental commitment

- Committed to operating an environmentally sustainable and responsible airline by taking actions today that shape a more sustainable future in the air and on the ground.
- Focusing on:
  - Compliance with applicable laws and regulations
  - Fuel efficiency and emissions reduction
  - Sustainable fuel sources
  - Sustainable products and waste management
  - Stakeholder, employee and customer engagement
- Learn more at [united.com/ecoskies](https://united.com/ecoskies)





## Fast facts

**7 domestic hubs**

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**~50 countries**

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**~340 destinations**

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**~1,260 aircraft**

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**~4,500 daily departures**

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**148 million passengers in 2017**

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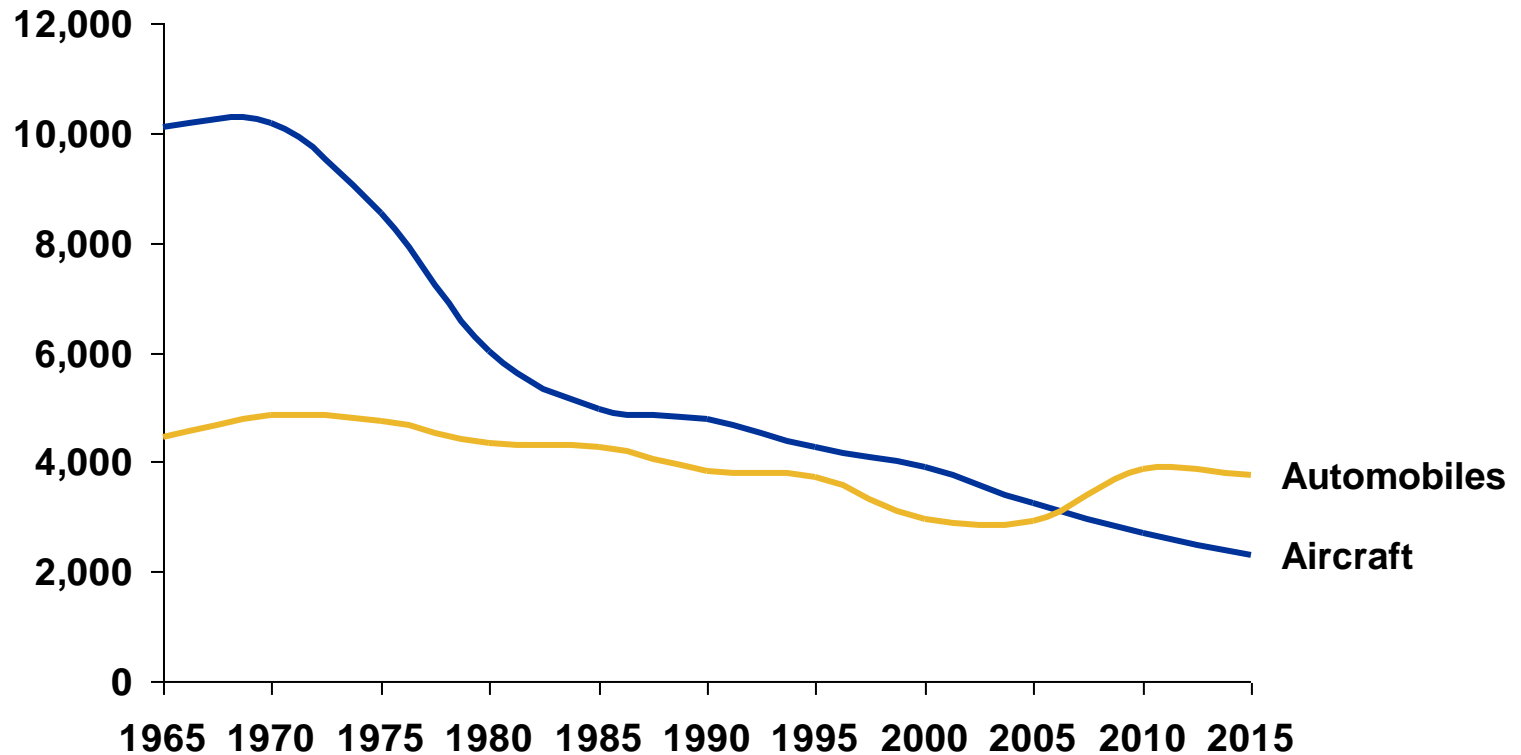
**4.0 billion gallons in 2017**

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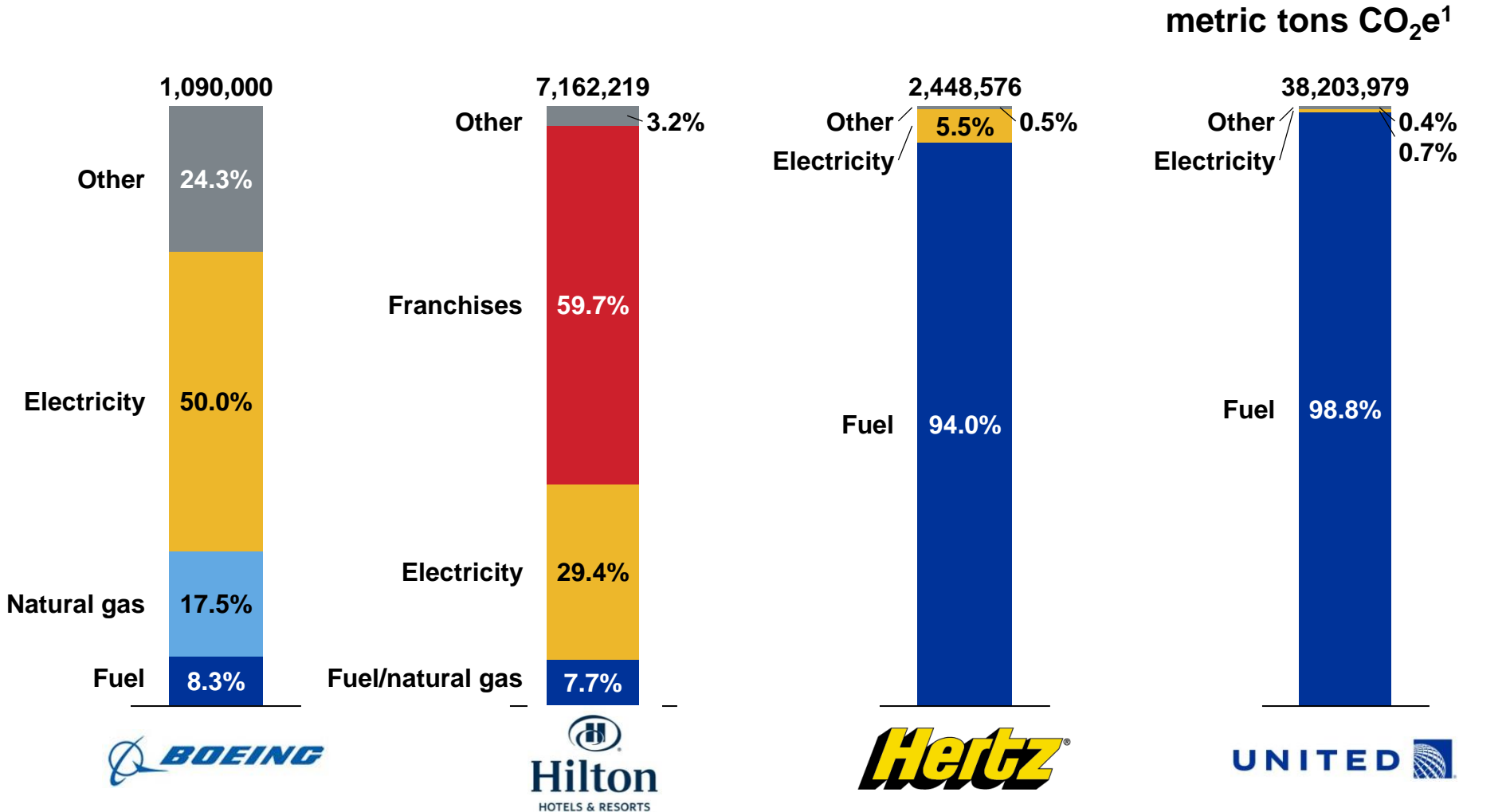
# Industry environmental perspective

## Energy Intensity of Aircraft and Automobiles



Source: U.S. Department of Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics 2016, Table 4-20: Energy Intensity of Passenger Modes

# Airline emissions are nearly all from jet fuel



<sup>1</sup> Company environmental reports and 2015 Carbon Disclosure Project responses



**United is the first U.S. airline to commit to reducing its greenhouse gas emissions—50% by 2050**

**21 million metric tons per year**  
Achieving this goal would be the equivalent of removing 4.5 million cars from the road—all the cars in Los Angeles and New York City combined.



# Four pillars of climate action

## 1) Technology

- New aircraft designs/engines
- Sustainable alternative fuels

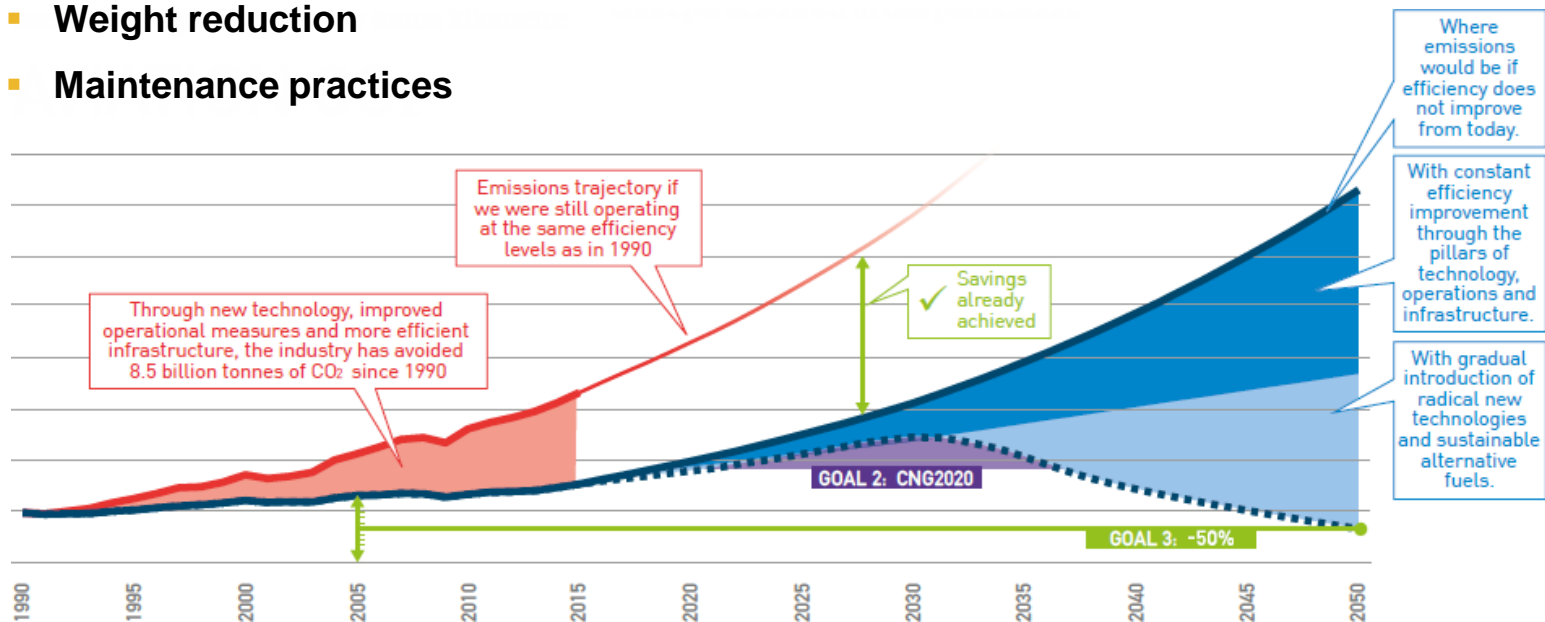
## 2) Operations

- Flight procedures
- Weight reduction
- Maintenance practices

## 3) Infrastructure

- NextGen ATC
- Single European Sky
- Airport capacity

## 4) Global Market-Based Measure



# United has a four-pillar environmental commitment

## Fuel efficiency and emissions reduction



## Sustainable fuel sources



## Sustainable products and waste management



## Stakeholder and customer engagement



# **Sustainability at United**

## **Fuel Efficiency and Emissions Reduction**

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**We have been working on sustainability since our days  
as a Bay Area tech startup**



# United invests over \$2 billion on improving its fuel efficiency each year

## 200+ new aircraft on order

United's newest aircraft will consume 15%-20% less fuel<sup>1</sup> than the aircraft they will replace.



<sup>1</sup> Available seat-miles per gallon



# In 2017 we retired the 747 from our fleet after 47 years

## Jumbo fuel savings

We replaced the 747-400 with the 777-300ER, which has a more than 20% improvement in fuel efficiency.<sup>1</sup> Our first 747-100 took to the skies in 1970.



<sup>1</sup> Available seat-miles per gallon



# Fuel efficiency<sup>1</sup> has improved by 40% since 1991...



## Load factors a supporting role

While load factors have increased over time, the majority of this improvement is due to more efficient aircraft.

<sup>1</sup> Revenue passenger-miles per gallon

...and over 80%<sup>1</sup> since the first-generation jets



## Fewer engines

The higher reliability of modern engines allows for fewer of them, reducing aircraft weight and drag, thereby reducing fuel use.

<sup>1</sup> Revenue passenger-miles per gallon



# Small changes can add up to big savings

In 2017 United switched to a lighter paper for *Hemispheres* magazine

This reduced the weight of each magazine by just 0.8 ounces...

...but saves 170,000 gallons of fuel per year...

...and nearly 200 trees per year

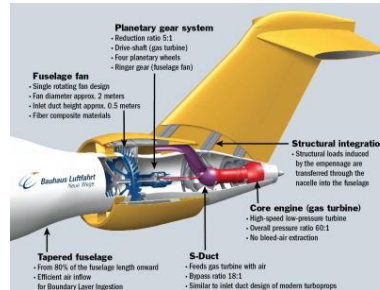




# Many new concepts for future aircraft designs are being considered



**Airbus  
Ducted fans**



**Bauhaus-Luftfahrt  
Propulsive fuselage**



**Boeing  
Blended wing body**



**ESAero  
Turboelectric propulsion**

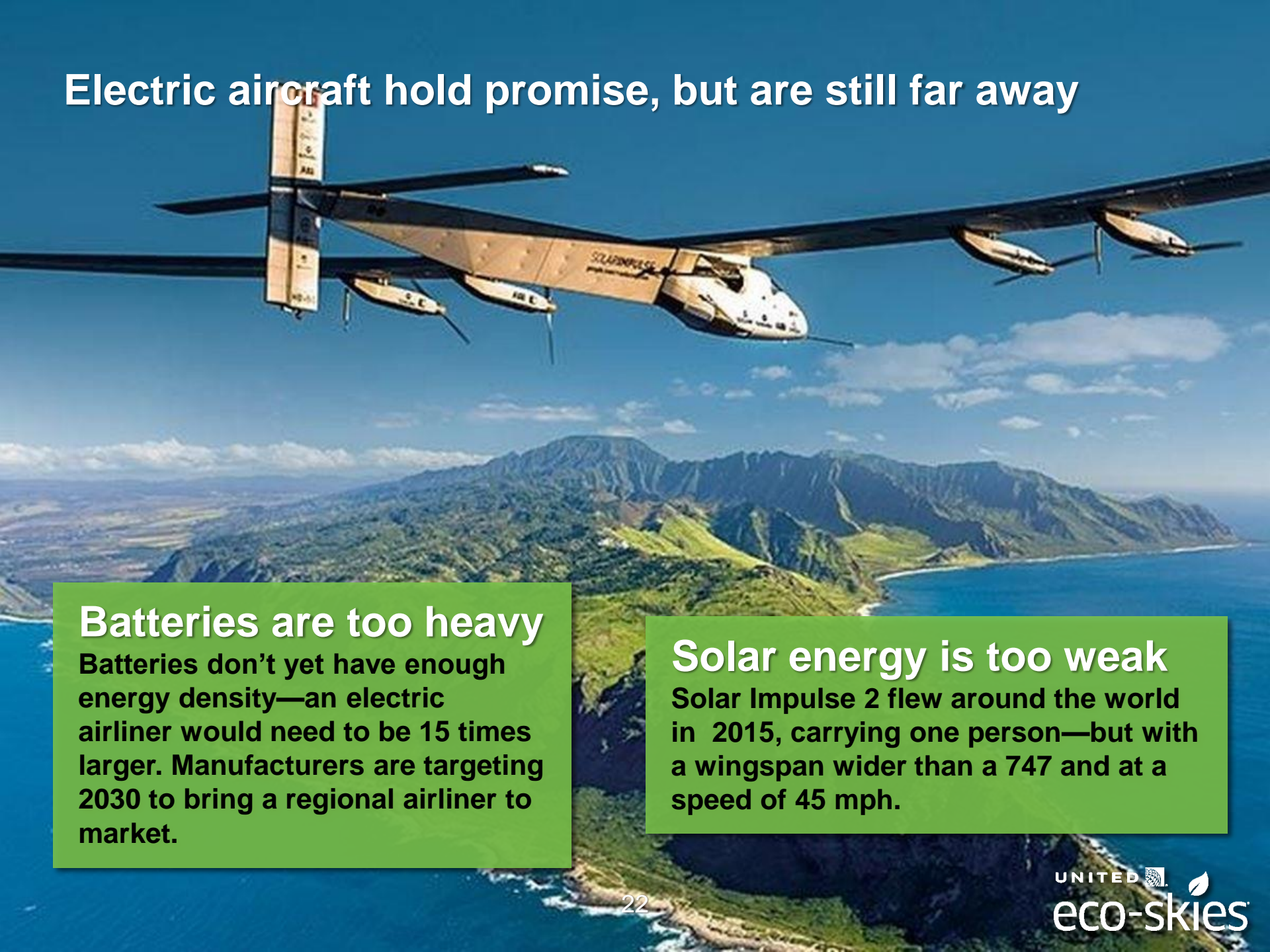


**Lockheed Martin  
Hybrid wing body**



**MIT  
Double-bubble fuselage**

# Electric aircraft hold promise, but are still far away



## Batteries are too heavy

Batteries don't yet have enough energy density—an electric airliner would need to be 15 times larger. Manufacturers are targeting 2030 to bring a regional airliner to market.

## Solar energy is too weak

Solar Impulse 2 flew around the world in 2015, carrying one person—but with a wingspan wider than a 747 and at a speed of 45 mph.

# **Sustainability at United**

## **Sustainable Fuel Sources**

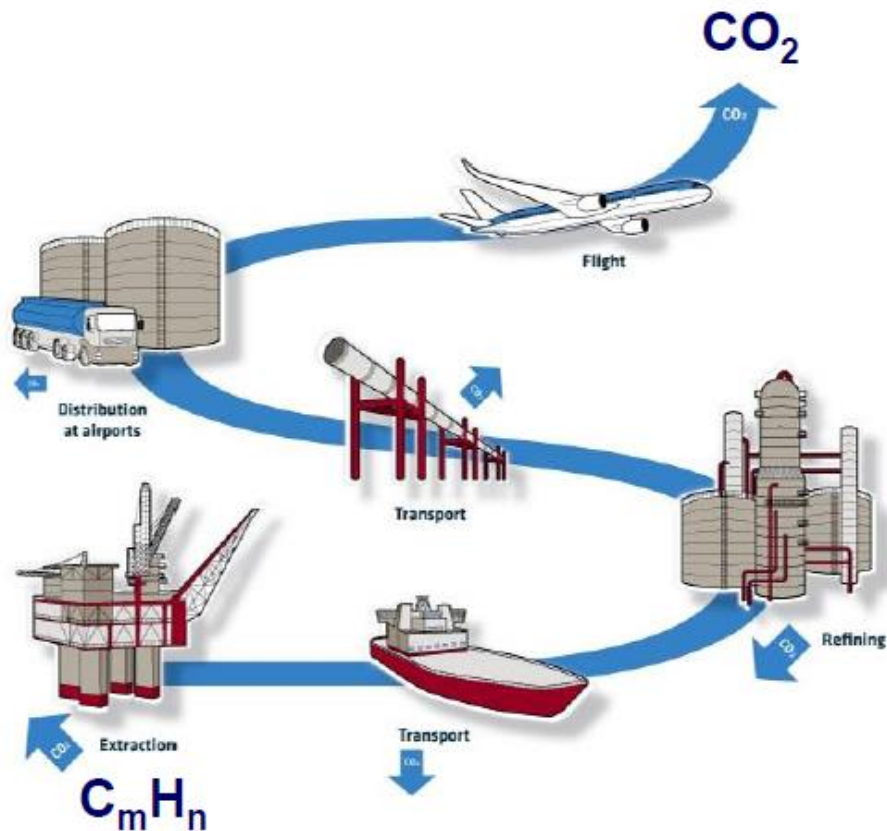
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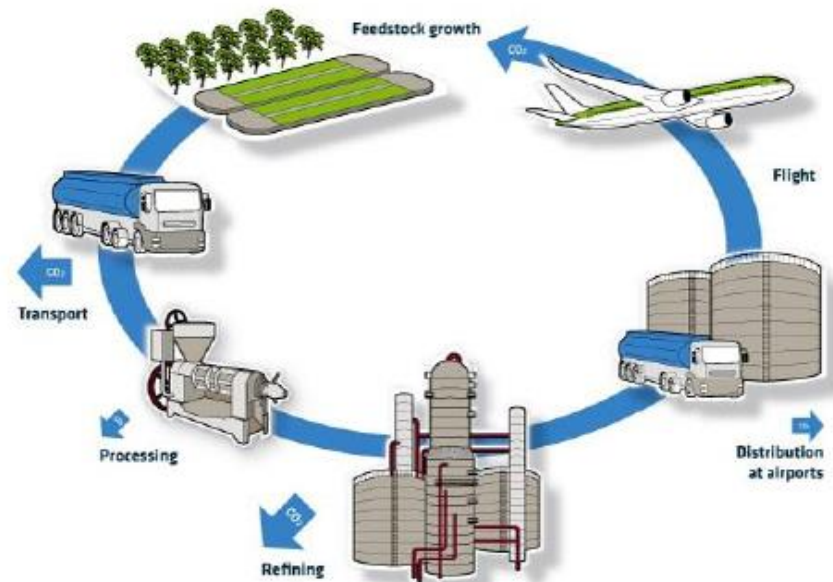


# Biofuels have lower CO<sub>2</sub> emissions on a lifecycle basis

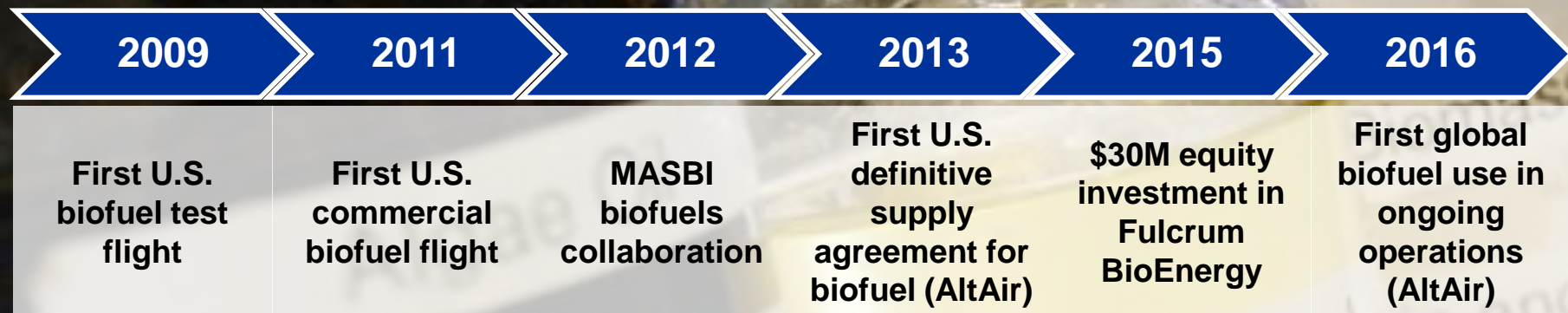
## Petroleum-based fuel



## Biofuel



# United is the leader in sustainable aviation biofuels



## United has the...

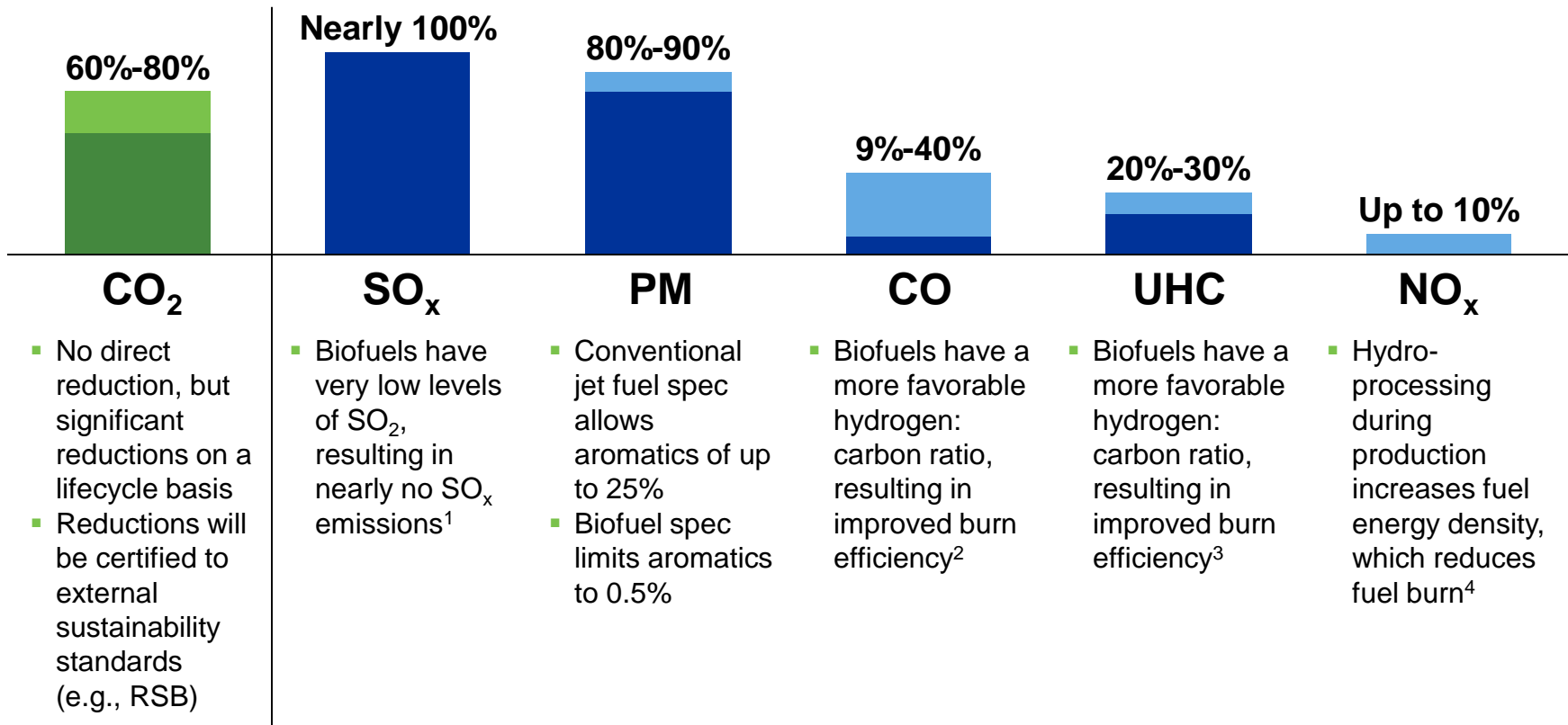
- Largest biofuel investment
- Largest biofuel contract

## Why biofuels?

- Batteries are too heavy
- Solar energy is too weak
- No new infrastructure

# Biofuels also offer numerous air quality benefits

## Emissions reduction vs. conventional jet fuel



<sup>1</sup> Moses, C.A., "Comparative Evaluation of Semi-Synthetic Jet Fuels (FT-SPK)," *Coordinating Research Council, 2008.*

<sup>2</sup> Corporan, E. et al., "Alternative Fuels Tests on a C-17 Aircraft," *Air Force Research Laboratory, 2010* and Anderson, B.E., et al., "Alternative Aviation Fuel Experiment," *NASA, 2011.*

<sup>3</sup> Corporan et al., "Emissions Studies of Alternative Jet Fuels," *Energy & Fuels, 2011.*

<sup>4</sup> Stratton, R.W. et al., "Impact of Non-CO<sub>2</sub> Combustion Effects on the Environmental Feasibility of Alternative Jet Fuels," *Environmental Science and Technology, 2011.*



# In March 2016 United became the first U.S. airline to use sustainable aviation biofuel on an ongoing basis



**March  
2016**

United began flying *AltAir's* biofuel from non-edible waste oils from its Los Angeles hub in March 2016.



**2+ million  
gallons**

United has purchased over 2 million gallons of sustainable aviation biofuel from *AltAir*.



**30/70  
blend ratio**

*AltAir's* biofuel is mixed at a ratio of 30% biofuel and 70% traditional fuel.



**2 years of  
flights**

Since 2016, United has flown the equivalent of over 2,000 biofuel flights with the 30/70 blend.



**60% CO<sub>2</sub>  
reduction**

*AltAir's* RSB-certified biofuel provides a 60% reduction in CO<sub>2</sub> emissions on a lifecycle basis versus traditional jet fuel.



**65 new  
jobs**

This project created 65 new jobs at the previously idle *AltAir* refinery in Paramount, California.



# Global Climate Action Summit – SFO-GVA biofuel



<https://youtu.be/pKZBnV-3zTE>

In 2015 United invested \$30 million in



- Use landfill waste to capture recyclables, generate renewable electricity credits, and produce jet fuel
- Greater than 80% reduction in CO<sub>2</sub> lifecycle emissions
- Co-develop up to five facilities
- 90 million gallons per year for 10 years





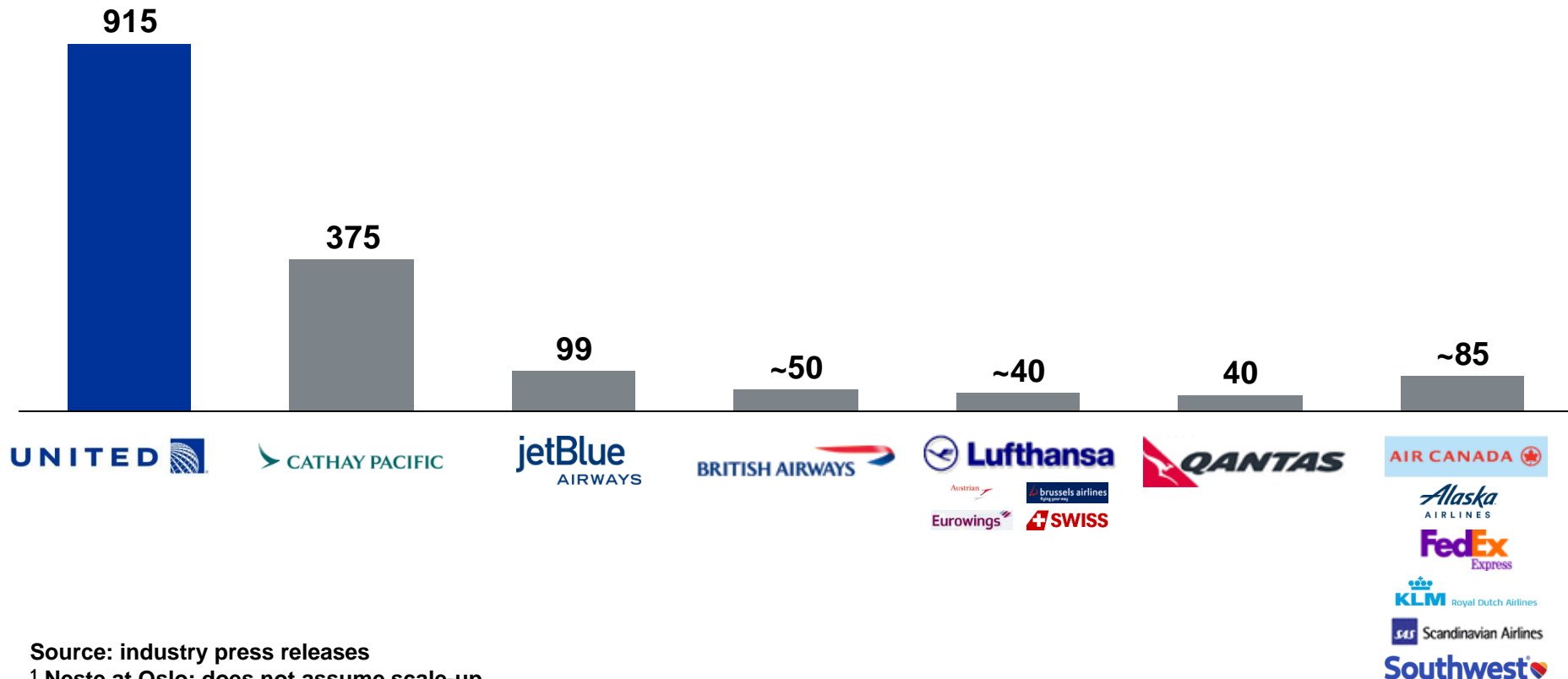
# In May 2018 Fulcrum broke ground on its first biorefinery near Reno

## Opening in early 2020

The Sierra BioFuels Plant will be the nation's first commercial-scale plant to convert landfill waste into renewable fuel. While this site will not supply United, it is the precursor to United's first facility, which is next on Fulcrum's development program.

# United has over half of the industry's current biofuel commitments...

Estimated biofuel commitments<sup>1</sup>  
M gallons



Source: industry press releases

<sup>1</sup> Neste at Oslo: does not assume scale-up

Alaska / Gevo and Hawaii BioEnergy: assumes 3M gal/yr each for 3 years

British Airways / Velocys: assumes 10M gal/yr for 5 years

KLM / AltAir: assumes 3M gal/yr for 3 years

Southwest / Red Rock: assumes same volume as FedEx / Red Rock

...but scaling up will require many suppliers

**Additional  
biofuel suppliers**



# **Sustainability at United**

## **Sustainable Products and Materials Management**

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# Our newest facilities are certified to LEED standards



## Houston's LEED Silver Terminal B South renovation

- Consumes 20% less energy than a conventionally-built structure
- Highly efficient glass, low-consumption light and plumbing fixtures, zoned HVAC equipment, a cool roof system, a daylight harvesting system, and a light shelf in passenger waiting areas to direct daylight inside



## San Francisco's LEED Gold Terminal 3 East renovation

- Improvements to heating, ventilating, and air conditioning (HVAC) systems, and electrical load centers
- Seismic resistance enhancements



# United Clubs at LAX, SAN and DEN have received sustainability certification

## 'Green' lounges

Our United Clubs in Los Angeles, San Diego and Denver have sustainability certification for avoiding polystyrene products, recycling, composting, and donating unused food.





**United's headquarters is the largest office building to receive Energy Star certification**

## **Third-largest building ever**

**In 2018 Willis Tower received Energy Star certification from the EPA, placing it in the top 25% of similar facilities nationwide for energy efficiency. Commercial buildings with certification use an average of 35% less energy than typical buildings.**



# We're reducing plastic and sourcing sustainable food and amenities on board



- **#SheddTheStraw** in November 2018, United replaced onboard plastic stir sticks and picks with environmentally-friendly alternatives made out of bamboo



- **illy's** internationally-certified supply chain includes farmers who earn above-market prices in exchange for meeting quality standards for the finest coffee
- United now serves breakfast sandwiches sourced with **cage-free eggs**



- **Cowshed's** amenity kits are made from sustainable resources and natural botanicals
- 50,000+ pounds of unused kits are collected annually and repurposed by **Clean the World**, who provides hygiene kits to groups in need

United® partners with Clean the World® to recycle unused portions of amenity kits and repurposes these items into new hygiene kits.



Clean the World®

# Cleanliness should not be a luxury.

As part of our Eco-Skies commitment to the environment, United has partnered with Clean the World to recycle the unused portions of our amenity kits and repurpose these items to build new hygiene kits.



Clean the World®



# United – Eco-Skies – Repurposing amenity kits – 2018



[https://youtu.be/YD\\_raD7Nh8g\\_](https://youtu.be/YD_raD7Nh8g_)

# **Sustainability at United**

## **Eco-Skies Partners**

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**eco-skies** 

# Environmental non-profit and innovation partnerships



- Since 1998 United and **Conservation International** have partnered to bring attention to and provide guidance on environmental sustainability, conservation issues and best practices.



- United – the official airline of the PGA TOUR – partners with **Audubon International** to relocate raptors (hawks, owls, kestrels, etc.) from New York/New Jersey (PANYNJ) airports to suitable golf course habitats.



- United has partnered with Chicago-based **Clean Energy Trust** since 2009 to support the Clean Energy Challenge, an annual contest providing mentoring and funding to develop clean energy start-ups.



# A unique new partnership with Audubon International to decrease aircraft bird strikes

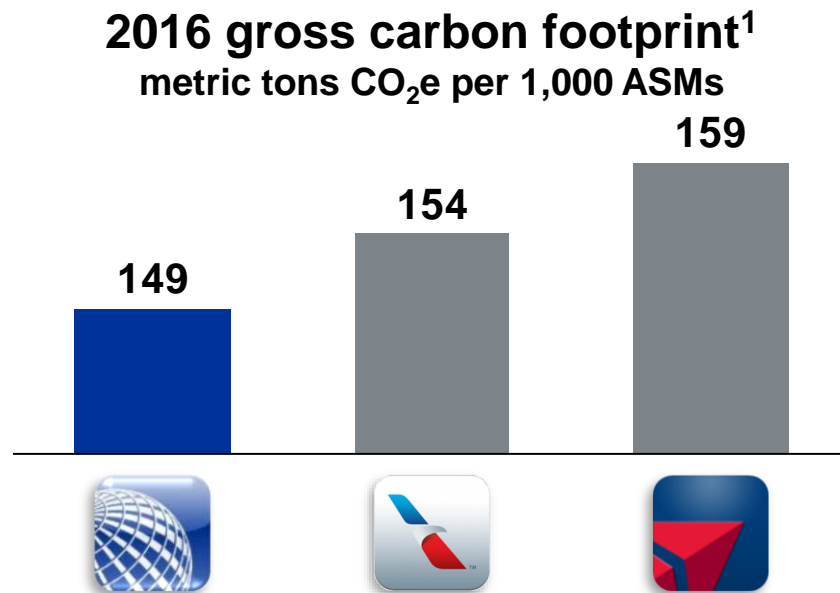
## **Audubon International**

**Relocating raptors (hawks, owls, kestrels) from New York/New Jersey (PANYNJ) airports to suitable golf course habitats to:**

- **Decrease the likelihood of aircraft bird strikes**
- **Encourage threatened species to thrive in the wild**
- **Increase natural pest control for golf courses**

# In 2017 we added an environmental component to our Global Performance Commitment

- We will be first in gross CO<sub>2</sub>e per ASM
  - Gross CO<sub>2</sub>e excludes offsets and best captures actual emissions from our operations
  - ASM = available seat-mile = one seat transported one mile, the standard measure of capacity



<sup>1</sup> Source: airline corporate responsibility reports



In 2017, United's gross carbon footprint will be lower than both American and Delta, measured in gross carbon emissions.

*Gross carbon emissions are measured by carbon emissions per available seat-mile.*



# Customers can offset their Scope 3 emissions



CarbonChoice

The CarbonChoice offset program provides corporate customers with usage reports and offsetting options for emissions associated with their travel on United

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**Fly carbon neutral**  
Support sustainability around the world  
with **Eco-Skies CarbonChoice<sup>SM</sup>**.  
Learn more at [united.com/carbonchoice](https://united.com/carbonchoice)

**UNITED**   
**eco-skies** | CarbonChoice



# What can customers do to travel more sustainably?

## Fly nonstop



- Flying nonstop is the single biggest action one can take—and also saves time

## Choose a low-carbon airline



- Select an airline with better fuel efficiency
- Select an airline taking strong steps towards low-carbon fuels

## Pack light



- If every passenger packed one pound less, together we could save 23,000 metric tons of CO<sub>2</sub> per year

## Offset emissions



- As a final step, consider offsetting your emissions
- Generic calculators tend to be less accurate and higher than the true figures from airlines themselves

# Sustainable aviation won't happen overnight—but it will happen at an accelerating pace



**1886**  
**Benz Patent-Motorwagen**



**1997**  
**Toyota Prius**



**2008**  
**Tesla Roadster**



**1903**  
**Wright Flyer**



**2016**  
**Airline biofuels**



**20??**  
**Carbon-neutral aircraft?**

# Questions?

- **Aaron Stash**

**Environmental Strategy & Sustainability**

**aaron.stash@united.com**