Honeywell’s UOP
Renewable Fuels from Sustainable Sources: Beyond Potential to Production

Jim Rekoske, Vice President & General Manager
UOP Honeywell
Honeywell Overview

$33 B Broad and Diverse Businesses, Technologies and Products

- Aerospace: 38%
- Transportation and Power Systems: 32%
- Automation and Control Solutions: 16%
- Specialty Materials: 14%
DoD Energy Efficiency – Touching Every DoD Mission

Honeywell

Energy Efficiency Solutions for the DoD

- Fixed Wing Aircraft
  - Green fuels
  - FMS
  - Smartpath
  - Aircraft navigation
  - Latch
  - Engines
  - Thrust recovery valves
  - ECS
  - Electric actuation
  - Fuel pump
  - Intake/airflow

- Forward Operating Bases
  - ThermStrong foam
  - Smart Grid
  - Oil and hours monitoring
  - Metering
  - Renewables services
  - and integration
  - AGT 1990
  - Green fuels

- Building/Base
  - ESPCA
  - HVAC upgrades
  - Lighting upgrades
  - DECS system implementation
  - Motor/compressor upgrades
  - Gas detection
  - Combustion controls
  - Misting controls
  - Renewable integration
  - Programmable thermostats
  - Direct digital controls
  - Variable frequency drivers
  - Economizers
  - TERRA Strong
  - Air seal/weatherization

- Surface Vehicles
  - Green fuels
  - Spectraflex
  - Turbochargers
  - LEDs
  - AGT1500 (TIGER)

- Helicopters
  - Green fuels
  - Spectraflex
  - LEDs
  - T-Flight
  - Electric actuation
  - Fuel pumps
  - Engines
  - ECS

- Emissions Reduction

- Fewer Kilowatts

- Fuel Savings

- Lower Weight
Green Fuels for Energy Security

**Honeywell Solutions**
- Green Fuels – diesel, jet, bunker fuel
  - Green Jet in all DOD aircraft
  - Green Diesel in tanks and ground vehicles
  - Green Diesel in Ships

**Energy Efficiency Savings**
- Green fuels certification and use across land, sea, air installations and platforms
- Fuel (Gallons) – Impact 3 billion gallons per year DOD fuel use
- Emissions – ~6M MT CO2 annual savings with 25% Green Jet and Diesel in fuel stocks
- Assures domestic fuel supplies
- Lowered GHG
- Enhanced DOD Energy Security Requires government scale up for high rate production

**Pyrolysis Oil for installation and Forward Operating Base Power – DOE grant**
Honeywell Renewable Fuels Vision

• Building on 96 years of petrochemical industry technology and expertise
• Produce real “drop-in” fuels instead of fuel additives/blends
• Leverage existing refining, transportation, energy, biomass handling infrastructure to lower capital costs, minimize value chain disruptions, and reduce investment risk
• Focus on path toward second generation feed stocks and chemicals
UOP Renewable Fuels Technologies

- **Natural Oil/Fats** → **UOP/Eni Ecofining™ Process** → **Honeywell Green Diesel™**
  - Green Jet (if req)
- **Natural Oil/Fats** → **Renewable Jet Process** → **Honeywell Green Jet™**
  - Green Diesel
- **Biomass** → **RTP® (Pyrolysis)** → **Upgrading Process** → **Green Power / Fuel Oil (now)** → **Green Fuels**
- **RTP® (Pyrolysis)** → **Envergent Technologies – UOP/Ensyn JV** → **Green Fuels (2012)**

Rentech / UOP Alliance
Completed Flight Demonstrations

- **Successful ANZ Flight Demo Date: Dec. 30, 2008**
  - Feedstock: Jatropha oil

- **Successful CAL Flight Demo Date: Jan. 7, 2009**
  - Feedstock: Jatropha and algal oil

- **Successful JAL Test Flight: January 30, 2009**
  - Feedstock: Camelina, Jatropha and algal oil

- **KLM European Test Flight: November 23, 2009**
  - Feedstock: Camelina
Recent Service Bio Jet Fuel Demos

USAF A-10C Bio Jet Test
25 March 2010
Eglin AFB

Navy Green Hornet Bio Jet Test
22 April 2010
Pax River NATC

Royal Netherlands Air Force
16 June 2010
Gilz Rijen Air Base Netherlands
## DoD Renewable Fuel Delivery Status

<table>
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<tr>
<th>Customer</th>
<th>Fuel Type</th>
<th>Awardee</th>
<th>Producer</th>
<th>Quantity</th>
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<td>HRJ-5 (camelina)</td>
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<td>UOP</td>
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<td>Produced</td>
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<td>Air Force</td>
<td>HRJ-8 (tallow)</td>
<td>UOP</td>
<td>UOP</td>
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<td>UOP – Pilot Plant</td>
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<td>TBD – DESC</td>
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<td>TBD</td>
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</tbody>
</table>

**Actual Production – Not Just Potential**
Summary

• Honeywell’s UOP has production-proven technologies for renewable fuels
  – Available for license today
  – Demo capacity in operation

• Our technologies are feedstock flexible
  – Camelina, tallow, triglycerides from algae, other oil seed crops
  – Actively developing full biomass conversion processes

• Our technologies deliver real, drop-in fuels
  – No compromises needed; chemically and physically indistinguishable from petroleum-derived fuels
  – No changes to delivery, consumption infrastructure

Real Biofuels are part of the future... but they also part of the fuel mix today!