BioJet Sustainable Fuels

Next generation aviation biofuels
BioJet brings together high volume feedstock and bio-refining technology to make ASTM quality fuel.
GreenJet process overview

Camelina → Seed Crusher → Seed Meal Revenue

Algae → Oil Separator → Algae Co-Products Revenue → GreenJet → Green Diesel

GreenJet → Commercial Aviation Customers

GreenJet → Car / Truck Marine Customers
GreenJet is not Biodiesel

Hydroprocessing / Isomerization (Ecofining™)

Lipid Feedstock (Camelina oil, algae oil, other)

- Hydrogen
- Methanol

GreenJet / GreenDiesel

- Propane
- Glycerol

Biodiesel (FAME)

“Drop-in” Replacement Fuel

Separate Infrastructure Required

Unlike traditional biodiesel, GreenJet / GreenDiesel can be used in existing engines with no modifications, additional equipment or infrastructure.
Hydro-treatment Process
- First reaction removes oxygen from natural oils
- Produces diesel range waxy paraffins
- Second reaction “cracks” diesel paraffins
- End product is molecularly identical to aviation fuel
GreenJet – ASTM Quality Fuel

Meets fuel performance requirements
Requires NO change to airplanes or engines
Requires NO change to infrastructure
Can be mixed or alternated with Jet-A fuel

* GreenJet is blended 50:50 with conventional jet fuel to meet aromatics requirement

ASTM Status – GreenJet SPK up for review and confirmation in 2010
### GreenJet Boeing Fuel Test Results

**Boeing fuel testing requirements:**

- Freezing point
- High temperature thermal stability
- Energy density
- Storage stability
- Elastomeric compatibility
- Must be a replacement solution
- Meet ASTM fuel specs
- Have a low CO₂ footprint

<table>
<thead>
<tr>
<th>Property</th>
<th>Jet A or Jet A-1</th>
<th>SPK</th>
<th>ASTM Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fluidity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freezing point, degrees Celsius</td>
<td>max -40 Jet A</td>
<td>-63</td>
<td>-55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-47 Jet A-1</td>
<td></td>
</tr>
<tr>
<td><strong>Combustion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net heat of combustion, MJ/kg</td>
<td>min 42</td>
<td>44.0</td>
<td>43.5</td>
</tr>
</tbody>
</table>

*Data Provided by UOP

- **23 °C Lower Freeze Point**
- Nearly 4% more energy content
BioJet, Boeing and UOP have partnered to flight-test GreenJet fuel

December 30th, 2008
Air New Zealand
Jatropha

January 7th, 2009
Continental Airlines
Algae & Jatropha

January 30th, 2009
JAL
Camelina, Algae

August 2nd, 2009
Ms. Boeing, Seafair, Seattle WA
Camelina, Algae
GreenJet – Reduces Greenhouse Gas by 84%*

* Based on a Life Cycle Assessment performed by Michigan Technological University
Fuel From Camelina – Next Generation Biofuel Feedstock

84% GHG reduction vs. Jet-A
*Based on results from Michigan Technological University Life Cycle Assessment (LCA)

100% Drop-in replacement

Does not compete with food

Camelina Feedstock

UOP
A Honeywell Company

Ecofining™ Process

GreenJet/Diesel Fuel

BioJet Sustainable Fuels
Camelina – “Industrial Canola”

Advantages of Camelina

- Thrives on marginal soils; 5M+ targeted acres
- Annual farm input cost:
  - Camelina: ~$60/acre
  - Canola: ~$137/acre
- $.40-.70 per gallon less than soybean & palm oil

TGI Yield increase results

- TGI has improved yields through breeding by 33% in two years of development
- TGI expects 100%+ yield increase with yield genes by 2011

Camelina Field Trials

![Camelina Field Trials](image-url)
Targeted Growth: Examples of yield increase in Oilseed Crops

**Soybean**
- Yield Increase: 50%, 67%, 35%

**Canola**
- Yield Increase: 50%, 77%, 150%

Soybean Field Trials in Chile February 2008

Canola Field Trials in Saskatoon July 2007
Characteristics of Camelina

- Member of *Brassicaceae*
  - Related to Arabidopsis, Canola, etc.

- Low input crop
  - Adapted to marginal conditions
  - Northern U.S. and Southern Canada
  - Central Europe
  - Southeast Asia

- Oil producing crop
  - Seed Oil in the Range of 35-38%

![Graph showing fatty acid percentages in Camelina](image.png)
Sustainable Oils uses three cumulative methods to enhance the yield of its camelina. Each of these “Elite” programs will dramatically increase crop yield.

*Note: Traditional crops like soybeans have experienced +400% crop yield increases due to breeding, in the past few centuries. Because camelina is a new agricultural crop, yield-enhancing breeding programs will have a dramatic effect on increases in production.
In collaboration with Solix Biofuels, TGI works with a unique closed photo-bioreactor technology.
BioJet – History and Milestones

- BioJet Formed (2008)
- Pre-Construction (2009)
- Construction (2009-
  2010)
- Sales (2010-
  2011)
- Production Contract (2011)
- DOE Grant (2011)
- ASTM Cert. (2011-
  2012)
- Loan Secured (2012)
- Pipeline Cert. (2012)
Thank You!

BioJet
Sustainable Fuels

Next generation aviation biofuels

BioJet  GreenJet fuel  Camelina  Algae  Bio Refining