# JAL BIOFUEL
# Flight Demonstration


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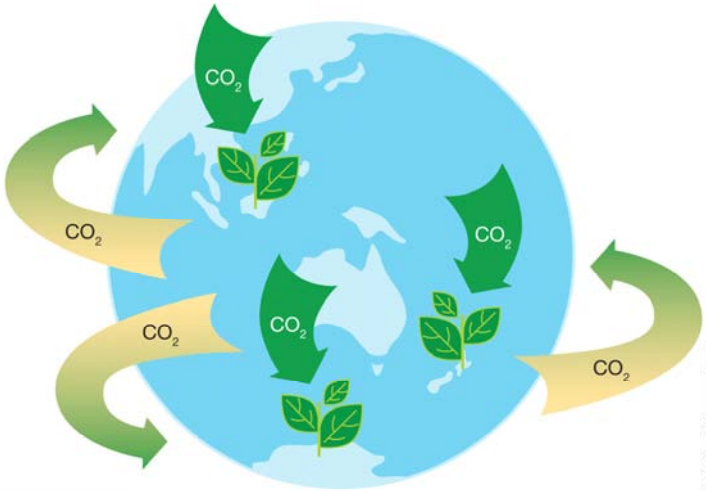
# Biofuel

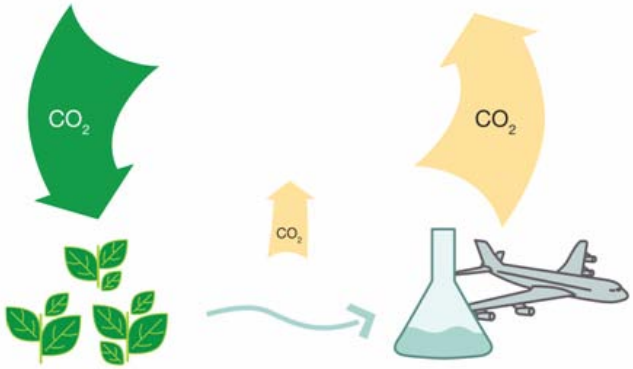



**Plant-based fuel**

**Plant-based feedstocks absorb $CO_2$ emissions as the feedstocks grow.**

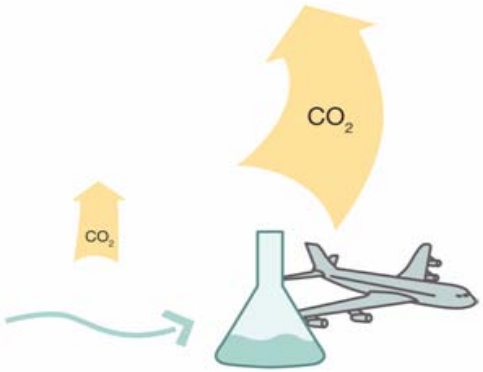
**Petroleum-based fuel**

**$CO_2$ emissions from petroleum-based fuel are NOT absorbed because the source of the fuel is not plant-based.**



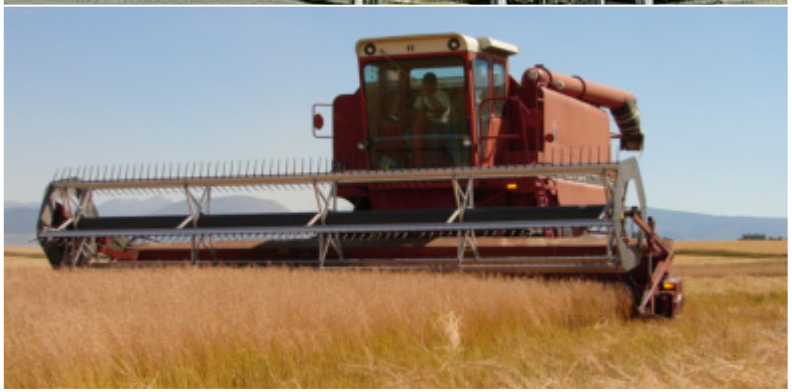

Biofuel

**Jet-A**



# JAL Biofuel Flight Test Program Overview

- **Purpose: Encourage sustainable biofuel development for aviation**
- **Work with feedstock suppliers & fuel processors**
- **Focus on sustainable biofuels to address industry concerns about:**
  - **$CO_2$ emissions, fuel availability and cost**
- **Demonstrate biofuel production, test, operability & benefits**



JAL

BOEING

Pratt & Whitney
A United Technologies Company

UOP
A Honeywell Company

Sustainable Oils
Your trusted energy growth partner.

# Airlines and Engine Manufacturers

**4 airline and 4 engine manufacturers are participating in Boeing Biofuel Project**

- **Virgin Atlantic: Boeing 747-400 + GE Engine**
- **Air New Zealand: Boeing 747-400 + Rolls-Royce Engine**
- **Continental Airlines: Boeing 737 + CFM Engine**

**Japan Airline: Boeing 747-300 + PWA Engine**

# Biofuel Demo Flight Process

**Evaluate bio feedstocks**

**Identify required processing methods**

**Help create "drop-in" $CO_2$ neutral, sustainable biofuel**

**Demonstrate use of biofuel**

# Sustainable Biofuels Will Primarily Stem from Second Generation Sources

## First-generation biofuels

- Inefficient and unsustainable sources of energy
- Require large landmasses and mostly grown for human consumption
- Annual crops which remove natural carbon sinks
- Fatty Acid Methyl Ester (FAME) Fuel

***Examples:***

**Ethanol produced from corn and soybean feedstocks**

**Soybean**

## Second-generation biofuels

- Derived from *non-food crops* utilizing *new biomass-to-fuel-conversion technologies*
- Sustainable sources of energy
- Require smaller landmasses and improve carbon sinks in degraded areas
- Non-FAME Fuel

***Examples:***

**New fuels from algae, jatropha, Switchgrass, and other feedstocks**

**Babassu**

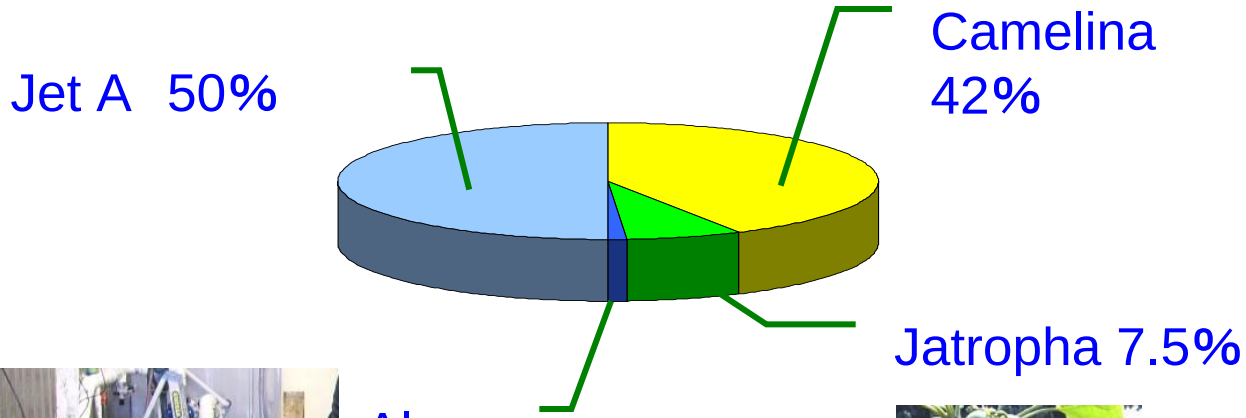
**Algae**

**JAL Demo Flight to Use**

**Non-food Crop Derived 2nd Generation Biofuels**

# Blended Biofuel - JAL

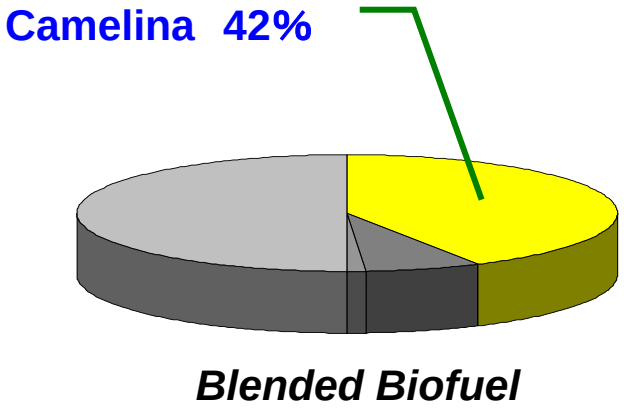
- **Biofuel 50%、Jet A 50%**
- **Feedstocks of Biofuel are Camelina, Jatropha and Algae.**




# Biofuel Feedstock - Camelina

**Camelina**

- **Camelina is an energy crop, given its high oil content and ability to grow in rotation with wheat and other cereal crops.**
- **The crop is mostly grown in more moderate climates such as the northern plains of the U.S, and originally hails from northern Europe and Central Asia.**
- **It can be grown even in dry areas, poor soil and at high altitudes.**
- **It is classified as a 'traditional' crop, but is considered next-generation given that its primary use is as a biofuel feedstock 。**



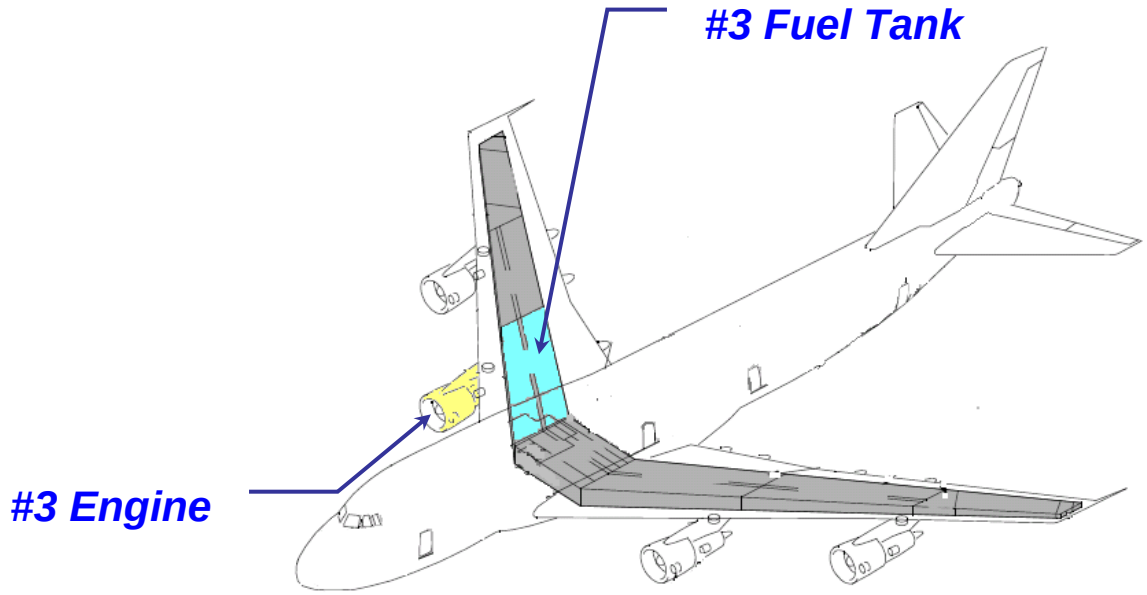

***Blended Biofuel***

# About Jet Fuel

- **Characteristics of Jet Fuel**
  - **Kerosene, called Jet A or Jet A1**
  - **Required Special Characteristics because of Aircraft Operational environment: Temperature, Pressure, etc..**
    - **Volatility**
    - **Combustibleness**
    - **Cold Performance**
    - **Low Sulfurous**
    - **Thermal Stability**
    - **Etc**
- **Bio Jet Fuel also needs to meet these requirements.**

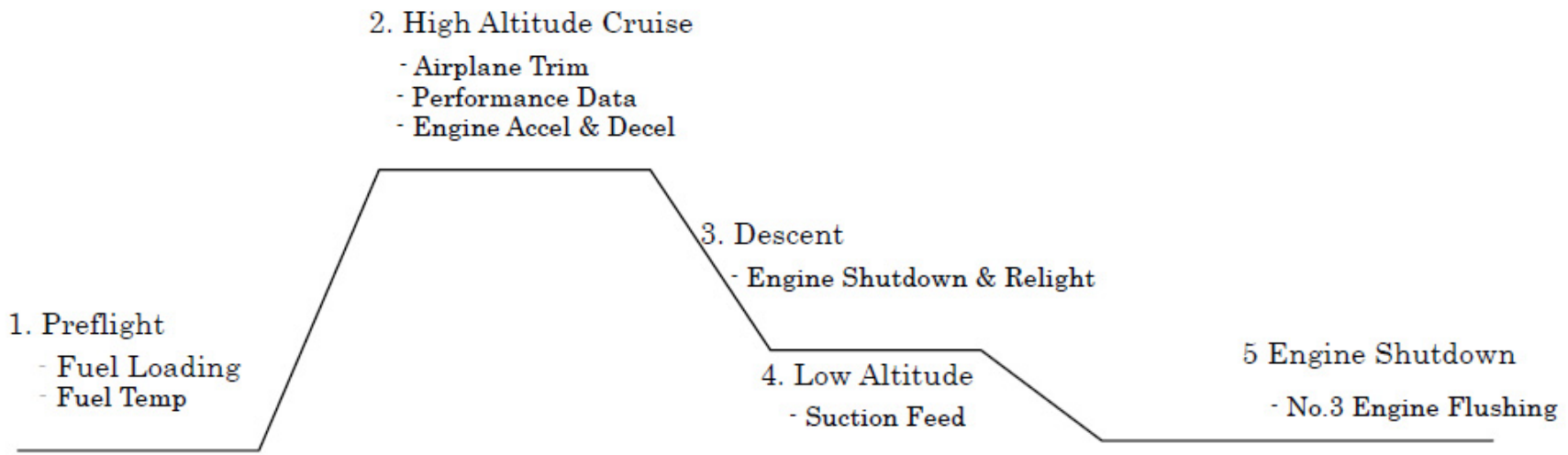
# JAL Biofuel Demonstration Flight

- **Date: 2009/1/30**
- **Area: Departure/Arrival at Haneda Airport.**
  **(Approximately 1.5 hour flight)**
- **Airplane: Boeing 747-300 with PW JT9D engine**
- **Load blended Biofuel in #3 Tank and use in #3 engine.**
- **Other Tanks/engines are operated with Jet A.**



# JAL Bio Fuel Flight Profile

1. Preflight
   A. Fuel Loading
   B. Fuel Temperature
2. High Altitude Cruise (35,000～39,000 ft)
   A. Airplane Trim
   B. Performance Data
   C. Engine Acceleration & Deceleration
3. Descent
   A. Engine Shutdown & Relight
4. Low Altitude (15,000～20,000 ft)
   A. Suction Feed
5. Engine Shutdown
   A. No.3 Engine Flushing



# Demo Flight - Fueling

# Demo Flight – Preflight Ceremony

# Demo Flight – Taxiing to Takeoff

# Demo Flight - Landing

# Demo Flight – After Landing

# After the Demo flight ….

- We will analyze the aircraft data during both ground runs and Flight compared with conventional Jet A operation.
- Results from the project will be made public. This includes feedstock selection, fuel processing, fuel property testing, engine operability and emissions tests, and an analysis of data taken during the flight .
- We expect the report will help the discussion to add the Biofuel to conventional Jet fuel specification.
- Once Biofuel will be authorized as Jet Fuel, we can use the Biofuel as same as conventional petroleum-based Jet fuel.
- To make the Biofuel viable, I think still many hurdles must be cleared such as
  - How to keep a certain amount of biofuel available
  - Make the Biofuel cost competitive to the Jet fuel

# THANK YOU !!!