National Aeronautics and Space Administration

Subsonic Fixed Wing Project
Alternative Fuels Research

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Green Aviation Summit
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NASA FAP Alternative Fuels Research Effort

National Plan Goals...
Energy and Environment Goal 1: Enable new aviation fuels derived from diverse and domestic resources to improve fuel supply security and price stability.
Energy and Environment Goal 3: Advance development of technologies and operational procedures to decrease the significant environmental impacts of the aviation system.

FA/SFW Technical Challenge (draft):
Reduced Emission Aircraft - Enabling concepts and technologies to dramatically reduce or eliminate harmful emissions affecting local air quality/health and global climate change attributable to aircraft energy consumption.
NASA Alternative Fuels Effort

What are we trying to do?
• Develop technology and knowledge base that helps enable, improve, and sustain alternative fuels for the aviation industry.

Why?
• Alternative fuels have the potential for reducing the gaseous and particulate emissions of aircraft as well as reduce the aviation dependency on foreign petroleum.
NASA Alternative Fuel Research Facilities

Combustion Testing

CE-5 High Pressure Flametube

SE-5 High-Pressure Laboratory Scale Burner

Validation Experiments

Exhaust Plume Contrail Experiments

SE-11

Chemical Kinetics

CE-24 Well Stirred Reactor
NASA Alternative Fuels Research Facilities

- Alternative Fuels Laboratory
- Fischer-Tropsch Reactors
- Fuel Thermal Stability

Greenlab

- Fundamental Biomass Experiments/Model validation
## Alternative Aviation Fuel Experiment - AAFEX

**Location:** NASA Dryden Aircraft Operation Facility  
**Dates:** January 20 – February 3, 2009  
**Sponsors:** NASA, Air Force, EPA, FAA  
**Aircraft:** DC-8 with CFM56-2 engines  
**Fuels:**  
1. Standard JP-8  
2. Fischer-Tropsch Fuel from Natural Gas (FT1)  
3. 50/50 JP-8/FT1 blend  
4. Fischer-Tropsch fuel from Coal (FT2)  
5. 50/50 JP-8/FT2 blend  
**Runtime:** ~35 hours total
AAFEX Test Site Arrangement

Boeing, GE, Pratt and Whitney, CMU, Harvard, MSU, UCSD, and UTRC also participated.
Particles Greatly Reduced with F-T Fuel
Advanced Low Emissions Combustor Concept Testing with Biojet Fuel in NASA CE-5 Flametube Facility

9-Point LDI

NOx Emissions

Particulate Emissions
Alternative Fuels Research Laboratory

- Hot Liquid Process Simulator for fuel thermal stability studies
- Three 1-L Fischer-Tropsch Reactors to study F-T reaction process in order to increase jet fuel yield and reduce energy consumption
- Advanced catalysts will be developed and tested

F-T Reactor Product Samples
Collaboration with DOE NETL to investigate lipid extraction and analysis from several Salicornia species

Algae Open Pond Modeling Interdisciplinary approach combining biology-transport physics to optimize overall open pond algae process

Collaboration with Seambiotics, Phycal LLC
Broad Range of Research Activities are being conducted on Alternative Fuels