



In the Midst of A Fuels Evolution – An Army Perspective

2006 SAE Commercial Vehicle Engineering Congress
& Exhibition

Industry Forum: Alternative Energy for the Future



SUPERIOR TECHNOLOGY



FOR A



SUPERIOR ARMY

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In The Midst of A Fuels Evolution

- Army is already using alternative fuels in its non-tactical fleets
- Fuels used in tactical fleets must accommodate military's worldwide deployment
- Under the Office of the Secretary of Defense (OSD) Assured Fuels Initiative, DOD is pursuing qualification and use of unconventional fuels (not made from petroleum) in its aircraft, ships and tactical vehicle fleets



Fuel Use in Non-Tactical Vehicle (NTV) Fleets

(2005 Federal Fleet Report, Government Services Administration)

Army's GSA Fleet Profile*

By Type of Vehicle (57,422 total)

Sedans, Vans,
SUVs
58.9%

Light Trucks
15.6%

Buses
3.4%

Heavy Trucks
5.7%

Medium Trucks
16.3%

By Vehicle Fuel Type

Gasoline
49.9%

Diesel
21.0%

E-85
27.5%

LPG, CNG,
LNG, Electric
1.6%

Fleet Fuel Use*

• Under EPA Act, E.O. 13149, NTV fleets operating in U.S. must increase use of non-petroleum based fuels

• On-going efforts to add refueling stations for alternative fuels

By Type of Fuel ** (51 M gal total)

Gasoline
83.5%

E-85
0.1%

LPG, CNG,
LNG, Electric
0.01%

Biodiesel
(B20)
0.4%

Diesel
15.9%

** All data in gasoline gallon equivalents (GGE).

* Data shown for worldwide profile; about 93% of fleet is domestic.



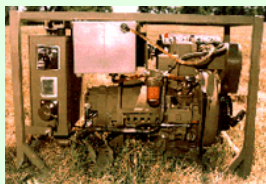
Army Tactical Vehicles and Equipment

- Tactical vehicle fleets (wheeled and tracked)
- Various other equipment (CE & MHE, Other, Future)
- Army aircraft (not shown) — various helicopters and UAVs (Unmanned Aerial Vehicles)

Other



POWER PLANTS



GENSETS



FORK LIFTS

Wheeled Vehicles



HMMWV



FMTV



STRYKER



HEMTT

Tracked Vehicles



ABRAMS



BRADLEY



M113

Construction & Materials Handling Equipment

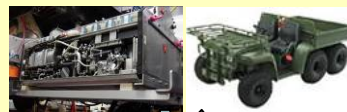


**CRANES / DOZERS /
SCRAPERS / GRADERS**

Future Equipment



**HYDROCARBON
REFORMERS**



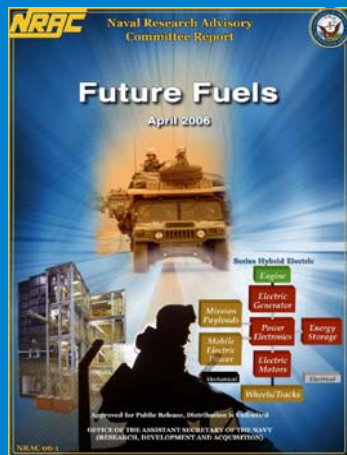
**FUEL CELL
APUs**



Tactical Mobility Fuel

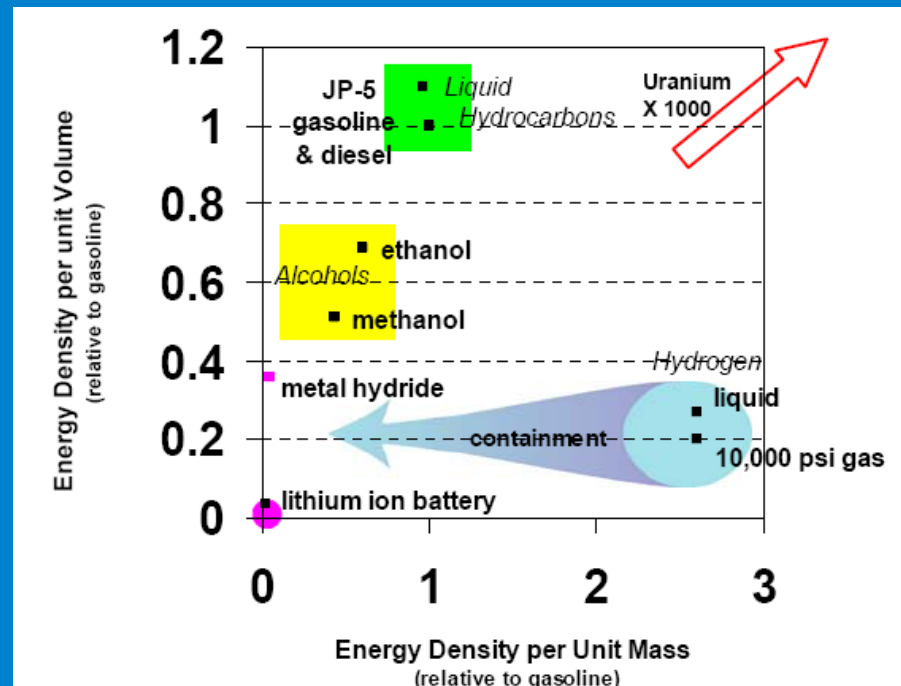
- Tactical vehicle designs impose severe limitations on volume and weight

- Energy density is therefore the primary consideration for fuel



The Naval Research Advisory Committee –
NRAC Report on
Future Fuels, 04/2006.

- Hydrogen presently unsuitable as a tactical mobility fuel
 - made using other fuels
 - containment reduces energy density by 10× - 20×



NRAC Future Fuels Report, 04/2006

**Liquid hydrocarbons –
the ideal fuel for tactical
mobility**



DOD Key Fuels and Specifications

Single Battlefield Fuel

Kerosene-type fuels

JP-8 / F-34

- MIL-DTL-83133

JP-5 / F-44

- MIL-DTL-5624

Jet A-1 / F-35

- ASTM D 1655 (U.S.)
- Defence Standard 91-91 (most ROW)

Commercial & Other Military Fuel

Diesel fuels

No. 2-D and No. 1-D

- A-A-52557 (CID*)
 - ASTM D 975

F-76 (mil-spec marine distillate fuel)

*Commercial Item Description

End-uses in DoD fleets



**CI engines
designed to use
diesel fuel**



Biodiesel Not Approved for Use in Tactical Vehicles

*Critical issues arise due to factors for use differing from those typical of commercial or non-tactical fleets –
Tactical vehicles/equipment must be ready for
worldwide deployment at a moment's notice*

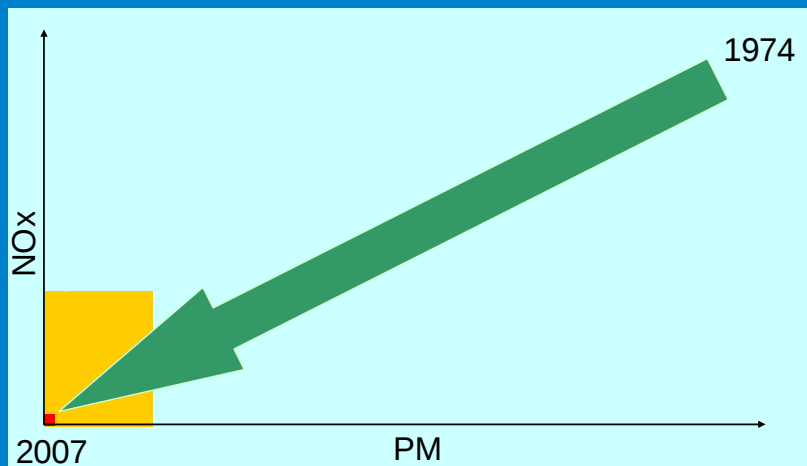
- Fuel stability is poor – susceptibility to oxidation
 - Acids/polymers formation (filter plugging, high-T deposits)
 - No guarantee fuel is stable (no stability test in B100 spec)
 - No guarantee use will always be in timely manner (true tactical fleet)
 - Degradation in short time-frames possible (affects ability to store equipment)
- Low temperature properties are unacceptable
 - Incl. blends with JP-8 (+20°C freeze point) or diesel fuel (+2-3°C cloud point)
- Other
 - Elastomer compatibility
 - Water affinity
 - Microbial growth
 - Solvency effect



Emission Standards & Fuel Quality – Some Impacts

2007 / 2010

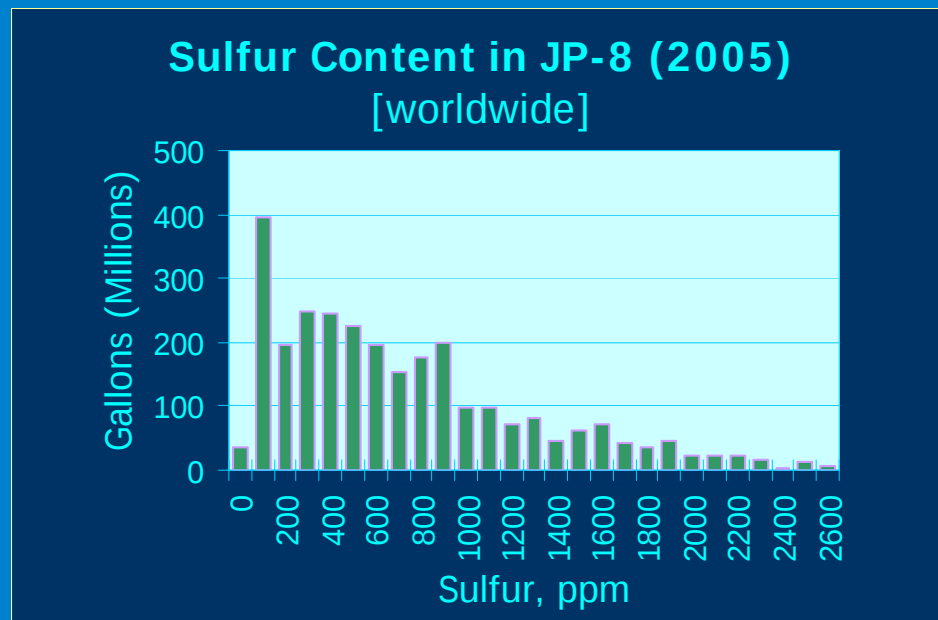
Emission Standards – Drastic Impact on Tactical Vehicles



Engines with aftertreatment systems and/or EGR systems would cause significant vehicle integration and thermal management issues.

Engine systems must be modified to meet military requirements.

JP-8 sulfur content typically far exceeds that of fuel newer engines designed to use (<15 ppm sulfur)



Data from PQIS 2005, DESC-BP

Tactical vehicles in U.S. fueled with JP-8 for deployment readiness.

Continued National Security Exemptions* from EPA needed.

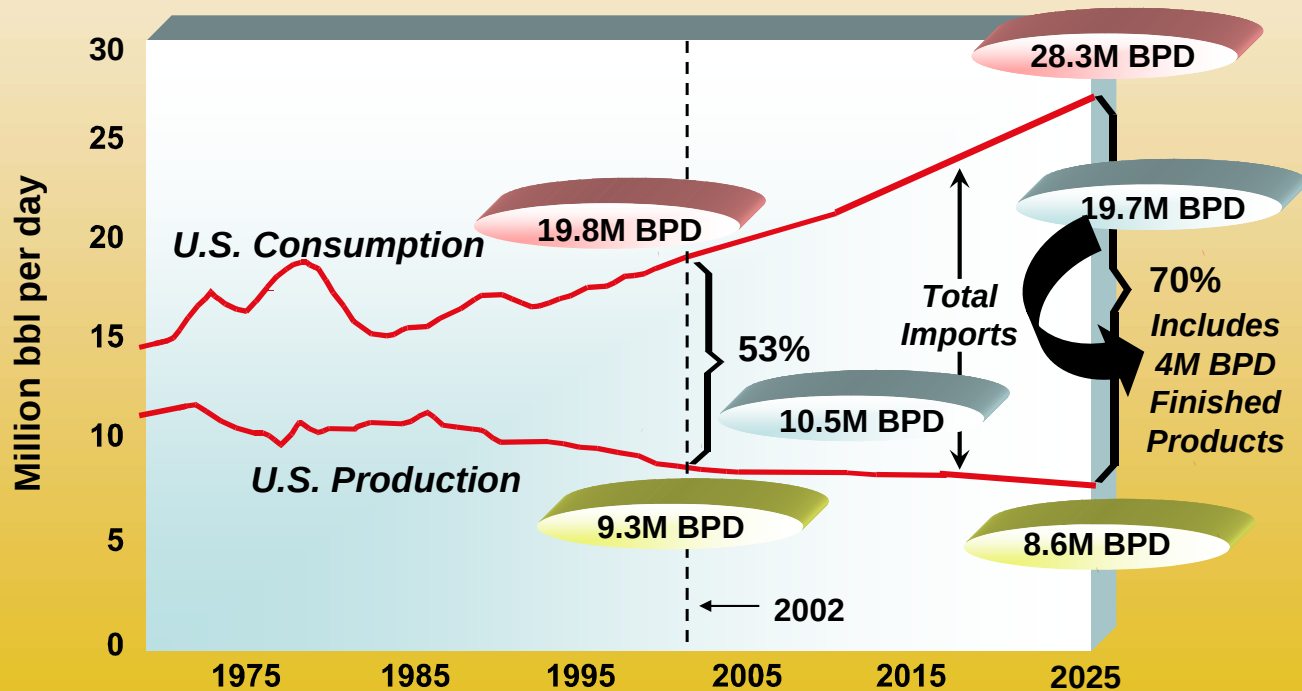
* For emissions and use of high-sulfur fuel. 8

OSD Assured Fuels Initiative

Vision: DoD/AT&L intends to catalyze commercial industry to produce clean fuels for the military from secure domestic resources using environmentally sensitive processes as a bridge to the future.

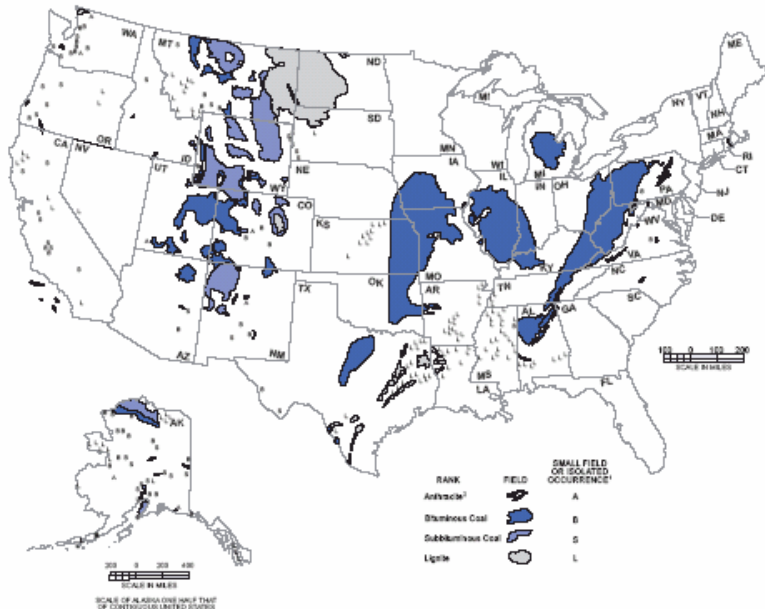
Dr. Theodore K. Barna
Assistant Deputy Under Secretary of Defense
Advanced Systems and Concepts

Increasing Reliance on Petroleum Imports



Evaluating All US Energy Resources

Coal

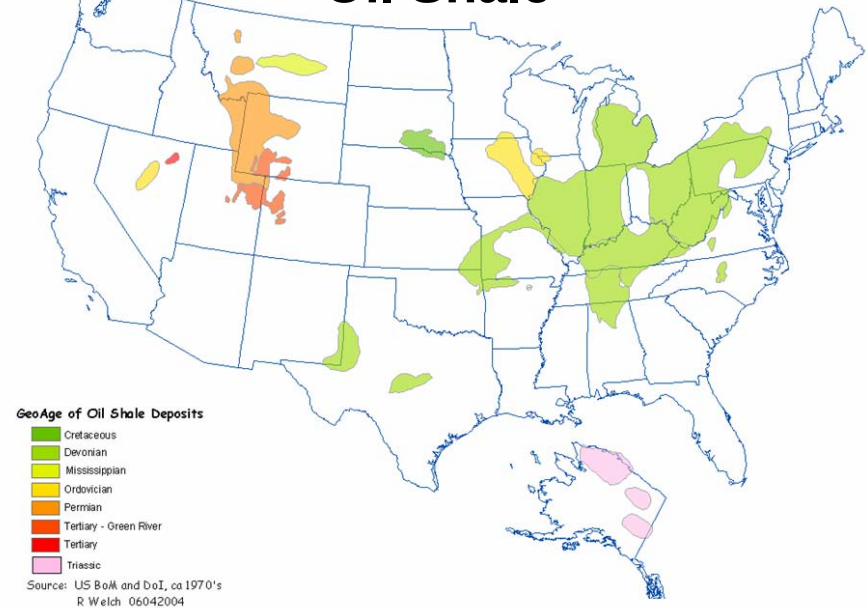


Sources: United States Geological Survey, Coalfields of the United States, 1960-1961; Texas Bureau of Economic Geology, Lignite Resources in Texas, 1980; Louisiana Geological Survey, Near Surface Lignite in Louisiana, 1981; Colorado Geological Survey, Coal Resources and Development Map, 1981; and Mississippi Bureau of Geology, 1983.

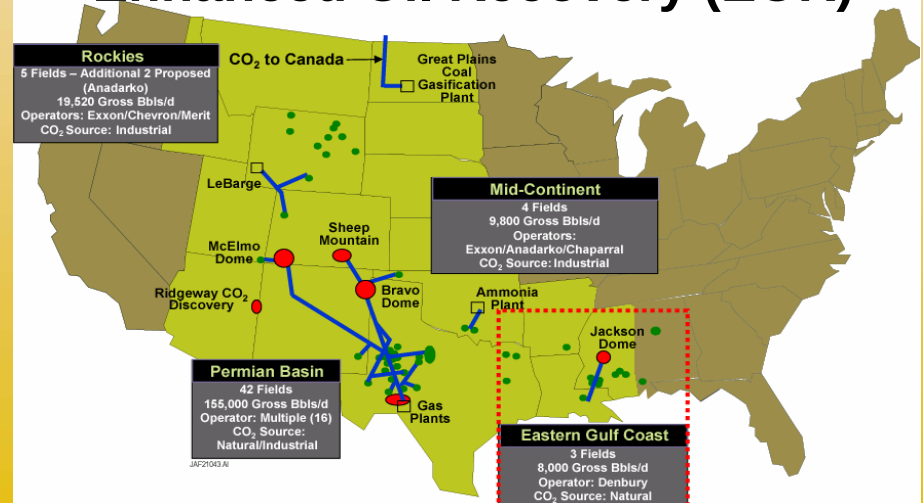
Domestic Resources

- + 1.4 Trillion barrels (shale)
- + 900 Billion barrels of FT (coal)
- + 0.15 Billion barrels (pet coke)
- + 22.7 Billion barrels oil reserves
- + 32+ Billion barrels of oil (EOR)
- + 100 Million pounds of pulp waste/year
- Total 2.3+ Trillion barrels equivalent**

Oil Shale



Enhanced Oil Recovery (EOR)

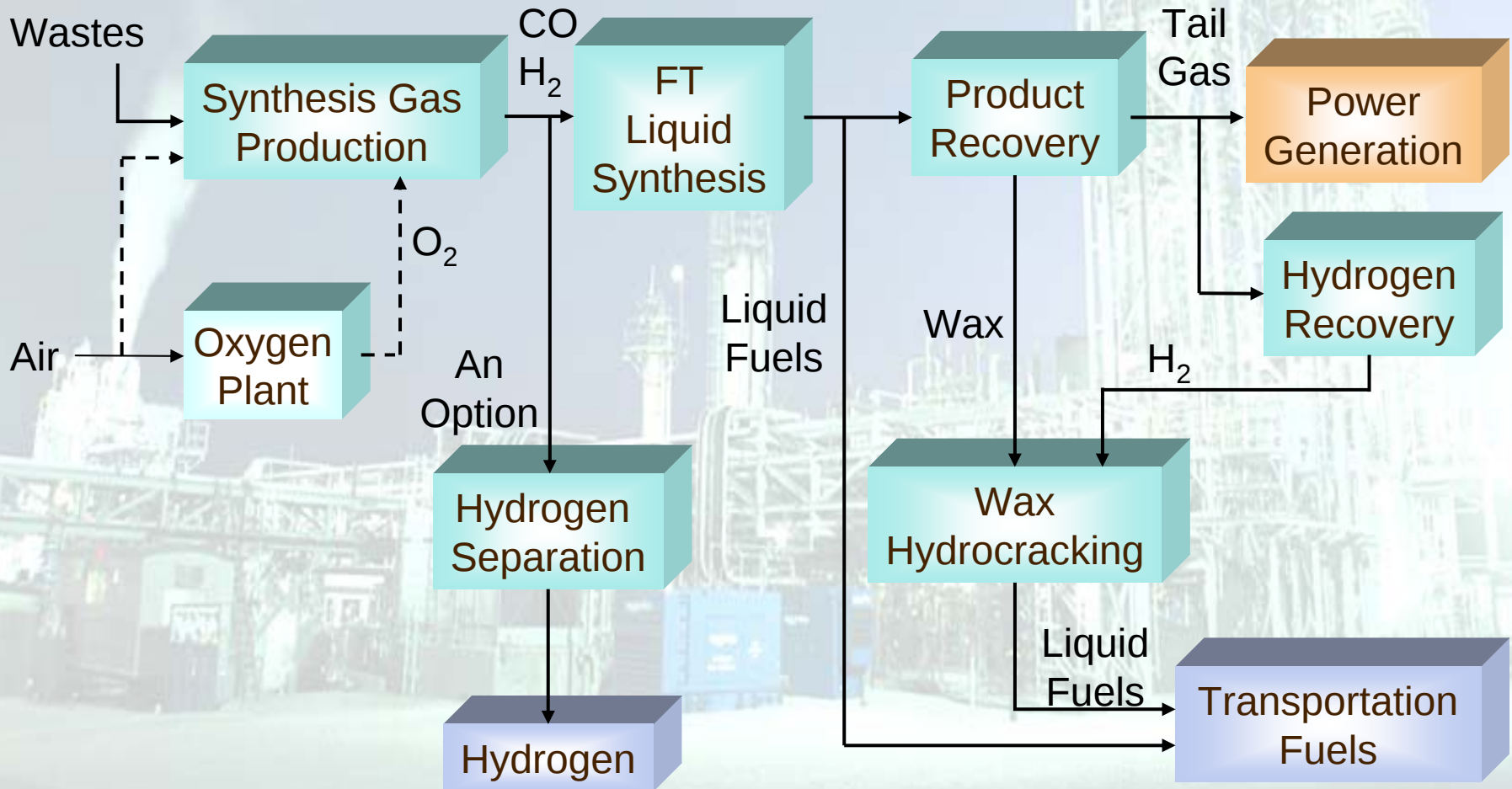


Key Goals

- **Total Energy Development (TED) Program**
 - Catalyze the industry to produce fuels for the military from domestic energy sources.
 - Develop a roadmap to provide fuel for the Joint Battlespace Use Fuel of the Future Program and implementation
- **Joint Battlespace Use Fuel of the Future (JBUFF) Program**
 - Develop fuel specifications that allow for use of fuels made from unconventional (non-petroleum) resources in tactical ground vehicles, aircraft, ships, and other military equipment
 - Qualify use of fuels in all tactical vehicles, aircraft and ships
 - Provide a transition plan for DoD-wide use of unconventional fuels

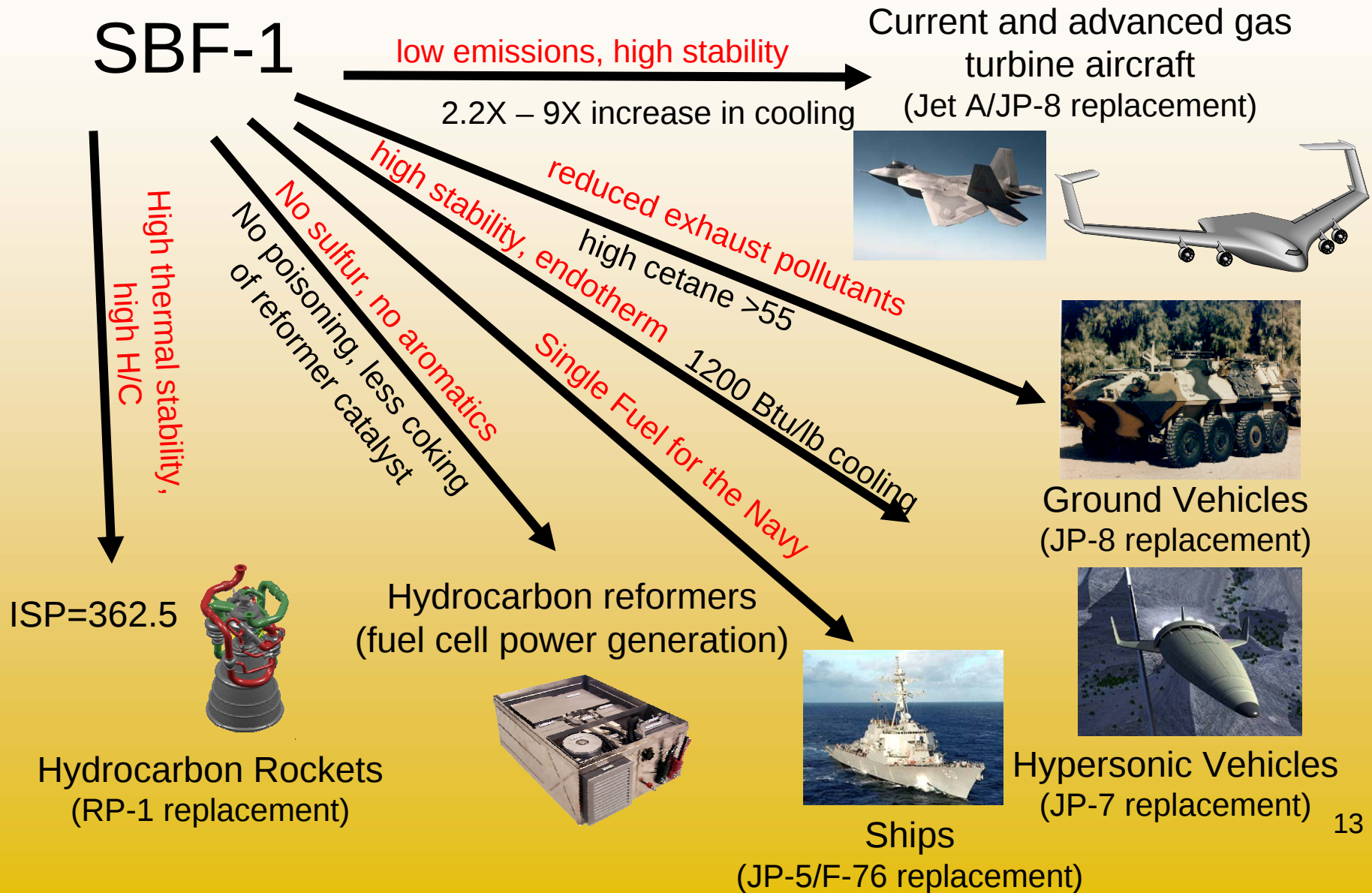
Fischer-Tropsch Technology

Natural Gas
Coal
Pet Coke
Biomass
Wastes



SINGLE BATTLESPACE FUEL

From Unconventional Resources



EPAct 2005

- Declares oil shale, tar sands, and other domestic and unconventional resources strategically important and that they should be developed to reduce the growing dependence of U.S. on politically and economically unstable sources of foreign oil imports
- Requires DOD develop strategy to use fuels produced from these resources
- Provides DOD authority to procure such fuels
 - Multiple and multi-year contracts allowed
- Requires creation of Federal Task Force
 - By Secretary of Energy, in conjunction with Secretary of Interior, Secretary of Defense
 - To recommend a program to accelerate commercial development of clean fuels made from these domestic resources
 - Members of task force to include Governors of affected States and Representatives of local governments in affected areas

91 -- Request for Information - Synthetic Fuel

Vendors
Federal Business Opportunities



91 -- Request for Information - Synthetic Fuel

• [Attachments \(1\)](#) - Posted on May 30, 2008

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Contracting Office Address

Defense Logistics Agency, Logistics Operations, Defense Energy Support Center, 8725 John F. Kingman Road, Fort Belvoir, VA, 22060-6222

Description

PART I: SHORT-TERM OBJECTIVE

This is a Request for Information (RFI) only as defined in FAR 15.201(a). The Government seeks to identify responsible potential sources and obtain information regarding possible supplies of synthetic fuel for aviation purposes that meet the Fitcher-Tropisch dual synthetic fuel specifications for delivery to various Air Force and Navy installations for aircraft Weapon Systems testing and subsequent use. The Department of Defense (DoD) is investigating the feasibility of aviation synthetic fuel requirements of up to 200,000,000 U.S. gallons, or any portion thereof, for delivery during calendar year 2008, with 100,000,000 gallons meeting the JP-8 flashpoint of 18 degrees C and 100,000,000 gallons meeting the JP-5 flashpoint of 60 degrees C.

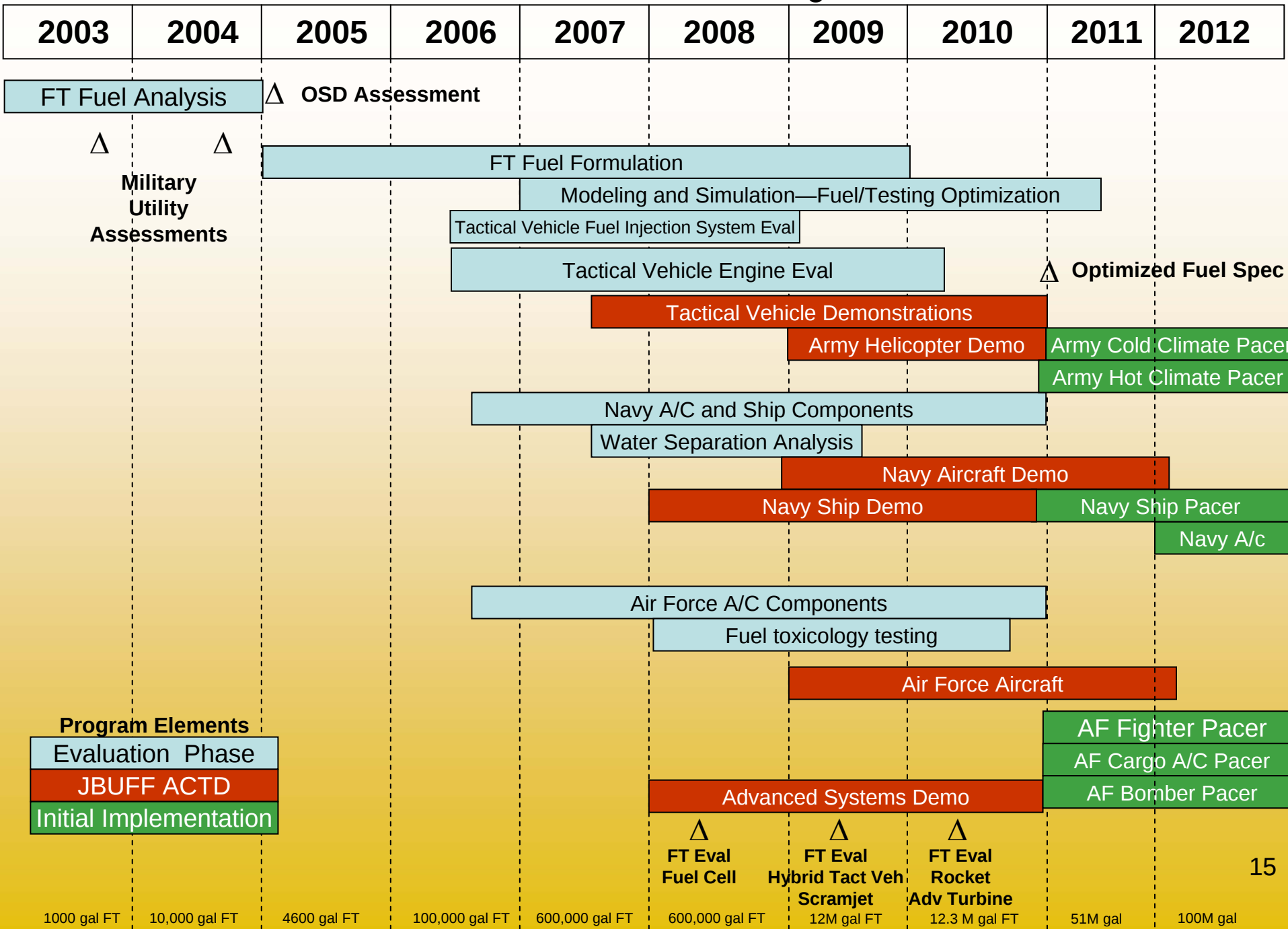
PART II: LONG-TERM OBJECTIVE

DoD is interested in long-term prospects for the manufacture and supply of aviation synthetic fuels in increasing quantities, with an emphasis on domestic industrial capability and feedstocks.

<http://www.fbo.gov/PL/AT/CFR/2008/05/30/91001/91001.asp>

*Defense Energy Support Center
issued Request for Information from
potential suppliers of synthetic fuel.*

Straw-man Overall JBUFF Coal FT Fuel Program to Produce SBF-1





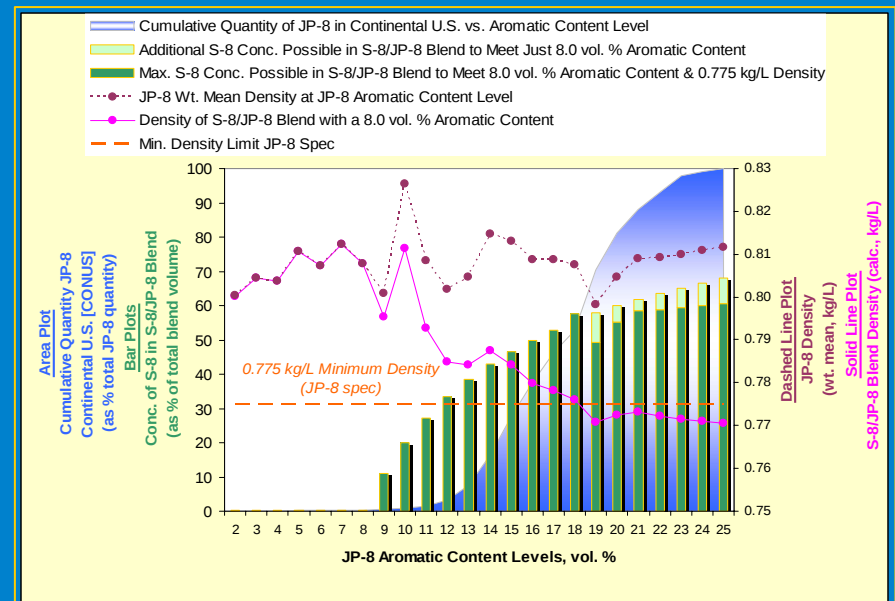
Near-term use of Fischer-Tropsch (FT) Fuel

SAE Paper No. 2006-01-1702, April 2006

“Properties of Fischer-Tropsch (FT) Blends for Use in Military Equipment”

Muzzell, P.; Stavinoha, L.; Freerks, R.; McKay, B.; Terry, A.; Sattler, E.

- Use of synthetically-derived (FT) hydrocarbons in blends with JP-8 is reasonable strategy to begin evolution towards reducing petroleum content of military's primary bulk fuel
- In near-term, FT fuel supply availability realistically only supports wide-use implementation of blends



Significant amounts of FT kerosene can be used in blends with JP-8 in continental U.S. to produce fuel meeting established criteria for use of semi-synthetic jet fuel in aircraft.

THE WORLD'S ULTIMATE WEAPON RUNS ON WATER...
EVERYTHING ELSE RUNS ON FUEL.

