Fuels of Tactical Use to the DON

30 Jan 2014

Presented To: Farm To Fleet Industry Day

Presented By: Rick Kamin
Navy Fuels Lead

Navy Tactical Fuel Specifications

JP-5
Specification
MIL-DTL-5624V

F-76
Specification
MIL-DTL-16884M

JP-5

- Revision V issued July 2013
- Includes up to 50% blends of Fischer Tropsch and HEFA
- Cites ASTM D7566 Appendices A1 and A2 with modifications to some properties

F-76

- Revision N target issue date Feb 2014
- Revision will include:
  - Up to 50% blends of Fischer Tropsch and HEFA
  - Lower max sulfur to 15 ppm

JP-5 Applications

Aviation

Afterburners

Non-Afterburners

MIL-DTL-5624V JP-5 Spec

Carrier Support Equipment

Ship Propulsion (JP-5 Downgrades)

Carrier Emergency Diesel Generators

Differences Between JP-5 and Commercial Aviation Fuel

JP-5 (MIL-DTL-5624V)	Requirements	Commercial Aviation (Jet A)
60°C (min)	Flash Point	38°C (min)
-46°C	Freeze Point	-40°C
.788-.845 kg/L	Density	.775-.840 kg/L
40 (min) *Alt Fuel blends only*	Derived Cetane Number	No Requirement
13.4 mass% (min)	Hydrogen Content	No Requirement
AO, CI/LI, FSII Required	Additives*	Additives Optional

*AO – Antioxidants
CI/LI - Corrosion Inhibitor / Lubricity Improver
FSII - Fuel System Icing Inhibitor

F-76 Applications

Boilers

Gas Turbines

MIL-DTL-16884M F-76 Spec

Diesels

Differences Between F-76 and ISO 8217

F-76 (MIL-DTL-16884M)	Requirement	ISO 8217
12.5 wt% (min)	Hydrogen Content	Not Specified
Ca: 1.0mg/kg Na+K: 1.0mg/kg Pb: 0.5mg/kg V: 0.5mg/kg	Metal Content	Not Specified
-1°C (max)	Cloud Point	Not Specified
10 min (max)	Water Separability (Demulsification)	Not Specified
460 microns (max)	Lubricity	520 microns (max)
1.5 mg/100mL (max) *40 hour test*	Storage Stability	2.5 mg/100mL (max) *16 hour test*
0.1 wt% (max)	Sulfur Content	1.5 wt% (max)

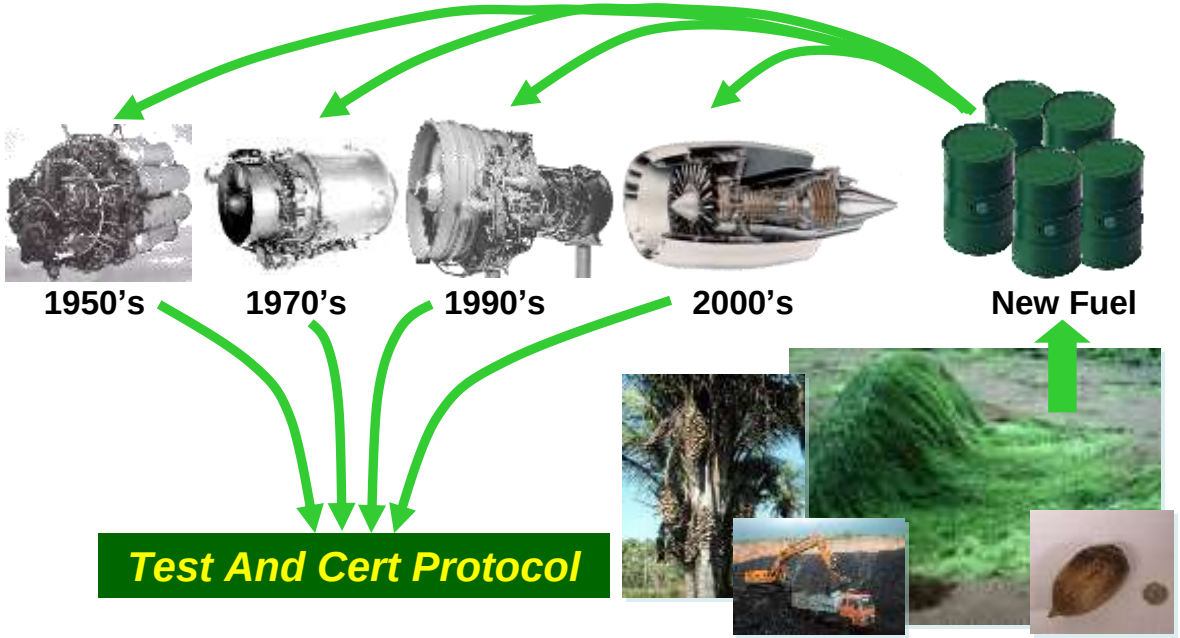
Primary Qualification Requirement

Must be a drop-in replacement, invisible to the operator

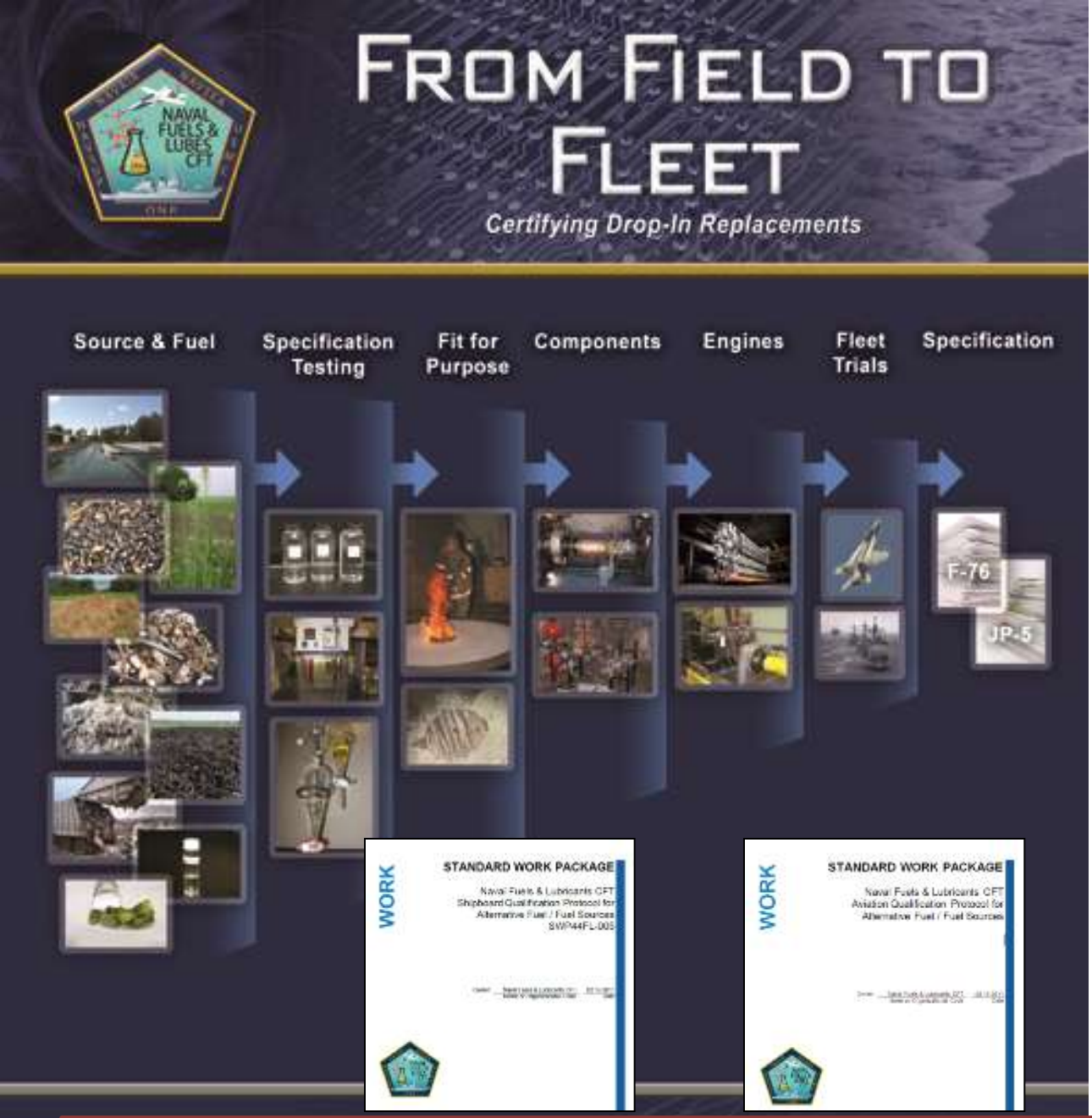
- ✓Meets fuel performance requirements
- ✓Can be mixed or alternated with petroleum fuel
- ✓Requires NO change to aircraft or ship
- ✓Requires NO change to infrastructure

Challenge:

Existing Systems



Not Changing the Fuel : Just The Source



Qualification Process

Phase 1:

- Chemical And Physical Property Similarity
  - Specification
  - Fit For Purpose

Phase 2:

- Performance Similarity
  - Materials
  - Components
  - Propulsion/Fuel Systems
  - Distribution Systems

Phase 3:

- Operational Similarity
  - Platform Trials

Phase 4:

- Fleet Operability
  - Field Trials

Separate Qualifications For Naval Aviation And Ship Propulsion Fuels

JP-5 Qualification Protocol: Components, Full Scale and Platform Tests

System	Component Test	Full Scale Test	Platform Trial
Fuel Handling	Shipboard Fuel Test Equipment	Centrifical Purifier, Filter-Coalescers	
Diesels	Injectors: EMD 645, PA-6B	EMD645, FME PA-6B	
Gas Turbines	Atomizers: Honeywell 131-9, 36-200, 85-129H, G250 Fuel Control: GE 414 Combustors: GE F414, RR AE3007	GE-414-400, RR-402-408, Honeywell GTCP 36-200	F/A-18 E/F, MV-22

F-76 Qualification Protocol: Components, Full Scale and Platform Tests

System	Component Test	Full Scale Test	Platform Trial
Fuel Handling	Shipboard Fuel Test Equipment	Centrifical Purifier, Filter-Coalescers	Self Defense Test Ship (ex- Paul F. Foster (EDD 964))
Diesels	Injectors (Cat 3500, FME 38D 8-1/8, MTU396, Paxman-Valenta RP2000, Yanmar L)	Cummings QSB, CAT 3512B, MTU 396, FME 38D 8-1/8	Rigid Hull Inflatable Boat
Gas Turbines	Injector Atomizers, Combustor Rig (RR 501-34K)	RR 501-34 K	Self Defense Test Ship (ex- Paul F. Foster (EDD 964))
Boilers	Block Valves, Spray Plates		

Current Efforts/Plan Forward

JP-5

- **Alcohol To Jet**
  - Lab testing 95% Complete
  - Component/ Engine Testing In Process
  - Flight Tests Planned Summer 2014
- **Direct Sugar To Hydrocarbon**
  - Lab testing 90% complete
  - Similarity analysis on-going to determine component/engine req'ts
- **Hydroprocessed Depolymerized Cellulosic**
  - Lab testing 70% complete
  - F414 combustor test planned 2014
  - Component/Engine testing planned 2015
- **Catalytic Hydrothermolysis**
  - Lab testing 60% complete
  - Component/Engine testing planned 2015

F-76

- **Direct Sugar To Hydrocarbons**
  - Laboratory testing 95% Complete
  - Component /Engine Testing in Process
  - Platform trials planned 2014/15
- **Hydroprocessed Depolymerized Cellulosic**
  - Laboratory Testing 90% Complete
  - Component/Engine Testing in process
  - Platform trials planned 2015
- **Catalytic Hydrothermolysis**
  - Lab testing 60% complete
  - Component/Engine testing planned 2015

Summary

- Navy tactical fuels (JP-5 and F-76) have operational applications requiring spec requirements beyond those of commercial specifications
- Navy qualification protocols well defined but are living documents
- F-76 and JP-5 Fischer Tropsch and HEFA qualification testing successfully completed
  - JP-5 spec revised, F-76 spec revision close
- Navy aggressively moving to qualify promising candidates for both aviation and shipboard applications


Changing Paradigms
Diverse Energy Resources
Energy Efficient Acquisition
Existing Fleet Efficiencies
Culture & Behavior Changes
Tactical Advantage
Questions ?