Navy’s Energy Program

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• Increased efficiency translates to greater combat capability
  • Consuming less fuel allows for greater range with same amount of fuel
  • Lower fuel consumption means reduced strain on supply lines
The Evolving Energy Demand Demographic

**Worldwide Total Energy Demand**
(2005-2035)

**Worldwide Liquid Fuel Consumption**
(2007 & 2035)

‘Chindia’ and ROW are becoming the global energy driver

* Source: EIA International Energy Outlook 2010
Not only is oil a finite resource, but cost of production rises as the cheapest sources are exhausted.

*Source: Based on 2011 BP Statistical Review (assumes current rates of production continue and no new reserves found).
** Source: Brad Bourland, Chief Economist, Jadwa Investment Group, Riyadh
Navy Energy Goals

SECNAV Targets

Increased Alternatives Afloat 2020
50% of total DON energy consumption from alternative sources

Increased Alternatives Ashore 2020
At least 50% of shore-based energy from alternative sources; 50% of installations net-zero

Sail the “Great Green Fleet” 2012/2016
Green Strike Group: local operations/sail

Reduce Non-Tactical Vehicle Petroleum Use 2015
Reduce petroleum use in commercial vehicle fleet by 50%

Energy Efficiency Acquisition
Evaluation of energy factors mandatory when awarding systems/buildings contracts

CNO Targets

Reduce Consumption Afloat 2020
Navy will increase efficiency and reduce consumption afloat by 15%

Reduce Consumption Ashore 2020
Navy will increase efficiency and reduce consumption ashore by 50%

Protect Critical Infrastructure 2020
Navy’s critical infrastructure will have reliable backup/redundant power systems where viable
Retooling the Fleet

Expanding tactical reach and enhancing combat capability

Risk

Strategic Value
Energy ROI (eROI)

Shore Energy Security and Compliance

Minimize TOC
- Maximize cost savings and cost avoidance
- Complimentary SRM and BOS impacts/effects

Minimize Shore Energy Consumption
- Minimize energy consumption / maximize energy efficiency
- Maximize carbon neutrality, emissions reduction

Provide Reliable Energy to Critical Infrastructure
- Criticality of Infrastructure
- Reliance on energy
- Frequency and duration of outages
- Incremental back up power

Achieve Regulatory Compliance and Stakeholder Expectations
- Meet legal and regulatory mandates
- Enhance Quality of Life / Quality of Service for Navy
- Enhance public perception of Navy

Develop Enabling Infrastructure
- Improve data and information about energy production and consumption
- Develop Flexible Energy infrastructure
- Demonstrate and enable new energy technology adoption that enables energy independence

True eROI is complex and consists of both quantitative & qualitative factors
Changing the Acquisition Process

- **Policy Progress**
  - **Program Requirements Manual**
    - Energy Efficiency Key Performance Parameter (KPP)
    - Fully Burdened Cost of Energy (FBCE) reference into Sustainment KPP
  - **ASN (RDA) Memo**
    - Energy evaluation factors in the Acquisition Process
  - **Total Ownership Cost Guidebook**
    - Energy expenses to Operations & Support Costs section

- **Major Program Progress**
  - **OHIO-Replacement:**
    - Energy Efficiency Key System Attribute (KSA) for Capabilities Development Document
  - **Landing Ship, Dock (LSD(X))**:
    - Recommended Operational Energy as an attribute under the Mobility & Endurance Capability
  - **Fleet Replenishment Oiler (T- AO(X))**
    - Energy Efficiency KSA to be evaluated during the AoA phase

- **Next Steps**
  - Navy Operational Energy in Acquisition Team (EN-ACQT)
Culture Changes

- **Education**
  - Master's Program (Engineering and Policy)
  - Executive Education

- **Fleet**
  - Energy ‘E’
  - Aviation
    - ENCON: Improve fleet usage of fuel
  - Maritime
    - i-ENCON: Successful program
  - Expeditionary
    - SEAL Team Initiative: Goal of Net Zero Water/Energy
    - NSW Village Stability Operations
    - EX-FOB
Navy Biofuel Program

Alternative fuel must be a drop-in replacement, invisible to the operator

- Meets current fuel performance requirements
- Can be mixed or alternated with petroleum fuel
- NO change to aircraft or ship configuration
- NO change to transport/storage infrastructure

**Current**
Hydrotreated Renewables Test & Certification
- Chemical & Physical Properties
- Component Performance
- Platform Performance
- Long-term Operability

**Near-Term Future**
Feedstock/Process Validation
- Biological Conversion
- Biomass-Butanol-Fuel
- Pyrolysis
- Others

**Longer-term Biofuel Solution**
Integrated Alternatives

- Multiple Feedstocks
- Scale Up
- Cost-Effective

Engineer the fuel not the platform
# Potential JP-5/F-76 Non-Petroleum Production Pathways

<table>
<thead>
<tr>
<th>Process</th>
<th>Feedstock</th>
<th>Composition</th>
<th>Producers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogenated Esters and Fatty Acids (HEFA)</td>
<td>Deox Hydroprocessing</td>
<td>Triglyceride oils</td>
<td>Iso &amp; N paraffins</td>
</tr>
<tr>
<td>Fischer Tropsch</td>
<td>Gasification/FT &amp; Hydroprocessing</td>
<td>Coal/NatGas Biomass</td>
<td>Iso &amp; N paraffins</td>
</tr>
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<td>Gasification/FT &amp; Hydroprocessing</td>
<td>Coal/NatGas Biomass</td>
<td>ISO &amp; N paraffins &amp; 1-ring aromatics</td>
<td>SASOL, Shell, Rentech</td>
</tr>
<tr>
<td>Alcohol to Fuel</td>
<td>Fermentation-olig/hydrotreating</td>
<td>Sugar to Alcohol</td>
<td>Iso &amp; N paraffins</td>
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<td>Sugar to Alcohol</td>
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<td>Byogy, Swed Biofuels, Logos</td>
</tr>
<tr>
<td>Direct Sugar To Hydrocarbon</td>
<td>Fermentation</td>
<td>Sugar</td>
<td>Paraffins</td>
</tr>
<tr>
<td>Thermocatalytic</td>
<td>Hydrotreated, thermo-catalytic</td>
<td>Lignocellulosic</td>
<td>Paraffins &amp; aromatics</td>
</tr>
</tbody>
</table>
Commercial Adoption

➢ Regulation
  • Jul 2011, ASTM approval of 50/50 jet fuel
  • January 2012, EU Carbon Tax

➢ Wright brother moments
  • Dec 2008 – Air New Zealand first ‘drop-in’ biofuel flight
  • Jan 2009 – Continental US carrier biofuel flight
  • Mar 2011 – AeroMexico first commercial transplant Boeing 777

➢ Paris Airshow – Transplant biofuel flights
  • Boeing 747-8 with all engines burning biofuel
  • Gulfstream 450 first business jet to complete leg

➢ Commercial long term testing of biofuels
  • Alaska – Seattle/DC and Seattle/Portland
  • Lufthansa – Frankfurt/Hamburg
Warfighting First
Operate Forward
Be Ready
Aligned with CNO Sailing Directions