US DEPARTMENT OF THE NAVY
Advanced Biofuels Efforts

Chris Tindal
Director for Operational Energy
Office of the Deputy Assistant Secretary of the Navy (Energy)
Energy Security Concerns

- In 2012 alone the Department of the Navy faced unplanned expenditures of $500 million simply due to fuel price increases.
- Every time oil rises $1/barrel it costs the Navy $30 million+.
- Global oil markets convey substantial economic and supply risk.
- More energy options allow our operators added flexibility.
- SECNAV Goal: By 2020, 50% of our energy will come from alternative sources.
USS Princeton (CG 59) refuels from oiler USNS Henry J. Kaiser (T-AO 187) in the Pacific Ocean.

Royal Australian Navy S-70B Sea Hawk helicopter.

2012 Great Green Fleet Demonstration.

SECNAV and CNO aboard USS Chafee.

USS Nimitz (CVN 68), USS Princeton (CG 59).
1,800 hours of shipboard gas turbine operation

240 flight hours

Four ship-to-ship Refueling At Sea evolutions

One air-to-air refueling

No operational differences noted:

- Logistics Infrastructure
- Ship power plants and aircraft

Less filter changes
Synthesized Hydrocarbons in Bulk Fuels

- Starting April 2015, F-76 and JP-5 in US assets may contain synthesized hydrocarbons
  - Hydrotreated Esters and Fatty Acids (HEFA)
  - Fischer-Tropsch Synthetic Paraffinic Kerosene (F-T SPK)
  - Other pathways added when test and certification completes (Pyrolysis, alcohol to jet, synthesized iso-paraffins, co-processing, catalytic hydrothermolysis, hydrothermal liquefaction, etc.
  - Eventual goal is 336 million gallons (neat) of alternative fuels per year by 2020

- This means fuels passed by a US tanker or received on a US Naval installation could consist of up to a 50% biofuels blend
- Since they were qualified as drop-ins, no attempt will be made to segregate or identify the alternative fuels. They will simply be treated as F-76 or JP-5.
Synthesized Hydrocarbons in Bulk Fuels

- Inland/ East/ Gulf Coast fuel delivery starts 1 April 2015
  - Covers Norfolk, Mayport, and Jacksonville

- Rocky Mountain/ West Coast contract solicitation soon for fuel delivery starting 1 October 2015
  - Covers San Diego, Bremerton, Hawaii

- Western Pacific bulk fuels contract will have alternative fuels annexes added to F-76 and JP-5 for deliveries starting 1 Jan 2016
  - Covers west of Hawaii to the Middle East

- Atlantic / European / Mediterranean fuels contract has alternative fuels annexes added to F-76 and JP-5 soon. New delivery contract starts 1 July 2016
Great Green Fleet 2016

• Year-long event throughout CY 2016

• Highlight deploying ships with 3+ energy conservation measures (ECMs) or alternative energy for propulsion, deploying aircraft with 2+ ECMs or alternative energy propulsion

• Ushers in the “New Normal”

• Maximize likeness to Great White Fleet, but no dedicated group or itinerary for 2016

• Need international biofuel acquisitions
Defense Production Act Advanced Drop-In Biofuels Production Project

- Multiple, Commercial Scale Integrated Biorefineries
- $510M Agency Funding
- No More Than a 50% Cost Share
- Cost-competitive with conventional petroleum w/o subsidies
- Produced domestically
## Defense Production Act Advanced Drop-In Biofuels Production Project

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Feedstock</th>
<th>Conversion Pathway</th>
<th>Fuels</th>
<th>Capacity (MM gpy)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emerald Biofuels</strong></td>
<td>US Gulf Coast</td>
<td>Fats, Oils, and Greases</td>
<td>Hydroprocessed Esters and Fatty Acids (HEFA)</td>
<td>F-76</td>
<td>82</td>
</tr>
<tr>
<td><strong>Fulcrum Bioenergy</strong></td>
<td>McCarran, NV</td>
<td>Municipal Solid Waste</td>
<td>Gasification – Fischer Tröpsch (FT)</td>
<td>JP-5, 8</td>
<td>10.8</td>
</tr>
<tr>
<td><strong>Red Rock Biofuels</strong></td>
<td>Lakeview, OR</td>
<td>Woody Biomass</td>
<td>Gasification – Fischer Tröpsch (FT)</td>
<td>F-76, JP-5,8</td>
<td>12</td>
</tr>
</tbody>
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## Current Efforts/Plan Forward

<table>
<thead>
<tr>
<th>JP-5</th>
<th>F-76</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alcohol To Jet</strong></td>
<td><strong>Direct Sugar To Hydrocarbon</strong></td>
</tr>
<tr>
<td>▪ Lab testing 95% Complete</td>
<td>▪ Laboratory testing 95% Complete</td>
</tr>
<tr>
<td>▪ Component/Engine Testing In Process</td>
<td>▪ Component/Engine Testing in Process</td>
</tr>
<tr>
<td>▪ Flight Tests Planned Fall 2014</td>
<td>▪ Platform trials planned 2014/15</td>
</tr>
<tr>
<td><strong>Direct Sugar To Hydrocarbon</strong></td>
<td><strong>Hydroprocessed Depolymerized Cellulosic</strong></td>
</tr>
<tr>
<td>▪ Lab testing 90% complete</td>
<td>▪ Laboratory Testing 90% Complete</td>
</tr>
<tr>
<td>▪ Similarity analysis on-going to determine component/engine req’ts</td>
<td>▪ Component/Engine Testing in process</td>
</tr>
<tr>
<td><strong>Hydroprocessed Depolymerized Cellulosic</strong></td>
<td></td>
</tr>
<tr>
<td>▪ Lab testing 70% complete</td>
<td><strong>Catalytic Hydrothermolysis</strong></td>
</tr>
<tr>
<td>▪ F414 combustor test planned 2014</td>
<td>▪ Lab testing 60% complete</td>
</tr>
<tr>
<td><strong>Catalytic Hydrothermolysis</strong></td>
<td>▪ Component/Engine testing planned 2015</td>
</tr>
<tr>
<td>▪ Lab testing 60% complete</td>
<td></td>
</tr>
<tr>
<td>▪ Component/Engine testing planned 2015</td>
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</table>
THANK YOU