

Navy Fuels *Great Green Fleet* Vision

Latest Milestone on the Road to Energy Security

ON 22 OCTOBER 2010, in the waters off Naval Station Norfolk, the Navy reached another milestone on the road toward energy security. Conducting a full power demonstration of an alternative fuel-powered riverine boat, the Riverine Command Boat - Experimental (RCB-X) ran on a 50/50 blend of algae biofuel and petroleum, achieving a top speed of 44.5 knots (about 52 miles per hour).

power on biofuel, let alone one derived from algae.

The successful RCB-X demonstration came almost one year to the day after Mabus laid out his energy goals for the Navy and Marine Corps. The Naval Sea Systems Command's advanced fuels program office is leading the testing and demonstration program in coordination with the Task Force

around the world between 1907 and 1909. The purpose of the *Great White Fleet's* "world tour" was principally to showcase the Navy's capabilities and U. S. seapower, though coincidentally, like the *Great Green Fleet*, it was meant to provide an operational evaluation of innovative energy efficiencies. *The Great Green Fleet* will experiment with hybrid electric drive and other energy saving technologies,

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"Running the RCB-X at its maximum power throughout this test of a 2nd generation marine biofuel was a Wright Brothers moment for the Navy," stated Rear Admiral Philip Cullom, director of the Energy and Environmental Readiness Division on the Chief of Naval Operations staff, which leads the Navy's Task Force Energy.¹ It was the first time a naval surface vessel from any nation has ever been driven at full

Energy Maritime Working Group. The riverine demonstration is just one of a series of progressively larger scale tests and evaluations scheduled through 2012. These exhibitions will culminate in 2012 with a Green Strike Group of U.S. Navy ships and aircraft operating locally and in 2016, with deployment of a Great Green Fleet of ships and tactical aircraft, all powered by alternative fuels.

The Great Green Fleet

The *Great Green Fleet* is of course a takeoff from the *Great White Fleet*, a group of naval vessels that sailed

but the main purpose behind this journey will be to demonstrate the Navy's commitment to achieving energy security, enhancing combat capability, and reducing greenhouse gases.

"Going green is about combat capability and assuring the Navy's mobility," said Cullom. "By having reliable and abundant alternate sources of energy, we will no longer be held hostage by any one source of energy, such as petroleum."²

Tom Hicks, Deputy Assistant Secretary to the Navy (Energy), agrees.



On 22 October 2010, the Navy conducted a full power demonstration of this alternative fuel-powered RCB-X running on a blend of 50 percent algae-based and 50 percent petroleum-based fuel, achieving a speed topping 44 knots (about 52 miles per hour).

“Alternative fuels really give the Navy a chance to divest a bit from petroleum to provide some increased insulation from a pretty volatile petroleum market.”⁵

Why Algae?

Algae are attracting attention as a fuel source because the strains can potentially produce at least ten times more fuel per acre than the corn used to make ethanol or the soybeans used to make biodiesel. Moreover, algae can be grown on virtually any type of land, using brackish water, meaning that fuel production would not compete with food production.⁴ Another advantage of biofuels is that fuels made from biomass burn cleaner than fossil fuels and require no drilling to acquire, which means fewer greenhouse gas emissions throughout the fuel’s lifecycle. According to Solazyme, the company from which the Navy acquired its algae-based oil, this type of fuel results in up to 85 percent less greenhouse gas emissions than fossil fuels.

Solazyme is one of several companies working to engineer the “perfect” strain of algae for biofuel production. Jonathan Wolfson, the company’s Chief Executive Officer and co-founder says, “Our unique microbial conversion

technology process allows algae to produce oil in standard industrial fermentation facilities quickly, efficiently and at commercial scale.”⁵

Presently, the company grows algae in tanks inside a Pennsylvania warehouse. Fed by sugar beets, switch grass or a host of other plants, the algae is cut and dried into pebbles that resemble couscous. It is then shipped to Iowa, where the oil is extracted. After the oil is extracted it is sent to refineries in Texas, where it is blended with traditional diesel.

In September 2010, the U.S. Navy ordered more than 150,000 gallons of ship and jet fuel from Solazyme. The company received a \$21.8 million grant from the U.S. Department of Energy in 2009 to build a new refinery in Riverside, Pennsylvania, to help push production to commercial levels.

Don’t Call it Biodiesel

The algae-based fuel used by the Navy is known as hydro-processed renewable diesel (HR-D). Unlike biodiesel, HR-D does not include water; which is incompatible with shipboard fuel systems. HR-D is a drop-in



Rear Admiral Philip Cullom shows off a container of the algae-petroleum fuel blend.

replacement for traditional fuel, meaning that the fuel system's integrity is not compromised, and there are no performance or maintenance issues. The RCB-X demonstration provided further evidence of this. "The boat's performance was indistinguishable from what it would have been using standard diesel fuel," said Cullom.⁴

The RCB-X is a 49-foot boat which the Navy one day hopes to use for patrols in rivers and bays. Cullom said it was an ideal place for the team to begin alternative fuels testing. "It's always best, of course, when you're doing testing like this to start small. We'll be able to extrapolate the performance that we see here into the next series of tests," he said.¹

What About Cost?

Because the market is still in its infancy, the fuel is not yet cost-competitive with petroleum. Initial

supplies of the experimental renewable diesel fuel cost around \$400 per gallon, but with time, that price has dropped to around \$60 per barrel, according to Cullom.¹

Tom Hicks explains some of the reasons for the high cost. "The quantities we are buying today, there's research and development that is factored into that—there's a lot of testing and certification that we are buying, and these are very small batches. As the Navy, we purchase roughly 32 million barrels of fuel per year, so that's 1.2 or 1.3 billion gallons of fuel. The quantities you are talking about here are pretty small—20,000, 50,000, 100,000 gallons of experimental biodiesel fuel, which is pretty small relative to that. To an extent, you pay for that lack of economy of scale at this point."³

Cullom feels that the Navy initiative, by increasing demand for such products, will help drive prices down over time.

What's Next?

The Navy isn't the only branch of the military testing alternative fuels. The Air Force has tested a biofuel blend in its C-17 Globemaster III cargo plane.

Cullom said that with the successful test of the RCB-X on biodiesel under their wing, the Navy will expand the test to larger ships of the fleet. But first, the Navy's Task Force Energy is turning its attention to testing the use of biofuels in one of its workhorse aircraft—the Sikorsky MH-60 Seahawk helicopter.

"Our goal, as a Navy, is to be an early adopter of new technologies that enhance national security in an environmentally sustainable way," said Cullom.⁶

For more insights into the Navy's demonstration of alternative fuels, see our cover story entitled "From Seed to Supersonic: How Camelina Powered the Navy's Premier Fighter Jet" in this issue of *Currents*. [↴](#)

¹ *Navy on Course to Meeting Energy Conservation on Ships—Interview by Max Cacas Reporter, Federal News Radio.*

² *Great Green Fleet—Navy News Service.*

³ *The U.S. Navy and Biofuels—by Robert Rapier, Consumer Energy Report.*

⁴ *New York Times, 26 July 2010.*

⁵ *Navy Taps Solazyme for Bioengineered Algae Fuel by Jason Dearen, Associated Press and Navy Unveils Its 'Mean, Green Riverine Machine' In Norfolk by Bill Sizemore, Norfolk Virginian-Pilot.*

⁶ *Navy to Fuel Half Its Vessels Alternatively By 2020 by Natalia Real, Fish Information and Services, 26 October 2010.*

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