

In an effort to offset increasing oil prices and improve national security, the US military is looking towards biofuels. In fact it is going so far as to say that by 2016 half of its fuel usage will be from renewable sources

Mavericks

by **Luke Tuchscherer**

Last year, the US military announced plans to use biofuels for 50% of its fuel by 2016. These plans, while ambitious, seem to make perfect sense when one factors in the rising cost of fuel, as well as the security risk to troops guarding supply lines.

Of course, this also means that there is potentially an extremely lucrative market for biofuels providers to tap into.

In August 2010, Boeing's managing director of Environmental Strategy, Billy Glover, announced at the Farnborough Airshow in the UK that the US military's plans should be seen as a positive move as opposed to a threat.

Glover said that producers should see the opportunity as a 'golden goose'. The US navy's plans for instance, include ideas to use biofuels for its airforce, as well as converting its fleet to biofuel, and consequently reducing dependence on foreign oil as well as reliance on fossil fuels for transport and ground installations.

Frank Pane, the director of the Defense Logistics Agency (DLA) Energy's Energy Plans and Programs, talks about its role in supplying fuel to the military.

'The services identify their fuel requirements and the DLA procures the fuel to meet those requirements,' he says. 'DLA Energy's recent purchases of hydro-treated renewable fuels have had camelina, tallow and algae as feedstocks. However, DLA Energy is feedstock neutral and does not advocate one over another.'

As for government mandates



The navy uses 30 million barrels of petrol a year

being put in place, Pane says: 'There are a number of mandates that have been issued. These include the Energy Policy Act of 2005, Executive Order 13423, Energy Independence and Security Act of 2007 and Executive Order 13514. Additionally, the services have established their own internal goals.'

'The services will comply with all mandates as required, and map to their respective alternative fuel energy goals.'

Indeed, in January last year, the United States Department of Agriculture (USDA) and the Department of the navy (DoN) signed a memorandum of understanding (MoU) to encourage the development of advanced biofuels and other renewable energy systems.

Agriculture secretary Tom Vilsack said at the time: 'This agreement is part of President Obama's vision of

a coordinated federal effort to build a clean energy economy, create new jobs and reduce our dependence on foreign oil.'

Ray Mabus, secretary of the navy, added: 'In order to secure the strategic energy future of the US, create a more nimble and effective fighting force and protect our planet from destabilising climate changes, I have committed the navy and Marine Corps to meet aggressive energy targets that go far beyond previous measures.'

From a strategic perspective, the objective was to reduce reliance on fossil fuels from volatile areas of the world. Tactically, on the battlefield, the costs of transporting fuel have exponentially increased. For example, in extreme cases, a gallon of petrol could cost up to \$400 (£286).

'Even more serious and sobering, we are putting

our sailors and marines in harm's way as fuel convoys often meet a lethal enemy,' Mabus said. In fact, 10% of US armed services casualties are related to the security of the fuel supply chain.

The five energy targets set out in the MoU were as follows:

- When awarding contracts, appropriately consider energy efficiency and the energy footprint as additional factors in acquisition decisions.
- By 2012, demonstrate a Green Strike Group composed of nuclear vessels and ships powered by biofuel. By 2016, sail the Strike Group as a Great Green Fleet composed of nuclear ships, surface combatants equipped with hybrid electric alternative power systems running on biofuel, and aircraft running on biofuel.

- By 2015, cut petroleum use in its 50,000 non-tactical commercial fleet in half, by phasing in hybrid, flex-fuel and electric vehicles.
- By 2020, produce at least half of shore-based installations' energy requirements from alternative sources. Also, 50% of all shore installations will be net zero energy consumers.
- By 2020, half of DoN's total energy consumption for ships, aircraft, tanks, vehicles and shore installations will come from alternative sources.

One element of the navy's 'Great Green Fleet' is the F/A-18 Super Green Hornet strike fighter, a jet that has been built to run on a 50/50 biofuel blend.

In November last year, Cobalt Technologies, the California-based firm that commercialises biobutanol as a renewable chemical and fuel, signed a Cooperative Research and Development Agreement (CRADA) with the navy to develop technology for the conversion of biobutanol into full performance jet and diesel fuels.

Under the CRADA, n-biobutanol produced by Cobalt will be converted to bio-jet and biodiesel fuels using technology developed at the US Naval Air Warfare Centre Weapons Division in China Lake, California, US.

In addition, Cobalt will have an option to obtain an exclusive license to commercialise process improvements, made under the CRADA, for the production of all military and civilian transportation fuels.

Responding to why providers want to develop biofuels for the military Cobalt's chief financial officer Steven Shevick says: 'First, it's a huge market. The military is the largest single user of fuels in the US. The Air Force alone uses 2.5 billion gallons of jet fuel per year. Total military consumption of jet fuel is close to 4 billion gallons. Military consumption of diesel fuel is approximately

1 billion gallons annually.

'Second, the military is focused on alternatives to petroleum. The branches each have goals for substitution of petroleum with alternatives as part of a larger 'green military' initiative, and there are specific goals, such as the navy's Green Hornet programme. Well-organised goals, programmes and testing protocols have been put in place to achieve these objectives. This gives the military greater focus than private industry.

'Third, energy security is a high priority for the military,

so they are willing to be the lead customer, if a fuel can pass their rigorous testing requirements. Fourth, this is a segment for which corn ethanol is not appropriate, unlike petrol blending, and therefore the field is wide open.'

Cobalt is focused on cellulosic feedstocks primarily because they satisfy the military's mandate that alternative fuels be sustainable. Also, the ability to use a variety of feedstocks offers the promise that a military base could be fuel self-sufficient, which requires that whatever process it chooses be capable of processing local feedstock.

The San Francisco-based firm Solazyme is another company dealing with the military after signing two Department of Defense (DoD) contracts in 2009 to research, develop, and demonstrate commercial-scale production of algal-derived advanced biofuels to meet the US navy's specifications for military tactical platforms for both ships and jets.

In July last year, Solazyme delivered 1,500 gallons of

100% algae-based jet fuel for the navy's testing and certification programme. The fuel, called Solajet HRJ-5, was manufactured through Solazyme's proprietary fermentation process in collaboration with renewable jet fuel processing technology from Honeywell's UOP.

The fuel was designed to meet all of the requirements for naval renewable aviation fuel. In preliminary tests, it also met the fuel requirements of the US Air Force and meets the standards for commercial jet fuel.

Then, in September, the

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firm delivered more than 20,000 gallons of its 100% microbial-derived, non-alcohol shipboard fuel, Soladiesel HRF-76, to the navy.

Solazyme's CEO Jonathan Wolfson said at the time: 'Our renewable oil production technology, which results in a 100% military-spec, drop-in replacement fuel from algae can be a significant component of the navy's long-term strategy to supply 50% of its energy from renewables by 2020.

In October, the navy gave a public demonstration in Norfolk, Virginia, showing an experimental Riverine Command Boat using the 50% algae, 50% NATO F-76 fuel.

The mixture forms a 50/50 blend of hydro-processed renewable diesel, also known as HR-D. HR-D does not include water, which is incompatible for shipboard fuel systems and does not have the limited serviceable life (often six months) of biofuels. A blended hydro-processed renewable diesel fuel helps ensure that the reliability of the fuel system is sustained.

The navy's deputy assistant

secretary for energy, Tom Hicks, agrees that the navy's motivation for using biofuels pertains to national security, the fact that the navy uses 30 million barrels of petrol per year, as well as enhancing the navy's war fighting capabilities:

'We want to be more selective as to who we buy from. Homegrown or locally-sourced biofuels mean that we can avoid getting oil or petroleum from countries that don't necessarily share our values,' he says.

The navy is researching a variety of feedstocks such as camelina, algae, jatropha and sugarcane. However, Hicks points out that all the feedstocks have two main things in common.

'The fuels we use must have lifecycle greenhouse gas emissions equal to or less than petroleum, and they mustn't compete for food or water sources or have a negative impact – direct or indirect – on land use.'

The aforementioned Great Green Fleet will be tested and certified by 2012.

As well as the Hornet and the Riverine Command Boat, the navy will test more fleet and aircraft vehicles over the course of 2011 and by 2012 hopes to be carrying out local exercises with a carrier strike group using alternate fuels. The plan is then to deploy that strike group by 2016.

However, Hicks did point out that the navy is looking for complete drop-in replacement for petroleum. 'Engines and infrastructure cannot be changed, so we're looking for a straight up replacement.'

Meanwhile, Honeywell announced last June that its Honeywell Green Jet Fuel had been used to power a Boeing AH-64D Apache helicopter, flown by the Royal Netherlands Air Force.

The flight, conducted at the home of the Royal Netherlands combat helicopter fleet at Gilze-Rijen Airbase, was the first helicopter flight using sustainable aviation biofuels.

Natural oils from algae and cooking oil were converted into green jet fuel using process technology developed by Honeywell's UOP. The fuel was blended in a 50% mixture with traditional jet fuel and the blend was used to power one of the Apache's engines for a series of test manoeuvres. No modifications were made to the engine or airframe for the flight.

Jim Reksoske, VP and general manager of Renewable Energy & Chemicals for Honeywell's UOP, shares his views on the growing role of biofuels in the military.

'The efforts we are seeing today are driven by the value that the military sees in terms of emissions reductions and energy independence, not by mandates.'

The EU has recently extended the Emission Trading Scheme to the aviation industry setting the mandatory target for airlines



The navy's Green Hornet has been built to run on a 50/50 biofuels blend

to reduce their CO₂ emissions starting from 2012. This includes all flights (regardless of the originating countries) arriving and departing the EU. The US does not have such strict mandates in place.

Honeywell has seen an interest in a broad range of second generation, non-food feedstocks include algae, camelina, jatropha and tallow.

'To date, we have produced

almost 600,000 gallons of Green Jet Fuel for the US Air Force, navy and army from these sources,' says Reksoske. 'The Royal Netherlands Air Force Apache helicopter also flew on Green Jet Fuel made from algae and used cooking oil. These feedstocks are attractive because they do not interfere with the food supply and are not taking away cropland that is needed for food.'

In terms of the use of biofuels in the military in the future, Reksoske was optimistic. 'To date the US military has demonstrated this fuel on six different platforms and will continue to work towards certification to allow for long-term use.'

'We've seen similar dedication from the Netherlands with their testing programme on the Air Force Apache helicopter and we continue to work with others around the world looking to adopt a biofuels strategy.'

Therefore it would seem Boeing's Billy Glover is right. This really could be a 'golden goose' for the biofuels industry. As mandates continue to be introduced and enforced, as military services around the globe continue to want to not only protect their soldiers but also their bottom line, an exciting new market is opening up. ●

Although there is no specific mention of AlphaKat in this article, written initially early in 2010, we are informed that Covanta Energy's acquisition of the marketing and development license for KDV in USA has parallel implications with the development of military use for the process since it can convert biomass into Diesel in a mere 3 minutes!