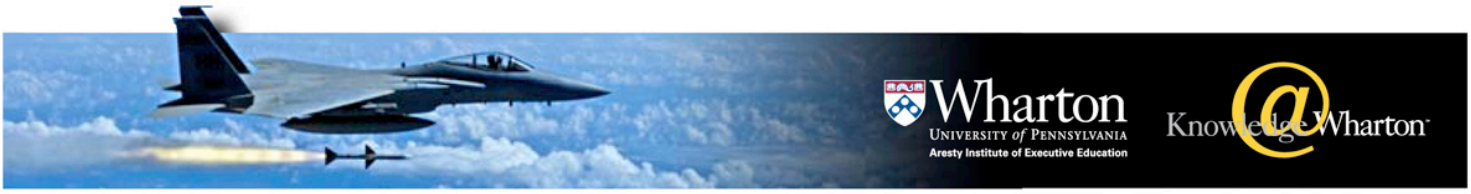

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U.S. Military Hopes to Be Energized by Alternative Fuels:
High Costs, Supply Risks Send DOD Searching for Ways to Save Energy

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The U.S. Army announced in mid-January that it plans to lease thousands of electric vehicles for passenger transport, security patrol, maintenance and delivery services on Army bases.

These neighborhood electric vehicles, manufactured by Global Electric Motor Cars, a division of Chrysler Corp., will help the service dramatically reduce carbon dioxide emissions.

While helping the environment is a great ancillary benefit, the real attraction is the massive cost savings from going green. The fuel or energy costs for the electric cars will be significantly less -- an estimated $460 annually compared to $1200 annually for gasoline powered cars. That translates to about 11.5 million gallons less consumed over six years.

And that's just for Army passenger transport vehicles zipping around bases.

The U.S. military is the world's single largest consumer of oil. It spent $13.6 billion for energy in 2006, or about 340,000 barrels of oil per day, according to Alan Shaffer, the director of plans and programs for the Office of Defense Research and Engineering.

Measuring the Full Fuel Burden

The heavy use of oil has other more significant operational implications for the U.S. military. The ongoing wars in Iraq and Afghanistan require more fuel than any war in history. This fuel is delivered to the war theater over vulnerable supply lines -- large oil convoys that cannot be armored and are easy targets for insurgents. Protecting these convoys requires combat forces in armored fighting vehicles and attack helicopters, diverting soldiers from combat missions to self-protection missions. When these logistics are factored in, the cost is known as "fully burdened cost of fuel." A study published in 2001 by a Defense Science Board task force found that the cost of delivering fuel over land in battle was about $15 per gallon and $26 per gallon when delivered via airborne tanker. That was when a gallon of oil was 90 cents. Estimates in 2006 peg that cost at $42 per gallon when delivered via airborne tanker.

In an effort to give its fighting force the ability to travel farther into enemy territory without having to rely on vulnerable and expensive supply lines, the Pentagon is spearheading research into alternative energy and lighter materials that would require less fuel. The military has even updated its acquisition requirements by making fuel efficiency something that defense contractors must seriously consider.

The Department of Defense (DOD) set a policy requiring "fully burdened cost of fuel" to be part of the acquisition analysis process. The policy calls for three pilot programs -- the Joint Light Tactical Vehicle, the Maritime Air and Missile Defense of Joint Forces alternative ship propulsion, and the Next-Generation Long-range Strike Concept Decision—to help determine how best to evaluate during the acquisition process the cost of energy usage over the lifecycle of a weapons system, including the fully burdened cost of fuel.

The findings from these pilot projects will be integrated into Defense acquisition instructions. But the Pentagon says that until the pilot project and their findings are studied carefully, it will not explicitly consider fuel costs and the fully burdened cost of fuel in the equation when it looks at developing or designing new systems.

A DOD 2008 report to Congress on "Energy Efficiency in Weapons Platforms" noted that the

department had been "culturally reluctant to press hard for lighter materials and new technology solutions for propulsion when the war fighter, our most important customer, values proven mechanical reliability improvement in heavy armor over all other priorities."

"When you bring a new factor into the acquisition process, you need the analytical capabilities to make sure a new decision process works well," said Cmdr. Darryn James of the U.S. Navy, a military spokesman who follows the DOD's green initiatives. "It will be a few years before a policy change is in place that takes fuel costs into consideration."

Still, the spike in oil prices during the summer of 2008, the instability in the Middle East and the rise of Russia as a petro-state have created a sense of urgency in seeking energy efficiency in all the forces.

'Scary' Costs Ahead

Admiral Gary Roughead, the chief of Naval operations, said at a January symposium that he studied the operating costs of what the Navy is buying today and what the operating costs will be 25 years forward, and it "scares the heck out of me." He said he was stumped by the idea of how his successors will deal with the energy costs. He urged that the U.S. Navy acquire the most efficient fleet to avoid runaway costs as fuel prices spike. "And it's not just going to be trailing another shaft or turning the lights out in more spaces," said Adm. Roughead. "We have to have some dramatic improvements."

Indeed, the DOD is thinking big. It has spearheaded research partnerships with private companies to better tap into renewable energy sources like solar, wind and geo-thermal. It has spurred research into bio- and synthetic fuels, and lighter yet stronger energy efficient materials.

While several large aerospace and defense manufacturers have made some incremental progress toward improving fuel efficiency, a lot of the experimental work is conducted at smaller companies around the country.

"Most of this kind of experimentation -- almost 90% of it -- is done with private companies," said Daniel Goure, vice president with the Lexington Institute, a nonprofit public policy research organization headquartered in Arlington, Va. "It's almost like the Law of Gravity that small companies in the defense sector are the most innovative."

But Goure adds a caveat. The challenge for smaller defense companies is to scale up when they try to move from theory or model to production for energy efficiency or alternative fuels. "That requires huge capital investments, lots of people and lots of infrastructure."

One project that exemplifies the need for massive scale cooperation between government and large companies is the drive to develop, test and certify synthetic fuels. The Air Force tested a synthetic fuel blend in its B-52 Stratofortress and worked closely with the Commercial Aviation Alternative Fuels Initiative, which represents airlines, airports and manufacturers. The project takes advantage of the fact that commercial and military fleets share common platforms, wiring and engines.

Another model is the large company-small startup collaboration, with encouragement and incentives from the DOD. Just last October, Smart Fuel Cell, a German maker of fuel cells and off-the-grid power systems, in collaboration with DuPont, took first and third prize for a Wearable Power competition sponsored by the Department of Defense Research and Engineering. The competition was set up in 2007 to encourage innovation to streamline how

soldiers can use portable energy on the battlefield.

The 2008 competition required that the power pack attached to a standard military vest provide 20W of average electric power for 96 hours, meet brief peak-power demand of up to 200W and weigh no more than 8.8 pounds. The equipment needed to pass a simulated field test. There were about 170 entries, but in a team effort with DuPont, the Smart Fuel Cell electrical power system, the M-25 Portable Fuel Cell, won the $1 million first prize. The M-25 combines DuPont's direct methanol technology with Smart Fuel Cell's commercially available systems and integration expertise.

Whether this system becomes the source for the U.S. military's portable energy needs remains to be seen. Analysts, however, agree that battery technology will play a bigger role in the future but remains one of the biggest energy challenges facing the DOD.

Today, soldiers are increasingly carrying various devices that require battery power, from communicators, GPS units, night-vision equipment, etc. Because soldiers literally carry this equipment, the batteries need to be light, long lasting and rechargeable. But most importantly, there needs to be a standard for batteries so they work in multiple devices so that you don't also need various rechargers.

"That would be a huge revolution in the supply chain," said Goure. "And in some sense, it may be simpler—although hugely complex—than trying to invent a new battery."

The Challenge of Retrofitting

Alternative energy sources can be integrated without much difficulty into the existing infrastructure of the military's bases around the world. That process is already underway with the use of solar, wind and geothermal energy on bases in the United States and abroad. The difficulty is how to integrate energy efficiencies into the current fleet of ships, aircrafts and tanks. Alternative fuel sources do not work effectively in older systems. For example, bio-fuels tend to freeze at much higher temperatures making their use sketchier high-up in the skies. While oil repels water, bio-fuels can blend easily with water, which could lead to corrosion in naval systems.

"You don't just retrofit simply for energy efficiency," said Goure. You wait for a midlife upgrade and that's a slow process, he says. A midlife upgrade occurs about 20 years into a fleet's service and then it takes 10 to 15 years to retrofit a fleet. "And they aren't going to retrofit a jet engine or turbines on a destroyer. It just ain't going to happen until it's time for a new fleet."

The best energy security plan should focus on reducing demand, assuring supply and improving future acquisition processes, according military experts. "We are making great progress in energy security but we still have a lot of more work to do in order to meet our strategic goals to protect our war fighters, benefit the American taxpayers, and help the environment. The Army will continue to leverage new and emerging technologies to ease its dependence on fossil fuels," said Paul Bollinger, deputy assistant secretary for Energy and Partnerships for the Army.