The Future FOB

Sustainment in the future

by 2ndLt Jon Asheim

Sustainability is a practice commonly associated with the green movement to protect the earth. The truth is that sustainability is a very broad concept with nearly endless applications. With our resources unable to match the rapid growth of urban populations, designers rely on the principles of sustainability to create smarter cities that yield a smaller energy footprint.[1] Smart-grid technology, renewable energy, water catchment systems, and the net-zero concept are only a few of the strategies used to create more energy-efficient cities.[2] Why not apply the principles of sustainability to the forward operating base (FOB)? The FOB is not significantly different from a neighborhood attempting to go off-grid. The outpost requires food, water, a stable energy source, and a healthy supply of ammunition. Liquid logistics, the diesel fuel and water required to sustain operations, are in need of constant resupply. The resupply comes in the form of an armored convoy that must navigate miles of improvised explosive device–laden terrain. But what if we were able to do away with the FOB's demand for fuel and water? What if we were able to operate near full autonomy, harvesting energy and water at the point of consumption? This capability will allow Operating Forces to push deeper, fight lighter, and become increasingly maneuverable. In the case of the FOB, energy efficiency and lethality work hand in hand.

The primary problem faced by the post-9/11 Operating Forces came in the form of a logistical burden. The increased demand for energy following 2001 is the product of a 250 percent increase in radios, a 300 percent increase in computers, a 200 percent increase in the number of vehicles, and a 30 percent decrease in miles per gallon of the vehicle fleet.[3] Logistics have taken a toll on our mobility, security, and overall lethality. In Iraq and Afghanistan, 80 percent of convoys are for fuel.[4] The result of the increased energy demand downstream is that the fuel itself requires fuel; the fuel requires 24/7 security where it is stored, and its transportation requires additional fuel for the convoys. We begin to see what is known as the fuel multiplier, described by the Naval Postgraduate School as "the total amount of fuel the DOD must procure per gallon delivered to the battlefield."[5] On top of the fuel needed to power operations on the forward edge, water is another asset that presents its own challenges. According to the Army Corps of Engineers, the transportation of one gallon of water in Afghanistan requires seven gallons of fuel.[6] Reducing the demand for fuel and water will minimize our logistics chain and allow us to focus on the fight itself.

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What if we were to update the FOB concept?

The organization of the Marine Corps, which revolves heavily around war, places a surprisingly large emphasis on energy strategy. The efforts made by the Marine Corps to identify this problem and implement solutions were successful in dealing with our energy demand issues downstream at forward outposts. The Expeditionary Energy Office is the major contributor in the procurement of alternative energy technologies that have allowed expeditionary units to become less reliant on energy. Operational practices shifted from the use of inefficient diesel generators to a hybrid solar/diesel system that utilizes fuel cells to store the excess energy.[7] This effective use of sustainable technology not only brings us closer to achieving complete self-sustainment, but it also acts as a combat multiplier. A unit with a smaller logistics footprint gains increased flexibility because it is able to distance itself from the supply chain and is less affected by its pull. In warfare, flexibility results in increased speed. Speed, when used in battle, is a powerful weapon.[8]

Looking Forward

What if we were to update the FOB concept? What if it was off-grid and completely self-sustaining, producing all necessary energy and water on site? How would we do it? To find the answer, we need only look to the commercial innovations of the private sector. Industries structured around disaster relief, mining operations, and smart cities hold the key to reducing our energy demand and the logistical dependence that comes with it. Observing common practices in sustainable energy strategies offers a future course of action for the design and operation of FOBs. Energy efficiency is often the product of necessity, as is the case for Israel, whose scarce resources are often met with conflict. Israel is a leader in intelligence as a result of constant war, but its innovation does not stop there. The country adopted an ethos of sustainability, leading the world in several tech start-ups and, more specifically, in atmospheric water generation.

An Israeli firm has designed a system that is able to generate clean potable water from the atmosphere.[9] The process requires little energy and has been field-tested in disaster-relief efforts and military operations. The ability to generate clean water at the point of consumption could mean the end of water resupply convoys, which would in part contribute to a decrease in the amount of improvised explosive device casualties sustained on such convoys.[10] A FOB that is able to generate its own water will have the ability to operate independent from larger installations.

Another field that can be improved upon is renewable energy harvesting. Our current solar arrays, though effective, are in need of an upgrade.[11] The heavy modular construction of traditional solar panels can be replaced with the cheaper, more mobile, flexible solar arrays that have gained traction in the private sector. Flexible solar uses flexible photovoltaic cells, which allow for rapid deployment and immediate power. It is cheaper to make and can be adapted to fit any pre-standing structure. It is also incredibly light, facilitating its transportation and deployment.[12] Immediate energy allows for the rapid construction of a FOB in any location. The problem now lies with the fact that an outpost must be able to operate through the night.

Advancements in fuel-cell technology will allow for the continued operations of an installation through periods of reduced sunlight. The Marine Corps' current lead-acid fuel-cell systems store the energy generated from traditional photovoltaic solar panels and diesel generators to then be used should the scenario permit.[13] Lead-acid battery technology is not as energy dense as the lithium-ion systems used in modern electric cars and households. Lead-acid technology is heavier and does not produce as much power-to-weight as lithium-ion, adding unnecessary bulk to our forces at the cost of an inefficient system.[14] Tesla is the worldwide leader in lithium-ion battery technology. Their newest interface designed for the commercial market can be paired in parallel with infinitely scalable energy storage. The ability to store energy enables the user to respond to fluctuations in energy demand during times of peak consumption, thus creating an energy efficient system. A FOB with the ability to store large amounts of energy will have a stable supply and require less fuel resupply. The energy stored in fuel cells can be taken directly from renewable sources such as solar power. This continuous, self-sustaining energy cycle allows an almost indefinite supply of energy. Indefinite energy can be a powerful weapon in FOB design.

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Conclusion

A FOB with the ability to store and allocate renewable energy is able to distance itself from the supply chains that typically limit operations. Flexible solar, atmospheric water generation, and advanced fuel cells are all assets that will get us closer to the goal of self-sustainment. Freeing our forces from *the tether of fuel,*[15] as Gen James N. Mattis once predicted, will grant us increased speed. FOBs will dominate locations where logistics resupply is uncertain. With energy as our newest weapon, we will reach a level of combat power and lethality that we can only dream of.

Notes

1. Patrick M. Condon, *Seven Rules for Sustainable Communities: Design Strategies for the Post-Carbon World*, (Washington, DC: Island, 2010).

2. Ibid.

3. Joshua Reichert, et al., *From Barracks to the Battlefield*, (Washington, DC: The Pew Charitable Trusts, 2011).

4. Alan Haggerty, *S&T and Maneuver Warfare: A Current Success and a Future Challenge*, (Alexandria, VA: Department of Defense, 2008).

5. Eva Regnier, et al., *The Fuel Multiplier in Multi-Stage Supply Chains*, (Monterey, CA: Defense Resource Management Institute, 2013).

6. *Power and Energy Considerations at Forward Operating Bases*, (Washington, DC: U.S. Army Corps of Engineers, undated).

7. *USMC Expeditionary Energy Office Report on Expeditionary Energy Data Collection within Regional Command Southwest, Afghanistan,* (Washingon, DC: USMC Expeditionary Energy Office, 2012).

8. Headquarters Marine Corps, *MCDP 1-3, Tactics,* (Washington, DC: 1997).

9. Anita Hamilton, "This Gadget Makes Gallons of Drinking Water Out of Air," *The New York Times,* (New York, NY: April 2014).

10. *Sustain the Mission Project: Casualty Factors for Fuel and Water Resupply Convoys,* (Arlington, VA: Army Environmental Policy Institute, 2009).

11. Office of Naval Research, *Media Release: Solar Energy Powers Marines on Battlefield*, (Online: 2010), available at http://www.onr.navy.mil.

12. Renovagen Ltd., *Products: Rollarray Multi-Gen,* (Online: 2016), available at http://www.renovagen.com.

13. *Power and Energy Considerations at Forward Operating Bases.*

14. Tom Lombardo, *Tesla's Powerwall by the Numbers,* (Online: May 2015), available at http://www.engineering.com.

15. *From Barracks to Battlefield.*