



Marines Create Power, Filter Water on the Go

Both the Army and Marine Corps hope to one day deploy troops that can operate at length with little or no resupply. But there are limits to how much an individual can carry and how long those supplies will last.

Marines especially can count on being far from base for days on end during amphibious forced entry operations. And once in combat, they can't count on resupply.

There are two schools of thought on how to mitigate the risk of running out of supplies in the field. One is to artificially increase a Marine or soldier's load-bearing capability. The less expensive, simpler avenue is to develop ways in which necessities can be foraged.

Short of developing Tony Stark's Iron Man suit and disregarding farsighted exoskeletons that would allow troops to carry hundreds of pounds, Marine Corps engineers want troops to gather what they need to survive and communicate where they fight, rather than lugging water and batteries into battle.

The Marine Austere Patrolling System, or MAPS, may go a long way toward achieving that goal. Wearing MAPS on a chest rig, a Marine can harness solar energy and purify found water without any peripheral equipment. It moves in the direction of making a Marine's communication and other equipment "transparent," said Capt. Frank Furman, logistics program manager for the Office of Naval Research's expeditionary maneuver warfare and combating terrorism department, and a Marine infantry officer with two tours in Afghanistan.

Creating a sense of seamlessness between Marines and their equipment — making systems "transparent" — has been one of the main challenges of the program, Furman said in an email to National Defense.

"The ideal form factor is for it to be completely transparent to the user," he said. "We're not quite there."

ONR has teamed with the Naval Research Laboratory to develop the photovoltaic cells that are incorporated into the rig. The solar panel can be worn on a Marine's back to draw power while on the go, or laid out on the ground when stopped.

The water filtration system is made by Cascade Designs, an outdoor equipment company. MAPS is assembled at the Naval Surface Warfare Center in Dahlgren, Va.

Furman described how the system would be used during a 48-hour operation — a period during which he would likely need at least three disposable batteries. He would likely pack double that number to create a buffer in case one is a dud, or he had to stay in the field longer than expected.

The number of batteries a Marine will carry depends on multiple factors — the mission, its duration and the weather are a few considerations. Batteries don't last long in the cold.

The role of the Marine is another factor — a machinegunner may carry none, while a platoon commander may carry a bunch because he has the radio.

Standard 5590 and 2590 radio batteries weigh about 2 and 4 pounds, respectively. On the high end, Furman said he has carried as many as eight cells on an operation, for a total battery load of

up to 32 pounds. A normal battery load for a dismounted Marine is between 2 and 4, or up to 18 pounds of batteries.

"Here's where MAPS comes in," Furman said. "Because it uses a central battery, you don't need spares for each type of battery."

The central battery is connected to devices like GPS and night vision goggles by way of an energy management system that divides up the available charge, ensuring that nothing goes dead before the others. A Marine will not lose his radio before his night vision, for instance.

The 20-watt solar panel has a charging throughput rate of about 20 watts — more than enough to recharge the battery in sunlight, or run a radio directly, he said. The photovoltaic cell captures more of the sun's energy and is more flexible than previous versions, which allowed them to be worn as part of a garment. Where previous cells were about 6 percent efficient, MAPS cells are 30 percent efficient.

"Because it incorporates energy harvesting, you mitigate the risk of running out completely," Furman said. "So if you're running low, you lay out your solar panel, and at least have the energy to send out a critical transmission like, 'We're running low, send me a helicopter!'"

The Army has a similar system that runs on the flexible conformal battery and peripheral communications equipment, which is gaining acceptance with the Marine Corps as it is fielded in Afghanistan (see story on page 32).

The Marine Corps went one step further with MAPS by building in a water filtration system that is attached to the Marine's Camelback water bladder. As with batteries, water is something a Marine doesn't want to run out of in combat. Furman said if he estimated he would need a gallon of water for an operation, he would routinely bring two, adding 17 pounds to his load.

"If you run out of water, you die. If you can get water locally, the risk of running out is much less," he said. "So you can afford to reduce that safety factor. This is a critical point."

The "ultra filtration hollow-fiber" filter is an inline system that connects directly to the tube of a Camelback worn by the Marine. Sucking on the tube draws water from the bladder through the filter, automatically cleaning it before it is consumed.

Work is ongoing to develop a self-cleaning passive filtration system that sits inside the bladder itself. Furman believes such a system will be ubiquitous within five years.

Such a suit offers demonstrated advantages to the individual Marine going ashore. It also has a ripple effect on the logistical tail that keeps that Marine and fellow troops fighting.

Marines who need water need convoys to truck it in. Those convoys need drivers who are vulnerable to attack on the road. Those trucks need fuel and mechanics and other support personnel.

A Marine with a personal, reusable filter can gather water from anywhere as long as the source is fresh water.

"You have cascading effects down the chain," Furman said. "This type of product can harness the same principal, but in a positive way."

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