

Forging Fuel

Expeditionary additization

by Connie Braesch

Getting the high-quality fuel that warfighters need to conduct their missions is not as straightforward as driving up to a gas pump. To ensure military aircraft, vehicles, and equipment operate at peak performance, Defense Logistics Agency Energy (DLA Energy) relies on the injection of three additives into commercial jet fuel: a fuel system icing inhibitor, a corrosion inhibitor/lubricity improver, and a static dissipater.

According to Samuel Cooks, the DLA Energy Strategic Policy & Programs Directorate Energy Initiatives Program Manager:

The additives prevent formation of ice in fuel, fight micro-organism growth, reduce fuel-system corrosion problems, add lubricity, and improve ground safety during storage, transfer and issue.

Cooks then explained that in enduring locations and defense fuel support points, suppliers normally inject the necessary additives before the final delivery to a base, camp, or station; however, sourcing military-specification fuel in an expeditionary environment on short notice or in small quantities can be tough. Furthermore, Cooks assert that

for small-scale requirements in remote locations or when commercial delivery of military-specification fuel isn't available in the local market, on occasion the fuel must be additized on-site to sustain operations.

According to Marine Forces Pacific, the Corps needs an expeditionary fuel additive injection system to address this critical capability gap. To help find a mission capable solution, in the fall of 2017, the Marine Corps Expeditionary Energy Office partnered with DLA Energy. Maj Kelvin Chew, a technology and experimentation analyst for the

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Cpl Subik, a bulk fuel specialist with Marine Wing Support Detachment 24, moves a fuel line toward a landing pad in order to start fueling a AH-1W Super Cobra helicopter during a field test for an expeditionary mobile fuel additization capability system as part of RIM of the PACIFIC Exercise at Pohakuloa Training Area, HI, 18 July 2018. (Photo by LCpl Adam Montera.)

Marine Corps Expeditionary Energy Office, asserts that

facilitating development of this tactical capability helps enhance supply chain resilience ... This foraging capability supports expeditionary advanced base operations in a contested environment by allowing units to leverage commercial fuel stores to support a single fuel supply chain.

Why Additize?

While military aircraft, vehicles, and equipment can use commercial-grade

fuel, the inclusion of the additives helps improve the warfighter's equipment performance and lifespan. According to CWO David Gentry, airfield officer-in-charge at Marine Wing Support Detachment:

It is important because it allows the aircraft to fly higher, faster without the worry of the water in fuel freezing up ... and you don't have to worry about ground vehicles overheating.

He continues by asserting, "If operating in the colder climate, the static will



Marines and Soldiers additize fuel in a tank truck at Pohakuloa Training Area, HI, using the Marine Corps expeditionary mobile fuel additization capability prototype system during the RIM of the PACIFIC Exercise, 18 July 2018. (Photo by author.)

build up, but the static dissipater will help to remove it.” This corresponds with Richard Cordes, liaison officer to the Naval Petroleum Office in his assertion that,

Anytime you’re talking about military aviation, you want them to perform at the top level. Yes, aircraft can use different grades of aviation fuel. But think of it like this: If you use one tank of lower-grade fuel in your vehicle, is it going to hurt it? No, not that one tank. But over prolonged time, it’s going to lessen the performance and life of that vehicle.

Identifying a Solution

When timing or conditions require the Services to additize commercial fuel in the field, special equipment, training, and quality control measures are needed. CWO Gentry stated:

Right now, the Air Force and the Army do it on a sustainment-brigade level where they additize hundreds of thousands of gallons. We’re looking to additize smaller quantities.

To develop the prototype system, the expeditionary mobile fuel additization capability (EMFAC) team turned to Hammonds Technical Services, which, since 1986, has built equipment specifi-

cally for additive injection. According to Jeff Hammonds, Vice President of Engineering and Sales for the company,

the Army is the primary user of larger systems that handle bulk fuel on a larger scale. Those systems are basically mobile fuel farms.... The Marines came to us for something truly two-man portable, lightweight and smaller for lower product-delivery flow rates, so we took our commercially available equipment and implemented that small-scale design.

Maj Chew further emphasized the importance of the size and weight of the EMFAC system:

The Army’s system weighs over 950 pounds and requires heavy equipment to move. The one we’re building is just over 200 pounds. We’re taking an existing fuel additization system and downsizing it so it can be more expeditionary, mobile and require a lighter footprint.

Putting the System to the Test

The Marine Corps Expeditionary Energy Office is training Marines from across the country on how to operate the system and gather feedback to refine the equipment and operating pro-

cedures. “We received a lot of feedback on this system, which has allowed us to improve the design—not just in the past few weeks but over the course of months,” Maj Chew said. “We have made improvements, so we have the best-informed design.”

In July, during the 2018 RIM of the PACIFIC (RIMPAC) Exercise in Hawaii, the EMFAC portable additive injector system was put to the test in a full-scale exercise. RIMPAC is a huge operation involving many countries.

So if we can use it in this type of environment, it gives us more of a real-world scenario where fuel that needs to be injected can go from inception all the way into the aircraft, stated Cordes.

Although a Marine Corps–led capability development, the Army also participated in the RIMPAC testing. Marines and Soldiers independently operated the EMFAC system to additize fuel trucks for use in a forward arming and refueling point at Pohakuloa Training Area, HI. According to Cordes:

The scenario we used was as if we came across fuel in a country and it did not meet the specifications needed for Marine Corps aviation ... With the system, we can inject the fuel with the needed additives, put it directly into an M-970—which is a mobile refueler—take it forward and use it to refuel aircraft and equipment.

The full-scale scenario required the Marines and Soldiers to set up and calibrate the equipment, calculate additive amounts, give a thorough briefing of the operation, execute proper additization, recirculate the fuel, pull samples, and run laboratory tests. According to Gentry:

Once we were satisfied the fuel met military specifications, we used the fuel on the runway to refuel operational aircraft.

Maj Chew asserted that,

The focus is on validating the systems performance and their ability to safely operate the system in an operational environment during a live exercise ... They need to get acquainted with the environment and use the system with-

out all the comforts and safeguards of being in a controlled environment like the base.

Training and quality control is a significant part of equipment testing. He continued that,

everyone involved was given familiarization training on the setup, calibration, operation, safe handling and troubleshooting of the injector system before every evolution of the testing. The Marines and soldiers also received extensive training on fuels laboratory testing and quality specifications.

DLA Energy played a key role throughout each phase, from the delivery of the commercial-grade fuel to the refueling of operational aircraft. DLA Energy quality assurance representatives monitored the additization process and laboratory specification test:

We get involved with training the Marines and the Army for additive-injection processes and procedures that help them within their exercises and when they deploy...We go through the process on how to sample the fuel, test it and understand the premixing of additive and injection rates.

The joint Service partnership is invaluable. Maj Chew explained that

this is not something we can do notionally and expect to be proficient. The support we have received from DLA Energy has been key for us. The presence of DLA Energy [quality assurance reviews] with the Marines taught them much more about fuel than they normally see on a day-to-day basis.

... the preference is to use DLA provided-fuel.

He asserted that the EMFAC testing throughout the RIMPAC scenario was successful and the additized fuel met military specifications.

We have identified what could go wrong, how to mitigate risks and identified the roles and responsibilities of the EMFAC team. To be able to demonstrate that the Marines are capable of additizing fuel on their own in an austere environment is a great success ... From when the Urgent Universal Need Statement was signed in December 2017 to where we are now has been a pretty fast process for a

complex operation such as this. Now it's just refining the process.

What Will Happen Next?

The Marine Corps Expeditionary Energy Office plans to take the feedback and lessons gathered throughout the training and testing and incorporate it into its field procedures and training guides. "Before it's released to [the] Operating Forces, we must ensure they have the proper documentation and procedures to follow," Maj Chew said. "Eventually, we hope to integrate fuel additization into our Petroleum Laboratory Specialist Course at the Marine Corps Bulk Fuel School at Fort Lee."

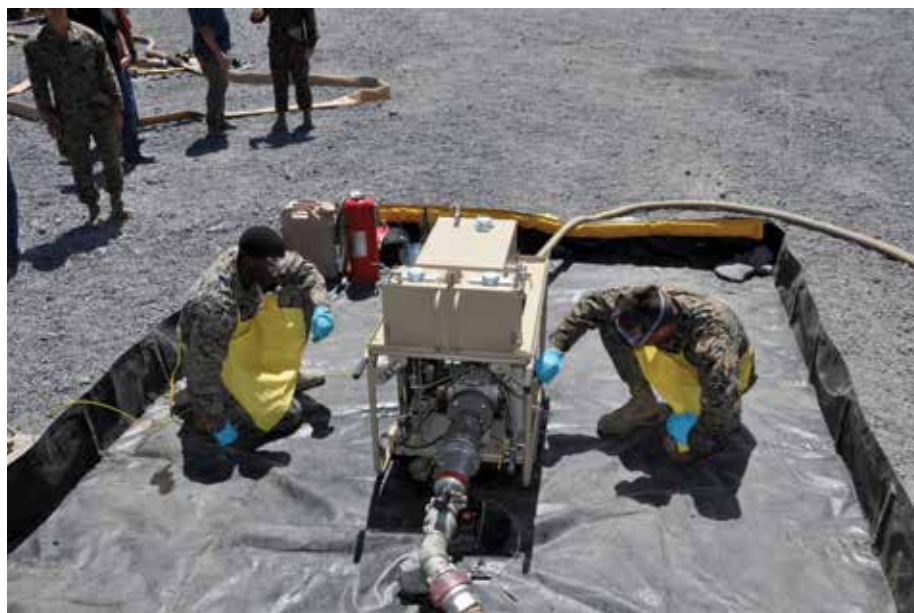
Cordes, the senior Marine Corps fuels officer, is working with all the stakeholders to report the feedback to DLA and HQMC:

This capability is extremely critical. This system gives the Marine Corps that secondary ability if DLA can't source the military-specification fuel we need in the area we're operating.

While the capability is needed, Cordes, CWO Gentry, and Maj Chew all agreed the preference is to use DLA-provided fuel. "Our intent is not to replace DLA Energy's role," Maj Chew said. "It's to train Marines and Soldiers to do this in contingency operations where MILSPEC [military specification] fuel isn't available."

As the DOD Executive Agent for bulk fuel, DLA Energy's goal is to improve the efficiency and effectiveness of the fuels supply chain. COL Doug Henry, USA, former DLA Energy Chief of Staff stated:

To be clear, DLA Energy is not moving away from procuring and delivering MILSPEC fuels. Yet, this capability gives the services a portable, small-scale solution addressing the historic gap between requirements generation and when DLA Energy can deliver a MILSPEC product. We look forward to helping the Marines and the other military services innovate this rapid-deployment injection capability to increase lethality through greater supply chain resiliency and strengthen readiness postures to meet global requirements.



Cpl Bellamy (left) and Sgt Grable watch closely as the Hammonds Model TPI-3T-3A portable fluid powered additive injector additizes commercial jet fuel during the RIM of the PACIFIC Exercise, 17 July 2018. The injector is a prototype expeditionary mobile fuel additization capability used to convert commercial jet fuel into military specification fuel. (Photo by author.)



Sgt Grable examines a sample of fuel before conducting laboratory testing to ensure it meets military specifications during the RIM of the PACIFIC Exercise, July 2018. (Photo by author.)

In the coming months, Maj Chew said, his office will continue to work with Marines across the nation to familiarize them with the process:

We're going to continue experimentation and work with wing and ground units to expand the exposure and gain more advocacy and requirements from the fleet. As we look forward at venues where [O]perating [F]orces can train to maintain this capability, we'll ensure they stay proficient so when they need to use this for its intended purpose, they aren't starting from scratch.

The Marine Corps 7th Engineer Support Battalion at Camp Pendleton, CA, plans to conduct another full-scale EM-FAC test this spring, during Operation PACIFIC BLITZ.

