



SAFT

Illuminating the Path to a More Electrified Future

With the Advanced Flightline Power and Light System (AFPALS) light cart project, the U.S. Air Force and Concurrent Technologies Corporation (CTC) demonstrate the benefits of a hybridized approach to aircraft maintenance and repair with the help of Saft's 6T battery.

Introduction

The U.S. Air Force uses light carts on the flightline to provide illumination for aircraft maintainers during hours of darkness and to provide mobile electricity for power tools during all hours. Striving for more efficient, environmentally responsible, and operator-friendly power with less reliance on fossil fuel is a common goal for military, business, and society in general. For the U.S. Air Force's maintenance teams, the benefits of electrifying their aircraft maintenance light cart were more practical. "Having a continuously running diesel engine

is inefficient, stinky, noisy, and impedes communication," said Mr. Thomas Layne, Project Lead from the Air Force Research Laboratory's Advanced Power Technology Office (AFRL-APTO). Indeed, CMSgt Marcus "Woody" Haralson, who oversees the ground support equipment for active-duty Air Force members all over the world, agrees. He stated the request for an electrified light cart came directly from the field.

"We literally have had the same equipment since the 50s and 60s," he said. *"Modern aircraft needs modern support equipment."*



TotalEnergies

With equipment efficiency, maintainer health & safety, and combat capability in mind, Chief Haralson fully embraced this forward-looking project that will result in a better, more modern light cart. CTC was successful in the competitive award to hybridize the equipment incorporating energy storage. The resulting AFPALS is "an energy-efficient, hybrid light cart prototype that includes a plethora of varying technologies considered for the next generation light cart," according to AFRL-APTO. It provides flightline and perimeter illumination necessary for aircraft maintenance, troubleshooting, and perimeter lighting to secure the outskirts of deployed/contingency locations.



Chief Haralson Presents AFPALS to Leadership during USAF Basing & Logistics Conference

Incorporating Battery Technology

The Air Force's goals for AFPALS were to reduce fuel consumption, increase run-time, incorporate remote health monitoring and control, and improve lighting with light emitting diode (LED) lights. According to Mr. Bryan Tipton, CTC Technical Lead, in the process of developing the project they considered a wide variety of Li-ion based energy storage.



AFPALS Demonstrated at Andersen AFB, Guam during Agile Combat Employment Exercise

"We became aware of the USAF led large-format battery standardization effort with the Army and Navy; specifically, the Li-Ion 6T battery development efforts within the Army. The general feeling was that Saft already had a fielded product," he said.

The possibility of standardization across the Army, Navy, and Air Force was attractive, as well as the inherent safety, UN38.3 certification, and integrated controller area network to monitor the individual modules. The UN38.3 certification is necessary to allow transport of the equipment containing Li-ion batteries by air. CTC integrated Saft's 6T battery into AFPALS to enable hybrid (diesel engine-battery) and battery-only operations. In hybrid mode, the diesel engine is required to operate one hour out of three to recharge the battery. When in use, the generator charges the battery and auxiliary loads, enabling two hours of operation fully on the battery for the one hour of charge. According to Mr. David Moyer, CTC Project Manager, "Laboratory testing of AFPALS in hybrid operation with efficient LED lights indicated 50-55% reduction in fuel consumption and 65-70% reduction in amount of engine run time." Mr. Tipton said it would be unrealistic to achieve the same results with a lead-acid battery due to the necessary duty cycle and cycle life. He estimated for this application with the Saft published cycle lift, the Li-ion battery could yield seven to eight years of useful life.

CTC also incorporated a customized remote health monitoring and control system from Tactical Lighting

Systems (TLS) into AFPALS. The system remotely monitors the engine and battery health and alerts the operator control interface when maintenance or service is required. The remote control can also turn the engine and lights on and off, without physically having to be at the unit. These features reduce engine operations duration, reduce maintenance, improve fuel efficiency, and improve the safety of field personnel by limiting exposure in the field. According to Chief Haralson, in a typical airfield setting, it could take several hours to move around the perimeter access for light cart refueling. Reducing the time and exposure of the Airmen, especially in a deployed setting, improves the success of the mission.



Improved ROI, Healthier and Safer Maintenance Crews

The Air Force has already seen positive results from the AFPALS. Chief Haralson said that during a two-week AFPALS demo, they consumed a little over one gallon of fuel per night from a 32-gallon fuel tank with 10 hours of darkness, whereas the legacy cart would have used seven gallons. Aside from fuel consumption, he's seen a decrease in maintainer touch time since the need to refuel has been reduced. He said, "I have seen all kinds of positives. I'm saving money and other consumables by running in hybrid or full electric mode, I reduce the amount of times I have to change the oil, fewer moving pieces, fewer things breaking down." He really highlighted the occupational health aspect to being exposed to diesel generators with potential hearing damage and the effects of breathing in diesel exhaust.



He also said the safety aspect of the battery is critical. *"I don't have enough fingers to tell you how many times I've seen an Airman arc a battery,"* he said. *"I like the safety aspect of the Saft battery not having a voltage potential when the system is turned off. It's important for the guys who are in close contact with the battery."*

Mr. Layne agrees and further notes that using a common battery format will contribute to simplified logistics chains, equipment designs, and increase production volumes resulting in cost savings.

He said, *"We are trying to enable Energy on-Demand where we can. Batteries can allow us to use our energy more efficiently compared to continuously running diesel engines, and this improves combat capability. All the flightline support equipment requires continuously running diesel engines, for example generators, air conditioners, hydraulic test stands; and all these things are making noise, emissions, and burning up fossil fuel whether they need to or not. The battery-based 'energy on demand' architecture will improve energy efficiency, environmental conditions, operator conditions, safety, and maintenance."*

The Light Cart of the Future

With the AFPALS project now complete, Chief Haralson declared it a raging success. This project allowed us to get out in front and execute proactive modernization for the first time. We were able to experiment with new technology, which ultimately led to state-of-the-art requirements for the Light Cart of the Future. This project allowed us to get to "new-new" modernization instead of "new-old" replacement where we simply buy newer versions of the old equipment. Based on the success of the Hybrid AFPALS, Chief Haralson now also envisions a place on the flightline for a full-electric ground power cart.

Mr. Layne said, *"I'd say we are in a transformation like the commercial auto industry, and a lot of equipment as it wears out will transition to hybrid or full-electric."*

For this to happen, he says, moving toward a common battery will be critical to reduce costs, simplify logistics, and remove barriers to entry. Saft's 6T is a 24V Li-ion standard 6T-sized battery used in a wide variety of military applications. It doubles the useful capacity of lead-acid batteries in the same footprint.

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