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24V LI-ION 6T BATTERY TO MEET TODAYS POWER AND ENERGY GOALS

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ABSTRACT

Lithium Ion batteries, a well established technology for soldier portable electronic requirements is still finding its role in larger scale vehicle applications. Li-Ion is emerging as a contender in mobile applications where volume, weight, temperature sensitivity, energy density and battery management control is more important than initial cost.

INTRODUCTION

The Army's first use of trucks in a military operation was in the Punitive Expedition in pursuit of Mexican revolutionary Francisco "Pancho" Villa in June, 1916. The Villistas had raided Columbus, N.M., killing several people. Brigadier General John Pershing organized a large force of troops, horses and vehicles to catch Villa. Among the motor vehicles were 1915 GMC model 15, three-quarter-ton trucks.

The operation encountered severe conditions leaving many of the trucks stuck in sand and subsequently abandoned. While Villa was not caught the Army learned much about motor vehicle operation and support requirements and consequently was better prepared to use mechanized vehicles when they became involved in the First World War in 1917.

BATTERY TECHNOLOGY TODAY

The same Lead Acid battery technology that was in the vehicles chasing Pancho Villa in 1916 is still being used today in our military vehicles. Lead Acid batteries, invented in 1859 (158 years ago) used in vehicles for the primary purpose of Starting, Lights and Ignition (SLI) are now required to do that but also run a multitude of electronics, sensors and communitions gear.

MILITARY REQUIREMENTS

It is estimated there are over 500,000 vehicles in todays military fleet. Tactical vehicles have at least 2 12Volt Lead Acid 6T batteries (total 24V) and in some cases as many as 8 – 12 6T lead acid batteries onboard. 6T is the NATO Battery format and the most commonly used battery in military vehicles throughout the world.

The military began using Lithium Ion batteries in significant numbers in 2004 when Bren-Tronics won the $260M "Omni Charge" contract. This contract included soldier portable Li-ion batteries and chargers. Building a Li-ion battery in the 6T format had been a challenge due to the chemistry, electronics and high cost. After years of design and development effort, Bren-Tronics introduced their family of 24V Lithium Ion 6T's in 2015.

LI-ION BATTERIES

The advantages Li-ion batteries bring to the war fighter are numerous. Lithium ion batteries offer 3 to 4 times the energy of their lead acid counter parts. The projected capacity of a lead acid battery is 60 Ah and 1.44 kWh while the actual capacity of the Bren-Tronics Li-Ion 6T battery offers 125 Ah and 3.2 kWh. That additional energy can be used to power sensors, jammers, communications, control systems and in the future Active Protection Systems, something lead acid batteries will have trouble meeting.

Weight and cube are significant factors in any program. One Lead Acid battery weighs 88 pounds and as previously mentioned each tactical military vehicle has at least two batteries for a total weight of 176 pounds. One Bren-Tronics 24V 6T battery weighs only 42 pounds and can replace two of the lead acid batteries providing the SLI capability of the replaced lead acid batteries. Since the Bren-Tronics battery meets the NATO 6T form factor, our substantially lighter battery is a drop-in replacement, no special battery box or cabling is necessary. In this simple scenario, you've just reduced your weight by 134 pounds and gained the space taken up by the second battery. Using the Stryker as an example where there can be up to 6 or in some cases even 8 lead acid batteries the weight savings can be significant. Two or three Bren-Tronics 6T's could replace 6 lead acid batteries saving over 400 pounds and easily meeting the energy requirements. If one was to do a one for one replacement of Li-Ion 6T's you'd still realize more than a 50% weight savings with a significant energy boost that could meet very aggressive Silent Watch requirements.

SAFETY

The properties of Li-Ion allow for Battery Management Systems (BMS), something that is not possible with lead acid batteries. A BMS not only can provide the user a multitude of information including State of Health, Battery status and diagnostics it also will protect the battery and prevent over current, over temperature, and most significantly, overcharge, and over discharge. Once the issue that triggered the protection is removed and if the battery is safe to resume operation, the BMS will allow that to happen.

TEST RESULTS

Tests conducted at TARDEC over the past year are now indicating that the life of a Bren-Tronics Li-Ion 6T battery ranges between 6 to 10 years. Each 'cycle' test starts with a fully charged battery and stops when the battery is completely discharged or 100% depth of discharge. Two of the Bren-Tronics batteries currently being tested at TARDEC have just reached 2,000 cycles and we're confident they would each have at least 3,000 cycles left. If one 100% DOD test with a lead acid battery were preformed it would severely damage the battery to the point where a new one would be required if further operation is required. Compare 10 years of battery life to just months for a lead acid battery and one can see a significant savings in battery costs, battery maintenance and the logistics required to support a worldwide Army.

REFERENCES

[1] Early Days of Motorized Military Vehicles, Military.Com

[2] GM Military History page