

Energy Storage Manufacturing—High Power, High Energy Density Lithium Ion (Li-Ion) Batteries

Implement automated manufacturing processing to reduce production costs while improving overall battery performance, safety, and reliability.

OBJECTIVE / SOLUTION

This ATO-M is designed to improve the current limited manufacturing capability for high power 30Amp/hr battery cells by automating selected manufacturing processes. The goal is to increase the production rate and yield of battery cells and to reduce production costs while improving overall battery performance, safety, and reliability. Target metrics of the program include: reducing the cost of the 30kW-hr battery pack from \$115K to \$58K, increasing power density to 3KW/kg, and increasing energy density to 150W-hr/kg. Technology improvements will be integrated with the ATO-M effort to include new electrolyte and electrode materials that will enhance high temperature stability. New circuit breaker technology inherent within the structure of the cell will also be evaluated to reduce the risk of overcharging and venting. Development of prismatic lithium ion cells optimized for an integrated cooling system will be investigated.

ACHIEVEMENTS

The contract award was made in July 2004, and program kickoff meeting took place in August 2004. The project scope includes 880 tasks over 6 years which include: manufacture of improved electrodes, cell closure and bussing/circuit breaker, cell filling, cell formation, battery assembly, performance and safety, and liquid cooled module and prismatic cell development. For this program, the coater, beta gauge, and mixing system have been installed and machine run qualifications have been completed. Process definition and process design trials have been initiated and long lead equipment and materials orders have been placed and are being delivered. Cell filling process studies, and alternates have been on-going. New bussing system and cell circuit breakers are being designed and tested for cost reduction and safety improvements. Large volume formation process improvements and process studies for the improved filling process have been evaluated and new equipment is on order. Technology investments in joint TARDEC/ARL ATO ILLG.2004.03 for developing new fire retardant electrolyte and thin electrode materials to increase cell power density are being executed in parallel with this ATO-M. Technology will be transferred at the end of 2007 and maturation will continue through 2009.

BENEFITS

- Affordable high power and high energy density Li-Ion batteries suitable for traction and pulsed power applications.
- Expansion of silent watch and silent mobility capabilities.
- Additional boost power for dash mobility and acceleration with a positive impact on survivability.
- Pulsed power applications for direct support of the directed energy weapons without the use of a pulse forming network (PFN).
- An automated Li-Ion battery manufacturing process.

STATUS

- Start of work meeting with battery technology experts from TARDEC, ARL, and Industry (SAFT) held in August 2004.
- Project plans and execution for long lead equipment and process design to meet ATO-M objectives are in process.
- Circuit breaker design verification is in progress; currently tableless bussing approach has been selected and is being evaluated.
- Process and fundamental studies for cell filling including electrode porosity, separator porosity, and cell porosity as a complete system is ongoing. Process trials testing is ongoing and selection of new formation equipment is ongoing.
- Method to manage thermal transfer within a liquid cooled module is in the design process.

WEAPON SYSTEMS / SECONDARY ITEMS IMPACTED

- Manned and Unmanned Ground Combat Vehicles (MGCV/UGCV)
- Electro-Magnetic (EM) armor, electro-thermal chemical guns, rail guns, high power Directed Energy Weapons (DEW), and low power Solid State Heat Capacity Laser (SSHCL)

POTENTIAL COST AVOIDANCE

- Reduction of the battery pack cost by half its current cost.
- Total Net Present Value cost avoidance is \$183,000,000



Unmanned Ground Vehicle (UGV)



SAFT Battery Pack



Directed Energy Weapon