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## Integration of a 600-V Li-ion Battery into a 60-kJ Capacitor Bank for Simulation of Repetitive Pulsed Power Discharge Testing

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The U.S. Naval Research Laboratory (NRL) has designed, constructed, and tested a twelve-bank system designed to be powered exclusively through Li-ion batteries and discharged into a water-based resistive load. An NRL-designed rapid capacitor charger is used to modulate the  $\approx$ 630 V open-circuit voltage on the battery bank to charge the capacitor to a maximum value of 5 kV. The charger uses a full-bridge IGBT with a modified pulse pattern to avoid saturation of the transformer and is controlled with a microcontroller on a custom circuit board. A series of experiments has been performed to evaluate the performance of the batteries used in the pulsed power system. These experiments simulated both a single-cell and a parallel-cell system at both high discharge and low discharge rates. The experiments show a reduction of life of approximately 75% when the cells are operated in parallel versus as a single cell system. The results of the lifetime study and operational testing will be discussed, as well as an analysis of a post-mortem battery study when end-of-life has been reached on batteries operated at the high discharge levels necessary for pulsed-power systems.

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