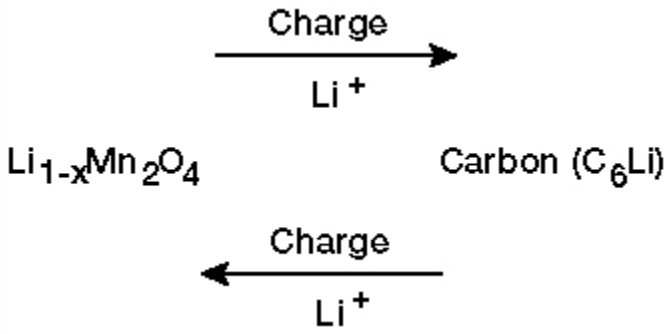
Lithium Ion Batteries

Lithium ion batteries, which use a new battery chemistry, are being developed under cooperative agreements between Lockheed Martin, Ultralife Battery, and the NASA Lewis Research Center. The unit cells are made in flat (prismatic) shapes that can be connected in series and parallel to achieve desired voltages and capacities. These batteries will soon be marketed to commercial original-equipment manufacturers and thereafter will be available for military and space use. Current NiCd batteries offer about 35 W-hr/kg compared with 110 W-hr/kg for current lithium ion batteries. Our ultimate target for these batteries is 200 W-hr/kg.

This new system has charge/discharge characteristics very close to those of cells containing metallic lithium anodes, without the presence of lithium metal. In the following equations, it can be seen that only lithium ions are involved:

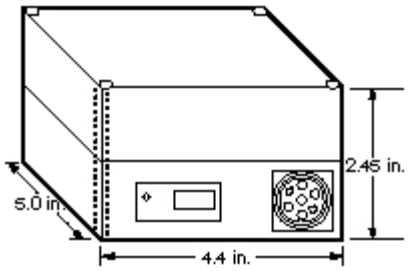


The absence of lithium metal, high energy density, and other factors lead to benefits for space, military, and commercial use. Lithium ion batteries are smaller and lighter than NiCd batteries, with no toxic materials, no free liquids (use a solid polymer electrolyte), no gas pressure, no thermal runaway, and no incineration problems. They produce no explosions when abuse tested by exposure to short circuits, nail punctures, water immersion, overcharge, overdischarge and reversal, and hydraulic pressures to 1500 psi. In addition to generating only low levels of heat, they operate at higher temperatures and are more powerful than conventional batteries (average discharge voltage is 3.7 V).

Some expected applications are given in the following table:

Nonmilitary uses	Military and space uses
Cellular phones	Backpack radio battery BB590L (see figure)
Laptop computers	Missile launch battery
Portable radios	Marine battery, swimmer[a]
Two-way radios	Satellite batteries
Electric vehicles	

[a]Submersible.



BB590L portable lithium-ion radio battery (capable of 15 V at 8 A-hr, or 30 V at 4 A-hr).

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