

# LITHIUM-ION BATTERIES

## LONG RUN TIME

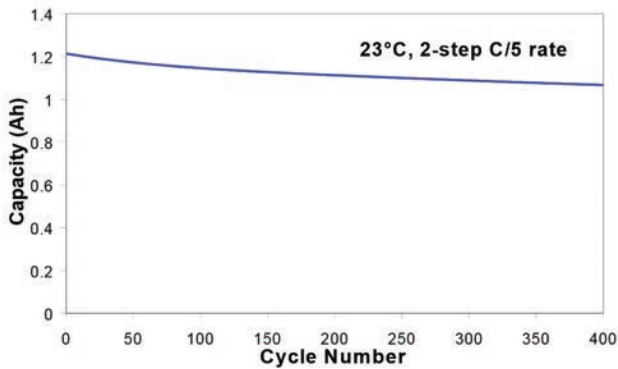
Lithium-ion (Li-Ion) is the most advanced battery technology available today for portable devices. Li-ion has the highest energy density available, meaning that it is the lightest rechargeable battery for the power provided. For the same space used by NiCd (Nickel-Cadmium) or NiMH (Nickel-Metal Hydride), Li-Ion batteries provide longer run time for much less weight. In the MultiRAE Plus, the 4.8 oz (136 gram) Li-Ion battery provides approximately 20 hours of run time, while the old 5.6 oz (159 grams) NiCd battery provides just 10 hours of run time.

## Excellent Charge Retention

NiCds can self-discharge. Even if there is no load on the battery a NiCd will lose charge all on its own. Li-Ion batteries were designed for powering satellites and have excellent charge retention.

## Long Cycle Life

Li-ion batteries still have 80% of their original capacity even after 400 complete discharge cycles.



For the QRAE Plus, which has a 20+ hour battery, a complete charge cycle would be using it 10 hours, recharging it, and then using again for 10 hours and recharging it again.

After 1,000 charging cycles, a MultiRAE Plus or QRAE Plus Li-Ion battery still has 80% of its original 20-hour capacity. Even if used eight hours per day, five days per week, after 3.8 years (which is 400 complete discharge cycles), these Li-Ion batteries still have 16 hours of run time available (20 x 0.80 = 16).

## No “Memory Effect”

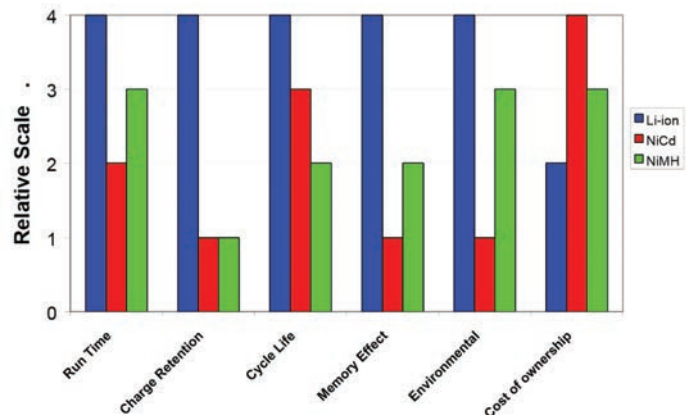
Li-Ion batteries have no “memory effect,” unlike NiCd and even NiMH to a lesser degree; they don’t need to be completely discharged to maintain their working duration. If a 10-hour NiCd battery is used repeatedly for just 2 hours and then returned to a charger without a complete discharge, it soon develops a memory and becomes just a 2-hour battery. A 10-hour Li-Ion battery can be used repeatedly for just 2 hours without compromising its full working duration.

## Environmentally Safe

Elemental lithium is highly reactive. When mixed with water, it reacts violently. Some lithium batteries used in cameras react violently with water if they are opened. However, Li-Ion batteries are stable and safe. The lithium in Li-Ion batteries is bound into the polymer of the battery. Even if cut open and exposed to water, Li-Ion batteries are safe and are rated non-hazardous for air transportation and disposal. Li-Ion batteries contain the lowest amount of toxic heavy metals and are much more environmentally “friendly” than NiCd batteries. Throwing out a Li-Ion battery is similar to disposing of a hunk of plastic.

## Lowest Cost of Ownership

While Li-Ion batteries have a higher initial cost, their long life and superior performance translates into the lowest “cost of ownership” for any battery used in portable instruments. Where a \$155 NiCd might only last two years, a \$200 Li-Ion can easily deliver four or more years of use. That is a 100% increase in lifetime for just a 29% increase in battery purchase cost. Another way of looking at it is that a NiCd costs \$77.50 per year of use while a Li-Ion battery costs just \$50.00 per year of use.

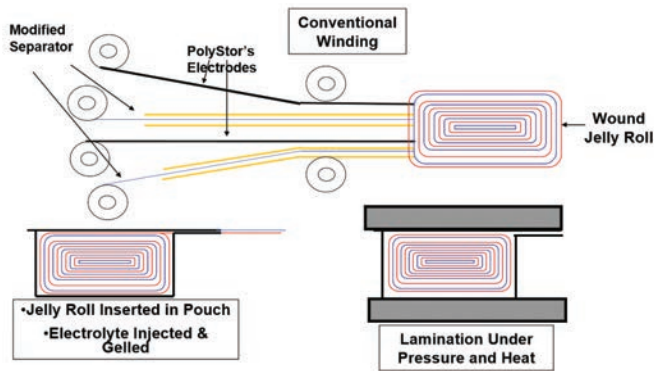


### “Prismatic” Li-Ion Batteries

Part of Li-Ion battery efficiency is their “prismatic” nature. Batteries were traditionally round metal “cans.” Battery packs were made by shrink-wrapping a number of cans together until the desired capacity was reached. However, the space between the cans was wasted.



As most batteries are part of a square device, room in the square battery compartment was lost to the round batteries. Li-Ion batteries can be made to fit the available space. They are assembled like a jelly roll. Then they are laminated under pressure to form their final shape.



### MULTIRAES AND QRAES CAN BE UPGRADED TO LI-ION BATTERIES

Upgrading to Li-Ion batteries can provide substantial increase in battery runtime and life. Upgrading to Lithium-Ion batteries must be done by RAE Systems factory personnel because a new UL label is required. Contact RAE Systems Service for more details.

Product	NiCd Run	Li-Ion Run	\$% Inc
QRAE	12 hours	20 hours	+66%
MultiRAE Plus	10 hours	16 hours	+60%

Many of our customers who have upgraded have noticed that sometimes when a new Li-Ion battery is put into a MultiRAE or QRAE, the screen does not display “Charging...” and the charge LEDs blink red/green at a high rate. This is not an indication that the battery’s internal protection (fuse) has gone bad. When the Li-Ion battery drops below a critical voltage, it exhibits this behavior. If the MultiRAE is left on a charger, and the battery gets a charge in it, the problem goes away and normal charging resumes. Used under normal conditions, when the battery isn’t allowed to completely discharge, this problem should not reappear.