

From: Paul McGill <mcgill@mbari.org>
Subject: **Rover Li battery test**
Date: July 25, 2012 10:57:47 AM PDT
To: Alana Sherman <alana@mbari.org>, Ken Smith <ksmith@mbari.org>
Cc: Richard Henthorn <henthorn@mbari.org>

Here are the results of our cold room testing to determine how much energy was left in the Rover Li batteries after the Nov11 to Jun12 deployment. This email documents everything we know about the batteries so we don't have to figure it out again. Ken, you can skip to the last paragraph.

The battery packs we order from Electrochem are 4S7P, rated at 15.6 V and 210 A-h. We use four of these packs to fill a Rover sphere, so the resulting pack is 8S14P, or 31.2 V at 420 A-h. The Electrochem 3B36 cells used to build the battery packs spend most of their time at about 3.6 V per cell and we have isolation diodes in the string, so our packs are actually closer to 28 V. The 3B36 data sheet derates the cells from 30 A-h down to 25 A-h at 0 degC, so each sphere is actually 350 A-h at 28 V, or 9800 W-h.

Our last deployment was from 20Nov11 to 11Jun12, for a total of 204 days. According to my Rover power budget spreadsheet we draw an average of 2.931 W during a deployment, so the last deployment should've used 14.35 kW-h, or 1.46 spheres of Li batteries. This means that each sphere should've had about 26% of its capacity left after the last deployment.

Our cold room load test of one sphere of batteries showed 79 A-h of capacity left out of a total of 350 A-h, or 23% remaining. This is really close to the predicted 26% and tells us that both the battery energy rating and power budget aren't too far off (or they are off in the same direction).

The bottom line: based on our field experience and lab tests, two spheres of Li batteries should run the current Rover for almost exactly 9 months. One alkaline and one Li sphere would not run the rover for 6 months. Modifying the Rover to replace the Tri-M power supply with a Wakey board would stretch the Rover deployment with two Li spheres to 14 months.

Paul