Life in the Atacama Field Journal
October 1 – 6, 2005
Mina Guanaco, Chile

Agenda
• Conduct Site F investigation

Status and Progress

• Collected landing site panorama. We got off to an excellent start by quickly getting Zoë to the landing site, setting up the weather station, and collecting the first panorama. We were done by early afternoon, had the landing site panorama uploaded to the remote science team in Pittsburgh.

• Experienced high winds. On the first day of operations after Zoë had arrived at the landing site we had high winds and clouds as a weather front moved in. Shortly before dawn wind that the rover was sustained above 45 KPH (30 MPH) and gusting to 55 KPH(40 MPH). Several hours later winds were 70 KPH (45 MPH) with gusts to 90KPH (55 MPH). Zoë sustained the winds without problem and with the tail into the wind there was no significant fluttering of the solar panels. We delayed the start of operations in part because of concern for a gust lifting the panels (like a wing) as the rover climbs or descends terrain and presents an inclined surface; and in part because the science plan called for extensive fluorescence imaging and the dyes could not be sprayed into the target area as they were instead carried downwind. The first rover operations did not begin until 2:00pm.

• Got our bearings. One of the implications of the long field season, over two months this year, is that we have to rotate people. So not surprisingly it takes a bit of time to catch up with the current state of the system and get comfortable with operations. This is particularly true for the rover drivers who monitor Zoë as it executes the daily plan, record and sometimes debug conditions for traverse termination, and restart the plan. We spent a bit of time the first day driving in circles while we cleared up coordinate confusion with the localization system and timing issues with a new rover executive (the software that parses the plan) that Zoë was running. By the end of the day we were on track.

• Collected much fluorescence data. The remote science team has developed a protocol where the collect a series of measurements each time they encounter a new habitat. This involves about 7 fluorescence sequences (taking 3 hours). It is producing very interesting results. In this site especially in the field we are hearing that the science team believes they are finding many organic
molecules (carbohydrates, lipids, and protein). Now available online at: http://www.fieldrobotics.org/atacama and click on Science Data.

• Encountered impassible terrain. After detailed investigation near the landing site, Zoë was commanded on long daily drives, first north along the valley, and then southeast. The science team produced plans for 10km of traverse each day and Zoë tried hard to deliver, exceeding 3km of traverse every sol and reaching a peak of 9.9km of traverse with science actions (panorama, fluorescence imaging, plowing, etc.)

We did encounter several terrain features that were too much for even Zoë to handle. At higher altitude, 3000 m (10,000 ft) it encountered drainages likely cut with snow melt that had embankments almost 6 m (20 ft) vertical. Zoë did decide to stop at the lip of these “canyons”, although the rover wrangler was right there ready to intervene if needed. There were collapses that Zoë was able to descent and ascend but it’s planning software is not yet sophisticated enough to search out these small features (too small to be seen by satellite) or to reason about the best way to approach a slope and succeed with minimal traction. In the interest of expedience and to obtain the maximum benefit for the science investigation, we documented these situations and made notes for for future research development, then manually drove Zoë across the divide to resume its plan autonomously.

• Experienced battery fault. Zoë usually operates with Lithium-Polymer batteries (3000 Whr total capacity) that were custom built to meet our specification. (We have lead-acid batteries spares that provide about 1/5 the capacity.) The Li-Ion batteries (2) are each made of 20 individual cells and have a their own computer to monitor charging and cell voltages. These batteries have proven very reliable and allow Zoë to build large energy reserve during the midday when solar energy can reach 1100 W/m2, which in turn means it can operate earlier in the morning and later in the day when light
levels are low. We have noticed a couple occasions where the controller on one of the two batteries will fault, likely due to a low voltage in one of the cells. This is detected by the health monitoring software. The fault leads to a drop in bus voltage which in turn can cause computers to reboot. We are looking into possible remedies as we learn more about battery behavior but thus far the fault clears and the rover comes back up. At this point it is only a minor annoyance, and perhaps the cost of trying new technology.

Upcoming
• Continue Site F remote science investigation

Weather
Everyday: Early clouds clearing, cool (5-15°C), windy (maximum 25m/s, about 55 MPH), dry (5-10 %RH). Science data online at: http://www.fieldrobotics.org/atacama under Science Data.

Quote of the Day
“I fired a snot rocket 30 feet! … It won’t hold as a world record because I didn’t do it in both directions.”