

## **University Rover Challenge 2008 – Requirements and Guidelines**

Any issues not covered by these published rule sets will be addressed on a case-by-case basis by the University Rover Challenge (URC) Director. Please consult the Questions and Answers portion of the URC web site (<http://www.universityroverchallenge.org>) for updates.

### *Rover Guidelines and Competition Overview*

- The 2008 University Rover Challenge will be held June 5-7, 2008 at the Mars Society's Mars Desert Research Station (MDRS) near Hanksville, Utah.
- The rover shall be a stand-alone, off-the-grid, mobile platform. No tethers will be allowed during its operation for connection to external sources.
- Teams will operate their rovers from designated command and control stations. These stations shall be tents with tarp walls restricting visibility of the course (to be provided). Basic power (120V, 60Hz), tables, and chairs will be provided.
- The rover shall be judged in the four competition events outlined below. The four tasks will be independent events. The rover is not required to be in the same configuration for different events. Teams will have at least three hours to reconfigure, adjust and repair their rovers in between events, and will not have to compete in more than 2 events in a single day. Each event shall be worth 100 points, for a total of 400 points.
  - Geology Task:

Teams will be given a field briefing by judges and will be tasked with investigating multiple sites of geological interest within a 0.8 km radius of the start gate. Judges will provide a general description of the tasked sites, to include GPS coordinates with their accuracy range. Teams shall document each sample site according to the Remote Science Documentation Procedure described below. Additionally, teams shall provide a detailed analysis of each site, to include a spectral analysis (both visible and infrared spectra) of any relevant geologic features. Teams will be given 30-60 minutes to collect data with the rover (exact amount of time to be announced on-site), after which they will be given an equal amount of time to prepare data for a field briefing to the judges. Teams may be given many sites from which to choose; however will be expected to collect data from no more than 4 sites of their choosing from that list.
  - Soil Characterization Task:

Teams will be given a field briefing by judges and will be tasked with investigating multiple sites of biological interest within a 0.8 km radius of the start gate. Tasked sites will be given general descriptions to include GPS coordinates with their accuracy range. Teams shall document each sample site according to the Remote Science Documentation Procedure described below. Additionally, teams shall provide a detailed analysis of each site, to include measurements of local soil water concentration, pH level, and subsurface temperature (ideally 10 cm below the surface). Teams will be given 30-60 minutes to collect data with the rover (exact amount of time to be announced on-site), after which they will be given an equal amount of time to prepare data for a field briefing to the judges. Teams may be given many sites from

which to choose; however will be expected to collect data from no more than 4 sites of their choosing from that list.

○ Emergency Navigation Task:

Teams shall be required to deliver an emergency supply container to a simulated distressed astronaut (within 1 meter of the astronaut, as designated by the presence of a space suit) as quickly as possible. The supply container (to be provided on-site) shall be no larger than 30cm x 30cm x 15cm, weigh no more than 6kg, be orientation independent, and will be covered in the loop portion (i.e. – the soft side) of a VELCRO style fastener (which teams must utilize to secure the box to the rover). The emergency supply container must be delivered, however it does not need to be deployed. A maximum time limit between 30 and 60 minutes, and a last known GPS location for the astronaut will be provided to teams; however teams should expect the astronaut to have strayed from this location. The astronaut will be located within a 1.5 km radius of the start gate. Line of sight communication with the start gate will only be guaranteed for 80% of the course. While it will be possible to reach the astronaut by traversing moderate terrain (less than 15% slope), the ability to traverse aggressive terrain will improve the likelihood of success. Scores will be based on speed of delivery. Extreme shock to the container should be avoided.

○ Construction Task:

Rovers shall be required to secure several ½” hex bolts on a mock-up equipment panel. The bolts will be placed between 15cm and 75cm above the ground, and may lie at inclinations of no more than 45° in either direction from the horizontal plane. All bolts will begin in the proper threaded slot, and must be secured by turning clockwise. Measures to prevent over-tightening and/or stripping should be employed. Rovers shall have to travel up to 0.5 km across relatively flat terrain (negligible slope) to reach the panel.

● Remote Science Documentation Procedure:

For the Geology and Biology Tasks, teams shall follow these guidelines at each site. At a given site, the team shall take a close up, high-resolution picture with some indication of scale (scale can be indicated post-capture). The team shall then produce a wide-angle panorama showing the full context of the site and immediate surrounding area. The panorama must indicate cardinal directions, and have some indication of scale. Teams must also record the detailed GPS coordinates of each site, to include elevation and accuracy range.

- For each of the individual events, the rover shall begin from a start gate defined by a 10 meter radius from the team’s command and control tent. The rover shall return to the start gate within the time allotted, or will suffer a penalty of up to 10 points depending on the finishing distance from the start gate.

- The maximum allowable mass of the rover when deployed for any competition event is 50 kg. This mass does not include any other hardware used to prepare or maintain the rover, any

spare power sources not being used, or any additional rover configuration components not on-board for the particular competition event.

- For each event in which the rover is overweight, the team shall be assessed a penalty of 10 points, plus 1 additional point per kilogram over 50.
  - Rovers over 75 kg in any given configuration must be cleared with the URC Director by email prior to May 2, 2008 to be eligible to compete.
  - The combined mass of spare power sources and additional rover configuration components shall not exceed 20 kg.
  - There will be no weight limit imposed on command and control team equipment, base communications equipment or maintenance tools.
- The rover shall not be required to be autonomous. However it shall be operated remotely by a team which will not be able to view the rover on the site or the site itself directly. The rover may be commanded by the team using a wireless link, with information needed for guiding the rover acquired by the rover's own on-board systems and transmitted to the team wirelessly. There shall be no time delay in communications, as the URC is based on the assumption that the rovers in question are telerobots, being operated by astronauts on or orbiting Mars.
  - The GPS standard at MDRS is NAD 27. Teams shall adhere to this standard.
  - Wireless communication methods used by teams shall adhere to all applicable FCC standards and regulations. Teams must submit details regarding any wireless communication devices being implemented to the URC Director no later than May 2, 2008. Teams must notify the URC Director immediately of any changes after this date. Teams may be required to power down communications equipment at the event sites while not competing, so as not to interfere with other teams.
  - Communications equipment must not rely on the team's ability to watch and track the rover first hand. Equipment may be directionally steered if kept inside the command and control tent. Any communications equipment outside of the tent shall be stationary. Teams may have a member visually track the rover and rotate/steer communications equipment placed outside of the tent. This person may not communicate with the rest of the team inside the tent, and will result in a penalty of 10 points per event utilized.
  - The test site is located in the desert of southern Utah. As such, the site will have a full spectrum of sloped terrain from flat to vertical. Except for when noted in this document, the objective sites shall be reachable by paths of no greater than a 15% slope. The rover shall also be capable of withstanding such an environment in the early summer, including airborne dust and temperatures that can easily reach 100°F. Although it is improbable, rovers shall be able to withstand extremely light rain. Rovers will not be expected to compete in heavy rain or thunderstorms.

### *Team Management*

- Teams shall be required to track all finances as related to this project, and submit a final expense record (soft or hard copy is acceptable) no later than the first day of URC event – June 5, 2008. Teams shall be penalized 50 points per day if they are late in submitting the expense report, and will be disqualified for not submitting their expense report by the end of the URC event.
  - The maximum allowable cash budget to be spent on the project is \$12,000 US, which shall include money spent on parts and components for the rover, rover modules, rover power sources, rover communications equipment, and base station communications equipment (only that equipment used to communicate with the rover). The budget limit shall not apply to command and control equipment not included above (i.e. base station computers and monitors), tools, volunteer labor time, or travel expenses.
  - Teams may acquire in-kind donations of equipment. Such donations do not count against the cash budget. Corporate sponsorship is encouraged.
  - Teams may be required to submit receipts as proof of budget upon request (donations must be documented by the donor).
  - Any parts and/or components purchased in previous years and/or leveraged from previous rovers for the URC 2008 rover shall be valued at current prices (teams must be prepared to document valuations).
  - International teams have an allowable budget equivalent to \$12,000 US based on the most advantageous documented currency conversion rate between August 1, 2007 and June 5, 2008.
  
- There shall be one division of competition open to both graduate and undergraduate students. Teams shall be permitted to include secondary school (high school) students.
  
- Teams are encouraged to work with advisors. However, advisors are expected to limit their involvement to academic level advising only. Non-technical team management duties, including tracking finances, fall within the duties of the students.

### *Logistics*

- Details concerning the logistics of the competition will be provided via the URC email announcements list, and will also be posted on the URC web site.

### *Schedule*

February 1, 2008 – Indication of Participation deadline for teams.

May 2, 2008 – Deadline for submission of communication details.

May 16, 2008 – Deadline for submission of travel team information.

June 5, 2007 – Deadline for submission of expense report.

June 5-7, 2008 – URC 2008 competition.