The Mars Society’s Mars Desert Research Station (MDRS) provides a unique environment for simulating planetary surface exploration activities. It enables the field testing and development of systems and procedures in an integrated environment that includes a human crew. It also allows participants to get invaluable first-hand experience with this type of operation, thus making it particularly suitable for participation by students of aerospace engineering and related fields.

After concluding seven highly successful two-week rotations at MDRS from spring 2005 to spring 2011 (MDRS Crews 37, 47, 60, 69, 79, 93, 101), the Mars Society @ Georgia Tech student chapter (MSGT) assembled another crew of its members interested in pursuing Human Space Flight-related research and outreach at MDRS during Spring Break 2012 and the week before, from 10 to 25 March 2012.

The mission will include multiple science and engineering activities:

- Navigation, communication, and data transmission research
- Amateur Radio on the International Space Station (ARISS) program, ISS contact using HAM radio equipment
- Wind Turbine demonstration and evaluation
- Astronomical and atmospheric observations
- Human factors and crew dynamics research
- Waste water processes and management investigations
- Particulate matter (i.e. dust) mitigation research
- NASA INSPIRES outreach opportunities

The crew will be led by Matthew Miller, a 5th year aerospace engineering undergraduate whose role will be the crew’s commander. Crew members for the five station crew slots and mission support will be selected in early 2012. The crew is currently undergoing thorough training and familiarization in preparation for their mission at MDRS. The mission support crew will be based out of a Mission Support Center on the Georgia Tech campus and will work closely with the Mars Society mission support personnel in conjunction with the crew at the Mars simulation.

Following the mission, a post-mission report and conference papers will summarize the results and document mission planning, organization, and lessons learned.
The Mars Desert Research Station Crew 115 is composed of a diverse group of space enthusiast individuals. The 10 person group includes a variety of engineering majors and years in school ranging from first year to graduate students. The crew will be split in two groups, the mission support team that will support the crew at Georgia Tech, and the group that will travel to Utah to spend two weeks in Mars simulation. During the simulation the crew will perform a wide range of experiments and extra vehicular activities.

**Crew 115 Biographies**

**Jackie Alexander – Crew Geologist/Health and Safety Officer**

With hopes of one day being an astronaut, Jacqueline Alexander applied to Georgia Tech and successfully entered the class of 2014 to major in mechanical engineering. She is a member of Astronomy Club, Wreck Racing, and African American Student Union (AASU). She is very interested in human space flight and astronomy. An interesting fact about her: As part of training with the US Navy, she flew a T-34C (the first plane students at flight school learn to fly), lived on a US Submarine for a week, navigated a US Navy ship, and spent a week with the Marines over the summer. Jackie grew up as a military brat. She was born in Savannah, Georgia and has lived in Hawaii; Columbus, Georgia; Fayetteville, North Carolina; Seoul, South Korea; and Vienna, Virginia. In her free time, Jackie likes to play the piano, work-out, and socialize on facebook.

**Jordan Bell – Mission Support**

Jordan is a second year aerospace engineering student from Herndon, Virginia and a member of the Honors Program. She is interested in rocketry and hopes to intern for NASA this summer. Currently she is a Resident Advisor and the Principal Bassist for the Symphonic Orchestra. This past summer she interned at the National Air and Space Museum, Udvar Hazy Center.

**Shelby Bottoms – Mission Support**

Shelby Bottoms is a first-year Aerospace Engineering student at the Georgia Institute of Technology. She is from Overland Park, Kansas and plans to work in the space industry upon graduating in 2015. On campus, Shelby is on the Georgia Tech Goldrush Dance Team and is involved with Emerging Leaders, Engineers Without Borders, Christian Campus Fellowship, M&M Mentoring, and Astronomy Club. She has a passion for space, and as a teenager she attended astronomy camp, many years of space camp, and held a summer internship at NASA Johnson Space Center. She is very excited to be a part of MDRS Crew 115!
Jenny Dowling – Executive Officer

Jenny Dowling is a 5th year aerospace engineering major and is excited to be graduating in the spring of 2012! She will be continuing with graduate school after graduation for a MS in aerospace engineering. After attending space camp for the first time in elementary school she enjoyed it so much that she returned two more times for space academy and advanced space academy in Huntsville, AL. She co-oped at NASA Kennedy Space Center in the expendable launch vehicles fluids and propulsion group with a rotation into the shuttle environmental control and life support systems group. She was also a Propulsion Academy intern this past summer at Marshall Space Flight Center. She is the vice president of Georgia Tech’s AIAA chapter and is an avid swing dancer and treasurer of Georgia Tech Dance Association. She is really excited to be a part of the MDRS 115 crew!

Graham Kosiba – Crew Engineer

Graham Kosiba is a 3rd year Mechanical Engineering student at Georgia Tech. Graham was born in Gainesville, GA. Graham has always had an unquenchable thirst for science and learning. Space has always been a source of passion and true wonder for Graham. Like so many, Graham grew up claiming to become an astronaut, he is still steadfast in his claim. On campus Graham is the Vice President of the Planetary Society at Georgia Tech and a member of the Glee Club. As a co-op student Graham alternates school and work semesters for GE Aviation in Cincinnati, OH. Outside of academia Graham enjoys longboarding, listening to and playing music, and climbing trees. Graham is looking forward to this research opportunity immensely and can’t wait to ship out to Mars.

Matthew Miller - Commander

Matthew Miller is a 5th year Aerospace Engineering undergraduate at Georgia Tech. He has participated in an array of aerospace related ventures spanning from the AIAA Design/Build/Fly, private aerospace consulting, to academic undergraduate research. As Theodore von Kármán once said, "Engineers create the world that has never been." Ever since standing under the Saturn V at Kennedy Space Center in grade school, Matthew has had the desire to contribute to the construction of the next generation of human space flight unlike anything the world has ever seen.

Chrissy Redmond – Mission Support Lead/Outreach Coordinator

Christine Redmond is a sophomore studying Aerospace Engineering at Georgia Tech. Christine served as Health and Safety Officer and Outreach Officer on crew 101 in spring 2011. Her interest in engineering was first sparked after watching the movie October Sky in the fourth grade. Competing in the Sally Ride Toy Challenge throughout middle school and spending a few weeks at Space Camp in Huntsville Alabama locked her heart on NASA. She has spent the past three summers at NASA’s Goddard Space and Flight Center working in the Mechanical and Advanced Manufacturing branches. She hopes to work for NASA after finishing her formal education.
Jacky Silva – Mission Support Senior Advisor

Jackelynne Silva is an Aerospace Engineering graduate student at Georgia Tech. She was born in Cusco, Peru, and moved to New Jersey in 2001. Jackelynne earned two bachelor degrees from Rutgers University, Mechanical & Aerospace Engineering and Spanish Translation & Interpretation, with a Minor in Mathematics. For the past three years, she worked for Lockheed Martin, Space Systems Company as an Antennas Mechanical Design Engineer and as a Systems Integration and Test Engineer for commercial and government satellite programs. Her research experience includes reliability of lunar structures and the design and construction of a space elevator climber. Jackelynne has been an active member of SHPE, SWE, and AIAA. In her recent roles, she served as Chairperson of the AIAA Greater Philadelphia Section and as organizer and session chair of ICES-Space Architecture Technical Committee. Jackelynne’s interests include human space exploration, human factors, life cycle systems engineering, design and construction in extreme environments.

Lisa Thornsberry – Chief Scientist/Sponsorship Coordinator

Lisa Thornsberry is a fourth-year student pursuing a major in Chemical and Biomolecular Engineering and a minor in Spanish at Georgia Institute of Technology. She grew up in the Atlanta area in Milton, Georgia. Lisa became interested in human space flight after living in Houston, Texas during the summer of 2011, where she had the opportunity to tour Johnson Space Center and attend several presentations by astronauts. Lisa is involved in several campus organizations and is president of Mobilizing Opportunities for Volunteer Experience (MOVE), Georgia Tech’s largest community service organization. Lisa is an active member of Buckhead Church.

Kyle Yawn – Chief Engineer/Radio Specialist

Kyle Yawn is a fourth year Aerospace Engineering student at the Georgia Institute of Technology. He is also pursuing a minor in Nuclear and Radiological Engineering. Born and raised in Bonaire, GA, Kyle was given a passion for human spaceflight in middle school thanks to a wonderful teacher. Through the International Science and Engineering Fair as well as the Team America Rocketry Challenge and the Student Launch Initiative in middle school and high school, Kyle was able to gain valuable experience early in scientific and engineering processes which made him that much more passionate about spaceflight. He has spent the better part of the past two years working at NASA Goddard Space Flight Center and NASA Johnson Space Center covering a variety of roles from exploring methods to remove lunar dust from space suits, designing and certifying hardware for use on the International Space Station, developing an atmospheric processing module to produce methane from the Martian atmosphere, as well as supporting real time maintenance operations on board the International Space Station. Kyle believes that humanity must remain focused on human space exploration and that the Earth has incredible benefits waiting when we begin traveling outside of low Earth orbit once again. He plans on working for NASA upon graduation.
Experiments

**ARISS Ham Radio Communication Simulation with ISS:**
Many education groups have communicated with astronauts on board the International Space Station via an amateur radio or ARISS communication. By conducting an ARISS communication with the ISS crew, we will be demonstrating our ability to communicate with an orbiting spacecraft from the Martian surface. This will be important for relaying communications back to Earth, and eventually when a permanent settlement begins on the Red Planet, we will need to communicate from the surface with the next crew that is arriving.

**Constructing and Testing the Reliability of a Balloon-Launched Repeater:**
Communication using only geological elevation around the Hab for repeater placement proved to be insufficient in allowing constant communication with base and the EVA team. Past Georgia Tech crews 37 and 47 have attempted deploying a payload-carrying tethered balloon as an effort to provide constant communication to EVA crews. Implementation of balloon communication systems on Mars provides the benefit of cutting down launch mass of a radio tower, minimizes risks which crews may face conducting a mountain climbing EVA required to set up repeater, and it is more cost effective than a low-orbiting communications satellite.

High winds in past crew rotations have prevented successful experiment results. Crew 115 will build on the knowledge and resources acquired from past crews as well as implement wind stabilizing fins on the balloon design to further develop this experiment. The plan is based on equipping each EVA team member with a GPS receiver coupled to a handheld amateur radio for automatic position transmission to the Hab, where the positions can be displayed and forwarded for publishing on the Internet in near-real-time. A ground-based repeater will be placed in a strategic location in the area of operations to enhance coverage. An additional repeater will be attached to a tethered helium-filled balloon, further increasing communications range. The crew will use the positioning data recorded during EVAs to improve and update the MDRS database of waypoints, exploration sites and trails.

**Dust Mitigation Study:**
Dust mitigation and management is a field that requires further study and will be one of the main challenges to overcome while living on Mars. Dust would be a problem if it gets into the habitat, it could be harmful to the health of astronauts and difficult to remove, clogging up the air filters within the habitat. Experiments with dust mitigation techniques will be conducted within the airlock of the habitat. This study will attempt to mitigate the amount of dust from space suits carried into the airlock. The experiment will be conducted with both Earth regolith and lunar simulant.

**Food Study:**
Crew 115 will be participating in the food study as it has during the past three rotations. This experiment is organized by investigator Jean Hunter, of the Cornell University. This will entail consuming only shelf-stable foods for the duration of simulation in order to increase mission realism as well as to monitor psychological impact of such a diet. A major goal of this food study is to determine the acceptability of available instant foods and food prepared by the crew from shelf-stable ingredients. This study will also assess the time commitment for preparation of instant and crew-cooked foods and determine if they are correlated with the cook's self-reported cooking skill and experience along with assessing the effect of the type of food consumed on crewmembers' intake of food, and aspects of crewmembers' mood.

**Ham Radio Experiments:**
HAM radio is a great form of emergency communication on Earth, and will prove very useful to the exploration of the Martian surface. One way that we can demonstrate this use is through using APRS systems. These systems will be located on each crew member when conducting an excursion away from the base and will record GPS coordinates. Using HAM radio we can transmit these coordinates back to the base in order to monitor where each crew member is. This information is extremely useful in an emergency situation, and can also give the public an idea of what our surface exploration paths consist of.

**Human Factors Investigation:**
A major aspect pertaining to long duration human space flight is the maintenance and evaluation of crew psychological health. The success or failure of a mission hinges on the proper function of crew dynamics. Experiments will be conducted during simulation to examine the mechanisms that can promote or degrade effective interactions within the crew. This examination will be linked to the characterization of physical stress endured by crew members during simulation. Personality profiles will also be utilized to better explain the morphology of crew dynamics during simulation.
**Modeling of Waste Water Treatment Kinetics:**
We will perform an experiment on the wastewater treatment capabilities of the Mars habitat. Measurements of outdoor temperature, water temperature, crew water usage, chemical oxygen demand, dissolved oxygen content, pH, and conductivity will be used to determine the Monod model parameters for the microbial treatment tank. This model can be used to make estimations of scale-up feasibility for a similar waste-water treatment system to accommodate a larger crew, with the end-goal of supporting a colony on Mars.

**Greenhouse Experiments:**
This experiment will test the feasibility of installation and remote control capabilities of a robotic planter. The planter will be installed on site and controlled from ground control. The experiment is designed to simulate the possibility of sending a crew to Mars to set up kits, have them return, then when plants have reached a harvesting growth send the originally planned general population.

**Predicting Radiation Maxima through Sunspot Activity:**
Sunspots are one of the first recorded solar phenomena and date back as far as 364 BC. These dark spots occur in the photosphere and last a couple of months on average. The spots appear dark because they are 1500 K cooler than the surface, which is 5800 K. Sunspots are correlated with the magnetic activity of the sun. The spots occur in groups of two with one being magnetic north and the other magnetic south. In addition, prominences are associated with sunspots. Prominences are curving loops which are anchored by the sunspots and occur in the Chromosphere. Sunspot activity has a period of eleven years. By tracking sunspots insight can be gained into predicting high points of solar activity. This is essential for a mission to Mars because Mars does not have an atmosphere and cannot shield solar radiation.

**Remote Terrain Scouting:**
Much of the surface exploration can be assisted via topographic data from spacecraft orbiting Mars. However, the detail level of this data can be expanded further by aerial vehicles controlled by the crew members at the base. Since Mars has an atmosphere, vehicles similar to our present day UAVs can be deployed to map the terrain and make more efficient use of the crew's time by directing them to areas of the most biological and geological interest. By deploying and operating UAVs with mounting video cameras in the areas surrounding our base, we can have a better idea of what areas we would like to study before venturing too far away from the safety of our habitat. We will then have images to study before leaving the base to more effectively utilize our time and therefore minimize risks of venturing into the unknown.

**Wind Power Verification:**
Wind power has been identified as a top choice for energy generation for some systems on Mars. Wind power could still generate electricity during month-long Martian global dust storms which would inhibit solar power generation. Crew 115 will continue researching the feasibility of using wind power as a supplement to the gas generator power system of the hab. Power output of the turbine will be monitored over an extended period of time and wind speed at various points around the hab will be recorded to determine ideal placement of wind turbine.

**Outreach**
Crew 115 has exciting plans to continue an outreach initiative with the NASA INSPIRE program. NASA INSPIRE is a national program sponsored by NASA with the goal to encourage 9th through 12th grade students to explore STEM careers. The central point of the INSPIRE program is an Online Learning Community (OLC) through which NASA reaches students from all regions of the country. INSPIRE students will submit research proposals through the OLC to Crew 115 for review. Crew 115 will then select the top experiment proposals and work with the high school students to develop their experiment for the upcoming mission to MDRS. During the two week simulation Crew 115 will conduct a chat with the OLC from the MDRS. Students will receive an update on the mission and have the opportunity to ask questions to the crew. Additionally, Crew 115 will be working with local elementary schools coordinating different educational projects varying by age group.
SPONSORSHIP OPPORTUNITIES

The opportunity to participate in the Mars Desert Research Station experience is described by the Mars Society as “hard work, no pay, eternal glory.” Out of the 10 crew members, four will be supporting as Mission Specialists from the GT campus, and six will be supporting from the Mars simulation station. This six student crew must provide its own funding to be able to participate in this incredible opportunity to learn, to conduct experiments, and to explore the challenges that must be overcome to one day colonize Mars. We are asking for your partnership as we gather the financial support that is necessary for us to participate.

Expenses

The expenses of our mission total $8,100. This cost covers our travel to the Mars Desert Research Station and our living expenses while at the station. An itemized budget is listed below.

<table>
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<tr>
<th>Expense</th>
<th>Cost per person</th>
<th>Quantity</th>
<th>Subtotal Cost</th>
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<td>Round Trip Airfare (Atlanta, GA to Grand Junction, CO)</td>
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<tr>
<td>Room and Board at MDRS</td>
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<td>Hotel for Arrival &amp; Departure in CO</td>
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<td>First Aid, CPR, and Other Training Expenses</td>
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<tr>
<td>Experiment Equipment &amp; Shipping Costs**</td>
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<tr>
<td><strong>TOTAL COST</strong></td>
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</tbody>
</table>

** If interested in specifically sponsoring a particular project, please let us know.

Sponsorship Levels

Silver Level ($100)
Name of company or organization listed on all crew documentation (including submission of research to conferences, website, presentations, and any printed literature)

Gold Level ($250)
Name and logo of company or organization listed on all crew documentation (including submission of research to conferences, presentations, website, and any printed literature)

Platinum Level ($500)
All gold level benefits, plus
Acknowledgement of donation in the Georgia Tech newspaper, The Technique (distribution of over 13,000 copies)
A book of resumes of all crew members

How to Contribute

Any personal or corporate sponsors should be made payable to the Georgia Tech Foundation and mailed to this address:

Georgia Tech Foundation
760 Spring Street NW, Suite 400
Atlanta, Georgia 30308

Please include a short note with your check stating the purpose or designation of your gift or note the purpose on the memo line of your check. Your gift will be recorded and receipted promptly on behalf of the specific program, school, or other designation you indicate. The Georgia Tech Foundation, Inc. Tax ID is 58-6043294.
**The cover page image was taken during GT Crew 101 simulation of two crew members exploring the martian landscape**