National Aeronautics and Space Administration

NASAfacts

The 19th Annual NASA Great Moonbuggy Race

‘Space racers’ sustain nation’s legacy of engineering innovation

Huntsville Center for Technology student racers gear up for the 18th annual NASA Great Moonbuggy Race in April 2011. (NASA/MSFC)

The 19th annual NASA Great Moonbuggy Race is set for April 13-14 at the U.S. Space & Rocket Center in Huntsville, Ala. More than 90 student teams — most of them seasoned “space racers” from schools that field competitors year after year — will demonstrate the same engineering skills and innovation that made NASA’s Apollo-era lunar rover program a success four decades ago.

The event challenges high school, college and university students to design, build and race lightweight, human-powered rovers — “moonbuggies” — which address challenges much like those faced by NASA’s lunar rover developers in the late 1960s. The competition is designed to teach students to troubleshoot and solve problems, and demonstrates NASA’s continuing commitment to inspiring new generations of scientists, engineers and astronauts.

Teams registered to compete in the 2012 race include students from 20 states and Puerto Rico; and international challengers from seven countries, including returning teams from Canada, India, Germany and Russia and — for the first time — racers from Italy, Pakistan and the United Arab Emirates. Roughly a quarter of the registered teams are new to the race in 2012.

The race honors the legacy of the first NASA Lunar Roving Vehicle, which made its inaugural excursion on the moon’s surface July 31, 1971, driven by Apollo 15 astronauts David Scott and James Irwin. Two more rovers followed in 1972, enabling still greater scientific exploration during the Apollo 16 and Apollo 17 missions.

Forty years later, teams competing in the NASA Great Moonbuggy Race strive to uphold that

engineering tradition. Scheduled around a typical school year, the project begins during the fall term, as teams organize, solicit sponsors, design their racing machines and begin construction. Each team may include up to six students and a teacher/mentor. High school students square off in one division; college and university teams compete in another.

Their challenge each year is to deliver a two-person, human-powered buggy, and to achieve the fastest vehicle assembly and race times, while avoiding penalties on a grueling course — slightly more than half a mile of rock, gravel, sand and other materials which simulate the harsh lunar surface. Top prizes are awarded to the three teams in each division that finish fastest, with the fewest penalties.

Eight college teams participated in the first NASA Great Moonbuggy Race in 1994. The race was expanded in 1996 to include high school teams, and student participation has swelled each year since. More than 70 teams fielded moonbuggies in 2011.

The NASA Great Moonbuggy Race is organized annually by the Academic Affairs Office at NASA's Marshall Space Flight Center in Huntsville. It has been hosted by the U.S. Space & Rocket Center since 1996.

The race is sponsored by the Human Exploration & Operations Mission Directorate in Washington. Major corporate sponsors are Lockheed Martin Corporation, The Boeing Company, Northrop Grumman Corporation and Jacobs Engineering ESTS Group, all with operations in Huntsville. Other corporate and institutional contributors include Science Applications International Corporation (SAIC) of Huntsville; ATK Aerospace Systems of Salt Lake City, Utah; Davidson Technologies, Teledyne Brown Engineering, Booz-Allen Hamilton and Stanley Associates, all of Huntsville; the American Institute of Aeronautics and Astronautics; and the Systems Safety Society's Tennessee Valley Chapter.

The NASA Great Moonbuggy Race is one of dozens of educational programs and initiatives the 10 NASA field centers implement each year to inspire and engage America's next generation of scientists, engineers and explorers — those who will carry on the nation's mission of exploration and discovery in the decades to come.

The rules

Teams selected as first-, second- and third-place winners in the high school and college divisions are judged based on the shortest total time to reconfigure their collapsed moonbuggies and complete the lunar obstacle course without incurring time penalties for various vehicle and course violations. Each team is permitted two runs of the course. The shortest total assembly, course and penalty time results in each team's final score.

Each vehicle must be solely human powered and propelled by two students — one female and one male — over the course. Every vehicle is required to have a specific set of lunar rover-style accessories: fenders, a flag and simulated batteries, communications antenna, radio and TV camera.

Registered 2012 high school teams

Academy of Arts, Careers & Technology, Reno, Nev.
Alfonso Casta Martinez High School, Maunabo, Puerto Rico
Cape Girardeau Career & Technology Center, Cape Girardeau, Mo.
Carlisle County High School, Bardwell, Ky.
Central Magnet School, Murfreesboro, Tenn.
Chambers County Career Technology Center (two teams), Lafayette, Ala.
Cherokee High School, Rogersville, Tenn.
Chicago Public Schools, Chicago, Ill.
East Chicago Central High School, East Chicago, Ind.
East Limestone High School, Athens, Ala.
Elk Valley High School, Longton, Kan.
Fairhope High School (two teams), Fairhope, Ala.
Fajardo Vocational High School, Rio Grande, Puerto Rico
Franklin County High School (two teams), Winchester, Tenn.
Huntsville Center for Technology (two teams), Huntsville, Ala.
International Space Education Institute, Leipzig, Germany
Isidro Sanchez High School, Luquillo, Puerto Rico
Lima Senior High School, Lima, Ohio
Marble Falls High School, Marble Falls, Texas
Mount Juliet High School, Mount Juliet, Tenn.
Pana High School (two teams), Pana, Ill.
Pelham High School (two teams), Pelham, Ala.
Petra Mercado High School, Humacao, Puerto Rico
Rafaelina E. Lebron Flores High School, Patillas, Puerto Rico
San Andres High School, Mesilla, NM
Teodoro Aguilar Mora Vocational High School (two teams), Yabucoa, Puerto Rico
University Garden High School, Rio Piedras, Puerto Rico
Virginia City High School, Virginia City, Nev.

To reach the starting line, teams first must demonstrate that their folded or collapsed moonbuggies will fit into a 4-foot-by-4-foot-by-4-foot cubic container, similar to transport conditions experienced by the original lunar rovers during their journeys to the moon's surface in the Lunar Excursion Module. Folded moonbuggies next are lifted by the two drivers and carried 20 feet without touching the ground, demonstrating lightweight portability. The buggies then are assembled and readied for the course by the drivers, and evaluated for safety by the judges.

The buggies race against the clock, rather than side-by-side. Judges mark their progress, assessing penalty points if the drivers' hands or feet touch the ground, or if buggies lose onboard equipment. The drivers push hard to conquer each obstacle without overturning their machine or exceeding the 10-minute time limit on the course.

Some 350 members of the Marshall Center volunteers assist with the moonbuggy race each year, maintaining safety at many busy spots on the race course and serving as timekeepers, vehicle inspectors, obstacle judges and crossing guards.

The course

The U.S. Space & Rocket Center's maintenance and grounds crew spends two weeks prior to each year's competition preparing the simulated lunar course. It covers slightly more than half a mile of cement patios and pathways that wind around

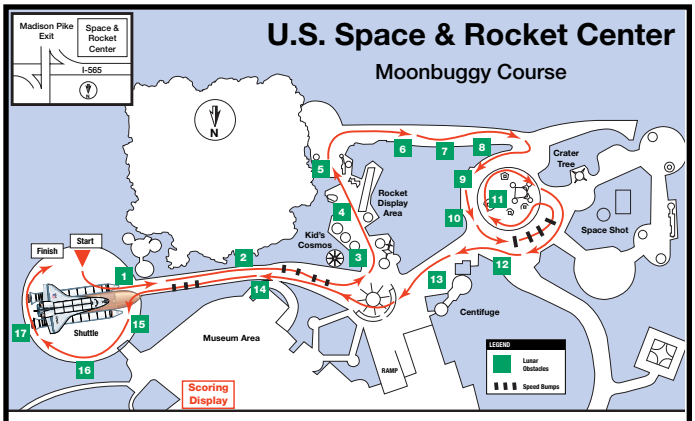
Registered 2012 college/university teams

Alabama A&M University, Huntsville, Ala.
Amity University, Noida, India
Bevill State Community College (two teams), Sumiton, Ala.
Cameron University, Lawton, Okla.
Carleton University, Ottawa, Canada
Central Connecticut State University, New Britain, Conn.
Christian Brothers University (two teams), Memphis, Tenn.
Collegio Nuestra Senora del Perpetuo Socorro, Humacao, Puerto Rico
Colorado School of Mines, Golden, Colo.
Drake State Technical College, Huntsville, Ala.
Escuela Vocacional Metropolitana Miguel Such, Rio Piedras, Puerto Rico
Galgotias College of Engineering & Technology, Uttar Pradesh, India
Guru Gobind Singh Inderprastha University, New Delhi, India
Guru Tegh Bahadur Institute of Technology, New Delhi, India
International Space Education Institute (two teams), Leipzig, Germany
JSS Academy of Technical Education, Uttar Pradesh, India
Middle Tennessee State University (two teams), Murfreesboro, Tenn.
Mukesh Patel School of Technology Management & Engineering, Maharashtra, India
Netaji Subhas Institute of Technology, New Delhi, India
North Florida Community College, Madison, Fla.
Ohio State University, Columbus, Ohio
PEC University of Technology, Chandigarh, India
Pittsburg State University (two teams), Pittsburg, Kan.
Purdue University Calumet (two teams), Hammond, Ind.
Ravat & Bahra Institute of Engineering and Biotechnology, Punjab, India
Rhode Island School of Design, Providence, R.I.
Rhodes College Dept. of Physics, Memphis, Tenn.
Samford University, Birmingham, Ala.
Sharjah College, Sharjah, United Arab Emirates
Southern Illinois University, Carbondale, Ill.
Southern Methodist University, Dallas, Texas
Tennessee Tech University (two teams), Cookeville, Tenn.
Thapar University, Punjab, India
University of Tennessee, Knoxville, Tenn.
University of Alabama in Huntsville (two teams), Huntsville, Ala.
University of Central Florida, Orlando, Fla.
University of Memphis, Memphis, Tenn.
University of Puerto Rico, Humacao, Puerto Rico
University of Wyoming, Laramie, Wy.
Youngstown State University, Youngstown, Ohio

the exterior of the popular Huntsville space museum and NASA Visitor Center, twining through an atmospheric backdrop of famous American rockets and space vehicles.

The course includes 17 unique obstacles built of plywood, aluminum and discarded tires. These obstacles and other portions of the course are enhanced with approximately 20 tons of gravel and 5 tons of sand. The material is carefully shaped to resemble craters, basins, ancient lava "rilles" and other obstacles found in the harsh lunar landscape.

The unearthly landscape of the current course was designed in 1993 by Dr. Larry Taylor, a lunar geologist and professor at the University of Tennessee at Knoxville; Dr. J.M. Wersinger, a physics professor at Auburn University in Auburn, Ala.; and the Marshall Center's Dr. Frank Six, now Marshall's university affairs officer supporting the race.



Course map

The NASA Great Moonbuggy Race course and specific obstacles vary slightly in detail from year to year. This outline gives participants a general idea of the course layout.

- The starting line is located under the space shuttle, near the "Pits" Area where moonbuggies are inspected and repaired. Obstacle 1 is under the space shuttle.
- Next, the course slopes up slightly on a paved path that leads to Obstacle 2, travels over a hill, and then slopes downward to Obstacle 3.
- A sharp turn to the left leads through the U.S Space & Rocket Center's rocket display area to Obstacle 4 and Obstacle 5.
- The course turns sharply to the right, remaining on asphalt and moving uphill through Obstacle 6, Obstacle 7 and Obstacle 8.
- At the end of this straight section, a sharp turn brings participants to Obstacle 9 and Obstacle 10, on the circular downhill path leading to the lunar crater area.
- The course veers left into the permanent crater area and Obstacle 11. Racers must take a 360-degree, clockwise turn around this simulated lunar surface. Its largest interior crater includes a challenging, 18-inch change in terrain.
- Exiting the crater area, moonbuggies turn right toward Obstacle 12, Obstacle 13 and Obstacle 14, on a path that starts flat, then slopes uphill. At the last of these obstacles, it slopes downward again. Speed bumps help slow descent.
- Finally, the course takes a left turn as racers enter the shuttle area and tackle Obstacle 15, Obstacle 16 and Obstacle 17 before reaching the finish line.

Safety is paramount on the challenging course. Every driver is required to wear a seatbelt during the race, and more than 175 hay bales line the drive path to protect speeding drivers and spectators alike.

The repairs tent

Student "pit crews" make use of NASA's buggy repairs tent throughout the competition, welding snapped struts, replacing bent wheels and installing new chains and sprockets. The tent includes work tables and benches, equipment and material supplies for working on up to eight moonbuggies at a time.

Racers from the University of Puerto Rico in Humacao topped the college division of the 18th annual NASA Great Moonbuggy Race —their second, consecutive first-place victory. (NASA/ MSFC)

Team members make their own repairs, with oversight and guidance provided by Marshall Center engineers and technicians. All pit crew members are required to wear safety glasses in the work area, and repair operations are supervised and assisted as necessary by trained professionals.

Repair tent equipment, provided by the Metals Engineering Division of Marshall's Engineering Directorate, includes a variety of welding machines, hand tools, machining equipment, duct tape and epoxy — and a sizeable pile of salvaged scrap metal to replace or strengthen damaged vehicle parts.

The prizes

Top prizes are awarded to the three teams in the high school division and three in the college division that post the best official times, which factor in pre- and post-race inspection results, assembly and course time, obstacle faults and any other assessed penalties.

In the high school division, the first-place team receives a trophy from the Marshall Center and a one-week trip to the Advanced Space Academy at the Space & Rocket Center, courtesy of ATK Aerospace Systems. In the college and university division, the first-place team receives a trophy from the Marshall Center. The first-place winning team in both divisions also receives $2,850 in cash from Northrop Grumman to support a team trip to NASA's Kennedy Space Center, Fla.

Marshall also gives commemorative plaques to the second- and third-place teams in the high school and college divisions, and presents a medallion and certificate to each team member of the top three teams in both divisions.

The Marshall Center's Engineering Directorate presents the Frank Joe Sexton Memorial Pit Crew Award plaque to the team whose engineering ingenuity, resourcefulness and teamwork most successfully overcomes race-day obstacles. Sexton, a NASA welder who mentored numerous welders and engineers among the Marshall workforce, worked on the original lunar rover and numerous other space vehicles until his death in 2000. NASA also presents plaques for "Best Team Spirit" and "Featherweight." The latter award recognizes the team that designs the lightest, fastest buggy on the track.

New for the 2012 competition is the AIAA Telemetry/ Electronics Award, presented by the American Institute of Aeronautics and Astronautics to the team that develops and operates the most innovative and useful telemetry system — an automated data-gathering and delivery system mounted on the buggy to return real-time information during the race.

Additional prizes for each division include a $1,000 cash award from AIAA for best moonbuggy design; a "Most Improved Team" award from Jacobs Engineering, which includes a check for $250; and an award for fastest rookie team of the year from Northrop Grumman. AIAA also awards a "Crash and Burn" plaque and cash prize to the college or university team that faces and resolves the most dramatic vehicle breakdown of the day's race. Every participating moonbuggy team receives a plaque from Science Applications International Corp.

For complete race rules and other official information, visit:

http://moonbuggy.msfc.nasa.gov

For high-resolution images and additional information about past races, visit:

http://www.nasa.gov/topics/moonmars/moonbuggy.html

For information about other NASA education programs, visit:

http://education.nasa.gov

National Aeronautics and Space Administration

George C. Marshall Space Flight Center
Huntsville, AL 35812
www.nasa.gov/marshall

www.nasa.gov

NASA Facts

FS-2012-03-25-MSFC
8-528566