

## Great Moon Buggy Race: A Worthy Space Outreach Endeavour

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The exciting annual Moon Buggy Race, organized by Marshall Space Flight Center for colleges/universities and high schools participation, takes place every April on the grounds of the U.S. Space and Rocket Museum. This year, of the more than 100 Moon Buggy teams, there were 35 international teams with more than 1,000 students from Germany, Canada, India, Bangladesh, Romania, Serbia, etc., as well as teams from many of the USA states and Puerto Rico. This is a great event for “Space Outreach” to our future scientists, engineers, and space enthusiasts, something that the European Space Agency might consider implementing in Europe.

Before they arrive, participants design and build a vehicle, conforming to certain lunar roving vehicle specifications, recreating the experience of the original Apollo astronauts during the Apollo 15, 16, and 17 Missions to the Moon’s surface in the early 1970’s. The race requires each team to collapse its buggy into a 4 x 4 x 4 ft volume (1.2 x 1.2 x 1.2 m), and then to unfold it, as the clock runs, and complete the ~0.7 mile (1.1 km) course of simulated moonscape – craters, basins, rills, crevasses and ridges, fashioned out of crushed limestone gravel.

Racing against the clock, two “astronauts” (one male & one female) bicycle-power their Moon Buggy over obstacles as the lunar course winds through and around a backdrop of famous rockets and space vehicles (e.g., Saturn I & V, Gemini). The total effort – design, build, test, & race – is a hands-on experience that requires high schools and university students to address engineering problems similar to those faced by the original NASA Lunar Rover Vehicle (LRV) development team. The participating students display an amazing grasp of technology. They come to the contest to put their masterpieces to the test, and perhaps to launch their careers as

next-generation engineers, scientists, and space explorers.

The first NASA Great Moon Buggy Race was held in 1994, to commemorate the 25<sup>th</sup> anniversary of the Apollo 11 lunar landing. At that time, Dr. Frank Six from Marshall Space Flight Center and Professor Larry Taylor, a lunar geologist from the University of Tennessee, as part of a space outreach endeavor, initiated the Moon Buggy Race for universities & colleges. Taylor designed the unearthly race course that includes 17 unique obstacles built of sheets of plywood and wooden timbers, with attached old tires of various sizes (tractor, truck, auto, bicycle). These obstacles and other portions of the race course are covered with approximately 20 tons of crushed rock and gravel and 5 tons of sand. These materials are carefully shaped into craters, basins and obstacles simulating the harsh landscape of the alien lunar surface. Over the years, the course has been made as safe as possible. 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.

In spite of their fine engineering, only ~ 2/3rds of the buggies make it around the course on the first run. But, with lots of work including over-night, almost all make it thru the course the second day. Time penalties from going off course, getting off the buggy to help get thru an



obstacle, going around an obstacle, etc., are added to the setup time for taking the buggy from the box and assembling it, with the total time determining the winner.

**RULES:** The teams consist of up to six (6) students plus one teacher/instructor, who have undertaken the design and building of the Moon Buggy. Two students are picked to be the ‘astronaut riders’ on the Buggy, mostly based upon their physical fitness for this strenuous race. Each vehicle must be solely human-powered by the one male and one female students over the race course. Each Buggy is required to have a specific set of parts – fenders, a flag, and simulated Mission hardware, including batteries, communication antenna, radio and TV cameras. To start, the teams must demonstrate that their unassembled Moon Buggy will fit into the 4 x 4 x 4 ft. cubic container, similar to transport conditions experienced by the original lunar rovers during their journeys from Earth to the Moon. Folded Moon Buggies then carried by the two riders to the pre-qualification line, where they are assembled and readied for the course by the drivers, and evaluated for safety by the judges.

**CONTEST:** Each team is permitted two set-ups and course races, over two days. The combined times for the set-up and the race-course completion are added together, along with any penalty times for breaking the rules, such as dismounting in order to push the Buggy thru an obstacle. If it is necessary to make minor or major repairs to the Buggies before or after the first run, there is a large “Repair Tent” provided by several engineering companies, such that welding, grinding, tooling, even painting of parts can be made. This is an essential part of the race structure in order to minimize the frustrations of the student competitors, and becomes the major tasks of the non-driving team members.

**PRIZES:** Although the colleges and high-schools have the same rules, there is a separation of awards for these two divisions. Top prizes are awarded to the three teams in the high-school division and three in the college division

that post the best “assembly-and-race times”. First prize for the high-school team is a large trophy from NASA and a one-week trip to the Advanced Space Academy at the Space and Rocket Center (Space Camp). In the college and university division, the first-place team receives a large NASA trophy and a fully paid trip to Cape Kennedy to experience the next shuttle launch. The second and third place teams in each division receive commemorative plaques and medallions and a NASA-Achievement Certificate. All participating Moon Buggy teams receive a plaque from the NASA Science Applications International Corp. Additional prizes for each division include \$1,000 award from the American Institute of Aeronautics and Astronautics for best Moon Buggy Design, another award for the “Most Improved Team”, another award for the “Fastest Rookie Team”. Lastly there is a “Crash and Burn” plaque and cash prize to a college and a high-school team that faces and resolves the most dramatic vehicle breakdown of the races.

In reality, it is common for the high-school teams to have better overall times than the colleges, largely because at the high-school ages of student, there is typically a much greater involvement of the fathers in the school projects. This Moon Buggy Race is a great experience for all involved in the design of all portions of the buggy, especially the drive train, suspension, steering, etc., followed by the actual construction. For some students, this was the first time they had learned “which end of a screwdriver to use.” And the team work and overall fellowship has proven to be an enduring and invaluable experience for all involved.