NASAfacts

Cube Quest Challenge

Teams Demonstrate Advanced CubeSat Technologies at the Moon or Beyond to Win Prize Purse

Objective

Sponsored by NASA's Centennial Challenges program, university and private developer teams are competing for prizes by building 6 unit CubeSats then demonstrating superior performance in one of two divisions, the Lunar Derby – in lunar orbit – or the Deep Space Derby – 2.5 million miles from Earth. From these two arenas, competitors attempt to achieve any or all of the contest goals including: highest data communications rate; transmission of the largest volume of data within a specified time frame, data transmission from the farthest range beyond 2.5 million miles; and/or longest survival in the deep space environment. There is also a prize for achieving lunar orbit. To ensure data integrity, each satellite must transmit NASA-provided communications data to be eligible for prizes. NASA believes that CubeSats with these kinds of capabilities will contribute to new and more affordable missions to explore the Moon and beyond.

Prize Purse

The total prize purse for the competition is $5 million. An already completed competition element offered three launch opportunities on NASA's Artemis I, the first uncrewed lunar flyby mission of Orion, launched atop the agency's Space Launch System (SLS) rocket.

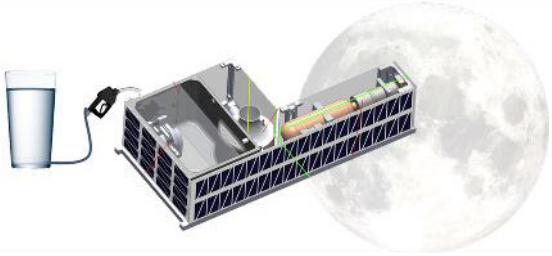
Ground Tournaments During a series of four Ground Tournaments (GTs), a $460,000 prize purse was awarded for CubeSat designs judged as meeting or exceeding benchmarks for excellence. At GT-4, the final Ground Tournament, the Centennial Challenges announced the names of three top scoring teams, each awarded $20,000 and a secured launch aboard Artemis I. The three Artemis I launch winners are: Cislunar Explorers, CU-E3 and Team Miles.

Other qualified teams can procure their own launch (prior to completion of the Artemis I mission) in order to compete for the in-space prizes.

Cislunar Explorers

Cornell University (Ithaca, New York)
Goals: Achieve Lunar Orbit, Spacecraft Longevity

Notable Technologies: Cislunar Explorers used a Cornell-designed water electrolysis propulsion system utilizing a 3D-printed titanium nozzle that burns hydrogen and oxygen safely stored as water. The 6U CubeSat splits into two 3U units that each generate sufficient power for electrolysis of the water propellant, and that spins for stability and to separate liquid water from the gases. Cornell has also developed their own CO_2 cold-gas thrusters for attitude control, and a UHF amplifier for communications at lunar distances. They use off-the-shelf cameras for optical navigation.

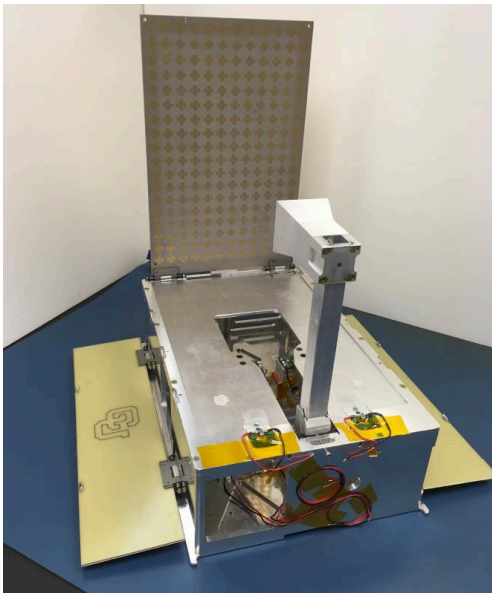


Cislunar Explorer 6 unit CubeSat splits into two; each uses water for its propellant.

CU-E3

University of Colorado Boulder
Goal: Best Burst Data Rate, Highest Data Volume, Farthest Communications Distance, Spacecraft Longevity

Notable Technologies: CU-E3 is focused on winning the communications distance, data rate and data volume prizes by using their novel CU-designed deployable reflect-array antenna with a deployable feed horn driven by their own X-band transmitter. CU-E3 has partnered with Atlas Space Operations, located in Traverse City, Michigan, for ground station services.



CU-E3 plans to win using their own X-band transmitter that drives their unique deployable reflect-array antenna.

Team Miles

Fluid & Reason (Tampa, Florida)
Goal: Farthest Communications Distance
Team Miles is team of citizen inventors who came together to compete in Cube Quest. Since competing, they have began to commercialize their technologies.

Notable Technologies: Team Miles will use 12 of their own ConstantQ plasma thrusters, iodine-fueled electric propulsion, canted to allow 3-axis pointing control as well as speed them beyond the 2.5 million mile range. The team has radiation tested their custom Resilient Affordable CubeSat Processor flight computer and other electronics to determine their survival over the duration of the mission, expecting to reach 4.8 million miles.

Team Miles propels their CubeSat with 12 iodine-fueled plasma thrusters, controlled by custom radiation-tolerant computer.

Other Teams with Other Launches

The Cube Quest rules allow any qualified U.S.-based team to obtain their own launch in order to compete with their 6U CubeSat for prizes in the Lunar Derby or Deep Space Derby. Teams have 365 days after their spacecraft is deployed to conduct operations that can be entered into the in-space challenge.

NASA's Cube Quest, a NASA Centennial Challenge, is managed at Ames Research Center in Silicon Valley, California. Centennial Challenges, part of the Prizes and Challenges program within NASA's Space Technology Mission Directorate, offers incentive prizes to generate revolutionary research and technology solutions to problems of interest to NASA and the nation. Centennial Challenges is managed at NASA's Marshall Space Flight Center in Huntsville, Alabama.

For more information on the Cube Quest Challenge, visit: **www.nasa.gov/cubequest**

For information on the Centennial Challenges program, visit: **www.nasa.gov/winit**

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