2018 DROP TOWER CHALLENGE

Microgravity Expulsion from Water

https://spaceflightsystems.grc.nasa.gov/education-outreach/expulsion/

WHAT? Teams of grade 9-12 students are challenged to design and build objects that sink in water in normal gravity, but will be expelled as far as possible out of the water during free fall in NASA's 2.2 Second Drop Tower. The expulsion must result from hydrophobic surface of each object. As an extreme example, the leaves of the Lotus flower have a superhydrophobic surface where researchers are working to mimic the Lotus effect.

The challenge begins as each team prepares their proposal, consisting of a short entry form with conceptual drawing(s), and e-mails it to Ed-DropTower@lists.nasa.gov. If selected for testing, the team builds their unique test objects based on information provided on the challenge website. The objects are then sent to NASA where they will be put in vessels of water and dropped 24 meters (79 feet). During the fall, the objects and water will experience 2.2 seconds of apparent near-weightlessness, i.e., microgravity. Video results are then provided for student analysis and the preparation of written report that is submitted to NASA. Student teams will be evaluated on both their report and success with the challenge. NASA will then invite the top-performing teams to present their results in a student poster session at the 2018 meeting of the American Society for Gravitational and Space Research (ASGSR).

2.2 Second Drop Tower

WHO? The design challenge is for students in grades 9-12, where teams will be favored over individuals in selection. The program is limited to students from the United States, but citizenship is not required. It is open to all fifty states, the District of Columbia, Puerto Rico, American Samoa, Guam, the Northern Mariana Islands, the U.S. Virgin Islands, and all DODEA schools for the children of U.S. military personnel. Students are free to get help from adults, for example in building their experiment hardware. An organization (e.g., school, science center, 4-H club, Scout troop) may submit no more than five proposals, where it is envisioned that no more than two will be selected from a single organization.

WHERE? NASA anticipates selecting ten teams local to the fall 2018 ASGSR conference site (for which the location and dates have yet to be announced) and ten more teams that are not local (e.g., more than 150 miles distant). The microgravity tests will be conducted in the 2.2 Second Drop Tower (shown above) at the NASA Glenn Research Center in Cleveland, Ohio. But research participation is remote, where teams interact with the NASA staff by e-mail.

WHEN? Proposals are due by November 10, 2017 and can be submitted any time before that deadline. Team selections will be announced by mid-December, when a status e-mail will be sent to all teams who submitted proposals. The team-built test objects should be sent to NASA when ready but must arrive at NASA by no later than February 10, 2018. The objects will be tested in the Drop Tower in February and March, where the video results will be provided to the teams following the testing. The student analysis of the results will form the basis for a written report that is due to NASA by May 1. In mid-May, NASA will announce the challenge winners and invite them to present a poster on their research at the ASGSR's fall 2018 conference.

CONFERENCE? The top-performing teams will be invited to prepare and present a poster about their research in a student session during the 2018 meeting of the American Society for Gravitational and Space Research (ASGSR). The conference location and dates have yet to be announced, but the student session will be on a Saturday, presumably in October or November. Awards will be presented to teams on that day for both challenge success and the poster presentations. ASGSR is expected to provide limited travel support to the invited non-local teams who present their results at the meeting.

WHY? This challenge enables students to learn about experiment design and construction and to participate in research related to space station science, both of which can inspire the pursuit of Science, Technology, Engineering, and Mathematics (STEM) careers. Furthermore, participation in a NASA challenge is an accomplishment worth noting on college applications!

DROP TOWER? While falling down NASA's 2.2 Second Drop Tower an experiment behaves as if gravity has nearly vanished! Our sensation of gravity and weight comes from a resistance to its pull, for example because of the floor preventing us from falling. If we are freely falling (e.g. after jumping off a diving board), we feel weightless and free-fall is the basis for many amusement park rides. This occurs because all objects fall at the same acceleration unless acted upon by another force. As one result, the astronauts and the ISS fall together (around the Earth) such that the astronauts float within the space station. This happens even though the space station is so close to the Earth that the gravity is only about 10% less than that at the Earth's surface.

MICROGRAVITY-INDUCED EXPULSION? Surfaces can be either hydrophobic or hydrophilic, that is "water fearing" or "water loving." Gravity will cause objects that are more dense than water to sink to the water's bottom (sedimentation) and that is strictly required of all objects submitted for this challenge. But sedimentation is eliminated during microgravity and an object's interaction with the water instead becomes governed by its surface properties. As one might expect, objects with "water fearing" surfaces can be pushed from the water and the goal of this challenge is to cause the object to be expelled from the water as far as possible during microgravity.

QUESTIONS? E-mail the challenge staff at Ed-DropTower@lists.nasa.gov.