



## *DIVING INTO EXPERIMENTAL RESEARCH* **MICROGRAVITY DIVER CHALLENGE**



[www.asgsr.org](http://www.asgsr.org)

[www.nasa.gov](http://www.nasa.gov)

**WHAT?** Teams of grade 9-12 students are challenged to design and build diving objects that will submerge in water as far as possible when exposed to microgravity in NASA's 2.2 Second Drop Tower [1]. After student proposals are evaluated, selected teams will compete in the challenge and are encouraged to present their results at the American Society for Gravitational and Space Research (ASGSR) conference [2] in Seattle, WA.

Teams are only responsible for their diving objects. NASA will provide the rest of the experimental hardware.

A diving object in microgravity is illustrated in a video at YouTube on POW - Ping Pong Ball On Water [3]. After developing their concept, each student team prepares their proposal - consisting of a short entry form with a conceptual drawing(s) - and e-mails it to [celere@lists.nasa.gov](mailto:celere@lists.nasa.gov). If selected, the team builds their unique diving objects based on information provided on the challenge website [4]. The objects are then sent to NASA where they will be put in vessels of water and dropped 24 meters (79 feet), during which they will 2.2 seconds of apparent near weightlessness, i.e., microgravity. Video results are then provided for student analysis and reporting.

**WHO?** The design challenge is for students in grades 9-12, where teams will be favored over individuals in selection. Students are free to get help from adults, for example in building their experiment hardware. An organization (e.g., school, science center, 4H 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?** For this challenge, NASA anticipates selecting 10 teams local to Seattle (the conference site) and 10 teams non-local to Seattle. Limited travel funds will be available to non-local teams to assist with financing their participation at the conference. The drops will be conducted in the 2.2 Second Drop Tower (shown on the right) at the NASA Glenn Research Center in Cleveland, Ohio. But research participation is remote, where teams can interact with the NASA coordinator by e-mail.



**WHEN?** Proposals can be submitted at any time up to Wednesday, February 1, 2017 and team selections will be announced on Friday, February 10. At that time, a status e-mail will be sent to all teams who submitted proposals.

Team-built diving objects should be sent to NASA when ready but must arrive at NASA by no later than Wednesday, March 15. It is expected that the diving objects will be tested in the Drop Tower during the month of March. Video results will be provided to the teams after their objects have been tested in the drop tower. Video results and the student analyses will form the basis for a poster presentation at the October conference.

<https://spaceflight systems.nasa.gov/diver/>

**CONFERENCE?** Participating teams are encouraged to prepare and present a poster about their research in a student session at the American Society for Gravitational and Space Research (ASGSR) conference [2] in Seattle, Washington on Saturday, October 28, 2017. Awards will be presented to teams on that day based on both the posters and success with the challenge. Some limited travel support will be made available to non-local teams who present their results at the meeting.

**WHY?** This science 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 STEM careers. Selection in a nation-wide NASA challenge is an accomplishment worth noting on college applications!

**MICROGRAVITY-INDUCED DIVING?** When an object is floating on water in normal gravity, an upward force is exerted by water that opposes the weight of the less dense object. However, in microgravity [5], there is effectively no “weight” and the interaction between the object and the water is governed by the contact angle or wettability of the object by the water. Thus, to submerge the object for this challenge, it may be necessary to increase the wettability of the object. However, note that the objects must still float in water when experiencing normal gravity or they will not be accepted for testing.

**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 holding us to keep us from falling. If we are freely falling (e.g. after jumping off a diving board), we feel weightless and that is the basis for many amusement park rides. This works 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 on the Earth's surface.

## REFERENCES

1. **2.2 Second Drop Tower:**  
<http://facilities.grc.nasa.gov/drop/>
2. **ASGSR 2017 Meeting:**  
<https://asgsr.org/index.php/meetings/2017-meeting>
3. **Sample video:** This **YouTube** video shows a middle-school student team's ping pong ball in water during microgravity in the 2.2 Second Drop Tower.  
<https://www.youtube.com/watch?v=wOqYCt-n2ts>
4. **DIVER web site:**  
<https://spaceflightsystems.grc.nasa.gov/diver/>
5. **Microgravity explained:**  
<http://www.nasa.gov/centers/glenn/shuttlestation/station/microgex.html>

**QUESTIONS?** Send an e-mail to [celere@lists.nasa.gov](mailto:celere@lists.nasa.gov) to NASA's DIVER staff.

<https://spaceflightsystems.grc.nasa.gov/diver/>