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Micro-g NExT FAQs

Micro-g Neutral Buoyancy Experiment Design Teams Frequently Asked Questions

Contents

FAQs: General

1. ***What is the Artemis program?***
   The Artemis program is NASA's lunar exploration program which will use innovative new technologies and systems to explore more of the Moon than ever before. To learn more, please visit https://www.nasa.gov/what-is-artemis.

2. ***What is Orion?***
   Orion will serve as the exploration vehicle for the Artemis program. It will carry the crew to space, provide emergency abort capability, sustain astronauts during their mission, and provide a safe re-entry from deep space return velocities. To learn more, please visit https://www.nasa.gov/exploration/systems/orion/index.html.

3. ***Can I submit a design for more than one tool?***
   Each team may submit a proposal for only **one** of the Micro-g NExT challenges.

4. ***Can I participate in Micro-g NExT if I have a green card/am a Legal Permanent Resident or DACA student?***
   Micro-g NExT is currently available to U.S citizens enrolled in U.S institutions of higher learning.

5. ***Can we choose the test week dates?***
   When submitting your proposal you can indicate your preferred test week from the list of scheduled weeks. We will do our best to accommodate your preferred week, but your first choice is not necessarily guaranteed.

6. ***How many teams will NASA select to travel to Houston for a test week?***
   The number of teams is not predetermined but rather based on the quality of submitted proposals. There will be no more than 8 teams in a test cycle. There could be more than one test cycle per week.

7. ***Can more than one proposal be submitted from the same school?***
   Yes, more than one proposal can be submitted from the same school. However, students may only belong to a single team.

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8. ***Can returning teams participate?***
   Returning teams may participate; however, teams may only have 2 returning members.

9. ***Do members who have submitted a proposal, but have not been selected constitute a returning member?***
   No, the requirement only refers to teams that have traveled to Houston.

10. ***Can teams be comprised of students from multiple schools?***
    Absolutely! We encourage collaboration and interdisciplinary teams.

11. ***What expenses does NASA cover?***
    The selection of a team for this opportunity does not include a monetary award to your institution. NASA assumes responsibility for all costs involved with prototype testing in the NBL. Each team is responsible for all other costs including travel to Houston and cost of building the prototype.

12. ***Where can I find information about the Neutral Buoyancy Laboratory (NBL)?***
    Information about the NBL can be found at the following link:
    https://www.nasa.gov/centers/johnson/pdf/167748main_FS_NBL508c.pdf

13. ***Are there hardware requirements and/or standards my team should be aware of before testing in the NBL?***
    Requirements for hardware that will be tested in the Neutral Buoyancy Laboratory (NBL) can be accessed in the NBL Engineering and Safety Requirements document.

14. ***Do I get to dive with my team's prototype during testing in the NBL?***
    Professional NBL divers will test the tools and students will direct the divers from the Test Conductor Room of the NBL facility.

15. ***With whom will my team interface with at NASA?***
    Your team will have multiple interfaces at NASA, each of which serve a different function. Your main interface will be the Micro-g NExT coordinator.

16. ***The outreach portion of my project involves development of K-12 curriculum for classroom use.***
    Are there any suggested components I need to incorporate?
    You may consult with a current K-12 educator on this topic. It is suggested that you consider the following:
    - All curricula are aligned to national standards.
    - Each curriculum piece provides the user with a connection between the curricula topic and microgravity, the NBL, or your prototype's potential use in space exploration via an introductory paragraph. This adds relevance to the material.
    - A curriculum incorporates the 5E model to the extent possible.
    - The curricula are written in grade level appropriate language.

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17. How does my team's design potentially benefit space exploration?

NASA is currently working on systems to take humans beyond Low Earth Orbit to explore the solar system. Some of the destinations of interest are celestial bodies with milligravity to microgravity. As part of NASA's exploration objectives, new tools and procedures are necessary to carry out the upcoming missions.

18. Can we coordinate social media outputs about the project with Micro-g NExT?

Absolutely. This can be coordinated with the Micro-g NExT coordinator. We will typically retweet a team's posts. We encourage you to use our hashtag #MicrogNExT.

19. If selected, what is the first step?

Your team will be invited to attend a 1-hour orientation session with the Micro-g NExT staff. Attendance of this session is required of the faculty advisor and student team. The session is conducted online.

20. Who is responsible for writing the procedures that will be used to conduct test in the NBL?

Your team is responsible for drafting the diver procedures and coordinating with the assigned Ops Lead to finalize the procedures.

21. My choice for faculty advisor is not a U.S. citizen. Is he still able to work with my team?

Yes, he can still act as your advisor. However, he will be unable to travel to Houston for the test week. **Any person participating in the Test Week in Houston must be a US citizen.**

22. What happens if our CAD file is larger than 25 MB?

Your proposal file must be smaller than 25 MB in order to be submitted to the Micro-g NExT website. This is to ensure all proposals can be reviewed properly from the same database. You will submit two separate files – a proposal and a CAD file. Each file has a size limit of 25 MB.

23. How much time should I anticipate spending on this project?

Time requirements will vary from team to team. Expect to spend a large portion of your time on design, creation, and outreach. If your team is struggling with time management, please work with your faculty advisor to set a feasible timeline. The workload of this project is comparable to that of a 3 credit hour course.

24. Does a prototype need to be submitted with the proposal?

A prototype is not required to be submitted with the proposal. However, any prototyping you do will add to the quality of your proposal.

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25. What is considered outreach?

Outreach may consist of a presentation to a school group, a symposium, or other similar event. You may also incorporate a social media plan in your outreach.

26. How should outreach be documented in the proposal?

Include a description of activities you plan to carryout. The description should include the purpose of the activity, the intended audience, the expected number of participants, and the perceived impact of the activity. It helps to have a letter of support from organizations you plan to work with in your outreach efforts. It is advised that you begin making connections now.

27. Are BS/MS students who have yet to be immersed in graduate courses allowed to compete in this project?

As long as your academic status is listed as an undergraduate student when we verify with your college/university, you are eligible to participate as a student.

28. When will we hold the outreach component?

Your outreach component can occur prior to test week, but as some outreach components will include testing results, some outreach could occur after your team's test week.

29. If a school submits multiple proposals, does each proposal need a different outreach section?

Yes, each proposal will need its own outreach section.

30. Do we need a signature from the Department Head or any other management individual from our school before submitting the Letter of Intent and/or the Project Proposal?

You do not need a letter of endorsement for the Letter of Intent, but it is a requirement for your team's proposal.

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FAQs: Technical: General

Please visit the EVA Reference Website. It provides a reference you can use when considering your design. You will only be judged on your ability to meet the requirements outlined in the challenges. You are not required to meet the requirements outlined in the website.

1. ***Is there somewhere to get more in detailed specs regarding the NBL (such as density)?***
   The NBL is filled with chlorinated water with a density of approximately 1 g/cm^3.

2. ***What will be the depth of operation in the NBL?***
   Assume a depth of 40ft. That is the maximum depth of the NBL.

3. ***What are the tether attachment point dimensions/specs?***
   See the EVA Reference Website for tether dimensions. Note there is a 1" diameter hole for the tether to be inserted.

4. ***What is the size of an EVA glove?***
   See the EVA Reference Website for glove dimensions. You can also use a ski glove as a reference. It is approximately the same thickness as an EVA glove. Remember that when a space suit glove is pressurized its nominal position will be "hand open" and the astronaut needs to expend energy to close their hand.

5. ***Is water pressure blasting allowed?***
   Yes, air or hydro pressure is allowed. However, it is important to remember the environment where the tool would ultimately operate. In the vacuum of space, water would flash freeze, making any type of water blasting very difficult to impossible. On the other hand, using water pressure blasting to represent a different blasting method that would work in space is legitimate.

6. ***Who would own the intellectual property rights?***
   NASA hopes to potentially utilize some of the ideas that your team puts forward in a future space mission. Therefore, we ask that teams complete a "Statement of Rights" document. See the Proposal Guidelines for specifics regarding this topic.

7. ***May we 3D print parts of the tool?***
   Yes. Though you'll want to consider the loads that your tool will encounter and ensure that the plastics used in the 3D printer can handle those loads.

8. ***Do I have to meet all of the requirements?***
   You will be scored based on how many requirements you meet. So you do not have to meet all of the requirements, but you will lose points depending on how many you do not meet.

9. ***Some requirements are vague. What should I do in this case?***
   Some requirements are purposely vague. We want you to do the research and provide the rationale for why you designed it the way you did.

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10. Can I use a CO_2 canister?

For usage in the NBL, no, you cannot use any type of pressurized canister. If your device is pneumatically powered, you will be required to use standard shop air from the NBL which has a maximum of 125psi.

11. Is our team allowed to use gun powder or nail guns?

They are not strictly forbidden but you will seriously need to consider safety if you choose to implement these types of designs in space. Also a critical part of this challenge is to actually be able to test your tool in the NBL. You would have to prove to NASA without any doubt that the device is safe for the operator. In addition, you should consider the vacuum environment of space and how you would implement such a system.

12. Can we have detachable parts on the prototypes?

Yes. You can have multiple pieces of hardware to accomplish the challenge. All pieces together should fit within the given dimensions.

13. Will we have to make a waterproof version of our tool?

You will have to make a version of your tool that operates in the NBL. We will work with you to ensure you are using approved materials.

14. How strict is the "one hand usage" rule?

All requirements are there for a reason. You will be scored based on how many requirements you are successfully able to meet. Also, the one-handed requirement refers only to performing the action of the tool: such as the act of chipping or the act of grabbing. Two hands can be used for setup or tool management.

15. Are we able to use magnets for any part of the challenges, just as a small component, not as a whole?

Yes, magnets are okay in that capacity.

16. Does the prototype have to be built on a 1:1 scale, or can it be smaller?

The simulation in the NBL will be full-scale, 1:1. However, doing scale prototypes during the proposal phase is recommended to show the validity of your design.

17. How often can the teams ask for technical clarifications? Will all technical clarifications be posted for all teams to see?

All questions and their answers will be continuously posted in this FAQ document. Check this document regularly. Ask as many questions as you'd like, we'll get to them as soon as we can.

18. What kind of CAD program is best for all of these? SolidWorks or AutoCAD?

You can use any CAD program you'd like, or none at all. A 3D model is not required, though it is recommended as it is easier to understand a design that way.

19. Can you combine the functions of multiple tools together to save cargo space?

That's a great thought and an important consideration for space tool development. For the purpose of this activity, we ask you select only **1** challenge.

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20. Is there any existing equipment, i.e. tool chucks for pneumatic tools, which we could adapt for our tool?
Yes there are. We would highly encourage you to look at Commercial Off The Shelf (COTS) hardware. It will save you money and time to adapt existing hardware to your tool.

21. Are there any existing tools or technologies which the astronauts/divers already use that we could implement in our design, which is also available for final testing at the NBL?
We will provide tethers and a bag. It is up to you and your team to design the tool. You can look for commercially available products and integrate them into you design though.

22. How will the astronaut be tethered?
For the challenges, the astronaut will be attached to a foot restraint and have both hands free to perform operations.

23. Are vibrations a major consideration for the tool that can be pneumatically powered?
I wouldn't say those are a *major* concern, but they are a hazard. You'll have to cover that in your hazard analysis if you are selected. But we don't anticipate any issues. We used a number of pneumatically powered tools in the past.

24. Do the prototype materials need to be NBL and Space approved?
For the purpose of the proposal, the minimum requirement is to describe the materials you would use in the NBL. Any additional information you want to provide about what you would do in a legitimate space application would be very valuable as well.

25. What is the connector type for the pneumatic air supply? Quick-connect?
See Pneumatics Interface Description

26. Will we be expected to provide a pressure regulator?
No. NASA will provide you with a pressure regulated air supply.

27. What are the temperatures our materials need to be able to withstand?
The actual testing will occur in the NBL which is about 85°F. So for this effort of developing a prototype, temperature will not be a major factor. For space application, there is information online that details different temperatures ranges in space.

28. Can we use incompressible fluid in the prototype?
We ask that you *do not* use hydraulic systems for this round of Micro-G NExT.

29. Can aerogel be used?
As Aerogel can have different formulas, it will be up to the team to prove that it is safe to use in the water. You'll need to provide the Safety Data Sheet and do testing of your own to show it is safe.

34. Is there a standard connection for attaching and detaching parts?
No. Your team can design whatever connection you'd like.

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35. Does the air tank for the pneumatic power count as a device?

No. If you use pneumatic power, you will be provided with only an air hose.

36. Does this have to be automated or will we be able to instruct the divers as to what to do?

For Challenge 1, the device must be automated. For the remaining challenges, you will have a direct line of communication with the test subject during the duration of your test.

37. Can we have more than two parts as detachments?

Yes.

38. If we have something on our design that fits the requirements, but upon using it, that part may stretch outside of the dimensions given, is that allowed? Or does everything has to stick within the dimensions you gave us?

The dimensional requirement is a stowage requirement. If your tool doesn't fit into that box when stowed, consider making your device in multiple pieces. Also, not meeting one of the requirements does not disqualify you. You just won't get full credit for meeting that requirement.

39. Can our design deviate slightly from proposal drawings to actual day of testing?

Yes. As with all proposals, there may be slight modifications. However, all changes will need to be approved.

40. Can we adapt technology used in other industries for our design?

Absolutely!

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FAQs: Technical: 2020 Challenges

1. ***Challenge 1: What is the ANGEL beacon?***
   The ANGEL beacon is a new generation of technology (Second Generation Beacon, or SGB) used for locating persons in distress via satellite tracking.

2. ***Challenge 1: How do we get the beacon?***
   The NASA SAR Office will provide the crew beacons and crew survival aids for use in this study. The Universities would be required to provide a solution to home in on the beacon 121.5 MHz signal either through purchasing a commercial homer (readily available) or designing their own homer (which some have done with, for example, a raspberry pi).

3. ***Challenge 1: Would it be advantageous for the team or at least some members to attain a HAM Radio operator license?***
   This is not seen as advantageous. Since we are decoding a spread signal, the time used for getting a HAM radio operators license might better be used on other aspects of the project.

4. ***Challenge 1: What is an UAV?***
   An UAV is an unmanned aerial vehicle.

5. ***Challenge 1: What weight can we expect for the vehicle? We know it needs to be carried by the drone but were looking for a ballpark weight estimation.***
   A Group 1 UAV can carry up to 20 pounds, and a Group 2 up to 55 pounds. A good weight to aim for is 15-30 pounds, but anything in the wider range would meet the requirements.

6. ***Challenge 1: Can the mobility of the SAVER be described a bit more? Does it need to have both marine and land roving capabilities?***
   The intent for the SAVER is that it can be dropped from a UAV into the marine environment only (fresh and saltwater), not on land. Once dropped it would need to surface and "swim" to the person in distress.

7. ***Challenge 1: Are we expected to provide a package that would be "shake proof" in order to test the integrity of the joints and or solder points?***
   Whatever electrical/mechanical designs a team comes up with needs to handle the proposed drop load and operational loads during use. A vibration or shock test on their hardware is not necessary, but it needs to be robust enough to withstand a 6-10 foot drop into the water without breaking mechanical/electrical hardware.

8. ***Challenges 2-4: Do the materials we use need to be able to perform in space or do they just have to work underwater for the test?***
   Propose a tool that meets the design requirements and will work underwater. You do not have to select materials that will work in the vacuum and temperatures extremes of space. You are making a prototype of a concept, and we are interesting in seeing how that concept works.

9. ***Challenge 2: Is the design philosophy such that the astronaut rotates the pivot by hand, making the goal primarily to prevent it from jamming?***

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Yes, the astronaut can rotate the pivot mechanism by hand and use the other hand to hold up the device. The primary goal is to make a super cool pivot mechanism that we want to put on all of our EVA tools! Included in that is that it's dust-tolerant.

10. ***Challenge 4: Are there requirements on rock size range and should the device catch extra dust around the sample?***
    The size range is located in the requirements matrix and we are not asking to collect regolith around the sample.

11. ***Challenge 4: Does the sample collected also need to be stowed in the pocket with the tool after it has been collected?***
    Yes, the sample needs to be contained within the sampling device.

12. ***Challenge 4: Does the collected sample + tool need to fit within the same size requirements for the tool (empty)?***
    The size requirement is for the tool only. However, the sample must fit inside the tool and stowed after collection.

13. ***Challenge 4: Are different materials accepted for the end of the sampling device or is it restricted to the aluminum and steel options?***
    Yes, flexible materials are acceptable but need to be approved on a case-by-case basis by Mary at the NBL. Email the reduced-gravity email. In general, Teflon is really the only other material that the geologists and curation team want touching the samples.

14. ***Challenge 5: Does the coring bit have to be reusable?***
    Not necessarily, we'll leave it up to your design. We won't be sending an entire drill mechanism to the moon for just one sample, so it would be nice to be able to swap out to take multiple samples.

15. ***Challenge 5: What is the power hand drill connector size limit?***
    13mm, (0.512”) drill chuck

16. ***Challenge 5: What will the range of RPM be for the drill?***
    RPM is adjustable based on device needs, nominally up to 1000 rpm.