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Micro-g NExT FAQs

Micro-g Neutral Buoyancy Experiment Design Teams Frequently Asked Questions

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FAQs: General

1. ***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.

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

3. ***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.

4. ***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.

5. ***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.

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

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

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8. ***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 prototype. However, in the event that a development stipend is awarded to the team by Micro-g NExT, the program will need each team to identify an institutional financial representative.

9. ***Where can I find information about the Neutral Buoyancy Laboratory (NBL)?***
   Information about the NBL can be found at the following link:
   http://dx12.jsc.nasa.gov/site/index.shtml

10. ***Are there hardware requirements and/or standards my team should be aware 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.

11. ***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.

12. ***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 a Micro-g NExT coordinator.

13. ***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.

14. ***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 Journey to Mars, new tools and procedures are necessary to carry out the upcoming missions.

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15. My project will employ social media. Can we coordinate social media outputs about the project with Micro-g NExT?

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

16. 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.

17. 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.

18. 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.**

19. 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.

20. 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.

21. 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.

22. What is considered outreach?

Outreach is 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 activities.

23. 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,

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and what perceive will be the 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.

24. 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 on Undergraduate when we verify with your college/university, you are eligible to participate as a student.

25. 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.

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

Yes, each proposal will need its own outreach section.

27. 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. ***Have the challenge documents been updated since original release?***
   Yes, the documents were updated on October 5, 2017.

2. ***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.

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

4. ***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.

5. ***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.

6. ***Is the ideal operating position "standing" relative to "ground"?***
   The ideal operating position is "lying down" relative to the ground.

7. ***Should any modifications to our tool be necessary during testing, will there be access to tools or a machine shop?***
   Yes, we will provide loose hand tools, screw driver, pliers, etc during testing week; but there will be limited to no access to larger machining tools (i.e. mill, lathe, etc.).

8. ***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.

9. ***Can individual storage containers be connected to one another?***
   Yes. As long as there is no cross contamination between the samples, the individual containers can be connected.

10. ***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.

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11. May we 3d print parts of the tool?

Yes. Though you'll want to consider the loads that your tool will see and ensure that the plastics used in the 3D printer can handle those loads.

12. 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.

13. 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 rationale for why you designed it the way you did.

14. 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 standard shop air from the NBL which has a maximum of 125psi.

15. 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.

16. 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.

17. 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.

18. 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.

19. 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.

20. 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.

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21. ***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.

22. ***What kind of CAD program is best for all of these? Solid words 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.

23. ***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 Program we ask you select only 1 challenge. If it happens to accomplish more than 1 function that's great, but it will only be judged on a single function.

24. ***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.

25. ***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.

26. ***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.

27. ***Could you please explain the provided tethers in greater detail? Will they couple to the tool?***
    The tether has 2 hooks attached by webbing. There is a cam buckle in the middle that allows the length of the tether to be adjusted.

28. ***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.

29. ***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.

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

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31. Will we be expected to provide a pressure regulator?

No. NASA will provide you with a pressure regulated air supply.

32. 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.

33. Can we use incompressible fluid in the prototype?

We ask that you *do not* use hydraulic systems for this round of Micro-G NExT.

34. 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 for connection for attaching and detaching parts?

No. Your team can design whatever connection you'd like.

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?

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: ISS EVA Challenges

1. ***In fixing a hole, will there be an issue with sticking things through the hole that may come into contact with other components in the exterior?***
   This will not be an issue. Assume that if something is put through the whole there will not be anything behind it.

2. ***By cutting a zip tie, do you mean removing an existing one, or cutting the excess when attaching a new one?***
   The cutters will be used for removing existing zip ties.

3. ***Is there a reason why the hole won't be repaired from the inside of the module, avoiding a spacewalk?***
   If a hole is created in the pressure wall of the ISS, the first action the crew will take is to close both hatches of the module, thereby isolating the leak. Once that module is sealed, all of the air within that module will vent to space. In order to access that module, you would have to open one of the hatches and the crew would have to put their spacesuits on. But when they open up the hatch, the air from the rest of the ISS will then rush into the affected module and then out the hole into space, thus creating an even worse situation. So doing a spacewalk is the preferred method of repair.

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.

5. ***What will the material of the pressure wall be?***
   Aluminum 6061

6. ***Will there be water on both sides during pressurization?***
   There won't be any pressurization. The test stand will be in water and the water pressure will be the same on both sides of the aluminum. Methods for verifying the leak was properly sealed are yet to be determined by the testing team, but a potential idea was to use an air hose to release air bubbles on the backside of the aluminum to see if any air bubbles through the hole.

7. ***What is the clearance behind the test piece?***
   Assume you will have at least 6" of clearance between the test piece and the mounting structure behind it.

8. ***Can a leak hole edge project out of the plane of the aluminum surface?***
   It is possible for an edge to project out of the plane of the surface. But it might only be a slight bulge. We will most likely create the hole using a drill bit, in which case you won't have to worry about the edges.

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9. ***It says the angle of incidence will be between 0 – 45 deg. Does that mean that the hole might be oblong? Or does it mean that any burs created might be at that angle?***
   This means that the hole will be made at an angle between 0 – 45. So the hole could look oblong.

10. ***What type of material is the handrail?***
    The actual handrails are made of Aluminum 6013-T6. But we'll most likely use Aluminum 6061 since the two alloys are so similar.

11. ***Are the MMOD impacts on the handrail visible to the naked eye?***
    Generally, yes, you can see the MMOD impact on the handrail, as it exposes the silver-colored aluminum underneath the gold anodizing coating. However, you cannot visually determine if that impact resulted in a sharp edge or not. Your tool needs to be able to detect the sharp edge hazard.

12. ***Is there a certain number of zip ties the tool should be able to retrieve?***
    Your tool should be able to cut and retain at least one zip tie at a time. The crew would cut and retain one zip tie, release that zip tie into a trash bag, and then move on to the next zip tie. Ideally the tool would be able to retain more than one zip tie, as that would reduce the number of times crew members would need to stop to throw them away. Feel free to try increasing your zip tie retention abilities to increase the robustness of your design!

13. ***How tight of a space will the zip tie tool have to operate in?***
    Assume you will have plenty of space to operate the tool. We will **not** provide you a tight space to operate in during the testing.

14. ***Should the tool be integrated with the glove?***
    You can create a tool that slides over fingers of the glove, wraps around the palm, or any other method that is self-restrained around the glove. You may not permanently connect to any part of the suit or glove, or make holes in the glove to mount your tool.

15. ***What exactly do you mean by "retain"?***
    Capture. Grab. Once you cut the zip tie your tool needs to hold on to it so it doesn't float away.

16. ***Could the zip tie, after being cut, be grabbed with the astronaut's hand?***
    No. Your tool needs to provide a means to cut and grab the zip tie. You cannot rely on the astronaut performing that function.

17. ***How precise are the requirements for detection? Are exact locations needed?***
    There will be a number of visible craters on the handrail. Some will have sharp edges and some won't. So your tool will need to provide a "yes or no" if there is a sharp edge, not provide exact coordinates of the sharp edge.

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18. Is image-sensing a plausible solution for sharp edge detection?
We are going to assume that by image sensing you mean taking pictures or using another instrument to scan the handrail, look at the data, and make a determination. If that's the case, then no. We'd prefer you don't submit options like this.

FAQs: Technical: BRUIE Challenge

1. ***Will the device need to penetrate the ice?***
Yes, the device will need to penetrate the ice in order to take a sample.

2. ***Will samples be collected from actual ice or some other medium?***
Samples will be collected from actual ice.

3. ***Does the cutting head need to exit one end of the cylinder, or can it come out the side?***
Depending on your design, it could exit either way. However, make sure the design meets the size requirements.

4. ***Does the device need to take multiple samples at a time?***
Per the requirements, only one sample needs to be taken. However, the design may be more desirable if multiple samples could be taken.

5. ***Is the device being pushed up against the ice with the 10lb of buoyancy?***
The device will be mounted on a platform, which provides 10lb of buoyancy.

6. ***Will we be sampling from below the ice?***
Yes, the device will be placed on a buoyant rig and placed against the ice. It will not be firmly anchored to the ice.

7. ***Should we assume Earth seawater properties?***
Assume the properties of the NBL for this challenge, which is chlorinated water.

8. ***Will the core sample retract into the body? Will there be a platform in the body that raises the device to the surface of the body? Or should we worry about that length in addition?***
Yes, the core sample will retract into the body. You will need to worry about the length. Because of the modular instrument design of the rover, the device will extend from the cavity, take the core sample, and retract so that the rover can continue its movement along the ice.

9. ***Is there a person that would be handling the tool or do we program it to use it automatically?***
The tool shall operate remotely.

10. ***What is the optimal sample size our instrument needs to collect?***
The device shall collect cylindrical samples 0.5" in diameter and 3" in length.

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11. Is there a schematic going to be made available on how it would interface?
Additional information about the test platform will be made available later in the year.

12. Are any electronics diagrams necessary for our proposal?
Please include as much supporting information as possible.

13. If we do have to code, what kind of software should we use?
The students are free to use any coding language or software.

14. The really the device is completely independent of the rover. The rover is just an attachment point?
Yes, the rover serves as attachment point and transport vehicle.

15. Temperature Sensing – do we need to maintain the temp or can we keep all of them at -5C?
The device shall maintain the stratigraphy of the sample during collection, containment, and transportation. The sample shall not melt.

16. Do we need to anchor the drill or will the platform do that?
The platform will not be anchored. If you need to anchor the device in one position, you will have to include that in your design.

17. So while it needs to be able to be stowed in a particular space, does it need to actuate from a stowed position?
No, it does not need to actuate from a stowed position

18. Can we move the device or does it need to be firm?
Your tool can move, but must be able to retract once the sample retrieving process is done.

19. What have you seen that causes the drill to freeze during the collection operation?
Freezing of the drill is most likely caused due to heating of the drill bit, which causes melting of the ice. The melted water then refreezes on the drill once the operations come to a standstill.

20. How many amps will the 12 volt supply for the coring challenge carry?
Student projects will be allowed to connect to the NBL's electrical outlet: DC 12v, 25 amp. No other electrical power sources will be allowed.