.

Micro-g NExT FAQs

Micro-g Neutral Buoyancy Experiment Design Teams Frequently Asked Questions

Contents

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.

.

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.

9. ***Where can I find information about the Neutral Buoyancy Laboratory (NBL)?***
   Information about the NBL can be found at the following link:

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 the 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 exploration objectives, new tools and procedures are necessary to carry out the upcoming missions.

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 the 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, 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.

.

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

6. ***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.

7. ***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.

8. ***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.

9. ***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.

.

10. ***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.

11. ***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.

12. ***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.

13. ***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.

14. ***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.

15. ***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.

16. ***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.

17. ***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.

18. ***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.

19. ***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.

.

20. ***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.

21. ***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.

22. ***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.

23. ***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.

24. ***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.

25. ***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.

26. ***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.

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

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

29. ***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.

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

.

31. 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!

.

FAQs: Technical: ISS EVA Challenges

1. ***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.

2. ***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.

3. ***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.

4. ***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.

5. ***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.

6. ***Are there any intrusions/shard edges on the side of the handrail FACING the station?***
   No, only on the 3 faces shown in Figure 3

7. ***Where can more figures/dimensions for the handrails be found?***
   We cannot provide more than what is shown in Figure 1. The specific dimensions of the profile are proprietary. Look around online for any other publically available images.

8. ***Is this challenge going to be inside of the pool or tested on the dry deck surface?***
   All testing will be done in the pool

9. ***\Why is the Sharp Edge Detection and Removal/Covering challenge up again?***
   The ISS Program is very interested in this challenge and we want to see more design ideas.

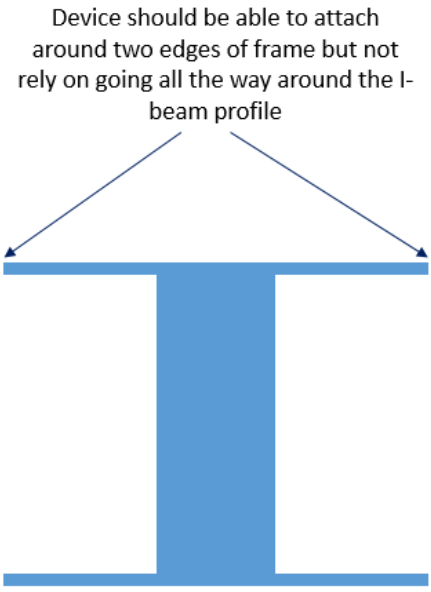
10. ***When will further (Exact) dimensions be provided for the CETA cart and Truss? Are the rails a 1'' square on CETA?***
    Give us a few weeks to get these to you.

.

11. Many of the requirements for challenges are pretty vague. Is that intentional to encourage creative designs?
Yes.

12. How far are the handrails spaced from another?
On ISS they are all over the place and some are right next to each other (in-line). For the NBL testing they will be ~10" apart, but each team will only have 1 handrail to test on. This distance can be adjusted depending on which designs are selected.

13. The description says only partial truss access may be available. Can you clarify which portion of the truss this is?
See Figure 2 in the challenge document. The device should attach around two edges of the frame (similar to I-beam profile). See notional image below. These specific dimensions will be sent out soon.



Notional I-beam profile of truss frame

14. Can you clarify what the two fault tolerant requirement means?
The device will should have a redundant feature built in so that if one fails, the second will allow the device to still be operational.

15. Will a mock-up glove or astronaut suit material be provided for testing purposes for the sharp edge challenge?
Testing will not occur with the suit glove. A swatch will be used to check for sharp edges.

16. What are the materials of the truss frame and square grid?
Both are made of aluminum.

17. What is the best way to recreate the examples of the sharp edges for testing?
It is up to the students to create their own examples of sharp edges for testing.

.

18. What depth will the testing be conducted at?
It may vary, but at a maximum 40 ft.

19. Does the camera have to clamp onto the whole width of the truss/I-beams or just across the thickness of the truss/I-beams?
The clamp cannot just clamp onto one edge and rely on friction to stay in place.

20. For challenge 2 can you clarify what you meant by the attachment cannot rely on friction?
The device cannot rely on just gripping the I-beam.

21. What do you mean by permanently fixing/covering the sharp edge? Would this be possible to do in NBL testing environment?
Each team will have one handrail to repair. It is preferable if the device is removable. Also keep in mind that you do not want to damage the handrail. When we say permanently, we mean that the solution will protect the astronaut from the sharp edge at all times.

22. Can the apparatus for challenge 1 be a permanent attachment onto the rails?
No, the device needs to be removable.

23. Will modular camera mount designs require the use of multiple mounts in one EVA?
We would like to see one design for all mounts, not just a removable end effector. We would do not foresee the need to use multiple mounts during an EVA.

24. Is it required to be able to remove the camera from the mount?
Yes, because we are providing the camera.

25. In regards to the CETA, which part of the square grid is oval? It is difficult to tell in the picture.
The actual square grid frame profile is 1" x 1" octagonal.

26. Do you want the surface on the handrail for challenge 1 to be cosmetically perfect? Like should it be flat after repair, or is a smooth dent fine as well?
A smooth dent is fine. The handrail will have impacts that have both sharp and non-sharp edges. Your device will need to detect and differentiate between the two.

27. Can we have a separate mounting for each surface for challenge 2?
Technically yes, but the intention for this challenge was not to have separate mountings.

28. Is there a time limit for the NBL part of challenge 1?
All teams will have a 20 minute testing window.

29. Would a concealed blade count as a sharp edge on the tool?
It will depend, but it will need to be explained in the Hazard Analysis.

30. Is it a standard go-pro camera mount?
Yes, please look in the challenge document for the link.

.

31. Are the hand rails and trusses magnetic enough to use magnets in the camera design?
The handrails and truss are aluminum, which is not magnetic.

32. For the 1st challenge, should the edge of the rail be taken into consideration?
According to the challenge document, there are three sides of the handrail that could be impacted. Yes, the edges between those three faces could have impacts.

33. The ends of the ISS handrail where it is screwed on have different dimensions than the rest of the rail. For the first challenge, will we also have to take the edge/end pieces into consideration?
No, you will only need to worry about the actual handrail, with the given dimensions.

34. Is it just going to be the GoPro and the Waterproof housing case? (no other attachments to the GoPro?)
We will provide the GoPro and Waterproof housing case. Each team will be responsible for procuring a GoPro-compatible interface to the housing case. See updated challenge document for a detailed image and some example interface pieces.

35. For challenge 1, could it be a two part kit such as a detection device and a tool customized for the job?
Yes, as long as the overall system fit into the allocated dimensions and meet the weight requirements.

36. Will we be given specifics on the camera used?
The GoPro will fit inside the case given at the link in the challenge document.

37. When you say "detect sharp edges"(challenge 1), does that mean we have to have some sort of indicator, and is that a part of the criteria, or does it only matter that we fix all the sharp edges?
Detection must occur and have some sort of indicator for the user.

38. What is your definition of stable for the camera? Does it have to be able to withstand kick loads?
If a camera is stable, it means that it can produce a clear image. It would be advantageous to design your device to be durable in case there are unexpected forces applied to it.

.

FAQs: Technical: Mini-Arm Challenge

1. ***What size and shape of container will the samples be located in before being extracted by the end effector?***
   The samples will not be in a container, but on a flat surface.

2. ***Will the nylon cores be in a pile or stacked neatly?***
   This will be determined by the team. Be sure your gripper can grasp the cylinder shape.

3. ***Does the design need to accommodate the nylon core upright and on the ground?***
   Assume the cores will be on the ground.

4. ***What are the units for figure 2 on the end effector?***
   End-effector units are inches with millimeters in square brackets. The fasteners are metric (M3).

5. ***In the CAD drawing, what is the diameter of the circle that the end effector interface holes lie on?***
   The Challenge Document will be updated as needed to give that dimension.

6. ***Is the acrylic sample similar in material properties to the actual ice samples?***
   Acrylic is a good analog and substitute of ice given the circumstances. Ice tends to melt too quickly for the testing situation.

7. ***What are the maximum and minimum lengths of the aluminum extrusions we will be interacting with?***
   No minimum or maximum lengths. We are more testing that it can grip.

8. ***Does the end effector need to act autonomously (sense successful contact and clamp) or can it be remotely controlled?***
   It should perform remotely and give feedback as necessary to the operator on the surface.

9. ***Can the end effector expand beyond the listed volume for storage?***
   Yes, as long as it is able to stow inside of the required storage volume.

10. ***Does the interface have rotation integrated already? (about the z-axis of the "Allowable end-effector volume" cylinder?***
    Yes. The z-axis will be accounted for by the arm

11. ***Will the team have control of the arm during testing, or will it be operated by a diver?***
    The arm will be operated by a technician on the surface.

12. ***Are pneumatically-powered designs permitted for challenge #3?***
    As long as the design meets the safety requirements and design specs that have been provided for you.