TEAM GUIDE 2022

IDAHO STEM ACTION CENTER

IDAHO EXHIBITION OF IDEAS (IDX) TEAM GUIDE 2022

I**daho Exhibition of Ideas (IDX)** is a multi-week, team-based digital design and fabrication competition where students learn and practice design, iteration and rapid prototyping skills with 3D printing technology. Student teams brainstorm, develop and prototype an idea for a solution that responds to a challenge theme and incorporates 3D design/printing in some way. Each team works with an educator Coach, who guides the team through the design process and assists with documentation. IDX culminates in a regional Student Showcase, where teams will present their solution to a panel of judges and compete for prizes.

The Challenge Theme for the Spring 2022 Student Showcase is **Space Exploration**. You can find more information about this theme, as well as suggested topic areas and resources, in the "2022 Theme Information" section at the end of this document.

Team Eligibility:

- Each team should consist of 4-6 youth
- Youth must be in grades 5-10. Submissions for the 2022 Showcase will be judged in **two divisions:** Junior (Grades 5-6) and Senior (Grades 7-10). Mixed-grade teams are welcome; however, division will be determined based on the grade level of the oldest student on the team.
- Each team should have at least 1 adult coach who is responsible for guiding the team, assisting with documentation and submission and coordinating travel to the Showcase
- Coaches should have previously completed an Idaho FabSLAM or IDX 3D Printing / Digital Fabrication for Educators training between 2016-2021. Schools/organizations where one staff member has completed this training may be eligible to bring additional teams, led by Coaches who have not received training, provided there is collaboration with the educator who has been trained. One coach should not lead more than one team.
- Teams must have access to a 3D printer and associated software in order to complete their Showcase entry

Please contact Erica Compton (erica.compton@idaho.stem.gov) with questions about team/coach eligibility.

Regional Showcase Locations, Dates and Times

Three Regional Showcases will be held at the following dates/locations. Showcases will begin with team set-up at 11:00am and conclude between 3:00 and 4:00pm.

Treasure Valley - Saturday March 12, 2022
Pocatello, ID - Friday, April 8, 2022
Lewiston, ID - Friday, April 8, 2022

Teams must attend the Regional Showcase in the location closest to the sponsoring school/organization.

Exact schedules and venue information will be provided to registered teams closer to the event.

Showcase Submission Requirements

Teams are required to submit an original idea that responds to the Challenge Theme. Team entries should include the following:

1. **Solution Prototype:**
   a. A physical representation of the solution idea created primarily by 3D printing.
   b. Prototype should be thoughtfully designed and respond to the theme in a meaningful way.
   c. Teams are highly encouraged to bring and display previous prototypes and iterations, including failed prints, that help tell the story of the team's process.
2. **Digital Documentation:**
   a. A minimum one-page website detailing the team's process and what they have learned. Structure/platform of the website is up to the team.
   b. Webpage should include both visual (photos/video) and written content.
   c. Coaches are permitted to assist students with documentation (capturing photo or video) but not direct content creation.
   d. Teams will be asked to provide the URL to their published webpage a few days prior to the Showcase
3. **Presentation:**
   a. A presentation of no more than 5 minutes introducing the team's idea and describing the design process.
   b. Include information about the solution, how the team arrived at the idea, challenges encountered, changes made, roles of individual team members and how the team might reiterate the design in the future.
   c. A slideshow is NOT required, however teams may use one if they wish.
   d. The presentation will be followed up by a 3-minute Q&A with the judges. Students should be prepared to answer judge questions independently, without assistance from the Coach.
4. **Visual Materials:**
   a. Each team will be allotted a (6-8ft.) table to display the prototype, previous iterations and any accompanying visual materials.
   b. Team presentations will take place at team tables
   c. No specific visual materials are required however teams will receive a "Display" score based on how they use the space to explain their idea and process.

A full scoring rubric can be accessed at this **link**

At the Showcase: What to Expect

- Each Showcase will be approximately four hours in length, though times may vary depending on the number of teams attending.
- Teams will be allotted one hour at the beginning of the Showcase to set up. Most teams complete set-up within 20-30 minutes.
- A catered lunch will be available for students and coaches following set-up.
- Judges will travel from table to table for team presentations. A judging line-up will be provided so that teams know when they will be visited by the judges.
- Judges will spend 8 minutes with each team: up to 5 minutes for the presentation and an additional 3 minutes for Q&A.
- In order to expedite the judging process, websites will be reviewed by judges prior to the start of the Showcase. **Teams will be asked to submit their website URLS a few days prior to the scheduled Showcase date.**
- While the judges deliberate, student tables will be open to family members/members of the public. Students are also encouraged to visit the displays of other teams. All participating students will be asked to vote on a "Student's Choice" award for their favorite entry. The Student's Choice Award will be given out alongside other prizes at the end of the Showcase. Students are not allowed to vote for their own project.
- The Showcase will conclude with a brief Awards Ceremony, where prizes will be given to selected teams.

Prizes

- Prizes will be awarded based on the scores given by judges on the rubric
- A 1st, 2nd and 3rd prize will be awarded for both Junior and Senior level
- All students are eligible to vote for a "Student's Choice" prize, which will be awarded to the team that receives the most votes. Students are not permitted to vote for their own team for Student's Choice.

IDX: Team Roles & Responsibilities

Student Role:

Students are the "makers" and bear most of the responsibility for developing a solution idea and completing a prototype. Student responsibilities include:

- Attending meetings/work sessions and participating by sharing ideas, giving feedback and contributing talents to get the work done
- Using 3D design software to design and model the agreed-upon solution
- Using 3D printing software (with Coach supervision/assistance) to complete prints and subsequent iterations
- Working to reach milestones and complete the project on time
- Documenting the team's process on a webpage, including:
  - Developing an idea and prototype from start to finish
  - Important discoveries and decisions along the way
  - Challenges encountered and how the team responded/iterated
- Being able to explain the project idea and the design process, including:
  - The role of each individual team member in developing the final prototype
  - The reasoning behind different design decisions
  - The overall value of the solution idea
- Answering judge questions
- Creating the presentation and display materials for the Showcase

Coach Role:

Each team has an educator who supports the team and acts as the point of contact with STEM Action Center. The Coach's responsibilities include:

- Registering the team with STEM AC
- Arranging travel to the Showcase (STEM AC will provide travel stipends)
- Ensuring that any school-required permission slips or forms are completed by youth and their parents/guardians
- Coordinating with youth/parents as needed to set up meetings and work sessions for them to complete the project
- Introducing youth to 3D design software and printing technology and assisting with technical troubleshooting
- Guiding youth through problem solving/design thinking process
  - Provide a scaffolding/process for students to identify a problem, brainstorm a solution and develop a prototype
  - Ask questions about design ideas and prototypes
  - Prompt them to think about factors/users/circumstances they may not have considered
- Submitting team webpage URL, final .stl file and any information requested by STEM AC

2022 THEME INFORMATION

The 2022 IDX Student Showcase challenge theme is **Space Exploration**. As this is a broad topic about which students may not have a lot of prior knowledge, we have identified three subtopic areas in which students can focus their research and design work. Your team may choose to complete a project within one of these areas or a space-related topic of your own choosing (see Topic Area #4).

TOPIC AREA #1: LIFE IN SPACE

When space agencies like NASA develop new tools and technologies for space exploration, they often have to focus on "big" issues like launching a new type of rocket or landing a robot precisely on the moon. While astronaut health and safety is of the utmost priority, there isn't always time or money to focus on the little things that might make day-to-day life in space more comfortable or convenient.

But life in space is full of challenges. Many of these challenges relate to the condition of microgravity -- when people and objects appear to be weightless. Most of what we know about living in microgravity comes from the experience of astronauts living on board the International Space Station, or ISS. Without gravity to hold it in place, everything on the ISS has the potential to float away: food, tools, your toothbrush -- even sleeping astronauts! Astronauts on the ISS also have to exercise every day since they aren't using their muscles to stand up or walk around.

There are other challenges as well. It can be hard for astronauts on the ISS to get a good night's sleep, due to motion sickness, or the fact that they experience 16 sunrises and sunsets every day. They can also experience feelings of isolation, homesickness, and even boredom, once the initial excitement of being in space wears off.

Your Mission: Design a solution for one of the challenges of everyday life in space. Represent your solution with a 3D printed prototype. You may focus your solution on the ISS, or think ahead to what life might be like for future astronauts living on the moon or Mars.

Suggested Resources:

NASA: A Day in the Life Aboard the International Space Station
Comprehensive NASA hub of K-12 resources on what it's like to live and work in space, organized into different topics. Each topic has its own page, with an overview, link to a Youtube playlist, plus additional suggested resources. There is a wealth of information here for students to discover small challenges astronauts encounter throughout their day.

NASA Knows! (Grades 5-8) "What is Microgravity?"

Wonderopolis: "Do Astronauts Get Bored in Space?"

PBS Documentary: A Year In Space
Watch with IdahoPTV Passport or PBS Documentaries Free Trial on Amazon Prime

Scott Kelly, Endurance, Young Readers Edition: My Year in Space and How I Got There

TOPIC AREA #2: MOON ROCKS

In 2017, NASA launched the Artemis program with the goal of returning humans to the Moon and exploring more of the lunar surface than ever before. These explorations, along with the establishment of a lunar base camp, will pave the way for an eventual mission to Mars.

A primary objective of the Artemis I Mission will be the collection and return of geologic samples from the Moon's surface. Conducting research on the Moon has different technological and equipment needs than the crewed space missions of the last 50 years, which have all been conducted within spacecraft or while floating in space. NASA is in the process of developing an entirely new type of spacesuit, which will offer astronauts more freedom of motion as they conduct their work on the Moon.

In addition, NASA is working to develop a new suite of tools for Moon geology work -- using the tools from the Apollo missions as a starting point, but updated for the 21st century. This includes tools for collecting, documenting and transporting samples, as well as minimizing the accumulation of moon dust on spacesuits, boots and inside lunar modules and spacecraft. Tools designed for the lunar environment must take into account a number of unique constraints, including limited hand dexterity, avoiding sharp edges that could puncture spacesuits, and limited transport capacity -- both when traveling to the Moon and while navigating the lunar surface. Even with the new spacesuits, NASA hopes to limit the amount of times astronauts have to kneel down and stand back up, as this will take a lot of physical effort.

Your Mission: Design a solution that helps with geology research and/or dust mitigation on the Moon. Represent your solution with a 3D printed prototype. Your solution can be a response to an existing tool need identified by NASA (e.g. tool carrier, universal extension holder, sample bag dispenser and many others you will find in the research material) or a new idea you believe would help aid missions on the Moon.

Suggested Resources:
NASA Video: "Spacesuits for the Next Explorers"
Houston, We Have a Podcast Ep. 155: "Artemis Moon Tools"

Powerpoint: Artemis Geology Tools (Selected Slides # 3, 11, 16-18, 22)
Some slides in this presentation contain information that is beyond the scope of students participating in this challenge. We recommend focusing on the numbered slides identified above, which provide basic information about the kinds of tools NASA is hoping to develop.

Geologic Tools for The Moon: Review of Apollo
Catalog (with pictures!) of the geology tools used on the Apollo missions.

Artemis Plan: NASA's Lunar Exploration Program Overview
NASA Micro-G Next 2022 Design Challenge Descriptions
This document contains the challenge descriptions for a college-level engineering competition that asks students to develop real tool designs that could be used on the Moon. While some of the design constraints are beyond the scope of IDX participants, you may wish to use the very specific tool needs defined by NASA in this document as a starting point for brainstorming your team's solution.

TOPIC AREA #3: SPACE JUNK

NOTE:
This topic and the associated resources deal with emotional and scientific concepts that may be better suited for older students (aged 13 and above).

Since the launch of the first satellite in 1957, humans have sent a lot of objects into orbit -- but we don't always have a plan to get them back down. As a result, non-working satellites, abandoned launch vehicles, fragments from exploded spacecraft and other pieces of "space junk" continue to orbit the Earth. You may think of space junk as a harmless curiosity, but it actually poses a serious threat to human and robotic missions in space.

NASA estimates there are approximately 23,000 pieces of space junk larger than a softball orbiting the Earth, 500,000 pieces the size of a marble or larger, and approximately 100 million the size of a grain of salt. About 27,000 of the largest pieces are tracked by the U.S. Department of Defense; if a collision seems possible, NASA can maneuver the ISS and other critical satellites out of the way. At the speed these objects travel -- upwards of 17,000 mph -- a collision would destroy a satellite on impact. The remaining debris is too small to be detected on radar, making collisions more difficult to predict, but these particles have the potential to tear through spacesuits, chip the windows of the ISS and put holes in the solar panels of the Hubble Space Telescope.

Your Mission: Design a solution that helps address the growing space junk problem. This could take the form of protective measures for the ISS and critical satellites; mitigation measures that the likelihood of tools or small parts being released into orbit during missions; end-of-life design for satellites (satellite features that make it easier/more economical to retrieve them once they're no longer in use); or active debris removal (ADR) -- systems designed to intercept pieces of debris and redirect them to Earth's atmosphere to burn up.

Represent your solution with a 3D printed prototype. For the purposes of IDX, solutions should focus on the structure and function of the proposed solution over the technical requirements of maneuvering a satellite into place or matching speed with a debris object. Consider design features or elements that could be added on to existing technologies for debris mitigation and removal.

Suggested Resources:
Video: "Attack of the Cosmic Space Junk!"

DCODE by Discovery Video: "Space Junk Around Earth"

Time for Kids, October 16, 2020 Article: "Space Junk"

May 26, 2021 NASA Briefing: "Space Debris and Human Spacecraft"

TOPIC AREA #3: SPACE JUNK

Suggested Resources: (continued)

NASA ARES Orbital Debris Program Office

This is a great resource for exploring the full range of mitigation measures humans have taken or planned to take regarding near-Earth orbital debris, not just debris removal, as well as learning more about how we track and model orbital debris. Click through the links on the right side of the page to explore different topics.

Real ADR Technologies in Development:

- BBC News, September 19, 2019: "RemoveDEBRIS: UK Satellite Nets 'Space Junk'"
- ELSA-d 2021 Press Kit from Astroscale
- Space.com, "ESA partners with startup to launch first debris removal mission in 2025"

TOPIC AREA #4: OPEN-ENDED

Identify a (real) problem related to space exploration and design a solution for it.
Use research to inform your design. Represent your solution with a 3D printed prototype you will present at the IDX Showcase.