

14TH ANNUAL



**2023 RESEARCH POSTERS
COMPETITION
GUIDELINES**
GUIDELINES

Great Minds in STEM
2023 Research Posters Competition Guidelines

TABLE OF CONTENTS

Overview	3
Eligibility	3
Registration and Hotel	4
Abstract Submission	4
Awards	4
Abstract Guidelines	4
Poster Format	6
Poster Resources	6
Poster Presentation (Dimensions, Set-Up, Judging, Teardown)	6
Judging	7
Virtual Research Scholars Exhibit Hall	7
Videos	7
Important Dates and Deadlines	8
Contact Information	8
Information Release and Disclaimer	8
Undergraduate and Graduate Student Poster Judge’s Score Card	9
Sample Winning Abstract	10

Great Minds in STEM
2023 Research Posters Competition Guidelines

OVERVIEW

The 14th Annual Great Minds in STEM Research Posters Competition will be held during the 2023 GMiS Conference, at the Pasadena Convention Center, in Pasadena, CA, from October 11 – 14, 2023.

The Research Posters Competition is intended to provide underserved and underrepresented undergraduate and graduate students pursuing full-time studies in a related science, technology, engineering, mathematics (STEM), or health discipline the opportunity to showcase their aptitude for scholarly scientific and technical investigations. Students are encouraged to present their individual and unclassified research their senior design projects, capstone projects, thesis, dissertations, internship projects and research lab projects, regardless of the progress/stage of their research.

The purpose of the GMiS Research Posters Competition is to:

- Provide a premiere, national forum for traditionally underserved and underrepresented STEM undergraduate and graduate students to showcase their technical research talent
- Challenge students to communicate their research with a balanced technical/lay audience perspective
- Stimulate interest in scientific and technical research
- Encourage networking among other student researchers and with STEM professionals with similar research interests
- Increase public awareness of the relevance of STEM research and its benefits to society

The competition is also a great forum for students to showcase their work to prospective corporate, lab or university recruiters, as a pre-cursor to attending the career fair. Additionally, competition awards will be presented to the top undergraduate and graduate students¹. Winning abstracts will be profiled online at www.greatmindsinstem.org on the Virtual Research Scholars Exhibit Hall.

ELIGIBILITY

	Undergraduate Students	Graduate Students
Traditionally underrepresented groups in STEM (i.e. women, Hispanic/Latino, African American, Native American)	X	X
Must be enrolled full-time (12 hrs undergraduate/9 hours graduate) at an accredited college/university in the U.S. or Puerto Rico <i>Exception: Doctoral students classified as doctoral candidates, but not working full-time and making satisfactory progress toward dissertation</i>	X	X
Must be pursuing a technical degree in science, technology, engineering, math or related health	X	X
Only individual students may present; teams are ineligible per poster presentation	X	X
Students may present only one poster as the lead presenter	X	X
Projects must be unclassified	X	X
Projects may be at any stage of the research process	X	X
Conference registration required	X	X

¹ Awards are subject to change depending on funding

Great Minds in STEM
2023 Research Posters Competition Guidelines

REGISTRATION AND HOTEL

Participants need to pay their own conference registration. Please refer to the conference website for current registration fees.

Early-Bird Registration is \$175 through September 15. Regular Registration is \$225 thereafter. If you are in need of a discount, please contact GMiS at info@greatmindsinstem.org for further information.

Registration does not include hotel accommodation. Please visit the GMiS Conference website for a list of preferred hotels and rates. Individuals must arrange their own hotel accommodation.

ABSTRACT SUBMISSION

After you have completed the registration process, login to gmisaccess.org to renew or create an account and then access the **Research Posters Competition Portal** to upload your abstract and the optional poster and video link.

AWARDS

Top prizes will be presented to students who are recognized for having the best Research Poster based on both technical merit and presentation as determined by judges. Winners will be announced on Friday evening at the Student Leadership Awards Show. **Winners must be present to receive award or will forfeit their award.** Awards and recognition will be presented in the following categories as follows²:

Undergraduate Students	Graduate Students
Computer Engineering/Computer Science	Computer Engineering/Computer Science
Engineering and Technology	Engineering and Technology
Math and Science	Math and Science

All poster presenters MUST attend the Student Leadership Awards Show on Friday evening. Winners must be present to win.

ABSTRACT GUIDELINES

Abstracts must be submitted as .doc, docx or pdf only. **Late submissions will not be accepted and automatically disqualified.**

The length of the **extended abstract** must be between 775 – 800 words. Graphics, drawings, or tables are **not** permitted in the abstract. The abstract should be a concise summary of the research project and meet criteria as outlined in the Judging Section. The abstract will be evaluated on both content and adherence to formatting guidelines. Please refer to the attached winning abstract as a sample of the required format.

Authors are strongly encouraged to review their abstract prior to submission and ensure that proper spelling and grammar have been utilized and that all italicization, math and scientific notations, etc. are correct.

² Awards are subject to change depending on funding

Great Minds in STEM
2023 Research Posters Competition Guidelines

GMiS reserves the right to make any formatting edits to the abstract only for the sole purpose of fitting any Research Poster Competition Proceedings.

The **General Format** of the abstract must adhere to the following:

- Typed, Single-spaced
- 1-inch margins
- Times New Roman, with 11 or 12-pt font (expect for header requirements)

The **Abstract Heading** must adhere to the following:

- Title of Project (Bold, Centered, Times New Roman, 14 pt)
- Author(s) (Centered, Times New Roman, 12 pt)
- The project/research advisor should be included
- Institution, Department, City, State, Zip (Centered, Times New Roman, 12 pt)
- If the authors are from different institutions, please add a superscript number to the matching author and matching institution
- Keywords: List five (5) keywords for indexing

Sample Abstract Header

**A Physics-Based Simulation Study of Tensegrity Damping Strategies for
Controlled Hopping on Small Solar System Bodies**
M. Retana¹, B. Hockman², J. Ahmar³, M. Pavone²
University of Nevada, Reno, Reno, NV 89557¹
Stanford University, Stanford, CA 94305²
University of California, Berkeley, Berkeley, 94720³
Keywords: Hedgehog, Tensegrity, Microgravity, Damping Strategies, NTRT

The **Abstract Content** should include:

- Introduction
- Hypothesis or Intent
- Materials and Methods
- Predicted or Actual Results
 - If research results are not available at the time of submission, authors are encouraged to submit predicted results. Students are encouraged to discuss differences between their hypothesized results and their actual results when presenting their research at the conference.
- Summary/Conclusion
- List of Cited References (APA 7th Ed. format; does not count towards word count)

Authors are strongly encouraged to review their abstract prior to submission and ensure that proper spelling and grammar have been utilized and that all italicization, math and scientific notations, etc. are correct. Abstracts with incomplete information will not be considered for the competition. GMiS reserves the right to make any formatting edits to the abstract only for the sole purpose to fit the Research Posters Competition Proceedings.

Great Minds in STEM
2023 Research Posters Competition Guidelines

POSTER FORMAT

The format of the poster is at the discretion of the presenter. However, it should be sufficient to technically explain and illustrate the research project to the public and the judges. Presenters should carefully critique the content and arrangement of their posters. The flow of information in the poster layout should be done in a way that easily reveals the research process and addresses salient points. Graphs, charts, tables and references should adhere to **APA 7th Ed.** formatting. Avoid the use of “whiz bang” pictures that are visually attractive, yet do not add much to the content. At minimum, it is recommended that the poster contain the following sections:

- Abstract
- Problem Statement
- Results
- Introduction
- Hypothesis
- Conclusion
- Background
- Proposed or Actual Testing (Procedure)
- References

Presenters are encouraged to cite the sponsorship of their work, such as corporations or government agencies. Relevant resources to the work should be recognized and cited. Presenters are also encouraged to list their mentors.

POSTER RESOURCES

There are many resources regarding designing a good research poster. Here are two resources:

Making a Better Research Poster - https://www.youtube.com/watch?v=AwMFhyH7_5g

Poster Presentations - <https://www.youtube.com/watch?v=-62rK6htjWE>

POSTER PRESENTATION

If selected to present, **only the authoring student may present his/her work** at the conference. No substitutions will be allowed under any condition. Mentors are not allowed to co-present. This is an individual competition and **not a team competition**.

Presenters will be provided with a display board that stands approximately **8 ft (wide) x 4 ft (tall)**. No other audiovisual equipment, lighting, tables, chairs, stands, etc. will be provided or allowed. **Presenters MUST also bring at least 10 copies of their abstracts**. The abstracts are to be secured to the board, so the judges can easily take a copy to review. Push pins and tape adhesives will be provided.

Set-Up, Judging and Teardown

	Graduate	Undergraduate
Setup	Thurs., Oct. 12 12:00 PM – 2:00 PM	Fri., Oct. 13 7:30 AM – 9:30 AM
Location	Pasadena Convention Center	Pasadena Convention Center
Judging <i>(Times subject to change)</i>	Thurs., Oct. 12 2:30 PM – 5:30 PM	Fri., Oct. 13 10:00 AM – 1:00 PM
	Each poster presentation will be evaluated by at least two (2) STEM professionals from academia, industry, or federal government.	

Great Minds in STEM
2023 Research Posters Competition Guidelines

Once a poster has been evaluated twice, presenters may leave the session. However, posters must remain displayed until 3:00 PM on Saturday, Oct. 14.

JUDGING

Each abstract and poster will be reviewed based on the two principles - Intellectual Merit and Broader Impact – as outlined by the National Science Foundation. Abstracts and posters will also be evaluated on the overall writing, content and presentation. According to the National Science Foundation’s *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 - 2022 and Proposal & Award Policies & Procedures Guide*, successful projects demonstrate Intellectual Merit and Broader Impact if the following questions are succinctly addressed:

Intellectual Merit - The Potential to Advance Knowledge

- What is the potential for the proposed activity to advance knowledge and understanding within its own field or across different fields? (NEED)
- To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts? (HYPOTHESIS)
- Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? (METHODS)
- Does the plan incorporate a mechanism to assess success? (RESULTS)

Broader Impact - The Potential to Benefit Society Beyond Increasing Knowledge

- What is the potential for the proposed activity to benefit society or advance desired societal outcomes?

VIRTUAL RESEARCH SCHOLARS EXHIBIT HALL

As part of the student experience, GMiS will host a virtual Research Scholars Exhibit Hall to showcase the excellence in research innovation and design processes. This virtual hall will host all the abstracts, posters, presentations, video links, and contact information for the presenters. Conference attendees will have access to the Research Scholars Exhibit Hall to read the abstracts, view the posters, listen to the presentation videos and contact the presenter for follow-up discussion questions on their research. The Virtual Exhibit Hall will be made available post-conference.

VIDEOS

The video is optional for students. This will not be part of the judging. Rather, the video will allow conference attendees to virtually engage with the presenter and learn more about the project than what is already presented in the abstract and poster. The video should be no more than 5 minutes and the preferred link is a YouTube Channel link.

Here are links to resources regarding how to record a presentation video and how to upload your video to YouTube and obtain a video link.

- How to Record Audio on Microsoft PowerPoint - <https://youtu.be/Z0gQ98RYZOs>
- How to Use Zoom to Record You and Your Screen Simultaneously - <https://youtu.be/gk711FJB35s>
- How To Upload Videos To YouTube 2020 - https://youtu.be/qzpG_MkIPuY

Great Minds in STEM
2023 Research Posters Competition Guidelines

IMPORTANT DATES AND DEADLINES

Wednesday, September 6, 2023 11:59 PM PT	Priority Deadline Research Posters Competition - Abstract Submission
Friday, September 8, 2023	Conference Cancellation Deadline (Minus an administrative fee) Must be requested by email to info@greatmindsinstem.org . Refunds will not be accepted after this date.
Monday, September 13, 2023	Research Posters Competition – Finalists Priority Notifications
Friday, September 15, 2023	Early-Bird Student Registration Deadline (\$175 w/o hotel). Please email GMiS for a discount rate of \$125 before this deadline.
Saturday, September 16, 2023	Regular Student Registration Begins (\$225 w/o hotel)
Wednesday, September 20, 2023	Courtesy Reminder - 21-Day Advance Airfare
Friday, September 29, 2023	Late Deadline - Abstract Submission
Wednesday, October 4, 2023	Research Posters Competition - Finalists Late Notifications
Thursday, October 12, 2023	Graduate Session: Poster set-up: 12:00 PM – 2:00 PM Presentations: 2:30 PM – 5:30 PM
Friday, October 13, 2023	Undergraduate Student Session Poster set-up: 7:30 AM – 9:30 AM Presentations: 10:00 AM – 1:00 PM Awards Presented at Student Leadership Show Awards
Saturday, October 14, 2023	Posters only showcased at career fair. Posters may be removed after 3 PM.

CONTACT INFORMATION

Please direct all communication regarding the competition to gacruz@greatmindsinstem.org or visit <https://posters.gmis-scholars.org/>

INFORMATION RELEASE AND DISCLAIMER

By participating in the Great Minds in STEM Research Posters Competition, I grant permission to Great Minds in STEM to publish and release, in whole or in part, information about the research concept presented in the abstract and/or poster, my photograph, contact information, institutional and/or employer affiliation; and other such information for audio, video, social media and print promotional materials, and to share with sponsors and stakeholders.

*I affirm that I am the primary author and will be the primary presenter. I affirm that the research presented in the poster, at the GMiS Conference, is **not classified**. I have obtained all requisite permissions from my project/research advisor(s) to publicly share and release the information presented in the research poster. I affirm that this poster is my original work.*

Great Minds in STEM
2023 Research Posters Competition Guidelines

**UNDERGRADUATE AND GRADUATE STUDENTS
RESEARCH POSTER - JUDGE'S SCORE CARD***

**Subject to change*

Presenter's Name: _____
Judge's Initials: _____ **OVERALL SCORE** _____

ABSTRACT

60 Possible Points	Points Possible	Points Earned
The extent, which the abstract conforms to the required formatting: Typed, single-spaced, 1-inch margins, Times New Roman, 10-12 pt Font	8	
The extent, which the abstract clearly summarizes the research project	22	
The extent, which the abstract clearly demonstrates Broader Impact	15	
The extent, which the abstract clearly demonstrates Intellectual Merit	15	
TOTAL SCORE	60	

POSTER

125 Possible Points	Points Possible	Points Earned
Clear and succinct Introduction	5	
Clear and succinct Background	5	
Clear and succinct Hypothesis/Intent	5	
Clear and succinct Problem Statement	5	
Clear and succinct Materials/Methods	5	
Clear and succinct Data and Results	5	
Tables, figures, graphs, and/or charts are clear, relevant and explain the project	5	
The extent to which the poster demonstrates innovative research	5	
The extent to which the poster is presented in a professional manner	5	
The extent to which the research is laid-out in an orderly and concise manner that is readable and logical	20	
The extent to which the poster demonstrates Broader Impact – The extent to which the findings may be utilized for society	15	
The extent to which the poster demonstrates Intellectual Merit	15	
The extent to which the presenter articulates knowledge of research	20	
The extent to which the presenter acknowledges questions thoroughly	10	
TOTAL SCORE	125	

SAMPLE WINNING ABSTRACT

A Physics-Based Simulation Study of Tensegrity Damping Strategies for Controlled Hopping on Small Solar System Bodies

M. Retana¹, B. Hockman², J. Ahmar³, M. Pavone²
University of Nevada, Reno¹, Reno, NV 89557
Stanford University², Stanford, CA 94305
University of California, Berkeley³, Berkeley, 94720

Keywords: Hedgehog, Tensegrity, Microgravity, Damping Strategies, NTRT.

In the last 10 years, space agencies have developed an increasing interest in exploring asteroids and comets. These small bodies may provide clues regarding the origin of our solar system and how life originated on Earth. However, most efforts to explore these bodies have been unsuccessful. For example, ESA's Rosetta mission demonstrated the complexity of landing a rover in microgravity when its lander Philae failed to grasp onto comet 67P/Churyumov-Gerasimenko. The total cost of the mission was 1.6 billion Euro and the time from launch to attempted landing was almost 11 years. After touching the comet's surface, Philae bounced multiple times on the comet's surface to an off-nominal configuration.

The intention of the project is to investigate the feasibility via dynamic simulation of a hybrid rover. The concept combines an internally actuated rover denominated *Hedgehog* and *Tensegrity* robotic structures for exploration of asteroids and comets. The combination of Hedgehog which is a flywheel propelled cube-like robot, with Tensegrity structures provides controlled mobility in microgravity. Hedgehog uses the principle of conservation of momentum when spinning three internal flywheels and applying a brake transferring the flywheel momentum to the rover. The Tensegrity exoskeleton enhances the ability to absorb and dissipate large amounts of impact energy allowing controlled landing of the rover.

The geometry of Tensegrity structures allows for the exoskeleton of the rover to be mechanically stable as stress is applied. Impact and collisions may deform the rover, but the Tensegrity properties enable the rover to return to its original shape. We predict that combining Hedgehog with a Tensegrity structure will allow for more reliable mobility than using Hedgehog by itself. The innovative concept exploits the benefits of Tensegrity structures while transferring the mobility task to its payload—Hedgehog—and uses the Tensegrity structure as a landing exoskeleton capable of absorbing impact after landing.

To evaluate the performance of the hybrid rover in microgravity, the open-source NASA Tensegrity Robotics Toolkit (NTRT) simulation environment proved to be an effective solution. This platform is based on the Bullet physics engine and implemented in C++ allowing for modeling simulation and control of Tensegrity robots. The team, composed of two underrepresented engineering students without background in programming, built the Tensegrity Hedgehog rover in the NTRT supported by Stanford faculty. Tensegrity structures and NTRT are highly inexpensive teachable tools to bring to classrooms and broaden the participation of minority students in the field of space robotics.

Great Minds in STEM
2023 Research Posters Competition Guidelines

The testing strategy consisted of placing Hedgehog inside a basic 6-bar Tensegrity structure without active dampening at 0.0057 m/s^2 which represents Phobos' gravity. After comparing a Hedgehog Tensegrity 6-bar model against a 12-bar model, simple drop tests simulations confirmed the use of more bars enabled greater absorption of impact energy. The rover design changed to a 12-bar cube Tensegrity configuration with 24 internal cables from center of the six faces of Hedgehog. Internal cable connections allowed Hedgehog to transfer all its momentum from its chassis to the Tensegrity exoskeleton via 24 pre-tensioned cables. Later tests consisted in dropping the hybrid rover perpendicular to a flat surface at an altitude of 24 m. The rover's velocity profile changed from 0 m/s in former tests to 5 m/s with an overall mass of 10 kg.

After landing, the rover left the comet's surface at a faster rate than using Hedgehog by itself. These preliminary results simply showed the Tensegrity cannot passively provide the required dampening. Therefore, future work will include active dampening mechanisms within the Tensegrity structure to absorb the impact energy upon landing. Additionally, implementation of Tensegrity external cable controllers (actuators), flexible rigid bars, and multibody mobility in NTRT would likely enhance dampening of the hybrid rover. Finally, experimentation through a collaboration between Stanford University and NASA Johnson Space Center sharing microgravity tests beds will yield data to accurately assess the feasibility of using Tensegrity structures and Hedgehog. In conclusion, NTRT provides a realistic simulation environment for Hedgehog Tensegrity Hybrid robots. Further simulations efforts will demonstrate if the hybrid rover is an effective method for exploration of small solar system bodies.

Besides the high scientific value of exploring asteroids, the knowledge acquired from deploying autonomous robots in small bodies contributes to the development of smarter robots for Earth applications. The expertise of exploring space will help develop Earth robots capable of exploring nuclear accident sites such as Fukushima and perform specialized tasks to shut down the reactor. Additionally, these robots could be deployed in hazardous areas such as Houston after a hurricane, and Mexico after an earthquake to autonomously identify survivors.