# 10TH ANNUAL

GREAT Minds in STEM™

# RESEARCH POSTERS COMPETITION GUIDELINES

Great Minds in STEM™
2019 Research Posters Competition Guidelines

**TABLE OF CONTENTS**

Great Minds in STEM™
2019 Research Posters Competition Guidelines

## OVERVIEW

Great Minds in STEM™ announces its Tenth Annual Research Posters Competition to be held at the 2019 GMiS Conference, at Disney's Coronado Springs Resort, in Lake Buena Vista, FL, from September 25 – 28, 2019.

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 submit their senior design projects, capstone projects, thesis, dissertations, internship projects and research lab projects, regardless of the progress/stage of their research.

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 students[1]. Winning abstracts will be profiled online at www.greatmindsinstem.org

## ELIGIBILITY

| | Undergraduate Students | Graduate Students |
|---|---|---|
| Hispanic/Latino, African American, or Native American descent | 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 *Exception: Doctoral students classified as doctoral candidates, but not working full-time and making satisfactory progress toward dissertation* | 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 |
| Eligible for travel grants | X | X |
| Conference registration fee required | X | X |

## ABSTRACT DEADLINES

| | | |
|---|---|---|
| **Priority Deadline** (With Travel Grant) | **July 26, 2019 (11:59 PM EST)** | If applicants would like to be considered for a travel grant, the abstract and competition form **MUST** be received by this deadline. |

[1] *Awards are subject to change depending on funding*

| | | |
|---|---|---|
| | | If applicants **DO NOT** want to be considered for a travel grant, the abstract and competition form **MUST** be received by this deadline. |
| **Regular Deadline** (Without a Travel Grant) | **August 20, 2019 (11:59 PM EST)** | NOTE: Registration w/hotel closes on August 23. Therefore, it is ***strongly*** advised that applicants submit their abstract well in advance of this deadline to allow ample time for committee review of the abstract and notification of acceptance/decline. |
| **Final Deadline** (Without Hotel or Travel Grant) | **September 13, 2019 (11:59 PM EST)** | Registration with hotel closes on August 23. Applicants, who have not registered prior to August 23, will not have access to hotel rooms at the conference site. However, their abstracts will still be considered for presentation. |

Abstracts must be submitted as .doc or docx only. No Portable Document Format (PDF) will be accepted. Abstracts received in any format other than Microsoft Word will not be considered. **Late submissions will not be accepted and automatically disqualified.** (Documents are requested in Word to allow GMiS to compile abstracts into a Research Posters Competition Proceedings).

## ABSTRACT SUBMISSION PORTAL

http://www.greatmindsinstem.org/conference/RPC

## REGISTRATION

Participants need to pay their own conference registration fee, which includes hotel and most meals. Please refer to the conference website on current registration fees.

Participants, who are selected to present a research poster, will be provided a discount code to register for the following options:

WEDNESDAY ARRIVAL – QUAD HOUSING (2 beds/4 students)
THURSDAY ARRIVAL – QUAD HOUSING (2 beds/4 students)

No discounts will be provided for any other rooming options.

## TRAVEL

Travel grants, for airfare, are available on a highly competitive basis for finalists to and from the conference, based on a 21-day reservation. Finalists, who choose to travel by personal vehicle, may be reimbursed mileage to and from the conference. No other travel grant types are available. Further details will be provided to awardees.

**Finalists, whose travel has been arranged, in whole or in part by GMiS, and fail to present will be billed the costs of any associated travel expenses. In fairness to travel grant recipients, NO EXCEPTIONS will be made to this rule.**

**The deadline to submit an abstract, to be considered for a travel grant is July 26, 2019.**

## AWARDS

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 follows[2]:

| 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

The length of the **extended abstract** must be between 750 – 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.

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 heading format of the abstract must adhere to the following:

**Title of Project (Bold, Centered, Times New Roman, 14 pt)**
Author(s) (Centered, Times New Roman, 12 pt)
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)

**NOTE: The project/research advisor should be included**

Keywords: List five (5) keywords for indexing

The content of the abstract should include:

- Introduction
- Hypothesis or Intent
- Materials and Methods
- Predicted or Actual Results
    - If research results are not available at the time of the submission, authors are encouraged to submit predicted results. Students are encouraged to discuss differences between their

[2] *Awards are subject to change depending on funding*

hypothesized results and their actual results when presenting their research at the conference.

- Summary/Conclusion

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.

## POSTER FORMAT AND RESOURCES

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 must adhere to **APA 6th 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
- Introduction
- Background
- Problem Statement
- Hypothesis
- Proposed or Actual Testing (Procedure)
- Results
- Conclusion
- 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.

There is a myriad of resources regarding designing a good research poster. Here is just one resource - *How to Distinguish a Good Poster Design From a Bad One* - www.nuigalway.ie/remedi/poster/media/Posters_Good_and_bad.pdf

## 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., Sept. 26<br>3:00 PM | Fri., Sept. 27<br>7:00 AM – 8:00 AM |

| | | |
|---|---|---|
| Location | Disney's Coronado Springs Resort<br>Convention Center | |
| Judging *(Times subject to change)* | Thurs., Sept. 26<br>5:00 PM – 7:30 PM | Fri., Sept. 27<br>10:30 AM – 12:30 PM |
| | Each poster presentation will be evaluated by two (2) STEM professionals from academia, industry, or federal government. Once a poster has been evaluated twice, presenters may leave the session. However, posters must remain displayed until 3:00 PM on Saturday, Sept. 28. | |

## JUDGING

Each abstract and poster will be reviewed by a minimum of two STEM professionals based on the two principles outlined by the National Science Foundation. Abstracts and posters will be evaluated on the overall writing, content and presentation as it relates to the baseline principles of Intellectual Merit and Broader Impact. According to the National Science Foundation (*NSF Strategic Plan for FY 2006-2011: Investing in America's Future (NSF 06-48),* successful projects can demonstrate Intellectual Merit and Broader Impact if the following questions are succinctly addressed:

Intellectual Merit

- How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields?
- How well qualified is the proposer to conduct the project?
- To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts?
- How well conceived and organized is the proposed activity? Is there sufficient access to resources?

Broader Impact

- How well does the activity advance discovery and understanding while promoting teaching, training and learning?
- How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
- To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks and partnerships?
- Will the results be disseminated broadly to enhance scientific and technological understanding?
- What may be the benefits of the proposed activity to society?

## IMPORTANT DATES AND DEADLINES

**Friday, July 26, 2019 (11:59 PM EST)** — **Priority Deadline** for consideration of a travel grant to attend GMiS Conference

**Friday, August 2, 2019 (11:59 PM EST)** — **Registration Cancellation Deadline for a Partial Refund.** (Minus a 10% administrative fee) Must be requested online through the registration system by 11:59 PM EST

**Tuesday, August 20, 2019** — **Regular Deadline** for applicants who **DO NOT** want to be considered for a travel grant. Note, it is advised not to wait

| | |
|---|---|
| | until August 20 to submit the abstract, given the short notification period to confirm registration, which closes on August 23. |
| **Friday, August 23, 2019** | Last Day to Register for GMiS Conference with Hotel option |
| **Friday, September 13, 2019** | **Final Submission Deadline** – At this point, there are no hotel and travel grants available. |
| **Friday, September 20, 2019** | Last Day to Confirm Participation in the Research Posters Competition. No Confirmation = No Participation. |
| **Thursday, October 26, 2019** | Graduate Students: Poster set-up beginning at 3PM<br>Graduate Students: Presentations 5:00 PM – 7:30 PM |
| **Friday, October 27, 2019** | Undergraduate Students: Poster set-up from 7AM – 8AM.<br>Undergraduate Students: Presentations 10:30 AM – 12:30 PM<br><br>Awards Presented at Student Leadership Show Awards |
| **Saturday, September 28, 2019** | Posters only showcased at career fair. Posters may be removed after 3 PM. |

## CONTACT INFORMATION

Please direct all communication regarding the competition to **posters@greatmindsinstem.org.**

## INFORMATION RELEASE AND DISCLAIMER

Research posters presented at the GMiS Conference must not be classified. It is the author's responsibility to obtain all requisite permissions to release the information presented in the research poster. By participating in the Great Minds in STEM Research Posters Competition, at the GMiS Conference, in Disney's Coronado Springs Resort, from September 25 – 28, 2019, the author grants 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, participant photographs, contact information, and institutional and/or employer affiliation, and other such information for audio, video and print media, including social media. Posters must be original in content. Posters must have all proper citations and permissions.

**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. Retana[1], B. Hockman[2], J. Ahmar[3], M. Pavone[2]
University of Nevada, Reno[1], Reno, NV 89557
Stanford University[2], Stanford, CA 94305
University of California, Berkeley[3], 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 Rosseta 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.

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.

## RESEARCH POSTERS COMPETITION FORM

***Incomplete entry forms will not be accepted. Please write N/A if not applicable.***

| | |
|---|---|
| First Name _____ Last Name _____ | |
| Mailing Address/City/State/Zip | |
| Email Address _____ Phone Number | |
| Classification | ☐ HS Junior ☐ HS Senior<br>☐ Freshman ☐ Sophomore ☐ Junior ☐ Senior<br>☐ Masters ☐ Doctoral ☐ Doct. Candidate ☐ MD/DVM Student |
| Poster Category: Based on context of research project, not your major field of study (Please select **ONLY ONE**) | ☐ Computer Engineering/Computer Science<br>☐ Engineering and/or Technology<br>☐ Math and/or Science<br>☐ Health/Medicine |
| Gender: | ☐ Male ☐ Female |
| Race/Ethnicity | ☐ American Indian or Alaska Native ☐ Asian/Pacific Islander<br>☐ Black/African American ☐ Hispanic or Latino(a)<br>☐ Native American ☐ White ☐ Multiracial/Ethnic<br>☐ Other |

| | | |
|---|---|---|
| College Students | College/University | |
| | Major | |
| | Have you been a College Captain? ☐ Yes ☐ No<br>If Yes, which year(s)? | |
| | Have you previously attended the HENAAC Conference? ☐ Yes ☐ No<br>If Yes, which year(s)? | |
| | Have you previously participated in the Research Posters Competition?<br>☐ Yes ☐ No If Yes, which year(s)? | |
| | Have you previously been awarded a HENAAC Scholarship?<br>☐ Yes ☐ No If Yes, which year(s)? | |
| | Are you a CAHSI student? ☐ Yes ☐ No | |
| Abstract Title | | |
| Primary Presenter | | |
| Primary Author | | |

| | |
|---|---|
| Co-Authors | |
| | |
| **Contact Information for Project/Research Advisor:** | |
| Name | |
| Title/Position | |
| Department | |
| Institution | |
| Email | |

*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.*

*By providing my PRINTED NAME, below as an electronic signature, I agree to the above statements.*

PRINTED NAME: _____

DATE: _____

Please submit this complete form along with your abstract to posters@greatmindsinstem.org by the appropriate deadline.