

**DRAPER  
TECHNICAL CHALLENGE COMPETITION**

for

**NSBE STUDENTS**  
in conjunction with the

**2022 NSBE Region 1 Regional Conference**

**D R A P E R**

**The Charles Stark Draper Laboratory, Inc.  
555 Technology Square Cambridge,  
MA 02139**

## **BACKGROUND**

Draper is a not-for-profit, engineering organization dedicated to applied research, development, and technology transfer of advanced solutions to our nation's most challenging problems in security, space, healthcare, and energy.

Located in Cambridge, Massachusetts, Draper traces its roots to MIT. When it became independent in 1973, it retained a strong educational mission manifested in the robust education programs offered to graduate and undergraduate students. Some 50-60 masters and PhD students participate in the Draper Scholar Program, an opportunity to work on solutions to real-world problems as the basis of their thesis research. Undergraduate programs include internships and co-op programs.

As part of our educational outreach and in support of NSBE students in Region 1, Draper is sponsoring a Technical Challenge Competition to showcase NSBE student members' ability to cultivate innovative ideas, solve technical problems, and present their ideas and solutions with technical writing and presentation skills. The goal of the competition is for students to develop an innovative solution to one of the technical problems listed below. The competition starts in October 2022 and will culminate at the Region 1 Fall Regional Conference in November 2022.

## **COMPETITION OVERVIEW**

Draper staff will administer the competition, judging the students' ability to solve a technical problem, and selecting the winning team through a review committee comprised of Draper staff. Each team must develop an innovative technical solution to a problem of their choosing from the Technical Challenge prompts provided and if selected as a Finalist present their approach to Draper staff.

Competitors will submit (a "Competitor") an abstract via email (an "Entry"), the details of which are outlined below and the review committee will evaluate the Entry, if received by the competition deadline, to identify the Finalists prior to the conference.

Selected Finalists will be tasked with presenting their ideas and solutions at the NSBE Region 1 conference in the form of a PowerPoint presentation, with one winning team chosen following the presentations for the scholarship award.

### **Process**

Each team will propose a technical approach to a problem area of the Competitor(s)' choosing based on the Technical Challenge prompts provided for the 2022 competition.

The first phase of the competition requires Competitor(s) to submit an abstract of no more than 300 words, briefly summarizing the problem statement, their approach, and how it relates to work conducted at Draper. The second phase, for Competitor(s)' whose

abstracts were selected (a “Finalist”), consists of a technical presentation to a panel of judges, showcasing the team’s proposed solution to the problem in greater detail. The presentation will aim to persuade that the student’s approach is (i) technically feasible and (ii) thorough with respect to solving their chosen problem. The proposal may include experimental procedures and intended analysis, preliminary design and testing, or a systems level design that solves the problem.

## **Technical Challenge Prompts**

### **Big Data Background:**

During COVID, cell phone manufacturers developed a technique for contract tracing using anonymized cell phone data to determine when people were in proximity. With the advent of the internet of things and ubiquitous cell phones, the work is awash in sensors.

Challenge:

If you could access sensors on many phones and internet of things, what could you do with it for the public good? What challenges would you foresee: technically and ethically? What are the technologies and steps you would need to execute this project?

### **Chemistry Background:**

Recently the field of chemistry and polymer science has generated efficient means for cross-coupling in the form of click chemistry, as well as efficient motifs for synthesizing well controlled macromolecular architectures (LRP, ROMP, ADMET, etc.) However, both developments exploit functional groups which are not readily compatible.

Challenge:

Considering these limitations, what is an effective means to incorporate click functional monomers, that would enable post polymerization side chain click coupling, into a polymer with controlled molecular weight and low polydispersity.

### **Manufacturing Background:**

If humans ever have long-term habitation on the moon or mars, it will be important to be able to build things in place. New advances in 3-D printing make this somewhat more accessible than in the past but resources would be a challenge.

Challenge:

How could extraterrestrial compounds (differing impurities, isotope percentages, or e.g. really high-Z materials that are not stable on earth) impact processing/properties or offer novel capabilities that do not exist on earth? OR what if we brought stuff back to earth; what could we do with it?

### **Crypto technology Background**

Cloud storage allows people and data to connect from anywhere and at any time. The data is entrusted with a third party, who offers adequate security measures like encryption

and MFA. However, concerns over the security and privacy still remains. The data in cloud computing is mutable in that the stored data can be changed or tampered with. A new technology using Blockchain offers a more secure and flexible alternative to data storage. It is an encrypted system that uses different methodologies to encrypt and store data. It also distributes the data across different node which forms a consensus on the exact location of the data. This is different from cloud storage where the data remains in one location and accessible by a user. Blockchain prevents modification or deleting of existing data that helps prevents data tampering. Unlike cloud storage which can be public or private, Blockchain is always public. Every transaction is accounted for and cannot be hidden from the user. The distributed nature of the data, transparency of the transaction and the immutability of the transacted data make it a reasonable candidate for creating a Voting Block chaining System which provides anonymity using crypto algorithms. A vote on the Blockchain can be traced real-time and cannot be altered.

Challenge:

What protocols should be implemented to handle data sharing over multiple nodes?

Device multiple methods to prevent duplicating of Blockchains?

There are different approaches to implementing Blockchains, which can make the solution either bloated and cost prohibitive on the one hand or potentially weaken the security on the other. What policies and tradeoff should one consider factoring in robustness, security, and redundancy of a Voting Blockchain System?

### **Human centric Design Background:**

As we become more aware of the devastating long-term effects of head injuries, there's is a consistent push for innovative ways to detect and diagnosis head trauma particularly concerning sports and the military.

Challenge:

Students describe your approach to designing novel embedded systems to track head impacts/decelerations in real time?

### **Eligibility and Criteria:**

- Competitors must be a member of NSBE.
- Employees of Draper (and their immediate family members and/or those living in the same household, whether or not related) are not eligible to win.
- Must be a Graduate or Undergraduate student enrolled in a degree program for the 2022-2023 academic calendar year.
- Teams must consist of 1-4 members
- All majors welcome
- Competitors must register their information, along with the title and abstract submitted via email, listing names, addresses, phone numbers, e-mail address, NSBE Membership Number, college attending, major and degrees received or expected (B.S., M.S., etc.).

- Student-competitors under the age of 18 are required to provide the contact information, name, email, and phone number, of a parent, guardian or university advisor, to [nsbe@draper.com](mailto:nsbe@draper.com), in order to participate and receive the scholarship award.

#### **Paper Submission and Presentation:**

- All abstracts submitted must be no more than 300 words, excluding the title, single spaced, and should follow a standard style for technical papers per standard preparation guidelines. The abstract must be typed and in English. Any elements appearing in an Entry must be the Competitor's own original work, created solely by the Competitor. Use of anything that is not the Competitor's own original work, may result in disqualification. Draper reserves the right to reject any Entry that it deems, in its sole discretion, to violate any of these content related requirements.

**DEADLINE: All abstracts must be submitted in pdf format to [nsbe@draper.com](mailto:nsbe@draper.com) no later than November 1st, 2022 at 11:59PM.**

- In the final round at the conference, each finalist will be assigned a 10-minute time for their presentation (7 minutes for content and 3 minutes for questions) to a panel of at least three judges.
- The presentation material should be in format of Microsoft PowerPoint slides and must be emailed to [nsbe@draper.com](mailto:nsbe@draper.com), no later than 9 AM on the day of the competition.

#### **Judging Criteria**

The following criteria will be used to evaluate the written abstract and for problem solution and the technical presentation:

##### **Abstract:**

- Clear Identification of Problem Statement (45%)
- Novel Technical Approach (45%)
- Why is Draper uniquely suited to help solve this technical problem (10%)

##### **Technical Presentation:**

- Innovation and Creativity (20%)
- Technical Depth of Solution (20%)
- Alignment with Draper Capabilities (10%)
- Depth of Research into Prior Art (15%)
- Feasibility of solution (15%)
- Broader Impact, Potential Benefit to Society (10%)

- Presentation skills (10%)

In the event of a tie, the judges (at their sole discretion) will determine the winner based on a team's ability to convey the problem challenges, risks, feasibility, and overall creativity/originality of the tied entries. Judges' decisions are final, binding, and conclusive on all matters related to the competition.

### **Awards**

All Finalists participating in the final round of the challenge competition at the Fall Regional Conference will be recognized by Draper. The winning team will be chosen by the judges based on the competition guidelines.

First Place Scholarship Award: \$3,500

The winning team will be selected and notified at the conference. However, any team that is unable to present their presentation at the conference will be disqualified.

\*\*\*Note: Participants should also review our opportunities for summer 2023 internship postings: <https://www.draper.com/careers/studentopportunities>. (Priority review will be granted to Competitors).\*\*\*

### **Terms of Participation/Registration (the "Rules")**

Submitting an Entry constitutes agreeing to the terms of these Rules and all decisions of Draper, which are final and binding in all respects.

By submitting an Entry (or accepting any award), each Competitor understands and agrees that their Entry and name may be posted online without further compensation or review. The Competitor(s) gives Draper the right to post the presentation and/or Competitor(s)'s photograph in connection with the competition further agrees to release Draper from all claims that any such use by Draper, including any commercial advertising, web content, or any other public materials subsequently produced, presented and/or prepared by and for Draper.

Competitors further release Draper from all past, present, or future claims that Draper's use of the Competitor's Entry or Likeness infringes on the competitor's rights with regard to any elements, characters or ideas contained therein. By submitting an Entry, the Competitor(s) acknowledge and agree that the personal information they provide may be maintained in accordance with Draper's policies.

By submitting an Entry and/or accepting an award, each Competitor acknowledges and agrees that Draper shall retain for itself an irrevocable, non-exclusive, royalty free license to copy, adapt, distribute, or display their presentation, and to make, use, or distribute,

any and all intellectual property rights in connection with the Entry inclusive of the related presentation without any requirement for further compensation.

Each Competitor acknowledges and agrees that (a) Draper and other participants have access to and/or may create or have created media or other materials, ideas and concepts which may be similar or identical to the Competitor's entry in theme, idea, format, technical solution, and/or other respects; (b) the Competitor shall not be entitled to any compensation or other consideration because of the use by Draper or any other participant of any such similar or identical material, ideas and/or concepts; and (c) Draper or another participant's use of material containing elements similar to or identical with those contained in the Competitor's entry shall not obligate Draper to negotiate with nor entitle the Competitor to any compensation or other equitable remedy claims for such use.

By acceptance of the award, the Finalist agrees on behalf of him/herself, his/her heirs, executors, representatives, assigns, administrators and next of kin to indemnify, hold harmless and release Draper and its officers, directors, employees, and any other person or entity associated with this competition from any and all liability claims or actions of any kind with respect to or in any way arising from or in connection to this competition, participation in any competition-related activity; and/or delivery/mis delivery, acceptance, possession, use, or misuse of an award, including, but not limited to, liability for personal injury, bodily injury (including wrongful death or disability), damage to property, and damage or loss of any other kind.

In all events, the sole maximum liability of Draper and its affiliates shall be limited to the value of the award(s) set forth herein. IN NO EVENT WILL DRAPER OR ITS DIRECTORS, OFFICERS, EMPLOYEES, AND REPRESENTATIVES, BE RESPONSIBLE OR LIABLE FOR ANY DAMAGES OR LOSSES OF ANY KIND, INCLUDING DIRECT, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES ARISING OUT OF COMPETITOR'S PARTICIPATION IN THE COMPETITION OR ACCESS TO AND USE OF THE INTERNET SITE [www.drapr.com](http://www.drapr.com) or [www.drapr.com/nsbe](http://www.drapr.com/nsbe).

Draper is not liable or responsible for (i) any costs associated with accepting or otherwise using the award; (ii) incorrect, inaccurate or incomplete entry of information by Competitor(s); (iii) entries which are garbled, damaged, incompletely received, otherwise defective or lost due to any reason; (iv) any required documents that are not fully executed and received by Draper at the designated address by the due date specified herein; (v) a Finalist being unable to present its papers at the conference as set forth herein; (vi) an Entry being deemed ineligible or otherwise non-compliant with any aspect of these Rules; (vii) any incorrect or inaccurate information, however caused, associated with or used in the competition or by any technical or human error; (viii) any problems or technical malfunction of any telephone network or lines; computer online systems, servers, or providers; computer equipment; software; or failure of email or Entry on account of technical problems or traffic congestion on the Internet or at any website or combination thereof, including injury or damage to participant's or to any person's computer related to

or resulting from participating in this competition, downloading materials from Draper's website or emailing entries; (ix) cheating or fraud by any Competitor; or (x) any typographical or other error in the printing of these Rules or any materials associated with the administration of the competition or the announcement of the awards.

**\*\*\*Draper reserves the right to cancel the competition at any time. \*\*\***

By submitting an Entry, all Competitor's permit and authorize Draper, and its employees, agents and representatives who are acting on behalf of Draper, to use their likeness and/or name in any photograph, image, video, motion picture, performance, or sound recording (collectively, "Likeness") for any commercial or noncommercial purpose, and to use and license others to use it for such purposes. Competitors understand and agree that these Likeness materials will become Draper's property and will not be returned.

Competitors authorize Draper to edit, alter, copy, exhibit, publish, or broadcast Competitors' Likeness at any time by means of any media, including print, video presentations, television, radio and satellite transmissions or rebroadcasts, news bulletins, mailers, billboards or signs, brochures, website placements, podcasts or other digital delivery or publications. Competitor waives any right of privacy associated with the Likeness and any right to inspect or approve the finished product, including written or electronic copy, wherein the Likeness appears.

Except where prohibited by law, all issues and questions concerning the constitution, validity, interpretation and enforceability of these Rules, or the rights and obligations of the participant and Draper in connection with this competition, shall be governed by, and construed in accordance with, the laws of the Commonwealth of Massachusetts, without giving effect to any choice of law or conflict of law rules.

Winner(s) are responsible for the reporting and payment of all federal, state and local taxes incurred by the acceptance of the award. Awards cannot be assigned, transferred, exchanged, or otherwise redeemed. Draper will use its reasonable efforts to provide winners with the relevant form for submission for payment of the scholarships. If the winning team consists of more than one person, such team agrees to share the scholarship funds on a pro-rata basis and it shall notify Draper of the appropriate allocations to effect payment of such scholarship funds.

**ANY VIOLATION OF THESE RULES BY ANY COMPETITOR (AT DRAPER'S SOLE DISCRETION) MAY RESULT IN SUCH INDIVIDUAL'S DISQUALIFICATION AS A WINNER AND ALL PRIVILEGES DUE SUCH INDIVIDUAL MAY BE IMMEDIATELY TERMINATED WITH AN ALTERNATE AWARD WINNER WILL BE SELECTED.**



# **APPENDIX**

## **PRESENTATION ORGANIZATION**

The technical presentation must include, but is not limited to the following sections:

- Pitch Title
- Problem
- Prior Approach/State of the Art
- Solution and how is your solution different?
- Outcomes and Deliverables
- Conclusion
- References

### **References**

References cited in the text should be listed on a separate and last page. The formatted references cited in the text should be based on IEEE standards. For additional information, you can visit the following website:

<http://www.ieee.org/documents/ieeecitationref.pdf>

