



Connect Tri-Cities  
STEM Challenge  
October 2019  
Mission Support Alliance, LLC

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## Section 1 – Guidelines and Background

The objective of the competition is to stimulate interest in Science, Technology, Engineering, and Math (more commonly referred to as “STEM”). The competition will allow teams to demonstrate essential problem solving skills.

The competition is among student teams, each representing a high school, to develop new concepts for solving a problem or addressing a basic need of general interest to society or of particular relevance to their state or region. Each team will be comprised of five students and a faculty coach, all selected by the participating high school. All teams will work on the same STEM problem as described in Section 2.

The competition’s prizes and awards are as follows:

- a. 1<sup>st</sup> place – \$2,000 scholarship for each student team member and \$1,000 for the faculty coach
- b. 2<sup>nd</sup> place – \$1,000 scholarship for each student team member and \$1,000 for the faculty coach
- c. 3<sup>rd</sup> place – \$500 scholarship for each student team member and \$500 for the faculty coach

Each team will receive \$100 for material expenses necessary to complete the challenge.

This year the field of contenders will compete in a preliminary competition at the HAMMER training facility in Richland on October 15 or 16, 2019, schedule to be determined. The top five teams emerging from this preliminary competition will go on to compete as part of the finals at the Connect Tri-Cities event that will be held at the Three Rivers Convention Center in Kennewick, WA on October 21, 2019.

Each team shall submit a written project summary, which will be provided to the competition’s judges in advance of both the preliminary competition and the Connect Tri-Cities final event. Requirements associated with the project summary are provided in Section 3.

At both the preliminary competition and Connect Tri-Cities event, each team will be scheduled to make a presentation of their work to the judges, including a demonstration of the Challenge Outcomes presented in Section 2. The rules and competition schedule are provided in Section 4.

Additional Challenge Outcomes will be identified to the winners of the preliminary competition. Performance of the new challenge outcomes will be in addition to those identified in Section 2 and will be a required element that will assist in identifying the winner of the finals competition.

Using the written project summary and results of the presentation, the judges will evaluate each team’s effort according to the criteria presented in Section 5.

Section 6 includes answers to some common questions regarding this competition.

## Section 2 – Problem Statement

### Non-Violent Uses of a Medieval Device

You have been invited to participate in a reality television show that has been created to show how people lived during medieval times. It's a peaceful village and the residents have been given the challenge of how to use previously used medieval armaments for non-violent purposes.

A small trebuchet has been found in a barn and the elder of the village has inquired as to how this device could be used in the farming of fruits and vegetables that are being grown in the area. He also asks how it could be used for other beneficial uses such as the creation of electricity.

#### Challenge Outcomes:

1. Build a trebuchet that will fit within a maximum volume of 3 ft (high) x 2 ft (wide) x 3 ft (high) that has the following capabilities:
  - a. Launching a spherical (or near-spherical) perishable object with a mass that ranges between 1/8 oz (3 g) and 7 oz (197 g) a distance that may range between 10 ft. and 20 ft. into a target that may look like a hoop (or similar) with a minimum 12 inch diameter.
    - *Each team will draw cards to determine (a) the object being launched and (b) the target distance.*
    - *The Connect Tri-Cities organizers will provide the objects being launched and the "target."*
  - b. Protecting the object from damage due to the launch and landing.
  - c. Generating sufficient electricity to light an LED light with lumens equivalent to a 60W incandescent bulb for 2 seconds.

#### Limitations and Restrictions:

- Trebuchets shall be created and constructed by the team – no pre-made or commercially available kits permitted.
  - No pre-charged batteries or other electrical storage devices are allowed.
2. Answer these questions following the guidelines in Section 3:
    - a. What assumptions did you need to make to solve the problem?
    - b. What hazards would the residents of the village face using the trebuchet?
    - c. How did you address those hazards? Use the following hierarchy of hazard controls to describe your response:
      - i. Elimination – Physically removing the hazard (e.g., removing the blade from the cutter to ensure that it cannot be used to cut)
      - ii. Substitution – Replace the hazard (e.g., replace a lead-based paint with a non-lead based paint)

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- iii. Engineering Controls – Adding physical barrier to prevent contact with the hazard (e.g., putting a guard over the cutting blade to prevent human contact)
- iv. Administrative Controls – Change the rules for the way people work (e.g., procedures, training, signs and postings)
- v. Personal Protective Equipment – Protect the worker with personal protective equipment (e.g., hard hat, safety glasses, steel-toe boots)
- d. Assuming that the objects being launched are fruits and vegetables, how would you protect the objects being launched?
- e. How did the application of Science, Technology, Engineering, and Math help you solve this problem?
- f. What additional information would you have liked to have in solving this problem?
- g. What are two other creative ideas your team had with respect to the peaceful use of the trebuchet?

## Section 3 – Requirements for Written Project Summary

The written project summary should conform to the following format and content requirements.

### Format specifics:

1. Software – Microsoft Office Word
2. Page size – Letter ( 8.5” x 11”)
3. Margins – 1” top and bottom, 1.25” left and right
4. Text Alignment – Left justified
5. Font and Size – Times New Roman, 12 point
6. Line Spacing – Single
7. Document Length – 10 pages maximum, including tables, figures, and illustrations, but not including cover page

### Content specifics:

<b>Project Summary Outline</b>	
<b>1. Cover Page</b>	The project summary cover page should list the project title, team members, faculty coach, and school.
<b>2. Abstract</b>	Provide a brief summary of the background, objective, and the desired outcome of the challenge.
<b>3. Technical Details</b>	This section should answer the questions posed in the problem and provide the information requested in the problem (Section 2). Describe the solution that your team developed to utilize medieval armaments for non-violent purposes.
<b>4. Team</b>	Identify members of the team and delineate their contributions to the project. Explain how the team members worked together in terms of communication, scheduling, assignments, conflict resolution, etc.
<b>5. Expense Report</b>	Provide an itemized list of any materials that were purchased to support this project. Remember that the total value of procured items cannot exceed \$100.
<b>6. References</b>	List all sources of information (websites, books, journals, community resources, subject matter experts, etc.) that were consulted to complete the project. References shall be documented in accordance with the American Psychological Association (APA) citation and format ( <a href="https://owl.english.purdue.edu/owl/section/2/10/">https://owl.english.purdue.edu/owl/section/2/10/</a> ).

Additional considerations:

1. The written project summary should be structured for readability by the judges. Each judge will have multiple documents to review so please try to use graphics as well as text to communicate your important messages. A well-illustrated short document is more likely to be understood than 10 pages of dense text.
2. Pay attention to syntax as well as spelling and punctuation. Minimize the passive voice and maximize the active.
3. The written project summary and team presentation should be consistent and reinforce each other. Although the written project summary will be given to the judges in advance, a team should not assume that every judge will be intimately familiar with its content during the presentation. Points considered important by the team should be emphasized during the presentation.
4. Each team's written project summary is due by 12 a.m. (midnight) on:
  - Monday, October 7, 2019 for the preliminary competition and
  - Thursday, October 17, 2019 for the finals competition.

Each entry shall be transmitted electronically to [Tracy\\_Desmond@rl.gov](mailto:Tracy_Desmond@rl.gov). All summaries should be transmitted as a single file.

## Section 4 – Rules and Competition Schedule for Team Presentations

### Preliminary Competition:

When: Tuesday or Wednesday, October 15 or 16, 2019

Where: HAMMER Training Center, 2890 Horn Rapids Rd, Richland, WA 99354. Administrative Building 6091, Room 10.

### Finals Competition:

When: Monday, October 21, 2019

Where: Three Rivers Convention Center, 7016 W. Grandridge Blvd., Kennewick, WA 99336.

### Rules and Schedule:

- a. Each team will bring their presentation on a marked USB thumb drive. Teams will not be allowed to use their own laptops or other audio/visual equipment. The following equipment/software will be available in the presentation room:
  - Microsoft Windows-based computing resource (laptop or desktop)
  - Standard Microsoft Office programs (e.g., PowerPoint, MediaPlayer, etc.)
  - Adobe Acrobat/Reader
  - Projector and screen
  - Pointing device (e.g., laser pointer)
- b. Teams that plan to use video or animation in their presentation should ensure that their USB thumb drive contains the necessary software application(s).
- c. Each team will have 5 minutes to set-up their trebuchet, 15 minutes for their presentation to accomplish the Challenge Outcomes, and 5 minutes for questions from the judges.
- d. The faculty coach is expected to introduce themselves and their team members at the start of the presentation. Presentations will be made by student members of the team only.
- e. Only one team is permitted in the presentation room. Teams will not be allowed to listen or observe other team's presentations. No member of a team, school representative, friend, or affiliate is allowed to hear or observe a competing team's presentation.
- f. The presentation schedule will be communicated via email to each coach.

## Section 5 – Judging Criteria

The judges will evaluate each team's efforts against the following criteria:

1. Written Project Summary (20 points total):
  - a. Format follows requirements in Section 3 (5 points)
  - b. Clarity/use of visual aids such as charts, graphs, pictures, etc. (5 points)
  - c. Demonstration of critical thinking/problem solving skills (10 points)
2. Oral Presentation (30 points total):
  - a. Organization and presentation of content (5 points)
  - b. Clarity/use of visual aids (5 points)
  - c. Staying within allotted time (5 points)
  - d. Quality of responses to questions (15 points)
3. Meeting the overall intent of the competition (50 points total)
  - a. Understanding of STEM subjects (10 points)
  - b. Innovation and creativity in addressing the competition problem (10 points)
  - c. Quality and functionality of the prototype (20 points)
  - d. Quality and persuasiveness in both the written project summary and oral presentation (10 points)

A total of 100 points is the highest possible score .

## Section 6 – Common Questions

1. What are the team requirements?
  - a. The only requirements is that each team has five student members and a faculty coach from the sponsoring high school. The members can be from any grade level. The competition encourages creativity and “out of the box” thinking as well as some proficiency in STEM-related subjects. These qualities will be assessed at the team level, not at the individual level.
2. Can team membership change during the competition?
  - a. Once a team is formed, membership changes should be discouraged except in unavoidable circumstances. Each such request will be considered by the sponsoring school on a case-by-case basis.
3. Can teams use “outside” help?
  - a. Teams are encouraged to seek outside help for technical information and education, especially in the early stages of their activities, but are strongly discouraged from using such assistance to accomplish resolution of the problem. Teams shall not solicit or accept expense assistance beyond the funds provided, regardless of the form, such assistance might take. Teams are on the honor system to comply with the spirit and intent of the competition, which is to encourage creative, independent thinking with a sound basis in STEM-related subjects on a level playing field.
4. Can teams ask for more information or clarification on the details of the challenge?
  - a. No. Teams should carefully consider the details of the challenge and when necessary, make assumptions to move forward. Any assumptions that the team considers important to addressing the Challenge Outcomes should be identified in the written paper and oral presentation.