

Centurion Competition - 2022

(Three Categories: Grades 6-8, Grades 9-12, OR College, Military, Corporate, and Organization)

Rules & Overview

Objective of the Centurion Competition

- To inspire and invigorate the true nature of the Engineering Spirit!
- To challenge a team of two or more individuals to design and build a trebuchet within design specifications (See p.4)

Goal

To build a trebuchet to safely and accurately launch a standard lacrosse ball¹ to accurately hit one or more targets set between 50-200 feet away².

Team Registration Rules

1. The Centurion Division is open to all 6-12 schools, Colleges, Military Branches, Corporations, or Organizations
2. All middle and high school teams must have at least one adult sponsor who remains with the students during the entire competition.
3. Only one team per school, military service branch, corporation or organization can register.
4. To register, submit the following to Jennifer Albert at jalbert@citadel.edu or (fax) 843-953-7258 by January 14, 2022:
 - a. Group Registration Form (completed by teacher/adult mentor on behalf of team)
 - b. Group Registration Packet (including signed Release and Hold Harmless Agreement and Media Release Form) for each competitor and teacher/adult mentor
 - c. Pre-survey form completed by each competitor
5. Space is limited to 24 teams per division: middle school (24 teams), high school (24 teams), and adult (made up of college, military, corporations – 24 teams), totaling 72 teams at maximum capacity.
 - South Carolina Lowcountry Tri-County Schools (Berkeley, Charleston, & Dorchester) will be given priority.
 - Non-Tri County Schools will be added to a waitlist and will be notified by January 14, 2022 of eligibility.
6. No registration fee is required.

Funding

If funding is available, Lowcountry K-12 schools that require funding to support the construction of a team trebuchet and participation in this event will complete a *Memorandum of Understanding (MOU)*.

The **MOU** requires each school to:

1. Lead a team of two or more students in the development of a trebuchet in order to compete in the Storm The Citadel 2022 Trebuchet Contest on February 12, 2022.
2. Attend, along with their team of students, and compete in the “Storm The Citadel” 2022 Trebuchet Contest on February 12, 2022.
3. Return registration, release forms and pre-surveys on time (by January 14, 2022).
4. Maintain timely communications via email and phone with STEM Center staff.
5. Utilize funds only for trebuchet materials, transportation to and from the event, and other items in to support the team’s participation in the trebuchet competition.
- 6. ORIGINAL RECEIPTS ARE REQUIRED!**

Contact Jennifer Albert for more information via email: jalbert@citadel.edu or phone: 843-953-7121

Please read carefully the Safety and Design specifications when designing and constructing your trebuchet. The regulations are there for your benefit. If you arrive at competition with a trebuchet that does not meet specifications, you will be disqualified from competition (and we want everyone to be able to compete!). Every trebuchet will be inspected prior to competition.

Competition Schedule

Date of Competition is set for **Saturday, February 12, 2022** at The Citadel on Summerall Field (main outdoor area within The Citadel campus). A map will be sent to all registered teams.

All schools will be notified immediately in case of any changes.

1. Sign-in for the competition begins at **7:00am at the Registration Table** in McAllister Field House.
2. Registration consists of a formal sign-in of all team members with inspection/qualification following shortly thereafter.
3. The inspection/qualification process will consist of:
 - a. A basic construction inspection ensuring that the trebuchet is safe to operate and meets trebuchet guidelines (see below).
 - b. Submittal of your optional Trebuchet Design Report for Best Design Award.
 - c. An operational test demonstrating that the trebuchet can launch a lacrosse ball at least 50 feet.
4. Qualification Process
 - a. Safety and design inspections will be performed and verified by a designated judge.
 - b. An operational demonstration that the trebuchet can launch a lacrosse ball a distance 50 feet or more.
 - c. Practice time: not to exceed 5 shots or 10 minutes.
5. Awards ceremony will be held on Summerall Field after competition and judging and is currently scheduled for approximately **2:00pm** (after Barbarian Division Competition).
6. Competition Schedule is attached.

Trebuchet Design and Construction Rules

1. **Materials:** The primary structural components must be wood (this includes laminated wood, and composite wood). With that said, please feel free to use other additional materials in your design. No Plastic Structural Components Allowed (meaning that plastic can be used- but cannot be used as a load bearing material- this includes 'plastic wood'). Metal can be used-such as hinges, fasteners, and axles. However, no welding or brazing is allowed for any structural components.
2. **Size and Weight:** When designing your trebuchet- keep in mind that your trebuchet is to be designed for **accuracy**, not distance. Maximum limitations and guidelines can be seen below. Your trebuchet can be smaller than these maximum restrictions.
3. **Physical Integrity:** All components must be securely affixed to the trebuchet during the competition; the sling, the release mechanism, the counterweight, and all other trebuchet parts must stay securely attached to the trebuchet during the competition (especially during launch!).

Other aspects of integrity include (see diagram on p. 3):

- **Main Throwing Arm Max: 60 inches Long;**
- **Must have 2 locking mechanisms: one for triggering and one for safety**
- **Counterweight Detachable For Inspection**
- **Maximum Counter Weight: 50 lbs**
- **Height from Base to Main Axle Max: 70 inches**
- **Base must be sturdy with no excessive wobble**
- **The base must not have excessive wobble during launch.**
- **Wheels are OK on the base as long as they are securely attached and do not pose any obvious safety concern**
- **Extra weight is allowed to be placed on the base to increase stability (such as sandbags).**
- **Significant cracks, loose parts, obvious deformations, and any other observed problems with trebuchet must be corrected prior to competition or run the risk of disqualification.**



4. **Safety/Conformance:**

- All aspects of the safety regulations will be strictly enforced:
- All trebuchets must be able to be remotely triggered by a distance of at least 5 feet (a rope attached to a trigger pin is an example of an acceptable remote trigger).
- No catapults or catapult/hybrids are allowed.
- No energy other than the gravitational potential energy of the counterweight can be used to power the trebuchet. No springs, explosives, electrical devices, elastic material, flexible arms, or deformed components that store energy can be used.
- Two arm locking mechanisms are required, one for triggering and one for locking the arm in place when reloading to prevent misfire as well as locking the arm during transport.
- No other ballistics other than those supplied by The Citadel may be used during qualification, practice, and competition.
- The Trebuchet Qualification Checklist (see below) must be completed prior to registration.

*** Safety goggles will be provided for team members within the designated trebuchet launch area.**

Awards

Three categories of prizes will be awarded to the top three teams from each competing division:

1. **Most Accurate**: These trophies will be issued to the teams that have the highest combined score based on their proximity to the targets. Each team is allowed four launches during the formal competition stage and the sum of the scores of the four launches will be their final score. Please see competition rules for more information.

Submit a design report by February 4, 2022 to gain extra points!!

*****Wildcard Teams from each division will be selected by the judges to enter the final heat in for Most Accurate*****

2. **Farthest Distance** (optional): The competition will be divided by divisions. The winner of each division will compete in an overall distance competition. These trophies will be issued to the teams that have the highest score based on the maximum distance that their trebuchet launches the projectile. Teams will be given two launches and the better of the two will be used as the distance score. Trebuchets competing for this award can use no more than 50 lbs. of counterweight. **The distance shots are limited to 500 feet or less.**
3. **Best Design** (optional): These trophies will be issued to the teams that have displayed excellence in the documenting the design process in a written report. See below for design report criteria. ***Teams that submit design reports will be entered into the Best Design contest and will receive 1pt toward the most accurate competition.***

The Design Report must be submitted by

5:00pm on February 4, 2022 to be eligible for the Best Design

Award Please submit all design reports to:

Jennifer Albert at jalbert@citadel.edu or via mail at: STEM Center of Excellence,
171 Moultrie Street, Bond Hall Room 340,
Charleston, SC 29409

A design report is not required for the other Award Categories

4. **Spirit Award**: These trophies will be issued to the teams that show excellence in any combination of the following criteria: Trebuchet décor, costumes/apparel, historical detail, cheers, and overall “Team Spirit” (*please be respectful and mindful of other teams and to the spirit of the competition*)³.
5. **Video Award**: Tell us your story! Create a 1-2 minute video documenting the story behind building and testing your trebuchet. See pg. 13 for criteria and rubric.

Trebuchet must pass safety and operational inspections to be eligible for the Spirit Award.

*****All prizes and trophies will be appropriately awarded to the team as a whole, not the individuals of a team.*****

1. Qualification

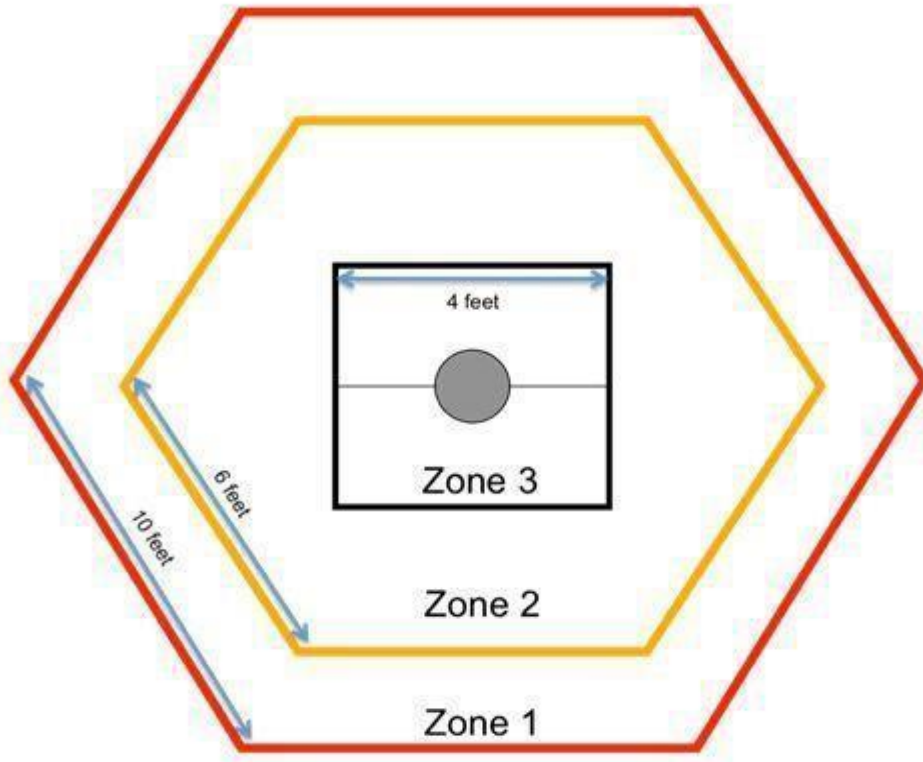
After registration, each team is required to qualify for the competition. Steps for qualification include:

- a. **Submittal of prequalification checklist (see below).**
- b. Safety and Compliance Inspection by judges.
- c. Qualification Testing: Each team must demonstrate that their trebuchet can safely launch a lacrosse ball at least 50 feet safely.
- d. A team that does not pass the safety/compliance inspections or does not pass the qualification test will be given a sufficient amount of time to make required repairs and modifications. If they fail any qualification or inspection a second time, they will not be allowed to compete. It is highly recommended that each team allow enough time prior to the competition date to ensure that their trebuchet operates safely and consistently.

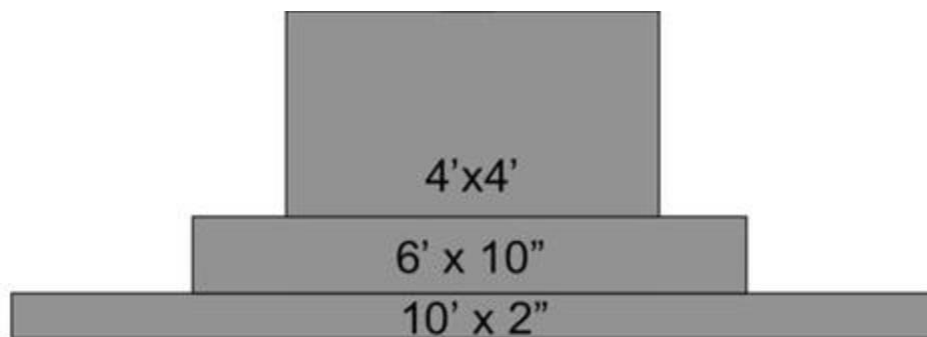
2. Accuracy Competition

- Each team will be given a maximum of 10 minutes and 5 practice shots to test the operability of their trebuchet within the qualification area. Markers will be designated within the qualification area for the minimum distance (50 feet) as well as the target distance.
- Designated launch areas will be set up for each launch site. When teams are called to the launch area, they must transport their trebuchet with both safety latches engaged and the counterweight basket empty.
- Teams will be designated to a launch area based on a random drawing. No launch area will have any advantage over another. A period of approximately 10 minutes will be given to each team to set up their trebuchet.
- Each team will be given four projectiles for the official competition.
- After each team is ready, a judge will issue the order to begin launching. Each team in succession will launch one projectile after they are given a signal.
- After each team had a chance to fire a projectile, that team will have at a maximum of 2 minutes to launch their next projectile.
- If a team is not ready to launch after within their 2-minute timeline, they will be disqualified from competition. Exception: Each team will have the ability to use a "time-out". This time out can only be used once. Competition for other teams will continue during this time-out period, and no projectiles may be fired from the team that is using their time out. If all teams have fired all four of their projectiles during this time out period- and the time-out team is still not ready, they will be disqualified after 5 minutes.
- Points will be given for proximity to the center of the target; a closer proximity yields a higher score. Care will be taken by our judges to ensure that the score is based on where the projectile hit first- not to where it eventually rolled. The sum total of the score will be their total accuracy score. All decisions of the judges are final. The target is designed and constructed such that it will be relatively easy to determine accuracy. Please note that the target zones are spread out in relative areas- and that even a few inches can make a world of difference! Please note the diagrams of the target and competition area.
- **STC 2022 will have ONE firing line for the Accuracy competition.** Teams will be informed of the distance from the target of the firing line at the competition when they register.

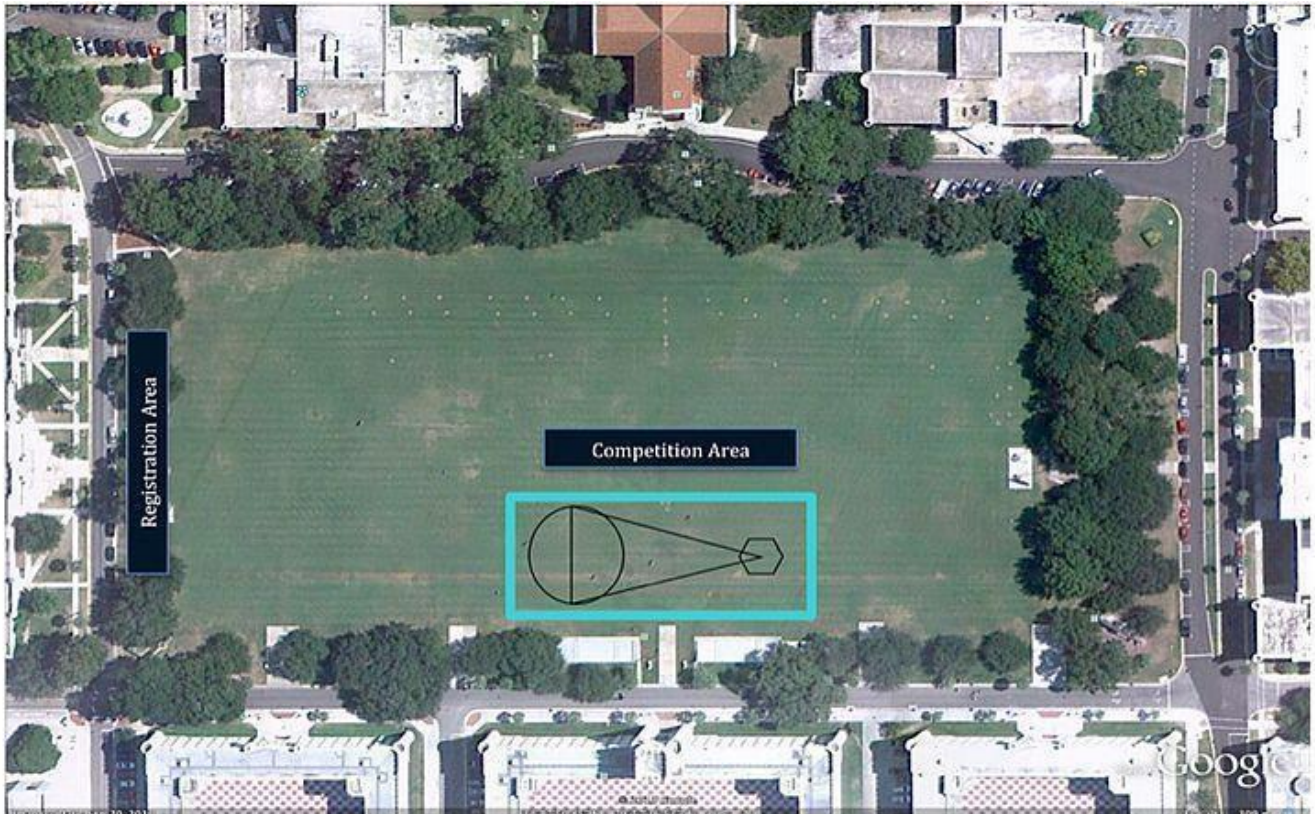
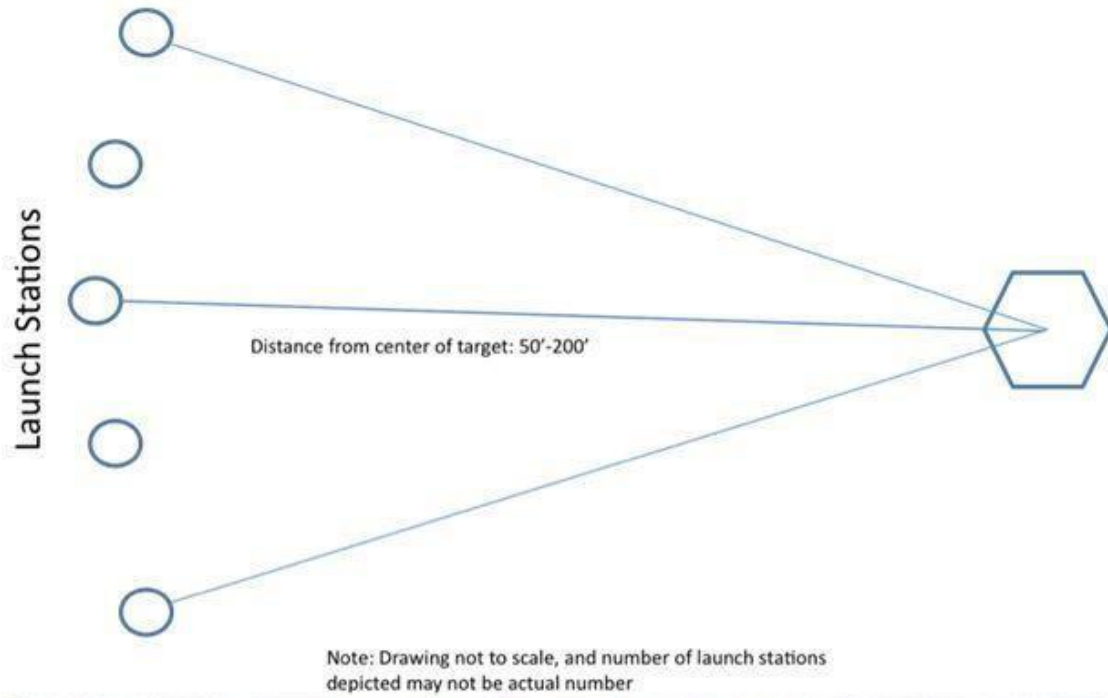
Competition Target: Top View



Competition Target: Side View



Field Layout (Basic)



Scoring

- Any ball that lands outside of the target area will be issued 0 points
- Zone 1 (inside the first area) yields 1 point
- Zone 2 (inside the second area) yields 2 points
- Zone 3 (inside the center area) yields 3 points
- ***Ball in a Bucket yields 1 extra point each***

Grouping Bonus:

Any team that lands a ball in the same zone close to their previous ball (no more than 5 feet apart) will be awarded additional points.

1 additional point will be awarded for the first ball that lands close to the previous ball

2 additional points will be awarded to the second ball that lands close to the previous ball

3 additional points will be awarded to the third ball that lands close to the previous.

If a ball lands in a different zone, no grouping bonus is awarded even if the ball is close to the original ball; grouping bonuses are only awarded for balls that are in the same zone.

For example: > 1st shot in zone 1 yields 1 point > 2nd shot in zone 1 (within 5 feet of the first shot) yields 1 point + 1 grouping bonus point > 3rd shot in zone 2 yields 2 points (no bonus) > 4th shot in zone 1 (within 5 feet of the first two shots) yields 1 point + 2 bonus points

¹ All rubber balls will be supplied by The Citadel, and will be similar in size and weight, with no team having an advantage over another.

¹ Teams will not know the exact distance from which the trebuchets will be launched before the date of the competition. That would ruin the fun and the fundamental aspect of the competition; which is to be able to know how much counterweight is required to propel a rubber ball a certain distance. Testing the trebuchet before the competition is very important.

³ It is important to have fun during this competition, and we want all teams to enjoy their time during the event. It is also important to have a positive team spirit; although you are competing against others you should remember good sportsmanship. Any unsportsmanlike conduct or other negative behavior may be cause for disqualification. Remember, this is also a learning event, and one of the best ways to learn is to observe how others completed their project.

STC Design Report Rubric

Team Name: _____

School/Organization Name: _____

Criteria	Description	Points Available
Names	Team Name & Members Present	1
Design	Trebuchet Design (Visuals of construction, list of materials used)	2
Budget	Spreadsheet of budget	1
Experiment	Experimental Design <i>How does the mass of the counterweight effect distance?</i>	2
Graphs/Data	Graph of Test Trial Results	2
Summary	Summary of Lessons Learned <ul style="list-style-type: none"> • Summary explanations of choices and decisions made in the design of the trebuchet • Discussion of Obstacles/Problems and solutions • Discussion of modifications/changes 	2
X-tra	Extra Credit: Video submissions are encouraged to supplement any pictures included in the written report.	1
Total	10 + 1	

Comments

Trebuchet Competition Schedule

(subject to change)

Time	Event
7:00	<ul style="list-style-type: none"> • Barbarian Division Registration and Drop-Off Period Starts
8:00	<ul style="list-style-type: none"> • Hoplite Division Registration Begins • Centurion Middle School Division Registration and Drop-Off Period Starts
8:30	<ul style="list-style-type: none"> • Centurion High School Division Registration and Drop-Off Period Starts • Centurion Qualifications Begin
9:00	<ul style="list-style-type: none"> • Centurion College, Military, and Corporate Division Registration and Drop-Off Period Begins
9:15	<ul style="list-style-type: none"> • Hoplite Competition Begins • Centurion Middle School Division Registration Ends
9:30	<ul style="list-style-type: none"> • Centurion Middle School Division Competition Begins
10:00	<ul style="list-style-type: none"> • Centurion High School Division Registration Ends
10:30	<ul style="list-style-type: none"> • Centurion College, Military and Corporate Registration Ends
11:00	<ul style="list-style-type: none"> • Hoplite Division Awards Announcement and Presentation
11:00	<ul style="list-style-type: none"> • Centurion High School Division Competition Begins
12:00	<ul style="list-style-type: none"> • Lunch available
12:15	<ul style="list-style-type: none"> • Centurion College, Military and Corporate Division Competition Begins
1:30	<ul style="list-style-type: none"> • Barbarian Division Competition Begins
2:45	<ul style="list-style-type: none"> • Awards Ceremony For Centurion and Barbarian Division

Prequalification Checklist – Centurion Division

Team Name: _____

School/Organization Name: _____

(Must be completed by team captain and must be supplied upon registration)

	Team Check	Judge Check (At
Safety and Physical Integrity		
Main Throwing Arm Max: 60 inches Long		
Height from Base to Main Axle Max: 70 inches		
Two separate arm locking mechanisms installed		
The Trebuchet is only powered by the gravitational potential energy of the counterweight		
The base is solid and does not have excessive wobble during launch (Wheels are OK on the base as long as they are securely attached and do not pose any obvious safety concern)		
There are no significant cracks, loose parts, or obvious deformations		
The main counterweight is detachable for inspection, and the total counter weight does not exceed 50 lbs		
Materials		
The <i>primary</i> structural components are wood and/or metal		
There are no plastic load-bearing components in the structure		
Competition Readiness		
The trebuchet is fully built and tested; the team is knowledgeable of proper set-up and operation		
The team has tested the trebuchet and it has the ability to hurl a projectile at least 50 feet		
Our team has reviewed all rules for competition		
Our team is ready to compete!		

STC22 Centurion Video Award

Criteria:

- Team name, Team mentor and Team members
- Construction timeline
- Video of the construction and testing of the trebuchet.
- Problems
 - Did you have any problems building your trebuchet? Why?
 - How did you fix it?
- Solutions & Conclusions
 - All changes and modifications you made to the trebuchet and the reasons why; this includes any decorations!
 - What did you learn?

Rubric:

	4	3	2	1	Total
Purpose and Content	Clearly relates to the learning objective or illustrates the team's trebuchet journey.	Relates to the learning objective or illustrates the team's trebuchet journey.	Some relation to the learning objective or story.	Does not relate to the learning objective or does not illustrate the team's trebuchet journey.	
Titles, Transitions, and Effects	Titles and/or transitions enhance the video.	Titles and/or transitions do not detract from the video.	Attempts to use titles and/or transitions, but they detract from the video.	No titles or transitions exist.	
Video / Photos	Video and Photos relate to the subject.	Videos and photos mostly relate to the subject	Videos and photos are few and some are off topic.	No videos or photos relate to the subject.	
Audio	Movie includes voice and music. Audio levels are just right.	Movie includes voice and music. Audio levels are too low or too loud.	Movie has only music. Audio levels are too low or too loud.	Movie has no sound.	