

The Aggie Crane Challenge

2012 TAME State Math and Science Competition - College Station, TX

Supply list:

3 small boxes	tape
3 paper cups	2 marbles
4 large paper clips	2 rubber bands
4 toothpicks	1 clothespin
1 pair of scissors	4 large hex nuts
8 feet of string	3 sharpened pencils
1 gallon zip bag	2 pipe cleaners



Objective:

Design and build a crane to deliver marbles to the top of the very tall Aggie stadium, Kyle Field. The objective is for your team to design a versatile crane that scores the most points based on several criteria: the height that the crane can lift a load, the ability of the crane to pivot on the vertical axis, and the maximum load it can lift. The team with the highest total number of points wins. Awards will also be given to teams that design the most innovative working models.

Instructions: READ INSTRUCTIONS AND RULES THOROUGHLY.

- You have 45 minutes to assign team roles, design, build and test your crane.
- Discuss and assign member roles – each team member must participate and each role must be assigned. If your team has less than five members, some of the members will serve in more than one role. The roles are:
 - PROJECT MANAGER** will serve as the team leader. He/she is responsible for verifying that all documentation is complete, all requirements are met, and that the project is completed on time.
 - LEAD DESIGN ENGINEER** will lead the design phase for your team. He/she will lead the team in determining what approach they will take to earn points. He/she must complete item one and Design Drawing/Plans on the Team Information and Documentation Form.
 - LEAD MATERIALS ENGINEER** will ensure only materials provided are used in the project and see that materials are not lost or misplaced during the building phase. He/she is responsible for checking that the team receives all materials listed and that they meet specifications.
 - LEAD CIVIL ENGINEER** will lead the construction phase. He/she makes sure that the crane is stable and that it can properly lift a load of marbles. He/she should check that the design is properly documented for scoring.
 - LEAD TEST ENGINEER** will lead the testing phase for your team. He/she will act as the team's representative during judging. He/she must complete items two through four on the Team Information and Documentation Form.
- Fill out the Team Information and Documentation Form completely for your crane in the space provided.



Rules:

- Work with your assigned team. No one other than your team members can participate in planning and building your crane.
- Each member must have an assigned role and all roles must be assigned.
- You may only use the supplies given to your team for your project. You may manipulate the provided materials in any way that is safe.
- Once time has been called, you may not touch your crane until testing begins. Any team that violates this rule will be disqualified.
- Cranes must be left intact until all judging is complete and all scores have been tabulated. You may not take your crane with you.
- The crane's base must cover the area indicated on your table.
- Your crane must include a take-up reel or similar mechanism to lift the load.
- You may only touch the take-up reel and pivot control of the crane in order to demonstrate its movement capabilities during pivot and maximum height testing.
- You may not touch the crane in any way during the maximum load testing. You should account for this by creating a way to lock the take-up reel during this portion of testing.
- When you are done, give your Team Information and Documentation Form to your judge.
- In the event of a tie, the quality and completeness of your team's documentation will be used to break the tie.

Suggestions:

- Spend at least 5-10 minutes planning and drawing your design before building.
- Test your crane as you build to make sure it works.
- Be creative. There are many different ways to build a winning crane, so think about different approaches you could use. Your project will be judged using the following metrics:

Metric	Point value
Crane successfully executes a 90°pivot	100 points
Height load is lifted	5 points per inch
Maximum load lifted	10 points per marble

NOTE: Testing will occur in this order: 90°pivot testing, height testing, maximum load testing. For the 90° pivot testing, the crane will be loaded with two marbles and must keep the load off of the table at all times. For the height testing, the crane will be loaded (starting on the table) with two marbles and must use a take-up reel or similar mechanism to lift the load to its maximum height. Height will be measured from the top of the table to the bottom of the crane's bucket. For the maximum load testing, the crane will be lifted to half of the maximum height and marbles will be added until the crane breaks or the load touches the table.

Consider these points in designing your crane:

- How will you keep the crane's arm from breaking off of the base as it lifts a load?
- How will you stop a heavy load from tipping the base?
- How will you wind and unwind the cable so the load can go up and down?



Team Information and Documentation Form

Team Number: _____ Crane Name: _____

Team Members:

Role	First Name	Last Name
Project Manager		
Lead Design Engineer		
Lead Materials Engineer		
Lead Civil Engineer		
Lead Test Engineer		

Design Documentation:

1. Describe your design approach – which of these was important for your crane? Tallest crane, heaviest load, smooth and sturdy pivot, etc.

2. Describe what happened when you tested your project the first time.

3. What changes did you make to address any design challenges?

4. Describe what happened when you re-tested your project.



DESIGN DRAWING/PLANS: