



2013 TAME STATE MATH AND SCIENCE COMPETITION

THE ROVER PROJECT

PROJECT DESCRIPTION

"Congratulations on being the first team of humans to reach Mars. Unfortunately, your spacecraft crashed upon impact and destroyed your Mars Rover. Your mission is to build a replacement self-propelled vehicle using debris gathered from the wreckage." Design and build a self-propelled vehicle (rover) that NASA could use to explore a remote planet, maybe Mars!

For this competition, the focus is on the distance the rover can travel. Your team will earn 5 points for each inch traveled and an additional 30 bonus points for every 6 six inches traveled.

Other recognitions: Creative use of materials, an innovative propulsion system and an interesting name for the rover will all add to your point total. The team with the most points wins!

SUPPLY LIST – CHECK IMMEDIATELY – YOU HAVE FIVE MINUTES TO REPLACE ANY MISSING ITEMS

| RAW MATERIALS, MAY BE ALTERED | | | |
|-------------------------------|----------------------|-----------------|--------------|
| 12 craft sticks | duct tape | 2 cups | clay |
| 10 rubber bands | 1 gallon zip baggie | 10 cotton balls | small baggie |
| paper clips | corrugated cardboard | 2 dowels | zip ties |
| pencil | 3 round balloons | 8 straws | sand paper |
| string | 3 long balloons | 4 skewers | |

| TEAM TOOLS , MAY NOT BE ALTERED | TOOLS AVAILABLE AT FABRICATION STATION |
|---|--|
| 1 pair of scissors | glue gun and glue sticks |
| 2 tickets to be redeemed at the Fabrication Station | needle-nose pliers/wire cutters |
| team number sticker | |

REQUIREMENTS, REGULATIONS AND CONSTRAINTS

Like all engineering projects, this one also comes with a set of design specifications and production constraints. The team and the rover must also follow all regulations and directives. Failure to do so will result in penalties or disqualification.

REQUIREMENTS:

- Each rover must have a propulsion system (something to make it move on its own), a release mechanism (some way to get the rover moving) and a chassis (vehicle body).
- The team number sticker must be visible when looking at the rover from above.
- The rover must be self-propelled and cannot be pushed forward by a team member.
- Rovers must be able to travel on the floor in the testing area. Each time the rover travels down the testing area it has completed one 'run' down the track.

MATERIALS/RESOURCE CONSTRAINTS:

- Only the materials provided (and listed in this document) may be used in building the rover.
- Only the tools and glue provided at the fabrication station can be used as supplemental materials.



TIME CONSTRAINTS:

- Teams have 60 minutes to design, build and test the rover.
- After 60 minutes, time is called and construction is halted. The rovers must be moved to the judging area at this time.
- Each rover will complete three official runs for judging with a ‘reset and repair time’ between the runs. Only the test engineer may reset the propulsion system between runs. All team members may help repair the rover if needed.

PRODUCTION CONSTRAINTS:

- Only the production engineer may visit the fabrication station. He/she must redeem a ticket to glue parts or use the tools provided at the station.
- The rover (or its parts) must be taken to the fabrication area. Tools and glue guns cannot be checked out for team use at the work table.
- Team time at the fabrication station is limited. Each team may receive up to 4 dots of glue and use the other tools available at the station for a maximum of 5 minutes. The volunteer at the fabrication station will enforce the time limit.

REGULATIONS:

- Only qualified runs will be scored at judging. To qualify the following must happen:
 - Rovers must be released from behind a clearly marked starting line in the judging area.
 - All parts of the rover must be behind this start line when the rover is released.
 - The rover must touch the ground as it moves.
 - The rover must move forward and a portion of its body must cross the start line.
- Once the rover is released it cannot be touched while in motion and until the judges score the run.
- Team members may watch the judging runs from a distance, as specified by the judges.
- If the rover rolls backward or runs into an obstacle, judges will wait until it stops and then measure the distance traveled. If the rover stops behind the start line, the distance traveled will be counted as 0.
- If necessary, teams may repair the rover during the ‘reset and repair’ time between runs. However the design may not be changed during this time. The fabrication station is closed during testing.

SCORING:

Judges will score the design, performance and creativity of the rovers as follows:

| TASK | SCORE |
|---|---------------------|
| Rover has a name | 10 |
| Rover chassis is creatively built and decorated | 10 |
| Team can explain why the rover moves (identify its propulsion system) | 10 |
| Team number sticker is visible when looking down at the rover | 10 |
| Rover completes 3 qualified runs | 10 |
| For the top 2 qualified runs, 5 points are awarded for each inch traveled by the rover. The perpendicular distance between the start line and the part of the rover closest to the start line is used to calculate score. | Distance * 5 |
| For every 6 inch segment traveled, 30 bonus points are added to the score. | Segments * 30 |
| TOTAL SCORE | Sum of above |

The longest single qualified run and completeness of documentation will be used to break any ties.

REWARDS:

The top 5 teams (by score) will be recognized at the awards ceremony. Celebrity judges will reward the most interesting and creative teams.



DESIGN BRIEF

- Introduce yourself to your team. Decide who will take on the different roles. Each team member must have an assigned role and all roles must be assigned. If your team has less than six members, some team members will serve in more than one role. (Engineering Team Members, page 4)
- Determine what materials and techniques you will use to propel your vehicle and design the structure of the vehicle. Record your design in the team documentation form. There are many different ways to propel a vehicle, so think about Newton's third law! (Design Drawing, page 5)
- Test as you build to make sure the vehicle works as planned. (use the 'Engineering Design Process') As you test, give answers to the questions provided on page 6.
- Be creative and have fun with this project!

Good luck!



PROJECT DOCUMENTATION

Team Number: _____

Rover Name: _____

ENGINEERING TEAM MEMBERS

- PROCESS ENGINEER will verify that the team-designed rover has a name, team members have specific roles, and documentation is complete. She/he will make sure the team finishes on time.
- PROPULSION ENGINEER will lead the team in designing, building and testing a propulsion method that will move the rover. Remember that the rover must be self-propelled (cannot be pushed to start).
- DESIGN ENGINEER will lead the overall design and is responsible for including the design drawing(s) in the documentation. He/she will lead the team in developing a strategy to maximize points earned.
- STRUCTURAL ENGINEER will lead the team in designing a strong vehicle that moves well. She/he will visit the fabrication station and use the tools/glue efficiently.
- PRODUCTION ENGINEER will lead the building phase of the competition. She/he will ensure that all the materials and tools provided are considered by the team when building the rover.
- TEST ENGINEER will serve as the team's representative during judging. He/she will set up the rover propulsion system during testing.

| ROLE | FIRST NAME | LAST NAME |
|---------------------|------------|-----------|
| PROCESS ENGINEER | | |
| PROPULSION ENGINEER | | |
| DESIGN ENGINEER | | |
| STRUCTURAL ENGINEER | | |
| PRODUCTION ENGINEER | | |
| TEST ENGINEER | | |



DESIGN DRAWING(S) AND NOTES



PROPULSION SYSTEM

What makes your rover move?

STRATEGY

What was your team's plan for scoring the most points? Did it work or were there any revisions?

IDEAL WORLD/REAL WORLD

What additional supplies/tools would have helped your team build a better rover? What was your most challenging task as a team?



JUDGES SCORING SHEET

Team number: _____

Rover Name: _____

SCORING METRICS

| METRIC | | COMPLETE? |
|---|-------------------|--------------------------|
| Rover has a name | | <input type="checkbox"/> |
| Rover chassis is creatively built and decorated | | <input type="checkbox"/> |
| Team can explain why the rover moves (identify its propulsion system/energy source) | | <input type="checkbox"/> |
| Team number sticker is visible when looking down at the rover | | <input type="checkbox"/> |
| RUN | DISTANCE (INCHES) | QUALIFIED RUN? |
| 1 | | <input type="checkbox"/> |
| 2 | | <input type="checkbox"/> |
| 3 | | <input type="checkbox"/> |

VERIFICATION

Judge's name – please print

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