

2018 DISTRICT SECME FESTIVAL AND OLYMPIAD COMPETITION RULES
SECME: The Gold Standard in STEM

SECME MOUSETRAP CAR CONSTRUCTION REQUIREMENTS
(MIDDLE AND HIGH)

(Any team not adhering to the construction guidelines will not be able to place)

The Mousetrap Car Engineering Design Competition **requires participation in these areas:**

1. Mousetrap Car Performance Run
2. Technical Report on Mousetrap Car
3. Design Drawing of Mousetrap Car
4. ~~Team Interview with Judges~~ (Team interviews only occur at the National SECME competition)

This is a **team competition** and should reflect the coordinated efforts of all members. **Three (3) students must be on each team.** TIP: Consider alternate students that have worked with the team throughout the process to have replacements in the event an initial team member is not available to compete at local/regional competitions and/or travel to the national competition. Also, each team member is expected to be able to serve as a spokesperson and be fully involved with all aspects of the entry.

CAR CONSTRUCTION AND DESIGN

1. A **standard mousetrap**, usually about 4.5 X 10 centimeters and weighing about 25 grams **MUST** be used to build the car.
2. The standard mousetrap **MUST** have **one single spring** (not two small springs). Standard mousetraps with more than one spring each are not allowed.
3. Components of a mousetrap are: wooden base (on which other components are mounted), spring, bail, locking lever, and bait hook (see component sketch on page 29).
4. Each mousetrap's "single" spring must be the sole source of power for the car. You may **NOT** use rubber bands, CO₂ boosters, or any other agent or element for extra power.
5. In the design and construction of the car, the original mousetrap spring and wood base **MUST** remain intact. These two components may **NOT** be cut or altered in any way— physically, chemically, or thermally. Only the locking levers and bait holders (with the staples that hold them on) may be removed from the base, if desired. The bails may be straightened from their original bent configurations but **NOT** cut (shortened), added to (lengthen), or reinforced. Bails must remain as components of the completed car.
6. The spring must be visible and/or accessible to the judges for inspection.
7. The car must have a minimum of three wheels and can be made as long or short as desired as long as requirement #5 above is met.
8. Mousetrap cars will be tested on a smooth flat surface. Distance will be measured from the front of the front wheel(s) at the starting point to the front of the front wheel(s) at the stopping point of travel, utilizing a straight line to connect the two points (**total displacement and not the path traveled**).
9. There will be two (2) runs for each car and the run with the highest performance score will be used for final scoring of the mousetrap car's performance.

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CALCULATING THE ENGINEERING DESIGN (MOUSETRAP CAR) SCORE
(MIDDLE AND HIGH SCHOOL PERFORMANCE SCORE)

Two formulas are used to calculate the Performance score for the car run:

$$P = \left(\frac{w}{W}\right) \times \left(\frac{D}{L}\right) + \left(\frac{3D}{T}\right) \qquad F = \frac{P}{P_H} \times 100$$

where

w is average weight of a standard mousetrap measured in grams (always a constant 25 g).

W is the total weight of the completed mousetrap car (measured in grams).

D is distance the mousetrap car travels (measured in centimeters).

The mousetrap car's distance will be measured from the front of the front wheel(s) at the starting point to the front of the front wheel(s) at the stopping point of travel, utilizing a straight line to connect the two points. **There are NO MINIMUM OR MAXIMUM distances.** If the mousetrap car stops due to hitting an object or wall, the distance will be measured from the starting point to the point of impact. So that all teams have the same advantages/disadvantages, **OBJECTS WILL NOT BE MOVED (chairs, cones, tables, signs, etc.)** during the competition to allow a mousetrap car to gain more distance.

L is the length of the completing mousetrap car (measured in centimeters).

The mousetrap car will be measured from the furthest point of the front of the car to the furthest point of the rear of the car while the car is at resting state and the spring unwound.

Please refer to MOUSETRAP CAR DRAWING EXAMPLE (on next page) for more information on how to measure L.

T is time measured from the time the mousetrap car is released until the car has stopped (measured in seconds).

P is the mousetrap car performance run score.

P_H is the highest performance score on the competition.

F is the final performance score.

NOTE: The final performance score will be combined with scores for the Technical Report, Design Drawing, and Team Interview.

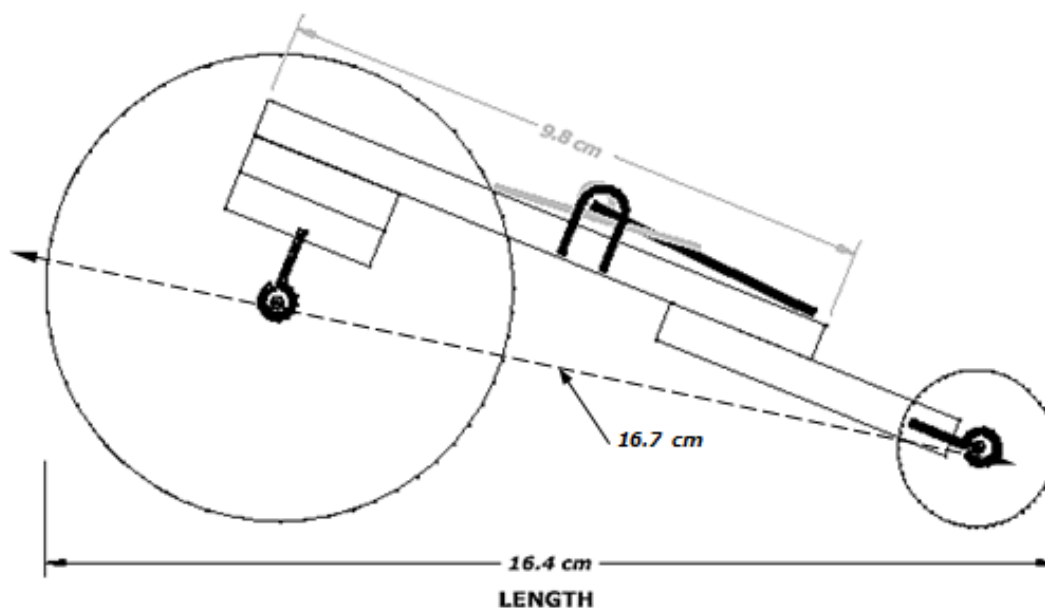
*Judges will measure "L" (see illustration on following page) and "W" prior to the mousetrap car Performance runs. These measurements, together with "D" and "T" (determined by the car's performance), are used to calculate "P" in the formula above.

Overall Team Score for the whole competition is sum of the following 4 categories (Max Total of 365 pts)

- 1) Performance Run (max 100 points)
- 2) Technical Report (max 105 points)
 - Bonus Handwritten Calculations (**max 5 points**)
 - Show hand written calculation of hypothesis of the mousetrap car performance.
- 3) Technical Drawing (max 85 points)
- 4) Team Interview (max 75 points) – Nationals Only

*See pages that follow for guidelines and evaluation sheets on each component of the Engineering Design (Mousetrap Car) Competition.

Measurement of “L,” the Mousetrap Car’s Longest Dimension
(From the farthest point at the front of the car to farthest point at the rear of the car)



“L” is the car’s length (measured in centimeters) from the farthest point at the front of the car to the farthest point at the rear of the car while the car is at a resting state and the spring unwound. If the bail has been straightened and protrudes past the front or rear of the car, the measurement will be taken from the end of the bail to the other end of the car.

L (for this example) = 16.4 cm

Technical Report:	
Design Drawing:	
Best Performance Run:	

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**SECME ENGINEERING DESIGN COMPETITION GUIDELINES:
MOUSETRAP CAR CONSTRUCTION AND OPERATION
(MIDDLE AND SENIOR EVALUATION SHEET)**

Please Check

☐ Middle School

☐ High School

Team Name			
School Name			
District		State	
Student Name #1		Grade	
Student Name #2		Grade	
Student Name #3		Grade	
Judge's Name		Date	
Distance:	First Run	Second Run	
Time:	First Run	Second Run	

Calculation Formulas

$$P = \left(\frac{w}{W}\right) \times \left(\frac{D}{L}\right) + \left(\frac{3D}{T}\right)$$

$$F = \frac{P}{P_H} \times 100$$

¹ W (g) – Weight of Standard Mousetrap	<u>25 g</u>
W (g) – Weight of Mousetrap Car	
² D ₁ (cm) – 1 st Run Distance measured	
³ L (cm) – Length of Car measured	
⁴ T ₁ (s) – 1 st Run Time measured	
P ₁ -1 st Run Performance Score	
D ₂ (cm) –2 nd Run Distance measured	
T ₂ (s) – 2 nd Run Time measured	
P ₂ - 2 nd Run Performance Score	
⁵ P _H - Highest Performance Score on Competition Day	

Technical Report (<u>max 105 pts</u>)	
Technical Drawing (<u>max 85 pts</u>)	
Interview (<u>max 75 pts</u>)	
Best Performance Run, F (<u>max 100 pts</u>)	
Overall Total (<u>max 365 pts</u>)	

(Note: F is combined with scores for Design Drawing, and Technical Report to arrive at Overall Team Score in competition.)

¹ This is the **standard weight of a mousetrap** in grams (g), which is **always 25 g**.

² This distance is measured from the **marked starting line** to the **front wheels** of the mousetrap car in centimeters (cm).

³ This is the length of the mousetrap car **measured from the front of the car to back of the car**.

⁴ This time is measured from the **time the mousetrap car is released until the vehicle stopped** in seconds (s).

⁵ This is the **highest performing mousetrap car on competition day**.

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SECME ENGINEERING DESIGN COMPETITION: MOUSETRAP CAR DRAWING
(MIDDLE AND HIGH ONLY)

As a part of the Engineering Design Competition, each team is required to prepare a scaled drawing depicting the car that they have designed and built. **The drawing evaluation, which is normally completed during the competition registration, must take place before the performance runs of the mousetrap cars begin. If the drawing is not evaluated before the performance runs begin the technical drawing points will be forfeited.**

ENGINEERING PAPER REQUIREMENTS (0-5 points):

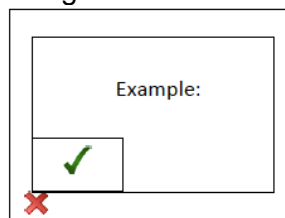
1. The engineering paper is required to be the standard ANSI C 17" X 22" paper (see pg. 86 for online paper vendor) (0-1 pt)
2. The paper must be a plain, non-grid, 16-pound vellum sheet (0-1 pt)
3. There must be a 1" border on all sides (0-1 pt)
4. A **legend** is to be drawn in the bottom left corner of the drawing inside the 1" border (0-2 pt)

REQUIREMENTS GUIDELINES:

1. NO MOUNTING OR FRAMES ALLOWED BUT DRAWING MAY BE LAMINATED FOR PROTECTION IF DESIRED.

2. Allowing for the required 1" border on all sides, the actual drawing is to cover the exposed area of 15" X 20."
3. The Mousetrap Car Drawing entry is required to illustrate the actual mousetrap car built by the team (photographs and computer generated drawings will NOT be allowed).
4. All dimensions are required to be illustrated on the drawing.
5. The scale and the units are required to be indicated on the drawing.
6. The team's Mousetrap Car Drawing is required to show front, side, and top views.
7. All parts of the car are required to be labeled.
8. Ink pens, pencils or markers may be used.
9. A **legend** is to be drawn in the bottom left corner of the drawing inside the 1" border with the following information:

- **Competition Division**
- **Team name**
- **Team Members' Names and Grade Levels**
- **School Name**
- **School District**
- **School Coordinator's Name**
- **Date of Competition**



AT ALL COMPETITIONS, THE MOUSETRAP CAR DRAWING WILL BE JUDGED ON:

- ☐ ENGINEERING PAPER REQUIREMENTS (0-5 pts)
- ☐ RESEMBLANCE (between the actual mousetrap car and the drawing) (0-25 pts)
 - Be sure to have a completed technical drawing with **all views (front, side, and top views)** of the mousetrap car illustrated. If **all views (front, side, and top views)** are not illustrated on the technical drawing the team will receive **zero points**.
- ☐ SCALE (0-15 pts)
- ☐ NAMING/LABELING (of all of the parts) (0-15 pts)
- ☐ APPEARANCE/NEATNESS (0-15 pts)

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SECME ENGINEERING DESIGN COMPETITION GUIDELINES:
MOUSETRAP CAR DRAWING

(Evaluation Sheet)

Please Check

☐ Middle School

☐ High School

Team Name			
School Name			
District		State	
Student Name #1		Grade	
Student Name #2		Grade	
Student Name #3		Grade	
Judge's Name		Date	

ENGINEERING PAPER REQUIREMENTS(0 – 5 pts):

POINTS:

- | | |
|--|---------|
| <input type="checkbox"/> ANSI C Size Engineering Paper (17" x 22") | _____/1 |
| <input type="checkbox"/> 1" Border (All Sides) | _____/1 |
| <input type="checkbox"/> 16 pound Vellum Paper | _____/1 |
| <input type="checkbox"/> Title and legend (on drawing) | _____/2 |

TOTAL ENGINEERING PAPER REQUIREMENTS (max 5 pts) /5

EVALUATION CATEGORIES(0 – 80 pts):

POINTS:

I. RESEMBLANCE: (0-25 points) _____/15

The accuracy to which the Mousetrap Car Drawing illustrates the actual Mousetrap Car designed and built by the team.

II. SCALE : (0-20 points) _____/15

The proportions in the Drawing correctly relate to and represent the team's actual Mousetrap Car.

III. NAMING/LABELING: (0-20 points) _____/15

The correctness of the names/labels of all of the parts in the Drawing of the Mousetrap Car.

IV. APPEARANCE/NEATNESS: (0-15 points) _____/15

The quality of the visual presentation of the Mousetrap Car Drawing.

EVALUATION CATEGORIES TOTAL (max 80 pts) /80

TOTAL (The highest possible score is 85) /85

Judge's Notes:

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SECME ENGINEERING DESIGN MOUSETRAP CAR
WRITTEN TECHNICAL REPORT
(MIDDLE AND HIGH SCHOOL)

The technical report is a very important part of being a professional engineer. In addition to designing and building new technologies, engineers have to be able to communicate their ideas, efforts, processes, progress, and results in a professional written format. As a part of the SECME Engineering Design-Mousetrap Car Competition and to help sharpen technical written communication skills, each team is required to write a Technical Report describing the design, construction, and operation of their Mousetrap Car.

Your technical report should be a reflection of this year's efforts by your team. Evidence of plagiarism or re-submission of previous years' reports will result in deduction of points or zero score.

STRUCTURE: (Maximum points for Structure is 25 points)

1. Cover Page: The technical report must include a cover page that is formatted as specified on the next page.
2. The technical report must be double-spaced.
3. The technical report must be on 8½" x 11" white paper with 1" margins on all sides.
4. The technical report must be typed with a 12pt standard legible text font (see acceptable fonts below).
5. The technical report must be neat with all pages numbered and in order.

ACCEPTABLE FONTS:

Arial	This is an example of 12 point Arial font
Calibri	This is an example of 12 point Calibri font
Courier New	This is an example of 12 point Courier New font
Times New Roman	This is an example of 12 point Times New Roman font

CONTENT: (Maximum points for Content is 65 points)

1. COVER PAGE (1 page)
2. TABLE OF CONTENTS (1 page)
3. ABSTRACT (½ -1 page)
4. INTRODUCTION
5. DESIGN
6. CONSTRUCTION PROCEDURE
7. OPERATION OF MOUSETRAP CAR
8. CONCLUSION/RECOMMENDATIONS (1-2 pages)
9. ACKNOWLEDGMENTS (Optional)
10. APPENDIX

Main Body: These 4 Sections
Should Be a Maximum of 7 Pages

MECHANICS: (Maximum points for Mechanics is 15 points)

1. Correct punctuation, capitalization, and spelling
2. Use of past tense and passive voice
3. Report flows logically from one idea to the next with minimal fragmentation

**AT ALL COMPETITIONS, THE MOUSETRAP CAR TECHNICAL REPORT WILL BE
JUDGED ACCORDING TO THE TECHNICAL REPORT BREAKDOWN. (See next
page for breakdown)**

2018 DISTRICT SECME FESTIVAL AND OLYMPIAD COMPETITION RULES
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MOUSETRAP CAR ENGINEERING DESIGN TECHNICAL REPORT BREAKDOWN
(MIDDLE AND HIGH SCHOOL)

Structure (0 – 15 points)

- 1) Cover Page (0–2.5 pts):
 - a) Title (SECME: Mousetrap Car Technical Report)
 - b) Name, grade, and complete home address of team members
 - c) Team's school name & address
 - d) School system/district name
 - e) School coordinator's name
 - f) Date (date of competition)
- 2) Double-Spaced (0–2.5 pts)
- 3) 8½"x11" white paper w/ 1" margins (all sides) (0–2.5 pts)
- 4) 12pt standard acceptable text font (0–2.5 pts)
- 5) Pages are numbered and in order; Report is neat (0–5 pts)

Content (0 – 70 pts + 5 bonus pts)

Table of Contents: (0–5 pts)

- a) Professionally indicates which page each parts of the report can be located
- b) Maximum one page

Abstract: (0–5 pts)

- a) Includes the essential points of the purpose, methods, scope, results, conclusions, and recommendations
- b) This is your chance to convince the readers that they should continue reading in a clear and concise way
- c) One-half to one page of technical report
- d) Should be 10% or less of the total report

Introduction: (0–5 pts)

- a) Introduce the problem to be solved, your hypothesis, and your planned methods and design process to resolve the problem while dealing with any restrictions.

Design: (0–15 pts)

- a) Discuss the thoughts, design ideas, and experimental process by which you designed your car.
- b) Reference the data tables from the appendix to defend the conclusions which cause you to change your design.

Construction Procedure: (0–25 pts)

- a) List materials and tools utilized
- b) Clearly describe the procedures taken to build your car so that someone with little knowledge of your car would be able to understand your efforts.

Operation: (0–8 pts)

- a) Explain the actions necessary to prepare the car to operate as well as what actually happens when the car is in motion. Be explicit about the steps taken.

Conclusion: (0–5 pts)

- a) Discuss the results of your final design and why it is superior to prior designs.
- b) Explain how future cars can further be improved and possibly a future hypothesis.

Acknowledgements: Optional

Appendix: (0–5 pts)

- a) **MUST** include sketches of the car (top, profile, and undercarriage views)
- b) **MUST** include all data tables and/or charts from experimentation comparing the various trials
- c) Bonus points for including handwritten calculations (5 pts).

Mechanics (0 – 15 pts)

1. Correct punctuation, capitalization, & spelling (0–5 pts)
2. Use of past tense and passive voice (0–5 pts)
3. Report flows logically from one idea to the next with minimal fragmentation (0–5 pts)

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SECME ENGINEERING DESIGN COMPETITION GUIDELINES:
MOUSETRAP CAR WRITTEN TECHNICAL REPORT
(EVALUATION SHEET)

Please Check

☐ Middle School

☐ High School

Team Name			
School Name			
District		State	
Student Name #1		Grade	
Student Name #2		Grade	
Student Name #3		Grade	
Judge's Name		Date	

STRUCTURE: (0 – 15 points)

POINTS

- | | |
|---|----------|
| <input type="checkbox"/> Cover Page (0 – 2.5 pts) | ____/2.5 |
| <input type="checkbox"/> 8 ½" x 11" white paper w/ 1" margins (0 – 2.5 pts) | ____/2.5 |
| <input type="checkbox"/> 12 pt./Standard Font/Computer Typed (0 – 2.5 pts) | ____/2.5 |
| <input type="checkbox"/> Double-spaced Text (0 – 2.5 pts) | ____/2.5 |
| <input type="checkbox"/> Report is neat and thorough; pages are numbered and in order (0 – 5 pts) | ____/5 |

STRUCTURE TOTAL

/15

CONTENT: (0 – 70 points +5 bonus points)

- | | |
|---|---------|
| <input type="checkbox"/> Table of Contents (0 – 5 pts) | ____/5 |
| <input type="checkbox"/> Abstract (0 – 5 pts) | ____/5 |
| <input type="checkbox"/> Introduction (0 – 5 pts) | ____/5 |
| <input type="checkbox"/> Design Background (0 – 15 pts) | ____/15 |
| <input type="checkbox"/> Construction Procedures (0 – 25 pts) | ____/25 |
| <input type="checkbox"/> Operation (0 – 5 pts) | ____/5 |
| <input type="checkbox"/> Conclusion (0 – 5 pts) | ____/5 |
| <input type="checkbox"/> Appendix (0 – 5 pts) | ____/5 |
| <input type="checkbox"/> Bonus Hand Written Calculations | ____/5 |

EVALUATION TOTAL

/75

MECHANICS: (0 – 15 points)

- | | |
|--|--------|
| <input type="checkbox"/> Correct punctuation, capitalization, and spelling (0 – 5 pts) | ____/5 |
| <input type="checkbox"/> Correct use of past tense and passive voice (0 – 5 pts) | ____/5 |
| <input type="checkbox"/> Report flows logically from one idea to the next with minimal fragmentation (0-5 pts) | ____/5 |

TOTAL (The highest possible score is 105)

/105

**NOTE: DECISION OF THE JUDGES IS FINAL

2018 DISTRICT SECME FESTIVAL AND OLYMPIAD COMPETITION RULES
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SECME ENGINEERING DESIGN MOUSETRAP CAR
TEAM PRESENTATION/INTERVIEW WITH JUDGES
(MIDDLE/HIGH)

All mousetrap car teams that advance to the 2017-18 SECME **National Competition** will be required to deliver a PowerPoint presentation. To foster and encourage our SECME students to practice and sharpen their interview skills, each team will be required to prepare and deliver a 5-7 minute PowerPoint presentation to the panel of interview judges. After the presentation the judges will have 2-3 minutes to ask questions.

TEAM PRESENTATION/INTERVIEW REQUIREMENTS AND GUIDELINES:

1. The presentation will be delivered as a group.
2. Each team member is expected to have a speaking part.
3. Each team member is expected to be able to serve as a spokesperson in response to the judges' questions.
4. School coordinators, chaperones, and/or parents (or any other adults) are not allowed to accompany their team during the presentation/interview. Only the 3-member student team and the judges will attend the team interview (with exception of other competition staff/facilitators, photographers, etc.)
5. The team presentation/interview will be conducted apart from and after the car's performance runs.
6. The team presentation/interview has a maximum point value of 75 points and is a single element in determining each team's overall competition score. The other 290 potential points are earned from the Technical Report, Technical Drawing, and Performance (car's best run).
7. If your team wins their Regional/District/State competition, their PowerPoint presentation is due at the SECME national office on or by May 7, 2018 (11:59pm EST). Failure to send the PowerPoint presentation on or before the due date will result in a deduction of twenty points (20 pts) from their presentation/interview score.
8. Resubmissions are not allowed. Please review, edit, correct and save the version you want to use before submitting it on or before the due date.
9. The PowerPoint presentation submitted to the SECME National office will be the one used during the interview. No updated versions.

Minimal sections to include in PowerPoint presentation: Introduction, Traditional or alternate design, materials, construction methods, operation, conclusion and recommendations.

HINT: Practice, Practice, Practice so that your presentation is 5-7 min long.

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SECME ENGINEERING DESIGN COMPETITION GUIDELINES:
MOUSETRAP CAR TEAM PRESENTATION/INTERVIEW WITH JUDGES
(Evaluation Sheet)

Please Check:

☐ Middle School

☐ High School

Team Name			
School Name			
District		State	
Student Name #1		Grade	
Student Name #2		Grade	
Student Name #3		Grade	
Judge's Name		Date	

Evaluation Categories:

POINTS

TEAMWORK (0 – 10 pts) _____/10

- Each member contributed with identifiable roles in final design and preparing their car to run in competition.

APPLICATION OF TECHNICAL PRINCIPLES (0 – 15 pts) _____/15

- Team analyzed requirements for car to perform and efficiently transfer energy from spring to propel their car

KNOWLEDGE OF DESIGN (0 – 15 pts) _____/15

- The design reflects understanding of the formula used to judge performance
- The design demonstrates systematic efforts to maximize score

ORAL COMMUNICATION SKILLS (0 – 15 pts) _____/15

- Each team member speaks clearly to the basis for their car's design and what was applied in construction and testing.

DELIVERY (0 – 5 pts.) _____/5

- Appropriate volume and rate of speech
- Speech is varied to show emphasis and interest
- Appropriate posture, eye contact, and gestures

VISUAL AIDS (0 – 15 pts.) _____/15

- Visual aids reflect thought and creativity
- Clear connection between visual aids and message
- Visual aids add value to the presentation

TOTAL SCORE: (The highest possible score is 75) _____/70

TOTAL TEAM INTERVIEW SCORE (Average of all interviewers) _____/75