# VEHICLE DESIGN

1. **DESCRIPTION:** Teams write a proposal as if they were going to create a Mousetrap or Gravity Vehicle and then answer questions from ES(s) about their proposal.

   **A TEAM OF UP TO:** 2 **APPROXIMATE TIME:** 5 minutes

2. **EVENT PARAMETERS:**
   a. Each team will write a proposal to build a Mousetrap (Div B) or Gravity (Div C) Vehicle, including the Ramp for the latter, and submit it as a single PDF file in advance of each competition. Details for how and when to submit the file must be released well ahead of each competition.
   b. The proposal may be no longer than 6 pages in Division B and 8 pages in Division C, excluding the budget section in rule 2.d.viii., which has no page limit. If the proposal, excluding the budget section, is too long, ES(s) will stop reading at the page limit.
   c. The proposal must include enough information (i.e. device dimensions) for the ES(s) to determine that the proposed device would not incur a construction violation according to the Mousetrap or Gravity Vehicle rules.
   d. The proposal will be scored on the following areas, where each area is worth the specified number of points:
      i. [1 point] Identifying information: school/team name, team number, student names, title
      ii. [10] Evaluation of the problem: scoring incentives and constraints in Mousetrap or Gravity Vehicle rules, implicit constraints (i.e. cost, build time), mathematical analysis where appropriate
      iii. [8] Background research (Div C only): explores important scientific concepts underlying a Gravity Vehicle, information supports the rest of the proposal
      iv. [20] Design specification: all information needed to build the device, description of how it is run within the competition setting, verification that all construction parameters are met
      v. [23] Design rationale: analysis that supports all significant aspects of chosen design, evaluation of trade-offs, mathematical analysis where appropriate, uses ideas presented in previous sections
      vi. [8] Plan for testing and calibration: explanation of what data/observations are needed, procedure to acquire data/observations, how data/observations will be used
      vii. [3] References (Div C only): included where appropriate, consistent style throughout document, appropriate style chosen
      viii. [8] Budget: complete itemized list of parts and materials, includes testing equipment, line items have a clear or explained purpose, reasonable estimates and precise costs used where appropriate
      ix. [5] Figures: included where appropriate, easily decipherable, properly labeled, complement the text of the proposal
      x. [5] Format: aids in understanding of content, consistent throughout document, appropriate format chosen, reasonable margin and font sizes, reasonable font choice or legible handwriting
      xi. [9] Scientific writing style (Div C only): adequate detail, succinct explanations, no unnecessary information, neutral and impersonal perspective, declarative and expository tone
   e. It is not necessary for teams to construct or test any physical prototypes. Research involving physical devices or video of physical devices will not be scored.
   f. Students may receive advice and feedback on their proposal, but all uncited words and images must be their own. Even though Division B is not scored on references, any unoriginal content must still be cited.

3. **THE COMPETITION:**
   a. ES(s) will review a team's proposal before that team's competition time. During the competition ES(s) will conduct a 5 minute Q&A with the team about their proposal over video conferencing software.
   b. The Q&A session is a chance for ES(s) to get a deeper understanding of the teams' proposal and design process, not to give feedback about the proposal. Questions may include but are not limited to:

i. If you were also to consider this factor in your analysis, how would that change your thinking?
ii. What were your goals in designing your vehicle?
iii. If the construction parameters were different in this way, how would that affect your design?
iv. How would you decide in what way to adjust your device for a particular target distance?

c. The Q&A responses will be scored on the following areas, where each area is worth the specified number of points:
i. [5 points] Ability to offer clarification on the proposal
ii. [5] Justification of answers
iii. [5] Understanding of Mousetrap or Gravity Vehicle rules
iv. [5] Understanding of design principles
v. [5] Good scientific communication (Div C only)

d. Teams must participate in a Q&A to receive a score for their proposal.

4. **SCORING:**

a. The proposal score will be scaled to be worth 75% of the overall score, and the Q&A will be scaled to be worth the remaining 25%.
b. It is encouraged for there to be at least two ESs scoring the proposals and Q&As to minimize the subjective nature of the event.
c. Proposals submitted late and/or in an improper format will have their proposal score multiplied by 0.9.
d. If the proposed device would incur a construction violation according to the Mousetrap or Gravity Vehicle rules, or the proposal excludes the information necessary to make that determination, the overall score will be multiplied by 0.7.
e. Ties will be broken using the following criteria in this order: (1) highest proposal score, (2) predetermined scoring rubric sections.
f. If ES(s) have strong cause to believe a team is in violation of rule 2.f., the team may be subject to disqualification for plagiarism.