

ASME 2012 Student Design Competition:  
***Energy Relay***

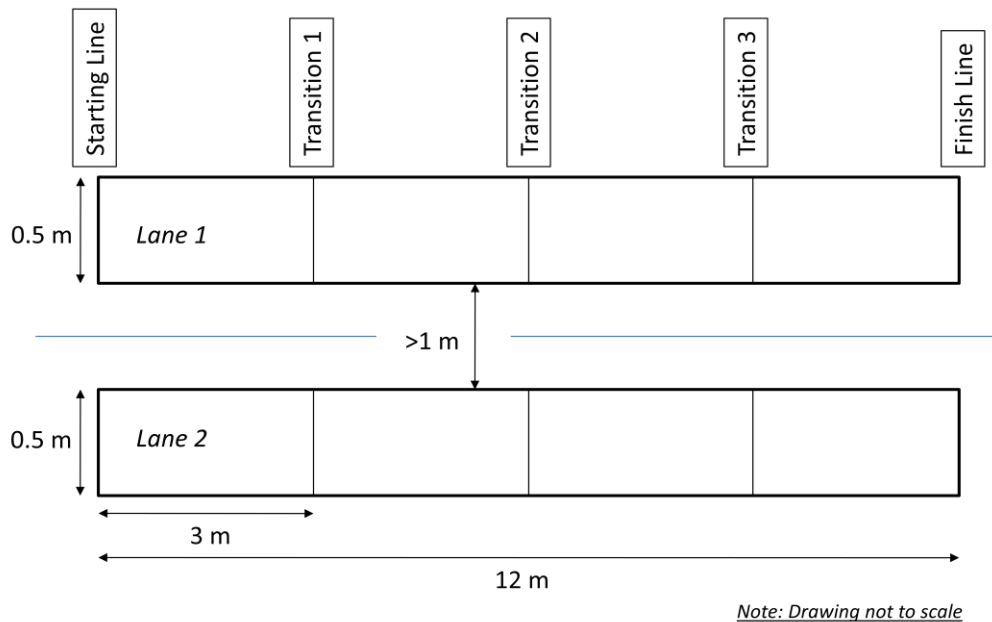
Providing energy to a world with a growing population and rising expectations is a challenge that engineers must embrace and solve. So many factors must be considered and balanced: cost, efficiency, resource availability, environmental impact, sustainability, and more. Many different potential solutions are being proposed and developed. While the winners have yet to be determined, it is safe to assume that the future will include a wide variety of solutions that together will power our planet.

Providing transportation energy is a major piece of the overall energy challenge, and is the focus of the 2012 Student Design Competition. Practicing engineers in transportation areas are developing a variety of technology options and looking to integrate these technologies. You must do the same for the competition described below.

**Project Task:** Design four self-propelled devices which can collectively complete a relay race in the shortest period of time. Each device must contain an on-board energy source and trigger the motion on the next device. The devices will compete on a course as shown below. Bonuses will be awarded for devices having different energy sources and for initiating subsequent devices.

**Project Guidelines:**

1. The track will be a straight path as shown in Figure 1. Surfaces will not be defined and may include hard floors, carpet and/or anything else that could be encountered at the venue. There are no barriers on the sides. The sides will be defined by tape.
2. Before each test run, one device will be placed with its leading edge on the starting line, with the subsequent devices located on transition lines 1-3.
3. Students will initiate the first device in the relay by toggling a clearly labeled on/off switch. Subsequent to this all devices must operate autonomously.
4. The motion of Devices 2-4 in the relay must be initiated by the prior device, after it has traversed its segment of the course.
5. Each of the four devices may be powered by a different type, or unique combination of, energy source(s). Note that devices using combustion, fossil fuels, or nuclear power sources, as well as live animals, are prohibited in this competition.
6. Each device, as it would be placed on the track, must fit in a box with internal dimensions measuring 100 mm by 100 mm by 200 mm. Each device must arrive at the contest venue in a separate box, satisfying the above dimensions, provided by the team.



***Figure 1: Track Layout.***

Scoring:

1. Teams will have a maximum of 3 minutes to position their devices on the competition surface.
2. At the end of the 3 minutes the judges will begin timing for the run whether teams are ready or not.
3. Judges will determine scoring based on vehicle positions at the end of the 120 second run time, teams must then pick up their devices.
4. Each relay team will complete two runs, one in each lane. All teams will complete their first run prior to any team completing its second run.
5. Though two teams will compete concurrently, scoring will be based solely on the provided formula for Total Score.
6. Teams must run both heats with the same four devices; teams may run the four devices in a different order for each heat.

Scoring Formula:

- $\text{Run Score} = \text{Total Number of Devices Initiated} \times 15 + \text{Max}(120 \text{ s} - \text{Trial Time}, 0) + (\text{Number of devices with different Energy Sources Initiated}) \times 50$

where Trial Time is measured in seconds and recorded as the elapsed time between switch-based device initiation and when the final device crosses the finish line. To receive a trial time of less than 120 seconds, four devices must be initiated and the fourth device must cross the finish line in less than 120 seconds.

$\text{Total Score} = \text{Sum of Two Run Scores}$

- The final device must cross the finish line within the designated lane to earn a Time Trial score less than 120 seconds.