

### **Background**

In our rapidly changing world, engineers will constantly be required to provide innovative solutions to problems and to address new requirements. Energy and transportation have provided engineers with a constant supply of challenges. It is assumed that the development of our trucking industry will enhance innovations in various fields of transportation while highlighting recent progress in renewable energies.

### **Design Task**

Your team is required to develop a new concept for an electric, solar-powered prime mover truck. As part of the project, you will also need to build a scaled prototype to demonstrate your concept. The prototype will also be used at the end of the course for a presentation to a group of investment brokers who are keen to develop the concept into a full-production version.

### **The Challenge**

The final prototype must meet the design requirements, including performance in terms of how far it can travel, while carrying given load and how fast it is. The success of your design will be evaluated in various categories.

Your team will be recognized for:

- Most innovative features
- Best construction quality
- Coolest design
- Effective project management
- Performance in Pursuit Event

**Come and join us in creating sustainable transportation solutions for the future!**

### Introduction

In our rapidly changing world engineers will constantly be required to provide innovative solutions to problems and to address new requirements. Energy and transportation have provided engineers with a constant supply of challenges. It is assumed that the development of novel solar powered trucks will enhance innovations in various fields of transportation while highlighting recent progress in renewable energies.

### Design Challenge

Your team is required to develop a new concept for an electric, solar-powered load-carrying truck. As part of the project, you will also need to build a scaled prototype to demonstrate your concept. The prototype can be assumed to be used at the end of the course for a presentation to a group of industry professionals and potential investors who are interested in developing the concept into a full-production version for sustainable transport solutions.

### Design Brief

Your client has written to you with the following request:

*We strongly believe that competition drives innovation, and we are committed to transforming the transportation sector into one powered by renewable energy.*

*We, therefore, invite YOU to take part in our design competition for the new generation of solar-powered freight-carrying trucks.*

*We are looking for an efficient design of a solar-powered truck that can carry substantial loads over long distances.*

*The design must demonstrate the potential of using renewable energy for heavy-duty transport while remaining practical and reliable.*

*Initially, we need a prototype with full specifications for all features, so we can present it to potential investors who may help bring this concept to full production.*

*UNSW is the world's leading university in the field of photovoltaic energy. We have also heard that the engineers at UNSW have great cross-discipline abilities and feel you will be best suited for this task.*

*All the best and we look forward to viewing the results at the end of the term!*

### Specifications for your prototype solar vehicle

- The prototype of the prime mover truck will need to be a **scaled** version of a road-ready truck. This means that every part of the truck must be on the same scale. For instance, make sure that the average human can fit through the doors.
- It needs to be a road vehicle with a minimum of two seats for drivers, a cabin for sleeping and a cargo hold to securely carry the load.
- It needs to be articulated and contain the prime mover and trailer.
- It needs to be powered by solar panels. You **MUST** include a capacitor in your power system.
- It needs to include at least three items that were 3D-printed or laser-scribed (or other digital fabrication methods).
- **Size & Scale:** Your prototype can be any length, height, or width, provided it is to scale and resembles a prime mover. While no maximum size is specified, it must fit and move freely on the given track without interference and without veering off the track/guide rail.
- **Design Trade-off:** Larger trucks add weight, while smaller ones reduce solar panel space. Choose the balance that best meets your design and performance requirements.
- As a prime mover, the prototype will need to carry a cargo of at least 2 kg.
- It needs to be an efficient design with minimal friction.
- The vehicle must exhibit three innovative features not yet seen in the electric vehicle industry.

### Safety

Throughout this project, safety is of paramount importance. As engineers, you will find that safety in the workplace is a number one priority. You will be required to use tools and materials and it is a **MUST** that you understand how tools are to be used correctly, and materials handled safely. This project has a mentor system and if you are unsure about any aspect, please first consult your mentor.

### Construction

You are free to construct the prototype from any materials, however, **no toxic or dangerous materials** will be allowed. Again, consult your mentor if you are unsure. You are free to utilise all resources available in makerspaces adhering to all safety and access related guidelines and with responsibility.

### Performance testing

The test track will be a pursuit-style racetrack (an oval-shaped track) as shown in Fig. 1 below, which you will have access to throughout the term to test your prototype ahead of the race day.

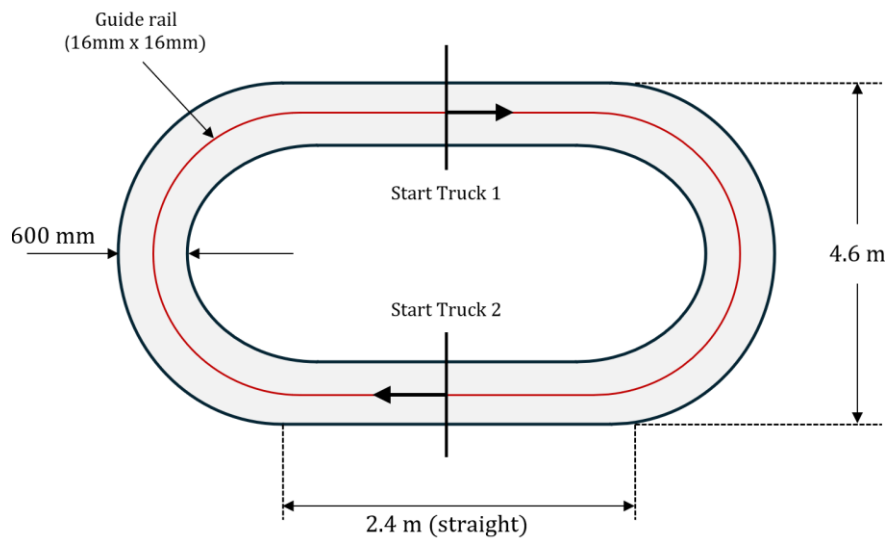


Fig. 1 Pursuit Race track layout

The oval track is made of corflute which is a smooth board. The guide is approximately 16mm wide and 16mm high. The track is made up of 6 curve sections at each end. These 6 curves make a half circle and join the straight. Refer to the picture below. The straight section on each side is 2.4m long. The total length of the track is 19.3m. We have done our best to make the joins as clean as possible however there will be some bumps and bulges. You will need to consider this and design your guides to cope with this.

### The final competition

- The racing will be a knock-out event that will provide you with the opportunity to demonstrate how amazing your vehicle is.
- Two trucks will be raced at a time. The winner will progress, while the loser will have a second chance to compete.
- The event will be held outside. Although we hope for a sunny day, the design will still be tested even under less-than-optimum conditions.

### Spirit of the project

This project is designed to be as open-ended as possible to allow innovation and learning. The mentors and the course coordinators will rein teams finding loopholes in this project, which gives an unfair advantage.

### Points to consider

Your prototype will need to be robust to stand the rigor of solar powered transport innovations and speed.

Carefully review the marking criteria and weighting.

Be careful of getting caught in the details.

Start early. There is a lot to do!

Keep testing and improving your designs as you progress.

### Course Staff (All contacts via MS TEAMS on 2025 T3 DPST1071-ENGI1371)

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