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# Purpose

The implementation of an autonomous vehicle (aka Rover) draws together almost every category within the ACES skill set: design, engineering, group cooperation, time-management and technical reporting. Add to this pursuit an element of friendly team-competition and we’ve got the making for a most memorable term. While your team is expected to perform as a single unit, you are well-positioned to pursue your own personal design and engineering preference within your group by accepting the primary responsibility for the domain.

# Project

The **ACES Rover** project involves the design and implementation of an autonomous vehicle that is required to navigate a custom obstacle course. Some may view this as a two-month hackathon. Specifications of the craft are stated at the end of this document and are subject to change.

## Supervisors

Mr. D’Arcy (PCB Design, General) : crdarcy@rsgc.on.ca

Mr. Elia (Rover Design) : paulelia2000@gmail.com

Nick Woollcombe (Course Design) : nwolloocombe@rsgc.on.ca

## Organization

The project is organized to give you the opportunity to develop your **team** skills (*leadership, communication, resilience, compromise, etc.*) as well as strengthen your own **individual** engineering skills and passions.

## Teams

Teams will consist of three members, **proposed by you** subject to specific balanced criteria. Each ACE was asked in December for a personal ranking of preference for you skill domains: design, hardware, and software. They are available for your review at the project home page,

<http://darcy.rsgc.on.ca/ACES/TEI3M/1819/Tasks.html#Rover>

Now, considering a 1st preference to be worth 3 points, a 2nd preference worth 2 points and 3rd preference worth 1 point start to assemble you ideal team Since each student brings 6 points to his team total, each team will present a total of 18 points with no less than 5 points attributable to each domain. Within each group, each student will be designated as the one of the domain representatives for the group. The design rep will meet with Mr. Elia on a regular basis.

## Coordinator

From the group of three, one member is to be elected to the role of **coordinator** and will be required to liaise with Mr. D’Arcy throughout the duration of the project.

## Development Sessions

Monday January 14 Day 4 11:30-12:50
Tuesday January 22 Day 2 9:30-10:50
Monday January 28 Day 6 1:30-2:50
Tuesday February 5 Day 4 11:30-12:50
Monday February 11 Day 8 8:15-9:30
Monday February 25 Day 8 8:15-9:30

# Skill Integration

Tri-weekly projects to this point in your ACES career have isolated on one or two concepts or components to explore their unique purpose and functionality. Our Rover project gives you the opportunity to combine the skills you have developed into a single pursuit to explore the issues and implications of having multiple concepts perform in concert.

## Design

You have been introduced to two new software packages (ViaCAD and EAGLE) that are indispensable tools in the design and electrical engineering arenas. Your Rover is expected to take advantage of this new knowledge through their incorporation into its final form and functionality.

## Hardware

Our ACES program is predominantly focused on the physical hardware aspects of analog and digital technology. The Rover will be the most complex device you have created to this point and will push you even further into the areas of sensor feedback, power management and mechanical motion.

## Software

As the Rover is expected to respond accordingly to the challenges the course presents, it is no small task to have the onboard software manage the overall performance of the vehicle. Onboard sensors have been selected to provide data that must be accessed in a timely manner and acted upon to meet the course conditions.

## Reporting

There are **two** aspects of reporting in this project. The first required the development of a 1 minute (maximum) interim video in which the concept features of your Rover are presented to the audience. Your final mark to some extent is dependent on how closely the final vehicle matches the concept.

The one category for which each student is *singularly* responsible is that creation of a comprehensive entry in their Engineering Report under the title, ACES Rover. Wise students will gather media and data **throughout the term** so their report reflects the *totality* of the development stages of the project and not simply the final days of the competition, leaving the impression that the summary is an afterthought.

## Project Management

Your team’s success will depend less on your particular technical advantage and more on your ability to meet your target deadlines. In this way, your rover will be ready for completion on the qualifying dates. A significant number of parts and services are beyond the inventory and ability of the DES to facilitate so allowing ample time to secure these assets is the real challenge that will define your achievement

To assist you with your planning an organization, the team leader will be asked to submit their Gantt chart to handin by the end of the day on the first class of each week. Mr. D’Arcy will coordinate them.

Gantt Chart[: https://www.youtube.com/watch?v=Yqdja\_r-zAE](file:///C%3A%5C%5CUsers%5C%5CChris%20Darcy%5C%5CAppData%5C%5CLocal%5C%5CTemp%5C%5C%3A%20https%3A%5C%5Cwww.youtube.com%5C%5Cwatch%3Fv%3DYqdja_r-zAE)

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# Competition

**Two days** of qualifying runs will be undertaken to determine time penalties applied to each team to the final day of Competition.

## Dates

### Concept Video

Tuesday February 5 midnight Email handin with YT link to 1 min (maximum) video.
Subject: **Concept Video**

### Qualifying

Friday March 1 Day 4 11:30-12:50
Tuesday March 5 Day 6 1:30-2:50

### Final

Thursday March 7 Day 8 8:15-9:30

# Evaluation Categories

Understandably, with an ambitious undertaking such as this one, there are many areas from which individual credit can and should be determined. Assignment of credit is on both a group and individual basis. These categories and proportional weightings are outlined below.

## Competition (Group: 40%)

Credit for the final competition phase of the project will be awarded based on the total time to complete the course less any penalties.

## Skill Domain

For each of the three domains teams will be ranked and proportional credit awarded

### Design (Group: 10%)

Subcategories may include: overall measurements, application of CAD (2D, 3D, PCB) esthetics, quality, performance, uniqueness

### Hardware (Group: 10%)

Subcategories may include: assembly, build quality, reliability robustness, power

### Software (Group: 10%)

Subcategories may include: reliability, efficiency, organization, commenting/documentation

## Reporting

### Concept Video (Group: 10%)

A discussion and graphic renderings of the planned concept of your Rover will be presented in a 1-minute YouTube video that will be made available for public viewing. This interim deadline of midnight February 5th provides groups with an incentive to get their research underway immediately, to focus their discussions and hold them to a measure of account for the final product.

### Engineering Report (Individual: 20%)

The only category of evaluation for which you are entirely responsible is your Engineering Report summary. The best submissions will document, and provide evidence of, the complete journey from the assignment of groups, through the research phases and groups sessions, through the design and engineering testing to the final qualifying and final competition rounds.

# The Rover

The maximum dimensions of the rover are limited to W×H×L = 16cm×16cm×16cm.

# The Course

The course has a start line and finish line.

The course will consist of a series of walled corridors, elevation changes, overhead transoms, and other (*secured and unsecured*) obstacles.

Walled corridors are positioned 9” apart, with obstacles guaranteeing clearance of at least 8” in all three dimensions.

# Inventory of Supplied Parts

Each team will be provided with the following, to be return at the end of the term

1 HC-SR04 Ultrasonic Motion Sensor

2 Power

# Supplemental Budget

Each team is provided with credit up to $150 for parts and services. Coordinators will keep all receipts and hand them to Mr. D’Arcy (as one) at the end of term.

# Resources (\*RSGC-Friendly)

\*2D Laser Cutting: Sawdust & Noise
<http://www.wecut4u.com/laser_cutting/laser_cutting_service.html>

\*3D Printing: Objex Unlimited <https://objexunlimited.com/about-us/>

PCB: DirtyPCBs <https://dirtypcbs.com/store/pcbs>