

WATERLOO **ENGINEERING**

Junior Team Design Competition Problem

Spring 2013
Waterloo Engineering Competition
July 5 - 6

SCHEDULE

The schedule of the Junior Team Design competition is as follows:

Friday, July 5	5:15 p.m. – 5:30 p.m.	Check-In	RCH Lobby
	5:30 p.m. – 6:00 p.m.	Welcome/Briefing	RCH 302
	6:00 p.m. – 11:15p.m.	Design/Build (including a 15 min food break)	Various Assigned Classrooms
	11:15p.m. – 11:45p.m.	Submissions/Debriefing	RCH 302
Saturday, July 6	7:30 a.m. – 8:00 a.m.	Check-In	RCH 3 rd Floor Lobby
	8:00 a.m. – 11:00 p.m.	Prototype Presentations	RCH 301/302
	11:00p.m. - 11:15p.m.	Break	
	11:15p.m. - 11:30p.m.	Finalists announced	RCH 302
	11:30p.m. - 12:30p.m.	Prototype Presentations - Finals	RCH 302
	12:15p.m. - 12:30p.m.	Break	
	12:30 p.m. – 1:00 p.m.	Prizes and Closing Ceremony	RCH 302

Pizzas will be available to teams around 9 - 9:30p.m., during the design and build stage. Please remind the competition coordinators and volunteers of your dietary restrictions and /or allergies.

GENERAL RULES

1. Competitors will be presented with a 15 minute question period following the welcome and briefing. Competitors may ask as many questions as they like during this period. However, after this, questions WILL NOT be answered.
2. The design and build stage is five (5) hours in duration.
3. All communication devices MUST be turned off throughout the duration of the competition.
4. Visitors are not allowed during the design and build stage. Violation of this rule will result in immediate disqualification.
5. All submitted materials must be labelled according to the following guidelines:
 - a. Prototypes must have the team number clearly labelled.
 - b. The team number and names of all team members must be written on the back of the poster.

All deliverables must be submitted to the submission desk prior to the end of the design and build stage. It is the team's responsibility to bring its deliverables from the design area to the submission desk. Teams will receive a penalty for late submissions. If a team is three (3) or more minutes late, the team will be disqualified.

Competitors MAY NOT use the blackboard when delivering presentations.

If teams are unsure about rules or require further clarification, please ask one of the organisers. Volunteers may be able to assist, but in the event of discrepancies between volunteers and organisers, the organisers' opinion will be followed.

Time remaining in the competition will be announced to competitors at the 2 hour, 1 hour, 30 minute and 10 minute marks.

Keep work stations clean. Tidy up at the end. Failure to do so will result in marks off your presentation score.

THEME

The theme of the Junior Team Design competition is "Civil Crisis".

SCENARIO

Syria has been engaged in a civil war and both sides are fuelling all supplies and aid into the internal war. There is a large population dispersed around the country that is not receiving the proper aid. The government of Syria warns that anybody who tries to interfere with their internal affairs will be fired upon sight. Around Syria's border, there is a 50 km "danger zone". The UN has told Syria to allocate resources to the famished civilians, but they refuse to listen. The UN is designing a plan to send in resources. Sending in stealth soldiers would be dangerous due to the landmines outside the countries borders and being detected 'within the borders. Syria also has basic radar so any sort of land or air vehicle would be detected. So what can we do?

The UN has hired your company to build an autonomous stealth vehicle to be deployed at the edge of this "danger zone" that can traverse rapidly over the terrain towards the country's border. Our intel has confirmed that the least monitored location is through a rocky terrain, so that will be the path that the vehicle will take. Once it reaches the border, the vehicle will launch resources over it. The aim is to hit the most densely populated city located near the centre of the country, and from there, local aid services will distribute the resources. Each aid package will save up to 50 lives! Our intel tells us the government of Syria will be oblivious to the situation if we proceed as planned.

OBJECTIVE, REQUIREMENTS & CONSTRAINTS

This is a two step design challenge. A one touch mechanism (ie hit a button, flick a switch, release a pin, etc) to move the vehicle across the terrain then an automatic launch mechanism which would launch items into the designated targets. The entire terrain is 200cm x 60cm with a 10cm fence at the end. Before the launch, the entire vehicle must fit within a 40cm x 40cm space and constrained to a height of 20cm. The vehicle must completely cross the obstacle before launching.

Each item is worth 50 points. The items can not be stacked at anytime. As you move away, the targets get larger and carry certain multipliers with them (1x, 2x and 3x as you move further away). To receive points the items has to be physically touching the target boundary. Each team has 3 attempts; the attempt with the highest points will be counted.

You will have a 5 hour time limit from the beginning of the build session to create a working prototype and a poster board for your presentation. Entries that are received late will be disqualified. Prototypes and posters are due in the shop at the end of the build session. Each team has a budget of \$3500. Cost-effectiveness is an important objective.

After the build session, the teams will be required to present their solution to a panel of judges. You will use the poster board aid to present as a team to the judges. Following this, you will have a maximum of 3 attempts to complete the challenge. Points will be awarded for a cost-effective solution, how lightweight and robust the vehicle is and a stealthy appearance. Be prepared to be held accountable for all money spent.

DELIVERABLES

At the end of the development and build stage, each team is required to submit the following items:

1. A working prototype of the machine
2. A poster presentation as a visual aid
3. A prototype model name

PROCEDURAL RULES

The following rules must be followed during the design and build stages of the competition. Any teams in violation of these rules may be disqualified at the discretion of the WEC staff.

1. Teams have five (5) hours to complete the design and construction of their prototypes.
2. Teams are not allowed to leave the competition premises unless they have submitted their prototypes and presentations to the competition staff.
3. Laptops are not permitted.
4. Teams may only use materials that they purchase from the shop.
5. Provided tools may only be used to construct the prototype and may not be used as part of the prototype. The tools must be returned at the end of the design and build phase of the competition.
6. Final prototype and presentation materials must be submitted to the submission desk prior to the end of the design and build stage. It is the team's responsibility to bring its deliverables from the design area to the submission desk.
7. Purchase Requisition Forms at the shop are to be completed by WEC staff only.

PROTOTYPE TESTING RULES

In the first 20 minutes of the design and build stage, the scenario setup is open to all teams to look at and take measurements. Afterwards, the scenario setup will be available for teams to perform prototype testing. Each testing period is 10 minutes, and is signed-up for on a first-come-first-serve basis. There will be two setups available.

Reservations

Each team may only have one reservation at any time, and must use up the testing period before reserving the next one. Teams may only reserve whichever time slot is available next (i.e. teams may not specify a time).

Cancellations

Teams are allowed to make cancellations to reservations. A cancelled time slot then becomes the next available testing period, and can be reserved by whichever team makes the reservation next. Time slots after the cancellation will not be bumped up.

PRESENTATIONS

Teams will create and present a 7 minute presentation for a panel of judges. Order of the presentation and the rooms in which teams present will be determined randomly, and will be announced 30 minutes prior to the presentation start time. Judges and the general audience may ask questions following the presentation. Testing of the prototype will be given a maximum amount of time of 5 minutes and will follow the question period. Parts of the presentation should be shared equally between the team members to score full points.

Because of numbers, teams will be divided into two rooms with two judge panels for initial judging. The top two teams in each room will perform a second presentation to all judges. From here, the judges will select the winning teams. The first place team will represent the University of Waterloo at the Ontario Engineering Competition in 2014. In the event that the first place team is unable to attend, the second place team shall take their place.

SHOP RULES

1. A maximum of one (1) person per team may be in the shop at any time.
2. Building materials will be available for preview at the shop. Competitors may examine the materials, but are not allowed to leave the display table with unpaid materials.

3. Teams are allowed to take pictures of building materials with a camera, but not a cell phone.
4. Teams must purchase the quantity of items that they request. If a requested quantity is not available, the team may request a new quantity.
5. Teams must keep track of their purchases for their own records. The shop will keep track of the official purchase records. In the event that a team has lost track of their purchases, the team WILL NOT be told how much they have spent.
6. All sales are final. Be sure to verify purchased items and quantities before leaving the shop.
7. Teams may not trade building materials. Violation of this rule will result in immediate disqualification for both teams.
8. Please be courteous and professional to shop personnel. The shop reserves the right to refuse service to an individual who behaves unprofessionally.

MATERIALS LIST

Materials	Unit Price (\$)	Limited
Balloon	40	
Binder Clips (2 Sizes)	100	
Cardboard	30/cm ²	
Clothes Pin	30	
Double Sided Tape	30/cm	
Dowels (2 sizes)	60	
Duct Tape	25/cm	

Elastic Band (Assorted Sizes)	50	
Foam Board	40/cm ²	
Foam Sheet	15/cm ²	
Hot Glue Stick	50	
Magnets	300	
Masking Tape	20/cm	
Mouse Traps	400	
Paper Clip (2)	30	
Paper Plate	40	
Pipe Cleaner	30	
Plastic Fork	30	
Plastic Knife	30	
Plastic Spoon	30	
Plastic Wheel	30	
Playdoh	30/ball	
Popsicle Sticks	15	

Pot Pie Pans	50	
Skewers	40	
Sponge	40	Rare
Spring (Assorted Sizes)	200	
Steel Wire	40/cm	
Straw	20	
String	10/cm	
Styrofoam Balls (2 sizes)	75	
Styrofoam Cup	100	
Thumb tack	10	
Toothpick	10	
Twine	20/cm	
Wheels (2 + axle)	300	Rare
Wood board	50/cm ²	
Zip Ties	30	
Zip-lock Bags	40	

MARKING SCHEME

The following marking scheme is specific to the Spring 2013 Junior Team Design competition and will be used by judges during the presentation and demonstration.

Design Creativity / Originality 10%

Practicality 5%

Aesthetics 5%

Performance 40%

Vehicle moves halfway of the terrain 10%

Vehicle reaches end of terrain 10%

Prototype score for the best round:

> 500 5%

> 1000 7%

> 1250 8%

= 1500 +2%

Does not meet size constraints -5%

Prototype does not move - 50%+

Packet does not start under the line - 20%*

Prototype damages test setup - 20%*

Presentation 35%

Poster 10%

Quality & Flow 7%

Design Process 5%

Meet Constraints & Criteria 5%

Highlights & Usability 5%

Prototype Critique 3%

Cost: under 50% of budget + 2%*

Cost: every 10% over budget - 2%*

Teamwork 5%

Workload distribution 3%

Team synergy 2%
 Does not follow dress code - 2%*

TOTAL 100%

In case of a tie in total marks, the teams will be ranked based on their points scored in Design & Performance.

Completed marking sheets will not be disclosed to competitors; however, if teams wish to know their strengths and weaknesses for improvement in future competitions, judges will be available after the competition for questions.

* The ± signs denote bonus or penalty points, respectively. Lowest possible score for each marking category is zero (0) points.

† The WEC marking scheme explicitly states that a contraption not being able to move constitutes as a design fail. Be sure to keep this in mind when competing at the OEC, as the same rule applies but is not stated in the marking scheme.

PURCHASE REQUISITION FORM

Team Number: _____

Team Member #1: _____

Team Member #2: _____

Team Member #3: _____

Team Member #4: _____

Item	Unit Price	Quantity	Total Price	Volunteer Initial

