

# **WATERLOO** **ENGINEERING**

**Junior Team Design  
Competition Problem**

Fall 2012  
Waterloo Engineering Competition  
Nov 2-3

**SCHEDULE**

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

Friday, Nov 2	5:30 p.m. – 6:00 p.m.	Competitor Check-In	RCH 101
	6:00 p.m. – 6:30 p.m.	Welcome/Briefing	RCH 101
	6:30 p.m. – 10:30 p.m.	Design/Build	Various Assigned Classrooms
	10:30 p.m. – 11:00 p.m.	Submissions/Debriefing	RCH 101
Saturday, Nov 3	7:30 a.m. – 8:00 a.m.	Competitor Check-In	E5 third floor foyer  (Note: changed from delegate package)
	8:00 a.m. – 1:00p.m.	Presentations	Various Assigned Classrooms
	1:00 p.m. – 2:30 p.m.	Prizes and Winner Announcements	TBA

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 four (4) 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.
6. 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.
7. Competitors MAY NOT use the blackboard when delivering presentations.
8. 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.
9. Time remaining in the competition will be announced to competitors at the 2 hour, 1 hour, 30 minute and 10 minute marks.
10. 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 "High Level Delivery".

**SCENARIO**

As more and more people are inclined to try climbing high mountains, the risk of people being stranded on the top in a storm increases. Bad weather prevents any kind of air rescue, so in order for the stranded people to survive, a new method of delivering supplies to the top of the mountain must be devised.

Many deaths occur from hypothermia and from lack of oxygen on mountains such as Everest. A climber expecting to summit and descend in a few hours from the camp 4 on Everest could be stuck on the top for much longer if a surprise storm hit. A possible way for this person to survive would be to get a package of blankets, warmer clothing, and oxygen canisters up to the top.

**OBJECTIVE, REQUIREMENTS & CONSTRAINTS**

Your engineering company has been approached with a request to create a solution. Therefore, your challenge is to create a self-deploying structure in order to transport the aforementioned aid supplies to the top of the mountain (with one flat face fully touching) without the supplies falling off the opposite side.

Your pack of supplies must start below a height of 10 cm from the base platform. Teams will be given a "pack" with which to design their contraption around and to do their testing. However, parts of your contraption may start above this height and may even attach to the top of the mountain (via eyelets) as long as the mechanism fits within a 30cm x 30cm x 45cm volume when your team's trial is ready to commence. If parts of your contraption are starting on top of the mountain, they cannot overhang the sides or slope of the mountain. The release mechanism must be one-touch (ie hit a button, flick a switch, release a pin, etc). This mechanism must be deployable in a minimum amount of time and with minimal human effort. Points will be awarded for creative set-up mechanisms and design. Because this contraption must be transported to the base of any mountain, they must be small and lightweight. This will allow for easy transportation to and from the location, as well as allow for easy storage when not in use. There is a small rectangle on top of the mountain. If your supply block can sit within this rectangle without touching any of the lines, bonus marks will be awarded.

You will have a 4 hour time limit from the beginning of the build session to create a working prototype and a poster board for 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 \$4000. 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 aide to present as a team to the judges. Following this, you will have a maximum of 3 testing tries to complete the challenge. Points will be awarded for a cost-effective solution. 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

### **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 four (4) 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**

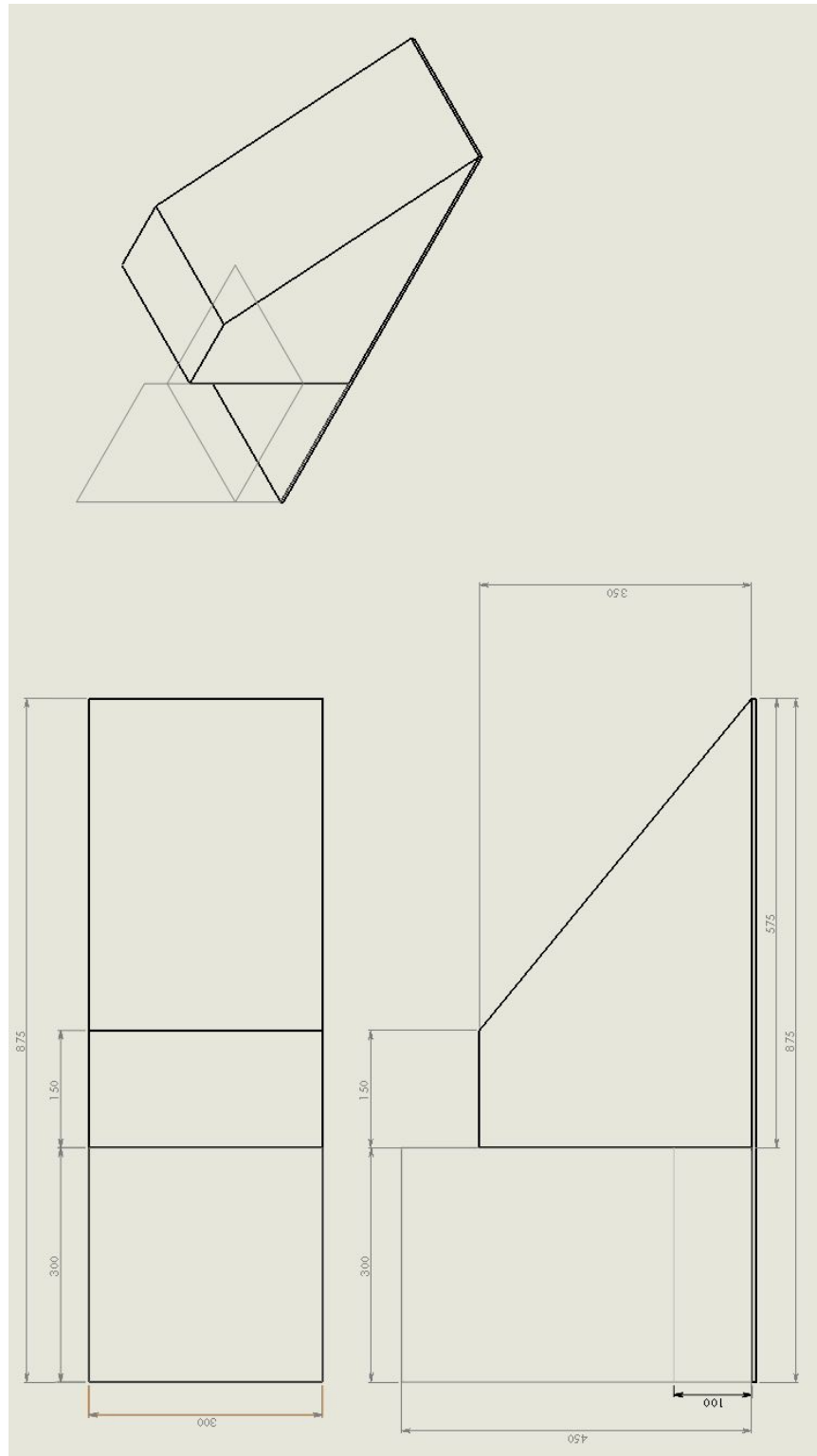
Teams will create and present a 6-8 minute presentation for a panel of judges. Order of the presentation and the rooms in which teams present will be determined randomly, and will be announced 30 minutes prior to the presentation start time. Judges will be permitted 5 minutes following the presentation in which judges and the general audience may ask questions. 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 February 2013 at McMaster University. In the event that the first place team is unable to attend, the second place team shall take their place.

**TESTING**

Due to the nature and scope of this scenario it is vital that a team's solution be successful during its first deployment. During the testing period, teams will have a total of 5 minutes to set up and complete their deployment. Teams will score full points if their device deploys successfully during the first attempt and will lose 2.5% for every successive attempt as shown in the marking scheme.

**TEST SCENARIO MEASUREMENTS**



Note: drawing is not to scale. All dimensions in millimetres.

**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**

<b>Construction Material</b>	<b>Unit Price</b>	<b>Limited Items</b>
Foam Sheets	15 /cm <sup>2</sup>	Rare
Foam Board	40/cm <sup>2</sup>	
Cardboard	30/cm <sup>2</sup>	
Paper Plates	20	
Pot Pie Pans	40	
Skewers	20	
Popsicle Sticks	15	
Toothpicks	10	
Plastic Spoon	30	
Plastic Fork	30	
Plastic Knife	30	
Straws	40	
Thumb Tacks	10	
Nails (assorted sizes)	20	
Zip Ties	30	
Steel Wire	40/cm	
Twine	20/cm	
String	10/cm	
Pipe cleaners	30	
Playdoh	30/ ball	
Sponges	40	

<b>Motion</b>		
Wheels (2 + axle)	200	Rare
Styrofoam Cups	100	
Styrofoam Balls (2 sizes)	75	
Dowels (2 sizes)	60	

<b>Power</b>		
Mouse Traps	400	
Rat Traps	800	Rare
Elastics (assorted sizes)	50	
Springs (assorted sizes)	200	
Paper Clips	30	
Binder Clips (2 sizes)	100	
Clothes Pins	30	
Balloons	40	
Magnets	300	Rare

<b>Adhesives</b>		
Duct Tape	25/cm	
Masking Tape	20/cm	
Double Sided Tape	30 /cm	
Hot Glue Sticks	50	

**MARKING SCHEME**

The following marking scheme is specific to the Fall 2012 Junior Team Design competition and will be used by judges during presentation and demonstration.

<b>Design Creativity / Originality</b>	<b>15%</b>
<b>Practicality</b>	<b>5%</b>
<b>Performance</b>	<b>40%</b>
Packet moves halfway up mountain	15%
Packet reaches top of mountain	15%
Prototype deploys packet on top of mountain	10%
Lands within rectangle	+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%*
Number of failed deployment attempts (n)	- 2.5% x n
<b>Presentation</b>	<b>35%</b>
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%*
<b>Teamwork</b>	<b>5%</b>
Workload distribution	3%
Team synergy	2%
Does not follow dress code	- 2%*
<b>TOTAL</b>	<b>100%</b>

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.

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\* The  $\pm$  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

**PURCHASE REQUISITION FORM (continued)**

Team Number: \_\_\_\_\_

Team Member #1: \_\_\_\_\_

Team Member #2: \_\_\_\_\_

Team Member #3: \_\_\_\_\_

Team Member #4: \_\_\_\_\_

<b>Item</b>	<b>Unit Price</b>	<b>Quantity</b>	<b>Total Price</b>	<b>Volunteer Initial</b>