

# **WATERLOO** **ENGINEERING**

**Junior Team Design  
Competition Problem**

Fall 2010  
Waterloo Engineering Competition  
November 5 – 6

**SCHEDULE**

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

Friday, Nov 5	5:30 p.m. – 5:45 p.m.	Check-In	RCH 110
	5:45 p.m. – 6:30 p.m.	Welcome/Briefing	RCH 110
	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 6	7:30 a.m. – 8:00 a.m.	Check-In	RCH 3 <sup>rd</sup> Floor Lobby
	8:00 a.m. – 1:30 p.m.	Prototype Presentations	Various Assigned Classrooms
	1:30 p.m. – 2:00 p.m.	Prizes and Closing Ceremony	RCH 302

Pizzas will be available to teams around 8:00p.m. – 9:00p.m., during the design and build stage. Please remind the competition coordinators and volunteers of your dietary restrictions and/or allergies.

**GENERAL RULES**

1. All questions regarding the competition problem must be asked during the welcome and briefing session, after the competition problem has been presented. No questions will be answered during the design and build stage.
2. All communication devices must be turned off throughout the duration of the competition.
3. Visitors are not allowed throughout the design and build stage. Violation of this rule will result in immediate disqualification.
4. Dress code for presentation and demonstration is business casual to business formal.
5. Competitors may not use the blackboard when delivering presentations.
6. 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.
7. Keep work spaces clean. Tidy up at the end.

**THEME**

The theme of the Junior Team Design competition is “Stranded”

**SCENARIO**

Your plane has crashed into a remote island with no civilization and there are no salvageable communication devices. From the crash you were able to salvage a map and some other selective materials. From the map you were able to identify 4 different islands in the distance with civilization. Your team decided to design and build a projectile launcher from the few items that you were able to salvage. It will be used to launch some rescue information packages to the islands. You were only able to create 8 rescue information packages from that salvaged material. To increase your chances of getting rescued it is best to send the information package to all 4 of the islands hoping at least someone will respond.

**OBJECTIVE, REQUIREMENTS & CONSTRAINTS**

The purpose of this competition is to design a projectile launcher that will launch a given projectile into set “zones” on the ground, pre-marked on the test site. The machine will be set behind a firing line. The machine must remain behind the firing line at all times, and no part of the machine with the exception of the projectile, shall cross the firing line. You may reallocate the machine in any manner, so long as it is in the firing zone.

Each team is given a maximum of \$1700 for budget. Bonus will be given for teams who stay significantly below the budget, and penalties will be given for teams who go above the budget.

Each team is given 3 minutes in total for the demonstration, but points will be given to teams who finish under the time (refer to the marking scheme). While each team only gets 8 shots, this time is accounted for reloading times for teams to re-adjust and calibrate their machines to target different distances and/or target types. However, parts other than the ammunition are not allowed to be added or removed from the machine during the demonstration period.

Each team is given 2 shots per target, but shots are transferrable between targets (i.e. if you hit on your first shot, you are given 3 tries for the next). The total ammunition given is 8, and bonus points are given for any remaining ammunition (provided that all targets are hit) for 2% per ammunition up to a maximum of 8%.

The following constraints must be met by the design:

1. The machine shall be mobile. In a real life scenario, the machine must be able to move by pushing, and should not require lifting up.
2. There must be a release mechanism, and the release mechanism may not involve any form of cutting or severing any part of the machine. Pulling a string is permitted at a cost of design penalty at the judges’ discretion, but the preferred designs are levers, or pulling a pin.

**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 (posters will be provided)

**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. Teams will receive a notification when there is one (1) hour remaining in the design and build phase.
8. 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.

**PRESENTATION TIMING**

Each team is given a maximum of 1 minute for setup, followed by 9 minutes of poster presentation, and then 3 minutes for demonstration.

**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.
9. The shop will close 30 minutes before the development and build stage ends.

**MARKING SCHEME**

The following marking scheme is specific to the Fall 2010 Junior Team Design competition and will be used by judges during presentation and demonstration.

<b>Design</b>	<b>25%</b>
Overall Quality and Durability	10%
Mobility	2% †
Release Mechanism Elegance	5%
Range Control Elegance	8%
<b>Performance</b>	<b>40%</b>
Targets reached (4 total)	7.5% x 4
Extra Ammunition Left Over	2% bonus per ammunition*
Reload Time (ranked)	10%
<b>Presentation</b>	<b>18%</b>
Poster	10%
Design Process	5%
Prototype Critique	3%
<b>Cost</b>	<b>2%</b>
Under 70% of budget	2%
Between 70% and 100% of budget	1%
Above 100% of budget	0%
Each 20% above budget	-1%*
<b>Originality</b>	<b>10%</b>
Daring/Outside the Box	4%
Creativity	3%
Uniqueness	3%
<b>Teamwork</b>	<b>5%</b>
Knowledge	3%
Workload distribution	2%
Positivity	+1%*
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.

† 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>

**LIST OF SHOP MATERIALS**

Wooden board (custom size)	\$7/cm <sup>2</sup>
Foam board (custom size)	\$11/cm <sup>2</sup>
Wood (15cm x 15cm)	\$400
Nail	\$20
Zip Tie (Large)	\$70
Zip Tie (Small)	\$40
Mouse Trap	\$800
Rat Trap	\$1,100
Popsicle Stick	\$60
Twine	\$3/cm
Aluminum Foil	\$20/cm
Saran Wrap	\$15/cm
Plastic Shot Glass	\$150
Styrofoam Cup	\$250
Paperclip	\$10
Pipe Cleaner	\$50
Paint Roller (Large)	\$400
Paint Roller (Small)	\$250
Toothpick	\$4
Skewer	\$40
Plastic Fork	\$50
Plastic Spoon	\$50
Straw	\$15
Elastic Band (Assorted Sizes)	\$40
Rope	\$10/cm
Styrofoam Ball (Small)	\$50
Pot Pie Pan	\$250
Plastic Plate	\$200
Plastic Bowl	\$250
Clothes Pin	\$100
Extension Spring (149.5 X 6.4 mm)	\$400
Extension Spring (11.1 X 38.1 mm)	\$450
Extension Spring (41.3 X 4.8 mm)	\$450
Compression Spring (69.9 X 14.3 mm)	\$500
1/4" Dowel	\$15/cm
7/16" Dowel	\$18/cm

1/8" Dowel	\$20/cm
3/16" Dowel	\$25/cm
3/8" Dowel	\$25/cm
1/2" Dowel	\$30/cm
3/2" X 2" Square Stick	\$40/cm
Duct Tape	\$8/cm
Double Sided Tape	\$15/cm
Masking Tape	\$4/cm
Hot Glue Stick	\$50
Super Glue	\$80
Paper Muffin Cup	\$20
Sponge	\$200
Candle Holders (small)	\$200
Pebbles (L)	\$200.00
Pebbles (S)	\$50.00
Rainbow paper	\$50.00
Styrofoam balls	\$15.00
Felt Protectors	\$60/each
Hooks	\$80
Hinges	\$600