

WATERLOO **ENGINEERING**

Junior Team Design Competition Problem

Fall 2013
Waterloo Engineering Competition
November 8th-9th

SCHEDULE

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

Friday, November 8th	5:30 p.m. – 6:00 p.m.	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, November 9th	7:30 a.m. – 8:00 a.m.	Check-In	RCH 3 rd Floor Lobby
	8:00 a.m. – 11:30 p.m.	Prototype Presentations	RCH 103/105
	11:30 a.m. – 12:00 p.m.	Break	
	12:00 p.m. – 12:30 p.m.	Finalists announced	RCH 103
	12:30 p.m. – 1:30 p.m.	Prototype Presentations - Finals	RCH 103
	1:30 p.m. – 1:45 p.m.	Break	
	1:45 p.m. – 2:15 p.m.	Prizes and Closing Ceremony	RCH 103

Pizzas will be available to teams around 7 - 8:30p.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. 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 "Dangerously Reactive Conveyance".

SCENARIO

Uranium mining near the Grand Canyon is a very costly and dangerous endeavour. Your team has been tasked to find a reliable method to transport these dangerous goods as part of a recent contract with a local nuclear materials processing company. Currently, the major issue is that safe transportation systems are located on the opposite side of the canyon from the mining site.

With such volatile and fragile materials to transport, keeping the transport situation safe for humans and the environment will be paramount to successful transport of the mined uranium across the canyon.

DEFINITIONS

ONE TOUCH – Act performed by an individual that initiates the prototype and clearly does not impart any force from the individual to the system in the intended direction of action. Acts such as hitting a button, flicking a switch, releasing a pin, are all valid ONE TOUCH mechanisms. This action only occurs once per demonstration attempt.

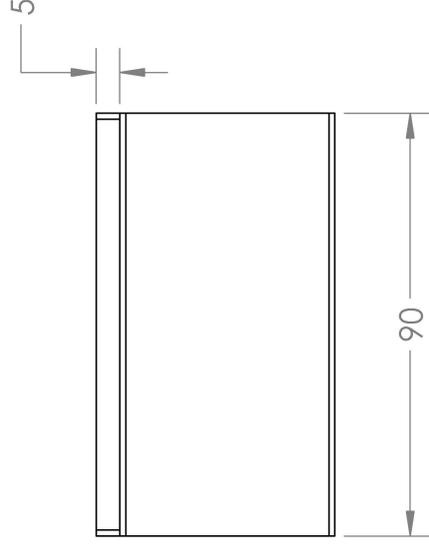
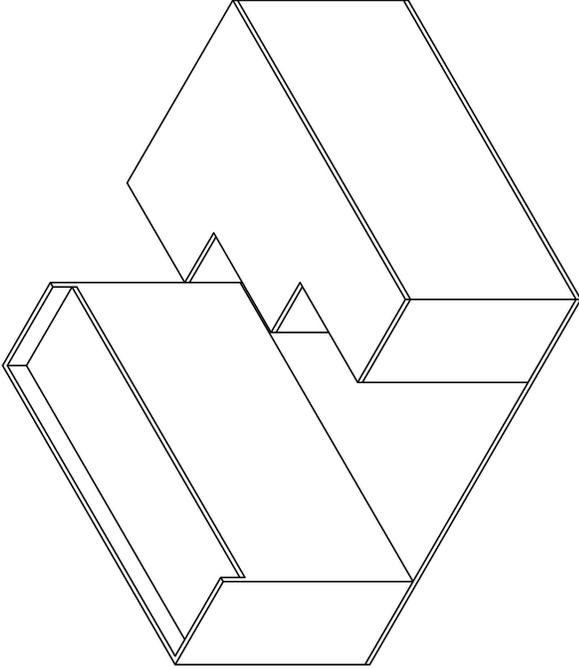
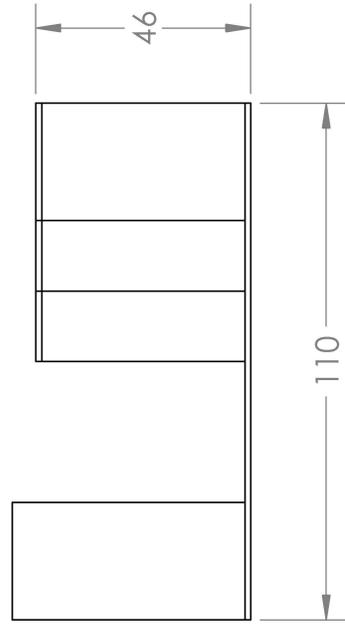
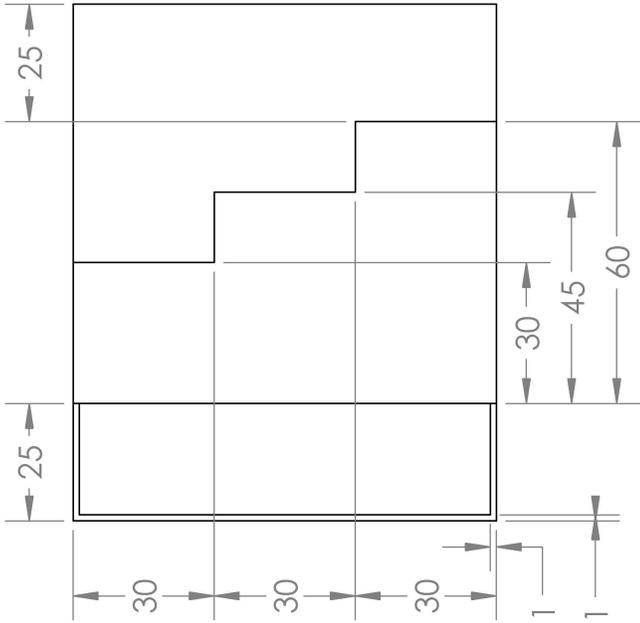
STARTING DIMENSIONS – Represents the completely enclosed bounding box dimensions around the prototype in the initial configuration just prior to the ONE TOUCH act.

OBJECTIVE, REQUIREMENTS & CONSTRAINTS

This design challenge requires the use of a ONE TOUCH mechanism that moves the uranium pods (marbles) from one side of the canyon to the other. Each team is given 5 uranium pods to transport. The canyon test setup is comprised of three different horizontal spans that are 30cm, 45cm, and 60cm long respectively. The 60cm span provides the easiest and cheapest route for the transportation systems on the other side of the canyon and the 30cm route is most inconvenient of the 3 options. The prototype device must be transportable to the mining site, and so must fit in a set of STARTING DIMENSIONS that is 20cm X 20cm X 20cm. After the ONE TOUCH mechanism has been activated, the prototype has no size limitations. The prototype must be stationed in front of one of the 3 span options in each demonstration attempt, and any portion of the prototype cannot be crossing the dotted lines on the test setup. The prototype may be temporarily affixed to the test setup, so as long as removal of the prototype does not leave residue or otherwise damage the test setup.

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 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 \$2500. Keep in mind that cost-effectiveness is an important objective.

After the build session, the teams will be required to present their solution to a panel of judges. Your team will use the poster board as an aid while presenting to a panel of judges. Following this, you will have a maximum of 3 attempts to complete the challenge in a 5 minute window. Performance will be judged by the maximum number of uranium pods that have been safely transported and are resting on the opposite side of the canyon after an attempt. The best attempt will be scored. Teams performing multiple attempts are to reset the test setup so that all uranium pods are back in the starting zone. Additional points will be awarded for a cost-effective solution, which achieves the goal of safely transporting the uranium. Be prepared to be held accountable for all money spent.



ALL FASTNERS TO BE MADE FLUSH.

INTERNAL SUPPORTS TO BE FABRICATED AS NEEDED.

UNLESS OTHERWISE SPECIFIED	
PRIMARY UNITS	CM
NO BURRS OR SHARP EDGES	
TOLERANCES	
0 DECIMAL PLACES	±1
1 DECIMAL PLACE	±0.8
2 DECIMAL PLACES	±0.2

WEC FALL 2013

**DANGEROUSLY REACTIVE
CONVEYANCE TEST SETUP**

PRINTED ON 22/10/2013

SCALE: 1:16

SHEET 1 OF 1

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 and cell phones 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.

PRESENTATIONS

Teams will create and present a 6-8 minute presentation for a panel of judges. The dress for presenters is a minimum of business casual (NO JEANS). 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 February of 2014 at UOIT in Oshawa. 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

Material	Unit Price (\$)	Limited Items Rating
Balloons	40	-
Bubble Wrapping Roll	15/cm	-
Cardboard	2/cm ²	-
Clothes Pins	30	-
Double Sided Tape	30/cm	-
Dowels	100	-
Duct Tape	25/cm	-
Elastics (Various)	30	-
Eye Screws	30	Rare
Finishing Nails	20	-
Foam Board	3/cm ²	-
Hot Glue Sticks	50	-
Magnets	50	-
Masking Tape	20/cm	-
MDF Board	8/cm ²	-
Modelling Clay	30/"ball"	-
Mouse Traps	400	-
Paper Clips (2 sizes)	20	-
Paper Plates	20	-
Pipe Cleaners	30	-
Plastic Fork	30	-

MATERIALS LIST (CONTINUED)

Material	Unit Price (\$)	Limited Items Rating
Plastic Knife	30	-
Plastic Spoon	30	-
Popsicle Sticks (Various)	15	-
Pot Pie Pans (Large)	40	-
Pot Pie Pans (Small)	20	-
Rat Traps	200	Rare
Skewers	20	-
Sponges	40	-
Springs (Various)	50	-
Steel Wire	40/cm	-
Straws (Small)	25	-
Straws (Xtra Large)	100	-
String	10/cm	-
Styrofoam Balls	75	-
Styrofoam Cups	100	-
Thumb Tacks	10	-
Toothpicks	10	-
Toy Dump Truck	500	Ultra Rare
Twine	20/cm	-
Wheels (2 + Axle)	200	Rare
Zip Ties	30	-

MARKING SCHEME

The following marking scheme is specific to the Fall 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%
# of Uranium Pods transported across 30cm Span	4%/Uranium Pod
# of Uranium Pods transported across 45cm Span	6%/Uranium Pod
# of Uranium Pods transported across 60cm Span	8%/Uranium Pod
Prototype does not meet STARTING DIMENSIONS Constraint	-20%*
Prototype does not move	-40%†
Prototype is not a ONE TOUCH mechanism	-30%†
Prototype crosses the dotted lines before ONE TOUCH act	-20%†
Prototype damages test setup	-20%*
Presentation	35%
Poster	10%
Quality & Flow	7%
Design Process	5%
Meets Constraints & Criteria	5%
Highlights & Usability	5%
Prototype Critique	3%
Cost: Spent Under 75% of Budget and above 50% of Budget	+2%*†
Cost: Spent 50% or less of Budget	+5%*†
Cost: Every 10% Over Budget	-2%*
Does not follow dress code	-2%*
Teamwork	5%
Workload Distribution	3%
Team Synergy	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 prototype 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.

