

WATERLOO **ENGINEERING**

**Junior Team Design
Competition Problem**

Fall 2011
Waterloo Engineering Competition
November 4 - 5

SCHEDULE

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

| | | | |
|-----------------|-------------------------|-----------------------------------|---------------------|
| Friday, Nov 4 | 5:30 p.m. – 5:45 p.m. | Competitor Check-In | RCH 101 |
| | 5:45 p.m. – 6:30 p.m. | Welcome/Briefing | RCH 101 |
| | 6:30 p.m. – 10:30 p.m. | Design/Build | Various Classrooms |
| | 10:30 p.m. – 11:00 p.m. | Submissions/Debriefing | RCH 101 |
| Saturday, Nov 5 | 7:00 a.m. – 7:30 a.m. | Competitor Check In | RCH 2nd floor foyer |
| | 7:15 a.m. – 7:20 a.m. | Judges Check In | |
| | 7:20 a.m. - 7:30 a.m. | Judges Briefing | RCH 110 |
| | 7:30 a.m. – 10:50 a.m. | First round of Presentations | RCH 105/110 |
| | 10:50 a.m. - 11:05 a.m. | Deliberation and break for judges | RCH 1110 |
| | 11:05 a.m. - 11:10 a.m. | Announcement of finalists | RCH 110 |
| | 11:10 a.m. - 12:30 p.m. | Second round of presentations | RCH 110 |
| | 12:30 p.m. - 12:40 p.m. | Final Deliberation | RCH 110 |
| | 12:40 p.m. - 1:00 p.m. | Announcement of winners | RCH 110 |

Pizza will be available to teams around 8:00p.m. – 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 about the problem statement will not be answered.
2. All communication devices must be turned off throughout the duration of the competition, being caught using any electronic device during competition is grounds for disqualification.
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. 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.
8. Time remaining in the competition will be announced to competitors at the 2 hour, 1 hour, 30 minute and 10 minute marks.
9. Keep work spaces clean. Tidy up at the end as points may be taken off for a room left untidy.

THEME

The theme of the Junior Team Design competition is “Firefighter”.

SCENARIO

You can hear the siren of a fire truck all the time. Severe losses and damages will happen if the firefighters cannot make it in-time and put out a fire. The pathway from the fire stations to the fire location is not always so smooth. There could be steep hills, bumpy roads etc; however, the firefighters have to get to the emergency location no matter what to save people’s lives and property. Firefighters cannot put off the fires with their bare hands: in some cases they require water, and in others sand.

OBJECTIVE, REQUIREMENTS & CONSTRAINTS

A fire breaks out in one of the houses in the countryside. The house has already half burnt down - the roof has totally burnt off, and the windows have blown out. The only part of the house remaining is the front wall. As a group of firefighters, you are required to extinguish the fire to save what remains of the property and keep the fire from spreading! However, the only source of water and sand nearby is located uphill, while the house caught on fire is downhill. What makes it worse is the road isn’t paved adequately! As a result, you need to come up with a solution so that you can utilize the water/sand uphill to extinguish the fire.

There are no restrictions on the design; however, the release mechanism must be one-touch (i.e. hit a button, flick a switch, release a pin, etc). This mechanism must be deployable in a minimum amount of time after the one-touch trigger. The design has to carry resources a minimum 5 centimetres above the ground below the top platform. Points will be awarded for creative set-up mechanisms and design. You want to carry enough resources to put off the fire.

Any spill of water or sand will cause the points deducted. If the wall of the house is knocked off, or a team’s prototype damages the competition setup, the team will be disqualified. Of course, you will be evaluated based on how much fire you put off as well.

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 \$3000. 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 total of 3 testing tries to complete the challenge within 5 minutes, therefore keep in mind your design must be restorable to the original condition. 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 are purchased from the shop. Teams may not return or trade purchased materials.
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, otherwise teams will be disqualified.
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.
10. Teams will receive a notification when there is 2 hours, 1 hours, 30 minutes and 10 minutes remaining in the build period.
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 setups are open to all teams to look at and take measurements. Afterwards, the scenario setups 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.

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.

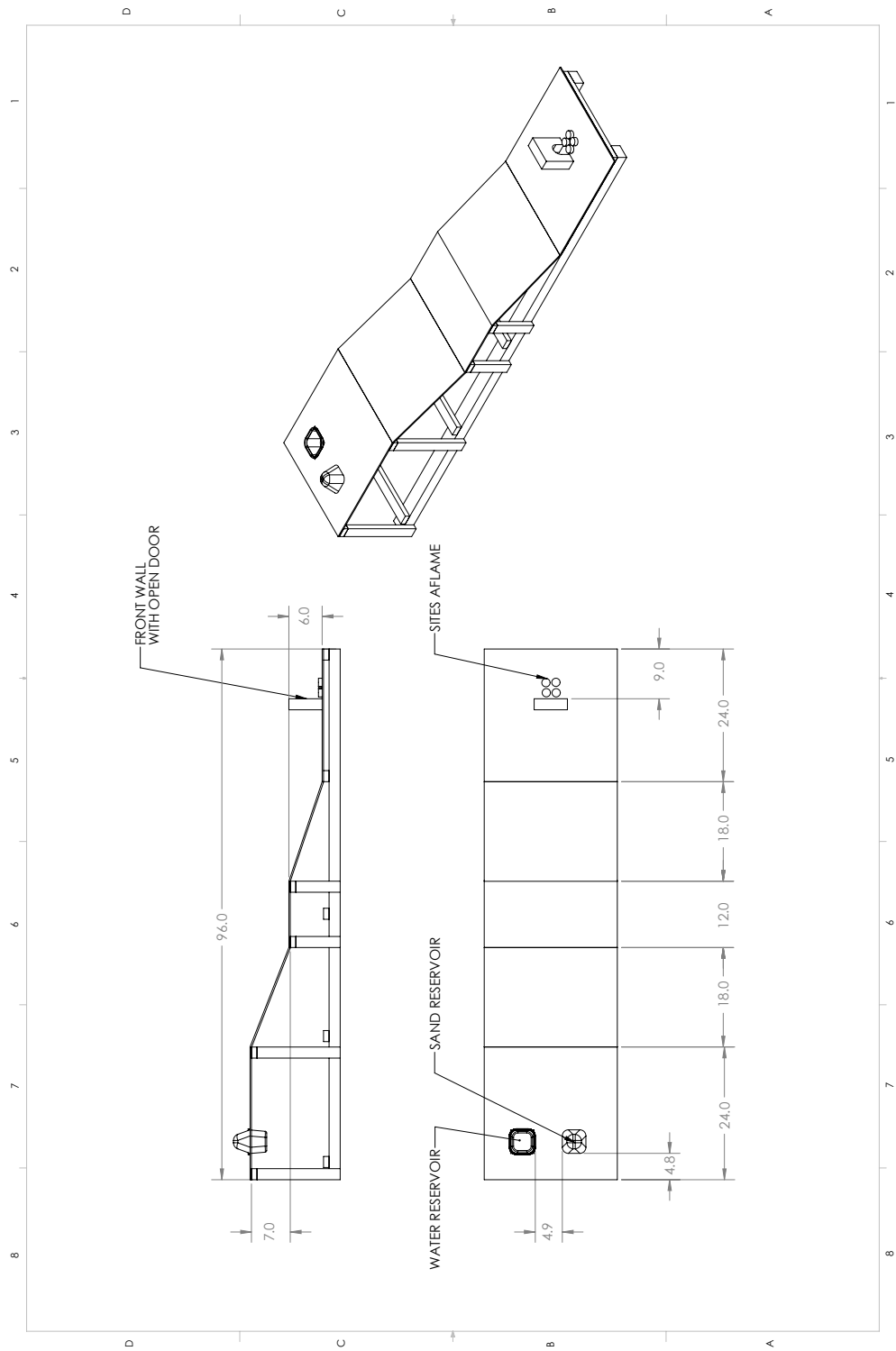
PRESENTATIONS

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 at presentation check-in on Saturday morning. Parts of the presentation should be shared equally between the team members. Testing of the prototype will be given a maximum amount of time of 5 minutes and will follow the presentation.

Judges will be then permitted 5 minutes following the presentation in which judges may ask questions.

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 2012 at the University of Toronto. In the event that the first place team is unable to attend, the second place team shall take their place.

TEST SCENARIO MEASUREMENTS



Note: Drawing dimensions are in inches. You will be expected to confirm these measurements.

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 which would be grounds for disqualification. A cell phone in "Airplane Mode" or with its radios off, is not permitted.
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

| Item Description | Size | Price | Item Description | Size | Price |
|----------------------------------|---------------------|--------------------------------|--------------------------------|-----------------|--------------|
| General | | | Thumb Tacks | Each | \$50 |
| Foam Sheets ** | | \$100 | Binder Clips | (2 sizes) | Small – \$50 |
| Foam Board | per cm ² | \$2.00 | | | Big – \$80 |
| Cardboard (per cm ²) | per cm ² | \$2.00 | Eye hooks (assorted sizes) | Each | \$60 |
| Paper Plates | Per | \$50.00 | Wheels (2 wheels => free axel) | Each | \$400 |
| Pot Pie Pans | each | \$100.00 | Cotton Balls | Each | \$10 |
| Dump Truck Bucket** | Each | \$100.00 | Styrofoam Cups | Each | \$70 |
| Mouse Traps | Each | \$100.00 | Styrofoam Balls | (2 sizes) | Small – \$80 |
| Elastics (assorted sizes) | Each | \$50.00 | | | Big – \$100 |
| Skewers | Each | \$80.00 | Zip Ties | Each | \$70 |
| Dowels | (2 sizes) | Small – \$100 Large - \$200 | Plastic Rope | (per cm) | \$4 |
| Plastic Hooks | Each | \$100 | String | (per cm) | \$2 |
| Popsicle Sticks | Each | \$30 | Pipe cleaners | Each | \$40 |
| Skewers | Each | \$120 | Magnets ** | Each | \$75 |
| Toothpicks | Each | \$30 | Playdough | cm ³ | \$3 |
| Plastic Spoon/Fork/Knife | Each | \$20 | Modelling Clay | Per stick | \$80 |
| Straws | | \$50 | Sponges | | \$200 |
| Paper Clips | (2 sizes) | Small – \$10 | Balloons | | \$30 |
| | | Big – \$20 | Adhesives | | |
| Nails (assorted sizes) | Diff Sizes | \$20 | Duct Tape | (per cm) | \$12 |
| Clothes Pins | Each | \$20 | Masking Tape | (per cm) | \$5 |
| Aluminum Foil | Per cm | \$10 | Hot Glue Sticks | | \$60 |
| Paint Rollers | Each | \$50 | Double Sided Tape ** | (per cm) | \$10 |
| Rocks | Each | \$10 | Electrical Tape | (Per cm) | \$8 |
| Plastic Hooks** | Each | \$30 | White Glue | Per ¼ Cup | \$30 |
| | | | Super Glue** | Per tube | \$50 |

Note: ** denotes a rare item

MARKING SCHEME

The following marking scheme is specific to the Spring 2011 Junior Team Design competition and will be used by judges during presentation and demonstration.

| | |
|---|-------------|
| Design & Performance | 50% |
| Able to reach house with resources | 20% |
| Fire extinguished (5% per candle) | 20% |
| Precision of resource deployment | 10% |
| Resources not 5 cm above ground | - 10%† |
| Prototype does not function | - 50%† |
| Spilt Resources | - 10% |
| | |
| Presentation | 35% |
| Poster | 10% |
| Quality & Flow | 7% |
| Design Process | 5% |
| Meet Constraints & Criteria | 5% |
| Highlights & Usability | 5% |
| Prototype Critique | 3% |
| Cost: every 10% under budget (up to max 5%) | + 1%* |
| Cost: every 10% over budget | - 2%* |
| | |
| Creativity / Originality | 10% |
| | |
| Teamwork | 5% |
| Workload distribution | 3% |
| Team synergy | 2% |
| Does not follow dress code | - 2%* |
| Workroom not tidied up | - 2%* |
| | |
| TOTAL | 100% |

DESIGN AND PERFORMANCE DEFINITIONS:

Able to reach house with resources: A team's prototype must be able to transport resources from the top of the problem setup to the house at the bottom of the hill. The resources don't necessarily need to be deployed.

Fire extinguished: There will be four candles to be put out. Each one should be fully extinguished for full points to be awarded. Each candle will carry 5% weight for the final total.

Precision of Resource Deployment: Resources will not be deemed spilt if they are being used to put out the fire at the house, but the precision at which they are deployed will be judged. If the fire is fully put out with spilling little resources, full points will be awarded. If the deployment of resources is not precise, marks will be deducted at the discretion of the judges.

Resources not 5 cm above ground: Resources must be kept 5 cm above ground while being transported from resource piles to the house. Resources may be transported below 5 cm on the upper platform. Once resources are at the house, this rule does not need to be applied.

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 |
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PURCHASE REQUISITION FORM (continued)

Team Number: _____

Team Member #1: _____

Team Member #2: _____

Team Member #3: _____

Team Member #4: _____

| Item | Unit Price | Quantity | Total Price | Volunteer Initial |
|------|------------|----------|-------------|-------------------|
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