WATERLOO
ENGINEERING

Senior Team Design
Competition Problem

Spring 2013
Waterloo Engineering Competition
July 5-6

GENERAL RULES

1. All questions regarding the competition problem must be asked during the welcome and briefing session. No questions will be answered during the design and build stage.
2. Teams are not allowed to leave the building unless they have submitted their prototype and presentation to competition staff.
3. All communication devices must be turned off throughout the duration of the competition. This means you may not use a cell phone camera to take pictures for the purpose of your presentation or in the shop in this competition.
4. Wireless on laptops must be turned off. Violation of this rule will result in immediate disqualification.
5. Visitors are not allowed throughout the design and build stage. Violation of this rule will result in immediate disqualification.
6. Teams may only use materials they have purchased in the shop.
7. Final prototype, gear box packaging, 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.
8. Competitors may not use the blackboard when delivering presentations.
9. Keep work spaces clean. Tidy up at the end - marks will be deducted otherwise.

SCHEDULE

Friday, July 5th	5:00 p.m. – 5:30 p.m.	Competitor Check-In	RCH Foyer
	5:30 p.m. – 6:00 p.m.	Welcome/Briefing	RCH 301
	6:00 p.m. – 12:00 p.m.	Design/Build	Various
	12:00 p.m. – 12:30 a.m.	Submissions/Debriefing	RCH 301
Saturday, July 6th	7:30 a.m. – 8:00 a.m.	Competitor Check In	RCH Foyer
	8:00 a.m. – 12:30 p.m.	Presentations/ Demonstrations	RCH 307
	12:30 p.m. - 1:00 p.m.	Announcement of winners	RCH 307

Volunteers will give instructions to teams on when and where to get their pizza, which will be available at some time between 7p.m. – 8p.m. Please remind the competition coordinators and volunteers of your dietary restrictions and/or allergies. Dress code for presentation and demonstration is business casual. There will be a question period after the problem is presented. No questions will be answered during the development and build stage to ensure fairness in the competition.

THEME

The theme of the Spring 2013 Senior Team Design is Bombsquad.

SCENARIO

Your scouts have spotted what looks to be an unmanned enemy camp ahead; however there are very obvious trap set up. This looks to be the perfect place to set your camp for tonight but unfortunately, one of the scouts tried to disarm one of the bombs by hand and lost his life in the line of duty. Your team has decided that they must build a semi-remote controlled bomb defusing robot to clear the area from the remaining bombs. The scouts who returns mapped the region and have shown you where the remaining ten bombs are located but they also have no way of knowing if there are any enemy combatants near the far regions of the terrain. Even with no signs of the enemy, the robot is going to need to start the mission from where the scouts left the camp and carry out the mission from there. This camp is crucial in attempting to gain ground on the enemy and with the bombs defused, allows your troops to move in safely.

OBJECTIVE, REQUIREMENTS & CONSTRAINTS

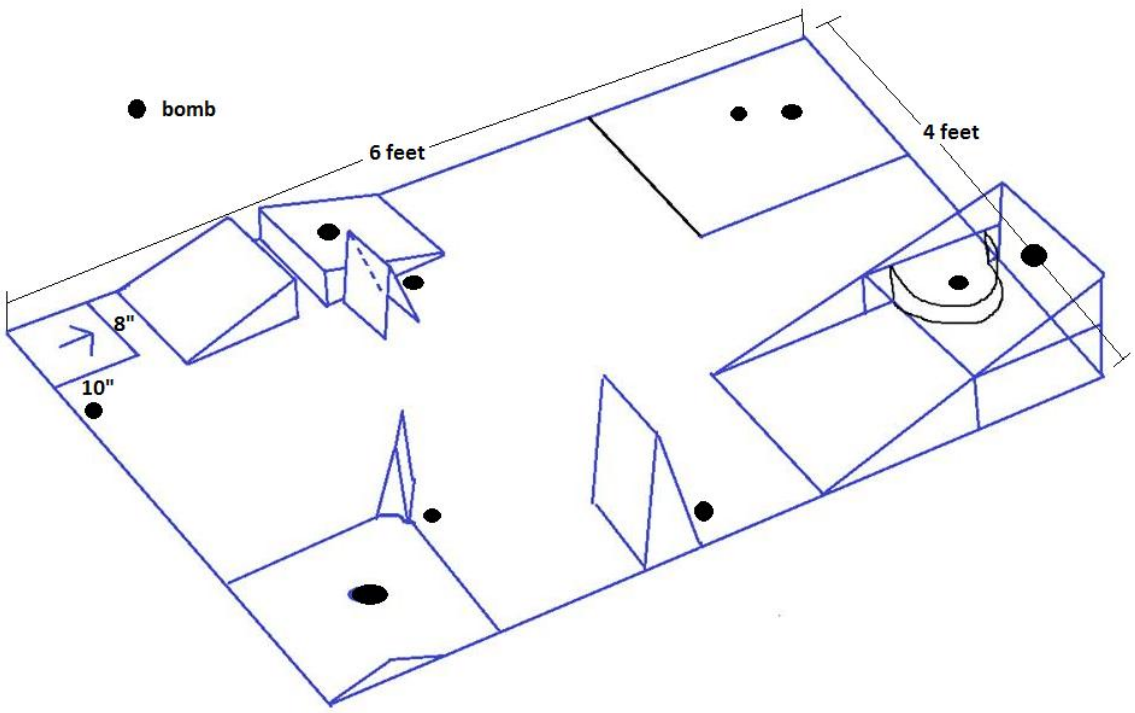
Design a device that is remotely controlled through a minimum of one (1) metre of cable using only the materials provided. It must be capable of traversing numerous types of difficult terrain and perform an action to defuse the bombs once they are reached. In order to reach all of the mines your robot can not be any longer than 10 inches, no wider than 8 inches, and no taller than 3.5 inches.

The vehicle will start in the designated area and will be controlled remotely via use of the control panel. Once the vehicle has entered the competition area, teams will not be permitted to touch the vehicle in any way. The vehicle must be guided to the location of the mines, perform the diffusion task, and return to the insertion point within 10 minutes or your efforts will be noticed by the enemy camp. Your robot can not cross the boundary into the un-scouted area as who know what is out there.

Your device may not damage the competition problem setup. Additionally, during construction of your device, you may not damage your headquarters or the building in any way. Doing so will result in immediate disqualification from the competition.

The remote control and the attached cable must not have direct physical impact on the retrieving vehicle, i.e. steering by pulling the vehicle is not allowed. Only two people are allowed to operate the device at any point which includes a person holding up the cable to prevent physical interference. Teams are not permitted to touch the vehicle during demonstration. The Waterloo Defense Council has granted you $10,000 to design this device. Any additional funds required to construct your device will be taken out of your hard earned work term savings. In the event that a team goes over budget, their budget will be compared to that of the lowest budget successful team and penalized based on percent error to a maximum of 10%. See the marking form for additional details.

Terrain Layout



PROTOTYPE TESTING RULES

The scaffold and a portion of the terrain 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.

Consumable Items

Some items are consumable, for example: batteries. Teams are responsible for purchasing enough of these consumable items from the shop during the design and build phase to successfully complete the presentation and demonstration.

SHOP RULES

1. A maximum of two (2) people per team may be in the shop at any time.
2. All sales are final. Be sure to verify purchased items and quantities before leaving the shop.
3. Teams may not trade building materials. Violation of this rule will result in immediate disqualification for both teams.
4. The competition shop will keep track of the official expense forms. However, teams are encouraged to keep track of their own Purchase Requisition Form to have an idea of how much they have spent. The shop will not tell teams how much they have already spent.
5. The shop will close 30 minutes before the development and build stage ends.

DELIVERABLES

At the end of the six- (6) hour development and build stage, each team is required to submit and return the following items:

1. A working prototype of the machine
2. A PowerPoint presentation
3. Purchase Requisition Form
4. Complete toolkit, any tools borrowed from the store, and all packaging

MARKING SCHEME

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

Design & Performance	**60%**
Aesthetics	5%
Able to diffuse a single bomb	10%
Able to diffuse 2-6 of the bombs	10%
Able to diffuse 7-9 of the bombs	15%
Able to diffuse All (10) the bombs	5%
Within budget	10%
Maneuvering abilities	5%
Not able to move at all†	- 60%*
Per touch (After first touch)	- 5% each time*
Exits boundary	- 20% *
Presentation	**30%**
Explanation of Design Process	15%
Demonstration of Teamwork	7%
Knowledge	3%
Presentation Quality and Flow	3%
Effective use of Time	2%
Not Following Dress Code	- 5%*
Originality	**10%**
Daring/Outside the Box	4%
Creativity	3%
Uniqueness	3%
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.

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* 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 vehicle not being able to move constitutes as a design failure. 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.

Item Description	Size	Price	Item Description	Size	Price
General			Off-road Wheel 1		$250
Metal Wire	Per cm	$10	Off-road Wheel 2		$275
Cotton String	Per cm	$5	Ball Caster		$400
Multipurpose Twine	Per cm	$7	Axle		$200
All-Purpose Rope	Per cm	$12	**Construction**		
Bubble Wrap	Per cm^2	$5	Cardboard (light)	Per cm^2	$5
Aluminum Sheet	Per cm^2	$10	Cardboard (heavy)	Per cm^2	$8
Foam Wrap	Per cm^2	$5	Foam Board	Per cm^2	$5
Plastic Bag		$250	Styrofoam	Per cm^2	$8
Ziploc Bag		$200	Coroplast	sheet	$1000
Plate		$200	Plywood ½”	Per cm^2	$15
Spring (Various Sizes)		$25	Hardboard ¼“	Per cm^2	$12
Nail (Various Sizes)		$5	Wood Dowel (ø 1/4”)		$100
Screw (Various Sizes)		$7	Wood Dowel (ø 1/2”)		$150
Nut & bolt (Various Sizes)		$7	Wood Dowel (ø 3/4”)		$200
Rubber Band		$25	**Adhesives**		
Wooden Skewer		$90	Hot Glue Stick	1 Stick	$150
Plastic utensils (sp., for.)		$75	White Glue	Sml. Cup	$100
Popsicle Stick		$20	White Glue Stick	1 Stick	$110
Pipe Cleaner		$25	Super Glue	1 sml. tube	$250
Paper Clip		$10	Double Sided Tape	Per cm	$12
Party Drinking Straw		$40	Packing Tape	Per cm	$8
Zip Tie	7½"	$30	Electrical Tape	Per cm	$5
Foam strip		100	Duct Tape	Per cm	$10
			Electrical		
Wheels			Electric Motor #1	1.5-3 V	$ 400
Slick Wheel		$225	Electric Motor #2	4.5-6 V	$ 600
			Double Gearbox		$1500
			Single Gearbox	3-speed	$1000
			Battery Holder	1x 9V	$100
			Battery Holder	4x AA	$200
			Toggle Switch		$200
			On/Off Rocker Switch		$200
			On/Off/ On Rocker Switch		$350
			Electrical Wire	Per cm	$2
			Battery	AA	$25
			Battery	9V	$50

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: _____

Item	Unit Price	Quantity	Total Price	Volunteer Initial