WATERLOO
ENGINEERING

Senior Design
Competition Problem

Spring 2014
Waterloo Engineering Competition
July 4-5, 2014

SCHEDULE

The schedule of the Spring 2014 Senior Team Design competition is as follows:

Friday, July 4	5:15 p.m. – 5:30 p.m.	Competitor Check-In	MC 2035
	5:30 p.m. – 6:00 p.m.	Welcome/Briefing	MC 2035
	6:00 p.m. – 12:00 a.m.	Design/Build	Various assigned classrooms
	12:00 a.m. – 12:30 a.m.	Submissions/Debriefing	MC 2035
Saturday, July 5	7:30 a.m. – 8:00 a.m.	Competitor Check-In	RCH 3rd-floor lobby
	8:00 a.m. – 12:30 p.m.	Presentations/Demonstrations	RCH 307/308
	12:30 p.m. – 1:00 p.m.*	Announcement of Winners	RCH 307

*Times are approximate and will be confirmed on the day of the competition.

Pizza will be available to teams around 8:30p.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. 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 six (6) hours in duration.
3. All communication devices MUST be turned off throughout the duration of the competition. You may not use a cell phone camera to take pictures for the purpose of your presentation or in the shop during the competition.
4. Wireless on laptops must be turned off. Violation of this rule will result in immediate disqualification.
5. Visitors are not allowed during the design and build stage. Violation of this rule will result in immediate disqualification.
6. Teams may not leave the premises until they have submitted their deliverables.
7. Time remaining in the competition will be announced to competitors at the 2 hour, 1 hour, 30 minute and 10 minute marks.
8. 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 indicated on the first slide of the presentation. The team number must be indicated in the name of the presentation.
9. 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.
10. Keep work stations clean. Tidy up at the end. Failure to do so will result in marks deducted from your presentation score.
11. Dress code for presentation and demonstration is business casual to business (ie. no jeans).
12. Competitors MAY NOT use the blackboard when delivering presentations.
13. 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.

THEME

The theme of the Junior Team Design competition is "*Covert Ops*".

SCENARIO

Austin Bond, aka Agent 003, the famous spy, has been assigned to disable the mysterious laser weapon device in the lair of the power-hungry Dr. Largo. However, the enemy has caught wind of his plans and activated the lair security system, which has released a toxic gas, deadly to humans. Also, intelligence sources revealed that Dr. Largo installed a fail-safe system that will activate the weapon upon unauthorized entry into his lair, unless all the fail-safe keys are turned in sequence within his impossible time limit. Agent 003 sends a distress signal to R, the technical genius, who has promised to produce a remote-controlled device that will disable this.

R gives the task of producing this device to you, the Senior Design teams. Your task is to produce a working prototype that can disable all the alarms within the lair in the sequence revealed by intelligence sources within the given time. Failure is not an option, as the consequences of the weapon's activation are unthinkable. Time is short, and the task is hard. Good luck.

OBJECTIVE, REQUIREMENTS & CONSTRAINTS

Design a rescue vehicle that is remotely controlled through a maximum of one (1) metre of cable using only the materials provided. It must be capable of manoeuvring within confined spaces, with sufficient speed to deactivate all fail safes, and deactivate the weapon at the center of the lair.

The vehicle will start from the lair entrance and will be controlled remotely via a control panel. Once the vehicle has entered the lair, teams will not be permitted to touch the vehicle in any way. The vehicle must be guided to each fail-safe in sequence, arriving at the succeeding fail-safe within 20 seconds of the previous one. The vehicle must stay on the path or else risk discovery. Once the vehicle has de-activated the final fail-safe, you have 40 seconds to de-activate the weapon.

Your device must not damage the competition problem setup. Additionally, during construction of your device, you must 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 rescue vehicle, i.e. steering by pulling the vehicle is not permitted. Only two (2) people are allowed to operate the device at any point during the demonstration which includes a person holding up the cable to prevent physical interference of the cable and the problem setup. Teams are not permitted to touch the vehicle during demonstration. R has granted your team $10,000 to design your device. Any additional funds required to construct your device will be counted against you.

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.

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.

DELIVERABLES

At the end of the design and build stage, each team is required to submit the following items:

1. A working prototype of the machine
2. A PowerPoint or PDF 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 six (6) 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. Phones and other personal communication devices are not permitted. Wireless must be turned off on laptops.
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.

SHOP RULES

1. A maximum of two (2) people 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 design and build stage ends.

PRESENTATIONS

Teams will create and present a 10-12 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. Teams 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 next Ontario Engineering Competition. In the event that the first place team is unable to attend, the second place team shall take their place.

MATERIALS LIST

TBD

MARKING SCHEME

The following marking scheme is specific to the Spring 2014 Senior Team Design competition and will be used by the judges during the presentation and demonstration period.

Design & Performance	60%	
Aesthetics	2%	
Able to make first turn	2%	
Able to hit the first button	2%	
Able to hit second button in time frame	5%	
Able to hit succeeding buttons in time frame (per button)	2%	
Reaching the weapon	10%	
Within budget	10%	
Successful de-activation of weapon	20%	
Not able to move at all	-	50%*
Not able to reach button in time (per button)	-	1%*
Hit lair walls	-	20%*
Below budget (with the condition that the device can move) per $1000	+	5%*
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 solution	4%	
Creativity	3%	
Uniqueness	3%	
TOTAL	100%	

In case of a tie in total marks, the teams will be ranked based on the 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 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.

‡ 'Successful Weapon Deactivation' is classified as the device having reached the weapon and pushed the button within the time frame.

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