



# Skills Canada BC ~ 2012

## GEARBOTS Engineering Challenge Scope Document



### **Location:**

Provincial Competition  
TradeX, Abbotsford, BC  
Wednesday, April 18<sup>th</sup>, 2012

### **Technical Chair/ Committee:**

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v1.0

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**Target audience:**

Jr Skills Level with two categories: see page 3 for a description of the challenge options

- **Jr. Engineering Level** ages 9-14 - challenge option
- **Sr. Engineering Level** ages 9-15 – competition option

**Duration:**

Total of 4 hours working on the mission (does not include a one hour lunch break)

**Purpose of the challenge:**

To build and program a fully autonomous robotic device that can complete a number of themed missions in a set time period.

**Tested skills and knowledge:**

Students will apply the engineering process using effective iterative design to complete a number of missions within a set time period.

**Equipment supplied by the each team:** (consisting of 3 students per team each)

- Teams are responsible for bringing their own robotic equipment & laptop computer
  - One (1) laptop computer (this will be strictly enforced), NXT 1.0+ Edu software (or RobotC, NI LabVIEW) tape measure(s), extra batteries, + one (1) NXT education base set #9797 + one (1) optional education resource set #9648 (NO extra / 3<sup>rd</sup> party sensors/attachments allowed)
  - FisherTechnik Robo platform including Robo Pro software – standard equipment contained in the ROBO TX Training Lab kit (with three motors) – contact info@gearbots.org if you have any questions about this option
  - It is recommended that teams pre-build a robotic device prior to attending (REMBot's dimensions are ideal for this type of challenge).
  - Visit <<http://www.gearbots.org/SkillsCanada.html>> for additional resources / suggestions.

**Supplied by the committee:**

- Themed challenge mats, 4'x8' testing table and supporting equipment, paperwork and other related materials to complete the themed missions

**Skills Canada BC supplies:**

- Adequate space for the 42 teams / 126 participants, tables, chairs, lunch, water, electrical requirements, awards for the Sr. Engineering Level participants, event t-shirts, handling of all registration of teams and participants

**Judging criteria:**

- **Jr. Engineering Level** is designed for teams wanting to complete the challenge without the added pressure of awards and rankings based on total missions completed, total points and lowest time.
- **Sr. Engineering Level** is designed for teams wanting to compete for the traditional Gold, Silver and Bronze awards judged and ranked total missions completed, total points for total missions completed and lowest accumulated time.

**Team size:**

- Each team will consist of up to three (3) people - co-educational is encouraged
  - **Jr. Engineering Level** ages 9-14
  - **Sr. Engineering Level** ages 9-15

**Number of teams entered:**

- Limited to the first 42 teams registered on a first come, first serve basis. Registration is through Skills Canada BC (max. 3 teams per school / organization)

**Mission statement:**

The purpose of the challenge is to provide an opportunity for students to work together in engineering teams to creatively solve problems using programmable, (autonomous) lightweight robotic devices.

**Origin of the GEARBOTS Engineering challenge:**

The type of challenge is loosely modeled after the First Lego Leagues international competition. However, the GEARBOTS Engineering Challenge only focuses on the effective robotic engineering design and programming aspects. This type of themed challenge was developed and adapted by GEARBOTS Educational Recourses (Robotics 9 course requirement at Yale Secondary School and the GearBots engineering summer camp) to create a one-day challenge.

The idea is simple; students that are training on a number of lightweight robotic devices attend a one-day event where they participate in a themed challenge. The challenge has a number of missions from two bases. The object of the event is to work together in their engineering teams, effectively apply the iterative design process, complete as many missions as they can while accumulating the most points with the fewest penalties and lowest accumulated time.

**Event philosophy:**

This themed challenge has been chosen deliberately by GearBots Educational Resources. We wanted to create a challenge that focused more on the process rather than just the outcome of an event. Therefore, for this challenge event, only the Sr. engineering category will be awarded metals for the top ranked teams.

**Assessment philosophy:**

Teams are judged using a clear / concise assessment rubric. Teams will be assessed / ranked by the total number of missions completed (total number of points scored per mission and time) however, this should not be the only factor for determining success or failure.

**The GEARBOTS Engineering Challenge will provide students with an opportunity to...**

- Apply the practical use of math concepts and applied physics
- Solve real-world science and engineering problems, training that is transferable to all academic disciplines and career pursuits
- Gain an increased interest in science, technology, engineering, math (STEM Education)
- Understand what engineers do — the engineering profession is “demystified”
- Receive recognition and acclaim typically reserved for their peers in sports

**As a result of these types of challenges, students have an opportunity to demonstrate:**

- Abstract thinking, self-directed learning, teamwork, project management, decision-making, problem-solving, and leadership

**Overview of the GEARBOTS Engineering Challenge:**

- Teams can only use the NXT Mindstorms® or the FisherTechnik® platforms
- Engineering teams build and program a robotic device to complete a variety of missions within a set time period. Students will learn about the specific nature of the challenge on the morning of April 18<sup>th</sup> 2012
- Visit <<http://www.gearbots.org/SkillsCanada.html>> to see last year's challenge and additional documents / building plans needed for the event

**Benefits of the Challenge:**

- Little preparation needed - single day event (only basic programming skills required)
  - Converting cm in rotations or degrees, programming degree turns, wait for blocks, loops, and switches,
  - travelling to a location, collecting objects, pushing objects to drop zones, following lines, and avoiding lines / areas
- Goal of the challenge is to keep all teams as equal as possible at the start of the challenge
  - NO team will know what the challenge is before the event
- The purpose of the challenge is to provide an opportunity for students to work together in engineering teams to creatively solve problems (It is more about the process rather than the outcome/final results).

**Target Audience:** - Total of 42 teams / and max. 126 participants

- **Jr. Engineering Level** (challenge event) See below for a definition - ages 9-14 (co-educational) – Beginners / new to platform (less focus on results more on process)
- **Sr. Engineering Level** (competitive event) See below for a definition – ages 9-15 (co-educational) – Competitive teams using NXT or FisherTechnik® platforms using a number of program language like NXT-G 1.0+, CMU RobotC / NI LabVIEW, and/or ROBO Pro

**Challenge Options:** - Total of 42 teams / and max. 126 participants

- **Jr. Engineering Level** challenge event – This level is designed for teams new to the platform and want to participate with the help or assistance of their mentor / coach. This level will be considered a non-competitive challenge and teams are participating for the experience
- **Sr. Engineering Level** challenge event – This level is designed for teams wanting to participate in a competitive challenge where teams are ranked on number of missions successfully completed / total accumulated points and lowest time for all recorded missions. In this level, mentors/coaches **ARE NOT** allowed to interact with their teams.

**When and Where:**

- BC Skills Canada Provincial Competition at the TradeX in Abbotsford BC – April 18<sup>th</sup> 2012

**Registration Procedures:**

- Teams (up to 3 students ages 9-15) – all registration will be through the Skills Canada BC organization (you must first register your school with Skills BC and then your teams)
  - Fee includes: lunch provided by Skills Canada, event t-shirt, prizes, team awards, and sponsorship swag
  - Visit <<http://www.skillsCanada.bc.ca/>> to register school / teams and participants

**Timeline:**

- Teams should register with Skills Canada BC for the Provincial competition in Abbotsford
- Registration will be available on a first come first serve basis
- There will be a restriction of **three (3) teams per school / organization** – depending on demand, teams may bring more than 3 teams if space is available.

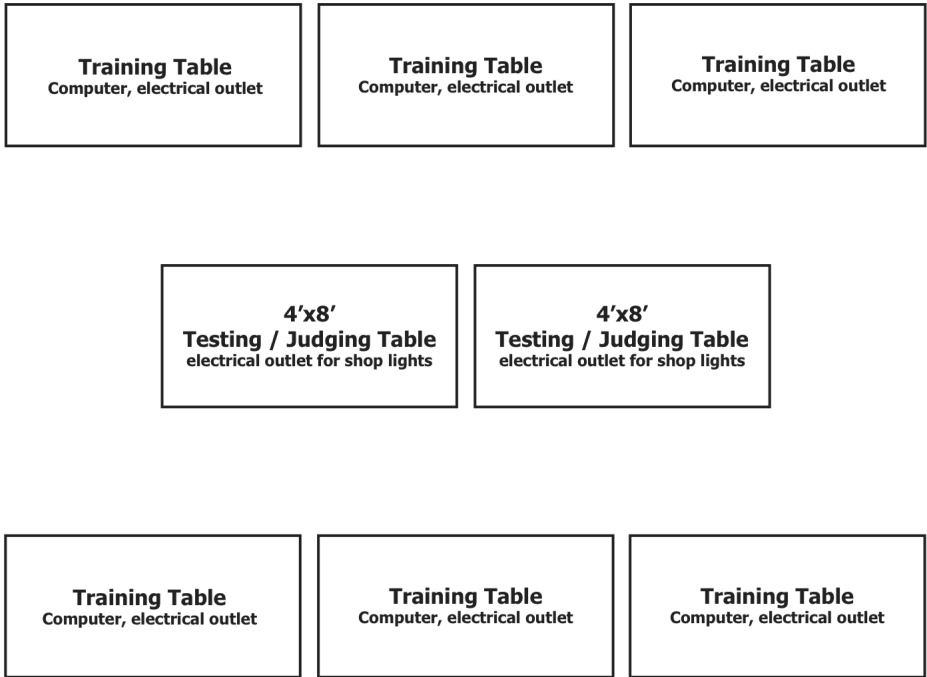
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- Event Agenda:** (Lunch will be provided by Skills Canada – only registered participants will receive a lunch)
- 8:30-9:15am Registrations / engineering teams setting up at their assigned table / orientation
  - 9:15-9:30am Team captain meeting / overview of the challenge / rules / expectations
  - 9:30-11:30am Teams working on the challenge missions / judging of individual missions
  
  - 11:30am-12:30pm Lunch Break– all teams will not be allowed to work on the challenges during the lunch break. Teams are given time to explore the other events and learn more about Skills Canada events
  
  - 12:30-2:30pm Teams working on the challenge missions / judging of individual missions
  - 2:30-3:00pm Clean-up / pack-up
  - 3:00-3:30pm Team awards / recognition / concluding comments

**Zone layout:**

Each zone will consist of 6 lab tables, 18 chairs, two 4’x8’ testing /judging tables, electrical access for 6 computers, 2 shop lights, one dedicated judge / zone leader.

**Note:** Diagram is not to scale – the challenge will have 7 zones



**Expectations for the event:**

- Teams are expected to demonstrate professional / respectful behaviour at all times during the competition (at their assigned lab tables, testing table, judging table and around the TradeX facility)
- Participants are expected to wear their name tags while in the competition area
- Participants are expected to wear their event T-Shirt
- Teams can take breaks, eat, or go to the bathroom when they need – just let your zone leader or your coach know
- During the lunch break – no teams will be allowed to work on their missions
- Teams are not to touch another team's robotic devices or materials (lab table supplies, computer, robot at testing table, etc.)
- Teams are ONLY allowed to use one computer and the required equipment. See below for further details.

**Logistics of the event:**

- For the challenge, we will have 42 teams and up to 126 participants.
- There will be seven (7) zones. Each zone consist of six (6) teams of three students each and have two (2) designated testing / judging tables
  - Testing table = 4'x8' testing board
- Each zone will have a designated judge during the event
- There will be two (2) bases (Alpha and Beta). Each base will have several primary missions and one extension mission (the extension mission can only be attempted once all of the primary missions from that base are completed and assessed)
- Running time for each mission (regardless of how many attempts are made to complete each mission)
- If a problem arises, teams are to communicate immediately with the zone leader / judge for directions
- Teams can use their time however they wish and primary missions can be done in any order (exception will be the start of the competition and the extension mission)
- Once a team has mastered a mission, they can asked the designated zone judge to assess the mission
- Once a mission has been assessed, teams are to start working on a new mission
- Once a mission has been assessed, robot/program can be altered for the next mission

**Rules for the event:**

- Robots must be autonomous (no Bluetooth control or other wireless remote devices allowed)
- Teams can only use the required equipment and programming language (see section above)
- Teams are free to build whatever devices they need to complete the missions
- Teams are free to use a variety of programming software (ie. NXT-G 1.1/2.0/2.1, RobotC, NI LabVIEW or FisherTechnik® Robo Pro) to complete the missions
- Teams can start at any primary mission for either the ALHPA or BETA BASES
- Teams cannot physically touch / alter robotics path once the mission has started
- The robot must fit completely within the starting base (exception will be given to the wires)  
- Dimensions of the start box is W=12" H=12.3"
- Wires communication / controls cannot be used to complete the mission (only for downloading programs)
- The robot can touch the side boards and use the side boards to complete the missions
- On returning to base, time stops once the robot crosses into the base – teams can touch the robot once this happens
- If you want to abort the mission and start over, a small point deduction will be assessed by the judge (running time until the team has completed the mission)
- For the Sr. Engineering Level category, coaches / mentors **are not** permitted to assist their teams in completing any aspect of the missions
- When the robot is in the ALPHA BASE or BETA BASE, altering the device is permitted (i.e. changing programs or adding and removing attachments)
- No touching the judging table once a mission has been started
- Teams can start with any primary mission from either the ALPHA BASE or BETA BASE

**Assessment of missions:**

- Judges interpretation / assessment of the missions are based on an assessment rubric and are considered final
- Tan lines or other designated lines/objects (one dimensional) on the board are "No Touch Zones" (a small point deduction will be applied if your robot touches or crosses over them - an exception to this rule is the wires on the robot)
- For each mission, teams will be awarded points for achieving the required elements of the mission. Also, the time will be recorded for each mission. Teams will be assessed on the total points awarded, their mission times and lowest time

**The "DO OVER" Clause – Only for the Jr. Engineering Level**

- The "**Do Over**" Clause applies only to the Jr. Engineering category – What do we do when the wheels fall off? Each team will be given a booklet of three (3) "**Do Overs**". They can be used start the current mission over. It cannot be used to start a past mission over in the hopes of improving you overall score. No penalty points will be deducted and the team is awarded a fresh start. Once they are used, they are gone. – teams cannot use another team's unused "**Do Overs**".