National Robotics Competition 2018

NRC – WRO Challenge Manual

Organised by:

Operational Partner:

A. Competition Categories

World Robot Olympiad has three regular competition categories, and an Open category:

1. Regular Category
   - Elementary (Primary)
   - Junior (Secondary)
   - Senior (Tertiary)
2. Open Category

A team may only participate in one category each year.

B. Age Group Definition

1. Primary: Participants up to 12 years old in the year of competition.
2. Junior (Secondary): Participants 13 - 16 years old in the year of competition
3. Senior (Tertiary): Participants 16 – 19 years old in the year of competition

Winning teams with members at the age of 16 in the competition year will not be eligible to compete in the WRO Junior High category. The next best ranking team with the appropriate age requirements will qualify.

NOTE:

- It is strictly enforced that students cannot be older than specified in the Age Group Definition.
- If all members of a team are younger than required, then the team must participate in the corresponding competition.
- Participants are not confined to school- going students. Anyone can participate in the corresponding age groups.

C. Team Definition

NRC is a team- based challenge. To participate in each category of competition, students must work in teams.

A team consists of one (1) coach and maximum 3 team members.

One (1) coach and one (1) team member is not considered to be a team and cannot participate.

D. Coaches

The minimum age of a coach in the NRC tournament (and assistant coaches) is age 20 at the time of registration for the NRC final.

Coaches may work with more than one team; however, each team needs to be assisted by a responsible adult. This person may be an assistant coach.

Coaches may offer students advice and guidance prior to the competition, however during the actual competition, **all work and preparation** must be performed by the student members of the team.

E. General Rules – Regular Category

1. The rules of competition at NRC

1.1. **NRC will follow the gameplay of WRO Challenge for the elementary, junior and senior categories. The respective categories in NRC are Primary, Secondary and Tertiary.**

1.2. A surprise additional rule may be announced on the morning of the competition.

1.3. The announcement of this additional rule will be handed over to each team in writing.

1.4. The finals for the presentation will be on 7th September. Top selected teams will be called back from each category for the finals.

1.5. The finals for the challenge will be on 8th September. The following teams will be called back for the finals:

- Top 20 Primary teams
- Top 20 Secondary teams
- Top 10 Tertiary teams

2. Qualification for participation and team composition

2.1. Age of participants – Please refer to Section B - “Age Group Definition”

2.2. Team composition – Please refer to Section C – “Team Definition”

2.3. Team coach – Please refer to Section D – “Coaches”

3. Material

3.1. **The controller, motors and sensors used to assemble robots must be from LEGO® MINDSTORMS ™ sets (NXT or EV3). The HiTechnic Color Sensor is the only third-party element that can be added to this configuration.**

3.2. **Only LEGO branded elements may be used to construct the remaining parts of the robot. NRC recommends use of Education versions of LEGO MINDSTORMS.**

3.3. **The EV3/NXT Intelligent Brick, motors and sensors must be AUTHENTIC LEGO parts. Modification of any original parts eg. EV3/NXT Intelligent Brick, motor, sensors etc are not allowed. Violation of this rule may result in disqualification.**

3.4. Teams should prepare and bring all the equipment, software and portable computers they need during the tournament.

3.5. Teams should bring enough spare parts. Even in the case of any accidents or equipment malfunction, the council (and/or organizing committee) is not responsible for their maintenance or replacement.

3.6. Coaches are not allowed to enter the court to provide any instructions and guidance during the competition.

3.7. **All the parts for the robot should be disassembled and in their initial state (not pre-built) when the assembly time starts. For example, a tire cannot be put on a wheel until assembly time begins.**

3.8. Teams may not use any instruction sheets/guides to assemble their robot, whether written, illustrated or pictorial no matter what format they are in (including paper- based and digital).

3.9. Teams can do the necessary programming beforehand.

3.10. It is not allowed to use screws, glues or tape or any other Non-LEGO material to fasten any components on robots. Non- compliance with these rules will result in disqualification.

3.11. Control software **depends on the Challenge category:**

a. For **Primary and Junior (Secondary) age group** only ROBOLAB®, NXT® and EV3 software is allowed.

b. In the **Senior (Tertiary) age group** it is allowed to **run any software and any firmware on NXT / EV3 controllers.**

3.12. The motors and the sensors for the robot are supplied by LEGO® and HiTechnic. Any other products are not allowed. Teams are not allowed to modify any original parts (for example: EV3, NXT, motors and sensors, etc.) A robot made with modified parts will be disqualified at that match. Allowed sensors and motors:

	9842 - NXT Motor with Tacho
	9843 - NXT Touch Sensor
	9844 - NXT Light Sensor
	9845 - NXT Sound sensor
	9846 - NXT UltraSonic sensor
	9694 - NXT Colour sensor
	45502 – Large Motor
	45503 – Medium Motor
	44504 – Ultrasonic Sensor

	44506 – Color Sensor
	44507 – Touch Sensor
	44509 – Infrared Sensor
	45505 – Gyro Sensor
	HiTechnic NXT Color Sensor V2

4. Regulations about the robot

4.1. The maximum dimensions of the robot before it starts the “mission” must be within 250mm × 250mm ×250mm. After the robot starts, the dimensions of the robot are not restricted.

4.2. Teams are allowed to use only one controller (NXT or EV3).

4.3. The number of motors and sensors to be used is not restricted. However, it is only allowed to use official LEGO® materials to connect motors and sensors.

4.4. It is not allowed for the teams to perform any actions or movements to interfere or assist the robot after the actions to start the robot is performed (the program is run or the central button is pressed to activate the robot). Teams that violate this rule will get a score of 0 in this particular run.

4.5. A robot must be autonomous and finish the “missions” by itself. Any radio communication, remote control and wired control systems are not allowed while the robot is running. Teams in violation of this rule will be disqualified and must quit the competition immediately.

4.6. The robot can leave on the field any parts of the robot that are not containing main units (controller, motors, sensors) if needed. As soon as the part is touching the field or its game element and does not touch the robot it is considered as a free LEGO element not being part of the robot.

4.7. The Bluetooth and Wi-Fi function must be switched off at all times. That means that the full program needs to run on the controller.

4.8. Use of SD cards to store programs is allowed. SD cards must be inserted before the robot is inspected and may not be removed for the duration of the competition once inspection is completed.

4.9. No multiplexers allowed.

5. Prior to competing

5.1. Each team must prepare for the match in their specified place until the “check time”, when the team’s robot must be placed in a designated area.

5.2. Teams cannot touch designated competition courts before the start of the “assembly time” is announced.

5.3. Judges will check the state of parts before announcing the start of the assembly time. Teams must show that their parts are separated. Team members cannot touch any parts or computer during this “check time”. The assembly time doesn’t begin until officially announced at the event.

6. Competition

6.1. The competition consists of 150 minutes of assembly, programming and calibration, and 2 runs for the challenge. Each team will be allowed to go for all 2 runs. The best score among the 2 runs will be considered as the final score.

Surprise rule may be implemented to test the team's ability to adapt/modify their robot and programming.

6.2. Competitors are NOT allowed to assemble their robot outside of specified assemble, maintenance and testing times.

6.3. All teams will be given time for calibration their robot before each round.

6.4. Competitors begin testing their robots once the time is officially announced at the event and can immediately start the test runs.

6.5. Upon successful inspection of the physical dimensions of the robot, the robot will be allowed to compete.

6.6. If a violation is found at the inspection, the judge will give the team three (3) minutes to rectify the robot. However, it is not possible to participate in the match if the violation is not corrected during the time given.

6.7. Before the robot is placed in the quarantine area for inspection the robot must have only one executable program with the name "run2018".

6.8. The robot will have 2 minutes to complete the challenge. Time begins when the judge gives the signal to start. The robot must be placed in the starting area so the projection of the robot on the game mat is completely within the start area. The EV3/NXT robot is switched off. The participants are allowed to make physical adjustments to the robot in the starting area. However, it is **not allowed** to enter data to a program by changing positions or orientation of the robot parts **or to make any sensor calibrations of the robot.** If a judge identifies this the team could be disqualified from the competition.

6.9. Once physical adjustments have been made to the satisfaction of the participants, the judge will give the signal for the EV3/NXT robot to be switched on and a program to be selected (but not run). After that the judge will ask the team about the way to run the robot. There are two possible cases:

a. the robot starts moving immediately after the running the program.
b. the robot starts moving after pressing central button, **other buttons and sensors cannot be used to start.**

If option a) is used the judge provides a signal to start and the team member runs the program. If option b) is used the team member runs the program and waits for its start. No changes in position of

the robot or its parts are allowed in this moment. Then the judge provides the signal to start and the team member presses the central button to start the robot.

6.10. If there is any uncertainty during the task, the judge makes the final decision. They will base their decision to the worst outcome available for the context of the situation.

6.11. Your attempt and time will end if:

a. Challenge time (2 minutes) has ended.
b. Any team member touches the robot during the run.
c. The robot has completely left the game table.
d. Violation of the rules and regulations within.
e. The mission is completed.

6.12. The score calculation is done by the judges at the conclusion of each round. The team must verify and sign the score sheet after the round, if they have no fair complaints.

6.13. The ranking of a team is decided depending on the overall competition format. **For example:** it could be the best score of a round or the best run out of two rounds. If competing teams acquire the same points, the ranking is decided by the record of time (where time has not already been taken into consideration of the scores calculation). If teams still remain tied, rankings will be determined by consistency of performance by examining which team achieved the next highest score during previous rounds.

6.14. Outside specified assembly, programming, maintenance and testing time it is not allowed to modify or exchange the robot. (For example, during inspection time teams are not permitted to download programs to robots or change batteries). However, batteries are allowed to be charged during any specified inspection time. Teams cannot request time out.

6.15. The score will never result in a negative score. If the score would be negative in case of penalty points, then the score will be 0, example: A team got 5 points for mission and 10 penalty points, then the team will be ranked with 0 points. Same goes for a team with 10 points for a mission and 10 penalty points.

Grand Finals (8 September 2018)

6.16. The top 20 teams from each of the Primary and the Secondary Divisions and the top 10 from the Tertiary Division will pit their robots against one another to vie for the Best Robot Performance Award.

6.17. Details of the Surprise Mission will only be made known in the morning of the Grand Finals. Teams will be given approximately 3 hours to modify their robots to accomplish this mission. Results from the Surprise Mission will be used to determine the Best Robot Performance Award.

7. Presentation for Regular Category

Format of Competition

The competition will have three regular categories: Primary, Secondary and Tertiary levels. It will run over a four days' period, from 3rd of September to 6th of September 2018.

The details of the presentation are as follows:

7.1. The judging will be executed in three age groups: Primary, Junior (Secondary), and Senior (Tertiary). Please refer to Section B – "Age Group Definition"

7.2. Teams will do their presentation in a room with a panel of Judges after they have completed their 2 Challenge Runs.

7.3. Each team will have to prepare a presentation with a duration of 5 to 7 minutes (Q&A session will be immediately after the presentation for another 3 to 4 minutes).

7.4. The teams are allowed to use **any** visual materials for their presentations (e.g. laptop, charts, tri fold boards, etc)

7.5. The whole team is required to be present for the presentation.

7.6. Official language for all presentations is English. Interpreters are not allowed.

8. Judging Criteria for Regular Category Presentation

Category	Criteria	Points
Programming (Total Points: 50)	**Automation** - The project uses appropriate inputs from sensors to run specific routines and clearly demonstrates automation in the completing of the tasks.	**15**
	Good Logic - The programming options used make sense, work reliably, are relevant in terms of their use, complexity and design.	**15**
	Strategy - Use of sub-routines and sub-functions, how the team complete mission objectives, Coming up with different strategies to see what works.	**20**
Engineering Design (Total Points: 50)	**Technical Understanding** - Team members are able to produce clear, precise, and convincing explanations about each step of the mechanical and programming process	**10**
	Engineering Concepts - The project shows evidence and good use of engineering concepts and team members are able to explain the concepts and need for use. Designer / Builder applications.	**10**
	Mechanical Efficiency - Parts and energy have been used efficiently - evidence of proper use of mechanical concepts / principles (gears/pulleys/levers/wheels & axles)	**10**
	Structural Stability - The project (robots and structures) are strong, sturdy and the demonstration can be run repeatedly - parts don't detach - little need for repairs.	**10**
	Aesthetics - The Robot design is functional yet unique and aesthically appealing.	**10**
Presentation (Total Points: 50)	**Successful Demonstration** - Interesting method of presentation to translate the Theme.	**15**
	Communication & Reasoning Skills - The team are able to present their project idea in clear, concise and engaging way.	**15**
	Quick Thinking - The team are able to easily answer questions about their project. They are also able to deal with any problems that arose during the presentation.	**10**
	Visuals and Decorations / Props - The materials used to communicate the project to others are unique, interesting and aesthically appealing.	**10**

Content (Total Points: 50)	**Contents** - There is evidence that team members explains the depth of the content relevant to the theme.	**15**
	Research skills - The team is able to show how they conduct their research & the sources they obtained their information from. Eg.Internet, survey.	**15**
	Learning value - The team is able to explain the research journey and give an insight to what they have learnt.	**20**
	Maximum Points	**200**

8.1. During Presentation Prelims, teams will need to show the Judges a short video of the robot running according to the challenge requirements.

Presentation Finals (7 September 2018)

During the finals, shortlisted teams will give a presentation focusing on the award for which they are being considered. E.g. Teams considered for the "The Best Content Award" are to pitch their presentation towards their content research.

Each team is given only **10 mins** (5 mins presentation, 5 mins Q&A) for the presentation finals.

Important notes:
Teams that are considered for the presentation finals will be informed through their touch-point (either their teachers-in-charge or their team leaders). **Each team is to provide its touchpoint's contact number when they register for the presentation preliminary.**

9. The Championship Awards

This is the most prestigious award that a team can win. It is bestowed on the team that embodies the NRC spirit.

Teams are considered for the *Championship Award* based on their overall excellence and total learning experience during the course of the competition.

As a *Championship Award* recipient, the winning team is recognised as being outstanding and the assessment is based on the scores of the top 20 finalists according to the following weightage:

- 60% on Robot Performance (Surprise Mission Score)
- 40% on Best Presentation (10% Programming, 10% Engineering Design, 10% Presentation and 10% Content)

10. Competition Area

10.1. Teams are allowed to fix/programme their robot in the designated area provided by tournament officials (each team has its own area). People, other than competing students are not allowed to enter the competition area, apart from authorized NRC Organizing Committee staff and special personnel.

10.2. The standard of all competition materials and courts are according to what are provided by the committee on the competition days.

11. Prohibited matters

11.1. Destruction of competition playing fields, materials or robots of other teams.

11.2. Use of dangerous items or behaviours that may create or cause interference with the competition.

11.3. Inappropriate words and/or behaviour toward other team members, other teams, audience, judges or staff.

11.4. Bringing a cellular/mobile phone or a medium of wire/wireless communication into the designated competition area.

11.5. Bringing food or drink into the designated competition area.

11.6. Competitors using any communication devices and methods while the competition is in process. Anyone outside the competition area is also banned from talking to or communicating with competing students. Teams violating this rule will be considered as disqualified and should quit the competition immediately. If communication is necessary, the committee may allow team members to communicate with others under supervision by tournament staff or by exchanging a note under permission by judges.

11.7. Any other situation which judges might consider as interference or violation of the spirit of the competition.

11.8. The organisers reserves the rights to disqualify teams that don't adhere to the rules, and to amend the rules at any time without prior notice.

Updated on 30 July 2018