WORLD ROBOT OLYMPIAD™

WRO®

JAPAN

RoboMission ミドル競技
Elementary Game Rules
Ver. 1.1

CONNECTING THE WORLD
MARINE LIFE PRESERVATION

Official Game Rules for the WRO International Final. Version: January 15th 2023

(Note: Rules for local WRO events may vary!)

LEGO education™

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Information on how to use these game rules in countries:

We deliberately have a mix of simple and more difficult tasks in the game rules. These rules are also used for the WRO International Final, where we expect to see many teams that can solve all missions. At a local, regional or national level however, there will be many teams that do not have the experience, knowledge or time to solve everything. This is intentional. By offering simple and more complicated tasks all teams will be able to solve parts of the challenge and can keep trying to improve their work. (Also see chapter 6)

※ このルールブックは，WRO 2023 RoboMission Elementaryのルールをもとに，WRO Japan RoboMission 競技委員会がWRO 2023 Japan決勝大会 ミドル競技 Elementary部門用に一部を修正し，作成しています．

更新履歴：
Ver. 1.1：8ページの得点表の2段目の得点「15点」を「20点」に修正

1. Introduction

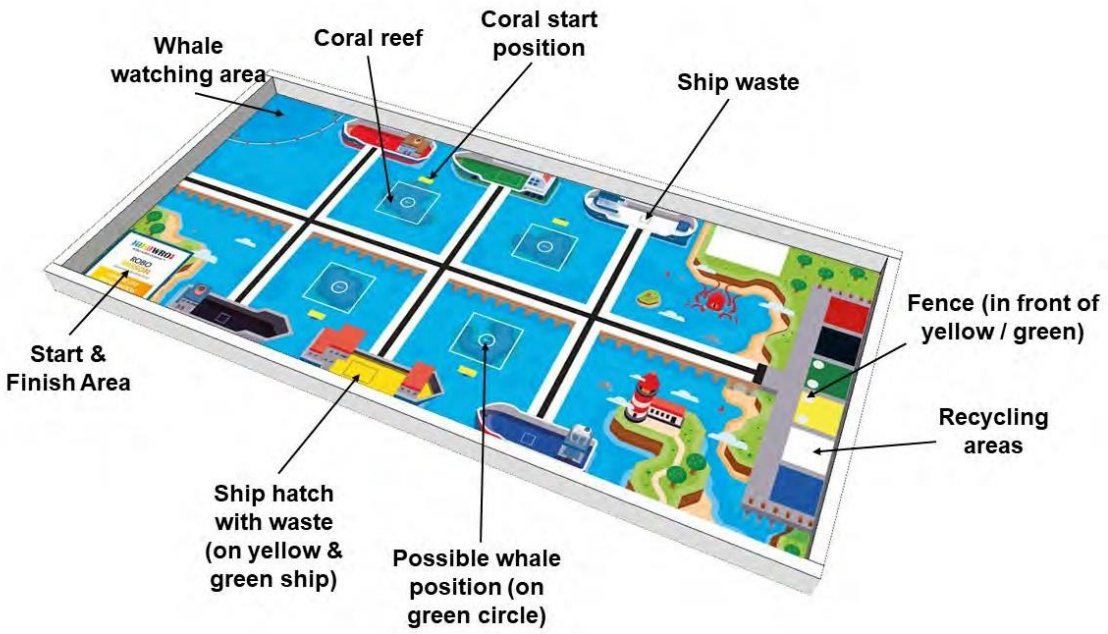
Life underwater is important and humans depend on it for food, clean drinking water and even for protection against flooding. That is why it is important that we protect the water against pollution and that we protect and restore the underwater eco-systems.
To protect our oceans, we have the “MARPOL convention.” It is an agreement between countries worldwide that ships cannot pollute the water and throw their waste overboard. This means that ships will need to save all their waste until it can be collected.

There are also many initiatives that help to restore underwater areas. One of the most important is the protection and restauration of coral reefs. Many other underwater animals find food and protection there and these reefs also reduce the risk to coastlines from flooding.
But the coral reefs are damaged in many places. Researchers are working hard on finding ways to restore the coral reefs. One solution is growing corals in an aquarium and then bringing them to the existing reef.

On the Elementary game field, the robot will help managing ship waste, restore coral areas and rescue a whale from a shallow area in the sea.

2. Game Field

The following graphic shows the game field with the different areas.



If the table is larger than the game mat, place the two sides of the start area against the walls.

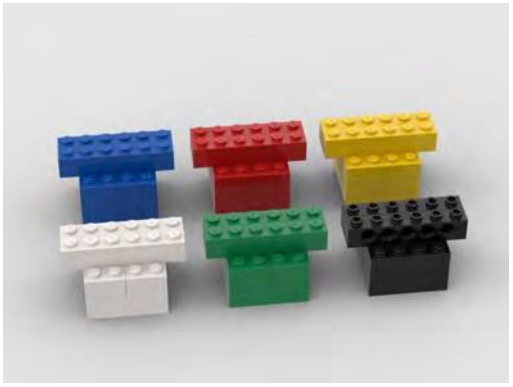
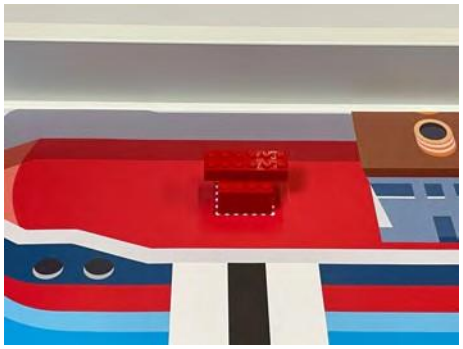
For more information about the table and game mat specifications, please take a look at WRO RoboMission General Rules, chapter 6.

3. Game Objects, Positioning, Randomization

Waste (1x)

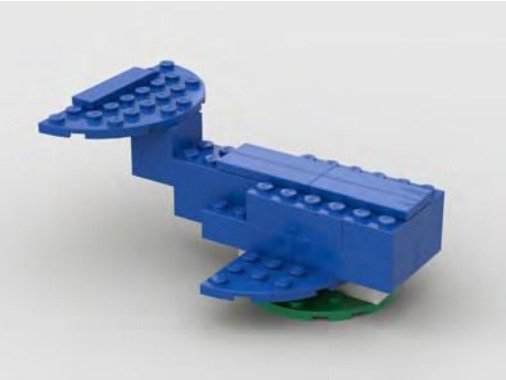
In every round there is one waste objects on the field:

- **One of four other** waste objects is **randomly selected in each round**, it is placed on the ship of their colour.

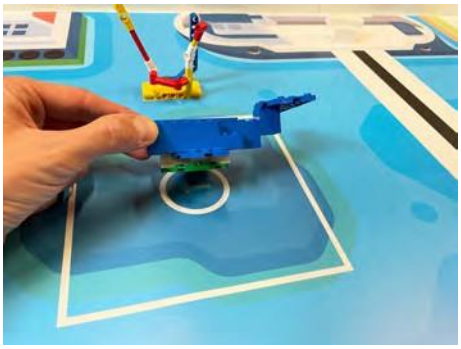
 Waste objects (one red, one black, one white, one blue)	
 Start position of waste *(on a ship, always in this orientation with the long side parallel to the wall.* *Possible ships:* *red, black, white and blue)*	

Whale (1x)

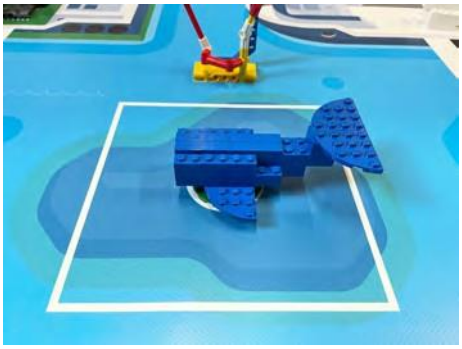
There is one whale on the field. The whale is **randomly placed in each round** on one of the white circles on the field. The whale is always placed looking in the direction of the little arrow on the game field, see the following photos.



Whale (1)



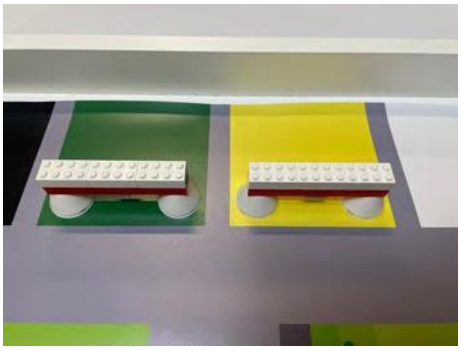
Place in orientation of the arrow



Start position of object on the field
(one possible start position)

Fence (2x)

Two fences are placed in front of the yellow and green recycling areas.

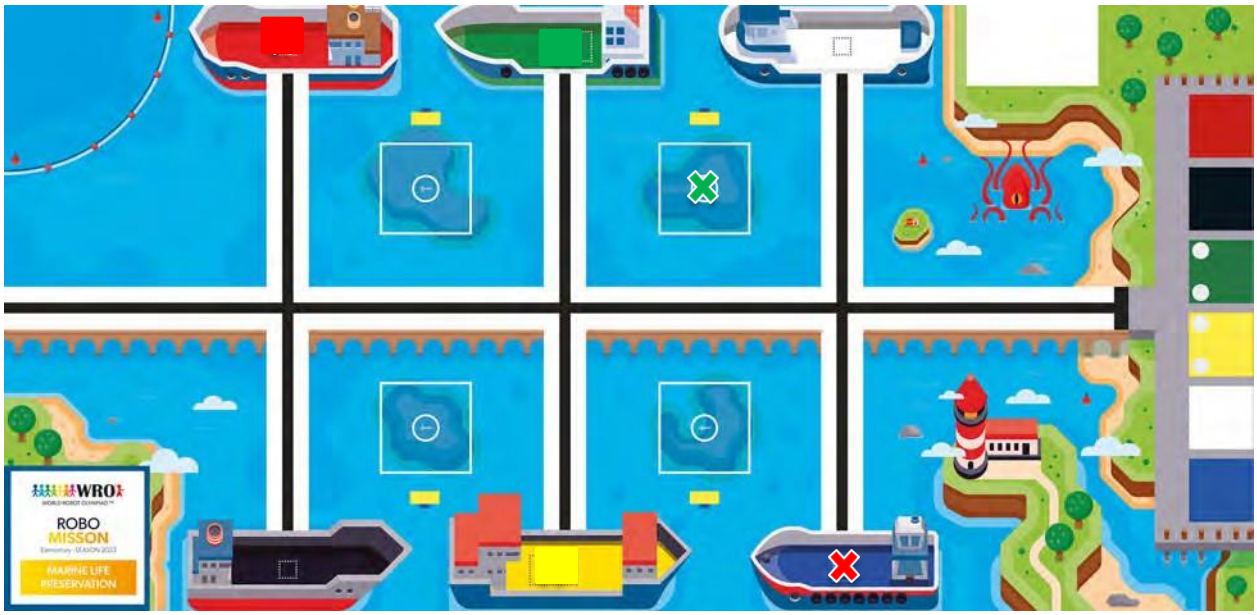
 Fence (2)	 Start position of the fences

Summary randomization

On this field, the following objects are **randomly placed in <u>each round</u>**:

- One waste object on ships that is not the green or yellow ship
- The whale on one of the white circles

One possible randomization you can see here: green X for the whale, red X for waste object (here on blue.)



4. Robot Missions

For greater clarity, the missions will be explained in multiple sections. The team can decide which parts of the missions they will do and in which order. Final scoring will be based on the situation on the field at the end of the run.

4.1 Manage Ship Waste

The robot should bring the waste from the ships to the recycling areas on the game field, therefore, the robot needs to collect the waste from the ships.

Full points are awarded if the waste is in the corresponding-coloured recycling area (e.g. the blue waste in the blue recycling area).

4.2 Rescue the Whale

A whale has been spotted in one of the coral reefs. The sea is shallow there and it is not the best place for this big animal. It might be lost. There is a whale watching area in the open ocean where people can see these animals in their natural environment. The robot should bring the whale from the coral reefs to the whale watching area in the open ocean.

Full points are awarded if the projection of the whale is completely inside the whale watching area. The whale watching area is defined by the dark blue line in the top-left corner. The dark blue line itself does not belong to the whale watching area. It is not allowed to damage the whale game object.

4.3 Get bonus points

Bonus points will be awarded for not moving or damaging the fences. A fence is moved if at least one pillar of the fence is no longer touching the grey circle where it is placed at the beginning.

4.4 Park the robot

The mission is complete when the robot returns to the Start & Finish area, stops, and the projection of the robot is **partly (top-view) within the Start & Finish area**.

5. Scoring

Definitions for the scoring

“Completely” means that the game object is only touching the corresponding area (not including the black lines).
Please note that there is a new rule about damaged game objects in the RoboMission General Rules (Rule 6.8).

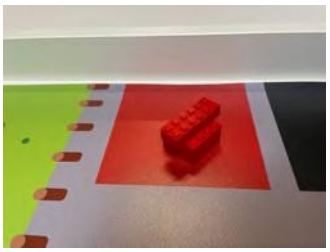
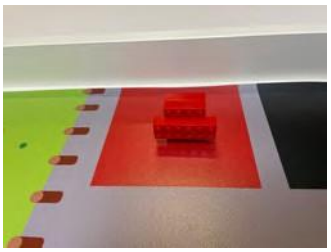
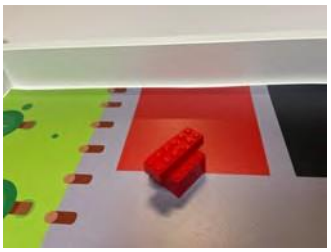
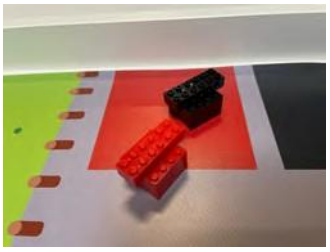
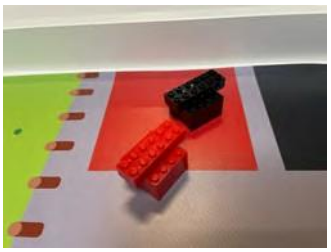
Tasks	Each	Max.
Manage Ship Waste		
Red/Black/White/Blue Waste is completely inside the recycling area of the corresponding colour.	**30**	**30**
Red/Black/White/Blue Waste is touching the recycling area of the corresponding colour.	20	
Red/Black/White/Blue Waste is outside the ship.	**10**	**10**
Rescue the whale		
The projection of the whale is completely in the whale watching area and the whale game object is not damaged.	**20**	**20**
The projection of the whale is partly in the whale watching area and the whale game object is not damaged.	10	
Get bonus points		
Fence pillars are touching the gray circles and fence is not damaged	**10**	**20**
Park the robot		
Projection of the robot is partly in the Start & Finish Area *(only if other points, not bonus, are assigned)*		**20**
Maximum Score		**100**

Scoring Interpretation

Red/Black/White/Blue Waste is <u>completely</u> inside the recycling area of the corresponding colour. ➔ 30 points

Red/Black/White/Blue Waste is <u>touching</u> the recycling area of the corresponding colour. ➔ 20 points

Red/Black/White/Blue Waste is outside the ship. ➔ 10 points

 40 points (completely inside and outside the ship)	 40 points (ok if lying)	 30 points (only touching and outside the ship)
 30 points for red object(only touching and outside the ship) in the case that waste is red	 30 points (in this case it counts as touching the correct black area)	 10 points for black object (only outside the ship) in the case that waste is black

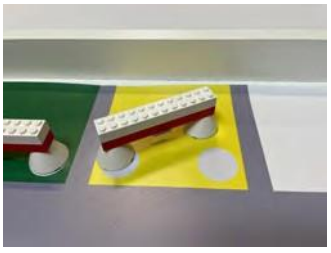
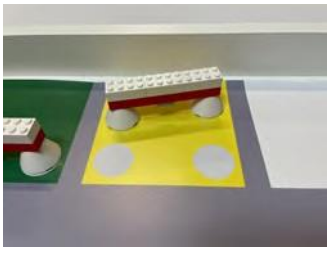
The projection of the whale is completely inside the whale watching area and the whale game object is not damaged. ➔ 20 points
The projection of the whale is partly the whale watching area and the whale game object is not damaged. ➔ 10 points.
Note: The whale watching area is defined by the **dark blue line** in the top-left corner. The dark blue line itself does not belong to the whale watching area.

10 points (projection partly)

20 points (projection completely)

0 points (whale damaged)

Fence that is not moved or damaged. ➔ 10 points.
Note: A fence is moved if at least one pillar of the fence is no longer touching the grey circle where it is placed at the beginning.

 10 points, OK not moved.	 0 points, not OK moved.	 0 points, not OK moved.
 0 points, damaged.		

Projection of the robot is partly in the Start & Finish Area
(only if other points, not bonus, are assigned) ➔ 20 points.

Please note: The blue line surrounding the area does not belong to the area, the project has to be over the white inner area. Cables only do not count for the projection of the robot.

		
The projection of the robot is not in the area, 0 points.	The projection of the robot is partly in the area, 20 points.	The projection of the robot is completely in the area, 20 points.

Scoring Sheet

Team name: _____ **Round:** _____

Tasks	Each	Max.	#	Total
Manage Ship Waste				
Red/Black/White/Blue Waste is completely inside the recycling area of the corresponding colour.	**30**	**30**		
Red/Black/White/Blue Waste is touching the recycling area of the corresponding colour.	15			
Red/Black/White/Blue Waste is outside the ship.	10	10		
Rescue the whale				
The projection of the whale is completely in the whale watching area.	**20**	**20**		
The projection of the whale is partly in the whale watching area.	10			
Get bonus points				
Fence pillars are touching the gray circles and fence is not damaged	**10**	**20**		
Park the robot				
Projection of the robot is partly in the Start & Finish Area *(only if other points, not bonus, are assigned)*		**20**		
Maximum Score		**100**		
			Total Score in this run	
			Time in full seconds	

6. Local, regional, and international events

WRO competitions take place in around 90 countries, and we know that teams in each country expect a different level of complexity. The challenge as described in this document will be used for international WRO events. This is the last stage of the competition, where the teams with the best solutions participate. That is why the game rules are challenging.

WRO feels that all participants need to be able to have a good experience in the competition. Teams with less experience should also be able to score points and succeed. This builds confidence in their ability to master technical skills, which is important for their future choices in education.

We deliberately have a mix of simple and more difficult tasks in the game rules. This means that all teams will be able to solve parts of the challenge and can keep trying to improve their work.

WRO Association recommend that our National Organizers consider the situation in their country. They can adapt the rules for events in their country even further. They can decide to make the challenges easier for local, regional, and national events, so that all participants have a positive experience.
All National Organizers can make their own choices, so each competition fits their specific situation and ideas. Here we provide some ideas to make the challenges easier.

Ideas for simplifications:

- Have a fixed position of the whale (communicated before or selected at the start of the competition day
- Have two fixed colours of the waste objects that are placed on the mat (communicated before or selected at the start of the competition day)
- Take out one or both fences (in this case adjust the scoring for bonus points)