Take care: those rules are a Beta version. There are not the final one

Moon Village !

Moon destination!

A. Contest presentation

Eurobot^{open} and Eurobot^{open} Junior are two events open to young robotics teams of amateurs. These teams can be composed of students involved in Eurobot^{open} in the frame of a school project, group of friends, or independent clubs. Eurobot^{open} and Eurobot^{open} Junior share the same goal: to allow young people to be involved in an active-learning process and put into practice their knowledge and know-how by participating in a fun and friendly event.

About Eurobot^{open}

The age limit for participating in the Eurobot^{open} final is 30 years old. Each team may have a supervisor to whom the age limit does not apply. Teams that do not respect this age limit will not be allowed to participate in the Eurobot^{open} final. The technical challenge is to build an autonomous robot as well as an optional secondary autonomous robot.

About Eurobot^{open} Junior

The age limit for participating in the Eurobot^{open} Junior final is **18 years old**. Each team may have a supervisor to whom the age limit does not apply. The technical challenge is to build a **remote controlled robot** as well as an optional autonomous robot.

Be careful, according to your country's educational system, this age limit may be slightly different. Check the registration requirements stated by your National Organizing Committee.

A team is a group of young people who have built one robot (and optionally a secondary robot) for the event.

One person can be part of only one team, **even if several teams can belong to the same organization**. However, we encourage teams to share their experiences. The project can be supervised by someone over the age limit (teacher, parent, group leader, etc.), but the robot **must be designed and built completely by the team's members**, not the supervisor.

One organization (club, school, etc.) can supervise and register several teams, if allowed by the registration requirements set by your National Organizing Committee. The acceptance of these requirements is compulsory to validate your registration and your entry.

Eurobot^{open} and Eurobot^{open} Junior are intended to be held in a friendly, sporting and fair-play spirit. As every sport events, refereeing decisions are pronounced with no possible recourse, except if an agreement between each participant is met.

Eurobot^{open} and Eurobot^{open} Junior European finals gather teams which are selected on national finals. These final events take place in Europe, but remain open to all other countries. Countries where more than three teams are registered must organize a national qualification[1], in order to select teams among registered teams that will attend the international final.

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[1] National Robotic Cup for Eurobot^{open} or National Robotic Challenge for Eurobot^{open} Junior

As usual, some parameters can vary from one year to the next. Accordingly, please read the rules carefully even if the chapters may seem familiar to you (playing field dimensions, robots dimensions, starting area dimensions etc.).

The rules for both events (Eurobot[open] and Eurobot[open] Junior) are similar. The aim of this approach is to provide an almost common platform for the Eurobot[open] event, dedicated to autonomous robots, and for Eurobot[open] Junior event, dedicated to wire-guided robots. Thus, a Eurobot[open] organizer has also the ability to organize a Eurobot[open] Junior contest, and vice versa. Think about it when you will organize an official or friendly event.

WARNING! : This document presents the Eurobot[Open] and the Eurobot[Open] Junior 2017 rules. To distinguish between them, you will find information dealing with Eurobot[Open] in blue and Eurobot[Open] Junior in yellow. Information common to both rules is in black.

B. Theme presentation

The Moon has always fascinated men. Our natural satellite, even if it's difficult to reach as situated averaging 238 897 miles away from the earth, has an important influence on our planet and way of life. Without the moon, we would almost have no tides.

To date, 12 men had the chance to walk on it. The first and most famous one is Neil Armstrong followed by Buzz Aldrin the 21 June 1969. The last space exploration mission of Apollo Program was in 1972, 44 years ago!

Since then many projects are being studied like a permanent Moon base construction since 2008.

It would allow a better scientific Moon exploration but could also be used as a launch base to reach planet Mars or even further. The low gravity of the Moon, 6 times less important than the one of the Earth, facilitates the launch rocket process.

A lunar base will also permit, for example, titanium exploitation while it is rare and difficult on Earth.

In March 2016, ESA (European Space Agency) has revealed its Moon village project which will take place in 20 years. The target is to create a basis with all materials found on the Moon in collaboration with all interested countries which will bring their knowledge in different fields. The Moon village project would be the first step towards men's facility in space.

It is within this target that your robots will set out to conquer the Moon.

Your missions will be:
- Collecting titanium ores or extracted from the Moon ground and lunar modules brought back from Earth by rocket.
- Building a Moon base: thanks to lunar modules brought from Earth and the ones already on the Moon.
- Funny action: launching a spacecraft in order to prepare flights leaving for planet Mars.
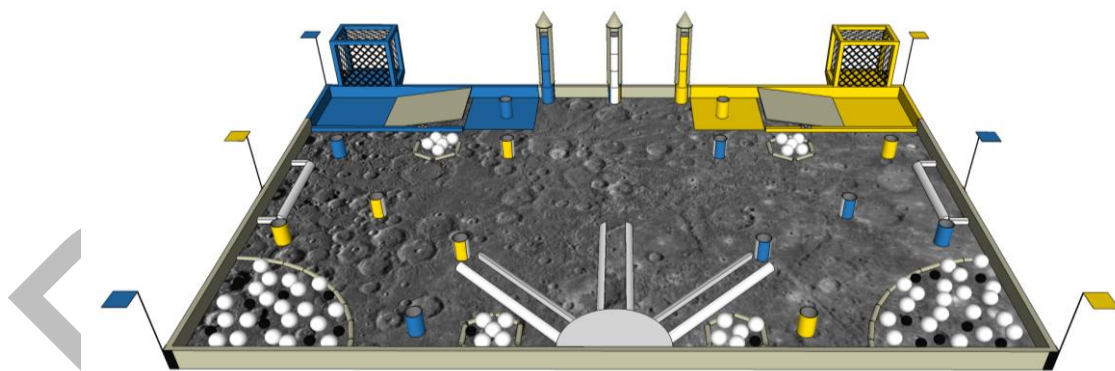

Figure 1 : Overview of the playing area with playing elements

Watch out:

All actions are independent some of the others and no order is imposed.

No action is obligatory. Give careful thought to your strategy.

C. Playing area and actions

1. Important information:

Organizers commit themselves to build the playing area with as much accuracy as possible. Nevertheless, they reserve the right to some modifications if they think it is necessary.

No objections regarding differences in dimensions will be taken into account.

Eventual changes of the technical specifications will be announced on the Eurobot website, (http://www.eurobot.org/) or on the website of the National Organization Committee (NOC) in your country.

Teams are advised that the quality of the painting on surfaces can vary from one table to another, and can deteriorate as time goes by.

If any problems concerning the rules occur, the specifications of the playing area and its elements could be changed during the year. We therefore strongly encourage the participants to check our website regularly (http://www.eurobot.org/) as well as your NOC's own website for news. You can also follow the discussions and get further information in the forum (http://www.planete-sciences.org/forums/).

The answers in the forum are provided by an official referee and are official answer taken into account during matches and approvals.

2. Playing area

The playing area is a 3000x2000 mm rigid rectangular flat, which can be made in two parts of 1500x2000 mm or more. References are provided in the appendix.

Warning: this year, the Eurobot^open Junior playing area is not 10% tilted towards the publics, but it is horizontal like the Euroboto^pen playing area.
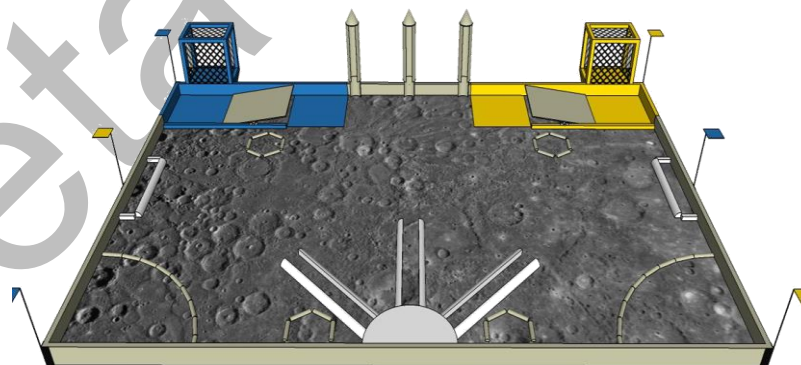
Figure 2 : Overview of the playing area without any elements

Full specifications of the playing area and playing elements (dimensions, positions at the beginning of the match, colors and other references) are listed in the appendix.

In the rest of the document, horizontal and vertical directions are stated relative to the playing area. Notions of "left", "right", "front", and "back" are stated relative to the spectator point of view.

3. **Starting areas**

a. **Description**

Arrived on the Moon, the robots get out of their spaceship.

Each team have a starting area, divided in two distinct areas by a spaceship door represented by a seesaw:
- Area 1: located in the back corner of playing area
- Area 2: located on the playing area back at the opposite of the seesaw with area1.

The seesaw is initially lowered towards area 1. The both balance positions are the complete low position from one side or the other.

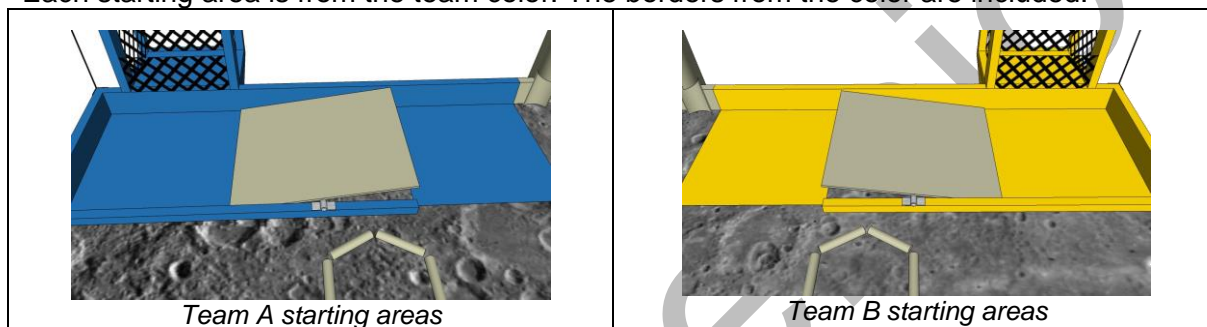Each starting area is from the team color. The borders from the color are included.

| *Team A starting areas* | *Team B starting areas* |

Figure 3 : overview of starting areas

b. **Constraints**

Before starting, the robots must stand entirely within the limits of the starting areas in vertical projection. Please make sure that your robots can stand together in the starting area.

The seesaw and the basket are not included in the starting area.

A robot can be alone or with the other robot on its area.

If a robot is initially placed in area 2, the playing elements forecast at this position are definitively remove of playing area. Those elements can also be removed before the match on the team decision.

The robots are not allowed to enter the starting area of the other team.

4. **Collect titanium ores and lunar modules**

To build a moon base, the robots need lunar modules to complete their work: mining resources extracted from the Moon and lunar modules imported from Earth.

a. **Description of the playing elements and layout**

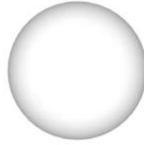- **Ores:** they are titanium ores represented by balls.

Figure 4 : Overview of a titanium ore

● **Moon rocks:** they accompany the ores and are represented by balls.

Figure 5 : Overview of a moon rock

● **Craters:** they are delimited by small borders disposed in arc of a circle or by the outer border of the playing area. They contain titanium ores and moon rocks.
    o Each crater near the starting areas contains five titanium ores.
    o Along the front border of the playing area, each crater contains five titanium ores and one moon rock.
    o Each crater in front corners contains 20 titanium ores and eight moon rocks.
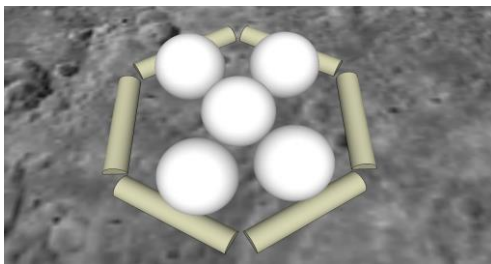
Figure 6 : overview of a small crater
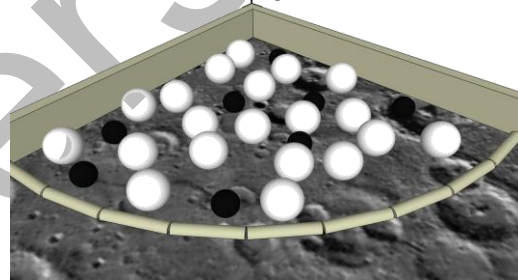
Figure 7 : Overview of a big crater

● **Rockets:** the three rocket are located on the back of the playing area. They are composed of half opened tubes surmounted by a nose. They contain, in their inner space.

Figure 8 : Overview of "empty" rockets

Figure 9 : Overview of "full" rockets

● **Lunar modules:** they are represented by tubes and are distinguished in several categories :
    o Eight monochrome lunar modules, uniformly painted with team colors.

o Ten polychrome lunar modules, yellow/blue with two separation bands with neutral color (white). The position and orientation of the lunar modules at start are set and detailed in appendix.

Lunar modules are initially located:
- o In rockets :
  - ▪ Four lunar modules in each rocket
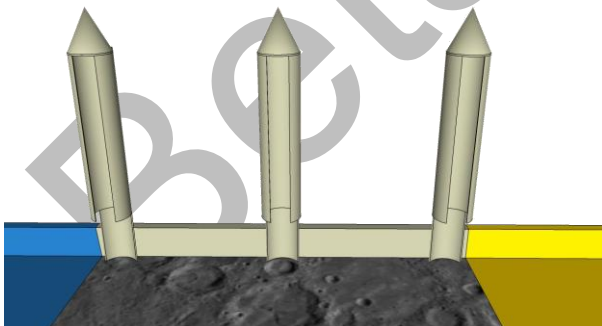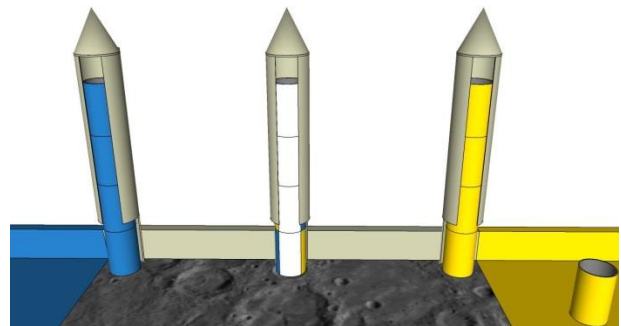 - ▪ Both side rockets contain monochrome lunar modules
  - ▪ Central rocket contains polychrome lunar modules
- o One lunar module from the team color is placed in the starting area 2 if no robot is placed in this area at start and if the team wishes it.
- o On the moon floor; three blue, three yellow and six polychrome units.

Figure 10 Overview of a monochrome lunar module

Figure 11 : Overview of a polychrome lunar module

- **The shuttle:** it is composed of :
  - o One cargo bay represented by a "basket"
  - o The starting area representing the access airlock of the team shuttle.
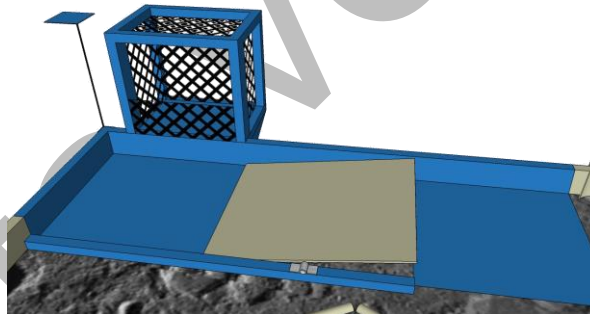
Figure 12 : Overview of a team shuttle

b. Actions and constraints

Actions:
- Bring a maximum of useful resources (lunar modules or titanium ores) in the team shuttle.

Constraints:
- The paying area of each team cannot have more than ten titanium ores or moon rocks at most.
  - o Moon rocks are counted before titanium ores.
  - o All titanium ores or moon rocks excess will not be counted
- There is no number limit of titanium ores or moon rocks in the shuttle cargo bay.
- The robots are not allowed to go in the opposite shuttle. The robot can neither drop off nor remove playing elements place in the opposite shuttle.

5. **Built the moon base.**

The robots shall assembly a moon base with the lunar module to permit the welcoming of the first human occupants. The lunar modules are more useful in the base than in their storage area.

a. **Description of the playing elements and layout**
● **Lunar modules:** tubes, as described here above (part 4a).
● **Places for lunar module:** they represent the places where moon base shall be assembled. They are delimited either by circle quarters or by the playing area border.
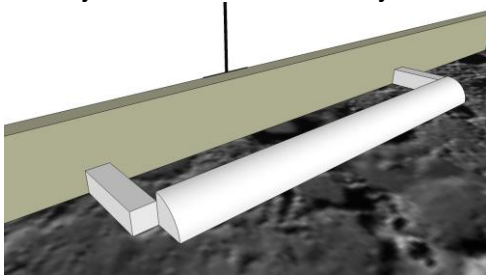
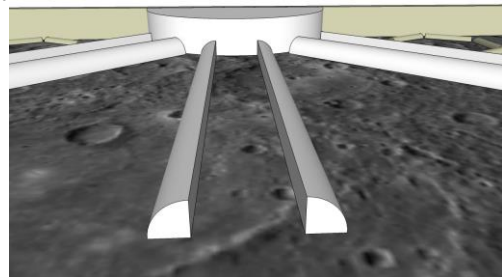**Figure 13 : Overview of a lateral lunar modules place**

Figure 14 : Overview of the central lunar modules place

b. **Actions and constraints**

Actions:

Robots shall place lunar modules in their places. Once a lunar module is in place, the robot shall verify that the color of its team is on the visible part of the lunar module (on top).

Constraints:

To be valid, a lunar module shall be:
● Show its team color on its visible part.
● Have its longitudinal axe at the horizontal.
● Be located in a lunar module place and be in contact with the playing area floor.
    ○ A lunar module is considered in a place if at least its half-length is inside the place.
A team is not allowed to remove a lunar module form its place but can turn over the lunar module in its place, to modify its visible color.

6. **Throw a spacecraft (funny action)**

The robots have built the moon base with success. Their last mission is to throw a spacecraft towards Mars.

a. **Description of playing elements and layout**
● **Spacecraft**: element provided by participants. It is preloaded on the principal or secondary robot.

b. **Actions and constraints.**

Action:

The robot shall throw vertically a spacecraft, after the regulatory time in a maximum delay of 5 seconds.

Constraints:

- Spacecraft weight shall not exceed 50g.
- During the match, the spacecraft shall not exceed the 350mm of the robot.
- The spacecraft shall separate itself from all point of view from the robot witch has thrown it (about 10 cm above the high point of the robot excepted the mast) and not exceed 2 meter high.
- Only one throwing action will be counted per team.

Notes:

- To enhance the spectacle and originality, the spacecraft can be equipped with parachute, aileron or all other upgrades that show a rocket or a flying object of your thoughts, in the limits of the constraints.
- Reminder: as all element or robot action, the spacecraft throw shall not be dangerous for the public. Ensure to make adapted propulsion system and spacecraft.

D. Project presentation

Both Eurobot^{open} and Eurobot^{open} Junior encourage you to practice science through entertainment. One of the fundamental objectives is to assist and value your work and projects of this year. To achieve this, we require you to make a Technical survey and a Poster.

It is demand to create attractive robots and, if possible according to the rules theme. To be creative and original will add value to your effort as much as your robot is efficient during his matches. That will increase the value of your project communication and visual effect of your robots, both for the public come to encounter you and for your own satisfaction of created something aesthetically and functionally completed.

1. Eurobot^{Open} technical poster

Each team is required to provide a technical poster. This poster should present information related to the design of the robot (drawings, technical references, design specifications, etc.). It should be at least DIN A1 (594x841 mm) in size, and ideally should be printed. The poster is intended to promote exchange and communication between teams.

Special effort should be made to make the poster understandable to a novice audience. Ideally the poster should include pictures and charts to explain the concepts.

The poster must also include:
- the team's name,
- the team members' names,
- the team's nationality.

This poster will be displayed in the team's stand. An English version of the poster must be supplied. Optionally, the team can provide other language versions as well. The poster must be supplied to the Eurobotopen association in PDF Format.

The chosen resolution of the PDF must guarantee that all texts on the poster will remain readable. If possible, the file size of the PDF should remain below 25 MB. The PDF version of the poster may be sent to Eurobotopen beforehand via your National Organizing Committee. It may also be provided on CDROM or USB key during the contest when presenting your robots for the approval.

In a general way, we strongly encourage the teams to discuss their projects by posting information on the internet or for example in the Eurobotopen forums.

2. Eurobot^{Open} Junior

As in the previous years, the presentation of your team's project (through project management on the long-term, tasks distribution ...) as well of your robots (technical systems implemented, chosen strategies ...) is an integral part of the event. Teams should present their projects in a way that is easily understandable and visible for the public and the other participants.

a. Constraints

This presentation should be done on a poster with a size of at least DIN A1 (594x841 mm). It is also possible to add further presentation supports (like video). Be creative!

We propose to the teams to create a blog, explaining the advancement of the robot. The blog we be created automatically when the team will register on the software Poolzor, the procedure will be

explain in details. Writing the blog is not compulsory to validate your register, but we encourage strongly the teams to make it to favor the exchange around their projects.

b. Evaluation

The project should be presented to the referees and/or "guardian angels" during the approval of the robots in order to show the whole work. This presentation will be taken into account for the approval process. During the event, a jury will examine all the posters and discuss with all present teams, in order to be able to give an "award for the best-presentation".

E. **The robots**

1. **Foreword**

Each team is allowed to register a maximum of two robots which are referred to as the "main robot" and the "secondary robot". The secondary robot has different constraints to its dimensions.

For Eurobot[Open] Junior, the main robot is wire-guided and the secondary robot is autonomous.

For Eurobot[Open] both robots are autonomous.

The construction of a secondary robot is optional. For beginner teams that are new to Eurobot it is recommended to focus on building a single functional robot. In general it is better to have one working robot instead of two robots that are barely finished. Having a secondary robot allows larger teams with more members to split their work into two projects.

The secondary robot can participate only with the main robot it has been created for and approved with. However it can participate alone if the main robot cannot participate. It cannot be re-approved with another robot.

A robot must not damage the opponent, the playing area or its elements.

During the contest, only two members per team are allowed in the backstage area and on. The path to the stage may contain steps or stairs. Therefore it is recommended to take care that the equipment is easy to transport.

Both the main and the secondary robots must each consist of interconnected parts. Hence they are not allowed to leave or lose any parts on the playing area with the exception of playing elements.

The use of objects, graphics or colours resembling the table or its playing elements is against the idea of fair-play and must not be used on the robot(s). This will be checked during the approval.

The robots are not allowed to fixate themselves on the playing area (for example by suction).

The robot(s) shall never prevent the opponent's robot(s) from scoring points, in particular blocking the access to playing elements. If a robot is motionless after for example finishing a task it should clear the area. However, blocking the access to already scored points is allowed.

Deliberately making the table vibrate or other similar actions will not be approved. If you are in doubt please contact the referees.

Use your imagination and be creative! Your robot can show emotions, play sounds or music to provide the audience and media with an attractive show.

2. **Dimensions**

The dimensions of the main and the secondary robot in Eurobot[Open] are identical to the ones in Eurobot[Open] Junior. Thus, a robot built for Eurobot[Open] Junior can potentially compete in Eurobot[Open]. The Eurobot[Open] Junior robot would only need to be modified in order to be autonomous.

Dimensions of the main and the secondary robot:

The perimeter is measured according to the figure below:

Dimensions of the main robot:	Dimensions of the secondary robot:
Start configuration ≤ 1200 mm Totally Deployed ≤ 1500 mm	Start configuration ≤ 700 mm Totally Deployed ≤ 900 mm

The perimeter of the main robot must not exceed 1200 mm at the beginning of a match. This is called the "starting configuration". During the match the robot may deploy to a maximum perimeter of 1500 mm which is called the deployed configuration.

The secondary robot's perimeter is independent from the main robot's perimeter. At start it must not exceed 700 mm but can extend up to 900 mm in the deployed state during a match.

In any case the height of the main robot and the secondary robot must never exceed 350 mm. The emergency button is allowed to exceed this limit but must stay below 375 mm in height.

For Eurobot^Open this height excludes the beacon support, sensors and electronic circuits that can be placed below the beacon support.

No components of the robot and playing elements manipulated at any moment by the robot should exceed 350 mm in height, in order not to disturb the beacons.

At the beginning of a match both robots together must be completely inside the starting area and may not exceed its limits.

3. Energy sources

In general, all forms of energy sources stored in the robot are allowed (batteries, springs, compressed air, gravitational energy...). Energy sources using chemical reactions like combustion or pyrotechnic processes are prohibited for safety reasons. Any corrosive products or other liquids that can splash are not allowed for the same reason. It is also prohibited to use living beings inside the robot.

If you have any doubts about an unusual energy source, please ask the referees in time and sharing with them the corresponding datasheets.

To prevent the risk of fire, special attention should be paid to the choice of conductors, depending on the intensity of current passing through them. It is also recommended to protect the wiring with a fuse that should be placed as close to the batteries as possible.

For Eurobot^Open Junior:

Beware! Power supply systems must be easily transportable. Teams may have to walk up/walk down stairs to access the stage where the matches take place.

Only electric energy can transmitted to the robot. The maximal voltage allowed is 13.8V (measured between two wires of the cable and of the robot). The organizers do not provide this energy source

during the event. Teams will have access to the standard 230V, 50Hz. In case of using batteries, these ones should be waterproof. The terminals must be insulated.

Batteries

If the team makes the choice to use batteries for energy source, we remind that only airtight batteries can be used.

Both robots must be able to play at least three matches consecutively. Please note that this also includes the time during the preparation phase before the match itself.

During the preparation phase the robots have to stand by waiting for the start signal. For details on the procedures of a match please take a look at chapter **"G. Match procedure"**.

Therefore, it is strongly recommended to have several sets of batteries with the possibility to **change them easil**y without too much effort. It is also very advisable to keep a set of batteries fully charged at any time.

Special note for batteries based on Lithium:
These types of batteries are permitted only under strict conditions:
- A charger suitable for the batteries in use must be presented during the approval.
- The batteries must remain inside certified and unaltered safety bags at any time. (This includes also the time when they are not in use or being recharged)
- A system to detect and prevent undervoltage is strongly advised.
- Those restrictions do not apply if the batteries are inside commercial products such as laptops, mobile phones or LEGO NXT and only if they are not altered or modified in any way.

  4. **Design constraints and mandatory equipment**

   a. **Common part**

1. Visibility

Two rectangular areas of 100x70 mm shall be free on at least two faces no matter which ones of the robot. Teams will receive stickers printed by the organization (team numbers, event sponsors, etc) to place on these free areas.

The teams are strongly encouraged to make the mechanism inside the robot visible from the outside of the robot. The goal of this advice is to allow the audience end other participants to see how elements are moved and carried in the robot. It is in the spirit of education and knowledge transfer to understand how the robots are functioning.

2. Starting cord of autonomous robots

The robots have to be equipped with an accessible device which shall be accessible on the robot. This device has to be triggered by pulling a cord with at least e length of 500 mm. This cord will not stay attached to the robot after the start. Any other devices like a remote control, activating by a switch hand or releasing the emergency button will not be approved.

The start of one of both robots may start the other one.

3. *Emergency stop button of autonomous robots*

The autonomous robots must be equipped with an emergency red stop button that is at least a 20 mm diameter. **It must be placed on top of the robot in a location that can be accessed safely by the referees at any time.**

The button in the released state may exceed the height limit by additional 25mm.

A simple downward movement, for example by the hit of a fist, must actuate the button.

Pushing this button shall stop immediately all actuators of the robot.

4. *Automatic shutdown (optional for Eurobot^{Open} Junior)*

Both robots must be equipped with a timer that stops the robot and its actuators after the 95 seconds of a match.

5. *Obstacle avoidance system (optional for Eurobot^{Open} Junior)*

Teams shall equipped their robots with an equipment to detect opponent robots.

The objective of such a system is to prevent collisions between robots during a match.

This point will be strictly verified at the approval. Referees will be attentive to non-fair-play teams which deactivate their avoiding system after the approval. The deactivation on purpose of avoiding systems might lead to the entire team disqualification.

Warning: Most events are filmed or photographed. Some cameras use autofocus systems with infrared light that could have a negative effect on your robot's sensors. Please make sure your system is robust against this influence.

b. Eurobot^{Open}

Beacon support

It is strongly recommended to equip your robots with a beacon support. Its purpose is to allow the opponent to put a beacon on top of each of your robots to be able to detect it.

This support can be made removable to only be mounted if needed. In that case the teams must be able to set it up quickly prior to a match.

The beacon support is optional. A team can also choose not to facilitate their robots with it. In a match with an opponent that depends on putting a beacon on your robot you will not be able participate. It will be considered as a scratch for your side.

The beacon support should at all times comply with the following specifications:
- It needs to have an 80x80 mm square surface, located at 430 mm above floor level. This is where the opponent's beacon will be placed.
- The surface of this platform has to be entirely covered with Velcro (the rough "hook" side)
- The structure supporting the platform (mast) must stay within the vertical projection of this platform.
- The mast can only host sensors and electronic circuits that also need to stay inside the platform's vertical projection.
- The mast should be stable and must be able to support a weight of at least 400 g.

c. Eurobot^{Open} Junior

1. Main robot control system

Each team must design a control panel for its main robot that may only be operated by a single pilot. The control panel is an in-box system allowing the control all the electrical devices of the robot. It is the only authorized communication device with the robot. As a consequence, any other remote control device is strictly forbidden.

2. The cable

The electric cable linking the robot to its control panel is not provided, it must be designed and create by each team, according to its own needs.

The electric cable linking the socket and the power supply should be at least 2 meters long.

For the reason of sufficient mobility on the playing area it should be at least 5 meters long. It will be supported by the co-pilot with a pole provided by the organizers.

In order to do not lie around, the electric cable must have to go out through the top of the robot.

During the match, the co-pilot should neither interfere in the piloting nor in the robot's settings (like the voltage for example). In this way, only the pilot can trigger the secondary robot starting.

Furthermore, the cable must not be used to guide the robot or to put it upright again after it fell down. Such action can be penalized.

3. Secondary robot control system

Teams can use any kind of control system for their secondary robot (analogue, microprocessor-based, microcontroller-based, embedded computer, programmed...).

These systems must be entirely embedded in the secondary robot.

The control system must allow the robot to play a match in the role of both colors. Ideally, this technical point should be configured just before the match starts.

5. **Safety**

a. **General**

All systems (i.e. robots and beacons) should comply with current national and European safety regulations. They must endanger neither the participants nor the audience during matches, as well at stands and backstage.

The robots must not have any protruding or sharp parts that can cause injuries or damage to the playing area, its playing elements or other robots.

The use of liquids, corrosives, pyrotechnics and living components is strictly prohibited.

All robots must comply with the legal standards for "low voltage". Therefore, **the internal voltage of the robots and beacons must not exceed 48 V**.

Potentials higher than 48 V are allowed only inside sealed commercial devices which comply with national and European regulations (such as lasers or LCD display back lighting). Those devices must be left unmodified and unaltered.

As a general rule, any device or system considered as potentially dangerous by the referees will be rejected. It must be removed from the robot prior to the competition, or will result in the team's disqualification.

b. Lasers

Only considerations based on the laser class definition "EN 60825-1:2007, Edition 2 -Safety of laser products– Part 1: Equipment classification and requirements" will be taken into account. Teams using a laser have to provide either the classification notice of the equipment or the laser component data sheet. Not being able to provide such a document will prevent the robot from being approved.

Based on this classification, lasers of classes:
- 1 and 1M are allowed without any restrictions
- 2 are tolerated if the projected spot is never projected outside the game area
- 2M, 3R, 3B and 4 are strictly prohibited

Caution: A laser device consists of the laser source, its electronics and the optics. Disassembling or modifying any of those components often leads to a change of classification. Only commercial products with unaltered components can be approved for Eurobot^Open.

c. Powerful lights

In case of use a powerful light, light intensity shall not be dangerous for the human eye in case of direct spot exposition. Be aware that some kind of LED provide warnings. Be responsible! Your machines runs in front of an non-well-informed public.

If any doubt, organization has the right to ask for manufacturer specification to verify that the lighting system is not dangerous.

If the system is considered as dangerous, it could be refused as well as laser class 2M and more.

d. Compressed air system

The pressure in systems using compressed air may not exceed 400kPa (4 bar).

F. Beacon systems (specific Eurobot^Open)

1. General points

Teams can use beacons around the playing area and on the opponent robot(s) to design a system for localization. The table provides three support platforms for each team to place beacons upon. These beacon supports are located on fixed positions as indicated by the figure below.

All beacons, i.e. those around the table and on the opponent robot(s) must have Velcro on the bottom side. It has to be the soft ("loops") side of the Velcro.

Beacons need to remain on their supports for the entire match.

All points regarding the safety of robots also apply to the beacons.
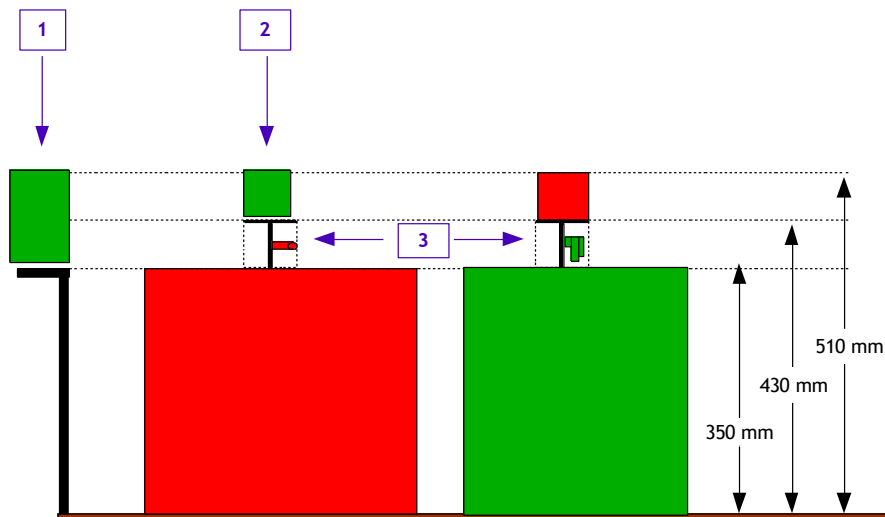
Figure 15 : Drawing of beacons positioning in the robots

Legend:
- 1: Fixed beacon (maximum size: L x W x H: 80 x 80 x 160 mm)
- 2: Opponent beacon (maximum size: L x W x H: 80 x 80 x 80 mm)
- 3: Mast to support the platform. Sensors and electronics may be placed around the mast as long as they stay within the vertical projection of the platform

2. Opponent beacon

A beacon can be placed on top of each opponent robot. It can be used to localize the robot for the obstacle avoidance system.

This beacon must not exceed the size of a cube with 80 mm edges. In the spirit of fair play the beacons may only contain components that have a real use.

Additionally, opponent beacons also need to have Velcro on the topside. It has to be the rough ("hook") side. During the matches a tag indicating the team's colour will be placed on top of it.

A beacon must not exceed 400g.

The superior face of the embarked beacon must be covered with Velcro ™ face hooks to receive the mark of identification of the robot, in the color of the team.

3. **Fixed beacon**

Each team can place three beacons on fixed locations around the table. Those locations are defined by the team's colour in the match as indicated in the figure below. The dimensions of the beacons must not exceed a cuboid with a base of 80 x 80 mm and 160 mm height.

The fixed beacons can be connected to each other using a wire. This wire must not disturb the match in any case.

The setup of the whole system must be possible during the 3 minutes preparation phase prior to the match and must not disturb the opponent team.
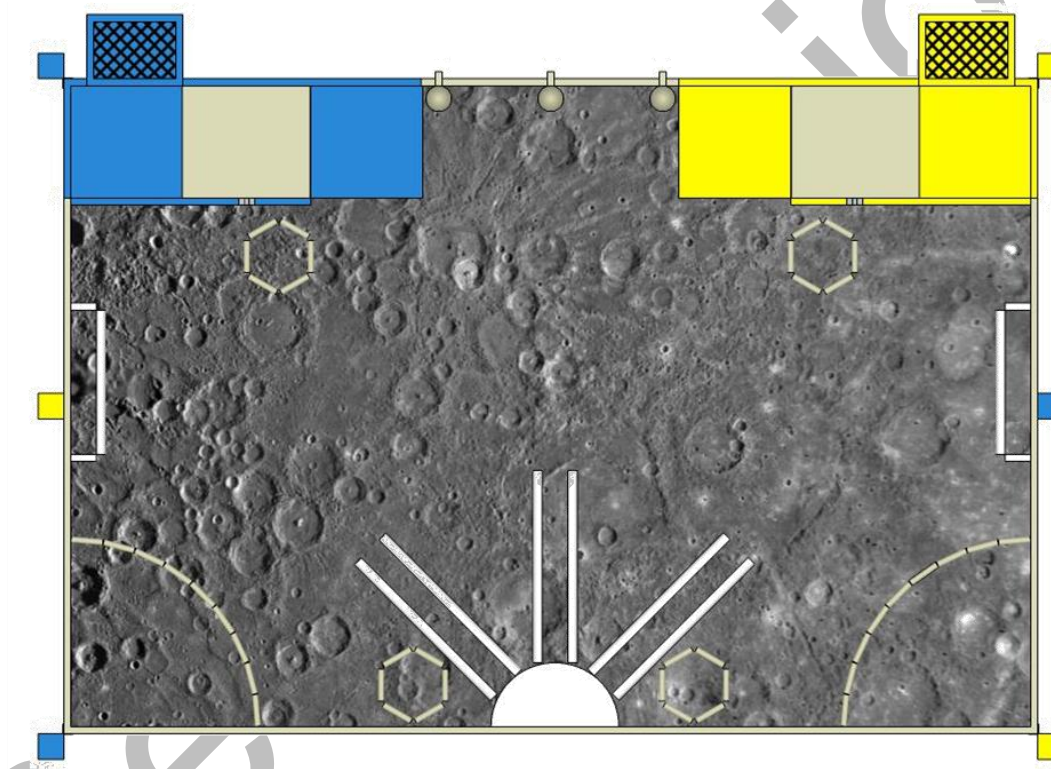
Figure 16 : Position of the beacon on the playing area

4. **Communication signals**

It is recommended to encode all communications to avoid interferences between the signals of different teams.

The organizers use high-frequency radio devices and cannot be held responsible for any interference with a robot caused by them.

Special attention should be paid to the strong ambient light during the event, especially when using infrared or other optical devices. Furthermore, this light may vary between different tables and also even during a single match.

Caution: beyond the edge of the playing area, there may be elements which can disturb color detection and communications signals such as:

- Decorative elements of the playing area
- People (referees, teams, etc.)
- Electronics systems (micro, camera, etc.)

Under no circumstances it is possible to requested to the people and decorative elements of the playing area to move away

5. **Identification tag**

Tags are assigned to the robots in each match. These tags have a negligible weight and are placed on top of the opponent beacon or beacon support if there is no beacon.

The tags have the colour of the team and allow the audience to assign the robots to the teams.

G. **Match procedure**

The matches have a duration of 90 seconds + 5 seconds for the funny action.

Only two members of each team are allowed to access the stage and the backstage area.

1. **The preparation phase**

At first the playing elements are put in place according to the figures in the appendix.

When arriving at the playing table, the teams have 3 minutes to set up their robots and beacons.

Failing to meet this deadline may result in the team's disqualification (scratch) from that match. In that case the opponent will play the match alone.

If both teams completed the setup, the referees ask if the teams are ready for the match. From this moment on it is forbidden to touch their robots or beacons (except the starting cord)! No objection regarding the playing elements or their placement will be accepted from this point on.

When both teams are ready, referees ask both teams if they are ready. At that point, both teams are not allowed to touch robots. No contesting on the positioning of any elements is allowed after the start of the game.

If both teams are ready before the 3 minutes the match can start earlier.

2. **The match**

The referees will give the signal to start the robots after a short countdown. It is forbidden to touch the robots, the beacons, the table and its elements unless it is explicitly authorized by a referee. This also includes pressing the emergency button! Failing to comply with that rule may result in a team's disqualification from that particular match (scratch).

Any elements leaving the playing area will not be able to go back to the playing area before the match ends and the validation process score.

After 90 seconds the robots must have stopped moving and switched off all actuators, except the necessary ones required to achieve the funny action.

After the end of a match, **no one except the referees** is allowed to touch the robots or the playing elements. The referees count the points on a so called match sheet and explain them to the teams. (Please take a look at the next section on how to count points.) If both teams agree with the result, they sign the match sheet, take their robots and leave the stage.

If one team does not agree with the result of the match it may present its arguments **calmly**, while the robots stay in place. Please remember that only two members per team are allowed on stage. The decision of the referees is final.

In case of judging difficult situations, the referees can decide to replay the match or not.

If for example all robots are blocked, the referees may announce an early match ends with both teams' agrement.

A team is scratched for the match:
- when none of the robots of a team has completely left the starting area during the match
- when the emergency button has been pushed during the time of the match
- For other refereeing decisions.

3. **The scoring**

After the match ends, the referees will score match for each team following this grading scale:

a. **Collect ressources**
2 points for each colored or polychromatic Lunar module in the shuttle
2 points for each valid titanium ore in the shuttle
3 points for each titanium ore in the shuttle cargo bay
Moon rocks don't scored any point

b. **Moon Base construction**
10 points for each valid lunar module

c. **Go to mars (funny action)**
20 points if at least one spacecraft flight to Mars successfully.

d. **Penalties**
A penalty leads to **a loss of 20 point**s for the match it occurred in.

A negative score will be rounded to 0.

An element controlled by a robot, does not score any points. A playing element is considered to be in the control of a robot if by moving the robot along its innate axis of locomotion the element is also moved.

Reminder:

Penalties are intended to compensate for damages or disadvantages as a result of an incident during the match. A penalty situation is considered as a non-compliance with the rules and should remain the exception. A penalty may result in a scratch for the team. The referees will also pay attention to the cumulated penalties given during the qualification phases (regional, national and also European).

e. **Bonus points:**
15 bonus points is given to all teams that are not "scratched", i.e. that have won or lost the match.

H. The contests

1. Forewords

The Eurobot^{Open}/Eurobot^{Open} Junior events are organized on three levels:

- **Regional:** where they exist (e.g. in France for Eurobot^{Open} Junior), they enable to qualify teams for the national final,
- **National:** it enable to qualify teams for the European final,
  Be aware that the number of team that can qualify has changed since last year!
- **European:** the last step that get together, in the same friendly spirit, qualified teams from country of Europe and elsewhere.

2. Approval

a. Pre-approval:

Before a robot can participate in a match it needs to be approved by a referee. In the **pre-approval** a referee verifies the robots' compliance with the rules. Therefor the robot should be able to demonstrate all action it is capable of.

b. Approval:

The robot(s) must demonstrate their ability to score at least one point under match conditions, i.e. in 90 seconds without the presence of an opponent team. The avoidance system and other equipment will also be tested in that phase.

If the main robot and the secondary (optional) robot pass the tests, they are declared as approved. If only one out of two robots pass the approval this robot is can play the matches on its own.

c. Significant technical modifications after the approval:

If significant changes are made to a robot, e.g. in its function, structure or dimensions, a referee needs to be informed. That referee will reapprove the robot and redo some test if it is considered necessary.

3. Qualification phases

Each team should have the possibility of playing at least three matches during the qualification phase. The local organizers can also decide to play more matches which are normally organized in rounds.

To choose the teams for the finals, a ranking is set up by using the accumulated points of each team during the qualification phase.

If two or more teams have the same number of points, the teams will be ranked by comparing their scores without considering the bonus points. If teams still level, the referees may decide to organize extra matches. In that case, pairs of teams competing for the same ranking will be drawn by lot and the winner of the resulting matches will move on to the final round.In the case of an odd number of teams, an opponent for the last team is drawn by lots. Points scored by the randomly chosen team will enter the ranking.

4. **The finals**

After the qualification phase, the first 8 or 16 teams (depending on the number of approved teams) will participate to the final phase.

According to the local contests, only the teams composed of people under 30 years old would participate to the final phase.
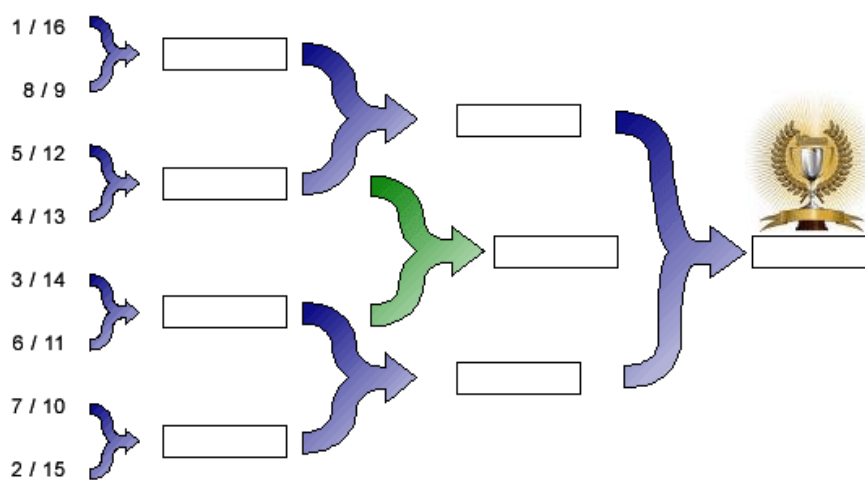
This is the schematic of the final tree :

Figure 27: Schematic of the finals

In this phase the matches are played as knock-out matches, i.e. the winner moves on to the next round.

If a winner cannot be determined (double scratch or draw) the match is replayed immediately. In case the situation is still unresolved, the points scored during the qualification phases will be taken to declare the winner.

The final match for the first place is played as "best of three". The team that first wins two matches wins the match.

5. **Qualification for the national finals**

Where the regional competitions exist (e.g. in EurobotOpen Junior in France) the number of teams that can qualify for the national competition is proportional to the total number of teams on national level.

The results of the qualification rounds are used to select the teams for the national finals.

Final rounds can still be hold to define the regional champion, but this champion is not necessarily qualified for the national competition!

At least one team received as special award (for example for creativity, fair play, best presentation, etc) and is also qualified for the national competition.

6. **Qualification for the European final**

Each country participating in Eurobot[Open] and/or Eurobot[Open] Junior organizes a national competition to determine the qualified teams for the international contest. The top teams in the final rounds (and not the qualification rounds) as well as the team who received a special award will qualify for the European finals.

For Eurobot[open], the first two teams and a special award will qualify to go to the European final. In the case where no team receives a special award, the three first teams will qualify for the European final.

For Eurobot[open] Junior, the number of qualified teams per country is proportional to the total of international registered teams.

For questions and comments feel free to visit the forum on http://www.planete-sciences.org/forums/. A volunteer from the refereeing committee will answer your questions there.

News and more information about EurobotOpen and EurobotOpen Junior are available at our website www.eurobot.org. It also contains links to your local organizations

The whole organization team of Eurobot[Open] and Eurobot[Open] Junior wishes you a lot of fun and success for the coming months, and looks forward to seeing you soon around a playing field!

Robotic Regards,

The Eurobot[Open] and Eurobot[Open] Junior organization committee.
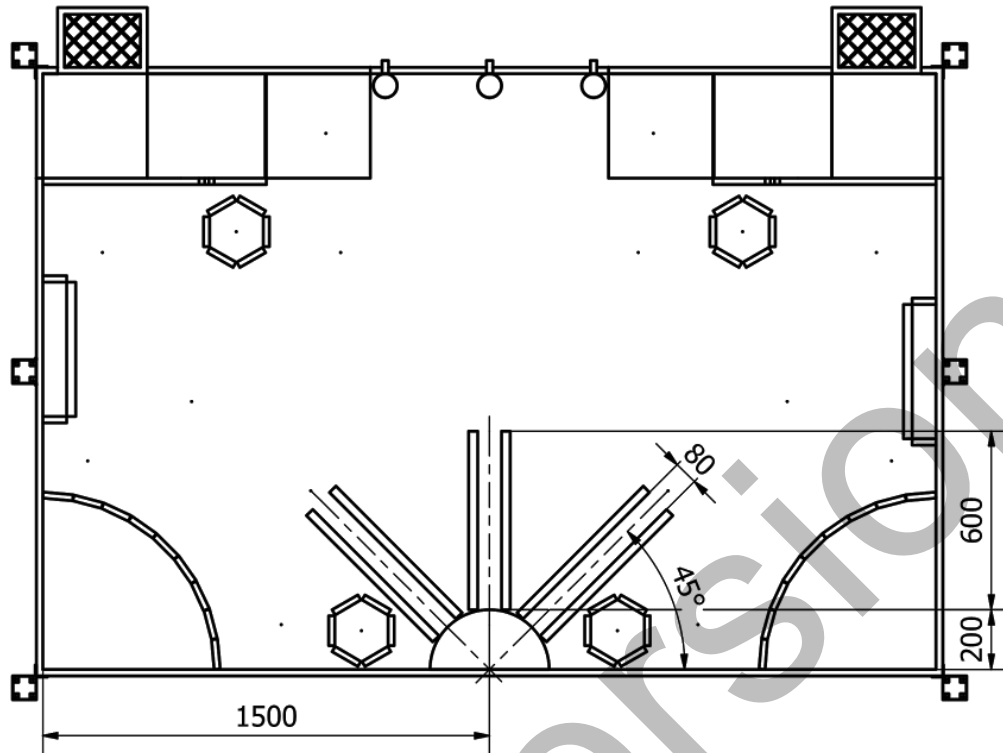
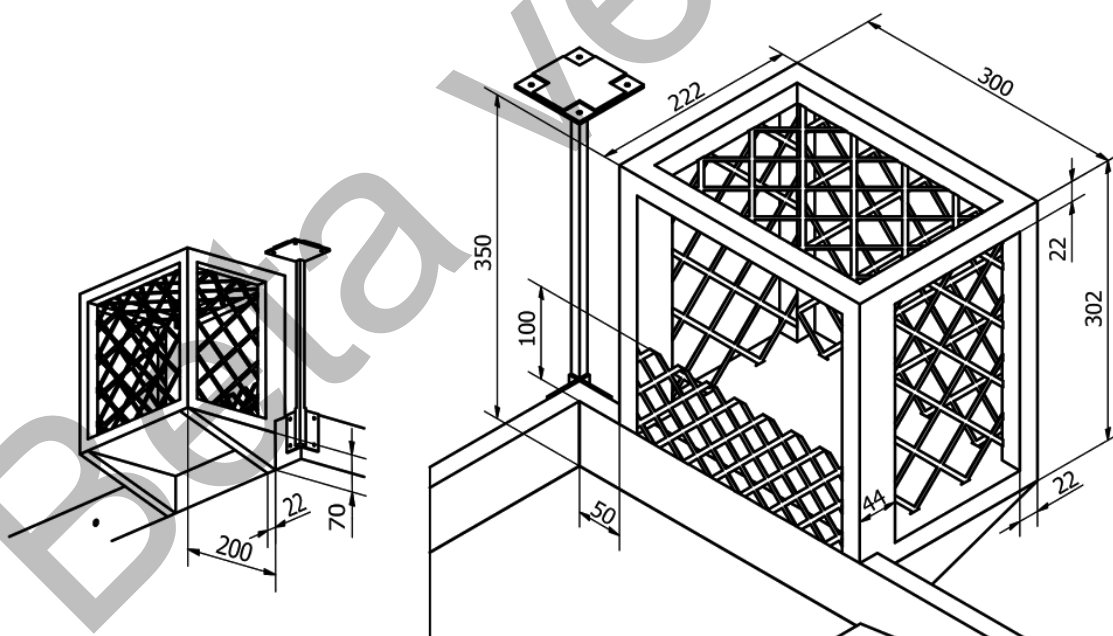# I. Appendix

1. General drawing
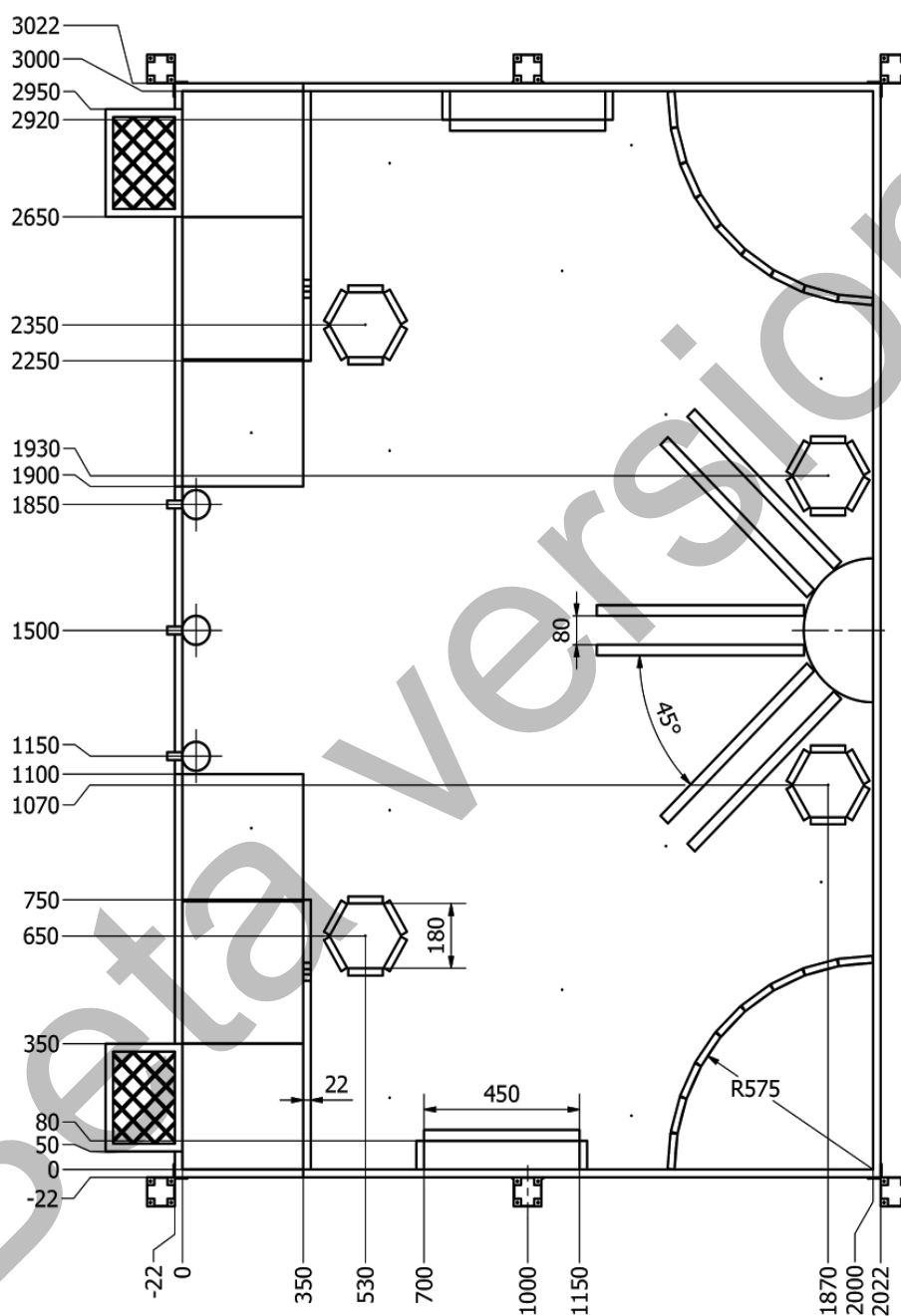
1. **Craters**
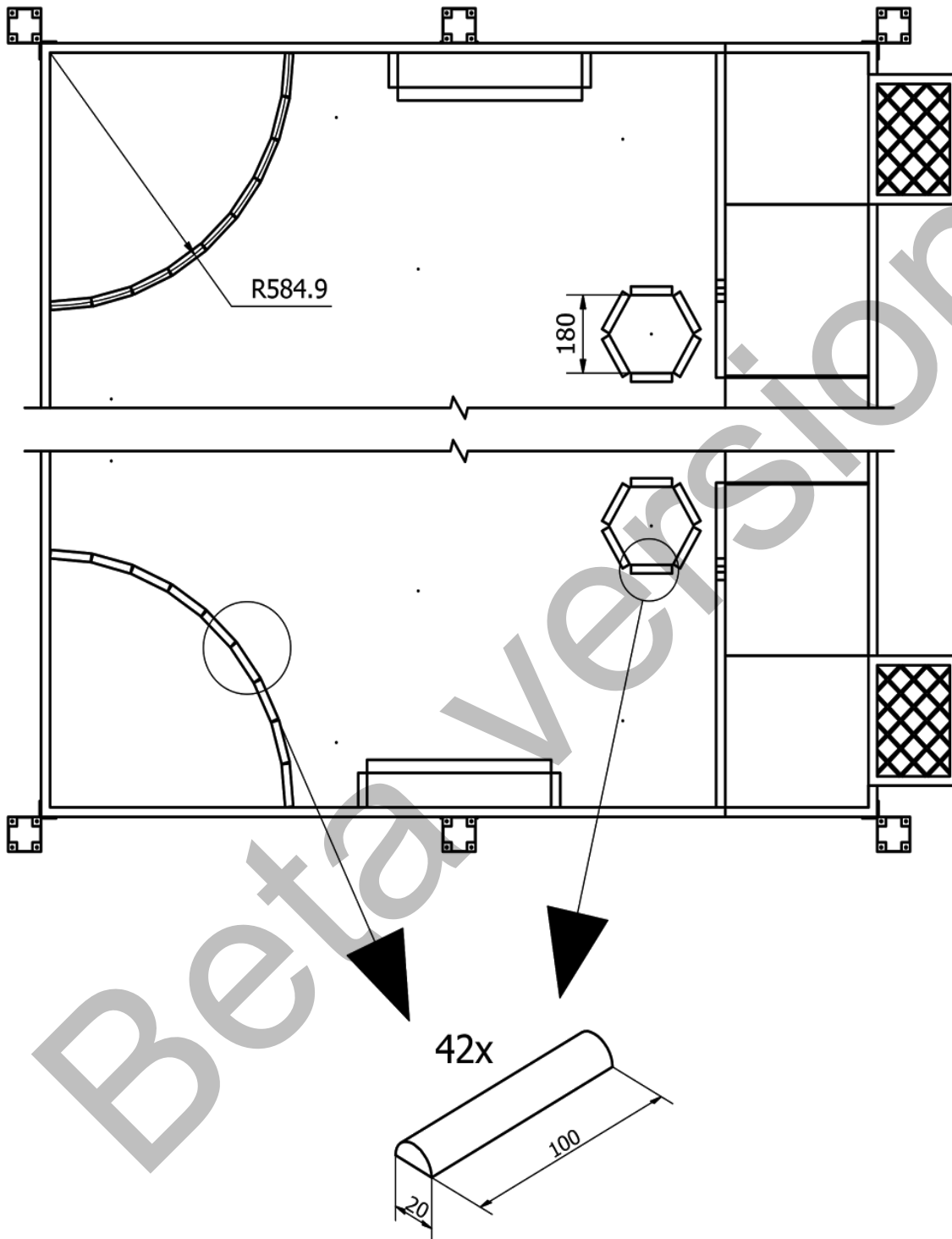
2. **Moon base**
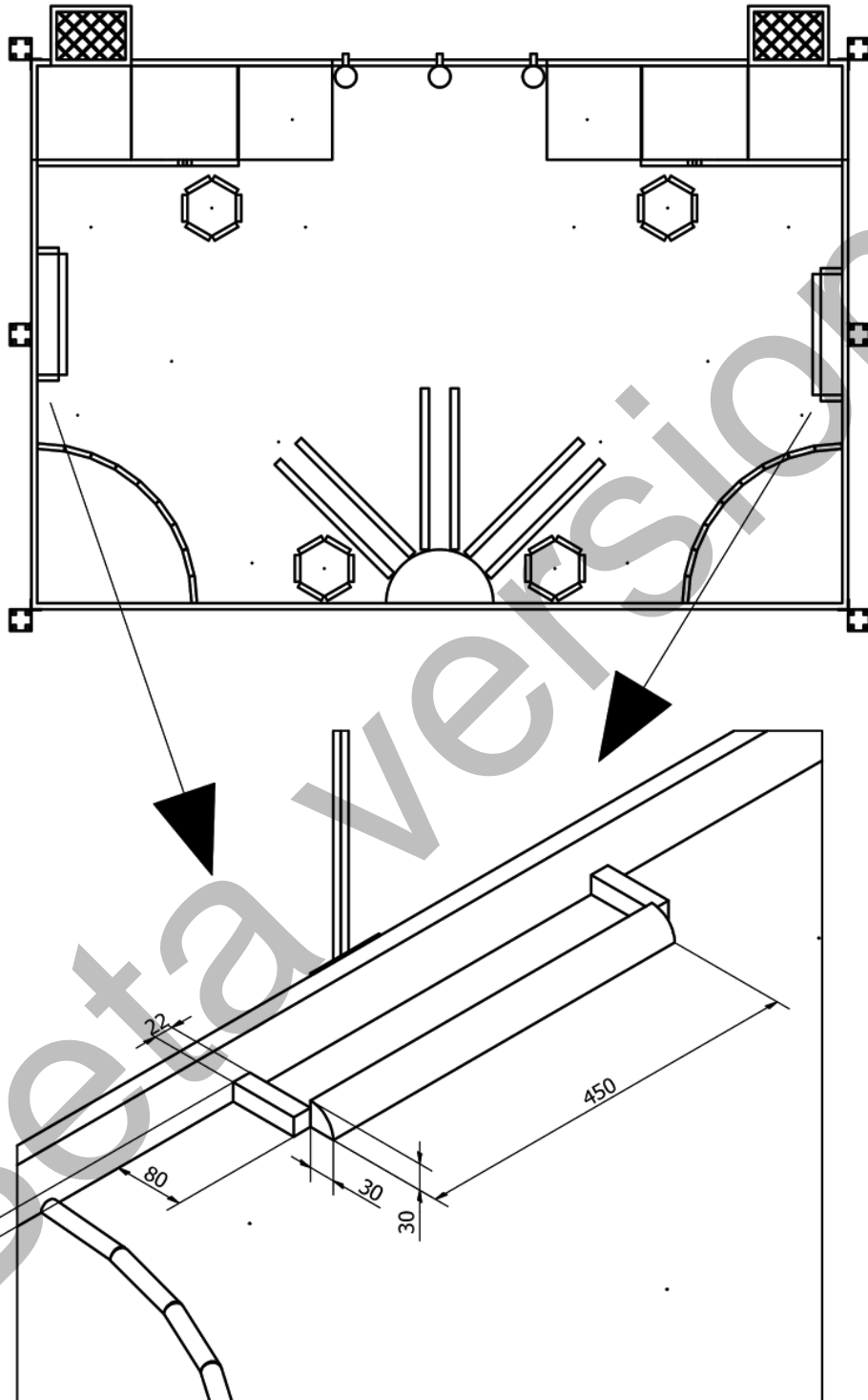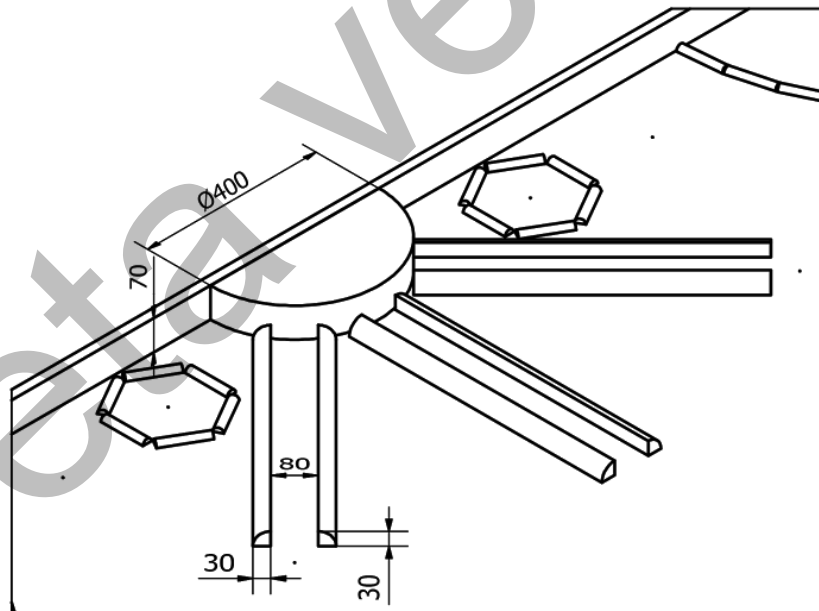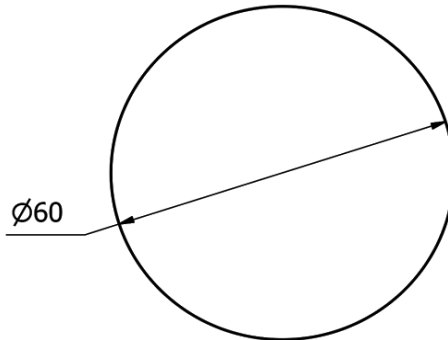
3. **Shuttle cargo bay**
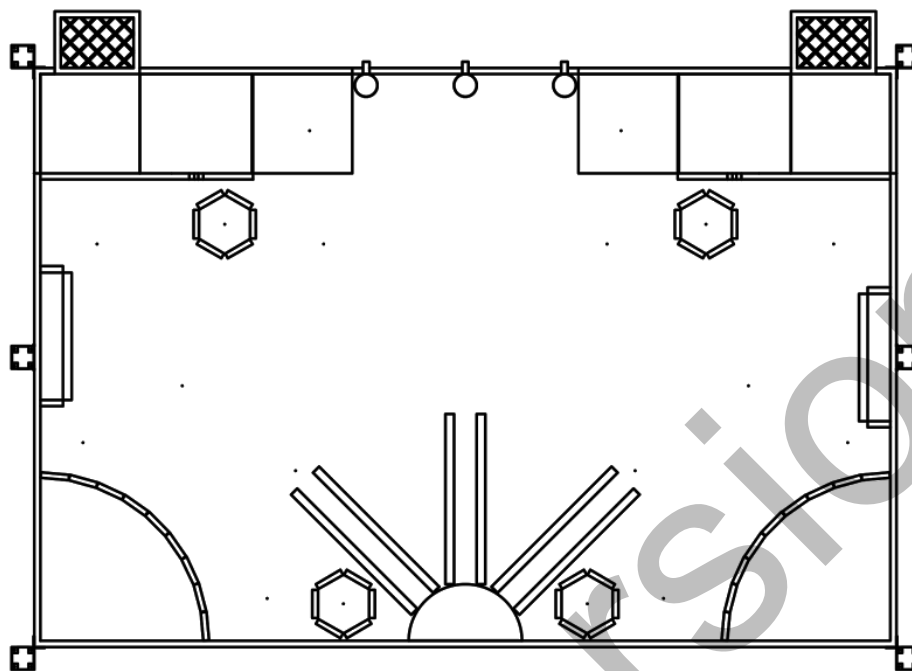
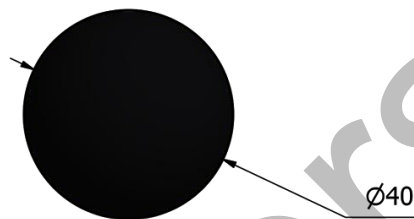## 4. **Rockets**
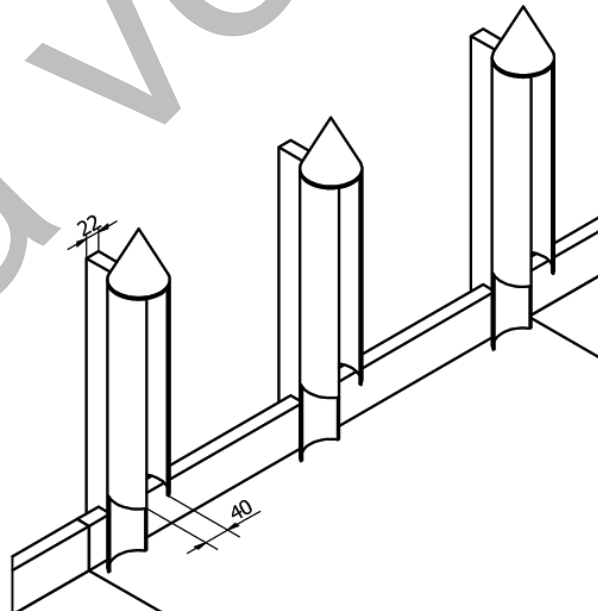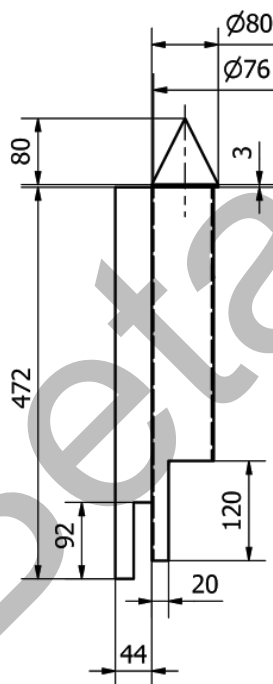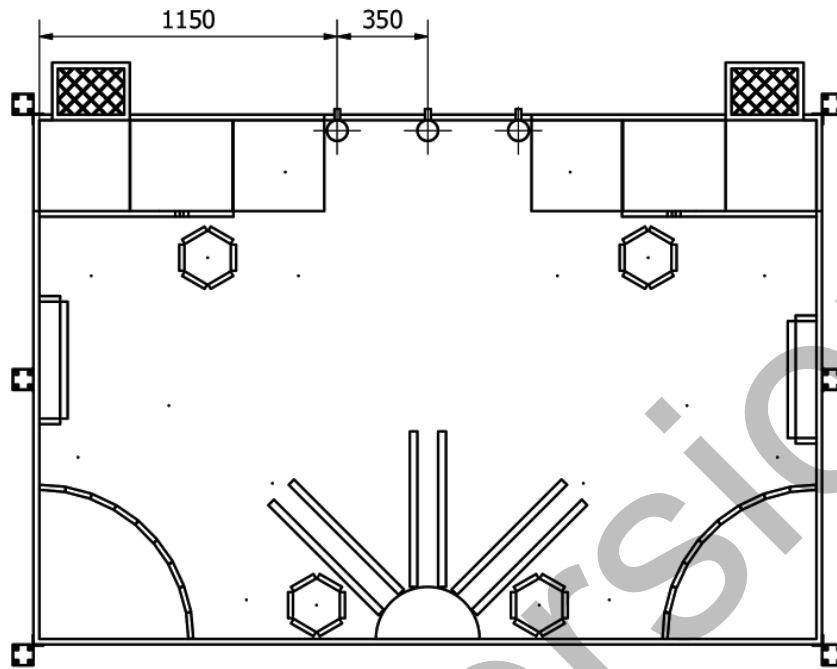
5. **Shuttle**
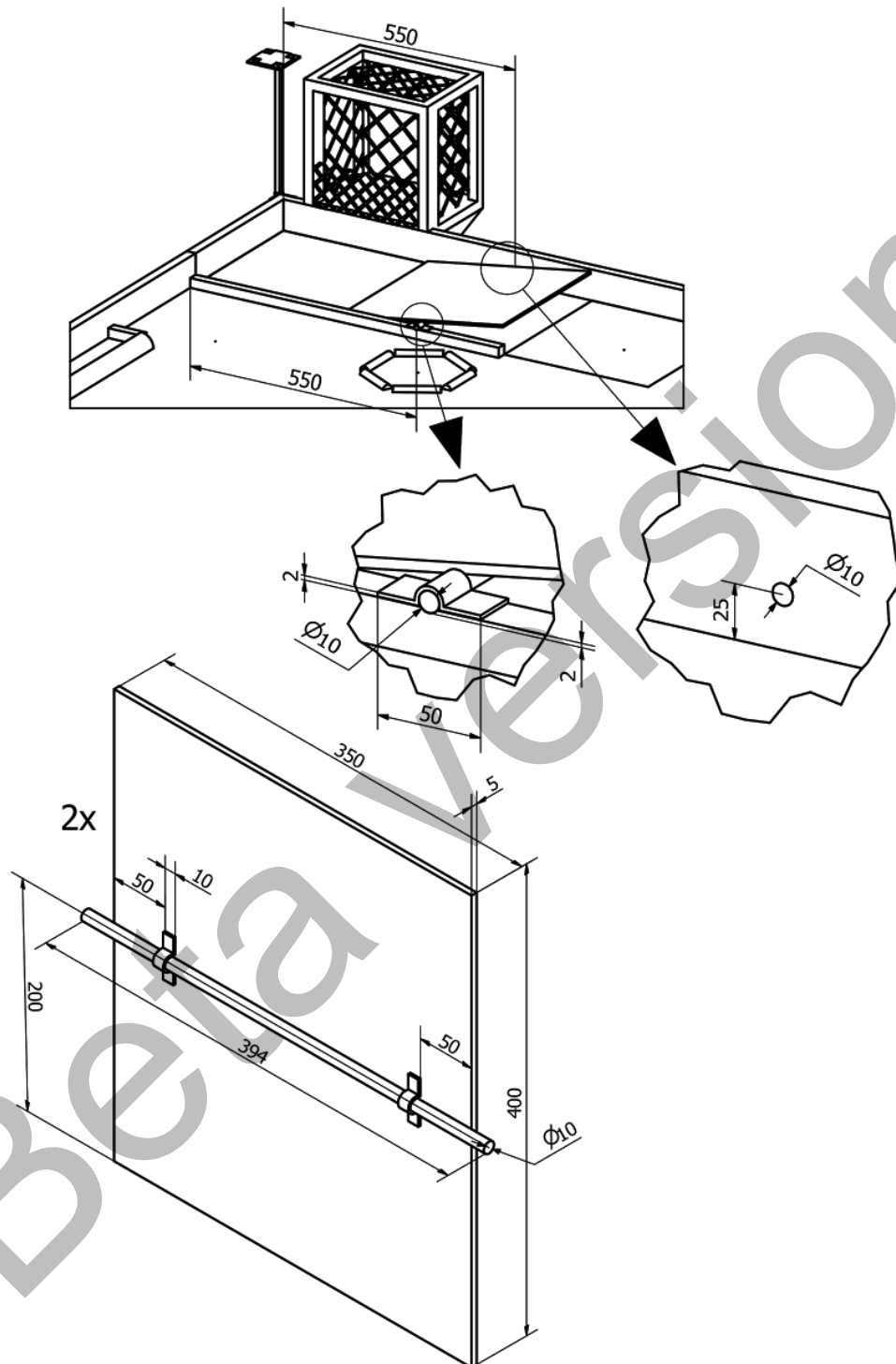
6. **Beacon supports (specific EurobotOpen)**
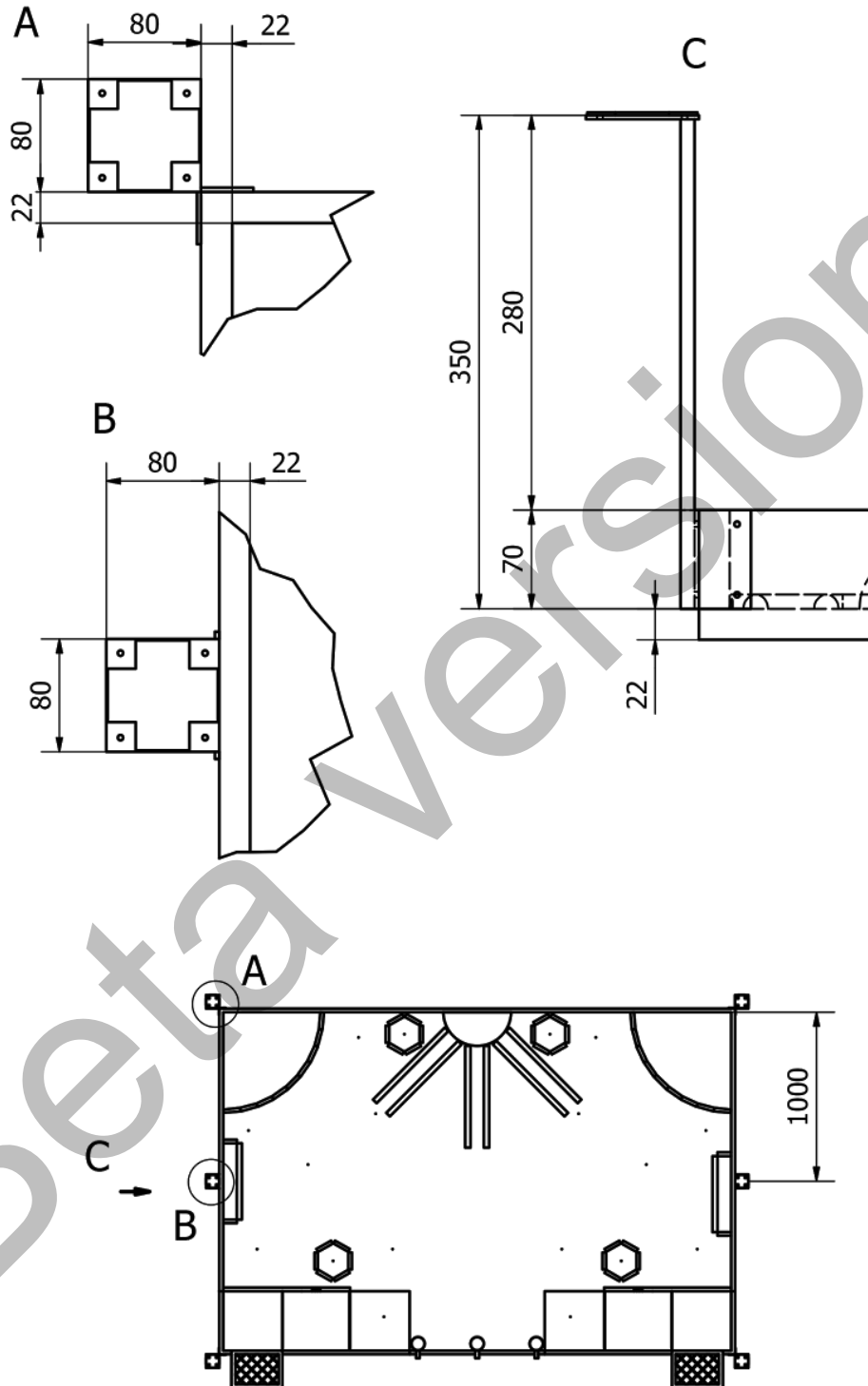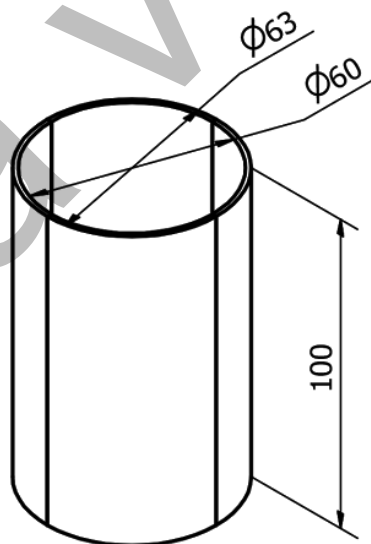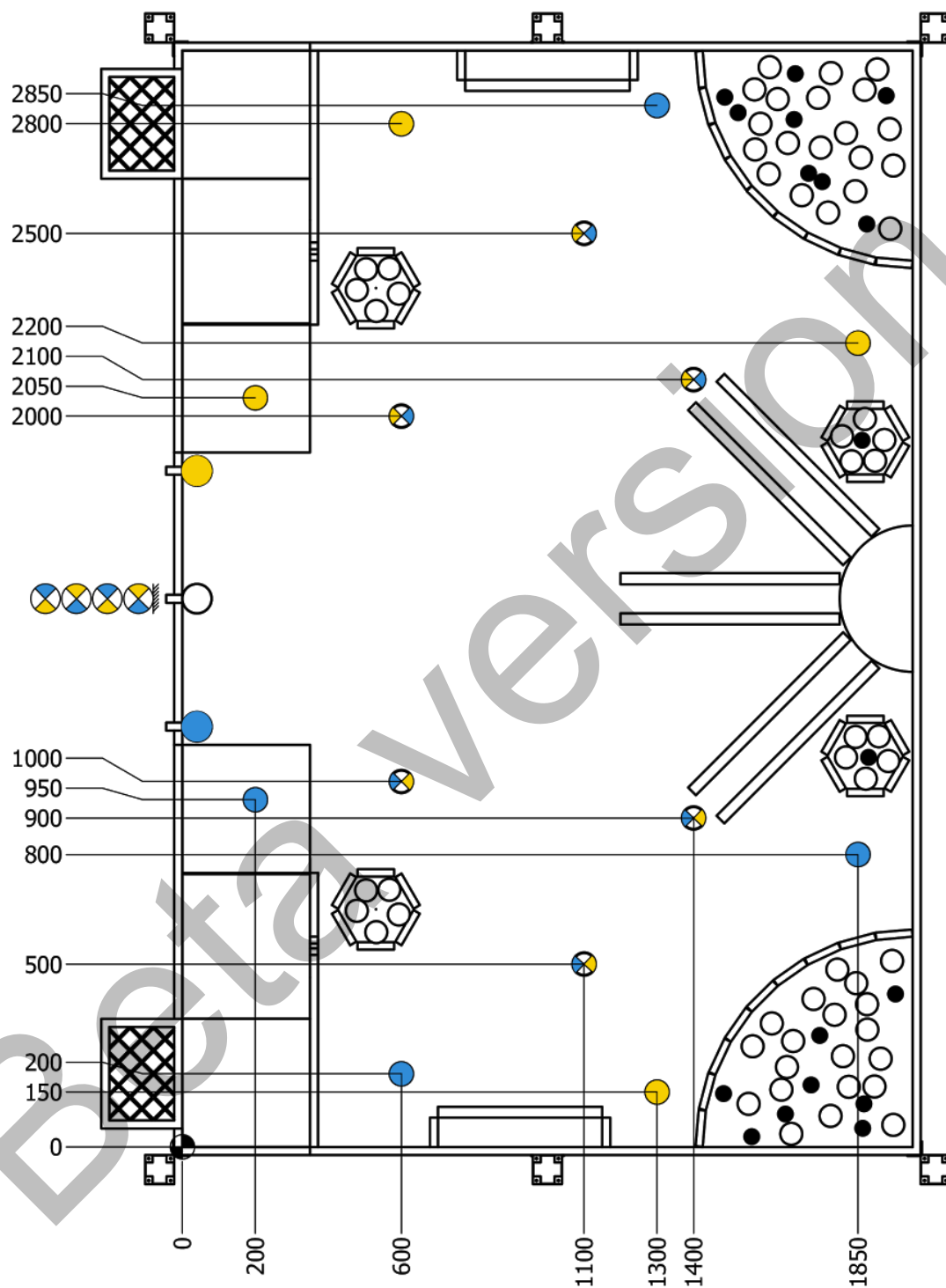
7. **Titanium ore**

8. **Moon rocks**

9. **Polychrome lunar module**

10. **Placement of the playing elements at the beginning of the match**

1. <u>Material references</u>

Material references for the elements available on the playing table:

Element	Material	Remark
Lunar Module	Rigid PVC	60 mm internal diameter
Ore	Polystyrene	60mm diameter
Edge crater	Wood	20 mm diameter half round
Playing area mat	vinyl, lino or painting wood	Surprise!!
Moon Rock	Polystyrene	40mm diameter
Cargo bay	Grill or net	meshes must be smaller than 40 mm
Rocket body	Rigid PVC	80 mm internal diameter

No objections regarding differences in dimensions will be taken into account.

The wood's density can change from one a country to another. It is highly recommended that the team tries different types of wood as the weight can vary change in a significant way.

The transparent plastic's density can change from one a country to another.

11. <u>Painting references</u>

	Colour	Reference
Team A	Sky blue	Ral 5015 Mat
Team B	Traffic yellow	Ral 1023 Mat
Titanium ore		Ral
Moon Rock	Dark black	Ral 9005 Mat
Moon base support + base half sphere	Traffic white	Ral 9016 Mat
Edge crater, seesaw	Pebble grey	Ral 7032 Mat
Playing area floor if it is not print		Ral

Rals hue can vary slightly from a printing-to-printing of the playing area mat.