2018 Engineering Games

Robotic machine specifications V1.0

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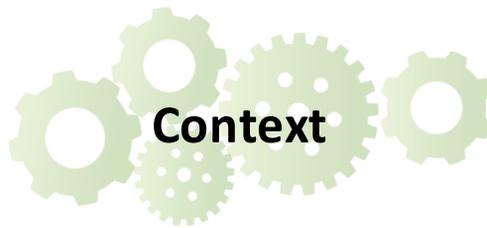
Conquerors

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Context

The verb conquer can either mean "Submit a country by force" or "Seduce someone". In our case, conquer means "winning something, becoming its master, usually by putting a lot of effort", because it's well known that the Engineering Games' robotic machine is not an easy task. The most tenacious and creative teams will certainly be the best at gathering territories and resources under their influence.
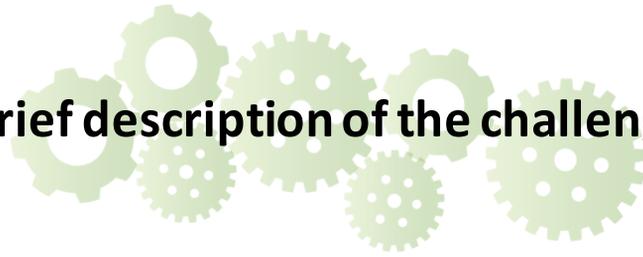
Indeed, such as the great conquerors who shaped the modern world, the challenge you are facing consist of leaving your mark in as many territories as you can. Therefore, you will have to collect resources and then use them to impose your control. However, like an emperor with a huge civilization, you will control your operations remotely.

Alexander the Great, Genghis Khan, Julius Cesar and even Joan of Arc had the same desire: extend their power. Will you be able to take up the challenge?

P.S. This note is for people who can read only in English. I would like to tell you that I did my best to make the best English version as I could and I hope it will be as clear as the French version. However, know that if there is an ambiguity between these two versions, the French one is the official reference and contains the official terms that will be used during the official competition. Cordially, Dominic Otis.

Brief description of the challenge

The main goal of the challenge is to conquer different territories, shown in Figure 1. To conquer one territory, you must deposit one or multiple flags in the pedestals meant for that purpose. These flags must be assembled by your machine with poles found on the course and banners already under your control.

Your civilisation is initially in the base camp where you have two preassembled flags. To conquer the entire course, you must cross a prairie, a desert, climb the mountain, harvest resources from the boreal forest, cross the wall and finally go into space to plant your flag on the moon.

Your robotic machine must be controlled by a single pilot-emperor with a wireless device and/or an artificial intelligence. However, your pilot-emperor will have no direct visual contact with the course.
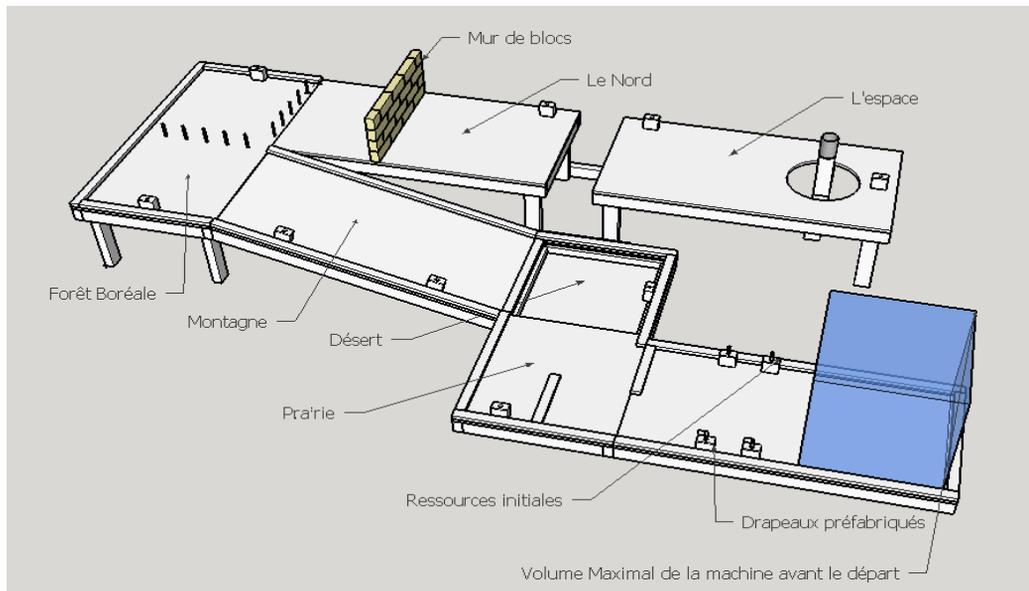

Figure 1 : Isometric view showing territories of the course.

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Challenge description

This section presents general rules and constraints of the challenge.

3.1 Definitions

Machine: Any object present in the initial volume at the beginning of a run, including the banners.

Driver-Emperor: Person in the control zone for the entire duration of a run. Only this person is allowed to control the machine.

General: Machine's team member who can be on stage during the challenge. There can be a maximum of 3 generals and they must stay in their zone for the entire duration of a run.

Wireless controller: Equipment that the pilot-emperor carries to control your machine.

Control zone: Zone in which the pilot-emperor must stay during the entire duration of a run. This zone will be surrounded by opaque curtains.

General zone: Zone in which generals must stay during the entire duration of a run.

**Note: The official position of the control and the general zone will be reveal later this fall, when the official competition location will be official. However, know that the general zone will be between the course and the control zone.

3.2 Volume and mass

Before your run, your machine must be contained in a volume of 20x20x20 inches, which is in the first 21 inches of the starting zone. The organisation will use a solid box to check this criterion. There's no mass limit for your machine. However, it is forbidden to damage the course in any way.

3.3 Motion on the course

3.4.1. A machine is considered to have exited the course as soon as any of its parts touch any surface that isn't part of the official course. Any part of your machine that exits the course becomes unusable for the rest of the run in progress. If a part of your machine falls outside of the course, your run isn't finished. However, you can't use that part in any way for the rest of that run. It can be picked up by a member of the organisation committee.

3.4.2 For security reasons, flying machines (e.g. drones and same type of machines) are forbidden. However, jumping machines or projectiles are tolerated, but the machine team will have to show that the machine is safe beyond doubts. The organisation committee reserves full discretion on that matter.
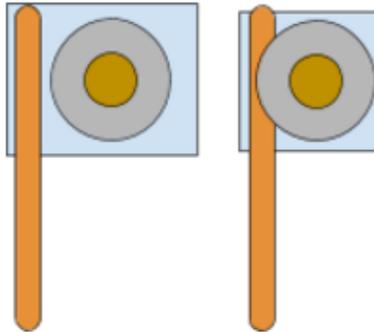
3.4 Flag manufacturing

Despite the two preassembled flags provided by your team in the starting zone, you will need to assemble flags if you want to conquer all territories. These flags will have to be built with two components: poles and banners.

Poles will be standard popsicle sticks (4.5"x0.375") placed on the course, in the specified locations mentioned in the course presentation, section 4. Your team will have to provide and position those poles during the official runs of your machine.

Banners must be provided by your team and will have to follow these specifications:

- Be opaque
- Must cover up one Canadian toonie after assembling it with the pole. The area covered by the pole does not count, as showed in Figure 2 below.

Figure 2 : Example showing minimal surface of banners. The flag on the left would be accepted, but not the one on the right.

Banners must be in your base camp with your machine at the beginning of a run and must be assembled with the poles on the course to create official flags.

The method of assembly is at the discretion of the teams.

When an official flag is placed in a pedestal, the banner must hold on to the pole until a committee member comes to take it at the end of the run. Every flag will be picked up by the pole, and then points will be awarded if the banner stays in place and meets the requirements of a valid flag. It is your responsibility to create a solid assembly. You can only place one flag per pedestal and every piece of a pole must be in a pedestal to be recorded.

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3.5 Wireless control

A wireless controller allows the pilot-emperor to conduct his machine on the different territories of the course. The pilot-emperor will be isolated in the control zone during the entire time of a run.

The wireless communication must only be done with one wireless link of your choice between the wireless controller of the pilot-emperor and the machine. Verbal communication is allowed between the pilot-emperor and his generals, as long as everyone is in their designated zone. The pilot-emperor cannot have any physical or direct visual contact with the course.

There are no constraints about the type of controller you use. You can use a videogame controller, a computer, a joystick or create your own controller. The controller must be worn by the pilot-emperor, either in his hands, on his lap or in a backpack. If you need it, there will be a standard 120 volts plug and a chair for the pilot-emperor in the control zone.
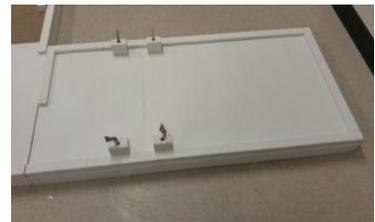
Course presentation

The course is entirely constructed with 2 standard 4'x8'x5/8'' plywood planks, 12 standard 2"x3''x8' wood planks, and 6 standard 1"x2"x8' wood planks. Every part of the course, except for the block wall, is painted with two coats of Boomerang latex recycled white paint[1]. The sand of the desert is playground Quikrete sand[2]. Construction tips are given lower in this section. A file with the official course pictures and a Sketchup[3] model are available on the 2018 Engineering Games website.

1. http://www.canac.ca/fr/product/peinture/peintures-apprets/peintures-dinterieur/peinture-recyclee-au-latex-br-clair-de-lune-378-l_3098.aspx
2. https://www.homedepot.ca/fr/home/p.sable-de-qualit-pour-aires-de-jeux-20kg.1000179897.html
3. https://www.sketchup.com/download

You must assume reasonable tolerances for a wood construction. Your machine should be able to adjust itself with variations of approximately ⅛ in. from the official given dimensions. Wood parts of the course may present some surface defects.

Territory 1 : Base camp
The base camp contains the initial volume, two poles and two manufactured flags. The only obstacle present in that zone is a bump on the ground, made with a 1"x2".

Territory 2 : Prairie
The prairie contains one pedestal and another obstacle made with a 1"x2".

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Territory 3 : Desert

The desert is a sand trap filled with sand at the same level as the prairie's ground. It also contains one pedestal. The sand will be levelled before the beginning of the first run of each team.

Territory 4 : Mountain

The mountain is made of a 2'x4' plywood plank at an angle of approximately 15°. It contains two pedestals on the same side of the slope.

Territory 5 : Boreal forest

The boreal forest contains ten holes with a radius of 7/16'' and a depth of approximately 1''. These holes will have one pole each at the beginning of a run. This zone also contains two pedestals at each extremity.

Territory 6 : The North

The north is a platform which contains one pedestal on the other side of a wall made of 2''x3'' wood planks. The planks which create the wall are neither attached to the ground, nor to each other. Follow the Sketchup model to know their length and how they are disposed.

Territory 7 : Space

This platform, eight inches away from the North platform, contains two normal pedestals and the moon. The moon is 6" higher than the platform height and at the center of a 6" hole. The moon, being more difficult to reach, is made from an Aylmer tomato soup can of 284 ml screwed on a wood support. For the appertophiles who are reading this, the can is being opened by the top with a two scroll wheel can opener, as shown in the picture.

Figure 3 : Can opening method used for the moon.

Construction tips

Most of the wooden planks are screwed together with standard wood screws. In order to ensure the stability of the raised platforms, the official course has 5/16" bolts to fix the platform legs. However, shoulders were made so that the head of the bolts is the inside the wooden planks. Every 1"x2" elevated edges are nailed in place with a compressed air nailer before the paint was applied. The poles are made with 2"x3" blocs with a length of 2.5", with a hole of 5/8" centered and deep over the entire thickness of the block.

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Competition program

On the competition day, each team will have 15 minutes on stage to introduce their machine and to do their runs.

The first 5 minutes are for the presentation video and for the preparation of the team on the course (initial positioning of the machine, pilot-emperor preparation, etc.).

The following 10 minutes are for the execution of the challenge. During this time, you are allowed to try as many runs as you want.

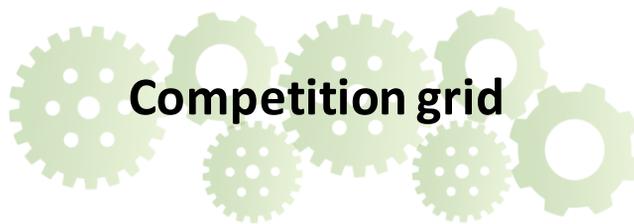Before the beginning of a run, the following criteria must be respected:

- All the pieces of the machine must be inside the starting volume.

- The wall, poles and manufactured flags must be put in their respective position by the team machine.

- The pilot-emperor must be in the control zone.

- The generals must be in their authorized zone.

An official run is finished if:

- The pilot-emperor gets out of his respective zone.

- Allowed time is over.

If there is time left, the team can try another run. In that case, the clock continues and generals must put the poles, the manufactured flags, the wall, and the machine back in their initial position. A member of the committee will take out and record the staked flags, and will then give authorization to the pilot-emperor to start when all the verifications have been made. Only the run with the most points will be considered for the final score.

Competition grid

Tableau 1 : Points given by criterion.

Criteria	Points
Performance	60 points
Judge evaluation	30 points
Presentation video	5 points
Mid-term report	5 points

Performance

During a run, points will be given based on the number of flags planted and their pedestal location. The grid below shows points given by pedestal territory.

Tableau 2 : Points given by pedestal territory.

Pedestal territory	Points
Prairie	1
Desert	4
Mountain	3 (2x)
Boreal forest	3 (2x)
The North	4
Space	5 (2x)
Moon	10

A *Mercantilism* bonus of 4 points is given to teams who extract all resources. A resource is considered extracted when it is entirely out of its initial hole.

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A *Master of the world* bonus is given to teams who plant their flags in every pedestal. Those points, which can give up to 15 points, will be distributed based on the fastest team. Points are given following this function:

$$Bonus_{Master\ of\ the\ world} = 15 * \frac{Best\ time}{Team\ time}$$

If a team cannot control their machine without a direct visual contact, the team can decide that a general, instead of the pilot-emperor, control their machine for a fraction of possible points. In that situation, the team will have 20% of normal points for every planted flag, without any possible points for bonuses.

Judge evaluation

Judges will be selected among Laval University's teachers, sponsors, and co-writers of this challenge, in order to evaluate, as fairly as possible, the different aspects of your machine. The judges' evaluation will be made based on a private 8 minutes oral presentation, the morning before the performance. A question period of 3 minutes will be at the judges' discretion right after the presentation.

The following grid shows the points awarded for different criteria of the oral presentation:

Tableau 3 : Points for the oral presentation.

Criteria	Points
Concepts and conception quality	15
Solution originality	10
Aestheticism and environnement respect	5

Presentation video

You have to create a presentation video and give it on a USB key during the first machine work period. This video will be presented during the competition and judges will evaluate it. It counts for 5 points of the final score and the grid below shows the different criteria.

Tableau 4 : Points for the presentation video.

Criteria	Points
Team members presentation	1
Global presentation of the machine	1
Presentation of an original/innovative concept	1
Video originality	2

The video must also follow these eligibility criteria :

- Respect of format: Numeric (USB key)
- Encoding respect: Watchable on VLC
- Handed over during the first machine work period
- Duration of 4 to 5 minutes
- The video cannot contain disrespectful content

If a video does not follow those eligibility criteria, the team who made the video won't have any points for it and it will not be showed during the competition.
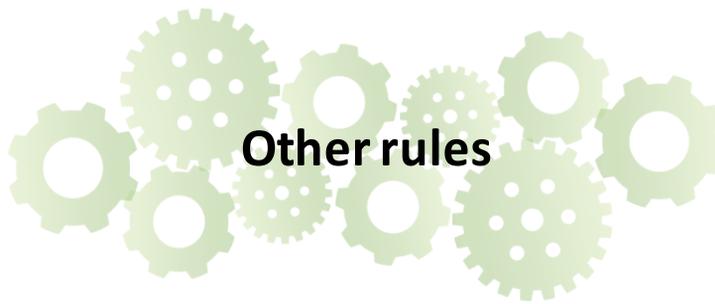
Mid-term report

A mid-term report of a maximum of 5 pages must be sent before November 20th, 2017 at this address: machine@jeuxdegenie.qc.ca. Evaluated elements are presented in the grid below.

Tableau 5 : Points for the mid-term report.

Evaluated elements	Points
Format and readability of the report	1
Blueprint, sketch and/or isometric view of the machine	1
Movement strategy	1
Flag manufacturing method	1
Concept used for the communication between the pilot-emperor and the machine	1

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Other rules

6.1 Maximum voltage of your machine is 24V.

6.2 Every element of your design must be safe for participants and the audience. The organisation committee keeps a complete discretion on that matter.

6.3 Explosives and containers under pressure are strictly forbidden.

6.4 It is mandatory that you can prove without any doubts that your machine does not contain poles before the beginning of a run.

6.5 It is prohibited to damage or soil the course in any way. Therefore, a machine cannot leave material, residues liquids, or anything else that can compromise the quality or integrity of any surface of the course.

6.6 It is possible for any delegation to send questions to the organisation committee if you want to clarify some ambiguous points of the challenge. You can send your questions at machine@jeuxdegenie.qc.ca and answers to relevant questions will be posted on the 2018 Engineering games website. Answers will be given in the language it was asked.

6.7 During Engineering games, you will be authorized to bring your own parts of the course. However, know that every part of course will be at the disposition of every team machine, with a waiting list system.

6.8 During the official competition, know that posters could be present under the mountain and the space. You will know the exact dimensions and position of those posters when you will arrive at Engineering games.

6.9 During Engineering games, three work periods will be scheduled for team machines to work on their machine and try some runs on the official course. Exacts moments of those periods will be given later this fall.

6.10 For Engineering games, sportsmanship means a lot. Therefore, the organisation committee encourages you to collaborate and cooperate with every other team so that everybody can give their best possible performance. As the young boy in La guerre des tuques said: 'The war, the war, ain't no reason to hurt one's self!'.