# Main Event: Search & Rescue

## Event Description:

Prior to the day of the event, teams of 2-3 students will create a robot that can navigate a blind maze using a live video feed and then find 3 randomly placed objects, remove them from the maze, and drop them into the safety target zone. Students' robots must be made from Lego pieces. Students may use rubber bands or tape to modify their claw for more grip.

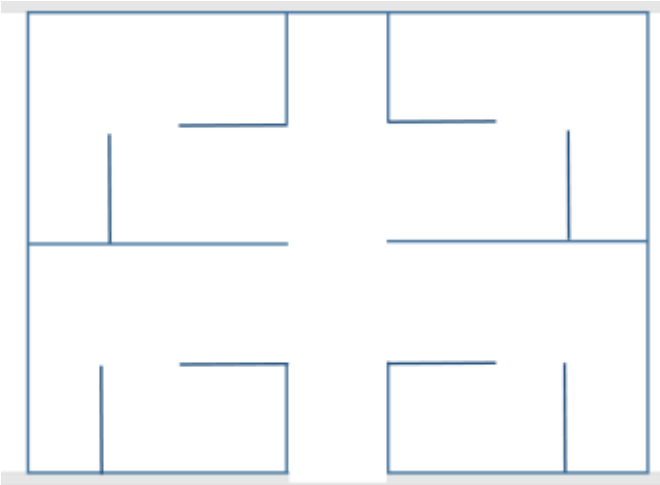
## Common Core Standards and 4C's:

Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own ideas clearly and persuasively. Creativity, Collaboration, Communication and Critical Thinking.

## Designing and Programming your Robot:

### *Design Specifications:*

Your robot will need to be able to drive around on a course and attempt to pick up and carry 3D printed figurines from their elevated base (3 5/8" tall) to the outside of the maze where it will drop it onto a flat target zone. The figurines will vary in size: small, medium, and large.



### *Course Layout:*

The course has one entrance which is also the exit. It is modeled after a small dwelling, with a central hallway that leads to two rooms on either side of the hallway (4 rooms total).

Each room will have extra walls/barriers. Each room layout is a rotation and reflection of a previous room.

The course itself will take up a space of 8ft by 8ft and will be curtained off. The walls of the maze will be 8" tall, and the paths/aisles will all have a minimum of 1.5' in width. There will be a gate at the entrance, measuring 8" high. The robot must be able to drive under the gate.

## Technical Requirements:

Vehicles must be constructed entirely with LEGO pieces.

The robot cannot be larger than 12(l)x12(w)x8(h)

The robots may be controlled with a remote control program through Bluetooth such as the NXT Remote Program (download the folder and extract to your desktop) or EV3 simple remote.

Your robot will need a way **to stream live video feed**. This can be accomplished with a cell phone, a goPro camera, or other small video recorder. Apps to stream include google hangouts, skype, robocam, and others.

Time will start as soon as the robot crosses the gate and time will stop as soon as it drops the 3rd figure, or 10 minutes have passed.

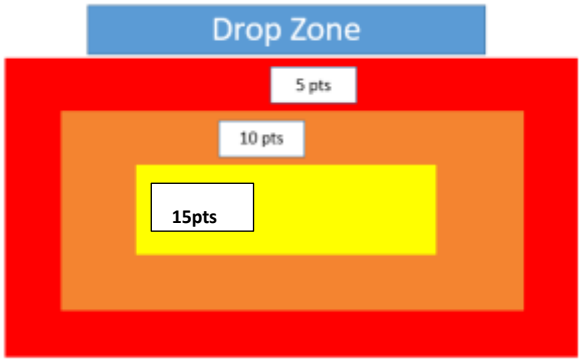
Teams will have 10 minutes to complete the course. The score and time combination will be used to calculate the FINAL SCORE (see scoring section).

ONLY registered students are allowed to touch the robot and computer that is used. (If a situation such as laptop failure arises, then the coach can inform a contest official and receive approval before entering the team competition area.)

Live student problem-solving is the spirit of this competition.

## Scoring:

Scores will be a combination of the points awarded from successfully completing the course AND from the time it takes to finish. The majority of the points come from rescuing the figures and dropping them carefully in the target zones. Time will mostly be used to help split ties, along with points from the Design Document.




**Rescue Points:** Students receive 5 points for each figure they successfully carry out past the gate. If the figure touches the ground at all, carry points are null.

**Drop points:** Students receive up to 15 points based on where on the target they drop the figure. If any part of the figure is on a higher scoring color, we will take the higher score. Students may also push the figure into a better color.

**Maximum Points:** Each figure can earn a maximum of 20 points: +5 for carry, and +15 for red drop.

**Locking Scores:** When two of the robot's wheels leave the target zone, the score is to be recorded, and the figure moved to the scoring bins.

### *Points from Course:*

| **Objective** | **Max Points** |
|---|---|
| **Rescuing large Figure** | 20 pts |
| **Rescuing medium figure** | 20 pts |
| **Rescuing small figure** | 20 pts |
| **Total** | 60 pts |

### *Points from Time:*

Up to 10 points will be awarded based off of your time as a ratio to the best time of all competitors. The time used will be from whichever round you scored the most points from the course.

| **Lego Robotics Scoring Breakdown** | | |
|---|---|---|
| | Max Points | Formula |
| **Points from COURSE** | 60 | See List Above |
| **Points from TIME** | 10 | First Place Time / Team's recorded time x 10<br>= Team's TOTAL TIME |
| **Points from Design Document** | 30 | See Next Page |
| **TOTAL POINTS** | 100 | |

# Search and Rescue Design Document

## Overview:

Students will create a document outlining the process of designing and testing their robot. There will be four main sections: Research, Specifications, Programming and Testing. The document will be submitted and scored prior to the tournament and will be worth 30 points. Design Documents must be converted to a PDF file before uploading to the Search and Rescue Design Document Submission Portal on Teams no later than 11:59 pm on March 3, 2018.

## Research:

In this section students will use the internet or other sources to search for facts and information about Robotics in Emergency Services. They will need to provide specific examples of emergency response robots (such as DARPA, search and rescue bots, etc) and cite the sources they used for their research. Finally, they should describe how this research relates to their own project.

## Specifications:

In this section students will list the dimensions of their robot (length, width, height) as well as a list of the primary components they used (motors and sensors). They will also include pictures of their robot.

## Programming:

Students will explain how they controlled their robot to complete the task. They should state what program they used and discuss specific settings. They will also include a screenshot of the program. Students will explain how they set up their video feed: describing both technology used, and apps/software used.

## Testing:

In the final section, students will describe the testing of their robot and what modifications they made to improve its speed and accuracy. This should include physical changes to the robot such as changing the wheels or redesigning the robot. It should also include changing the setting of the remote-control program. Students should include a data table showing the results of different trials.

## Sample Data Table:

We only included times of trials that were completed successfully without dropping any blocks or knocking down any of the starting towers.

| Trial | Time | Adjustments |
|---|---|---|
| **1** | 4:57 | First successful completion of the course. |
| **2** | 3:42 | Increased the speed of the motors to 90% |
| **3** | 3:30 | Used larger wheels on the robot. |
| **4** | 3:10 | Reset the controls of the program to easier buttons for driving. |
| **5** | 2:57 | Improved speed by practicing driving with a partner controlling the arm. |

## Getting Help:

Visit the Tournament of Technology Website Teams site to see a sample Design Document.

Contact Alaina Tudman Alaina.wood@fresnounified.org or Philip Siechert at Philip.Siechert@fresnounified.org if you have any further questions regarding this event.

## Search & Rescue Design Document Scoring Rubric

**Team:**_____

| Category | Exemplary | Proficient | Partially Proficient | Incomplete | Points |
|---|---|---|---|---|---|
| **RESEARCH:** | **5 points** | **3 points** | **1 point** | **0 points** | |
| **There are specific examples provided.** | 3 or more very relevant examples are provided. | 2-3 relevant examples are provided. | Only 1 somewhat relevant example is provided. | There were no examples provided. | |
| **WORKS CITED:** | **5 points** | **3 points** | **1 point** | **0 points** | |
| **Multiple reliable sources have been referenced or cited in the research.** | 3 or more very reliable sources have been referenced or cited in the research. | 2 reliable sources have been referenced or cited in the research. | Just 1 somewhat reliable source was referenced or cited in the research. | There were no sources referenced or cited in the research. | |
| **SPECIFICATIONS:** | **5 points** | **3 points** | **1 point** | **0 points** | |
| **The dimensions and components of the robot are clearly listed with multiple pictures.** | All dimensions/components are listed and there are 3 or more pictures of the robot. | Dimensions/components are listed and there are 2 pictures. | Missing dimensions or components and has just 1 picture. | Missing dimensions and components and there are no pictures. | |
| **PROGRAMMING:** | **5 points** | **3 points** | **1 point** | **0 points** | |
| **It is very clear how the programming makes the robot complete the tasks.** | It is very clear how the programming works. | It is somewhat clear how the programming works. | It is unclear how the programming works. | There is no explanation of the programming at all. | |
| **TESTING:** | **5 points** | **3 points** | **1 point** | **0 points** | |
| **There was significant testing to improve the speed/accuracy of the robot.** | 5 or more modifications were very clearly described in the testing. | 3 modifications were clearly described in the testing. | Fewer than 3 modifications were somewhat described in the testing. | There were no adjustments or modifications described in the testing. | |
| **DATA TABLE:** | **5 points** | **3 points** | **1 point** | **0 points** | |
| **A clear and detailed data table was included to show results of the testing.** | The data table was very clear and easy to read with multiple entries and detailed results. | The data table was clear with but lacked specific detail. | The data table was confusing and lacked detail. | There was no data table in the design document. | |
| | | | | ***Total Score (30 max)*** | |