FIRST LEGO LEAGUE

NATURE'S FURY℠ CHALLENGE

PREPARE. STAY SAFE. REBUILD.

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FIRST

LEGO education

Innovation Project

In the *FIRST*® LEGO® League NATURE'S FURYSM Innovation Project, your team will:

- **Identify** a community that could experience a natural disaster
- **Identify** a problem that happens when a natural disaster occurs
- **Create** an innovative solution that helps people prepare, stay safe, or rebuild
- **Share** your problem and solution with others

Think About It

Little did 10-year-old Tilly Smith know that her geography lesson would save her life. Tilly and her class sat quietly watching a video about a tsunami halfway around the world in Hawaii in the United States of America. They watched the ocean sizzle and froth and thought it looked like a fizzy drink being poured into a glass. They watched a wall of water rise up from the ocean and crash on the shore. They saw the damage left behind. It was interesting, but it seemed very far away from Surry, United Kingdom.

Then, Tilly and her family went to Phuket, Thailand, for winter holidays. On December 26, 2004, as Tilly and her family played on the beach, she noticed something strange. The ocean was bubbling — almost like a fizzy drink being poured into a glass.

Suddenly, Tilly realized where she had seen this strange sight before. She took action. Tilly told her parents that a tsunami was on the way. Tilly's parents had not learned about tsunamis in school, so they did not know what a tsunami was. She explained what she had learned and that everyone needed to get away from the beach fast. Tilly's parents took action, too. They shared what Tilly had learned and warned the hotel staff to get everyone to higher ground — just in case.

That day, the ocean did more than just splash on the beach. Not long after Tilly warned everyone, a huge wall of water washed across beaches, cars, buildings, and everything else near the water. Nobody died on the beach near Tilly's hotel. Thanks to Tilly, everyone got to safety before the huge wave arrived.

Others were not so lucky. The tsunami hit the coasts of 13 countries. The giant wave created by an undersea earthquake injured more than 600,000 people. Not everyone survived. Many, many people lost their homes. In some places, there was very little warning. The wave hit Sumatra just 30 minutes after the earthquake. It hit Tilly's beach less than two hours later.

WHAT HAPPENS WHEN FORCES OF NATURE HARM PEOPLE AND DAMAGE PROPERTY? A NATURAL DISASTER.
Tsunamis are not the only forces of nature that can cause natural disasters. Our planet has been moving and changing for millions of years. When forces of nature damage communities or put many people in danger, it's called a natural disaster. Natural disasters of all kinds happen in every part of the world. Each year almost 250 million people find themselves in or near a natural disaster.

THINK ABOUT IT.
- Rain helps the plants grow and gives us water to drink. But what happens when the rain falls so hard that rivers, streams, and lakes spill onto dry land? A flood.
- When the wind blows, you can fly a kite or paper airplane. But what happens when the wind blows so hard that it knocks down houses or picks up cars? A tornado or a hurricane.
- Did you know that the ground under your feet is moving? Usually, it moves so slowly that only the scientists who study it know it's moving. But what happens when it moves so hard and fast that you feel the ground shake or see lava flow? An earthquake or a volcanic eruption.

Any of these natural events could cause a natural disaster. Your Innovation Project challenge this season is to develop an innovative solution that helps people prepare, stay safe, or rebuild.

Choose a Community

Begin your Innovation Project by choosing a community where a natural event could cause a natural disaster. Your team's community could be a city, village, town, township, county, or district. You can choose the place where you live. You can choose a place nearby. You can choose a place far away, if your team is interested in a natural disaster that is not likely to happen near you. Choose a community where one of these natural events could happen:

- Avalanche or landslide
- Tornado or cyclone
- Earthquake
- Tsunami
- Flood
- Volcanic eruption
- Hurricane
- Wildfire
- Storm (wind, sand, blizzard, or rain)

NOT SURE HOW TO CHOOSE A COMMUNITY? CONSIDER THESE SUGGESTIONS:

Each Team Member — You or someone you know may have experienced a natural disaster. Begin by asking your own family and friends. Have they ever been in or near a natural disaster? When? Where? What happened?

Think about places where you have been. Could a natural disaster happen in any of those places?

Check the news. Are there any natural events currently happening around the world that might cause a natural disaster?

Make a list of the places. Be prepared to tell what you learned.

As a Team — Next, take a look at each team member's list. Talk about what happened in each place. Talk about how your team can find out more about the forces of nature that can threaten each place. Is the community near you? Can you talk with scientists, engineers, health professionals, volunteers, and emergency management officials who help during natural disasters?

As a Team — Choose a community to research and assess for your Innovation Project. Choose a community that could be threatened by one of the natural events from the list above. Work together to make the decision.

Identify a Problem

Next, learn about the natural event that could cause a natural disaster in your chosen community. Then identify a specific problem and find out what is being done to solve it.

As a Team — Choose one natural event that threatens the community and learn about it. (Make sure the natural event you choose is on the list in the "Choose a Community" section.) Remember, not every natural event becomes a natural disaster. It only becomes a natural disaster when a force of nature harms people or communities. Think about questions like:

- How could this force of nature cause a natural disaster in your chosen community?
- What problems would it cause? Would it harm people, property, or both?
- Is the community always at risk? At risk only during certain times of the year? Is the risk predictable? How do people prepare?
- How are people warned?
- Who provides emergency food, water and shelter ? How?
- Who clears the debris and rebuilds? How long does it take?

As a Team — Choose one specific problem that could happen if a force of nature threatens the community you chose. Then learn about current solutions.

What is being done today to prevent or manage the problem? How do people usually prepare, stay safe, or rebuild? Is a scientist, emergency manager, first responder, or engineer helping with research or developing new technology? Is the government, the military, an aid agency, a community activist, or a health care worker developing new programs? Some resources you may use to look for information include: reports, books, magazines, and websites. Use any research tools you have available. Be prepared to share your sources of information.

Professionals who work in and around your chosen community are often great resources to learn more about current solutions.

- Who makes the plans to keep people safe in a natural disaster?
- Who warns people that a natural disaster could happen?
- Who rescues people in danger? How?
- Who cleans up, repairs, and rebuilds after a natural disaster?

Find out about a professional who is working to solve the problem you identified. Can you connect with them in person? Over the phone? Using email or social media? By letter? Can you learn about how they plan for and respond to natural disasters in the community you chose?

Create an Innovative Solution

Now that your team has decided on a problem, your challenge is to create an innovative solution — **one that makes life better by improving something that already exists, using something that exists in a new way, or inventing something totally new.** Learning about current solutions is just the beginning. How can your solution help keep people and property safe before, during, or after a natural disaster? Could your solution shorten the time it takes to repair and rebuild? Could it prevent a natural event from becoming a disaster? How can your team reduce the impact of natural events on people and the places they live, work, and play?

Think about it. Work together! Brainstorm! Share all your ideas. One team member's "silly idea" just might inspire the perfect innovative solution. What could be done in a new way? What could be done better? A great solution might take all the imagination and ingenuity your team can muster. It might seem so obvious that you wonder why the problem even exists.

As a Team — Use the your team's research and design your team's solution.

* What would it cost?
* What technology do you need to make your solution?
* Would it be difficult or easy?
* Can anyone use your solution or only some people?

Think about how someone could make your solution a reality.

Share with Others

Once your solution is ready, share it! Tell others about the problem you researched and exactly how your solution can help. You choose how to share what you've learned. Give a talk. Create a website. Perform a skit. Make a comic book. Rap. Create a poster. Pass out flyers. Write a poem, song, or story. Your sharing can be simple or elaborate, serious or designed to make people laugh while they learn.

What is the best way to teach your audience about the problem and solution?

Think about who is helped by your solution. How can you let them know? Can you present your research and solution to first responders, lawmakers, scientists, emergency managers, engineers, or groups who already help with your problem? Can you share with the professional who helped you learn about the problem? Or residents of the community you chose? Maybe your team's solution will be the answer to a problem they have been trying to solve.

And remember, the most important thing is to have fun!

Present Your Solution at an Event

Finally, prepare a presentation to share your work with the judges at an event. Your presentation can include posters, slide shows, models, multimedia clips, your research materials—be creative! Remember, you want to leave a lasting impression.

TO BE ELIGIBLE FOR INNOVATION PROJECT AWARDS, YOUR TEAM'S PRESENTATION MUST:

1. Explain the problem your team chose to research (including the natural disaster your team chose).

2. Describe your team's innovative solution.

3. Describe how your team shared your findings with others.

4. Meet the presentation requirements:

   * Give your presentation live; you may use media equipment (if available) but only to enhance the live presentation.
   * Include all team members; each team member must participate in the Innovation Project judging session in some way.
   * Set up and complete your presentation in 5 minutes or less with no adult help.

Judges expect your team to:

* Clearly explain both the problem and your team's solution
* Use different types of research resources, including professionals in the field
* Consider existing theories and solutions as you develop your own solution
* Be innovative
* Show that you thought about what it will take to make your solution happen in the real world
* Target your sharing toward people who might benefit from your team's work
* Find a way to present your work that is both effective and creative

We cannot stop the forces of nature or prevent all natural disasters. But, by learning about them, you will be prepared to make a difference. Remember Tilly Smith? She saved many people by knowing the signs of a tsunami and knowing what to do. There are organizations and agencies around the world preparing for natural disasters every day, but they cannot be everywhere at once. The next time a natural disaster happens, you could be the one who saves the day. You will be ready for Nature's Fury!

Robot Game: Rules

Guiding Principles

GP1 - *GRACIOUS PROFESSIONALISM*® You are "Gracious Professionals." You compete hard against **problems**, while treating **all people** with respect and kindness. If you joined *FIRST* LEGO League with a main goal of "winning a robotics competition," you're in the wrong place!

GP2 - INTERPRETATION

- **If a detail isn't mentioned, then it doesn't matter.**
- Robot Game text means exactly and only what it plainly says.
- If a word isn't given a game definition, use its common conversational meaning.

GP3 - BENEFIT OF THE DOUBT If the referee feels something is a "very tough call," and no one can point to strong text in any particular direction, you get the **Benefit Of The Doubt**. This good-faith courtesy is not to be used as a strategy.

GP4 - VARIABILITY Our suppliers and volunteers try hard to make all Fields correct and identical, but you should always expect little defects and differences. Top teams design with these in mind. Examples include Border Wall splinters, lighting changes, and Field Mat wrinkles.

GP5 - INFORMATION SUPERIORITY If two official facts disagree, or confuse you when read together, here's the order of their authority (with #1 being the strongest):

#1 = MISSIONS and FIELD SETUP

#2 = RULES

#3 = **REFEREE** In unclear situations, local referees may make good-faith decisions after discussion, with Rule GP3 in mind.

Definitions

D01 - MATCH A "Match" is when two teams play opposite each other on two Fields placed north to north.

- Your Robot **LAUNCHES** one or more times from Base and tries as many Missions as possible.
- Matches last 2-1/2 minutes, and the timer never pauses.

D02 - MISSION A "Mission" is an opportunity for the Robot to earn points. Requirements are written in the form of

- **RESULTS** that must be visible to the referee at the **END OF THE MATCH**.
- **METHODS** that must be observed by the referee **AS THEY HAPPEN**.

D03 - EQUIPMENT "Equipment" is everything **YOU BRING** to a Match for Mission-related activity.
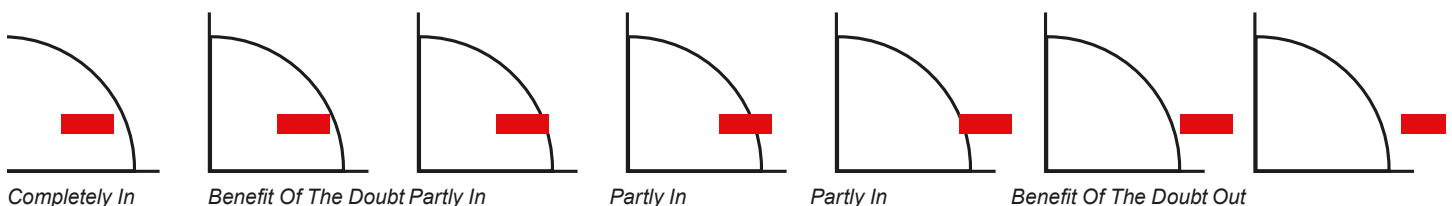
D04 - ROBOT Your "Robot" is your **LEGO® MINDSTORMS®** or **SPIKE Prime** controller and all the Equipment you've combined with it by hand which is not intended to separate from it, except by hand.

D05 - MISSION MODEL A "Mission Model" is any LEGO® element or structure **ALREADY AT THE FIELD** when you get there.

D06 - FIELD The "Field" is the Robot's game environment, consisting of Mission Models on a Mat, surrounded by Border Walls, all on a Table. "Base" is part of the Field. For full details, see FIELD SETUP.

D07 - BASE "Base" is the space directly above the Field's quarter-circle region, in the southwest. It extends southwest from the outside of the thin curved line TO the corner walls (no farther). The thin line around any scoring area counts as part of that area. When a precise location related to a line is unclear, the outcome most favorable for the team is assumed. (See diagram below.)

D07 - BASE

| Completely In | Benefit Of The Doubt | Partly In | Partly In | Partly In | Benefit Of The Doubt | Out |

D08 - LAUNCH Whenever you're done handling the Robot and then you make it GO, that's a "Launch."

D09 - INTERRUPTION The next time you interact with the Robot after Launching it, that's an "Interruption."

D10 - TRANSPORTED When a thing **(anything)** is purposefully/strategically being

- taken from its place, and/or
- moved to a new place, and/or
- being released in a new place,

it is being "Transported." The process of being Transported ends when the thing being transported is no longer in contact with whatever was transporting it.

Equipment, Software, and People

R01 - ALL EQUIPMENT All Equipment must be made of LEGO-made building parts in original factory condition.

> **Except:** *LEGO string and tubing may be cut shorter.*
> **Except:** *Program reminders on paper are OK (off the Field).*
> **Except:** *Marker may be used in hidden areas for identification.*

R02 - CONTROLLERS You are allowed only ONE individual controller in any particular Match.

- It must be from a LEGO Education Robot Set (RCX, NXT, EV3 or SPIKE Prime.
- ALL other controllers must be left in the **PIT AREA** for that Match.
- All remote control or data exchange with Robots (including Bluetooth) in the competition area is illegal.
- This rule limits you to only **ONE** individual **ROBOT** in any particular Match.

R03 - MOTORS You are allowed up to **FOUR** individual motors in any particular Match.

- Each one must come from a LEGO Education Robot Set.
- You may include more than one of a type, but again, your grand total may not be greater than **FOUR**.
- ALL other motors must be left in the **PIT AREA** for that Match, **NO EXCEPTIONS**.

R04 - EXTERNAL SENSORS Use as many external sensors from a LEGO Education Robot Set as you like.

- You may include more than one of each type.

R05 - OTHER ELECTRIC/ELECTRONIC THINGS No other electric/electronic things are allowed in the competition area for Mission-related activity.

> **Except:** *LEGO wires and converter cables are allowed as needed.*
> **Except:** *Allowable power sources are ONE controller's power pack or SIX AA batteries.*

R06 - NON-ELECTRIC ELEMENTS Use as many non-electric LEGO-made elements as you like, from any set.

> **Except:** *Factory-made wind-up/pull-back "motors" are not allowed.*
> **Except:** *Additional/duplicate Mission Models are not allowed.*

R07 - SOFTWARE You can use any software that allows the Robot to move autonomously – meaning it moves on its own. No form of remote control is allowed.

R08 - TECHNICIANS

- Only two team members, called "Technicians," are allowed at the competition Field at once.
  Except: *Others may step in for true emergency repairs during the Match, then step away.*
- The rest of the team must stand back as directed by event officials, with the expectation of fresh Technicians being able to switch places with current Technicians at any time if desired.

Play

R09 - BEFORE THE MATCH TIMER STARTS After getting to the Field on time, you have at least one minute to prepare. During this special time only, you may also
- ask the referee to be sure a Mission Model or setup is correct, and/or
- calibrate light/color sensors anywhere you like.

R10 - HANDLING DURING THE MATCH
- You are not allowed to interact with any part of the Field that's not **COMPLETELY** in Base.

  Except: *You may Interrupt the Robot any time.*

  Except: *You may pick up Equipment that* **BROKE** *off the Robot* **UNINTENTIONALLY***, anywhere, any time.*

- You are not allowed to cause anything to move or extend over the Base line, even partly.

  Except: *Of course, you may* **LAUNCH** *the Robot.*

  Except: *You may move/handle/***STORE** *things off the Field, any time.*

  Except: *If something accidentally crosses the Base line, just calmly take it back – no problem.*

- Anything the Robot affects (good or bad!) or puts completely outside Base **stays as is** unless the Robot changes it. Nothing is ever repositioned so you can "try again."

R11 - MISSION MODEL HANDLING
- You are not allowed to take Mission Models apart, even temporarily.
- If you combine a Mission Model with something (including the Robot), the combination must be loose enough that if asked to do so, you could pick the Mission Model up and nothing else would come with it.

R12 - STORAGE
- Anything completely in Base may be moved/stored off the Field, but must stay in view of the referee.
- Everything in off-Field Storage "counts" as being completely in Base and may be placed on an approved holder.

R13 - LAUNCHING A proper Launch (or re-Launch) goes like this:
- **READY SITUATION**
  – Your Robot and everything in Base it's about to move or use is arranged by hand as you like, all fitting "**COMPLETELY IN BASE**" and measuring no taller than 12 inches" (30.5 cm).
  – The referee can see that nothing on the Field is moving or being handled.
- **GO!**
  – Reach down and touch a button or signal a sensor to activate a program.

IF FIRST LAUNCH OF THE MATCH – *In this case, accurate fair timing is needed, so the exact time to Launch is the beginning of the last word/sound in the countdown, such as* "**Ready, set, GO!**" *or* **BEEEEP!**

R14 - INTERRUPTING If you **INTERRUPT** the Robot, you must stop it immediately, *then calmly pick it up for a re-Launch. Here's what happens to the Robot and anything it was Transporting, depending on where each was at the time:

- **ROBOT**
  – Completely in Base: . . . . .Re-Launch
  – NOT completely in Base: . . . . .Re-Launch + Penalty

- **TRANSPORTED** THING WHICH **CAME FROM BASE** DURING THE MOST RECENT LAUNCH
  – Always: . . . . Keep it
- **TRANSPORTED** THING WHICH **DID NOT COME FROM BASE** DURING THE MOST RECENT LAUNCH
  – Completely in Base: . . . . Keep it
  – NOT completely in Base: . . . . Give it to the referee

The "PENALTY" *is described with the Missions.*

IF YOU DON'T INTEND TO RE-LAUNCH – *In this case, you may shut the Robot down and leave it in place.*

R15 - STRANDING If the **UNINTERRUPTED** Robot loses something it was Transporting, that thing must be allowed to come to rest. Once it does, here's what happens to that thing, depending on its rest location:

- **TRANSPORTED THING**
  – Completely in Base: . . . . Keep it
  – Partly in Base: . . . . Give it to the referee
  – Completely outside Base: . . . . .Leave as is

R16 - INTERFERENCE
- You are not allowed to negatively affect the other team except as described in a Mission.
- Missions the other team tries but fails because of illegal action by you or your Robot will count for them.

R17 - FIELD DAMAGE
- If the Robot separates Dual Lock or breaks a Mission Model, Missions obviously made possible or easier by this damage or the action that caused it do not score.

R18 - END OF THE MATCH As the Match ends, everything must be preserved exactly as-is.
- If your Robot is moving, stop it ASAP and leave it in place. (Changes after the end don't count.)
- After that, hands off everything until after the referee has given the OK to reset the table.

R19 - SCORING
- **SCORESHEET** The referee discusses what happened and inspects the Field with you, Mission by Mission.
  – If you agree with everything, you sign the sheet, and the scoresheet is final.
  – If you don't agree with something, the head referee makes the final decision.
- **IMPACT** Only your **BEST** score from regular Match play counts toward awards. Playoffs, if held, are just for extra fun.
- **TIES** Ties are broken using 2nd, then 3rd best scores. If still not settled, event officials decide what to do.

Robot Game: Field Setup

The field is where the Robot Game takes place.

- It consists of a field mat, on a table, with mission models arranged on top.
- The field mat and the LEGO® pieces for building the mission models are part of your Field Setup Kit.
- The instructions for building the mission models are here.
- The instructions for how to build the table are here.

> **NOTE: BEGINNING IN 2019-20, THE FIELD MAT SIZE IS DIFFERENT AND WILL HAVE DIFFERENT RULES SURROUNDING ITS PLACEMENT ON THE TABLE.**

Mission Model Construction

Build the mission models - Use the LEGO elements from your Challenge Set. It will take a single person four to five hours to do this, so it's best done in a work party. For any team members with little or no experience building with LEGO elements, mission model construction is a great way to learn. This step is also a nice time for new team members to get acquainted with each other.

Mission Model Arrangement and Setup

Dual Lock - Some models are secured to the mat, others are not. Where a model needs to be secured, the connection is made using the re-usable fastening material from 3M called Dual Lock, which comes in the flat clear bag with the LEGO elements in your CHallenge Set. Dual Lock is designed to stick or "lock" to itself when two faces of it are pressed together, but you can unlock it too, for ease of transport and storage. The application process for the Dual Lock is only needed once. Later, the models can simply be locked onto the mat or unlocked. To apply Dual Lock:

Step 1 - Stick one square, adhesive side down, on each box you see on the mat with an "X" in it.

Step 2 - Press a second square on top of each of those, "Locking" them on, adhesive side up. TIP: Instead of using your finger, use a bit of the wax paper the squares came on.

Step 3 - Lower the model onto the squares.

CAUTION - Be sure to place each square precisely on its box, and each model precisely over its marks.

CAUTION - When pressing a model down, press down on its lowest solid structure instead of crushing the whole model. Pull on that same structure if later you need to separate the model from the mat.

TIP: For large and/or flexible models, apply only one or two sets at a time.

Models - Marks on the mat along with the pictures at the end of this section give you most of the info you need to arrange and set the models (place/set as pictured). Here are the remaining details, not obvious from the text:

Models

BATTERY, FLASHLIGHT, AND BOTH RADIOS - Direction doesn't matter.

MAN AND CHILD - Face as shown.

THE FOUR MODELS IN BASE - These are placed anywhere you like in Base and/or other legal storage areas.

TSUNAMI - "Wave" cylinders should be mostly centered. Stud direction doesn't matter.

TREE - Removable branch is all the way into its holder and points directly east (no north/south tilt).

ROOF DEBRIS - At the beginning of the match, these are "owned" by the referee (ref), who can keep them anywhere, but if kept on the field, they must be placed as pictured, and do not count/score as being on the field.

TRUCK - The truck has four models on board: bread, medicine, a loose fuel, and a loose water.

HOUSE DEBRIS/OBSTACLE - The tan wall's tilt direction is toward Base.

TREE DEBRIS/OBSTACLE - Stud directions (on rollers) don't matter.

LOOPS - All must be vertical and symmetrical.

BASE ISOLATION - The west building is pushed north to the back of the tray. Window directions don't matter.

EVACUATION SIGN, BATTERY

PETS, TREE, FLASH LIGHT, ELECTRIC LINES
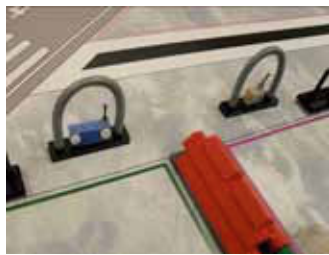
2-WAY RADIO, BOOM BOX

HOUSE, MAN, DIRT BIKE

GENERATOR, LADY

GRAIN, LADY, CHILD, WATER, BUILDING SEGMENTS

TSUNAMI

ROOF DEBRIS (PENALTY OBJECTS)

TRUCK, FUEL, WATER, MEDICINE , BREAD

OBSTACLE

BASE ISOLATION, BUILDING SEGMENTS

BASE ISOLATION

DIRT BIKE

WATER

BARRIER

OBSTACLE

AMBULANCE

OBSTACLE

PROGRESS DIAL – This model is Dual Locked to the center of a competition setup, which means it sits half on your north border wall, and half on the other team's north border wall. If your practice table doesn't have a "dummy wall" behind your north border wall, build one by fastening a scrap piece of wall to the center back side of your table as shown. (A dummy floor is shown here, but that's not needed for Nature's Fury.)

DUMMY WALL
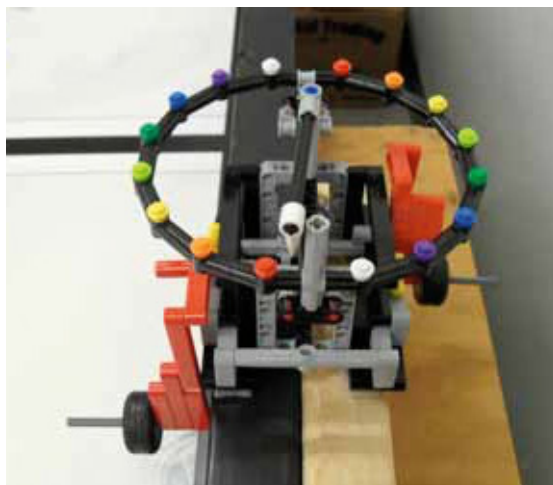
STARTING POSITION

CARGO PLANE ARRIVAL END - Place the frame parallel to the runway and use as much Dual Lock as needed to get a solid mount. The string enters the pulley from the bottom, and the pawl (stopper bar) is on top.

The rest of the steps for this model only apply to you if your border wall is shorter than 3" (77mm)…

When you built this model, you built it for a tall border wall, and as such, the reel is flipped downward. But If you have a short wall, the reel needs to be flipped upward. If your border wall is shorter than 3" (77mm), take apart and rebuild the pulley end to match the pictures labeled "SHORT BORDER."

- Take the axle out. The gear, reel, and two spacers will fall off.
- Remove each L-beam with its tiny companion beam still fastened to it.
- Trade these 2-piece units with each other, and reinstall them upside down.
- With the gear at the northwest, reinstall the pulley and spacers, with the axle coming from the northwest.
- Finally, swap the stopper bar to its corresponding hole near the gear. The string still enters the pulley from the bottom.

TALL BORDER

FLIP AND TRADE THESE "L-UNITS"

SHORT BORDER

CARGO PLANE DEPARTURE END - This model is Dual Locked to the top of the south border wall as shown. Place the east corner of its base 56-½" (1435mm) from the inside surface of the east border wall. Apply full coverage of Dual Lock to the inside of the vertical wall under the tower and press it into place against the outside of the south border wall. **Do not put Dual Lock on top of the wall.**

(T = TOWER, SW = SOUTH WALL, EW = EAST WALL)
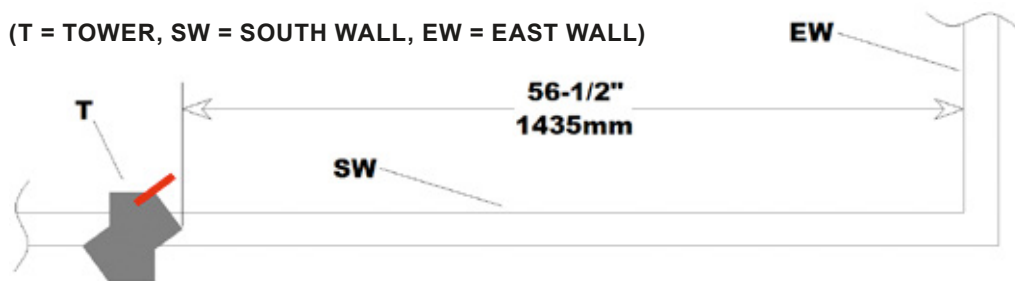
Put the hook end of the string through the plane's trolley from nose to tail, and hook onto the hitch bar, and latch the plane to the tower. If the string is not parallel to the runway, you can pull the tower's Dual Lock apart, move the tower a little as needed, and then press it on again. Finally, use the thumb-gear at the arrival end to put tension on the string until the cantilever (tire/arm weight) sits mostly level.

The rest of the steps for this model only apply to you if your border wall is shorter than 3" (77mm)…

When you built this model, you built it for a tall border wall, and as such, the tower is in its "short" configuration. But If you have a short wall, the tower needs to be lengthened. If your border wall is shorter than 3" (77mm) pull out the lock pins, extend the tower by two holes, and push the lock pins back in, to match the pictures labeled "SHORT BORDER."

- Pull out the four lock pins for ONE leg. A partial pull-out is all that's needed, so they let go of the inner beams.
- Move the lower two pins up a distance of two holes.
- Reinstall the inner beams two holes higher than they used to be.
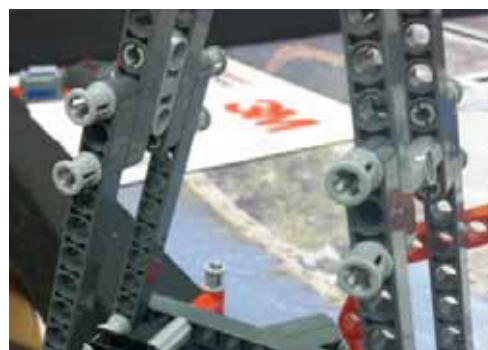- Do the same for the other leg.

In the middle picture, the four pins on one leg have been pulled out, and the far side lower pin has been moved up a distance of two holes.
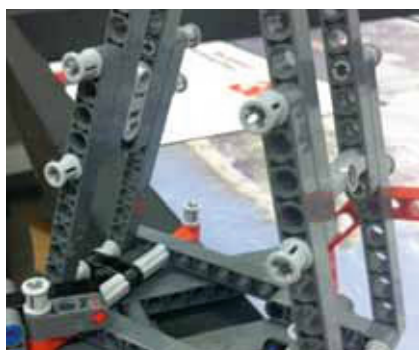
SHORT TOWER FOR TALL BORDER   **(ONE LEG BEING WORKED ON)**   **TALL TOWER FOR SHORT BORDER**

EVENT ORGANIZERS SHOULD TAKE EXTRA STEPS TO SECURE THE TOWER TO THE WALL.

| LEFT FIELD | CENTER FIELD | RIGHT FIELD |

Field Maintenance

- **Border Walls** - Remove any obvious splinters, and cover any obvious holes.

- **Field Mat** - Make sure the mat touches the south border wall, and is centered east to west. Avoid cleaning The mat with anything that will leave a residue. Any residue, sticky or slippery, will affect the robot's performance compared to a new mat (many events use new mats). Use a vacuum and/or damp cloth for dust and debris (above and below the mat). To get marks off, try a white-plastic pencil eraser. When moving the mat for transport and storage, be sure not to let it bend into a sharp kink point, which could affect the robot's movement. Events using new mats should unroll the mats as far in advance of the event day as possible. For control of extreme curl at the east or west edges of the mat, tape is allowed, with a maximum of ¼" (6 mm) overlap. Foam tape is not allowed. Do NOT put Dual Lock under the mat, or use it in any other than securing models as described.

- **Mission Models** - Keep the models in original condition by straightening and tightening solid connections often. Ensure that spinning axles spin freely by checking for end-to-end play and replacing any that are bent.

Robot Game: Missions

As future scientists and engineers currently on *FIRST*® LEGO® League teams, you will craft highly intelligent approaches to preparation, safety, and reconstruction when faced with the incredible destructive energy of natural events. Start the innovative thinking now, as you confront and master the symbolic missions of the robot game below.

Scoring Regions

| ORANGE | LT GREEN | YELLOW | LT BLUE | PINK | DK BLUE | DK GREEN | PURPLE | RED |
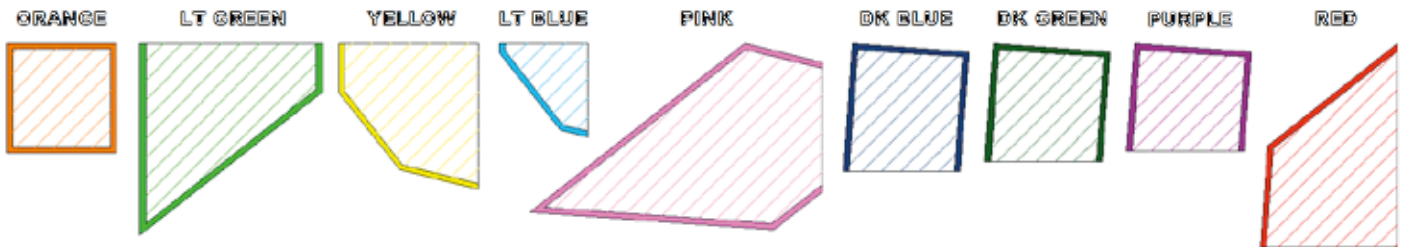
Missions

SUPPLY TRUCK
Condition visible at the end of the match:
— The supply truck is touching the mat in the yellow region.
(Note that the LT blue region is in the yellow region.)
Value: 20

EVACUATION SIGN
Conditions visible at the end of the match:
— The sign is obviously up (it doesn't need to be vertical), held in place only by the slider's friction with the mat.
— No part of the sign model is being touched by the robot, or any strategic object.
Value: 30
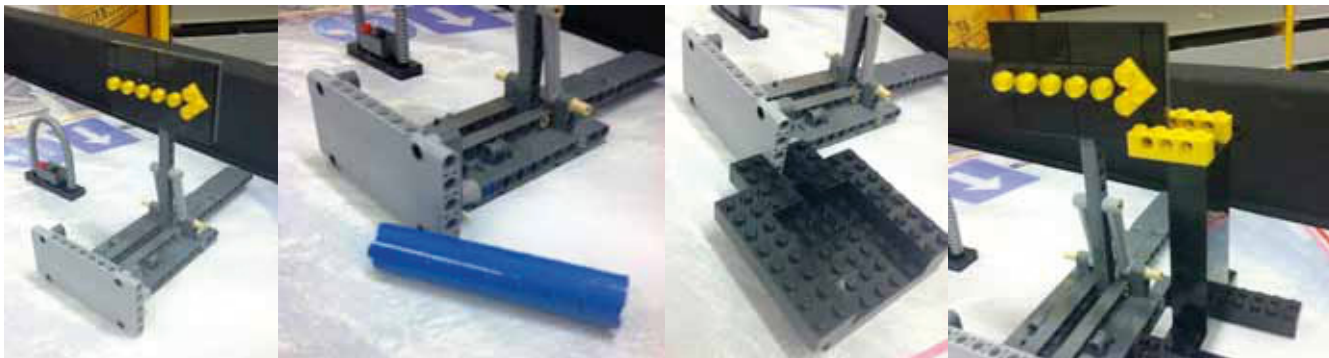
| SCORE | SCORE | NO | NO |

CARGO PLANE
Condition visible at the end of the match:
— The plane is in the yellow region.
(Points are given for yellow and not LT blue, or for LT blue, but not both.)
Value: YELLOW AND NOT LT BLUE… **20** -OR- LT BLUE… **30**
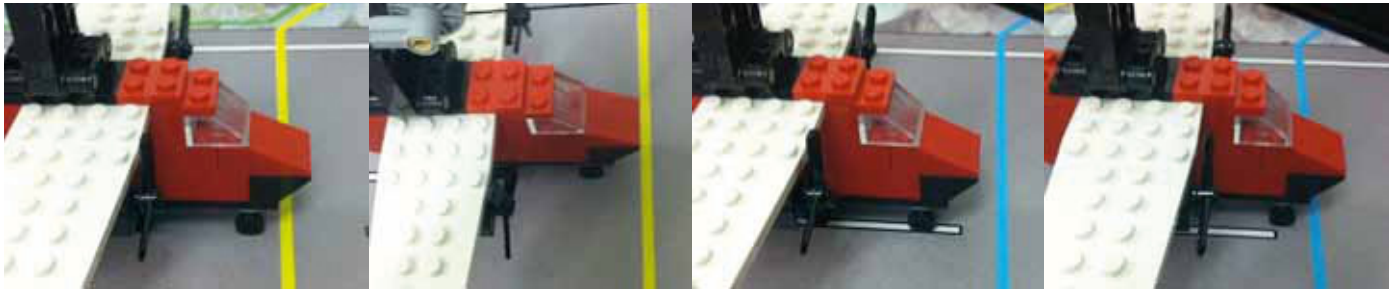
YELLOW	YELLOW	YELLOW	LT BLUE

TREE BRANCH
Conditions visible at the end of the match:
— The east tree branch is closer to the mat than the electric cables are.
— The tree and the electric cable models are upright, touching the mat.
Value: 30

TSUNAMI
Conditions visible at the end of the match:
— All three waves are touching the mat.
Value: 20

AMBULANCE
Conditions visible at the end of the match:
— The ambulance is in the yellow region.
— All the ambulance's wheels are touching the mat.
Value: 25

RUNWAY
Conditions visible at the end of the match:
— Nothing except wave water and/or the plane is touching the mat anywhere on the runway. **Value: 30**

CONSTRUCTION RELOCATION
Conditions visible at the end of the match:
— There are no gray building units anywhere in the LT green region.
Value: 20

BASE ISOLATION TEST

Conditions visible at the end of the match:
— The west tan building is undamaged: Four segments, 90° to mat, and "perfect" alignment.
— The east tan building is obviously damaged.
— *Nothing is touching either building except the rolling frame.
— *Nothing ever touched either building except the rolling frame.
— The damage was caused purely by movement of the rolling frame.
(*Exception: Fallen segments from the east building may touch the mat and/or the west building by chance.)
Value: 30

| SCORE | SCORE | NO |

| SCORE | REALLY? |

CODE CONSTRUCTION

Conditions visible at the end of the match:
— A multi-story building is in the pink region.
— The building is made of building segments only.
— The finished building does not rely on strategic objects or the robot in any way.
(Perfect nesting and alignment are not needed for this building.)
(If there are multiple buildings, only the highest score-worthy one scores.)
Value: 5 EACH SEGMENT OF HEIGHT
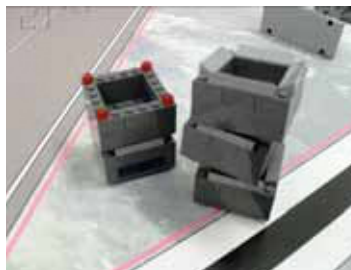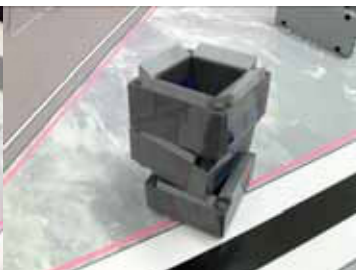
| H = 3 | H = 4 | H = 3 | NO |

OBSTACLES

*Condition visible DURING the match:

— The robot has crossed completely over the west line of the noted region, from the west only.

(This mission involves exceptions to the Rules...)

(This mission may be repeated as desired, in hopes of improved results.)

(Points given are permanent unless a better result replaces them later in the same match.)

(Points are given only for the best result achieved.)

(The robot may be rescued from this mission as needed, successful or not, without penalty.)

(Points given are permanent even if the robot later leaves or is rescued from the region.)

Value: DK BLUE…**10** -OR- DK GREEN…**16** -OR- PURPLE…**23** -OR- RED…**31**

| NO | DK BLUE | DK BLUE |

HOUSE LIFT

Conditions visible at the end of the match:

— The house is locked in its high position.

Value: 25

PROGRESS

Conditions visible at the end of the match:

— The pointer has reached colors as a result of red lever motion only (moving left in the picture).

(Points for this mission are awarded to both teams, no matter who operates the model.)

(No points are awarded if this model has not been operated.)

Value: COLORS REACHED…**2** EACH
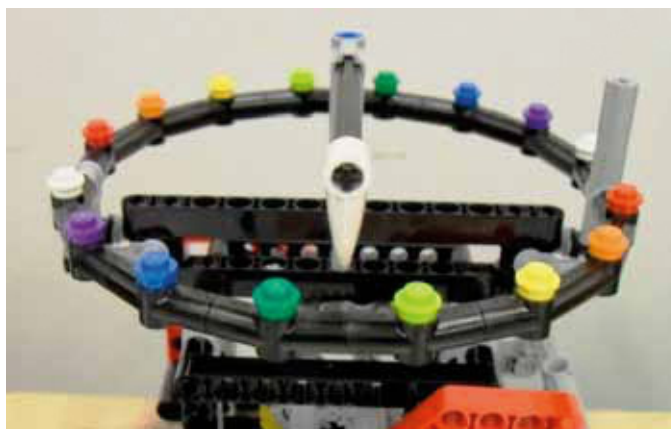
| LT GREEN | LT GREEN |

FAMILY

Conditions visible at the end of the match:

— At least two people are together in any colored region.

(Points are awarded for 2, or 3, but not both.)

Value: 2…**33** -OR- 3…**66**

WATER
Conditions visible at the end of the match:
— At least one person is together with (bottled) water in the same region.
Value: PEOPLE WITH AT LEAST 1 WATER…**15** EACH

SAFETY
Conditions visible at the end of the match:
— At least one person is in a region colored red or yellow.
(Points for people in red and people in yellow are combined.)
Value: PEOPLE IN YELLOW…**12** EACH, PEOPLE IN RED…**18** EACH

PETS
Conditions visible at the end of the match:
— At least one pet is together with at least one person in any colored region.
Value: PETS WITH AT LEAST 1 PERSON…**15** EACH

SUPPLIES & EQUIPMENT
Conditions visible at the end of the match:
— At least one non-water item is in a region colored red or yellow.
(12 Possible: 2-way radio, battery, generator, 2 fuel, grain, bread, medicine, boom box, flashlight, dirt bike, helmet)
Value: ANY IN YELLOW…**3** EACH, ANY IN RED…**4** EACH

SAFE PLACE
Conditions visible at the end of the match:
— If the only part of the robot in the RED scoring zone at the end of the match is obviously designed/added to the robot purely for extension, the condition doesn't score.
Value: 25

SCORE   **NO**

GAME PENALTY
If a penalty is earned (as described here and in the Rules), the ref places a roof debris model on the west-most possible roof mark which is completely empty. Placement is expected to be closely aligned on the mark, but may not be perfect. For penalties after the 4th, the west-most debris is placed as far as possible into the northeast corner of the LT blue region. The robot may not remove debris from the LT blue region.
Value: ANY IN LT BLUE…**– 13** EACH, ANY OUTSIDE LT BLUE…**– 10** EACH