



FIRST  
LEGO  
LEAGUE

EXPLORE

# ENGINEERING NOTEBOOK





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# Welcome!

I'm Jacob!



I'm Ruby!



We are excited to join you on your team journey! Come along with us as we guide you through the CARGO CONNECT<sup>SM</sup> challenge.

## Team Members:

1.

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2.

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3.

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4.

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5.

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6.

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I'm Max!  
Come on!  
Let's go!



# Team Journey

Explore the challenge



Learn about Core Values



Explore, create, test, and share as you go through the sessions

Create team model



Design team poster



Celebrate at an event



# Challenge Story

Let's think of ideas for different ways to transport cargo.



Let's explore how cargo is transported to places all over the world.



Let's create a team model showing how cargo is sorted and transported to its destinations.



Share your ideas, your team model, and what your team has learned with others.



# Core Values

Draw or write an example of your team demonstrating each Core Value when directed in the sessions!



## DISCOVERY

We explore new skills and ideas.

Grid area for Discovery.

## INCLUSION

We respect each other and embrace our differences.

Grid area for Inclusion.

## INNOVATION

We use creativity and persistence to solve problems.

Grid area for Innovation.

## TEAMWORK

We are stronger when we work together.

Grid area for Teamwork.

## IMPACT

We apply what we learn to improve our world.

Grid area for Impact.

## FUN

We enjoy and celebrate what we do!

Grid area for Fun.



Use the Core Values to guide your team through your journey.

Have lots of FUN as you develop new skills and work together.



# Session 1

## Tasks (20 minutes)

- Talk about Ruby and Jacob's questions.
- Use the space below to capture your inventive ideas!
- Follow the building instructions in Book 1 to make the truck.
- Look at the mat and discover how the truck works!

## Your team needs:



What products need to be transported to and from your community?

How is cargo packed and loaded onto vehicles?

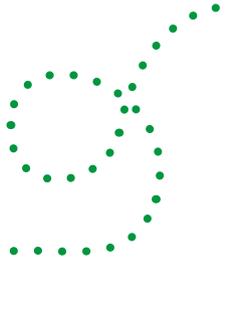


Large lined circular areas for writing answers to the questions.



# Let's Explore

Your team needs:



## Tasks (20 minutes)

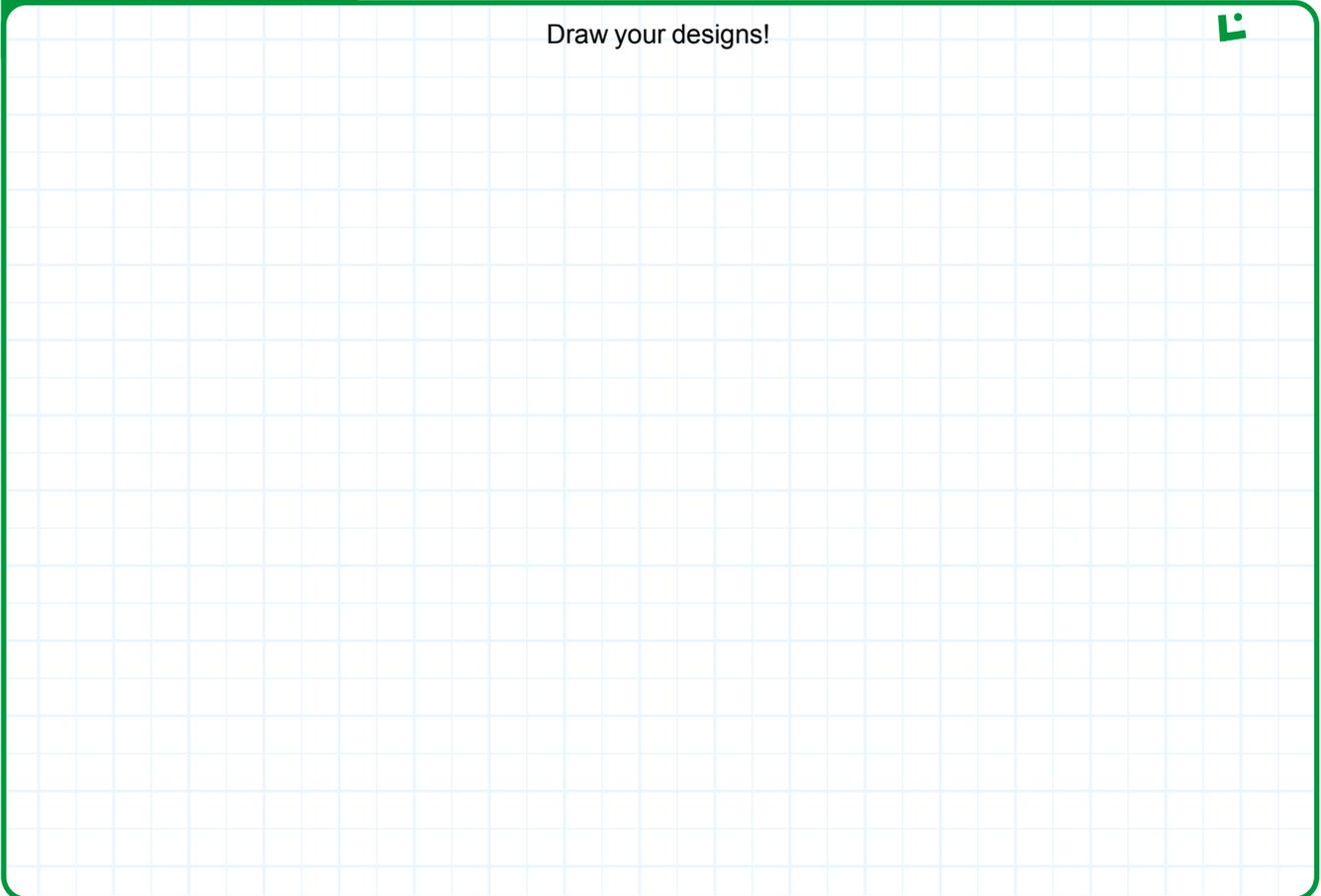
- Circle the routes the truck can take on the mat image.
- Draw your design of a truck that transports cargo.
- Label what products are in the cargo the truck transports.
- Share your creation with your team!
- Work as a team to build your amazing truck designs using the LEGO® prototyping pieces (Bag 4).
- Place your built trucks on the mat and show how they work.

What have you discovered? Share with your team!



## DESIGNS

Draw your designs!



# Session 2

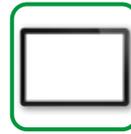
## Tasks (20 minutes)

- Open the WeDo 2.0 or SPIKE™ Essential app. Find your lesson.
- Can you make the robot go in a different direction? Capture your ideas!
- Explore how to change the existing program based on your ideas.
- Run your new program. See what happens.

## Challenge

- Can you add a propeller, steering wheel, or boat rudder to the robot?
- Redesign the robot. Play your program.

## Your team needs:



Classroom Projects:  
**Cooling Fan**



FIRST® LEGO® League  
Explore Unit:  
**Lesson 1**

Show me your innovative ideas!



## IDEAS

Draw your ideas!

# Let's Transport

Your team needs:



You built a truck that transports cargo last session.

Can you create two other forms of transportation that can transport cargo?



Reflect as a team on how an engineer creates innovative designs.



## Tasks (20 minutes)

- Explore the mat while thinking about Jacob's question.
- Draw a picture of your designs for two forms of transportation.
- Share your brilliant designs with your team!
- Create a design using the prototyping pieces to show your team's solution.
- Show how your creations work on the mat.

## DESIGNS

Draw your designs!



# Session 3

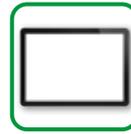
## Tasks (20 minutes)

- Open the WeDo 2.0 or SPIKE™ Essential app. Find your lesson.
- Can you code the robot to play a different sound or flash a light? Explain your solution.
- Change the existing program based on your ideas. Test it out!

## Challenge

- Can you make the robot flash a different color or move?
- Change the robot and play your program.

## Your team needs:



Classroom Projects:  
**Spy Robot**



FIRST® LEGO® League  
Explore Unit:  
**Lesson 2**

Use teamwork to solve this challenge!



## SOLUTION

Draw your solution!

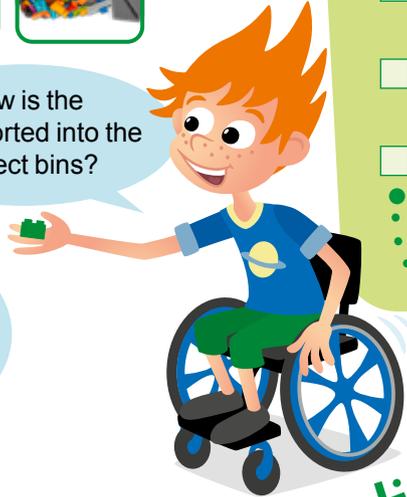
# Let's Sort

## Your team needs:



How is cargo loaded and unloaded at the sorting center?

How is the cargo sorted into the correct bins?



I wonder how your team has used teamwork. Can you think of an example?

## Tasks (20 minutes)

- Follow the building instructions in Book 2 to make the sorting center.
- Place the sorting center on the mat.
- Think of ways to help Ruby and Jacob.
- Try out the sorting center!
- Turn the crank to the right to sort the green cargo to the green bin.
- Turn the crank to the left to sort the blue cargo to the blue bin.
- Brainstorm and share your ideas for how the sorted cargo is loaded for transport to its next destination.

## IDEAS

Draw your ideas!



# Session 4

## Tasks (20 minutes)

- Launch the WeDo 2.0 or SPIKE™ Essential app. Complete your lesson.
- Can you program the robot to move backward? Do a turn? Capture your ideas.
- Change the existing program based on your ideas. Give it a test!

## Challenge

- Can you add a cargo container to the robot?
- Follow your plan and play your program.

## Your team needs:



Classroom Projects:  
**Milo the Science Rover**



FIRST® LEGO® League  
Explore Unit:  
**Lesson 3**

Be sure to include everyone's ideas on your solutions!



## IDEAS

Draw your ideas!

A large grid area for drawing ideas, with a green border and a green checkmark at the top right corner.

# Let's Drive

## Your team needs:



How is cargo transported in and out of my town?

What routes are used to get cargo to the sorting center?



How does a freight driver know what routes to use when transporting cargo? Talk as a team!



## Tasks (20 minutes)

- Chat about Ruby and Jacob's questions.
- Brainstorm, brainstorm, brainstorm!
- Place the sorting center on the mat.
- Use the mat to map out your planned path.
- Create your program and run it.
- Place the cargo delivered from the robot into the sorting center.



## Tasks (20 minutes)

- Read over Ruby and Jacob's questions.
- Get thinking!
- Write down your ideas in the table.
- Explore different areas on the mat where cargo packages are transported.
- Choose and list the different starting points and destinations in the table.

## Your team needs:



What cargo is transported in and out of your community?

What could be inside each cargo package?



## Cargo Packages

### CARGO PACKAGES

				
Product Inside Cargo Packages				
Starting Point				
Destination				

# Let's Motorize

Your team needs:



Talk as a team about how a warehouse worker ensures cargo is sorted correctly.



## Tasks (20 minutes)

- Follow the building instructions in Book 2 to make the motor and hub build.
- Connect the motor and hub build to the sorting center.
- Open the WeDo 2.0 or SPIKE™ Essential app.
- Re-create the program provided in Book 2. Try it out!
- How is blue cargo sorted into the blue bin on the sorting center? Brainstorm your ideas.
- Say what you would change in the program in the space below.
- Play your program to sort the blue cargo.

## IDEAS

Draw your ideas!

# Session 6

## Tasks (20 minutes)

- Start with Ruby and Jacob's questions while looking at the mat.
- Design how you would transport cargo by air and water.
- Show your team your innovative creation!
- Create your team's designs using the prototyping pieces.
- Place your solutions on the mat.
- Show how they will transport cargo safely from the sorting center to the island and icy area.

## Your team needs:



What safety features are there on the sorting center and the mat?

How is cargo from your community transported safely across the water?



## CREATION

Draw your creation!

# Let's Be Safe

Your team needs:



How would a safety specialist do a safety check on the sorting center? Explore ways as a team!



## Tasks (20 minutes)

- Start the WeDo 2.0 or SPIKE™ Essential app.
- Can you code the sorting center to have a safety flashing light when sorting? Think of how to create a program.
- Try out your program!

## Challenge

- Can you add a different sensor that makes the sorting center safer?
- Change the sorting center. Play your new program.

## IDEAS

Draw your ideas!

# Session 7

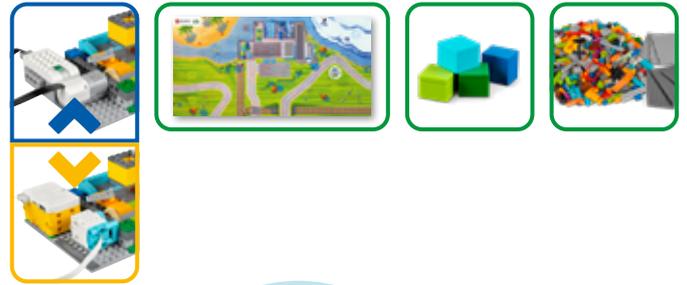
## Tasks (20 minutes)

- Imagine how to answer Ruby and Jacob's questions while looking at the mat. Dream big!
- Using the prototyping pieces, build ways to improve access to the destinations (house icons on mat).
- Show how you have improved access to each place for cargo deliveries.

## Challenge

- Create a new form of transportation that can access many different areas.

## Your team needs:



Can you build ways to improve transportation access or efficiency?

Can you build the destinations where cargo is being delivered?



# Let's Improve

## Your team needs:



Why would a machine operator make adjustments to the sorting center? Discuss as a team!



## Tasks (20 minutes)

- Launch the WeDo 2.0 or SPIKE™ Essential app.
- Can you use a sensor to improve the efficiency of the sorting process? Dream up your solution.
- Alter the sorting center to include a sensor.
- Create a new program and try it out on the sorting center.

## Challenge

- Can you add a different sensor to improve the sorting process?

## SOLUTION

Draw your solution!

# Sessions 8 & 9

## Tasks (80 minutes)

- Think about ways to answer the questions.
- Brainstorm ideas for each question.
- Explore the list of required parts on the next page.
- Draw your team model design and label the required parts.
- Make a plan! Create your team model together.

## Your team needs:



Can you explain how you improved the transportation of the products?

Can you show the entire journey of products from your community getting to their destinations?



Use these two pages to draw your team model design:



# Build Team Model

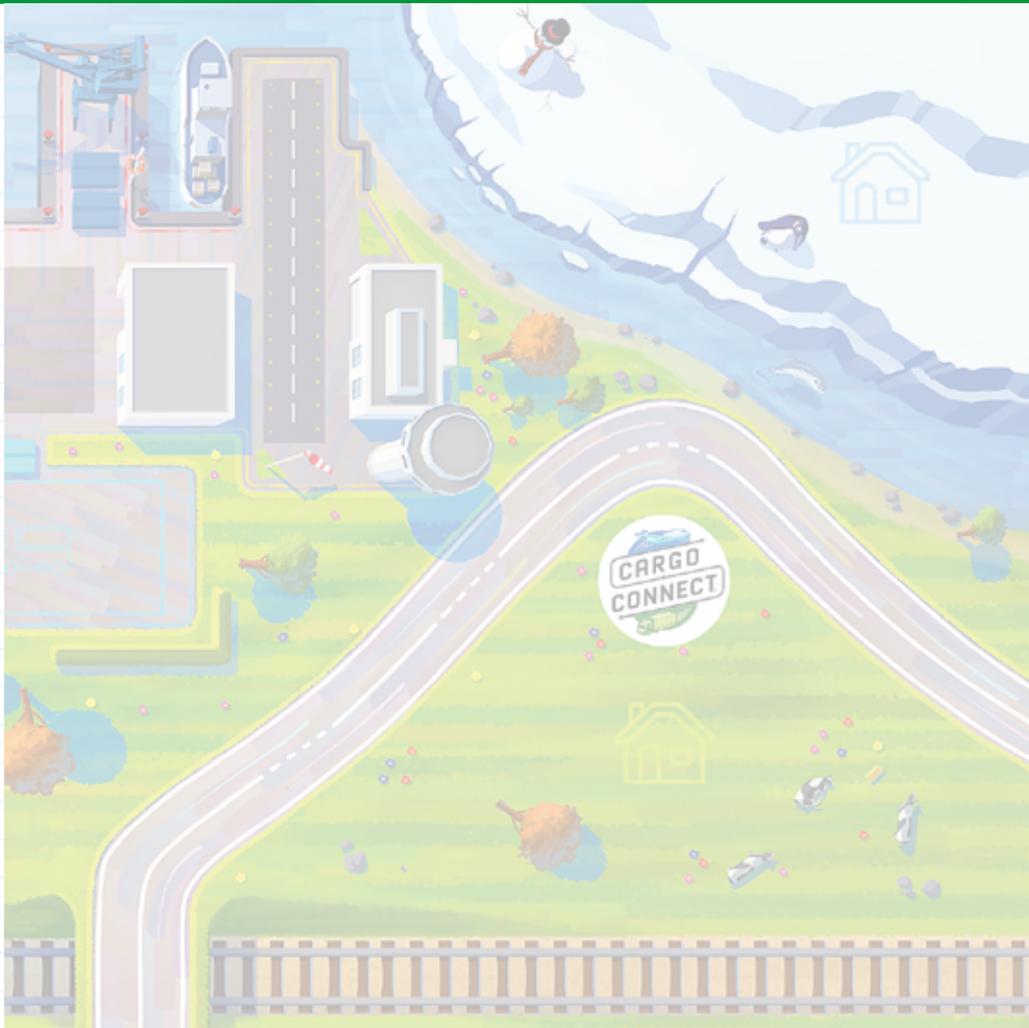
How does a courier deliver packages in your community?  
Think on this!



## Requirements

- Be made of only LEGO® elements.
- Include the Explore model.
- Have ONE motorized part.
- Use LEGO coding.
- Use the CARGO CONNECT™ mat.

Label the required parts of your team model.



# Sessions 10 & 11

## Tasks (80 minutes)

- Find your poster board and art supplies.
- Brainstorm what to put on your poster.
- Use the next page as a draft for your ideas.
- Work together to create your team poster. Teamwork!
- You can use words, drawings, and photos on your poster.

## Your team needs:



Describe your team journey throughout the sessions.

Make a team poster sharing what you learned about CARGO CONNECT<sup>SM</sup>!



## Team Poster



# Make Team Poster

Be creative!  
Think about how you  
will communicate  
your team journey.

Here's your chance to capture ideas for your team poster.

**Sample Topics:** *Explore, Create, Test, Share, Core Values, Team Journey.*

A large, empty grid box with a light blue grid pattern and a green border, intended for drawing or writing.A large, empty grid box with a light blue grid pattern and a green border, intended for drawing or writing.A large, empty grid box with a light blue grid pattern and a green border, intended for drawing or writing.A large, empty grid box with a light blue grid pattern and a green border, intended for drawing or writing.A large, empty grid box with a light blue grid pattern and a green border, intended for drawing or writing.A large, empty grid box with a light blue grid pattern and a green border, intended for drawing or writing.

# Session 12

## Tasks (40 minutes)

- Gather your completed team model and team poster.
- Talk about what your team would like to share at your event!
- Complete the next page to prepare for your event.
- Look over the reviewing sheet with your coach.



You will be taking part in a *FIRST*® LEGO® League Explore Festival. Invite your family and friends to your special event!

Share what you have learned and how your team had fun!



## Typical Event Setup

I'm going to share what we explored.

I will describe the team model.

I will explain the program and how it motorizes the team model.

We will show how the poster captures our team journey!

I can reflect on how our team used Core Values.



# Prepare for Event

Let's celebrate!



Consider what you will share at the event.

- Can you describe your team model?
- How did you use your mat to create your model?

- What did you learn about the challenge?
- How did you use Core Values?

- What part of your team model is motorized?
- How did you code your motorized part?

- What did you include in your team poster?
- How does the poster show your team journey?



# Career Connections



## Cargo Engineer

**Role:**  
Designs ways to safely and efficiently transport cargo.

*Links to Session 2*



## Freight Driver

**Role:**  
Moves cargo from one location to another.

*Links to Session 4*



## Warehouse Worker

**Role:**  
Sorts products and place into boxes for shipping.

*Links to Session 5*



## Exploration

*(Recommend completing after Session 7)*

**Look at the careers on these pages. Choose a job role, research it, and answer the questions.**

- Explain the job. What are some of this job's daily tasks?
- What is this job's yearly salary?
- What education or training is required?
- What other companies could people in this job work for?

## Fields of Study

- Transportation & materials moving
- Logistics and supply chain management
- Manufacturing & service operations
- Warehouse operations
- Aviation maintenance



### Safety Specialist

**Role:**  
Employs safety practices and ensures compliance.

*Links to Session 6*



### Machine Operator

**Role:**  
Monitors and maintains warehouse sorting machines.

*Links to Session 7*



### Courier

**Role:**  
Transports and delivers packages to customers.

*Links to Session 8 and 9*



### Reflection

*(Recommend completing after Session 12)*

**Look at the careers on these pages. Think about these jobs and what interests you.**

- What skills are needed in these jobs?
- What interests you about these jobs?
- Can you think of other jobs that relate to the transportation of cargo?
- Can you explore one of these careers for more information?

### Related Transportation Jobs

- Automation engineer
- Last-mile manager
- Delivery execution manager
- Machine learning specialist
- Transportation specialist
- Transportation analyst

# Use this spread to draw your designs and ideas!





Name:

Team name:

Let's think of ideas for different ways to transport cargo.



Let's explore how cargo is transported to places all over the world.



Let's create a team model showing how cargo is sorted and transported to its destinations.

Share your ideas, your team model, and what your team has learned with others.



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