Welcome!

Use the sessions in this Engineering Notebook as a guide for your team’s journey through the FIRST® FORWARD℠ season and CARGO CONNECT℠ challenge. Use the Core Values and the engineering design process throughout your team journey. Have lots of fun as you develop new skills and work together. This notebook is a great resource to share at your judging event, but it isn’t required.

Be sure to record what you learn and reflect on how your team collaborated to achieve your goals. Showcase your team’s amazing work on your robot, Innovation Project, and Core Values at your event and judging session. Remember, what your team discovers is more important than what you win. Check out the Career Connections pages at the end of this guide for real-life examples of transportation jobs!

**Core Values**

**FIRST® Core Values** will be evaluated during the Robot Game matches and during the Innovation Project and Robot Design presentations.

**Robot Design**

Your team will prepare a short explanation on your Robot Design, programs, and strategy.

**Robot Game**

Your team will have three 2.5-minute matches to complete as many missions as possible.

**Innovation Project**

Your team will prepare a 5-minute presentation to explain your Innovation Project.

Overview

Your team will:
- Apply teamwork and discovery to explore the challenge.
- Innovate with new ideas about your robot and project.
- Show how your team and your solutions will have an impact and be inclusive!
- Celebrate by having fun in everything you do!

**Gracious Professionalism®** is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community. We express our Core Values through Gracious Professionalism, and this will be evaluated during Robot Game matches. The team can demonstrate Coopertition® by showing that learning is more important than winning and they can help others even as they compete.

We found we were stronger when we worked together.

We embraced our differences and ensured we all felt welcomed.

We applied what we learned to improve our world.

We enjoyed and celebrated what we did!

We explored new skills and ideas.

We used creativity and persistence to solve problems.

We found we were stronger when we worked together.

We embraced our differences and ensured we all felt welcomed.

We applied what we learned to improve our world.

We enjoyed and celebrated what we did!

We explored new skills and ideas.

We used creativity and persistence to solve problems.

Gracious Professionalism® is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community. We express our Core Values through Gracious Professionalism, and this will be evaluated during Robot Game matches. The team can demonstrate Coopertition® by showing that learning is more important than winning and they can help others even as they compete.

We found we were stronger when we worked together.

We embraced our differences and ensured we all felt welcomed.

We applied what we learned to improve our world.

We enjoyed and celebrated what we did!

We explored new skills and ideas.

We used creativity and persistence to solve problems.
This year’s CARGO CONNECT℠ challenge is for your robot to deliver cargo to different forms of transportation or target locations around the field. Your robot must activate mission models that represent transportation safety, efficiency, connection, and access.

Design and create a robot that will complete missions in the Robot Game. Your innovative Robot Design, clear mission strategy, and functional programs are key in the CARGO CONNECT℠ challenge.

- **START**

  - **Build your mission models and identify your mission strategy.**
    Each mission and model also provides inspiration for possible solutions to your Innovation Project. The missions fit into four categories: safety, efficiency, access, and connections.

  - **Design and create your autonomous robot and programs.**
    Create a work plan for your Robot Design. Build a robot and its attachments using LEGO® Education SPIKE™ Prime or any LEGO® MINDSTORMS® set. Code your robot to autonomously complete a series of missions in a 2.5-minute Robot Game to score points.

  - **Test and iterate on your robot solution to complete missions.**
    Iterate on your Robot Design and programs with continual testing and improvements.

  - **Compete in Robot Game matches.**
    Your robot starts in the launch area, tries missions in the order chosen by the team, and then returns anywhere into Home. Your team can modify your robot when it is in Home before launching it again. Your team will play multiple matches, but only the highest score matters.

  - **Communicate your Robot Design solution at judging.**
    Prepare a short explanation that clearly explains the process your team used to create your robot and programs and how they work. Make sure your whole team is involved.

Here are sample roles your team can use during the sessions. Everyone on the team should experience each role throughout their FIRST® LEGO® League Challenge experience. The goal is to build your team to be confident and capable in all aspects of FIRST LEGO League Challenge.

- **Team Captain**
  Shares team progress with facilitator. Ensures session tasks are completed.

- **Creative Designer**
  Creates innovative designs for solutions to be discussed with the team.

- **Researchers**
  Investigate ideas and find relevant research from different sources to inform the team’s decision-making.

- **Project Manager**
  Focuses on time management and preparing for the event.

- **Communicator**
  Concentrates on how to communicate the team’s work. Writes scripts and prepares presentations.

- **Material Manager**
  Gathers materials needed for session and returns materials.

- **Builders**
  Assemble the LEGO mission models following the building instructions and build your robot.

- **Mission Strategist**
  Analyzes the Robot Game Rulebook and leads team strategy discussions on which missions to attempt.

- **Coders**
  Operate the device and creates the programs in the app.
Everyone depends on the transportation of goods for their daily needs. As more demands are placed on the transportation systems, we will continue to face challenges unless we find new ways, or improve existing ways, to transport products from place to place.

How can you improve the transportation of products? Identify a specific problem within this theme that you want to solve. Then, create or improve a piece of equipment, a technology, or a method of transportation to solve your specific problem.

Identify a specific problem related to making the transportation journey of products better.

The Project Sparks (covered in Sessions 1-4) explore some problems related to the challenge. Your Innovation Project could come from a Project Spark, but it doesn’t have to. It will help to focus on a particular product and how it is transported.

Think about how access, safety, efficiency, or connections relate to product journeys and see if you can improve any of them for a particular product that you are investigating.

Research your problem and your solution ideas.

What solutions already exist? Are there any experts who could help you? Think about the products that are transported in and out of your community. Research some of the journeys the products take to their final destinations.

Design and create a new piece of technology, equipment, or method of transportation that could improve the journey of the products.

This will be your Innovation Project solution. Make a model or prototype to show how your solution improves the way the products are transported.

Share your ideas, collect feedback, and iterate on your solution.

The more you iterate and develop your ideas, the more you will learn. What impact will your solution have on your community?

Create a creative and effective presentation that communicates your solution at an event.

Prepare a 5-minute presentation that clearly explains your Innovation Project solution and its impact on others. Make sure your whole team is involved.

*Community can be defined as just a town or city or a larger area like a state or country.*
As more demands are placed on transportation systems, we need to rethink how we move products from place to place.

Your challenge is to improve the way products are transported.

How can we find ways to solve the challenge? Make the product journey safer or more efficient! Get access to difficult destinations. Have better connections between different parts of the journey.

Great ideas! Let's plan how to design our solution. Can you help us?

CARGO CONNECT