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BOLT

SPACE MISSION

COACHES GUIDE

sphero.com/pages/global-challenge

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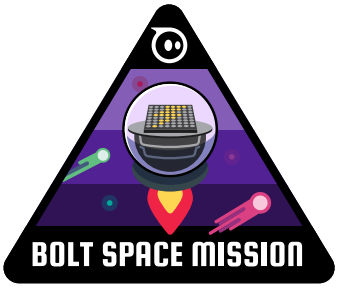
INTRO TO THE SPHERO GLOBAL CHALLENGE

Our mission at Sphero is to inspire the creators of tomorrow. With Sphero Global Challenge (SGC), students are engaging in problem solving, computational thinking, collaboration, and more. The SGC provides an opportunity for students to compete with other students around the world with the top teams from each country invited to participate in a live competition next spring. To see qualifying criteria, please refer to the Competition Rules and Competition Rubrics documents. We believe that this challenge will provide students many opportunities to have fun and build lasting memories. We encourage you, as a coach, to invite as many students to participate as you can. The weekly guides will help all students participate fully, regardless of their experience level.

This coaching guide will give you some tools and the structure to guide your students through the BOLT Space Mission event. However, with your registration, your team can compete in the other events as well, so we encourage you to explore these coaches guides and challenges to see how your students can take advantage of the Overall Performance Score judging criteria as outlined in the Official Rules Document for the best chance of becoming a finalist.



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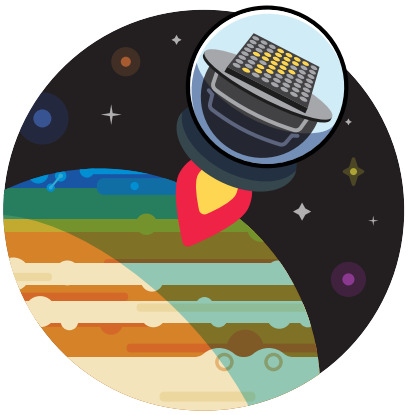
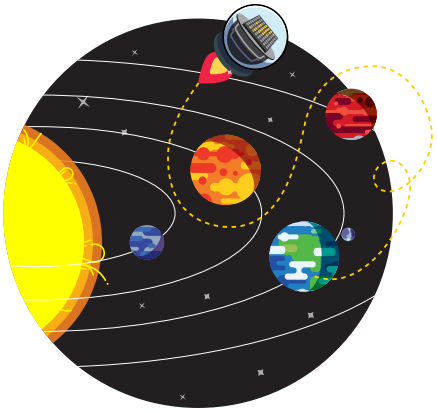
BOLT SPACE MISSION

HOUSTON, WE ARE A GO!



Gather some friends and create or join a team! It doesn't matter your ability level, there will be things that anyone can help with, and what better way to learn something new!

BOLT robots are taking flight as spacecrafts and are trying to complete missions in space. Design, program, and engineer solutions to each of the challenges to make sure that BOLTs have a productive and successful mission in space.



IN THE BOLT PROGRAMMING CHALLENGE, YOUR TEAM WILL:

Program BOLT to navigate through complex missions

Test and Debug your programs

IN THE BOLT ENGINEERING CHALLENGE, YOUR TEAM WILL:

Engineer a solution for transporting objects with craft materials.

During the challenge season, you will document your learning in your programming journal, and showcase your learning processes in an infographic.

BOLT SPACE MISSION OVERVIEW

This is a high-level overview of each of the missions of the BOLT Space Mission Objectives. For a more detailed description of the objectives and specific rules, please refer to the Sphero Global Challenge Official Rules document.

Mission Objective #1

Ambient Light Sensor

Students will set up a light source over the sun on the code mat. They will program BOLT to travel to three different regions/areas of the competition area to evaluate the light intensity of each portion of “space” - with the area closest to the Sun being the brightest. Programs must store those light intensity (luminosity) values as a variable and report the three values at the end of the program.

Mission Objective #2

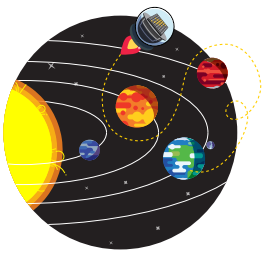
Asteroid Belt

Students will program BOLT to spin out of control as if it hit an asteroid, then use the magnetometer on BOLT to recalibrate and finish the objective.

Mission Objective #3

IR Communications

Students will program both BOLTs to play a game of Marco Polo in space. The BOLT on Earth will be set to receive a signal from the other BOLT and based on how far away the 2nd BOLT is, the BOLT on Earth will be able to determine what region the 2nd BOLT is in on the code mat.



Mission Objective #4

Rescue Mission/Lost in Space

Students will program both BOLTs in this challenge. BOLT #1 will navigate around Obstacles, hit targets, and rescue BOLT #2 and lead it back to Earth.

Mission Objective #5

Engineering Challenge

Students will build a chariot using the approved craft supplies (Sphero Craft Pack) while adhering to budget guidelines for their build. After building their chariot, they will drive BOLT through an Obstacle course on the Code Mat using other craft supplies.

MATERIALS FOR COMPETITION

In order to complete all of the missions of the BOLT Space Mission, you will need to have the following items:

Required Materials for Competition:

2 x Sphero BOLTs

Access to Sphero Edu app and a programming device

3x4’ hard & flat surface for a Competition Field

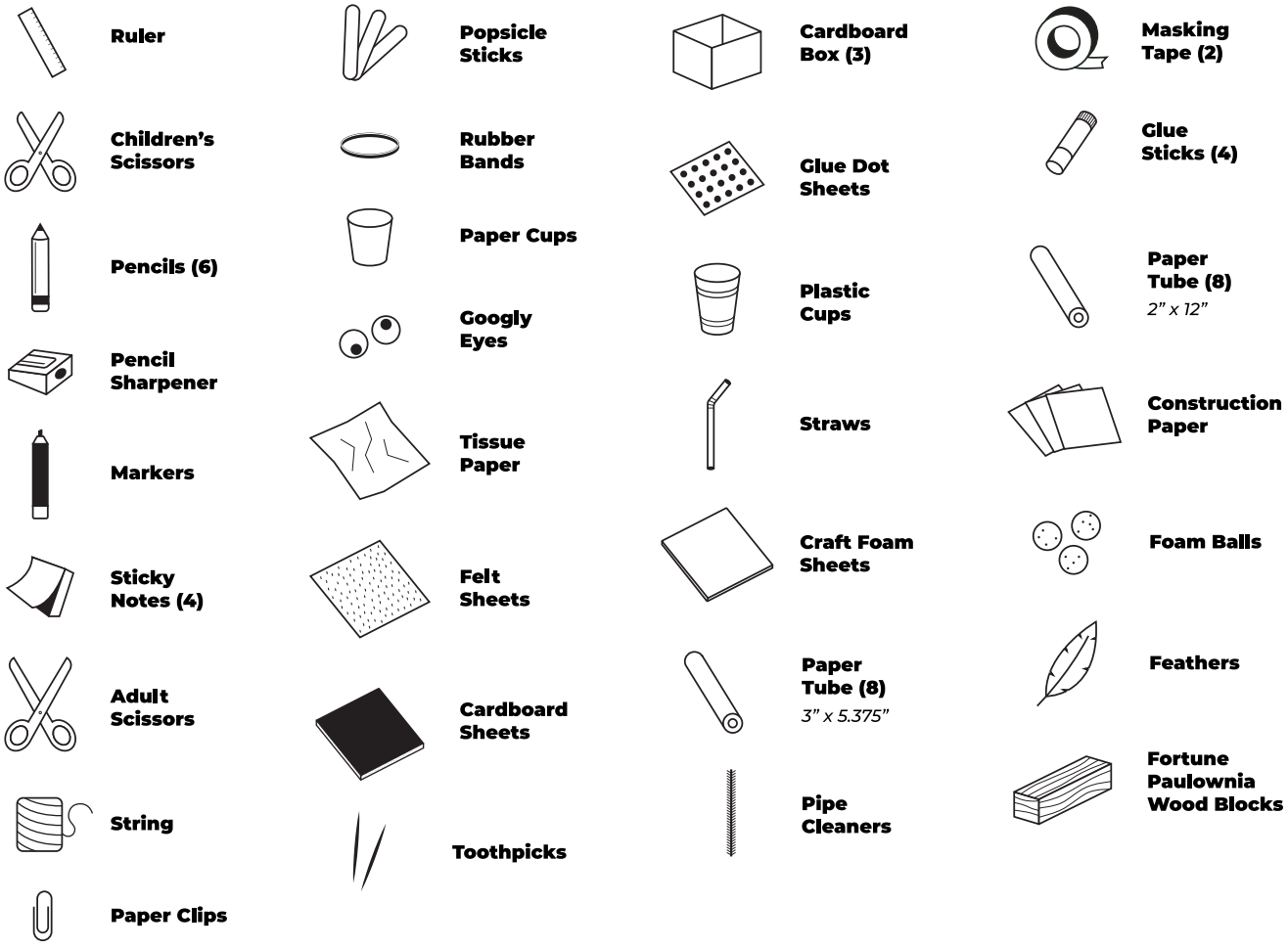
Various Craft Supplies to build with (all available in the Sphero Craft Pack)

Recommended and additional items for completion:

Sphero Craft Pack

Outer Space Code Mat

Printable Competition Field



SUBMISSION GUIDELINES

Teams will be required to submit three items for judging and evaluation. Please see the Official Rules document and that Evaluation Rubric for specifics on what will be submitted and on how each submission will be evaluated and judged.

1 Program File

a. Program file must contain a function for each Mission Objective

b. Use the following naming convention for your functions on the final code submission:

i. boltMo1

ii. boltMo2a, boltMo2b

iii. boltMo3a, boltMo3b

iv. boltMo4a, boltMo4b

v. boltMo5

2 Video of each Mission Objective combined into one video submission

a. Mission objective videos should not be edited or spliced. Mission Objectives should be filmed in one take.

b. After all Mission Objective videos have been recorded, please combine them using a video editing software to be one video. You may edit the final submission to have captions or titles, but please do not add sound effects or music to the background of the recordings of the Mission Objectives.

3 Code and Engineering Design Infographic

a. Infographic must be submitted as a .pdf file

b. The size of your infographic must be 8.5”x11” or 11”x17”

c. You can use one of the supplied templates for your infographic or you can create your own.

d. An infographic is a visual representation of an idea, process, or a dataset. You are responsible for creating an infographic that demonstrates the learning process over the course of the event.

1. How did the team work together?
2. How did you iterate on your ideas?
3. What was a struggle?
4. What was easy?
5. Show the iterations that you made during the engineering challenge and include the budget of your chariot.

TEAM ROLES

We highly encourage students to work in teams of 3-5 to help promote collaboration and team-work, and it will also help distribute the workload evenly. As a part of the competition, we recommend that students take on a role for the competition (or switch them for each Mission Objective) so that they feel like they are contributing evenly to the competition. Suggested roles could include, but are not limited to:

Programmers

Programmers are responsible for making sure that your BOLT robots do exactly what you want them to do. With several of the objectives, students are utilizing two BOLTs at the same time, so you can have 2 programmers at the same time.

Engineers

The engineer is responsible for the building of competition objects and placing them in the field based on the competition rules.

Debuggers

The debugger is an expert at troubleshooting. They are responsible for asking questions and coming up with procedures for solving problems with the code and/or engineering.

Mission Manager

The mission manager is a leader. They are great at bringing the team together to come up with plans and lead brainstorming sessions on how to approach each Mission Objective. Mission Managers should also be experts in the rules of the competition to ensure the team is in compliance with all of the rules and regulations.

Designer

The artist/creative team gives your mission and objectives that extra flair! Artists have an eye for making things beautiful and awesome. The designer can also be the videographer and help with coordinating the infographic for final submission.

RESOURCES

How to Use the Coaches Guide

This coaches guide will help you navigate your students through each objective of the BOLT Space Mission. This guide can be used as a template for lesson plans if you are incorporating the competition into your daily teaching plan, but it can also be used with after-school clubs. There isn't a required amount of time that you should spend on the completion of each objective, so students can move on to the next session if they're ready for it.

Each Mission Objective is broken down into two session types: learning sessions and working sessions. You can adapt these to your needs and provide more work sessions, or fewer learning sessions if need be. It is also very beneficial for the team coach to be established as a teacher in the Sphero Edu app so that activities can be assigned to the students and so that progress monitoring can take place on the Sphero Edu app.

Learning Sessions

The first session for each Mission Objective is geared towards learning a computer programming skill that will help students complete the mission. Learning sessions will be primarily students working through an activity in the Sphero Edu app to help approach the Mission Objective confidently.

Learning sessions are structured with the general outline of Exploration, Skills Building, Challenges, and Extended challenges. This allows students to dive into the concepts necessary to complete each of the Mission Objectives.

Working Sessions

The second session for each Mission Objective is allowing students to complete the objective by applying their knowledge from the learning session. Think of this as project work time or Mission Objective completion time. The nature of these sessions are very open-ended. Some general guidelines will be provided so that, as a coach, you can feel comfortable guiding students productively through their work sessions.

RECOMMENDED MEETING SCHEDULE

Planning out your Competition Season Schedule

If you are working with your students from scratch in programming with BOLT, we recommended a minimum of 12-14 team meetings to address the learning needs of the students with programming and circuit building. If you are incorporating Sphero Global Challenge into your lesson plans, you can adjust accordingly.

14 Meeting Agenda
1. Forming Teams
2. Precision Programming with BOLT
3. Challenge #1 Learning Session
4. Challenge #1 Working Session
5. Challenge #2 Learning Session
6. Challenge #2 Working Session
7. Challenge #3 Learning Session
8. Challenge #3 Working Session
9. Challenge #4 Learning Session
10. Challenge #4 Working Session
11. Challenge #5 Learning Session
12. Challenge #5 Working Session
13. Work Session to finalize Submissions
14. Finalize Submissions

10 Meeting Agenda
1. Forming Teams
2. Precision Programming with BOLT
3. Learning Session as needed
4. Learning Session as needed
5. Challenge #1 Working Session
6. Challenge #2 Working Session
7. Challenge #3 Working Session
8. Challenge #4 Working Session
9. Challenge #5 Working Session
10. Finalize submissions

6-8 Meeting Agenda
1. Forming Teams
2. Challenge #1 Working Session
3. Challenge #2 Working Session
4. Challenge #3 Working Session
5. Challenge #4 Working Session
6. Challenge #5 Working Session
7. Learning Session as needed
8. Finalize submissions

For additional support, join the Sphero Community forum for FAQs, official answers from the Game Design Committee and conversations about all things Sphero Global Challenge.

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SPACE MISSION

CHALLENGE GUIDE

COMPETITION FIELD SET UP

Competition Field Size: 6.56’ x 3.28’ (2m X 1m)

The Outer Space Code Mat is the ideal Competition Field for the BOLT Space Mission:

- If you do not have the Outer Space Code Mat, you may use tape to mark the grids every 10 cm like in the Code Mat. Or, print the Bolt Space Mission Grid printable.
- Specific Mission Objectives will refer to grid coordinates in order to allow anyone with or without a Code Mat to compete.
- For each Mission Objective, pay attention to the Competition Field setup for references to grid coordinates and the placement of BOLTs, Obstacles, and other items.

OBJECTIVE #1: AMBIENT LIGHT SENSOR

This is a high level overview of the Mission Objectives. Please refer to the Sphero Global Challenge Official Rulebook for a full explanation of the Mission Objective and Competition Field setups.

Objective

Teams must program BOLT to navigate through the solar system to test the light intensity (luminosity) of the different areas of space. For this objective, students will need to:

- Establish a bright light source (the Sun) and place the light source in the A1 corner of the Competition Field.
- Engineer an enclosure for BOLT to navigate under/inside to demonstrate the darkness of deep space. Enclosure must not be bigger than 8”x 8” x 5” and will be placed over Pluto (Grid S10).
- Program BOLT to read 3 different light intensity values on the Competition Field:
  - Earth (I2), Pluto (S10, and the Sun (A1)
- Program must have 3 variables called light1, light2, light3 that store the light intensity value (luminosity) at each location: light1 = Sun, light2 = Earth, light3 = Pluto
- Program must contain an if/else statement that evaluates if variable light1 is a greater value than variables light2 and light3.
- If light1 is the greatest value, the program must have a mission complete message to note success.

Required Materials

- 1 BOLT Robot
- General craft supplies or Sphero Craft Pack
- Additional light source (flashlight or lamp)

OBJECTIVE #1: AMBIENT LIGHT SENSOR

Competition Field Set-Up:

OBJECTIVE #2: ASTEROID BELT

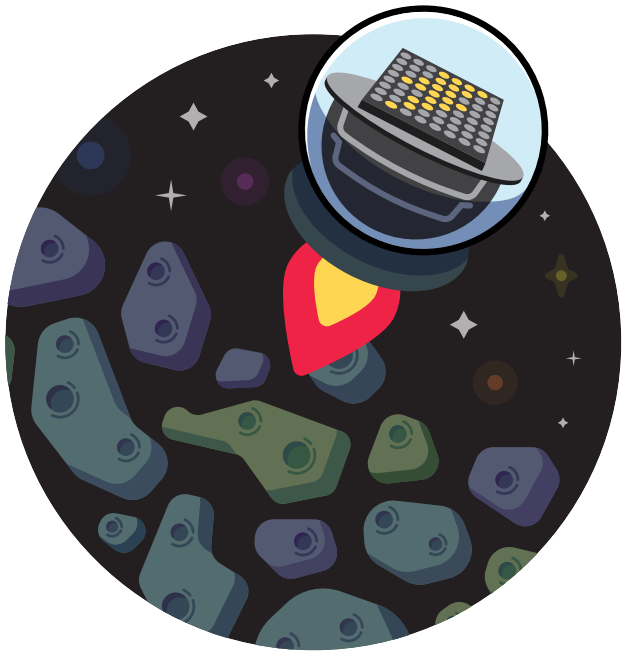
Objective

Students will program BOLT to spin out of control as if it hit an asteroid, then use the magnetometer on BOLT to recalibrate and finish the objective.

- BOLT #1 is travelling to deep space, and must go from Earth (I2) to Pluto (S10) and return to Mercury (E1) while passing through the asteroid belt.
- BOLT #2 is acting as an asteroid and must be programmed to move between L1 & L7 at a speed of 100.
- BOLT #1 must be programmed to navigate through the asteroid belt without hitting any objects or BOLT #2.
- BOLT #1 must have a raw motor block used to mess with the navigation system of the BOLT when it hits the asteroid belt (See layout for specific grids)

Required Materials

- BOLT x2
- General Craft Supplies or Sphero Craft Pack

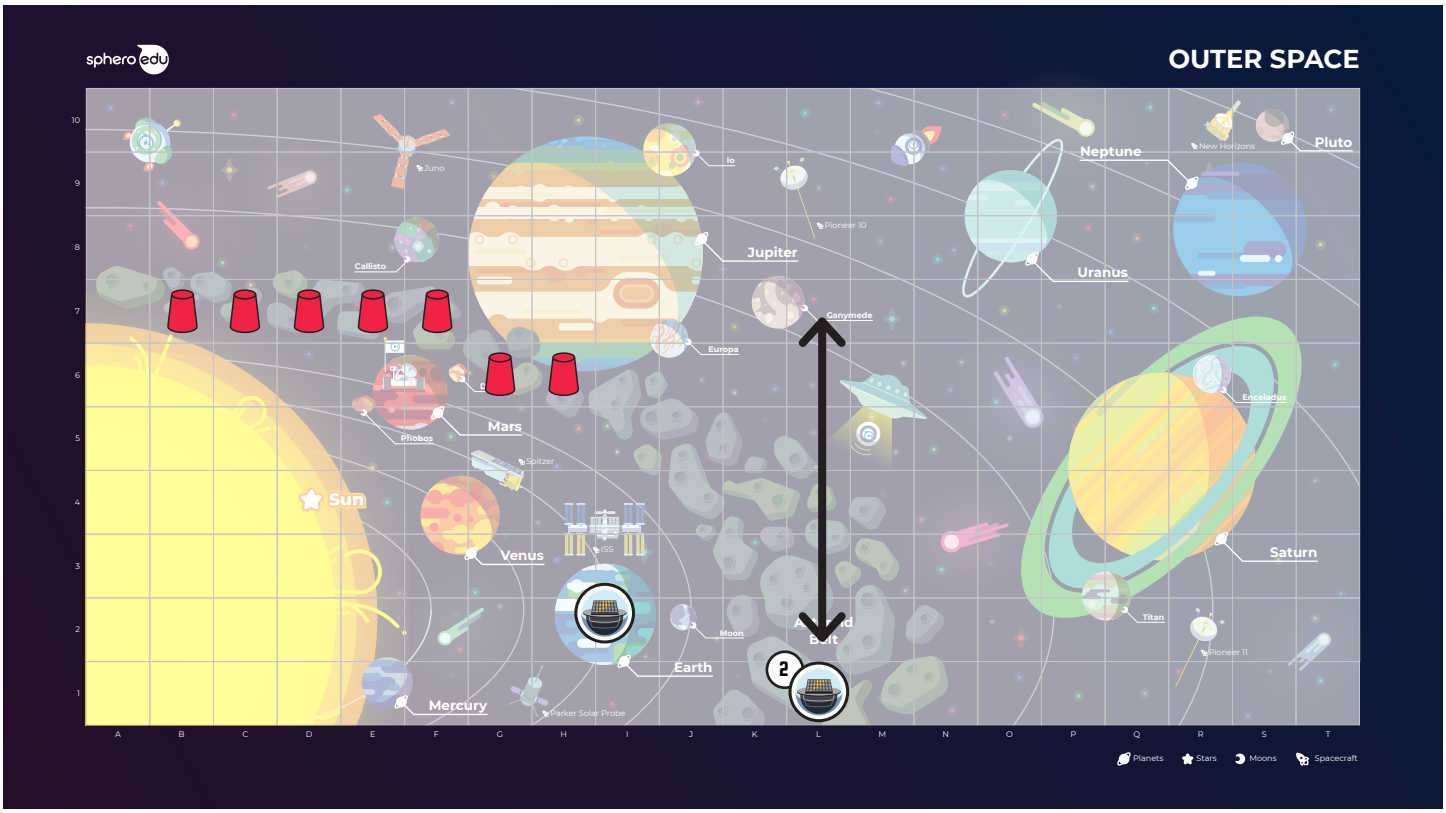


Set Up

- Place one BOLT on Earth (Grid I2).
- Place second BOLT on L1.
- Place 18 oz cups on the following grids as stationary asteroids to navigate between:
  - B7, C7, D7, E7, F7, G6, H6

OBJECTIVE #2: ASTEROID BELT

Competition Field Set-Up:



OBJECTIVE #3: IR COMMUNICATIONS

Objective

Students will program both BOLTs to play a game of Marco Polo in space. The BOLT on Earth will be set to receive a signal from the other BOLT. Based on how far away the 2nd BOLT is, the BOLT on Earth will be able to determine if it is on a planet inside or outside of the asteroid belt.

Required Materials

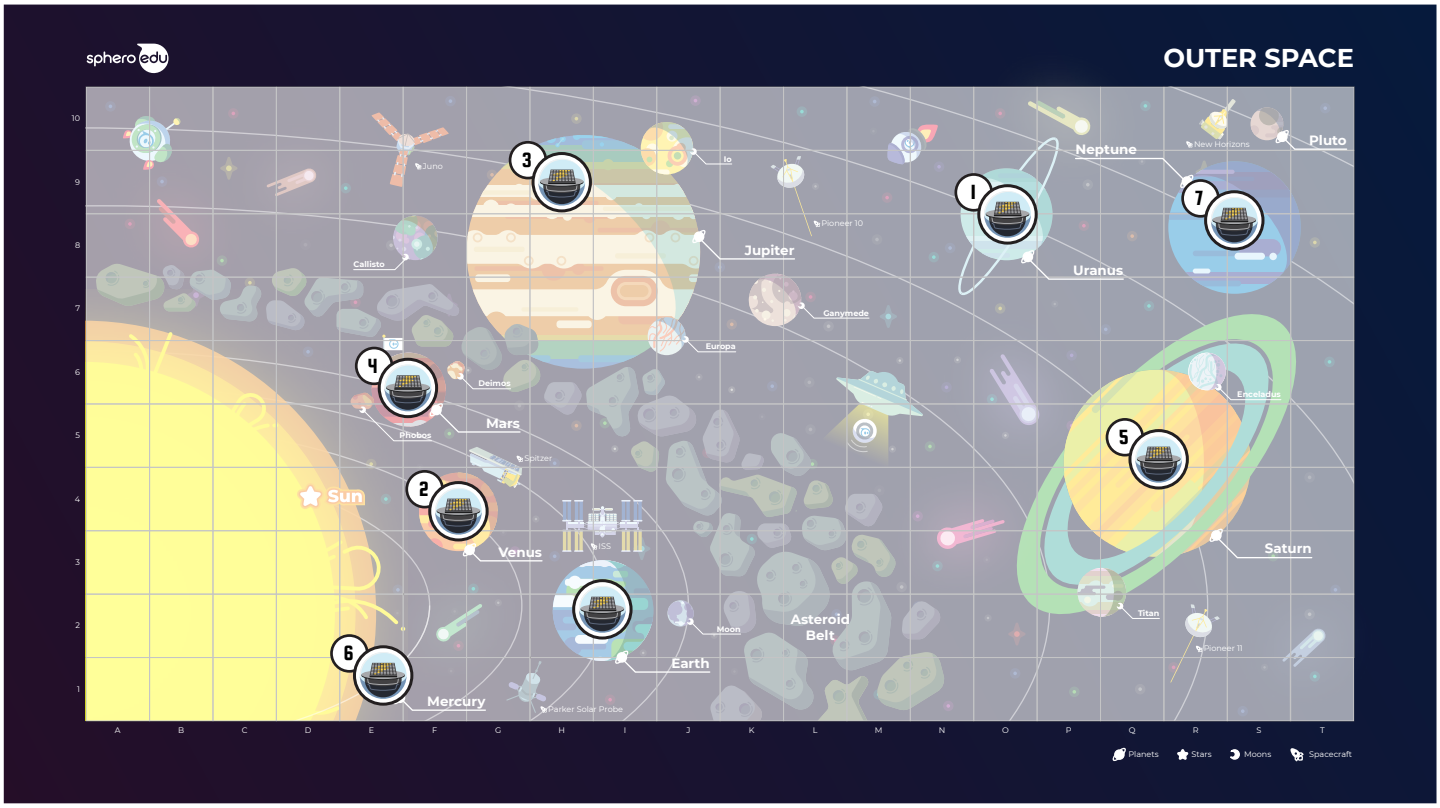
- BOLT x2
- General Craft Supplies or Sphero Craft Pack

Set Up

- 1 BOLT will be placed on Earth (I2).
- 2nd BOLT will be placed by hand on each planet in the following order so that the 1st BOLT can receive the signals to determine what region it is in.
  - Uranus (O8)
  - Venus (F4)
  - Jupiter (H9)
  - Mars (F6)
  - Saturn (R5)
  - Mercury (E1)
  - Neptune (S9)

OBJECTIVE #3: IR COMMUNICATIONS

Competition Field Set-Up:



OBJECTIVE #4: RESCUE MISSION

Objective

Students will program both BOLTs in this challenge. BOLT #1 will navigate around Obstacles and hit checkpoints to reach BOLT #2. As soon as BOLT #1 reaches BOLT #2, it will lead BOLT #2 via Infrared communication back to Earth without either BOLT hitting a cup.

Required Materials

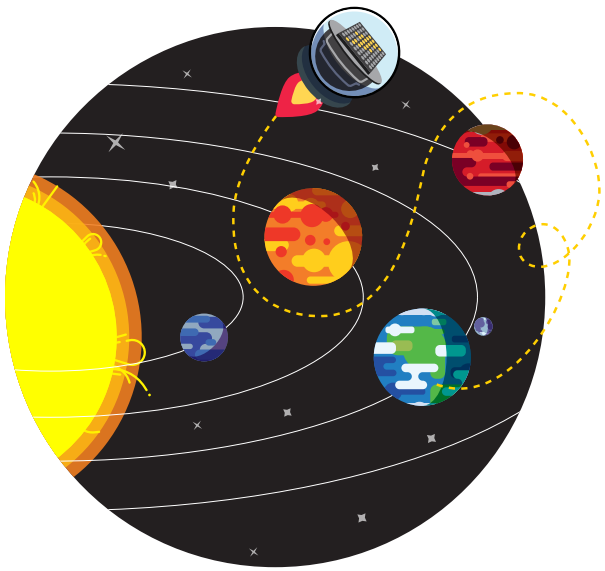
- BOLT x2
- 12 - 18 oz cups
- 6 foam balls (Ping pong balls can be used as a substitute)
- 2 - 5 oz. cups
- Craft Supplies

Set Up

- Place 18 oz cups as Obstacles on the following grids:
  - E1
  - E2
  - E3
  - F8
  - G3
  - G7
  - H3
  - H6
  - I3
  - I5
  - J3
  - J4
- Place 2 small cups with 3 foam balls each on C7 & C9.
- BOLT #1 will begin on Earth (I2).
- BOLT #2 will begin on Neptune (S8).

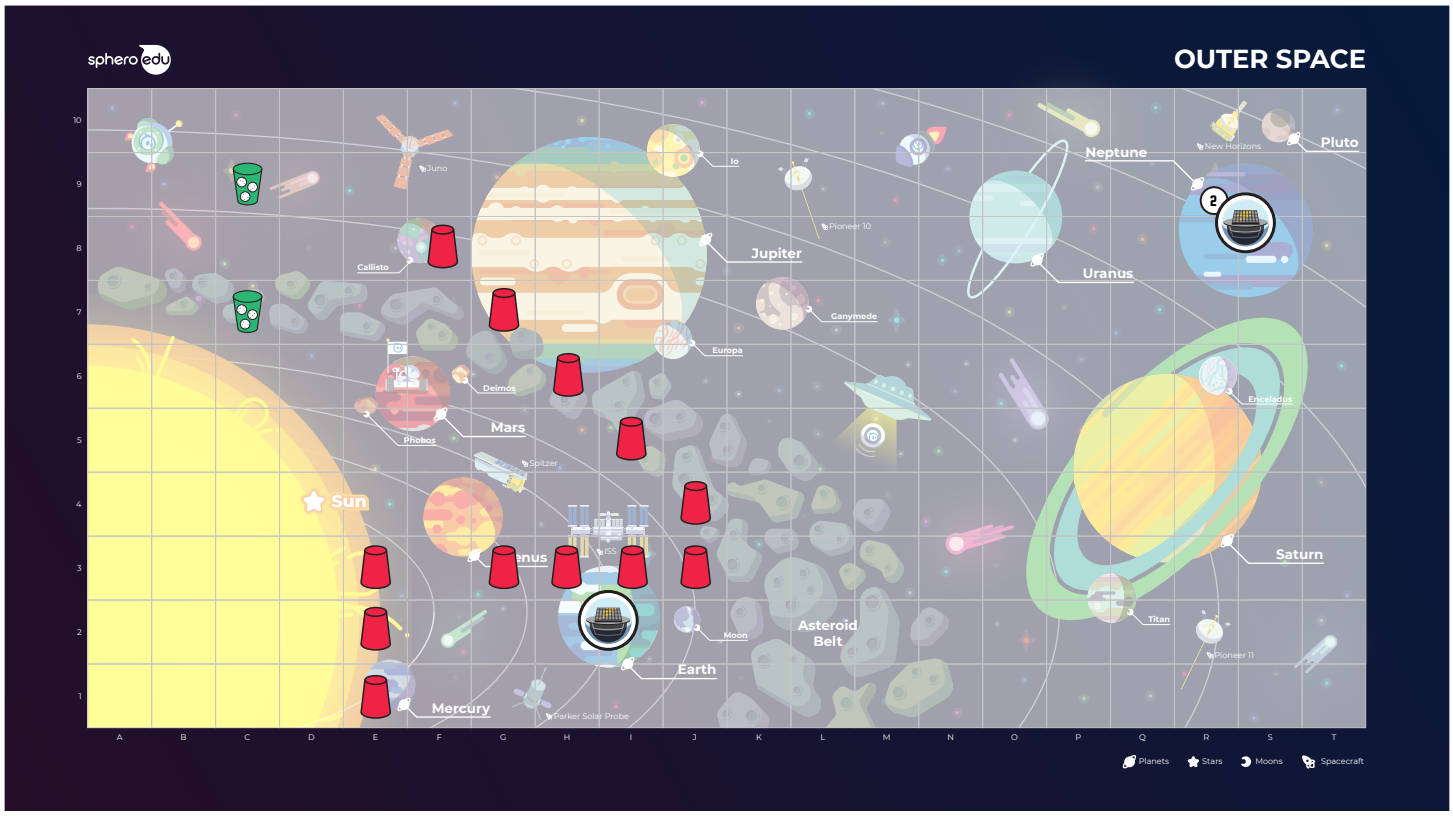
Bonus

For bonus points, if BOLT #1 can knock the foam balls out of the 2 cups, you will receive extra points for each ball that falls out of the cup. The cups must begin within the grids specified in the setup directions, but any craft materials can be used to engineer a solution for knocking the balls over.



OBJECTIVE #4: RESCUE MISSION

Competition Field Set-Up:



OBJECTIVE #5: ENGINEERING CHALLENGE

Objective

Students must engineer a chariot for BOLT to carry payload from the starting point on the setup, to the final position. The chariot must be built within the supplied budget restrictions, and need to be able to carry 25 small paper clips. Your BOLT chariot must also not come in contact with any of the Obstacles on the Competition Field.

- BOLT #1 must navigate through the Obstacle course while carrying the payload.
- BOLT #1 must get to BOLT #2 and send a message to move BOLT #2 thus allowing BOLT #1 to pass.
- BOLT #1's program must contain a variable called "boltMO5time" that announces the elapsed time of the program after BOLT #1 finishes in the landing zone.

You have a Engineering budget of $30, and your engineering build list and budgeting must be included on your infographic.

Required Materials

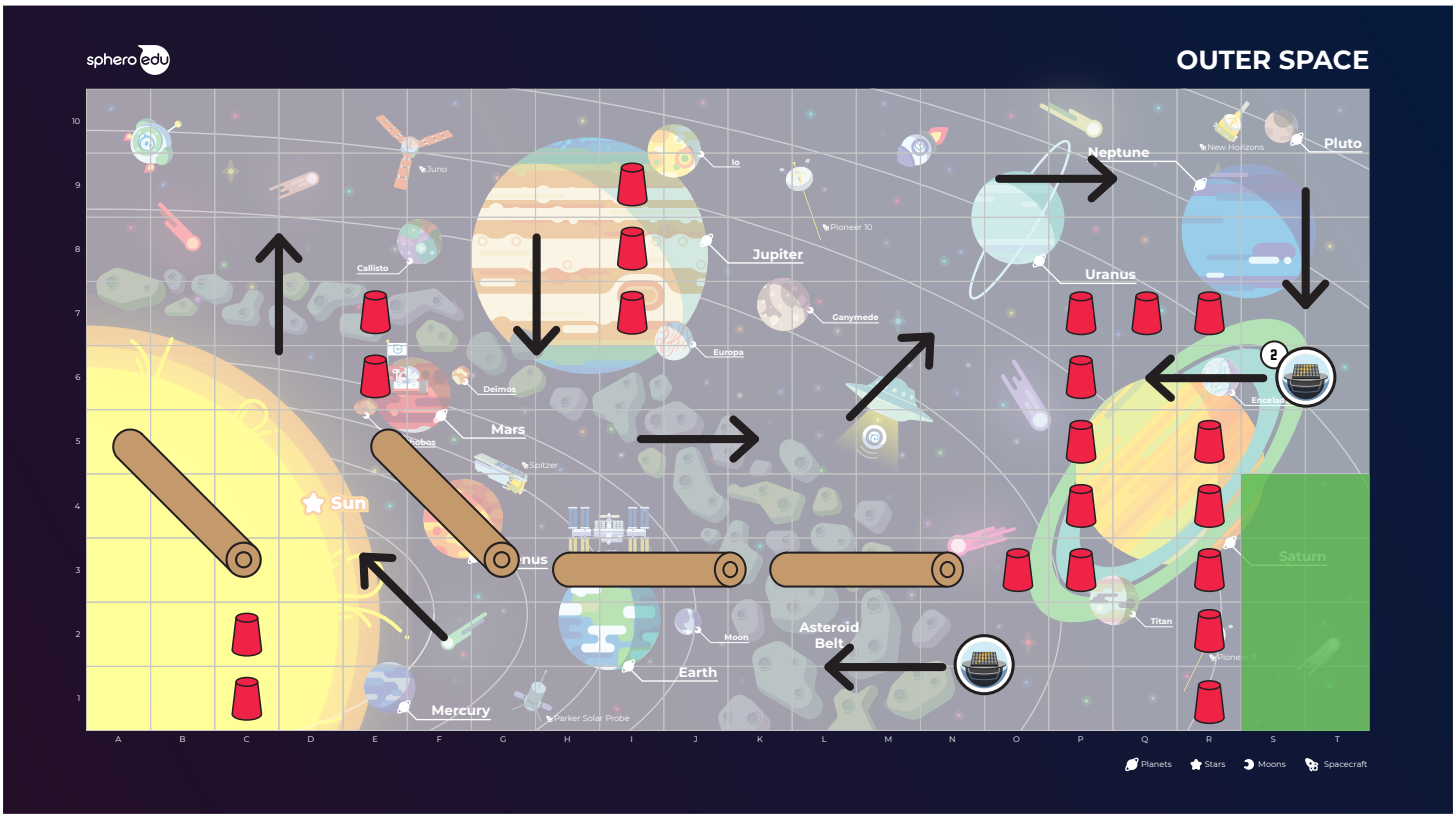
- BOLT x2
- Craft Supplies

Set Up

- BOLT #1 must begin in N1, N2, O1, or O2 coordinates.
- BOLT #2 must begin on the line between S6 and T6.
- Using cardboard tubes, and cups, establish the correct path on the Competition Field.
- The following grids should be used to establish the path for BOLT #1 & #2 to travel.

OBJECTIVE #5: ENGINEERING CHALLENGE

Competition Field Set-Up:



ENGINEERING SUPPLIES

All of the following items can be found in the Sphero Craft Pack. Teams may use craft supplies from around the classroom, but they must be from the list of items to use and they need to adhere to the dimensions and quantities allowed for the price.

Items	Quantity	Price
Cardboard Box	1	$20
18 oz Plastic Cup	1	$15
Paper cups	1	$10
Cardboard	1 sheet (12”x12”)	$7
Craft Foam Sheets	1 sheet	$7
String	30 cm	$6
Ruler	1	$5
Pencil	1	$5
Paper Tube (3” diameter)	1	$5
Paper Tube (2” diameter)	1	$5
Wood Blocks	1 block	$5
Rubber Bands	2	$4

Items	Quantity	Price
Masking Tape	30 cm	$20
Popsicle Sticks	4	$15
Straws	4	$10
Glue Dots	1 sheet (12 dots)	$7
Toothpicks	6	$7
Paper Clips	4	$6
Pipe Cleaners	4	$5
Felt Sheet	1 sheet	$5
Foam Balls	2	$5
Sticky Notes	10	$5
Tissue Paper	1 sheet	$5
Construction Paper	1 sheet	$4

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BOLT

SPACE MISSION

MEETING AGENDAS

AGENDA #1

Teamwork Makes the Dreamwork

Mission Objective: Intro to the Sphero Global Challenge

Time Required: 45-60 minutes

Supplies Needed

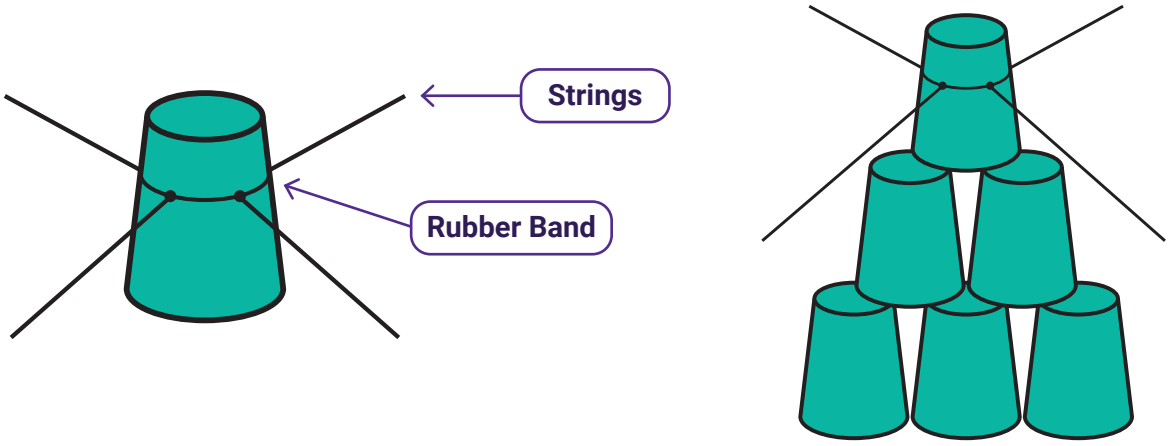
- Craft Supplies:
  - Rubber Bands
  - String
  - Cups
- Sphero Global Challenge Launch Video
- Sphero RVR & littleBits

Learning Objectives

- Students will be able to identify goals of the Sphero Global Challenge.
- Students will be able to work as a team to achieve a goal.

1 Warm-Up

Using craft supplies create the following set up for your teams:



Using only one hand, students must work together to build Cup structures

1. Pyramid
2. Tallest structure in 60 seconds

2 Steps

Gather all of the materials and provide a way for students to view the **Sphero Global Challenge Launch Video**, specifically the Mars Mission objectives.

Discuss:

- What is being asked of you?
- What Mission Objectives do you anticipate being the most difficult?
- What Mission Objective looks like the most fun?

Explore:

Read through each of the challenges as a group and refer to the grading rubric as you read the challenges.

Discuss:

- How does each Mission Objective get evaluated?
- Are there points in which you can earn bonus points? How does that work?

Read through the different roles on page 8 of the Coaches Guide.

Take time to lead a discussion on how the team will contribute to the challenges:

- As a team, how do you want to handle different roles and responsibilities in the challenge?
- Is there a role that you are excited about? Is there a role that you aren't as enthusiastic about?
- Does your team want to keep the same role the whole time, or do you want to switch roles for each Mission Objective?

3 Wrap-Up

Share the suggested roles (or roles that you came up with on your own) and ask students to jot down their ideal role, or a backup role.

Teacher Tip

Use the feedback that students provide in this exit ticket as a way to structure the team going forward. If students have naturally selected a variation of all of the roles, you've got a well-rounded team. If everyone on the team wants the same role, you may need to spend some time planning out how each team member can participate in their ideal role over the course of the whole BOLT Space Mission.

AGENDA #2

Achieving Precision with BOLT

Time Required: 45+ minutes

Supplies Needed

- BOLT Robots

Learning Objectives

- Students will be able to control BOLT with programming to achieve precision result.

1 Warm-Up

If students are new to programming BOLT robots, let them drive BOLT around using the joystick drive controls. This allows them to experience how BOLT moves.

2 Steps

After a few minutes of playtime in the drive controls, give students a series of new tasks:

1. Set up a line or target 10 ft. away from the students. Have students line up with their BOLT aimed at the target. With the joystick drive control, set the robot to full speed and ask the students to drive their robot to land exactly on the line/target 10 ft. away. Change the speed, and try again.

2. Set up a slalom activity for students with 4 “cones” or Obstacles about 1 foot apart. Have students drive their robots through the cones. Use a stopwatch to see which students can complete it the fastest without hitting an Obstacle.

After trying the tasks above, bring students together for a discussion around what they experienced with the simple tasks. Here are a few discussion questions:

- What task was the easiest to complete using the driving controls?
- How does speed change how easy the task task was?
- What could be done to make this more precise?
    - Hopefully this discussion leads to the idea of programming the robot. Programming allows for repeatable tasks and precise control of the robot.

Introduce students to the following two blocks:

- Roll (Heading, Speed, Duration)
- Delay (duration)

Using the two blocks, have students attempt the previous tasks but as programming challenges instead of driving challenges. The goal of this time is for them to explore the pros/cons of using different speeds and delay duration to get the most precise movements.

3 Wrap-Up

Bring students together at the end of the time you have and ask students what they've learned about programming BOLT.

A few items to bring up in discussion:

- To achieve the most precise result when programming BOLT, a delay block allows BOLT to come to a complete stop before moving on to a different movement block.
- If completing a task in a timely manner was important, what was the best delay duration to use?
- Without delay blocks, BOLT's turns are curved and unpredictable.

AGENDA #3

Sensor Data with BOLT

Mission Objective:

Students will set up a light source over the sun on the code mat. They will program BOLT to travel to three different regions/areas of the competition area to evaluate the light intensity of each portion of “space” - with the area closest to the Sun being the brightest. Programs must store those light intensity (luminosity) values as a variable and report the three values at the end of the program.

Time Required: 45+ minutes

Supplies Needed

- BOLT Robots

Learning Objectives

- Students will be able to use data from BOLT.
- Students will be able to create a variable and store data as the variable.

1 Warm-Up

Show students a 3-D blow up view of Sphero BOLT from the Sphero Edu app. Ask students if they recognize any of the sensors or components inside of the robot.

Use the following explanations for reference:

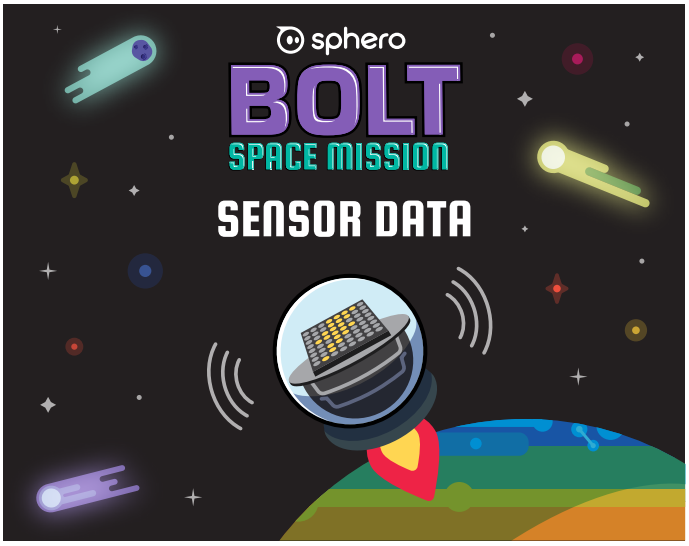
- **IMU (Inertial Measurement Unit):** measures the accelerometer and gyroscope data from the BOLT in 3 axes (X, Y, & Z)
- **Color Sensor:** uses magnetic north to re-orient a robot.
- **Ambient Light Sensor:** Measures the light intensity of the environment and returns the value in Lux (luminosity).
- **Infrared:** broadcasts/receives infrared signals for robot to robot communication.

All of these sensors and components produce data. This data can be used to act as triggers or events in your program.

In today’s activity you will explore how to utilize this data and to store that information for use later in a program.

2 Steps

Have student navigate to the Sphero Edu App to complete the activity to help them complete Mission Objective #1.



3 Wrap-Up

Now that students have learned about how to use data with BOLT, ask them to show you how a variable works to store the information for later in a program. Give students some time to showcase their variables working with the group.

AGENDA #4

Challenge #1 - Learning Session

Mission Objective:

Students will set up a light source over the sun on the code mat. They will program BOLT to travel to three different regions/areas of the competition area to evaluate the light intensity of each portion of "space" - with the area closest to the Sun being the brightest. Programs must store those light intensity (luminosity) values as a variable and report the three values at the end of the program.

Time Required: 45-60 minutes

**Teams may choose to use multiple days to work on this challenge if need be*

Supplies Needed

- BOLT Robot
- Additional light source (flashlight or lamp)
- Camera (possibly a tripod)
- Craft Supplies or Sphero Craft Pack

Learning Objectives

- Students will program BOLT to evaluate light intensity.
- Students will create and utilize variables to store data.

1 Warm-Up

Brainstorm (or continue brainstorming) a strategy for approaching Mission Objective #1.

Things to consider:

Programmer:

- What are the required variables to use?

Engineer

- How are you going to create the light source to act as the sun?
- How are you going to create an enclosure for the darkest light reading possible over Pluto?

Creative

- What type of creative elements can be added to your challenge to add to the rubric score?
- How will the Mission Objective be filmed?

2 Steps

After the brainstorming session, give students time to work on their challenge. Remind students that they can try (and film) their program as many times as they need—there are no penalties for trying things multiple times.

3 Wrap-Up

With about 10 minutes left in your meeting, ask students if they are ready to film the final running of their Mission Objective. If they are ready, have them prepare the Competition Field to show off their Mission Objective program. If they are not ready, have them clean up their materials and make a plan for continuing to work, or future filming of their Mission Objective.

AGENDA #5

Compass

Mission Objective:

Students will program BOLT to spin out of control as if it hit an asteroid, then use the magnetometer on BOLT to recalibrate and finish the objective.

Time Required: 45+ minutes

Supplies Needed

- BOLT Robot
- Handheld compass (if possible)

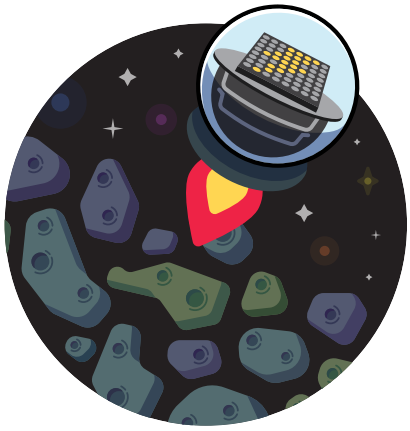
Learning Objectives

- Students will learn how to calibrate BOLT robots with the Magnetometer

1 Warm-Up

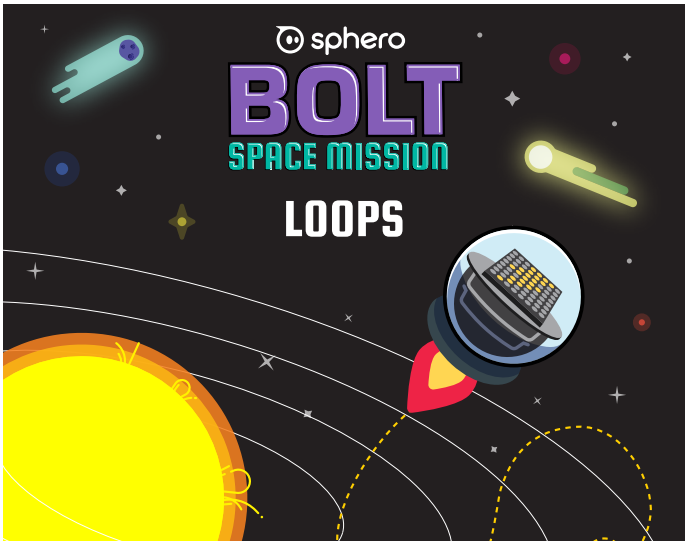
Discuss:

- Have you ever been hiking and had to use a compass?
- What does a compass do?
- How does a compass work?



2 Steps

Direct students to the Sphero Edu app to complete the BOLT Space Mission Compass activity.



3 Wrap-Up

After students have completed the activity, have them show you their programs running on the BOLT.

Follow up with a discussion about how the BOLT magnetometer functions the same way that a handheld compass would work as well.

AGENDA #6

Mission Objective #2 - Working Session

Mission Objective:

Students will program BOLT to spin out of control as if it hit an asteroid, then use the magnetometer on BOLT to recalibrate and finish the objective.

Time Required: 45-60 minutes

**Teams may choose to use multiple days to work on this challenge if need be*

Supplies Needed

- 2x BOLT Robots
- Camera (possibly a tripod)
- Craft Supplies or Sphero Craft Pack

Learning Objectives

- Students will be able to use the Calibrate Compass and Reset Aim block in their program

1 Warm-Up

Brainstorm (or continue brainstorming) a strategy for approaching Mission Objective #2.

Things to consider:

Programmer:

- How is the magnetometer block used?
- How does the resetting of the BOLT's aim work?
- How can you create a repeatable action for BOLT #2?

Engineer

- What does the Competition Field setup look like?

Creative

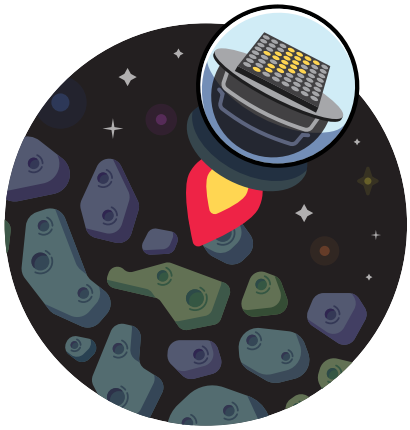
- How can you use the matrix animation block to add to your overall program?
- What do you need to film this Mission Objective?

2 Steps

After the brainstorming session, give students time to work on their challenge. Remind students that they can try (and film) their program as many times as they need—there are no penalties for trying things multiple times.

3 Wrap-Up

With about 10 minutes left in your meeting, ask students if they are ready to film the final running of their Mission Objective. If they are ready, have them prepare the Competition Field to show off their Mission Objective program. If they are not ready, have them clean up their materials and make a plan for continuing to work, or future filming of their Mission Objective.



AGENDA #7

IR Communications

Mission Objective:

BOLT #2 will send infrared communications that BOLT #1 will interpret to determine which region of the Competition Field it is in.

Time Required: 45-60 minutes

Supplies Needed

- 2+BOLT Robots

Learning Objectives

- Students will demonstrate how to use the Infrared Sensors of BOLT to send or broadcast messages

1 Warm-Up

Have students play a game of Marco Polo:

- One student puts a blindfold on
- He/She walks around the room trying to find the other members of the team
- The blindfolded student says “Marco”
- All of the other team members respond with “Polo”
- After a few rounds of playing Marco Polo, bring students together for a discussion

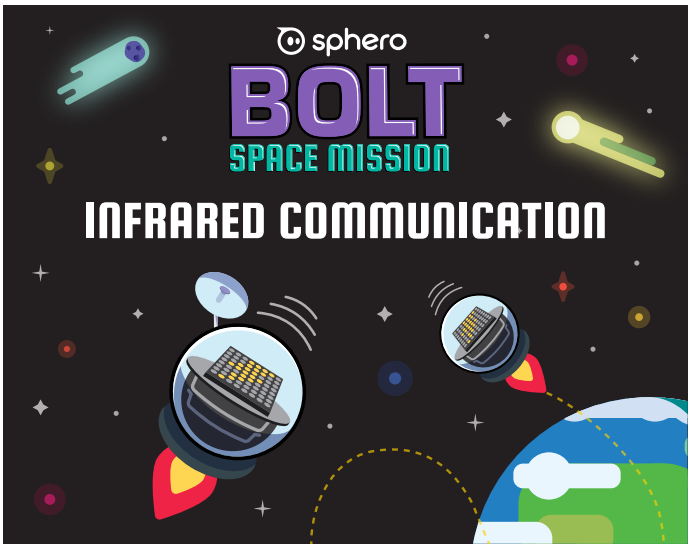
Discussion Questions:

- When you were blindfolded, how did you know where to find someone on your team?
- When you were blindfolded, how did you know if a teammate was near or far away?

Use this as a jumping off point for introducing Mission Objective #2.

2 Steps

Direct students to the Sphero Edu app to complete the IR Communication activity. In this activity, students will explore the difference between sending an infrared message and broadcasting an infrared signal.



3 Wrap-Up

Have students demonstrate their understanding by showing you their IR programs and talking through the differences between sending an infrared message and broadcasting an infrared signal.

AGENDA #8

Mission Objective #3 - Working Session

Mission Objective:

BOLT #2 will send infrared communications that BOLT #1 will interpret to determine which region of the Competition Field it is in.

Time Required: 45-60 minutes

Supplies Needed

- 2x BOLT Robots
- Camera (possibly a tripod)
- Craft Supplies or Sphero Craft Pack

Learning Objectives

- Students will be able to use the Send Message and On Message Received blocks in their program.

1 Warm-Up

Brainstorm (or continue brainstorming) a strategy for approaching Mission Objective #3.

Things to consider:

Programmer:

- How does the On Message Received block work?
- What is the best way to determine whether the BOLT on Earth is receiving a close signal vs. a far signal?

Engineer

- How does the orientation of BOLT change the behavior of the IR signals?

Creative

- How can you use the matrix animation block to add to your overall program?
- What do you need to film this Mission Objective?

2 Steps

After the brainstorming session, give students time to work on their challenge. Remind students that they can try (and film) their program as many times as they need—there are no penalties for trying things multiple times.

3 Wrap-Up

With about 10 minutes left in your meeting, ask students if they are ready to film the final running of their Mission Objective. If they are ready, have them prepare the Competition Field to show off their Mission Objective program. If they are not ready, have them clean up their materials and make a plan for continuing to work, or future filming of their Mission Objective.

AGENDA #9

Mission Objective #4 - Working Session

Mission Objective:

BOLT #1 must navigate the Competition Field without coming into contact with any Obstacles and lead BOLT #2 back to the starting point.

Time Required: 45+ minutes

Supplies Needed	Learning Objectives
• Sphero RVR • littleBits	• Students will be able to program BOLT to broadcast IR signal for another BOLT to follow

1 Warm-Up

Because Mission Objective #4 utilizes similar skills to earlier Mission Objectives, there isn't a learning session or Sphero Edu activity to complete before students should feel comfortable working on the Mission Objective.

Begin brainstorming how you can approach this challenge as a group.

Things to consider:

Programmer:

- How does the On Message Received block work?
- What is the best way to determine whether the BOLT on Earth is receiving a close signal vs. a far signal?

Engineer

- How is the Competition Field supposed to be set up?
- How can you engineer a way for BOLT to knock over the cups to achieve bonus points?

Creative

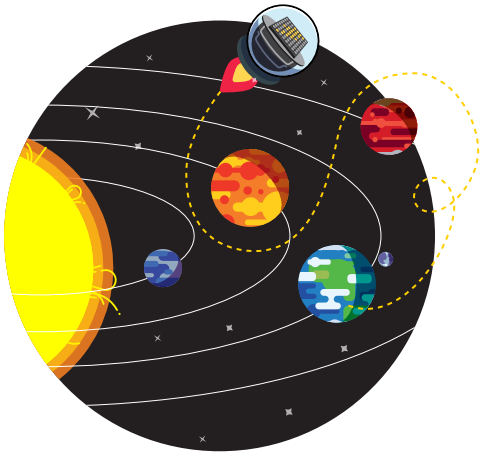
- How can you use the matrix animation block to add to your overall program?
- What do you need to film this Mission Objective?

2 Steps

After the brainstorming session, give students time to work on their challenge. Remind students that they can try (and film) their program as many times as they need—there are no penalties for trying things multiple times.

3 Wrap-Up

With about 10 minutes left in your meeting, ask students if they are ready to film the final running of their Mission Objective. If they are ready, have them prepare the Competition Field to show off their Mission Objective program. If they are not ready, have them clean up their materials and make a plan for continuing to work, or future filming of their Mission Objective.



AGENDA #10

Challenge #5 - Learning Session

Mission Objective:

Engineer a chariot for BOLT to carry payload from the starting point on the setup to the final position.

Time Required: 45+ minutes

Supplies Needed

- Sphero BOLT
- 18 oz cups
- Popsicle stick
- Post It Note
- Tape
- Straw

Learning Objectives

- Students will understand the engineering design process.

1 Warm-Up

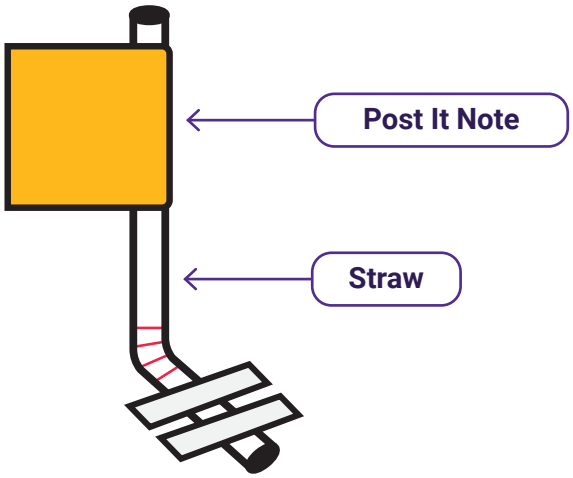
By now, you are very familiar with BOLT and how it navigates around Obstacles, on the Competition Field, and its potential limitations. With the final objective, you are asked to engineer a solution to transport a payload of objects in the Competition Field. But, look at BOLT. It's a Sphere, with nothing to connect to it. So, how do you do this? Have students brainstorm what they could do to have BOLT act as a motor to move things around.

Show students the image of the Engineering Design Process.

2 Steps

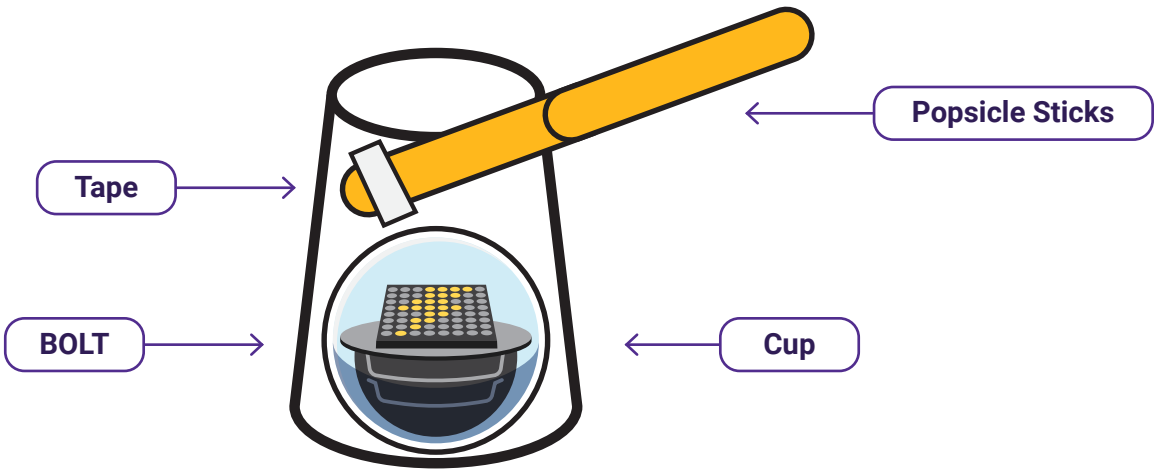
Set-Up:

- Build a target for each group of students as demonstrated in the picture. Have them tape it to the ground—this will be their jousting target.
- Give students a target, a BOLT, an 18oz cup, and 2 popsicle sticks with tape.



Create

Have students construct a jousting robot similar to the image below



Test

Have students program their BOLT to hit the target that is taped to the ground. Give them 5 minutes to try different speeds, distances, and aiming.

Discuss

How did things work with your jousting robot? Were you able to hit the target? What would happen when things were designed the way you were told?

Teacher Tip

he distribution of weight is the important thing for students to identify. The heavier side of a creation will want to be pulled by the BOLT and the cup. Have them think of ways to help redistribute the weight so that the jousting side of the robot is always forward.

Iterate

Now that students have seen how their jousting robot performs as directed, give them additional craft supplies, but the task remains the same.

Create, Test, Iterate, Repeat. Have students spend remaining amount of time building their jousting robot, testing, and iterating until they are successfully able to replicate a jousting robot to hit the flag almost every time.

3 Wrap-Up

Share

Have students demonstrate their jousting robots and have them explain their iterative process.

Discuss

What did students do to improve the accuracy of their jousting robot?

AGENDA #11

Mission Objective #5 - Working Session

Mission Objective:

engineer a chariot for BOLT to carry payload from the starting point on the setup to the final position.

Time Required: 45-60 minutes

Supplies Needed

- Sphero BOLT
- Craft Supplies

Learning Objectives

- Students will work through the engineering design process to succeed in Mission Objective #5

1 Warm-Up

Brainstorm:

Pass out or project the budgetary guidelines for Mission Objective #5. With the budget of $30 in mind, have students brainstorm a way for them to build a chariot to transport the payload as outlined in the Mission Objective setup.

2 Steps

Divide students up into programming and engineering groups to divide the workload for the Mission Objective. This Mission Objective could take more than one class period to complete, so be sure to see how students are using their time during the working sessions.

Things to consider for each role:

Engineers:

- How will you create a chariot that stays within budget but provides a stable and reliable outcome when BOLT drags it?

Programmers:

- What command need to be used to control BOLT #2 in relation to BOLT #1?

Debuggers:

- How can you help the Programmers and Engineers solve simple problems about the weight distribution of your chariot to BOLT program?

Creative:

- Does the aesthetics of the chariot matter?
- How can you work with the engineer to ensure things look good but perform effectively?
- What needs to be filmed in order to ensure the greatest score on the rubric?

Mission Manager:

- How is this Mission Objective evaluated?
- What can be done to ensure that the programmers and engineers are working towards the same goals?

3 Wrap-Up

With about 10 minutes left in the working session, come together as a group and decide on the overall status of your final Mission Objective. If the group is ready to film and complete the Mission Objective today, film and get ready to celebrate!! If the group needs more time, spend the last few minutes coming up with a plan for meeting again and getting to work on the final Mission Objective.