CANADA LEARNING CODE

Canadarm2

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Duration: 1 hour

LEVEL	SUBJECTS	PROVINCES / TERRITORIES	TOOL
Grades 4-6	Technology education, Science	All Provinces/Territories	Scratch

Overview

In this activity, students will imagine that they are Chris Hadfield remotely controlling the Canadarm2 and use Scratch to create a simulation in which they become the controller of Canadarm2 to put a new module on the International Space Station.

Prep Work

- Review the completed version of the project: bit.ly/canadarm2-example
- Print the Solution Sheet for the main activity: bit.ly/canada-takes-flight-solution

Lesson

This lesson was made in partnership with

CHRIS HADFIELD let's talk science

Minds On
Watch this video of Chris Hadfield:
https://www.youtube.com/watch?v=BR8svbP1iIw
Ask: What do we know about the International Space Station?

Key Coding Concepts

- Abstraction
- Conditionals
- Events
- Loops
- Parallel execution
- Variables

Curricular Connections

Science: Canadian contributions to space exploration

Math: geometry - translation, spatial awareness

References

Learn more about Chris Hadfield in this interview:

Introduction
Building the International Space Station (ISS) is no easy task! The crews of the ISS have to attach modules weighing tons, extend solar panels longer than a bus, and haul equipment to and from the space shuttle.

Canadarm2 is a Canadian-made robotic arm located on the International Space Station (ISS) that helped astronauts such as Marc Garneau and Chris Hadfield build the ISS in space. Since 2001, the 17-metre long Canadarm2 has been helping move equipment, supplies, astronauts, and even spacecraft such as SpaceX's Dragon capsule around the ISS.

In the International Space Station (ISS) actions have to be done in the correct order in order to place modules where it needs to go on the ISS. It will be a "lock & key" fit, so that the piece must go on properly in order for it to work.

http://thecanadianencyclopedia.ca/en/article/chris-hadfield/

Science At NASA
https://science.nasa.gov/science-news/science-at-nasa/2001/ast18apr_1
Canadarm - Canadian Encyclopedia
http://thecanadianencyclopedia.ca/en/article/canadarm/

Watch the Hadfield behind the controls of Canadarm2 video (or short clip)

- Q: In what ways is the Canadarm2 used on the International Space Station?
- Q: Where is a good place to go to control the Canadarm2?
- Q: Why are there so many cameras to help guide the astronaut when controlling the Canadarm2?
- Q: What are some of the challenges of using a robot such as the Canadarm2?

Using Scratch, we are going to create a game where we control Canadarm2, like in the video of Chris Hadfield.

Code Along

- Open up a new Scratch project at scratch.mit.edu and click on "create" (top, left corner).
- Point out the main elements: Stage, Sprites, and Scripts. Demonstrate how to drag and connect blocks.
- Give learners a few minutes to click on blocks and explore.
- Go through 1-2 challenges with the group, where learners are tasked with trying to make something happen in Scratch. For example, "Try to make Scratch move" or "Try to make Scratch say something when the space key is pressed" (See the Code-Along Challenges doc for more examples and solutions)

Activity
Show the example project so learners know what they are working towards. Ask them what they see - what is happening in this project?

Open the starter project (bit.ly/canadarm2-starter) and review the Sprites and backgrounds.
Have learners open the starter project on their screens and click "REMIX."

Use the Solution Sheet to guide learners through the following steps:

- Make the arm move
- Reset the arm's position
- Open and close the claw
- Pick up the modules
- Place modules on the port
- Reset the modules' positions
- Copy instructions to remaining modules
- Any Add-Ons, if time

Assessment

Learning Outcomes
I can create algorithms in Scratch
I can use conditionals to control what happens in my project
I can use loops to make things happen more than once
I can use events to control when things happen in my project
I can use broadcast messages to communicate between sprites in my project

Success Criteria
I remixed the starter project and renamed it with my first name.
My Canadarm2 can be controlled by the player
My Canadarm2 can collect and sort modules
I used broadcast messages to communicate between elements in my game.

Assessment Ideas:
Use Comments in Scratch for learners to explain their steps (right click > add comment).

Students could create a flowchart or sequence of steps using mathematical language before building the game in Scratch (e.g., turn 30º clockwise, travel forward 3 cm, turn 60º counterclockwise, etc.).

Extensions

Have students write a first-person account of an astronaut using the Canadarm2 to successfully capture a Dragon or Cygnus capsule.

Watch this video to learn about the 40 years of robotic innovation that Canada has made, including importantly the Canadarm!