NFB SPACE SCHOOL

MISSION
HADFIELD
34/35

# Educator's GUIDE

A NATIONAL FILM BOARD OF CANADA PRODUCTION

ONF NFB

# About the GUIDE

## ABOUT THE NFB SPACE SCHOOL INTERACTIVE WEBSITE

**NFB Space School** is an educational interactive production that brings the wonders of the universe into your classroom. Teachers and students have the opportunity to observe and connect with the monumental six-month mission of Canadian astronaut *Commander Chris Hadfield*, the first Canadian commander of the International Space Station (ISS). **NFB Space School** is divided into modules—**Mission** and **Leadership**—each with its own focus, background information, context and set of enrichment activities to meet the needs of multiple types of learners.

The content of each module is divided into three responsive screens arranged horizontally across the page. The central screen contains NFB-produced original content, featuring Chris Hadfield; **NFB Space School** host, Jeremie Saunders; and the characters they encounter. When users click on one of the adjoining side screens, a larger view is available, allowing them to shift their visual focus as they continue to listen to the central screen.

Below the central screen, in a navigation bar, the various chapters of the **Mission** module (A–D) are displayed—complete with brief pop-up text descriptions of the chapter content. The left screen features still images. These infographics and archival personal images enhance the themes and ideas discussed in the lesson videos. Images range from those related to Chris's personal journey of space exploration and travel to images of the spacecraft and equipment used in the journey into space, the building of the International Space Station, and of fellow astronauts working and living on the International Space Station. These images also provide students with technical and factual data about the topics discussed in the main video. The right screen features evocative film imagery of humankind's journey into space. These films provide further details and visuals about the topics discussed in the main video. By enlarging and moving between screens while absorbing Hadfield's words, users get to pilot their own experience, keeping them engaged in the primary interview content.

## ABOUT
# THIS GUIDE

This educator's guide is intended to assist junior and secondary school educators to incorporate NFB digital technologies and mobile applications into their classes. It will encourage students to engage with Chris Hadfield's mission as the first Canadian commander of the ISS; to learn more about the history and science of space travel; to develop an understanding of the scientific principles used to get humans into space; and to examine what can be learned from space travel and exploration. Several activities have been designed for students at a variety of levels and with a wide range of learning styles.

The content on **NFB Space School** and its educational support guide will strengthen ties to curriculum and encourage students and teachers to expand their ideas of classroom learning. The NFB encourages the integration of new technologies in the classroom, and this guide is designed to help students and teachers use the website and its resources to their full potential. Specific curriculum, unit, lesson and discussion suggestions can be found in the Classroom Activities section. The Additional Resources section near the end of the guide will also be useful to teachers looking for enrichment beyond the website. It offers links to other NFB products of interest, free online tools, traditional library resources and social media links.


## RECOMMENDED
# AGE LEVELS

Educators are always strongly encouraged to preview media content before presenting it to their students. However, **NFB Space School** is designed to be suitable for learners of all ages, with the intended school-aged audience being students between the ages of 11 and 15. Some activities and content within this guide will appeal to all students in this age range, while others are targeted at students of certain ages. There is enough flexibility within each of the activities to modify them and their learning outcomes so that they are meaningful to every participating student.

## RECOMMENDED
# SUBJECT AREAS

SCIENCE | LANGUAGE ARTS | ENGLISH LANGUAGE ARTS | FRENCH LANGUAGE ARTS
PHYSICAL EDUCATION | MEDIA LITERACY | CIVICS | FAMILY STUDIES | ART

## KEY
# THEMES AND CONCEPTS

- To identify applications of science and technology developed in response to human and environmental needs;
- To demonstrate an understanding of (and apply specific investigative processes to) the natural and constructed world;
- To seek solutions to practical problems;
- To describe the development of science and technology over time;
- To understand how the co-operation of many people and countries is involved in space travel and exploration.

The **Mission** module focuses specifically on the processes and technologies used to get into space and the building of the International Space Station. Science teachers will find relevant curriculum support in this module, but they may also want to explore other modules, for example the historical and motivational sections of the **Leadership** module, for enrichment.

## ABOUT
# THE MISSION MODULE

**NFB Space School**'s **Mission** module is presented as a series of seven short video interviews (chapters) with Chris Hadfield. Each has a unique theme that prepares teachers for curriculum links and outreach activities.

A synopsis of each chapter can be found in the next section of this guide. The chapters are designed to stand alone and can be used independently. They can also be viewed sequentially or divided between groups of students for individual, group or seminar work.

Following the completion of each lesson, teachers have the option to **Teach It**, by clicking on the **Teach It** link. This link leads to a **Learn More** and a **Quiz** icon. The **Learn More** function opens up a variety of online links and useful resources. The **Quiz** section provides a multiple-choice, content-based quiz that tests how much students have learned while exploring the **Mission** module. Students are encouraged to take the **Quiz** following each lesson. Some of the questions will require the students to have read the information shown on the left-hand screen as well as information gathered while watching and listening to the centre screen.

# YURI GAGARIN

Yuri Gagarin was born March 9, 1934, near Moscow, Russia. He was the third of four children and spent much of his childhood working on the farm where his mother and father also worked. While in school, Yuri loved both mathematics and physics. He eventually worked as a metalworker and went to an industrial school.

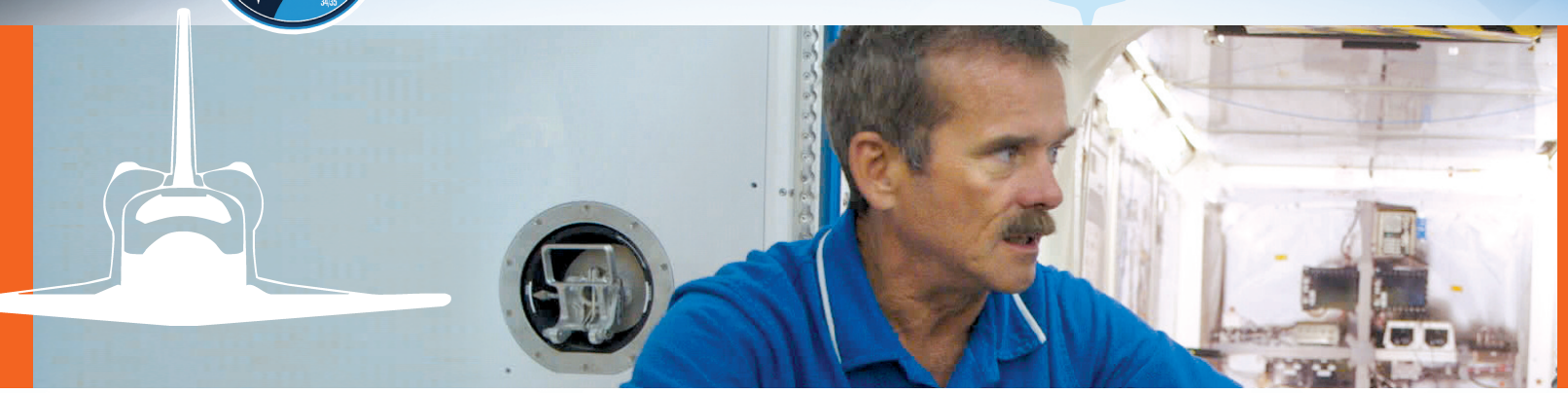
At this industrial school, he joined a flying club. He was a very quick learner and made his first solo flight at age 21, in 1955. Soon after, he joined the Soviet Air Force and learned to fly MiGs. He graduated from Orenburg Aviation School with top honours. Though Gagarin greatly enjoyed being a fighter pilot, what he really wanted to do was to go into space.

He applied to be a cosmonaut for the Soviet Union and, in 1960, was one of 20 people chosen out of 3,000 applicants. While training to become a cosmonaut, Gagarin excelled in the physical and mental tests. He was known to have a good sense of humour and the ability to remain calm. Eventually the skills and demeanour that Gagarin demonstrated led to him being chosen to become the first man in space.

On April 12,1961, Gagarin boarded *Vostok 1* at the Baikonur Cosmodrome. Even though he was fully prepared and trained, no one really knew what to expect. At 9:07 a.m., he was launched into space, and he completed a single orbit around the Earth. During this trip, he did not have control of the spacecraft, as scientists on the Earth feared that spaceflight might make him go mad. At the end of the orbit, *Vostok 1* reentered the Earth's atmosphere. When the capsule was still about 7 km above the Earth, Yuri ejected (as planned) and parachuted to safety. He eventually landed in a farmer's field.

This was Gagarin's first and only spaceflight, as he perished in a plane crash in March 1968. However, the 108 minutes that he spent in space gave him a place in history and the admiration of people in Russia and abroad. A crater on the moon is named after him, and when the astronauts of *Apollo 15* were on the moon, they left a plaque there naming the 14 men, Russian and American, who had perished in pursuit of spaceflight.[1]

[1] Excerpts from: *history1900s.about.com/od/1960s/a/yurigagarin.htm*



# CHRIS HADFIELD

Chris Hadfield was born on August 29, 1959, in Ontario, Canada, where he was raised and educated. After receiving a bachelor's degree in mechanical engineering at Royal Military College in 1982, he trained as a fighter pilot. He then enrolled at the University of Tennessee and graduated with a Master of Science in aviation systems in 1992. He attended the United States Air Force (USAF) Test Pilot School at Edwards Air Force Base, in California, and after graduating, served as an exchange officer with the U.S. Navy and did research work with NASA on pitch control margin simulation and flight. He was the pilot who completed the first military flight of F/A-18 enhanced-performance engines and also piloted the first flight test of the National Aerospace Plane external-burning hydrogen-propulsion engine.

Hadfield worked for the military in a variety of capacities until June 1992, when he was selected to become one of four new Canadian astronauts from over 5,330 applicants. The Canadian Space Agency (CSA) assigned him to work at the NASA Johnson Space Center in Houston, Texas, in August of the same year. While working there, he addressed technical and safety issues for Shuttle Operations Development, contributed to the development of the glass shuttle cockpit, and aided with shuttle launches at the Kennedy Space Center, in Florida. Hadfield was also NASA's Chief CapCom, the voice of mission control for astronauts in orbit, for 25 space shuttle missions.

In November 1995, Hadfield served as Mission Specialist 1 on **STS-74**, NASA's second space shuttle mission that met and docked with the Russian Space Station Mir. Hadfield flew as the first Canadian mission specialist, the first Canadian to operate the Canadarm in orbit, and the only Canadian to ever board Mir.

From 2001–2003, Hadfield was the Director of Operations for NASA at the Yuri Gagarin Cosmonaut Training Centre in Russia. His work included the direction of all International Space Station crew activities in Russia, managing training and crew support staff, and negotiating policy with the Russian Space Program and other International Partners. During this period, he also served as Mission Specialist 1 on **STS-100** International Space Station (ISS) assembly Flight 6A. As part of the 11-day flight in April 2001, Hadfield took two spacewalks, which made him the first Canadian ever to float freely in space. Hadfield retired as a colonel from the Canadian Air Force in 2003 after 25 years of military service. He was Chief of Robotics for the NASA Astronaut Office at the Johnson Space Center in Houston, Texas, from 2003–2006, and Chief of International Space Station Operations there between 2006 and 2008.

Hadfield continued to work for the ISS on a variety of assignments until September 2010, when he was assigned to **Expedition 34/35**. On December 19, 2012, he joined the Russian *Soyuz*, to become the second Canadian to take part in a long-duration spaceflight aboard the ISS.

On March 13, 2013, he became the first Canadian to command the ISS during the second portion of his five-month stay in space. On May 13, 2013, Hadfield, Tom Marshburn and Roman Romanenko landed in Kazakhstan after living for 146 days in space, 144 of which were spent aboard the station. During this flight, Hadfield and his colleagues set a record for the amount of time spent on research, as they conducted over 100 experiments. Hadfield and his crew's time living and working aboard the International Space Station was also captured and transmitted back to Earth in various forms, including: Twitter, photos and video. Hadfield became an interplanetary media superstar and brought the trials, tribulations and joys of day-to-day living aboard the ISS to people all around the world.

During his long career, Hadfield received many awards and honours, including induction into Canada's Aviation Hall of Fame in 2005 and commemoration on Royal Canadian Mint silver and gold coins for his spacewalk to install Canadarm2 on the International Space Station in 2006. In June 2013, Hadfield announced that he would retire from the CSA on July 4, 2013. He hasn't said what he'll do next—other than seek new challenges.[2]

[2] NASA biography of Chris Hadfield: *nasa.gov/pdf/64090main_ffs_bio_hadfield.pdf*
Canadian Space Agency biography of Chris Hadfield: *asc-csa.gc.ca/eng/astronauts/biohadfield.asp*

# DAVID SAINT-JACQUES

David Saint-Jacques was born on January 6, 1970, in Quebec, Canada. His education included a Bachelor of Engineering degree from École polytechnique de Montréal, in Montreal, Canada, in 1993, and a Ph.D. in Astrophysics from Cambridge University, in the UK, in 1998. Saint-Jacques' studies included theoretical work on astronomical observation, design fabrication, and commissioning instruments for the Cambridge Optical Aperture Synthesis Telescope and for the William Herschel Telescope in the Canary Islands. Saint-Jacques went on to earn a medical doctorate degree from Université Laval in Quebec City, Canada, in 2005, and his practical training was focused on first-line, isolated medical practice in 2007 at McGill University in Montreal, Canada.

Saint-Jacques started his career as a biomedical engineer. His broad scientific background allowed him to work with telescopes in Hawaii, Japan and Montreal, Canada. His medical training took him to the far north of Canada, to the Arctic village of Puvirnituq, where he was the co-chief of Medicine. After this he applied to the Canadian Space Program, and in May 2009 he was one of 14 members selected to go to Houston as part of the 20th NASA astronaut class.

Since graduating in 2011, Saint-Jacques has been assigned to the Robotics Branch of the Astronaut Office, participated in an underwater mission, NEEMO 15, and participated in the Pavilion Lake Research Project.[3]

[3] Canadian Space Agency biography of David Saint-Jacques: *asc-csa.gc.ca/eng/astronauts/biosaintjacques.asp*

# BAIKONUR COSMODROME

The Baikonur Cosmodrome is the launch complex where Sputnik 1, Earth's first artificial satellite, was launched. The Cosmodrome has been the launch location of all Russian crewed missions. Since the completion of the American Shuttle Program in 2011, all manned flights to the International Space Station have originated from here (as of 2013).[4]

# GLOSSARY OF TERMS

**Actuator:** a mechanism or device that puts something into automatic action

**Canadarm** and **Canadarm2:** technology built by Canadians that has been or is currently being used aboard the ISS to help maneuver large masses into their desired locations

**Candlepower:** measure of luminous intensity (amount of light)

**Centripetal motion**: motion of an object in a curved path

**CSA:** Canadian Space Agency. Established in March 1989, the Canadian Space Agency was created through an Act of Parliament, proclaimed in December 1990.

The Canadian Space Agency directs its resources and activities through four key programs:

- Earth Observation
- Space Science and Exploration
- Satellite Communications
- Space Awareness and Learning

**Dichotomy:** an idea that is split into two, usually contradictory, parts

**Gimbals:** a device allowing a thruster to move freely in any direction

**ISS:** International Space Station

**NASA:** National Aeronautics and Space Administration

**Quarantine:** strict isolation designed to prevent the spread of disease

**Sequoia tree:** an evergreen tree, generally considered the tallest tree in the world

***Soyuz***: Russian rocket ship

**STS:** Space Transportation System

[4] *nasa.gov/mission_pages/station/structure/elements/baikonur.html*


# Chapter Summaries

In each of the module's seven chapters, Chris Hadfield discusses aspects of space travel, from its beginnings to the journey to the International Space Station. The videos range from approximately two minutes to three minutes, 30 seconds in length.

## 1A EXPEDITION 34-35
## INTRODUCTION

Canadian astronaut Chris Hadfield focuses on what life experiences have brought him to this point in history and discusses what skills and abilities he will be using as he looks ahead to what awaits him on **Expedition 34–35** to the International Space Station. He describes himself as a "space-station astronaut" and talks about the need to be a "jack of many different trades" on his six-month mission to the ISS, from December 2012 through May 2013. At the end of the video, Hadfield also alludes to the support system necessary when a project of this magnitude is attempted.

## 2A PAST MISSIONS
## SECOND SHUTTLE—MIR DOCKING

Hadfield starts by discussing the role of the Soviet Union in the development of spaceflight. He talks about how the Soviet Union had the first human being in space and the first space station, MIR. He then focuses on how "changes in politics/time" led him to work on the installation of the docking module for MIR alongside astronauts from other countries who previously he might have had to fire upon, during his time as a fighter pilot. Hadfield also describes the joy and sense of accomplishment he felt as he became the first Canadian to use the Canadarm to maneuver the docking module into position, so that *Atlantis* could be docked with MIR, thus "physically joining the two programs" (meaning the Russian and American space programs).

## 2B PAST MISSIONS
## ISS—CANADARM2 ASSEMBLY

Hadfield explains why there was a need for the development of Canadarm2 and the role that Canadians played in the development of the ISS. He also describes the physical characteristics of the new Canadarm and how he became the first Canadian to walk in space during mission **STS-100**.

## 3A *SOYUZ*
# BAIKONUR

Hadfield explains why Baikonur, Kazakhstan, was chosen as the site of the first "space port." He tells us how the conditions were favorable at this site and how other sites around the world have also been chosen for similar reasons.

## 3B *SOYUZ*
# ROCKET

Hadfield and his fellow Canadian astronaut, David Saint-Jacques, discuss how the *Soyuz* rockets have evolved and been used since 1966 to help humankind get to space. The physical and chemical characteristics of the *Soyuz* rocket are discussed, and students can see the rockets up close in the video. ***Note: At the beginning of the video it is indicated that 355 people have flown in space, but this number is now out of date and will continue to increase as more spaceflights are made.

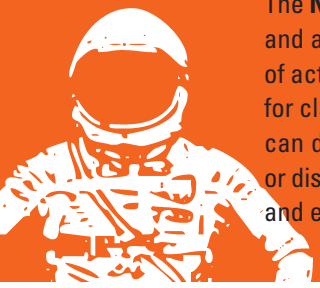
## 3C *SOYUZ*
# TRADITIONS

Hadfield focuses on the traditions that have been established at Baikonur and the role that traditions play in space travel today.

## 3D *SOYUZ*
# BACK-UP CREW

Hadfield introduces students to the concept of a "back-up crew" and the important role they play in the space program. He describes the need for a second prepared crew to be ready to go into space. He talks about how and why back-up astronauts prepare themselves physically in the same way as the main crews do, but need to train themselves mentally a bit differently.

## TEACHER PREPARATION:
# CLASSROOM ACTIVITIES



The **NFB Space School** resources are intended to be open-ended and are suitable for many applications and a diversity of learning environments. Each of the lessons provides starting points for a whole range of activities: from some closely related to curriculum outcomes to others that can serve as springboards for class discussions or project work. Educators interested in any of the ongoing media-literacy projects can design long- or medium-term projects based on the **Mission** module material. Single-day activities or discussions on the development of spaceflight and travel could be extended, depending on the interest and engagement of the learners.

# QUESTIONS
## FOR DISCUSSION

There are several ways to discuss **NFB Space School**, both before and after screenings. The following are suggested questions to ask students.

1
Is space travel important for humans? Why?

2
How have politics played a role in space travel and exploration? What are the social, political and scientific motivations to continue space exploration in Canada and other parts of the world?

3
What are some of the technologies that have been created for the space program but applied on Earth?

4
What do you think of when you hear the word “robot”?
How has the development of robots or robotics changed our way of life?

5
How has the science that has been done on or for the ISS affected or changed our lives on Earth?

6
Where do we find other examples of a “back-up crew” and what is its role?
How can mental and physical preparation change how we perceive an event?

7
What role did social media play in Chris Hadfield’s mission?
What effect has social media had on the Space Program?

# BACTERIA SWAB
## (TO ACCOMPANY VIDEO 1A)

In the video, Hadfield describes how he will have many different jobs once he is on the ISS. He indicates that collecting bacteria samples is one of them. In this activity, students will collect samples of bacteria from around their classroom and examine cultures to observe and hypothesize about what they have found.

## Age range 11 to 16

**Time needed:** 30–45 minutes for the initial collection and preparation of samples and then brief observation times (10–15 minutes) on future dates

**Subject area links:** Science (for central activity), Language Arts & English (for presentation skills for an intended audience)

**Learning outcome(s):** Students will implement appropriate sampling procedures. They will use instruments effectively and accurately for collecting data. They will observe and describe the characteristics of organisms within their own environment.

**Materials needed:** Petri dishes with agar, microscope (for more advanced study)

**Description and steps for this activity:**

1. Students will need to work in small groups of 2–3 for this activity.

2. Students will gather the appropriate materials and implement appropriate sampling procedures to gather swabs from places in their classroom or school (e.g. desk, doorknobs, fountain, washroom).

3. **The Swab:** To remove the swab from the tube, grasp the tube in the left hand and the cap with the small and ring fingers of the right. Pull the cap off. By using these fingers, the thumb and remaining fingers are free to grab the swab and remove it from the tube. Return the cap to the tube. If the source to be sampled is dry, moisten the swab before collecting the sample: A moist swab will much more effectively pick up bacteria than a dry swab. Open a tube with sterile water as described above (still holding the swab with the thumb and forefinger) and dip the swab into the water. Raise the swab above the level of the water and push it against the walls of the tube. Rotate the swab to force out excess water. The swab should be damp, but not dripping wet. To collect bacteria, rub the swab over the surface being sampled while you rotate the swab handle between thumb and forefinger. Expose all surfaces of the swab to the source, not just one spot. If you don't transfer the bacteria to an agar plate immediately, return the swab to its original tube for holding and transport.[5] For more information on Bacteria-Growing Experiments in Petri Plates, see *sciencecompany.com/Bacteria-Growing-Experiments-in-Petri-Plates-W155.aspx*

[5] *www2.hendrix.edu/biology/CellWeb/Techniques/samp&inoc.html*

# BACTERIA SWAB (*cont'd*)

4. Depending on the level of the students, teachers may wish to begin with basic observation of the colony and work on developing the students' ability to characterize the colony (i.e. by shape and size—round, irregular, punctiform (tiny); margin edge—entire (smooth), undulate (wavy), lobate (lobed); elevation—convex, flat, raised; colour—colour and opaqueness, translucence, shininess or dullness; texture—moist or dry (rough).

5. For older students, teachers may wish to include the preparation of a bacterial smear or perform a gram stain to provide further clarification as to the types of organisms present. A gram stain is used to determine if the bacteria have different constituents of their cell walls (peptidoglycan). A bacterium with a thick layer of peptidoglycan in the cell wall will stain a bluish-purple, and it is classified gram (+). If the bacteria has a thin layer of peptidoglycan it will stain pink, and it is classified gram (-).

ACTIVITY 2

General Classroom ACTIVITIES

# CREATE A ROBOT ARM
## (TO ACCOMPANY VIDEO 1A)

The development and use of the Canadarm has been instrumental in the development and advancement of the ISS. In this activity, students are encouraged to design and create their own "Robotic Arm" that can perform a simple task, using common household materials.

## Age range 11 to 16

Students of all target ages can form and articulate goals. Expectations may have to be modified for younger students.

**Time needed:** 1–2 hours

**Subject area links:** Art, Science

**Learning outcome(s):** Design and create an instrument that could be used to solve a problem, such as how to lift a Styrofoam cup off the table without touching it with your hands.

**Materials needed:** Varies with supplies available

**Description and steps for activity:**
An example of this activity can be found at: *ieee.org/documents/Build_Your_Own_Robot_Arm_Lesson_Plan102364.pdf*

Please note: Activity Six: What's in a Name? (to accompany Video 3A) could be used in conjunction with this activity.

ACTIVITY 3

General Classroom ACTIVITIES

# SPACE TIMELINE
## (TO ACCOMPANY VIDEO 2A)

The history of spaceflight and the contributions that were made by the Soviet Union are discussed in the beginning of this film. At the end, Hadfield talks about how different countries came together to help modify MIR to allow for a merging of the Soviet and American space programs. In this activity students will research and discover how space programs have developed in different countries around the world and identify how/what each country has contributed to the ISS.

## Age range 11 to 16

**Time needed:** Varies. A minimum one-hour session, in which students have access to the Internet or other media sources of information and around one hour of class time to put it all together.

**Subject area links:** Social Studies, Civics, Language Arts, English, Science

**Learning outcome(s):** Students will develop an understanding of the roles of various countries in the development of spaceflight and the exploration of space.

**Materials needed:** Depending on their method of presenting, students will need access to the Internet, visual materials, and communication tools.

**Description and steps for this activity:**
1. Students could work in small groups and be assigned a country that is currently involved in the ISS (Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Russia, Spain, Sweden, Switzerland, United Kingdom, and United States).

2. Students will then work together to gather information and create a timeline showing how they have been involved in space exploration and studies for their country.

3. At the end of the small-group time, the whole class could be brought together to create a larger, more complete timeline using the information gathered by each group. The timeline could be created physically and displayed in the classroom or it could be created digitally and posted online, using appropriate, school-approved websites/software (for example: Microsoft Excel, PowerPoint, Inspiration, Timetoast, Tiki-toki).

# CANADARM1 VS. CANADARM2
## (TO ACCOMPANY VIDEO 2B)

The development of the Canadarm2 is discussed in this video; some of the reasons why it is necessary are described. Students could be encouraged to compare and contrast Canadarm 1 and 2, using an appropriate graphic organizer and media sources.

## Age range 11 to 16

The sophistication of the discussion depends on the needs, level and maturity of the group.

**Time needed:** Varies. A minimum one-hour session, in which students have access to the Internet or other media sources of information and around one hour of class time to put it all together.

**Subject area links:** English, Language Arts, Science

**Learning outcome(s):** Students will see how the development of new technologies comes from the need for problem solving.

**Materials needed:** Internet, graphic organizer

**Description and steps for activity:**
Students can research the two technologies and compare and contrast them using a graphing organizer.

# WHY BAIKONUR?
## (TO ACCOMPANY VIDEO 3A)

In this video, Hadfield brings to light some of the reasons why we launch space vehicles from specific locations on the Earth. In the activity, students will work together to gather information about the geography of Baikonur, Kazakhstan, and then locate a site (city or town) in Canada that is +/- 1˚ latitude from that of Baikonur and prepare information on that city or town. It is important to note that Baddeck, Nova Scotia, is within +/- 1˚ of Baikonur and was the site of the first powered flight in Canada. Students could be broken into groups and asked to find locations by province (the territories have too large a latitude). An extension could be to have students compare and contrast the launch sites of Kennedy Space Center Launch Complex, Guiana Space Centre, Tanegashima Space Center and Baikonur.

## Age range 11 to 16

Activities can be designed to fit the needs and abilities of the group.

**Time needed:** One to two hours, depending on the complexity of the task(s).

**Subject area links:** Civics, Social Studies, Science, Language Arts and English

**Learning outcome(s):** Students will develop an understanding of the reasons why space vehicles are launched from specific locations on the Earth. They will understand the importance of working as a team and dividing up tasks. Remind students to consider the qualities that made Baikonur a prime location so that they may have an idea of what information to determine for their city or town.

**Materials needed:** Access to the Internet and digital maps (e.g., *mapsofworld.com/lat_long/canada-lat-long.html*) or physical maps of Canada (and the world)

**Description and steps for activity:**
This depends on the depth of information that the students are asked to find. Ideally, the activity would involve group dynamics, group decision-making and group process, as they determine what information is relevant to their central question: "Why are space vehicles launched from specific locations on the Earth?"

ACTIVITY 6

General Classroom ACTIVITIES

# WHAT'S IN A NAME?
## (TO ACCOMPANY VIDEO 3B)

The name *Soyuz* means "union" in Russian and Mir means "peace." How do new inventions get their names and what do they mean?

## Age range 11 to 16

Activities can be designed to fit the needs and abilities of the group.

**Time needed:** 15 minutes discussion time within small groups and then 30–45 minutes of Internet access and class time to communicate their results.

**Subject area links:** Civics, Social Studies, Science, Language Arts and English

**Learning outcome(s):** Students will explore thoughts, ideas, feelings and experiences related to the space program to come up with a name for their Robot Arm, and then transfer that name into different languages.

**Materials needed:** Internet or access to different language dictionaries

**Description and steps for activity:**
In this activity, students could be asked to give a name to their previously created Robot Arm (see Activity 2) and find out what that name would be in the other languages spoken by countries involved in the ISS. They could then present this information to the class along with a photo of their robotic arm (if their actual robotic arm is no longer available).

# UP WE GO!
## (TO ACCOMPANY VIDEO 3B)

In this video, David Saint-Jacques discusses the use of gimbals and gives an example of why there is a need for them on the *Soyuz* rocket. Students can perform a hands-on activity, where they are given a variety of different-shaped objects and asked to see which ones are easier to push up and then try to determine which characteristics of the objects made them easier to push up.

## Age range 11 to 16

Activities can be designed to fit the needs and abilities of the group.

**Time needed:** 45 minutes to an hour (depending on the number of items students are to test)

**Subject area links:** Science, English

**Learning outcome(s):** Students will explore and observe materials and events in their immediate environment and record the result. They will analyze qualitative and quantitative data and develop and assess possible explanations. They will analyze and describe the relationship between force and motion.

**Materials needed:** A variety of different-sized and -shaped objects (that fit in your hand)

**Description and steps for activity:**
Students are given an object and asked to record quantitative and qualitative observations of it before beginning. They then place it in their open palm and proceed to lift it upwards at a constant speed (without holding onto it). They are asked to write down observations about the level of difficulty in raising the object without it falling off their hand. Once the students have repeated this with a variety of objects (in a variety of orientations) they can analyze the results for possible explanations as to why some of the objects are easier to lift than others.

# CHEMISTRY IN SPACE
## (TO ACCOMPANY VIDEO 3B)

In this video David Saint-Jacques and host Jeremie Saunders discuss the power generated by the *Soyuz* rockets. Depending on their level, students could create a chemical reaction that produces $CO_2$ (baking soda and vinegar) to pop a film canister or plastic bag or make a rocket. At higher age levels, they could expand upon this by learning the chemical formulae, balancing the chemical reaction and discussing the energy transfers.

## Age range 11 to 16

Activities can be designed to fit the needs and abilities of the group.

**Time needed:** 30 minutes to an hour

**Subject area links:** Science, English

**Learning outcome(s):** Students will explore and observe materials and events in their immediate environment and record the result. They will predict and explain energy transfers in chemical reactions.

**Materials needed:** baking soda, vinegar, film canister, plastic bag or bottle (depending on level of students)

**Description and steps for activity:**

1. Students will observe a chemical reaction (baking soda and vinegar) and its effects on the motion of a film canister, plastic bag or bottle (possible links to: *exploratorium.edu/science_explorer/bubblebomb.html* or *wikihow.com/Make-a-Baking-Soda-and-Vinegar-Rocket*).

2. Ask students to record their findings as to whether or not a chemical reaction has occurred (emission or absorption of heat, formation of gas bubbles or solids, emission of light, or change of colour).

3. Students could use digital cameras to record the reaction. They could present their recordings to explain whether or not a chemical reaction has occurred.

# TRADITION AND SUPERSTITION
## (TO ACCOMPANY VIDEO 3C)

In the video, Hadfield explains some of the long history and traditions for the astronauts and crews in Baikonur. The purpose of these activities is to allow students to explore their own understanding of traditions and how they came into being.

## Age range 11 to 16

Activities can be designed to fit the needs and abilities of the group.

**Time needed:** Varies. A minimum one-hour session, in which students have access to the Internet or other media sources of information and around one hour of class time to put it all together.

**Subject area links:** English, Language Arts, Technology, Family Studies

**Learning outcome(s):** Students will be able to talk about what the terms tradition and superstition refer to. They will describe a tradition that they have observed in their own family. They will research and express how superstitions have come about and be able to explain the origins of some common superstitions.

**Materials needed:** Depends on the activity chosen

**Description and steps for activity:**
There are a number of approaches you can present to your class:

1. Students could look up the meaning of the words tradition and superstition and compare/contrast or create a graphic organizer.

2. Students could blog about a family tradition that they have.

3. Students could research and then prepare a traditional Kazakh meal (or they could bring in a traditional family dish and share the dish or recipe with the class—students would need to be made aware of any allergies among their classmates before undertaking this assignment).

4. Students could brainstorm superstitions and then find out more about the origins or meaning behind them. Some examples might be:

- Friday the 13th is an unlucky day.
- An itchy palm means money is coming your way.
- A rabbit's foot brings good luck.
- An apple a day keeps the doctor away.
- Break a mirror and you will have seven years bad luck.
- Step on a crack, break your mother's back.

5. You can also ask students to take their findings one step further: Ask them to blog or storyboard their findings. For a sample of a storyboard, refer to the NFB's Stop-Mo Studio tutorial video: *nfb.ca/playlists/stopmostudio/viewing/stopmo_storyboarding_your_idea/* and resource guide: *onf-nfb.gc.ca/medias/download/documents/pdf/Prod_Stopmo_L4_ANG_ib_05.pdf*

# WERE HUMANS THE FIRST AND ONLY?
## (TO ACCOMPANY VIDEO 3C)

In this video, Hadfield indicates that the first human in space was Yuri Gagarin. Students could be encouraged to discover what other organisms have been in space and what their contribution has been to the space program and our understanding of space travel.

## Age range 11 to 16

Activities can be designed to fit the needs and abilities of the group.

**Time needed:** Varies. A minimum one-hour session, in which students have access to the Internet or other media sources of information and around one hour of class time to put it all together.

**Subject area links:** English, Language Arts, Technology, Science

**Learning outcome(s):** Students will discover the role that other organisms have played in our understanding of spaceflight. They will evaluate social issues related to the applications and limitations of science and technology, and explain decisions in terms of sustainability, considering a variety of perspectives.

**Materials needed:** Access to Internet or library

**Description and steps for activity:**
Students will conduct research into which organisms have been in space and prepare a pamphlet that describes their organism and the role that it played in the space program. Some examples of organisms that have been in space include: fruit flies, moss, mice, dogs, monkeys, guinea pigs, frogs, rats, cats, wasps, beetles, tortoises, meal worms, fish, spiders, and newts.

# WE ARE GOING ON A TRIP
## (TO ACCOMPANY VIDEO 3D)

The concept of leaving the Earth for a two-day trip to the International Space Station will lead to some interesting questions about space travel and how it is accomplished.

## Age range 11 to 16

Activities can be designed to fit the needs and abilities of the group.

**Time needed:** 30 minutes to an hour, depending on the level of the students.

**Subject area links:** English, Language Arts, Technology, Science

**Learning outcome(s):** Students will be able to communicate ideas effectively on Twitter, within the limits of 140 characters. Comprehensive and directed ideas will be encouraged, as students have the opportunity to communicate with their classmates through a live, online platform.

**Materials needed:** Depends on the depth of activity

**Description and steps for activity:**
1. This activity encourages students to communicate bite-sized pieces of information about some of the research they uncover or to tell their personal stories. Students could be asked to tweet/Instagram about their plans and preparation for a two-day trip where they cannot stop or pick up anything along the way, as Hadfield did. These stories could be edited into tweet-sized bulletins and then sent out. Teachers may want to ensure that every student (with parental permission) has a Twitter account, so that classmates can receive each other's messages. Students need not open their own Twitter account, if educators are uncomfortable with this. Students can tweet from a shared and moderated classroom account.

2. As a class, decide upon a discussion hashtag (examples include: #MrTGr7ISS; #MsVHadfieldResearch). Students should all be tweeting to each other using the same hashtag. As a class, you can review and assess the online conversation using this hashtag. Encourage students to tweet their findings and respond to their classmates about their findings!

3. Tweets can be printed to hand in or assessed online.

# MEDIA COVERAGE
## OF CHRIS HADFIELD'S ISS MISSION

While watching a film or interactive project with your students, it is important to not only examine the content, but also how it's constructed. The following provides a bit of background about media literacy:

*Media literacy is concerned with the process of understanding and using the mass media. It is also concerned with helping students develop an informed and critical understanding of the nature of the mass media, the techniques used by them, and the impact of these techniques. More specifically, it is education that aims to increase students' understanding and enjoyment of how the media work, how they produce meaning, how they are organized and how they construct reality. […] Media literacy is a life skill.*

- ONTARIO MEDIA LITERACY RESOURCE GUIDE, ONTARIO ASSOCIATION FOR MEDIA LITERACY

**Media literacy education in Canada incorporates the following key concepts:**

1

All media are constructions. The media present carefully crafted constructions that reflect many decisions and are the result of many determining factors.

2

The media construct versions of reality. Much of our view of reality is based on media messages that have been pre-constructed and have attitudes, interpretations and conclusions already built in.

3

Audiences negotiate meaning in media. Each of us finds or negotiates meaning according to individual factors.

4

Media messages have commercial implications. Most media production is a business and so must make a profit. Questions of ownership and control are central.

5

Media messages contain ideological and value messages. All media products are advertising in some sense, proclaiming values and ways of life.

6

Media messages contain social and political implications. The media have great influence in politics and in forming social change.

7

Form and content are closely related in media messages. Each medium has its own grammar and codifies reality in its own particular way.

8

Each medium has a unique aesthetic form.

The above text comes from the Ontario Association for Media literacy (AMI) *aml.ca*.

The Association for Media Literacy has posted a blog entry specifically dedicated to Chris Hadfield: "the media-literate astronaut": *aml.ca/chris-hadfield-the-media-literate-astronaut*

An undertaking as big as Colonel Hadfield's aboard the ISS attracts a lot of media attention. As a moment in history, it offers an ideal opportunity for students to understand the roles that media plays in our lives and to examine the effects that various forms of media have on the formation of their opinions and perceptions. Before beginning any specific activity, teachers can discuss media in a general sense with their classes as a way of generating interest in the topic as well as getting an idea of their overall "media savvy." The questions can be modified depending on age/grade/ability levels.

# QUESTIONS RELATED
## TO SPACE EXPLORATION

1

Where did you get your information about Chris Hadfield's recent mission?

2

What did you notice about the different types of information
you received from various media outlets?

3

Think about the archival material available in **NFB Space School**.
What sense do you get of how the astronauts of the past were portrayed in the media?

4

Think about contemporary media portrayals of astronauts. How are astronauts portrayed today?
Do you notice any significant differences?

5

Are American and Canadian astronauts portrayed the same as Russian astronauts in today's media?
Which astronauts receive the most media coverage? Support your answers with examples.

6

Did you follow Hadfield's Twitter or Facebook feed while he was in Space? Why or why not?
Why do you think he updated his social media so often while he was in Space?

7

Hadfield didn't only tweet words, he also tweeted many photographs and videos.
Why do you think he did this?

8

How would you describe the media's reporting of Hadfield's recent mission to Space?
Think about some of the news reports you might have noticed while he was in Space.
(Educators might want to provide students with some examples for this question.)

9

Are you surprised by the amount of media attention Hadfield's mission received? Why or why not?

10

Hadfield was not alone aboard the ISS. Who were the other two astronauts on his mission?
Did you hear about them in the news as often as you heard about Hadfield? Why or why not?

11

How would you relate the medium of Twitter to other communication tools from the past?
Identify communication tools you would compare Twitter to from: 50 years ago, 100 years ago
and 200 years ago. How is Twitter similar to or different from these tools?

# ADDITIONAL WEBSITES

## RELATING TO MEDIA LITERACY IN SPACE

**Spaceflight Now**—a website dedicated to space travel and exploration that contains articles and videos on the latest comings and goings in space.
*spaceflightnow.com*

**A series of articles about Chris Hadfield's mission**—
*spaceref.ca/news/chris-hadfield*

# Related RESOURCES

## WEBSITES

**The Space Book Library:** *asc-csa.gc.ca/eng/youth-students/09-12/sbl.asp*
The above link provides a great list of suggested reading about space travel, real and imagined.

**NASA:** *nasa.gov*
The NASA website is the largest repository of facts, images, and history about space exploration. Many useful sections of this site are highlighted in the Learn More section of the Teach It page.

**Canadian Space Agency:** *asc-csa.gc.ca*
This excellent website provides great insight into space travel from a Canadian perspective.

**Where Is the ISS Now?:** *iss.astroviewer.net*
The above link displays the current position of the ISS.

**Chris Hadfield on YouTube:** *youtube.com/channel/UCtGG8ucQgEJPeUPhJZ4M4jA*
The above link connects directly to Chris Hadfield's YouTube channel. Hadfield clearly understands the power of social media and online communication. A search of the site brings up over 300,000 videos, covering a wide range of topics from music to the practicalities of life aboard the ISS.

**Canadian Space Agency on YouTube:** *youtube.com/user/canadianspaceagency*

**BBC Science:** *bbc.co.uk/science/space/solarsystem/astronauts/yuri_gagarin*
This portion of the BBC website Science contains articles and videos related to all aspects of Yuri Gagarin's first spaceflight and much more about space in general.

**World Spaceflight:** *worldspaceflight.com/bios/stats.php*
Up-to-the-minute facts about astronauts, cosmonauts and space travel in general.

**Spaceflight Now:** *spaceflightnow.com*
On space travel and exploration, with articles and videos on the latest comings and goings in space. Some of the readings are at a higher level.

## BOOKS

**Smithsonian Guides Spaceflight** by Valerie Neal, Cathleen S. Lewis, Frank H. Winter

Seven thematic sections detail landmark events, technological advances and the drama of the men, women and machines that took us into space.

**Spectacular Women in Space** by Sonia Gueldenpfennig

Space is the final frontier, and these ten women have established their place in it. This collection of biographies features women who have made an important contribution to the exploration of space.

**How Do You Go to the Bathroom in Space?** by William Pogue and John Glenn

Have you ever wondered what it's really like for an astronaut in outer space? From the exciting moments to the day-to-day details, from the serious to the humorous, you'll find answers to every question you've ever had about living in space!

**Do Your Ears Pop in Space? And 500 Other Surprising Questions About Space Travel** by R. Mike Mullane

This is a 240-page, soft-cover book in which the author answers 500 popular space questions, including: How does the space toilet work? Have astronauts seen any UFOs? Are astronauts superstitious? What's a Vomit Comet? How do astronauts eat, drink, bathe, brush their teeth, etc.? Virtually every aspect of spaceflight is covered, including: space physics, living in space and space physiology.

## ARTICLES

**How Many People Have Been in Space?**
*scienceline.org/2007/03/ask-romero-people_in_space/*

**Twitter**
*twitter.com/Cmdr_Hadfield*

## RELATED NFB FILMS

**Available on CAMPUS:**

- *Cosmic Zoom*
- *Discover Science Series* – 26-episode series
- *Hubert Reeves: Star Teller*
- *Satellites of the Sun*
- *Science Please* – Part 1
- *Science Please* – Part 2
- *Shadow Chasers*
- *Toutatis*
- *Universe*

**NFB Films Available for Purchase on DVD:**

- *1974*
- *Comet*
- *Cosmic Collision*
- *Discover Science Series*
- *My Jules Verne*
- *Pioneer Swaps with Astronomy Enthusiast*
- *Starlife*

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**Other Films About Space**

Space travel has interested filmmakers since the early days of cinema, and it can be both revealing and entertaining to screen films about space that were made before the current scientific understanding of what was "out there." Both of the following links include many suggestions for classroom viewing about space exploration.

*Wikipedia List of Films About Space*

*IMDB List of Films About Space*

## CREDITS

The **NFB Space School: Mission** educator's guide was written by April Butler, who has over 20 years of experience teaching science and math in Nova Scotia and consulting on curriculum development. It was written in collaboration with Claudia Sicondolfo, Team Leader of Educational Programming, NFB Education Team.