

Google Arts & Culture

# Learn Anywhere: International Space Station



In association with:



**KIELDER  
OBSERVATORY**  
Infinite Inspiration



The International Space Station photographed by Expedition 56 crew members from a Soyuz spacecraft after undocking.  
NASA/Roscosmos

## How to use this lesson plan

This plan takes you on an exciting journey with plenty of links through to amazing online content so no need to print. This lesson plan is suitable for anyone but we recommend it for ages 7 to 11. It's a lot of fun to go on this journey with parents, teachers or your friends, but it is designed so you can explore independently at your own pace. There are different types of questions to answer: can you discover, explore and invent? We think so.

Check in with your parents or teacher if you need to, but you'll need a tablet, computer or smartphone. You can do this *Learn Anywhere* Lesson on almost any device as long as you can get online and use a web browser.

There are 2 Chapters:

Chapter 1 – The International Space Station 45 minutes

Chapter 2 – Life on the International Space Station 60 minutes

You'll see some helpful signs on the way:



Useful information to guide you through the lesson.



Things you'll need to watch, read, learn and make things with during the lesson.



Digital activity time. Take quizzes and explore.



Estimated time to do a section of this lesson.



Explore online content. Discover videos, stories, or go and look at and zoom around pictures.



Activity time. This is where you get to design, make or write something of your own.



Headphones to listen to videos and audio.



## Things you'll need

Things that will help you during this *Learn Anywhere* lesson.



**Scrap Paper**



**Scissors**



**Brush and Paint**



**Notepad**



**Tablet or Computer**



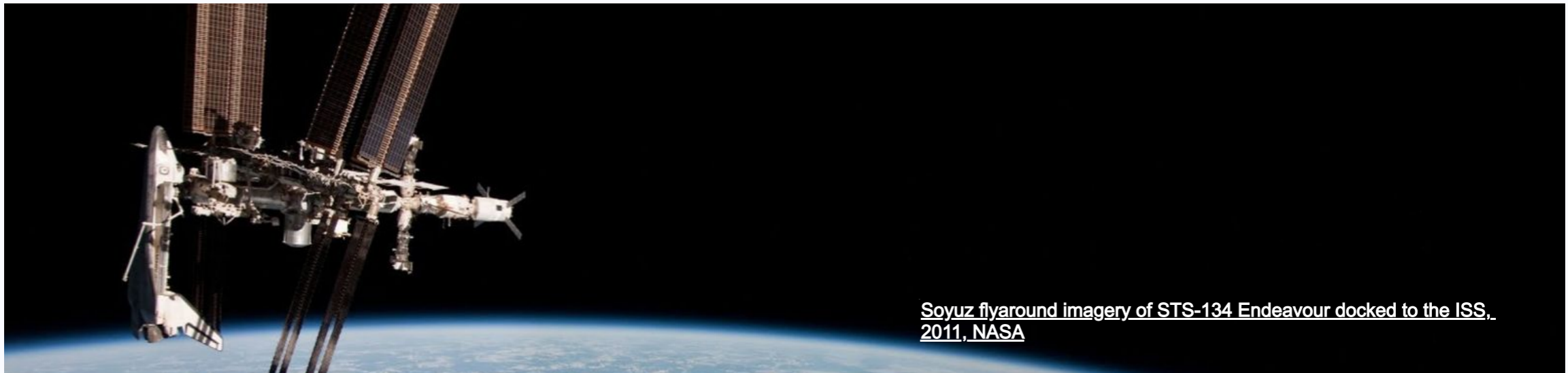
**Pens and Pencils**

## Welcome to *Learn Anywhere: The International Space Station*

In this *Learn Anywhere* lesson, you are going to learn all about the International Space Station. You will have a clear understanding as to what the International Space Station is, how it was built, why it exists and what it is like for astronauts to live on the space station. Get ready to investigate...

### What will you do?

1. Go on an adventure to discover the International Space Station
2. Hunt for facts and make discoveries about life on the International Space Station
3. Discover the scientific purpose of the International Space Station
4. Create your own design for a space station
5. Create your own plan for experiments to conduct in space



Soyuz flyaround imagery of STS-134 Endeavour docked to the ISS, 2011, NASA

### **What will you learn?**

1. Learn about the International Space Station
2. Explore the habitable quarters within the space station for yourself
3. Explore what day to day life is like for astronauts on the ISS
4. Discover how astronauts carry out basic tasks
5. Discover the scientific purpose of the ISS

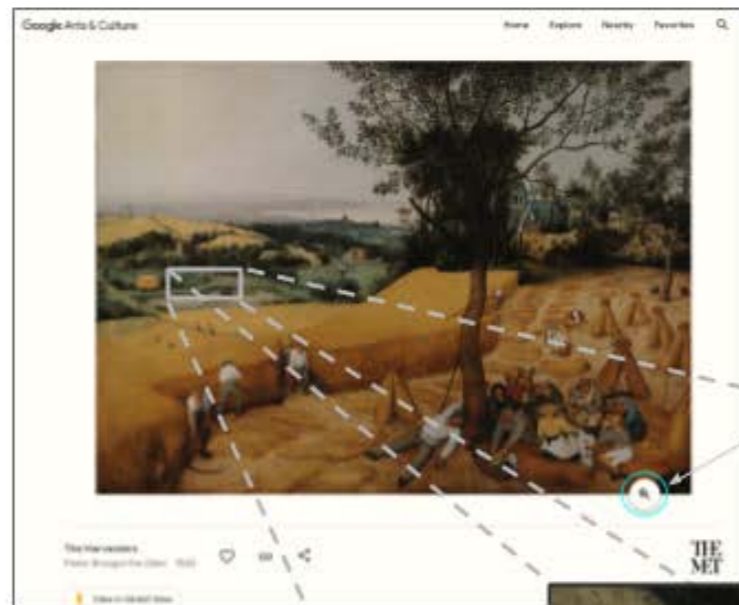
### **After studying this lesson, you will be able to:**

1. Describe the International Space Station
2. Understand what life is like for astronauts on the International Space Station
3. Understand the scientific purpose of the International Space Station
4. Create your own space station design

**Vocabulary:** astronaut, cosmonaut, crew, CSA, dehydrated, experiment, Earth, ESA, experiment, habitable, ISS, JAXA, laboratory, microgravity, Mir, mission, module, moon, muscle, NASA, orbit, rocket, Roscosmos, satellite, solar panel, space station, truss, weightlessness

There's one more thing to know before you go on your lesson. Google Arts & Culture pictures are big. So big that you can zoom in. Explore. Sometimes right down to a drop of water.

So you just need to click on a link, then on the Magnifying Glass symbol and zoom in with the Zoom Slider. Drag the white box around and you can explore the picture. You'll find out for yourself. Here's an example of a Google Arts & Culture picture and the zoom slider.



1. Click on the magnifying glass



Zoom Slider



2. Use the slider to zoom in. The white box can be dragged to different parts of the picture.



3. Explore art works in detail. Find hidden stories.

Pieter Bruegel the Elder, The Harvesters, 1565, The Metropolitan Museum of Art



Expedition 38 crew members pose for a crew portrait in the Kibo laboratory of the International Space Station, NASA

# Chapter 1



What's this chapter about?  
The International Space Station



What will I do?  
Learn about satellites  
Discover the history of the International Space Station  
Understand the purpose of the International Space Station



How long will this chapter take?  
45 minutes



## What is the International Space Station?

Have you ever looked up at the stars and spotted some lights that seem to move very fast, far overhead? They might be airplanes but, if they are very high up, they are satellites orbiting the Earth.

A satellite is any object orbiting the Earth, including the Moon, but we usually use the term to describe an object put into orbit by humans. We estimate there are over 2,600 functioning satellites orbiting the Earth and probably at least twice that number which are no longer working. Is that more than you thought?

Perhaps the most famous satellite is the International Space Station, or ISS. It is both a home and workplace for up to 6 astronauts, 7 in the near future.

It is the largest and heaviest human-made object in space – roughly the size of a football field. It orbits the Earth at a height of around 400 kilometres (about 250 miles up) and travels at around 28,000 kilometres (or 17,500 miles) per hour. At that speed, it only takes 90 minutes to orbit the Earth. You see one sunrise a day - the astronauts on the ISS see 15 or 16.

The ISS is in a Low Earth Orbit, or LEO. Other orbits around the Earth are called MEO, HEO and GEO - can you guess what these acronyms stand for?



Click [here](#) to find out more about those different orbits.



Click [here](#) to get to know the ISS.





## An international mission

The ISS is actually the ninth space station to be inhabited by crews, following the Soviet and later Russian Salyut, Almaz, and Mir stations and the U.S. Skylab.

A truly international space mission, 16 countries across the world have contributed towards the ISS via five space agencies: European Space Agency; NASA (United States), JAXA (Japan), Roscosmos (Russia) and CSA (Canada).

Due to its huge size, the ISS had to be assembled in space - a major undertaking. The first segment of the ISS was launched on 20th November 1998 – a Russian proton rocket named Zarya - and modules are still being developed and added today.

The ISS can be split into two parts.

The main truss is the backbone of the space station and contains lots of important equipment. In particular, the solar panels that power the space station are connected to the main truss.

In the middle of the station are the habitable modules. These are the sections that the astronauts can live inside safely without the need for a space suit. The different rooms within the space station are called “modules”. Each module has a different name and purpose. For example, the Harmony module has bedrooms for 4 astronauts. Columbus is the European laboratory and Unity is the kitchen.



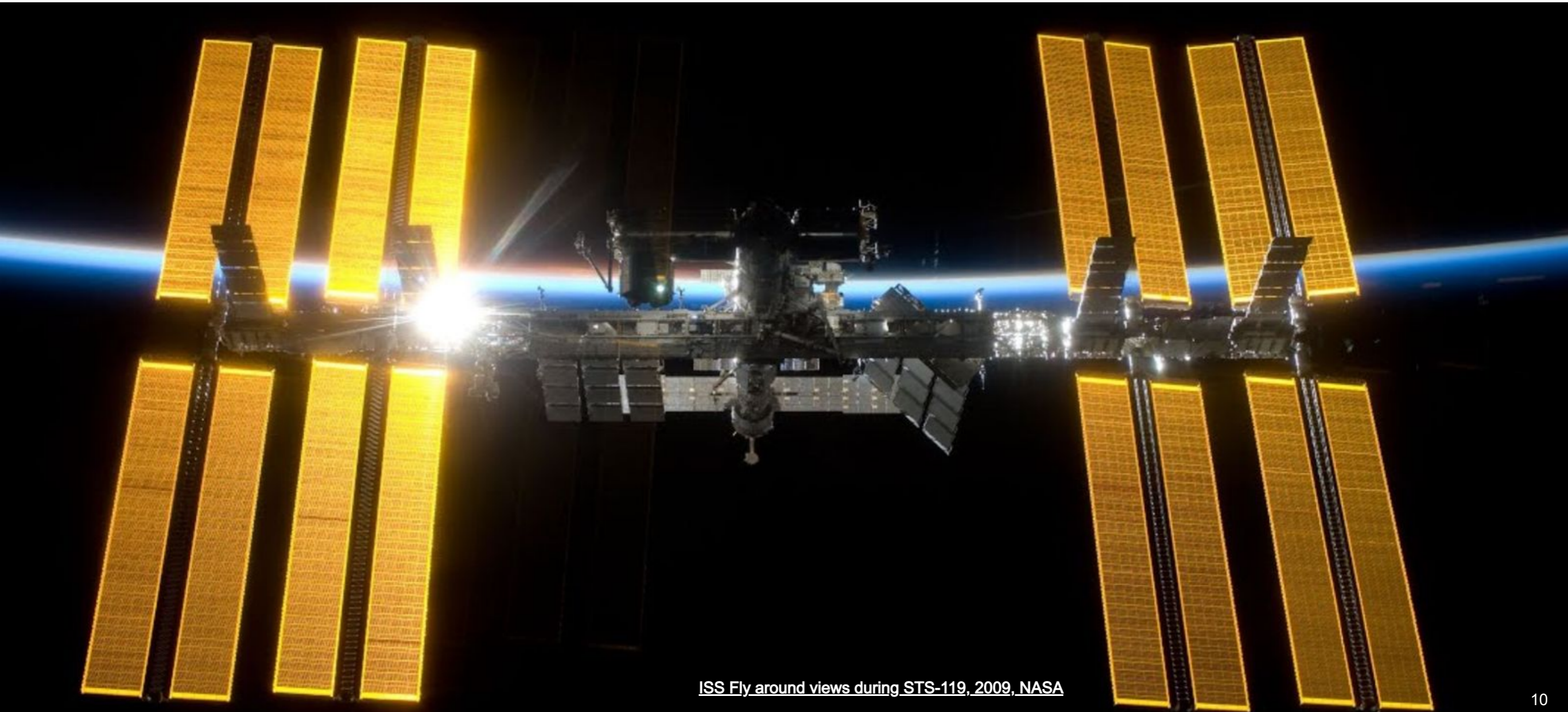
Click [here](#) to see a diagram of the ISS construction.



Click [here](#) to see a 3D model of the ISS.



Click [here](#) to see a history and timeline of of the ISS.



ISS Fly around views during STS-119, 2009, NASA



Each mission is associated with specific experiments. There are modules within the ISS that are dedicated laboratories.

A crucial role for the ISS is to understand the effect that long space missions can have on the human body. As a result, a lot of experiments end up treating the astronauts a little like laboratory guinea pigs to see how their bodies react to space.

The constant weightlessness that astronauts experience onboard the ISS has a negative effect on their bodies. Without the constant fight against gravity, bones and muscles can end up becoming much weaker. Once the astronauts return to Earth, their bodies eventually recover.

The science doesn't stop at the human body though. Before travelling to space, astronauts need to be trained to conduct a variety of different experiments. These can include growing plants, imaging Earth, 3D printing, making observations into deep space and even measuring radiation. Either way, astronauts are kept very busy on the ISS.



Do you have what it takes to be an astronaut on the ISS? Click [here](#) to accept the challenge.



Click [here](#) to have a look at some 3D interior views of the ISS.

Eyharts, Tani and Melvin in the U.S. Lab, 2008, NASA

# Questions for Chapter 1

Let's get started with some questions. When you **Discover**, you are comprehending and remembering. When you **Explore**, you are really able to understand it and think it through. When you **Invent**, you are able to comprehend, understand, remember, analyse and do something cool with your new knowledge.

## **Discover:**

How big is the ISS?

## **Explore:**

Why did it take so long for the ISS to be assembled?

## **Invent:**

If you were to create your own space station, what would it look like? Think about what you would need onboard and draw the design for your space station or create a model!





# Chapter 2



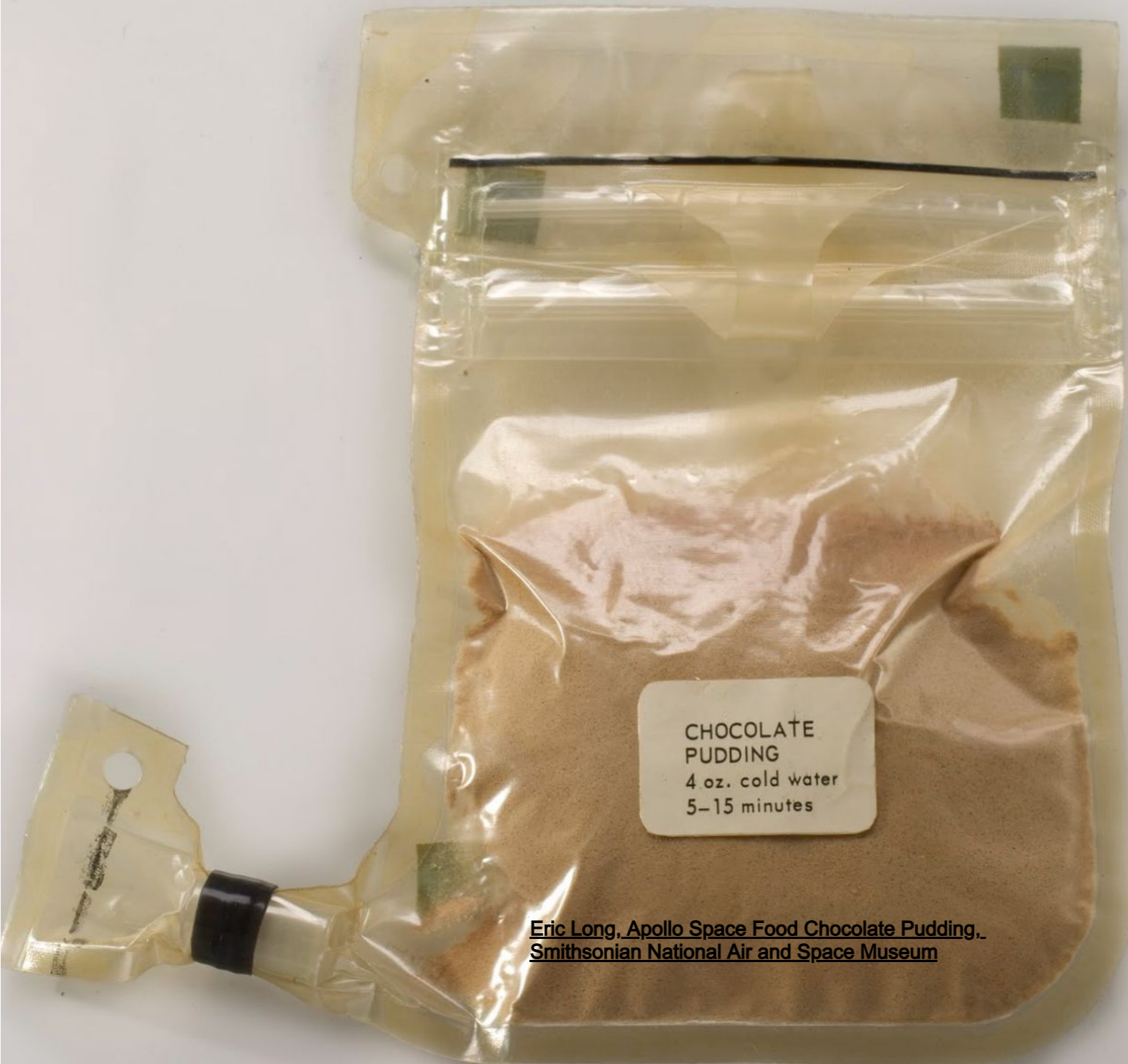
What's this chapter about?  
Life on the ISS



What will I do?  
Explore what day to day life is like for  
astronauts on the ISS  
Discover how astronauts carry out basic tasks  
Learn about how astronauts get to and from  
the ISS



How long will this chapter take?  
60 minutes



Eric Long, Apollo Space Food Chocolate Pudding, Smithsonian National Air and Space Museum

We've looked at and explored the International Space Station, but what is it like for the astronauts who live there?

Astronauts usually spend a few months at a time on the ISS for each mission, however in the past there have been significantly longer missions. The longest space mission to date was conducted by cosmonaut Valery Polyakov and lasted 437 days.

Simple things that we take for granted on Earth, such as fresh food or a warm shower, quickly become difficult up in space. Much of the food that astronauts eat on the ISS is dehydrated so it will last longer. This means they need to use special machines to rehydrate (add water) the food before it can be eaten.

Even an astronaut's bedroom is different to mine or yours. Roughly the size of a wardrobe, astronauts have a small room to store personal belongings. Inside this 'bedroom' is a sleeping bag that is fixed to the walls – this stops the astronauts from floating around and hurting themselves whilst asleep.



Click [here](#) to experience a day in the life.



Click [here](#) to see how space food has changed over the years.



Click [here](#) to see how astronauts love their chocolate.



Click [here](#) to see an astronaut's guide to life in space.





Astronauts need fun too. Click [here](#) to see the toys that have made it into space.



Buzz Lightyear and Magellan T. Bear,  
Smithsonian National Air and Space Museum





The best thing about the ISS? The views. Click [here](#) to see them.



[Aurora borealis as seen from 216 nautical miles \(400 km\) above south central Canada, NASA](#)



"It's amazing how space unites everyone. Despite from which country you are coming from, despite your religion or your background, it unites everyone... Our objective is one: it's for humankind." Hazza Al Mansoori, astronaut.

Read about this "Overview Effect" [here](#)



Earth observation taken by the Expedition 43 crew, 2015, NASA

# Questions for Chapter 2

Time for some questions. Here's a reminder of how it works. When you **Discover**, you are comprehending and remembering. When you **Explore**, you are really able to understand it and think it through. When you **Invent**, you are able to comprehend, understand, remember, analyse and do something cool with your new knowledge.

## **Discover:**

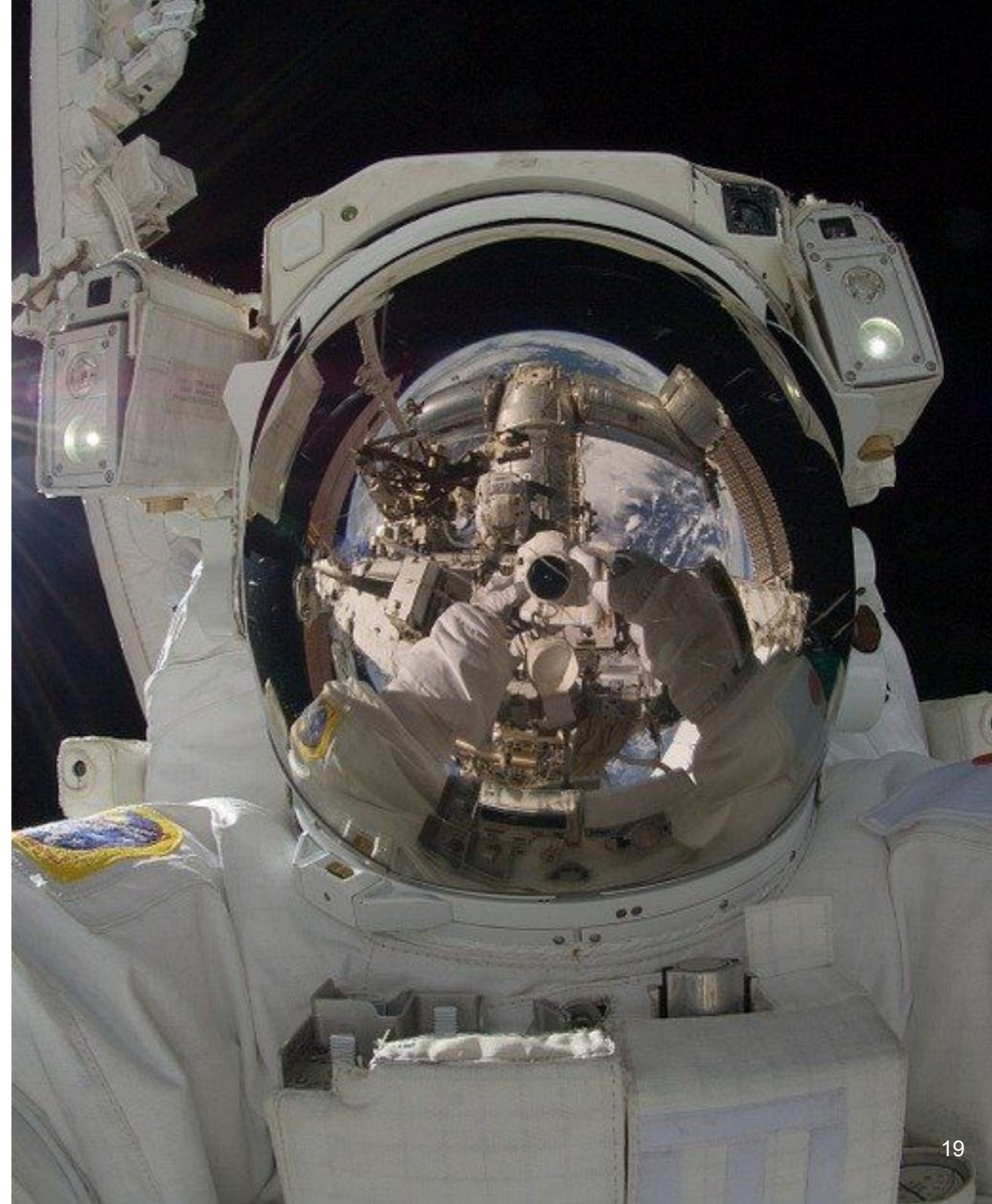
What kind of food do astronauts mainly eat?

## **Explore:**

Why is it important for scientists to understand the impact long space missions can have on the human body?

## **Invent:**

Imagine you could go and live on the ISS for a week. Describe what experiments in microgravity that you would do whilst you were there.



Congratulations. You have proven yourself an inventive student of the International Space Station.

Now it's time to continue your journey [here](#)



The SpaceX Falcon 9 rocket soars into space on Cape Canaveral Air Force Station in Florida, NASA

# Answers to all the questions

## Chapter 1

Discover: How big is the ISS?

Answer: the size of a football field

Explore: Why did it take so long for the ISS to be assembled?

Answer: The ISS had to be assembled individually a module at a time. This is because the ISS is far too big to be launched into space all at once, so instead needed to be put together over many different space missions.

Invent: If you were to create your own space station, what would it look like? Think about what you would need onboard and draw the design for your space station

Answers will vary, but any space station design that includes basics such as bedroom, bathroom, kitchen and a laboratory is acceptable. It is important to understand the need for other equipment such as solar panels for power, protection, and somewhere for a spacecraft to dock for astronauts to enter the space station.

## Chapter 2

Discover: What kind of food do astronauts mainly eat?

Answer: Lots of kinds, sometimes including fresh food after recent launches, but mostly dehydrated so it will last longer.

Explore: Why is it important for scientists to understand the impact long space missions can have on the human body?

Answers can vary but should include the importance of keeping astronauts healthy and can in particular be linked to future missions (e.g. to Mars) that will last a long time.

Invent: Imagine you could go and live on the ISS for a week. Describe what experiments in microgravity that you would do whilst you were there.

Answers will vary, but anything that describes an experiment that would result in something very different in space rather than on Earth is acceptable.