

SPACE STATIONS

MISSION OBJECTIVE: To learn how to live in space

Space stations are designed to allow humans to live in space. Space station crews conduct scientific research that can only be performed in **microgravity**, such as studying the long-term effects of spaceflight on the human body.

Early space stations

The world's first space station was the **Soviet Union's Salyut 1**, launched in April 1971. Eight more Salyut stations followed. In 1973, the United States launched its first space station, *Skylab*. Both *Skylab* and the Salyut stations were constructed on the ground and had just a single module. The first station with multiple parts was the Soviet Union's *Mir*, which was put together in space between 1986 and 1996. *Mir* was decommissioned in 2001.

Mission fact!

When *Skylab* **re-entered** Earth's **atmosphere** in 1979, it broke up over the town of Esperance in Western Australia. The town fined NASA US\$400 for littering. The fine was eventually paid on behalf of NASA by an American radio station, which raised the funds with the help of its morning show listeners in April 2009.

▼ This photograph of the **International Space Station** was taken by a crewmember on board the space shuttle *Discovery*.



▲ Canadian-born astronaut **Gregory Chamitoff** ponders his next move in a game of chess on board the **ISS**.

The International Space Station

Sixteen countries are working together to build the *International Space Station (ISS)*, which is already the largest space station ever constructed. Assembly began in 1998 and is due to be completed in 2011. The *ISS* is made up of 15 separate modules. These include laboratories, **docking** compartments, **airlocks** and living quarters. When complete, the *ISS* will be 110 metres (361 feet) long and will weigh almost 419 600 kg (925 100 lb). It is so large that it can be seen from Earth with the naked eye.

Life on board the ISS

ISS crewmembers perform a variety of daily maintenance tasks to keep the station running smoothly. They spend the rest of their working day carrying out experiments. To counteract the effects of weightlessness, they spend up to two hours a day exercising. In their free time, they watch DVDs, read books, play games and even talk to their families on Earth.



THE HUBBLE SPACE TELESCOPE

MISSION OBJECTIVE: To get a better view of the universe

The problem with Earth-based telescopes is that Earth's **atmosphere** blurs visible light and partly or completely blocks other types of **electromagnetic radiation**. This problem can be avoided by placing a telescope in space.

The Hubble story

The *Hubble Space Telescope* was named after American astronomer Edwin Hubble. Soon after its launch in 1990, scientists discovered a flaw in its main mirror, which took three years to repair. Once the telescope was working properly, it began sending amazingly clear and detailed images from space. The wait had been worth it.

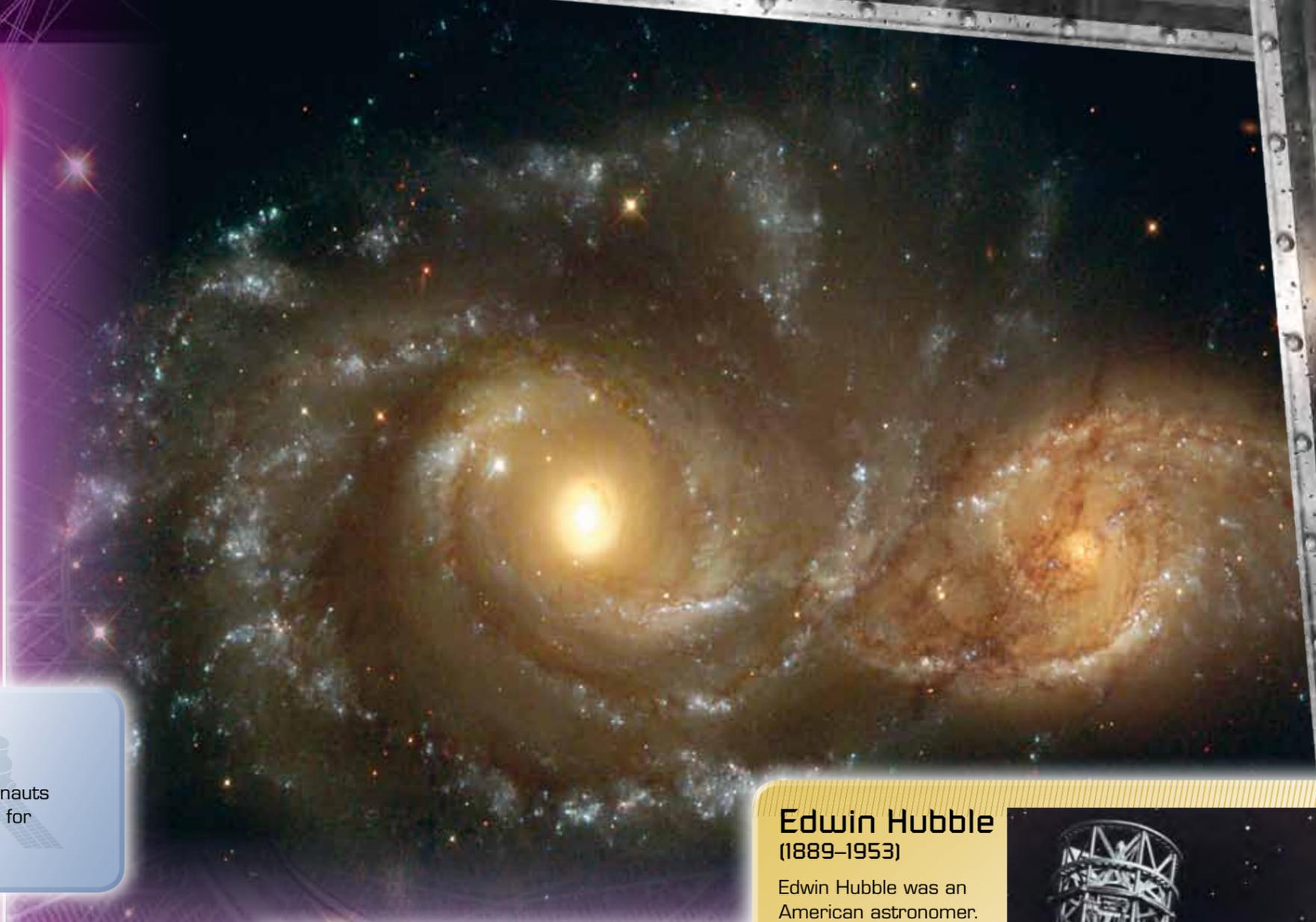
Mission fact!

The *Hubble Space Telescope* is the only space telescope designed to allow astronauts easy access to its scientific instruments for repair or replacement work.

How does the Hubble Space Telescope work?

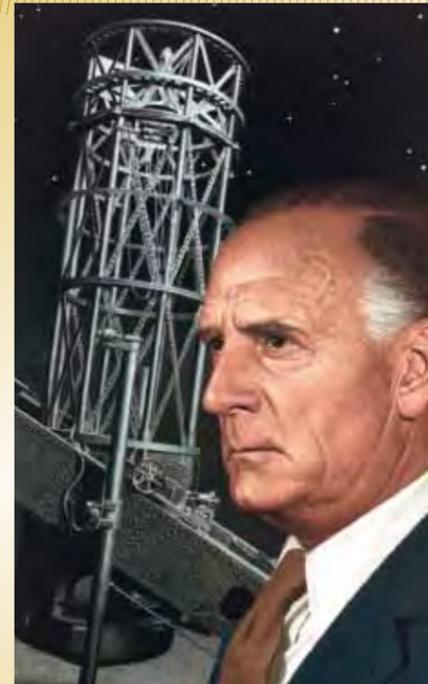
Hubble is in **low Earth orbit**. Scientists on Earth can point the telescope at almost any target they want to study. *Hubble's* instruments are sensitive to ultraviolet, visible and infrared light. Information from these instruments is beamed down to Earth via **satellite** and converted into pictures that scientists can study.

Technicians assemble the *Hubble Space Telescope* at Lockheed Missile Space Company in 1985. *Hubble* is 13.2 m (43.5 ft) long, has a diameter of 4.2 m (14 ft) and weighs 11 110 kg (24 500 lb)!



Edwin Hubble (1889–1953)

Edwin Hubble was an American astronomer. In the 1920s, he discovered that the universe contained not just one galaxy, but billions of them, moving away from each other at incredibly high speeds. This discovery eventually led to the development of the **big bang theory**.



This image taken by the *Hubble Space Telescope* shows two spiral galaxies interacting. The larger one, on the left, is pulling the smaller one towards it.

Hubble's discoveries

The *Hubble Space Telescope* has made an enormous contribution to the science of astronomy. It has given scientists a better understanding of the life cycles of stars and **galaxies**, and has shown that **black holes** not only exist, but that nearly all galaxies may have a black hole at their centre.

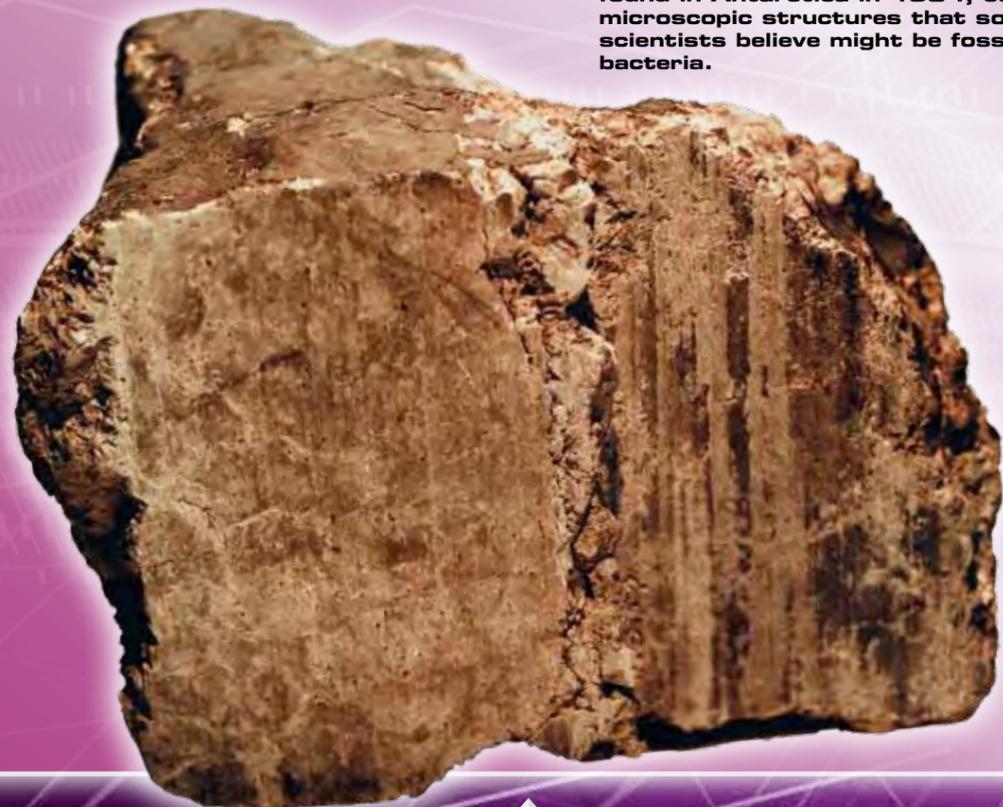
EARLY MISSIONS TO MARS

MISSION OBJECTIVE: To explore Mars

More spacecraft have been sent to Mars than to any other planet. This is partly because Mars is relatively close to Earth, but mainly because Mars is one of the places where we are most likely to find other life forms.

Is there life on Mars?

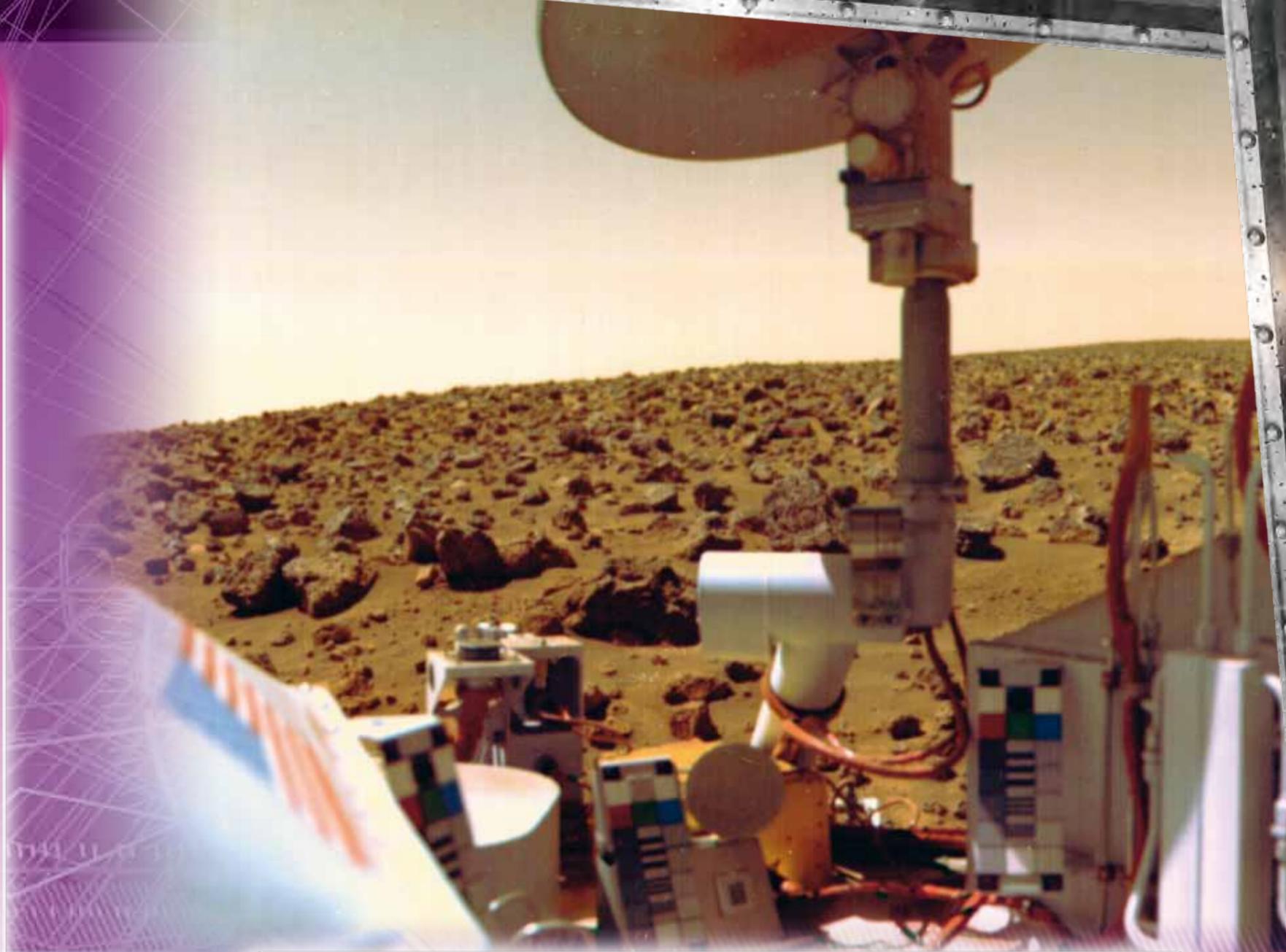
Of all the planets in the solar system, Mars is the most like Earth. Its atmosphere is the most similar to Earth's. Both planets have polar ice caps, four seasons, storms, volcanoes, valleys and canyons. Since they have so much in common, scientists have wondered for a long time whether life might exist on Mars too. Most missions to Mars have attempted to answer this question: Is there life on Mars now, or has it ever existed there?



▼ This meteorite from Mars, which was found in Antarctica in 1984, contains microscopic structures that some scientists believe might be fossilised bacteria.

Mariner Program

The Mariner Program involved a series of robotic space probes that NASA sent to Mars, Venus and Mercury between 1962 and 1975. *Mariner 4*, *Mariner 6* and *Mariner 7* performed brief flybys of Mars. When *Mariner 9* orbited Mars in November 1971, it discovered craters, volcanoes, canyons and evidence that water had once flowed on the planet's surface.



▲ This image of Mars was taken by the Viking 2 lander. The dish-shaped object is the antenna used to communicate with Earth.

Viking Mission to Mars

Launched in 1975, NASA's two Viking spacecraft each consisted of an orbiter and a lander. The mission objectives were to map Mars, analyse its atmosphere and surface, and search for signs of life. The Viking mission was a huge success, but it found no signs of life at either landing site.

Mission fact!

When *Mariner 9* arrived at Mars, the surface of the planet was completely hidden by dust storms. It took a couple of months for the dust to settle and for the spacecraft to get clear images.