SPACE

Half a century ago the age-old dream of space flight became a reality with the launch of the world's first satellite, Sputnik-1. Since then astronauts have walked on the Moon, spacecraft have flown to the outer reaches of the solar system and satellite networks have become an integral part of our lives.

In the 1970s the dream of living and working in space also became real with the launch of the first space stations. Today the International Space Station, a joint project involving countries from around the globe, has given humanity an ongoing presence in space.

Step into *Space* to find out about this journey from dream to reality — from the drama of the first rocket launch to the daily routine of life in zero gravity.

In these notes you will find:

Museum resources

+ Online collection

Many of the objects in the Museums collection can now be searched online through our online database.

http://www.powerhousemuseum.com/collection/database/

If you are reading these notes as a PDF document you can simply click on the object title and it will take you directly to the object record. If you have a hardcopy version, go to the web address above and type the object registration number (found next to the object name) into the online search field. Be sure to include all numbers, letters and slashes. Objects that are on loan to the Museum such as the Moon rock do not have registration numbers and are not found on the database.

While you are online you might also like to browse the other objects in our Space Technology collection. You can do this by selecting the 'Browse Categories' tab and then the 'Space Technology' category.

+ Design a space station discovery challenge

Powerhouse discovery challenges are inquiry-based lesson plans focusing on Museum exhibitions that:

- begin and end in your classroom
- involve a structured discovery process with links to the classroom curriculum
- provide a deeper understanding of the Museum's collection
- promote team problem-solving skills and are FUN!

The Design a Space Station discovery challenge asks students to contribute to the construction of the International Space Station. After your visit to the Museum, students build their own space station back in the classroom. Download your copy from:

http://www.powerhousemuseum.com/education/teachernotes.asp

+ Space exhibition joint visits

The *Space* exhibition can be combined with one of our joint visit partners to make it a full day of space exploration. Our space partners include Sydney Observatory located in the Rocks and the IMAX Theatre in Darling Harbour.

Sydney Observatory experience

On a night tour students can view the Moon and planets close up through the Observatory's telescopes, followed by an amazing show in the 3-D Space Theatre. Each tour is guided by one of our astronomy educators. Students can then explore the exhibition *By the light of the southern stars*, which blends the long tradition of Australian astronomy with the latest developments in this exciting field. Daytime tours are also available and include a planetarium experience and safe solar viewing. Telescope viewings can depend on the time of year and visibility.

Bookings: Tel 02 9921 3485
Email: observatory@phm.gov.au
Website: www.sydneyobservatory.com.au/education/

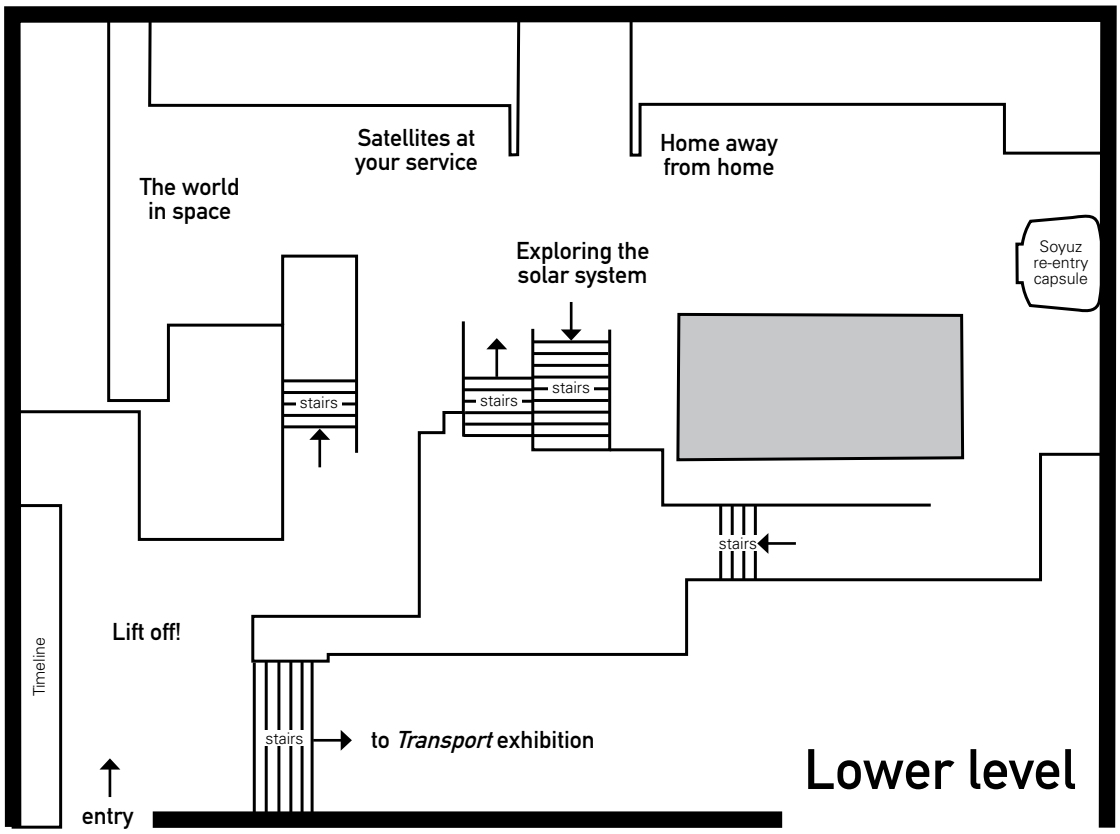
IMAX theatre

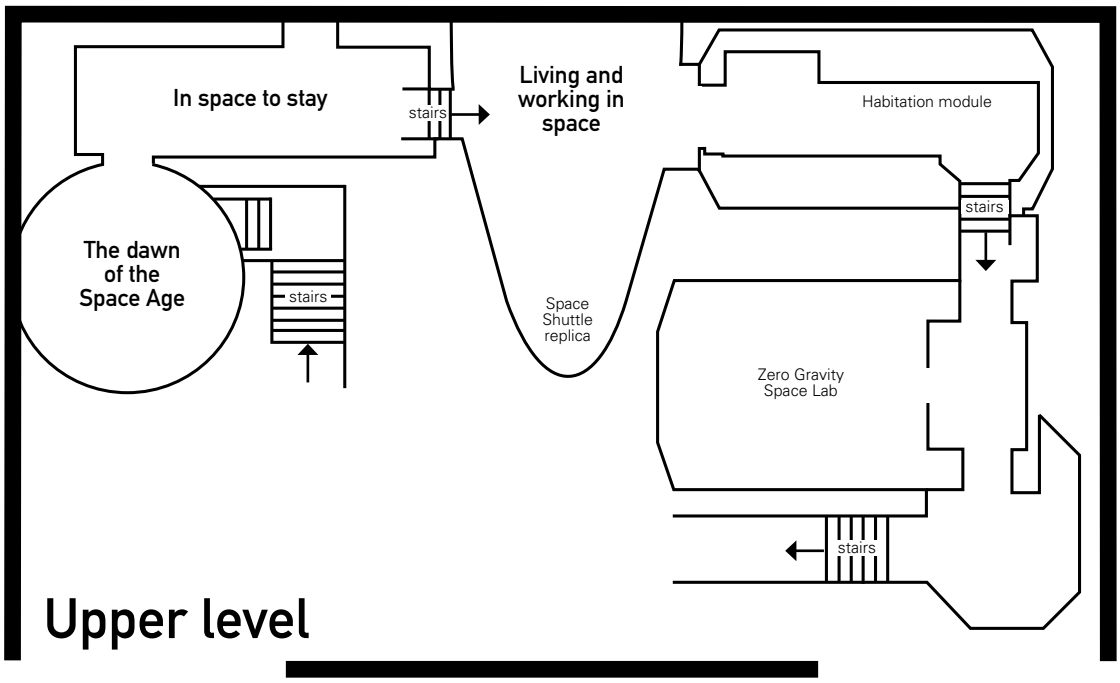
IMAX films are designed to educate and enlighten as much as they are to entertain. Home to the world's largest cinema screen, IMAX in Darling Harbour has an extensive library of educational films available to schools. Check out our website for exhibition-related film synopses and resources plus session times.

Operating hours: Sessions run every hour,
10.00 am – 10.00 pm daily

Bookings: Tel 02 9213 1600
Fax: 02 9281 3833
Email: education@imax.com.au
Website: http://www.imax.com.au/schools/

Space exhibition map





Timeline: rocket technology and science fiction before the Space Age

The idea of space travel has captured our imagination for thousands of years.

Long before the technology to achieve space flight was invented, stories of people trying to fly to the Moon and beyond were told in many cultures. In ancient Greek mythology, for example, Icarus soared into space on wings made of feathers and wax. The earliest story about a voyage to the Moon was written in 160 CE!

As scientific knowledge developed, such fantastic voyages eventually became a reality …

1045 Weapons powered by firework rockets — known as 'fire arrows' — are described for the first time in a Chinese military text.

1232 Chinese histories record the first confirmed use of weapons powered by firework rockets, during the siege of Kai-Feng-Fu.

1245 Armies across Asia and Europe begin to use rockets as a type of artillery.

1609–19 Johannes Kepler publishes his three fundamental laws of planetary motion, equations still used today to calculate spacecraft orbits.

1662 French novelist Cyrano de Bergerac is the first to suggest rocket propulsion for space flight.

1687 Sir Isaac Newton establishes his Third Law of Motion — 'for every action, there is an equal and opposite reaction' — which describes how a rocket works.

1792–99 Advanced war rockets are used against the British in India, leading to renewed interest in rocketry.

1804 Sir William Congreve invents a new war rocket for the British army, which is widely used by British forces in the 19th century.

1865 Jules Verne writes his first space travel story *De la terre á la lune* (From Earth to the Moon). His astronauts are launched on their journey by a giant cannon!

1902 French filmmaker George Méliès produces the world's first science fiction film, *Un voyage dans la lune* (A trip to the Moon).

1903 Russian schoolteacher Konstanin Tsiolkovski publishes the first work outlining the fundamental laws of space flight.

1926 American physicist Robert Goddard becomes the first person to build and successfully fly a liquid-fuel rocket.

1927 Rocket pioneers Hermann Oberth and Wernher von Braun are founding members of the German *Verein für Raumschiffahrt* (Society for Space Ship Travel).

1933 The influential British Interplanetary Society is formed, one of many rocket societies established in the 1930s.

1942 Werner von Braun's team, working with the German army, successfully tests the world's first long-range missile, the A-4 rocket.

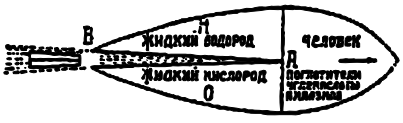
1944 The A-4 is used to bomb London and other cities and is given the name *Vergeltungswaffe 2* ('vengeance weapon' 2) or V-2.

1945 The end of World War II marks the beginning of the Cold War arms race. The V-2 becomes the model for missile development.

1947 Woomera rocket range is built in the South Australian desert by the British and Australian governments as a long-range weapons testing facility.

1950s Sounding rockets are developed alongside military missiles to learn more about the near-space environment.

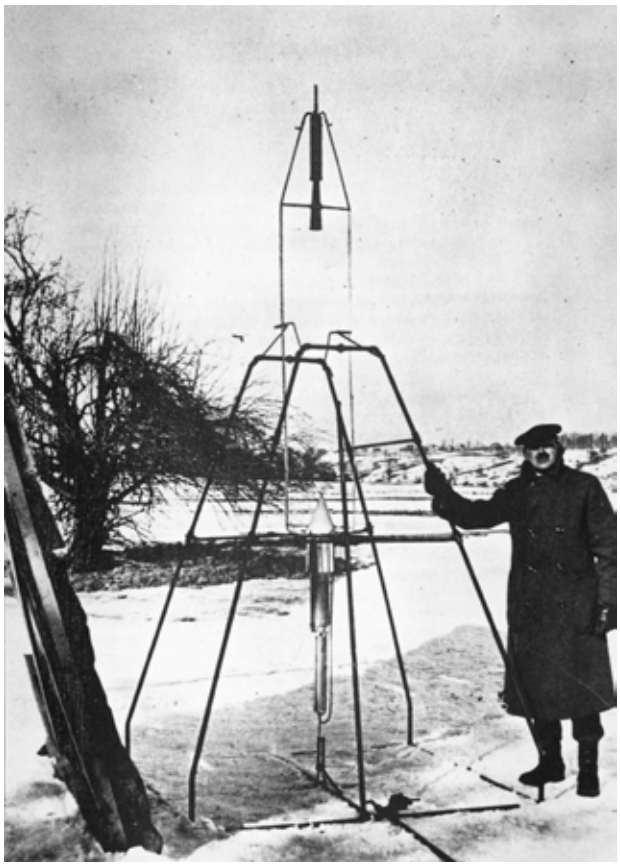
1955 The USA and USSR both announce plans to launch a satellite. The stage is set for the dawn of the Space Age …



Lift off!

In 1903 a Russian schoolteacher named Konstantin Tsiolkovski unlocked the secret of space flight, a challenge that had exercised great minds for centuries. Tsiolkovski showed that a rocket carrying liquid fuel and its own oxygen supply was the answer. Unable to carry out actual experiments, he used mathematics to prove that such a rocket would have the power to get into orbit and could operate in the vacuum of space. In 1926 American physicist Robert Goddard became the first person to build and successfully fly a rocket using the same principles.

This section looks at some of Goddard's early rockets, which would pave the way for the massive launch vehicles of today.



Goddard with his first liquid-fuel rocket a few days before the launch.

Objects you will see

- **Goddard rocket replica.** 87/1251
  http://www.powerhousemuseum.com/collection/database/?irn=71584
  Designed and built by American rocket pioneer Robert Goddard. Launched on 16 March 1926, the flight lasted 2.5 seconds and it was powered by petrol and liquid oxygen.

- **Hoopskirt hardware**
  This is one of Robert Goddard's original motor and fuel-line assemblies. It was part of an experimental rocket that he designed to achieve flight stability at a low cost. The rocket was nicknamed the 'Hoopskirt' because of its unusual shape.

Did you know …

How a rocket works

All rockets, from fireworks to giant space launchers, burn fuel which produces exhaust gases. These gases are forced out through a narrow opening in the rocket's base, pushing the rocket forward. This effect is called the reaction principle: 'for every action there is an equal and opposite reaction'. The movement of an inflated balloon which has been let go without being tied is another example of the reaction principle.

Rockets can operate in space because they carry their own oxygen supplies to burn the fuel.

The dawn of the Space Age

In October 1957 the Space Age officially began when the USSR (now Russia) launched the world's first artificial satellite, Sputnik-1.

The end of World War II had marked the beginning of the Cold War between the United States and the USSR. This quickly developed into a contest for superiority in space, known as the 'space race'.

Building on rocket technology developed by Germany during the war, rapid advances were made by the US and the USSR in the race to achieve space firsts.

Just 12 years after the launch of Sputnik-1, many science fiction fantasies had become realities, including that 'stuff of ancient legends' — a trip to the Moon!

This section looks at some of these great milestones in space history.

Objects you will see

- **Sputnik-1.** 97/2/1
  http://www.powerhousemuseum.com/collection/database/?irn=156934
  A replica of the world's first artificial satellite. Its launch by the USSR on 4 October 1957 stunned the world and marked the beginning of the Space Age.

- **Vanguard-1.** H6713
  http://www.powerhousemuseum.com/collection/database/?irn=246345
  A replica of the tiny Vanguard-1, the second US satellite. Launched in 1958, five months after Sputnik, it was the first solar powered satellite.

Soviet cosmonaut Alexei Leonov was the first person to 'walk' in space in 1965. Image courtesy Russian Academy of Sciences.

- **F-1 engine**
  Five F-1 engines powered the first stage of the Saturn-V rocket, which took Apollo astronauts to the Moon. They fired for 2.5 minutes and lifted the Saturn-V to about 61 km, before the first stage fell away.

- **Moon rock**
  The Moon rock on display was collected by the crew of the Apollo-16 (John Young and Charles Duke) in April 1972. It was found on the rim of Plum Crater, 30 metres north-west of the lunar module's landing site in the Descartes region. Weighing 89 grams, this fragment of the Moon is 3.9 billion years old, older than more than 99% of the surface rocks on Earth.

Audiovisuals

- **The real trip to the Moon**
  A compilation of original material from the Apollo-11 mission to the Moon.
  Running time: 3 minutes

- **Sounds from space**
  A selection of recordings from early space missions.

In space to stay

After the success of the Moon landing in 1969, establishing an ongoing presence in space became the next challenge.

In the early 1970s the USSR and the United States launched their first space stations. These orbiting laboratories, the predecessors of today's International Space Station (ISS), proved that people could live and work in space for extended periods.

At the same time the US also began to develop a re-usable spacecraft — the space shuttle — which could transport astronauts and equipment to and from orbit.

Find out about the early space stations in this section. Then step into the space shuttle for a journey to the ISS.

Objects you will see

- **Space shuttle**
  A life-size external replica of the forward section of the space shuttle, first launched in 1981.

- **Soyuz 4-5.** 97/2/9
  http://www.powerhousemuseum.com/collection/database/?irn=157010
  Soviet spacecraft Soyuz-4 and Soyuz-5 docked together while orbiting the Earth on 16 January 1969. It was the first time that two spacecraft carrying crews docked in space. They remained linked for about four hours and two crew members from Soyuz-5 made a space walk to Soyuz-4 for the return to Earth. Scale model 1:2

Skylab, the first US space station. Image courtesy NASA.

Some images you will see

- **Skylab**
  Skylab was the first experimental US space station launched in 1973. In total, three crews of three visited the station between May 1973 and February 1974, demonstrating that people could live comfortably and stay healthy in space for months at a time. In 1979 Skylab burned up on re-entry and debris fell across Australia.

- **Salyut space station**
  The Salyut ('salute') program was the first series of Soviet space stations. Salyut-1 was launched in 1971, with its first crew spending 23 days in orbit. The longest mission was 237 days in 1984 on Salyut-7.

- **The Mir space station**
  The Mir ('peace') space station followed the Salyut series. Launched in 1986, Mir remained in orbit until 2001. In 1993, following the end of the Cold War, the United States invited Russia to become part of the International Space Station project. The Shuttle-Mir program enabled NASA to learn from Russia's long-duration spaceflight experience and foster co-operation.

Living and working in space

What is it like to live and work in the weightless environment of space? What do astronauts eat? How do they sleep? And how do they go to the bathroom?

Astronauts Dr Andy Thomas and Dr Shannon Walker will share their experiences as they guide you through a visit to the International Space Station.

Start with their introduction in the space shuttle, then move on to the space station habitation module where you will find out all about life in space.

This is followed by a tour of the Zero Gravity Space Lab where you will experience the illusion of weightlessness.

International Space Station replicas

- **Habitation module**
  A replica habitation module based on a prototype design for living quarters on the International Space Station (ISS). Here you will discover how astronauts eat, sleep and exercise in orbit.

- **Zero Gravity Space Lab**
  Using special optical effects, the replica space lab creates the illusion of weightlessness associated with microgravity. This is accompanied by commentary from Andy Thomas and Shannon Walker about the research work carried out on the ISS and why it is important to people back on Earth.

Objects you will see

- **Thermal blanket.** 88/770
  http://www.powerhousemuseum.com/collection/database/?irn=88651
  Special heat-resistant materials, like the thermal blanket on display, are used to protect the shuttle orbiter and its crew from the heat of re-entry.

The International Space Station. Image courtesy NASA.

- **Manned Manoeuvring Unit**
  The Manned Manoeuvring Unit is a self-contained backpack that allows an astronaut to move freely in space. Tiny nozzles spurting jets of nitrogen gas act like rockets, pushing the astronaut where he or she wants to go.

Audiovisual

- **Mission Control Houston**
  Astronauts Dr Andy Thomas and Dr Shannon Walker talk about the work of the International Space Station.
  Running time: 3 minutes

Did you know…

Some ISS facts and figures

- Construction began November 1998
- Completion due in 2010
- Operational life: 10 years from time of completion
- Completed dimensions: length 88.4 m, width 108.5 m, height 43.6 m
- Orbits about 350 km above the Earth, so each orbit takes about 90 minutes.
- Total crew: six
- Number of countries contributing: 16
- Internal volume is equal to the interior of a jumbo jet
- The ISS is visible at night and looks like a bright, moving star. On completion it will be the brightest object in the night sky, apart from the Moon

Home away from home

In the early days of space exploration very little was known about the effect of staying in a weightless environment for extended periods. The appropriate technology had to be developed to ensure the space travellers would be as comfortable and healthy as possible during their time in orbit.

Space suits were designed that would allow the wearer to work effectively, long-lasting food was packaged so it could be easily consumed and special toilets were devised that would function in zero gravity. While many advances have been made since then, the fundamental principles remain the same.

This section looks at some of the solutions to the problems of living and working in space.

Objects you will see

- **Space shuttle flight suit**
  Astronauts on the shuttle and ISS don't use spacesuits unless they are working outside in space. Instead they wear light comfortable flight suits like the one on display worn by Dr Paul Scully-Power on the shuttle Challenger in 1984.

- **Space station casual wear.** 94/65/2
  http://www.powerhousemuseum.com/collection/database/?irn=141699
  A flight suit worn by cosmonaut Oleg Makarov during his stay on the Salyut-6 space station in January 1978. It is made of a wool polyester mix treated with flame retardants.

- **Sokol ('falcon') spacesuit.** 94/65/1
  http://www.powerhousemuseum.com/collection/database/?irn=141689
  A spacesuit worn by cosmonaut Gennadi Manakov for his flight to and from the Mir space station in 1990. Its outer skin is made of nylon canvas.

- **Space toilet.** 97/4/1
  http://www.powerhousemuseum.com/collection/database/?irn=158694
  A space toilet designed for use by cosmonauts on the Soyuz spacecraft.

- **Space food**
  A display of food and drink made for US and Soviet missions. (Use keyword 'Space food' for database search.)

- **Soyuz re-entry module.** 97/2/10
  http://www.powerhousemuseum.com/collection/database/?irn=156935
  A replica re-entry module of the first version of the Soyuz spacecraft. A Soyuz re-entry module is used for emergency evacuations on the ISS today.

- **Forel hydrosuit.** 97/3/5
  http://www.powerhousemuseum.com/collection/database/?irn=158078
  A Forel ('trout') suit from a NAZ-3 emergency kit. Soyuz spacecraft normally touch down on land but this one-piece flotation suit is included in case the crew needs to abandon ship after an emergency water landing.

Did you know …

When you have to go

Going to the toilet in the weightless environment of space has always been a difficult business. Early astronauts had to urinate into tubes and use faecal collection bags. Space food on these missions was designed to be 'low residue' to reduce the need to poo.

The USSR developed the first space toilets that used suction like a vacuum-cleaner to draw away wastes. Current space toilets on the shuttle and ISS work on the same basic principle. But during lift-off, landing and spacewalks, astronauts wear disposable adult nappies.

Satellites at your service

Since the first satellites were launched in the 1950s, they have become an increasingly important part of our lives. So much so, it's hard now to imagine life without them.

From live television broadcasts and mobile phone networks to weather forecasts and search and rescue monitoring — everyday, in some way, satellites are working for us up in space.

Ranging in size from a few square metres to as large as a house, they orbit above us gathering data and transmitting information day and night. From their vantage point above the Earth, they provide an important global view that would otherwise not be possible.

This section looks at some of these application satellites and the services they provide for us here on Earth.

Objects you will see

- **Space debris.** B2093
  http://www.powerhousemuseum.com/collection/database/?irn=210707
  A piece of space debris that is believed to be from a Soviet satellite.

- **Satellite materials.** 88/704D
  http://www.powerhousemuseum.com/collection/database/?irn=87123
  Satellites are made of light, strong materials that can withstand the stress of launch and the harsh space environment.

The Hubble Space Telescope being released into orbit by the space shuttle. Image courtesy NASA.

Some images you will see

- **Weather forecasts**
  Images taken by weather satellites, which observe Earth in many different wavelengths, including visible light and infra-red radiation.

- **Eagle Nebula**
  A view of the Eagle Nebula taken by NASA's Hubble telescope. This is just one of the many magnificent images of the universe returned by this telescope, which is one of the most well known space observatories. It was launched by the space shuttle in 1990.

- **The Optus D1 satellite**
  This is part of the network providing communication services for Australia and its local region. Television, education and telemedicine services can be provided to remote regions in Australia and developing nations via satellite.

The world in space

When the Space Age began in 1957, only two nations — the United States and the USSR — had the ability to launch rockets into space. Soon many other countries began to develop the technology to put their own satellites into orbit and explore the solar system.

Recognising the importance of having independent space capabilities, developing and developed nations alike have invested in successful space programs. Recent initiatives include the growth of a commercial satellite launch industry and even space tourism.

This section highlights a few of the national and multinational space programs operating today, with a special focus on Australia's place in space.

Objects you will see

- **ARC experiment.** 92/341
  http://www.powerhousemuseum.com/collection/database/?irn=126967
  The Aggregation of Red Cells (ARC) experiment was developed by Australian scientist Dr Leopold Dintenfass to examine the effect of weightlessness on normal and diseased red blood cells. The equipment was built by local industry. The ARC experiment made two space shuttle flights in 1985 and 1988. The results showed that healthy and diseased blood behaves differently in space, which could aid in the treatment and cure of certain diseases.

- **Black Arrow payload fairings.** 2003/218/5
  http://www.powerhousemuseum.com/collection/database/?irn=319881
  Two fairings that formed the nose cone of a Black Arrow rocket, protecting the satellite being launched.

Some images you will see

- **European Ariane 5 launcher**
  Originally developed by ESA, the Ariane rocket is one of the world's most successful satellite launchers.

- **The H-2A launcher**
  Japan's primary rocket, used for launching satellites and space probes. Japan has an active satellite building industry, producing all types of application satellites. Australia gets much of its weather data from Japanese satellites.

- **A Long March 2-C rocket**
  The Long March 2 family of rockets has been the mainstay of China's launch capability since the 1970s. The most recent version, Long March 2-F, is used for crewed space missions.

- **FedSat (Federation Satellite)**
  A technology demonstrator satellite developed as a project for Australia's centenary of Federation. Based on a British design, it carried Australian, US and South African experiments and was launched in 2002 by Japan's H2-A rocket.

- **The Tidbinbilla Deep Space Communication Complex**
  Tidbinbilla is part of NASA's Deep Space Network, used for tracking probes to the planets, and the only major NASA tracking station still operating in Australia. Satellites have replaced the tracking networks for Earth-orbiting spacecraft.

Audiovisual

- **Project Wresat**
  Launched on 29 November 1967, Wresat was Australia's first satellite. It was named for the Weapons Research Establishment (WRE), which managed the Woomera Rocket Range.
  Running time: 4 minutes

Exploring the solar system

Robotic space probes have revolutionised our knowledge of the solar system, giving us the chance to explore the planets close up.

Robot explorers can venture far beyond the range of crewed spacecraft into environments where it would be too difficult or dangerous for humans to go. Equipped with cameras and other electronic sensors, their discoveries have revealed a very different solar system to the one we thought we knew at the beginning of the Space Age.

Through the discoveries of space probes, we now have a much better understanding not only of our neighbours in space but also our own planet.

This section looks at some of the amazing images and information that these space probes have revealed to us.

Objects you will see

- **Model of Lunokhod-2 rover.** 97/2/3
  http://www.powerhousemuseum.com/collection/database/?irn=157004
  Lunokhod ('moon walker')-2 was the second of two remotely controlled Soviet lunar rovers. It landed on the Moon in 1973. Lunokhod-1 had landed in 1970.

- **Model of Luna-9.** 97/2/2
  http://www.powerhousemuseum.com/collection/database/?irn=157003
  On 3 February 1966 Luna-9 made the first successful soft landing on the Moon. It was one of a series of automated probes sent by the USSR to the Moon between 1959 and 1976.

Some images you will see

- **Mercury**
  Mariner 10 'mosaic' view of the Caloris Basin on Mercury, composed of many smaller images.

- **Venus**
  The first colour photos of the surface of Venus taken in 1981. Venus' thick, sulphur laden clouds reduced the surface light to a dull yellow.

- **The far side of the Moon**
  Pictures of the far side of the Moon, always hidden from the Earth sent back by the Soviet Moon probe Luna 3 in October 1959.

- **Mars**
  Images of the surface of Mars, revealing a very different planet from what had been expected.

- **Jupiter**
  Jupiter and its four largest moons in a montage of images from Voyager 1.

- **Saturn**
  A montage of Voyager-1 images showing Saturn and six of its moons, taken in November 1980.

- **Uranus**
  Uranus, a world tipped on its side, seen in true and false colour.

- **Neptune**
  Neptune's blue colour, like that of Uranus, is due to the quantity of methane in its atmosphere.

Voyager montage: Saturn and six moons. Image courtesy NASA.

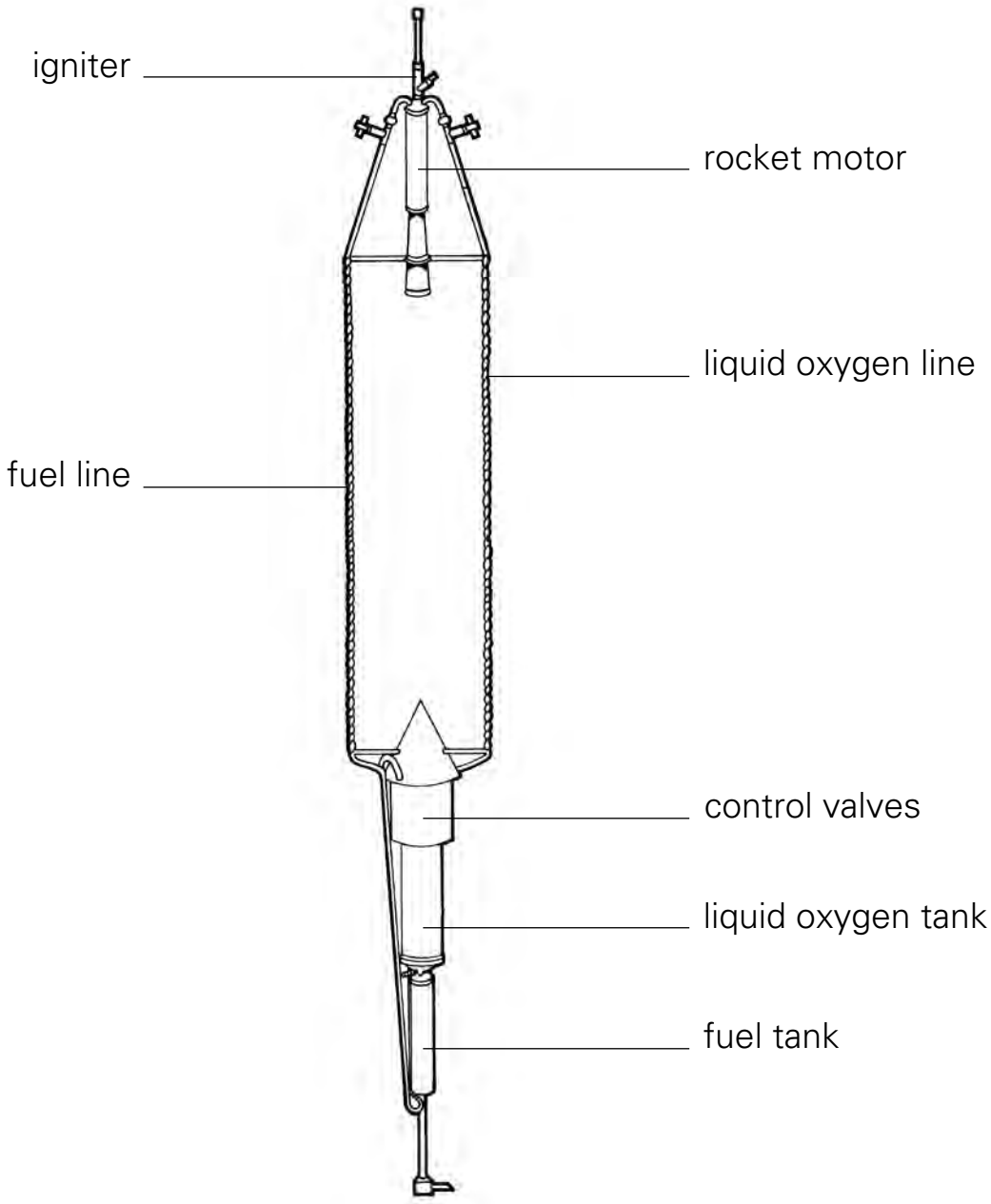
Objects in orbit

- **Sputnik-1.** 97/2/1
  http://www.powerhousemuseum.com/collection/database/?irn=156934
  A replica of the world's first artificial satellite. Its launch by the USSR on 4 October 1957 stunned the world and marked the beginning of the Space Age.
- **Vanguard-1.** H6713
  http://www.powerhousemuseum.com/collection/database/?irn=246345
  A replica of the tiny Vanguard-1, the second US satellite. Launched in 1958, five months after Sputnik, it was the first solar powered satellite.
- **Cosmos (geophysical).** 97/2/6
  http://www.powerhousemuseum.com/collection/database/?irn=157007
  Since 1962, the Soviet/Russian Cosmos series has launched over 2400 satellites, including a wide range of scientific, military and engineering satellites.
- **Cosmos 97 (molecular).** 97/2/7
  http://www.powerhousemuseum.com/collection/database/?irn=157008
  Cosmos-97 was launched in 1965. It carried a molecular generator, or maser, and performed experiments on long-distance communication in space.
- **Soyuz 4-5.** 97/2/9
  http://www.powerhousemuseum.com/collection/database/?irn=157010
  Soviet spacecraft Soyuz-4 and Soyuz-5 docked together while orbiting the Earth on 16 January 1969. It was the first time that two spacecraft carrying crews docked in space.
- **Model of Optus B-series satellite.** 92/302D
  http://www.powerhousemuseum.com/collection/database/?irn=126862
  The Optus B-series satellites were launched in 1992 and 1994 by Chinese Long March rockets and are in geostationary orbit above the South Pacific.
- **Model of Optus C1 satellite.** 2002/46/1D
  http://www.powerhousemuseum.com/collection/database/?irn=11411
  Orbiting 36 000 km above the South Pacific, the Optus C1 satellite provides commercial and military communications services. It transmits voice, video and data signals across Australia, Asia and the Pacific.

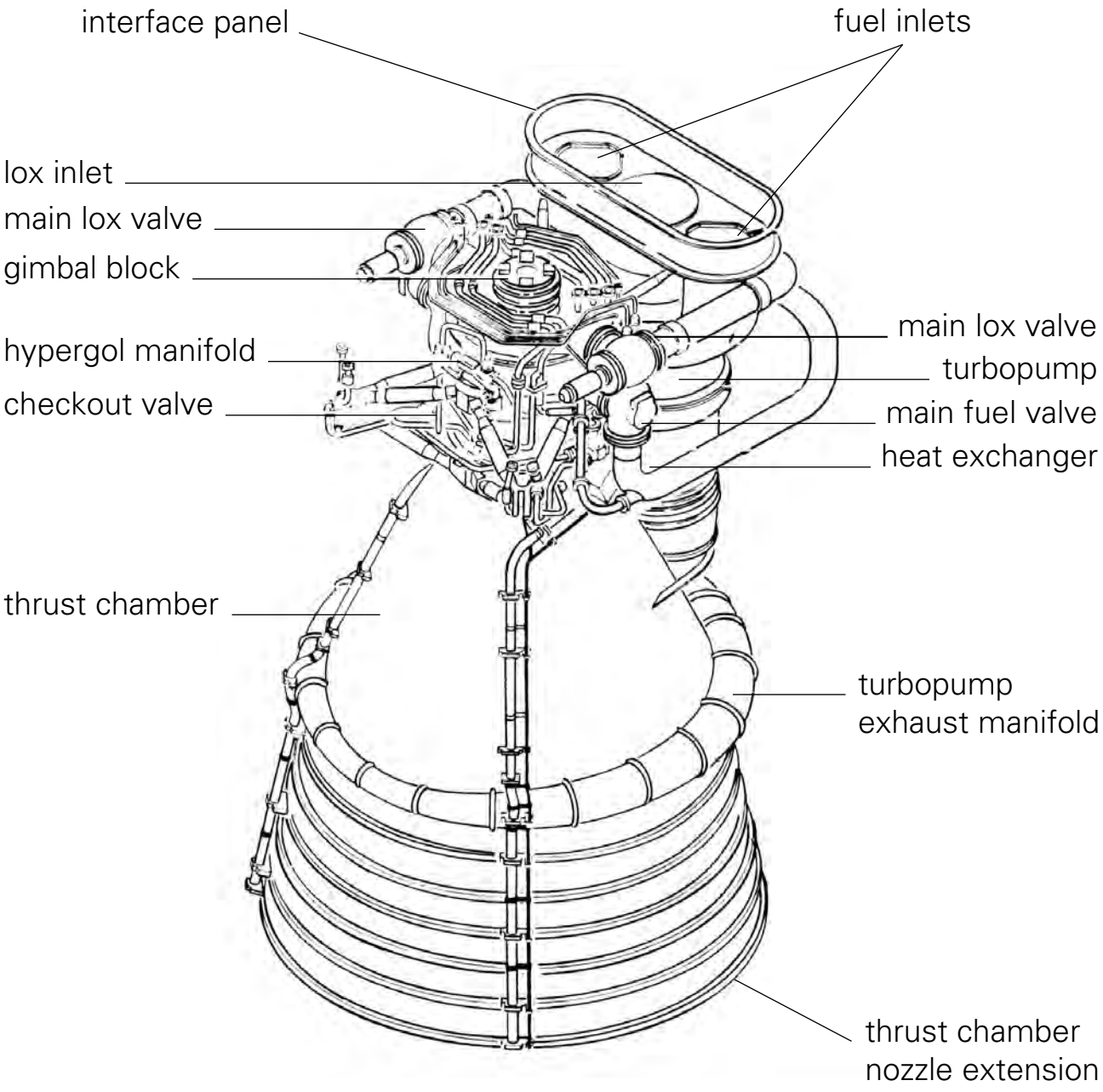
A Skylark rocket being launched at Woomera Rocket Range, South Australia. Image courtesy DSTO, South Australia.

- **Model of Luna-9.** 97/2/2
  http://www.powerhousemuseum.com/collection/database/?irn=157003
  On 3 February 1966 Luna-9 made the first successful soft landing on the Moon. It was one of a series of automated probes sent by the USSR to the Moon between 1959 and 1976.
- **Skylark.** 2003/218/1
  http://www.powerhousemuseum.com/collection/database/?irn=319877
  Sounding rockets launched at Woomera Rocket Range between 1957–78 included the British-built Skylark. Rockets like these were used for studying the physics and chemistry of the atmosphere at high altitudes.

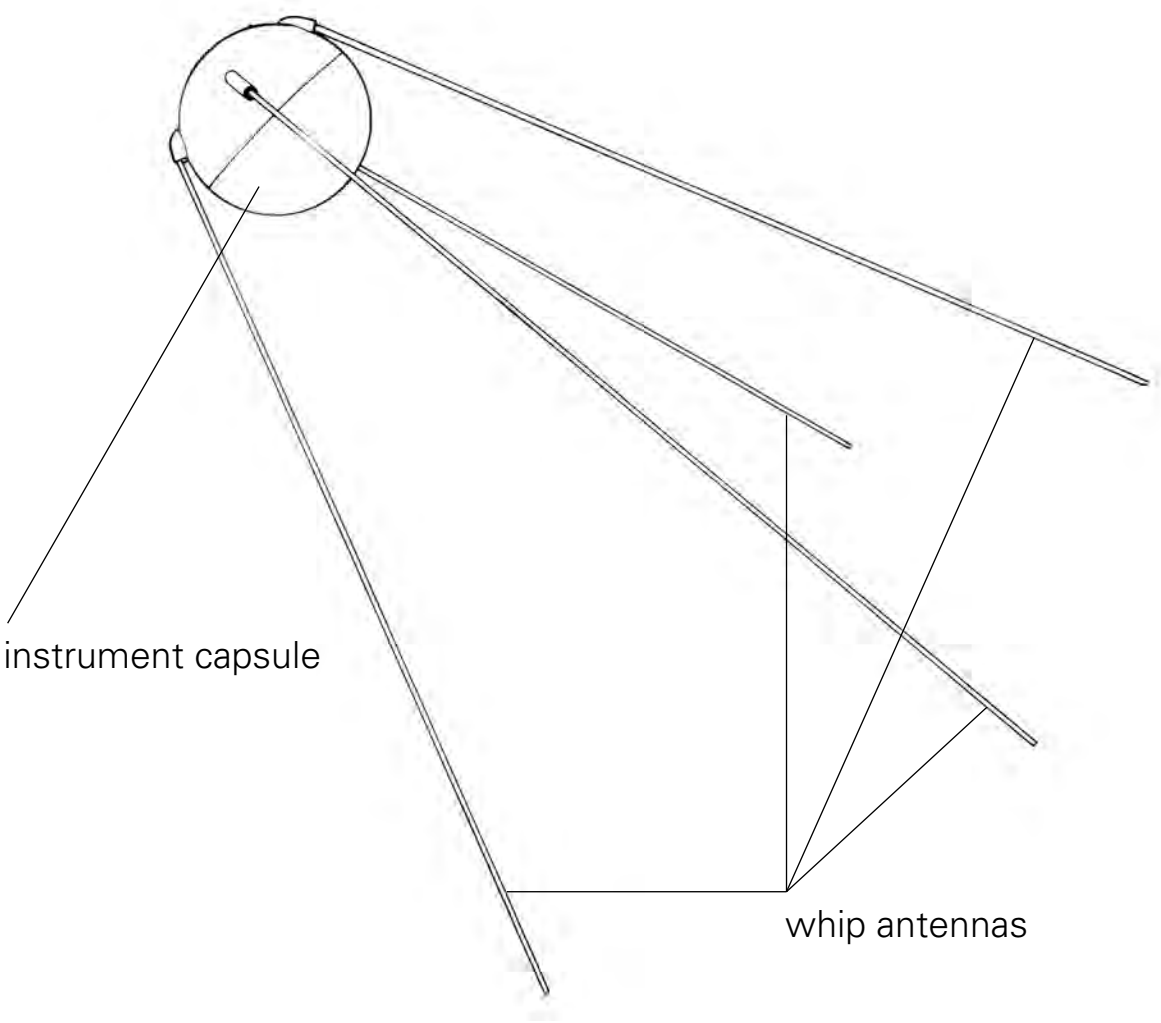
Goddard rocket



F1 rocket engine



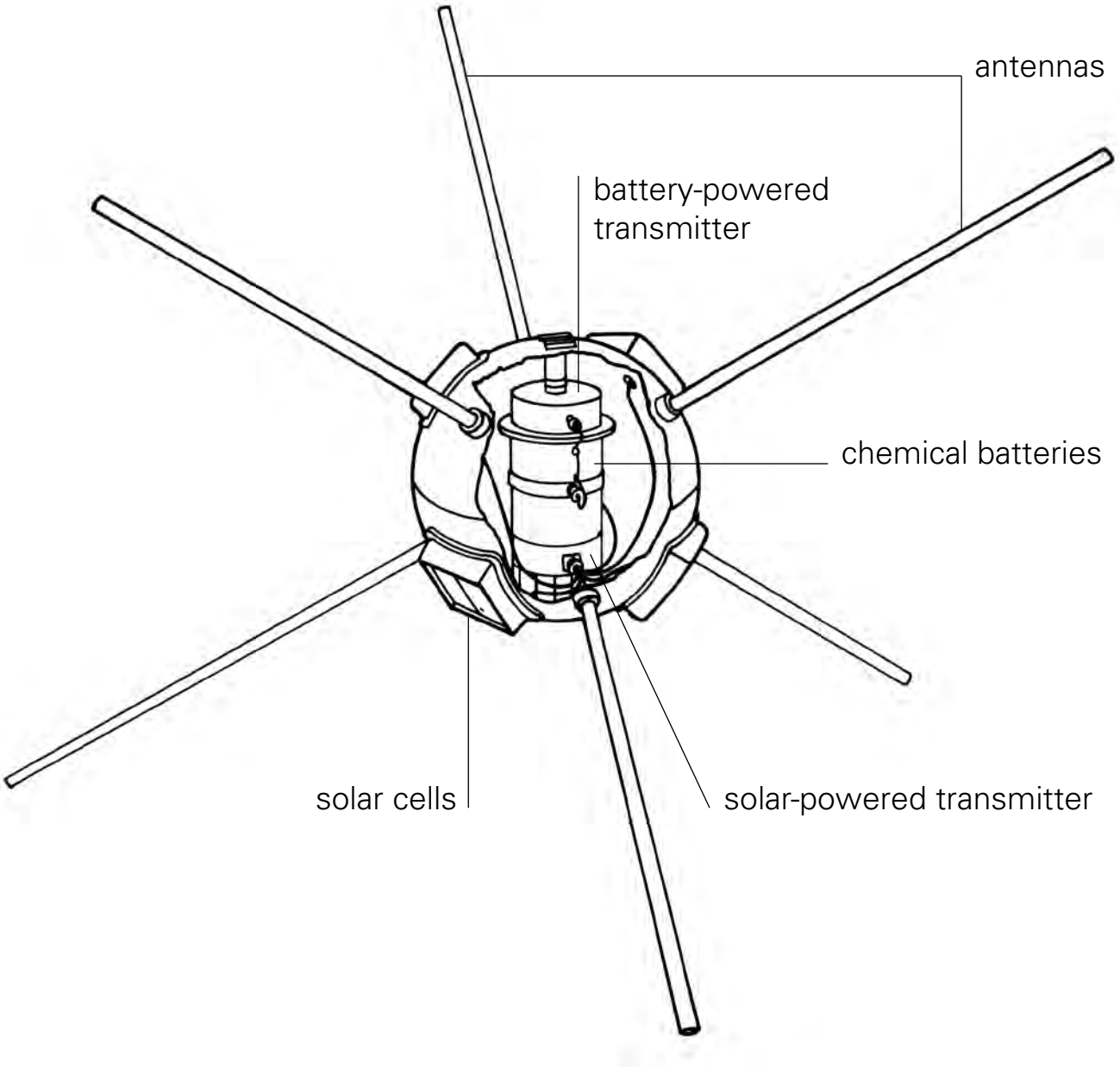
Sputnik-1



Specifications

Launched	4 October 1957
Diameter	0.58 m (instrument capsule)
Mass	83.6 kg

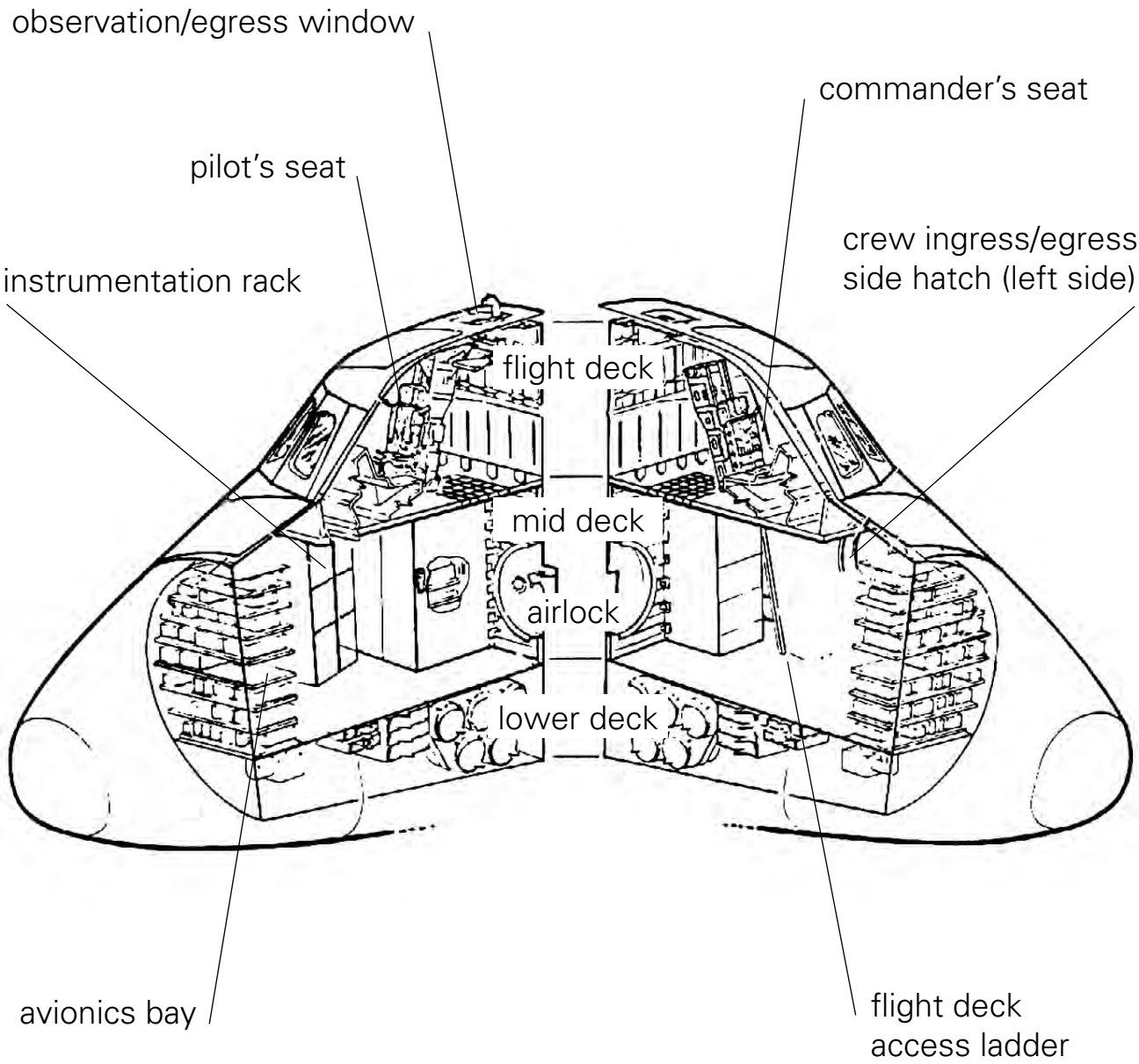
Vanguard-1



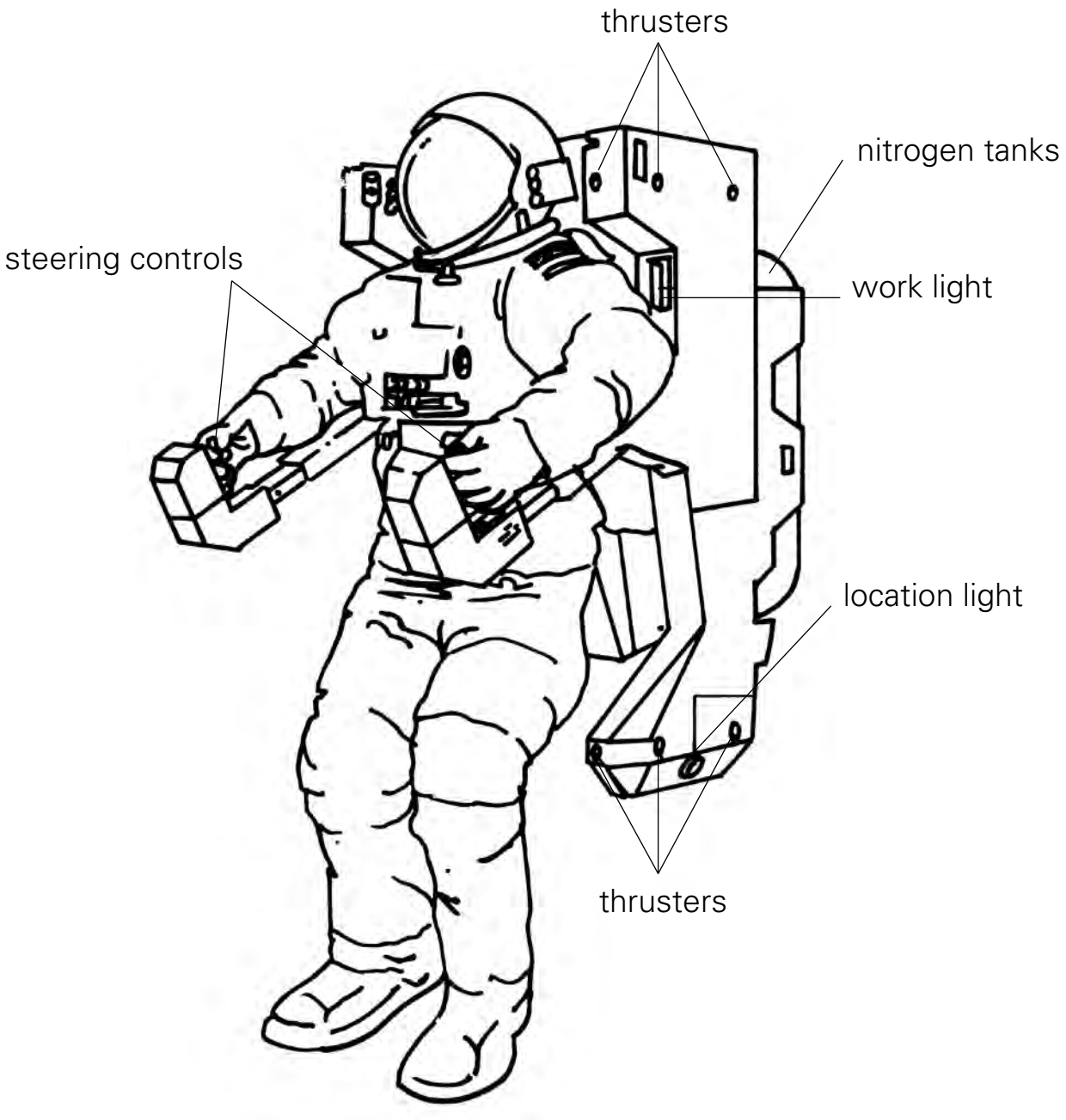
Specifications

Launched	17 March 1958
Diameter	0.16 m
Mass	1.47 kg

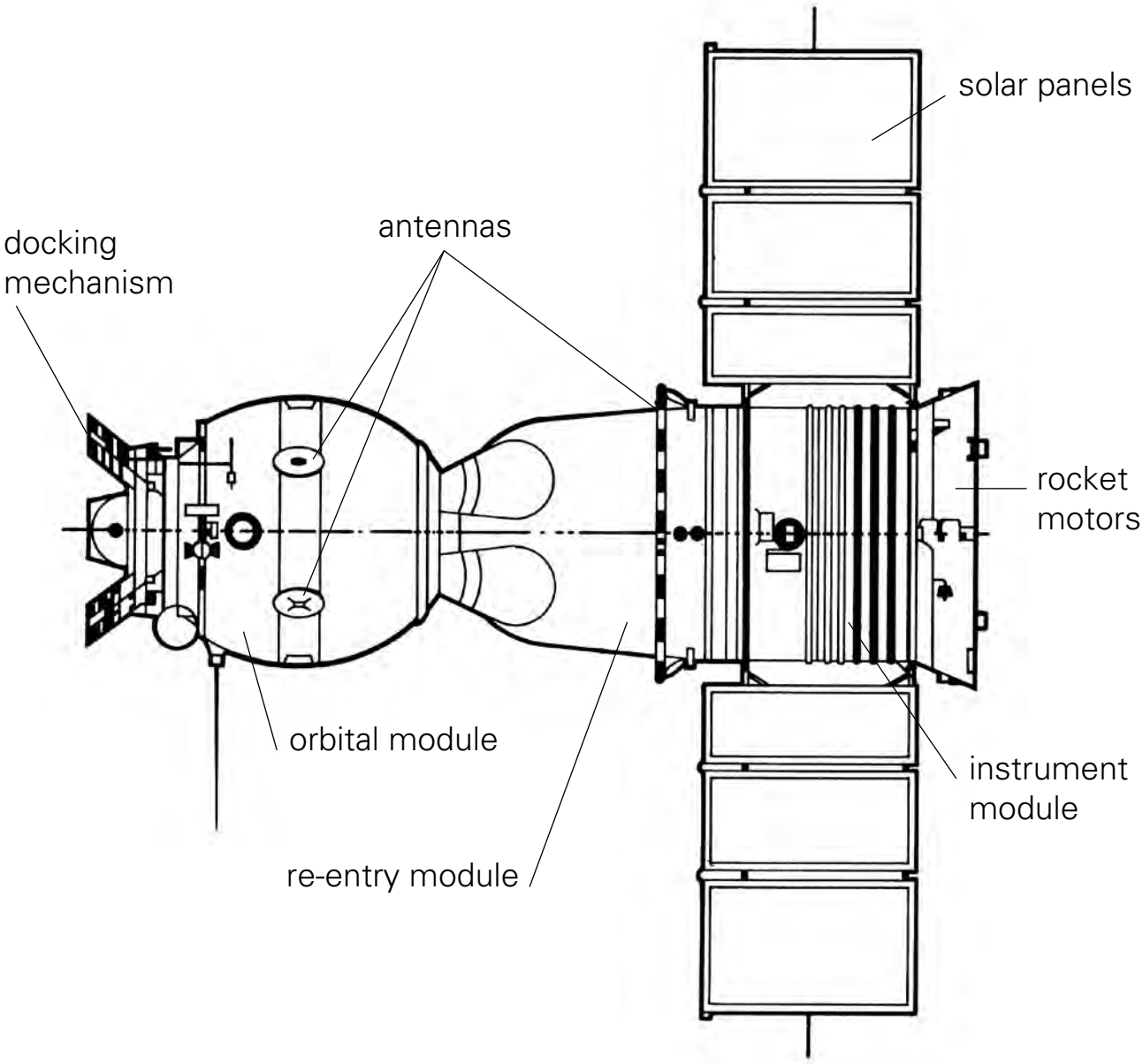
Space shuttle crew compartment



Manned Manoeuvring Unit

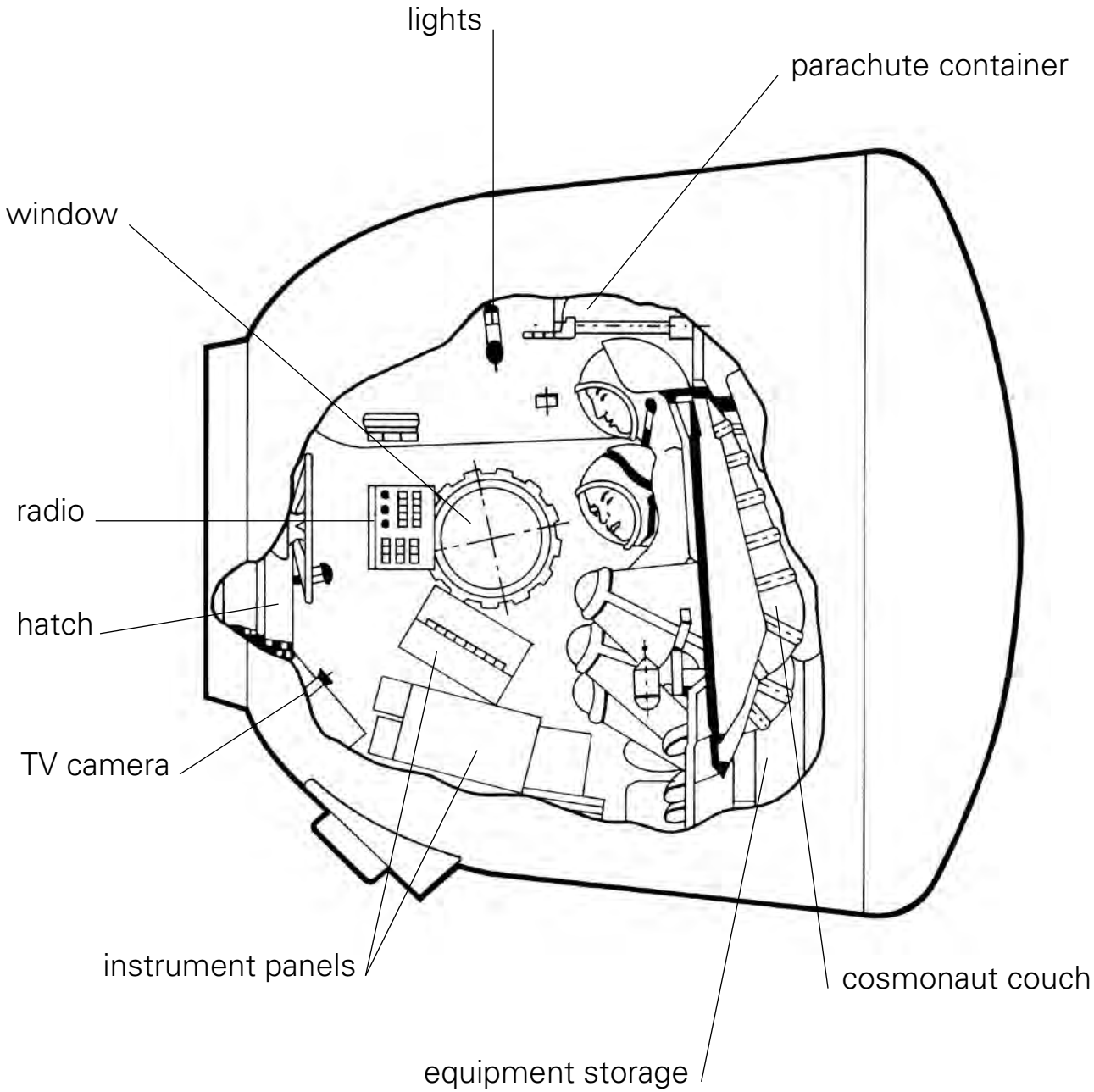


Soyuz spacecraft

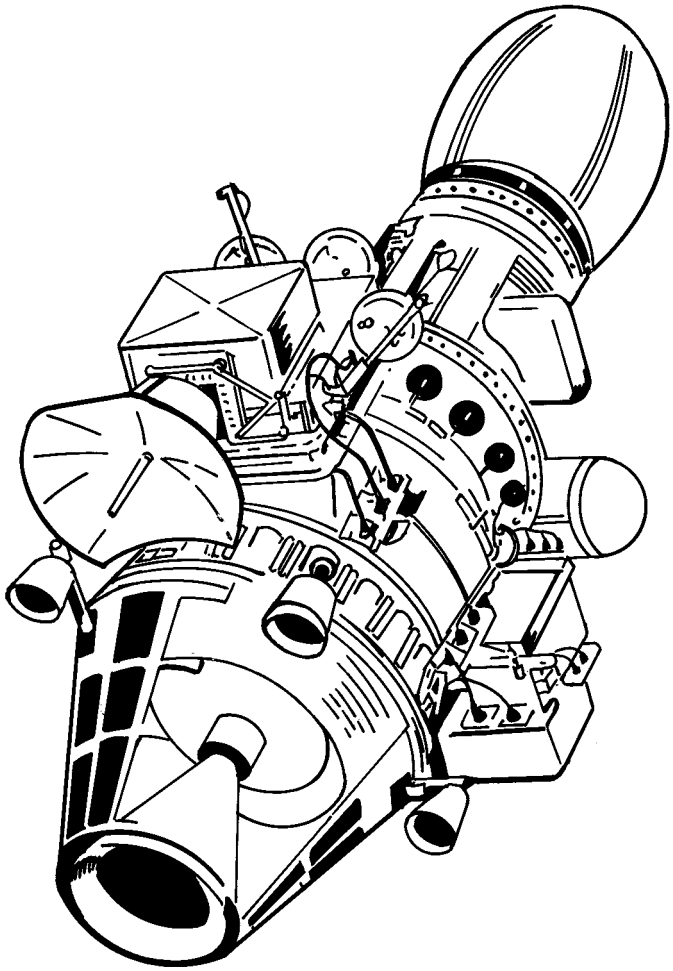


top view

Soyuz re-entry module



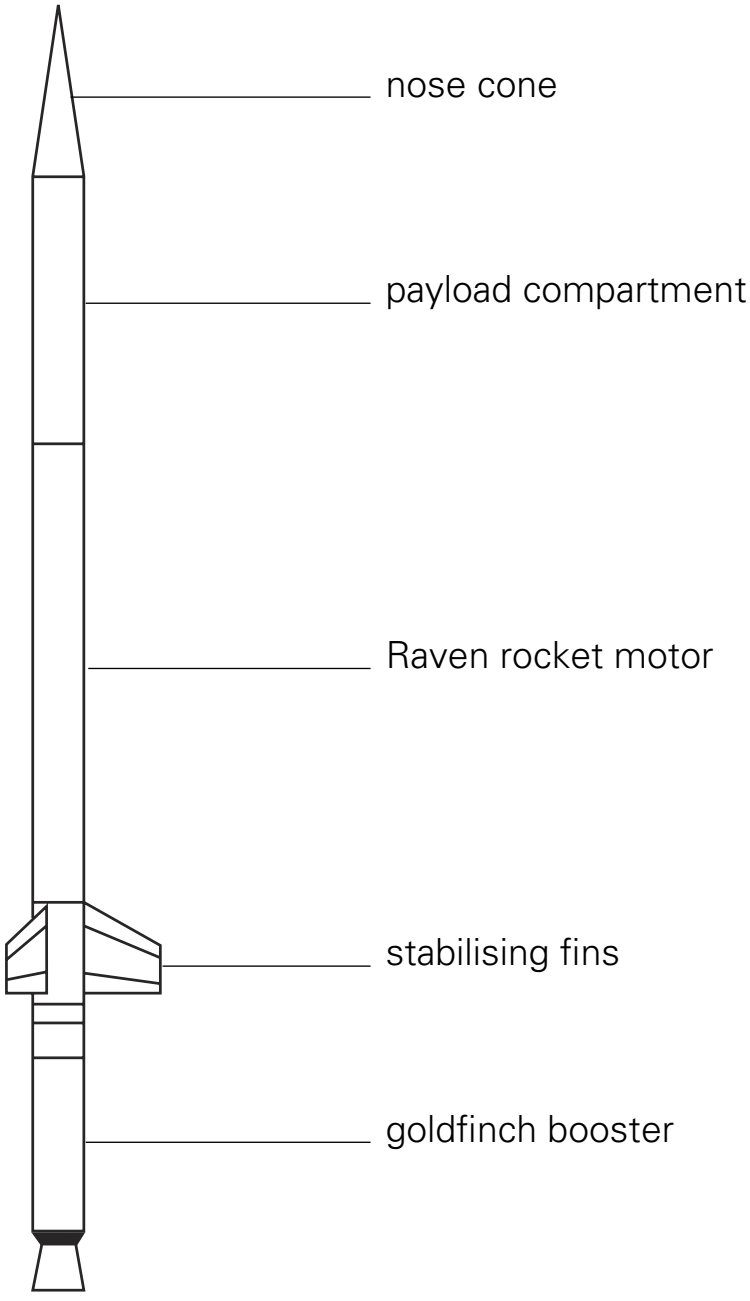
Luna-9



Specifications

Launched	31 January 1966
Length	4 m
Mass	1583 kg

Skylark rocket



Further reading

Spaceflight and planetary exploration
- http://www.nasa.gov
- http://www.spaceflight.nasa.gov/home/index.html
- http://www.jpl.nasa.gov/
- http://photojournal.jpl.nasa.gov/index.html
- http://www.solarviews.com

International spaceflight
- http://www.worldspaceflight.com/

Space agency websites
- http://www.esa.int/esaCP/index.html (ESA)
- http://www.jaxa.jp/index_e.html (Japan)
- http://www.space.gc.ca/asc/eng/default.asp (Canada)
- http://www.cnsa.gov.cn/n615709/cindex.html (China)
- http://www.roscosmos.ru/index.asp?Lang=ENG (Russia)
- http://www.isro.org/ (India)
- http://www.lowdown.com.au/ (unofficial website for Australia)

Space history sites
- http://history.nasa.gov/
- http://history.msfc.nasa.gov/rocketry/
- http://www.spacearium.com/special/spaceline/spaceline.org/rockethistory.html
- http://www.grc.nasa.gov/WWW/K-12/TRC/Rockets/history_of_rockets.html

General space information and news
- http://www.abc.net.au/science/topics/?topic=space
- http://www.bbc.co.uk/science/space/

Please note

The websites referred to in these notes were available and suitable at the time of publication. We advise teachers to check sites before recommending them to students.

For more information on the exhibition *Space*, visit the Powerhouse Museum's website
http://www.powerhousemuseum.com

For more information about education support or your booking, contact Education and Program Development at the Powerhouse Museum:
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