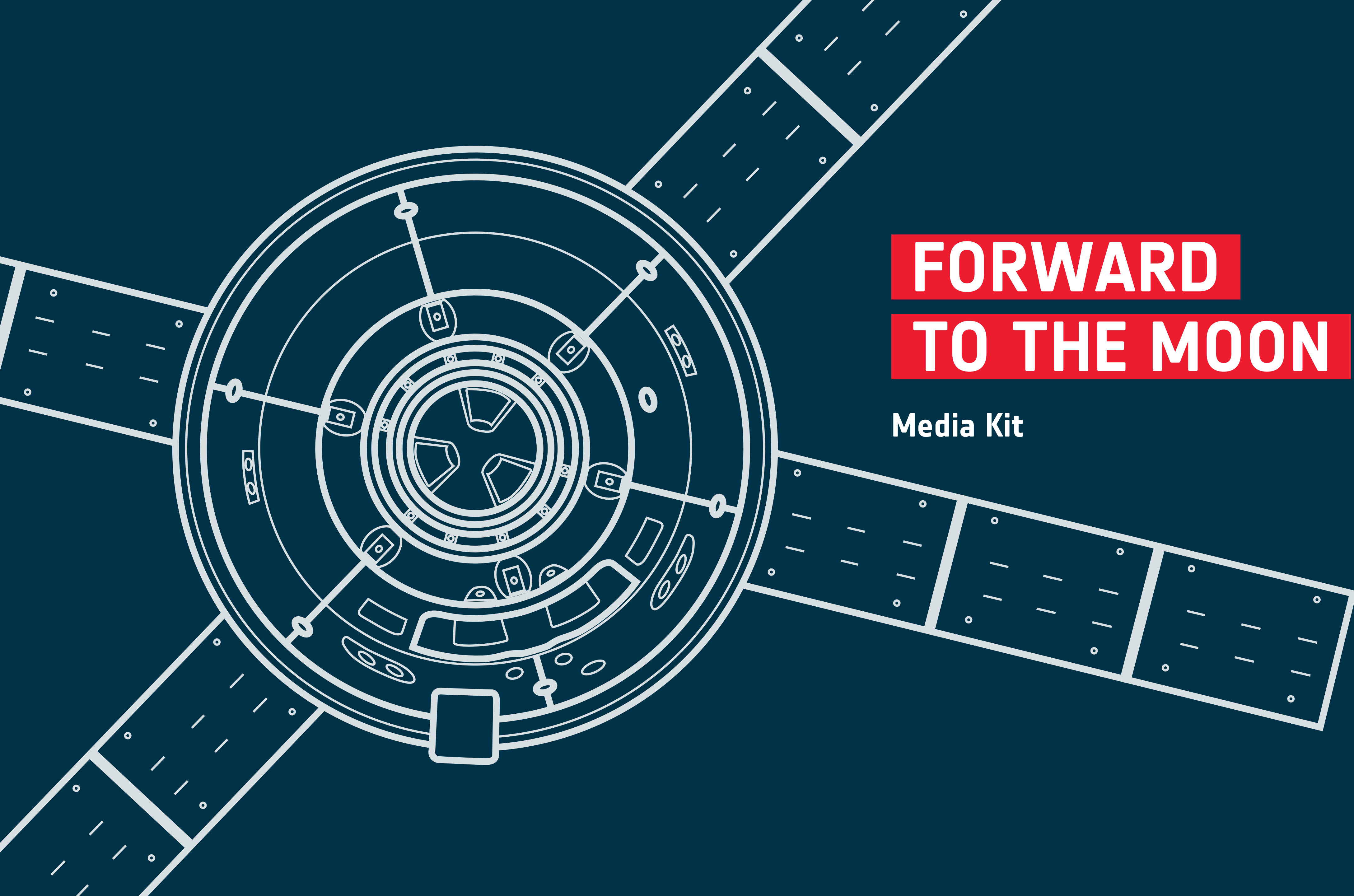


FORWARD TO THE MOON

Media Kit

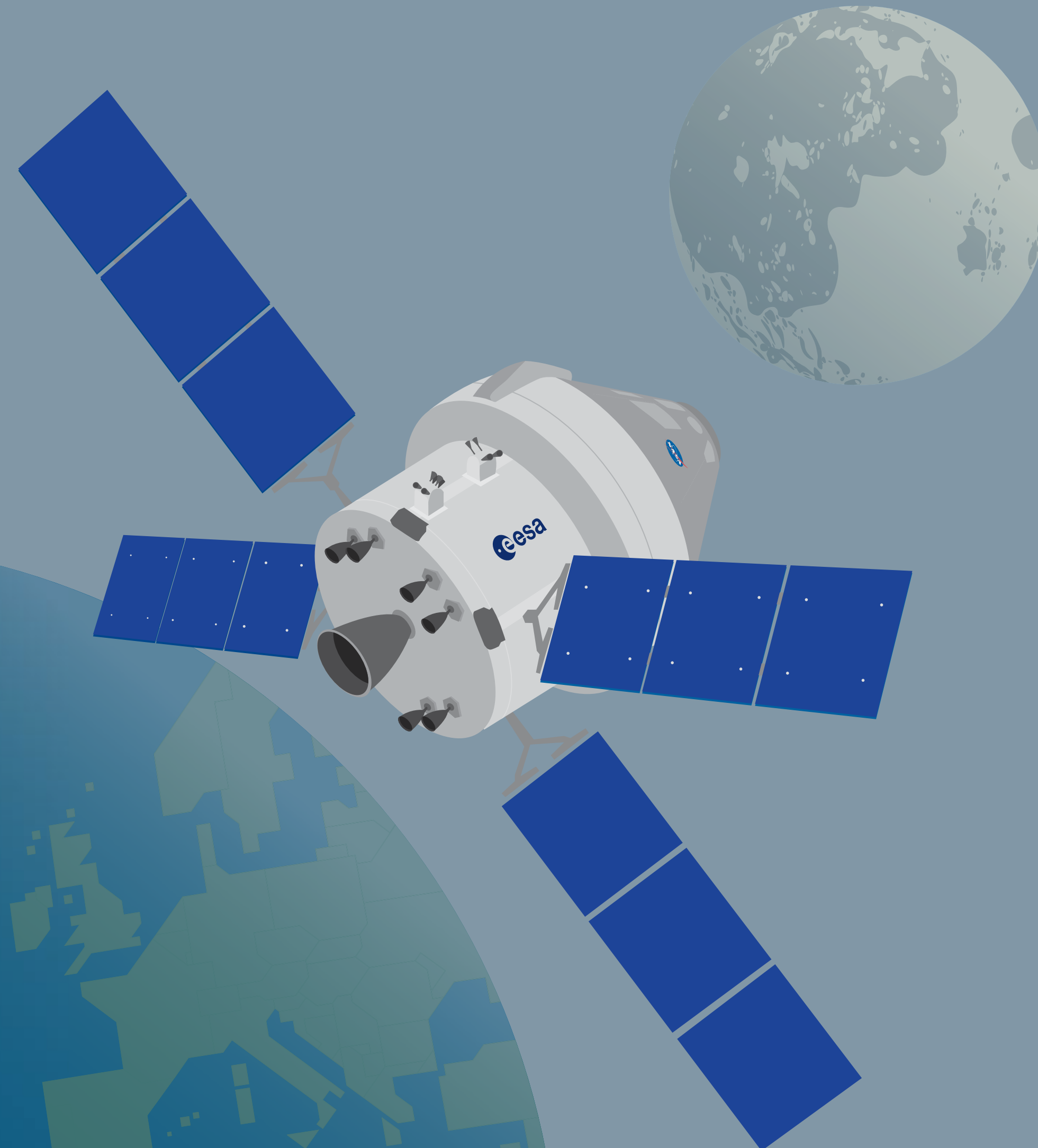


ORION

What is Orion?

Orion is a NASA spacecraft set for missions to **the Moon, Mars and beyond.**

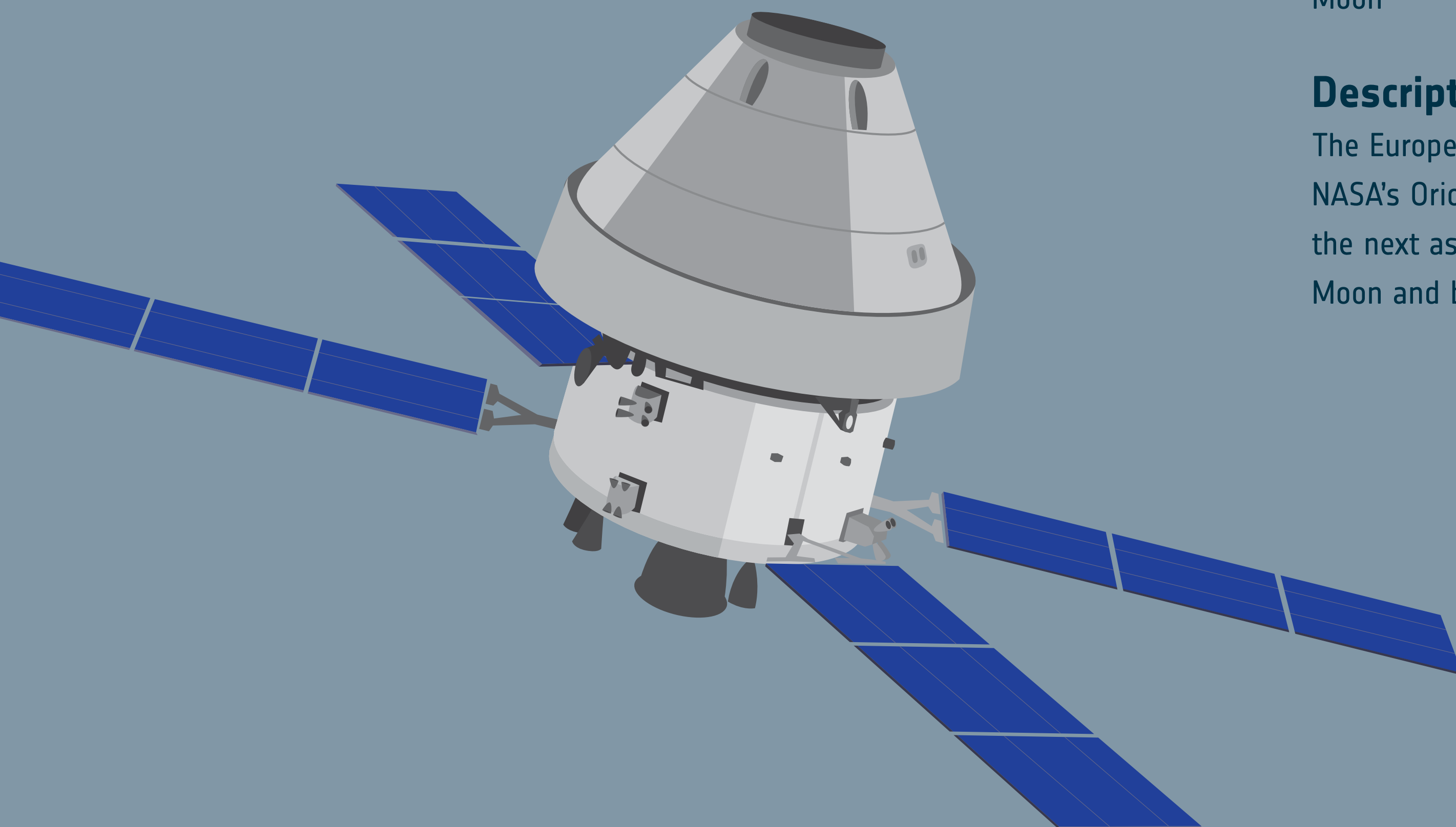
ESA has designed Orion's European Service Module – the **powerhouse** that will supply the spacecraft with electricity, propulsion, thermal control, air and water.



This is the first collaboration **between ESA and NASA** on a transportation vehicle that will carry astronauts farther into space than ever before.

ORION

European Service Module



Destination

Moon

Description

The European Service Module for NASA's Orion spacecraft will ferry the next astronauts to land on the Moon and back.

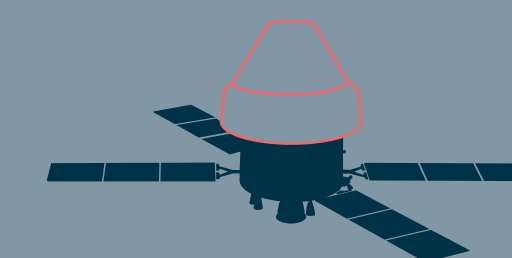
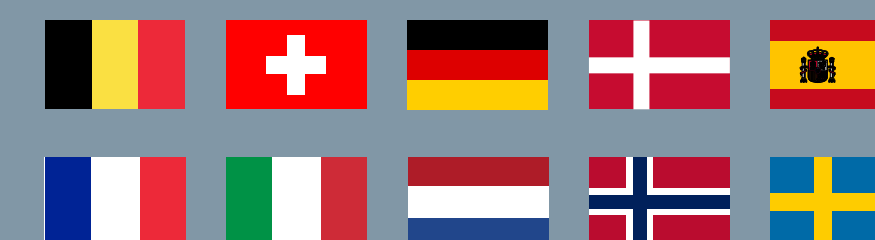
Why

Participate in the exploration of the Moon and to give Europe a key role in humankind's exploration programmes.

Prime Contractor

Airbus, Germany

Subcontractors from:



○ Crew Module (NASA)
● European Service Module (ESA)

ORION

The spacecraft

Crew Module

Habitat for four astronauts and cargo from launch to landing.

Only part of the spacecraft that lands back on Earth.

European Service Module

Provides electricity, propulsion, air and water.

Keeps the spacecraft at the right temperature and on course to its destination and back.

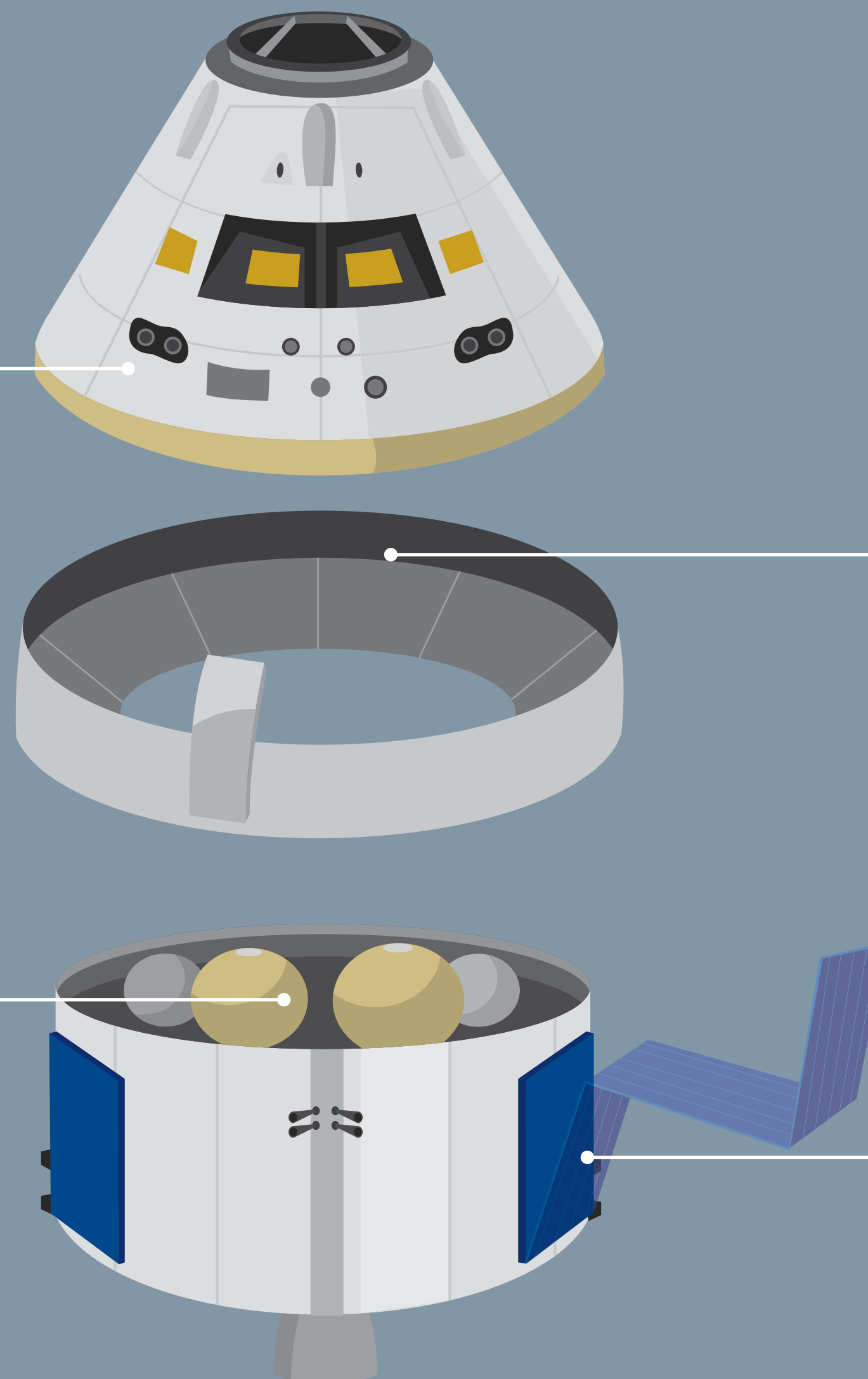
Crew Module Adapter

Connects electrical, data and fluid systems between the main modules.

Contains electronic equipment for communications, power and control.

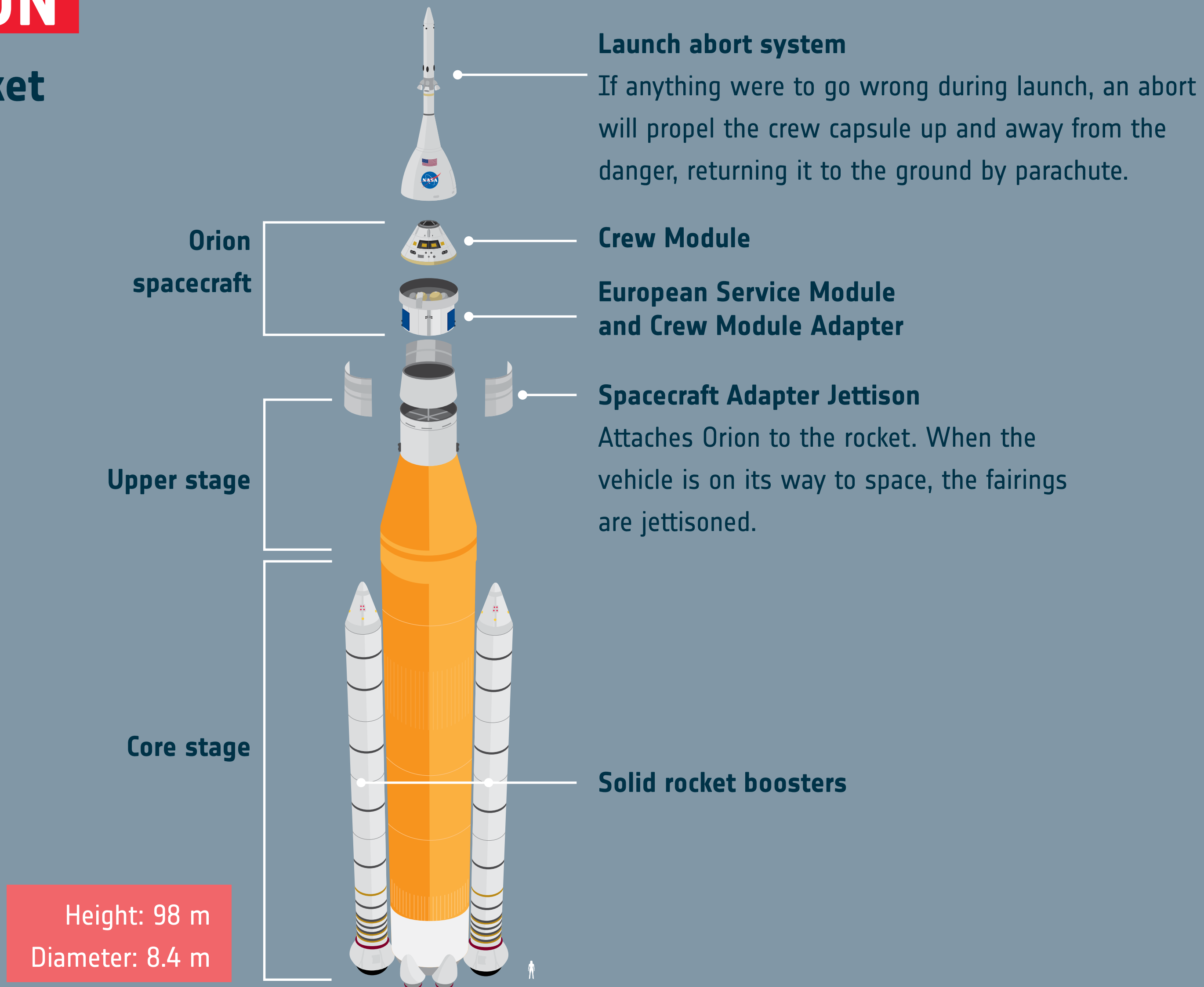
Solar arrays

The solar array turns on two axes to remain facing the Sun for maximum power and to protect from engine burns.



ORION

The rocket

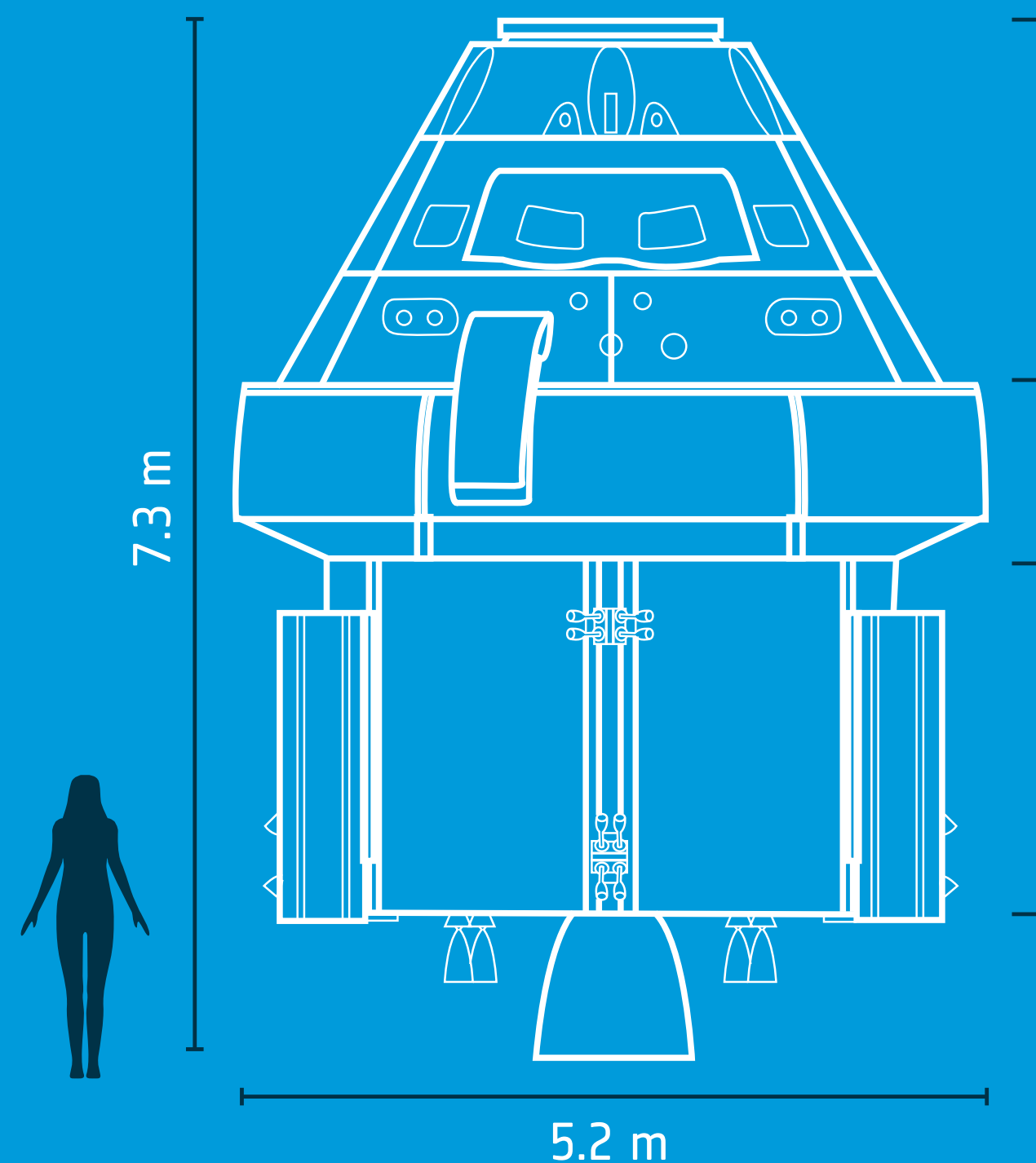


How to get to the Moon

Orion will be launched by NASA's Space Launch System – the most powerful rocket ever flown. The heavy-lift rocket will allow Orion to break free of Earth's gravity to explore our Solar System.

ORION

Dimensions



Crew Module

10 387 kg

Crew Module Adapter

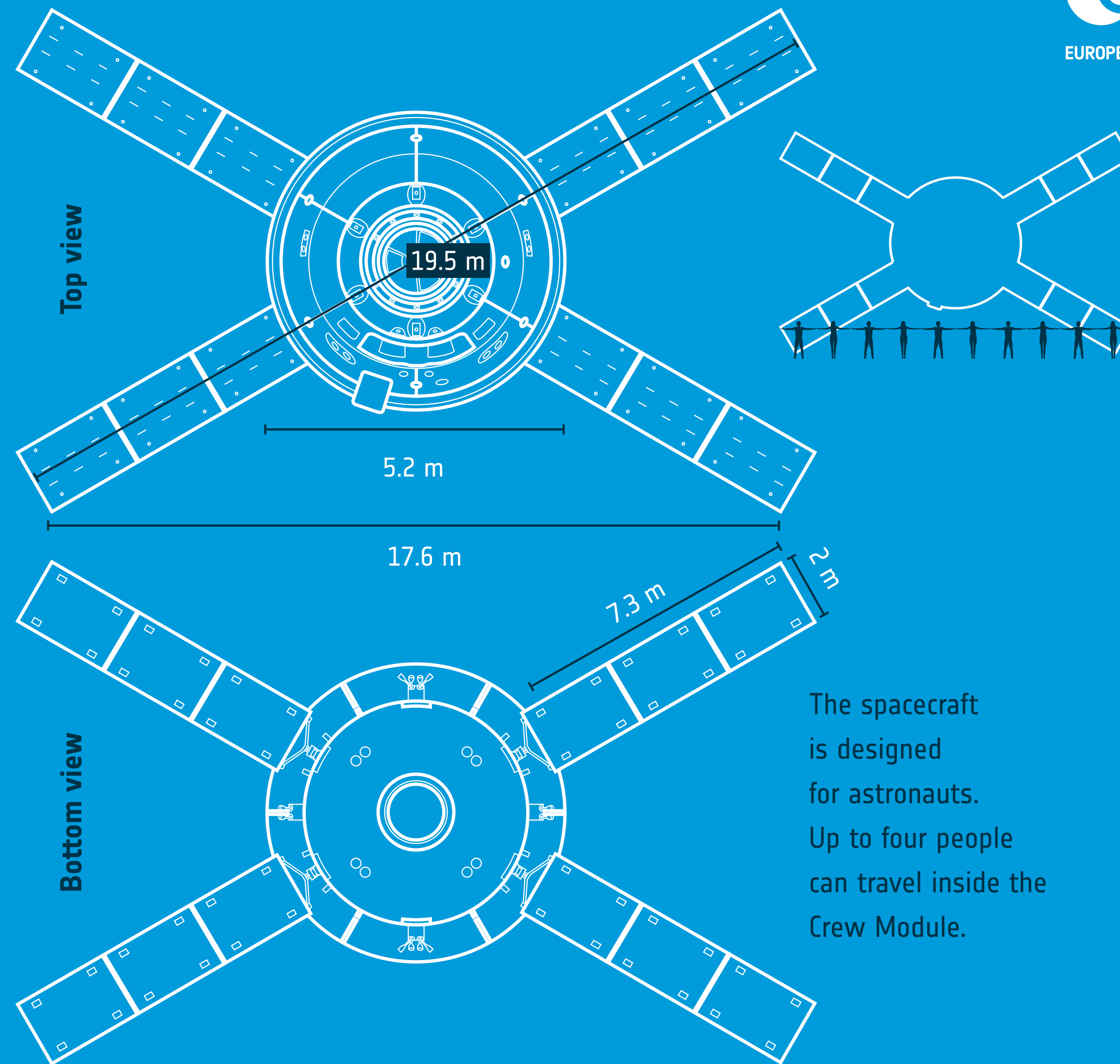
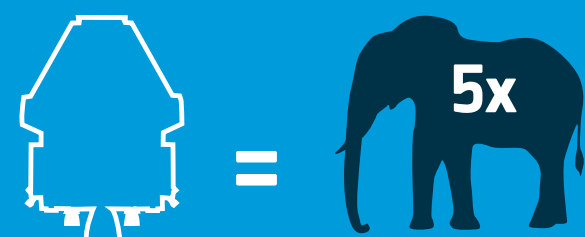
1961 kg

European Service Module

13 500 kg

25 848 kg

Height: 7.3 m



The spacecraft is designed for astronauts. Up to four people can travel inside the Crew Module.

ORION

The journey

Transport

Service Module and solar arrays transported from Germany to USA

2

Assembly

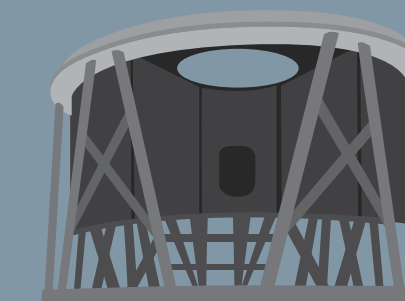
The European Service Module is assembled in Germany



1

Structure

The European Service Module structure is built in Italy



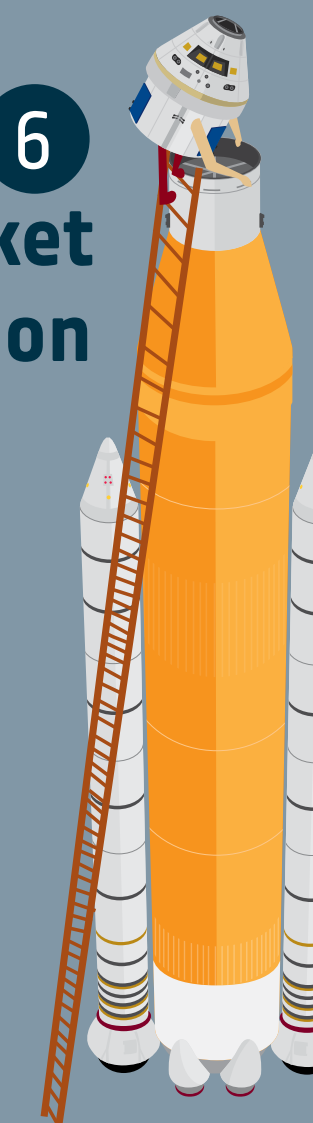
7

Liftoff!



6

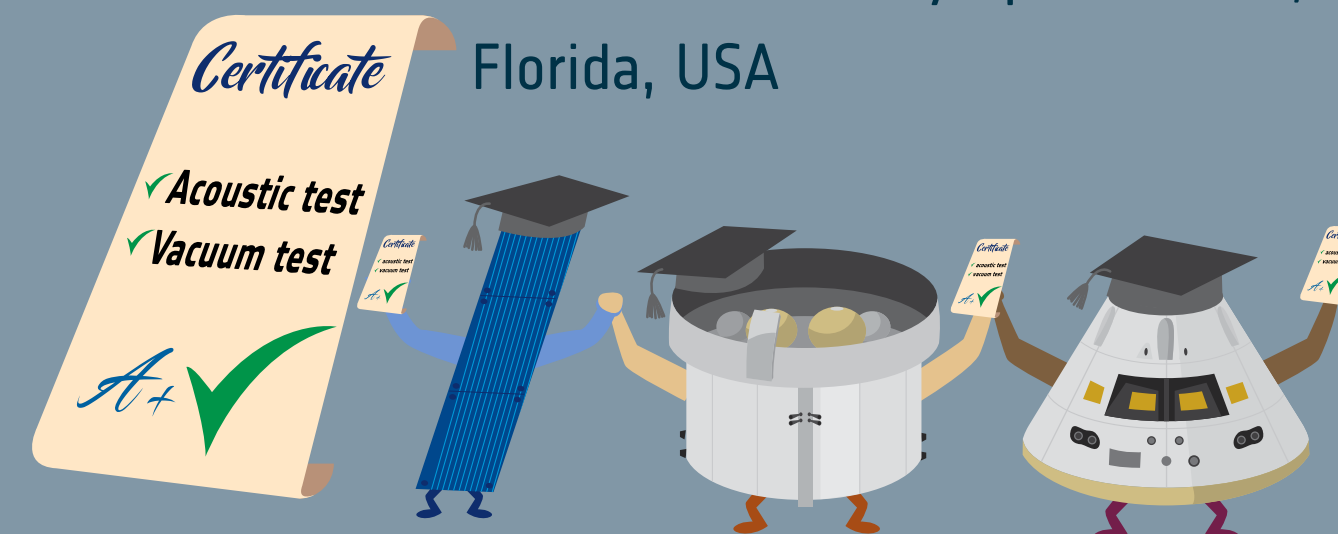
Rocket integration



5

Second module tested

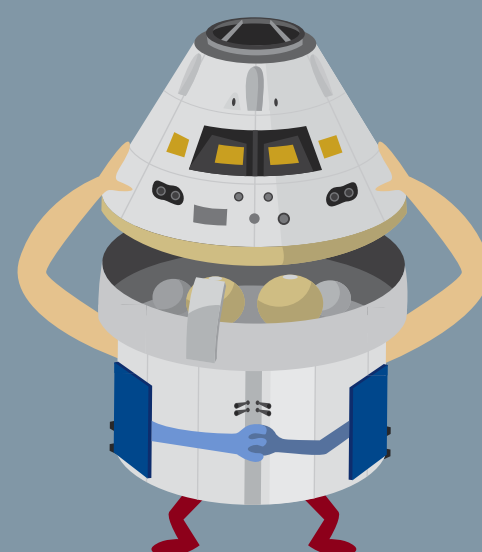
At NASA's Kennedy Space Center, Florida, USA



5

Assembly

Complete Orion Service Module and Crew Module at NASA's Kennedy Space Center, Florida, USA



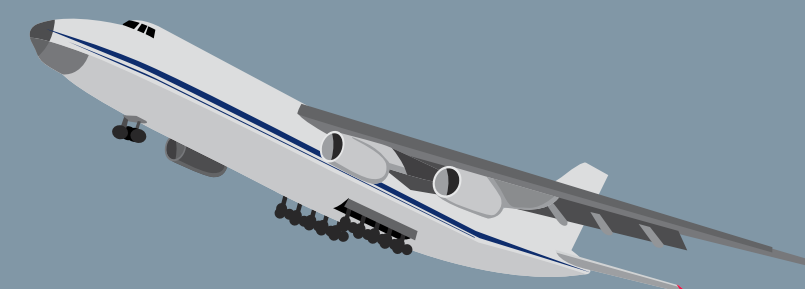
4

Celebration

European Service Module and Crew Module Adapter connected



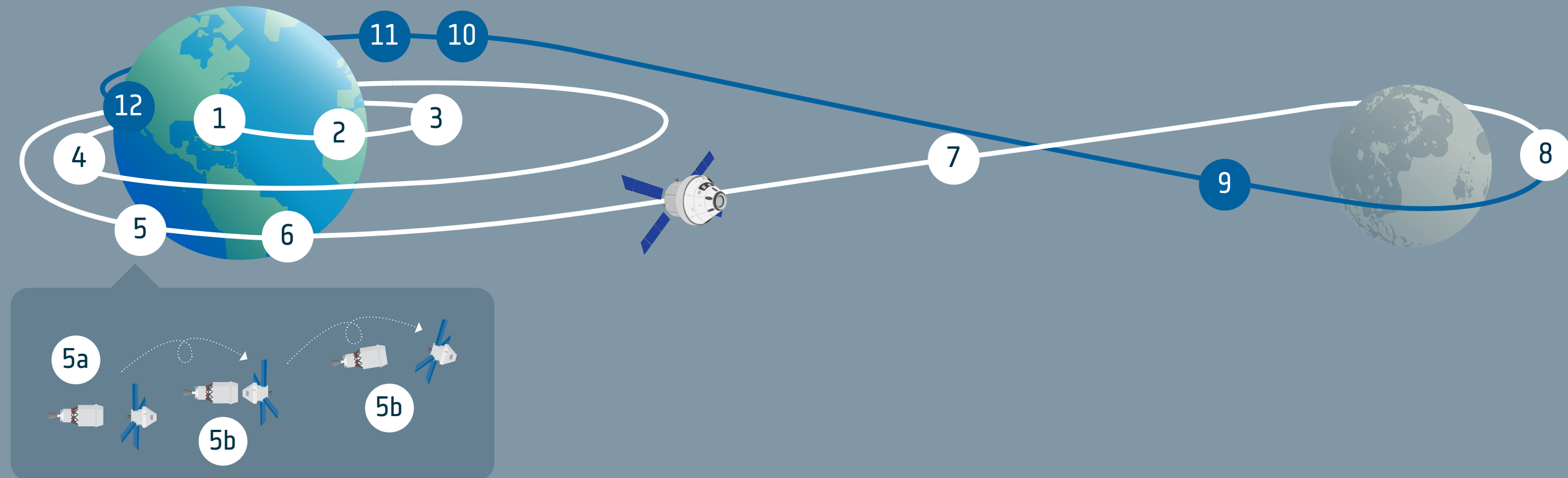
3



ORION

Artemis II mission step-by-step

- 1 **Liftoff**
Kennedy Space Center, Florida, USA
- 2 **Low Earth Orbit**
European Service Module deploys solar arrays
- 3 **Perigee raise manoeuvre**
Second stage propels Orion to a higher orbit
- 4 **Apogee raise burn**
Second burn to high Earth orbit for 23-hour system checkout
- 5 **Proximity operations demonstration**
5a Separation from second stage
5b Astronaut controls Orion to show capabilities
- 6 **Translunar injection**
Orion's European Service Module main engine fires to propel the spacecraft to the Moon



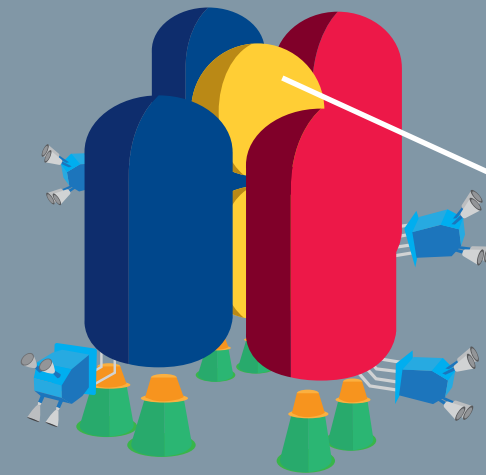
- 7 **Outbound coasting phase**
Four-day trip to lunar orbit with European Service Module correcting as necessary
- 8 **Lunar flyby**
7500 km from the Moon's surface
- 9 **Return to Earth**
Four-day trip with Return Trajectory Corrections supplied by Orion's European Service Module auxiliary engines
- 10 **Service Module separation**
European Service Module and Crew Module Adapter separate from Crew Module
- 11 **Crew Module reentry**
European Service Module and Crew Module Adapter burn up
- 12 **Splashdown**
Pacific Ocean

ORION

The European powerhouse

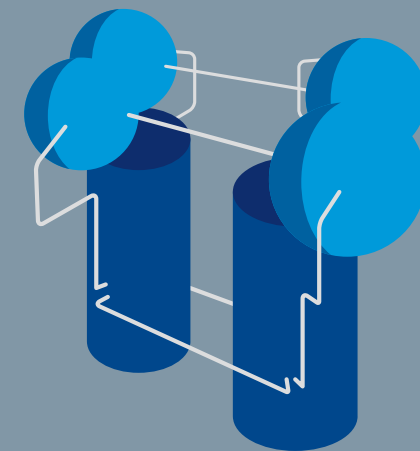
Propulsion system

Main engine has enough thrust to **lift a van on Earth**.
Four tanks hold 2000 litres of fuel, enough to fill **50 cars with fuel**.



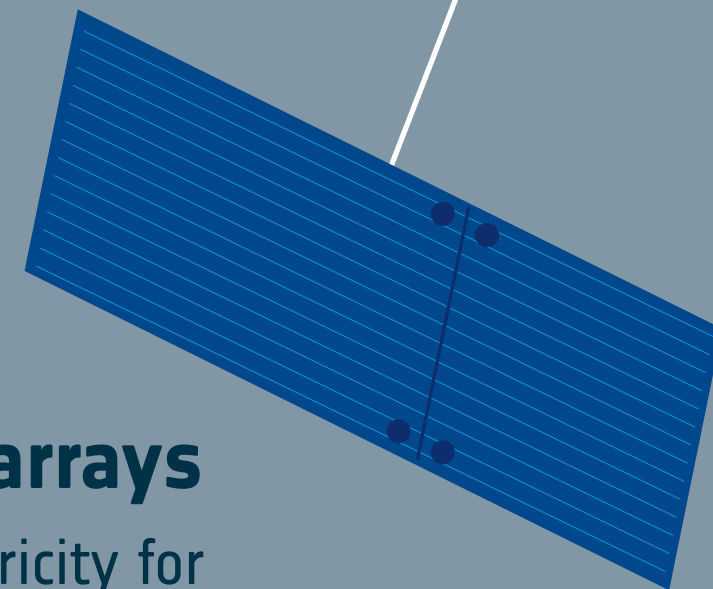
Consumables

Supplies enough water and air for up to **four astronauts** on a 20-day mission.



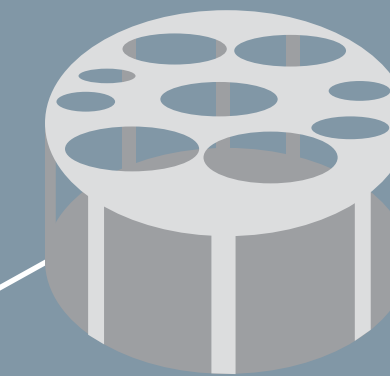
Solar arrays

Provides enough electricity for **two households**.



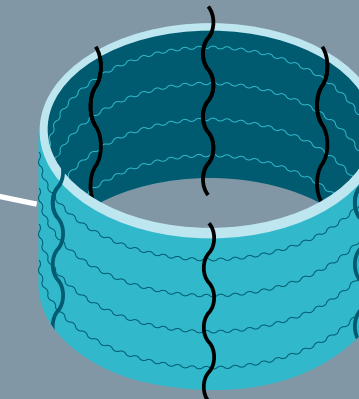
Structure

Like the chassis of a car, **the structure** holds everything together.



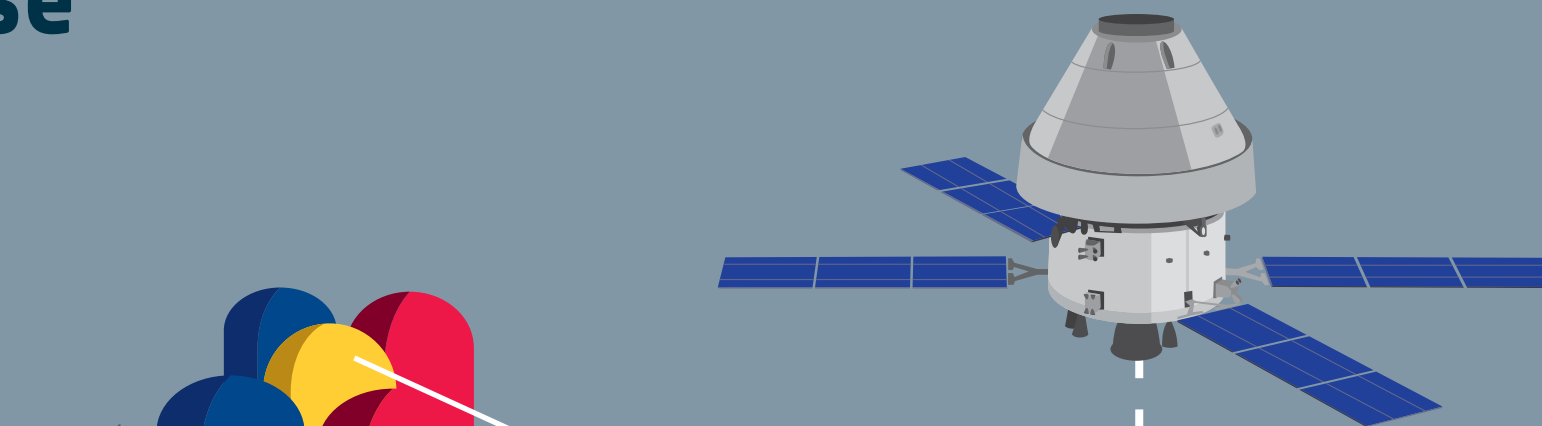
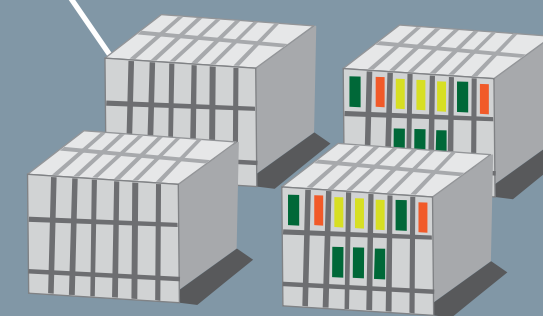
Thermal control system

Heaters and coolant pumped through six radiators keep Orion running warm despite space temperatures of **-75°C to +90°C**.



Avionics

The brain: computers control all aspects of the European Service Module.
Over **11 km of cables** to send commands and receive information from sensors.



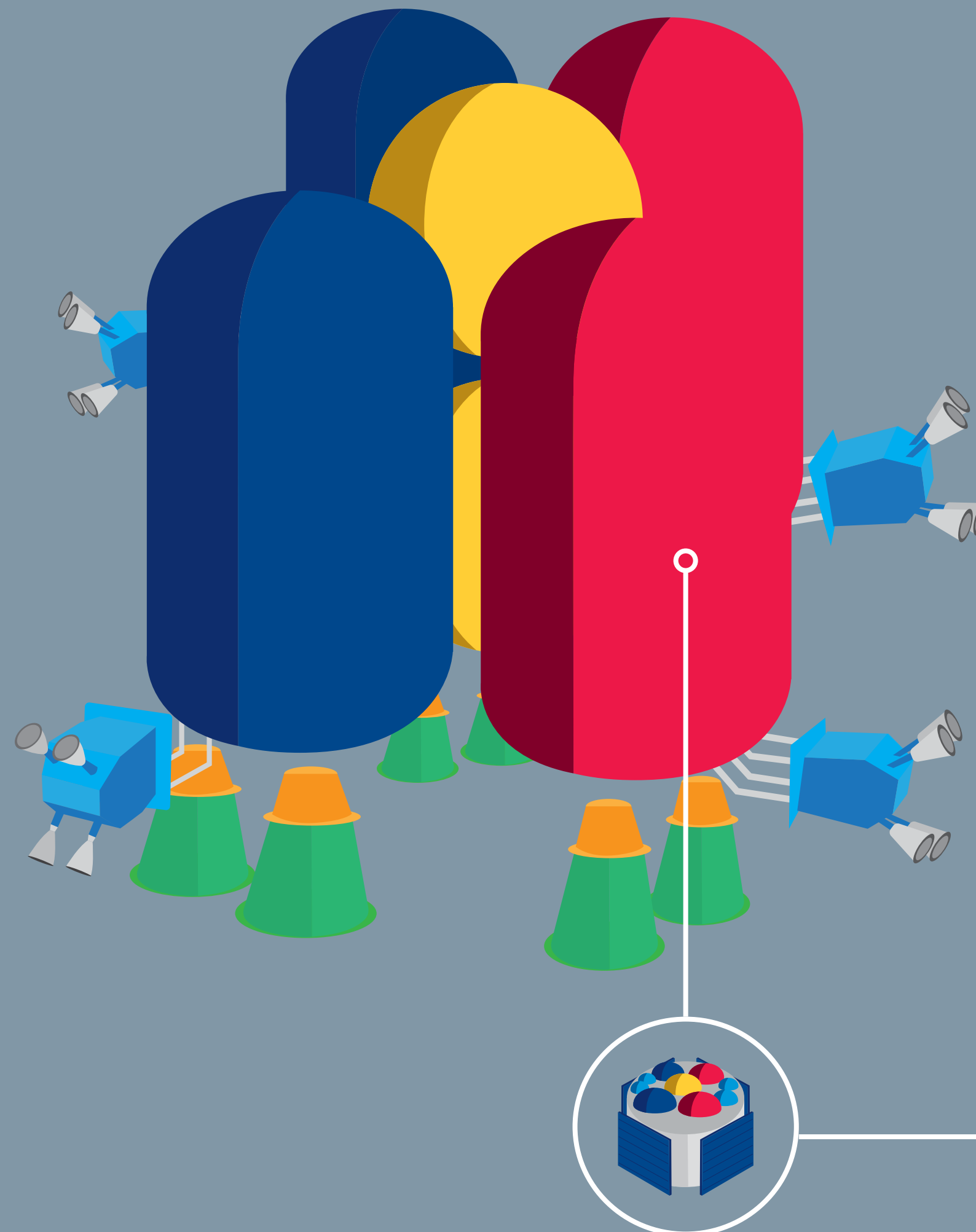
EUROPEAN SERVICE MODULE

Propulsion

Orion relies on the engines of ESA's European Service Module to navigate and orient itself in space. The engines can be fired individually to move the spacecraft and rotate it to any position.

33 engines, 3 types

- Main engine has enough thrust to **lift a van on Earth**
- Eight backup thrusters **can lift 50 kg** each on Earth
- **24 smaller engines** provide attitude control



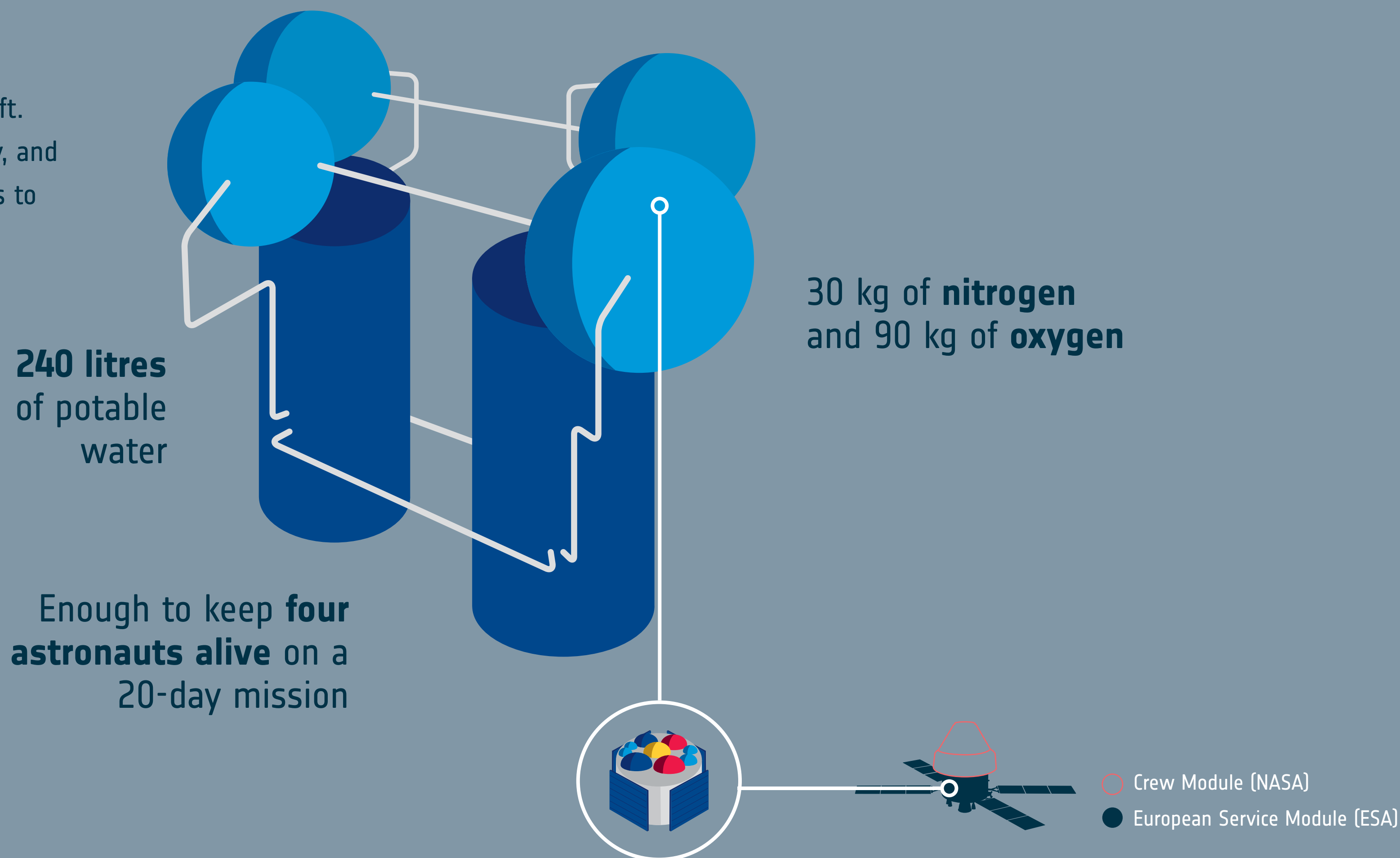
Fuel

- **Mixture:** MON oxidiser with MMH fuel
- Four tanks with **2000 l** capacity each
- **Helium tanks** push the fuel to the engines

EUROPEAN SERVICE MODULE

Air and water

The European Service Module provides air and water for the astronauts in the Orion spacecraft. The oxygen and nitrogen are stored separately, and mixed into the Crew Module for the astronauts to breathe.



EUROPEAN SERVICE MODULE

Power

Four solar arrays provide electrical power to Orion. Each wing is made of three panels. The solar array uses gallium arsenide cells that are more efficient, resistant and lightweight.

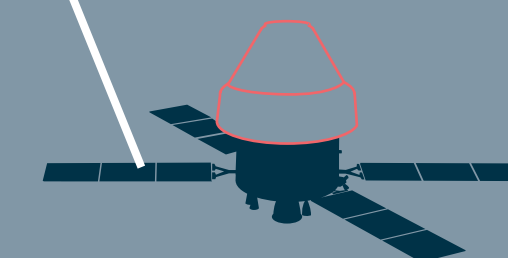
Provides more than **double the power** of ESA's cargo spacecraft

Wing length: **7 m**

Provides enough electricity for **two households: 11.2 kW**

Can swivel and rotate to **follow the Sun**

Solar array span: **19 m**



○ Crew Module (NASA)

● European Service Module (ESA)

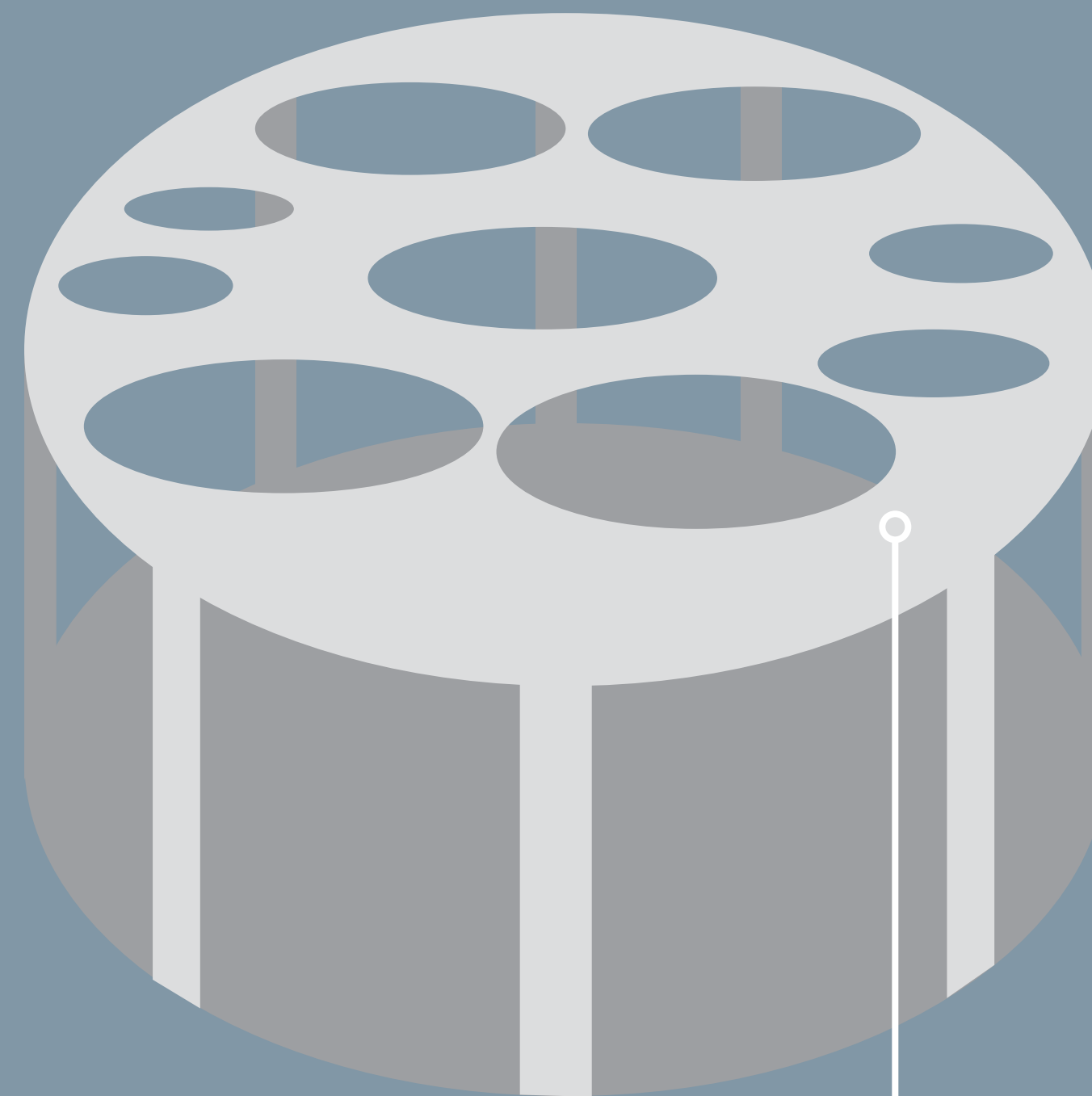
EUROPEAN SERVICE MODULE

Structure

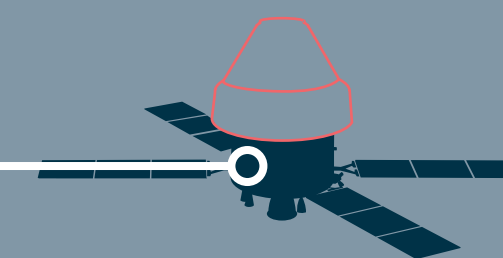
The European Service Module's structure is the backbone of the entire vehicle. The spacecraft withstands many stresses, from launch vibrations to temperature and pressure changes on its way to space.

Like the chassis of a car, the structure **holds everything together**

Covered with Kevlar to absorb shocks from micrometeorites and debris impacts



Absorbs vibrations from launch – similar to the thrust of 34 Jumbo Jets



○ Crew Module (NASA)
● European Service Module (ESA)

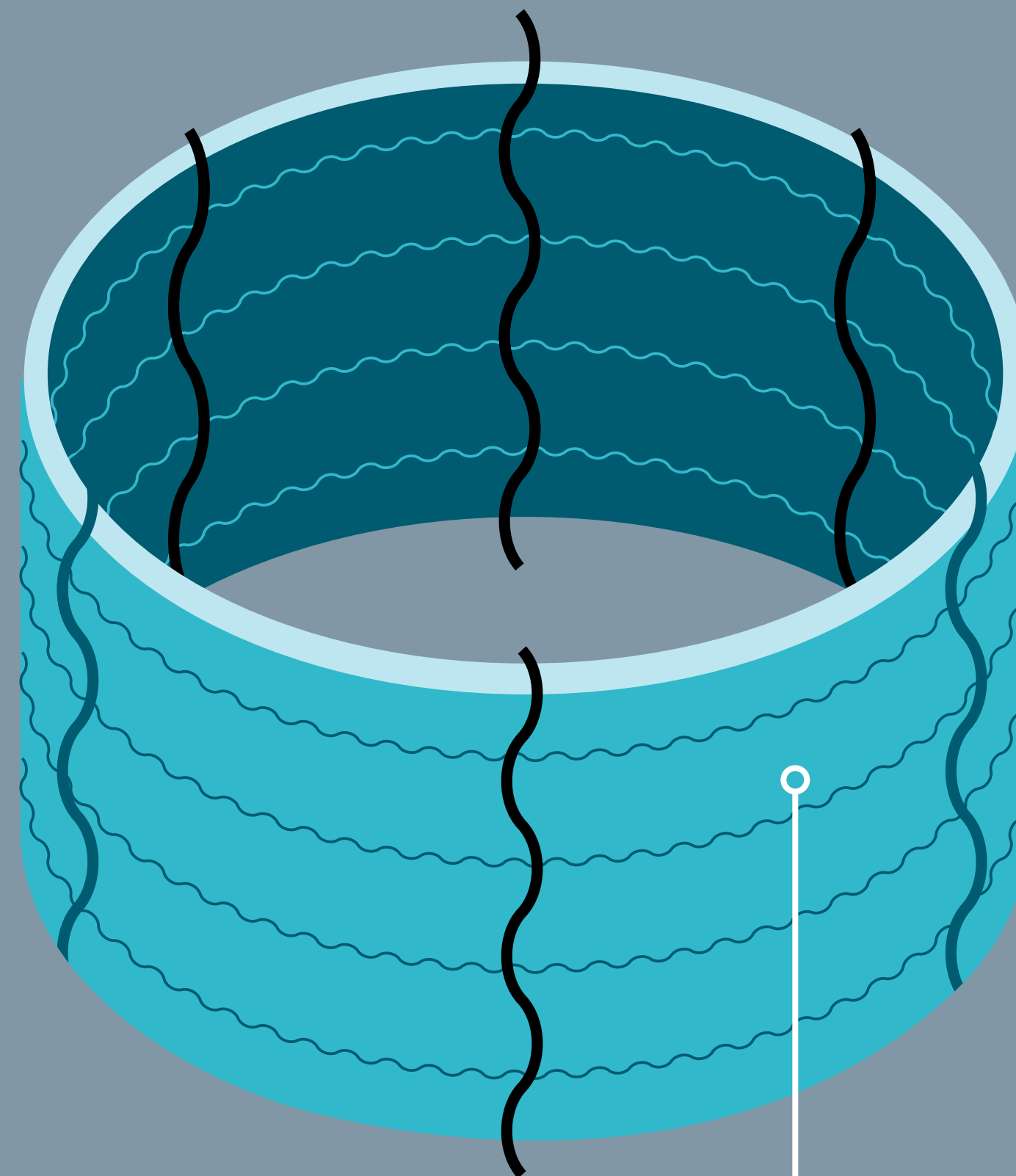
EUROPEAN SERVICE MODULE

Temperature control

Space is a harsh place with sharp changes in temperature. Radiators and heat exchangers control the temperature of the spacecraft to keep the astronauts comfortable and its equipment operating optimally.

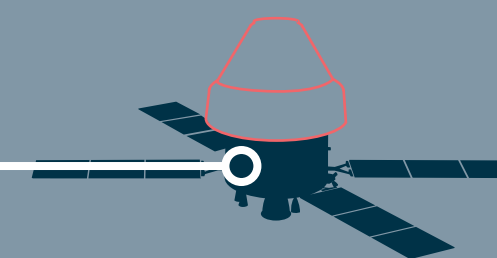
Six radiators
outside the Service
Module

Insulation:
multi-layer insulation
blankets



Coolant is **pumped** in a closed circuit, similar to a car

Coolant:
hydrofluoroether



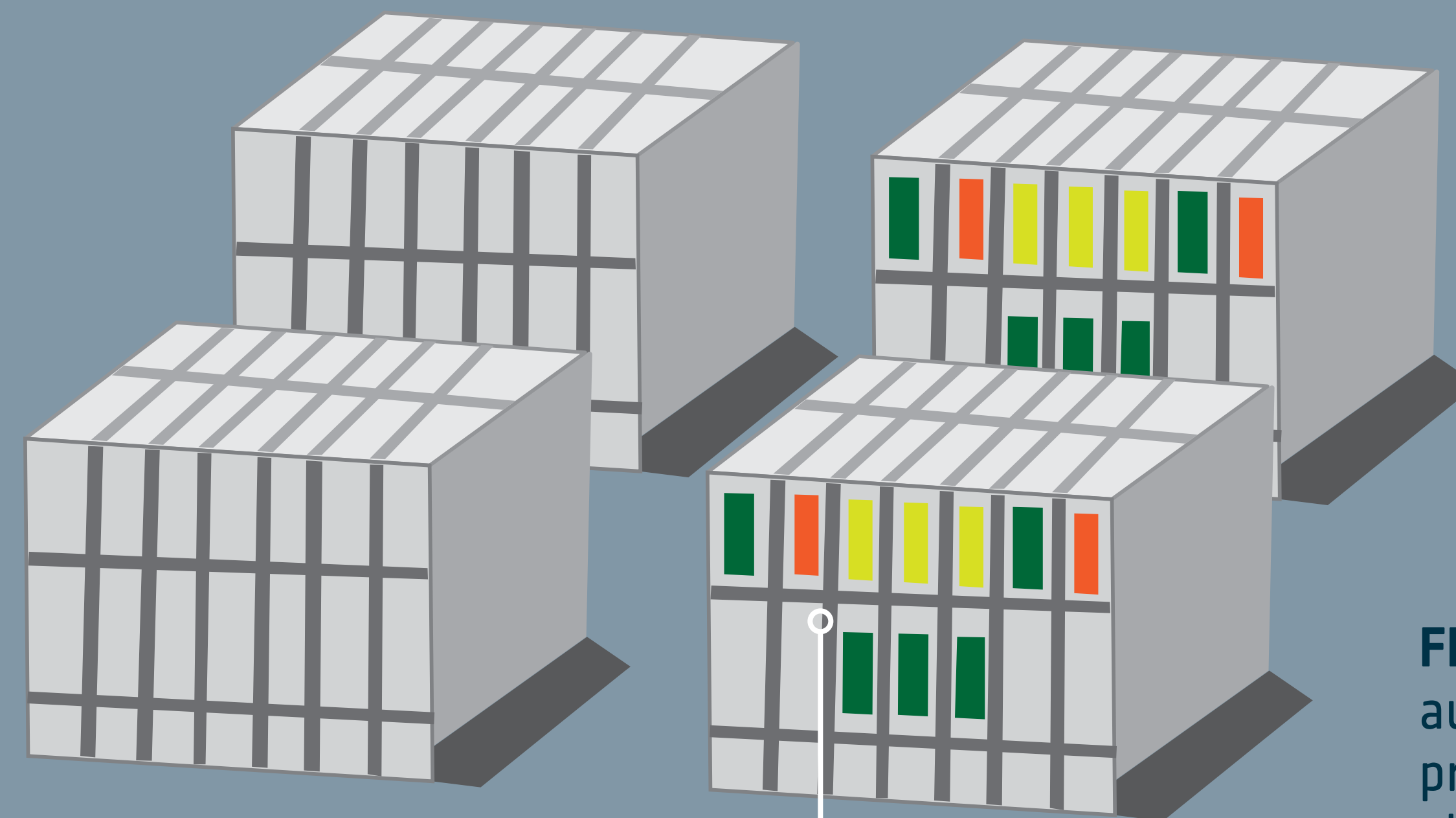
○ Crew Module (NASA)
● European Service Module (ESA)

EUROPEAN SERVICE MODULE

Avionics

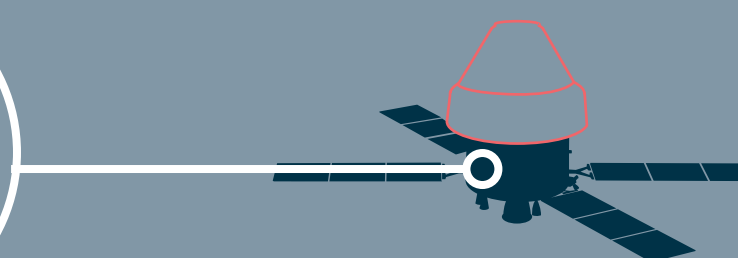
The European Service Module's brain combines the full automatic capabilities of an unmanned vehicle and human spacecraft safety requirements.

Computers
control all aspects
of the service
module.



Over 11 km of cables
send commands and
receive information from
sensors.

Fly-by-wire:
automatically regulates
propulsion, water,
electronics and
temperature.



○ Crew Module (NASA)
● European Service Module (ESA)

EUROPEAN SERVICE MODULE

An international collaboration

Germany ●

- Prime contractor
- European Service Module assembly integration and verification
- Propulsion and propulsion drive electronics
- Centralised parts procurement agent
- Data network harness for Qualification Module
- Reaction control thrusters

Italy ●

- Structure
- Thermal control system
- Consumable storage system
- Power control and distribution unit
- Photovoltaic assembly
- Meteoroid and debris protection system

USA ●

- Gas tank
- Valves, pressure regulators and pumps
- Data network harness for Flight Module
- Main and auxiliary engines
- Solar cells

France ●

- System tasks
- Avionics qualification
- Direct current harness
- Electronics
- Helium filters

Switzerland ●

- Secondary structure
- Solar array drive assembly
- Solar array simulator
- Mechanical ground support equipment

Belgium ●

- Tank bulkhead
- Electrical ground support equipment
- Pressure regulation units

Denmark ●

- Electronics
- Electrical ground support equipment

Sweden ●

- Propulsion Qualification Module integration

Norway ●

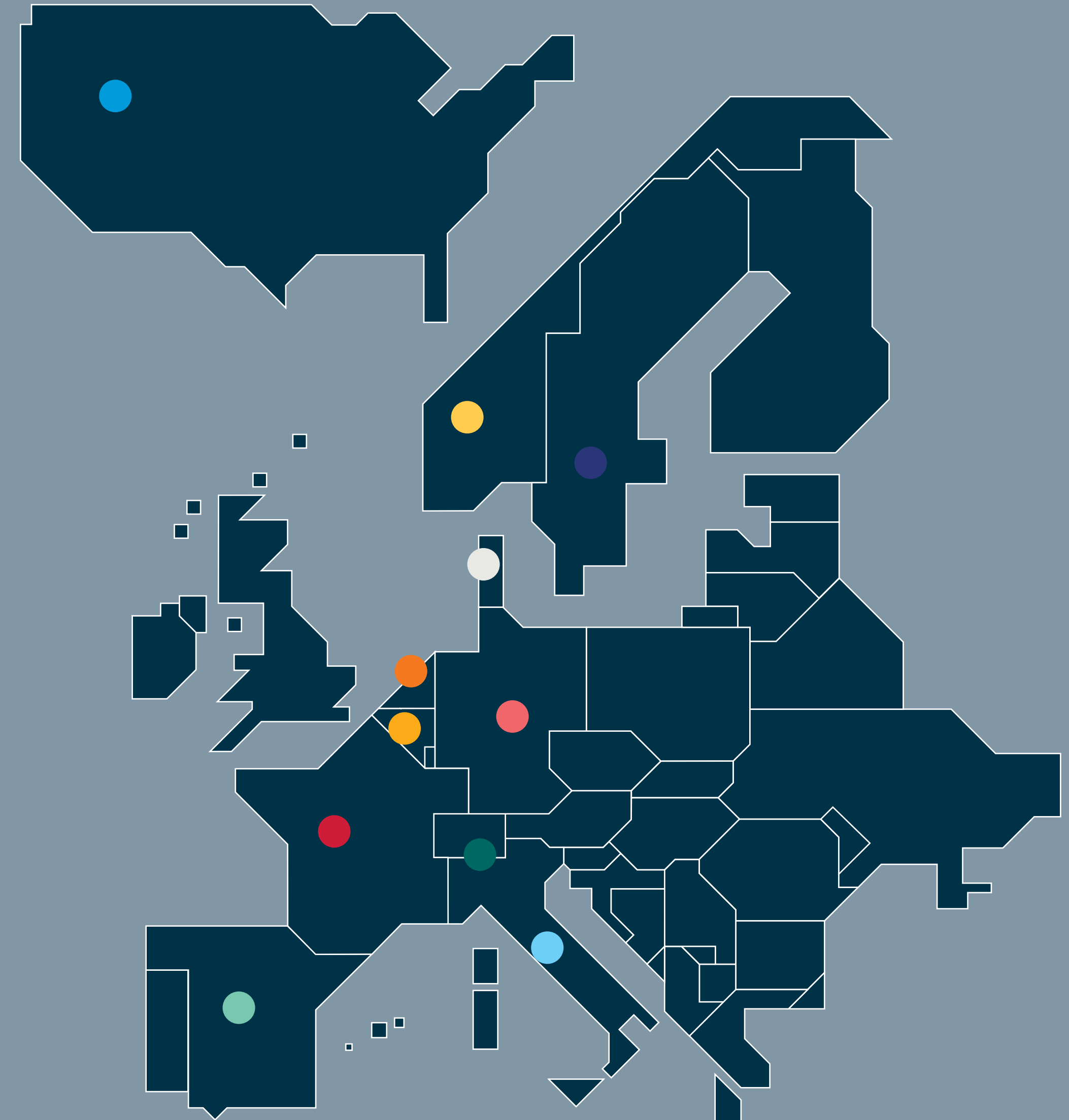
- Hydrophobic filter

The Netherlands ●

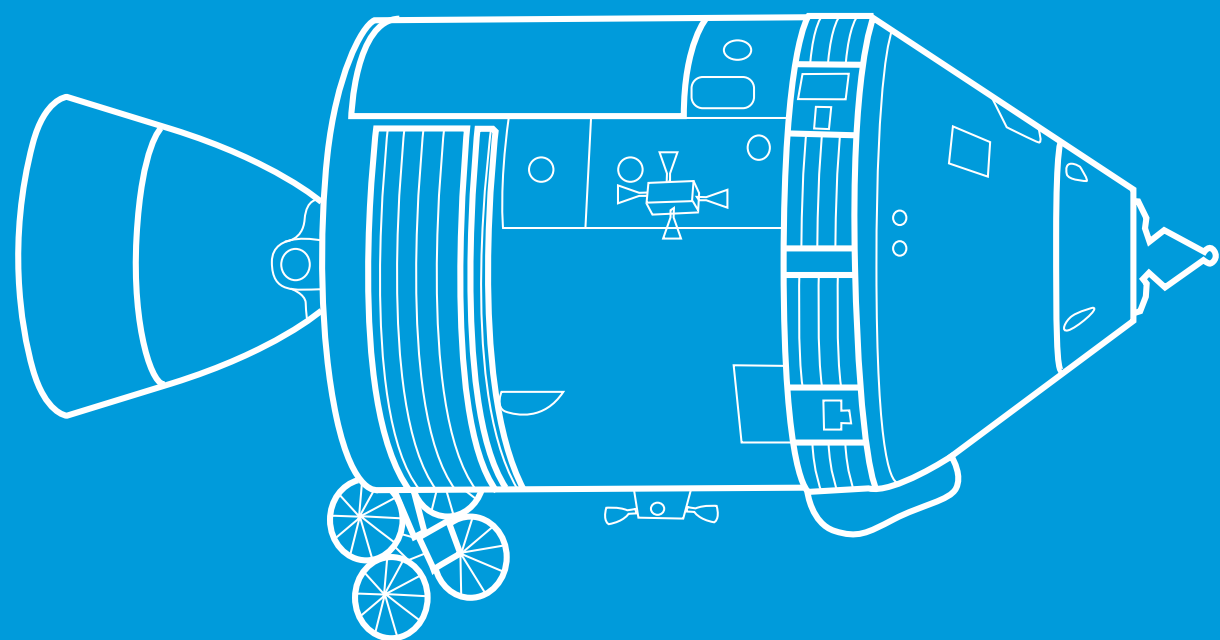
- Solar array wings

Spain ●

- Thermal control unit



APOLLO – AUTOMATED TRANSFER VEHICLE – ORION



Apollo

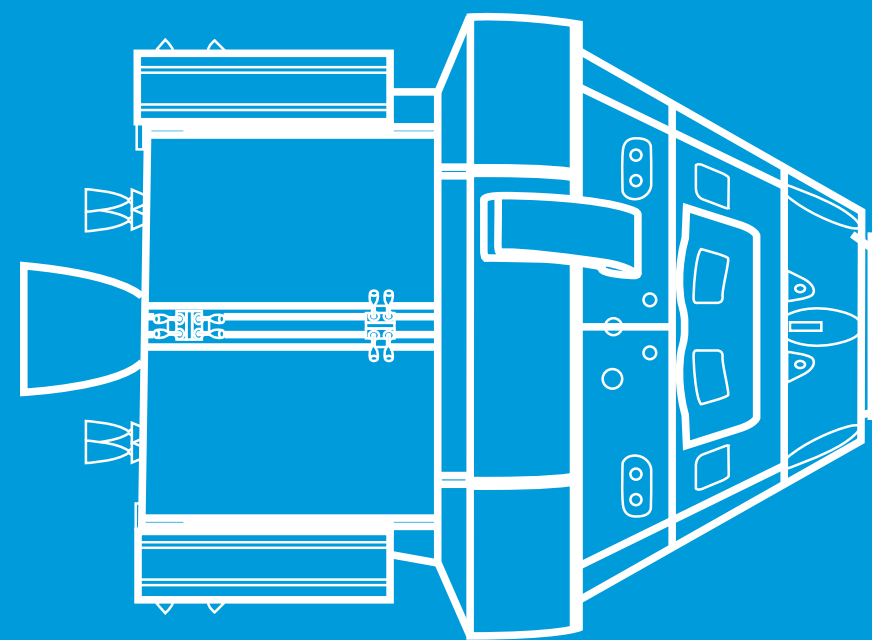
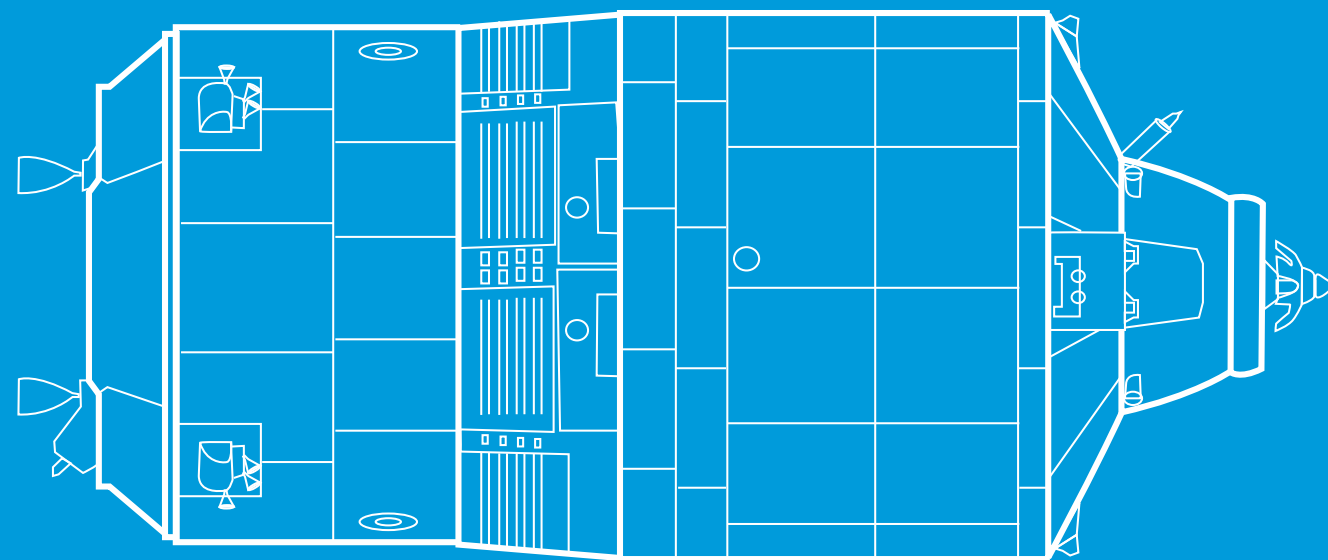
The Apollo spacecraft carried the first people to the Moon over 50 years ago. A complete lunar landing mission configuration was composed of the Apollo Command and Service Modules, plus a Lunar Module. The Command Module housed the crew and Service Module provided the propulsion for the lunar orbit insertion and trans-Earth burn for the return to Earth.

 3	 None	 USA
 9.9 m	 28 800	 14 days
 Fuel cells	 29	 400 171 km

Automated Transfer Vehicle

Five Automated Transfer Vehicles delivered more than 31 500 kg of supplies over the course of their missions to the International Space Station from 2008 to 2015. They boosted the Station to raise its orbit numerous times and similarly moved it out of the way of space debris

 0	 22.3 m	 10 European countries
 10.7 m	 20 750	 6 months
 Solar arrays	 32	 400 km



Orion

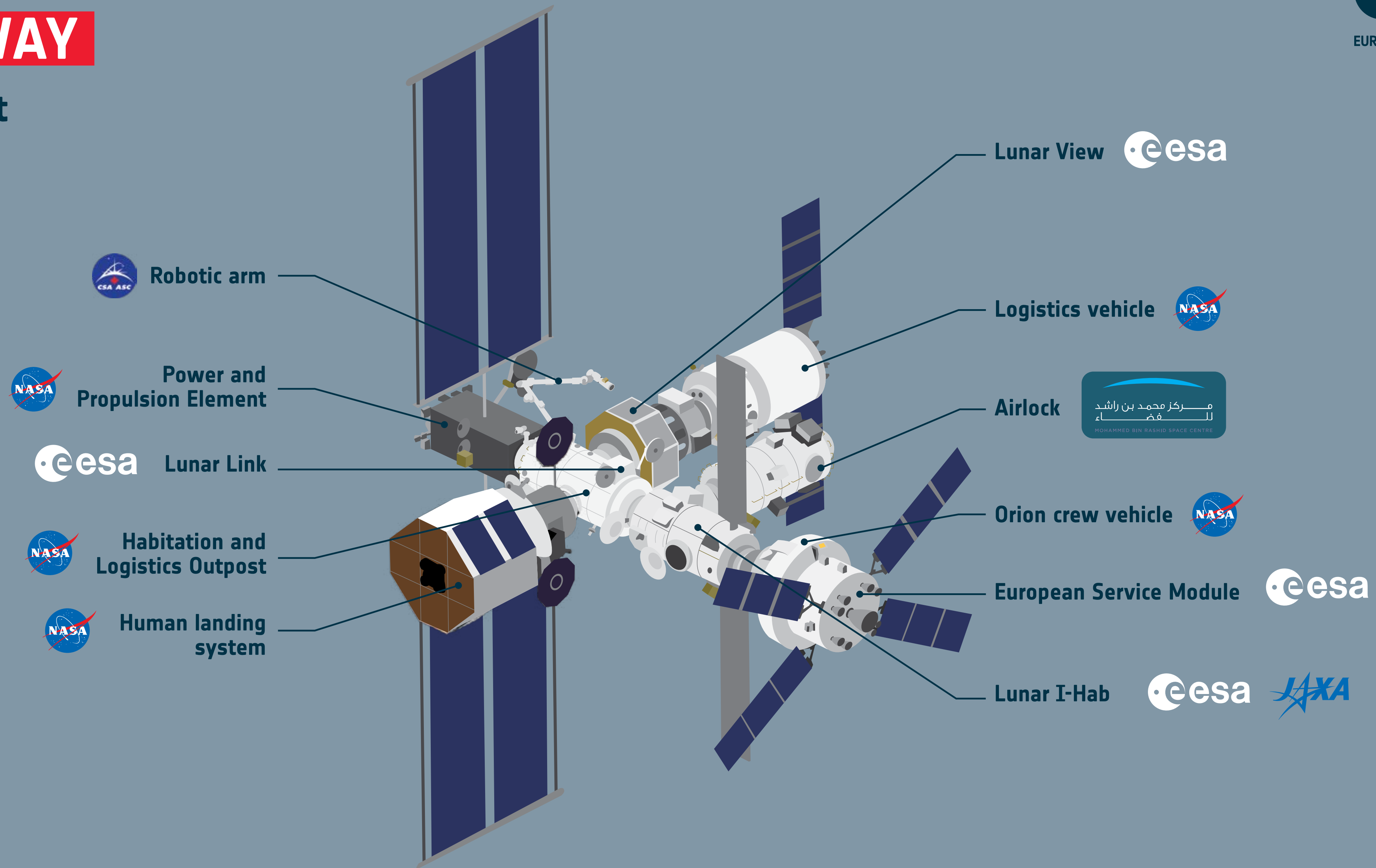
Orion is NASA's next spacecraft to send humans into deep space. It is designed to send astronauts farther into space than ever before, beyond the Moon and to asteroids. ESA has designed and is overseeing the development of the European Service Module, the part of the spacecraft that supplies air, electricity and propulsion.

 4	 19 m	 USA and 10 European countries
 7.3 m	 33 446	 21 days
 Solar arrays	 33	 500 000 km

 Crew	 Solar wing span	 Country	 Length	 Launch weight	 Mission length	 Power	 Engines	 Distance traveled from Earth
--	---	---	--	--	--	---	---	--

GATEWAY

The concept



GATEWAY

Lunar I-Hab

Where

Lunar orbit

What

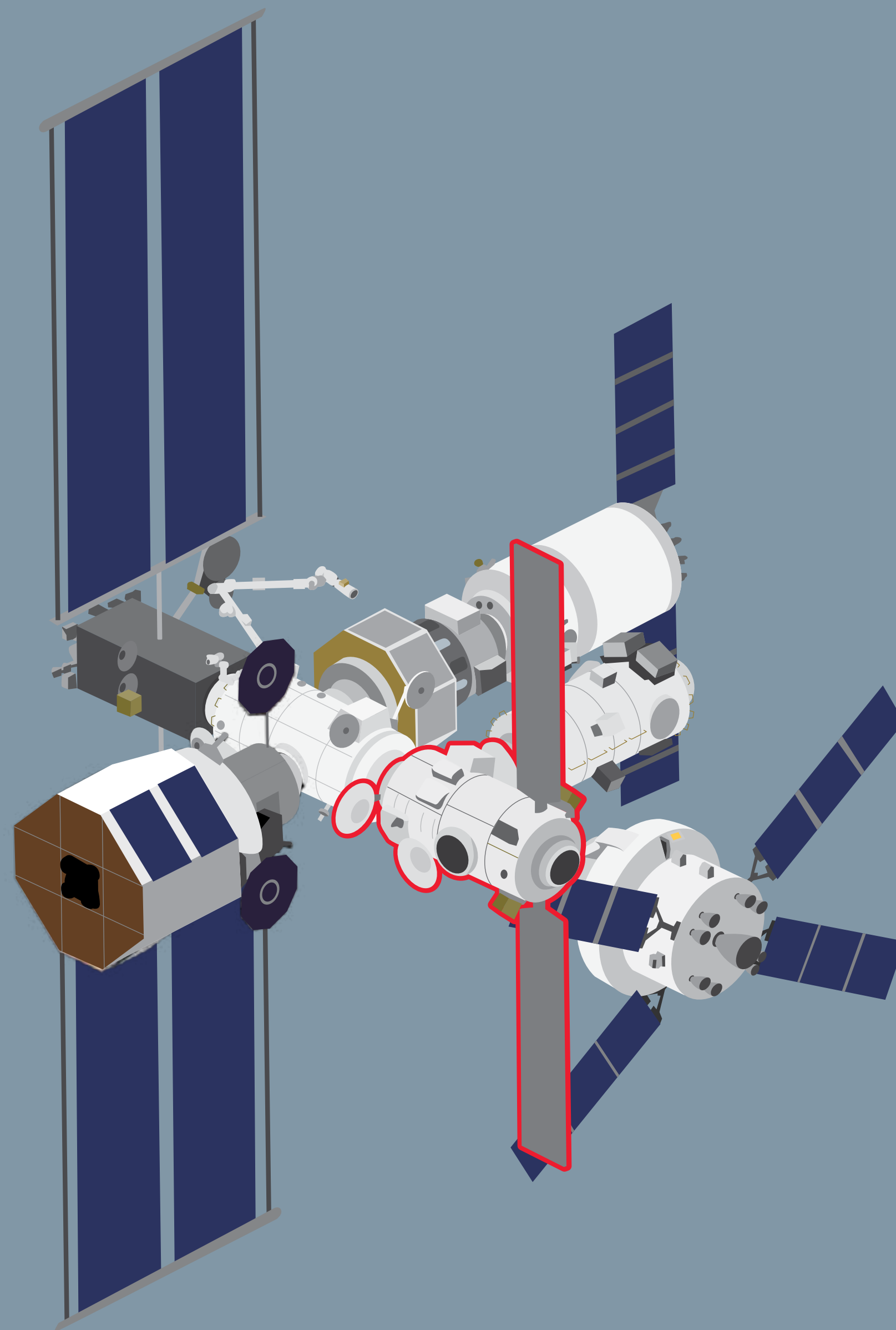
Lunar I-Hab will provide living quarters for astronauts and two docking ports for visiting vehicles

Who

Prime contractor:
Thales Alenia Space, Italy

When

Artemis IV



GATEWAY

Lunar View

Where

Lunar orbit

What

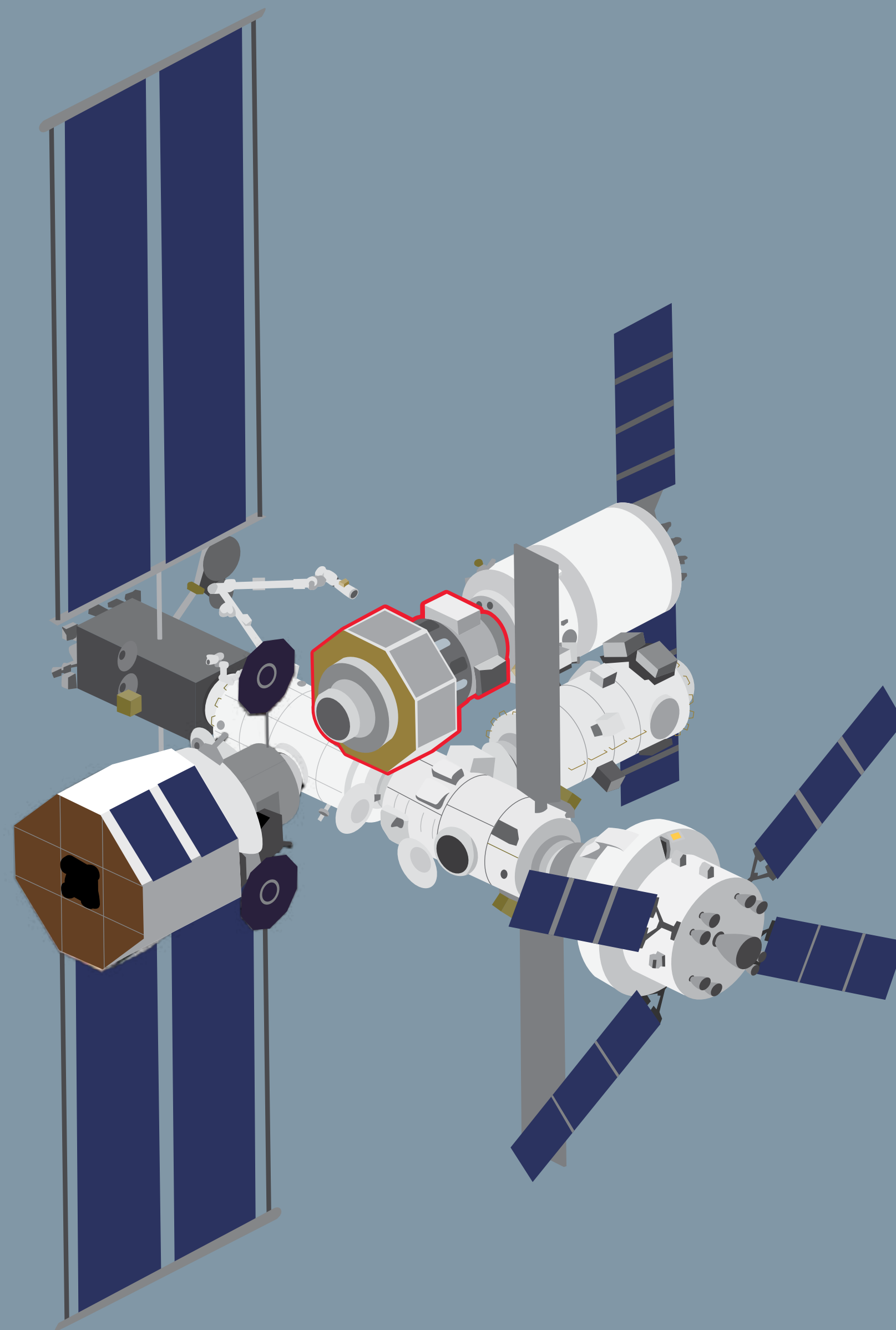
Lunar View will provide refuelling capabilities, cargo storage and windows to view space and the Moon

Who

Prime contractor:
Thales Alenia Space, France

When

Artemis V



GATEWAY

Lunar Link

Where

Lunar orbit

What

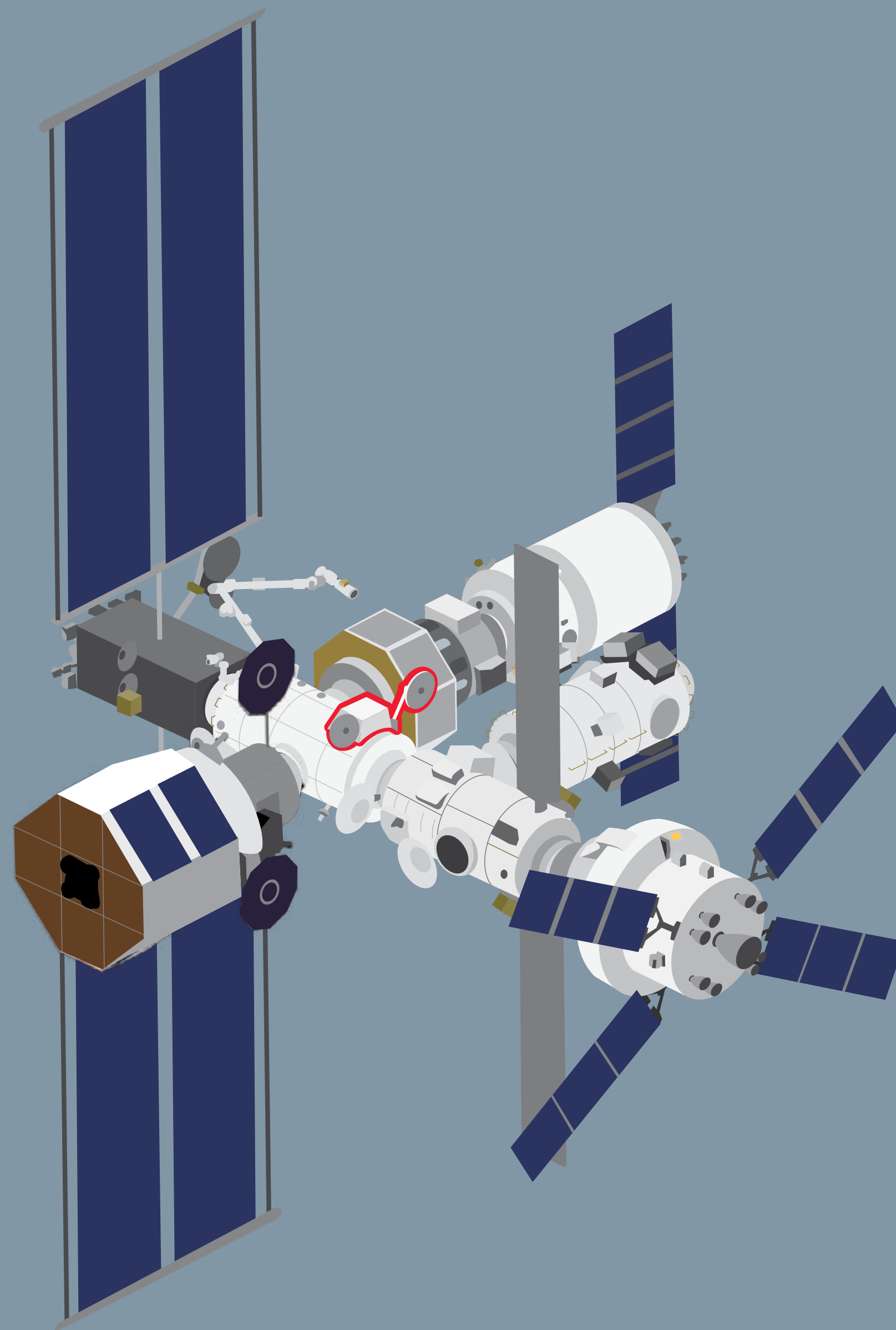
Lunar Link will enable communication between the Gateway and assets on and around the Moon such as rovers, human landers and satellites

Who

Prime contractor:
Thales Alenia Space, France

When

2027



MEDIA SERVICE



www.esa.int
www.esa.int/spaceflight



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[europeanspaceagency](https://www.instagram.com/europeanspaceagency)



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WEBSITES



Orion



Orion blog



Argonaut



Gateway



EUROPEAN SPACE AGENCY

Established in 1975, ESA now has 23 Member States and cooperates with many others. These countries are home to more than 500 million European citizens. If you're one of them, then we're working for you.

Our mission is the peaceful exploration and use of space for the benefit of everyone. We watch over Earth, develop and launch inspiring and unique space projects, fly astronauts and push the boundaries of science and technology, seeking answers to the big questions about the Universe.

We are a family of scientists, engineers and business professionals from all over Europe, working together in a diverse and multinational environment.

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