

# THE SPACECRAFT



Orion



3 crew members

~39 crew days consumable

Fuel Cell Powered (~14day max lifetime)



#### Command Module

Height 10'7" (3.2m)

Diameter 12'10" (3.9 m)

Habitable Volume 210ft³ (5.9m³)

Launch Weight 12,392 lbm (5,621 kg)

Landing Weight 10,977 lbm (4,979 kg)

#### **Service Module**

Height 22'7" (6.9 m)

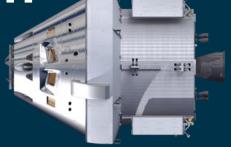
Diameter 12'10" (3.9 m)

Launch Weight 51,258 lbm (23,250 kg)

#### Performance

#### Crew

Habitable Volume 70 ft³/person (2.0m³)
Mission Support 14 days/3 crew
Power Source Fuel Cells



#### **Crew Module**

 Height
 10'10" (3.3 m)

 Diameter
 16'5" (5 m)

 Habitable Volume
 314ft³ (8.9m³)

 Launch Weight
 22,900 lbm (10,387 kg)

 Landing Weight
 20,400 lbm (9,253 kg)

#### **Service Module**

Height 16' (4.9 m)
Diameter 13'5" (4.1 m)
Launch Weight 34,085 lbm (15,461 kg)

#### Performance

#### Crew

Habitable Volume 78.5 ft³/person (2.2m³)
Mission Support 21 days/4 crew
Power Source Solar Arrays

# Orion

4 crew members

~84 crew days consumables

Solar Array Powered

Transition from minimal mission durations to long-duration and flexibility in cislunar operations

# **EUROPEAN Service Module**

# esa

### Germany

- · Prime Contractor
- European Service Module Assembly Integration & Verification
- · Propulsion and Propulsion Drive Electronics
- Centralised Parts Procurement Agent
- · On Board Data Network Harness for Qualification Module

# Italy

- Structure
- Thermal Control System
- Consumable Storage System
- Power Control and Distribution Unit
- · Photovoltaic Assembly
- Meteoroid and Debris Protection System

#### **Switzerland**

- Secondary Structure
- Solar Array Drive Assembly
- · Solar Array Simulator
- Mechanical Ground Support Equipment

### USA

- · Gas Tank
- Valves
- On Board Data Network Harness for Flight Module

# France

- System Tasks
- · Avionics qualification
- Direct Current Harness
- · Front End Electronics
- · Helium Filters

## **Belgium**

- · Tank Bulkhead
- Electrical Ground Support Equipment
- Pressure Regulation Units

### Sweden

 Propulsion Qualification Module Integration

#### Denmark

- Front End Electronics
- Electrical Ground Support Equipment

### Norway

Hydrophobic Filter

## Spain

· Thermal Control Unit

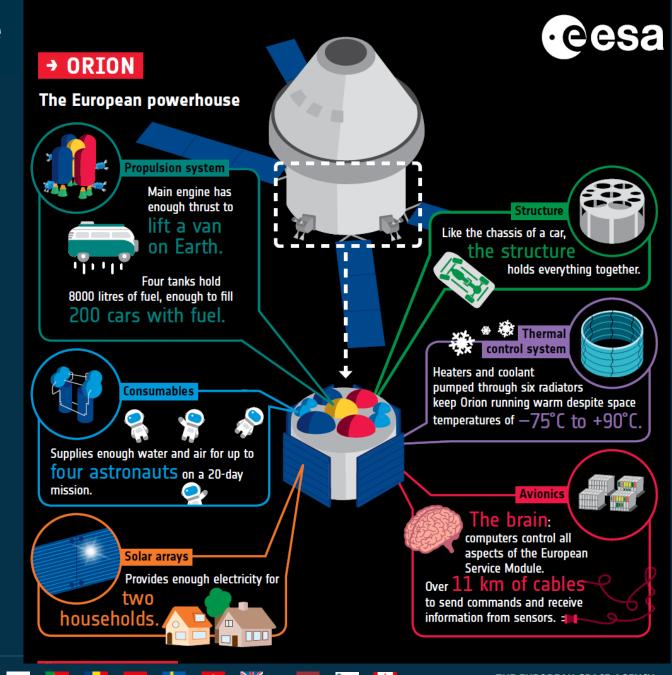
## The Netherlands

Solar Array Wings



# The European Service Module

- Power: 4 x 7m long solar array wings (double the power than ATV)
- Propulsion:
  - 33 Engines: 1 main engine + 8 AUX + 24 RCS thrusters
  - Propellant tanks + Helium
- Air & Water: 3litre/day water + 1kg of air.
  - 4 water tanks provide 240 kg of potable water.
  - gas: 1 nitrogen tank (30 kg) + 3 oxygen tanks (90 kg)
- Thermal control: radiators
- Avionics: computers and electronics
- Structure: to hold propulsion and consumable tanks, and provide robustness to the spacecraft.



# The European Service Module

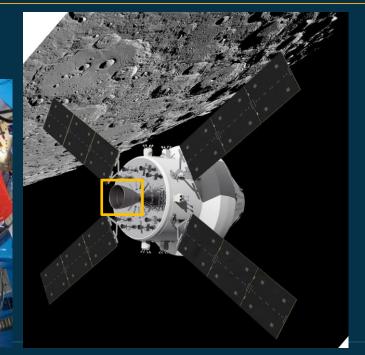
- OMS-E: Orbital Orbital Maneuvering System Engine (OMS-E) from the Space Shuttle
- 8 Auxiliary engines, same as used on ATV
  - Trajectory correction manoeuvres
  - Back-up to the main engine

 24 RCS thrusters which are the same as used on ATV (220 N) provide the impulse necessary for translation and attitude control manoeuvres.

ESM1 OMS-E flew on the shuttle Challenger,
Discovery and Atlantis. Its first launch was on the STS-41G mission in
October 1984, and its last shuttle mission was STS-112 in October 2002.



**OMS-E: Orbital Manoeuvring System Engine** 



# **Preparing for launch**













The First Uncrewed Integrated Flight Test of NASA's Orion Spacecraft and Space Launch System Rocket

# **Moon to Mars Planning Manifest**



CY	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
ESDMD-Led  Commercial Launch	Artemis I Uncrewed Flight Test  10 CubeSats • 4 ESDMD • 2 SMD • 1 STMD • 3 International	mmunications Network Upg	Artemis II Crewed Flight Test  SpaceX Uncrewed Lunar Demo  PPE/HALO Launch	xEVA Surface Suits ready for integration  SpaceX Crewed Lunar Demo  Science Payloads HERMES – SMD ERSA – ESA IDA – ESAVJAXA  Lunar Relay (SOMD)		Artemis IV I-Hab delivered to Gateway  SLS Block 1B  Mobile Launcher 2	Artemis V  ESPRIT delivered to Gateway  Deep Space Logistics  TBD Human Lander  Lunar Terrain Vehicle ready for surface operations	Artemis VI Airlock delivered to Gateway  Deep Space Logistics  TBD Human Lander	Deep Space Logistics  TBD Human Lander  Pressurized Rover via Cargo Lander	Deep Space Logistics  TBD Human Lander  Surface Logistics  Surface Habitat
SMD-Led  CLPS uses commercial launches.  CLPS include multiple payloads from multiple directorates	2-IM	VIPER AND PRIME-1 19C 20A	The second secon	Artemis Surface Science Instruments  ESA Lunar Pathfinder delivered for launch  P-12 CS-3 CP-21 CP-2	22 CP-31 CP-32 CT-1	MSR Earth-Return Orbiter (ESA) CP-41 CP-42	Artemis Surface Science Instruments LTV Instruments MSR Lander: Sample Fetch Rover MSR Lander: Mars Ascent Vehicle CP-51 CP-52 LTV	Instruments	MSR ars Ascent Vehicle launch	
STMD-Led All Commercial Launches	CAPSTONE Preliminary Nuclear Thermal Propulsion reactor design	Polar Resources Ice Mining Experiment (PRIME-1) IM Deployable Hopper Nokia 4G/LTE Lunar Comm	SEP Qual	· SPLIĈ	- 18 - 18 - 19 - 19 - 19 - 19	SRU Subscale Demo SRU Pilot Excavator (IPE) fertical Solar Array Technology (V tegenerative Fuel Cell Power Vireless Charging for Lunar Surfa unar Surface Scaled Construction Tech	delivered for s	yer ISRU (LADI)	ISRU Pilot Plant delivered for launch	7