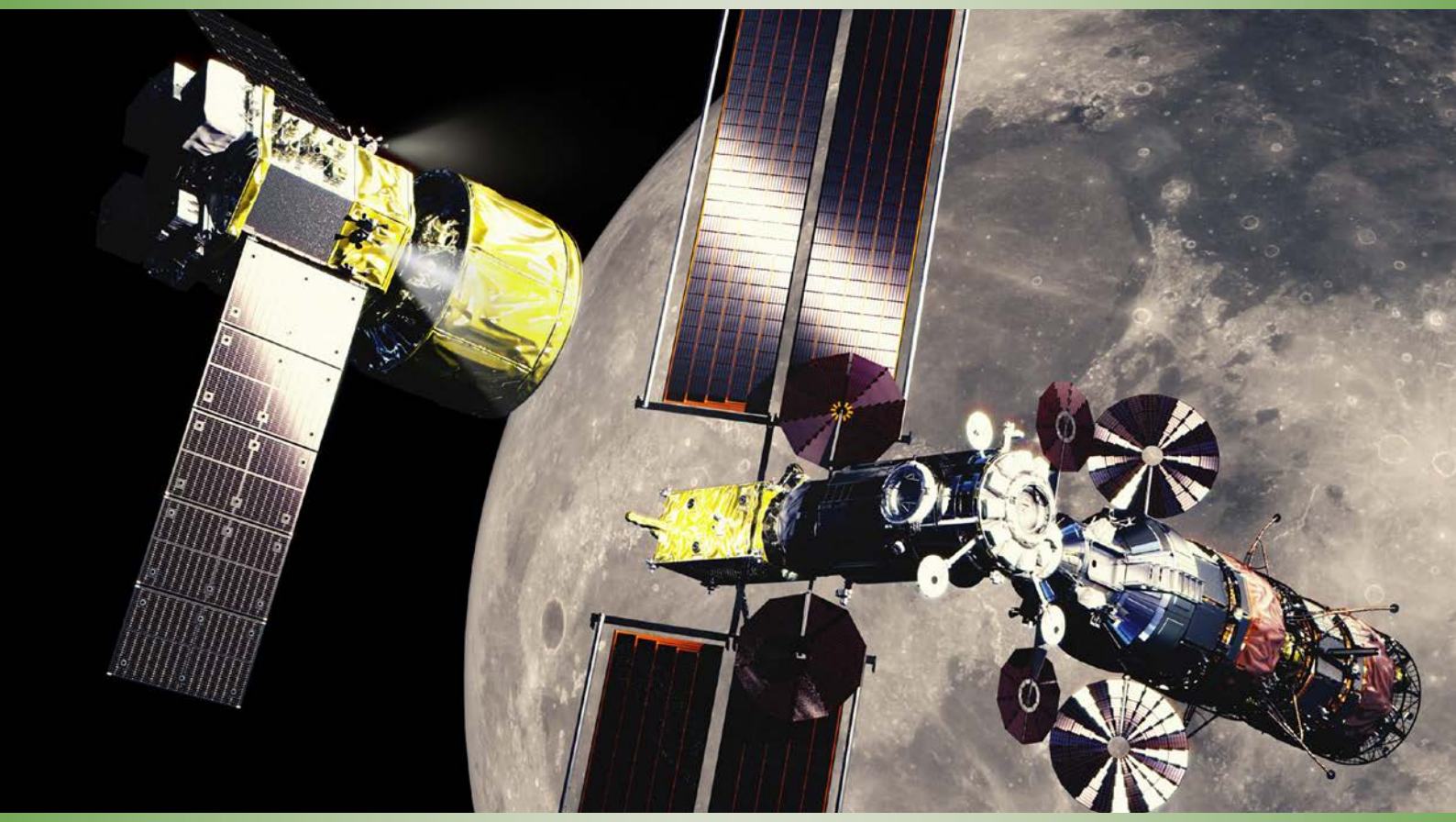
G-HAB

Lunar Gateway Habitation Project Team



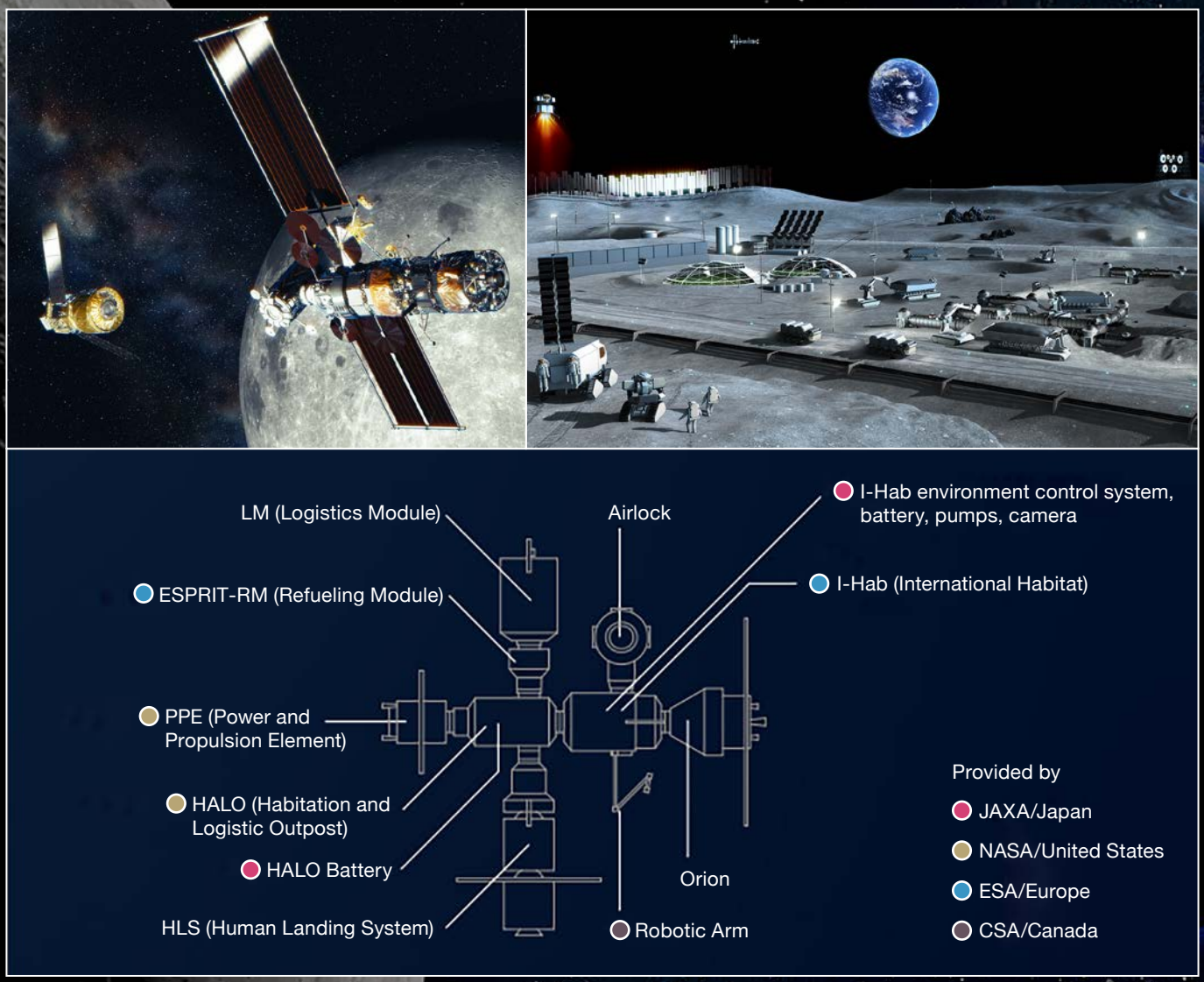
Japan Aerospace Exploration Agency

Lunar Gateway Habitation Project Team

Japan is participating in the Gateway Program to construct a new crewed space station in lunar orbit, utilizing experience and technologies developed through human spaceflight activities for the International Space Station (ISS) including Japanese Experiment Module called “KIBO” and cargo transfer vehicle, HTV called "KOUNOTORI".

Japan is responsible for providing habitation capabilities such as environmental control functions in the International Habitat (I-Hab) essential for crew life, and will provide equipment to control air circulation, air pressure, oxygen supply, temperature, and humidity, as well as carbon dioxide and harmful gas removal.

In addition, Japan will provide batteries for the Gateway (I-Hab and Habitation Logistic Outpost (HALO)), cameras inside and outside the I-Hab, and pumps for circulating refrigerant to cool I-Hab equipment.



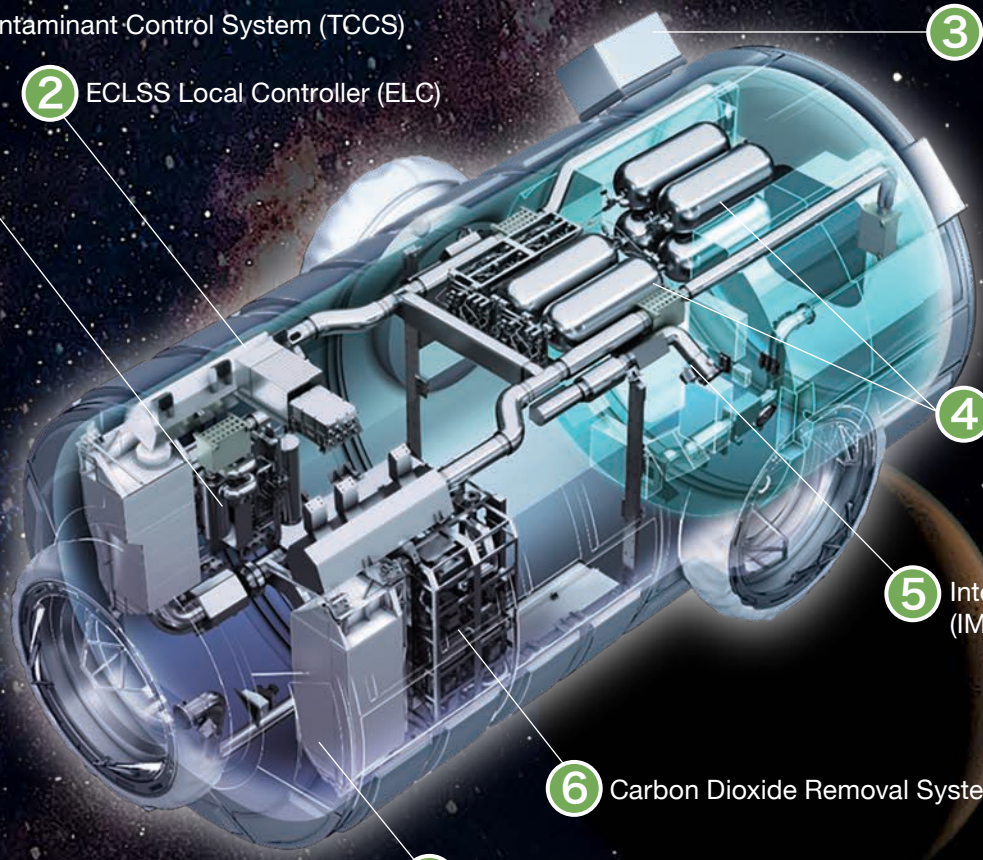
Upper left: Gateway (right) and Gateway Logistic Module (left, HTV-X image).
Upper right: artist image of Moon base
Lower: Gateway Responsibilities

Gateway’s Objective and Japan’s Participation

Under the U.S.-led international space exploration program, "Artemis Program", Gateway, crewed space station orbiting the Moon, will serve as a staging point for sustained lunar exploration activities. Many of space agencies participating in the ISS program are involved and share the responsibilities to develop modules and components. Once in orbit, Gateway will accommodate four astronauts for about 30 days per year and is expected to be utilized as a base for crewed exploration of Mars.

In addition to the contents described at the top of this page, which will eventually assist future crewed exploration and development of technologies on the ground, Japan is also responsible for transporting research equipment and tools (extravehicular activity suits and research tools) required for lunar activities as well as supplies to support astronauts including food and clothing, by providing a Gateway resupply vehicle.

Japan's responsibilities in the International Habitation Module (I-Hab)



① Trace Contaminant Control System (TCCS)

Regenerates air by removing traces of toxic gases such as ammonia, methane, aldehydes, and alcohols generated by the human bodies and onboard equipment, keeping 18 gases below the maximum concentrations allowed in the cabin.

② ECLSS Local Controller (ELC)

Receives commands from the Gateway system and from the ground and/or astronauts and gives instructions to devices necessary for environmental control. It also collects data such as pressure and temperature from each device and transmits the data to the Gateway system and to the ground.

③ I-Hab Battery

Utilizing the highly reliable battery technology acquired through the Japanese participation to the ISS program, JAXA will provide lithium-ion batteries using 190A h cells (JMG190), which are the same type of JAXA certified batteries used in the HTV-X. The battery provided to HALO is also a JAXA-developed product using the JMG190.

④ Pressure Control System (PCS)

Uses nitrogen and oxygen to control and maintain the pressure inside the cabin and the partial pressure of oxygen within a comfortable range for astronauts.

⑤ Inter-Module Ventilator (IMV) Assembly Parts

Exchange or shut off cabin air between I-Hab and the modules or space vehicles which will be mated with I-Hab, as in HALO and Orion. In addition to fans and valves, IMV Assembly Parts consist of HEPA filters and silencers to reduce fan noise.

⑥ Carbon Dioxide Removal System (CDRS)

Removes carbon dioxide (CO_2) emitted by astronauts. The system uses two alternating dehumidification cylinders to remove moisture from the air and two adsorption cylinders to remove CO_2.

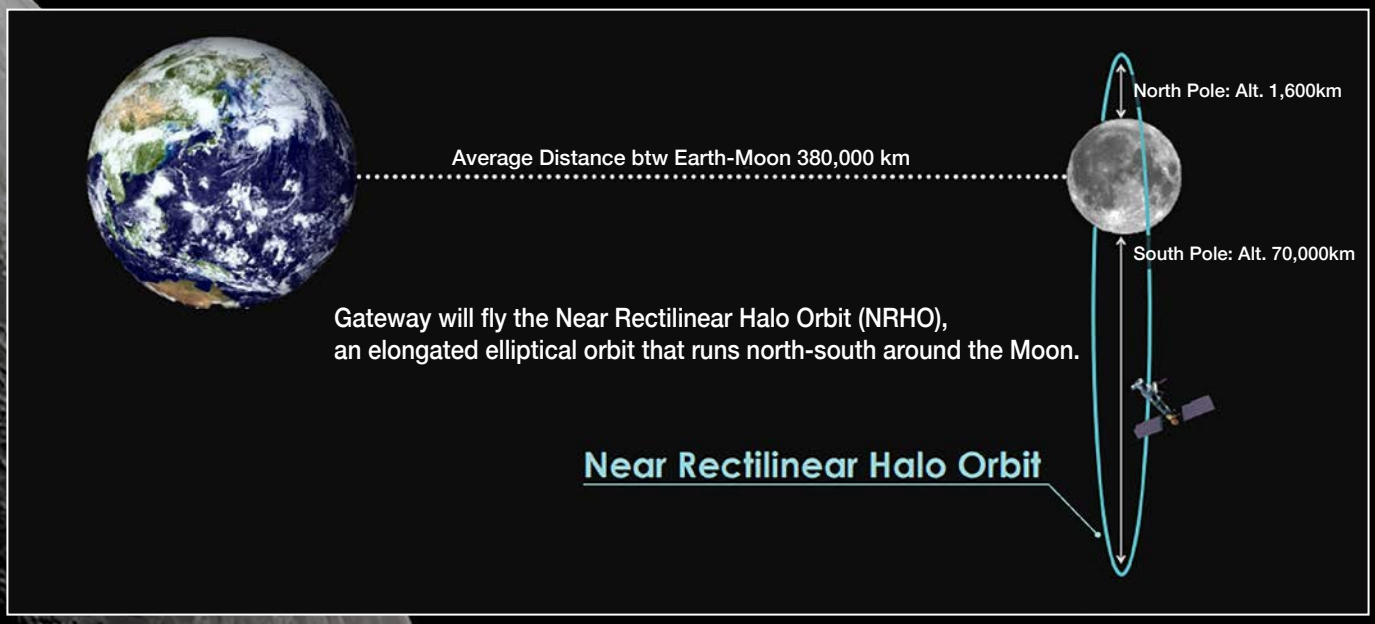
⑦ Temperature and Humidity Control (THC)

Controls the temperature and humidity of the air in the I-Hab cabin where astronauts work. It also provides appropriate air velocity distribution, circulates air, and removes particulates and microorganisms from the air.

JAXA also provides cameras inside and outside I-Hab and refrigerant circulation pumps to cool equipment.

Gateway Operation

■ Gateway orbit: NRHO



The NRHO is considered to have advantages below:

- ✓ Communication with the ground can be secured all the time as the orbit is always visible from Earth.
- ✓ The energy required to reach the NRHO is 70% of the energy to reach the low lunar orbit, thus reducing the transportation cost.
- ✓ The NRHO is suitable for communication relay for lunar south pole exploration due to its high visibility from Earth.

■ Lunar Landing via Gateway

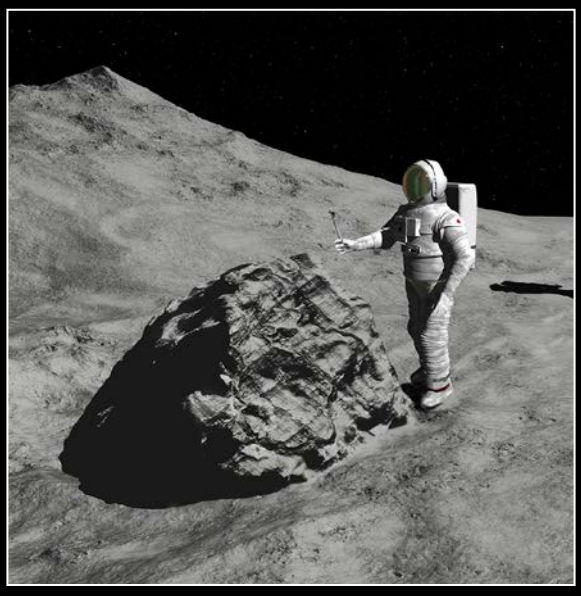
Gateway will also serve as a staging point for crewed lunar landings.

< Earth to lunar surface >

Astronauts will first board the Orion spacecraft, which is launched by the Space Launch System (SLS) and enter lunar orbit. Once in lunar orbit, the Orion spacecraft will dock with Gateway and the astronauts will transfer to the Gateway's cabin. The astronauts will then be transfer to the Human Landing System (HLS), which is also docked to Gateway, and will descend to the Moon's surface.

< Lunar surface to Earth >

The HLS will take off from the lunar surface and dock again with Gateway in lunar orbit. After astronauts transfer from HLS to Gateway and then board the Orion spacecraft again, the Orion will separate from Gateway and return to Earth.



Web Page

JAXA Space Exploration Center (JSEC) Web Page
https://www.exploration.jaxa.jp/e/index.html

Human Spaceflight Technology Directorate Web Page
https://humans-in-space.jaxa.jp/en/

JSEC "X" Account
@jsec_jaxa_en