Space Architecture Reinforced by Internal Ocean on the Moon

*Takuya ONO[1], Makiko NAGURA[1]

1. Kajima Corporation

Humans are expected to inhabit the outer space soon, e.g., the moon or Mars. When scientists and travelers start constantly living in outer space, the residence of maintenance crews and service staff will be needed to support them. If the duration of residence is prolonged, families would be expected to join them. This means that in such an era, space would be inhabited by regular households. As per our conjecture, gravity, and the sea would be primarily important to live in space.

The first requirement—Earth’s gravity (i.e., 1 G), is vital for humans and other living beings but cannot be transported from Earth. It is highly likely that without gravity, mammals cannot undertake the birthing process properly. Even if birthing is possible, normal growth cannot be expected in low gravity. Without healthy bones (that produce blood cells), blood health may also be affected. The negative effects of low gravity may not be limited to animals but may include plants. Furthermore, humans that grow up in low gravity will not be able to withstand Earth’s gravity. This means that life in space would produce “lunar humans” and “Martian humans” with weak legs, which could create community conflicts in the future. Although this issue may be solved in the distant future, it is too dangerous for humans to start living in low gravity, from now onwards.

We, therefore, believe that a rotating artificial gravity facility in outer space, which generates a gravity approximating that of Earth’s, would be useful. To approximate the 1 G environment, centrifugal force would be used in microgravity space while both gravitational and centrifugal forces are combined on celestial bodies. The other topic of our study is transportation systems in space, including means of inter-facility travel and artificial gravity transportation facilities connecting celestial bodies. People would live in the artificial gravity facilities for work and research; for leisure, they would use the low gravity environment unique to the moon and Mars, and the microgravity of outer space. These facilities would allow humans to have safe childbirths and maintain bodies that could return to Earth at any time. Recognizing that 1 G gravity is essential for humans to live in space, we propose an artificial gravity network, which supports human expansion to outer space.

Next, we propose that reproducing an Earth-like ocean is essential for humans to live in outer space. Water is crucial for ecology, and the ocean and flowing water have a significant visual impact on our mental health. The monotonous environment of the moon and Mars would soon become boring to people who are used to Earth’s rich global environment. However, if people could continue to enjoy marine sports and have landscapes such as the ocean and rivers, humans would be able to lead abundant lives away from Earth. Life on Earth was first born in the sea, and humans continue to have a close relationship with the sea. This suggests that the ocean is as important as gravity.

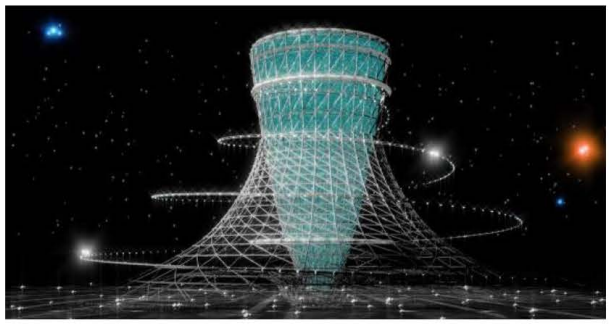
In addition, water is known to be effective at shielding from cosmic rays. With the ocean created on the proposed artificial gravity facility, the free water surface adheres to the floor due to the centrifugal force and becomes parabolic. By ensuring the necessary water depth, the ocean can also serve as a protective wall against cosmic rays.

In conclusion, the reproduction of artificial gravity and seas would enhance the feasibility of human expansion to space. Without these two requirements met, humans will not be able to leave Earth.

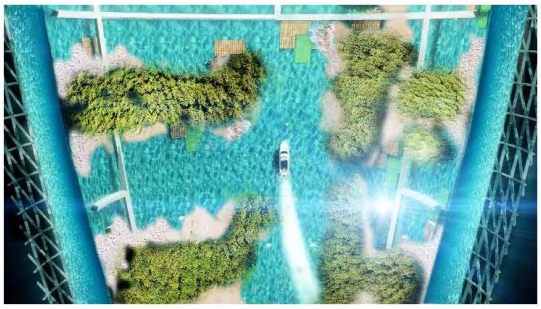
Keywords: ocean, space architecture, cylinder architecture, artificial gravity by revolving, lunar lava tube, parabolic architecture

Space theater

(Artificial gravity facilities under microgravity conditions)

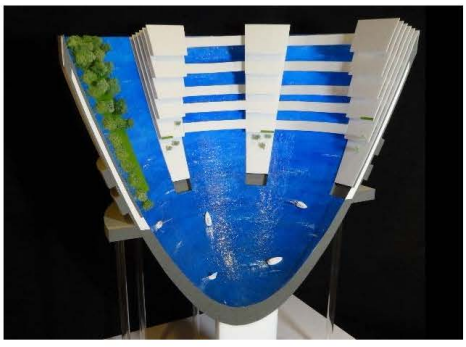


Artificial gravity facilities on the moon (Lunar glass)

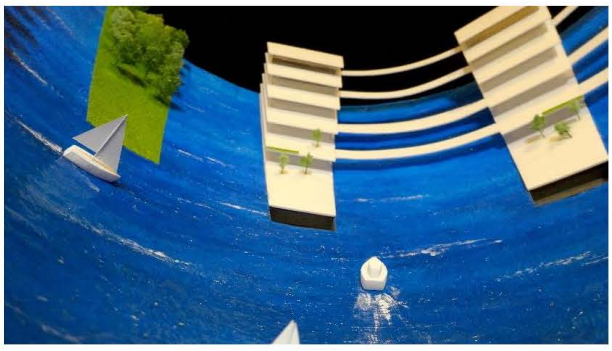


Lunar glass: Interior

Lunar glass: Details



Artificial gravity facilities on the Mars (Mars glass)



Mars glass: Interior

