

Go to the Moon, again



...by international cooperative and competitive interactions

- *Rapid Progress in Chinese Lunar Exploration*
- *Japanese Lunar Exploration Project –SLIM*
- *NASA's Lunar Orbital Platform–Gateway*
- *Future Colonization of the Moon*

Chinese Lunar Explorer Chang'e-4



Chang'e-4 lander landed on Von Karman crater in the far side Jan.3 2018. It was the first historic landing on the far side of the Moon

Yutu-2 rover (140kg) was released from the lander.

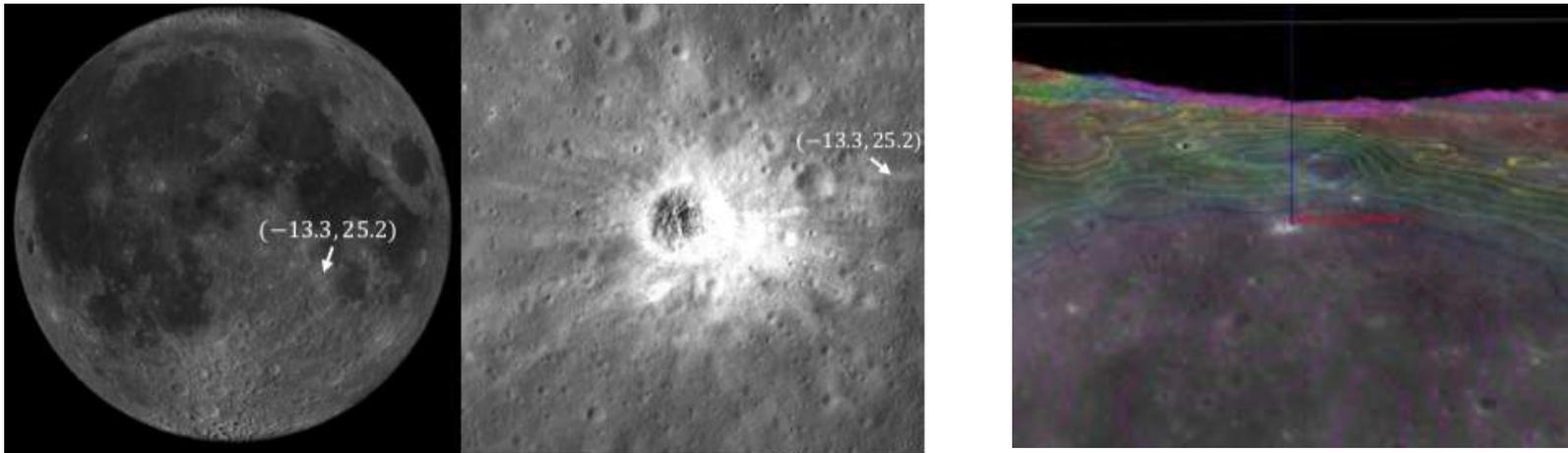
Source: <https://www.planetary.org/explore/space-topics/space-missions/change-4.html>

The image shows a small, gold-colored lander with blue solar panels on the lunar surface. The lander is positioned in the center, with a large, dark, rocky lunar crater in the background. The Earth is visible in the upper right corner of the frame. The lander has a gold dome on top and is supported by four legs. It is surrounded by lunar dust and rocks.

JAXA Smart Lander for Investigating Moon (SLIM) to be launched in FY.2021

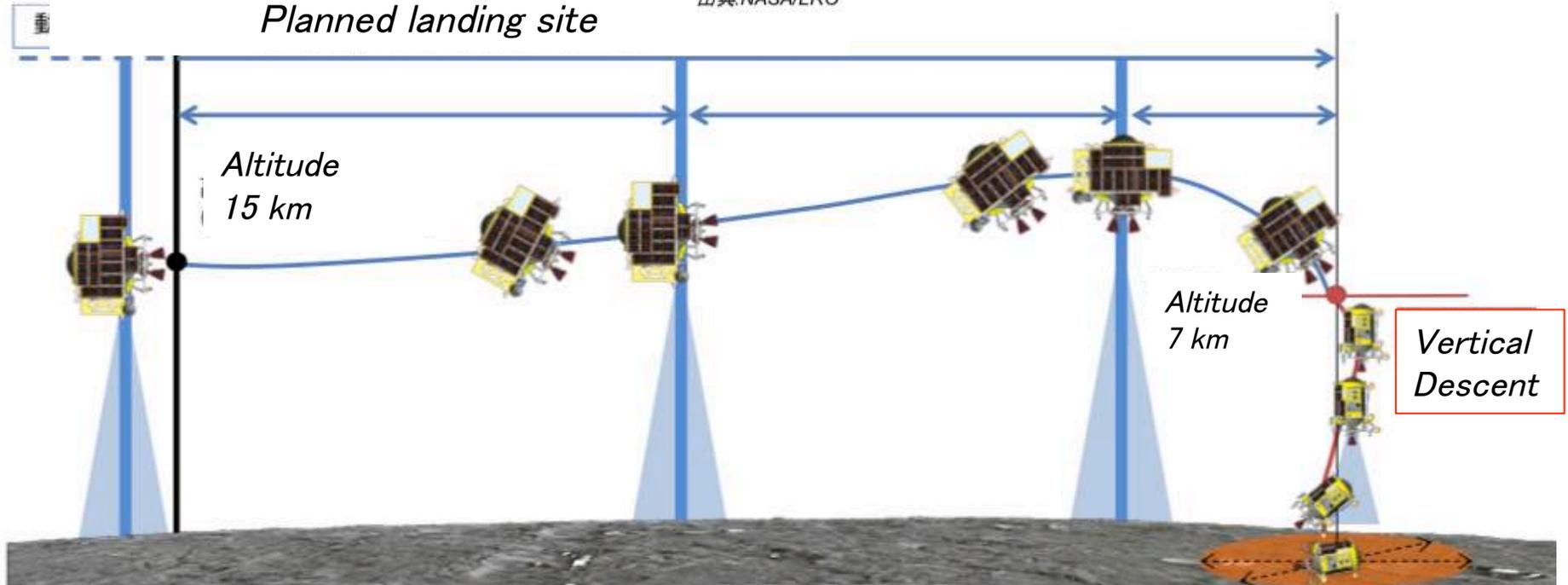
Demonstrate pinpoint landing technology necessary for the future lunar probes, using a small scale and lightweight system (120 kg)

SLIM Landing Site/Landing Operation



出典:NASA/LRO

Planned landing site



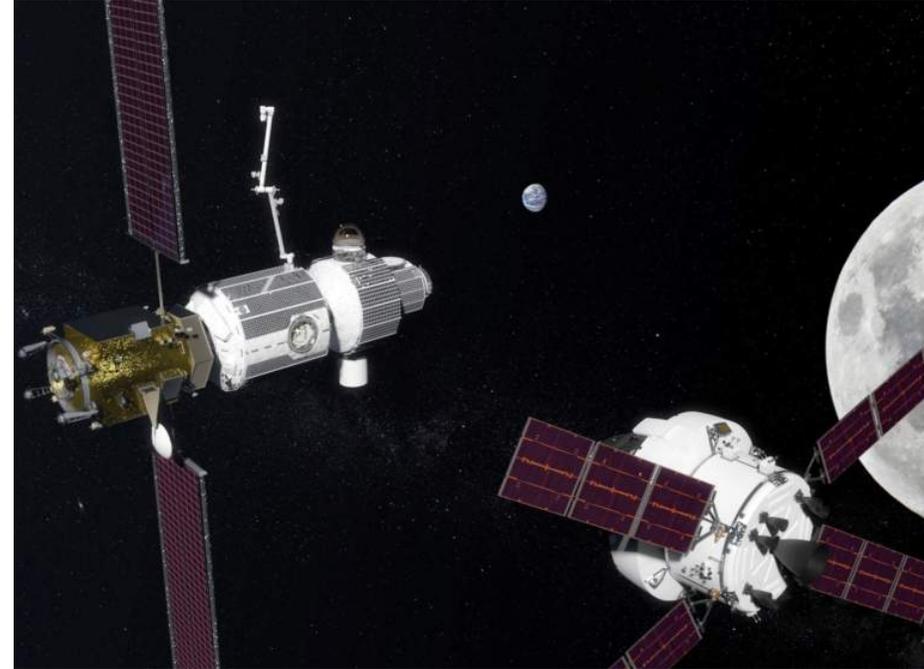
Landing sequence

<http://www.isas.jaxa.jp/home/slim/SLIM/technology.html>

Lunar Orbital Platform Gateway(LOP-G)



Existing International Space Station orbiting around the earth



Lunar Orbital Platform(LOP) orbiting around the Moon

Conceptual Image of Lunar Orbiting Space Station, proposed by the USA. The right panel shows the transfer vehicle from the earth approaching the LOP. Japan ,Russia, and ESA are considering participation in this program.

Japanese Participation in Lunar Orbital Platform Gateway

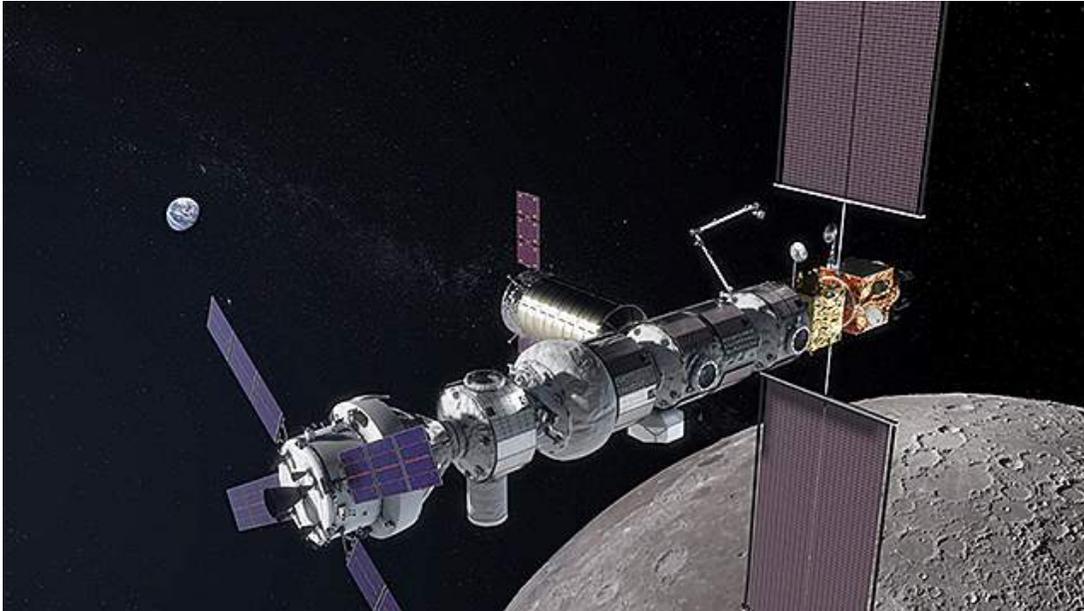


Image of Lunar Orbital Platform (LOP)

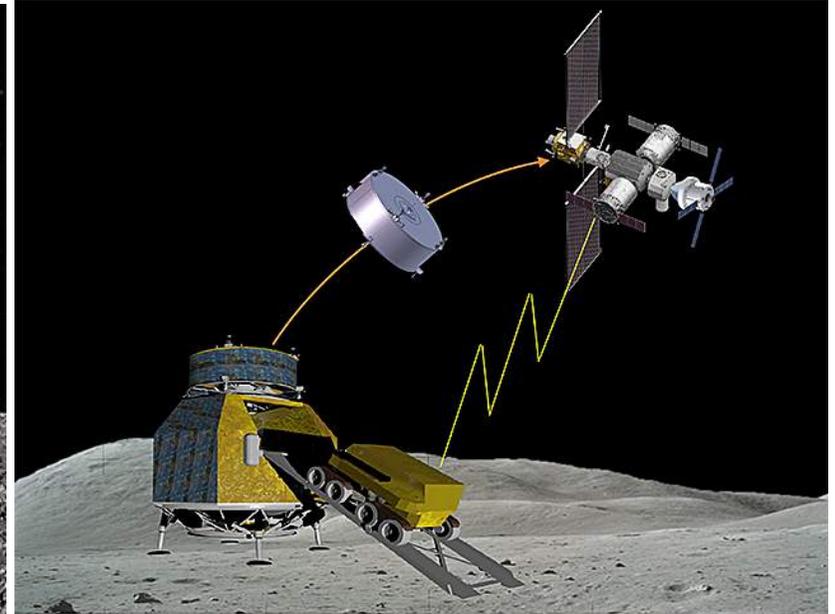


Image of HERACLES

JAXA is investigating a sample return mission “HERACLES” using the Lunar Orbital Platform Gateway. HERACLES will land on the lunar surface, collect samples (15 kg) by a rover, and transfer them to LOP. The samples will be carried back to the earth by the LOP transfer vehicle.

Future Dream



- Moon, the first step human expansion into space*
- Moon sightseeing*
- Moon city*
- Olympics on the Moon*
- Farming on the Moon*
- Solar power station on the Moon*

Human Expansion into Space



Dr. Gerard O' Neill

Dr. Gerard O' Neill first proposed the space colony at the Lagrangian point in 1969 to resolve the global energy and environment problems.



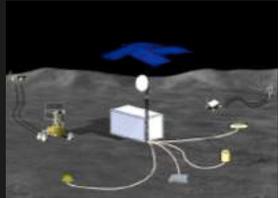
Prof. Tatsu Obayashi

Prof. Obayashi (Enthusiasm for Space, 1985)

Looking back through the human history, modern humans evolved in Africa and then migrated through Europe and Asia to reach the Pacific and Americas, without stagnation or shrinking. Hereafter, the human will go out of the Earth and expand into space.

Recent situation suggests the expansion scenario; Moon base as the first step, then orbital colonies, and other planets such as Mars.

Steps to “Living on the Moon”



Unmanned
Exploration
Service Station



Short-term Stay
Manned Base



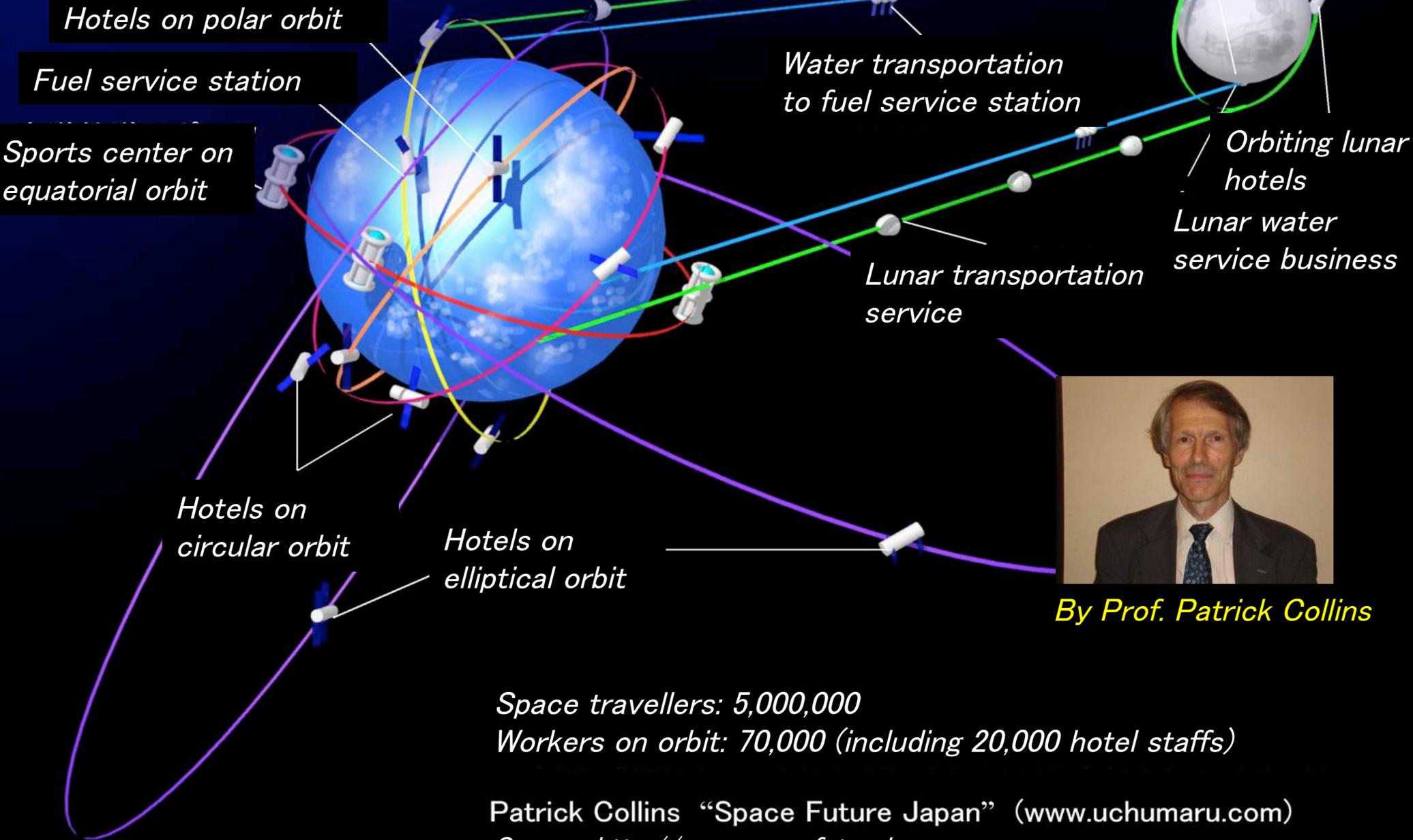
Permanent Manned Base



Moon City

-- → Exploration → Development → Emigration

A vision for space tourism business (30 years from now)



Lunar hotels at the polar region

Hotels on polar orbit

Fuel service station

Sports center on equatorial orbit

Water transportation to fuel service station

Orbiting lunar hotels

Lunar water service business

Lunar transportation service

Hotels on circular orbit

Hotels on elliptical orbit



By Prof. Patrick Collins

Space travellers: 5,000,000

Workers on orbit: 70,000 (including 20,000 hotel staffs)

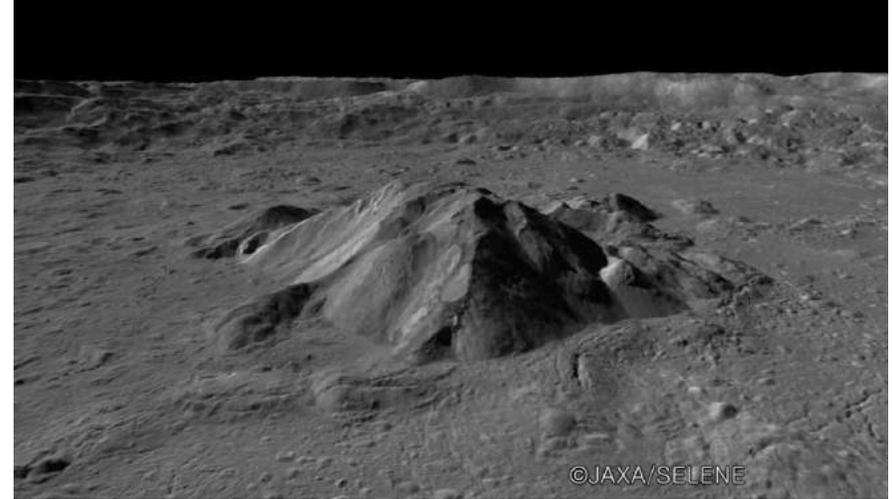
Patrick Collins "Space Future Japan" (www.uchumaru.com)

Source: <http://www.spacefuturejapan.com>

Moon Sightseeing



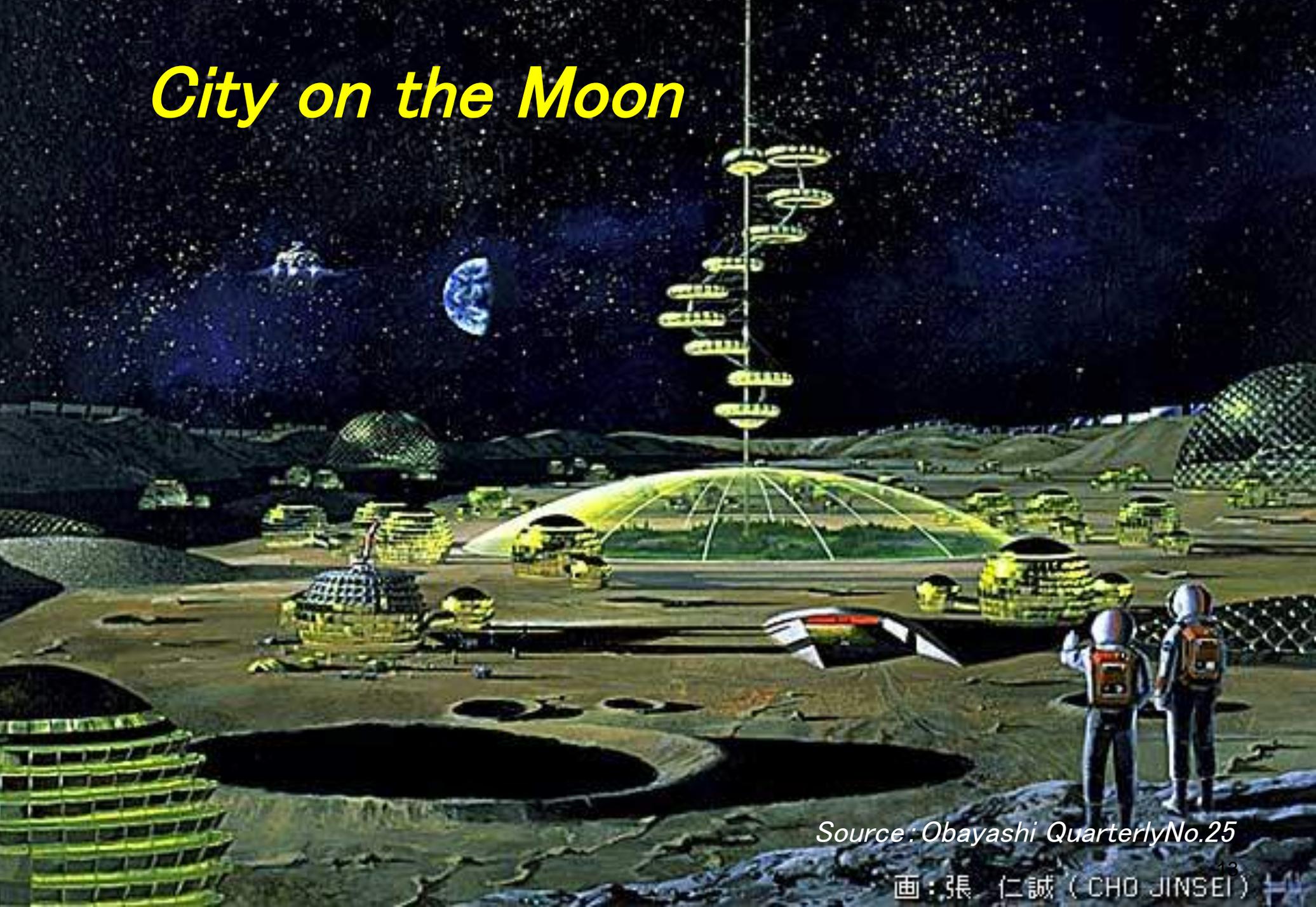
Source: http://spaceinfo.jaxa.jp/ja/moon_base.html



Tycho crater, one of the excellent scenic sites on the Moon.

A lot of magnificent geographical formations on the Moon and the beautiful blue earth from the Moon are particularly attractive for tourists. They will also enjoy the experience of the 1/6 gravity of the earth.

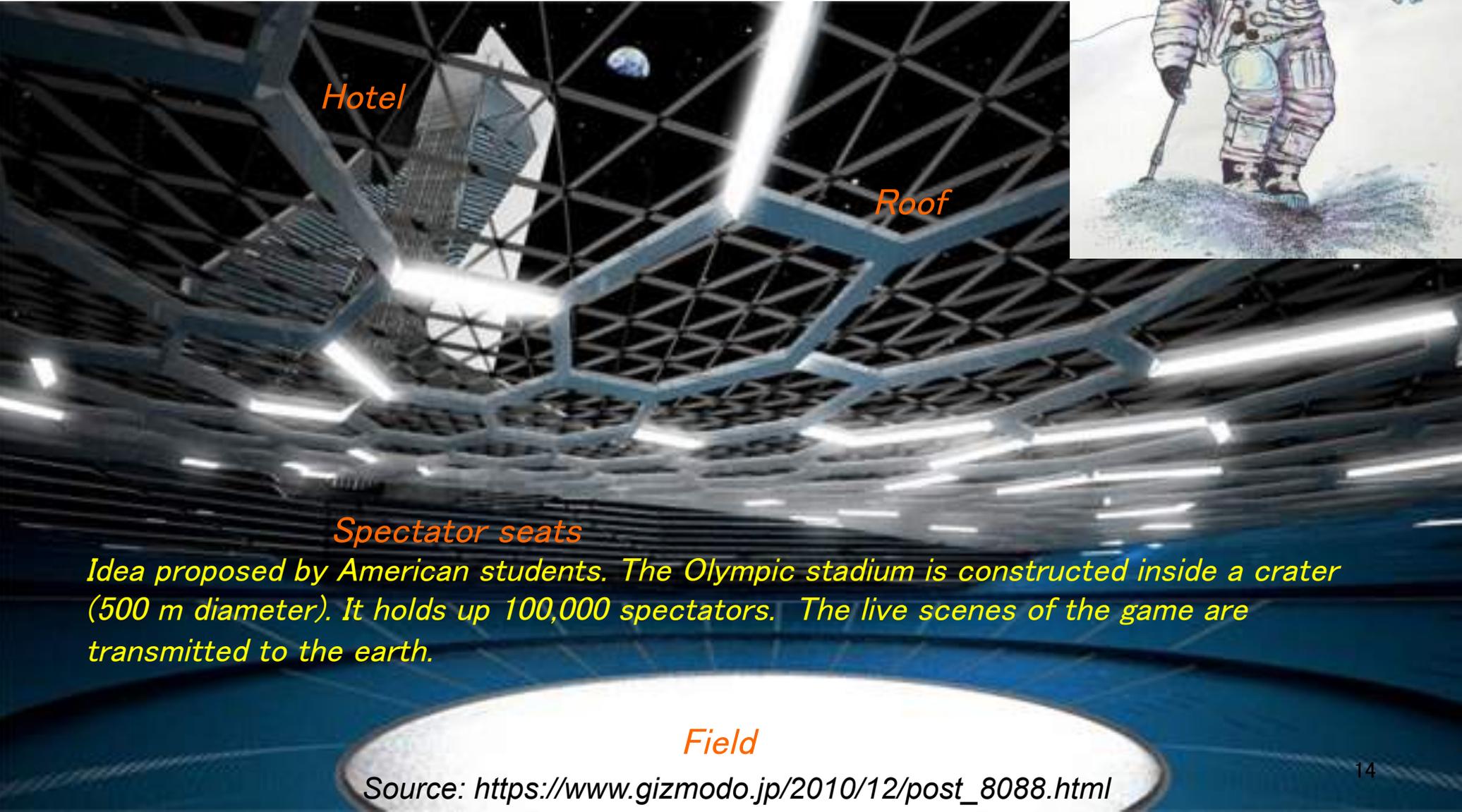
City on the Moon



Source: Obayashi Quarterly No.25

画: 張 仁誠 (CHO JINSEI)

Olympics on the Moon



Hotel

Roof

Spectator seats

Idea proposed by American students. The Olympic stadium is constructed inside a crater (500 m diameter). It holds up 100,000 spectators. The live scenes of the game are transmitted to the earth.

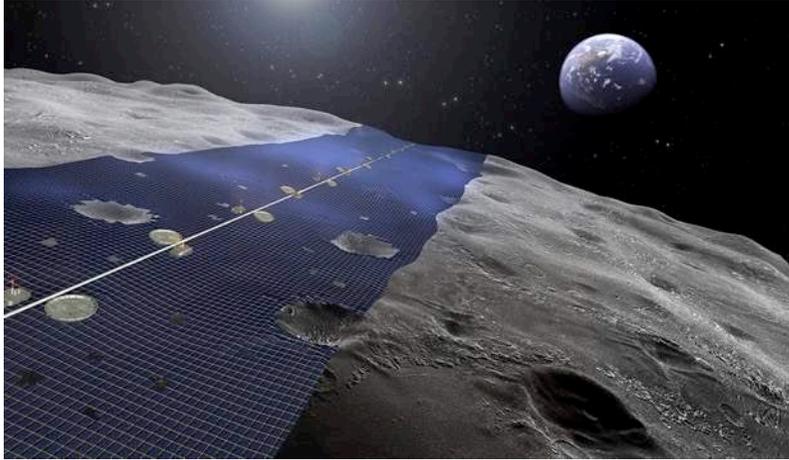
Field

Source: https://www.gizmodo.jp/2010/12/post_8088.html

Agriculture on the Moon

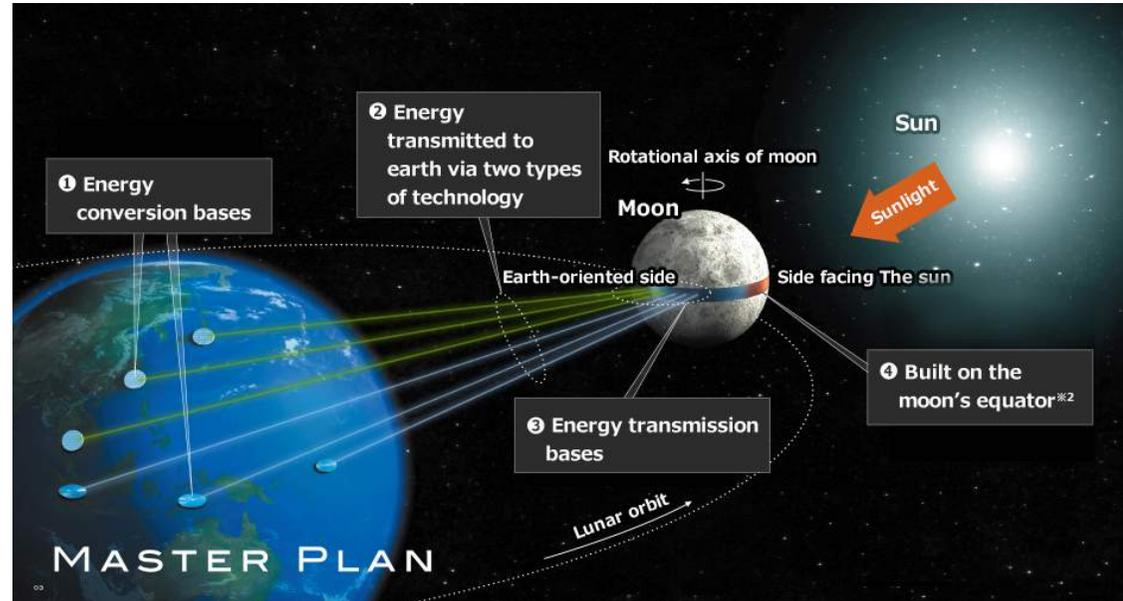


Power Station on the Moon: Luna Ring



Solar panels

Width: 400km, Length: 11,000km



*The system is constructed using lunar resources.
It is capable of supplying the world energy on the earth.*

Source :Shimizu Corporation

<https://www.shimz.co.jp/en/topics/dream/content02/>

Summary



- *People will revisit the Moon within 5 years and prepare the lunar base for permanent stay.*
- *After the initial settlement, the time will come when people enjoy sightseeing tours to the Moon, living there, utilizing the lunar resources for human prosperity, and preparing interplanetary flights.*