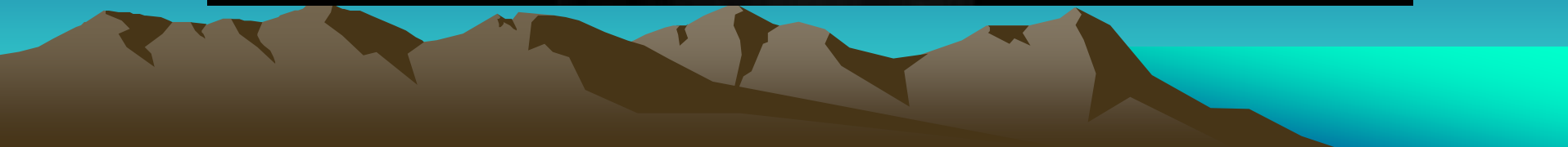


Resource Flows in a Lunar City



- JOHN MONSEES
- November 22, 2005

The Moon

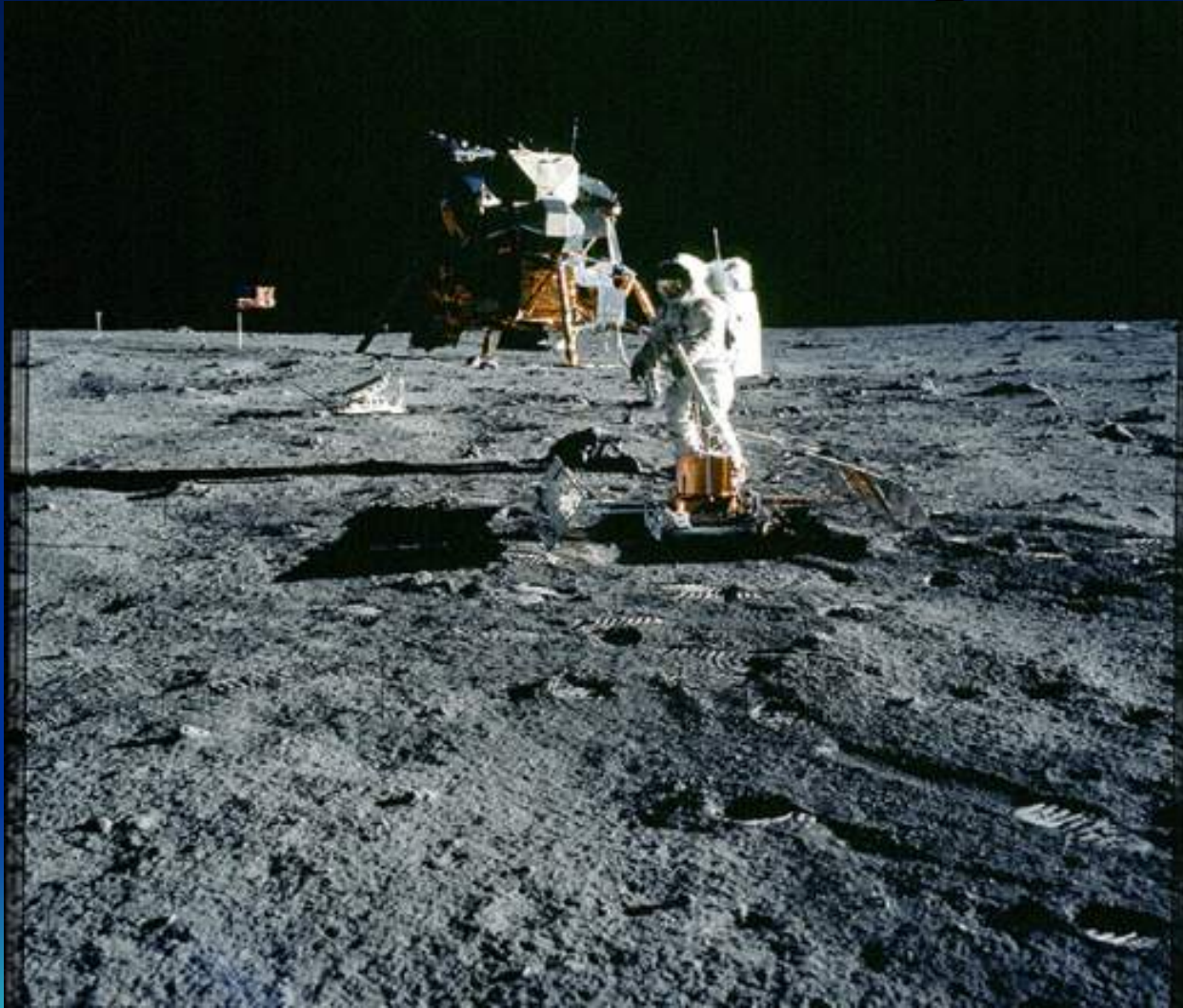


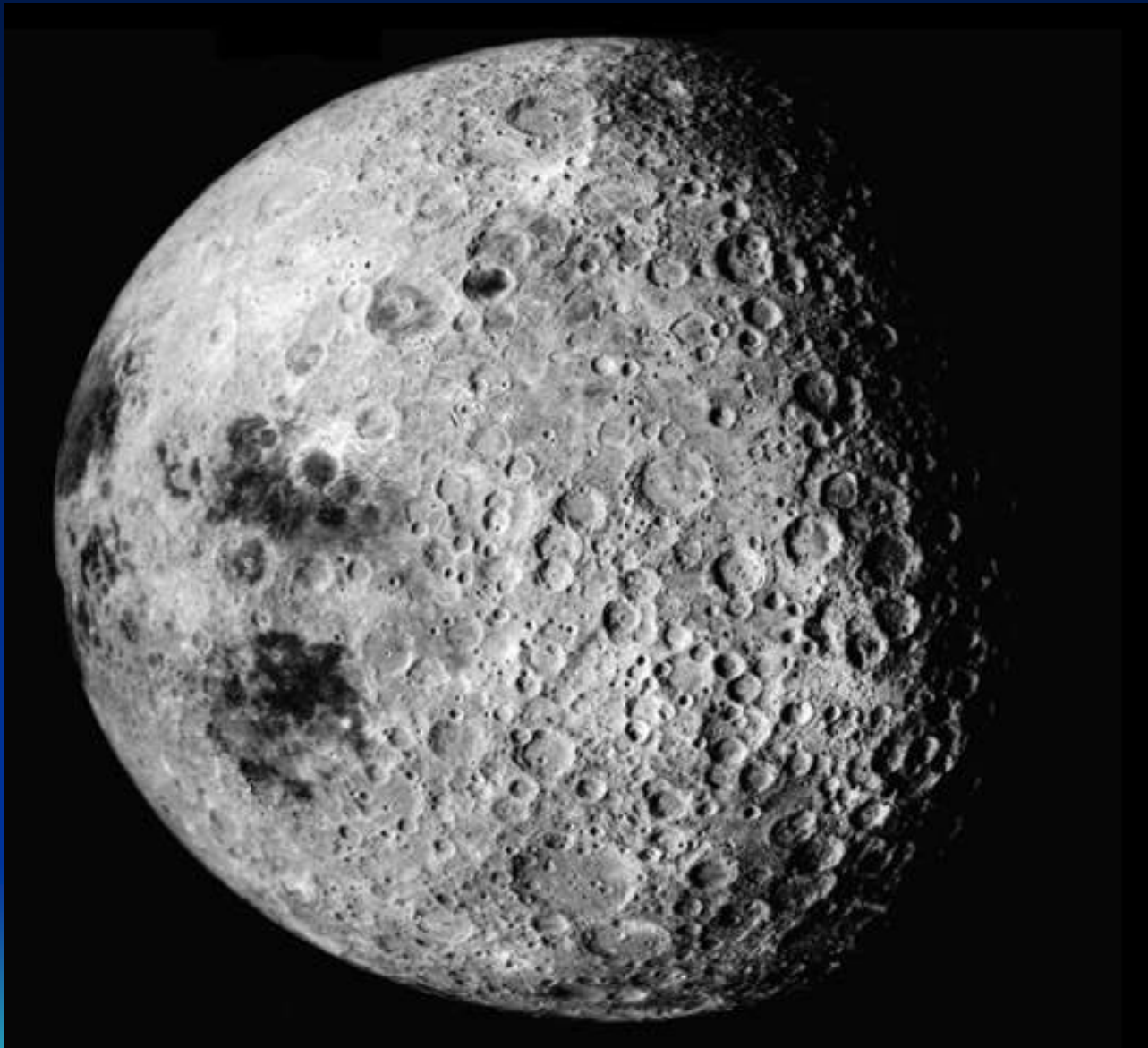
Moon Facts

- 240,000 miles from Earth.
- A lunar day = 28 Earth days.
- Moon's gravity is only 1/6 G.
- No appreciable atmosphere.
- Surface temperatures range from over 250 F in sunlight to -250 F in permanent shade.

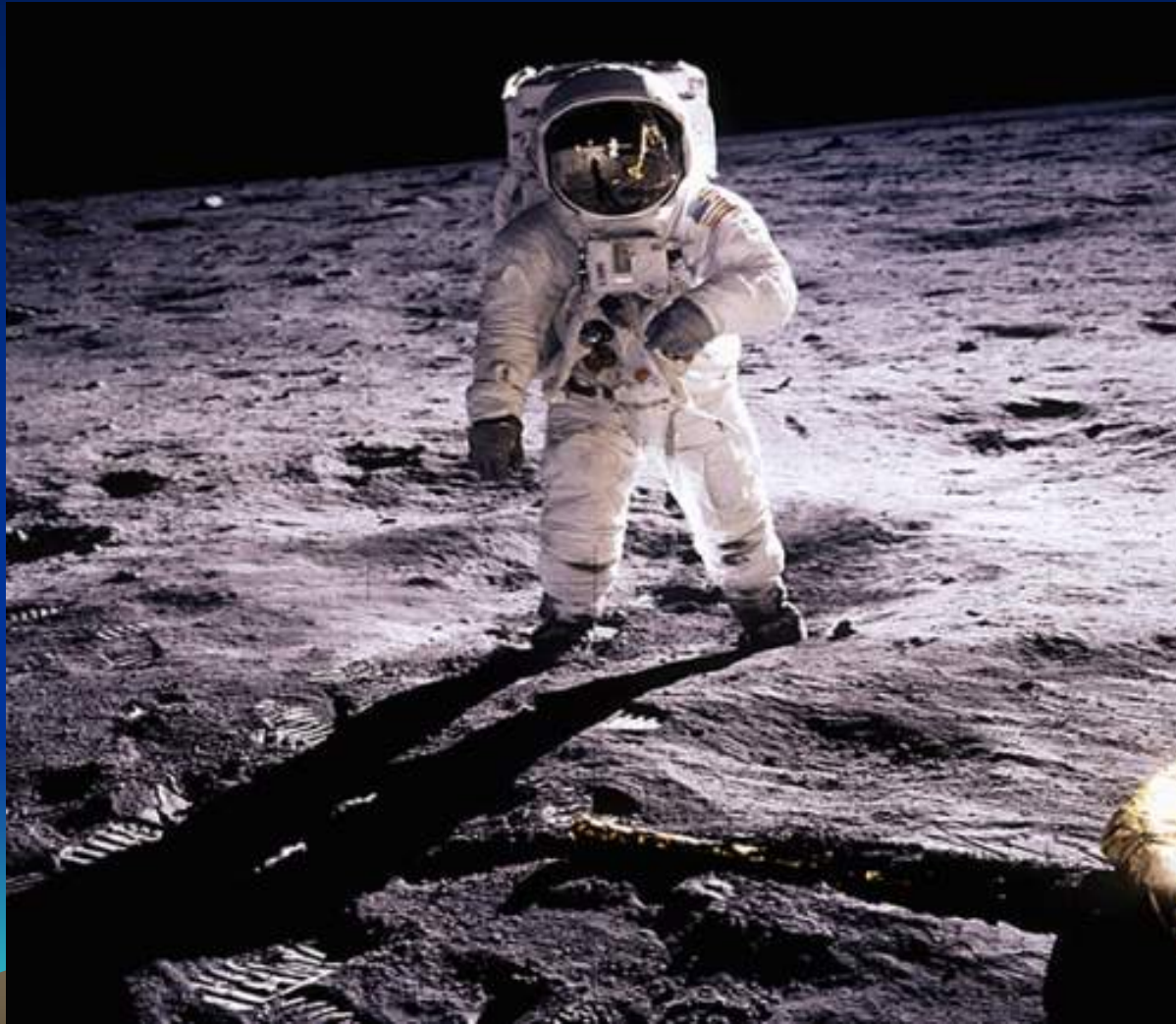


First Human Landing, 1969

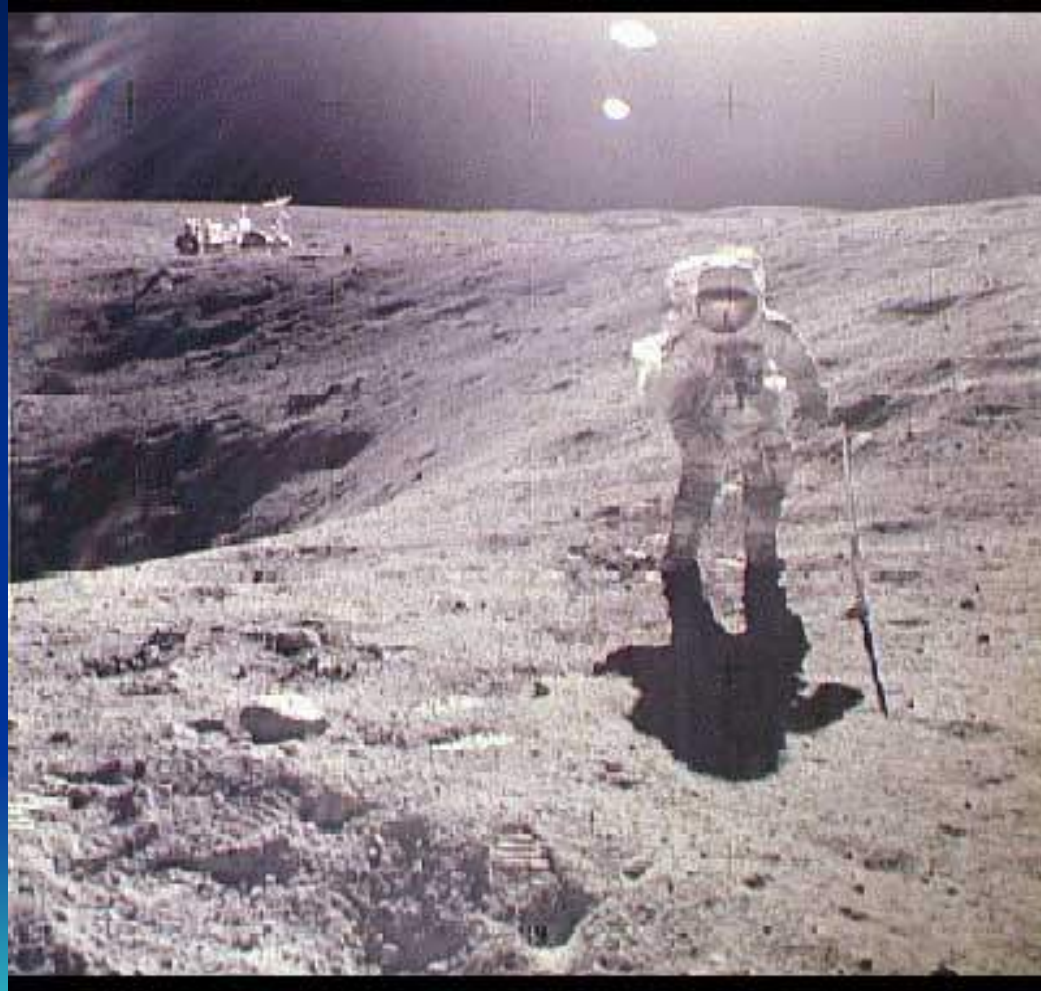




The Moon Lacks an Atmosphere



Exposure to full Solar radiation



The Moon is a Desert

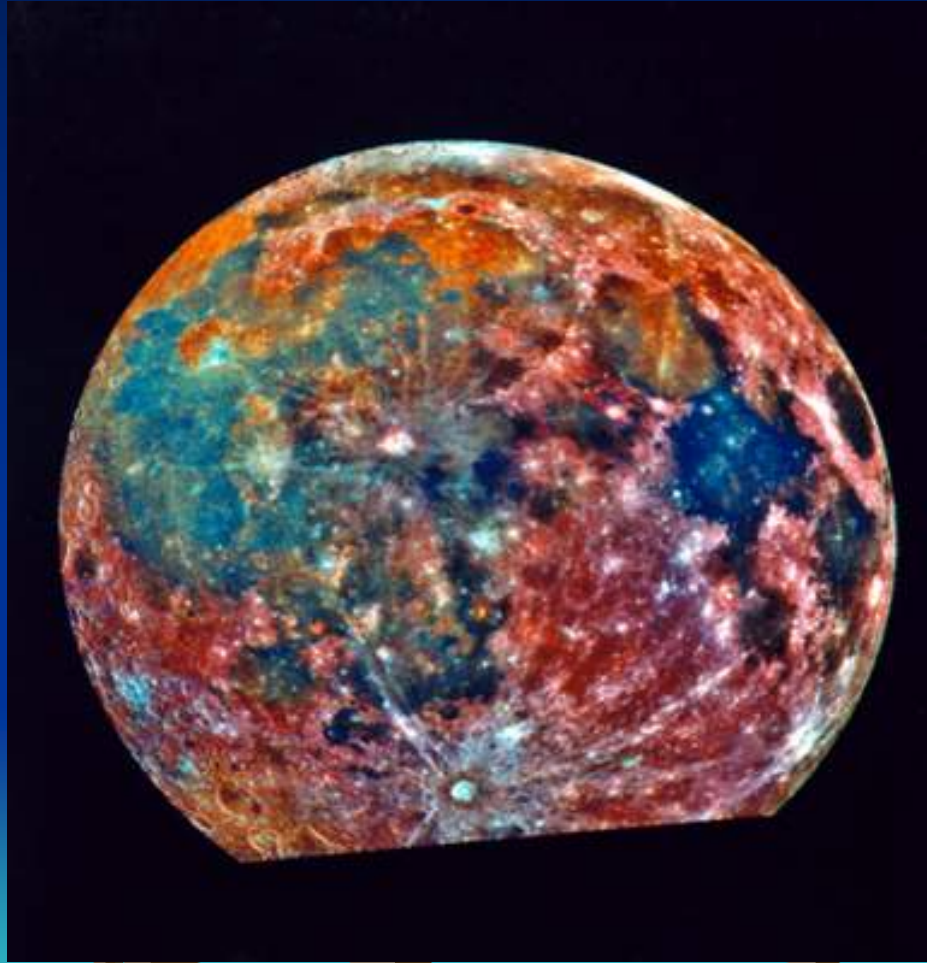


Why Settle the Moon?

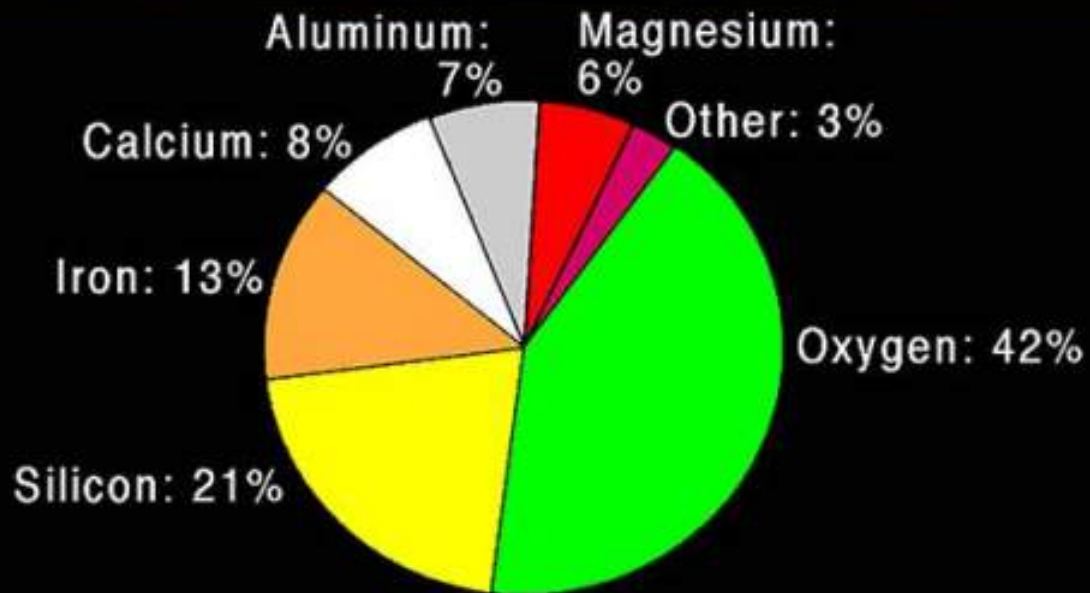
- Energy and mineral resources.
- Unique location for scientific research.
- Ideal for hazardous industries.
- Launch pad for human exploration of Solar System.



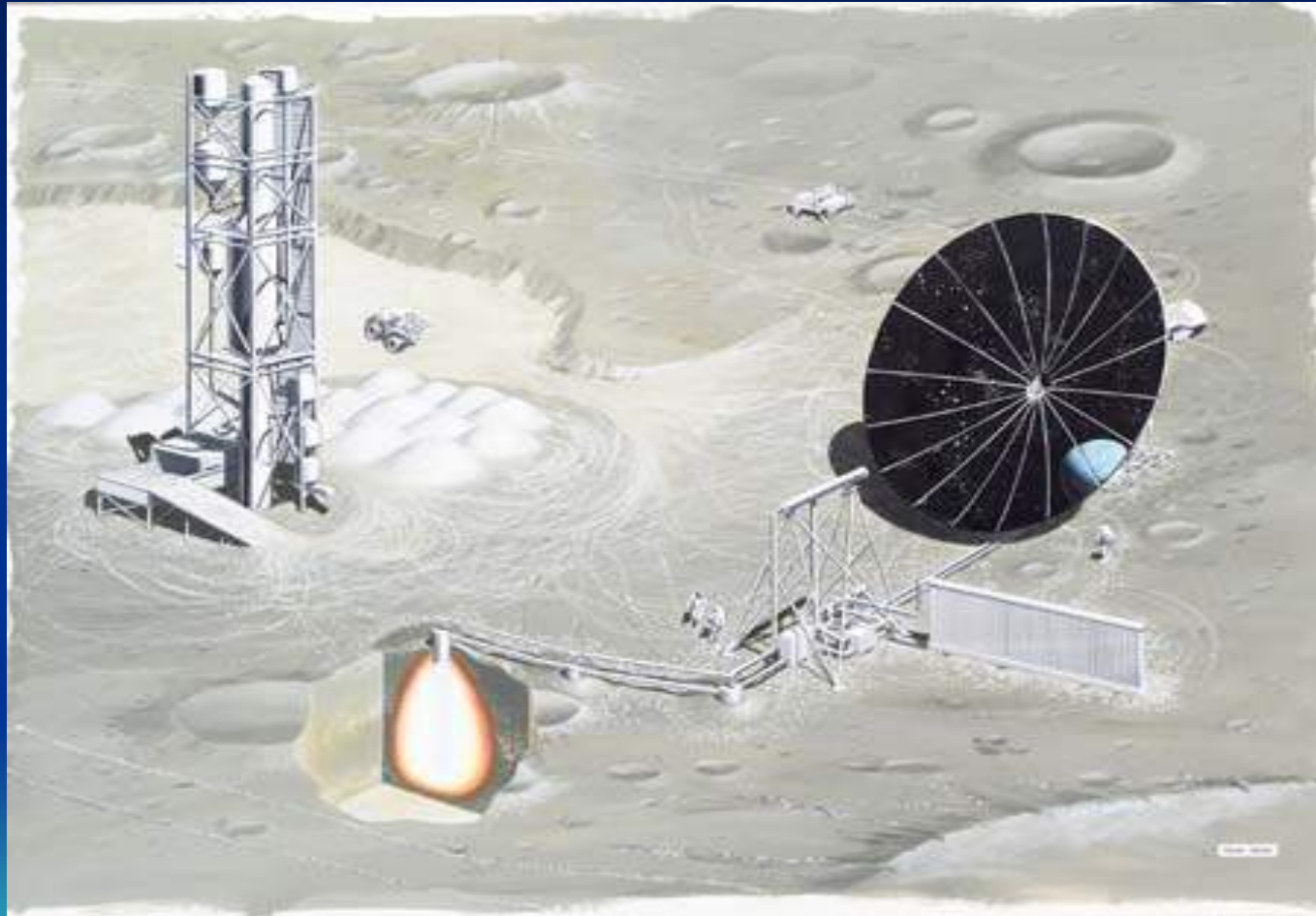
Mineral Resources



LUNAR SOIL COMPOSITION



Mining the Moon

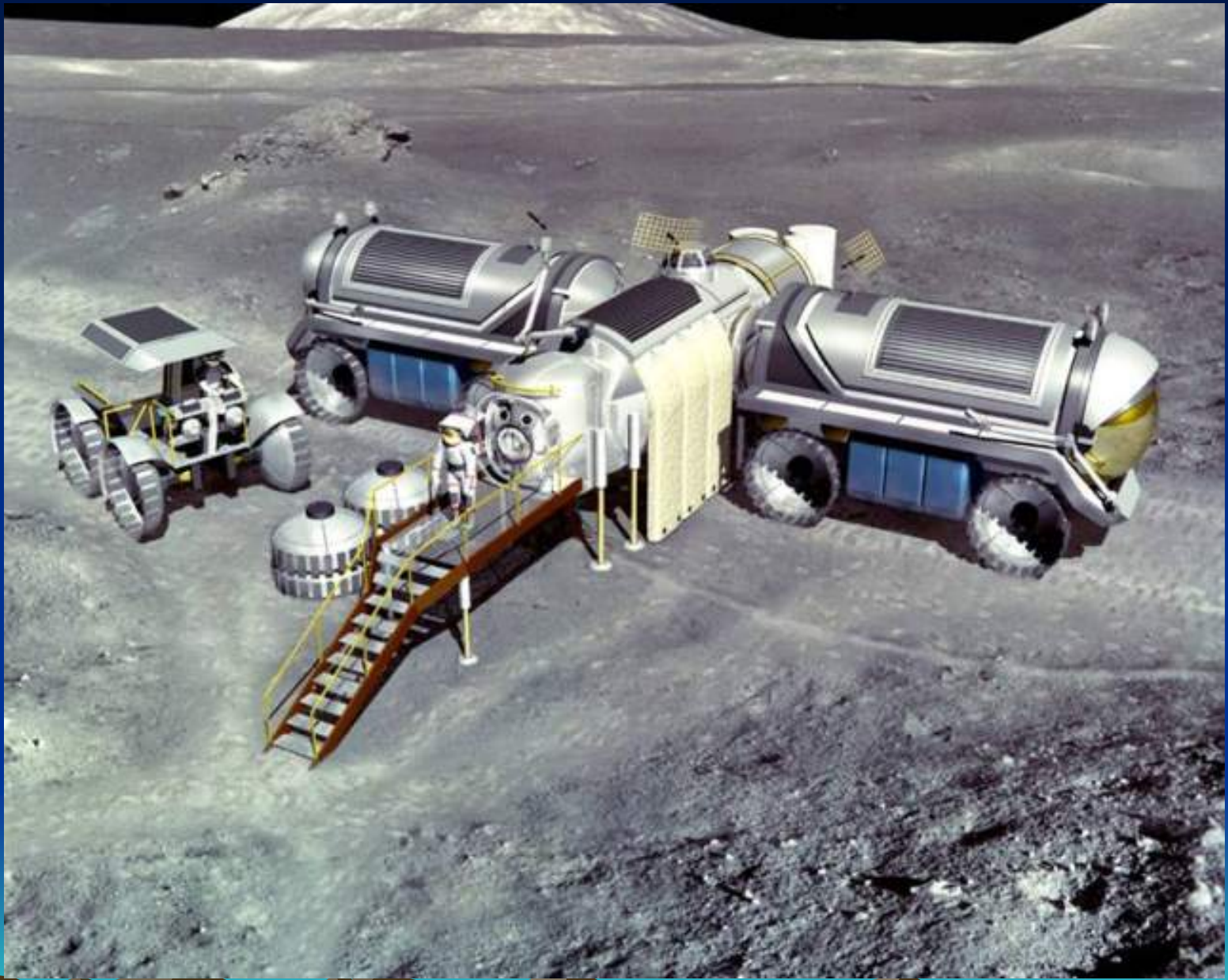


Initial Habitats

- First lunar habitat is likely to consist of a collection of small, prefab units manufactured on Earth.
- Government project.
- Pressurized canisters and inflatable domes.









Urban Design on Moon

- Dictated by Environmental Conditions.
- Given the expense of transport from Earth, the use of lunar resources critical.
- Resource flows in a lunar city must be circular.
- A breakdown of any flow could result in a catastrophic failure of the city.



Structures

- Building resources: minerals, metals, and regolith.
- “Superadobe” buildings.
- Subsurface tunneling.





Energy Flows

- Solar Energy.
- Photovoltaic Farms.
- Fusion Power: Helium-3 Mining.
- 25 tons of Helium-3 could produce enough electricity for the entire United States for a year.
- Refining 1 kilogram of Helium-3 generates 10 tons each of the following byproducts: carbon, nitrogen and hydrogen.





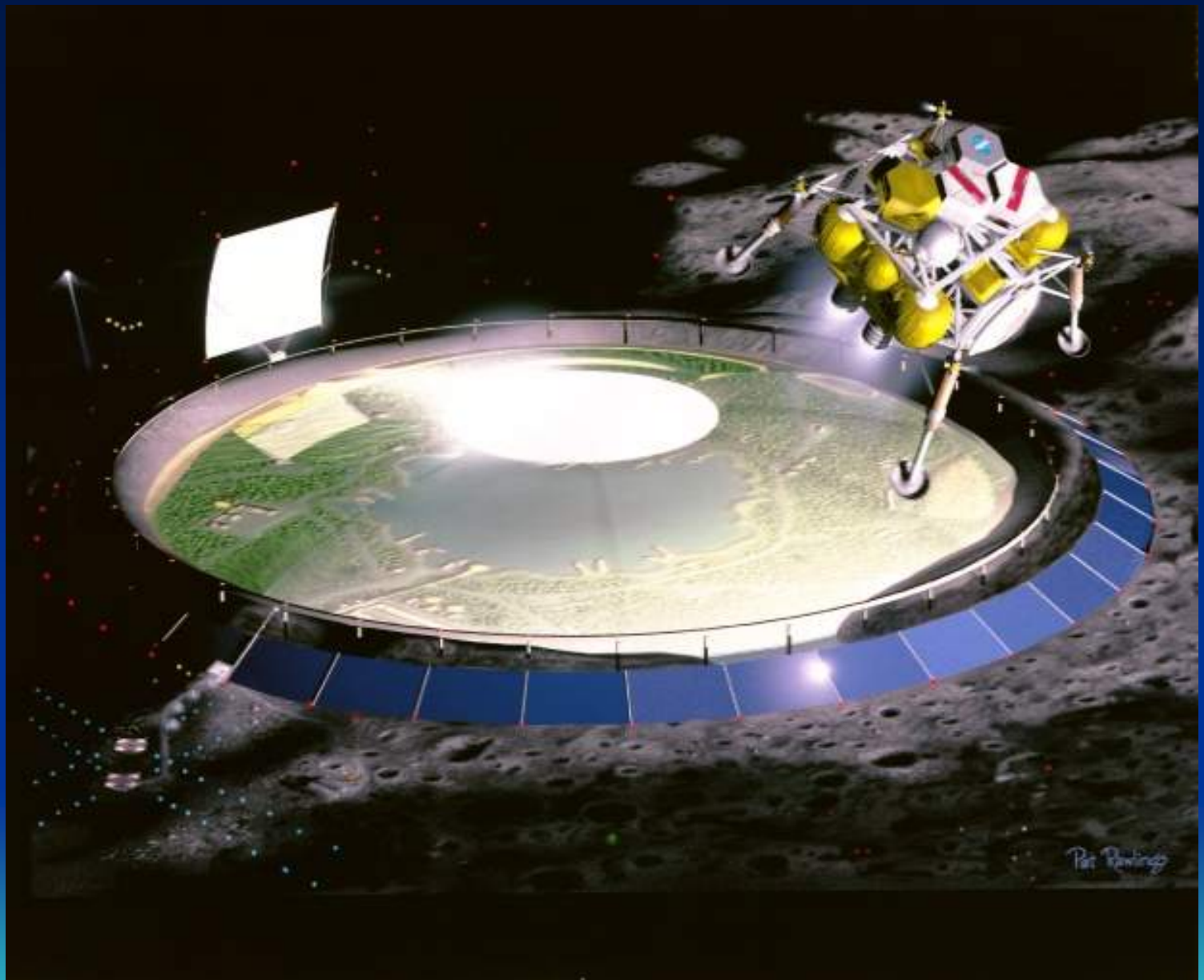


Water Flows

- No liquid water on Moon.
- Transporting water from Earth too expensive; finding a source on the Moon a necessity.
- Ice may exist as deposits in dark craters and in regolith as permafrost.
- Recent NASA probes have detected signs of ice in dark craters at the poles of the Moon.
- Waste water will be constantly recaptured, processed and reused in an endless cycle.



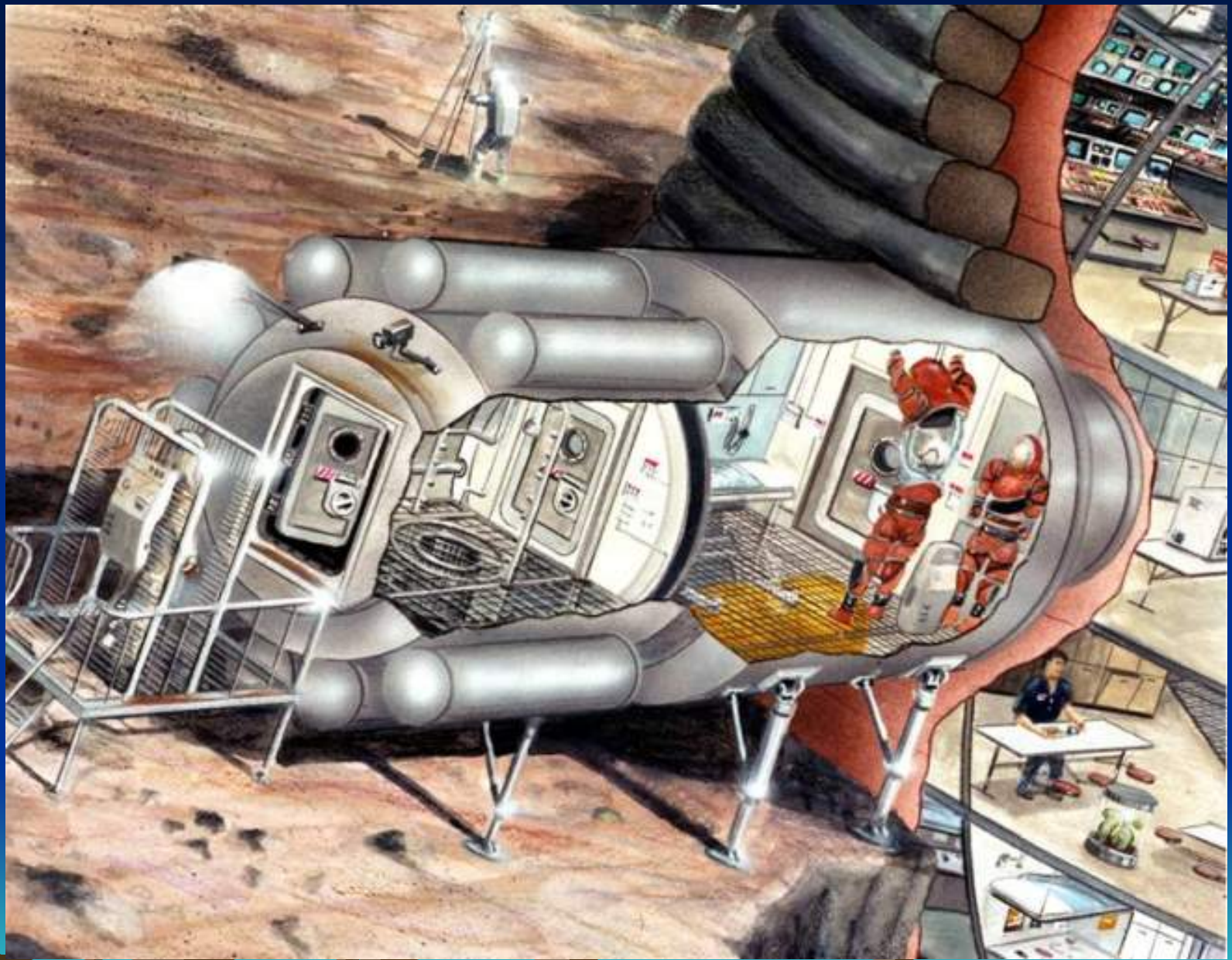


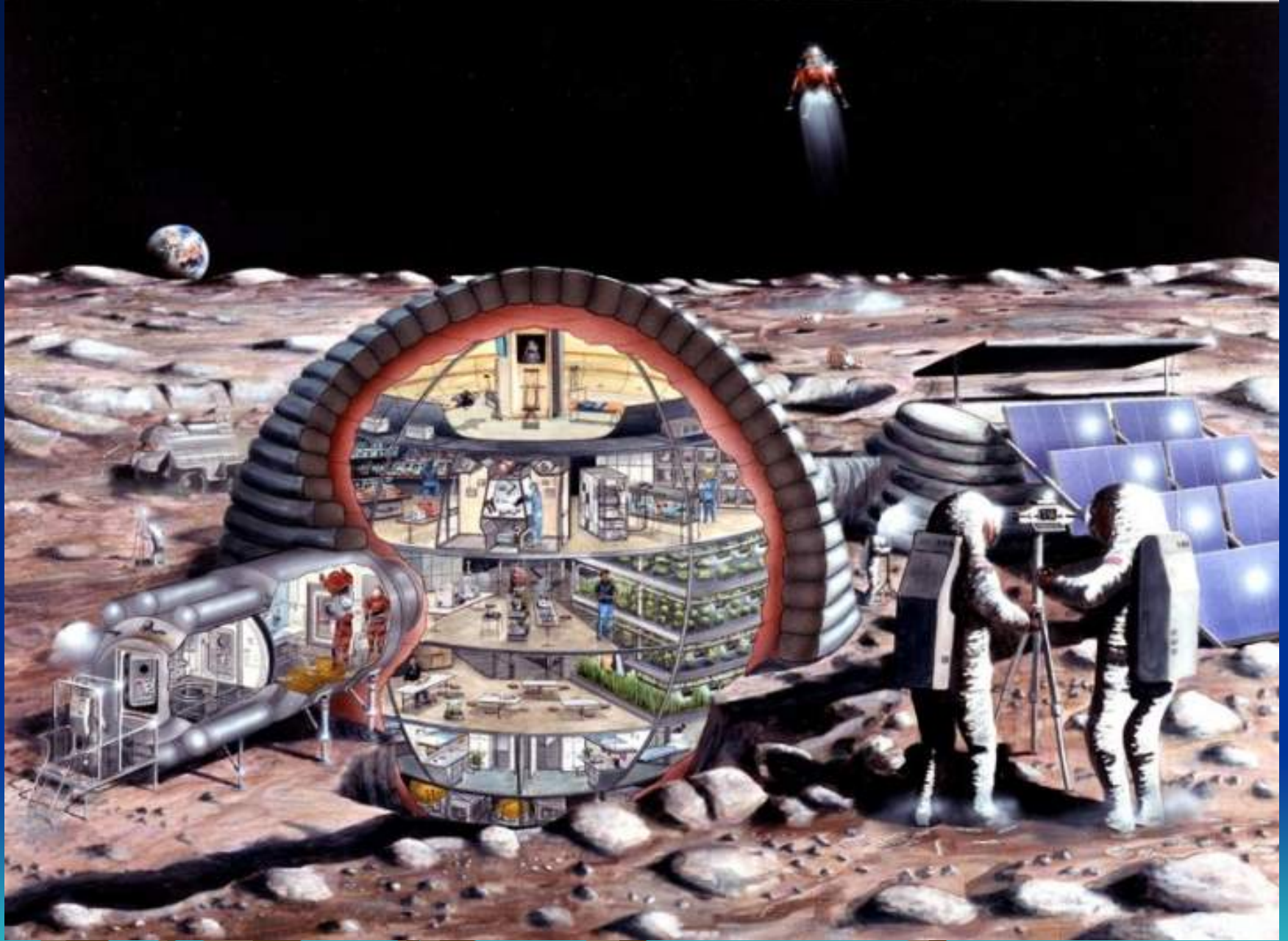


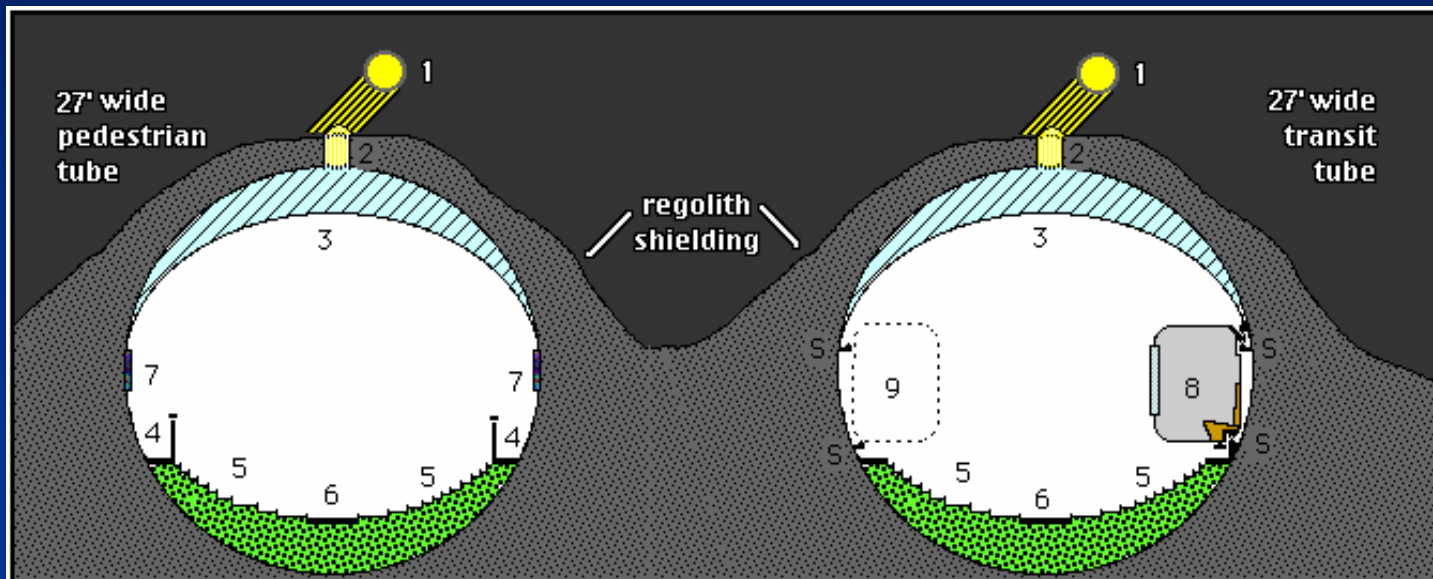
Atmospheric Flows

- Atmospheric quality and pressure will be monitored constantly by computer.
- Oxygen will be produced by refining lunar minerals to release oxygen.
- Lunar basalts can be processed to yield oxygen and iron, so that for every one ton of oxygen produced, 3.5 tons of iron will be recovered.
- Waste gases, primarily carbon dioxide, will be scrubbed from the atmosphere by treatment plants.
- Plants will be incorporated into the habitat to remove some carbon dioxide and add oxygen to the atmosphere.









On the barren Moon, shielded and pressurized pedestrian and transit corridors and tubes must do their share to host the vegetation biomass on which the settlement depends for fresh air and water. In this 27 ft. wide tube, sunlight (1) enters via a mirrored shaft or fiber-optics bundle (2) to filter through a sky-blue diffuser (3) to provide pleasant lighting. Pedestrian walkways (4 Left illustration) are high up the side slopes, with the bulk of the usable cylinder floor given to vegetation (5) and gardener access path (6). For further pedestrian enjoyment a continuous art gallery strip runs along either side (7). In the transit tube on the right, the transit cars (8, 9) are side-rail-mounted (S) to allow almost all of the floor of the tube to support vegetation. From MMM # 54, April 1992 -- Illustration by Peter Kokh

Waste Stream Flows

- Minimal waste generation.
- Maximization of recycling and reuse of wastes.
- No landfills on the Moon.
- Organic wastes will be particularly valuable.





Food Production

- Growing food plants using artificial systems is prohibitively expensive.
- Domed surface farms.
- Unknowns: Effects of Gravity and Lunar Night.
- The importation of food supplies is likely to continue for decades after the founding of the first lunar city.





