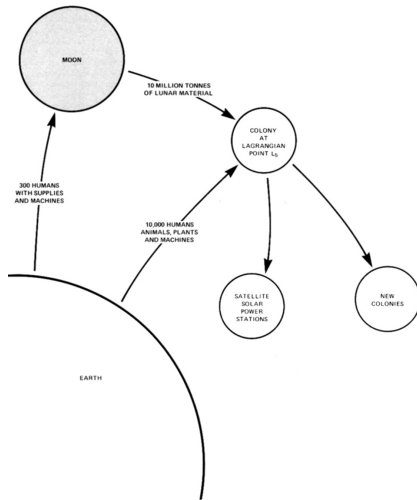
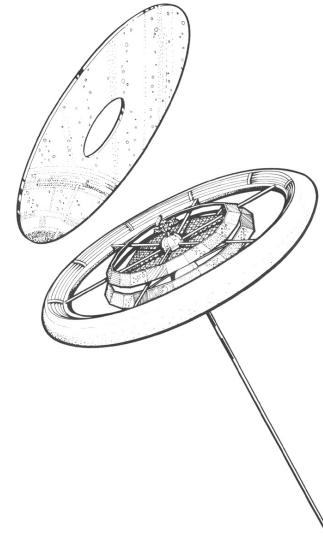


Designing a Space Settlement



A System to Support Living in Space



The 1975 Stanford Torus

Backstory:

- Gerard K. O'Neill, the idea of building cities in space
- NASA Systems Design and the 1975 Summer Study

Going in Circles:

- Basic Physics
 - Newton's Law of Universal Gravitation $\frac{GM_1 M_2}{R^2}$
 - How to move around a circle of radius R at a steady speed v --- centripetal acceleration $\frac{v^2}{R}$
- LEO (Low Earth Orbit) --- 84 min to orbit Earth
- GEO (Geosynchronous Earth Orbit) --- $5.63 R_E$ above Earth's surface
- Topography of Earth-Moon space: The Lagrangian Points -- L1, L2, L3, L4, L5

The System:

- Use solar energy gathered in space and on the Moon
- Mine material on Moon; launch it to L2
- Ferry material from L2 to L5
- At L5 use solar power to refine Al from lunar material
 - Build habitat for 10,000 people
 - Build solar panels and converters to microwaves
 - Build transmission antennas
 - Sell and beam microwave energy to Earth

The Habitat:

- Three crucial design criteria
 - pseudo gravity of 1 g
 - rotation rate of 1 rpm
 - livability -- 67 m² per person
- Consequence of the design criteria: The Stanford Torus
- Making it be nice

Big Problems

- Inventing/Designing a Mass Launcher
- Inventing/Designing a Mass Catcher
- Illuminating the interior
- Protecting against ionizing Radiation --- implausible solutions
- Keeping peace among humans living together
 - an example from the Summer Study

Afterwards -- some personal stories

- Putting together the report
- *National Geographic* July, 1976 "Colonizing Space" by Isaac Asimov, illustrations by Pierre Mion
- group-think
- Robert A. Heinlein's *The Moon Is a Harsh Mistress*; Arthur Clarke's *Rendezvous with Rama*
- Hardest work, most fun
- Uses in curricula --- 1985 Conference: *Space Colonization: Technology and the Liberal Arts*; a new course: "The Physics of Living in Space" resulted in an unpublished text

More Information

- Gerard K. O'Neill, "The Colonization of Space," *Physics Today* **27**(9), 32 (1974)
- *Space Settlements: A Design Study* edited by Richard Johnson and Charles Holbrow, NASA SP-413, 185 pp., USGPO (1977); on line at <https://settlement.arc.nasa.gov/75SummerStudy/Design.html>
- *Space Resources and Space Settlements*, Technical papers from the 1977 Summer Study, NASA SP-428. (O'Neill sought to shift attention back to large habitats and away from small ones like the Stanford Torus; on line at <https://settlement.arc.nasa.gov/spaceres/index.html>)
- *Space Colonization: Technology and the Liberal Arts*, edited by Charles H. Holbrow, Allan M. Russell, and Gordon F. Sutton, AIP Conference Proceedings 148, New York, 153 pp. (1986).
- Gerard K. O'Neill, *The High Frontier: Human Colonies in Space*, William Morrow, New York (1976).