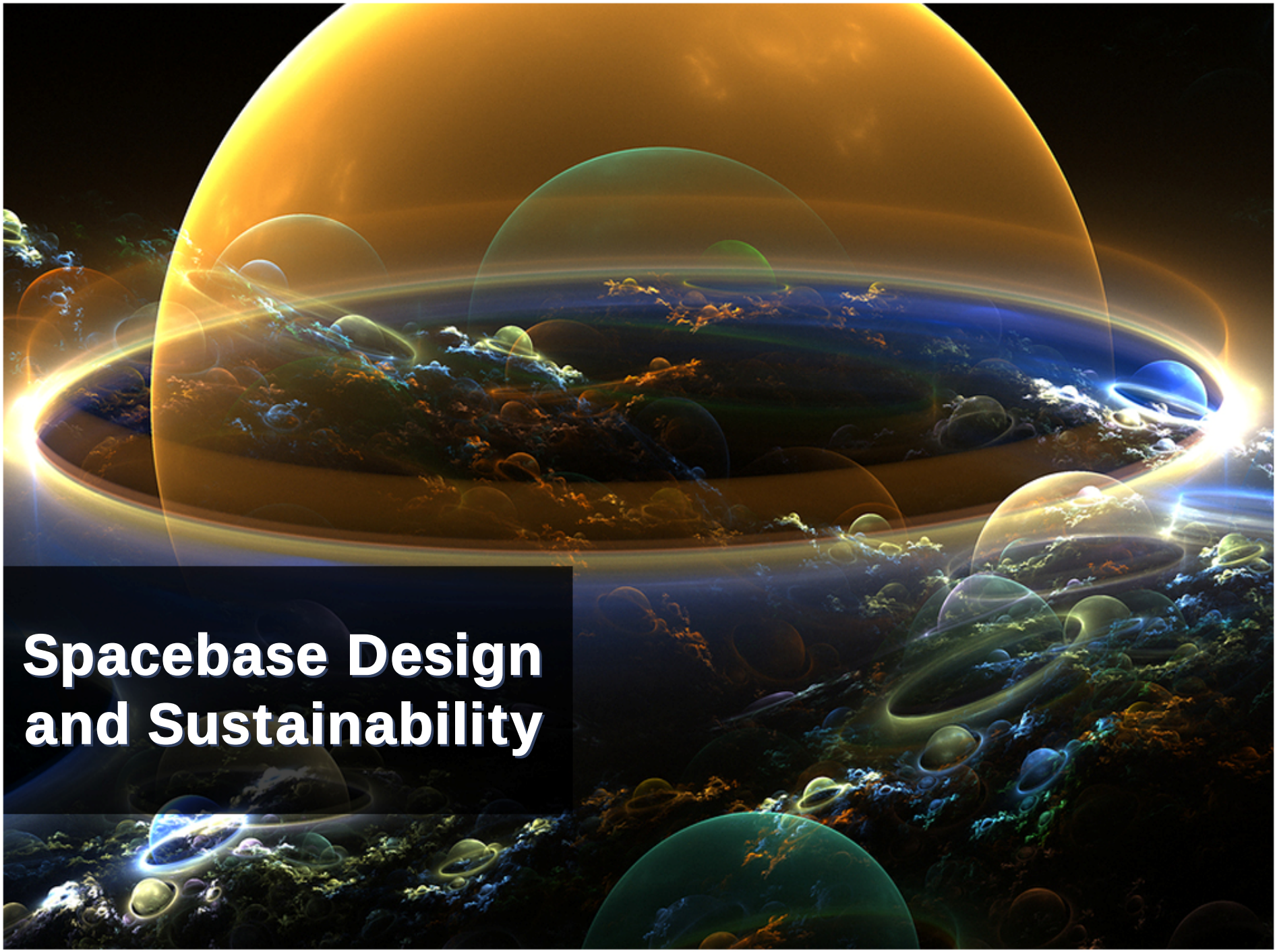
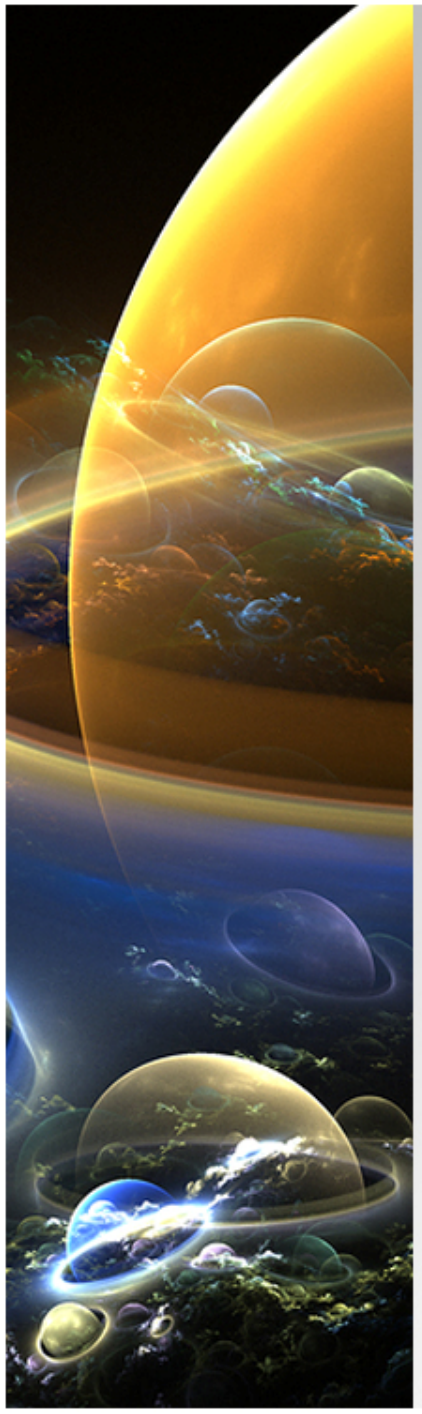
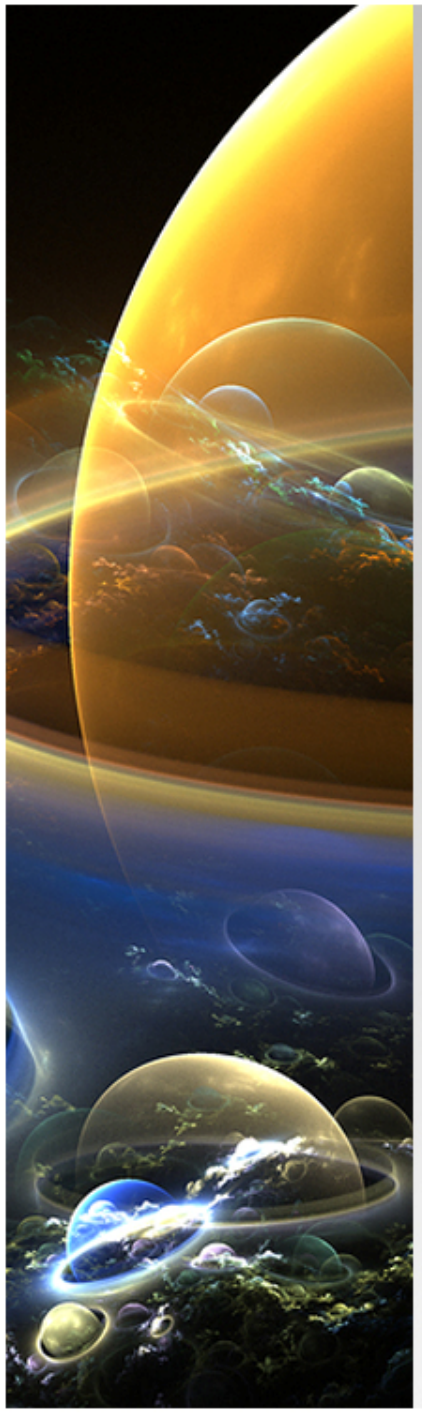

Spacebase Design
and Sustainability



Spacebase Design and Sustainability

TOTAL MANDATORY SELF-SUFFICIENCY

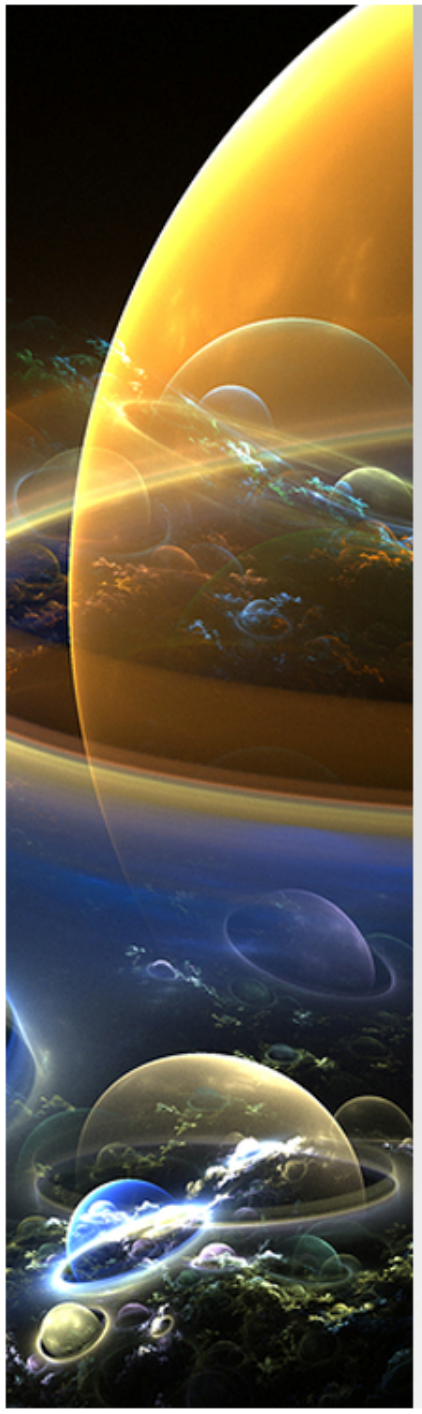
- A spacebase is an extremely remote outpost for human habitation in an inaccessible extreme environment where help is unavailable and problems must be fixed locally.
- The same could be said of human civilization on Earth.
- The design of a spacebase addresses all the same issues as the design of a sustainable civilization on Earth or even a sustainable remote community.



Spacebase Design and Sustainability

ESSENTIAL REQUIREMENTS of a spacebase are –

- to provide internally a human compatible (comfortable) life support environment
- 100% recycling and regeneration of life support materials such as air (oxygen) and water
- the production of food with the efficient use of only a small amount of labour
- total recycling of all organic waste materials to become nutrients for food crops
- the capture and processing (to make benign and reusable) of any toxic materials
- to harvest from its environment the energy and materials it requires to operate
- to meet the energy and material demands for viable operation at all times

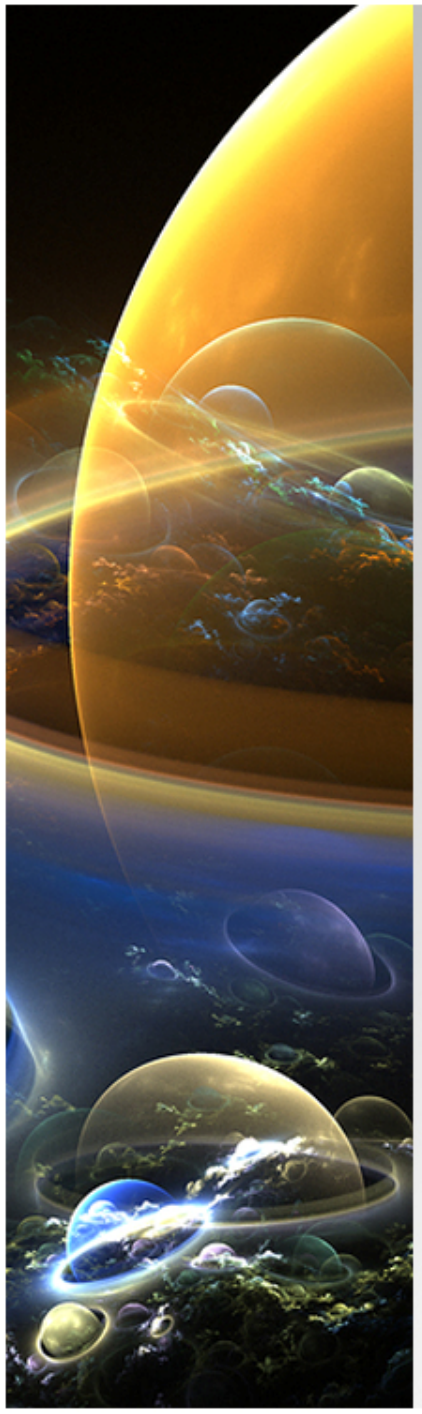


Spacebase Design and Sustainability

ESSENTIAL REQUIREMENTS of a spacebase (continued) –

- Systems must have high redundancy so if one system fails a back-up system will provide life support while the failed system is repaired.
- All of the equipment must be locally reparable by the inhabitants.
- For long term survival all the materials in the structure and machines of the spacebase must be capable of renewal - requiring 100% recovery, recycling and regeneration of all materials and parts.
- The design and planning must take into account the total requirements of all tasks to maintain and operate the spacebase and the availability of manpower while allowing for spare capacity to tolerate illness or incapacity of crew members.

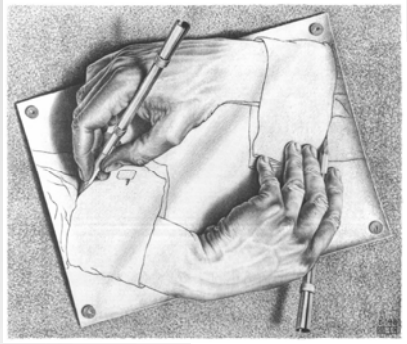
In summary – a completely self-sustaining life support system



Spacebase Design and Sustainability

So how do NASA propose to –

- Design
- Build
- Deploy - a lunar spacebase?



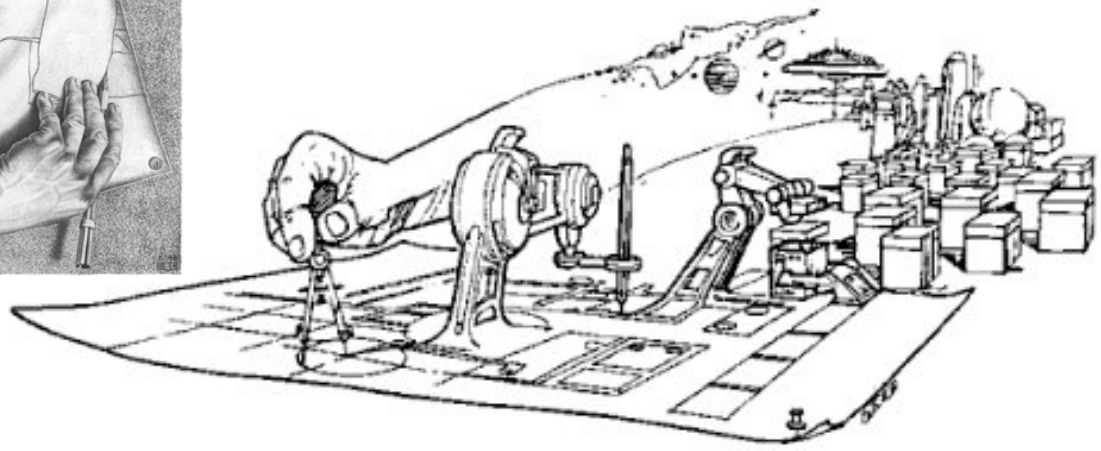
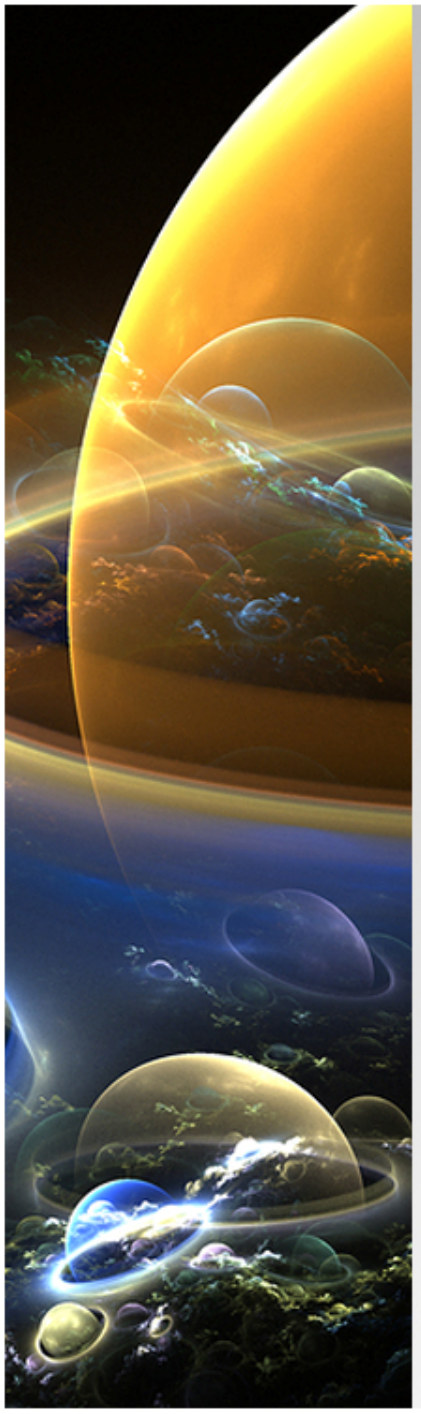
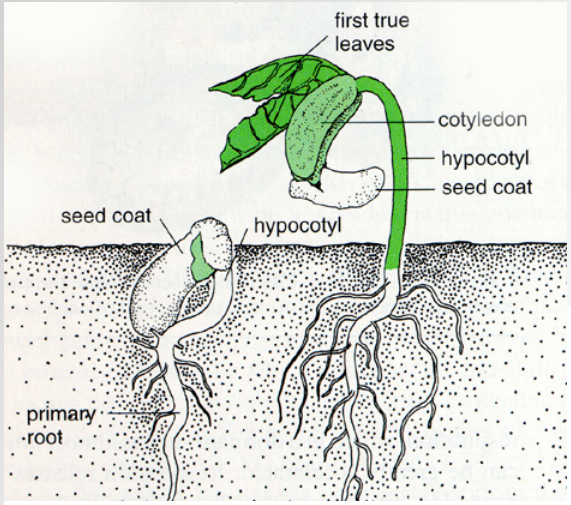


Figure 5.1 -
Automated space exploration and industrialization using self-replicating systems.



Spacebase Design and Sustainability



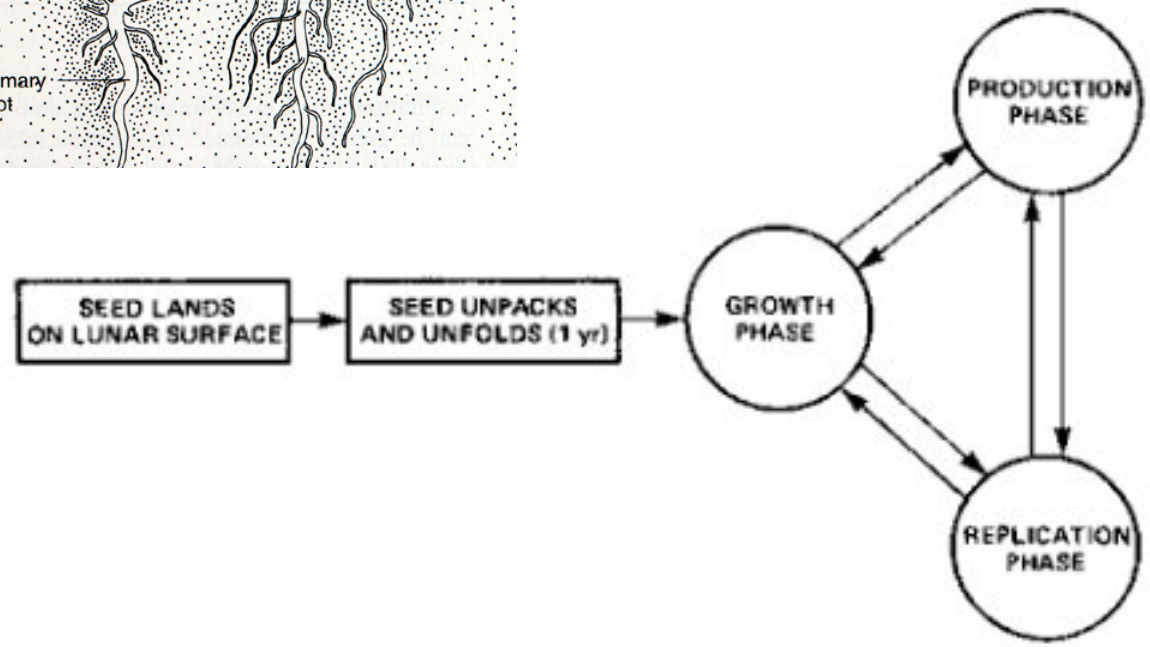
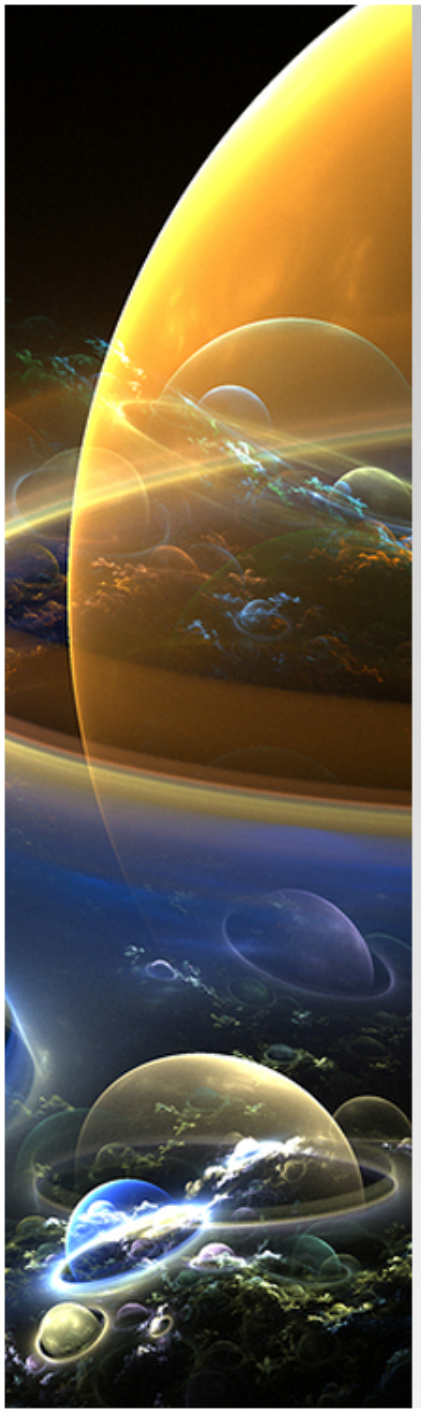
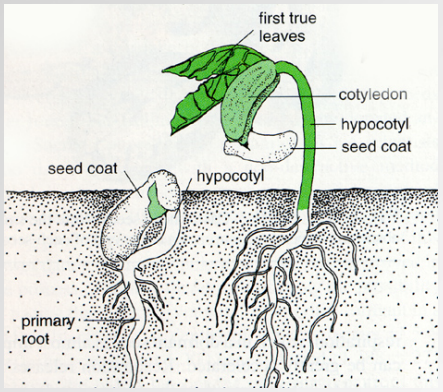


Figure 5.20 -
Flexible scheduling of LMF operational phases.



Spacebase Design and Sustainability



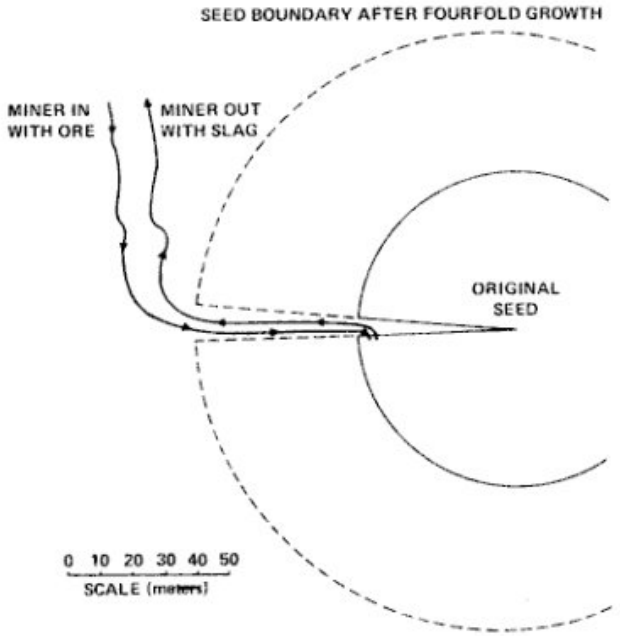


figure 5.39. -
LMF constant-angle wedge corridor access route.

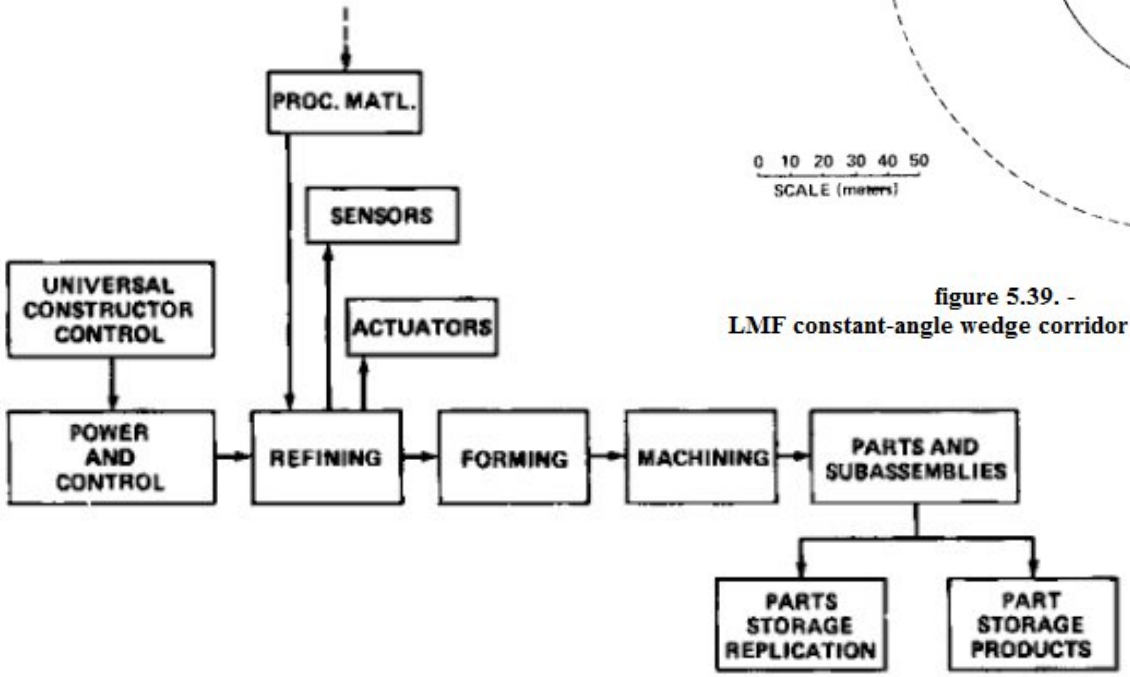
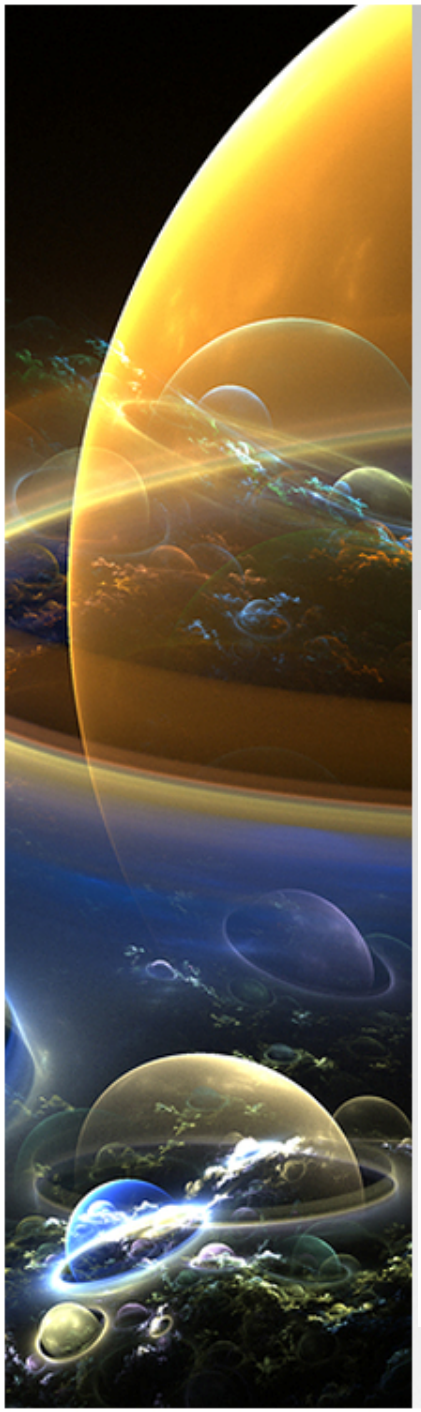


Figure 5.9 -
SRS parts production plant subsystem.



Spacebase Design and Sustainability

NASA's 1979-80 study concluded that with standard engineering design methods it would be difficult for the design process to not end up in an indefinite 'design iteration' loop …

EnGen Institute solved this problem in 1990

and has made several other significant improvements since …

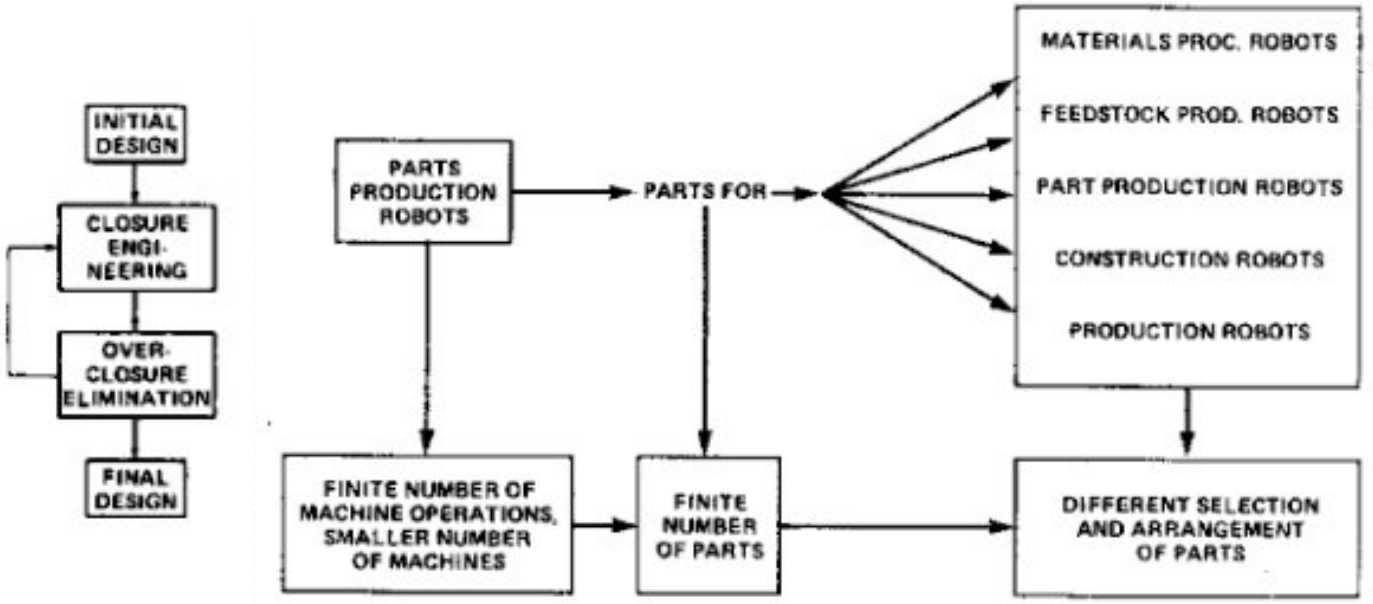


Figure 5.21 -
Closure of SRS parts production.

Spacebase Design and Sustainability

On Earth a Spacebase doesn't need a shell

More information …

http://www.islandone.org/MMSG/aasm/AASMIndex.html

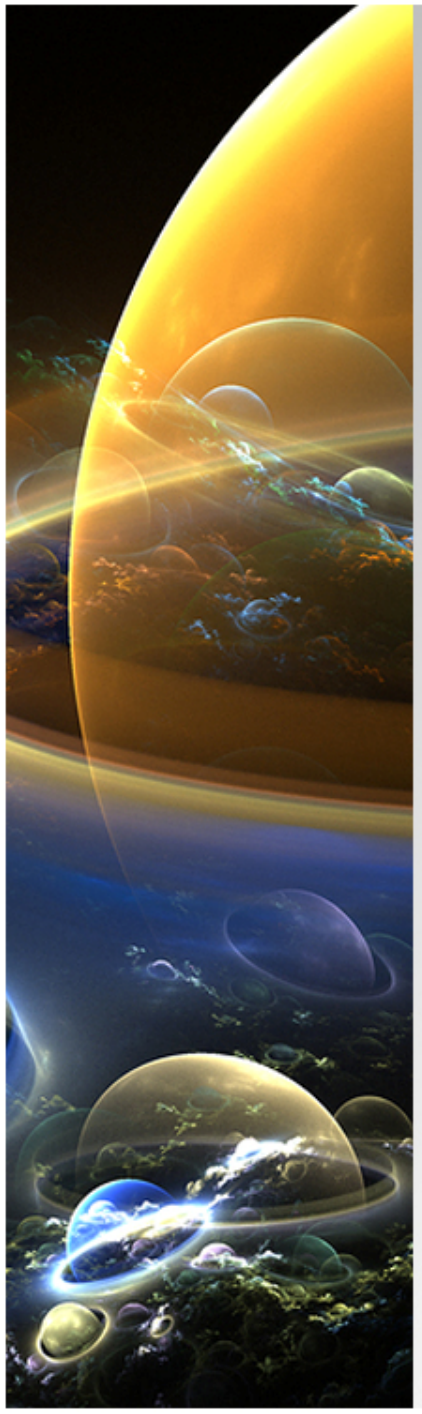
(NASA 1980 Workshop Report)

www.engen.org.au

ENGEN INSTITUTE

Total Sustainability

Life-Support Systems



Spacebase Design and Sustainability

QUESTIONS ???

John von Neumann – Theory of Self-Replicating Systems

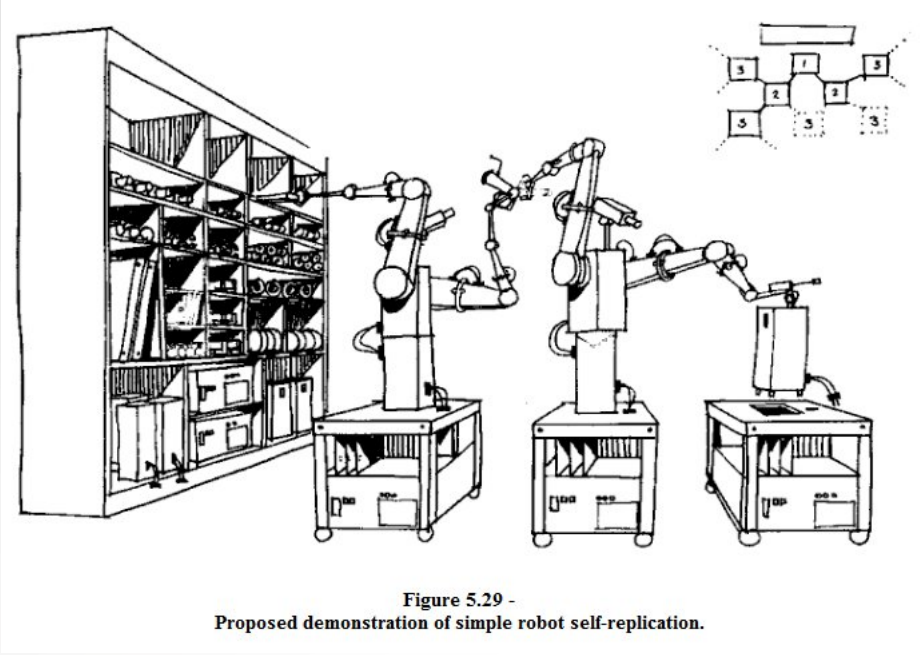


Figure 5.29 -
Proposed demonstration of simple robot self-replication.

Theory: Machines able to assemble their duplicate by remote control like Mars Rover - not autonomous