

Constraints on the pre-design of a human lunar minimal outpost

LEAG-ILEWG-SSR

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Ludivine Boche-Sauvan

GeorgiaTech - Arts et Metiers ParisTech

Robert Ernst

Bernard H. Foing

RSSD, ESTEC/SRE-S



Why such an outpost ?

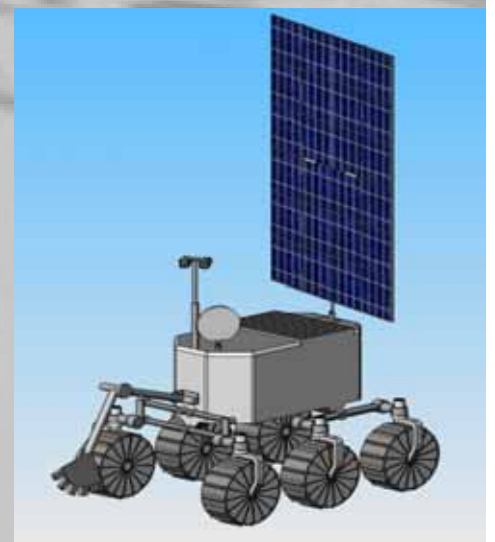
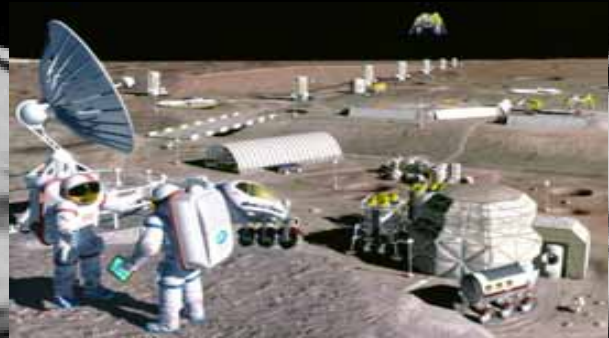
- To study the Moon and the solar system origin
- To carry out life science experiments under lunar conditions
- To test exploration technologies
- To learn to live off the land
- To prepare the exploration of Mars

What are the constraints ?

- If not in a polar region, the base is reachable every 14 days.
- If far side: need a satellite at least to communicate.

Solution: South polar area

- Both dark and far side: communication and observation
- Area of quasi-eternal light
- Proximity of H compounds/ Water ice in crater shadow
- Frequent addition of equipment possible
- Edge of South-Pole Aitken Basin
- Late Heavy Bombardment chronology



What are the constraints ?

Any facility has to resist to the lunar conditions:

- Vacuum
- Extreme temperature (-153°C to 107°C for equator, -60°C to -40°C for a polar region)
- Regolith
- Seism
- Micrometeorites

Transportation constraints

- Mass, volume, Deployment
- Modular cargo elements

5

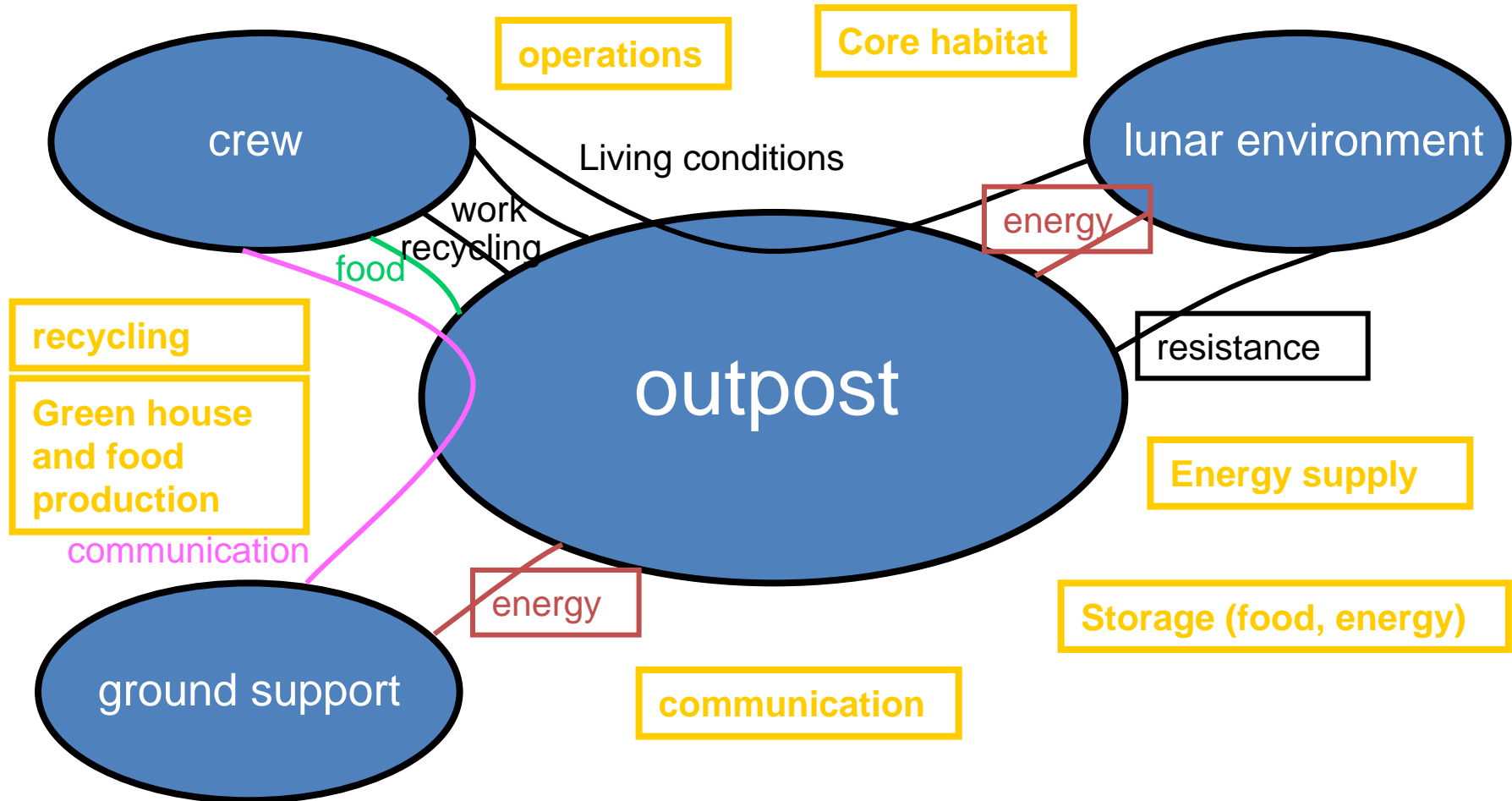
Presentation
Modular concept
Terrestrial demos

Objectives
Specifications
Modular concept

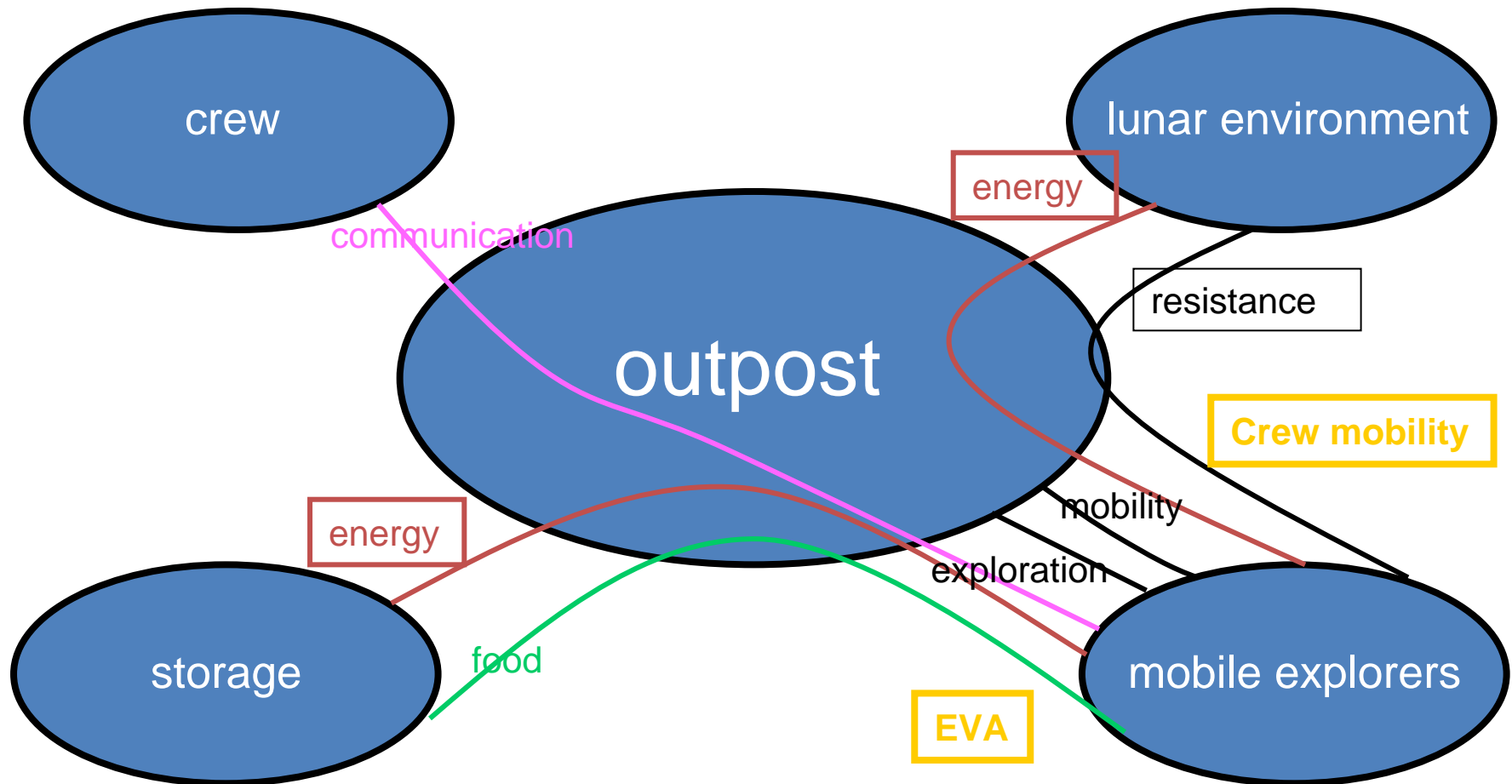
The modular concept



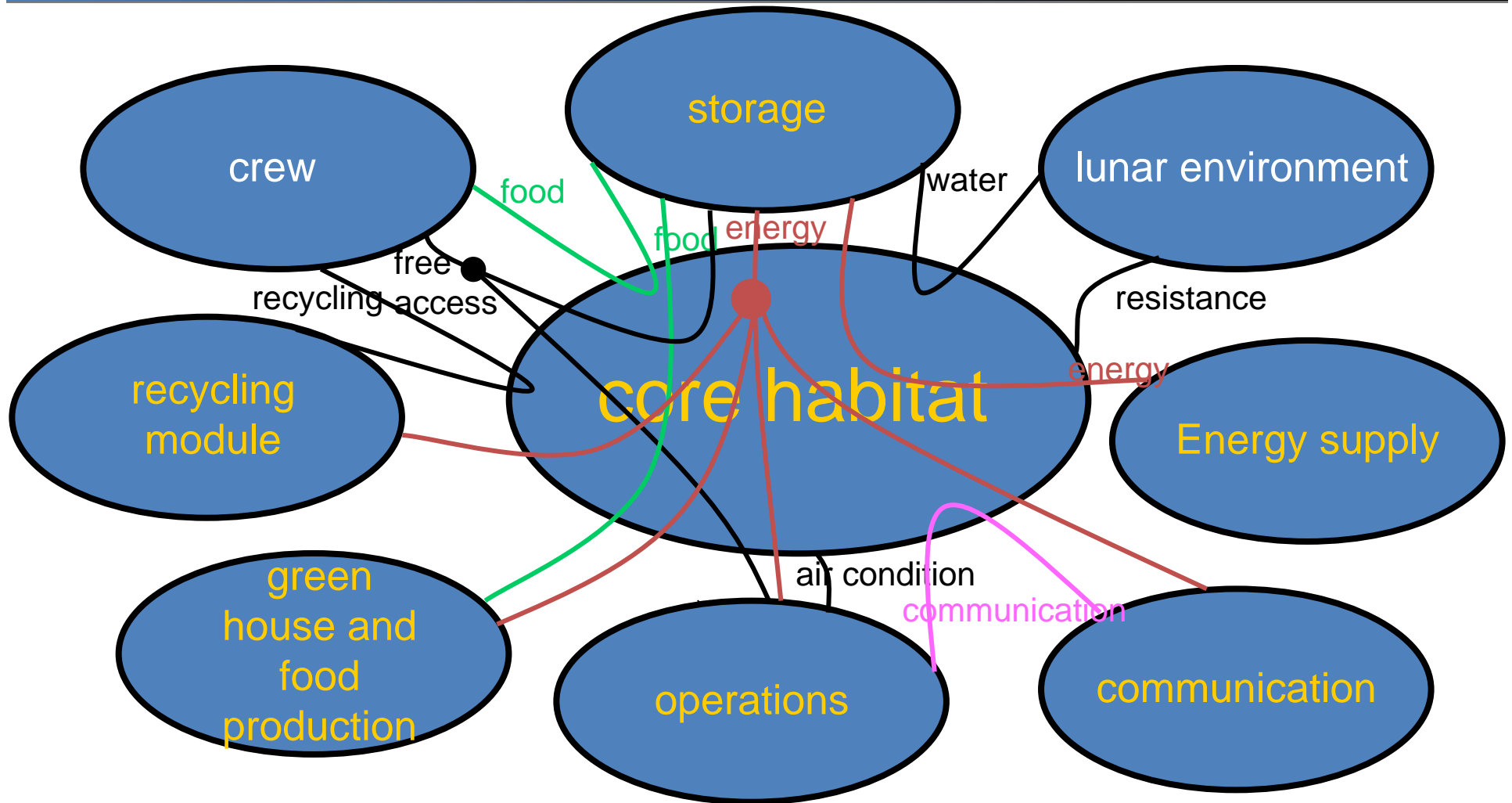
The constraints on the outpost during the habitat situation



The constraints on the outpost during the exploring situation



A core habitat for living conditions



Autonomous Lunar Exploration

Research of the Moon

Supported by mobility, deep & very deep drilling (= 10 – 100 m), sample return

Radio-astronomy from the Moon

Low frequency radio telescope deployment on lunar far side

Technology demonstration

E.g. ISRU, Life Support Systems

Lunar Outpost Support

Delivery of logistics and small infrastructure elements

Robotic rover for in-situ analysis

Power supply/distribution

Deep drill system

Logistics/maintenance elements

Waste management

Crane or payload

Communication assets

Navigation aids

Crew aids

Airlocks

Lunar Sortie Mission Support

Pre-deployment of logistics/cargo to landing site of human-rated lander or

along the path of a pressurised rover

Capability Demonstration

Soft/precision landing (500m)

Survival of lunar night

Payload deployment

Hazard Avoidance

Global Access



Lunar Lander Mission Scenario

Presentation
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Why ?
Core Habitat
Green House

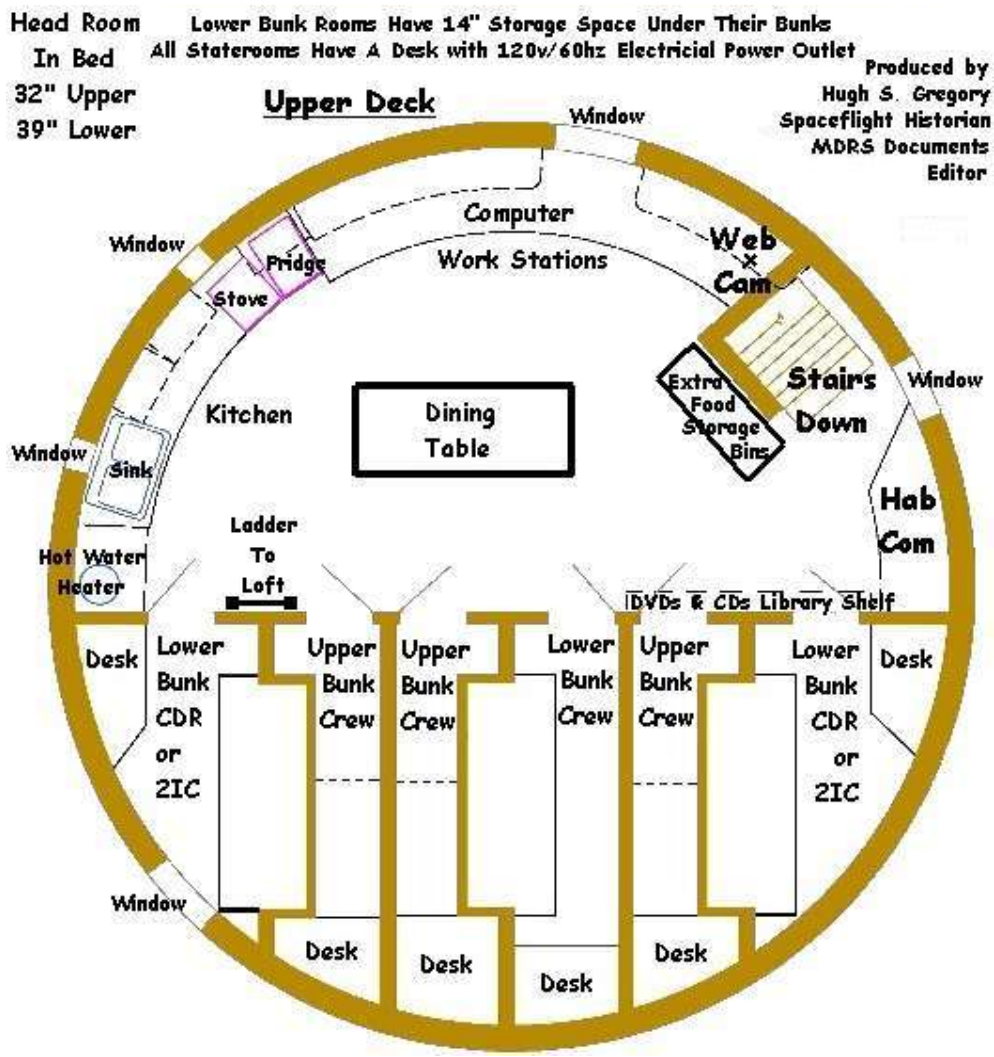
How can we learn from terrestrial demos?



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Operations module

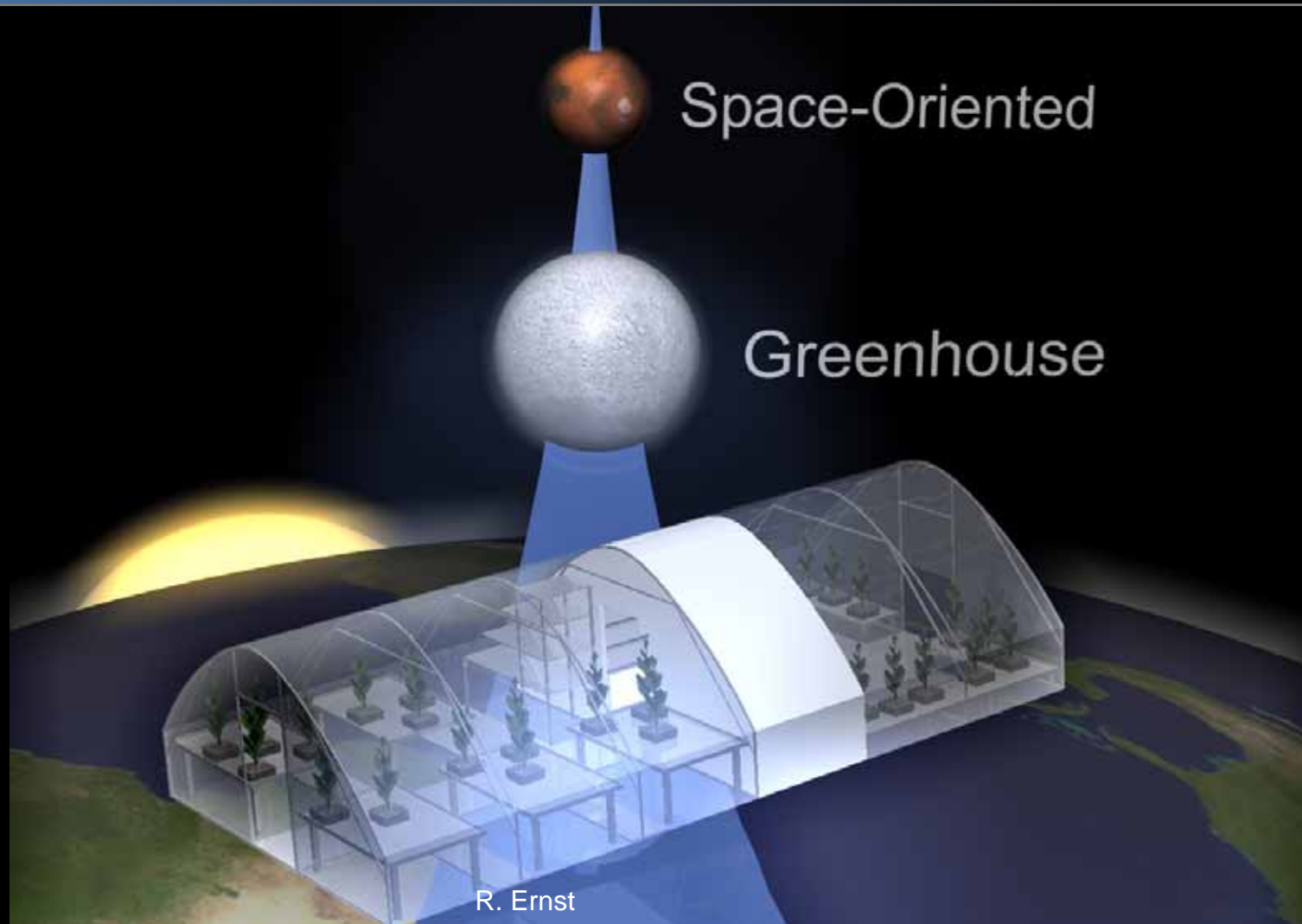


13

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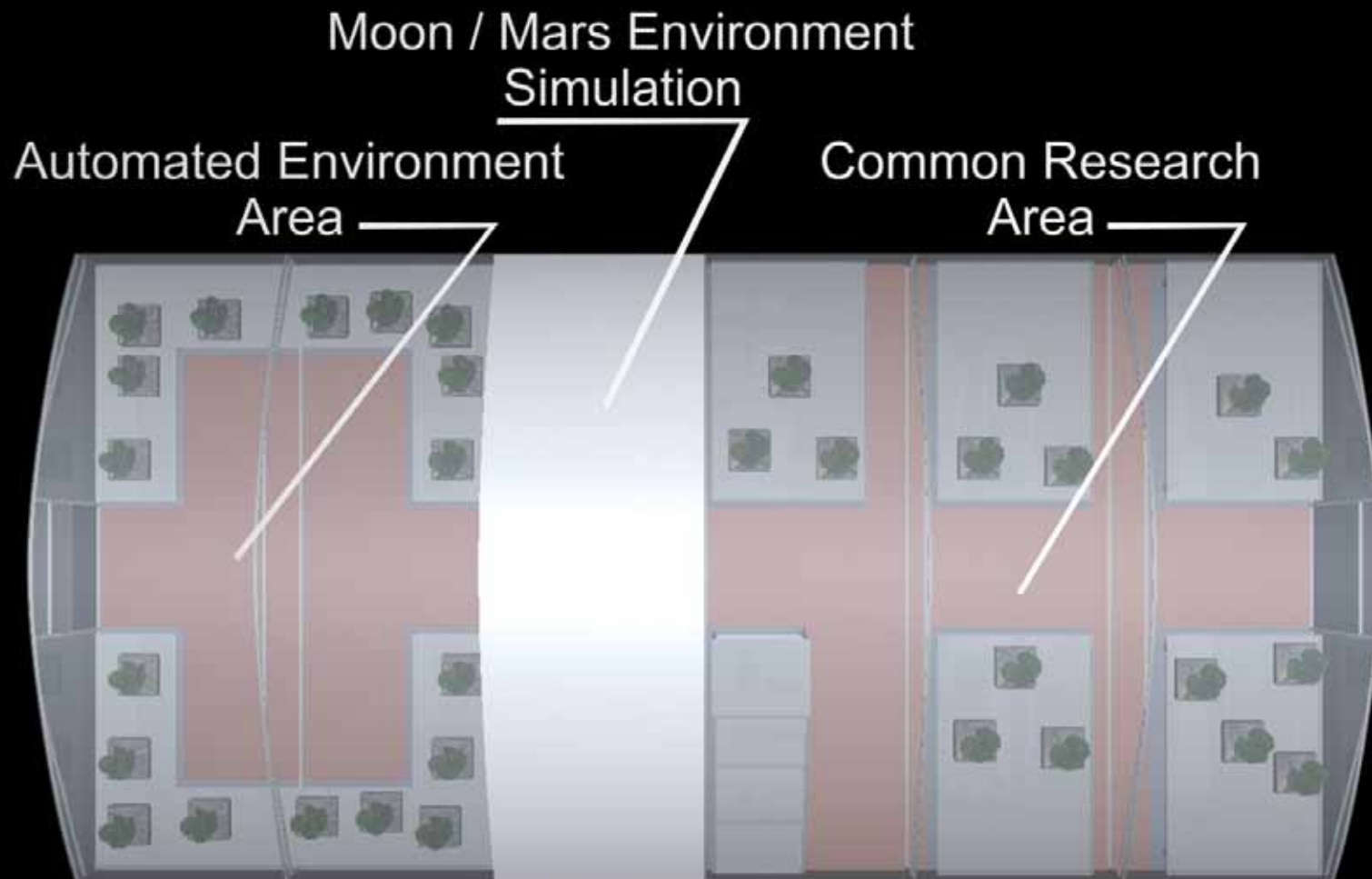
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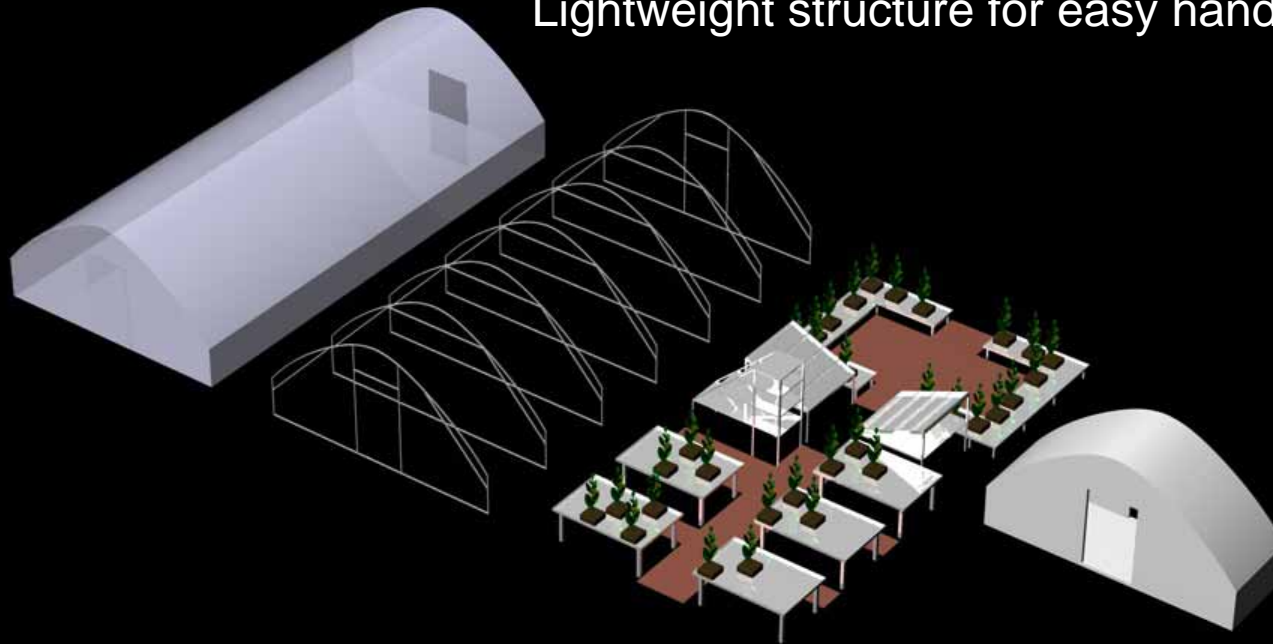


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How can we learn from terrestrial demos?

Special plastic foil to control the sun light input parameters

Lightweight structure for easy handling and assembly



special equipment for each section of the greenhouse

Thermal isolation for moon and mars environment simulation

R. Ernst

How can we learn from terrestrial demos?

- Monitoring of environmental parameters

- CO2 concentration
- O2 concentration
- Air / Ground Temperature
- Air / Ground Humidity
- Light intensity
- UV intensity
- Fire, toxicity



R. Ernst

Summary and perspectives

- Science and exploration goals
- Minimal lunar outpost constraints
- Core and support functions
- Live, work, research and expand
- Modular elements
- Evolutive design
- Survey of enabling technologies
- Terrestrial demonstration
- Operational scenarios

R. Ernst