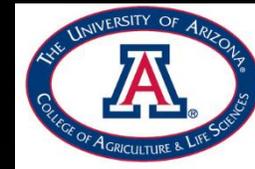


Lunar/Mars Greenhouse

An overview of our NASA supported University of Arizona Lunar/Mars Greenhouse Efforts

UA-Systems and Industrial
Engineering
UA-Biosphere 2
Sadler Machine Co., Tempe, AZ
Thales Alenia Space Italia/CNR

THE UNIVERSITY OF
ARIZONA
Tucson, Arizona



3/27/2021



Geographic South Pole- U.S. National Science Foundation's
Amundsen-Scott South Pole Station Pop. 50 Winter-150 Summer
Max Temp Winter -117 F (82.8C) Summer 9.9F (-12.3C)
7 months of isolation- no flights in or out

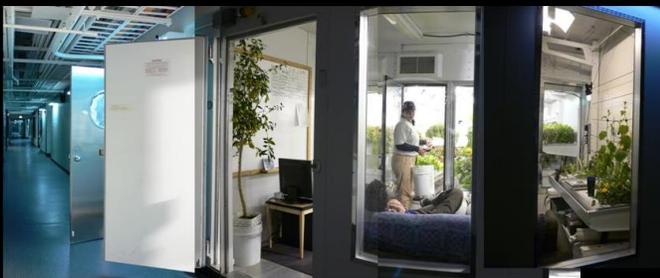




2001- U.S. NSF Amundsen-Scott South Pole Station Greenhouse, designed, fabricated, and initially operated by the University of Arizona Controlled Environment Agriculture Center/Sadler Machine.

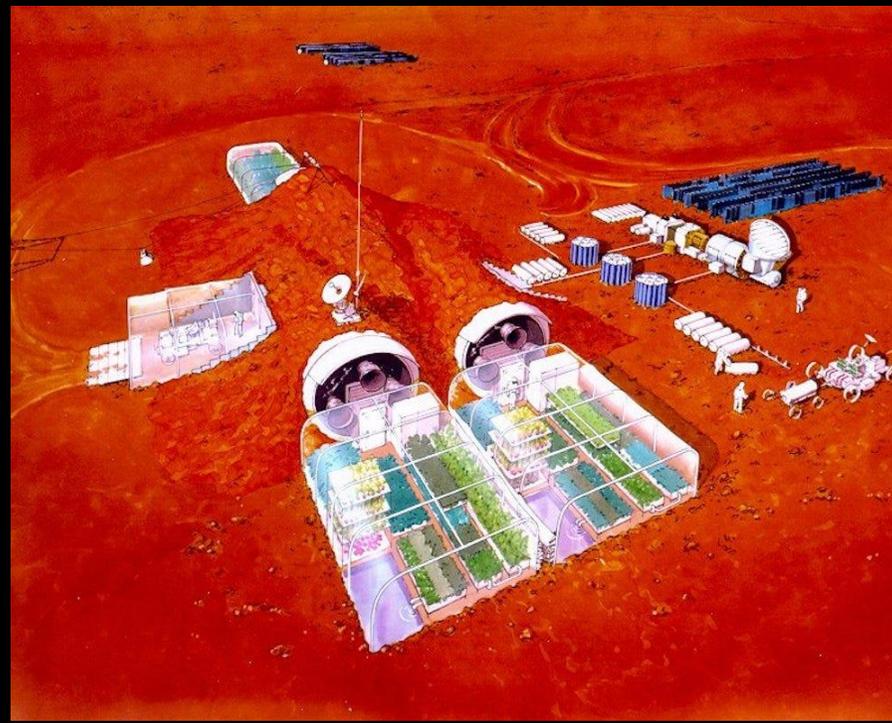
UA Students initially helped operated the greenhouse for the first 7 years, both wintering and remotely from Tucson, AZ



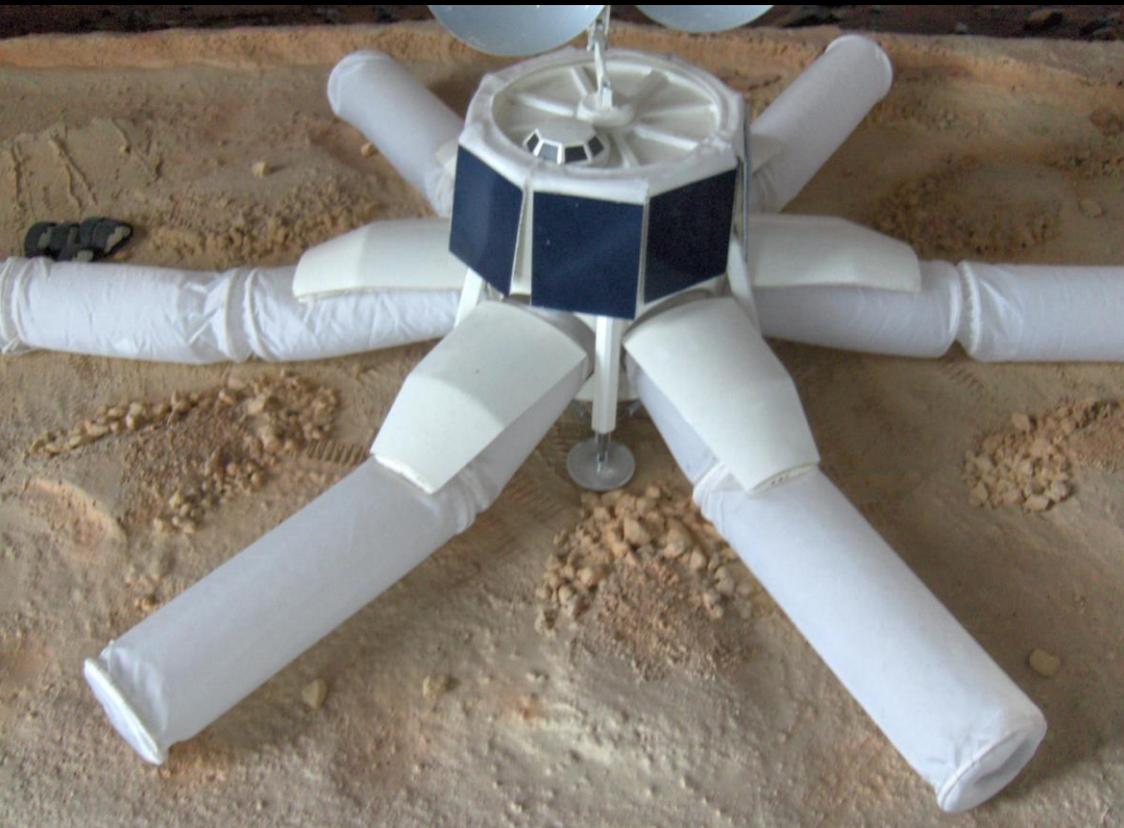


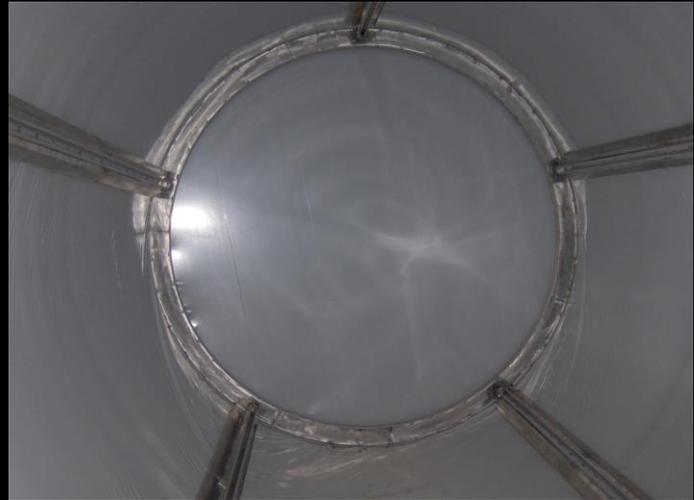
NASA Drawings
of future Lunar/Mars
Greenhouses
At the UA-CEAC,

NASA has supported
our Lunar/Mars
greenhouse efforts
Ralph Steckler Space
Grant- 2010 - 2017

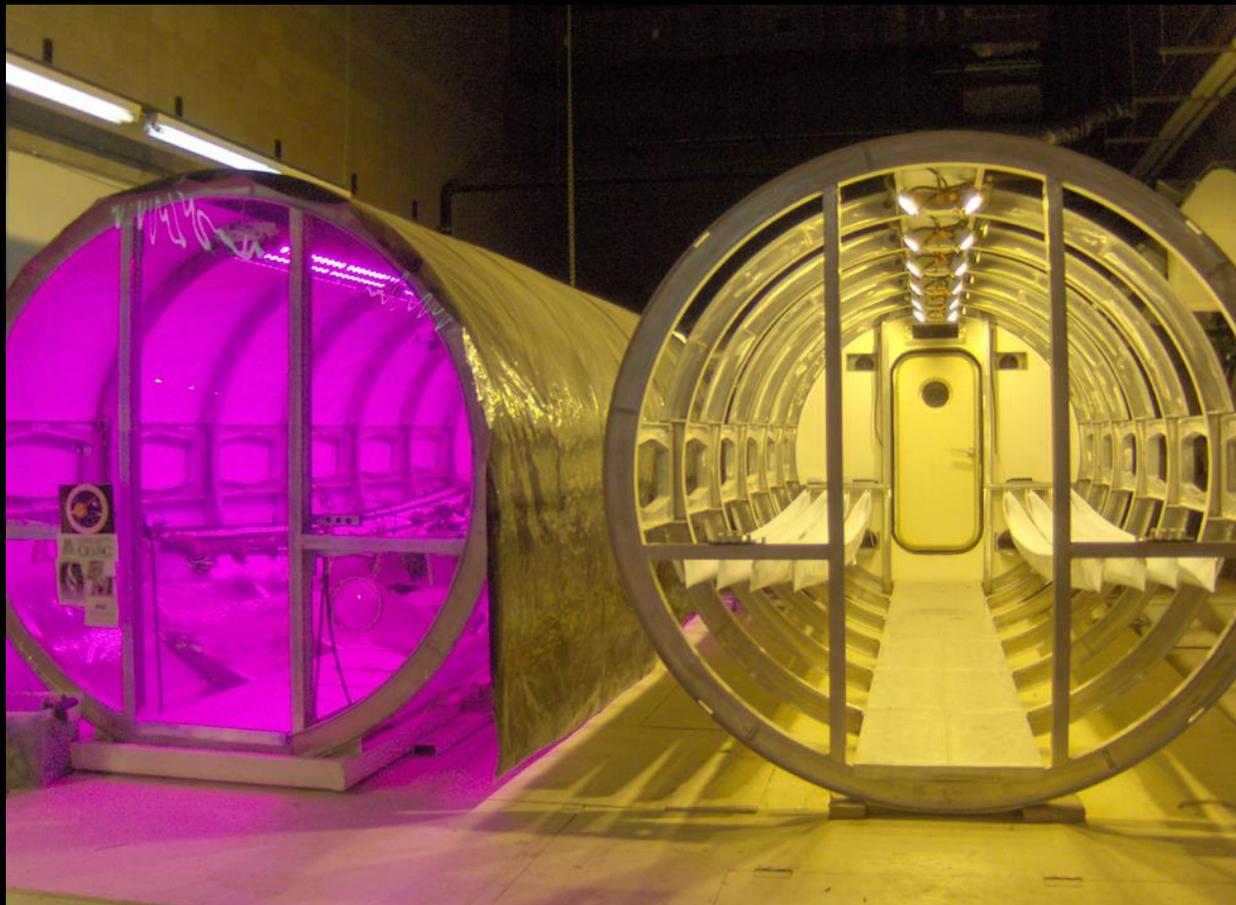


To design a successful LMGH, you need to know what the Habitat design will be. We followed JSC's Habitat Demonstration Unit (HDU) design that consists of inflatable membrane modules radiating from a central hub.





4-LMGH Units at
UA-Farm
5.5m long deployed
1m long collapsed







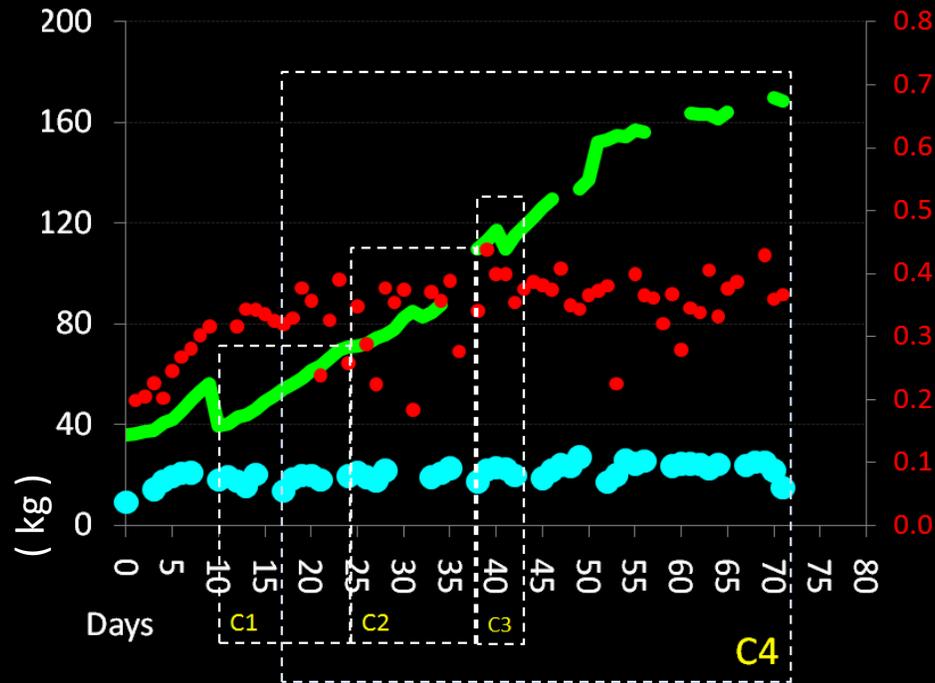
CEAC

AGC
The Ultimate
Greenhouse
Cover

Handwritten blue text, possibly a signature or date.

Phase 1 LGH Life Support Production Results

Oxygen (kg)
Biomass (kg)
Water (kg)



C4 = 58 Day Closure Interval

Change in growth after 58 days

Day 57 Max Water Condensed/day ~47.3 L

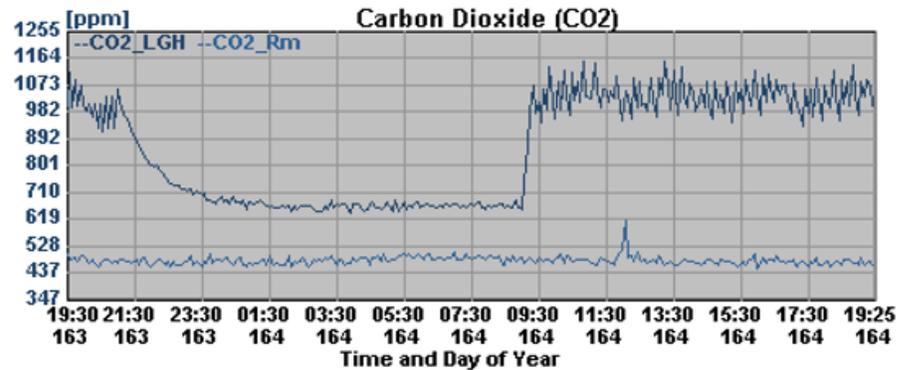
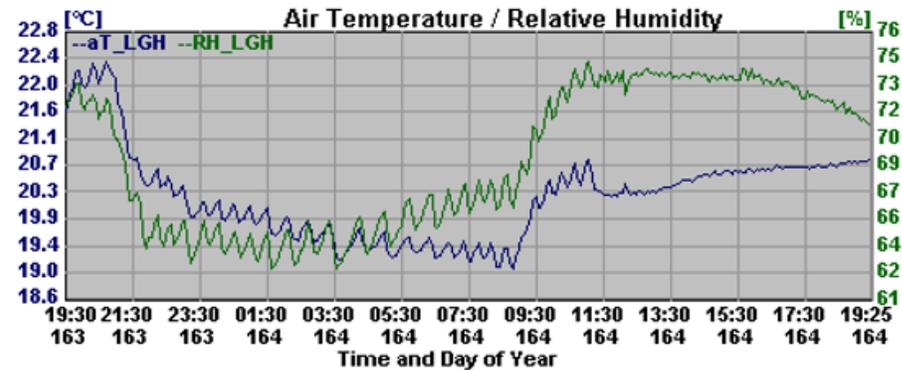
Controlled Environment Agriculture Center

Welcome to the **Greenhouse Monitoring System** of the Controlled Environment Agriculture Center (CEAC) at the University of Arizona. You will see real-time pictures of the current crops, as well as real-time microclimate data of the greenhouse where these crops are being grown.

Tomatoes Live! 2.0

[GH #Lunar](#)[Main Page](#)[Live Cameras](#)

| DATE (DOY) | TIME | aT_LGh (°C) | Tdp_LGh (°C) | RH_LGh (%) | CO ₂ _LGh (ppm) | O ₂ _LGh(%) |
|------------------|-------|-------------|--------------|------------|----------------------------|------------------------|
| 06/13/2009 (164) | 19:25 | 20.8 | 15.5 | 71.0 | 1001.0 | 20.240 |

[24 hr](#)[7 days](#)[CImSummary](#)[Raw Data](#)

Live view of the Lunar Greenhouse



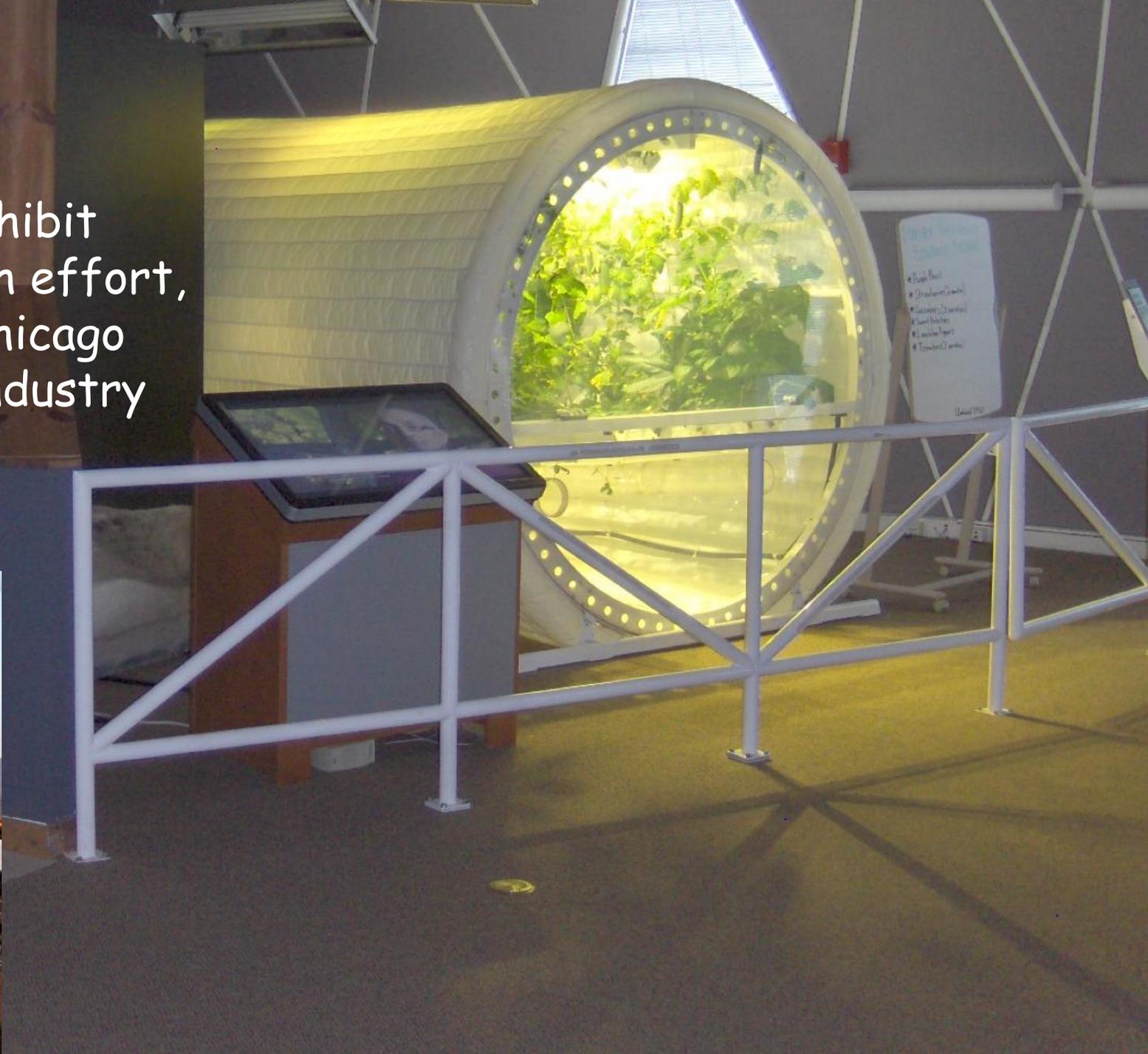
[[Large](#) | [Live](#)]

Oxygen concentration [ppm] 8.0

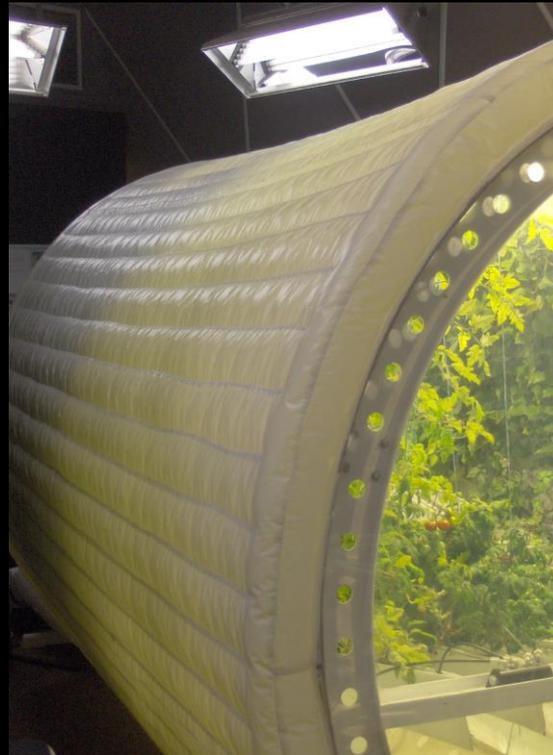
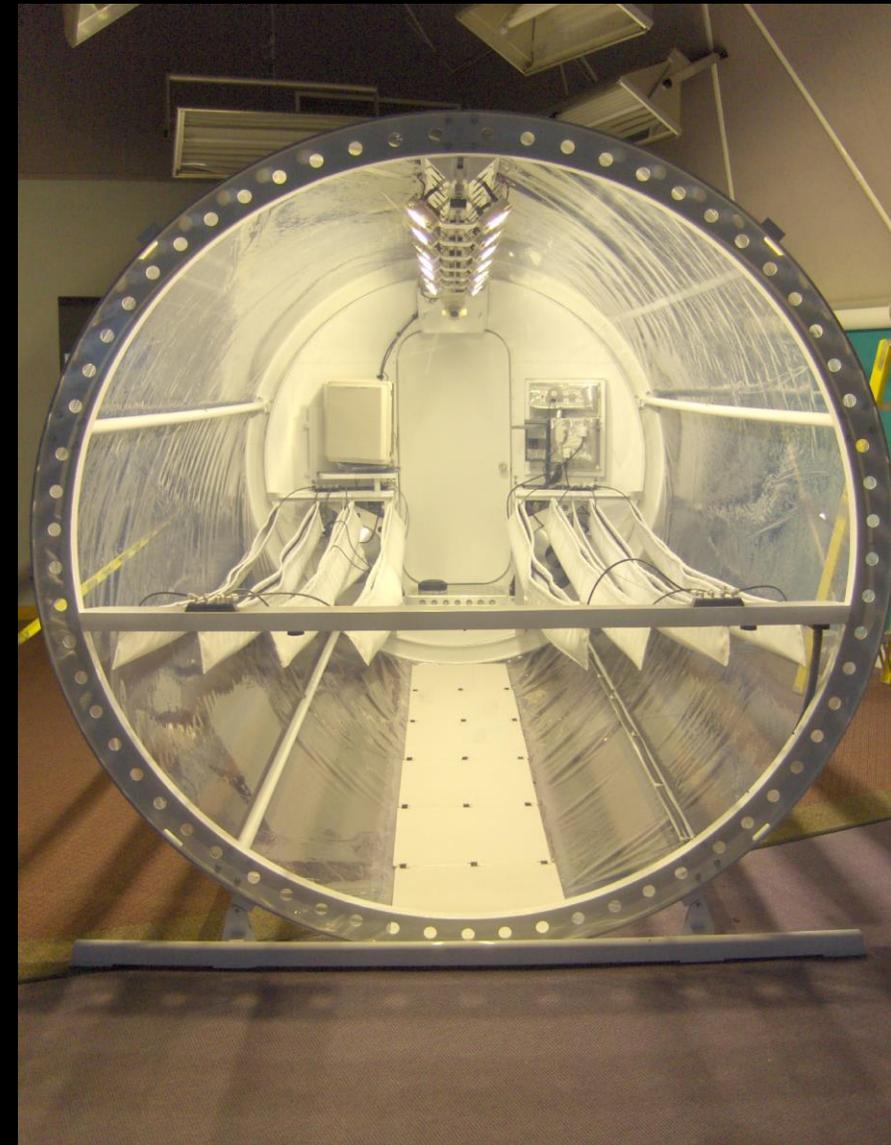
Farming on Mars:

Future Lunar/Mars Biospheres

UA-Biosphere 2 LMGH Exhibit
Our NASA grant Outreach effort,
earlier exhibited at the Chicago
Museum of Science and Industry
for 7 months.



Before the pandemic the B2 exhibit had 100K visitors/yr



ISS - Grow Rack demonstration of a membrane based Express Rack growing system



Next Generation LMGH





THE UNIVERSITY OF **ARIZONA**

Controlled Environment Agriculture Center
Systems and Industrial Engineering
Tucson, AZ



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Dr. Ray Wheeler, NASA Kennedy Space Center
NASA's Ralph Steckler Space Grant
University of Arizona Space Grant Consortium
Our friends at Aero-Sekur and Thales Alenia
Space-Italia, et.al.

Thank You!

