

# A Novel Approach for Engaging Academia in Collaborative Projects with NASA through the X-Hab Academic Innovation Challenge

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## Outline

- Introduction
- Process and Timeline
- History
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- Future Plans
- Conclusion



## X-Hab Introduction

- X-Hab Academic Innovation Challenge is currently in its Sixth Year of Execution
- It is run through KSC for NASA Human Exploration Operations Mission Directorate
- Solicitation partnering NASA and academia on technologies and studies for deep space missions
- NASA awards grant funds (~\$10k - \$50k) to design and produce functional products of interest
- Universities propose on a variety of projects suggested by NASA and are then judged on technical merit, academic integration, leveraged funding, and outreach.

## X-Hab Introduction (cont'd)

- Universities assemble a multi-discipline team of students and advisors that invest months working together, developing concepts, and frequently producing working prototypes.
- Students gain a quality experience, working real world problems that have the possibility to be implemented, and they work closely with subject matter experts from NASA who guide them through a formal engineering development process
- The first X-Hab in 2011 was run as a head to head competition. After that, it was decided to pursue a diverse portfolio of projects each year to gain more from the investment

## Notional Selection Schedule

- February Solicit project ideas, funding for projects in next fiscal year
- Early March Release solicitation
- Early April Questions for online technical interchange due
- Mid April Responses for questions published online
- Late April Proposal due date
- Late May Award announcements and announce selections for the fall
- June Collect project funding and obligate to NSGF

## Project Execution Schedule

- September Project kickoff meetings for new projects
- October Requirements and System Definition Review
- November Preliminary Design Review
- January Critical Design Review
- March Progress Checkpoint Review
- May Project Completion and Evaluation by NASA



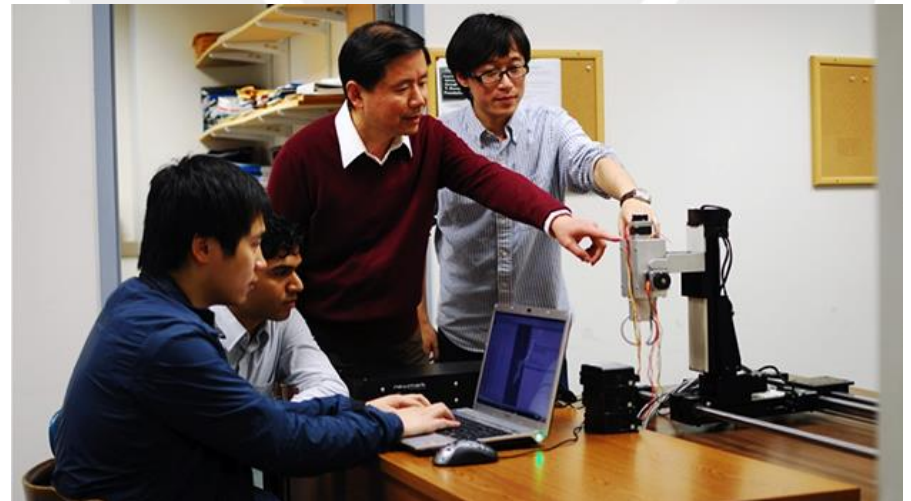
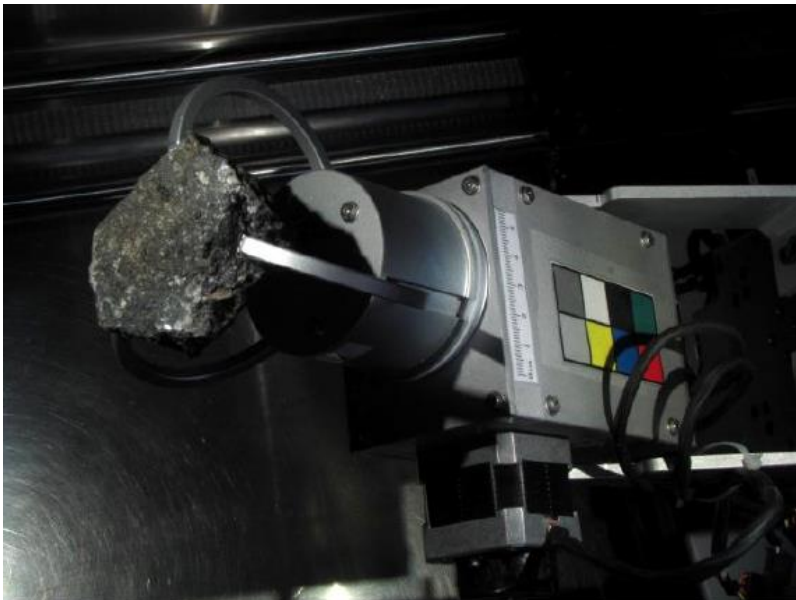
## X-Hab 2011

- Inflatable Habitat Loft competition
  - University of Maryland (bottom right), Oklahoma State University (right), and University of Wisconsin (below)



## X-Hab 2012

- Ohio State University: Plant Growth Monitoring System
- University of Bridgeport, Connecticut: Sample Handling System for GeoLab glovebox (pictured)
- University of Maryland, College Park: vertically-oriented habitat study.
- Oklahoma State University: horizontally-oriented habitat study.





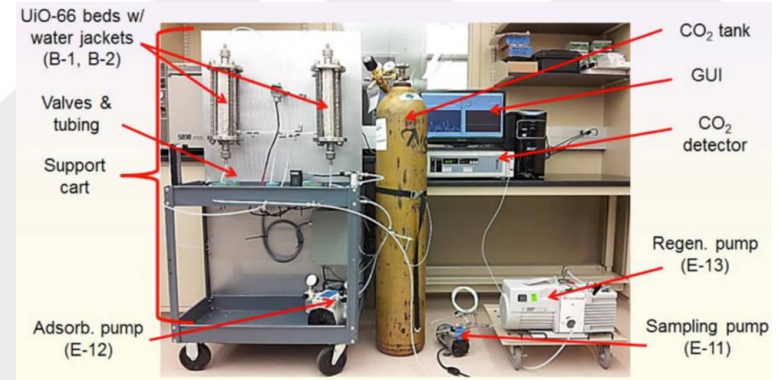
## X-Hab 2013

- University of Alabama, Huntsville: Microgravity Random Access Stowage & Rack System
- California Polytechnic State University: Vertical Habitability Layout and Fabrication Studies (pictured)
- Oklahoma State University: Horizontally Oriented Inflatable Deep Space Habitat
- Texas A&M University: Wireless Smart Plug
- University of Colorado: Remote Plant Food Production Capability



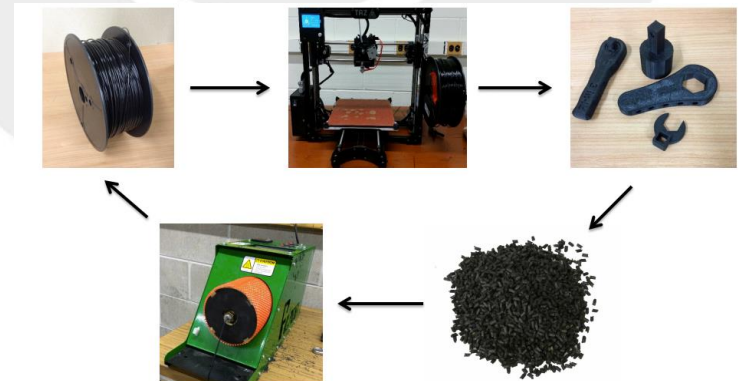
# X-Hab 2014

- University of Wisconsin, Madison: Badger Compartmentalized Onboard Material Extrusion Technology
- University of South Alabama, Mobile: Closed Environment Air Revitalization System Based on Metal Organic Framework Adsorbents
- Rice University, Houston: SpaceRing: a Versatile, Scalable Power-Generation and Cooling System
- University of Colorado at Boulder: Plant Anywhere: Plants Growing in Free Habitat Spaces (pictured)
- University of Maryland, College Park (2 projects): Vertical Habitability Layout Studies, Neutral Buoyancy/Parabolic Flight Habitat Studies
- Oklahoma State University, Stillwater: Horizontal Habitability Layout Studies



## X-Hab 2015

- University of Colorado at Boulder: Deployable Greenhouse for Food Production
- Oklahoma State University: Deployable Greenhouse for food production on long-duration exploration missions
- University of South Alabama: Development of a Volumetric Absorption System for CO<sub>2</sub> and H<sub>2</sub>O Multicomponent Isotherm Measurements
- University of Vermont: Design of a "Smart-Structure" Deployable Airlock (top)
- University of Wisconsin - Milwaukee: Design of a Carbon-fiber/Fused Deposition Modeling Spacecraft Structural Fabrication System (bottom)



## X-Hab 2016 (Sept 2015 kickoffs)

- University of Maryland, College Park, Md. - Inflatable/Deployable Airlock Structures
- Pratt Institute, Brooklyn, N.Y. - Human Centered – Designs for Mars Transit Habitat
- Oklahoma State University, Stillwater, Oklahoma - Deep Space Mars Transit Habitat Layout Studies
- University of South Alabama, Mobile, Alabama - Development of a Concentration Swing Frequency Response Device
- University of Puerto Rico at Mayagüez, Puerto Rico - Technology Development of Low-Power Required Manufacturing of Metals for the Zero Gravity Environment Project
- Utah State University, Logan, Utah - Student Experimental Microgravity Plant System (SEMPS)
- The Ohio State University, Columbus, Ohio - Water Assurance: Improve water delivery of a modular vegetable production system
- University of Colorado-Boulder, Boulder, Colo. - Performance Characterization and Enhancement of the MarsOASIS Space Plant Growth System



# X-Hab Selections 2011-2016



## Benefits

- Reports and Prototypes
  - NASA gets products in which they are interested at low cost
- Outreach
  - Teams do excellent outreach nationally and locally in conferences, schools, and various media
- Financial Flexibility
  - Cooperative Agreement with National Space Grant Foundation facilitates solicitation ahead of academic year
- Student Experience
  - Good project cycle experience ahead of employment



## Future Plans

- X-Hab has been run under one project within HEOMD's Advanced Exploration Systems Division
- Now supports multiple divisions in HEOMD and projects within AES
- Collaboration has become the norm rather than the exception with limited funds in architecture and technology development activities
- X-Hab can continue to grow to support HEOMD activities and engage the creativity of academia

## Conclusion

- The X-Hab Academic Innovation has evolved and matured as it enters its sixth year of operation.
- This model can serve as an excellent mechanism to engage academia in research and technology efforts not only within NASA but any government agency.
- The model benefits government with creative, low cost focused research through academic partners while the universities can tailor the curriculum to give their students a good systems engineering experience guided by the expertise of the agency.

## Questions?

- Thanks to the following folks:
  - Kriss Kennedy at JSC who created the concept of X-Hab
  - All the civil servants and contractors around NASA who have supported X-Hab project teams
  - National Space Grant Foundation
  - The university teams and their partners who have been so successful in executing projects.

## For more information

- NASA X-Hab Academic Innovation Challenge Public Page
  - [http://www.nasa.gov/exploration/technology/deep\\_space\\_habitat/xhab](http://www.nasa.gov/exploration/technology/deep_space_habitat/xhab)
- NASA Deep Space Habitat Facebook page
  - <https://www.facebook.com/pages/NASA-Deep-Space-Habitat/303267556447857>
- National Space Grant Foundation (NSGF) X-Hab site
  - <https://www.spacegrant.org/xhab>
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