RESILIENT EXTRATERRESTRIAL HABITAT ENGINEERING

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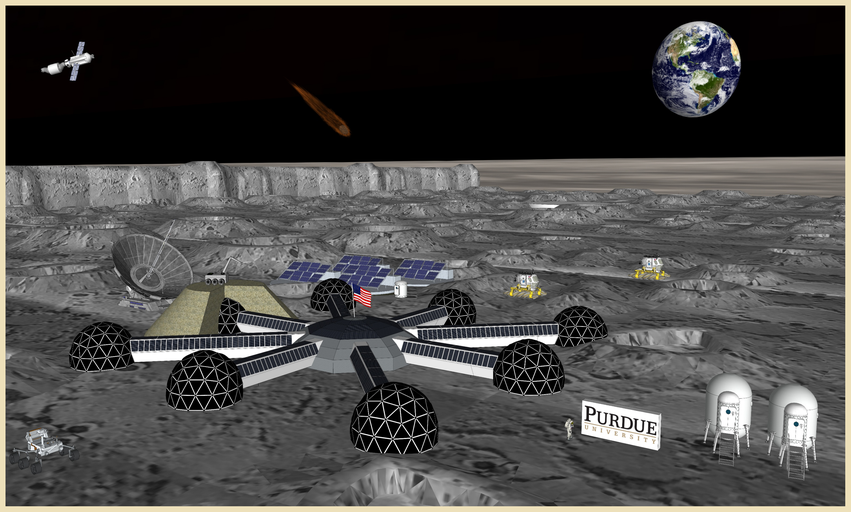
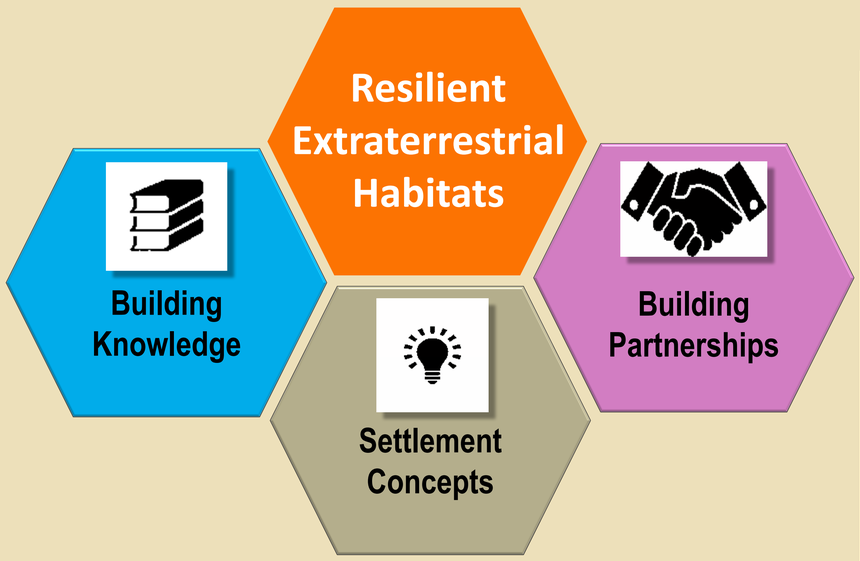
Introduction

- The **design**, **construction** and **operation** of safe and comfortable habitations is one of humankind's oldest activities.
- Humankind is now faced with new challenges as we begin to **move beyond Earth into Space**.
- The design of **sustainable**, **long-term** human **settlements** represents a multidisciplinary engineering and scientific grand **challenge for humanity**.
- Providing **livable conditions** in **Space** will require the highest applications of engineering and technology to **design** and **construct habitats** that are resilient to disturbances, such as:
  - *Extreme **threat** environment:*
    - Air pressure
    - Oxygen
    - Temperature fluctuations
  - *Environmental **hazards:***
    - Meteorite impacts
    - Radiation
    - Seismic motions
- A new **interdisciplinary** effort at Purdue University is in place to perform the science and **establish** the know-how to **build** resilient extraterrestrial habitats.



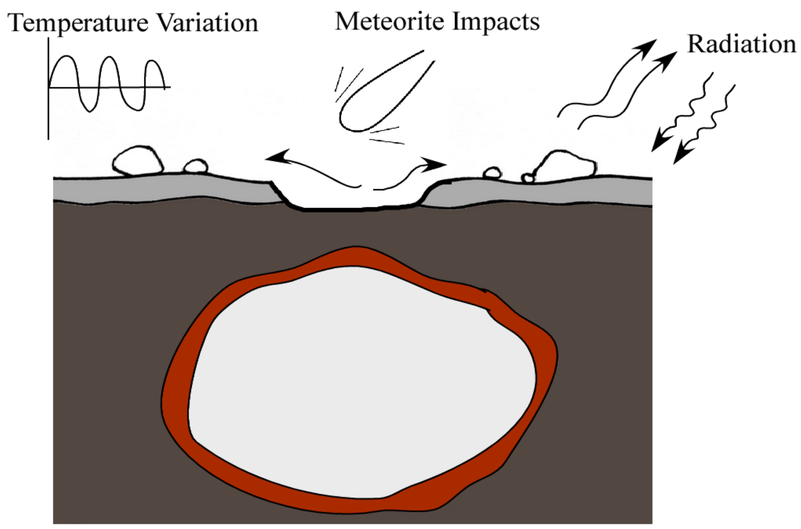


Building Partnerships

- Identify the **science** and **engineering needs** to achieve **long-term** extraterrestrial **habitats**.
- Exchange ideas and promote **discussion on research** needs focused on seeking answers to key **research** on resilient extraterrestrial **habitats**.
- A **Workshop** is planned for **Fall of 2018**, West Lafayette, Indiana.
- Email: **reth@purdue.edu**

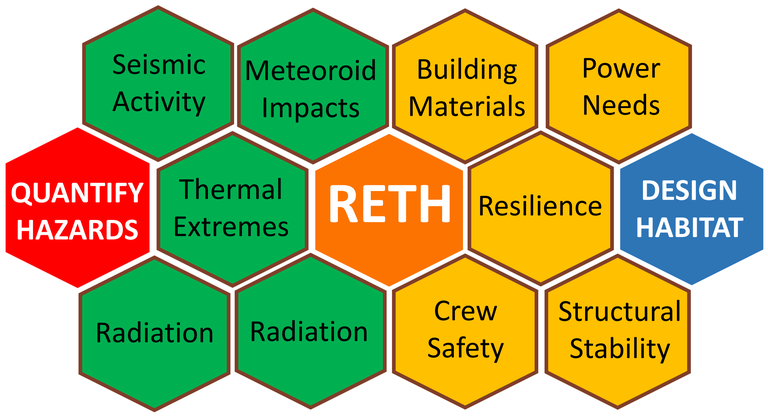
Settlement Concept

- Results from NASA's GRAIL mission have been used to determine the existence of a network of large, empty tubes in the **lunar lava flows**.



- Preliminary **FEM simulations** indicate that lava tubes with even 4 km width may **remain stable** with a roof as thin as ~40 m with both elliptical and circular shapes if the rock does not contain critical fractures.

Building Knowledge



- A **resilience framework** is developed to **design** a safe and resilient habitat where desired properties of the system are considered such as reconfigurability, robustness, scalability and rapidity.