### Hashtags: #spaceflight, #growfoodmartian

Contact: [[email protected]](http://www.cloudflare.com/email-protection)

### Tags: Hardware

**Growing Food for a Martian Table – Integrating a Deployable Greenhouse with a Human Habitat**

**Challenge Description**

Develop a conceptual design of a deployable greenhouse that could be used for pre-deployment on a space mission to the Moon or Mars. Consider what kind of habitat the greenhouse will be supporting and how it will interface with the habitat.

**Background**

For prolonged human missions to the Moon or Mars, non-perishable food supplies may be supplemented by regenerative life support systems, such as greenhouses, that produce food on the planet surface. These structures will be delivered, deployed, operated, and maintained in extreme environments. In addition, the presence of growing plants can have a positive psychological impact on explorers far from home.

**Solution Ideas**

Here are some ways for you to frame this solution:

The design(s) could specify for which location the greenhouse is intended (e.g., Mars, the Moon), and include how the greenhouse would interface with the habitat to which it belongs, even if the rest of the habitat arrives after it. A concept of the habitat could be included (size, number of people supporting, lifetime, how it will be organized, intended mission, etc.); design of the rest of the habitat beyond the greenhouse and its interface to the habitat is not necessary.

Desirable features of the greenhouse could include: small, stowage volume and mass; deployable upon landing; minimal resources for operations; run at low pressure (e.g., ¼ atmosphere to reduce leakage and structural requirements); pre-planted media or growing system; “priming” volume of water and required gases; recycle the transpired water back to the roots (i.e., close the water loop); thermal control system, including internal air recirculation; harvest and store oxygen generated from plants; and use in-situ resources (water, atmosphere, etc).

Ideas to consider for greenhouse design: inflatable, robotic harvesting of the crops; one crop cycle per greenhouse and then shutting down; drying crops in place (e.g., wheat, soybean, or potatoes); replanting capabilities (i.e. more than one crop); retrieving water and/or oxygen in system prior to shut down; supplying carbon dioxide as plants grow; opening thermal covers in day and closing the covers at night (see Mars Greenhouse Data presentation); generating photovoltaic power capable of running control systems and/or opening and closing covers; viable as a kit for deployment in arid regions on Earth; if the habitat occupants can visit the greenhouse and harvest the food themselves; and functions the greenhouse could serve the habitat beyond food/oxygen generation and water purification. Consideration if designing for Mars: CO2 could be used as a pressurizing gas to offset leakage.

**Sample Resources**

* [KSC Mars Greenhouse website](http://science.ksc.nasa.gov/biomed/marsdome/%20)
* [Mars Greenhouse Data presentation](http://data.spaceappschallenge.org/mars-green-house-information.pdf)
* [Inflatable Transparent Structures for Mars Greenhouse Applications](http://data.spaceappschallenge.org/ICES.pdf)
* [Articles Regarding Deployable Greenhouses](http://data.spaceappschallenge.org/fwsomearticleasresourcefordeployablegreenhousechal.zip)
* Space Apps 2013 Challenge: [Deployable Greenhouse](http://2013.spaceappschallenge.org/challenge/deployable-greenhouse/)