Space hardware for plant samples

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Abstract

This document aims to study previous and upcoming space missions that involved biological samples, to understand the hardware, procedures and aspects needed for such a mission. Additionally this document serves as a technical bridge and will try to break down some of the engineering aspects for other disciplines, as well as recommend feasibility of a similar project.

Mission idea

Who is plants for space?

Plants for Space is currently experimenting with genetically engineered moss that can have a programmed response to a stimulus. Applications of this technology could be extended to on demand production of medicine on a long duration space mission, reactive/adaptive food production and so on.

Proposed mission

To test the specimen in a space environment, Plants for Space wishes to transport a sample and test equipment into a microgravity environment. To do this supporting hardware will be needed (covered later in this document).

Previous missions

This list is not exhaustive and will mostly focus on plant based biological samples, but bacteria and bioscience experiments will be listed for completeness.

BioSentinel

https://www.liebertpub.com/doi/10.1089/ast.2019.2068

GeneSat-1

PharmaSat

O/OREAOS

SporeSat

https://www.eoportal.org/satellite-missions/sporesat#spacecraft

EcAMSat

AstroBio CubeSat (ABCS)

ISS

VEGGIE-1, 2 & 3. APH (Advanced Plant Habitat)

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EuCROPIS

Chang'e 4 "biosphere"

SpaceMoss
https://2015.igem.org/Team:UNIK_Copenhagen/Description

ARTEMOSS

Outline of hardware

Temperature control

Heating

Cooling?

Atmospheric control

Vibration

Sensing

Imaging

Lab on a chip? or other chemical detection

Additional sensing capabilities?
Things like radiation sensors, plant health (if this can be measured), atmospheric sensing

How this mission could be achieved

Satellite (cube or share on larger sat)

ISS experiment

Bibliography