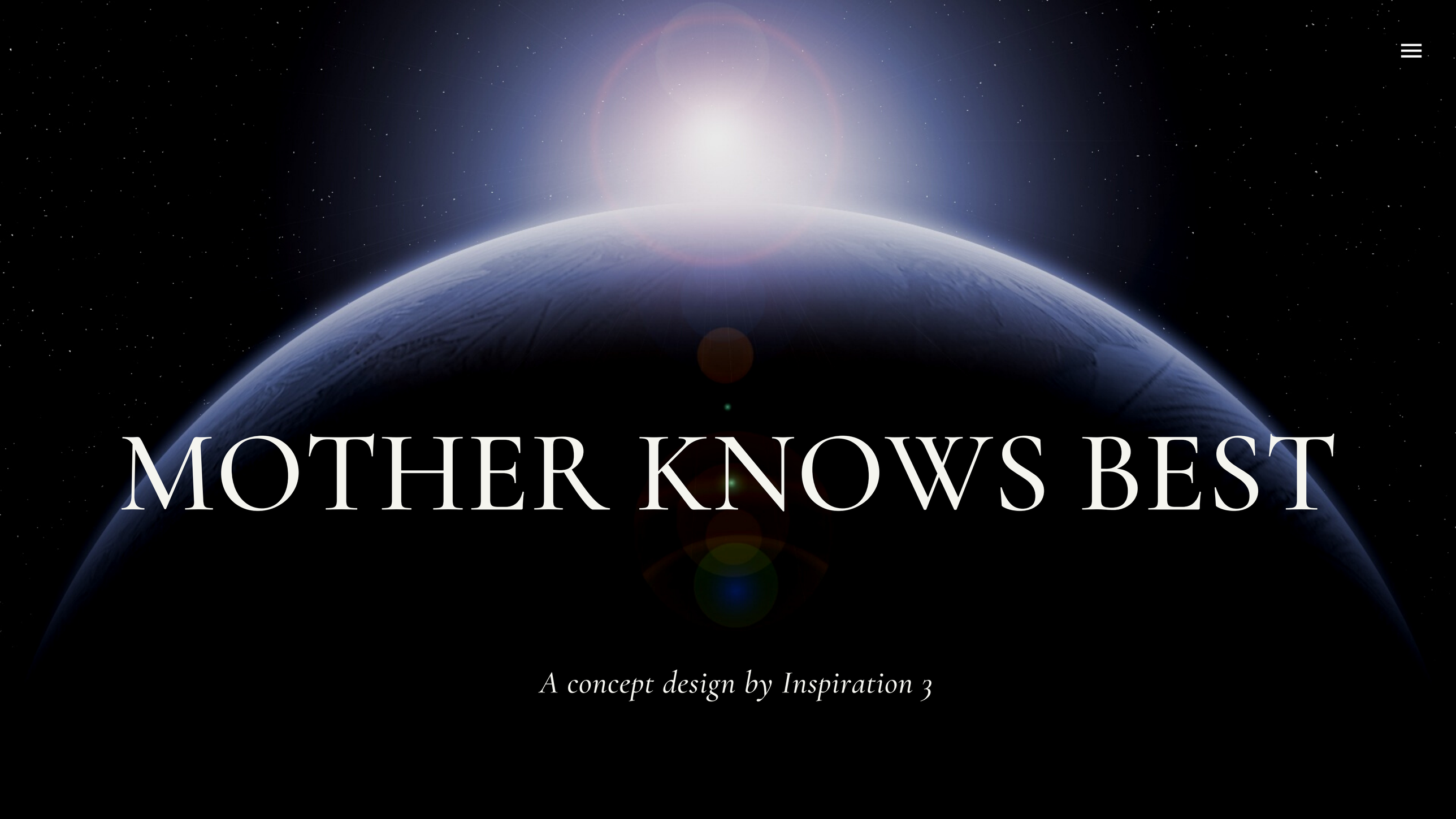

MOTHER KNOWS BEST
A concept design by Inspiration 3

Introduction

MKB comprises of 4 main components to provide a growing environment for crop production in space

Mother Unit (MU)

The heart and brain of the system and houses number of subprocesses

Structural Mounting Assembly (SMA)

The frame used to hold the Growth Chamber Systems (GCS) in place and piping system for nutrients

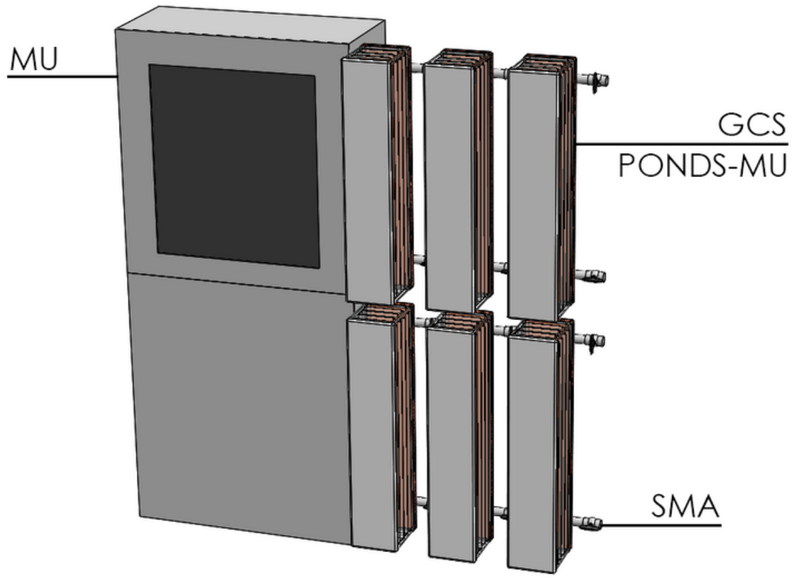
Growth Chamber System (GCS)

Provides dedicated growing environments for each set of crops

PONDS Multi Unit (PONDS-MU)

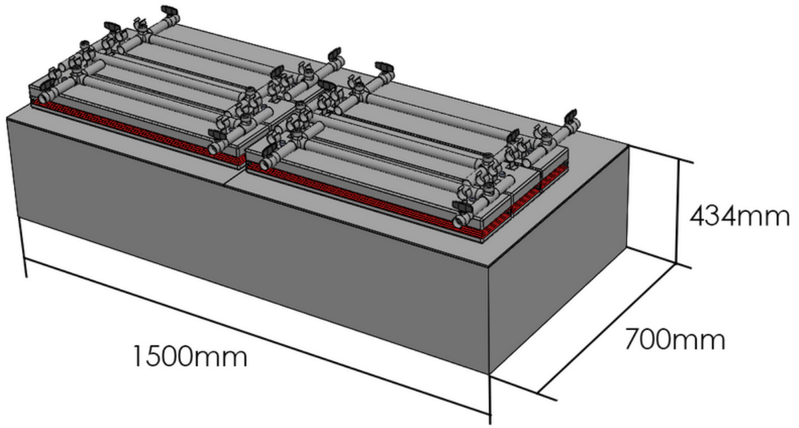
Vessel for 5 seeds with growing medium and nutrients embedded into the unit

Normal Operation Mode



All the components assembled and ready for operation

Stowed Away Mode



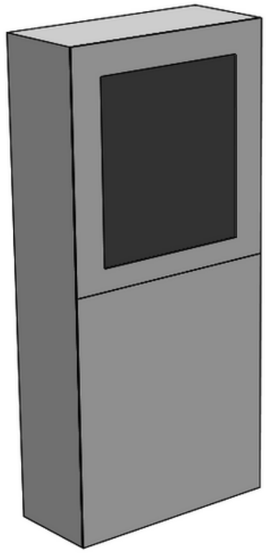
All components flat packed and can be stowed away. Total stowed volume: ~0.46m3

Mother Unit (MU)

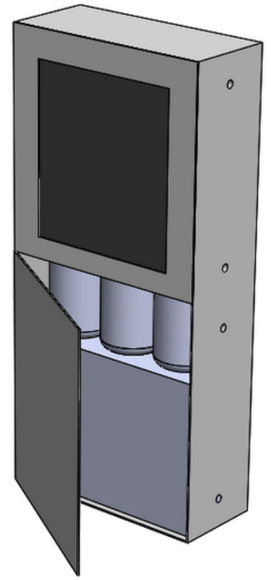
The MU is the central control unit for the system and also serves as the interface for the crew through its touch screen display.

The Mother Unit is comprised of a number of different subsystems and processes that help manage the overall function of the whole system.

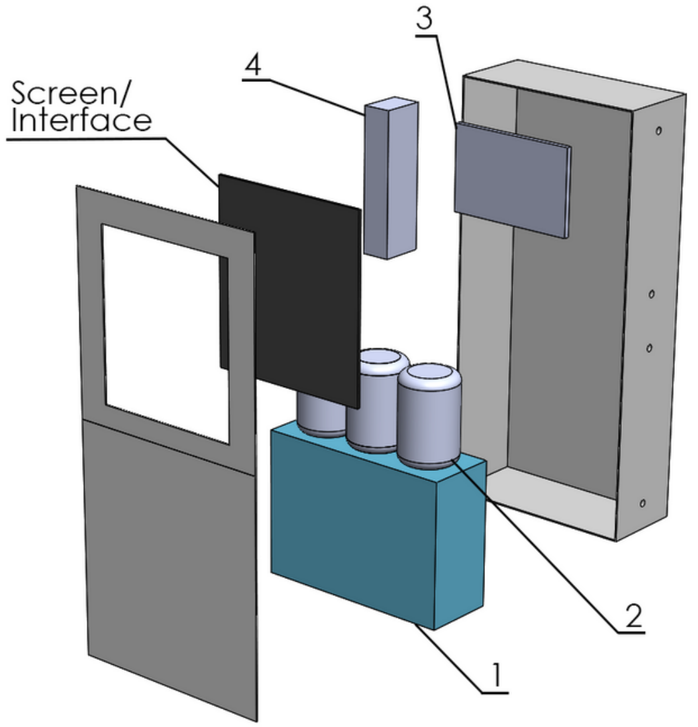
1. Nutrient Delivery System
    a. Air compressed water reservoir
    b. Pump to create pressure differentials
    c. Water input and output nozzles to SMA
2. Atmosphere Management System
    a. Gas canisters (CO2, O2, N2) and temperature control, monitoring and delivering the necessary environmental conditions to each GCS to maximise plant growth
    b. Future plans: capture CO2 from cabin crew and recycle O2 and N2 from byproducts from the spacecraft
3. Main Computer/Crops Health Monitoring System
    a. Runs on board computations from the data captured from the system, such as plant health and notifications to ground station and space crew
4. Power Delivery System
    a. Controls the delivery of power to both the MU functions and GCS



Mother Unit



Mother Unit with drawer opened



Mother Unit exploded view

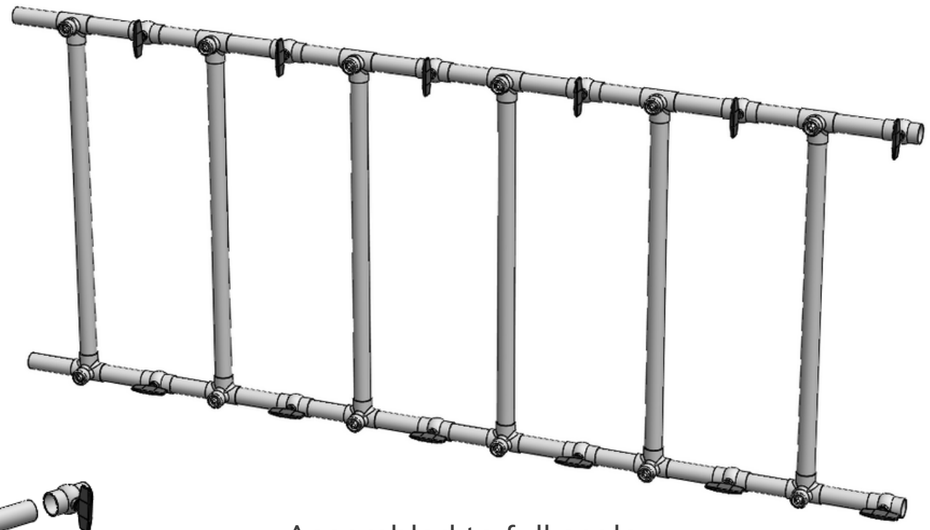
Structural Mounting Assembly (SMA)

The SMA frame is modular and expandable by adding more units to the side and allows the system to be deployed at any scale depending on the needs at the time.

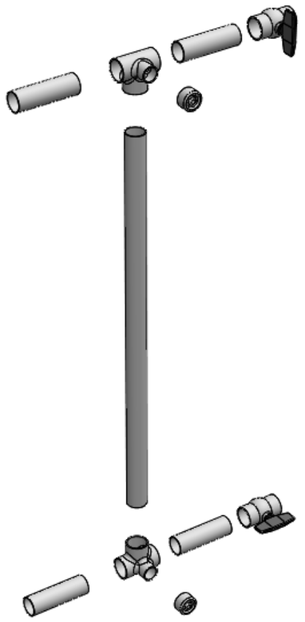
The frame contains valves and pipes and is the main delivery channel to get water to each of the crops.

The plugs that connect to each GCS are designed to be ‘plug and play’, requiring very little effort to enable a GCS.

Once a GCS is plugged into an SMA, the user will need to inform the MU what crop they plan to grow through its interface and off it goes.



Assembled to full scale



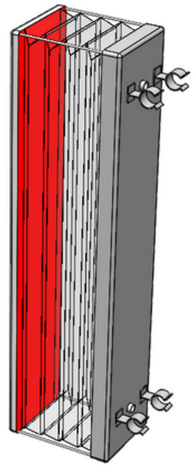
Exploded view of each component in SMA

Growth Chamber System (GCS)

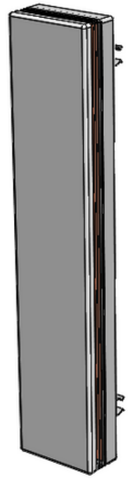
GCS provides a dedicated growing environment for the crop. At the top are the LED light fixtures, containing red and blue lights, and a central camera for monitoring plant health.

The body of the system is made from PET and is origami inspired to provide a mechanism to fold away when it’s not being used and also provides structural integrity when expanded out to its full height.

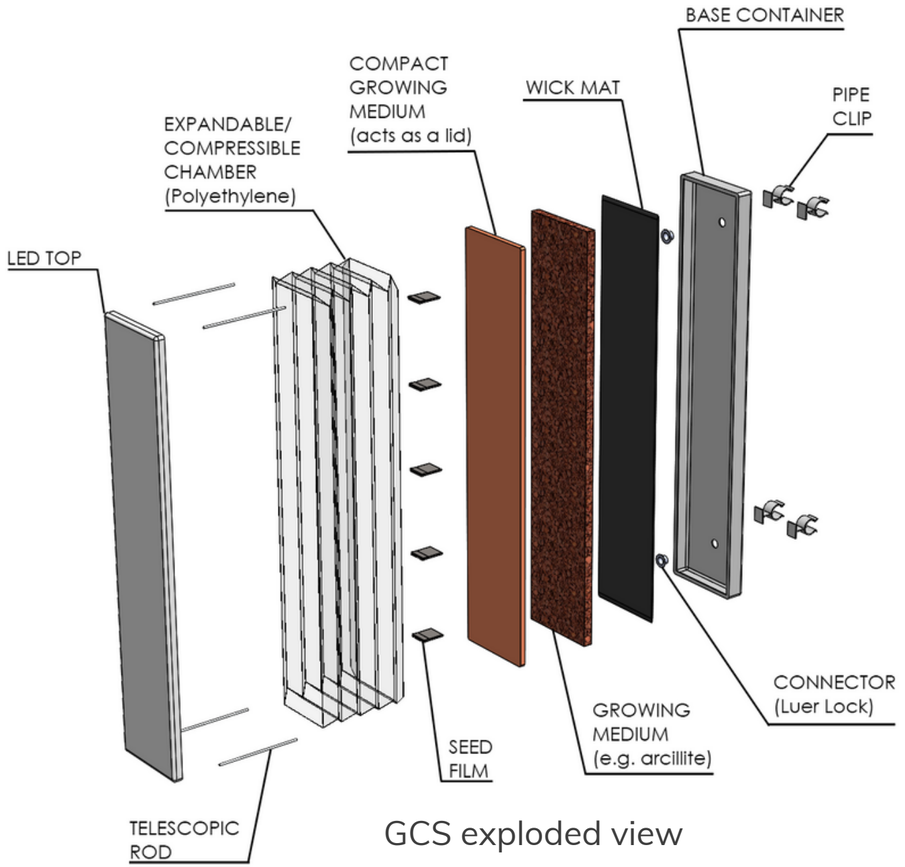
Each GCS unit attaches to the SMA which provides power, water, and the right environmental conditions for the crop that is selected to be grown in the GCS. The camera signal and sensor information is fed back through the same mechanism.



Expanded view from bottom



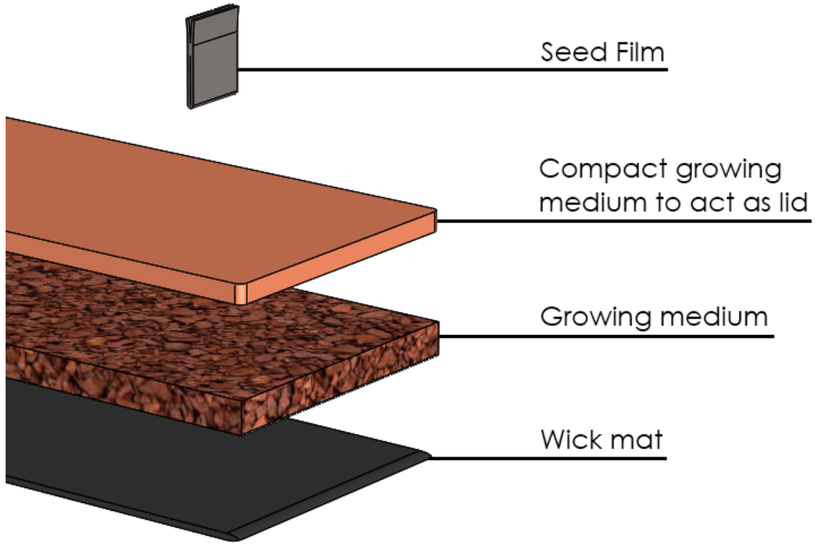
Compressed view from top



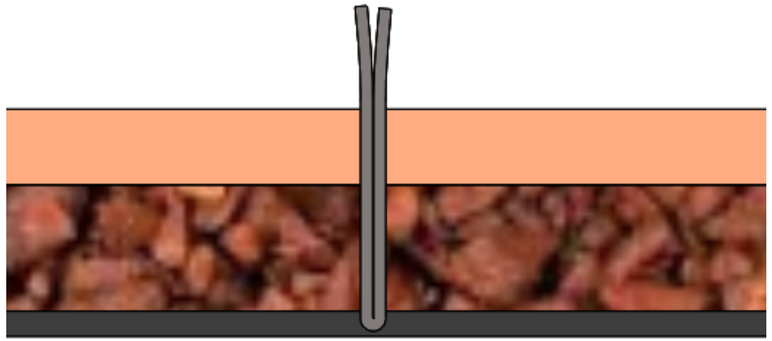
GCS exploded view

PONDS Multi-Unit (PONDS-MU)

PONDS-MU is the next iteration of PONDS, designed to be more economical and space efficient. Each PONDS-MU unit houses 5 seed films, each with multiple seeds to increase the chance of germination. The growing medium contains tailored nutrients requirements for the specific plant to grow. Each PONDS-MU unit can contain a different set of seeds so the crew can have a selection of different crops throughout their mission.

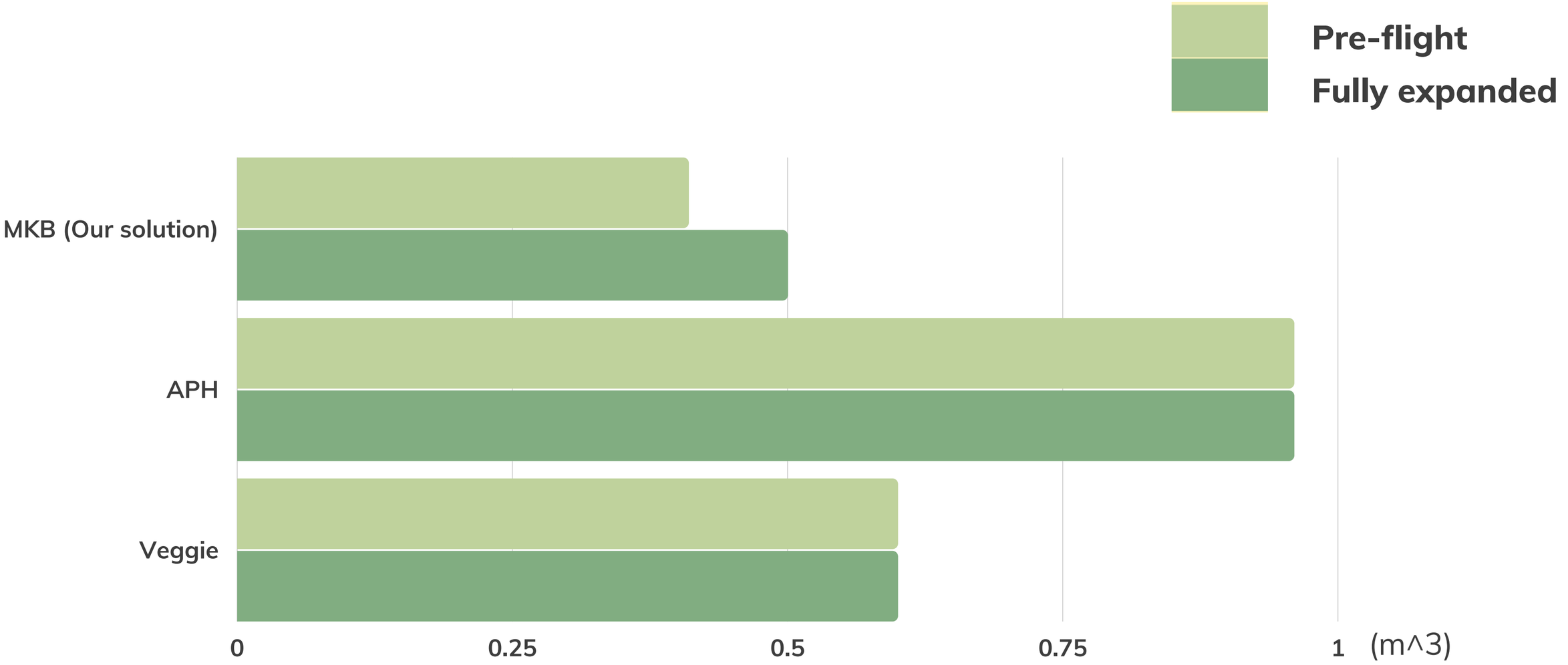


Exploded view



Cross-sectional view

Volume occupation comparison



*Space occupations are calculated based off the assumption to grow 30 heads of romaine lettuce at the same time.