MELiSSA
MICRO-ECOLOGICAL LIFE SUPPORT SYSTEM ALTERNATIVE

CREATING A CIRCULAR FUTURE

ASI Life Support Activities

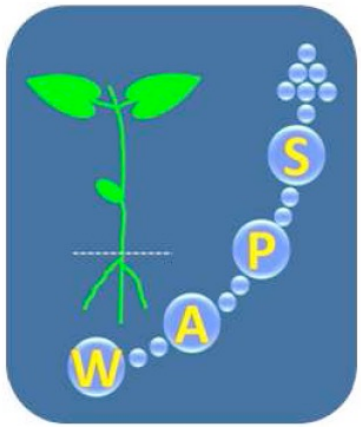
Marino Crisconio
Human Spaceflight and Microgravity Unit

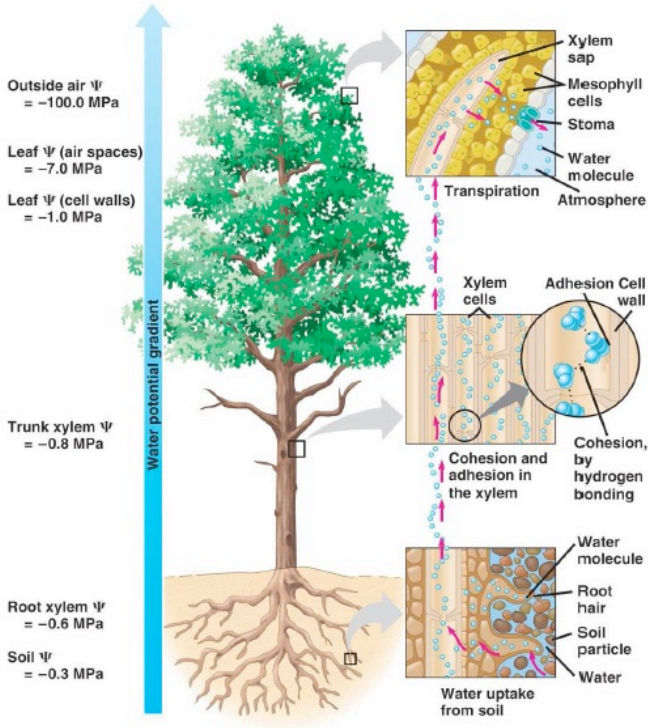
On going projects: Water Across the Plant Systems - WAPS

Selected in the ESA-ILSRA-2014, the experiment is plan to be executed on the ISS in 2022.

AIMS:

- evaluate the effects of microgravity on morphological and functional traits of plant organs with specific reference to the water flow pathway across root, stem and leaf;
- discriminate direct and indirect effects of microgravity on plant cells and tissues.





On-Going Projects: In-situ Resources Bio-Utilization to Support life in space - ReBUS

Selected in an ASI Call for Ground Based research.

Definition of a Bioregenerative Life Support System in space with the integration of different organisms (higher plants, fungi, bacteria, cynobacteria, insects).

AIMS:

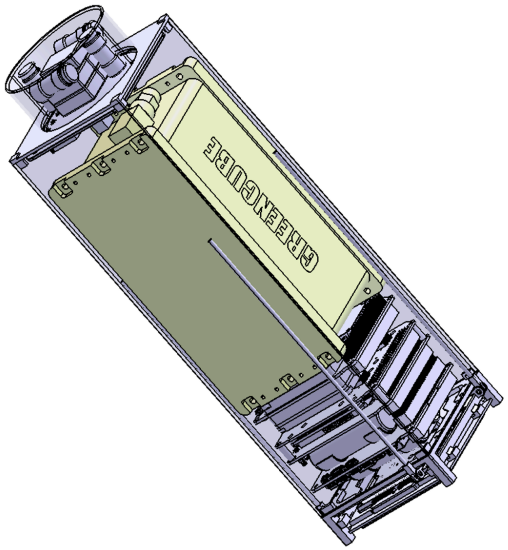
- minimizing the use of exogenous resources;
- maximizing:
  - ✓ the use of in situ resources (Lunar and Martian soils, water, gas in atmosphere);
  - ✓ the recycling of the organic matter produced in the system itself (crop residues, crew physiological waste.

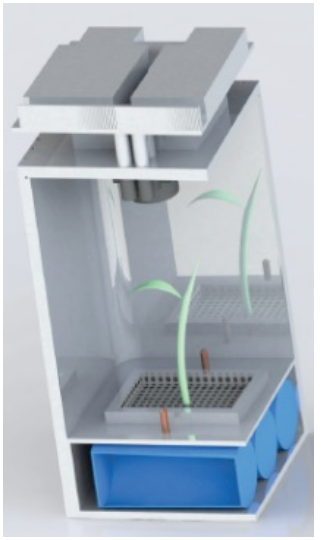
On-Going Projects: GreenCube – Microgreens cultivation in a CubSat

Selected to fly onboard VEGA-C.

GreenCube is a 3-U CubeSat aimed at cultivating brassicacae plants (micro-greens) on-board an autonomous Biological Life Support System.

- 3U CubeSat design (30x10x10 cm);
- Mission VEGA-C Maiden Flight (LARES2);
- Closed plant production system;
- 6000 km circular orbit;
- Growing room with O2, VOCs, Pressure, Temperature, Humidity, CO2 and radiation sensors to monitor plants state;
- Equipped with IR and VIS band camera for plants inspection and monitoring;
- Growth to Microgreen stage.





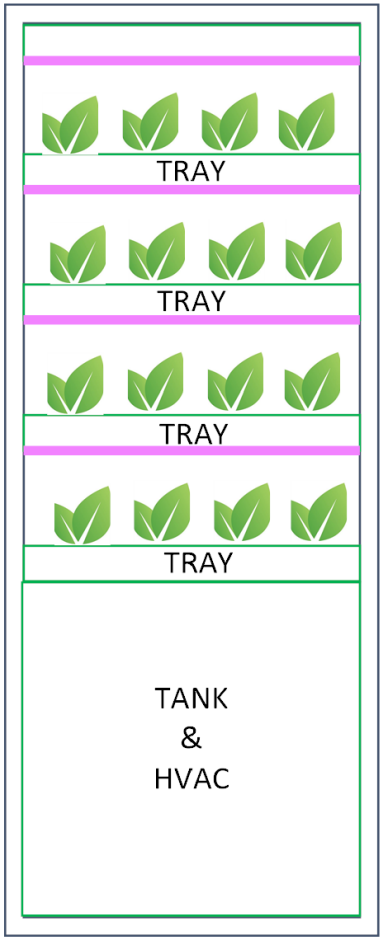
On-going project:

LED Optical system and Iperspectral Control for growing plants with potential application in Space - SOLE

Selected in the Call «POR FESR Lazio 2014-2020»

AIMS:

- Realization of a demonstrator for the soilless cultivation of microgreens/microvegetables, based on a solide-state LED lighting system;
- Implementation of a remote non-destructive monitoring system for real time evaluation of plant growth and health (iperspectral and fluorimetric analysis);
- Lighting conditions optimization (duration, quality, intensity) during the different growth phases.



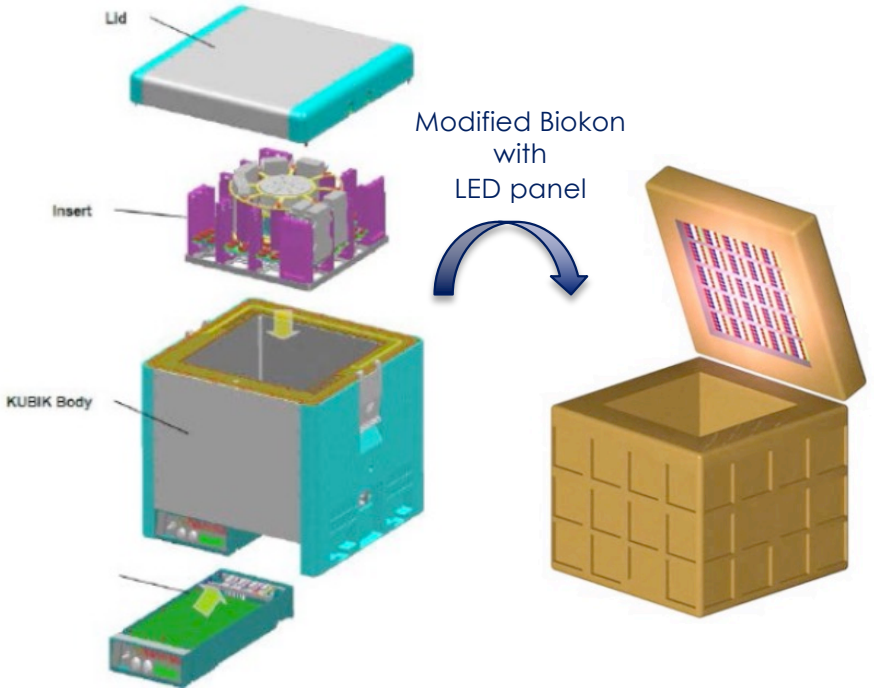
Future Projects:
MICROgreens for MICROgravity - MICROx2

Selected in an internal Call stemming from the «MIUR Progetti Premiali» special funds.

Definition of a national line of research for the realization of a regenerative system for life support in space focused on higher plants.

AIMS:

- identify and characterize the most suitable plants for the realization of an autonomous system for food production and water/air regeneration;
- definition of requirements for environmental control and development of a system for continuous monitoring of:
  - ✓ environmental parameters;
  - ✓ quality of the vegetable products.



Current Italian involvement in MELiSSA

- **PCU (Plant Characterization Unit)**
  - Facility aimed to study the higher plant processes
- **MPP (MELiSSA Pilot Plant)**
  - Contribution @ subsystem level for Higher Plant Compartment
- **PFPU (Precursor of Food Production Unit)**
  - Development of an integrated breadboard to demonstrate the bioregenerative production of food
- **System Study**
  - Aimed to study the system aspects of the MELiSSA project, from the independent processes up to the complete closed loop, including all generations in between
- **POMP (Pool Of MELiSSA Ph.Ds.)**
  - Contribution @ national level to POMP Program

The Italian Pool of MELiSSA PhDs - POMP

- A Pool of MELiSSA PhD students has recently been created at the European level through the establishment of a Melissa Foundation;
- ASI would like to implement a first set of Italian PhDs (e.g. 3 students) outside this specific frame of the Melissa Foundation, while maintaining a coherent and coordinated approach with MELiSSA activities;
- The Italian PhDs are planned to last at least three years and may include a research/training period in one of the entities of the MELiSSA consortium.

MELISSA

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THANK YOU.

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