

MELiSSA: the European project of closed Life support system

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The MELiSSA (Micro-Ecological Life Support System Alternative) project was initiated in 1989. It is intended as a tool to gain understanding of closed life support, as well as the development of the technology for a future life support system for long term manned space missions, e.g. a lunar base, a CIS lunar orbiter, or a mission to Mars.

The collaboration was established through a Memorandum of Understanding (i.e. MOU) and is managed by ESA. It involves roughly 40 organisations, 14 of these organisations have signed the MOU. It is co-funded by ESA, the MELiSSA partners, local, regional and national authorities. The driving element of MELiSSA is the production of food, water and oxygen from organic waste (e.g. inedible biomass, CO₂, faeces, urea). Inspired by the principle of an “aquatic” ecosystem, MELiSSA process comprises several processes, called compartments, from the anoxygenic fermenter up to the photosynthetic one (i.e. algae and higher plants). The choice of this compartmentalised structure is required by the very high level of safety requirements and justified by the need of an engineering approach and to build deterministic control strategy.

During the past 28 years of research and development, a very progressive approach has been developed to understand and control the MELiSSA loop. This approach starts from the selection of processes, their characterisation and mathematical modelling, the validation of the control strategy, up to the demonstration on Earth, at pilot scale. It includes as well the stress detection issues and the potential evolution of the metabolic pathways, mainly via the use of biomolecular techniques. Recently several flight experiments have been performed.

The project is organised in 5 phases: Basic R&D, Preliminary flight experiment, Ground & space demonstration, Terrestrial transfer, Education & communication.

This presentation recalls the main features of the project and summarises the recent achievements.

Short Summary

MELiSSA project is aiming to reach the highest degree of closure of crew metabolic resources, via recovery of these resources from the organic wastes of the mission.