SPACE V
PLANT THE FUTURE

MANNED ACCESS TO SPACE
IS NEXT

Mission

SpaceV is committed to studying and designing equipment to effectively cultivate plants in orbital stations and in future Moon and Mars settlements.

Astronauts' survival for long periods of time in space requires them to become autonomous from Earth's supplies through maximum exploitation of the limited resources available in situ and the adoption of new technologies.

This area of space research, where biology and robotics work together, is expanding and is a source of continuous innovation.

SpaceV innovative contributions to life support systems in space hinge around the Adaptive Feature of its greenhouse architecture. **Its aggrotech system will provide astronauts with locally grown food and oxygen.**

The future of manned spaceflight

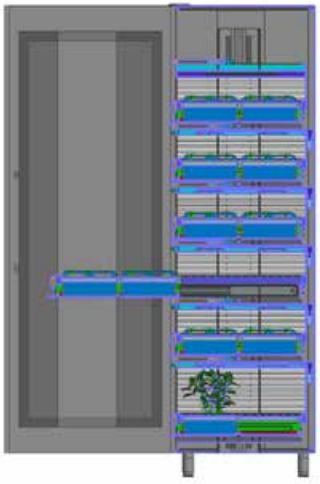
Plans to return to the Moon to stay are materializing while space travel is opening up to private initiatives, either for economic purposes or leisure. Humans are ready to expand their realm beyond earthly boundaries.

All indicators suggest that commercial space travel in Low Earth Orbit will bloom; competition will eventually settle in and accommodations for comfort as in hotels on Earth will become a distinctive competitive edge for paying passengers.

Astronauts traveling further away from Earth to operate stations around the Moon or living and working on extraterrestrial soil such as Moon or Mars will need life support systems able to grow vegetables aboard their spacecraft in extraterrestrial soil accommodations, gaining autonomy from terrestrial food supplies. Producing fresh vegetable food in space is indispensable for astronauts' health and well-being, both physical and psychological.
In all manned exploration missions the sustainability of life in space will demand consuming the minimum amount of volume and resources.

SpaceV contribution

Plants require a cultivation volume variable from seeding to harvesting. Great savings in energy, occupancy, and water consumption may be achieved with SpaceV multilayer adaptive smart greenhouse technology because the mechatronics of the adaptive greenhouse produces the automatic movement of the cultivation shelves and optimizes the height of the volume between them according to the precise level of growth of the plants in each production cycle. **An 80% increase in production yield per volume unit and a 43% decrease in the energy required are obtained.**
This innovation makes our type of greenhouse highly efficient, particularly suitable for a “hostile” environment such as space.

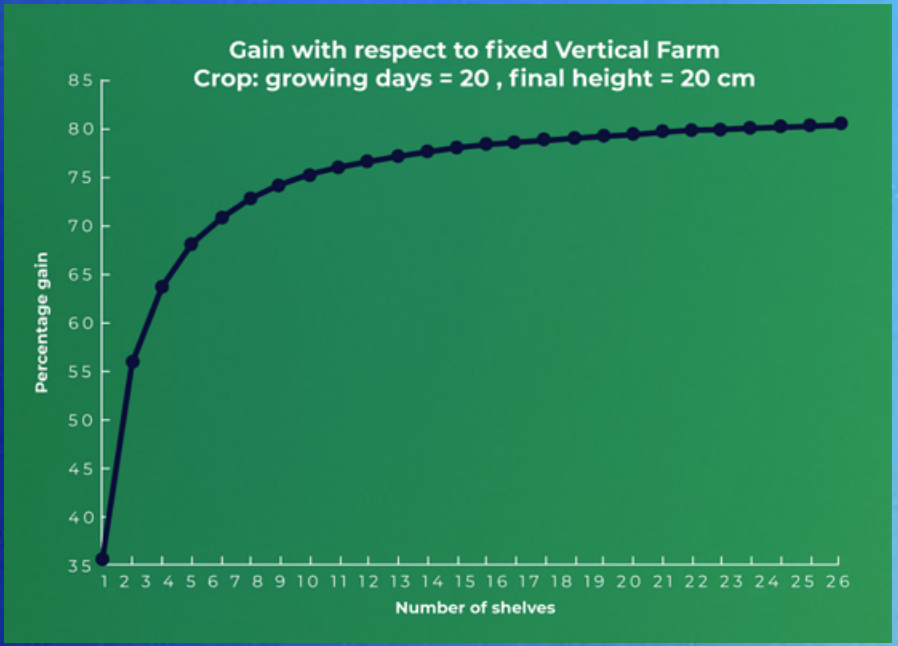


The multilevel adaptive greenhouse technology was developed and patented by Germina – SpaceV’s mother company – for horticultural and floricultural ground cultivations in precision farms, vertical farms and home cultivators. SpaceV has acquired these patents and transferred the technique to the life support system of space habitats where the environmental conditions are much harsher than on Earth and the motivations to save mass, volume, energy and water are ever more demanding.
We develop the next generation of agri-food production devices able to increase crop productivity in space and significantly reduce operating costs and energy consumption.

The adaptive greenhouse

The Multilevel Adaptive Greenhouse (MAG) is a mechatronics system capable of exploiting the normally unused volume in a traditional greenhouse and obtaining a substantial increase in crop production with a significant energy savings.

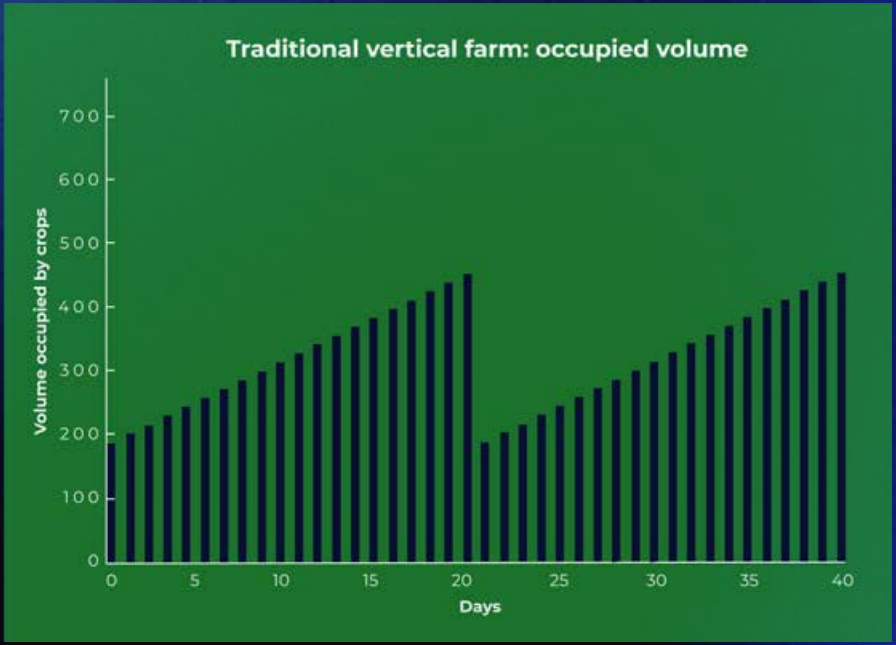
Traditional greenhouses are designed to host the plants at their maximum growth height, albeit the volume requested increases only progressively during the biological cycle. **The adaptive greenhouse instead modifies the volume between the cultivation shelves to the actual level of growth of the single crop.** It is a paradigm change from adapting the choice of crops to the structure of the greenhouse to adapting the greenhouse to the volume demand of the plant.

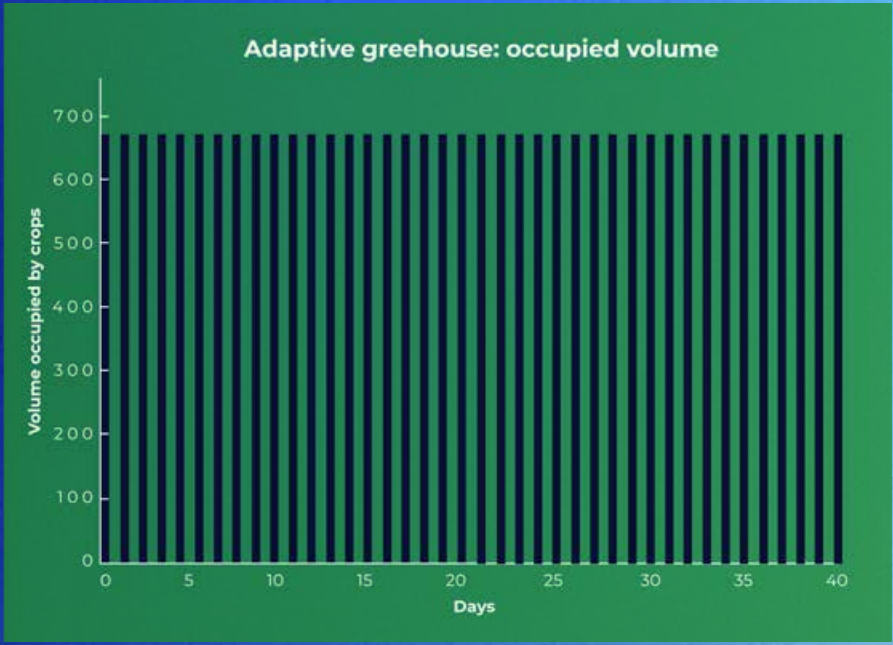


The adaptive greenhouse

Using the smart adaptive greenhouse, yield gains up to 135% may be achieved with less use of soil, water and nutrients compared to the traditional static greenhouse.

Thanks to a patented integrated ventilation and micro-conditioning system for each cultivation shelf, it is possible to grow very different plant species in the same rack, from mushrooms to strawberries. **This feature, combined with the shelves adaptive system, achieves an overall energy saving - lighting, air conditioning, motors feed - of 43% compared to an equivalent static vertical greenhouse.**





The next generation of space greenhouses

SpaceV's Multilevel Adaptive Greenhouse technology complies with the product reliability and safety requirements typical of all manned space equipment; it adapts to the demand of the space agencies and of the rapidly growing commercial space markets, in all scenarios requiring to produce vegetable food onboard.

- **Low-Earth Orbit manned laboratories such as the International Space Station**
- **Commercial space stations and hotels-in-space for tourists**
- **Lunar base headquarters and manned operating units**
- **Long duration space travel for planetary exploration**

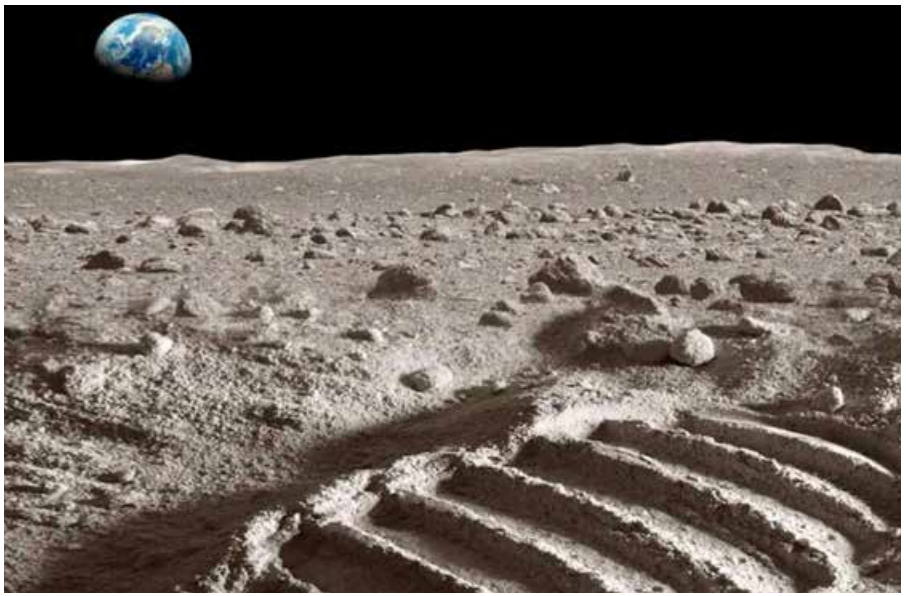
Our first multilayer greenhouse implementation aims to integrate the life support systems of orbiting stations in microgravity conditions. It will be similar to a functional rack of the International Space Station. Extreme care will be given to ensure the cleanness and microbial compatibility of the greenhouse with the station's environment.

At a later stage, when humans will settle on the Moon soil, in 1/6th G gravity conditions, the greenhouse architecture may grow in size and shape.

The growth substrate

The growth substrate for plants in space is an area of advanced research of its own.

In the weightlessness environment of orbiting stations, the hydroponic or aeroponic substrate is the natural choice. In future Lunar habitation structures other types of growth substrate coming from dedicated research are definitely possible.



SpaceV is collaborating with European technological leaders in the sector of inhabited space structures and sharing specialized skills necessary to develop the adaptive technology in the space environment and to promote it to agencies and private clients globally, in Europe and in the USA.

The space exploration challenge leads to solutions for planet earth

SpaceV smart greenhouse system, designed for space, may also foster habitation solutions for man's presence in isolated harsh environments on Earth; it may support terrestrial applications such as waste recycle and water treatment.

From space we gain inspiration, vision and knowledge that will lead to solutions also exploitable on our planet Earth, where infinite resources are no longer at our disposal.

SCAN ME

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