

## Mapping Synergies: Sustainable Development Goals and Research & Technology in Space Architecture and Human Spaceflight

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### Abstract

Space has been an essential tool driving innovation beneficial for humankind, for over 50 years. The 2030 UN Agenda, with a more specific focus on sustainability is a reminder to critically consider the beneficial aspects of Space exploration for Earth. The emphasized focus on sustainability within the 17 Sustainable Development Goals leads to examine how the full range of space technologies can contribute to achieve these ambitious goals.

Space habitats, extraterrestrial or in orbit, are highly innovative environments that require a high degree of autonomy from Earth. The more extended the planned mission becomes, the higher the degree of autonomy, and need for a qualitative and sustainable habitats. Virtually all space environments for long-term habitation of spacecrafts or other extraterrestrial modules and structures need a high efficiency in terms of cost, energy and resource utilization. These requirements and limited resource-availability do not need to harm or undermine the manufacturing and operation of extraterrestrial habitats, or manned missions. Enabling such undertakings leads to a number of technological developments and innovative solutions in, for example: in-situ resource utilization, advanced life support systems, energy utilization, resource mining, habitat structures, material technology and advanced plant growth systems.

Investments made into these advanced space applications enable spin-offs and technology transfers that provide the opportunity to bring new technologies and applications to Earth. These could contribute towards a greener Earth and the fulfilment of the 2030 Agenda with the targeted Sustainable Development Goals. However, there is room for improvement through this multiplier effect, by defining synergies and supporting global partnerships.

We will present a review, summarizing the research & technology development in space architecture and human spaceflight, within the framework of the Sustainable Development Goals. Three particular developments are evaluated in the framework of environmental sciences, 1) in-situ resource utilization, 2) advanced life support systems and 3) energy utilization. This research draws upon primary research to identify synergies and coupling with known environmental challenges within our terrestrial and non-terrestrial systems. This research aims to highlight those developments that could function as transfer-technologies, which could be significant to work towards the United Nations 2030 Agenda for Sustainable Development.

### Acknowledgements

The authors would like to thank ILEWG, the International Lunar Exploration Working Group for their support.

### References

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