

SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FAR FUTURE (D4)
Contribution of Space Activities to Solving Global Societal Challenges (4)

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UNDERGROUND TERRAFORMING

Abstract

In order to establish settlements for human habitation at any or multiple celestial bodies, including those at which severe and hostile surface conditions prevail, new technologies related to underground construction, must be developed. The design standards for such underground settlements must guarantee the following and other:

- Comfortable environment for inhabitants “work in shirtsleeve”.
- Standardized units.
- Maximum flexibility for installation upgrades.
- Decentralized expansion capability in any or all directions.
- Have short travelling distances between the interconnected habitable nodes.

We define “Underground Terraforming” as the technological capability of developing entire ecosystems for human habitation at hosting celestial bodies. For this, a natural barrier that is already present with the ceiling soil of the celestial bodies would guarantee natural protection against radiation even under extreme conditions. Remarkably, it is in most of the solid bodies of the Solar System that these settlements could be built almost immediately, allowing for a contained life support condition and without the need of a much more complex, expensive and time consuming atmospheric type of Terraforming, which would only be possible at very few bodies. In this paper, we discuss the enabling technologies, the underground city planning, the architectural requirements and the construction technologies to be utilized. We also include examples of proposals for underground settlements. If properly implemented, Underground Terraforming, started by unmanned missions to prepare for subsequent human missions, can accelerate many projects in most inhospitable bodies, including; rocky planets, moons, asteroids and comets and in doing so allow for their rapid development and jump-starting of a space-based economy.