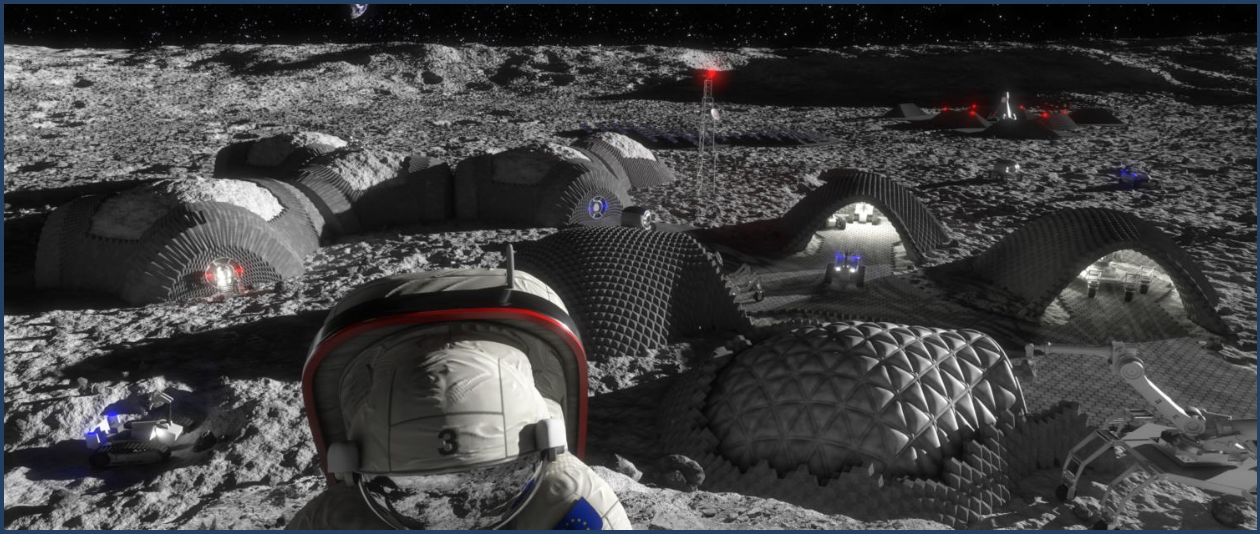
Design Concepts by Liquifer System's Group

5 Minutes Read



Liquifer Systems Group is an Austrian firm that specializes in space architecture, advanced life support systems, and associated technologies. They have been involved in a variety of space exploration and habitation initiatives, particularly in the design of creative and sustainable human spaceflight systems.

Liquifer Systems Group, situated in Vienna, specializes in developing unique concepts for future space missions and habitats. They have collaborated on several projects including space architecture and sustainable solutions for living and working in space habitats. A few of their design concepts are discussed below:

1] Regolight:

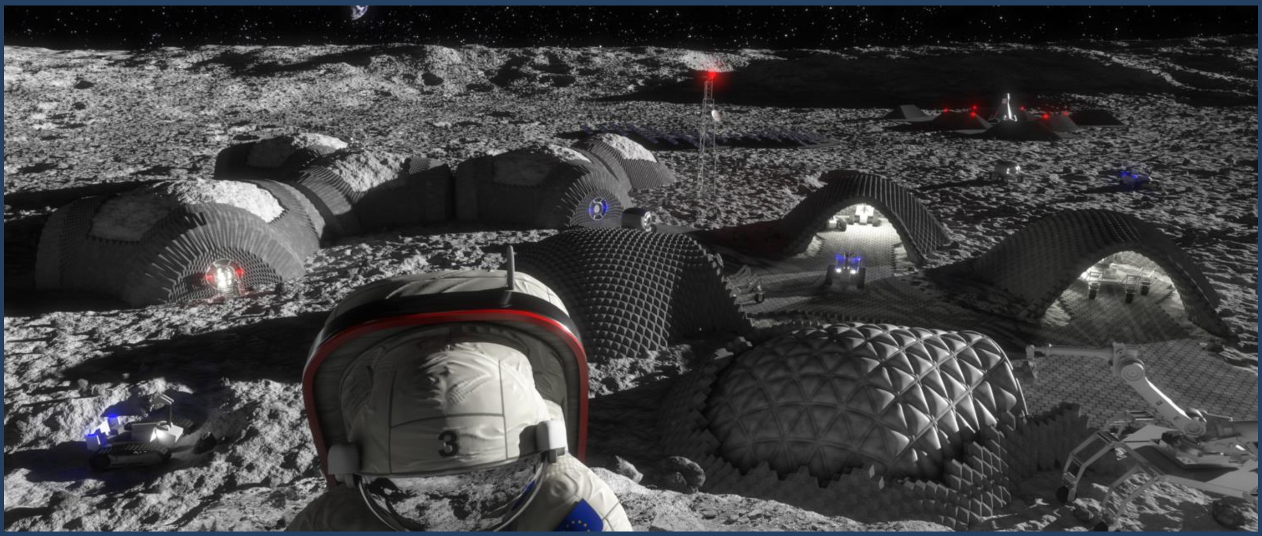


Figure 1_Regolight_© https://spacearchitect.org/wp-content/uploads/2020/03/Regolight_Scene_180619_SATC-LIQUIFER-1500x630.jpg

- Project Year: **2015 -2018**
- Type: **Sintering Regolith with Solar Light**

The forthcoming lunar mission should transcend the mere act of planting a flag and returning; rather, it should aspire to leave a lasting impact by creating functional structures that endure on the moon. Pioneering the perpetual utilization of lunar regolith marks a commendable initial stride towards establishing a human presence on the lunar surface.

Among the innovative techniques, solar sintering stands out. RegoLight is one such project that focuses on studying the sintering of lunar regolith simulants using concentrated sunlight to prepare for upcoming lunar missions, which aim to build infrastructure such as levelled terrain, dust shelters, launch pads, etc., as well as structural components for lunar dwellings.

The method of solar sintering harnesses solar energy to craft robust structures from lunar sand dust without the need for adhesives or binders. Solar sintering, classified as an In-Situ Resource Utilization (ISRU) process, empowers future lunar designs to be self-sufficient, eliminating dependence on Earth's resources and leveraging lunar regolith for habitat construction.

During this process, solar rays are concentrated on lunar regolith, and a lens generates a potent solar beam that fuses the regolith without compromising its granular composition. Employing an additive layer-by-layer construction approach, each layer undergoes solar sintering, and a stamping process further refines the compacted material, ensuring the quality of the final product.

Figure 2_3D Printed Brick from Moondust using Focused Sunlight _© https://spacearchitect.org/portfolio-item/regolight-2/

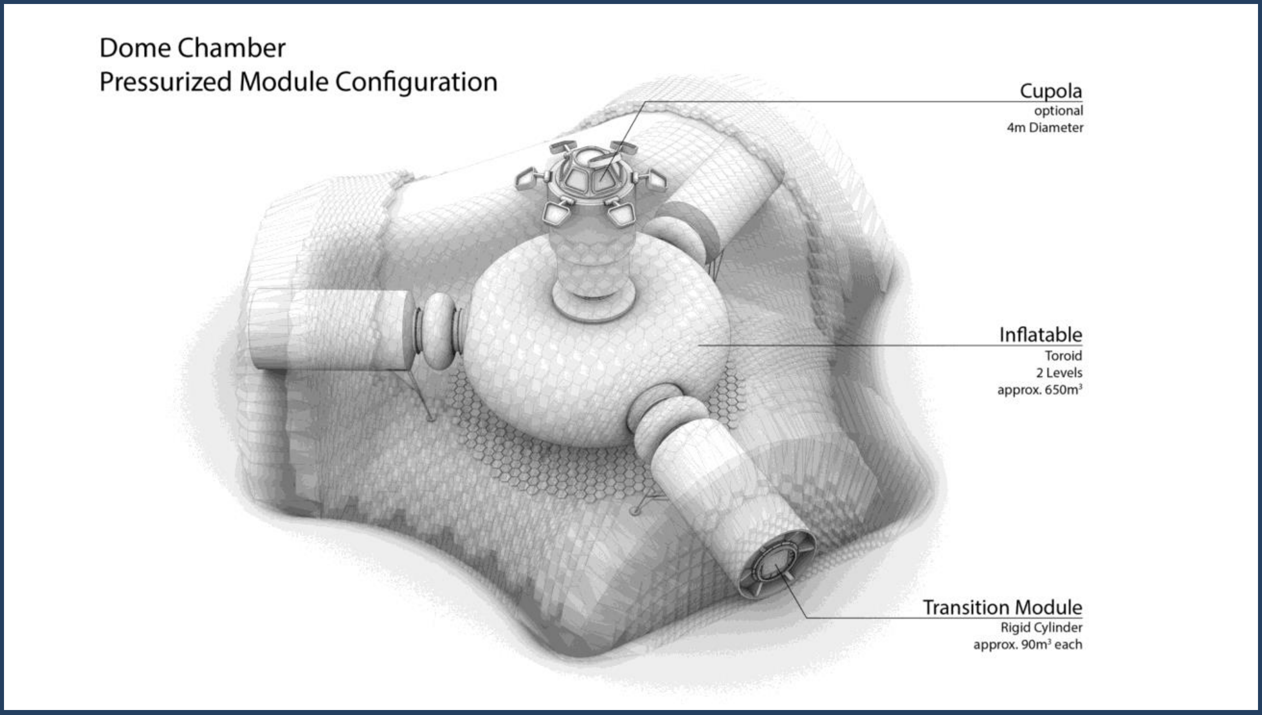


Figure 3_Dome Chamber made from Solar Sintering_© https://spacearchitect.org/portfolio-item/regolight-2/

As we contemplate future habitation on the moon, we will need to ensure human safety. Human activity on the moon's surface is poised to rely on 3D printing for constructing infrastructure using lunar soil (regolith), with the sun serving as the sole source of energy. While this technology is considered disruptive today, it is anticipated to become, mainstream tomorrow.

RegoLight a Horizon 2020 project advances the Technology Readiness Level of solar sintering lunar regolith from TRL3 (demonstrating the ability to sinter regolith in a laboratory setup, with a moving table, in a solar furnace) to TRL5 (demonstrating a movable printing head with accurate pointing of a concentrated solar beam and incremental deployment of regolith on the printing surface). Furthermore, solar sintering in a vacuum chamber is demonstrated to be approaching TRL6. Architectural scenarios and applications are generated based on the project's Finite Element Model and the mechanical properties of solar-sintered regolith.

2] Faster:

Figure 4_Faster_© https://liquifer.com/wp-content/uploads/2020/03/Faster_Render_Closeup-1.jpg

- Project Year: **November 2011 – November 2014**
- Type: **Forward Acquisition of Soil and Terrain for Exploration Rover**

FASTER is an acronym for Forward Acquisition of Soil and Terrain for Exploration is a rover that provides an alternative means of collecting surface information in unfamiliar areas during planetary exploration missions. Most robotic rovers traverse wide and varied terrain with little prior knowledge of the environment's trafficability. Estimates based on relatively scarce remote sensing data are occasionally inaccurate, and the rover may become trapped in soft sand or encounter unexpected obstructions. This happened to Spirit, the otherwise successful NASA Mars rover. To avoid such mishaps, planetary research rovers today move very slowly, covering only a few meters per day. In-situ physical investigation of the planetary surface is required to enhance travel velocities.

Partners in the FASTER project researched and demonstrated methods for effective in-situ soil acquisition and assessment of terrain features on planetary surfaces. The novel FASTER system combines a lightweight portable soil sensor with a compact all-terrain scout rover that can quickly and efficiently assess the trafficability of terrain, allowing for higher travel velocities and reducing the danger to the mother rover. Mobility, agility, and safety are critical factors in the unmanned exploration of the surface of Mars in an environment hostile to humans. Remote-controlled robots are a primary source of critical information; the faster and more reliably they can move across the surface, the faster and more reliably knowledge about the red planet can be transmitted.

Mars surface missions have been underway since the mid-1970s, and while numerous rovers have successfully traversed the Red Planet, the journey is fraught with danger. After five years of surface research, some perfectly functional rovers, including Rover Spirit, have become stranded in Martian terrain. The space industry is looking for ways to prevent these malfunctions sooner, and a collaborative technology (Space conceptions and design with artificial intelligence, communications satellites, aircraft, and robotics) initiative between six global corporations is underway. The partnership was made possible by the seventh European Union Framework Programme, which offers funding schemes for joint initiatives in the sphere of research and technology. Terra mechanics and systems engineering participated in the development of quicker. Two global and diversified teams with competence working on projects like this and in robotics allow us to discover new things that are novel to us and, hopefully, to other people. Additionally, it allows to construct systems and ideas that are not available today and that can ideally play a significant role in transforming the way humanity uses tomorrow.

Figure 5_Faster_© https://liquifer.com/faster/

Reference:

1) *Regolight* (n.d) *liquifer systems group*. Available at: https://liquifer.com/regolight/.

2) *Faster* (n.d) *liquifer systems group*. Available at: https://liquifer.com/faster/.

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Siddhi is a B.Tech student and a dedicated aerospace enthusiast aspiring to specialize in aerodynamics, propulsion, space science, satellites, and launch vehicles. Having recently completed an internship at the National Aerospace Laboratory, she has co-authored two international conference papers [IAC 2023, Baku]. Siddhi has also served as an ambassador for the International Astronomy and Astrophysics Competition 2023 and the National Students' Space Challenge 2023, in addition to holding the position of joint secretary at the Alatus Space Club in her college.

Currently involved in the student satellite project at the Centre of Space and Technology, Siddhi's daily commitment to design, writing, and knowledge reflects her unwavering dedication to achieving her career goals in the aerospace field.

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