ZEPHYROS a Habitat on Mars

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ABSTRACT

This research is about a space station which has been designed by considering some important affecting parameters. The habitat is on Mars surface but to protect it from hurricanes and dust storms (which occur often on Mars) we have found a series of processes.

Key words: *Mars, Space Station, Designing*

1 Introduction

The main aim of this research is to find how we can find a place to live in space and what parameters should be considered as the most important ones.

What is ZEPHYROS ?

2 Explanation

The name Zephyros sparked our interest becauseZepher is the ancient Greek God of Spring. We felt that this name is perfect for our house on Mars because this is a new idea that will bloom just like a flower in Spring. Zephyr was also the God of the winds, which often symbolize change, new ideas and environments, literally and figuratively.

We let the wind of inspiration take us to a place of ambition and hope, which lead to us designing this ideal habitat on Mars.

With this wind leading us to do the unexpected, we finally maintain our standards and achieve our goals. Our Mars habitat is well designed and thought through, and if someday we achieve to make it a reality, we can assure that it will be 100% safe and livable.

To explain the ZEPHYROS , it is started from its different parts.

For safety reasons, we will locate our shelter inside a crater on Mars' surface. That is because the radioactivity levels are lower and since the shape of the crater is proper for protecting the habitat from hurricanes and dust storms (which occur often on Mars). The lower level of the habitat, which includes the bedroom, the space toilet, the shower unit and the H2O and O2 tanks will be built underground where radioactivity protection is maximized, while the other two floors will be above the surface of the ground.

The shelter consists of three floors, which, because of the gravitational acceleration on Mars (3.69m/s^2) will be 7,25 m each. The greenhouse will be 9,63 m tall. The underground (-1 level) floor's area will be 23m^2, while the other two floors will be 25m^2, which means that the total area of the house will be 72m^2 and the greenhouse will be 17m^2. Our shelter will approximately accommodate 3-6 people and more beds will be designed accordingly. One local Mars resource we will use (and the most important one) is the soil from Mars' surface we will use to construct the outer casing of the upper floor. A series of processes will create a hard consistency that forms a brick. Most materials will be 3D-printed using a static construction rover and the rest will be gathered from the surface of the Red Planet (Martian soil to make bricks). We decided to place two airlock doors, one that connects the external environment with the airlock area and one that connects the airlock area with the internal environment, as an entrance to prevent loss of oxygen or pressure. The astronaut-helmet structure of the building (Extra vehicular Visor assembly) will provide protection from radiation, along with the housetop, which will be made of bricks of Martian soil. The aerogel Insulation Layer which will be applied to the house's human-interfacing surfaces will function as an extremely effective insulator, protecting from infrared radiation and ensuring thermal comfort. The residents' rooms will be on the-1 level, while they will be exercising at the gym on the ground floor. Working needs can be covered by the communication system and proper facilities, which will be installed in the living room area.

In order to ensure safe, reliable, long-lived power systems to provide electricity andheat for the residents, we will combine three different power sources for the shelter:

solar panels,

NASA RTG (Radioisotope Thermoelectric Generator, which converts heat directly into useable electrical energy),

and fuel cells, which produce electricity by chemical reactions.

There will be two main sources for water; the first one is related to the process of collecting all the liquids such as sweat and mostly urine and converting them, via the space toilet, to water. The second source is the water that will be provided through the fuel cells, as water production could be a by-product of power generation. The food source will mostly be planted vegetables that will be growing constantly in the habitat's greenhouse. More specifically foods that can be cultivated on Mars are: Dandelions because, they grow quickly, every part of the plant is edible and they have high nutritional value. Other nutritional foods that will thrive are micro greens, lettuce, arugula, spinach, peas, garlic, kale and onions. They could serve up to 3100 per day for 3-6 astronauts over a 600 day excursion to the Red Planet. Last but not least, the waste will be disposed via an airlock into space.

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3 Several parts in Zephyros (Figs. 1):

1- Airlock front door: two doors separated by a short corridor to create airlock

2- Window wall: made from high temperature polysulfone plastic (like in astronauts' helmets). Inner visor, made of ultraviolet-stabilized polycarbonate. filters ultraviolet rays and rejects infrared rays. Outer visor filters visible light and rejects ultraviolet and infrared rays . Together, they form an effective thermal barrier.

3- Housetop: made out of Martian Soil.

4- Aerogel Insulation Layer: applied to the house's human interfacing surfaces to ensure thermal comfort.

5- Greenhouse: vegetables will be grown with Martian soil, LEDs will ensure that the plants get enough sunlight and sheets of silica aerogel will make plant growth feasible.

6- Silica Aerogel

7- Small Greenhouses

8- Fuel Cells: used for providing extra electricity, heat, water, and CO_2 . The fuel will be the H generated from the electrolysis.

9- Solar Panels: to generate energy

10- Radioisotope Thermoelectric Generator (RTG): to convert heat directly into useable electrical energy

11- UHF Antennas: close range antennas functioning like walkie-talkie compared to the long range of the low gain and high gain antennas

12- Pneumatic (Vacuum) Elevator

13- Kitchen

14- Living Room

15-Spacesult Storage

16- Home Gym (gravity on Mars being 38% of Earth, humans could run the risk of muscle wastage and other health issues.

17- Bedroom

18- UWMS (space Toilet): will feed pre-treated urine into a regenerative system, which recycles water for further use

19- Shower Unit

20- Oxygen Tanks: will be generated with electrolysis by running electricity through water, water will be seperated into H and O_2 gas.

Floor height: 1 level: 7,15 meters
0 level: 7,25 meters
-1 level: 7,25 meters
Greenhouse height: 9,636 meters
Waste disposal: via an airlock into space

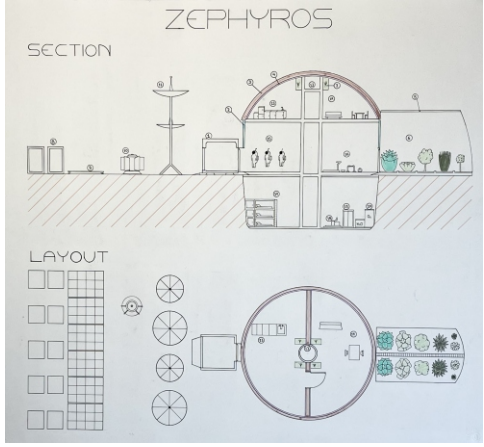

Fig. 1: Several parts of Zephyros