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Space Habitation Module For Mars

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Abstract: This study has been undertaken to design a stable and multi-purpose space habitation module for human civilization on planet mars. A complete description and analysis of the module have been provided with the design of various useful equipment. The forces are very well balanced and it is highly stable. Various equipment such as solar panels to extract solar energy for different purposes and a stable base with shock-absorbing qualities make this module extremely reliable and useful.

IndexTerms **– solar panels, space farming.**

I. INTRODUCTION

Outer space exploration has always been considered a very fascinating and important thing for a better understanding of the cosmos. To unveil the hidden secrets of outer space, It becomes a major responsibility of engineers to provide a solution that can help humankind to explore outer space. However exploring this inflated cosmos is a tedious thing as the cosmos has no end so to explore this vast cosmos, humankind can start with exploring the solar system. Planet mars could be the best option when it comes to exploring the solar system as it is well located in the solar system and have very similar properties to earth so it could be a good spot to explore the solar system. The possibilities of mars have motivathavemany organizations to build technologies that can support a human to stay on mars and can also observe different events happing in the cosmos. Building such technology is a hard task as the condition and atmosphere are quite harsh and without proper equipment, a researcher may encounter various difficulties. The surface of planet mars is very troublesome as its face is rocky, voca noes and craters on all parts of the planet so it makes it even more difficult to produce any kind of stable technology that could help us to explore the mars and outer space as well.

Till now there is not even one space habitation module, many space agencies are on it however they are not ready yet. So in this paper, we will be putting forward the space habitation module design that we have made which is going to be more useful and efficient. Some of its useful capabilities have mentioned below

- Shock resistant.
- Heat resistant.
- Solar energy usage.
- Solar sensitive material.
- Easily foldable.
- Space farming friendly.
- Enough capacity for energy storage.
- Nanomaterials to be used.
- Geometry of the module.
- Temperature and pressure to maintain inside the module.
- Air ventilation in the module.
- Process of removing CO2 released by the plants.
- How to protect it from radiation.

II. SPECIFICATION AND STRUCTURE OF SPACE HABITATION MODULE

An interior view is illustrated in the above figure, with a cross-section showing two deck levels. The lower deck includes all the primary crew work areas and the upper deck includes crew quarters wrapped with stowage to maximize radiation protection. The internal volumes of the forward and aft end domes are utilized as life support and vehicle systems, and the airlock is joined to the external forward dome supplies for EVA operations.

The MIG Baseline interior layout is used to help drive requirements for all configurations. The detailed necessities and mass for the MIG Baseline Configuration which is based on a 2018 refinement study represented in the technical paper, “Transit Habitat Design for Mars Exploration”. The factors were used to build the ACO habitat sizing tool for the baseline configuration, causing a habitat mass of about 55.5 metric tons (mT) with a pressurized volume of about 317 cubic meters (m3). The same settings were

then used for all the remaining configurations, varying only the particulars for the contractor's proposed modules. More details on the mass of each configuration can be found in Appendix A, and Section 4 on Mass and Volume provides a comparison of the configurations and a representation of a 10mT mass deduction approach to 45mT for the baseline configuration from the referenced 2018 refinement study.

Surface Habitats:

Surface habitats for Mars missions typically provide support for a crew of four over 300 - 500 days. The complete surface habitat is usually formed with several modules that require off-loading from a lander onto a mobility platform and transported to a base campsite for berthing to other modules. The base camp is usually about a kilometer or more away from the landing space to safeguard the habitats from litter scattering. Typical configurations for the surface habitats use ISS modules designed for living quarters, surface labs, nodes, and airlocks, with new logistics modules attached for each crew mission to the surface habitat. The module size and configurations given by The Boeing Company and Lockheed Martin concepts for Gateway are almost the same in size and design to meet the surface habitat needs.

Ascent Vehicle:

The cabin sizes for the descent to the surface from Mars orbit, roving on the surface, and ascent from the surface back to the Mars Transit Habitat have similar volumes that can probably be accommodated by the smaller

Cygnus diameter modules from the Northrop Grumman designs. In general, each of these modules can be designed to support four crews for about a week or two.

Growing plants for food in lunar or Martian habitats makes sense on many levels. As plants grow they remove CO_2 and replenish O_2. Also, it will work with the help of solar panels. Decomposers in soil or hydroponics systems can reuse biological scrap and provide nutrients for plant growth**.**

III. RESEARCH METHODOLOGY

The complete design has been done on fusion Autodesk and further analyzed using solid edge

3.1designing

The whole design has been done by calculating different forces at different parts of the module and further calculating the center of gravity for better stability. Lightweight silica and aluminum material have been used to optimize the performance of the module.

The geometry of the design is decided after a rigorous analysis of different proposed modules and then with the help of fusion 360 we created a mesh which further modified to get the optimized performance. The design has an interior chamber that can help to perform various activities such as space farming, research, and various other things. So to keep this whole design stable from any kind of difficult situation, a special kind of base has been produced which can absorb the shock waves and various other kinds of disturbances in the body.

IV. RESULTS AND DISCUSSION

Fig.2 to Fig.4 shows the side, bottom, and back view of the space habitation module. This space habitation module is designed for the Outer Space Settlement. It is designed to maintain the proper temperature and pressure that is required for space-farming by using solar energy and also keeping in mind to constantly remove CO_2 that is released by the plants during the process of photosynthesis besides it is also lightweight and also comes with the unique feature of being foldable thus making it easily portable. It is also made shock resistant to ensure a safe landing over the rough surface of Mars. Also, there is enough space to store energy that is collected from the sun as we are using solar energy for space farming as well as providing proper ventilation in the module.

Overall the result suggests that such a space habitation module is an idea that many space agencies are trying to come up with but are still researching. Also, its unique features such as:

- Lightweight
- Foldability
- Supporting space-farming
- Use of solar panels for space-farming
- Shock resistance, etc.

are a plus point that makes this a perfect design for space farming thus making it more reliable and meaningful. It is a module that is designed after thorough research also keeping in mind to make it more feasible for everyone.

FiguresandTables

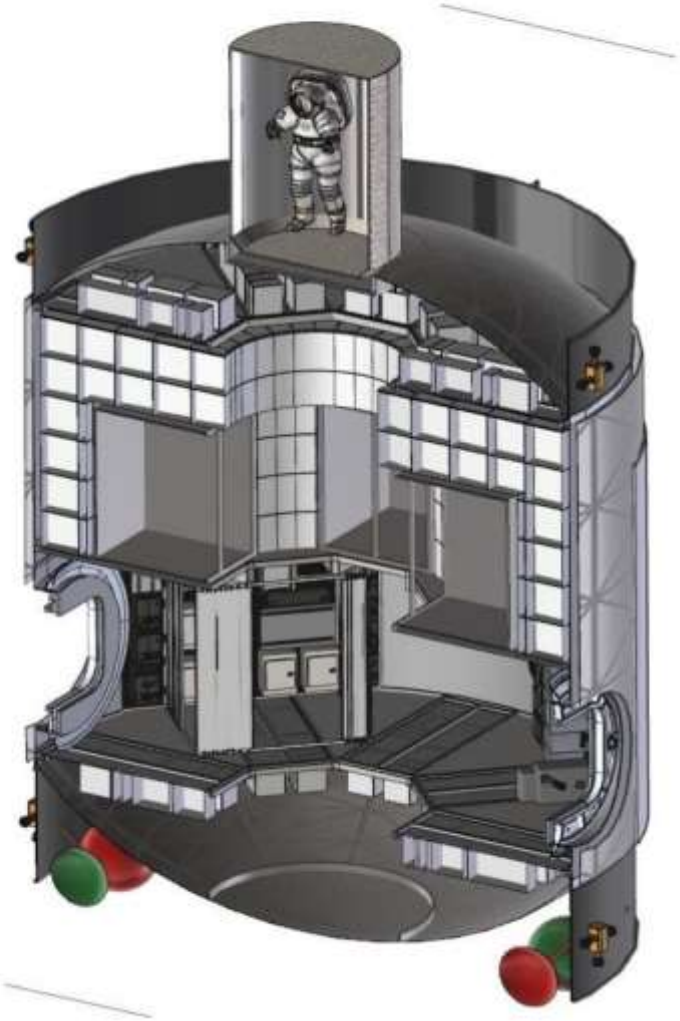

Fig.1 internal view of the space habitation module

FIG.2 SIDE VIEW OF THE SPACE HABITATION MODULE

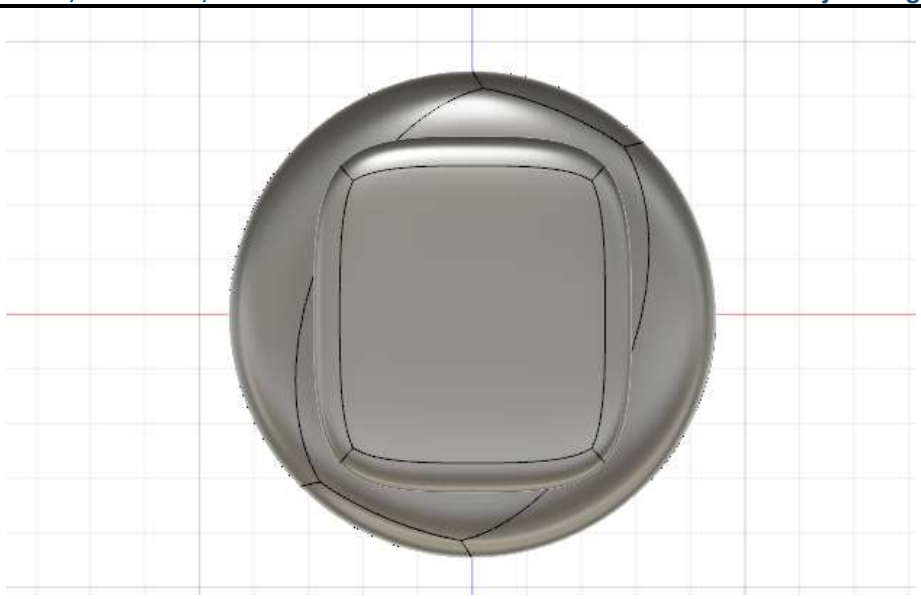

Fig. 3 bottom view of the space habitation module

Fig. 4 backside of the space habitation module

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