INNER DESIGN OF A HABITAT MODULE FOR PLANETARY SURFACES. I. Magyar[1], M. Udvardi[1], P. Szakolczai[1], R. K. Varga[1], B. Veres[1], Á. Papp[1], B. Berendi[1], N. Tóth[1], S. Tóczik[1], Á. Lovász[1], Sz. Bérczi[2], T. P. Varga[3], R. Cseh[4]. [1]Eötvös József High School, H-2890 Tata, Tanoda tér 5. Hungary, (mirene@freemail.hu), [2]Eötvös University, Institute of Physics, Dept. Materials Physics. H-1117, Budapest, Pázmány P. s. 1/a. Hungary (bercziszani@ludens.elte.hu), [3]VTPatent Kft. H-1111 Budapest, Bertalan L. u. 20. Hungary, (info@vtpatent.hu), [4]TavIR Project Development, H-1181 Budapest, Vándor Sándor u. 12. Hungary (csehrobert@tavir.hu)

Summary: The main goal of our study is the determination of an inner design of a habitat module, which is capable supporting prolonged stay on the surface of a planetary body, e.g. Moon or Mars, while withstanding the external effects encountered on the planetary surface.

Introduction: In the Eötvös József High School of Tata the student circle for Space Research and Robotics is operational since 2007. Based on its activities the student circle is in connection with several Universities including the Eötvös Loránd University (Budapest, Hungary), and the members of our circle are attending lectures and hands on sessions. During the work of the circle the students can become familiar with the latest results of space research and robotics, and they can also participate in independent research activities at high school level.

Fig.1. Circle meeting with some members

As a result of our circles activities, the members of the circle sent several publications for the Lunar and Planetary Science Conferences [1,2,3] and for the Lunar Exploration Analysis Group conferences [4]. In the present abstract we wish to summarize our recent activities related to space research and planetology, and the technical aspects of space exploration, during which we cooperated with the projects hosted by the ELTE Cosmic Materials Space Research Group.

Background: Overview of the functions of a „house" built on a planetary surface, regarding it's functioning as a house and as a space station. What are the habitat module's most essential functions?

It has to provide general means for technical activities, support for human presence, atmosphere, temperature, light, water circulation, food, storage, waste disposal and recycling. Energy supply is required for heating, temperature control, lightning, general maintance of the habitat module. Human activities: work, sleep and rest, social activities and recreation.

Functional analysis: In this study we examined a multi level habitat modul with a preferably spherical structure. In its multi level structure different levels can have different uses.

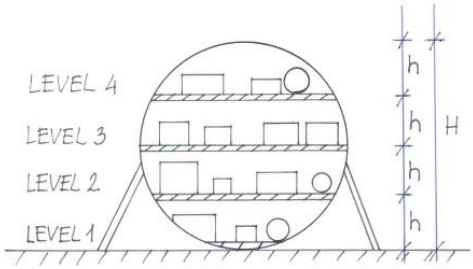

Fig.2. *Cross section of a possible spherical planetary surface habiotat modul*

Lower levels: energy source and support, storage area for supplies, tools, and waste, solid waste circulation. A limited reuseability of solid waste must be provided, thus a method for waste recycling is to be developed. Storage for water and other fluids, such as clean (drinking) water. This requires a full scale waste water management and circulation, where large part of the produced waste water can be reinserted to the clean water reservoirs, and the side-products (waste sludge) can be stored elsewhere.

The surface gravity of the planetary body, e.g. Moon or Mars helps the handling of fluids, because it creates similar circumstances present in Earth (in contrast to micro-gravity enviroments). When pumped upwards under pressure, the waters later accumulation is helped by gravity.

Requirements for gas storage and gas circulation: storage of gases required for human presence (oxygen, nitrogen). The composition of the internal atmosphere must be regulated, oxigen must be inserted and CO2 must be filtered from the internal atmosphere.

Middle levels: Living areas and rooms, additional working areas, sport and recreational facilities.

Upper levels: working spaces, laboratories for scientific activities. The upper level provides better view and panorama of the surroundings, thus providing an ideal place for a control center.

Transportation: At the center of the modul, a vertical elevator, staircase, or shaft could provide means for movement between the levels.

Practical considerations*:* Joining to another topic of the Cosmic Materials Space Research Group of the Eötvös Loránd University the chosen shape of the studied habitat module is a truncated icosahedron.

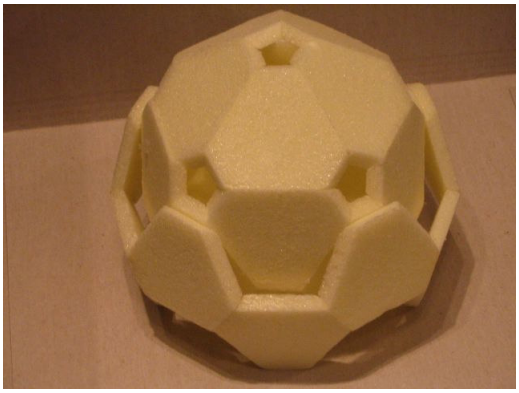

Fig.3. *View of a possible spherical structure of a planetary surface habitat module*

Implementation on the Moon*:* We must taking the external Lunar circumstaces into account:
- no outside atmosphere, an artificial internal atmosphere must be supplied (approx 0.8-1 bar)
- Completely airtight structure is requiered
- Every door and window must be completely air and pressure tight
- Day and night cycle is 14-14 days long. For human activities a continuous inner illumination must be provided., also an artifical 24 hour day and night cycle must be created for the comfort of the inhabitants.
- Smaller surface gravity, (1/6 of Earth surface gravity).
- Danger of meterorite impacts, (micrometeorites do not burn in the atmosphere).
- Energy supply: Solar energy during the day for power generation and heating, (energy production through solar cells). Energy reserves are utilized during the night, also auxiliary nuclear power may be required for continous, uninterrupted power supply.

Implementation on Mars*:* Mars has half the diameter of Earth, thus it's surface is one fourth and it's mass is approximately one eighth of the Earth's surface and mass.
- The surface gravity is one third of the Earth's surface gravity.
- Very low pressure atmosphere 0.75 mbar,
- The composition of the atmosphere is mostly CO2, with very small amounts of nitrogen, argon and water vapor
- Surface temperature range between min -70°C and max +20°C.
- In the atmosphere significant winds are large dust storms may be present.
- The day and night cycle is very similar to the Earths day and night cycle.

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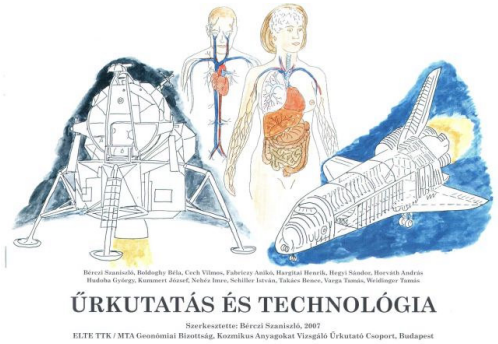

Fig.4. *Front page of the handbook of SPACE SCIENCE and TECHNOLOGY*

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