PLANETARY SCIENCE EDUCATION VIA CONSTRUCTION OF THE HUNVEYOR-3 EXPERIMENTAL PLANETARY LANDER IN BERZSENYI COLLEGE, SZOMBATHELY, HUNGARY: ROCK RADIOACTIVITY MEASUREMENTS. ***Zs. I. Kovács [1], I. E. Kövári [1], R Balogh [1], V. Varga [1], T. Kovács [1], S. Hegyi [2], Sz. Bérczi [3,4],*** [1]Berzsenyi Dániel College, Dept. Technology, H-9700 Szombathely, Károlyi G. tér 4. Hungary, [2]Pécs University, Fac. Science, Dept. Informatics and G. Technology, H-7625 Pécs, Ifjúság u. 6. [3]Eötvös University, Dept. G. Physics, Cosmic Mat. Sp. Res. Gr. H-1117 Budapest, Pázmány Péter sétány 1/a, Hungary, (bercziszani@ludens.elte.hu)

ABSTRACT

We built the Hunveyor-3 minimal space probe, an experimental lander of Surveyor type, on the Berzsenyi Dániel Teachers Training College, Szombathely, Hungary. Our group made a new arrangement of the frame which has more space for instrumentation. Among the new instruments (compared to the earlier Eötvös and Pécs University ones) there is a GM-tube for natural radiation measurements, which were carried out on rock types with planetary importance.

INTRODUCTION

Since 1997 two universities developed their Hunveyor experimental planetary lander robot in Hungary. Eötvös and Pécs University groups made specific instrumentation for lunar and Martian surface conditions [1, 2, 3, 4]. They also arranged desert surface terrain geology around the landers [5]. The Berzsenyi Teachers Training College group of teachers and students made newer frame arrangement, welded it from steel, and over arm and TV we placed new instruments on Hunveyor -3. One is a GM tube,

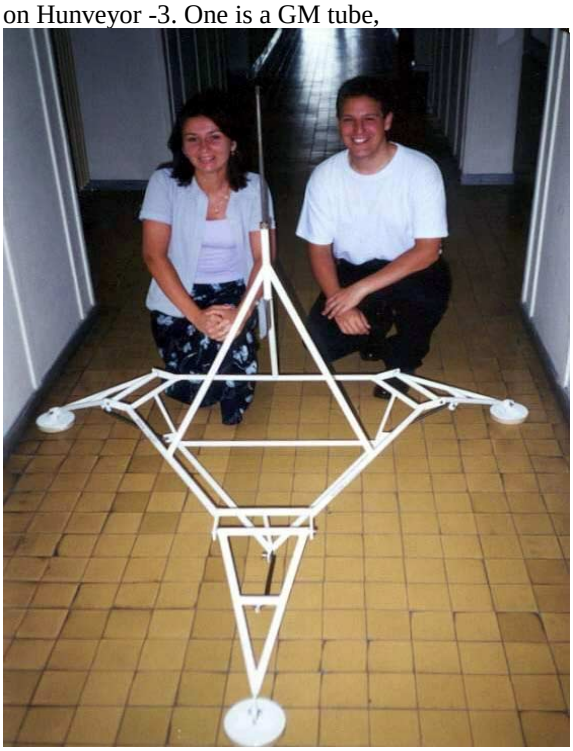

Fig. 1. Students with the welded Hunveyor 3 frame.

EDUCATIONAL BACKGROUND

We can use the minimal space probe both in planetary science education, technology education and environmental science education. By Hunveyor-3 we have an instrument assemblage which measures some of the surface streams on a planet, [6] and its measuring systems are operated by students [7]. But not only Hunveyor-3 but its rock-garden and surrounding desert conditions also serve education by modeling. So the Hunveyor-3 educational unit consist of two parts: 1) model of the environment, 2) model of the system which interacts, measures, communicates. Therefore the Hunveyor-3 educational unit is a matrix representation of technologies and planetary environmental streams. Therefore it is useful model for several science departments in the College which study various streams of the environment (winds, streams by precipitation, changing light conditions, etc.) but in terrestrial conditions. Hunveyor-3 support them in teaching and measuring streams of environmental side and it is important model for Dept. of Technology on the construction, operation and informatics side [6].

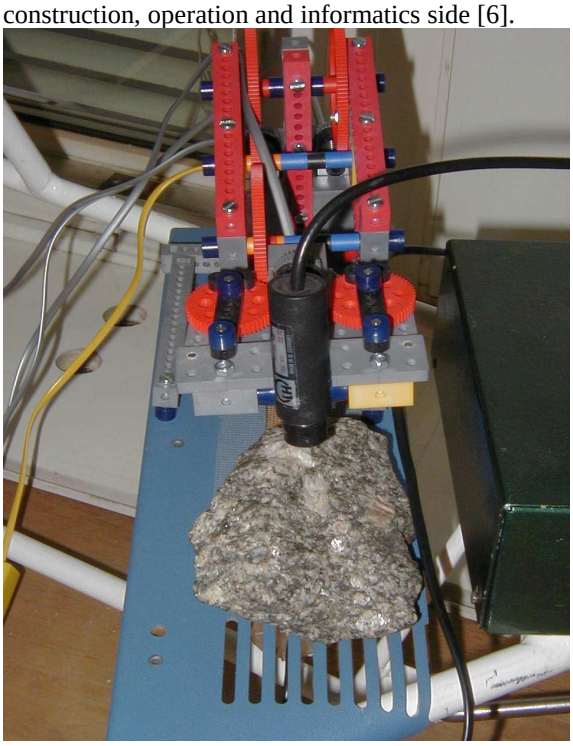

Fig. 2. The rock radiation measuring assemblage.

HUNVEYOR-3 OF BERZSENYI COLLEGE, SZOMBATHELY: ROCK RADIATION MEASUREMENTS

Zs. I. Kovács, I. E. Kövári, R Balogh, V. Varga, T. Kovács, S. Hegyi, Sz. Bérczi.

MEASURING NATURAL RADIOACTIVITY OF ROCKS (NOW ON TERRESTRIAL CONDITIONS, LATER ON THE PLANETARY SURFACE)

Natural radiation is a characteristic feature of various rocks. Especially gamma ray radiation of Venusian rocks were used in characterization and identification of rock types [7].

We collected and arranged in the rock garden of Hunveyor-3 different rock types, as basalt, andesite, red-limestone, red-sandstone, granite, etc. some of them with planetary, some with terrestrial importance [5]. We always measured the background radiation. We found that most rock types have no radiation emerging from the background except the red-sandstone and some fragments with ceramic origin.

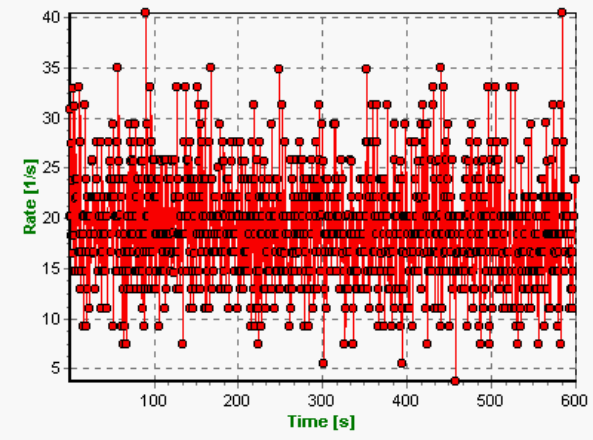

Fig. 3. The counts in the vicinity of the red-sandstone rock sample (duration of counting was 10 minutes).

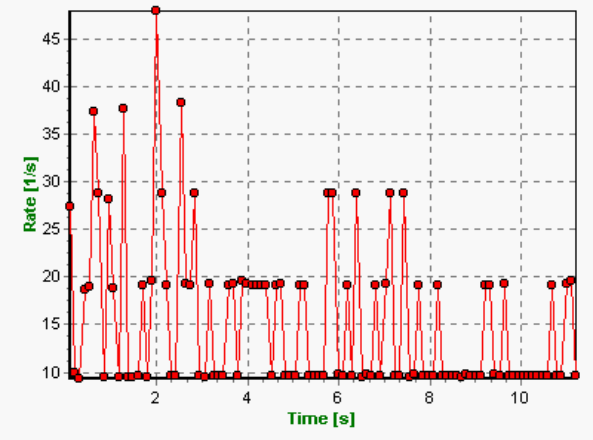

Fig. 4. The counts in the vicinity of a ceramic fragment (duration of counting was 10 seconds).

We also arranged a planetary desert around Hunveyor-3. where the selected rock types were originally arranged. In the radiation experiment the robotic arm was operated to move the rock samples below the minimal probe Hunveyor-3.

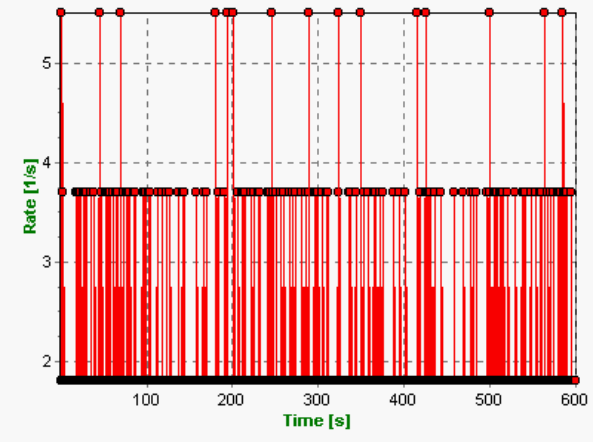

Fig. 5. The counts in the vicinity of a basalt sample did not show differences from the background.

SUMMARY

We built Hunveyor-3, the third minimal space probe experimental lander in Hungary. We carried out natural radioactivity measurements with the GM-tube instrument on the Hunveyor-3. Both the Hunveyor-3 model construction and the measurements with it showed the perspectives of the space science education program of Space Camp (Huntsville, Alabama) and other Space Centers [8] that the complex experiments related to space research intensify education on the fields of natural sciences and technologies. We continue this program with addition of new measurements to the Hunveyor-3 assemblage.

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