SPACE SIMULATORS IN SPACE SCIENCE EDUCATION IN HUNGARY (1.): A HUNVEYOR TYPE PLANETARY VOYAGE AND PLANETARY SURFACE OPERATIONS SIMULATOR. ***Sz. Bérczi[1], T. Diósy[1,2], Sz. Tóth[1,2], S. Hegyi[3], Gy. Imrek[3], Zs. Kovács[4], V. Cech[1], E. Müller-Bodó[1], F. Roskó[1], L. Szentpétery[5], Gy. Hudoba[6]*** [1]Eötvös University, Faculty of Science, Dept. G. Physics, Cosmic Materials Space Research Group, H-1117 Budapest, Pázmány Péter sétány 1/a. Hungary. [2]EWorld Hungary Kft., H-1026 Budapest, Garas u. 1, Hungary, [3]Pécs University, Faculty of Science, Dept. Informatics and G. Technology, H-7624 Pécs, Ifjúság u. 6, Hungary, [4]Berzsenyi College, H-9400 Szombathely, Károly G. tér 4, Hungary, [5]MANT, Hungarian Astronautical Society, H-1015 Budapest, Fõ u. 68. Hungary, [6]BMF, Kandó Kálmán College, H-8000. Székesfehérvár, Budai u. 45, Hungary. (bercziszani@ludens.elte.hu, hegyis@ttk.pte.hu, diosy@eworld.hu,)

Introduction: Space Camp, Huntsville, Alabama, (with NASA Marshall Space Flight Center) every year organizes International Space Camp, a week program for students and teachers [1]. There several Hungarian students could visit the various programs in which various space simulators operate. That is why that attention of space science education turns toward such type of new educational directions.

As a prototype we began not a Space Camp type manned spaceflight simulator, but instead a planetary voyage and lander, although the example to Hunveyor was also from NASA space arsenal: Surveyor. According to the electronic basic framework such systems contain a "terrestrial" direction and control room (it is only a computer in a minimal case) and contain another computer on the place of operations for the space works itself. This second one may be in another room, (it is also a computer in minimal case), but this is working on a planetary surface (metaphorically) and in the case of Hunveyor it is on board of the university lander probe in space simulator mode [2, 3].

In this work we show some deatils of the some electronic form, activities, possible combinations. The benefit of the system is, that in its skeletal basic structure both "ends" of the "terrestrial" and the "planetary" of a communication line the peripheries and programs are continuously extended, developed, multiplied, so finally a complex system of various space simulators can grow up in this program.

Other group of enthusiastic students and colleagues plan to build a manned space simulator (EMAUSZ) too, and we support their program by lending all knowledge we collected in the Hunveyor planetary simulator construction.

Two computers in two rooms connected: The hearth of the system is the communicational channel between two computers connected. Each ends use various peripheries. On "terrestrial" side are the directing and controlling peripheries (joystick, claviatures, monitors) while on the "planetary" side the sensorial, manipulator peripheries are dominant. In an on line connections the RS 232 ports of the PC-s were used for the connection [4]. Fig. 1.

Planetary simulator in work: Planetary simulator is interesting even if it is in its constructional stage. A whole travel was planned from launch till landing, and from beginning of instrumental operations till the manipulating works carried out on the surface. Like as in the Space Camp programs various accidents, failures, mistakes are programmed to make the program exciting (i.e. in a Martian case dust storm, or snow coverage cause transitional break, in some instruments.) Using Hunveyor in a sapce simulator mode the developed instruments get new roles (We plan and use Hunveyor for scientific instruments construction, too.) The whole space travel simulation attaches new programs to our system. We show some of them.

Peripheries: *During the voyage: camera as travel periphery***:** During the voyage toward a planetary body the sky with stars is the observed environment with the camera of the lander. This environment changes when mid-course maneuvers are carried out. In simulating a whole travel of a lunar probe the camera system was combined with a planetarium program. We plan to compute various other maneuvers (for example trying some instruments, etc.) together with simultaneous changing the stellar environment around the space probe. The travel toward the planet is an exciting place of combinations for the planetary simulator.

Camera + something: Web camera is everyday artifact but it is useful only, if the local environment is interesting [5]. Arriving to the landing site we concentrate to the surface characteristics of the planetary body, and we also follow the on board experiments. Over camera the most important planetary periphery is the little manipulator arm and the rover on the test-terrain around Hunveyor lander.

The manipulators and the camera of Surveyor style are moved with small number of simple DC motors. Even if the power system has not been built by solar panel, the system can work through network, and through controllers. In our system we use active experiments ("Surveyor-Type" mirror, arm, rover, etc.) with 2 motors each.

Planetary simulator on the internet: The Hunveyor Planetary Simulator System is planned to be taken on the internet, too. This needs informatics background fitted to the larger system, and will form a new educational style. Two years ago some parts of this system was realized with the arm and a rover, and camera was on the rover (Fig. 2.) [3]. In this case the planetary simulator's test-terrain contained a garden of solar system type rocks and desert forms arranged from sand. This system was easy to damage by parallel use (or short electrical interruption in network).

Planetary simulators: Summary: A planetary simulator construction is a special form of planetary science education. We made our system with "terrestrial" control room and a planetary lander site. The whole voyage simulation allowed many enthusiastic programs to be involved in the program, so finally astronomy, planetary geography, petrology and robotics with its electronic background were all educated during the use of a simulation. Many astronaut and robot working together can be simulated also in this activity. And planetary simulator is the most simple one. It is at the beginning, and further simulators, with manned flights can be practiced by constructing first this Hunveyor type one.

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SPACE SIMULATORS IN SPACE SCIENCE EDUCATION: A HUNVEYOR TYPE

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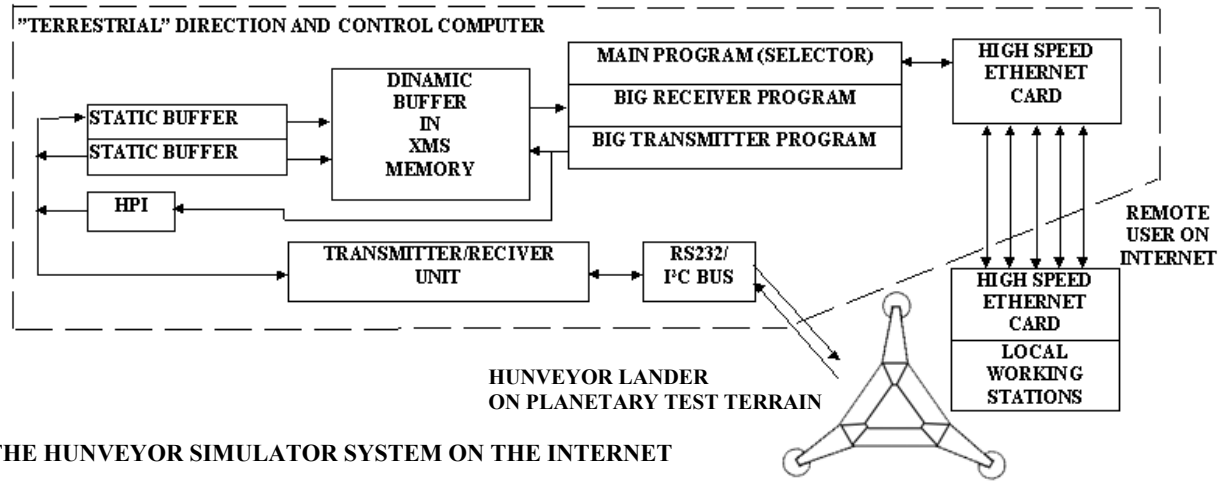
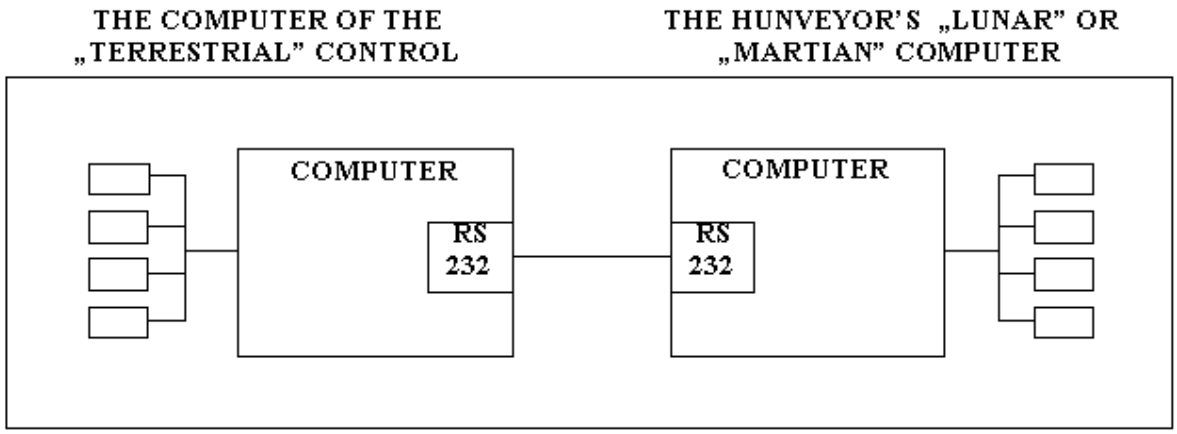
Fig. 2. If the planetary simulator is connected to the internet remote users can keep in contact with the program.



THE HUNVEYOR SIMULATOR SYSTEM ON THE INTERNET

Fig. 1. The basic arrangement of Hunveyor simulator.

The terrestrial and the planetary computers communicate with each other. Both of them may be extended and developed with various peripheries. On terrestrial side joystick, monitors and claviatures, on the planetary side motors of instruments and measurements can be attached to the system. The whole Hunveyor Planetary Simulator System preserves the benefits of our earlier lander construction and the developing program for new experiments on board of the lander, but extends its capability in educational works involving activities in astronomy and new topics in planetary geology too.



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