FIELD TRIP TASKS AND SIMULATIONS WITH HUSAR-2 ROVER AT THE MARS ANALOG DESERT STATION, UTAH, USA. *S. Hegyi[1], Z. Gőcze[1], A. Hegyi[1], P. Kovács[1], L. Baksa[1], Sz. Bérczi[2]*. [1]Pécs University, Dept. Informatics and G. Technology, H-7624 Pécs, Ifjúság u. 6. Hungary, (hegyis@ttk.pte.hu) [2]Eötvös University, Department of General Physics, Cosmic Materials Space Research Group, H-1117, Budapest, Pázmány P. s. 1/a, Hungary (bercziszani@ludens.elte.hu)

Introduction: Development of new instrumentation has always been the center of the annual program for the Hunveyor and Husar space probe models in Hungary [1-2]. Our goal was to carry out new simulation programs and comparative planetary educational programs with the robots [3-4]. Last year for Husar-2d rover the activities were focused on the tasks required by the Hungarian Crew No. 71 at the Mars Desert Research Station, Utah, USA, 2008 April. The requirements for the mobile rover unit were the follows: moving on various surface conditions, forward, backward, and siding rolling on small area, the model-car chassis should be high enough in order to carry out measurements in geological, geographical and chemical topics. We developed the Husar-2d rover module of the Husar-2 family to fulfill these requirements.

Husar-2d: This is the newest member of the Husar-2 family which was based on the earlier Husar-2a rover unit. It is capable of performing several new geological mobile measuring tasks over the basic task of serving contacts with Hunveyor-2 meteorological lander model. Because of the improved frame (high chassis) and individual drive of its wheels the new rover can travel on a variety of rocky or smooth soil surfaces. The chassis is centrally symmetric. It can turn around using the individually driven wheels. It has temperature sensors at both the front and back sides. The data are sent through a 802.11 g standard wifi to the Hunveyor computer (Fig. 1). The program that controls the movements of Husar-2d (HUSAR-2d Remote) is written only for an operator who is locally present.

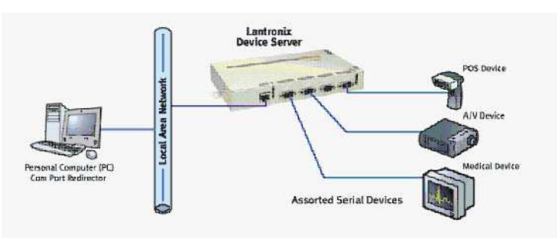

Fig. 1. The principle of communication of the Husar-2d.

The communication was built through the serial port, the data are transmitted by the wifi-router. Both the data analyzer of the Hunveyor-2 and the local control of the rover uses the serial port. The processor of the Husar-2d was a PIC 16F877. This processor has the programs of the basic functions of the remote control and the data analyzer gives commands to this processor to carry out the routine tasks. The sent and received signals are character type ones, therefore the direction was realized by a terminal emulator if the function of the signals sent was known. However, the data analysis is not possible in this way.

The communication of the Husar-2d was realized through a wifi-router: almost all units in the network receives an IP address from the router. This way all the units of the local network may have dynamic IP-address. Fixed IP-address had the web camera only in the local network (192.168.2.115), because the direction program requires a fixed IP-address in order to establish the connection. This type of communication makes it possible for the "terrestrial" control to take over the direction and control and carry out remote direction.

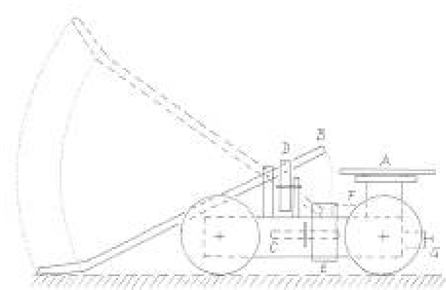

Fig. 2. Husar-2d sketch for the MDRS program.

Fig. 3. Husar-2d at work at the MDRS Utah station.

Astronauts of the MDRS station can also observe the functioning rover via a 802.11 wifi camera. At default this camera is turned off to conserve energy, but it can be activated anytime. Also, in case of a system failure the camera is automatically activated and turns to show the malfunctioning rover part based on the error signal detected by the various sensors. The rover is equipped with an ultrasonic distance detector attached to the front of the vehicle to detect extreme slopes in the terrain. If the difference in altitude is deemed too dangerous, the detector sends a warning to the operating system and immediately causes the rover HUSAR to stop. The problem must be solved by the operator after which the rover's operating system regains full control. The rover is also equipped with a front bumper which functions to detect large rocks that block the rover's path. In case this happens, the rover stops and behaves similar to the detection of a ravine detailed above. One of the most important rover functions is the collection of rock samples. This is achieved by a spoon which can pick up rocks and put them in a rotating holder attached to the side. This is required so the rover can pick up multiple rock samples. This designed allows the simultaneous uptake and storage of six samples since the holder is attached to a servo device which can rotate. This tool and function can be modified so the device is able to lay down glowing marking buoys behind the rover, and track them on the way back. This way the rover can find its way back to its original position. In principle, the rover is equipped with an autonomous power system. It is directly operated from 12 V batteries constantly charged by a solar panel that warrant long-term operation. This power system however, has problems, even if the principle behind it is perfect. The large body parts of the rover would require enormously big and high power solar panels. Li-ion batteries serve as secondary batteries, but their recharge is difficult due to large fluctuations in temperature and recharge characteristics. Due to these problems the batteries require a special adapter and a power outlet. The rover's dimensions were carefully designed and planned so it won't be too big. Some plastic body panels make it vulnerable to collisions. The rover was designed and built so it can be partially disassembled and not have body parts larger than 25x40x55 cm. Interestingly enough, this was necessary to comply with FAA regulations because the rover had to be taken to the MDRS in a carry-on luggage in a commercial airplane (this was the safest shipping method). See Husar-2d in Figs. 2-3.

Instruments: On the board of the rover the most important instrument is the robotic arm which has three degrees of freedom. The maximal length of extension is 30 cm, and the arm can lift up 500 g load at the most extended state. The arm has commutable tools. It will carry out a) measurements of soil strength, b) measuring the distance of the target rocks, and c) dust collecting package for Martian studies.

Summary: The Husar-2d rover was operated on the MDRS by the Crew 71 in their 2008 April program. Earlier the Husar-2b was used in the MDRS. This rover construction showed and tried good examples in new developments for the 8 Hunveyor-Husar University/College space probe robotic modeling program, where works run in Hungary.

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