LUNOKHOD "ROBOT-GEOLOGIST": SCIENTIFIC TASKS AND TECHNICAL CONFIGURATION.
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Introduction: Research and development of the Moon as a geological object, i.e. the same object as the Earth and other terrestrial planets of the Solar system, is the main task of the Lunar Program of research at the present stage, with the involvement of all geological, geochemical and geophysical research methods. It is practically impossible to carry out a geological survey around 500 km long route on the Moon at the next few decades with the help of a manned expedition for various reasons. But such routes can be implemented by means of the lunokhod "Robot-Geologist" at the next 10-15 years. The machine can easily cope with the tasks of thematic geological, geochemical and geophysical survey. Such studies should be carried out not only at the stage of automatic research, but also on the stage of manned missions in accordance with their rational combination and interaction.

Lunokhod "Robot-Geologist": Lunokhod is developed by Central Research and Development Institute of Robotics and Technical Cybernetics (St.-Petersburg) on the instructions of the Russian Space Agency (ROSKOSMOS) in accordance with the initiative and recommendations of Vernadsky Institute (Moscow). Lunokhod is projected on the basis of universal six-wheel platform, which will also be used for double manned lunar rover, and for freight and other vehicles for movement on the lunar surface (Fig. 1).

The concept of the lunar rover "Robot-Geologist" with a boring rig on board has been designed to perform well-defined scientific and practical tasks at the present stage lunar exploration [1]. The main task of the automatic "Robot-Geologist" is a thematic geological, geochemical and geophysical survey with sampling of lunar soil and shallow (3-6 m) drilling a few (5 and more) wells for sampling stratified core of regolith (Fig. 2). Planned length of the route rover is about 400 km (Table 1). The magnetometry, gravimetry, active and passive seismic experiment and logging measurements are also planned. One of the tasks of the "Lunar Robot-Geologist" is also deploying of the automatic research station of long-term monitoring (ARS) in accordance with the project Lunar Basic Network [2].

On the board of "Robot-Geologist" is planned to install the following scientific equipment: 1) Scientific navigation devices – radio beacon, TV-spectrometer, IR-spectrometer, TV-camera working field; 2) Instruments for geophysical research – set for active and passive seismic survey, geological radar, logging device, magnetometer and gravimeter; 3) Instruments for studying the composition of the lunar soil and gases – gas analyzer for the study of weakly bound volatiles in lunar regolith and for the study of the lunar atmosphere, gamma-spectrometer and neutron detector; 4) The sampler devices – drilling rig and manipulator with cassettes for the collection and storage of core samples and soil samples.

The rover to be used in areas where there are a variety of complexes of rocks of different ages, genesis, composition and spectral classes. According to the geological structure the Mons Rümker region in the northwestern part of the Oceanus Procellarum is one of the primary landing sites and research areas for the lunokhod "Robot-Geologist" [2] (Fig. 3).

The second major problem that can be solved with the help of the lunokhod "Lunar Robot-Geologist", is a search and reconnaissance to assess the content and distribution, and delineation of lunar resources, such as loosely coupled gas and frozen volatiles in the Polar regions of the Moon, as well as pre-exploration of the potential deployment location of the Lunar Polar Observatory (Fig. 4).

On board the rover is planned to install a manipulator and drilling device of the next generation LB10, with a potential drilling depth up to 15 meters, which is being developed taking into account the experience of successfully operated LB9 on board the "Luna-24". Delivery to Earth of samples collected is planned by the automatic transport spacecraft, which meets the rover at the end point of the route, and later with the help of the crews of manned missions.

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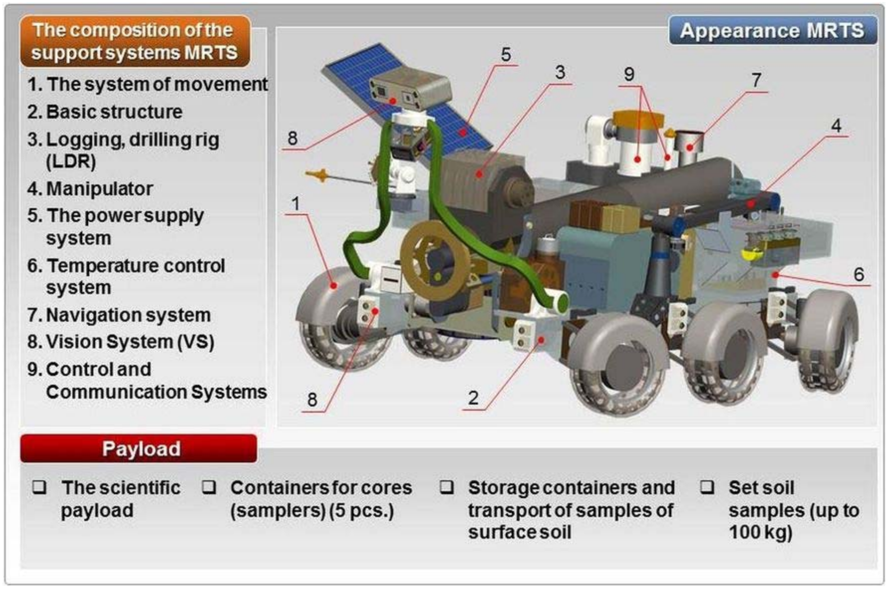
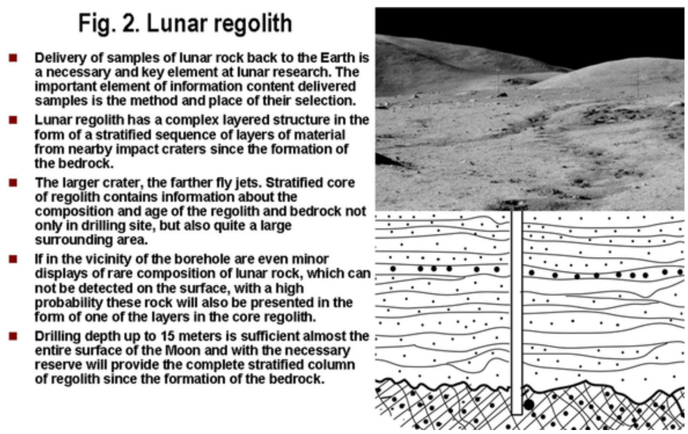


Fig. 1. Appearance of the Lunokhod “Robot-Geologist”



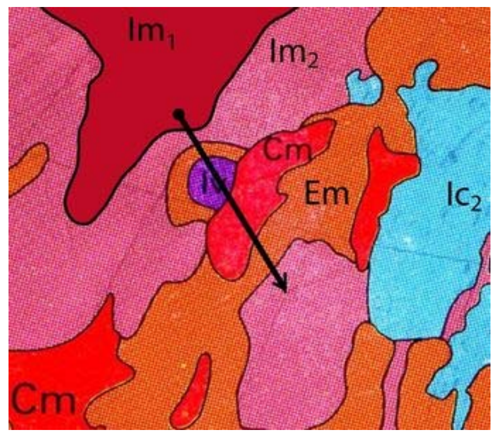
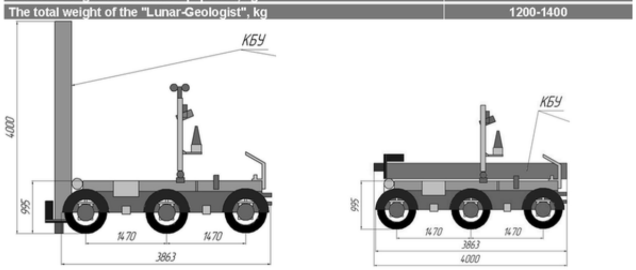


Fig. 3. Geologic map of Mons Rümker region [3]. Im1 – Lower Imbrian Series basalts; Im2 – Upper Imbrian Series basalts; Em – Eratosthenian System basalts; Cm – Copernican System basalts; Iv – volcanic province: Ic2 – crater material from Mare Imbrium basin. The arrow length is ~400 km.

Table 1. Features "Lunar-Geologist"	
Time active functioning, year	1-1,5
Cruising range - not less, km	400
The maximum speed, km/h	5
Average speed, km/h	2-3
Long gradeability, degrees	25°
The angle of the longitudinal dynamic stability, degrees	32°
The angle of the longitudinal dynamic stability, degrees	38°
The height threshold surmounted obstacles, mm	250
The radius of the working area of manipulator, m	3
The total weight of scientific equipment, kg	300-400
The total weight of the "Lunar-Geologist", kg	1200-1400



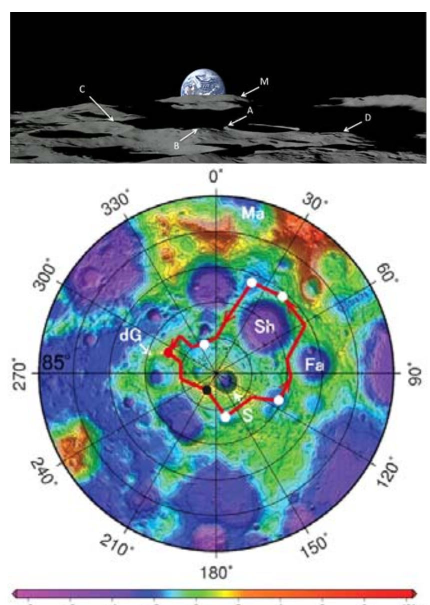


Fig. 4. The outline route (~400 km) at the South Pole (bottom). Topographic map by SC "Kaguya“ [4]. S – Crater Shackleton, dG - Crater de Gerlache, Sh –Crater Shoemaker, Fa – Crater Faustini, Ma – Mount Malapert. A - South Pole (Shackleton crater); B (up) – black circle (89.225º S, 240º E); C - red circle; D - Sverdrup crater rim; M - Mount Malapert [5].