

Development of LUNAR-A Penetrator System: Current Status and Future Prospect

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Abstract. The LUNAR-A, Japanese penetrator mission, was supposed to be launched in 2004. However, it was found that there were a malfunction of spacecraft subsystem and technical issues for penetrator system during a course of the qualification level test. Therefore, the further improvement and some modifications are required for reliability and robustness. The development of mother spacecraft was temporarily suspended and its launch was cancelled at the beginning of 2007, while we have put a three-year program into effect to accomplish the penetrator technology. With a success of next impact experiment using an upgraded qualification model planned in the 2007 fiscal year, we aim for the completion of penetrator technology. The follow-on mission will be considered within the framework of international collaborations.

The scientific objective of the LUNAR-A mission is to explore the lunar interior by seismic and heat-flow experiments. The seismic observations are expected to provide key data on the size of the lunar core, as well as data on deep lunar mantle structure. The heat flow measurements at two penetrator deployment sites will also provide important data on the thermal structure and bulk concentrations of heat-generating elements in the Moon. These data will provide much stronger geophysical constraints on the origin and evolution of the Moon than has been obtained so far. Besides these science goals, this mission would demonstrate the usefulness of the penetrator technology for future planetary explorations. In this respect the LUNAR-A mission should be thought of as the first step toward the more long-range goal of planetary geophysics. We believe that application and modification of the LUNAR-A type penetrators will expand the horizons of future planetary exploration. The LUNAR-A mission was officially cancelled in February, 2007. The main reason is that the reliability would be questioned because of no more than two penetrators available on the LUNAR-A mission, compared to the present JAXA's confidence level. Another reason of the cancellation lies in the deterioration in the quality of the instruments onboard the mother S/C due to the long-term storage since it has been manufactured. Therefore, a high degree of redundancy and robustness would be required for mission success. The follow-on mission to utilize the penetrator technology is now under consideration within the framework of Russian lunar program, which is called 'LUNA-GLOB'. It is supposed that four penetrator modules, which are the almost the same as the LUNAR-A type one, will be available and that the vigorous geophysical network will be established, possibly including a polar lander.

REFERENCES

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