

Research on the unmanned construction system of a manned lunar outpost

Project title | **Development and evaluation of the innovative remote construction system by cooperation of remote control and automatic control**

Institutions : Kajima Corporation, Shibaura Institute of Technology, Kyoto University and The University of Electro-Communications

Research outline

Objective

It will be difficult for humans to stay and conduct all the construction work on the moon and Mars. Similarly, on Earth, remotely-controlled or automated construction technologies are required to cope with the shortages of workers and to improve productivity and safety under strenuous environmental conditions. Among existing technologies, there is reliable unmanned construction technologies on the ground. It can be combined with the automated construction technologies or the time-delay compensation methods that are the research subjects of this project. If these technologies are realized, we will achieve remote construction system on the lunar surface, which can prepare several tens of square meters of land to place and shield the structures. Furthermore, the same new construction system can be applied on Earth to provide better productivity and safety.

Contents

In addition to the basic automated construction functionality, the following functions will be developed to achieve a remote construction system by "coordinating between remote and automated control":

- Functionality to support operation with time delay compensation. Even when there is a large communication delay of 3-8 seconds, the support function enables remote operations based on the work plan, without impairing the operability and stability of the remotely-operated construction machine.
- Functionality to automatically determine motion based on the surrounding environment. A function that autonomously selects an action (motion) corresponding to the task at the current position by detecting topographical changes that is difficult to assess in advance due to time delay constraints.
- Functionality for coordinated work between multiple construction machines. A function that autonomously changes operations, such as measures for collision avoidance, when there are malfunctions, such as interference, in the instructions to multiple remote construction machines.

