

A space utilization model for remote construction and educational support using satellite communications

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Case Overview

We retrofitted a remote operation system to a 3DMC backhoe (a hydraulic excavator that supports work through 3D control), enabling high-precision construction from anywhere in Japan using mobile networks and a commercially available game controller. We also developed a mobile office vehicle equipped with a commercial satellite communication service, which can be used for road clearance and unmanned construction during disasters. At our demonstration site (UNICONFIELD), we have accepted more than 300 students and other participants, also contributing to education. This is an innovative model that applies space communication technologies to social infrastructure and contributes to addressing labor shortages and strengthening regional disaster prevention.

Achieving high-precision remote construction through the integration of 3DMC, remote technology, satellite communications, and Wi-Fi



Integration of 3DMC backhoe, remote operation technology, and satellite communication technology ©UNICON

Key points regarding receiving the award (Comments from the selection committee)

By integrating high-precision remote construction technology, enabled by retrofitting a backhoe with a remote operation system for operation from anywhere in Japan, with a mobile office vehicle equipped with satellite communications, the initiative is expected to make a major contribution to disaster-site construction, where communications are difficult to secure and conditions are hazardous.

It is also highly evaluated for its active commitment to human resource development through training for students and young engineers and by providing opportunities to experience new ways of working using space communications.

It is further highly regarded for utilizing commercial satellite communication services and commercially available game controllers, while also promoting human resource development by widely introducing these technologies to students and others.

Concrete Results

1. Contribution to creating new areas for space development and utilization

By integrating a 3DMC backhoe, remote control technology, satellite communications, and wide-area Wi-Fi, we have achieved high-precision "ultra-remote construction" even in areas without mobile coverage. In 2022, it equipped a mobile office vehicle, in operation since 2017, with a commercial satellite communication service. In May 2023, it introduced a retrofit remote operation system for 3DMC backhoes and secured a communication radius of 300 m using wide-area Wi-Fi antennas. By combining satellite communications and local wireless networks, line constraints were reduced, and a shaping accuracy of ± 2 cm was achieved in test construction. Commercial game controllers were adopted to enable an intuitive and easy-to-learn operating system. In 2023, it opened its demonstration field, "UNICONFIELD," and accepted 120 visitors in FY2023, 210 in FY2024, and more than 300 in FY2025. It also signed a comprehensive emergency response agreement with Shintotsukawa Town, Hokkaido, establishing an initial response system using satellite communications.

2. Contribution to expanding the space development and utilization market

A remote construction package using commercial satellite communication services has been proposed since FY2023, expanding market awareness through exhibitions and demonstrations. At the 2024 International Construction and Survey Productivity Improvement Expo (CSPI-EXPO), a public demonstration successfully remotely operated an unmanned construction machine in Hokkaido from Makuhari Messe over a distance of about 900 km. At the 2025 Construction Technology Exhibition, a remote operation trial was conducted from Osaka over approximately 1,150 km, with 110 participants over four days. The initiative also participated in on-site verification by the Ministry of Land, Infrastructure, Transport and Tourism, and demonstrated practical application in FY2025 MLIT construction projects through remote excavation and transport operations. In terms of safety, an excavator proximity alert AI, including automatic web camera control and tracking, was developed in collaboration with a startup, achieving both reduced manpower and risk reduction. These initiatives were featured on television and in construction industry newspapers and led to the Japan Construction Machinery and Construction Association's "Japan Construction Machinery and Construction Grand Prize (Regional Award)" and the FY2025 Infrastructure DX Award Excellence Award (i-Construction / Infrastructure DX Promotion Consortium Member Initiatives Category).

3. Contribution to the advancement of the economy and society

The initiative presents a model that socially implements space communications and contributes to improving the sustainability of construction production in regional areas facing labor shortages and aging populations. Stable communications in areas without mobile coverage make it possible to choose "construction methods that keep people away" from hazardous locations and disaster sites, contributing to faster initial response and improved safety. Through disaster drills under municipal agreements, operational procedures assuming secured communications, including satellite communications, were made concrete. From FY2026, discussions with local governments will begin on using communication technologies for bird flu response, with the aim of future unmanned operations.

4. Contribution to technology

Previously, remote control operation required dedicated lines to ensure stable video transmission, resulting in high costs, while communication quality could not be secured in areas without mobile coverage, making operation difficult. Dedicated controllers for heavy machinery are expensive, and required time to master. This technology combines commercial satellite communication services and wide-area Wi-Fi, simplifying communications on-site. The use of commercial game controllers reduced operating system costs, and integration with 3DMC backhoes demonstrated high-precision remote construction (± 2 cm). It demonstrated the "scalability of a low-cost, high-precision solution that can also operate in areas without mobile coverage" and be adopted by regional construction companies.

5. Contribution to promoting public understanding and human resource development

Through tours and training at UNICONFIELD, six-month internships, and collaboration with universities, satellite communications and remote construction were translated into learning and hands-on experience. At the annual disaster prevention experience event, construction disaster prevention technologies using satellite communications were introduced to over 300 elementary, junior high, and high school students, promoting understanding through hands-on experience in "operating construction machinery with a game controller." A study tour was also held for 27 parents and children affected by the Noto Peninsula earthquake, raising awareness of the technology as one directly connected to social issues. In addition, participation in the Transport Digital Business Council (TDBC) and the e-Construction Machinery® Challenge is promoting solutions to industry challenges and broadening the human resource base. Going forward, the plan is to promote disaster response package projects through collaboration between multiple regions and accelerate the social implementation of space communications.

