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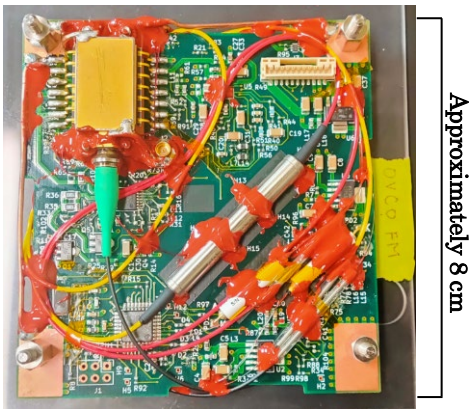
Mitsubishi Electric Successfully Demonstrates Light Source Module for High-capacity Laser Optical Communication in Outer Space

Quick, low-cost demonstration uses nanosatellite developed through industry-academia collaboration

Concept of space-based laser optical network for global communications



Newly developed light source module

TOKYO, June 20, 2023 – Mitsubishi Electric Corporation (TOKYO: 6503) announced today that it has successfully demonstrated laser optical frequency control using a new light source module, a key component of an envisioned high-capacity laser optical communication network to be deployed in outer space. The module, which produces a 1.5-µm wavelength signal, was installed in the OPTIMAL-1[1] nanosatellite developed through an industry-academia collaboration[2] and released from the International Space Station (ISS) on January 6. The use of a nanosatellite enabled the demonstration to be carried out faster and at lower cost than using a conventional large satellite.

OPTIMAL-1
Mission Badge

Mitsubishi Electric has been developing space-based optical technologies that are expected to increase data capacity (by ten times or more) as well as communication speeds and distances compared to systems that use radio waves.

Satellite images are increasingly being used for purposes such as assessing conditions in post-disaster areas and the state of remote forestry resources. Existing radio-wave satellite communication systems are limited in terms of capacity, speed and distance,

[1] Rectangular parallelepiped measuring 10 x 10 x 34 cm (WxDxH), released from Japanese Experiment Module "Kibo" aboard the ISS
[2] Led by ArkEdge Space Inc. and joined by Pale Blue Inc., SEIREN Co., LTD., University of Fukui, School of Engineering at The University of Tokyo, and Mitsubishi Electric

so new optical systems offering improved communications capabilities are required for faster and higher-resolution assessments from space. Advanced systems that use laser signals are expected to be increasingly adopted not only for their superior communications capabilities but also for using wavelengths shorter than radio waves, which allows the use of relatively small and easily installed terrestrial antennas.

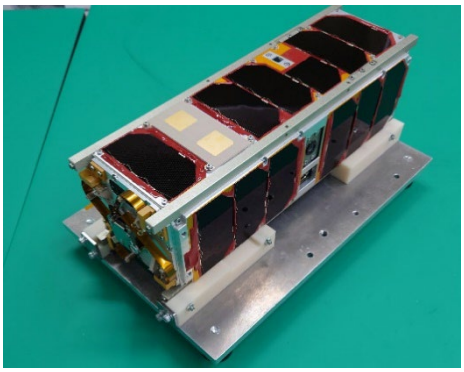
Features

1) World's first optical frequency control test in space with a 1.5-μm wavelength laser light source module

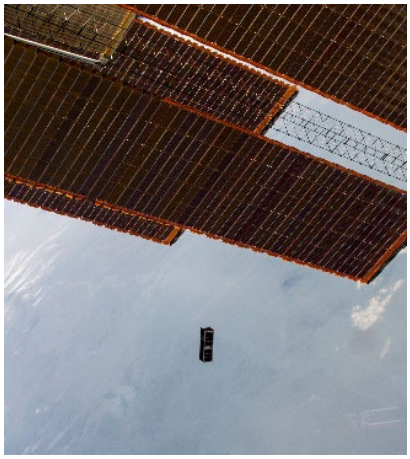
- Laser communication between satellites requires correction of the Doppler effect, which causes the laser optical frequency to change due to satellites moving at different speeds relative to each other. The new light source module was deployed in the world's first[3] demonstration of a laser frequency being adjusted by up to 60 GHz in space, sufficient for Doppler effect compensation.

2) Nanosatellite developed in industry-academia collaboration enables quick, low-cost demonstration

- Using a nanosatellite developed through an industry-academia collaboration project, the demonstration in outer space required only about one-third the time and one-hundredth the development cost of demonstrations performed with large satellites.[4]



OPTIMAL-1 module
(Courtesy of ArkEdge Space & University of Fukui)



Nanosatellite being launched from ISS
(Courtesy of JAXA/NASA)

According to ArkEdge Space Inc.'s Chief Executive Officer Takayoshi Fukuyo: "The development of nanosatellites has been gaining momentum in recent years. Nanosatellites weighing just a few kilograms can be developed and launched for low cost, so they are expected to be used in new applications, such as widespread observations of Earth using numerous satellites. The successful demonstration of the light source module aboard the OPTIMAL-1 is expected to advance the deployment of nanosatellites."

University of Fukui Associate Professor Yoshihide Aoyanagi said: "Conditions in outer space, including radiation, vacuum and temperatures, create harsh environments for equipment, so demonstrating the capability to operate in space is crucial for the development of satellites. I hope the successful demonstration of the OPTIMAL-1 will lead to further progress in industry's use of nanosatellites."

[3] According to Mitsubishi Electric's research as of June 20, 2023
[4] Compared to previous demonstrations conducted in outer space by Mitsubishi Electric

Future Development

Mitsubishi Electric will propose the demonstrated technology for use in large-scale space development projects. Also, the company will promote nanosatellites as an important demonstration platform for space-related research and development conducted through industry-academia collaborations. Mitsubishi Electric will continue to pursue technological development aimed at the early realization of space-based laser optical communications.

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About Mitsubishi Electric Corporation

With more than 100 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Mitsubishi Electric enriches society with technology in the spirit of its "Changes for the Better." The company recorded a revenue of 5,003.6 billion yen (U.S.$ 37.3 billion*) in the fiscal year ended March 31, 2023. For more information, please visit www.MitsubishiElectric.com

*U.S. dollar amounts are translated from yen at the rate of ¥134=U.S.$1, the approximate rate on the Tokyo Foreign Exchange Market on March 31, 2023