

## Article Overview

Japan is advancing long-distance optical cable technology using multicore fibers, including experiments with 12-core and higher-core fibers to increase transmission capacity for submarine and terrestrial networks.

## Overview of Multicore Fiber Development in Japan

Japan has been at the forefront of multicore optical fiber research, aiming to enhance the capacity of long-distance and transoceanic communication systems. Traditional optical fibers use a single core for signal transmission, but multicore fibers contain multiple cores within the same fiber cladding, allowing simultaneous transmission of multiple optical signals without increasing the fiber diameter. This approach significantly boosts data throughput while maintaining compatibility with existing infrastructure.

## Long-Distance Experiments

- o 12-Core Fiber Transmission: NEC and NTT successfully conducted a 7,280 km transoceanic-class transmission experiment using a coupled 12-core multicore fiber. Each core carried independent optical signals, and advanced signal processing techniques, including MIMO algorithms, were used to mitigate crosstalk between cores. This experiment demonstrates the feasibility of high-capacity long-haul optical networks for future submarine cables.
- o 19-Core Fiber Transmission: The National Institute of Information and Communications Technology (NICT) and Sumitomo Electric achieved 1.02 petabits per second over 1,808 km using a 19-core fiber. This represents a world record for long-distance, high-capacity optical transmission and highlights the potential for scaling multicore fiber technology to meet growing global data demands.

## Technical Considerations

- o Crosstalk Management: As the number of cores increases, optical signals can leak between adjacent cores, causing interference. Japanese researchers have developed coupled multicore fibers and advanced demodulation techniques to minimize this effect.
- o Optical Amplification: Long-distance transmission requires optical amplification systems compatible with multicore fibers to maintain signal integrity over thousands of kilometers.
- o Capacity Scaling: Multicore fibers allow for higher data rates without increasing the fiber diameter, making them suitable for submarine cables where space and weight are critical.

## Applications and Future Prospects

While specific 6-core fibers are not explicitly mentioned in the latest experiments, Japan's ongoing R&D in

# Japan Long-Distance Optical Cable 6 Cores

multicore fibers with 2, 4, 12, and 19 cores indicates that 6-core fibers could be implemented for regional or long-haul networks where intermediate capacity is required. These fibers are expected to support:

- o High-capacity submarine cables connecting Asia-Pacific regions
  - o Data center interconnects for 5G and cloud services
  - o Next-generation optical networks with scalable bandwidth
- Japan's multicore fiber initiatives aim to increase transmission capacity by several times compared to conventional single-core fibers, with laboratory demonstrations showing potential capacities exceeding 1.7 petabits per second over 3,000 km-class submarine cables . In summary, Japan is actively developing long-distance multicore optical cables, with 12-core and 19-core fibers demonstrating world-class transmission performance. While 6-core fibers are not specifically highlighted, the technology and infrastructure being developed make them a feasible option for high-capacity optical networks in the near future.

## NEC and NTT Successfully Conduct First-of-Its-Kind Long-Distance Transmission Experiment Over 7,000km Using

Combining these technologies, NEC and NTT conducted long-distance transmission experiments over 7,280km,

As a result, the optical signal bandwidth was expanded to 27 THz, which is more than 6.7 times wider than

NEC is currently engaged in a project to install a long-haul optical submarine cable system using two-core multicore

Larger-capacity optical submarine cables are coming into sight --What does the success of a long-distance

Multicore fibers are optical fibers with multiple light-propagating cores that exhibit higher transmission capacity than

In long distance transmission, signal distortion occurs due to linear and nonlinear optical effects, and after transmission,

Multicore fibers are optical fibers with multiple light-propagating cores that exhibit higher transmission capacity than conventional

Tokyo, Japan, March 21, 2024 - NEC Corporation (NEC; TSE: 6701) and NTT Corporation (NTT) today announced that they have

Current submarine cables use single-core fiber with one optical transmission path called a core within a single fiber,

World Record Achieved in Transmission Capacity and Distance: With 19-core Optical Fiber with Standard Cladding

The researchers simulated long-distance transmission using 19 recirculating loops, each 86.1 km long, through which

Sumitomo Electric Industries, Ltd. has developed a new-type coupled multi-core optical fiber suitable for ultra-long

NTT's breakthrough addresses this challenge head-on by introducing multi-core fiber optic cables, which enable

By combining these technologies, NEC and NTT conducted long-distance transmission experiments over 7,280 km,

Multicore fibers are optical fibers with multiple light-propagating cores that exhibit higher

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