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Polar Express - A Project of a Transarctic Submarine Fiber-Optic Communication Line from Murmansk to Vladivostok

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POLAR EXPRESS
A project of a transarctic submarine fiber-optic communication line from Murmansk to Vladivostok

General overview

In 2020, the project to build an underwater transarctic fiber optic communication line (FOCL) along the Murmansk-Vladivostok route was announced by the Ministry of Transport of Russia, Rosmorrechflot and Rosmorport. The new system includes 6 pairs of optical fibers with a capacity of 52–104 Tb/sec and total length of 12,650 km (approx. 7,860 miles). The project will connect Murmansk to Vladivostok along the shortest route from Europe to Asia and create an alternative to satellite communication systems in northern latitudes, minimizing the level of delay in transmission of information. The project will help meet the growing needs for online commerce, cloud technologies and big data by providing reliable, affordable connectivity and Internet access.

The significance of "Polar Express" for the development of the Far North can hardly be overestimated. The FOCL will provide stable telephone and Internet communications in the vast regions of the Russian Arctic. The complexity of these territories is that they are located at a great distance from the central regions of the economy, and the construction of land cable lines is associated with certain problems. For example, the permafrost factor may result in cable equipment failures.

Satellite communication also poses a set of problems. At high latitudes, it can only be provided with the Molniya type vehicles operating on highly elliptical orbit, but a larger number of such satellites is needed compared to those on geostationary orbits, their lifespan is shorter, and the bandwidth of the communication channels is still insufficient for today's tasks.

Project objectives

The "Polar Express" is pursuing both infrastructural and broader economic objectives. On the one hand, the projects support the development of local port digital infrastructure along the Northern Sea route (NSR) in support of the production and transportation of hydrocarbons (oil, gas etc.) in the Arctic region, resolving some of the problems of geological exploration. The new communication line is designed to coexist with the satellite networks (Iridium, Inmarsat 10GX, Express RV, etc.) in an effort to cover all of the Arctic region. Implementation of the project is supplemented by the development of digital data center infrastructure for Big Data in the Russian Federation as well as introduction and expansion of production capacities for high-tech equipment.

On the other hand, the “Polar Express” is to provide the shortest route for transit of telecommunications traffic between Europe, Asia and America, and thus minimize the level of delay in the transmission of information. It helps meet the growing international demand for the backbone fiber optic networks in the context of digitalization of the world economy, the development of “big data” technologies, e-commerce and the Internet of things (IoT), and as a result, the exponential growth of international IP traffic on routes: Europe-Russia / Europe – Asia/America – Asia. Furthermore, the new line provides direct connectivity for customers that have certain requirements for the level of delay and security of data transmission (e-commerce, technologies of unmanned transport systems, 5G/6G, quantum communications, etc.).

Geography and characteristics

The sub-sea laying has started in Teriberka, North of Murmansk, and will cross the Barents Sea to Amderma in the Nenets Autonomous Okrug, where a coastal station will be built. The next “leg” will reach Dikson, Russia’s northernmost mainland town on the coast of the Kara Sea. The line will then stretch to the port of Tiksi in Yakutia, then to Pevek and Anadyr on the Chukotka Peninsula, into the Pacific with a land station in Petropavlovsk-Kamchatsky and further south to Yuzhno-Sakhalinsk, Nakhodka, before ending in Vladivostok.

The cable will be buried 1.5 meters under the seabed in order to ensure safety in the offshore section of the route. In other places, where for geological reasons it is impossible to dig into the ground, the cable will rest on the seabed protected by a single or double armor that can resist pressure of up to 50 ton. This is particularly important for the shallow waters north of Siberia where water might freeze to the bottom.

Conclusion

The “Polar Express” project makes it possible to get away from the shortcomings and limitations of terrestrial and satellite communication lines. Laying 12 650 km of cable comprised of six pairs of optical fibers will provide data transfer rates of up to 100 Tb/sec with a signal delay of less than 90 milliseconds – this is on par with modern FOCLs operating in other, less harsh regions of Russia.

In general, the digitalization of the Arctic and the Northern Sea Route will allow for the development of other important projects in these remote areas, utilizing reliable and modern communications. The development of backbone communication networks will support the emerging major trade route of the future.