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ARCTIC DIGITAL INFRASTRUCTURE GAPS: OPPORTUNITIES FOR NEWSPACE

Abstract

The Arctic most obviously shows evidence of global climate change as temperatures rise at twice the global average. Sea ice loss has had the greatest impact, bringing about an increase in human activity across the Arctic and surrounding coastal areas. Once unnavigable shipping routes and coastal harbors have become seasonally available for increased maritime trade, resource extraction, tourism and the entire range of economic activity. Realizing the economic opportunities and governance responsibilities in the warming Arctic will require vastly improved digital infrastructure networks. The new networks must meet the unique requirements of Arctic users and integrate across networks covering lower latitudes. While the scope and organization of a complete Arctic digital infrastructure has yet to be formulated, NewSpace systems will play important roles in the Arctic and are already providing some of the required expanded coverage. Arctic digital infrastructure demand is inelastic; the customer base is small (compared to lower latitudes) but the demand for services is not optional, narrowing options for Arctic infrastructure solutions using small numbers of large platforms. While geosynchronous satellites (GEO) provide limited high latitude coverage, the greater part of Arctic satellite communications will likely be provided by low Earth orbit (LEO) constellations. Existing and planned commercial LEO systems, including large constellations, could meet future Arctic telecommunication requirements. Existing Global Navigation Satellite Services (GNSS) generally suffer reduced vertical accuracy and decreased availability at high latitudes, inadequate to serve the future needs of Arctic aviation, mapping, and science, among others. Various state actors have initiated, or proposed improvements to GNSS services in the Arctic including network partnerships between current GNSS constellations. New platforms in highly elliptical orbits (HEO) are also proposed. Arctic GNSS enterprises are exclusively governmental, though NewSpace constellations have been proposed to augment existing GNSS. Arctic requirements for surveillance are similar to lower latitude requirements with additional unique obligations. Iceberg location and tracking services, for example, must provide data to shipping in real time, requiring integrated data flows between sensors and telecommunications. As retreating ice opens new coastline and ports to unescorted shipping, border security requires increased space based surveillance and remote sensing. We show how emerging Arctic digital infrastructure gaps cannot be closed by existing communication, navigation, and surveillance satellites. Future LEO and HEO based systems, integrated with large constellation NewSpace systems, can meet Arctic digital infrastructure needs.