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Laser Communications in Action: Real-World Deployments from the Arctic to the Baltic Sea

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Astrolight designs and manufactures laser communication terminals optimised for free-space optical data transfer across low Earth orbit (LEO), space-to-space, space-to-ground, and maritime links. These terminals deliver secure, jam-resistant, high-data-rate connectivity. To date, three first-generation ATLAS-1 body-pointed space terminals have been deployed in LEO. A next-generation gimbaled variant featuring enhanced data rates and compatibility with the Space Development Agency (SDA) standard is currently under development. Astrolight has deployed an optical ground station in Greece and is establishing an additional facility in Greenland in partnership with the European Space Agency (ESA). In the maritime sector, Astrolight, in collaboration with the Lithuanian Navy, has developed shipborne laser communication terminal POLARIS to mitigate vulnerabilities to GPS jamming and provide secure data links. These terminals leverage C-band laser transceivers utilising commercial high-modulation-bandwidth laser diodes coupled with in-house-developed fibre amplifiers. Optical reception relies on high-bandwidth photodiodes, while tracking and acquisition use a combination of detectors, such as focal plane arrays, cameras, quadrant photodiodes, and position-sensitive detectors. Components for space environments are engineered to be vacuum-compatible, radiation-tolerant, and thermally resilient, while ground-segment hardware is ruggedised against equally harsh atmospheric conditions. Ultimately, sustaining the rapid expansion of the free-space optical communication industry depends on pioneering scalable, cost-effective solutions that push the operational boundaries of laser power, detector sensitivity, and modulation bandwidth.

