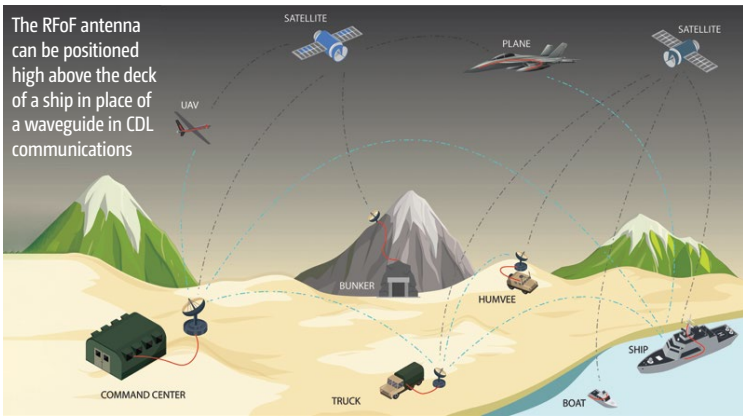
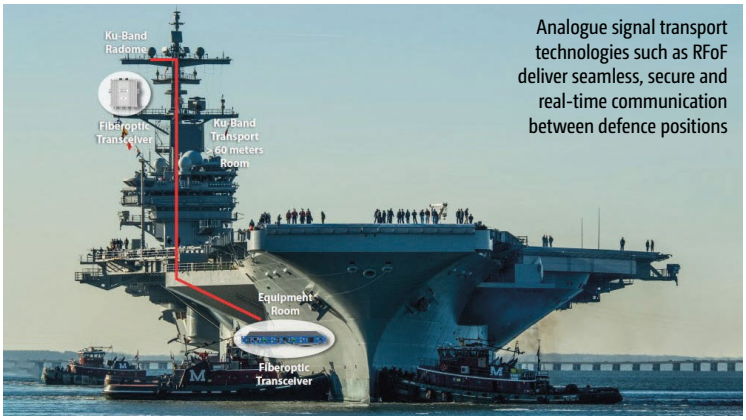
RFoF reinforces military communications

The stakes have never been higher for reliable and efficient communications for military use, says **Meir Bartur**

In an era where technological advancements such as automation are transforming every aspect of military operations, reliable and efficient communications have become paramount. When the Pentagon received $7.5bn in 2021 to fund unmanned systems across the US Air Force, Army and Navy, it created a higher expectation and standard for quality signal transmission across any and all air waves such as military radar, cellular and satellite communications, GPS and GNSS.

Higher radio frequency (RF) signal transmissions such as mmWave are required to transmit low latency and high bandwidth communications necessary to operate unmanned vessels. Even momentary delays at an inopportune moment could spell disaster. Unfortunately, those higher frequencies also introduce more attenuation and are easily obstructed by natural and man-made obstacles when compared to mid or lower frequency bands. As military vessels and equipment become increasingly automated, the significance of analogue signal transport technologies such as RF-over-fibre (RFoF) becomes critical to ensure seamless, secure and real-time communication within the military landscape.





How does RFoF work?

RFoF technology is an analogue signal transmission technique that converts RF into optical signals and back again to RF at its destination. RFoF is gaining more traction in military applications because of its ability to provide extended range of these higher frequency bands, more bandwidth, and significantly more resilient and secure communication compared to conventional RF systems. With automated military vessels and equipment operating over vast distances, the demand for reliable and high bandwidth communications has never been greater. RFoF offers virtually unlimited bandwidth capabilities and eliminates signal loss over long distances, ensuring seamless data exchange between automated assets and command centres.

Environmental key for unmanned vessels

RFoF is also resilient to electronic warfare. RFoF is immune to EMI, which disrupts communication channels and jeopardises the success of critical operations. This immunity enhances the reliability and security of communications, even in the presence of electronic countermeasures and electronic warfare threats.

Some of the biggest interference challenges are from natural harsh conditions common in everyday military environments where autonomous vessels are expected to operate. One example is the US Navy's unmanned surface vessels. The navy drone boats use waveguides to transport Ku-Band common data link (CDL) communication payloads between radomes mounted high above the decks of ships and equipment rooms situated within the hulls of ships. CDL is a secure communications protocol for transporting signals intelligence and imagery.

The problem with waveguides is they are rigid and RF performance is highly susceptible to any mechanical stress such as shock or vibration. They are also fragile and must be kept extremely clean and dry, a challenging task when deployed at sea or on the ocean for weeks at a time. The slightest moisture or the smallest contamination of dirt or salt degrades the transmission of waveforms and resulting RF performance. In order to keep moisture out, waveguides are usually filled with dried air or purified nitrogen, but any corrosion or oxidation of the waveguide inner metal surface will degrade performance. In one case, water entered the hull and, even with the nitrogen, disrupted the RF signal. In this case, RFoF antenna remoting was used as a replacement for the waveguide. It was resilient to the harsh environmental conditions, but reported as being more flexible and easy to install.

In the age of automation, military communications must keep pace with technological advances to ensure efficient and secure operations. RFoF technology has emerged as an opportunistic technology to provide superior bandwidth, extended range, immunity to EMI and other harsh conditions.

As autonomous vessels and weapons continue to evolve in response to emerging threats and challenges, RFoF can help ensure unmanned military assets are not a serious liability. ❑

About the author

Meir Bartur is co-founder and CEO of Optical Zonu, which designs and manufactures fibre optic components for analogue and digital transmission, business class services and coarse wavelength division multiplexing