HIGH-THROUGHPUT SATELLITE TECHNOLOGY OPTIMIZES OPERATIONAL EFFICIENCY AND ENABLES MISSION-CRITICAL COMMUNICATIONS

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As the offshore oil and gas industry continues its upturn, big data and satellite connectivity are going to be key topics of discussion for offshore business when it comes to optimizing operations.

In the remote and harsh environment rigs and offshore vessels are exposed to on a daily basis, having an always-on, highly reliable satellite communications service is non-negotiable. From emergency communications to the ability to transfer mission-critical data, consistent and reliable connectivity can mean the success or failure of an operation. It can also make the difference in life or death situations.

With high-throughput satellite (HTS) technology, operators can rest assured that their vessels, rigs and crew are running at maximum efficiency and safety. HTS technologies leverage spot beams and reuse frequency across these beams to increase throughput across a finite radio frequency (RF) spectrum. With the rapid growth in customer demand for broadband connectivity in any location, HTS technology enables service providers to meet those demands while often reducing the cost per bit delivered in the long run.

HTS Technologies And Benefits

HTS solutions include both Ka-band and Ku-band options. While this enables companies to use HTS technology to best fit their needs, each band has its own strengths and weaknesses. In order to choose the solution that works best with the intended application, a company should have an understanding of how HTS solutions are designed.

Spot Beam Technology

An HTS system uses a large number of small spot beams to provide stronger connectivity over a particular area, unlike a conventional satellite, which provides coverage through one large beam. Spot beams enable large-scale frequency reuse because they are concentrated in smaller areas, making each spot beam stronger than a conventional wide beam. Smaller spot beams mean better link performance but less coverage and require more overlapping beams for global coverage. On the other hand, larger spot beams can have weaker link performance, getting less reliable connectivity the closer a vessel moves to the edge of the beam.

The three most relevant classifications of HTS spot beam systems include Ka-band small spot beam systems, Ka-band large spot beam systems and Ku-band spot beam systems. While Ka-band large spot beams and Ku-band spot beams are around the same size, Ka-band small spot beams only cover roughly 15 percent of the traditional spot beam footprint. Similar to most modern satellite solutions, HTS systems are designed to be multi-purpose. In addition to spot beams, HTS antennas may also provide large regional and hemispherical beams, and their payloads may include transponders for several different satellite bands.

Global connectivity service providers with comprehensive network portfolios can take these systems a step further to extract maximum value by deploying a combination of these technologies for customers. For instance, network systems can be designed to leverage Ka-band from the teleport to the satellite, and Ku-band from the satellite to the remote site location, further optimizing the network to its fullest potential. This is being actively done across the Middle East and parts of APAC today, and the industry will likely see more of this as technologies progress and networks mature.

Alternate Technologies (MEO/LEO)

In addition to geostationary (GEO) satellites that leverage spot beam technology, recently launched

alternate technologies, including middle-earth orbit (MEO) and low-earth orbit (LEO) satellites, can be considered depending on region and operational requirements. These constellations have lower latency than GEO-based solutions which can enable improved real-time information sharing with corporate offices and headquarters locations, ostensibly leading to better decision making. These solutions often require complex tracking and added remote site equipment (including additional VSAT systems), and many don't provide true global coverage and service.

Rain Fade And Mitigation Technologies

One of the most important environmental considerations for offshore customers when it comes to satellite connectivity is weather. When high frequencies are transmitted and received in a heavy rain fall area, signal degradation occurs proportionate to the amount of rain fall (known as rain fade). Since a Ka-band runs at more than twice the frequency of Ku-band, it can be more susceptible to interference from rain. At lower frequencies, such as those found in Ku-band solutions, the link requires smaller margins to overcome propagation impairments.

Customers should consider the amount of rain fall that occurs over a specific period of time in the regions in which they operate. For instance, land-based regions in North America and across Europe and Russia, and offshore regions near the United Kingdom where rain fall is minimal, may benefit more from HTS Ka-band solutions. Conversely, heavy rain zone areas in Central and South America, and parts of the African continent, as well as the southern Asia regions, would be better suited for HTS Ku-band solutions.

Adaptive power control and adaptive coding and modulation are two mitigation techniques that can help compensate for rain fade when it occurs. Adaptive power control enables remote sites to automatically increase their power during a rain event in order to maintain performance and availability based on their requirements. However, increased power can lead to increased costs. Additionally, the dynamic power fluctuation may affect the life and reliability of a satellite and could increase interference with other users in the same frequency.

Adaptive coding and modulation enables remote sites to adjust modulation schemes automatically for different environmental conditions. In poor weather, allowing a remote to stay in the network while at a lower modulation provides an added mitigation to signal degradation. This technique can be used with both Ku- and Ka-band systems. While both of these techniques can help provide some compensation to signal degradation, each is only a partial solution to the overall issue.

Finding The Right Technology & Provider

Whether a company is drilling off the coast of Asia, or a vessel is transporting goods across the North Sea, one thing remains consistent, the need for a highly reliable, always-on communications solution. Partnering with a global service provider who understands the requirements for connectivity in different regions can help customers find the HTS solution that best fits their needs.

The right HTS system can go a long way in boosting efficiency and optimization, while enabling the transfer of critical data and emergency communications a company needs to operate without stress, regardless of location.

About the Author: *As vice president of global engineering, Sanjay Singam leads global engineering efforts focused on customer projects and support, as well as solutions strategy and development. Sanjay holds more than 10 years of industry experience in cost-effective engineering and operations management. Most recently, Sanjay served as part of the executive team leading operations and engineering at ipDatatel, LLC, a leading innovator in the home security IoT space, leveraging cellular technology. Prior to that, he held various engineering and operational leadership roles at Harris CapRock Communications, including director of global solutions and operations engineering, senior manager – RF and systems engineering and manager – product engineering. Singam launched his career at Invocon Inc., where he completed engineering projects for NASA and the International Space Station, as well as for the U.S. Navy.*

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