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# Innovation is Key to Solving Satcom's Challenges

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Customer demand for seamless connectivity is driving significant change across the satellite industry. Technology is advancing at a rapid rate, we're witnessing huge expansion in LEO, operators are increasingly adopting multi-orbit strategies, and there is a growing recognition that to deliver ubiquitous connectivity to users, the satcom and telco markets need to learn to work together. The satellite industry is rapidly developing, both in terms of the number of players operating, and the different technologies being utilized. We've gone from a very stable situation ten years ago, with just a few players in the market operating in a very controlled fashion, to a big explosion of activity in the last five to six years of both satellites in orbit for communication purposes, as well as new players in the market.



However, operating in this new environment is complex and operators are faced with fresh challenges at both ground and space level. This is driving the need for new ways to secure operational capacity and mitigate interference between systems. It's clear that the industry needs innovation across the spectrum if it is to succeed in this increasingly challenging landscape. While it's encouraging that we're already seeing innovations such as virtualization and new antenna technology making a difference, these are at the same time creating some challenges of their own. There is clearly still some way to go.

## The End of Siloed Working?

The end users today are not concerned about how they get their connectivity; they just want to be able to connect with the wider world in the same easy fashion as when they connect with their local community. They want connectivity that is reliable, high bandwidth, and cost efficient, no matter where they are, whether that is in London, on top of Mount Everest, or in the middle of the Pacific Ocean. However, delivering this ubiquitous connectivity is difficult for both satellite

operators and terrestrial cellular networks to achieve on their own. After years of working in separate silos, satcoms and telcos are coming to realize that working together may well bring mutual benefit.

Satellite networks bring unparalleled coverage and reliability to the table, offering connectivity solutions in regions where terrestrial infrastructure is lacking or economically unfeasible to deploy. By partnering with telco providers, satellite operators stand to gain access to established terrestrial networks, enabling seamless integration with existing communication infrastructure.

This collaboration facilitates the delivery of hybrid solutions that combine the strengths of satellite and terrestrial technologies, providing customers with robust, end-to-end connectivity solutions. Whether it's extending broadband services to remote areas, enhancing disaster recovery capabilities, or supporting IoT deployments, a partnership between satellite operators and telco providers stands to unlock new opportunities for innovation and growth.

## Managing Cause and Effect

The need for communication and connectivity are key drivers of technological innovation across multiple sectors, from commercial to defense. Being connected and having access to high bandwidth data is essential for much of our key infrastructure; many day-to-day systems and functions will grind to a halt if connectivity breaks. However, for satellite operators, the proper operation of their own satellite networks is not the only thing that they must consider. For networks do not operate in isolation. They must also consider the entire electromagnetic sphere.

Every system impacts every other system around it, yet these environmental impacts can be difficult to predict. So as an industry, we have to find new ways of maintaining operational efficiency. You can run tests on a sub-system in a lab and deploy it out in the field and everything looks good, but if multiple systems are deployed in one area, or on one vehicle, for instance, the interference between these systems can be significant. It is highly complicated and often time-consuming to test, correct and optimize these components. Therefore, the industry is looking for new ways of ensuring that separate systems can work together. Not only are there these potential interferences happening on the ground, but there are also a lot of new players starting to operate in the space segment alongside the traditional players. There is some uncertainty over how this will work in five to ten years when we have new players in Low Earth Orbit, and we have a lot of expansion in both the MEO middle and GEO orbits. All this activity cannot happen in isolation; each system can interfere with others, in some sense or the other. Understandably, traditional satellite operators are a bit concerned about how the impact of all this activity could potentially be damaging for not only their operations, but also the industry as a whole if not managed properly.

## Challenges that Come with Innovation

Of course, all of these developments and changes in LEO and MEO mean that the antenna technology itself is also innovating, in the form of phased array antenna and beamforming antennas. This is indeed great, and we clearly need this technology, but I think it's fair to say that it isn't quite there yet. The challenge comes with pairing that innovation with making sure that it is reliable enough and good enough to do the job required. Existing standards cover the use of reflector-based antennas primarily for MEO and GEO, and there is currently a lack of standards and regulation around these next-generation antennas.

As seen at both the Satcoms Innovation Group (SIG) roundtable discussion at SATELLITE 2024 organized in partnership with GSOA, as well as the recent follow-on webinar, there is industry wide agreement that we need to define the quality and operating standards that these antennas need to adhere to. And this will only be achievable through a collaborative, coordinated approach that takes into consideration the separate needs of LEO, MEO, and GEO operators, as well as antenna manufacturers and also testing capabilities and requirements.

Also important to mention is 5G, which again is a bit of a double-edged sword, because while it has the potential to be a key enabler for the satcom industry, there is also the possibility of interference occurring that needs to be considered. As the satcom landscape has become more complex, it's becoming increasingly important that operators are able to track interferences that occur in the network. Detecting interference is a big problem for a lot of satellite operators, especially as it can come from a number of different sources. While it is possible to come from another satellite in-orbit, it mostly originates from ground equipment. As the ground network increases and becomes more complex, this is making it all-the-more difficult to locate the source of the problem.

This is a real challenge for the industry because when there are a lot of the terminals on the ground, with some networks possibly switching away from using satellites and using terrestrial communication networks such as 5G, there may be a huge network of terminals that are still active, but not actually connected. This is a problem if a failure occurs on one of these stations, for instance, at a gas station in the middle of the desert, it can suddenly transmit a lot of noise in the spectrum that causes interference. Not only does this interference create a significant drop in performance, but locating the cause is a big challenge.

Similarly, virtualization of the ground segment and transition to the cloud is another important step on the road to creating connectivity networks able to meet the world's current and future communication needs. There is however a lot of uncertainty among satellite operators about how to make this change. Having said that, some important steps are already being taken in the right direction by the DIFI Consortium, which is working to enable transformation to a virtualized ground sector by establishing an interoperable Digital IF/RF standard that replaces the natural interoperability of analog IF signals. This will hopefully remove a lot of the unknowns that operators are facing when it comes to virtualizing the ground segment.

## **Embracing the Future**

By laying the foundations that enable innovation to flourish across the spectrum, from network architecture to interference mitigation and beyond, satellite operators can not only overcome current challenges but also unlock new possibilities for seamless, reliable, and future-proof communication services. As the industry continues to evolve, innovation remains the key to unlocking its full potential and meeting the ever-growing demands of a connected world.

Looking ahead, we can expect to see deeper integration between satellite and terrestrial networks, driven by advancements in technology and evolving customer requirements. Whether it's delivering low-latency services via satellite-backed 5G networks, supporting emerging applications such as autonomous vehicles and smart cities, or expanding connectivity to underserved regions, the partnership between satcom and telco providers holds immense promise for driving positive change and transforming the way we connect and communicate.