

5G NTN Moves Closer to Reality

As satellite and terrestrial networks move towards deeper integration, ST Engineering iDirect is positioning its Intuition platform at the centre of the transition. From native 5G NR-NTN and multi-waveform terminals to hybrid GEO/LEO architectures, the company sees the next few years as a critical period for proving the technology and building the business case for commercial adoption.



Based on an interview with

Bert Van Der Linden,

Director Product Management at ST Engineering iDirect

The satellite industry's transition towards 5G Non-Terrestrial Networks (NTN) is accelerating, but the path from demonstrations and laboratory testing to widespread commercial deployment will be gradual.

Speaking to Teletimes International, Bert Van Der Linden, Director Product Management at ST Engineering iDirect, said the industry is now entering a phase in which operators and technology providers are testing 5G NR-NTN in customer laboratories, assessing not only whether the technology works, but where it can deliver tangible technical and commercial benefits.

Van Der Linden expects 2027 to remain largely a year of testing, technology validation and customer education, with the possibility of the first commercial deployments for transparent, or "bent-pipe", satellite architectures emerging around the end of 2027 and into 2028.

That timeline reflects a wider shift already taking place across the satellite ecosystem. ST Engineering iDirect has been advancing

native 5G NR-NTN connectivity through its cloud-native Intuition ground system, demonstrating standards-based satellite access and interoperability with the broader terrestrial 5G ecosystem.

From technology trials to an ecosystem

For satellite operators, however, the significance of 5G NTN goes well beyond replacing one waveform with another.

Van Der Linden argues that operators need to consider the broader ecosystem that comes with 5G — including interoperability, partnerships and, eventually, closer integration and roaming between terrestrial and satellite networks.

As operators invest in their next generation of ground infrastructure, forward compatibility with 5G NR-NTN could therefore become increasingly important.

"2027 will mostly be about comparing the two worlds from a technology perspective," Van Der Linden explained, while pointing

to the parallel need to convince customers that next-generation ground systems should at least be forward-compatible with 5G NR-NTN.

This standards-based approach is central to ST Engineering iDirect's strategy. Intuition has been developed as a cloud-native, software-defined ground system intended to give operators greater flexibility as satellite networks evolve towards increasingly virtualised, multi-orbit and standards-based architectures.

Different use cases will move at different speeds

The transition will not happen uniformly.

For narrower-band and direct-to-device applications, ST Engineering iDirect believes much of the terminal-side technology is already taking shape.

The company has demonstrated a pilot version of its INT3000 multi-waveform 5G NR-NTN User Equipment modem, designed to support 5G NR-NTN alongside established satellite waveforms.



During the interview, Van Der Linden said the modem technology can address a broad range of frequencies and applications, but stressed that the availability of the network itself remains critical.

"The question is who's going to deliver that network?" he said.

Van Der Linden sees a distinction between emerging direct-to-device applications and demanding high-throughput satellite backhaul applications. While the technology is approaching readiness for narrower-band use cases, matching the performance required for high-throughput, highly reliable backhaul remains a more substantial challenge.

For high-throughput backhaul, Van Der Linden acknowledged that 5G NR-NTN cannot yet match the throughput and availability that established satellite platforms deliver today.

That distinction is important because 5G NTN should not necessarily be viewed as an immediate replacement for every existing satellite technology.

A hybrid path towards 5G NTN

For applications such as cellular backhaul, where extracting maximum spectral efficiency remains critical, established DVB-based technologies can continue to offer advantages.

ST Engineering iDirect's approach is therefore to give operators the ability to support both existing DVB technologies and emerging 5G NTN services rather than forcing an immediate migration.

According to Van Der Linden, Intuition's software-defined approach can support established satellite waveforms as well as 5G NR-NTN, allowing operators to introduce the new technology progressively.

"They can do the investment today, secure their business by the unknown new technology and then gradually over time move to 5G NTN," he explained.

This hybrid strategy could be particularly relevant for operators with substantial existing GEO infrastructure while simultaneously investing in next-generation

constellations or services.

An operator could, for example, continue operating DVB-based services over GEO while introducing 5G NTN over a newer LEO architecture. Van Der Linden describes this ability to combine technologies as part of a hybrid, multi-waveform approach.

Rather than treating DVB and 5G NTN as mutually exclusive technologies, ST Engineering iDirect is effectively positioning them as technologies that can coexist during what could be a multi-year transition.

Multi-orbit brings opportunity — and complexity

The same pragmatism applies to multi-orbit satellite networks.

Combining GEO, MEO and LEO capacity can provide operators with greater flexibility and allow different networks to be used for primary connectivity, backup, traffic offload or specific applications such as media distribution and streaming.



a single terminal or combined through separate systems.

For some operators, GEO could remain the primary service while LEO provides backup. For others, the relationship could be reversed, with GEO capacity used for backup or to offload particular types of traffic.

The modem itself is not necessarily the biggest obstacle.

“The modem is perfectly capable of doing this,” Van Der Linden said, while emphasising that multi-orbit implementation “heavily depends on the antenna.”

Europe could become an important catalyst

Europe's IRIS² programme provides another indication of the direction in which the industry is heading.

The European programme is intended to establish a sovereign, multi-orbit satellite connectivity infrastructure, with commercial and governmental services expected to develop towards the end of the decade.

Van Der Linden pointed to European programmes and operator plans as important drivers for 5G NTN, particularly as the industry moves from transparent satellite architectures towards more sophisticated regenerative payloads.

His expectation is that transparent architectures will reach commercial implementation first.

“So, transparent, I think the first commercial deployments, let's say end of 2027, 2028; regenerative more towards 2030,” he said.

The distinction is important. Transparent satellites largely relay signals between the user and ground infrastructure, whereas regenerative architectures can perform more network processing onboard the spacecraft. Moving towards the latter

represents a more substantial architectural transformation.

Building satellite intelligence into 5G

Another important part of ST Engineering iDirect's strategy is adapting technologies originally developed for terrestrial 5G to the particular physics and operating conditions of satellite networks.

Satellite links introduce characteristics such as longer propagation delays, different coverage footprints and stringent spectrum-efficiency requirements.

ST Engineering iDirect is working with Capgemini on elements of its 5G technology stack, but Van Der Linden stressed that the objective is not simply to deploy partner software unchanged.

“I don't want to just deploy a partner software and then say, look, this is my product. Where is my differentiator there?” he said.

Instead, the company's engineering teams are working to make the technology more “satellite savvy”, including improving its performance in MEO and GEO environments where round-trip delays become increasingly important.

That satellite expertise extends into areas such as scheduling — determining how bandwidth is allocated among users within a cell — and improving the efficiency with which available satellite capacity is utilised.

Van Der Linden states that technologies and expertise developed for ST Engineering iDirect's existing satellite platforms can increasingly be applied to 5G NR-NTN as well.

Tackling GNSS dependency and resilience

Another technical challenge is the dependence of 5G NR-NTN systems on Global Navigation Satellite Systems (GNSS) for positioning and timing information.



At CABSAT, ST Engineering iDirect will demonstrate a full end-to-end 5G NR NTN connectivity demo on Intuition with two 5G UEs, one is iDirect's INT3000 and one 3rd party 5G UE.

That dependency can create resilience concerns in environments where GNSS signals may be unavailable, jammed or spoofed.

Van Der Linden highlighted this as an increasingly important area of work within the standards community.

“If we do nothing in the standards, then the 5G NR system will become very dependent — or, we call it, vulnerable — for GPS spoofing [and] jamming,” he said.

3GPP work is already addressing GNSS resilience as the NTN specifications continue to evolve. Van Der Linden said ST Engineering iDirect has been contributing to the standards process and sees this as another area where its satellite-specific knowledge can contribute to the development of future 5G NTN architectures.

The transition has begun

5G NTN is therefore moving beyond the conceptual stage, but commercialisation is unlikely to arrive as a single industry-wide switch.

Instead, Van Der Linden sees a phased transition: laboratory testing and proofs of concept today; initial commercial implementations in selected applications over the next several years; and increasingly

integrated terrestrial and satellite networks as standards, terminals, constellations and business models mature.

ST Engineering iDirect's strategy reflects that reality.

Rather than asking operators to choose between the satellite technologies of today and the 5G ecosystem of tomorrow, the company is building Intuition around coexistence — bringing together cloud-native infrastructure, established satellite waveforms, native 5G NR-NTN and multi-orbit capabilities.

For operators, that could become particularly important during a period in which the technological direction is becoming clearer even though the precise pace of adoption remains uncertain.

As Van Der Linden's comments underline, the immediate challenge is no longer simply demonstrating that 5G NTN can work. The next phase is about proving which use cases it serves best, where it creates economic and operational value, and how satellite operators can move towards it without compromising the networks and services they already operate. ■

If you're attending CABSAT / SATExpo Middle East in Dubai this year, do visit ST Engineering's booth for live demos at their stand # H3-A10.

But Van Der Linden cautions that the economics and complexity of the terminal remain among the biggest considerations.

Different satellite constellations can require different antenna characteristics. Even within the same frequency band, operators may encounter differences such as linear

versus circular polarisation, adding another layer of complexity at the terminal.

While multi-orbit connectivity is technically attractive, Van Der Linden believes the practical equation will depend heavily on antenna technology, terminal cost and whether networks are integrated into