ESOA
EMEA SATELLITE OPERATORS ASSOCIATION

avia
ASIA VIDEO INDUSTRY ASSOCIATION

SATELLITES:
An integral part of the 5G Ecosystem

www.esoa.net

Executive summary

Satellites can provide services directly to end users and ensure that 5G services and capabilities can be accessed by as many people as possible by extending next-generation connectivity to underserved areas and places that terrestrial networks cannot or will not cover.

5G promises hyper-connectivity to revolutionise modern society but without embracing satellite communications, it also risks increasing the digital divide. The inclusion of satellites in the 5G ecosystem will ensure that the benefits of 5G will be felt by much larger communities and in much shorter timescales than if mobile operators go it alone.

Satellite networks can bring the latest technology on an accelerated basis to everyone, everywhere, including areas that 3G and 4G have passed by. This is being demonstrated during the COVID-19 pandemic where satellites are being used to support a range of uses including the rapid establishment of direct broadband connectivity to new medical facilities and to support tele-education and tele-working to otherwise disconnected groups at home and elsewhere. The non-discriminatory nature of satellite technology permits these services to be available to all citizens, regardless of country, population density, or economic status.

5G networks need unique satellite capabilities if they are to successfully deliver their promised benefits. Satellites can:

- Extend the reach of limited terrestrial 5G networks to underserved areas and places that terrestrial networks cannot cover (e.g. on land, in the air, at sea);
- Ensure service continuity for M2M/IoT devices and connected/autonomous vehicles by providing reliable communications and supporting software updates on moving platforms (e.g. passenger vehicles, aircraft, ships, trains, buses);

- Ensure robust and secure 5G services for critical and mobile communications (incident response, public safety);

- Optimise the efficiency of 5G networks by multicasting / broadcasting data;
- Enhance existing fixed network links with hybrid connections.

The satellite industry has successfully demonstrated that satellites can already support key features of the 5G ecosystem. The industry is committed to continuously improving technology and solutions and is working on standards in 3GPP, to ensure that the benefits of satellites are embedded into the 5G standards and ecosystem.

Fixed and mobile telecoms operators now have the opportunity to embrace satellite by embedding the technology into critical parts of their networks to ensure extensive and reliable 5G services from the outset and make their own networks more resilient and efficient.

Role of Satellites in the 5G Ecosystem

The next generation of communications technology, 5G, foresees a world in which "anyone and anything will be connected at anytime and anywhere". In this context satellites can/will enable communications on the move, direct to premises connectivity, cell-site and aggregated mobile backhaul, content distribution and in the future, direct connectivity to end user devices. Satellites will also support the 3 main use cases:

▶ Enhanced Mobile Broadband (eMBB)

This will deliver Gigabits per second (Gbps) of end user connectivity. Satellites already deliver direct broadband connectivity at 100mbps to users beyond the reach of other technologies; also enabling services for businesses and governments. Ongoing work in 3GPP will also enable direct integration of satellite into 5G to allow the same user eqiupment (UE) to access both terrestrial and non-terrestrial technologies. In addition video is still foreseen as a major driver for eMBB. Satellites can support high bandwidth applications as they already carry high definition (HD) and Ultra HD content and data, which can be pre-positioned close to the edge for more efficient delivery to users, thus offloading terrestrial networks and ensuring minimal delays for users. Satellites already help mobile network operators across the globe expand their 3G and 4G coverage - the same can be done for 5G.

▶ Massive Machine-Type Communications (MMTC)

This will connect the hundreds and millions of devices that will form the IoT. Today satellites support IoT applications such as supervisory control and data acquisition (SCADA), real-time global asset tracking, and weather sensors. New, flexible satellite technologies as well as hybrid terrestrial - satellite modems will enable IoT connectivity, and IoT backhauling from remote locations and from connected cars, aircraft, ships and trains. Smaller, lower cost, electronically steerable antennas, are making ubiquitous deployment of IoT via satellite cost-effective, quick and easy to implement.

▶ Ultra-reliable and Low Latency Communications (URLLC)

This will provide the assured connectivity that critical communications use cases need. Satellite systems are engineered to ensure low error rates and resilient communications and adaptive technologies ensure communications can be maintained at all times. To achieve low latency, as the GSMA has acknowledged[1], "content must be served from a physical location very close to a user's device". Satellites' strength in multicasting across wide areas can be leveraged to distribute common content to the network edge to achieve this low latency.[2]

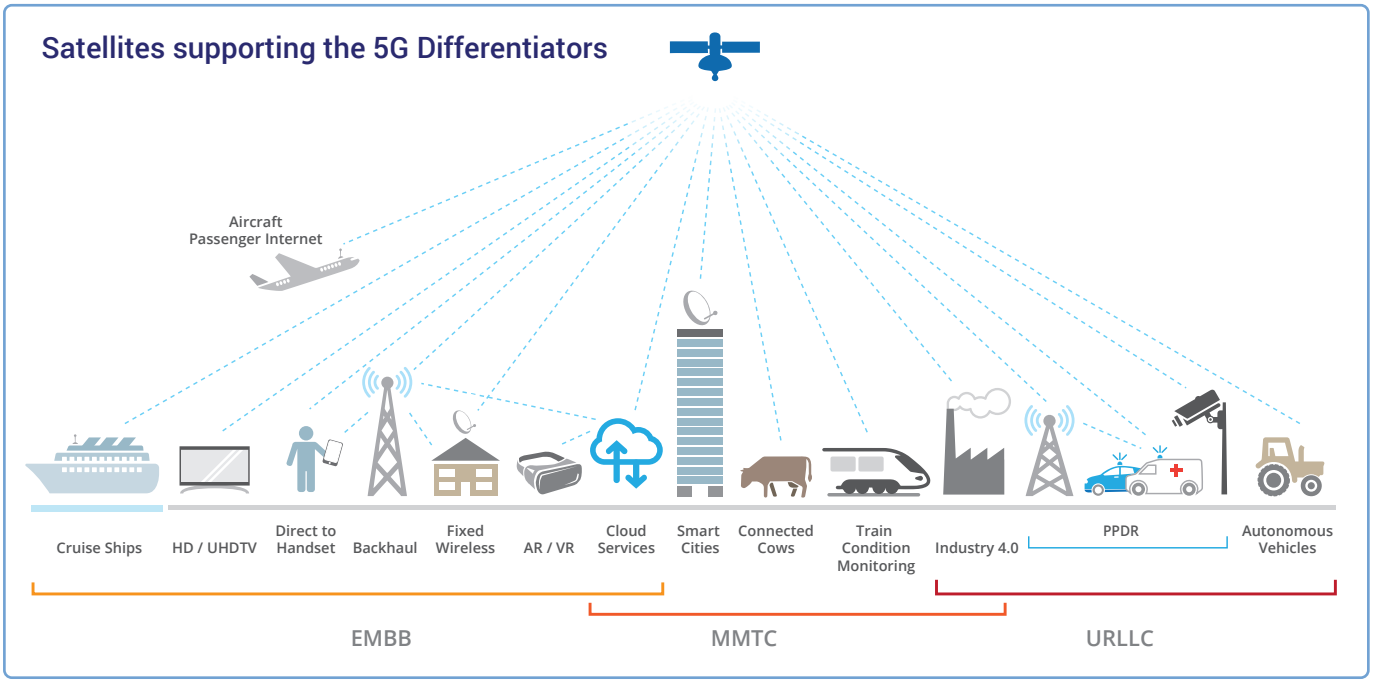
1 GSMA Intelligence, Understanding 5G, at p. 12 (2014).

2 ECC Report 280, at 22 ("The new edge-focused network infrastructure that IMT 2020 will demand means that satellites can play a role in connecting and updating the large number of edge servers"); NSR, Wireless Backhaul via Satellite, at 128 (11th ed., 2017) ("Paradoxically, the low latency requirement for 5G networks is a big ally in this vertical for satcom as many new locations for content servers will be required. In the transition to 5G, content needs to be moved to the edge and many new locations will be required, densifying CDN networks and making satellite multicast a viable option.")

Resilience in 5G

Unlike terrestrial technologies, satellites are largely immune to natural and manmade disasters and therefore inherently more robust. During the 2020 Covid-19 pandemic and in 2019 after Cyclone Idai, public safety and incident response vehicles relied on satellites for secure and guaranteed connectivity while illustrating the resilience of satellite communication. Satellites also helped to quickly restore communications where submarine cables were cut, most recently seen in the Democratic Republic of Congo, which relies on miles and miles of fibre for connectivity.[3] Incorporating satellite into 5G networks will ensure continuity of communications during and after a disaster.

Satellite networks are well-designed to help power the key 5G differentiators and enable and accelerate deployment.[4]



Preventing a 5G Divide

5G is expected to improve the lives of citizens no matter where they are. The COVID-19 pandemic highlighted that broadband connectivity is a basic need for all, necessary to ensure socio-economic inclusion and the functioning of economies, educational and healthcare systems.

5G must not be reserved for the urban elite. Most countries, not just emerging economies, still face a Digital Divide. In the United States 39% of rural residents do not have access to terrestrial broadband[5]. In the EU 6 million households are still unconnected[6]. Existing mobile networks have not achieved ubiquitous coverage and there is no reason to expect 5G will change this. Only a heterogeneous 5G network with multiple technologies will connect the excluded and allow them to participate in a world that is racing ahead with technological developments.

3 SES Press Release "SES's and Gilat Telecom's Resilient Network Restores Connectivity in Africa" February 10, 2020 (Restoring high-speed connectivity in the DRC within 4 days of major West African submarine cable cut) https://www.ses.com/press-release/sess-and-gilat-telecoms-resilient-network-restores-connectivity-africa

4 See ITU-R, "Key elements for integration of satellite systems into Next Generation Access Technologies" (rel. Jul 2019); see also ECC Report 280, Satellite Solutions for 5G (2018), ("ECC Report 280") (available at https://www.ecodocdb.dk/download/e1f5f839-ba17/ECCRep280.pdf).

5 See FCC 2016 Broadband Progress Report, Report, FCC 16-6, GN Docket No. 15-191, rel. Jan. 29, 2016.

6 GSMA Intelligence, Rural Broadband: getting up top speed, at p. 5 (June 2020)

To ensure users' 5G expectations are met, there are several key principles that regulators and policy-makers globally must adhere to:

Technology Neutrality

A stable, resilient, inclusive 5G ecosystem requires policies that encourage competition rather than focussing solely on fibre or equating 5G solely with terrestrial wireless. Integrating satellite as an add-on, at a later date, will be inefficient and costly.

Policy-makers should avoid prescribing **artificial speed and latency requirements** that will result in underperforming or over-engineered 5G networks that serve very few use cases and meet the needs of fewer people.

Fostering and incentivising the emergence of common standards to enable the seamless integration and interworking of different technology solutions will further promote the 5G vision. For many 5G use cases, satellite technology is ready and policy-makers must focus on moving from demonstrations and trials to pilots where MNOs incorporate satellites into their systems in a controlled environment with real end-users.

Encouraging Cost-Efficiency

Users around the world are disappointed that they do not have broadband coverage in places where they live and work. In many cases, this **lack of access is driven by cost.** This cost issue is amplified in the post-Covid economy and calls into question the case for targeted 5G investment when so many people do not even have access to 3G or 4G, now understood as vital for economies, health and education. Huge investments solely into terrestrial 5G connectivity cannot be justified - the benefits must serve all citizens, not just a privileged few.

Regulatory Considerations

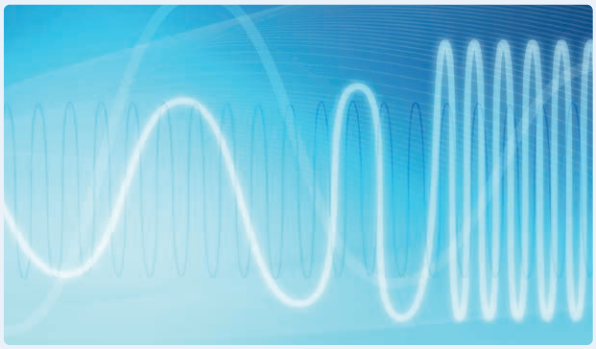
Emerging economies must ensure that regulation and licensing conditions promote the use of all 5G technologies, including satellite and hybrid solutions. Some countries take a General Authorisation approach to licensing which allows for unlimited satellite installations on their territory. Others charge fees per individual installation. This latter approach and other fees and duties applied excessively can prevent satellite from being adopted as one of the connectivity solutions, despite its vital role.

Only countries that promote a robust network-of-networks approach to 5G will fully reap the benefits of the new technologies and solutions of the 5G era.

Access to Spectrum Rescources

Access to sufficient spectrum is a requirement for all wireless systems, whether on the ground or in space. Regulators must therefore take a balanced approach to spectrum allocation and use for all bands.

As terrestrial mobile systems move to higher frequencies, where satellite systems have been operating for many years, the spectrum requirements of both sectors need to be carefully balanced. Rapid deployment of terrestrial 5G networks is best served by using spectrum bands that are neither in use nor planned to be used by satellites. This will ensure that both technologies will have the spectrum required and can work together to ensure reliability, reach and quality of service.



Satellites make intensive use of a wide range of frequencies, in various combinations of L-, S-, C-, Ku- and Ka-band. Next-generation HTS and VHTS systems require even more spectrum, including in the higher Q, V and E bands. MSS systems also require more spectrum and this will be considered at WRC23. Given the long-term nature of space-based investments, it will be critical to maintain viable and sustainable access to current and future satellite bands. This will enable continued growth of capacity and ensure that satellite systems can enable the 5G connectivity which users expect.

Conclusion

- By incorporating satellites into the 5G ecosystem the benefits of next-generation 5G connectivity can be made available to all users wherever they are.
- To successfully ensure that the 5G ecosystem includes all technologies, governments must embrace a standards-based, technology-neutral approach to regulation. This will enable the timely, widespread deployment of 5G.
- By working together, policy-makers and industry can improve the lives of all citizens by bringing them the full benefits of next-generation 5G communications.