Preparing for the Future Communication Ecosystems – A Perspective from the Satellite Industry

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Agenda

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5. Satellite components for the 5G system
6. Standardization activities
7. Different layers of spectrum regulatory framework
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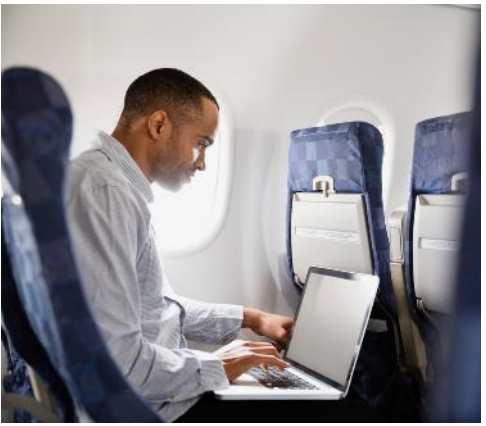
Fostering innovation across industries

Commercial Aviation



We work with 20 Commercial Airline Partners and over 3,000 aircraft

Mobility

We're the largest provider of connectivity for the offshore oil & gas market

Networks

7 out of 10 Mobile Network Operators work with us

Media

We reach over 2 billion people via TV and radio

Government

We're the largest provider of satellite services to the US Government

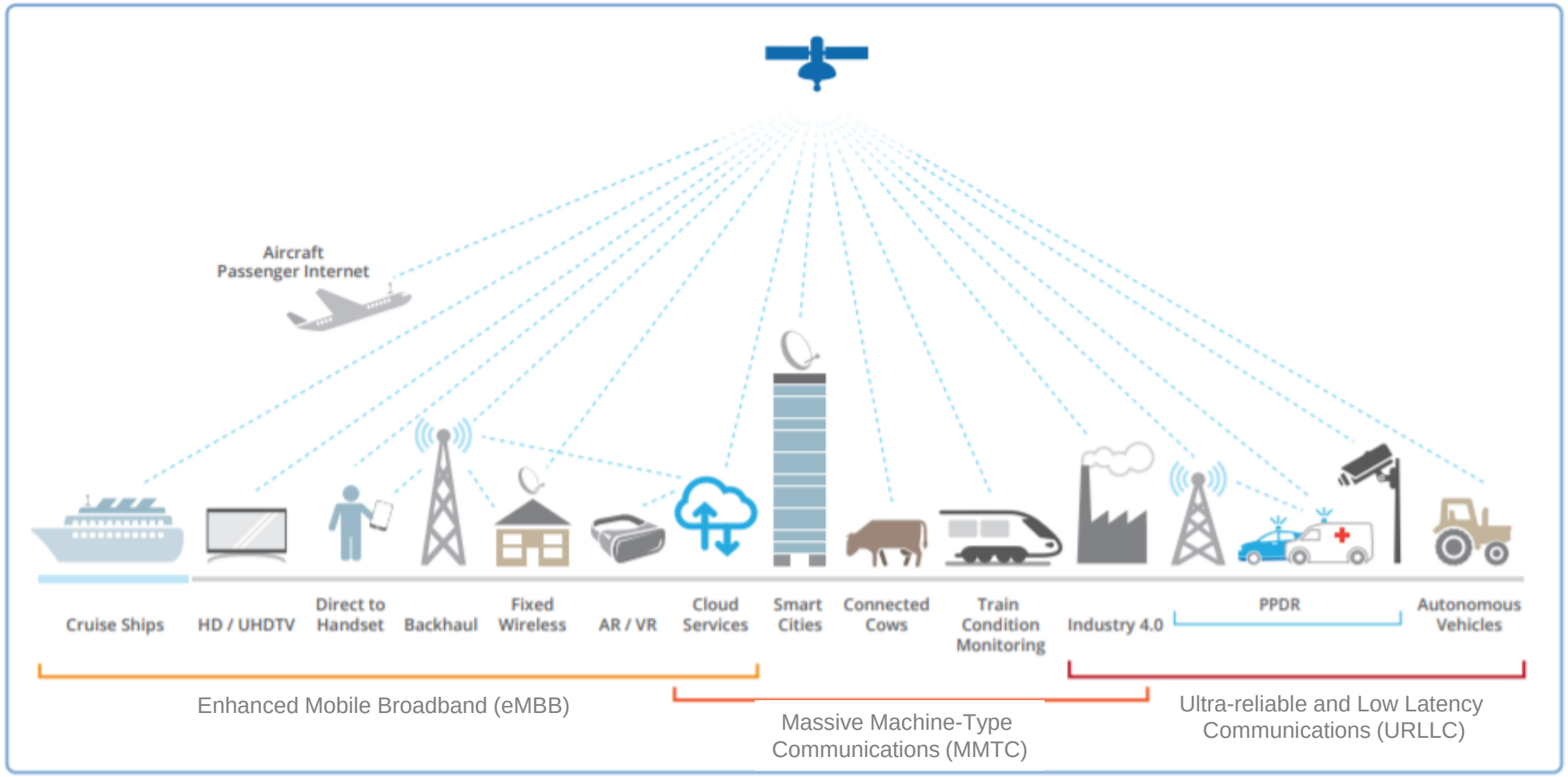
Constant field of innovation and renewal

Technical advances allow to extend service portfolio of satellites

- High Throughput Satellites – Multifold increase in achievable throughput and spectrum efficiency. Steerable spot beams allow to provide capacity to areas with high demand.
- Mega-constellations in low Earth orbit – Increase achievable thoughput and decrease latency.
- Mission Extension Vehicle – Extend life-time of the in-service satellite by five additional years of service.
- Cloud services – Directly connect users to cloud infrastructure through cloud gateways.
- Security – Satellite companies are involved in key projects working with the European Union & ESA around cyber-security & quantum communications to ensure that these key objectives in future networks are met.
- Resilience and reliability – Satellite infrastructure is designed for security and employs relevant and layered countermeasures to reduce risk and effectively counter cyber-threats.

Satellites supporting 5G differentiators

Satellites will support the three main use cases of 5G



Source: ESOA White Paper "SATELLITES: An integral part of the 5G Ecosystem"

Role of satellites in future communication ecosystems

Extend the reach of future networks: Increase in digital divide should be unacceptable

- As 6G moves to higher frequencies, pathloss becomes a determining factor limiting the achievable cell sizes. This poses a risk of that these services would be economically feasible only in urban environments
  - Integration of satellite communications with large, scalable coverage reduces the risk of digital divide
- Satellite backhaul for 5G & 6G can support key verticals in areas with no fibre/coverage: e.g.
  - Healthcare - need to treat growing aging population: home treatment, connected ambulances, etc.
  - Temporary Sites for greenfield locations - e.g. musical festival / construction site, etc.
  - IOT/M2M - Supporting sites around Europe such as utilities/critical national infrastructure
- Drive more efficient content delivery / reduce energy consumption
- Lead mass market application is eMBB: OTT/gaming involve huge transmission of data - data centres account for 2% of global greenhouse gas emissions
- Satellite overlay can be used to pre-position content for local storage, reduce data transmission needs and the burden on the network:
  - Gaming - whenever a new game comes out, huge amount of data needs to be downloaded (more & more games, more sophisticated, CGI/UHD imagery)
  - OTT/video content - every request streamed individually: huge data processing / energy required

Satellite components for the 5G system

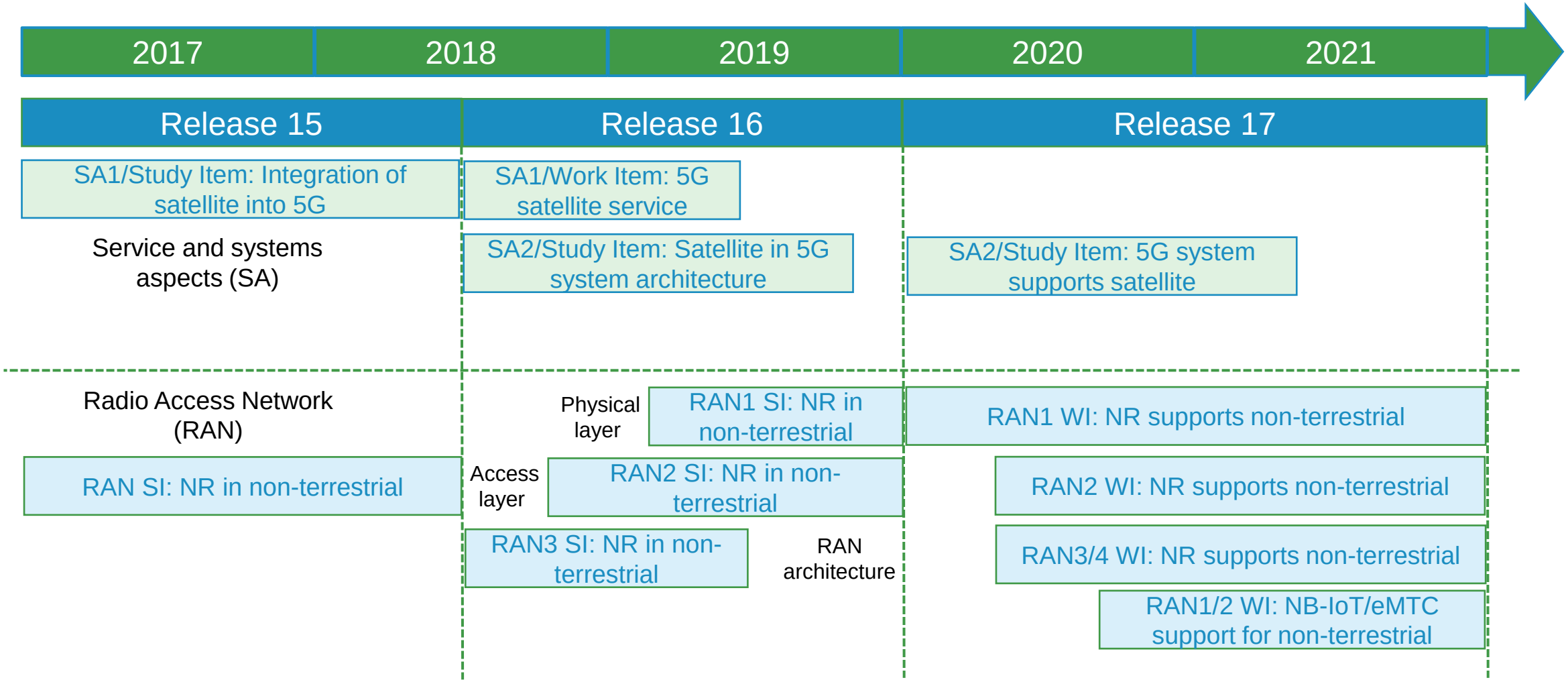
3GPP acknowledges the significant role that satellites can play in future systems

- Help foster the 5G service roll out in un-served or underserved areas to upgrade the performance of terrestrial networks
- Reinforce service reliability by providing service continuity for user equipment or for moving platforms (e.g. passenger vehicles-aircraft, ships, high speed trains, buses)
- Increase service availability everywhere; especially for critical communications, future railway/maritime/aeronautical communications
- Enable 5G network scalability through the provision of efficient multicast/broadcast resources for data delivery towards the network edges or even directly to the user equipment

3GPP TSG RAN TR38.811 “Study on NR to support non-terrestrial networks”

Standardization activities

3GPP activities towards 5G and satellite integration



SI = Study item, WI = Work item

Standardization activities

Outcomes of the 3GPP work

Lead Group	Title	Outcome
SA1	Study on using Satellite Access in 5G	TR22.822 (06-2018)
SA1	Service requirements for next generation new services and markets	TS 22.261 (10-2019)
SA2	Study on architecture aspects for using satellite access in 5G	TR 23.737 (07-2020)
SA2	Integration of satellite components in the 5G architecture	TS 23.501,502,503 (ongoing)
SA5	Study on management and orchestration aspects with integrated satellite components in a 5G network	TR 28.808 (04-2021)
RAN1	Study on New Radio (NR) to support non terrestrial networks	TR 38.811 (10-2020)
RAN3	Study on solutions for NR to support non-terrestrial networks (NTN)	TR 38.821 (01-2020)
RAN2	Solutions for NR to support non-terrestrial networks (NTN)	Not yet available (ongoing)
RAN1	Study on NB-IoT/eMTC support for Non-Terrestrial Networks	TR 36.763 (ongoing)

Different layers of spectrum regulatory framework

International level
ITU-R

ITU-R Radio Regulations is a binding treaty defining the allocation for frequency bands to different radiocommunication services, and related technical parameters and procedures for coordination of these services. Reviewed every 4 years at World Radiocommunication Conference (WRC).
ITU-R Recommendations and Reports contain studies on emerging technologies.

Regional level
Europe: EC, CEPT ECC

ECC Decisions, Recommendations and Reports are technical implementation measures aimed at harmonizing the use of the radio spectrum.
European Common Allocation (ECA) table
EC Decisions are binding to all EU member states

National level
Administrations

Frequency allocations, the National Table of Frequency Allocations
Frequency assignment, incl. Least Restrictive Technical Conditions
Individual rights of use (license) vs general authorization

Regulatory framework, spectrum resources

Continue to advocate that 5G is a Network of Networks on the international stage

Continued access to spectrum

- Continued access to core satellite spectrum resources such as C-, Ku- and Ka-bands.
- In case satellite spectrum bands are shared with new services, the sharing conditions should allow future development of the service in order to support variety of emerging use cases.
  - Protection of existing fixed earth station sites through separation distance is not enough.
- New frequency bands at higher frequencies, such as Q/V-band, to complement existing bands and to support variety of use cases.

Supporting new types of satellite use

- Bands currently used only for fixed satellite earth stations could in the future cater for mobile satellite earth stations in air, sea and land.
- Regulation and licensing conditions should promote the use of all technologies, including satellite and hybrid solutions.
- High-altitude platforms, as integrated and complementary part of satellite networks
- Inter-satellite links between satellites in different altitudes, such as LEO, MEO, and GEO

Regulatory framework, spectrum resources

Several AIs of the ITU-R WRC-23 have potentially an impact to satellite operations

Continued access to spectrum

- Agenda Item 1.2 to consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT)
- Agenda item 1.3 to consider primary allocation of the band 3 600-3 800 MHz to mobile service within Region 1 and take appropriate regulatory actions
- Agenda item 9.1 topic c) to study the use of IMT system for fixed wireless broadband in the frequency bands allocated to the fixed services on primary basis

Supporting new use cases

- AI 1.15 to consider operations of earth stations on vessels and aircraft communicating with GSO satellites
- AI 1.16 to consider operations of earth stations on motion communicating with non-GSO satellites
- AI 1.17 to consider regulatory actions for the provision of inter-satellite links in specific frequency bands

Conclusions

- Satellites already play a vital role in supporting and connecting terrestrial networks, but also by providing unique and complementary end-user connectivity in various business cases. This trend is expected to grow in the future.
- By incorporating satellites into the future communication ecosystems the benefits of these ecosystems can be made available to all users wherever they are.
- Only by promoting a robust network-of-networks approach to the future communication ecosystems will fully reap the benefits of the new technologies and solutions.
- Standardization activities are required to ensure seamless operation and full integration of different technologies for the benefit of all citizens.
- Regulatory framework at national, regional and international level need to promote the use of all technologies in future communication ecosystems, including satellite and hybrid solutions.
- Support & champion the inclusion of satellite in international harmonizing measures at ECC and ITU level.

Co-operation between policy-makers, research and industry can maximize the potential of these ecosystems.

Thank you

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