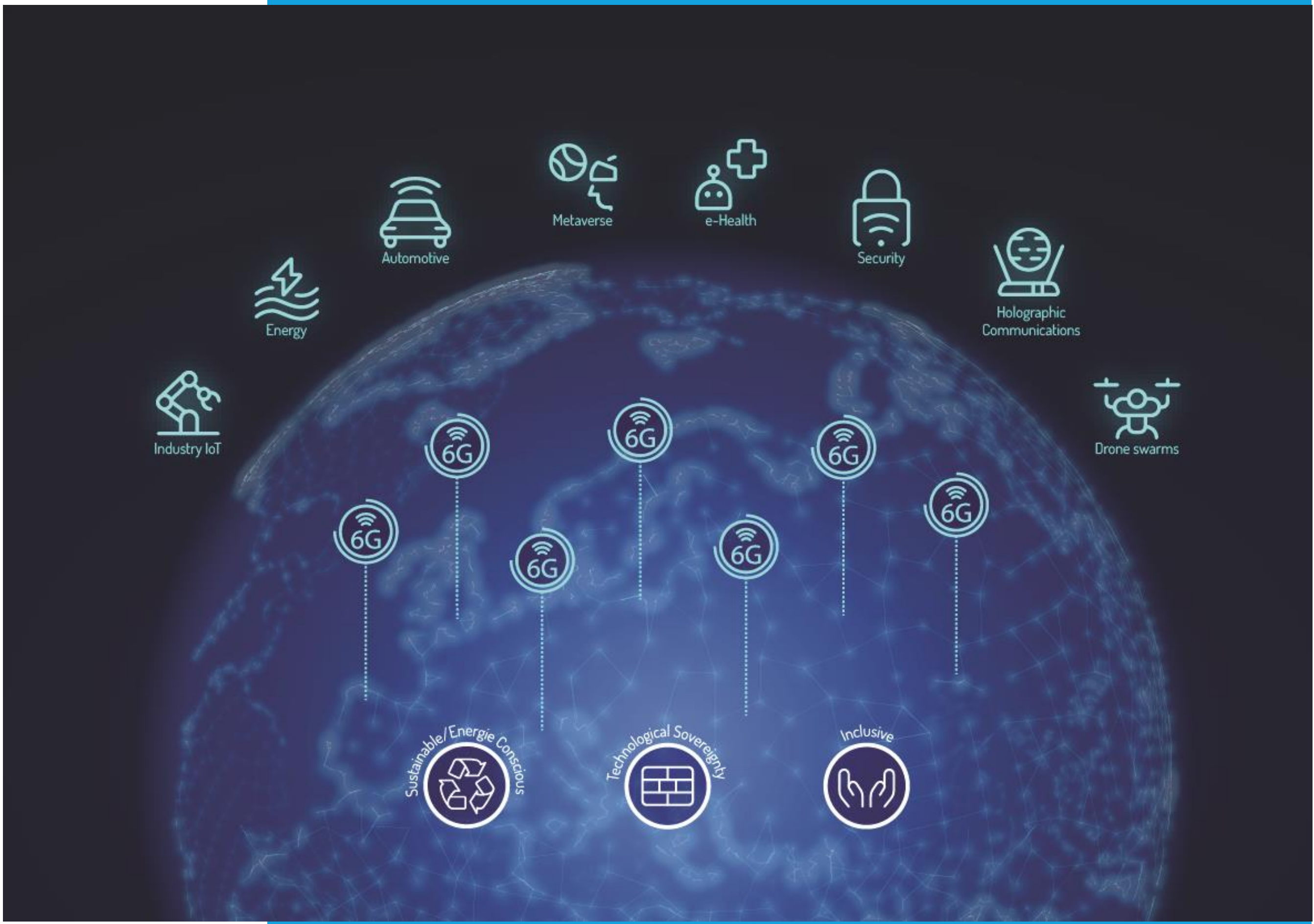
6G Smart Networks and Services Industry Association (6G-IA)



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Position paper

RESEARCH PRIORITIES ON NON TERRESTRIAL NETWORKS (NTN)

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1. INTRODUCTION

The Smart Networks and Services (SNS) initiative is currently halfway of its implementation period under the Horizon Europe programme. Three calls have been launched since the inception of the SNS initiative in 2021, two of them having already delivered significant R&I project work covering the multiple technologies underpinning the 6G vision. This work naturally includes projects covering the Non Terrestrial Networks (NTN) domain as part of the NTN component of Beyond 5G and future 6G mobile communication systems.

Time has now come to define the second half of SNS implementation and to update the R&I strategy and objectives for the key technologies and services targeted by future 6G systems in the light of global development. In this context 6G-IA organised a dedicated NTN workshop on 11 April 2024 to help defining the main objectives and scope of future work on NTN under the second part of the SNS implementation roadmap, and how possible synergies with other initiatives may be leveraged, taking into account the SNS budget limitations1 for a domain where R&I is highly capital intensive, especially for what concerns demonstration and validation activities. To that end, 6G-IA invited a panel of European experts in the field who provided their views for possible future actions. The NTN workshop was part of a series of stakeholders workshops covering also Cloud Computing, Security, Microelectronics, Wireless technologies and Photonics.

This report provides a synthesis of the discussions and a suggested way forward covering the next 3 years of SNS implementation and addressing the strategic NTN orientations for this period, together with the priority areas where R&I is highly needed.

The list of invited experts is to be found in Annex 1.

2. CURRENT STATUS

The satellite communication domain has significantly changed over the last decade. In the telecom domain, successful satellite systems have for long been implemented as proprietary system using mainly geostationary spacecrafts with specific application capabilities. The tremendous progress of the domain has allowed to radically bring down the cost of spacecrafts and of launches down to a level where constellations with hundreds or thousands of satellite may be commercially conceived. Low Earth Orbit (LEO) systems in particular are conceptually not new, but the current prospects offered by performance advances and lower costs could make possible the provision of space based communication services whose characteristics are getting much closer to those offered by terrestrial systems, in spite of the basic limitations of physics between Terrestrial and Non Terrestrial systems, e.g. latency or spectral/power efficiency, which are directly related to the distance between a device and an access point. Still, these are outweighed by other capabilities of space systems, notably their inherent capabilities to provide wide area coverage and an access cost that is independent from the population density, contrary to

[1] As a matter of reference, ESA budget in the Telecom domain is in the order of € 700 million per year, though this is not all related to 5G/6G activities.

terrestrial systems. Today, multiple satellite constellation are being considered by industry or already launched, and these advanced space communication systems are considered as sovereignty tools for policy makers across all major regions of the world.

These radical evolutions have led the satcom stakeholders to consider more systematically the maximum possible integration with 3GPP based terrestrial networks to provide an access/networking continuum where resources are indistinctly managed for Terrestrial or Non Terrestrial systems. This approach is considered particularly efficient as it gives access to the 3GPP ecosystem of standardised technologies, which has proven its power to drive down costs through economies of scale, provide global solutions and global interoperability. It also contributes to accessing to the user terminals market base, the corresponding retail channels, and applications.

The trend for integration of Non Terrestrial Networks (NTN) with Terrestrial Networks (TN) started already a few years ago, with the implementation in the early 2010 of several 5G-PPP, ESA or national projects looking more specifically into satellite as an access or backhaul component of 5G. This R&I work has led to the first ever set of 3GPP standards aiming at integration of satellite communications into a 5G network, which was made available under 3GPP Release 17. Since then, additional work has been (is being) carried out under Release 18 and 19 which cover additional NTN-TN integration capabilities. The main addressed features of this work include:

- Inclusion of satcom spectrum (S/L bands) in FR1 bands for IoT or moderate date rate services, including Direct to Device applications, NB-IoT eMTC and RedCap capabilities;
- Inclusion of satcom spectrum in FR2 bands for higher data rate Direct to Device applications or higher capabilities verticals (automotive, defence, etc.) served with 5G NR access capabilities and specific terminals (e.g. flat panel arrays);
- Support of both GSO and NGSO operations. Mobility inclusion of earth fixed/moving beams, further enhanced with discontinuous coverage and store and forward capabilities for low cost IoT scenarios, which is complemented by work on increased uplink capacity for massive IoT access scenarios;
- MBS features and specific localised broadcast support;
- Mesh operations and GNSS independent network;
- Support of on-board processing regenerative (software defined) payloads in addition to transparent scenarios, to provide additional flexibility of function placement for deployment options and gNB full or partial placement in the satellites2;
- Support of additional satcom bands in FR2 range (Q/V bands) is a possible future topic.

This work has been initiated in the 5G context. 6G is likely to bring additional challenges to TN-NTN integration whilst also opening additional service opportunities and R&I in this domain has been active for already a couple of years, again carried by SNS-JU projects (5 projects of the JU dedicated to NTN in 5G advanced of 6G), ESA projects or national projects.

[2] See architectural models at: https://arxiv.org/pdf/2310.17317

2.1. ARCHITECTURAL ASPECTS

This section outlines the main NTN architectural directions as discussed at the workshop and their potential requirements in terms of additional R&I efforts.

There is a widely accepted vision across the NTN community to focus on **multilayer, multi spectrum 3D architectures** to optimise the service capabilities that NTN should offer. Such an architecture is based on a multiplicity of satellite systems potentially operating at different (multi orbits operations), and interconnected with inter-satellite links. The figure 1 below tentatively outlines the overall system concept which is at the heart of the various R&I initiatives on 5/6G NTN in the world. It may however be noted that this figure provides an overall system concept which may however be implemented through multiple variations, including parameters such as:

- The number of orbits and the number of satellites;
- The overall set of covered frequency bands;
- The use of OBP (regenerative payload) or not;
- The functional split across the various satcom system nodes (device, satellite, gateway);
- The use (or no use) of ISL and across which orbits;
- The target coverage and application focus (maritime, defence..) …

The possibility to select different parameters to design an NTN architecture directly drives flexibility requirements that impact the service provision to users, the U/C plane implementation across the NTN segment as well as the management of the overall resources. This can be seen as a still open R&I topic that has also a number of testing and validation aspects, as not all of these issues are at the same level of maturity today.

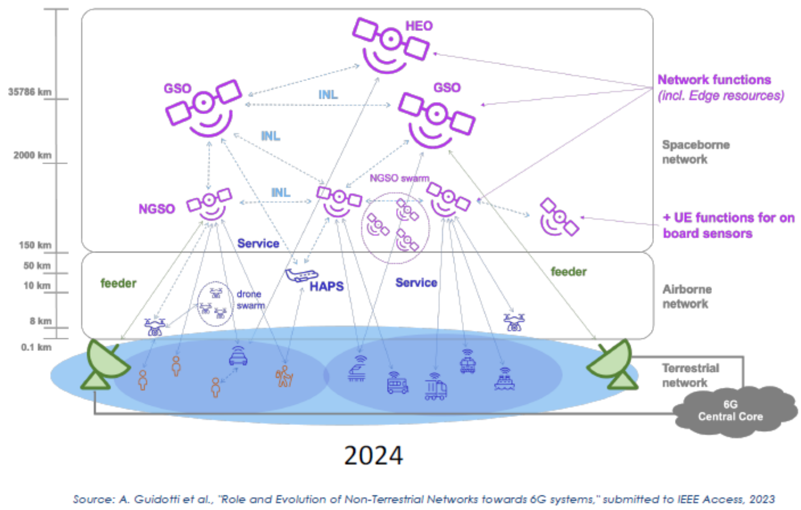

Figure 1. 3D Multilayer multi frequencies NTN concept.

source: A. Guidotti et al., "Role and Evolution of Non-Terrestrial Networks Toward 6G Systems," in IEEE Access, vol. 12, 2024

Autonomous resources configuration. Diverse requirements are pushing such capability for the space segment. On the one hand, having satellite resource configuration directly managed from the space segment allows simplified ground segment, which in turn helps to drive down cost as the network of ground stations used to manage a complex constellation may have a cost similar to the space segment itself. On the other hand, self and autonomous configuration also helps to cater for some attacks scenarios and reinforces the overall security/reliability of the system, whilst putting more functions in space may also increase the threat surface. This is in particular needed to realize a meshed system which fully benefits from ISL implementations, with different computing nodes capabilities. At this stage, such a self- management of a complete constellation is seen as a low TRL topic and will necessitate developments of technologies and architectures which are flexible enough to account for the specifics of the target constellation whilst at the same time offering resilient and trusted solutions.

Another complex issue is the integration with the overall network resource management system that also covers the TN part. At this stage, ongoing TN R&I (e.g. in SNS) cover end to end resource management using AI and going beyond localized AI (e.g. at RIC or NWDAF levels) to provide a multi domain end to end AI support visibility. Such work could potentially be extended to NTN in a more systematic way beyond R&I already running in this domain (e.g. 5G-STARDUST).

Integration/Unification. The vision of NTN towards 6G goes beyond integration and potentially considers "unification" as a viable objective, where feasible. Integration of satellite communications into 5G required, at 3GPP level, the development of dedicated interfaces and functional blocks not planned in the original terrestrial architecture of 5G. With 6G, the intention is to reuse indistinctly the architectural blocks (interfaces, functions, protocols, etc.) for both the TN and the NTN component to the maximum possible extent. This does not mean that satcom specifics are not any more needed. It rather implies that the design of the needed architectural blocks expands the parameter/attributes capabilities to cater for the NTN as part of the overall network of networks that 6G is supposed to realize. A case in point relates to the access waveform and MAC access, which may require optimization to cater for satellite channels and low PAPR requirements though largely based on the existing CP-OFDM technology developed for 5G. This is seen as a core element of unification between TN and NTN.

The integration approach using a moving constellation of satellites, i.e. a moving network, may also require revisiting transport and routing protocols to deliver a seamless end-to-end connectivity. R&I is already running on this topic but a comprehensive solution potentially covering all possible constellation types may still be missing. Such work requires a comprehensive collaboration between terrestrial and NTN stakeholders and a wide support to bring solutions to standardization bodies. In this particular domain, unification may not be possible whilst integration should be the target to start with.

Similarly, seamless access and service continuity requires additional R&I work. It should focus on integrated access management and E2E service delivery, taking into account the best service provision approach as a function of the service requirement (RT, delay tolerant, high/low capacity, etc.) which should also account for overall sustainability aspects, notably energy efficiency.

Multi tenancy. The tight integration of TN and NTN also requires the possibility to adapt to new business and role models, with the development of the multi-tenancy concept well known in the terrestrial domain but today less practiced in the NTN domain. Multiple SLA between a terrestrial MNO and one or several NTN infrastructure providers have to be possible, which in turn requires to define set of NTN resources that may be shared and implemented across multiple MNO's, reusing classical notions as found in the cloud computing domain (e.g. VM's or containerized resources). This may also alleviate competition issues by avoiding, through enhanced openness, full control by established gatekeepers. This is not a well-advanced domain at the moment, and how this impacts the various possible NTN implementation and the level of on board computing including core network components and their split between space and ground segments should be further investigated, with also a good potential to generate results towards standardization bodies.

Beyond multi tenancy, **multi-vendor** needs to be addressed to stimulate competition and an ecosystem of NTN solutions vendors. This is different from the today's situation where satcom platform and payload architectures are customized and interfaces are largely proprietary. It calls for the definition of open interfaces, especially for the satellite nodes including at payload unit level (antennas, ISL, digital processors), and their processing capabilities. Interfaces (electrical, functional, etc.) as well as requirements associated with the space environment shall also be standardized.

Multi domain, integrated mobility. Mobility requires unified or coordinated protocols for domain handover, either within an NTN segment, across two distinct NTN segments where an MNO has subscribed resources, or across an NTN and a TN segment. Predictive HO protocols exist, and some aspects (with several NTN satellites) have been demonstrated by industry. This topic is key to guarantee seamless service mobility between TN and NTN, and some earlier work such as the work carried out in the context of 5G PPP to guarantee service continuity between two PLMN across a border for CAM services may be taken as reference.

Carrier aggregation/multi-connectivity. Network integration will benefit from solutions enabling the UE to communicate with one or multiple nodes from the cellular, satellite, high altitude platform (HAP), or unmanned aerial vehicle (UAV) and exploit the radio resources of multiple component carriers. It corresponds to the classical function of TN of carrier aggregation, extended to the NTN case with aggregation of resources across multiple bands/nodes/networks, enhancing in turn the system reliability and security. It implies the development of dynamic and adaptable features for optimal resource utilization such as i) layer/node switching, for seamless mobility; ii) load balancing; iii) multipath packet operations (split or duplication); iv) Development of shared aperture multifunctional antennas for UT; v) Multiband TX/RX apertures. Compared to classical carrier aggregation for cellular systems, the system has here to cope with much more diverse channel characteristics in terms of latency and delays.

GNSS independence for positioning, Location Services (LCS). Since the introduction of 5G Release 18, NTN based positioning has attracted significant interest due to its numerous applications, including emergency services, lawful intercept, and charging and tariff services. This release considers single low-earth-orbit (LEO) positioning explicitly for location verification purposes, which requires a coarse location estimate. Extension of GNSS independent positioning is expected to cater for different constellations and to provide increased levels of user positioning, which requires to address several issues, notably the RT time with the satellite access node and the moving characteristic of the access point as element influencing the position measurement.

Spectrum coexistence. Integration of TN and NTN requires a strict interference mitigation approach to enable both domain to operate correctly. Studies (e.g. in 3GPP) have shown that co-existence is possible between the satellite MSS part of FR1 and the adjacent MS part of FR1. This should be even easier at higher frequencies, FR2, where natural directivity of the beams is higher. However, the potential opening of FR3 to the MS and usage for TN reopens the issue of spectrum co-existence, in a Ku band range that is heavily used by satcoms in Europe. Not only studies are needed, but also development of technologies that allow to manage spectrum in an interference efficient way, both from a system perspective and from an enabling technology perspective. It may also be noted that this issue is being considered as part of the Front-End Module proposal that originates from industry consultations for the microelectronics domain (16 October 2023).

It will be essential to favor the development of the ecosystem by allowing the improvement of spectral efficiency, lower the barriers for new entrants, both from the technical criteria associated with frequency sharing but also from the procedural point of view.

2.2. USE CASE ASPECTS

There are multiple use cases that are being considered for NTN support. At this stage, it is still needed to define the use cases against a set of KPI's that could form the basis of a standardisation initiative at 3GPP level. Some projects (e.g. 6G NTN, several ESA studies) have their views, but an industry wide consensus is still to be achieved.

Use cases have different requirements that are pushing the limits of technology. One of the most demanding scenarios relates to **Direct to device (D2D) connectivity**, notably satcom connectivity to hand-held devices. The use of LEO orbits with satellite access points distance to the hand-held device in the order of a couple of 100's of km makes such a scenario possible. Standardisation has also addressed this use case for low rate, but more may be needed to address higher rate accesses. Further work on the radio access (waveform) may be needed to support hand-held device form factors. Whilst it is likely that the industry will altogether be reluctant to radically depart from the 5G NR CP-OFDM radio access option, improvements to move towards lower PAPR capabilities or better robustness to intermodulation products may be considered. Whilst the spectrum co-existence between TN and NTN requires additional work (see FR3 above), extended scenarios where unused TN spectrum could be used ad-hoc by NTN devices may be worth considering. At architectural level, D2D may also require to have not only a full gNB but also some CN functionalities in space (e.g. UPF), which may require to reassess architectural aspects constraints in addition to optimising radio waveform.

Another classical use case for satellite is **coverage extension** and deployment for coverage of low-density zones. This is related to “digital divide” societal issues. Capabilities in this domain are related to integration with TN and seamless handover or service roaming capabilities between the NTN and TN domains. Implementation of architectural capabilities as described in above section would support such a use case.

Broadband direct to mobile VSAT enabled by GEO/LEO constellations is also an opportunity but requires developments for inexpensive D2D connectivity. In particular multi orbit flat array antenna for integration with vehicles are needed for various addressable market verticals e.g. automotive, rail, aero, and still in the R&I domain. This domain is subject of intensive work with automotive direct to car connectivity being seen as a key use case, with initiatives implemented notably between 5GAA and ESA. Such technology may also be used for fixed terminals, e.g. CPE equipment for fixed service applications.

Specific use cases only addressable by NTN are those offering connectivity notably to rail and aeronautics.. The aeronautical scenario is particularly demanding as it requires unification of a number of proprietary and non-interoperable systems under one single technology (6G) that covers multiple connectivity requirements, ranging from inflight connectivity for passengers to air traffic management connectivity between air traffic controllers and crew members, whilst ensuring 3D coverage. This topic is part of the Seamless Air Alliance representing the Aviation Industry with the objectives, to rationalize the Connectivity offering by standardizing Aircraft Terminal and leveraging 6G Non-Terrestrial Network (NTN) technology. In that context, the Seamless Air Alliance intends to promote Aviation requirements for future Connectivity solutions including 6G business & technical needs for the cabin and cockpit domains. Beyond R&I, an important aspect of this use case (and also for railways) is certification. Specific R&I for such use case includes notably universal modem based on standard chipset and electronically Steerable Antenna technology for satcom terminal commoditization. It is also believed that unified developments covering such a use case could be reused for maritime usage.

Governmental services, is another class of use case of interest, including early warning systems (EWS) using NTN broadcast capabilities for support to populations (part of the UN objectives to have full global coverage), PPDR or critical communications.

Multiple IoT services are also being considered, already in the early 3G PP releases, driving requirements such as increase uplink capabilities for massive access scenarios, support of limited capabilities devices (RedCap), on board processing with store and forward capabilities for low-cost constellations with intermittent coverage, low cost efficient antennas.

Integrated sensing and communications. This domain opens innovative applications using both NTN space-based telecommunications and Earth Observation (EO). NTN space segment provides connectivity for both EO and Comms scenarios. NTN and Earth Observation convergence and synergy requires NTN onboard regenerative architectures with edge computing/MEC capabilities where ‘Servers in Space as a Service’ can be employed for communications or sensing tasks. Envisaged EO applications mid-term cover RF EO/Remote sensing applications in support of environmental monitoring, sensing as a service e.g. cooperative localization and imaging, channel knowledge map construction etc.

can be served. EO Radar are considered in longer term. The domain started to be investigated (e.g. ESA 5GEOSiS) but there still need for convergence.

3. CRITICAL TECHNOLOGIES

In complement to architectural and use case issues potentially benefiting from additional R&I, the workshop also identified specific challenging space related technologies requiring significant efforts before the NTN-TN vision may be realised. The main such technologies are outlined in the table below:

Research Topic	Time frame	Target TRL
1--MIMO from Space, New antenna design for satellite, beam generation through satellite swarms, large antennas for direct to device connectivity, advanced NTN beamforming capabilities for 6G Networks (this may include, in the long term, integrated NTN MIMO BF capability on 6G air interface) **Justification:** interference mitigation for multi sat constellations, EIRP/link level optimization	Long-term	TRL 2➔5/7
2-UE flat panel antenna, low cost, optimized form factor. Phased array and agile beamforming IC capability. FR1 and FR3 range in priority **Justification**: UE integration in automotive, rail, maritime.., VSAT, CPE use cases.	Medium term	TRL 3➔6
3-Regenerative / software defined payloads, covering viable functional splits (RAN and Core), standardized interfaces, storage and computing (edge/MEC) capabilities. **Justification:** flexibility of integration of the space segment into the TN, ecosystem creation for space technologies, versatility for use cases coverage	Medium/long term	3➔5/7
4-Programmable Open Hardware, RISC V based solutions for flexible regenerative payloads **Justification:** see Regenerative Payloads. Also needed to virtualize the space segment.	Long term	2➔5
5-Optical satellite link for backhaul and/or Inter Satellite Links[3]. **Justification:** ISL is needed to optimize constellation against certain parameters such as latency, or autonomy from T network; Optical backhaul better supports very high-speed services whilst eliminating interferences from the radio part.	Medium	3➔6
6-Multi beam antenna for very high-capacity usages at Q/V bands or higher (W band) **Justification:** extension of satcom system capacity and interference mitigation/control.	Long term	4➔7
7-In-orbit and autonomous SDN controller	Long Term	3➔5

[3] This topic (what to potentially address under SNS) is addressed in more details in the Photonic consultation report, also taking into account key ESA initiatives like HyDreon

Justification: Dynamic and autonomous placement of SDN controller among TN and NTN nodes allows flexible management according to traffic requirements vs congestion.		
8-Satcom and GNSS independent UE localization (several options, constellation based or single satellite based). **Justification:** GNSS QoS independence and lower than 10 cm capability requirements	Short/medium	4➔6
9. Quantum payloads **Justification:** as security plays important role in several 6G use cases	Long Term	2 ➔5
9-Satellite propagation model calibration for polarization and multi path combination **Justification:** radio protocol layer 1, satellite antenna definition	Short/Medium	1➔3

Table 1: Main critical NTN Technologies outlined at the workshop

As expected, the workshop confirmed that ESA and Space Agencies are strongly engaged in these critical topics in the context of the 5G/6G initiative running under the ARTES programme of the Agency. In that context, and taking into account i) the very strong space focus of these critical technologies; ii) the magnitude of the needed budget and potential requirement for availability of in orbit space resources to reach impactful results, it is proposed that these technologies are not (or only marginally) directly addressed in the next phases of R&I implementation of the SNS-JU. Of course, this does not prevent specifications for these technologies to be reused under SNS projects if needed at system or subsystem levels to address their workplan.

4. POSSIBLE WAY FORWARD

Against the above background, it is proposed to focus the next stages of NTN activities under the SNS-JU on a "TN-NTN Unification Initiative" that would cover architectural and technological issues requiring a very tight cooperation between the SNO and the MNO's, towards a seamless TN-NTN communication continuum, and catering for a multiplicity of possible business models across the various domains. The initiative should eventually deliver end to end service capabilities either through a TN segment or through an NTN segment, depending on relevant parameters including coverage, RT or NRT constraints, bandwidth, sustainability aspects…

The proposed initiative should cover both R&I issues for low TRL topics and plan, towards the end of the SNS implementation, for demonstration of critical technologies and applicability to specific use cases, with ESA partnership or national initiatives where possible, possibly using low-cost demonstrators such as KeplerGen2, Cubesat etc., Priority topics for SNS are tentatively summarized in the table below.

Research Topic	Time frame	TRL
1-Management of multiple access networks through unified Control Plane capable of optimizing TN-NTN service provision according to traffic related parameters (QoS level, bandwidth, sustainability, latency, storage requirements..) and related RAN management, also accounting for demanding scenarios such as PPDR, emergency, disaster and relief operations.	Short-term	TRL 3➔ 6
2-Dynamic routing in multi-dimensional networks with selection of optimal paths for traffic, which is a key feature in leveraging the potential of NTN-TN integration including optical links [4], improving (transport) protocols, flexible topology and traffic routing across such dynamic topologies with long-propagation link characteristics. Extension of a reference multi orbit constellation system(s) as evaluation framework for the assessment of routing schemes including various architectural splits. It should cover robustness of the scheme for disaster situation when TN is not available.	Medium term	TRL 4➔7
3-AI Based end to end resource control, orchestration and management, with seamless TN-NTN resource management capabilities, covering rapid reconfiguration for emergency/disaster situations.	Short/medium term	TRL 4➔6
4-Spectrum issues including i) novel schemes for dynamic spectrum access and sharing in FR3 (7 – 24 GHz), providing good cost-coverage trade-off; ii) possible dynamic reuse of TN frequencies for NTN use where TN spectrum not used or for PPDR use in case of emergency needs. **NB:** also part of FEM microelectronics roadmap.	Short term	TRL 4➔6
5-Multi tenancy and end to end resource slicing capabilities across multiple tenants, covering the space resources and including seamless mobility and handover between various segment, either TN to NTN or across 2 NTN infrastructures.	Short term	3➔5
6-Integrated communication and positioning, GNSS free operations, study of various architectures (Network, UE, multiple satellites, etc.); integrated communication and sensing.	Medium term	3➔6
7-Multi access capabilities and carrier aggregation	Short/medium term	3➔6
8-Autonomous and self-configuration of NTN resources and stability vis a vis TN resource management and control.	Long Term	2➔5

Table 2: Proposed Issues to be covered under the next SNS phases

[4] This topic is also addressed in the Photonic consultation report.

The proposed "TN-NTN unification initiative" (deep integration to be targeted where unification eventually proves not to be feasible) would under SNS cover the issue outlined in table 2 over Work programmes 2025 and 2026, through subsequent complementary calls. Synergy with ESA is proposed through light mechanisms such as regular exchanges of information between the projects supported by ESA and SNS, possibly framed by an MoU.

In 2027, two complementary initiatives are proposed:

- Demonstration of some critical technologies, beyond PoC and possibly involving usage of low-cost space segment capabilities. Those would need to be provided through space Agencies and would require in advance planning.

- Focus on specific use cases involved in 6G domain and making particular use of the 3D dimension of 6G. Considering the current significant efforts dedicated by ESA in the automotive domain, it is suggested that SNS could address in priority the aeronautic domain (unified coms for passengers, cockpit and ATM) and the FRMCS domain, with possible room for complementary use cases (e.g. automotive for specific issues).

Altogether, these innovation/competitiveness related action would benefit fron complementary actions with RSPG at regulatory level to investigate applicability of Supplemental Coverage from Space in Europe (in line with the FCC Proposed Framework to Facilitate Supplemental Coverage From Space)

The table 3 below summarizes the proposed implementation roadmap for the next 3 years.

Table 3: NTN-TN Unification/integration initiative suggested implementation planning

	WP 2025	WP 2026	WP 2027	Budget (TBD)
SNS WP	**Topics 1, 2, 4, 5 to cover in priority.** The proposed projects targets unification/integration where unification not possible of TN and NTN with focus on dynamic routing and protocols, integrated Control plane serving both TN and NTN with RAN managemen, spectrum co-existence, and orchestration of resources towards Multi tenancy. Topic 6 on integration com/sensing may also be considered.	**Topics 3, 6, 7, 8. To cover complementary issues,** including positioning and sensing capabilities, AI assisted E2E resource management, multi access capability enhancement and autonomous self configuring NTN resource with TN interfacing.	-Dedicated complement for demonstration of specific technologies, e.g. multi segment handover, E2E slicing, RAN adaptation.. -Focused Use Case project, tentatively addressing aeronautic and/or FRMCS usages with possible complement in other Use cases.	TBD
Synchro	Light Synchro and information exchange through structured SNS/ESA framework	Light Synchro and information exchange through structured SNS/ESA framework	Reuse where applicable ESA or national agencies satcom resources for low-cost space segment (cube sat type)	

5. ANNEX 1: LIST OF PARTICIPANTS TO THE NTN WORKSHOP ON 11.04.24

Surname	***Name***	***Company / Institute / University***
BOUBENDIR	Amina	AIRBUS
GUTA	Maria	ESA
FRANCHI	Antonio	ESA
SCALISE	Sandro	DLR
RONTEIX	Flavien	THALES ALENIA SPACE
VANELLI-CORALLI	Alessandro	UNIVERSITY OF BOLOGNA
WEINGARD	Jeroen	NOKIA (Represented by 6G-IA)
MICHEL	Cyril	ERICSSON
EULER	Sebastian	ERICSSON
REYNAUD	Laurent	ORANGE (Represented by Prof. Vanelli-Coralli)
HECKER	Artur	HUAWEI
KHALIFA	Ebraam	QUALCOM
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BARANI	Bernard	6G-IA
KALOXYLOS	Alexandros	6G-IA
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ALBARES BUENO	Javier	SNS JU Office
FOURNOGERAKIS	Pavlos	SNS JU Office
MAZZONE	Chiara	SNS JU Office
KEMOS	Achilleas	EC CNECT E1
PEREIRA	Jorge	EC CNECT E1

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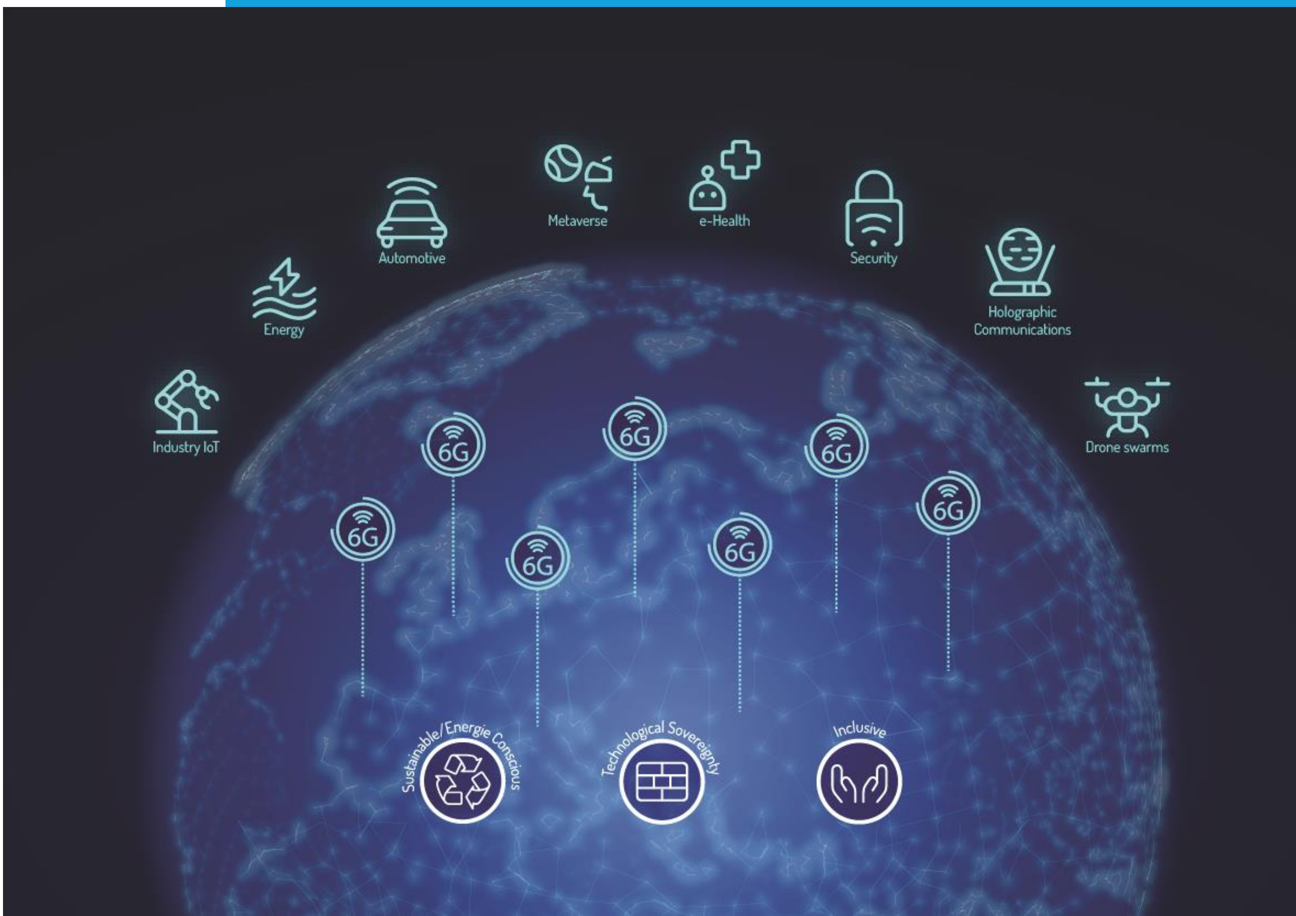

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