NTN CHALLENGES AND COLLABORATION OPPORTUNITIES

MARIA GUTA

ESA

Strategic Programme Line 5G/6G and Sustainability

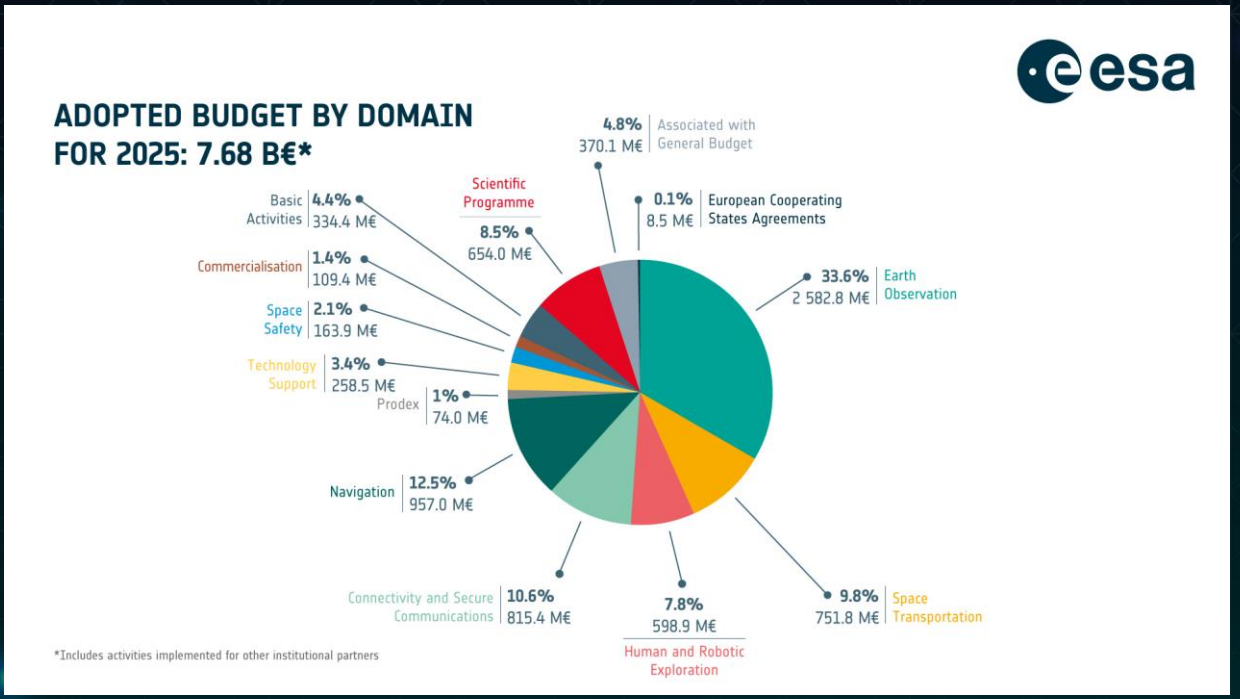
CSC Directorate

01 April 2025

23 Member States
4 Associate Members
including Canada
4 Cooperating Members

5 500+
ESA Workforce

85+ missions




6G NTN
Shaping the future of Global Connectivity
THE EUROPEAN SPACE AGENCY
esa
1975
2025
50

The Global Connectivity Challenge

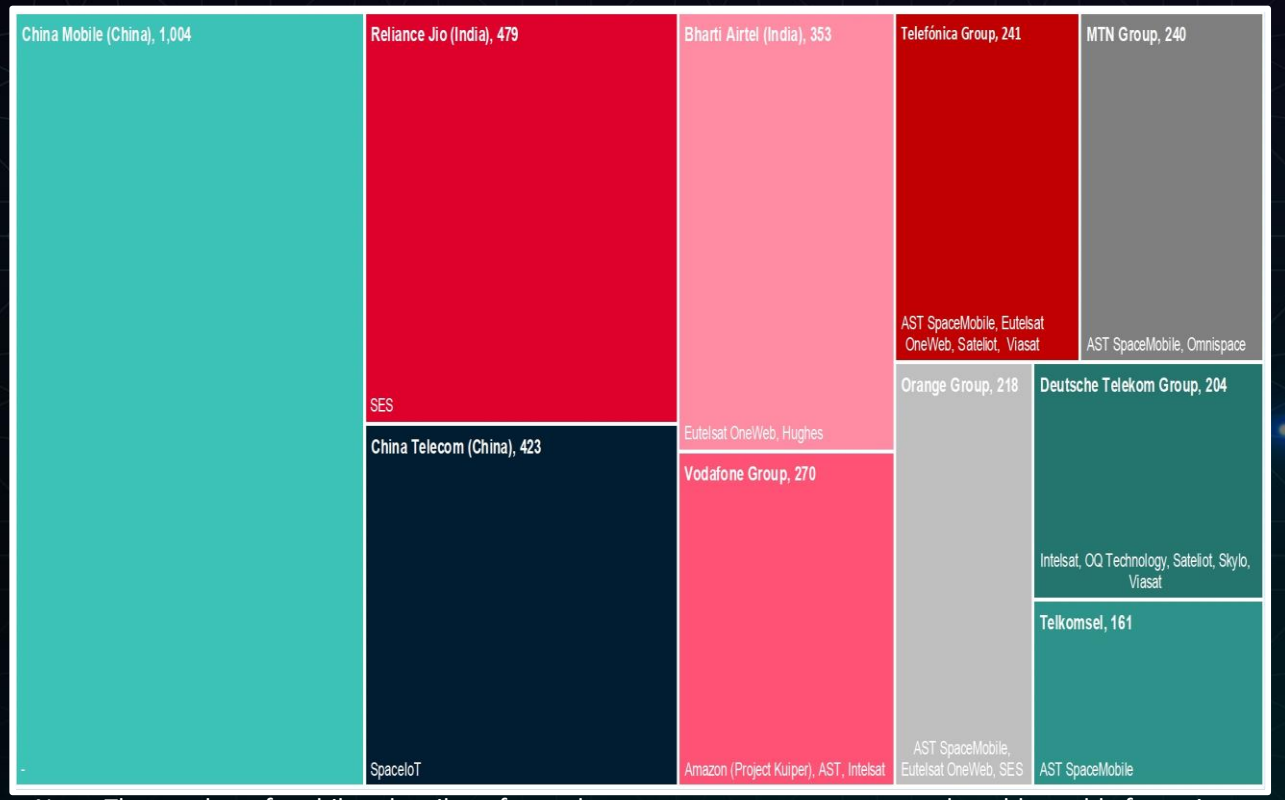
Increased demand

Terrestrial overwhelmed

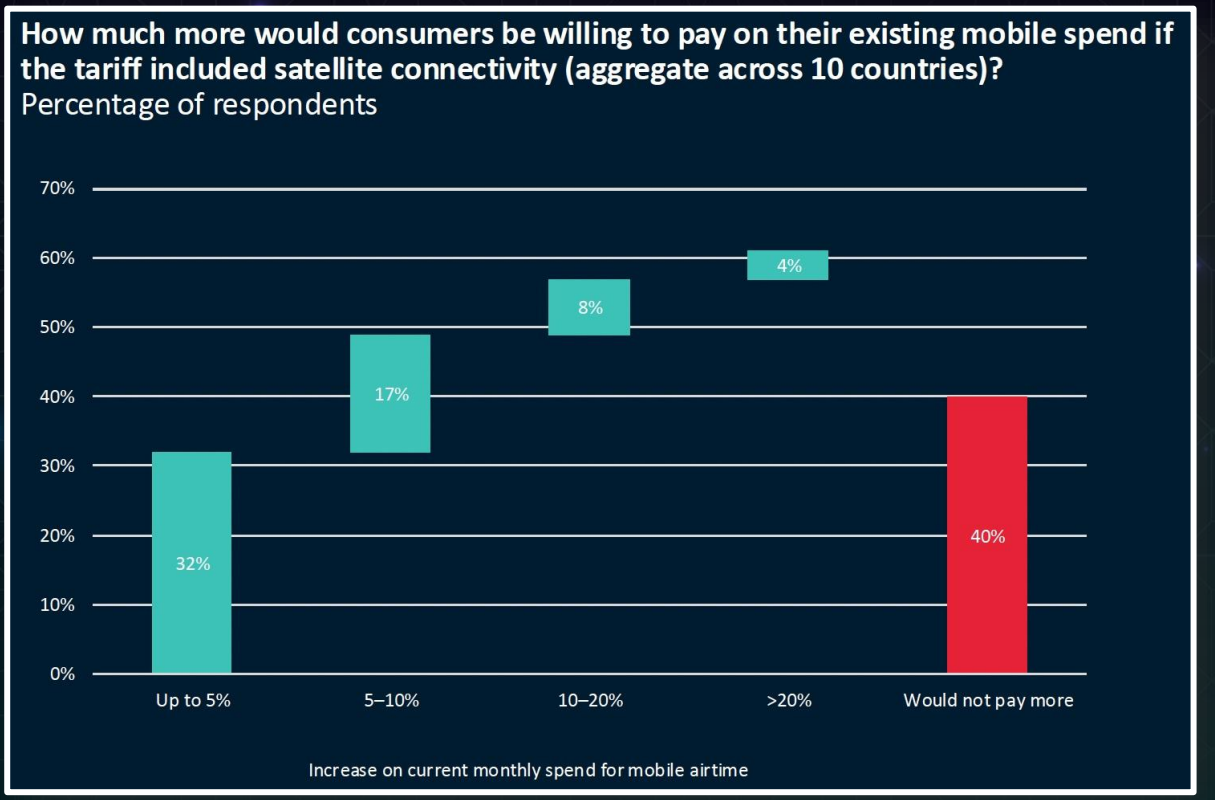
Smart cities, smart regions, autonomous mobility, remote work requiring ubiquitous networks.

Non-Terrestrial Networks provide the complementary layer needed for global ubiquitous coverage and resilience

Telcos buy in global with multiple satellite partners



Note: The number of mobile subscribers for each operator or group represents the addressable footprint for a partnership, assuming national satellite coverage.
Data correct to November 2024



GSMA Intelligence
MWC 2025 NTN Summit

Non-Terrestrial Networks provide the complementary layer needed for global ubiquitous coverage and resilience

The Vision for 6G NTN

NTN in 6G from Day 1
Global Standards

Sustainability &
Energy Efficiency

Space-Supported
Future Technologies

Sustainability in Space & on Ground

Energy-efficient satellites and ground stations powered by renewable energy

Green propulsion systems to minimize environmental impact

Debris mitigation to ensure long-term viability of space operations

ESA Zero Debris Charter
ESA Clean Space Initiative

Advanced Features for NTN

Collaboration Opportunities

Positioning Navigation Timing (PNT)

Ultra precise services critical for autonomous vehicles (cars, drones, vessels)

Integrated Sensing & Communications

Leveraging NTN networks for real-time environmental & infrastructure monitoring

Device-to-Device (D2D) Connectivity

Federated/Fragmented Multi-layer NTN for scalability, resiliency, lower costs

Technology Enablers of 6G NTN

Collaboration Opportunities

RIS
Reconfigurable Intelligent Surfaces

Dynamically controlling signals for improved coverage and efficiency

Distributed AI

Enable intelligent edge computing
Enhance network management with real-time autonomous optimization

ORAN

Optimise NTN systems efficiency

NTN/TN networks Digital Twins

Enable coherent network & topology and services orchestration

Space-Based Data Centers

Low-latency processing

Future Possibilities

Quantum Technology

Offering secure communications

High-Throughput Optical Space Communications

Deliver ultra-fast global data speeds

Metaverse & Mixed Reality

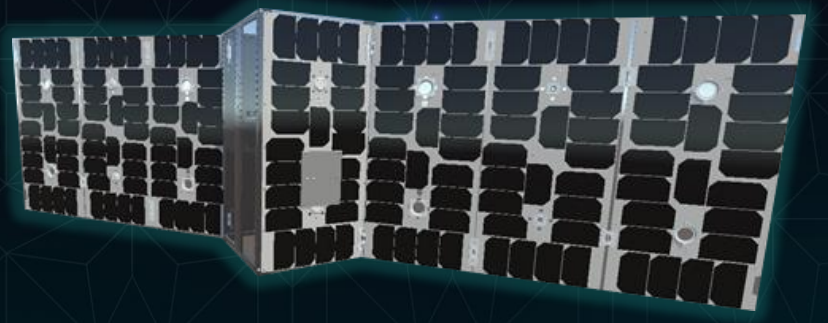
Immersive video services, remote collaboration & telepresence

In Orbit Laboratories

Collaboration Opportunities

REMI
Direct Access Reference Mission

MIXELS
5G Flying GNodeB



LINO
6G Laboratory In Orbit

Secure Connectivity (IRIS²)

IRIS² – The First Fully Fledged 5G NR -NTN Multi-Orbit Constellation

3GPP 6G Workshop
RP-250485

IRIS²
Introduction

SpaceRISE

▲ Contract signature on **16 December 2024**

- Total cost of the constellation: **€10.6bn ($11bn)**

EUTELSAT GROUP · SES · hispasat

SpaceRISE

Infrastructure Architect Member

ThalesAlenia Space

Subcontracted activities (Core Team)

AIRBUS DEFENCE & SPACE · ThalesAlenia Space · OHB · Deutsche Telekom · orange · TELESPAZIO a LEONARDO and THALES company · THALES · hisdeSAT

SpaceRISE Consortium proprietary and sensitive
IRIS² (DEFIS/2023/CD/0008)

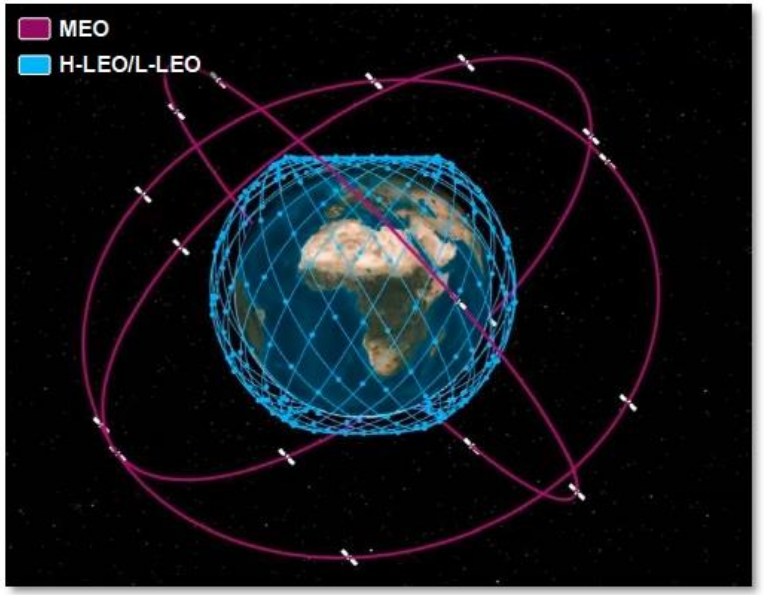
2

3GPP 6G Workshop
RP-250485

IRIS² – Technical description

SpaceRISE

Summary of technical features



Space Segment

- **264** satellites in **High-LEO** (1200 km)
- **18** satellites in **MEO** (8000 km)
- **10** satellites in **Low-LEO** (<750 km)

Connectivity

- **5G regenerative RAN in LEO and MEO**
- Support for transparent mode services
- Support for direct **UE-SAT-UE** connectivity
- Fully integrated in **5G Core Network**

UE

- **5G NR NTN** waveform in **Ku** and **Ka** bands
- **Mobile VSAT** terminals in both bands
- **Mobile broadband** satellite services
  (e.g., residential broadband, transportation, B2B satellite trunking, etc.)

3

International Collaboration

Global Standards & Partnerships

Memorandum

6GSNS ** MSSA
Mobile Satellite Services Association

SEAMLESS AIR ALLIANCE

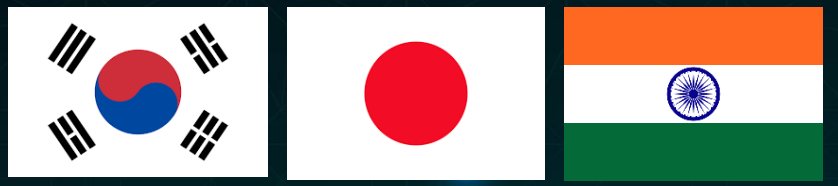
5G-EMERGE & D2D

In-Orbit Validations

Mixels REMI 6GLINO

International Collaboration

GSMA™ NTN Community



** NTN Forum

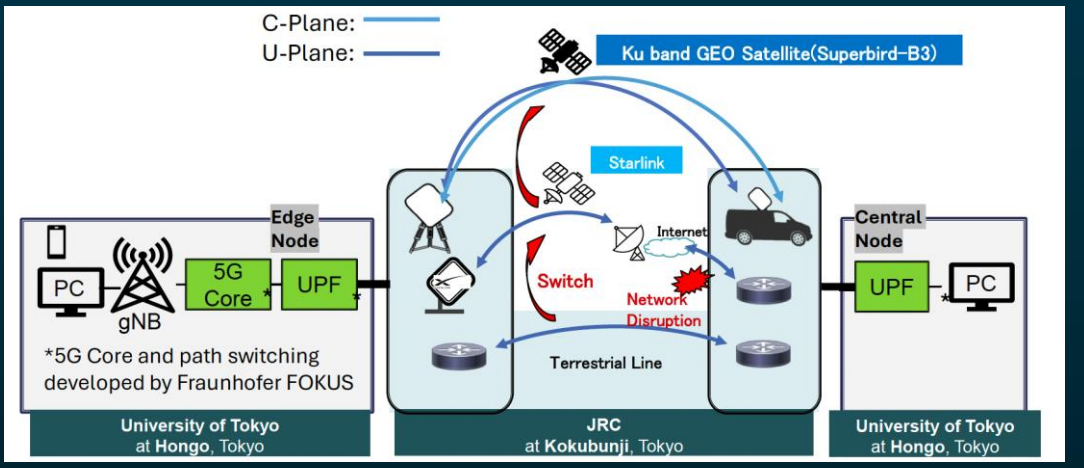
** In preparation


NTN FORUM
Hosted by the European Space Agency
38 Countries
219 Organizations
450 Registrations

ESA JAPAN Joint Efforts in 5G and SatCom

- 2008 Letter of Intent **(LoI)** between ESA-NICT
- 2009 Europe - Japan Satellite 5G/Beyond 5G workshop, NICT, Tokyo

ESA Japan joint demonstration experiments



Courtesy Mayuko Tsuji, Sachie Tsubokura (JRC) Broadsky Workshop, ka band conference 2024

Phase 1 trials (2020 – 2022) 5G Core over long distances –Video broadcast use combined with IoT
Phase 2 trials (2022 - 2024) Automatic Data path switch for LEO –GEO

Extend the successful collaboration on
'Joint Efforts in 6G NTN'

Acknowledgement

Japan side research results were partially obtained from the commisioned research in ”Research and Development on Satellite Terrestrial Integration Technology in Beyond 5G” by NICT Japan

ESA side research results were executed as part of the ESA ARTES Activity: “SATis5: Demonstrator for Satellite Terrestrial Integration in the 5G Context” Contract No 4000120663.

Let’s Build The Future Together

ESA is committed to building this future with you

Thank you!

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