ETSI Conference on
Non-Terrestrial Networks,
A Native Component of 6G

# Airbus views on 6G-NTN

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# 6G NTN – What's 6G and what it means for NTN?

## Interconnected heterogeneous networks

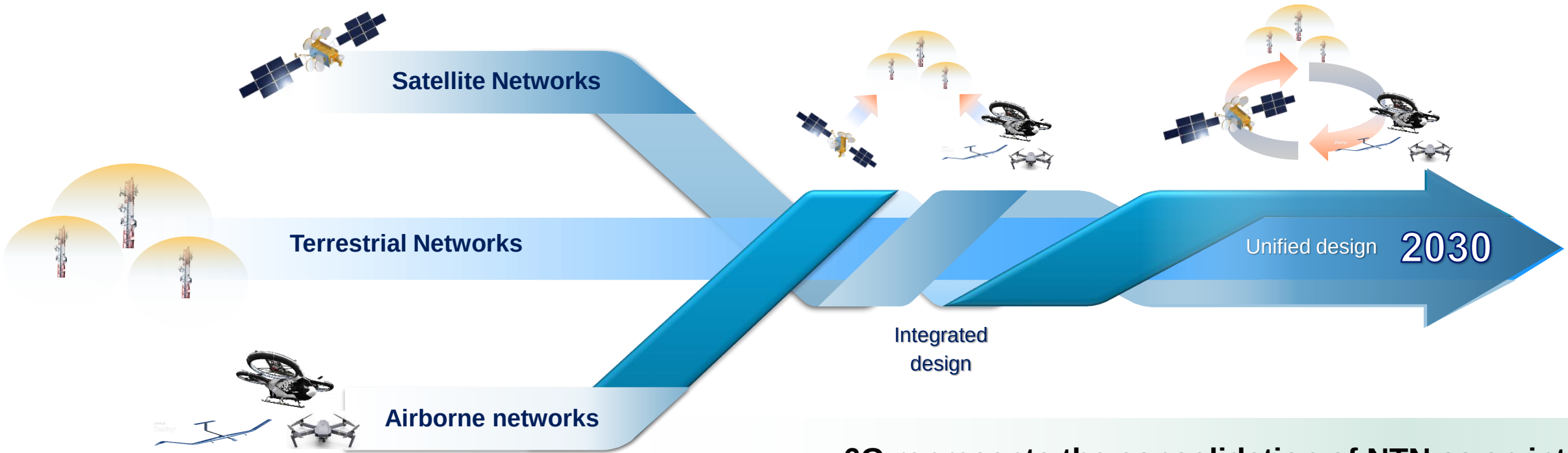
Design optimized **independently** and exclusively for terrestrial networks

## Seamless interconnections

Design optimized for terrestrial network component
**Minimum impact to support integration** of satellite for coverage and availability extension

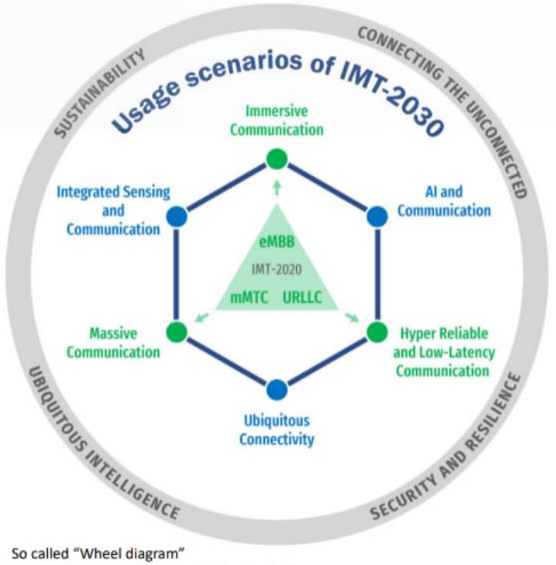
## Single unified network

**Design optimized for both terrestrial and space** components against a set of common goals




**6G represents the consolidation of NTN as an integral & native component of Telecom Ecosystem**

# 6G NTN- The true Global connectivity enabler




So called "Wheel diagram"
Source: Document 5/131 and edited in SG 5

## Integrated Sensing & Communications

| Aero Connectivity | Satellite-to-Device | Remote & Not-Spot Connectivity | Connected Cars | Maritime Connectivity | 5G for Defence / Gouv |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  | | | | |  |

6G NTN - Consolidation of Satellite role in future networks

- Enhanced User experience & Network capabilities
- Unique Ubiquity enabler
- Sustainable & Greener
- Increased Security and Resilience from Space

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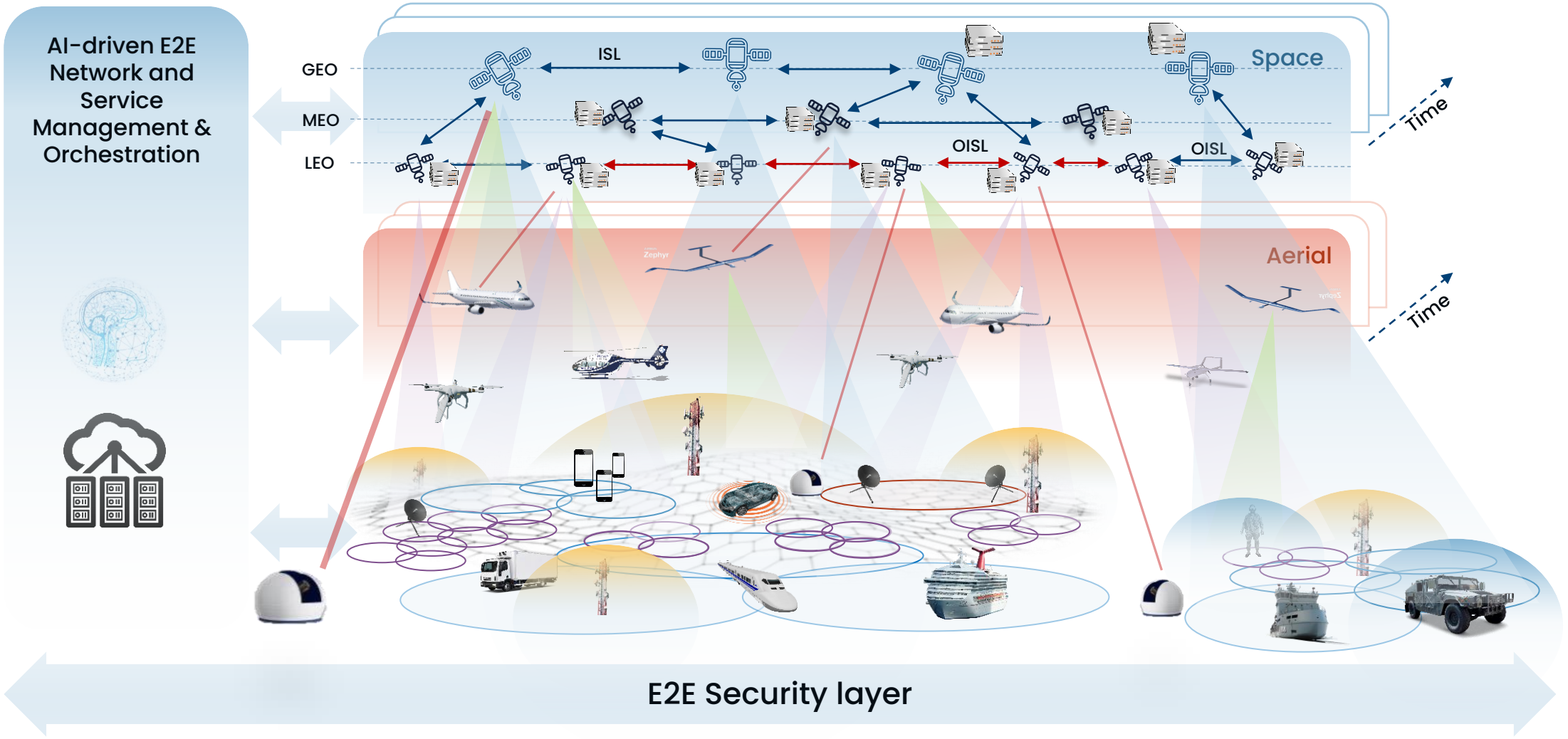
# 6G NTN – 3D Network Architecture vision

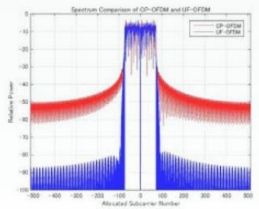


# 6G NTN– Key design drivers & R&D vectors (1/3)

## Efficient and flexible Waveform

**Spectrum efficient and flexible waveform optimized for both TN and NTN components**

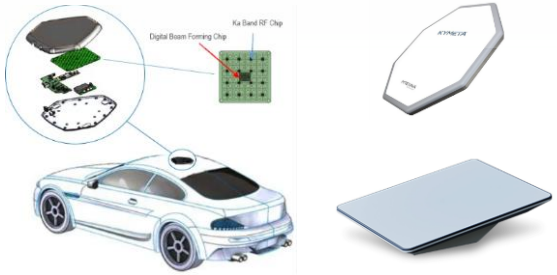
- Uniform waveform design for 6G NTN and TN with PAPR enhancements
- GNSS-free operation UE
- Advanced modulation, coding and multiple access schemes
- Flexible UL/DL framing structure ( residual multi-path in Satcom)
- Beam hopping-compatible



## Power efficient and affordable User terminal

**User terminals as the key enabler to unlock multi-orbit NTN and seamless TN/NTN integration**

- Power efficient user terminals to unlock diverse verticals
- Multi-orbit innovative ESA antennas as key technology enabler
- Reduced-size antennas for resource constrained UE
- Cost effective technology to close business case




## Free Space optics as 6G NTN meshed and high capacity enabler

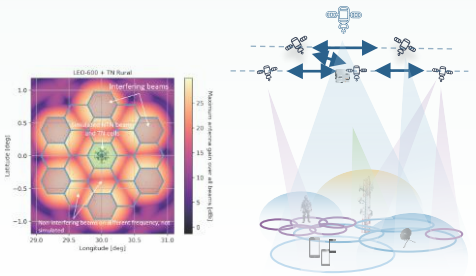
**Leverage on Optical technology to provide high capacity, resilient and mesh-enabled network**

- High capacity Optical ISL for Space mesh networks
- Efficient multi-orbit / multi-layer node connectivity
- High capacity feeder links for GSO and NGSO
  - Optimize ground segment CAPEX/OPEX by sensible reduction of ground stations

## Spectrum Coexistence TN / NTN

**Smart spectrum sharing across satellite and terrestrial to enable rapid NTN deployment**

- Near-optimal use of radio resources while leveraging on node and device capabilities heterogeneity
- Centralized management and optimization may be unavoidable to realizing a practical integrated TN-NTN
- Sensing and communication for cognitive spectrum sharing mechanisms



# 6G NTN– Key design drivers & R&D vectors (2/3)

## Multi-stakeholder Management and Orchestration

**AI-driven and Unified MANO towards a zero-touch management for multi-stakeholder TN/NTN networks**

- Standardized and open API NTN ground segment to seamlessly integrate NTN / TN and foster high interoperability networks
- SatCom adoption of 3GPP based Telecom Management & Orchestration frameworks
- Dynamic orchestration of VNF, smart routing and edge-based service provisioning in a dynamic network topology

## Evolving towards native NTN wireless AI/ML

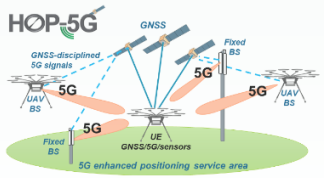
**Native AI/ML operating between devices and NTN network across all protocols and layers**

- ML operates autonomously between the device and network across all protocols and layers
  - Increase the “goodput” of a radio link through dynamic optimization of the radio interface configuration according to the radio link conditions
- Integrated ML procedures across to train performance and adapt to different environments
  - A more “open” ecosystem gives higher probabilities to obtain large-scale network data.


## Space functions convergence

**Integration of Communication, Computing, Caching, Sensing and Positioning**

- Use of RF communications signals for environmental monitoring (atmosphere, ground) and precision positioning
  - Enhanced positioning, navigation and timing (PNT) thanks to 5G/6G NTN infrastructure, especially with LEO satellites.
  - Integrated Sensing and Communications (ISAC)
- In-orbit data centers for storage and computing

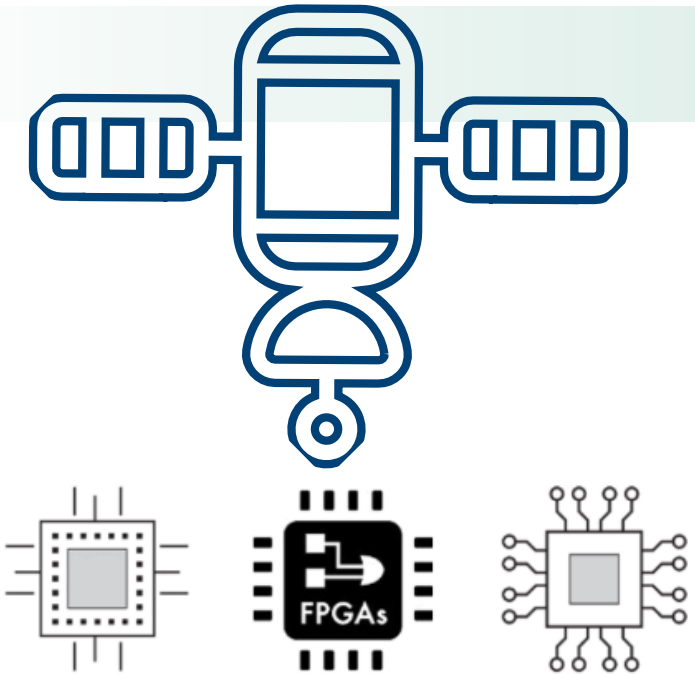



## Multi-layer NTN transport network

**Semantic networking and smart routing protocols for dynamic network topology**

- Seamless integration of terrestrial, airborne and spaceborne networking nodes (and users)
- Dynamic movement of nodes in the sky and space
  - Routing optimization
  - Handovers
- Placement of network functions in constrained platforms (LAPS, HAPS, Satellites)

# 6G NTN– Key design drivers & R&D vectors (3/3)




**6G space network nodes adopting functionalities beyond pure communication**

## Advanced On-board processing Payloads and Platforms

### On-board Processing (OBP) as a key enabler

- On-board PW efficient and optimized SW mission Implementation
- AI-driven OBP Hardware design
- High-Performance Edge Computing Services in the satellite for 5G/6G NTN use case for **Load Balancing** and **Latency Reduction**

### New Satellite concepts & technologies

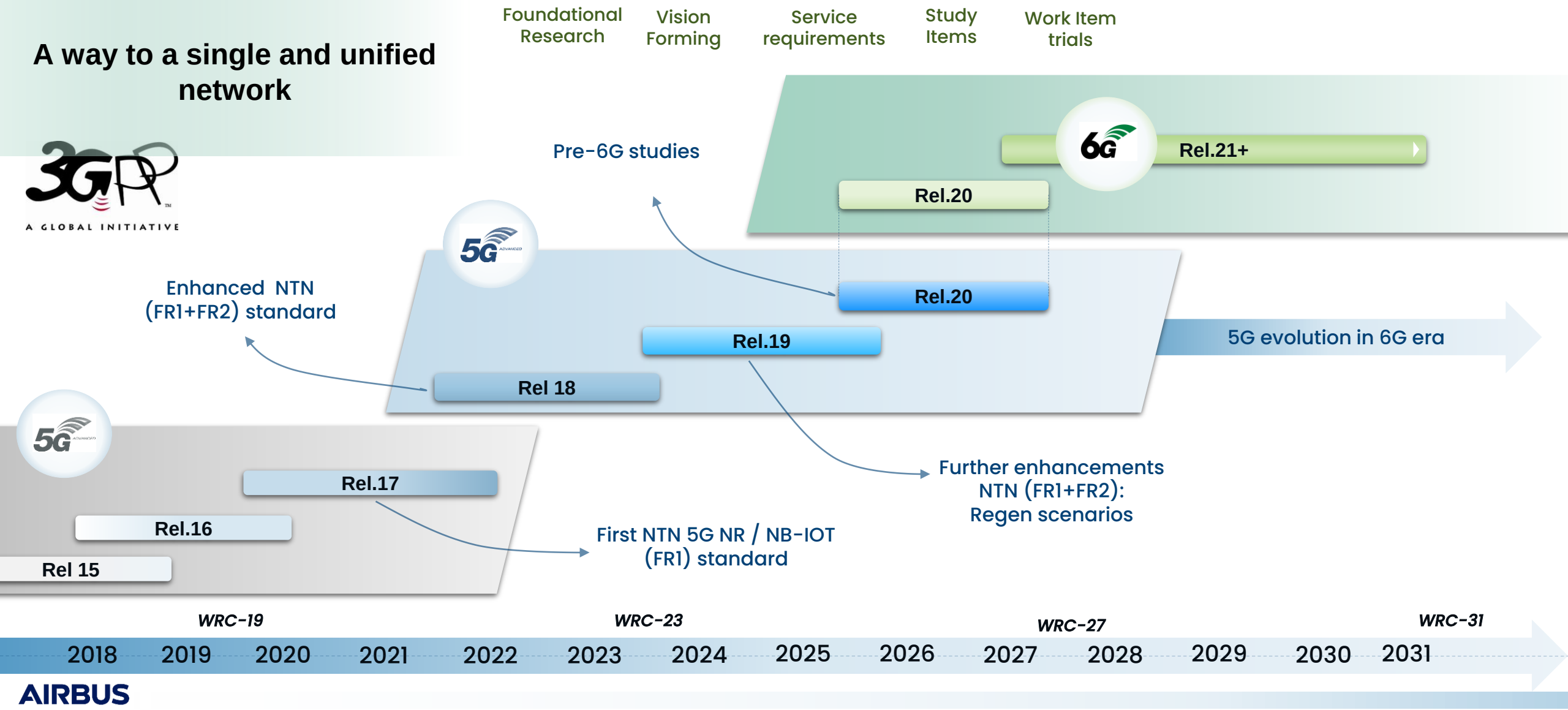
- LEO Flat platforms to accommodate large antenna arrays (FR1)
- Different active antenna concepts (FR1 / FR2)
- High data rate OISLs

### Re-purposable multi-mission 5G/6G Payloads

- 5G Earth Observation Server in Space (Repurposable 5G Payload)
- Convergence of Space Functions
- Integrated Sensing and Communication (ISAC)

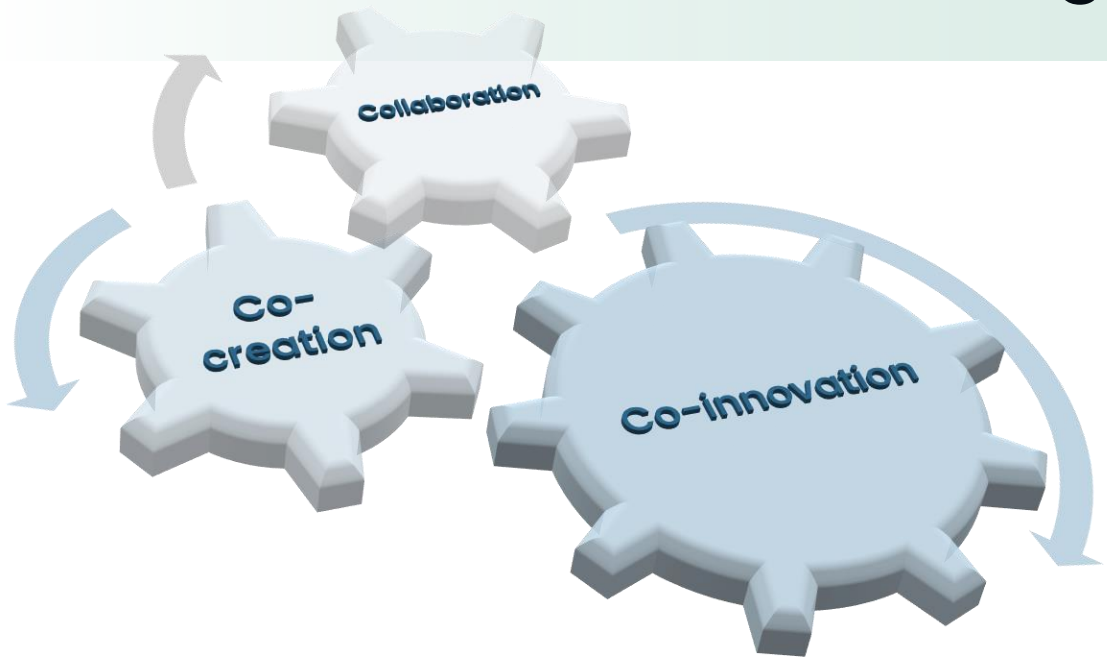
# 6G NTN – Standardization, key of success…

**A way to a single and unified network**



# 6G NTN – …as well as partnerships

## Collaboration, Co-innovation and Co-creation




**5G/6G NTN is revolutionizing satellite communications**

- Promises to unlock new revenue streams
- Become part of the global telecommunications ecosystem

**The satellite industry has to transform**

- Need to align with Telco standards and technologies
- Adapt the pace to follow 3GPP ecosystem
- Demonstrate business cases and build confidence
- Co-Innovate & -Create with vertical market stakeholders

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# Thank you

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