ESA Webinar

NTN Connectivity to support autonomous land vehicles.

- Use Cases -

NTN and TN are complimentary technologies.

By Design NTN offers a certain bandwidth per area. The number of devices is in direct correlation with the available bandwidth.

Coverage extension for **ubiquitous connectivity**

Sustaining bandwidth capacity for **seamless connectivity**

Network **redundancy** is greatly improved for small bandwidth services

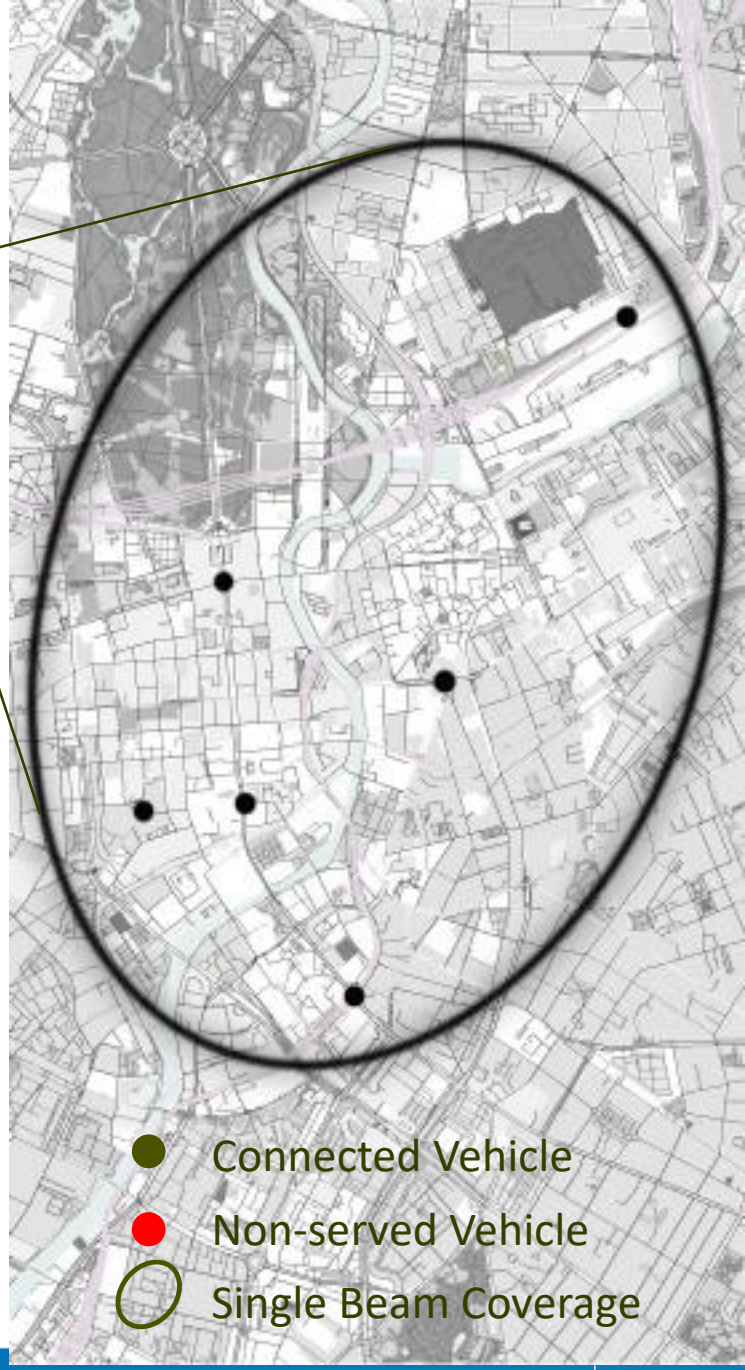
Broadband won‘t be available for everyone

Connection limited to **line-of-sight**

Frequency and **landing right regulations** are complex

NTN is a an important resource of ubiquitous connectivity.

A seamless NTN and TN product offer is key for a better (premium) connected life.



NTN must be integrated in Mobile Networks.

Ubiquitous Connectivity:

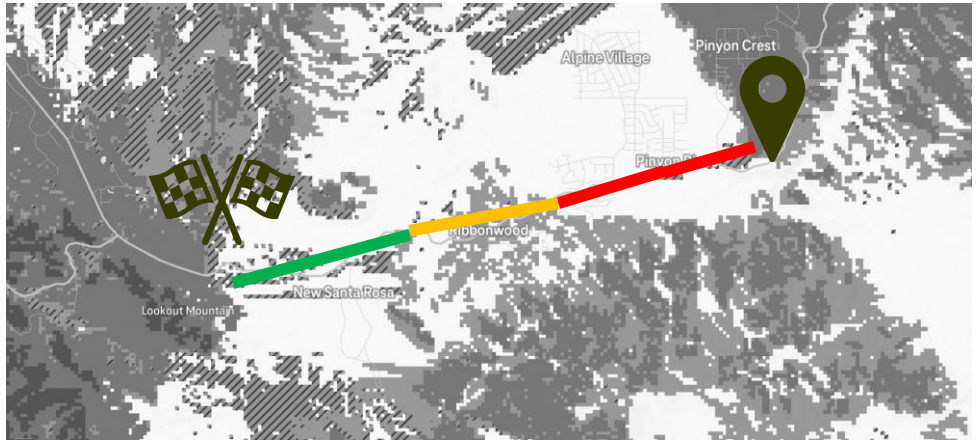
Filling the gaps of mobile networks.

Mobile Network Coverage around Palm Springs CA

In some areas there is no coverage at all.
Even narrowband applications like Emergency calls or remote control or service applications can´t be guarantied.

Seamless connectivity:

Balancing inconsistent coverage.



Mobile Network Coverage around Palm Springs CA

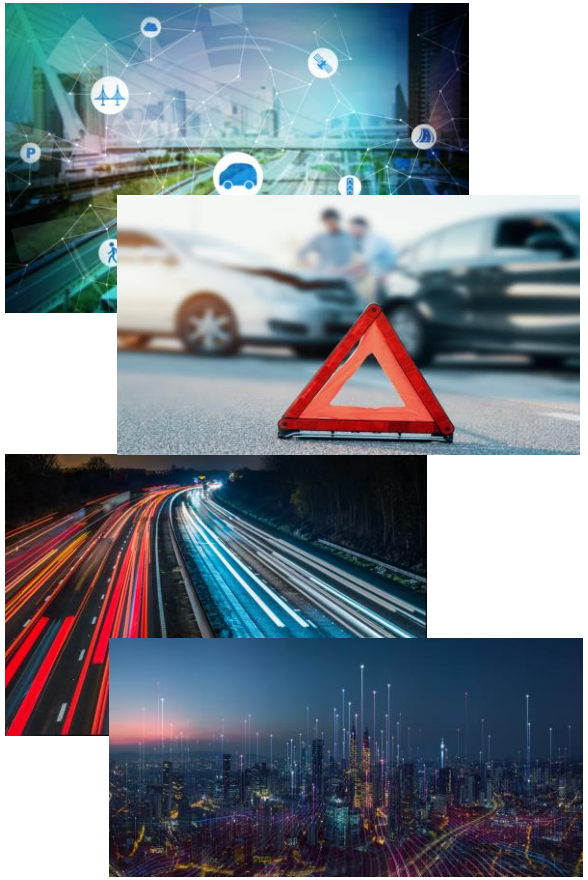
Mobile Networks are not able today to provide continuous connectivity even near-urban areas resulting in interrupted phone calls, streaming or entertainment services.

- **No pure NTN Use cases have been identified. NTN acts as complementary extension of mobile networks.**
- **Integration of NTN and TN on the basis of 3GPP Standards is our key requirement.**

Key benefits that NTN can bring to support the autonomous land vehicles sector (1/2).

1. **Connected cars performance parameters remote collection and processing** identified from road testing and/or related to V2X connectivity status might adopt NTN communication to complement terrestrial networks.
2. **Seamless transition between 4G/5G TN and NTN** for V2X and info transmission, such as road and safety information in remote areas.
3. **Traffic management in disaster situation.** NTN communication could be used as backup to TN for small bandwidth services.
4. **Commercial fleet management and logistics** rely on availability of mobile networks. NTN communication could be a viable option to monitor health and condition of assets on wide geographic area.

Key benefits that NTN can bring to support the autonomous land vehicles sector (2/2).



5. **Internet of Things (IoT) providing connected devices for on field monitoring and connected vehicles** to empower connected operations throughout vehicles telematics and smart monitoring sensors.
6. **Real time hazard warning** allowing autonomous vehicles receiving information relevant for the road ahead like route obstruction, potholes, or others.
7. **Hazard information collection and sharing** where vehicles collect hazard and road event based sensor data. Sharing of this data can be done via satellite communication.
8. **High Definition map update** to receive the highly dynamics parts of a HD map updated in real time for accurate trajectory planning and collision avoidance.