GMV's GNSS activities in LEO-PNT systems engineering and applications of interest for GMV

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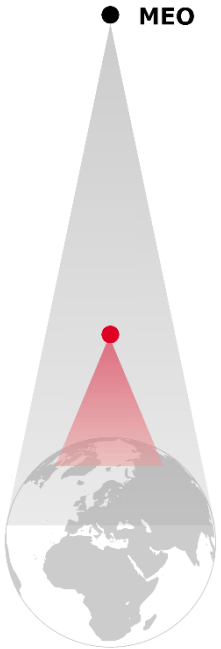
GMV-ICL-1

Overview

Context – The moment for LEOPNT

MEO (Medium Earth Orbit) orbits are usually preferred for global systems; the higher the altitude, the fewer satellites are needed.

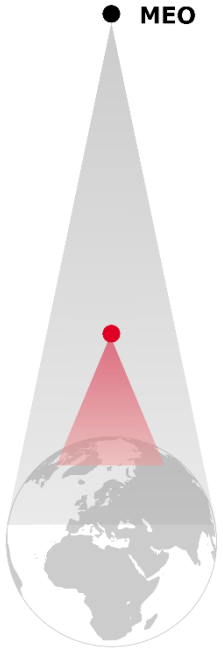


Private companies like **Starlink** offer services from space with constellations made up of **thousands of LEO satellites**.

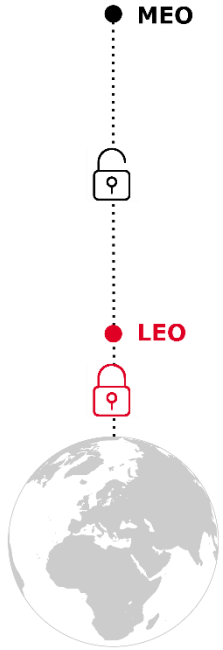
The **launch vehicle sector has undergone a revolution** in the last 15 years with the introduction of reusable rockets and new companies.

There is **growing interest in having alternative navigation solutions** without common failure modes with GNSS, in order to mitigate (economic) **risks**

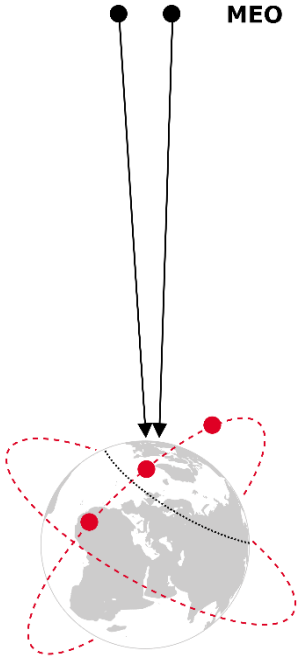
Why LEOPNT?



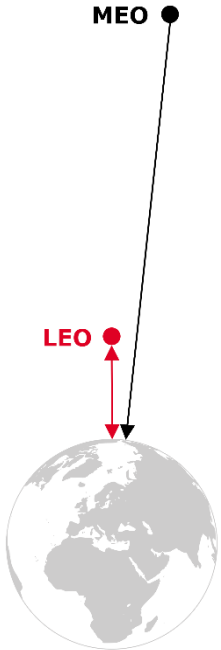
STRONGER SIGNALS



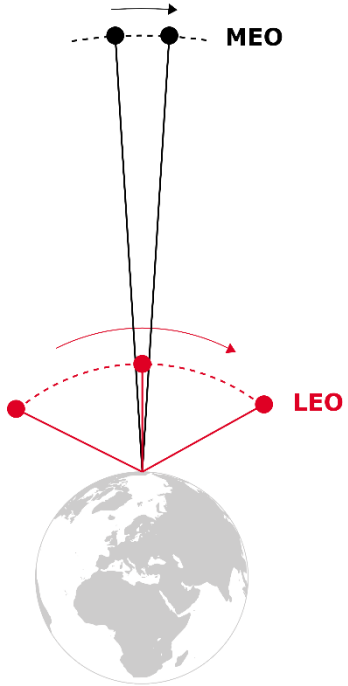
NEW SERVICES NEW SIGNALS



GEOMETRY DIVERSITY



TWO-WAY



FASTER DYNAMICS

LEO-PNT In-Orbit-Demonstrator

The **European Space Agency (ESA)** has launched a new program to develop space infrastructure with Low Earth Orbit (LEO) satellites.

The first step is the **LEO Orbit Demonstrator** for **Positioning, Navigation, and Timing (PNT) services**.

Accelerate LEO PNT **from concepts to demo through Fast-Track In-Orbit** and prepare the future anticipating PNT market trends and more demanding needs.

The mission includes the development and deployment of a complete system: **satellites**, **launchers**, **ground segment**, and a **user segment**.

The interest of end-users in key sectors such as **automotive**, **maritime**, **railway**, and **drones** will be evaluated.

A total of **five satellites** will be launched: **one pathfinder A** and **four pathfinder B** to complete the constellation by 2027.

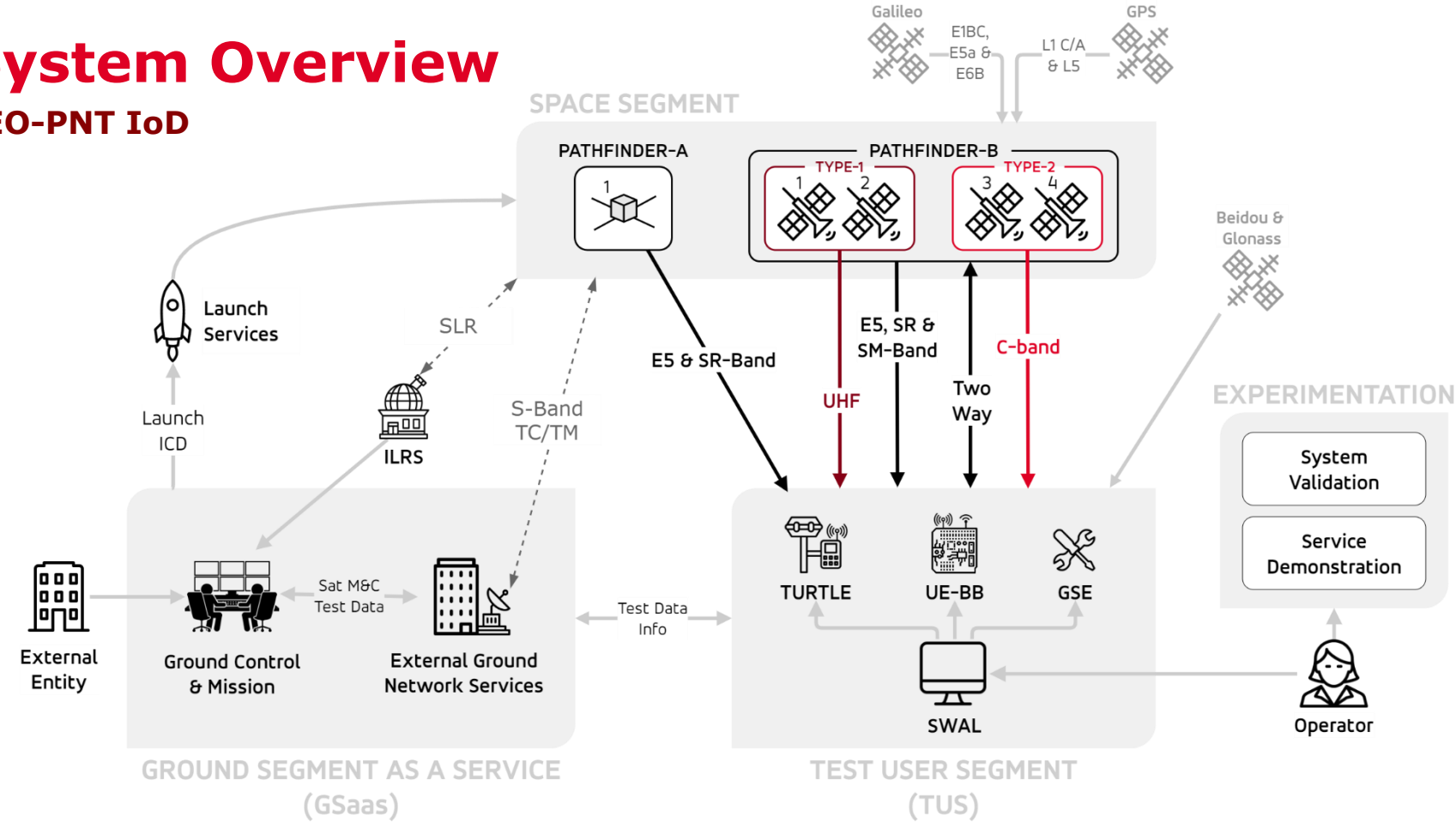
GMV is prime contractor of one of the two parallel European consortia responsible for the full mission.

78,4 M€ - **4 years** contract

GMV leads **pfA**, **Ground Segment** and **Operations** and Test **User Segment. a**nd coordinates launch activities.

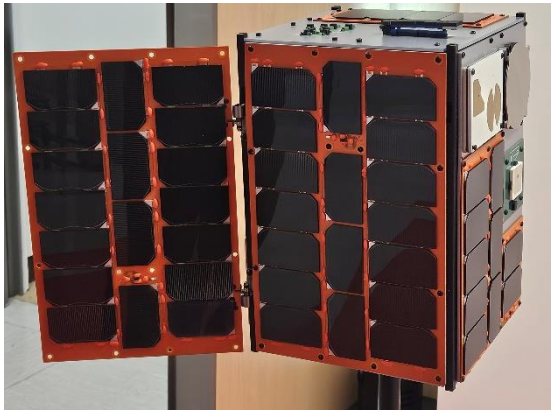
System Overview

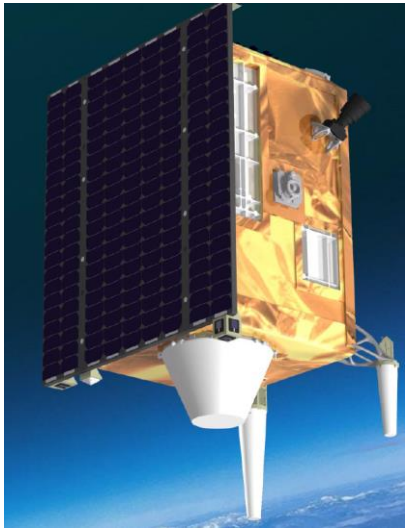
LEO-PNT IoD



Space Segment

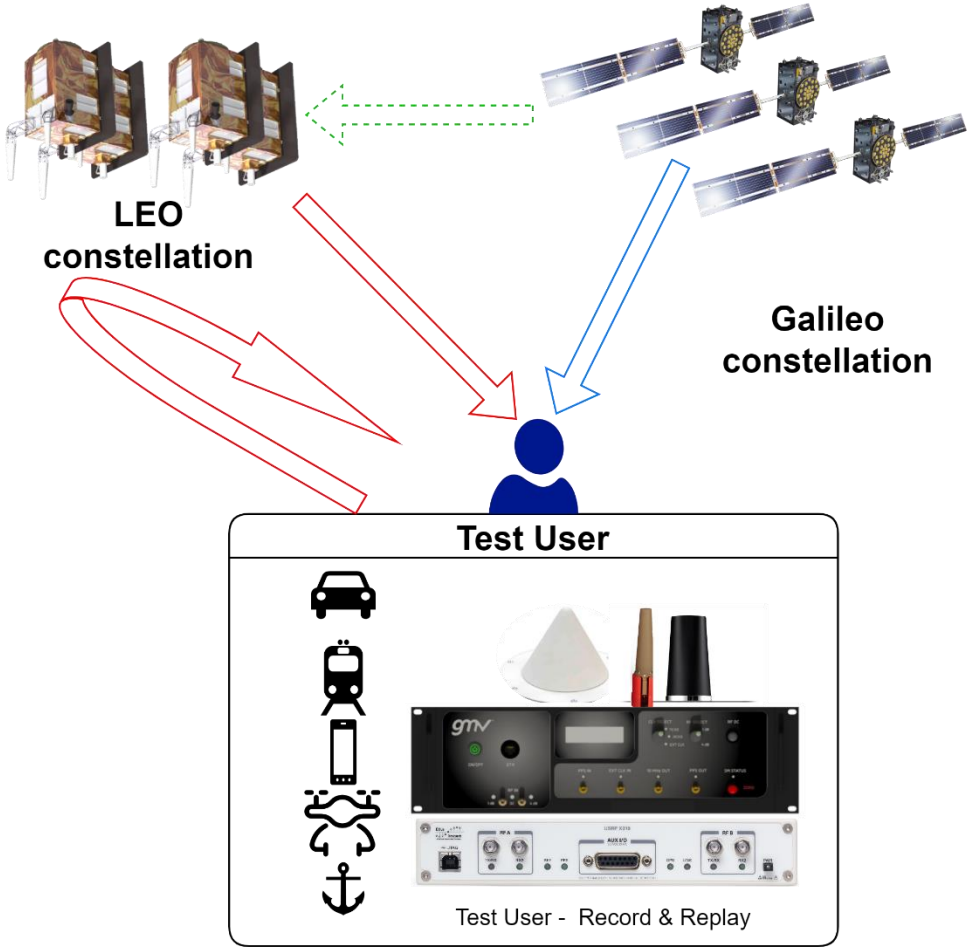
- One **12U Cubesat** precursor satellite **(Alén/GMV)** to be launched in Q4 2025
- **4 Microsatellites (OHB)** will follow with in 2027 with additional capabilities.
- New advanced signals in **UHF**, **L, S** and **C** bands.
- Innovative "**LEO shield**" concept for GNSS signals integrity monitoring.





User Segment

- **Test User Receiver and Transmitter** for the LEO PNT, supporting all IoD signals and functions.
- **Ground Support Equipment** with peripherical and complementary functionalities in support of the IoD
- **User Equipment Breadboards**, tailored to be representative user/field scenarios and configurations.



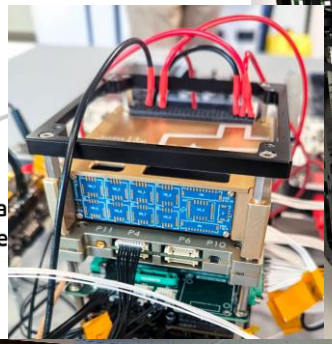
Ground Segment and Operations

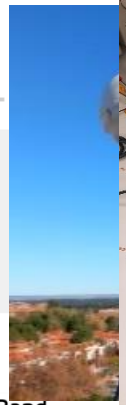
- **Ground Segment is provided as a Service** (GSaaS) by GMV.
- The **Control Center** is physically located in GMV premises in **Tres Cantos**, hosted in a **PaaS** which provides computational and storage resources.
- **Ground Stations** provided by KSAT.
- **Operations** are also provided by GMV.

NEW SPACE

KICK-OFF MEETING (APRIL 2024)

JANUARY 2025





External Entity

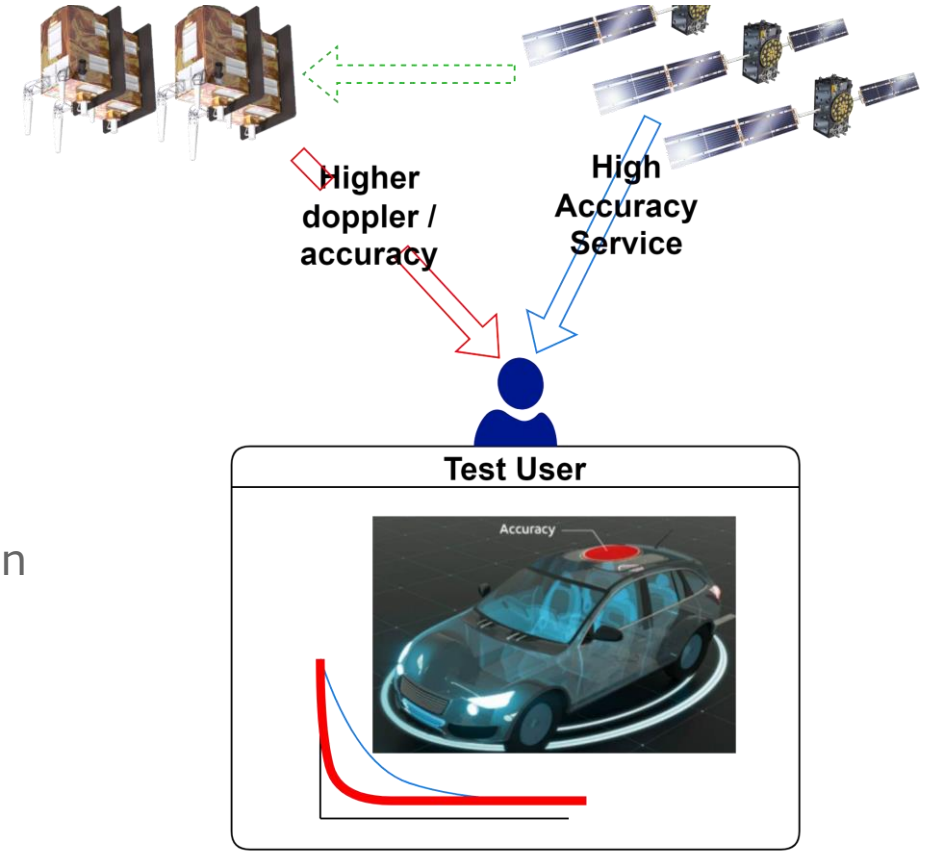
System Validation

Experimentation and applications of interest

Standard PNT & PPP accuracy in challenging enviroments

Experimentation

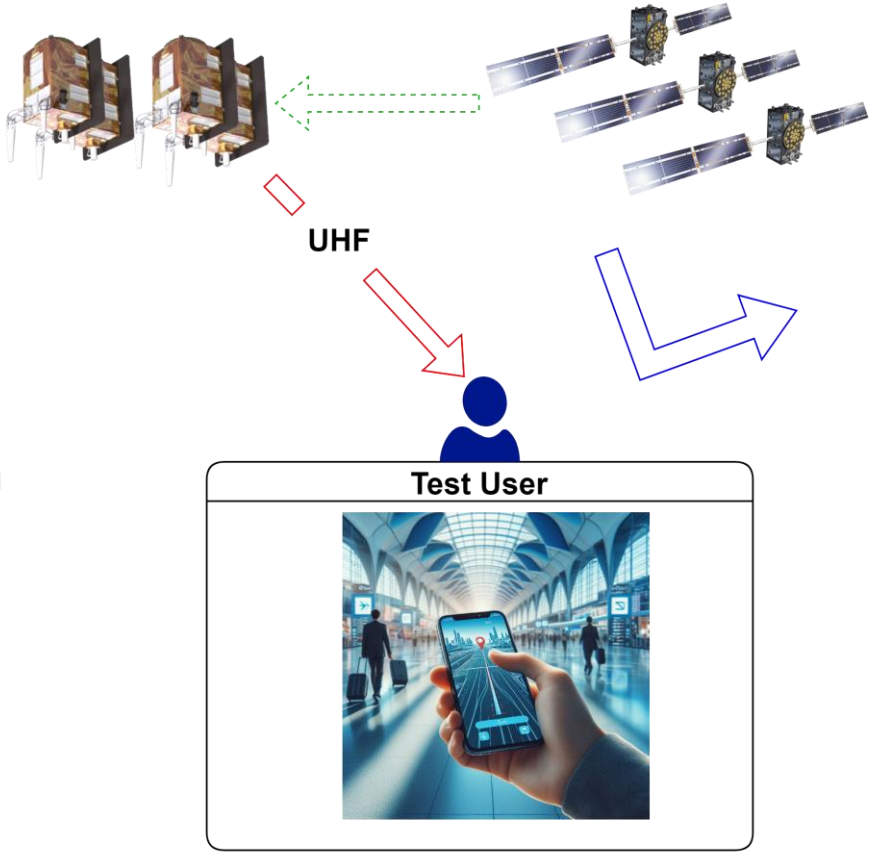
- Improved accuracy for User Rx
- Faster convergence time for User Rx
- Rapid geometric change of the LEO satellite with respect to the user station can remove atmospheric correction's dependency (and multipath!)
- Safer driving with better integrity and time to response!!!



Indoor navigation without infrastructure

Experimentation

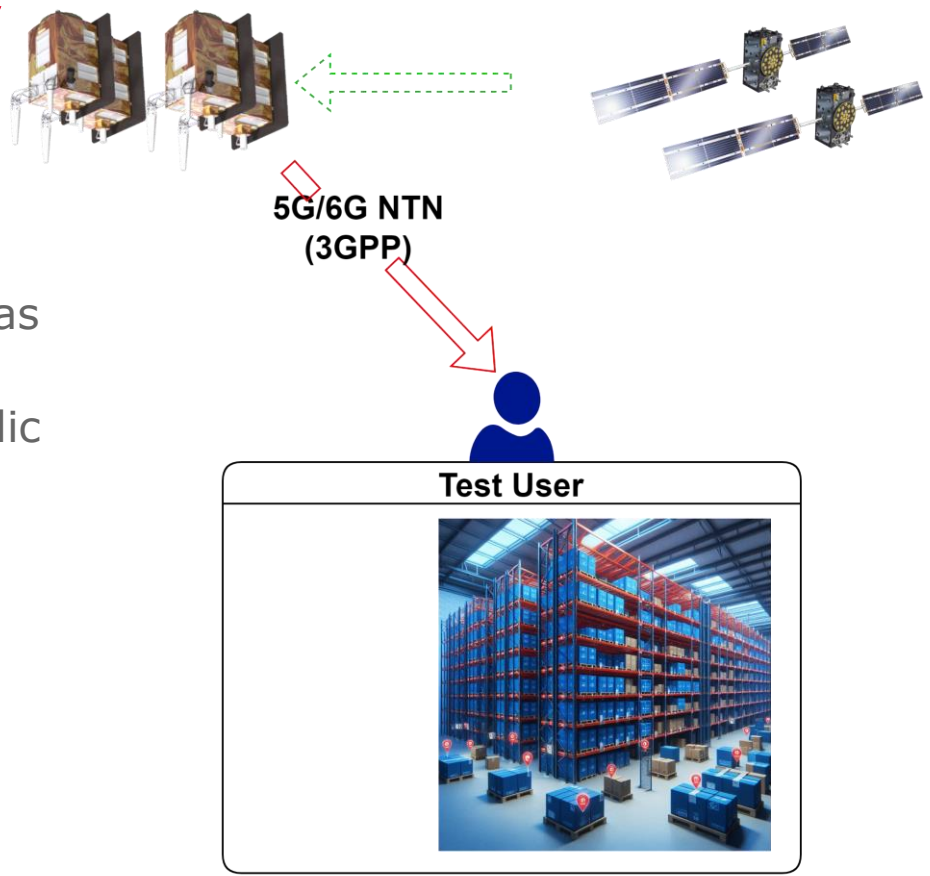
- New signals with better indoor penetration will allow PNT.
- Indoor positioning without deployment of infrastructures configured to the area of interest (e.g. 5G, Wi-Fi)
- Autonomous indoor navigation



Positioning of low energy devices

Experimentation

- New 5G / 6G NTN (3GPP) signals
- Low Energy PNT for IOT devices such as asset tracking devices.
- Sc1. Low Energy PNT for short, sporadic Connections
- Sc2. Low Energy PNT for long connections
- Also LoRaWan under test
- Focused on asset tracking devices.



Applications of interest for GMV

GMV ♥ LEO-PNT

- Improvement of PPP service, mainly for automotive (GMV Gsharp service)
- "LEO Shield" service, and other integrity/reliability applications
- On-board solutions for other LEO initiatives, not necessarily related to PNT
- Provision of Timing Services (including indoor).
- Integration of PNT with 5G Services
- Defence markets / secure positioning

GMV GSharp®

Thank you

Andrés Juez