TELESPAZIO
a LEONARDO and THALES company

Workshop EGNOS

Rome

24 – 25 September 2019

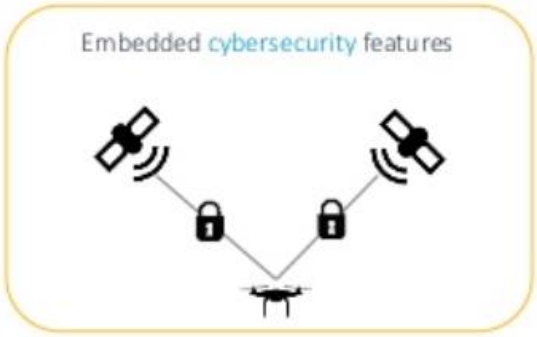
U-Space Services and Roadmap

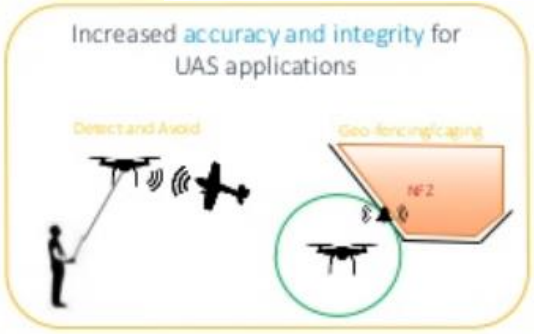
U1 (Foundation services)	U2 (Initial Services)	U3 (Advanced Services)
E–registration	Tactical geofencing	Dynamic geofencing
E–identification	Tracking	Collaborative interface with ATC
Pre–tactical geofencing	Flight planning management	Tactical deconfliction
	Strategic deconfliction	Dynamic Capacity management
	Weather information	
	Drone aeronautical information management	
	Procedural interface with ATC	
	Emergency management	
	Monitoring	
	Traffic information	

U–Space is a set of new services and specific procedures designed to support safe, efficient and secure access to airspace for large numbers of drones.

U-Space Services Issues Addressed by Telespazio Solution

- Need for enhancement of GNSS accuracy
- Lack of information of real-time monitoring of GNSS performance during flight;
  - Drone pilots trust on HDOP data only;
  - Unknown errors on NSE;
  - Low cost GNSS receivers are not able to provide GNSS integrity (even if the fix provided is based on EGNOS).
- GNSS threats not yet considered for small drones;
- Tampering position by drone pilots
- C2 and data link loss





The following main services are based on EGNOS/EDAS:

- Provisioning of Real-time EGNOS Drone position and integrity information to UTM in order to support operations requiring higher safety levels;

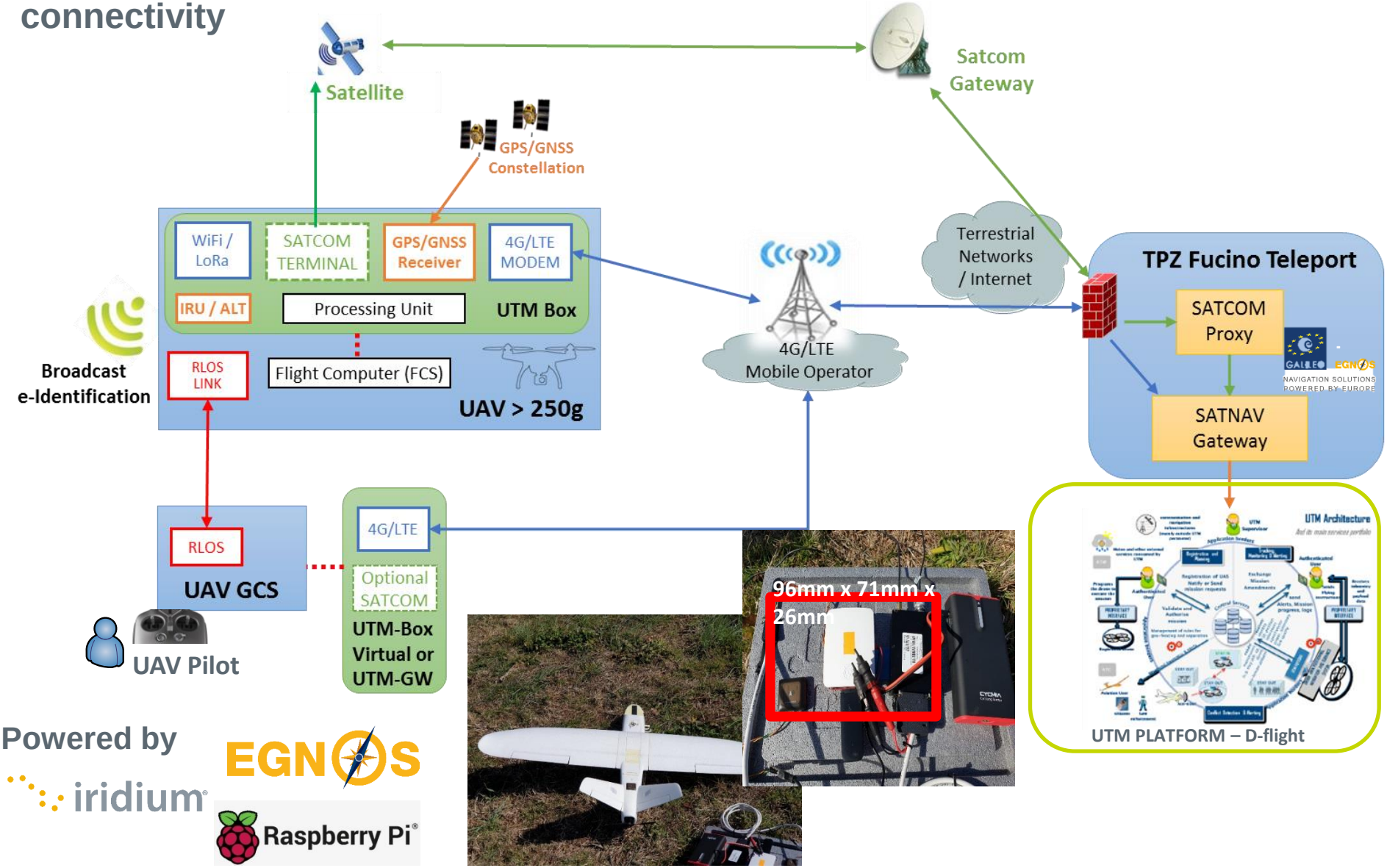
- Provisioning of Real-time EGNOS Drone position and integrity information to support drone operator in BVLOS operations;

- Anti-tampering functionality to support UTM in protection of positioning data.

- GNSS Monitoring and detection and mitigation of GNSS threats

The aim of the platform is to provide services to make safe, efficient and secure access to airspace for a large number of drones. This is done augmenting Drone positioning accuracy and integrity and giving the necessary situation awareness about GNSS performance during usual operations.

The reference architecture is based on an integrated terrestrial and sat connectivity



Powered by

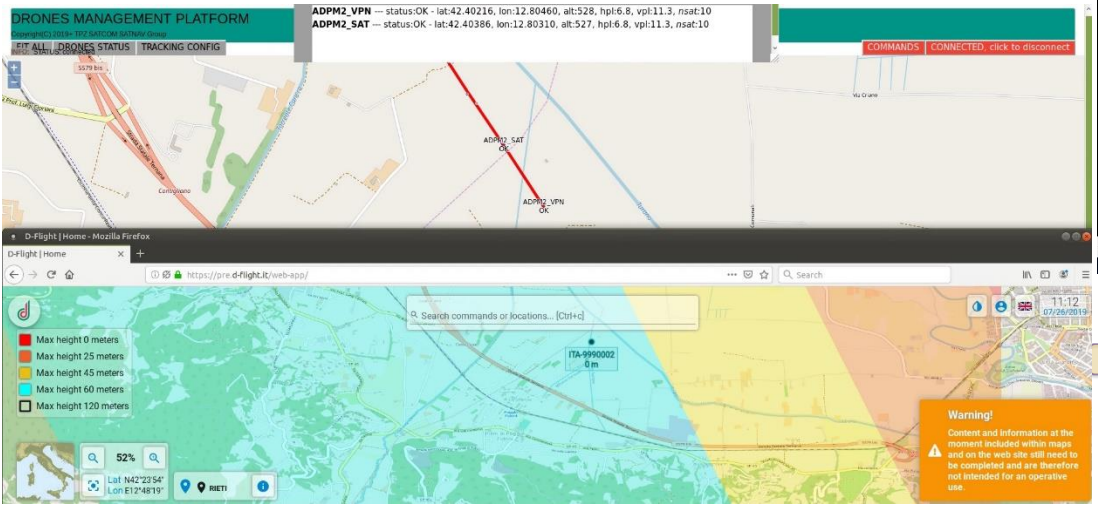
iridium EGNOS Raspberry Pi

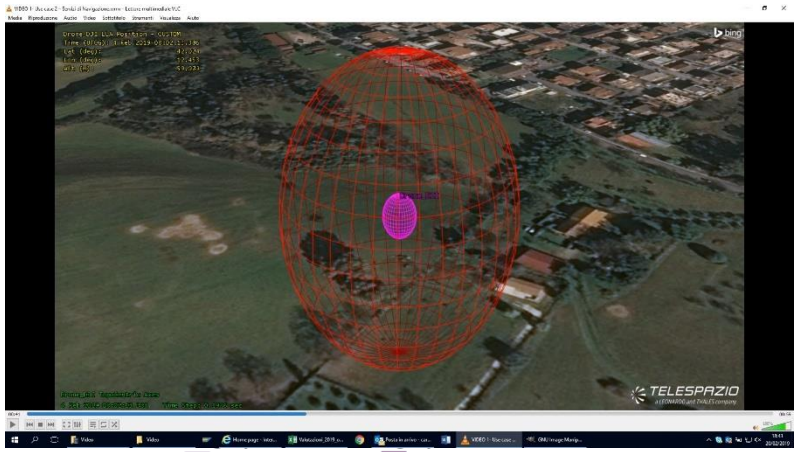
Real-time EGNOS Drone position and integrity

Provision of Real-time EGNOS Drone position and integrity information to UTM in order to support operations requiring higher safety levels

Provision of Real-time EGNOS Drone position and integrity information to support drone operator in BVLOS operations

GNSS Augmentation DATA:
Protection Levels
Status





NO Safety (red sphere)

Positioning Reliability (BVLOS Enabler)

- Geo-fencing
- Collision-Avoidance

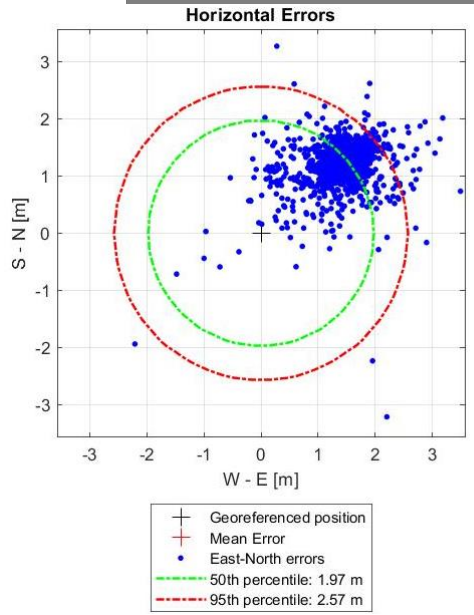
- SBAS Augmentation
- Integrity
- Accuracy

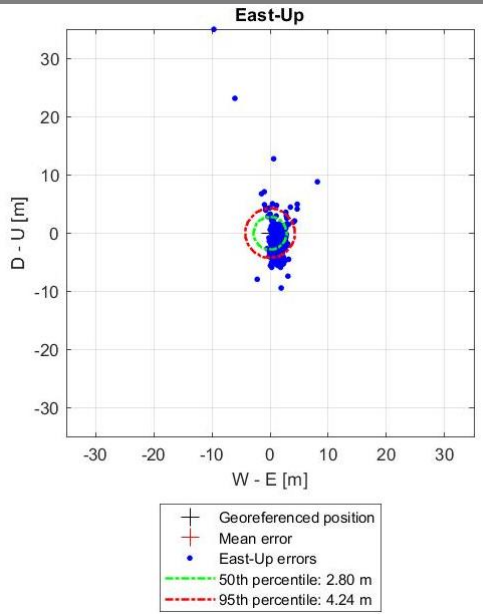
BRLOS

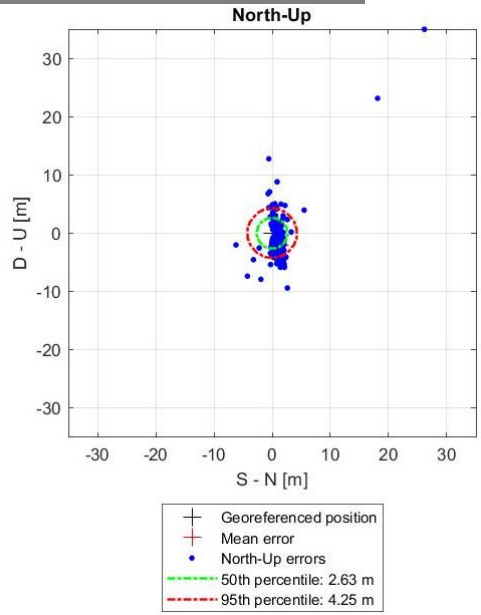
- Spoofing/Jamming Detection

D-flight Italian U-Space service provider

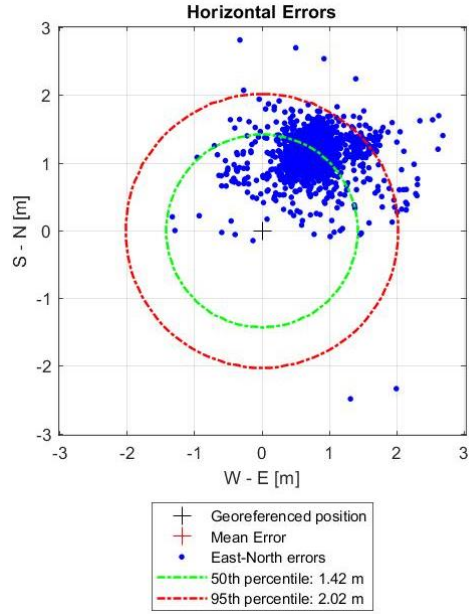
GNSS performance on a fixed wing drone - F2V Project flight test

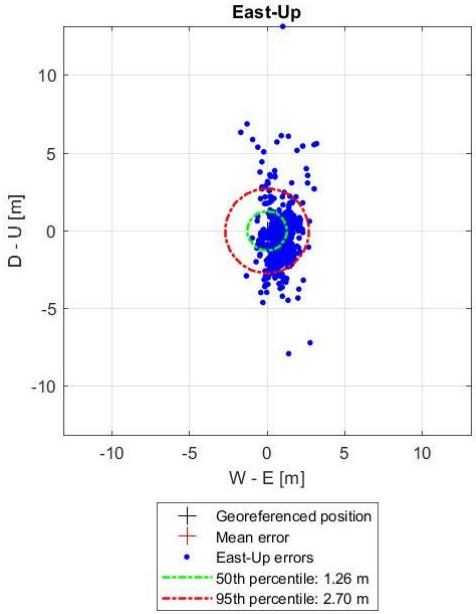


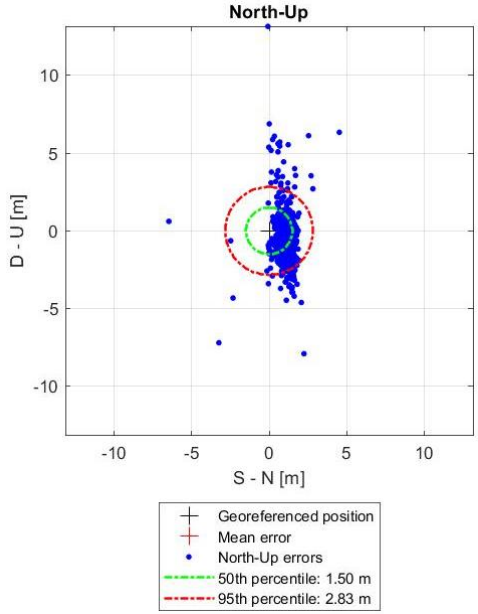




GPS standalone on-board Receiver Perfomance





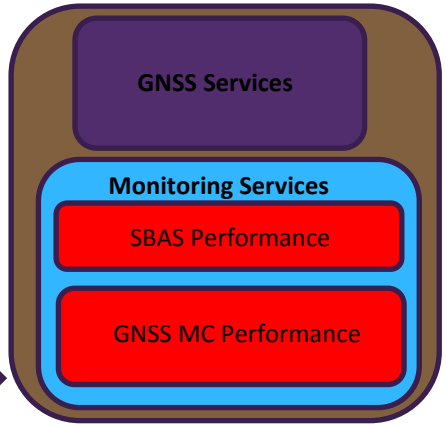


TPZ Augmentation Positioning Service Perfomance

GNSS Monitoring and detection and mitigation of GNSS threats

Anti-tampering functionality to support UTM in protection of positioning data

Drones Raw Data



Critical areas to Monitor

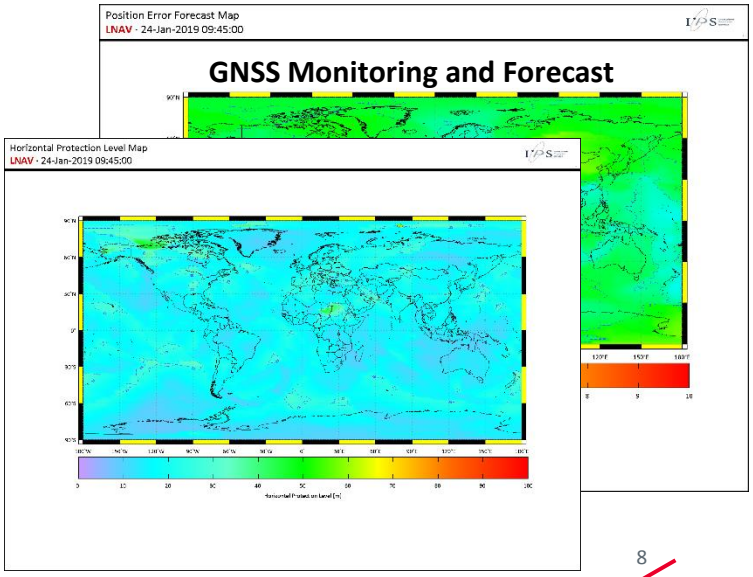
GNSS Stations Data

BRLOS

Monitoring output – all to UTM:

NOTAM
- *Anomalies report (postprocessing)*
- *Short time forecast of GNSS performances (30min to 45min)*
- *Ground Spoofing detection (real-time)*
- *Ground RF interference detection (real-time)*

To RPAS Operator
- *On-board GNSS Integrity monitoring (real-time)*
- *On-board RF Interference detection (real-rime)*
- *On-board Spoofing detection (real-rime)*



Full Flight View F2V – Paving the way for Telespazio drone services

Objectives

The Project F2V – Full Flight View integrates various Telespazio, E-geos, DBW and MPB Technologies installed on ADPM remote piloting aircraft for:

- **Safety flight operational context**: To implement new solutions that allow to operate/flight in safety state simulating different operative conditions;
- **Application field:** Innovative solutions for the territory control trough immersive mode, accuracy position, production of 3D maps of electromagnetic pollution and infrastructures control with 360°video camera, Video surveillance, all these data available on the AWARE platform with the integration of other data from cross-platform and multitemporal.

F2V Flight Trials have been done in the Turin area of Dora Park.

TELESPAZIO una società LEONARDO e THALES — *Team leader*

e-geos AN ASI / TELESPAZIO COMPANY

ADPM drones Lightweight efficiency

dbw communication

MPB WE ELECTRONIC!

Turin flight platforms and sensors/products

Flight type 1 Multimotor (MTOW max 8Kg) ➡ Safety of flight operations and Land control

Flight type2 Harmless drones (MTOW < 300g) ➡ Use for professional purpose for surveillance and monitoring of infrastructure.

Demonstration Objectives

Sensors/products

Iridium constellation

4G/5G/LTE Mobile Network

AWARE

Agile Watching of Asset and Resources

Electromagnetic sensor

VR/AR Viewer

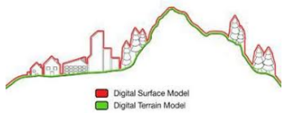
4K 360° camera

EDAS

EGNOS SatNav

HD Camera
FHD Camera

DSM/DTM Model



Reference Users

- UTM Service Providers
- Drone Operators
- Public Security
- Public Safety
- Critical Infrastructures monitoring/Interference monitoring

Running Telespazio R&D activities to support development of services for Drones:

- ***D-Flight*** - Development and Services of the Italian UTM Platform (ENAV/Leonardo/Telespazio)
- ***DIODE*** – D-flight Internet Of Drones Environment (U-space call 2018) with ENAV
- ***RPASInAIR*** – Integrazione dei Sistemi Aeromobili a Pilotaggio Remoto nello spazio aereo non segregato per servizi (MIUR) with DTA (Aerospace Apulia District)
- ***F2V*** - Full Flight View

- The developed architecture foresees a GPS or EGNOS (Open Service) receiver on board of the drone transmitting GPS raw data to a component of the Ground Segment in charge of performing Real-time EGNOS processing and monitoring of GPS navigation messages.

- Depending on the communication link used, raw data are received, using **LTE** or **Satellite links**, by NAVGW, the specific Telespazio service component designed and developed to enhance the accuracy of positioning and to evaluate its integrity in order to empower GPS only low cost receiver with EGNOS and allowing the exploitation of EDAS services for U-Space

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