European Global Navigation Satellite Systems Agency

Co-funded by the Horizon 2020 programme of the European Union

The GISCAD-OV Project: Innovative GNSS High Accuracy Services for Cadastral Surveying

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«EUREF 2021 Symposium »

27 May 2021

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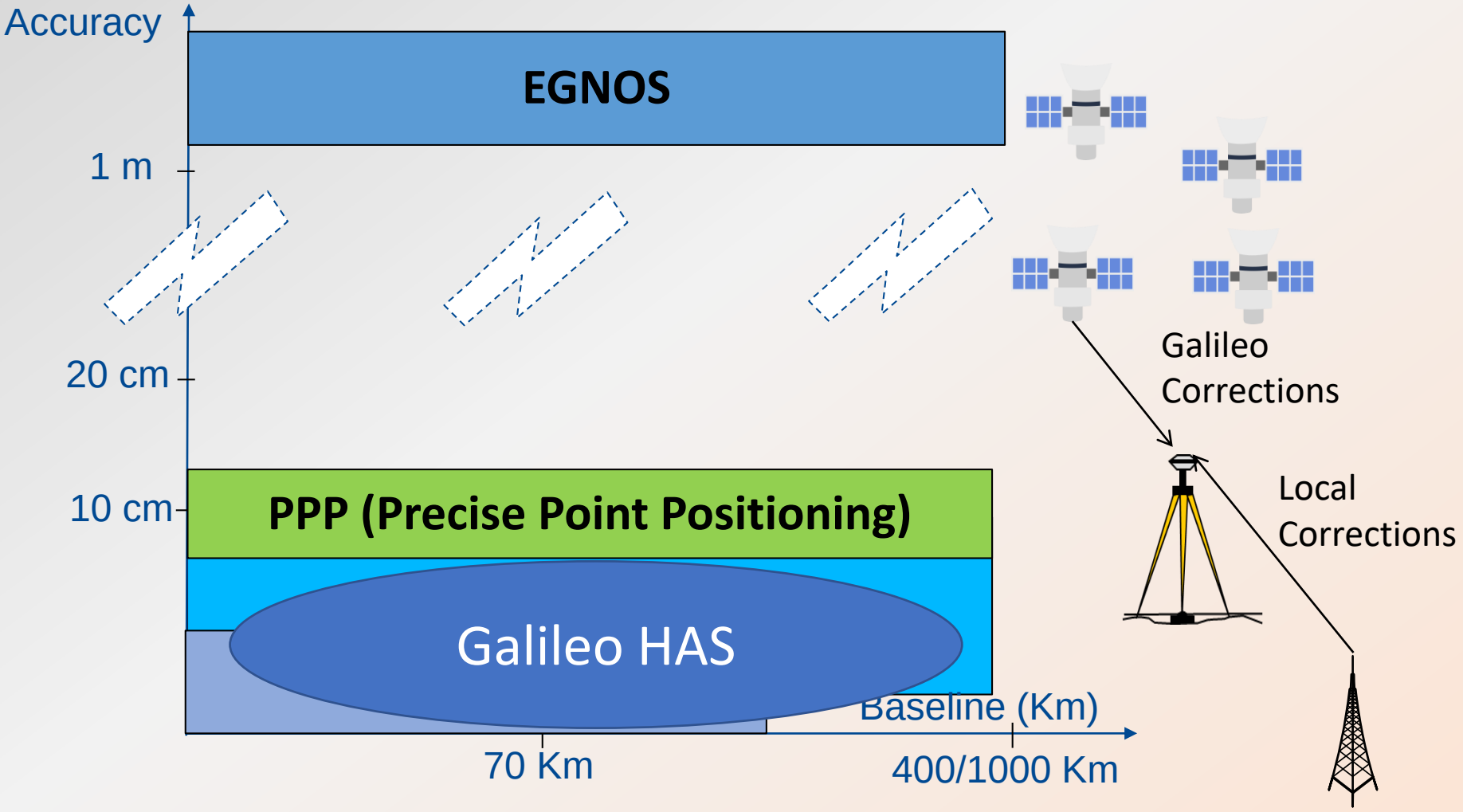
GNSS High Accuracy Services: current status



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Project Organisation

- Horizon 2020 Project
- Started on December 2019
- Project Duration: 36 months

- Project Members:
  - International Organisation of Surveyors
  - Local and PPP Service Providers
  - Service Providers
  - PPP and NRTK Software Company
  - NMCAs
  - Surveyors Service Providers
  - Receiver Manufacturers
  - Universities
  - RTCM and ISO Standardisation Chairmen
  - Advisory Board, including NMCAs

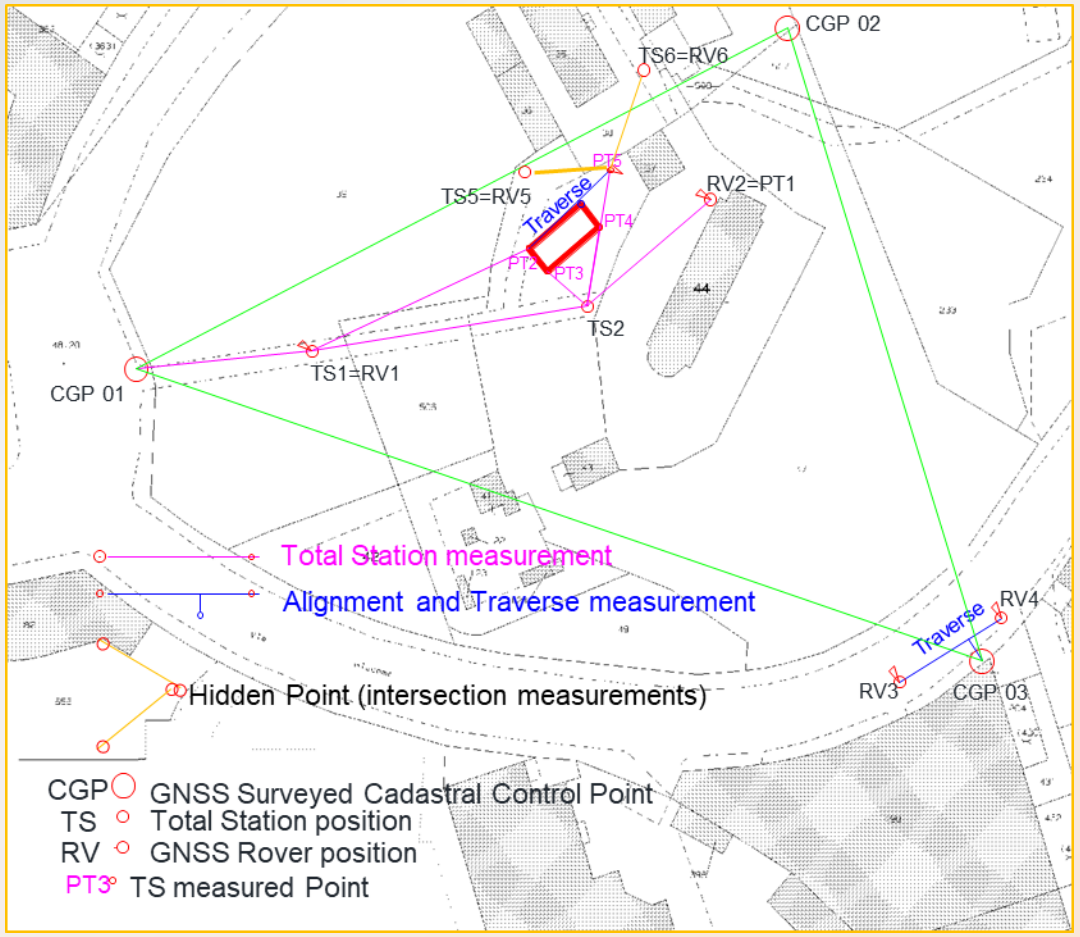
Organization	Type
GEOWEB SpA	Industry
EXAGONE	Industry
IGN-CNIG	Public Body
SOGEI SpA	Industry
UNIPD	University
GEO++ MbH	Industry
NOVATEL Inc	Industry
YORK University	University
GEOFLEX	Industry
TU Delft	University
TELESPAZIO	Industry
VUGTK	Public Body
CLGE	Public Body
UNIROMATRE	University

Project objectives

- **Objective**: design, development and validation of **reduced cost GNSS High Accuracy Services** for Cadastral Surveying and **Infrastructural Monitoring** applications through **Galileo HAS services, PPP and PPP-RTK**
- Main activities:
  - **Cadastral Surveying Requirements for High Accuracy GNSS**: all Value Chain actors involved (Augmentation SP, Software Companies, NMCAs, Professionals)
  - **Design and Development of an Augmentation System** for affordable and *reduced service price* High Accuracy Services for Cadastral Operations
  - **Cadastral Surveying Pilot Projects in seven EU Countries** Validation of Galileo Commercial Services and PPP through Cadastral Surveying
  - **Scientific and Cadastral Validation:** GNSS performances and NMCAs quality check
  - **Business Analysis** Involvement of the whole Value Chain for defining an affordable and cost effective Services for Surveyors
  - **Standardisation**: contribution to RTCM (SC-104, SC-134) and ISO 19152 LADM (LanD Administration Domain Model)

Cadastral Surveying procedures

- Instrumentation: GNSS, Total Stations, EDM
- Hidden Points
- NMCAs Validation
- Average Surveying duration more than 2 hours
- Surveys/year in single EU Countries: 10000-1300000
- National Reference Framework and INSPIRE



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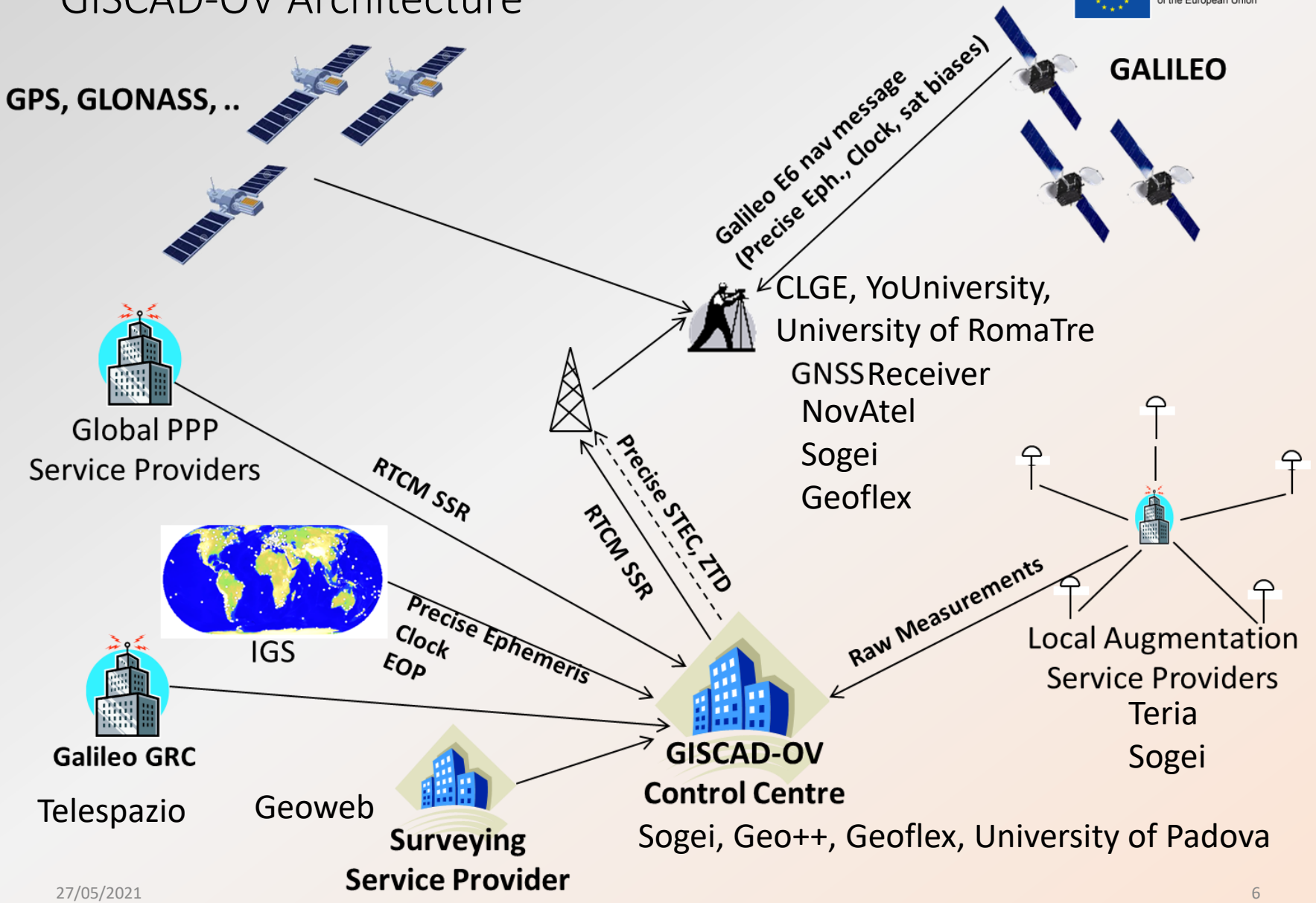
GISCAD-OV Architecture



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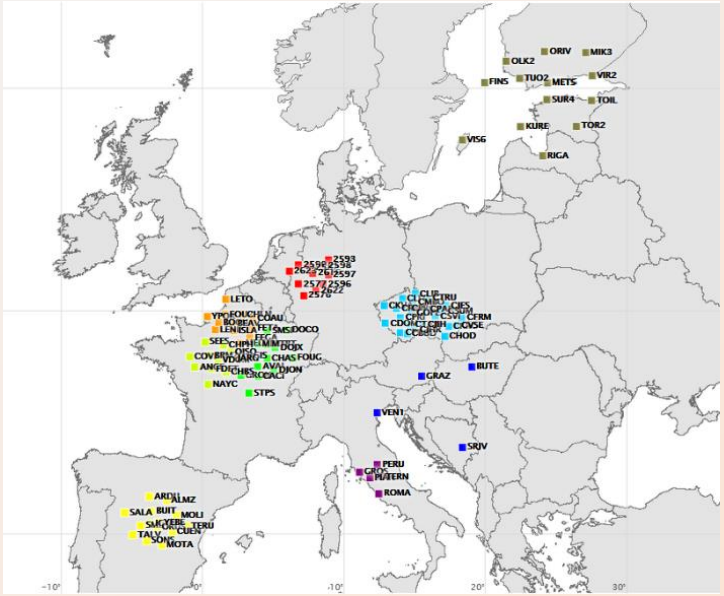
GISCAD-OV Service Levels

Cadastral Operation	Accuracy Requirement (1 σ)	Integrity	Availability	Time for Convergence/TTFA
SL1 Suburban or rural areas, cadastral map updates	30 cm	$2*10^{-3}$/hour (1)	High (97%)	Less than 10 min
SL2 Detailed Cadastral Points, Buildings insertion, boundary determination	<5 cm	$2*10^{-3}$/hour	High (93%)	5-10 min
SL3 Detailed Cadastral Points, Buildings insertion, boundary determination	<5 cm	$2*10^{-3}$/hour	High (93%)	1-5 min

(1) Derived from the maximum acceptable number of lost surveys/year

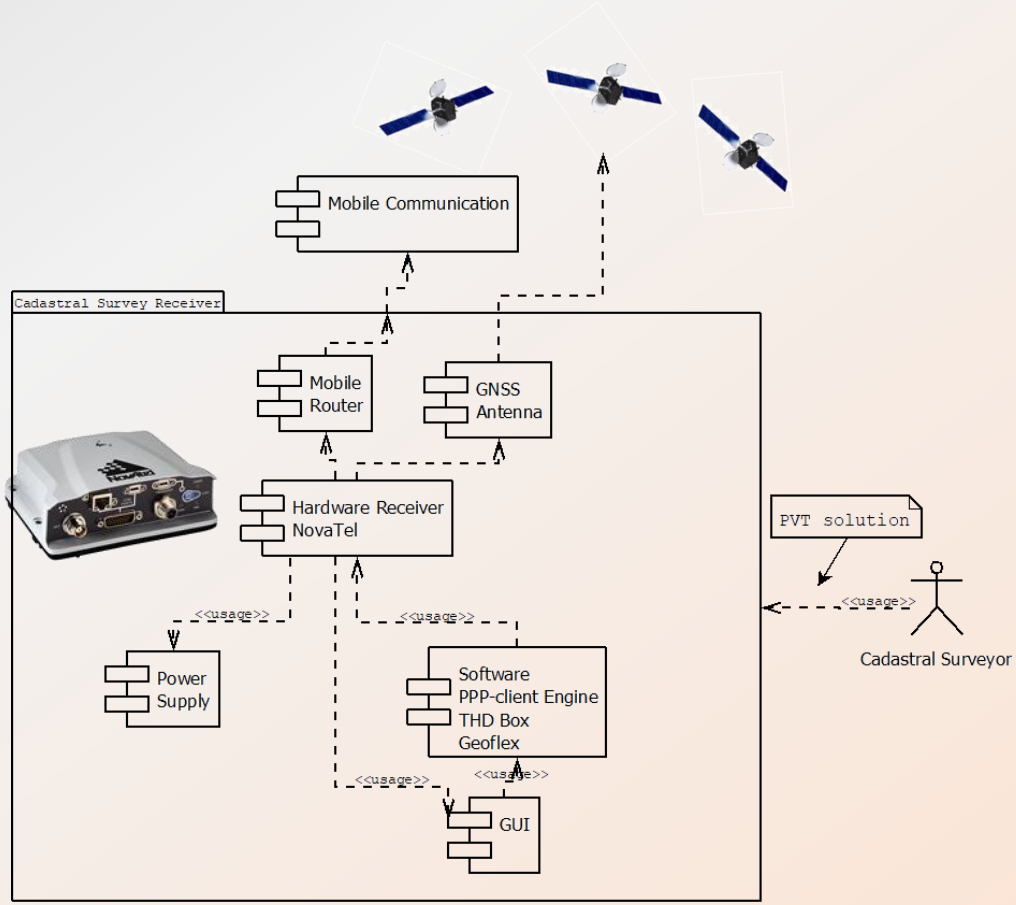
GISCAD-OV Control Centre and Augmentation (Sogei, Geo++, Geoflex)

- Integration of different GNSS High Accuracy systems:
  - Local Network SSR (Geo++)
  - Global SSR (Geoflex GNSSMart)
  - Reference Stations
- Performance analysis vs RTK and NRTK systems
- Control Centre in Rome (Sogei Data Center)

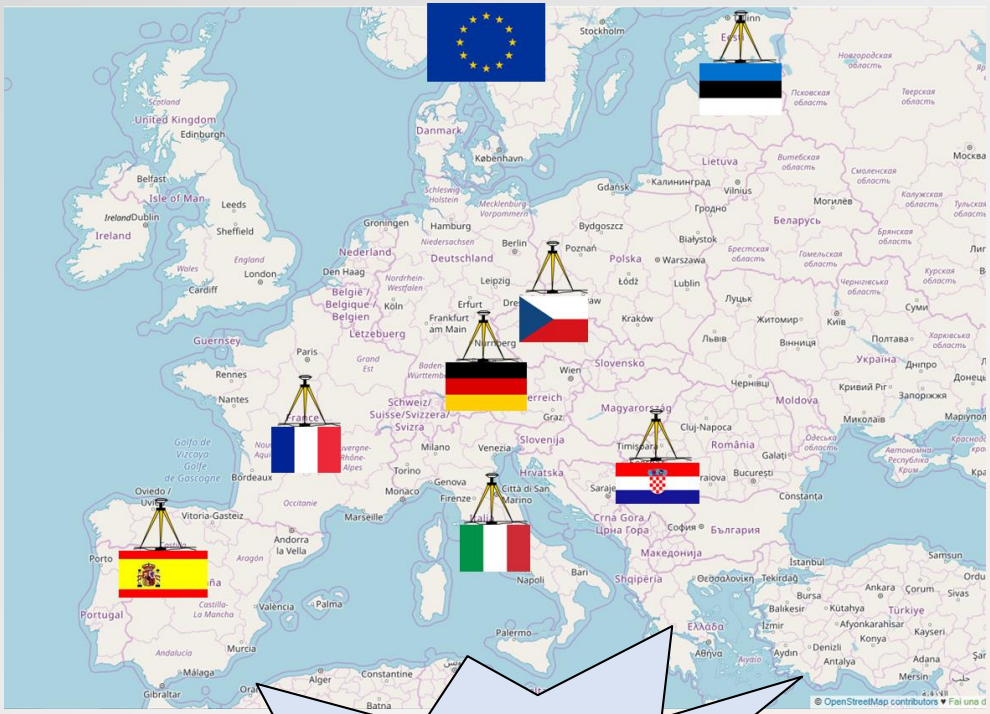


On-field Receiver Equipment

- Based on Commercial Receivers (NovAtel)
- Software receiver engine
- Mobile Communication
- Customizable output format
- Full Standard compliance and full backward compatibility vs RTK and NRTK



Pilot Projects (Lead by CLGE)



- ❑ Czech Republic
- ❑ Estonia
- ❑ Croatia
- ❑ France
- ❑ Germany
- ❑ Italy
- ❑ Spain

5 surveys/Country (NMCAs rules applied)

Galileo Based Infrastructural Monitoring on a bridge

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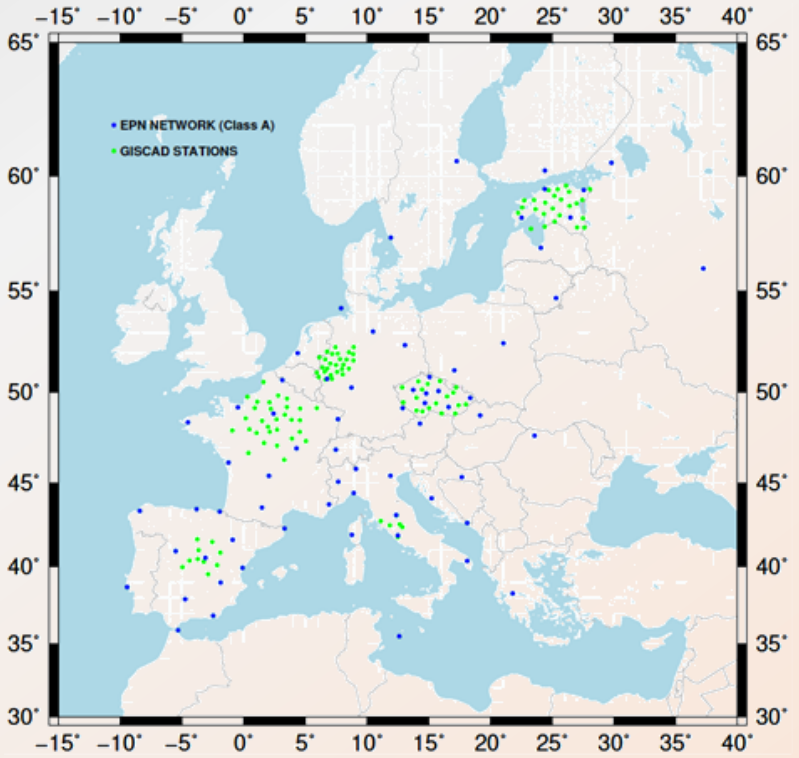
Reference Framework Determination (University of Padova)

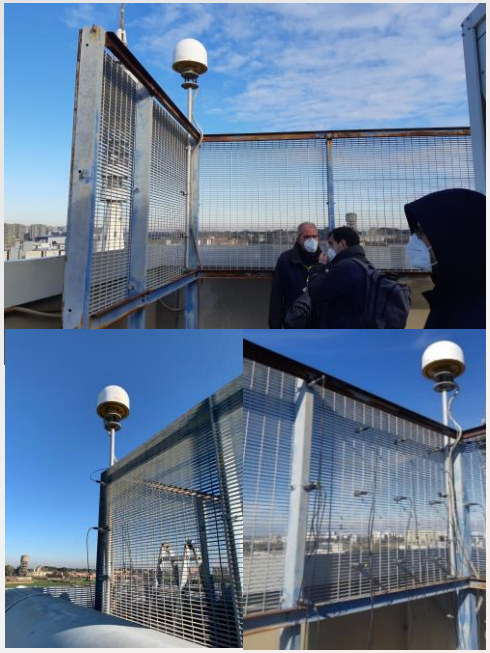
- European Reference Station files collection
- Weekly geodetic solution (IGb14 and ETRF2000)
- Global to National Reference Framework transformation parameters derivation
- INSPIRE Directive Compliance



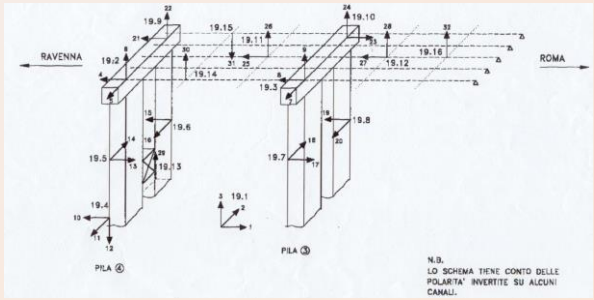
Infrastructural Monitoring (University of Roma Tre)

- Integration of Galileo HAS, High Accuracy GNSS and accelerometers for Infrastructural Monitoring
- Infrastructure Dynamic Monitoring
- Test on one or two possible sites

Steel frame
(rooftop of a SOGEI Building)
Validation test



CESI Viaduct (along route E45)
(San Gemini, Central Italy)
Operational Test



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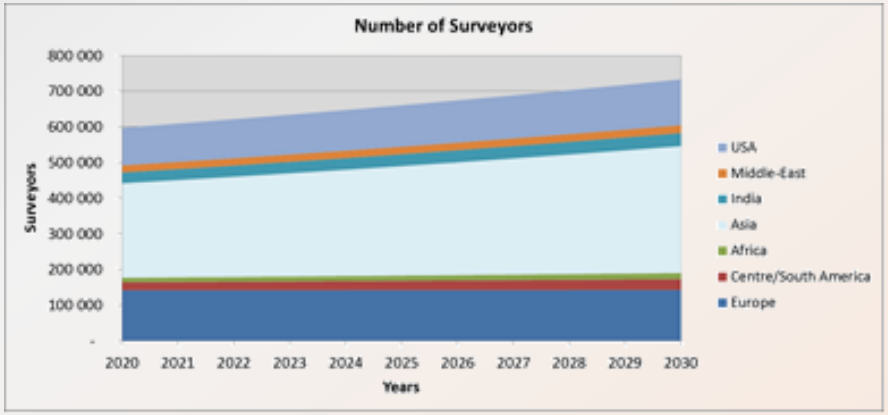
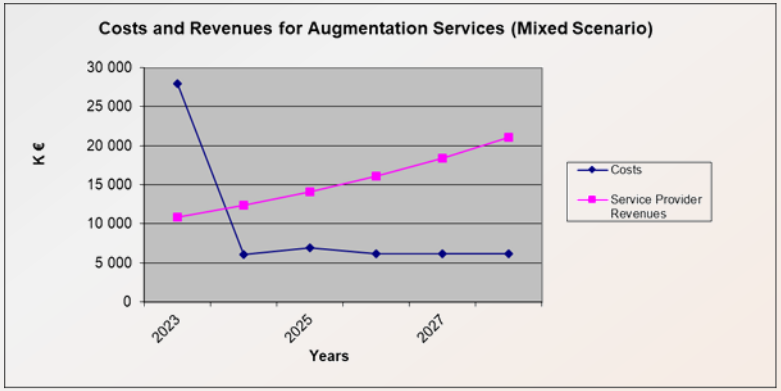
Expected Project Impacts

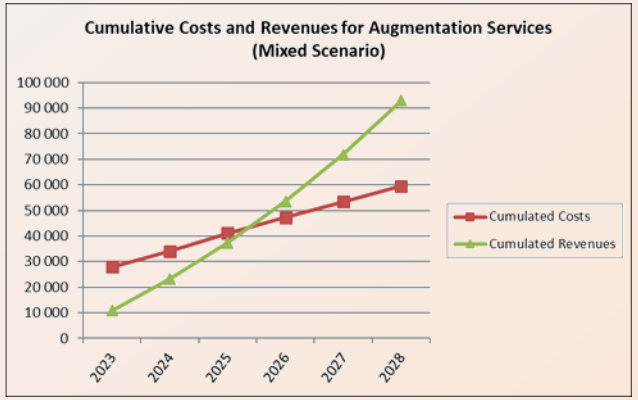
- **Service Providers**:
  - Reduced infrastructure and maintenance costs (<150 km sparse RS)
  - Communication burdens reduction through HAS
  - Service Levels Differentiation
- **Cadastral Professional users**:
  - Improved availability in urban areas
  - One-time terminal configuration
  - Reduced Service costs
- **Receivers manufacturers**:
  - Market uptake due to lower barrier to entry for High Accuracy Users
  - Cost production reduction due to economy of scale
- **NMCAs**:
  - Harmonized GNSS service levels on a wide area
  - Reduced time for cadastral acts approval
  - Increase in the number of processed acts per year

Business Analysis hints

- Cadastre is a niche but stable Market
- Business Analysis Scenarios:
  - Commodity
  - Mixed
  - Conservative
- Benefits for Agencies, Surveyors and citizens







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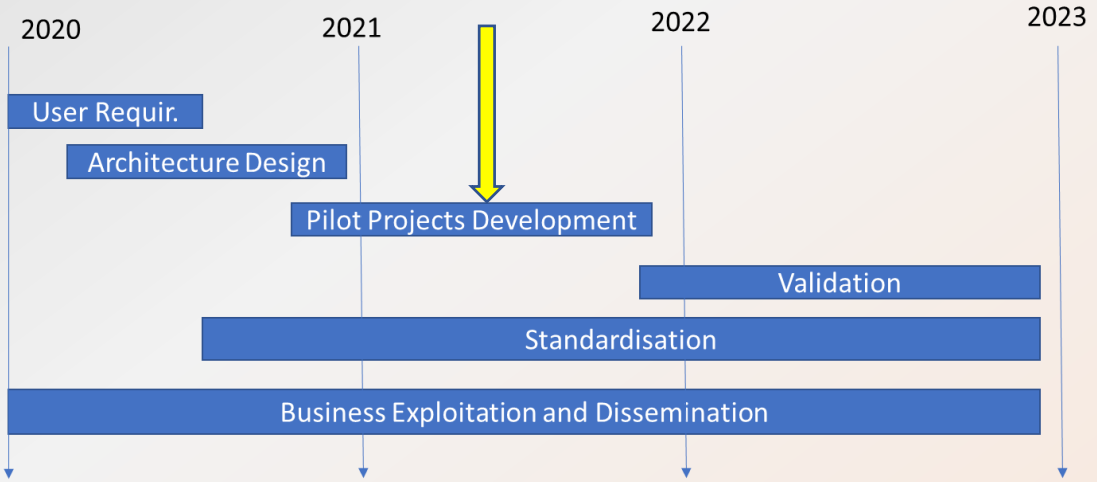
Timeschedule and Next Steps

- Current Status (2020):
  - User Requirements
  - Architecture Design and Development
  - Pilot Project Design
- Next steps (2021-2022):
- Pilot Projects development started
- Standardisation activities for GISCAD-OV within:
  - RTCM SC-104 and SC-134
  - ISO 19152 LADM
- Scientific and Cadastral Validation
- Business Analysis



Conclusions

- GISCAD-OV integrates current technologies and future Galileo HAS affordable High Accuracy services development for National Cadastral Surveying
- Timeschedule: End of 2019-end of 2022
- Integration of different solutions for Augmentation and Receivers
- Pilot Projects in 7 European Countries with real Cadastral Surveys

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Thanks for your attention

https://giscad-ov.eu/