





A GReD and Proteco solution



AProteco





GReD and **Proteco** entered in a strategic partnership with the purpose of design, build and deliver GoGuard service





What is **GeoGuard**?



GeoGuard is an innovative **end-to-end service** for the continuous geodetic & environmental monitoring of critical infrastructure and natural hazards

Provides **accurate positioning** with centimeter-level accuracy in near realtime or millimeter-level accuracy for daily/sub-daiy solutions







Critical Infrastructure, Bridges and Dams



✓ Transportation infrastructure such as road and railway bridges, airports and ports

- - ✓ Energy infrastructure such as hydroelectric dams





Critical Infrastructure, Towers





✓ Telecommunication infrastructure such as data and broadcasting network towers

 Energy infrastructure such as towers for high voltage transmission lines and wind farms





Critical Infrastructure, Oil & Gas







 ✓ Oil & gas infrastructure such as pipelines and storage

✓ Oil & gas infrastructure such as off-shore platforms





Critical Infrastructure, Water and Social







 ✓ Water distribution infrastructure such as **dams** and **tanks** for water distribution

 Social infrastructure such as cultural heritage sites, stadiums, hospitals and education centers





Natural Hazards, Land





 Subsidence & uplift due to natural phenomena or oil & gas production and storage



Landslides control





Natural Hazards, Meteo Now Casting





Meteo now casting, to forecast
torrential rainfall (emergency) and
cloudiness (solar farms)







GEOGUARD SYSTEM ARCHITECTURE





GeoGuard Monitoring Unit (GMU)



Proteco

A GMU is a remote terminal unit specifically designed to operate in challenging environments

✓ It can be **powered in any location** supporting AC, DC or solar power

 ✓ GeoGuard Cloud can remotely manage the units via two-way communication



GeoGuaro

GeoGuard Business Model

GeoGuard is an end-to-end service and includes activities and systems designed for the deliver solutions customized to different scenarios.

GEOGUARD SERVICE BUSINESS MODEL









GeoGua

GeoGuard solution advantages



	Accuracy ~ 1 mm	Continuous measurement (rate ≤ 1 day)	End-to-end permanent service	Low-cost	Remotely managed units	Unmanned (on-site)	Hub for other sensors
GeoGuard	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geodetic GNSS	Yes	Yes	Partially*	No	Yes	Yes	Partially
Total station (automated)	Yes	Yes	No	No	Partially	Yes	No
Total station (survey)	Yes	No	No	No	No	No	No
InSAR	Yes	No	Yes	No	No	Yes	No
Visual inspection	No	No	No	No	No	No	No







Solutions





Road & Rail bridges



Transportation industry is facing with an increasing demand for mobility, infrastructure aging and limited financial resources

It requires the definition of reliable methods, from both technical and economic points of view, for choosing the best strategies of repair and maintenance, based on the evaluation of the actual conditions of the infrastructure and on the prediction of its future state as affected by damage



\$57 trillion in infrastructure investment are estimated from 2013 to 2030*

* McKinsey Global Institute, Infrastructure Practices January 2013



GeoGuard for bridges



The solution meets the infrastructure monitoring and maintenance planning optimisation challenges by delivering an endto-end service which provides customers with **timely and accurate position measurements about the displacements** (at mm-level) of a set of points installed on bridge deck







High Voltage Power Lines Towers



A Proteco



GeoGuard for Towers



Continuous monitoring of towers displacements (at cm-level), allows to highlight "early warning", helps network renewal planning, reduces the insurance costs and prevents catastrophic failures that may results in injury, death or significant financial loss





Hydroelectric Dams

Earthquake, aging and climate change affect the health of the hydroelectric dams in particular for the sites in remote locations, like Chile and Peru, where high hydroelectric capacity are available, visual inspections are difficult and very poor monitoring systems are installed



Enel/Enersis, Melado Hydroelectric Dam (Chile)



Enel/Enersis, Ralco Hydroelectric Dam (Chile)





GeoGuard for Dams



Continuous monitoring of hydroelectric dams, in any weather conditions, by ridge displacements and land movements control allows to highlight anomalous behaviors and prevent catastrophic failures

Hydroelectric dams in remote locations can benefit on **high reliable and resilience solution** connected in continuous mode by satellite link







Landslides and Subsidence



Climate change consequences are worsening this scenario and limited financial resources available by local Government make it difficult to deal with the containment of these issues



Economic losses due to natural disasters (landslides, floods, earthquakes and drought) since 2000 are in the range of **\$2.5 trillion****

** UNISDR 2013 Global Assessment Report on Disaster Risk Reduction (GAR13)





GeoGuard for Landslides and Subsidence



Continuous monitoring of landslides and subsidence with **cost-effective**, widespread and high accuracy solution allows to control the high risk locations and better plan the interventions on the territory



Meteo Now Casting



Torrential rainfall is mainly generated by convective rain clouds, which can be extremely heterogeneous both spatially (horizontal scale down to less than 10 km) and temporally (may generate in less than 2 hours)

There is a need to improve the forecast of rain clouds, **especially around cities** that are expected to suffer more heavily from severe rainstorms due to climate warming





GeoGuard for Meteo Now Casting



High-resolution water vapor maps can support weather prediction models to **better forecast extreme rain cloud formation and subsequent rainfall**

Through the analysis of GNSS delays due to the presence of water vapor in the atmosphere a **continuous monitoring** can be done (e.g. every 30 sec – 1 min).

By exploiting cost-effective receivers in GMUs, **dense networks** can be deployed to increase the spatial resolution of water vapor maps.



GEONET station (Japan nation-wide network)

🔺 Uji dense network station





Customers





References









NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)







International collaborations

Research Institute – Kyoto University Middle and Upper (MU) atmosphere radar

Two GeoGuard units will be installed near the MU Radar in Shigaraki prefecture, near Kyoto, in Japan. The GeoGuard-derived water vapor will be compared and validated with respect to geodetic dual-frequency GNSS, microwave radiometers, radiosondes and Raman LiDAR.



Noint Usage / Research Center Kyoto University Research Institute for Sustainable Humanosphere









International collaborations

Fukushima Renewable Energy Institute, AIST (FREA)

One GeoGuard unit will be deployed within the FREA testing field. The GeoGuard-derived water vapor will be compared to geodetic dualfrequency GNSS, in order to validate it, and to study its use for improving the prediction of cloud coverage, in order to better manage solar farms.









Partnership





GReD at a glance

An **University spin-off** inside the Politecnico di Milano, with **ESRI Italia** and **4changing** as industrial partners.

GReD concerns about **R&D**, consulting and algorithms to perform top edge geomatics solutions.

Main areas of expertise:

- Global Navigation Satellite System(GNSS) high accuracy application to positioning and navigation;
- Geodesy and applied geophysics.



The Politecnico di Milano - Department of Civil and Environmental Engineering is one of the most relevant centers worldwide for R&D in advanced technology for multidisciplinary computation of georeferenced spatial data.









PROTECO Consortium was created by clustering the complementary excellent skills of different companies, to target the wide ICT Domestic and International market leveraging on strong Telecommunications and IT Competencies.



Main areas of expertise:

- TLC Transport & Next Generation Access Network
- Networking Security & Internet
- Solutions for vertical markets
- IT Consultancies Services, Data and Cloud
- Smart Grid & Smart Cities

Proteco has a **unique position** respect to the market providing Client **with a range of engineering services not easily replicable**

- ✓ more than 350 employees
- ✓ high level of education (> 90% of graduates)
- ✓ 7% of employees involved in R&D activities
- ✓ more than 250 people developing mission critical applications
- ✓ more than 80 expert in TLC engineering
- ✓ technology market leadership in vertical: energy, transportation, telecommunication, IP & security, SMART



The **GReD – Proteco** synergy







GNSS solution to study surface response to gas storage operations.





Extraction/Injection of large volumes from shallow depths causes variation in pore pressure and subsequent subsidence/uplift bowl.

Characteristics:

- Local scale: < 30 km x 30 km;
- Smooth deformations: wavelength of ~5 km;
- Rapid deformation;

Advantages:

- Continuous surveillance with the highest accuracy;
- Early indication of ground movements;
- Easy coverage of wide areas;
- High repetition rates;
- Highly reliable and economical, using field proven components.

Measuring System:

- All GNSS systems;
- Own or third party reference stations;
- Integration of additional sensors: tidal, pressure, temperature, vibration, strain, level, ...;
- Remote operability, early warning and alert systems.







Thanks for your attention

For more informations please visit our web site <u>www.geoguard.eu</u>







