PLANETEK ITALIA

Remote sensing supporting engineering

How to evaluate the environmental impact of infrastructures? What are the benefits from the use of Earth Observation techniques for the engineering design?

In the following paragraphs, brief descriptions of real case studies and projects in which Planetek Italia has been involved as a partner for EO activities in support for engineering and constructions.

Preciso® zeta TANZANIA

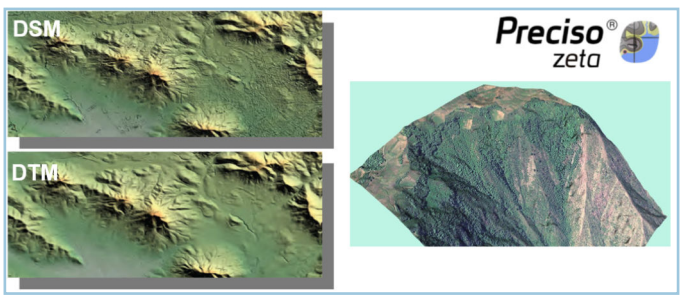
Production of Digital Elevation Models of the Earth surface for infrastructure development in Tanzania

In 2012, Planetek Italia has realised Preciso® Zeta, a geo-information product exclusively developed and distributed, which includes a DEM (Digital Elevation Model) extracted from satellite stereoscopic images at high spatial resolution for an area located in Tanzania. The main goal of this activity was to give the user an updated digital cartographic base map to analyse a water basin, for the preliminary design of a dam: slope and profiles evaluation, assessment of excavation activities and so on.

Using advanced automatic photogrammetric techniques together with post processing and editing activities, a DSM (Digital Surface Model) and a DTM (Digital Terrain Model, i.e. the DSM without vegetation and buildings heights) have been realised, with a pixel resolution of 1m. Stereoscopic satellite images, depicting the same area from different viewing angles, at high spatial resolution, have been used as input data. Positional accuracies of 4m (horizontal) and 1m (vertical) have been obtained on the output, compliant with the accuracies achievable for this kind of data.

Preciso® Zeta includes also high resolution RGB ortho images and contour curves, in vector format, for the area of interest.

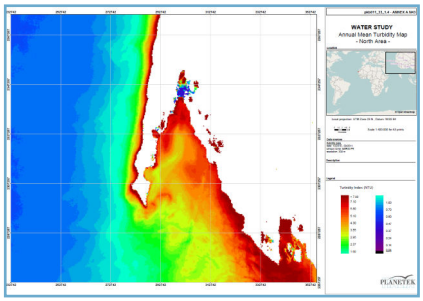
Preciso® Zeta highly fulfilled the user needs, giving him the possibility to use a product characterised by high precision, obtained with low costs e fast delivery times, if compared to traditional techniques (ground surveys, aerial acquisitions). Satellites can be a strong ally for environmental planning and infrastructure design.



TURBIDITY MAURITANIE

Water turbidity analysis using satellite data in Mauritanie

Thanks to the experience and the technological know-how acquired in the field of Earth/Marine Observation in several research projects (MarCoast, AcquaMar), Planetek has provided a water turbidity analysis service for an important italian Oil&Gas company.



The service has concerned an area which includes about 250 km of Mauritanian coasts. The user's goal was to understand the characteristics of the coastal and marine environment before to start the preliminary design of desalination plants.

Turbidity is one of the parameters which allow the evaluation of the water quality, relating it to their final use. For example, a low level of the turbidity is one of the most appreciated features for touristic purposes or for drinkable water monitoring. Furthermore, areas characterised by high turbidity levels suggest that off-shore excavation activities would have a smaller impact, compared to areas in which the turbidity level is lower and so the marine ecosystem can be more damaged.

The use of robust image processing algorithms, applied to hyperspectral medium resolution satellite images, have proved to be valuable. These algorithms take into account the spectral characteristics of the water and light absorption properties of suspended matters, allowing for an efficient monitoring of coastal and marine waters. Moreover, it was possible to characterise the turbidity on statistical bases, evaluating seasonal variation patterns with high levels of de-

tail.

The produced maps, very important for the user during the phases of the project, have shown that remote sensing technologies can give fast, cost-sustainable and reliable responses for the needs of O&G companies, in the field of water quality monitoring.

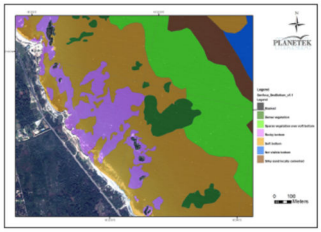
POSIDONIA MAPPING

Submerged vegetation mapping for an area located in Apulia (Southern Italy) from high resolution satellite data

The main goal of this project was to give the user updated maps of the marine bottom composition, in areas close to the Brindisi and Salento coasts, to be used as a support for the environmental impact analysis of the gas pipeline which should connect Azerbaijan and Italy, as a part of the TAP project (Trans-Adriatic Pipeline).

The user was interested in the evaluation in the area of interest, through satellite data recently acquired, of the *Posidonia Oceanica*, an important vegetal marine species capable to act as ecosystem protector and shield against the coastal erosion. For these reasons, the current Italian environmental laws have defined Posidonia a species which must be protected and defended from extinction. The off-shore project will take into account for the presence of these fundamental vegetable species.

Thanks to the experience and the technological know-how acquired in the field of Earth/Marine Observation in several research projects (MarCoast, AcquaMar), Planetek has provided services of submerged vegetation analysis and mapping which, using automatic and visual HR image interpretation techniques, given an appreciated contribution to the TAP project.



The satisfying results obtained have confirmed that, in one of the areas, Posidonia Oceanica was present, as observed in 2006 with direct sea measurements. The maps gave the user a clear indication on how to manage the design and development activities.

MANGROVES DETECTION

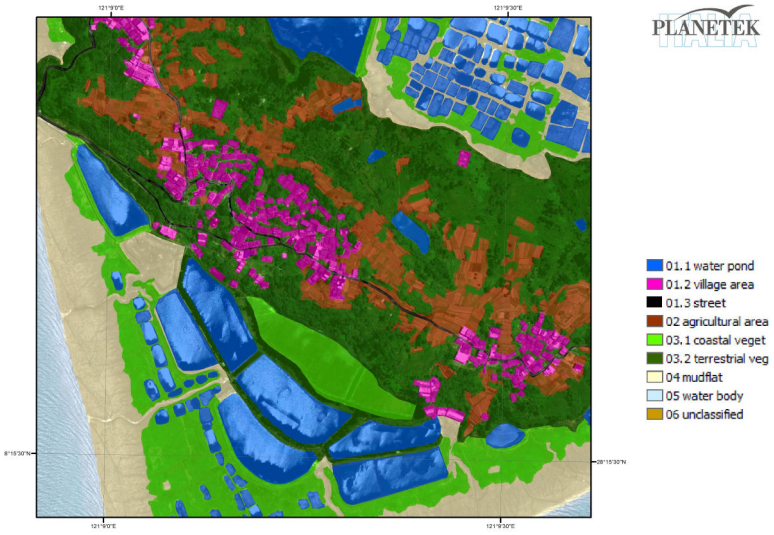
Land coverage analysis and mangrove distribution study for an area located in the Northern China

In 2013, Planetek signed a contract for a land coverage study for an area located in the North of China, using an high resolution image acquired from WorldView-2 satellite in July 2012.

More specifically, the user, involved in consultancies services for the Chinese authorities, was interested in obtaining a map of mangroves distribution, to investigate the presence of this species and its adaptability to the area of interest, with the final goal of understanding the possibility to make this area a natural research laboratory. In fact, mangroves are vegetal and forestry species whose existence is particularly important for local ecosystem equilibriums and must be preserved.

Using WorldView-2 high resolution satellite images, an orthocorrected maps has been produced first. Then, applying semi-automatic image processing techniques, a preliminary land coverage map has been obtained. The output of the classification has been refined with automatic and manual editing procedures and using direct ground surveys, photographic and textual, provided by the user during the project.

The study has underlined first the benefits coming from the combined use of remote sensing and ground surveys, capable to give accurate and reliable results. The comparison between the results of the automated classification obtained via software and the data obtained on site in some sample points has been very useful for the evaluation and the calibration of the automated techniques. At the same time, has been proved that the use of the modern high resolution multispectral sensors can support features extraction activities in a reliable way, giving an important instrument for the automatic detection and unique identification of thematic classes.



IRAQ MAPPING

Base maps production as support for the updating of Urban Development Plans for the area of al-Başra (Iraq)

In May 2013, Planetek Italia signed a contract for the production of a cartographic base map from medium resolution satellite images in natural colours, coming from RapidEye sensor, for an area located near the city of al-Başra (Iraq), about 12 000 km² wide.

The goal of the final user, involved in consultancies services for the Iraqi authorities, was to obtain a cartographic base as support for the realisation of Urban Development Plans and land use maps at scale 1:50 000. Planetek, using about 70 satellite images, each one 25 km² wide, has carried out the mosaicking and colour balancing service, needed for the achievement of a unique orthoimage capable to represent, in a continuous and homogeneous way, the area of interest.

Mosaicking operations have been performed on the optical RGB bands included in the raw satellite images. At the same time, the colours of the images have been balanced to obtain an output data in which the chromatic contrast between the frames composing the mosaic was no more present. This activity has been necessary, because every satellite scene had different acquisition dates and conditions and seasonal variations in the spectral response (and colour) of sea, vegetation and other feature: there was the need to even out the colours and to improve the results of the mosaic.

Finally, the data compression has been applied on the output data, aiming at reducing the storage consumption on the hard drive and making the access to the data more efficient, thus dramatically reducing the time needed to visualize the file.

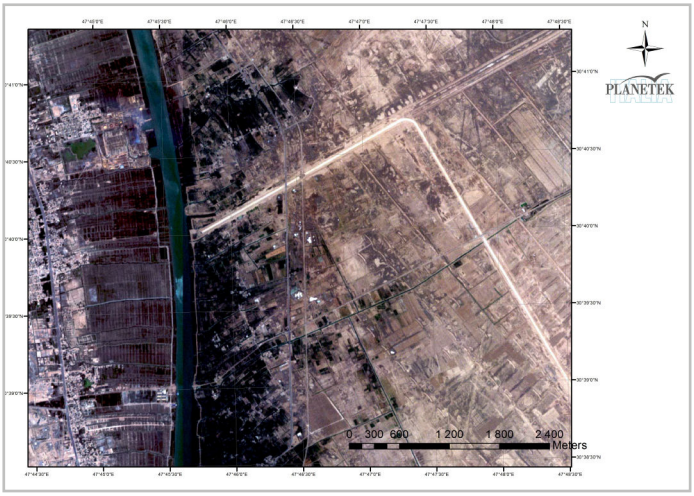
Several Civil and Environmental Engineering Companies frequently adopt Planetek remote sensing solutions, having realized the importance of Satellite Earth Observation and GIS data and services as a valuable support for activities like urban planning and design, especially in developing areas or countries back from war, in which cartographic maps don't exist or it is difficult to use traditional environmental analysis techniques (cartographic ground and aerial surveys) because of high costs and/or logistic difficulties.

SUPPORT FOR ROMANIAN MOTORWAYS DESIGN

Satellite orthoimages at high resolution as cartographic base map for the design of motorways in Romania

The target of this activity was the supply of satellite images at high spatial resolution, orthorectified and mosaicked, intended for the use as cartographic base for the preliminary design of a part of a motorway to be built in Romania.

Earth Observation techniques and Satellite Remote Sensing are powerful allies to support design and monitoring of infrastructures and works.



The orthorectification procedure, applied on the raw satellite images, is necessary to correct the geometric distortions due to satellite acquisition process. Furthermore, during this process it is important to consider that also terrain orography introduces perspective distortions on the image, which must be rectified to obtain a more realistic representation of the area of interest, in terms of reproduction of shapes of the objects and distances between them.

Planetek provides satellite images orthorectification service using an expert know-how. The use of professional photogrammetric and image processing software, as the ones of the Intergraph suite, of which Planetek Italia is the official reseller for Italy, plays a crucial role in this and other Earth Observation services provided.

CONSTRUCTION SITE MONITORING IN THE EXPO 2015 AREA

Checking the progress of the works in the area of Expo Milano 2015 (Italy)

In the early 2013, Planetek Italia has won a tender for the supply of high resolution satellite images, coming from new acquisitions and orthorectified, for the area which is going to be interested, in 2015, from Expo, the great non commercial Universal Exposition that will take place in the Lombardy city during 2015.

The user's interest was to have an updated picture, thanks to two acquisitions per year from 2013 to 2015, of the progress of works in the area of Expo and the way in which construction activities interact with the surrounding environment.

The project described is a typical use case of satellite images in support of the activities of monitoring and checking of works in a construction site. Orthoimages give the possibility to have a clear and reliable picture of the current situation, with high resolutions and visual impact, with the advantages of a fast and affordable delivery.

Furthermore, projects like this prove the usefulness of having multispectral data to analyse the state of the vegetation. These kind of data are obtained from sensors capable to analyse in detail the energy reflected from objects on the ground at various wavelengths, among which there are the ones that give indications about vegetation health, water and chlorophyll content, and so forth.

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The project will be completed on September 2015.

SUPPORT FOR SAUDI ARABIA RAILWAYS CONCEPT

Creation of updated base maps in support of the design of railways in Saudi Arabia

The present activity has concerned the production of high resolution orthoimages for an area located in Saudi Arabia. The output deliverables have been addressed for the use as reference base map for preliminary and detailed study of a new railway line of about 960 km, designed to connect two Saudi towns among the biggest.

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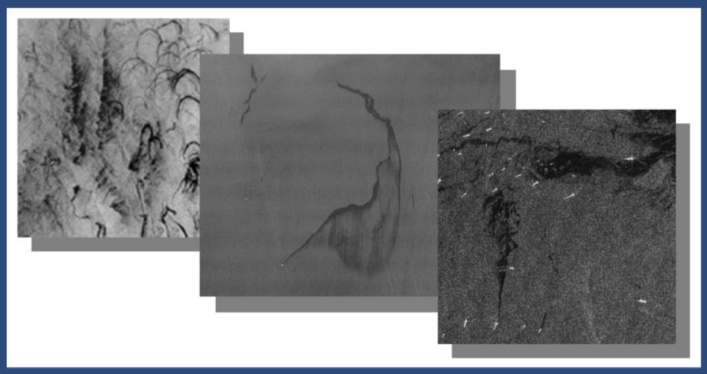


OIL SPILL DETECTION

Research for possible oil spills near off-shore platforms using radar satellite data (Italy)

The exploration of seas and oceans, searching for possible hydrocarbons spills, defined 'Oil Spills', is a very important topic. It involves both International Institutions, undertaken in the marine environment protection and in the ecological disasters prevention, and Oil&Gas companies, for the control and monitoring of the existing infrastructures and the research for new offshore oil fields.

These activities can be effectively supported by satellite technologies and, among these, by SAR (Synthetic Aperture Radar) sensors.

During the last years, after a period of technological research and development, supported by the International Communities – the European project Marcoast is a valuable example -, the use of Radar and SAR images has proved to be an excellent instrument, acknowledged by Regional and National Environmental Agencies, for the identification of ships, offshore installations and pollution phenomena due to possible oil spills.

Compared with the traditional monitoring technologies (sea measurements, collection of warnings from vessels, reports and direct interventions of Marine Authorities, et al.), the modern radar satellite platforms as TerraSAR-X, Cosmo-SkyMed, Radarsat, capable of acquiring high resolution images with a wide spatial coverage and daily revisit times, can represent a valid option for all the activities related to prevention purposes, rapid response and operation against possible environmental threats. Furthermore, the advantage coming from radar satellite data in terms of costs, availability and usability must be taken into account.

Planetek Italia includes in its portfolio services of Oil Spill detection from SAR images, already offered to Italian Oil&Gas companies for different purposes:

- research for natural oil spills;
- monitoring, prevention and disaster recovery;
- analysis of oil leakages produced by vessels, pipelines and off-shore platforms.

Preciso® wind – Preciso® wind map

A new service for the identification and analysis of possible wind farm sites

One of the most critical aspects in the feasibility study of an on-shore / off-shore wind farm is the identification of the optimal site, through the preliminary analysis of the local wind regimes (wind reanalysis).

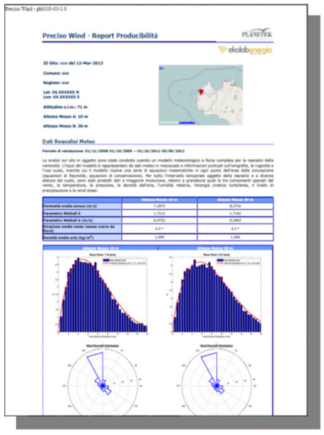
Preciso® wind is a wind reanalysis service studied to identify and characterize the optimal sites for the installation of wind turbines, through wind modelling and reconstruction and without the need for long and expensive wind measurement campaigns.

Preciso® wind uses for the reanalysis a meteorological model which employs large scale input data, coming from the ECMWF (European Centre for Medium-Range Weather Forecasts) reanalysis of the wind, temperature, humidity, ozone and surface pressure of the atmosphere. A significant and increasing contribution is represented by EO data provided by polar-orbiting and geostationary satellites, like ESA Meteorological Missions.

These input data are used to reconstruct wind fields at various heights above ground. The model estimates also other physical quantities used in the produced power calculation (air temperature, air pressure, etc.). The calculus of the meteorological model are performed by the company GAP Ltd, spin-off belonging to the Polytechnic School of Bari.

The activation of the Preciso® Wind service is very simple. The user must provide the coordinates of the sites chosen as potential location of a wind plant. After that, he can request a preliminary or producibility analysis.

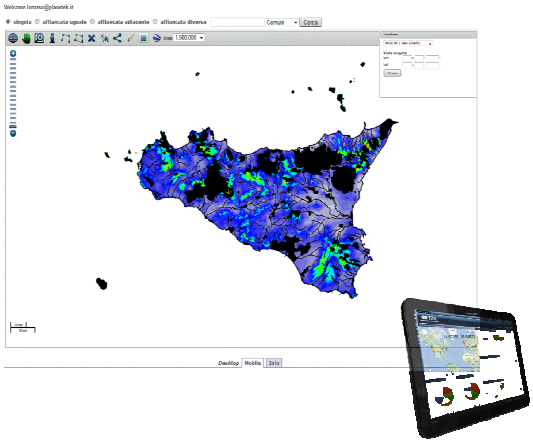
Preciso ® wind service verifies also the presence of environmental restrictions in the area of interest, due for example to the presence of natural areas protected by the current laws.



Preciso® wind

Moreover, using the wind series extracted by the meteorological model and the power curve of a wind turbine, it is possible to estimate the wind energy which can be theoretically produced in the site of interest.

Results are produced and delivered to the user in few workdays.



Planetek includes in its catalogue of wind services also *Preciso® wind map*, accessible on web by laptops and mobile devices, already developed for important workers in the wind sector in the Italian regions of Sicily and Basilicata.

Preciso® wind map gives the opportunity to visualize, at local / regional scale, thematic maps of the wind energy that can be produced, at various height from the ground. The user can superimpose on the map the layer of restricted areas, allowing for an 'intelligent' research of the areas which could host one or more wind turbines, thus excluding the areas not suitable because of environmental protection. Using the portal, the analysis activities are very simple, thanks to the presence of simple tools offered by the GIS environment: pan, zoom, measurements of areas and distances, visualization and search by coordinates, sharing of the results by e-mail, reporting and printing functions.

The mobile part of the system can be accessed by smartphone and tablet and offers the possibility, using the GPS coordinates directly measured from the device, to query the system in real time and to verify in a fast and direct way the wind potential of the visited site.

Preciso® wind instruments are capable to give fast and accurate responses to every kind of subject interested in the wind power sector. Several workers involved in the energy market (investors, wind turbines producers, private sponsors, banks, legal and technical advisors) use these services for their activities of analysis and design of investments in the wind field, considering these tools reliable, affordable and able to give fast responses.

PLANETEK ITALIA



CANTIERI ON LINE

A cloud-based solution for the management of a construction site using the web

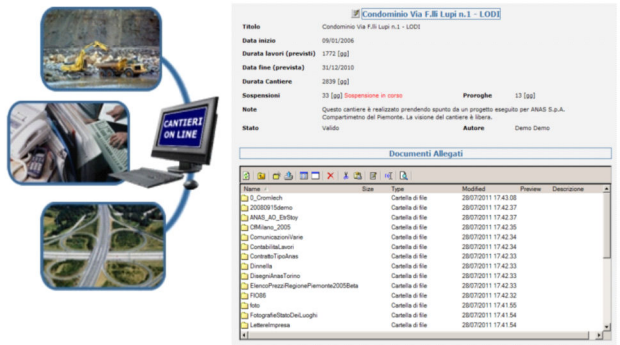
In 2013, Planetek signed with an important Italian EPC company a contract for the supply of a system for the web management of a construction site. The user's need was to have a solution for the control of the operations related to a construction site located on the Italian A3 motorway. CantieriOnLine answered to this kind of requirement.

CantieriOnLine is a system, available on the web, which allows for monitoring and controlling the progress of works in a construction site: it is possible to have a real time knowledge of the state of the works and to access documents, realised by the current or other users, thus answering to the primary needs when developing a modern construction yard.

Every working site has an home page, which gives an immediate view of the state of the work and of four specific sections: daily summary of the performed works, memorandum and service orders, sample taking, reception proofs.

With CantieriOnLine, it is possible to manage and standardize the work documents, allowing the rearrangement of data that are often heterogeneous for content and format, and therefore to satisfy the requirement of a platform for storing, sharing and updating documents in a fast and secure way.

Users access only the information and the sections expected for their role and everybody, trough his job, contributes to the creation of a complete repository, essential for the realisation and management of an infrastructure. Moreover, it is possible to organise precise databases of vehicles, people, zones and works, which help to characterize the working activities.



The user has found extremely important the possibility to have a system which allows everyone participating in the development of an infrastructure to work together, through internet. Furthermore, without any particular web programming skill and without possible limitations due to hardware and licensing, the system has been accessible in a simple way, granting at the same time high portability and efficiency.

Private Companies which have used or are using our solutions

Saipem S.p.A.
Edison Energia S.p.A.
Studio Galli Ingegneria S.p.A.
Net Engineering S.p.A.
Anas S.p.A.
Studio Pietrangeli S.r.l.
Italferr S.p.A.
REN Electron S.r.l.
Ikaros Power S.r.l.
Greenergy Impianti S.r.l.
MDF Energia S.r.l.
Tecnocons S.r.l.
Autostrada Bs-Vr-Vi-Pd S.p.A.
Autovie Venete S.p.A.
Gruppo Franza S.p.A.
AMTAB S.p.A.
Expo Milano 2015
Roma Servizi per la Mobilità
Autorità Portuale del Levante
Enereco S.p.A.
Renco S.p.A.
Sirti S.p.A.
Strada dei Parchi S.p.A.
Toto S.p.A.
ICQ Holding S.p.A.

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