innovation for a safer world.

CAE MAGAZINE
n.20 · *february 2018*

INDEX

PAG 1
Maldives: green light to the expansion of the national meteorological monitoring network with 25 new stations and control headquarters

PAG 3
Region of Sicily: green light to the integration works of the meteorological detection network for civil protection purposes.

PAG 5
Interventions in the “earthquake crater” in central italy: monitoring and alert system for the landslide in borrano di civitella del tronto (teramo)

PAG 8
Over thirty years of experience and hundreds of installations at high altitude: CAE’s commitment from snow knowledge to avalanche risk mitigation.

PAG 11
CAE talks about the “maintenance portal”: a simple and interactive web tool that supports our customers in the management of their monitoring and alert systems.

EDITORIAL

Maldives: green light to the expansion of the national meteorological monitoring network with 25 new stations and control headquarters

As part of the cooperation between the Ministry of the Environment for the Protection of Land and Sea of the Italian Republic and the Ministry of Environment and Energy of the Republic of the Maldives, in December 2015 a Memorandum of Understanding regarding climate change, vulnerability, risk management, adaptation and mitigation was signed.
As a matter of fact, the Maldives are highly vulnerable to natural disasters, especially during the South-West monsoon season, because of their geoclimatic conditions, and these risks clearly affect the profile of physical and socioeconomic vulnerability of the country. Extreme events, including sudden flooding, long periods of drought, high waves, rough seas, hurricanes, tornadoes and strong winds, will become more frequent due to the increase in frequency and intensity of climate change, and will negatively affect all major sectors of the national economy.
Because of all these phenomena, it is therefore of primary importance to strengthen real-time monitoring of meteorological conditions, by creating an efficient network of stations that act as an Early Warning System. Thanks to this

modern and timely technology it is possible to alert the population and transmit the latest information available on climate and on possible natural disasters, in order to save human lives and minimize any damages in case of environmental disasters.
With these premises and thanks to the Memorandum of Understanding signed between Italy and the Maldives, a new project has been approved and submitted to tender. The name of the Project is "Supply and Installation of Specialized Equipment and Related Services - Enhancing weather and climate monitoring and data management capacity of MMS (Maldives Meteorological Service) for reducing vulnerabilities of climate change in the Maldives – Project: Supply and Installation of 25 Automatic Weather Stations".
The aim of this project is to expand the already existing real-time meteorological monitoring network of the Maldives with new data collection stations, distributed in remote areas of the territory, in order to implement a prompt pre-warning action, alert the population and prevent catastrophes.
CAE won the tender and signed the contract on December, 4th, 2017, during a ceremony attended by the vice-president of CAE, Mr. Giancarlo Maria Pedrini, the Minister of Environment and Energy of the Maldives, Mr. Thoriq Ibrahim, and the Chief Executive of the Maldives Meteorological Service, Mr. Abdulla Wahid.
The project CAE is about to implement consists in the "turnkey" supply of 25 new weather stations, located in the various islands and in the airports which are about to be built in the Maldives. These stations will use the MHAS technology and each of them will be equipped with sensors in order to measure wind speed and direction, rainfall intensity and quantity, atmospheric pressure, air temperature and humidity. Through the GPRS communication system, each station will send the collected data in real time to the new control and management headquarters, located at the Maldives Meteorological Service in Malé. Thanks to a system of solar panels that recharge the battery supplying energy to the installed stations, which will be equipped with a power supply independent from the main electric system, the environmental impact will be minimized; moreover, the needs of the local population and the problems related to the lack of space, which are typical of these small islands, will be taken into account. In addition, in order to be able to view and analyse the collected weather data, CAE will provide not only the software to be used on the server and on new workstations, but also the tools for managing these data "on the go", which is to say apps for tablets and a website.
The project will be integrated with both field and classroom specific training activities addressed to the personnel of the Maldives Meteorological Service. The training will focus on: the functioning of the system as a whole and of its individual components, the use of the management and display software of the data collected by the headquarters, and the maintenance activities necessary to preserve the optimal functioning of the entire system. ■

RETURN TO INDEX

Region of Sicily: green light to the integration works of the meteorological detection network for civil protection purposes.

CAE has won the tender for the creation of a single integrated, redundant and flexible meteorological detection system for the Region of Sicily. The system will be useful to support the Decentralized Multi-hazard Functional Integrated Centre (Centro Funzionale Decentrato Multirischio Integrato) in the effective fulfilment of its task of identification and assessment of any critical conditions resulting from potentially adverse meteorological phenomena.

CAE is the leader company of the Temporary Grouping of Companies that has won the Sicilian tender for the integration of the regional meteorological detection system for civil protection purposes, which will also include LIDAR and cartographic surveys in specific areas of interest.

As you can read in the Technical Report provided by the Region of Sicily, the project originates from the need of the Decentralized Multi-hazard Functional Integrated Centre (CFDMI) to have adequate control and monitoring systems aiming at an effective prevention and real-time control of the meteorological, hydrological and hydraulic phenomena occurring on the regional territory and, consequently, at a mitigation of their effects for civil protection purposes. The effectiveness of this network is based on its consistency, timeliness, efficiency, reliability and redundancy. To date, none of these conditions is fully and adequately met, due to the obsolescence of most of the installed equipment and to its poor distribution; as a matter of fact, 25% of the regional territory is not covered by thermo-pluviometric stations. This entails some knowledge gaps that can become prejudicial in the forecasting phase, as well as in the monitoring and retrospective elaboration phases.

All the provided supplies and services aim at creating a complex meteorological survey system, with a high technological profile, as well as at performing specialized activities and services such as aerial surveys, LIDAR surveys, topographic surveys, mapping, DSM and DTM, in order to create and integrate the already existing Geodatabase. This extension will aim at solving some of the major problems, especially in those parts of the region where, for geological reasons, there is a greater propensity to phenomena of geomorphological instability and flooding, even in small watersheds. In order to guarantee the achievement

of all required reliability and efficiency objectives, this system will focus on the principles of integration, redundancy, timeliness and flexibility.
In order to guarantee the highest possible level of integration, a single system will be implemented starting from the network of the OdA (Osservatorio delle Acque - Water Observatory) which, due to implementation criteria and transmission systems, has proved to be suitable for the purposes of civil protection. The network will include both the existing stations and the new ones to be built. The system will have a single UHF radio network and two main control headquarters: the CC.OA (control headquarters of the OdA) and the CC.CF (control headquarters of the CFDMI). This solution will allow the CFDMI to manage all the stations jointly and simultaneously, without the need to overlap separate subsystems or split systems, which would need to be managed with more or less complex integration logics that often prove to be inefficient. The Giampilieri system will also be integrated into the data exchange procedures among the UHF radio stations. Finally, the new headquarters at the CS.SIAS (Secondary Headquarters of the Sicilian Agro-metereological Information Service) will receive the data from the main CC.OA headquarters, while the data collected by the stations of the SIAS proprietary network which interest the Administration will be integrated and subsequently transmitted to the main CC.OA and CFDMI headquarters.
As far as redundancy is concerned, backup repeaters will be integrated to both all new repeaters and old ones that were not already provided, with prompt management of the exchange between the main equipment and the backup one in case of failure of one of them. Furthermore, a GPRS/UMTS secondary communication system will be integrated.
The overall cycle times of the network will be reduced within 10 minutes, therefore leaving a margin for future network expansions in order to ensure this timeliness in the future.

Finally, the system will be extremely flexible and open to any potential subsequent expansions; moreover, it will allow to monitor different risk scenarios, in a fully integrated manner, with modular implementations that can be scaled over time. In order to do this, a real-time monitoring and alert system based on a multi-hazard technological platform will be implemented.
The implementation of the system includes:

- supplying and installation of n.225 pluviometric stations
- supplying and installation of n.25 anemometric stations
- supplying and installation of n.14 nivometric stations
- supplying and installation of n.19 new repeaters with backup units and of n.8 backup units for the already existent repeaters that were not already provided
- adaptation of the current UHF band radio interconnection network
- adaptation of the current Control Headquarters (Centrale di Controllo CC.OA)
- supplying and installation of the new Control Headquarters (Centrale di Controllo CC.CF) of the CFDMI
- supplying and installation of the new Secondary Headquarters (Centrale Secondaria CS.SIAS)

The complexity of this project is given by the need to carry out what was planned in order to integrate the already existing and functioning systems, apart from the size of the project itself, which covers the entire regional territory. The technical and organizational skills of CAE will be essential for the success of this project, and everyone in our company is ready for the challenge. ■

RETURN TO INDEX

Interventions in the “earthquake crater” in central Italy: monitoring and alert system for the landslide in borrano di civitella del tronto (Teramo)

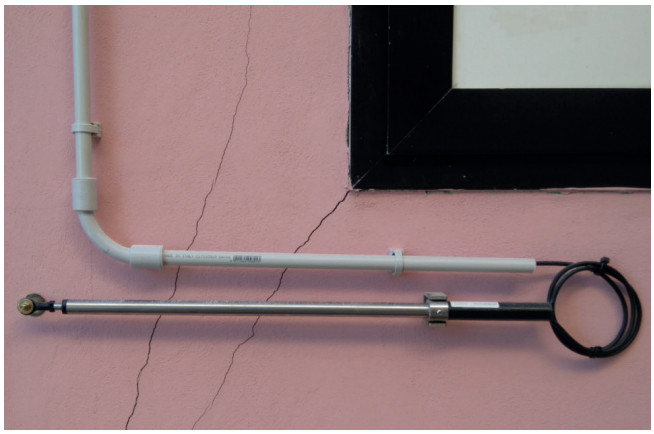
In February 2017, in the Municipality of Civitella del Tronto, and more precisely in the division of Borrano, an extensive landslide phenomenon affecting large areas of the territory reactivated.

The plausible causes of this phenomenon date back to a series of hydrogeological instabilities related to the geotechnical and lithological characteristics of the outcropping formations, as well as to the geological-structural evolution of this area and to an unorthodox rainwater regulation. This phenomenon has worsened after the last earthquake and it is still evolving at a very high speed of about 40-50 mm/year.

This scenario involves a serious risk for public safety, because of the emergency situations that could result from the likely possibility that future rainfall events may jeopardize and further deteriorate the situation; therefore, after an in-depth study of the phenomenon, the Regional Civil Protection has ordered the implementation of a monitoring and alert system dedicated to this kind of instability. This was possible thanks to the funds dedicated to the “earthquake crater” that are currently allocated by the Special Commissioner Paola De Micheli, MP.

After performing a feasibility study, CAE provided the Region of Abruzzo with a full-scale and modern “turnkey” monitoring and alert system that can be upgraded and modified at any time in a simple and fast way, without interfering with the functioning of the “Mesh” network, in order to adapt it to any possible future needs that may occur during the monitoring of the phenomenon.

The system uses self-configuring wireless networks thanks to the WSN technology (Wireless Sensor Network); each element of the system is self-functioning from an energetic point of view, thanks to the use of solar panels and buffer batteries.



More in detail, as far as the composition of the system, in order to monitor the micro-movements occurring deeply in the soil, we used chain inclinometers located in holes at a depth up to 80 m. Moreover, holes with piezometric sensors have been created and equipped for the measurement of the water level in the soil, which could be a forerunner for the reactivation of the instability.
As far as surface movements, we used surface clinometers and crack width gauges. The clinometers were used to measure the inclination variations of the structures where they are fixed, in order to monitor the above-mentioned variations both on a single axis and on two planes perpendicular to the surface where they are fixed. The crack width gauges were used to measure the displacement between two points when the movement occurs in a prevailing direction, as well as to control small movements. Both sensors are used to evaluate the good conditions of the monitored structures.
While monitoring soil movements, the system is also equipped with a Mhaster station that uses the meteorological data already available in the Municipality of Civitella del Tronto, thanks to the recent installation of the monitoring system located in Ponzano, a few kilometres away. This system allows us to associate the evolution of the instability to the rainfalls on the spot; at this purpose, we can distinguish among 3 phases:

- normality: no intense rainfalls or landslide movements have been detected;
- pre-alarm: rainfalls exceed a determined threshold of intensity, therefore the number of safety measures increases and the headquarters can send a warning notification;
- alarm: the movements of the geological sensors (significant inclinations) involve the need to send alert notifications via vocal synthesis message, SMS and FAX.

The system will guarantee the maximum reliability both in terms of data availability, allowing us to intervene in extremely rapid times in case of anomalies, and in terms of alert in real time; this means that, when the conditions of the system change and the pluviometric and geotechnical alert thresholds are exceeded, the system must communicate via vocal messages, SMS or e-mails, with the competent Authorities.
All this is possible thanks to the automatic diag-

nostic functionalities of the system, as well as to its duplex communication system (a GPRS/UMTS modem and a UHF band radio device connected to the remote measuring radio network of the regional monitoring service); this system sends the collected data both to the Municipal Operative Centre and the Functional Centre of the Civil Protection System. In such situations, the availability of the collected data is essential; therefore, apart from the traditional hardware and software devices, CAE provides the competent Authorities with a valid support to decision making, thanks to a data visualisation service that uses a WEB platform which is 24h mobile-accessible from an internet browser. ■

RETURN TO INDEX

Over thirty years of experience and hundreds of installations at high altitude: CAE's commitment from snow knowledge to avalanche risk mitigation.

The avalanche risk is an increasingly topical issue: what technological equipment is used by the authorities in charge of risk assessment? In which direction is technology evolving in order to increase the safety of the citizens? CAE outlines the past and the present of the nivometric monitoring systems and point out new ambitious technological horizons for the near future, when the alert systems will offer an extra tool for the safety of citizens.

For more than thirty years, CAE has gained a great experience in the field of snow measurement; as a matter of fact, the first nivo-meteorological stations were installed in 1984 to be used by the Avalanche Centre of Arabba (BL).

The nivometric monitoring has different facets and purposes, but generally it combines the main meteorological measures to the detection of specific measurements such as the height of the snowpack on the ground, the temperature at different heights from the ground and the amount of snowfall deposited on the ground.
Sites are usually identified by the customers according to their specific purpose. If the aim is to prevent the risk of avalanches, the sites are chosen by taking into account any events that have occurred in the past and must be representative of more or less large areas, therefore they must not be too subject to accumulation or exposed to strong winds that could make the measure not significant. On the other hand, if the purpose is to better manage the road conditions in case of snow, the site is identified on the basis of operational criteria in order to indicate the accumulation in certain sensitive areas, even if the snow measurement obtained in this case is not absolutely correct from a scientific point of view.
The installations are designed ad hoc in order to meet the most specific needs of the customer, as it has happened for example in the Region of Piedmont where platform poles have been installed, with balconies that allow you to set the station

and the sensors in an easily accessible area, even after heavy snowfall. Moreover, apart from the required customizations, the sites are naturally designed according to the WMO guidelines.

Typically, in addition to the classic measures of temperature, wind direction, wind speed and precipitation, which provide useful parameters to understand the snowpack and its accumulation, the nivometric installations implemented by CAE include:

- ULM30/N Snow gauge: it measures the level of snow settled on the ground (the principle is the same as the hydrometer) and therefore the unit of measurement is the metre [m].
- Thermometric pole: it is a sensor equipped with a series of equispaced thermometers set at different distances (typically at 0 cm, 20 cm, 40 cm, 60 cm, 80 cm, 100 cm, 140 cm, 180 cm, 220 cm, 260 cm, 300 cm, 340 cm). This measurement allows to measure the temperature of the snow on the ground at different heights and, therefore, to identify the layers where the snow is at risk of melting, which could cause sliding phenomena. It allows to collect useful information in order to prevent the risk of avalanches.
- Present weather measurement sensors are able to distinguish the type of precipitation that they are observing and, therefore, to give a high-quality description of the type of precipitation itself (rain, snow, fog, dew, etc.).

Every sensor on the market that is considered useful in a specific site can be integrated into the automatic station, so that the flexibility guaranteed to the customer is maximum.

Up to now, CAE has installed up to 254 nivometric stations. Many of them have requested an installation by means of a helicopter and are located at high altitudes. Among the sites where our company have implemented its technological equipment, there are the stations of Passo Marinelli at 3050 m and Passo del Moro at 2823 m, belonging respectively to ARPA Lombardy and ARPA Piedmont. The latter was installed in 1988 and in May 2013 it was able to measure up to 432 cm of snow. In 2009, the station of the Gastaldi refuge, located at 2672 metres and owned by the Region of Piedmont, measured up to 466 cm of snow. The station of Livinal Lunc (1837 m), owned by the Region of Friuli Venezia Giulia, on February, 6th, 2014 managed to measure the highest measurable snow level before the sensor was buried by the snow: 5 metres and 60 cm.

Up to now, the solutions provided in the nivometric

field have been a support to the understanding of real-time scenarios, both aiming at issuing bulletins and analysing deferred data for climatological purposes, in order to improve work planning and the management of the territory. However, the experience gained by CAE on other natural phenomena, combined with the robustness and the flexibility of the innovative technologies developed by our company, let us imagine new applications even in the field of automatic alert systems for avalanches. This kind of application could be very useful in scenarios where a phenomenon jeopardizes road and housing infrastructures, or when a mitigation work does not appear to be the definitive solution to a certain problem.

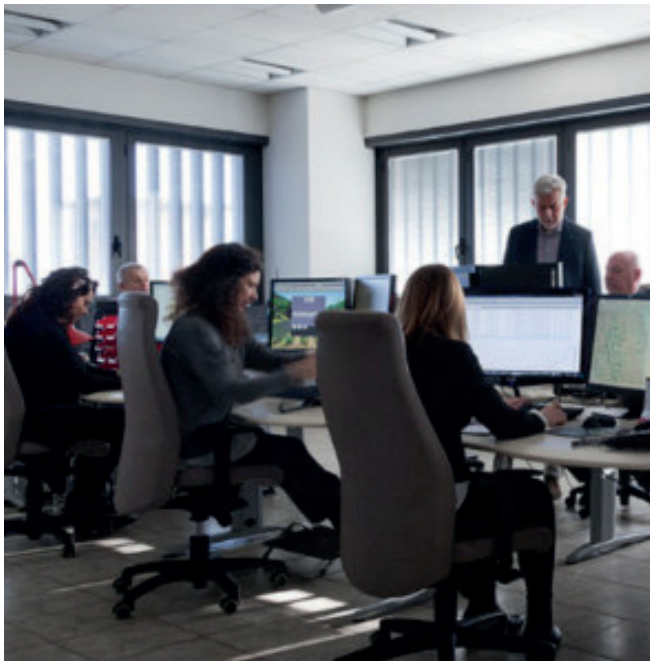
Guido Bernardi from CAE said: "We believe that the implementation of alert systems, even when they are automatic, is a way to meet our corporate mission and to create innovation for a safer world; that is the reason why we are at our customers' disposal to study and test our innovative solutions in the field of avalanche prevention and we are open to different types of applications, including experimental ones, in collaboration with the Public Administration." ■

RETURN TO INDEX

CAE talks about the “maintenance portal”: a simple and interactive web tool that supports our customers in the management of their monitoring and alert systems.

This portal, which has been deeply renovated in the last few years, is where customers know they can find, in an intuitive and effective way, all the information necessary to manage their monitoring and alert systems: documentation, images, operating statistics, maintenance reports, etc. It is an interactive tool that creates a closer connection between the technicians and the maintenance service offered by our company.

The portal was created on the basis of the maintenance experience gained by CAE, in order to provide a unique, complete and flexible tool that can allow us to describe the updated status of the monitoring network and report the maintenance activities carried out, therefore optimizing its functioning. Among the information provided, this tool



determines the percentages related to the types of intervention performed, as well as the number of the different kinds of intervention made over the last 24 months, divided in the following categories: stations, repeaters, central sites, headquarters and radio panels.

The tool is equipped with a dashboard that, through the use of charts and other dynamic tools, allows our customer to have an overall view of their own system, as well as the status of the interventions performed and to be performed. The layout of this page can be customized by the customer, by repositioning the dragging widgets or closing them as needed. Widgets are interactive and, when the synthetic view is no longer enough, they allow the customer to examine the interested section in detail or to shift the focus on a different time frame.

In addition to this summary page, which is useful as a quick view, the portal allows to explore every single component of the network in detail: stations, repeaters and headquarters. For each component you can find a serial number for the traceability of the product, its geographical position and the transmission network within which it is inserted, as well as the history of the interventions performed. Moreover, all documents and photos relating to each site are available. The information contained in the portal for each customer is updated dynamically due to the interconnection with the company information systems and to the accurate updating procedures followed by all the technical staff of CAE.

This portal is interactive, which means it is able to interact with the CAE maintenance service, therefore allowing the technicians of the operating room to directly enter the intervention requests. Apart from being connected to the site concerned, it has a section dedicated to the interventions, where the customers can search and analyse them in detail, together with related photos and reports.

This is an evolution of the traditional maintenance web portal that CAE has always made available to its customers: same logic, more information, better visualization, greater performance and ease of use. The portal also increases the independence of the customer, who can create users with different kinds of licence according to their specific internal needs, and upload documents in various formats. ■

CAE MAGAZINE

Managing Editor: Guido Bernardi
Editor-in-Chief: Enrico Paolini
Editorial Staff: Virginia Samorini, Daniele Fogacci, Laura Ruffilli
Editorial Assistant: Virginia Samorini

Contact Us: redazione@cae.it