innovation for a safer world.

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Innovation and reliability: CAE's test field

The new CAE's Vice-President, Guido Bernardi, and the technical Director, Lorenzo Giandomenico, talk about the new CAE's test field. This important investment in innovation, inaugurated in 2019, is a unique asset of its kind and allows us to perfect our new products by submitting them to more frequent and prolonged tests and to better understand the limits and strengths of the technologies we include in our integrated systems.

This new test field give us the opportunity to perform much more effective evaluation activities than those that can be carried out in the laboratory or with traditional test sites, increasing therefore the level of reliability of the products CAE puts on the market. Moreover, it allows us to compare CAE products with their equivalents, by installing them in a real environment under equal conditions. ■

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Hydrometeorological monitoring system of Lazio's region

Let's take inspiration from the article published on the newsletter by the Basin Authority of the Central Apennines District, which reports on the warning system for weather, hydrogeological and hydraulic risks in the days of the pandemic in Lazio's regional Functional Centre, in order to describe the structure of the hydrometeorological monitoring network, which is the result of 30 years of collaboration with CAE.

Today CAE, in temporary joint venture with another company, is responsible for maintaining this network, consisting of 238 stations and 42 repeaters. The UHF radio network, together with the energy independence of the stations, guarantees the **high standards of required reliability, even during emergencies**. Moreover, the radio network itself also allows the safe exchange of data with the systems of the Regions of Campania and Umbria, in a two-way communication.

The article describes the importance of the distribution of remote measuring stations across the territory, in order to be able to promptly perform various **measurements, essential for interpreting the evolution of a flood.**

The main measurements are related to the **rainfall**, the **level** and the **discharge rate** of rivers, as 200 stations are equipped with **rain gauges** and 82 with **hydrometers**. Moreover, a **discharge** detection system has been implemented on 10 hydrometric stations based on the combined use of an ultrasonic hydrometric sensor and a doppler radar sensor for measuring surface speed, able to guarantee better discharge estimation accuracy compared to classical methodologies, based on Rating curveonly.

However, in order to calculate estimates as accurate as possible, other measures are also collected relating to:

- air temperature;
- snowpack's thickness of the in mountain or hilly areas;
- air humidity;
- pressure;
- solar radiation.

Finally, the system is equipped with a control centre that receives and exchanges data also with external procedures, allowing the centre to feed hydrological-hydraulic modelling platforms, to

integrate real-time data with forecast data, to issue regional bulletins and warnings, and to feed territorial information systems and third-party software.

The control centre was already designed to guarantee data's display "on-the-go". However, to further facilitate remote working during the COViD-19 emergency period, the Administration has also been able to use **AEGIS**, a web platform useful for decision-making support allowing a real-time geo-spatial display of information from monitoring and warning systems. ■

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The implementation of the Citizen's Observatory begins

CAE in JV with CONIT (Permanent Technological Innovation Consortium) and Tech Rain, has won a tender launched by the Eastern Alps Hydrographic District, Brenta-Bacchiglione Basin, for the supply of a hydro-thermo-pluviometric monitoring network, the relevant maintenance services and the development of a web and mobile platform.

The creation of the network and the platform will allow the implementation and management of the Citizen's Observatory on the Brenta-Bacchiglione UOM (Unit of Management). The Citizen's Observatory will have a modular structure and will allow to acquire data from different sources and to homogenize them to make them available to all the modules of the project that will allow their management, processing, validation and publication. The platform will also integrate criticality reports from citizens and Authorities; information related to the management of volunteers and registered users's

data will be stored in special sections. The Administrator will have the ability to configure the system, by integrating external services and regulating access to individual features and sections, as well as by restricting them to particular groups of users.
Mainly, the platform will allow to coordinate the activities of volunteers and rescuers and will provide support to citizens and Authorities in managing behaviours during the alert or emergency phases.
Particularly, CAE will be responsible of the creation of the hydro-thermo-pluviometric monitoring

network providing the data to be published on the platform.

20 monitoring stations with Mhaster datalogger will be provided. The stations will be able to implement local alert measures and send notifications when preconfigured alert conditions occur. Such actions can be configured as consequences of complex sets of conditions.

Particularly, 12 hydrometric stations equipped with LPR radar sensors and 8 thermo-pluviometric stations equipped with THS thermo-hygrometer and PG2R heated rain gauges will be implemented. These devices are meant to detect snowfall, in addition to liquid rainfall, and to melt it. PG2R distinguishes itself from other products on the market because, despite the heaters, it does not require mains electric power, as it is able to operate with the only aid of battery and solar panel.

Moreover, 64 sites will be provided with hydrometric and nivometric staff gauges. Numbered cor-

nerstones will be provided for each of them, with seal as per description of the commissioning body. For their positioning, 1" static and differential GPS surveys will be performed and the relative monographs will be provided.

The supply of this system will be followed by the maintenance service, both in the field and remotely, in order to keep guaranteeing the maximum efficiency of the individual components and of the whole network over time.

The system will be completed by the construction of a control centre, at the headquarters of the institution in Trento, which will have the task of acquiring and centralizing all the data collected (from automatic stations and citizen's reports) and to allow experts to take appropriate measures in case of emergencies, through the use of special platforms developed by the JV. ■

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Belgrade: the flood monitoring and warning system is "Made in Italy"

The City of Belgrade is the largest urban settlement in the Republic of Serbia, as well as its administrative and commercial centre. In May 2014, the city suffered substantial damage, in particular in the peripheral area, and that led to the evacuation of many people. This event pointed out how vulnerable cities are to natural disasters, which is why the City of Belgrade, together with the United Nations Development Program (UNPD), has planned a 3-year cooperation to improve Belgrade's resilience to natural disasters. An annual work plan was drawn up within which the activities were defined and distributed over time, and the funds for their implementation were identified. Among these activities there is also the implementation of monitoring and warning systems.

CAE, in a temporary consortium with an important Serbian company, won the tender organized within the project aimed at strengthening the resilience and preparedness of the City of Belgrade in response to natural disasters and moments of crisis.

The project provides for the supply of:

- 34 stand-alone rain gauge stations;
- 7 stations equipped with heated rain gauges;
- 22 hydrometric stations;
- 3 UHF repeaters.

These are all cutting-edge supplies: the stand-alone rain gauge stations will consist of PG4i equipped with integrated datalogger and 3G module. PG4i is a stand-alone rain gauge that performs the activities of an entire rain gauge station, allowing you to record and send diagnostic information to a control center or to an FTP server, in addition to the data on rainfall intensity and totals.

The heated rain gauge stations will be equipped with PG2R, a rain gauge designed to reduce consumption to a minimum, which allows it to be used on stations powered exclusively by a solar panel and battery.

As far as the software is concerned, a centralized system will be provided for the configuration and maintenance of the network, together with a database, data visualization software and mobile apps that will allow to monitor the progress of the network even "on the go".

The consortium will also carry out installation, start-up, calibration and testing activities, as well as integration services with existing data belonging to the Hydro-meteorological Service of the Republic of Serbia. Finally, a specialized training will be provided to the end users. ■

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Roads at risk of flooding? Sardinia invests in technology and safety

In November 2013, the passage of Cyclone Ruven, also known as Cleopatra, led to heavy rains and discharged 440mm of water on the region of Sardinia on the morning of November 18th, causing serious damages: overflowing of canals and rivers, deaths and destruction. Extreme events of this kind are increasingly more frequent and consequently risk mitigation interventions have become necessary. After the approval of the Draft Agreement between the Autonomous Region of Sardinia, Province of Nùoro and ANAS S.p.A. for the implementation - carried out by the latter company - of the provincial road interventions entrusted to the Province of Nùoro by the Autonomous Region of Sardinia, ANAS has issued a negotiated procedure for the implementation of INTERVENTION S1. CAE has been awarded the contract for the supply and installation of a real-time network aimed at **alerting on the hydraulic and hydrogeological risk for Civil Protection purposes**,with specific focus to **safeguarding those who transit on the Provincial Road SP46, in the area at risk of flooding near the River Cedrino**.

The response times of the River Cedrino are very fast, as are the transfer times of the flood wave

(about 30 minutes). In this scenario, in order to guarantee the safety of those who transit through this area, it is essential to be able to apply the algorithms of CAE stations. When exceeding a certain threshold, these stations allow **to activate traffic inhibition devices, even without the intervention of a control centre**.

To meet the requirements of the project, CAE provided: **five hydrometric stations, a meteorological station and an automatic system to inhibit traffic, consisting of two automatic barriers** for the closure of the Provincial Road to the vehicular transit towards the Oloé bridge when the hy-

drometric levels exceed the thresholds of alert established by the Civil Protection Plans and the risk is high. The systems are connected to the Regional Radio Network managed by ARPAS/SASI, ensuring the **reliability of the service even in extreme weather conditions**.

This system has several purposes, specifically: the **meteorological station** will allow to increase the density of pluviometric information in the Cedrino Basin area, while all five **hydrometric stations** will contribute to define the Provincial Road closure thresholds, two of these are particularly strategic, as they are directly connected to the barriers and, therefore, it is possible to activate them automatically when the defined hydrometric thresholds are exceeded. Finally, the hydrometric station of the Rio Flumineddu is strategic to improve the calibration of the hydrological-hydraulic model of the Upper Cedrino Basin: from this improvement follow preventive assessments of calibration and forecast of flows and volumes flowed from Lake Pedra 'e Othoni, in addition to further considerations regarding the alert system of the Lower Cedrino area. To date, the system is about to be completed; the testing and integration to any effect on the Regional Civil Protection Network will follow shortly. ■

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