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## Tajikistan: hydrological stations, flow measurements and training for the Sughd region

Once again, even abroad, **professionalism and quality products are appreciated and repurchased**. In **2020**, CAE started work on implementing the monitoring and early warning system for **Lake Sarez in Tajikistan**. This was not a trivial project, all installations are located at an altitude of between **2,600 and 3,000 metres above sea level**, which can only be reached by **helicopter or a 24 km trek**, so a major effort in terms of logistics management, installation and operations was required. In fact, in the last issue we talked about some of the challenges we are prepared to tackle, being used to working **at high altitudes**. Due to **the lack of mains** electricity and cellular communication networks at most sites, the monitoring and communication stations are powered





solely by solar panels and rechargeable batteries, with data transmission via satellite transmitter ([click here](#) to find out more about the project).

In **2024**, the Hydro-Meteorological Service of Tajikistan returned to CAE technologies, precisely because they are considered **reliable** and **suitable for installation in highly hostile environments**. In this situation, **agro-meteorological stations** were provided and data was sent to a control centre



equipped with the **Aegis** web software. [Click here](#) to find out more.

Now, in **2025**, three new **monitoring stations** have been ordered and will be installed in the **Sughd** region to send data via GPRS to the control centre.

Each station will be equipped with:

- **CompactPlus** data logger;
- radar sensor for measuring water level and surface velocity for calculating **flow rates**;
- solar panel and backup battery.

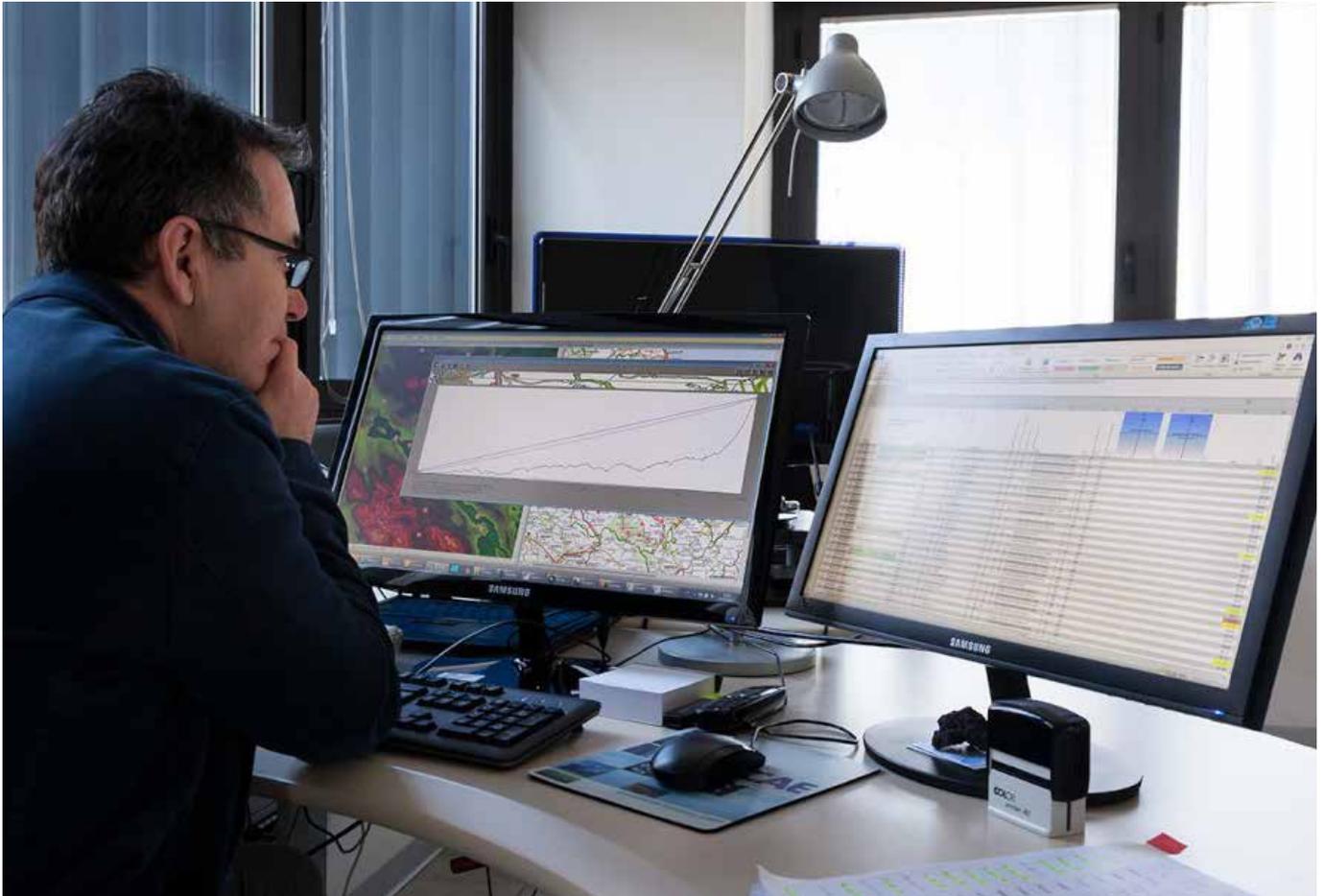
The order also includes the supply of three **ADCP** current meters (Acoustic Doppler Current Profiler), advanced instruments used to make velocity profiles of river currents, which are useful for measuring **flow rates** in rivers and optimising the water resource distribution.

CAE will provide **training** for each site, both on-site during installation and remotely when required. They will be important opportunities to learn about:

- system operation;
- the maintenance activities required;
- data collection and analysis;
- safety protocols;
- software;
- installation and calibration of hydrometers, sensors for measuring water surface velocity and calculating flow rates. ■

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## Reliable monitoring systems? It all starts with good planning



To **improve technical synergies and ensure faster project management**, the “Design” department recently became part of the “Innovation & Technology” area. Because the company is growing, work has been done, and more is planned, to reshape the internal structure, with just one goal: continue to guarantee customers get the highest quality in terms of products and services.

CAE provides solutions to mitigate risks related to extreme natural events. All the decisions taken by the authorities, from issuing a bulletin to automatically switching on a traffic light at the entrance to a flooded underpass, depend on the **reliability of the measurement** at the source, and the entire data recording and transmission chain. This reliabi-

lity depends both on the **quality of the specialised services** that accompany the technologies, such as **design**, installation and maintenance, and on the **robustness** and **accuracy** of the components and products that are developed and deployed.

In this article, we focus on the “Design” department, which, since 2021, has been headed by Ermes Fabbrì, a 35-year veteran of the company.

The department is involved in the early operational phases of the project, and is responsible for: carrying out executive and feasibility surveys, designing and drawing the plant configurations of the installations, supporting steelwork for equipment and sensors, designing radio communication networks, carrying out structural checks, producing

and managing documentation, drawing up monographs, following the paperwork for obtaining permits and preparing bills of materials.

**What are the main principles on which the design work carried out by the department is based?**

CAE systems have always been designed to ensure **maximum reliability** even, and especially, under **extreme conditions**, the keywords being:

1. **redundancy**: both regarding energy, meaning the station power supplies, and regarding telecommunications and the means of transmitting data measured in the field;
2. **robustness**: our installations have to withstand extreme conditions, and we can proudly show images of bridges swept away by flooding where the CAE station does not move an inch while neighbouring infrastructures, lighting poles, railings, etc. are swept away by the rush of water;
3. **safety**: our installations are designed to provide installers and maintenance technicians with high standards of work safety, taking into account, for example, site accessibility and road conditions for positioning hydrometric sensors;

4. **environment**: improving the environmental sustainability aspects of designed products by integrating material and process assessments into the development process.

The company's approach is to provide turnkey systems **that ensure maximum customer satisfaction**. To do this, there are several factors to consider, for example, we believe that it is essential to invest in **standardisation** processes in order to **reduce intervention times**. Another important activity is to support customers in obtaining **permits**: either by providing the necessary documents or by filing applications as a representative, thus interfacing directly with the issuing authorities: Councils, Park Authorities, Heritage Protection Authority and so on.

**What are you focusing on to grow the department? Is there any news?**

Of course, **professionalism** is essential. The department now consists of 6 people who complement each other to ensure customers receive a service that takes account of both great experience and important specific areas of expertise, thanks to the introduction of new professional roles that



we believe essential to providing the best service, including a structural civil engineer, a hydraulic civil engineer and a surveyor.

In addition, we have introduced the use of **new state-of-the-art software**. For example, considerable progress has been made in **radio network design** since I started working in CAE. Today we have software that allows us to predict issues that were previously only found with field surveys and tackle them in advance. On-site verification is still necessary, but the software allows us to arrive prepared,



ready to define the details, because on a macroscopic level the situation has already been analysed and studied beforehand at the desk. Since the 1980s, preventive remote analysis was always done with relief maps, but the level of accuracy achieved today is something else. Moreover, going into detail on our **core** business, today we use **parametric 3D software** capable of generative **design**, real-time simulations, additive manufacturing and the use of augmented reality. This software is also essential for obtaining the permits mentioned earlier. We are also in the process of introducing a new “management system” for 3D modelled drawings of company products, an essential tool for sharing information dynamically in real time to improve the group synergy in the ‘Innovation & Technology’ area.

The tools change, but not the goal, which is why we strive to stay up-to-date in order to provide the best possible service for our customers. ■



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## LANDSLIDES: presenting the latest generation Wireless Sensor Networks

Due to its geomorphological characteristics and significant urbanisation of the landscape, Italy is a country at high hydro-geological risk. For this reason CAE offers solutions aimed to mitigate the effects of the geological and hydro-geological risk, which takes the form of erosion of slopes, landslides, rock falls, sudden and rapid flow of debris, slow and continuous slope slipping over time.

These solutions can trigger automatic responses according to pre-set thresholds, stopping traffic and warning the population by means of traffic lights, light billboards, sirens and powered boom gates.

The systems we offer use wireless sensor networ-

ks distributed over the landscape in the form of a self-configuring mesh network; the flexibility of these tools allows simple and quick adaptation to different operating contexts and responding effectively to the various needs of the customers. In particular, they allow monitoring contexts that are difficult from the logistic point of view, where placing traditional cables would be arduous or excessively expensive. These monitoring and warning systems aim to protect the public under emergency conditions.

CAE is the current leader in Italy, and monitors **more than 50 landslides** in real time, in some cases with systems dedicated to a single spe-



cific landslide, in others **with entire monitoring networks** for several landslide masses.

CAE technology now comes in a **new guise**, WSNs will now consist of W-Master and W-Point with **868 MHz** wireless communication modules and **Modbus standard interfaces**. The mechanical and energy components have been overhauled to make it easier for technicians to work on them. Specifically, new solar panel power modes and different battery types were introduced to make

the system more flexible, depending on the site type and environmental conditions.

The **simplification process** has now also led to the development of **new management software** that allows the end user to **design, configure, install and activate** the network more **easily**.

This process resulted in **standardising landslide monitoring technology**, an increasingly indispensable feature. ■

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## The Eastern Alps District strengthens monitoring

Over the past five years, CAE has implemented several real-time hydro-meteorological monitoring networks on behalf of the **Eastern Alps District Basin Authority (DAO)**, specifically on river catchment areas: Piave, Brenta-Bacchiglione, Tagliamento, etc. for a total of **37 hydro-meteorological field stations and 2 control centres**. The remote monitoring network in the Adige basin is currently being implemented, and consists of: **30 automatic hydro-meteorological stations and 3 flood warning systems for road subways**. The networks built by CAE are able to interface with the forecasting computer platform that will allow the DAO to create and manage the Citizens' Observatory on each river basin. In addition, at these basins, CAE carried out the **topographical surveys and flow measurements** required to construct rating curves and real-time flow

monitoring systems.

Recently, the DAO launched a new tender for the creation of a monitoring system for remote sensing of hydrogeological and hydraulic variables, complete with instrument-based section surveys. The tender was awarded to CAE. The contract includes network maintenance and staff training services.

The overall order includes:

1. installation and maintenance of new remote control stations:
  - a. 4 rainfall stations;
  - b. 2 stations with cameras;
  - c. 2 hydrometric stations with a hydrometer and hydrometric rod with QR Code panel;
  - d. installation and maintenance of 4 hydrometric rods with QR Code panels;





2. installation of 1 QR Code panel at an existing hydrometric station;
3. integration of sensors in 6 existing DAO stations and the related extension of the maintenance period;
4. maintenance of 10 existing DAO stations;
5. maintenance of additional 18 hydrometric rods already installed.

The latest technologies available on the market will be used for this network to ensure maximum compatibility and integration with the installed system, including at the control centre.

The following will be used:

- **CompactPlus data loggers**: characterised by



quality, power and reliability, while maintaining **low power consumption**, making them the ideal instruments for demanding applications in **multi-risk systems**. They feature **powerful hardware** managed by an **embedded Linux operating system**, which provides ample flexibility;

- **PG2 and PG2/R rain gauges** to measure rainfall accumulation and intensity;
- **THS thermo-hygrometers** to measure tempera-





ture and relative humidity of the air;

- **WLR/L radar hydrometers** with a measuring range of up to 30 m for measuring the watercourse levels;
- **ultrasonic anemometer** to measure **wind speed and direction**;
- PTZ high-speed **cameras** for clear, sharp wide-angle views and excellent detail in difficult lighting conditions.

As with the other projects, panels with **QR codes**

will be set up to involve citizens in the observatory and take hydrometric readings or simply report on what they physically find at the site.

The brand new **Datalife Platform** will be installed at the existing **control centre** to complement the existing one and upgrade it to the latest and most innovative version available. It will be an evolution that encompasses all the functionality already available at the existing control centre, while introducing **several new features**. ■



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## An article was presented on soil deformation monitoring related to railway tunnel construction



The **XXVIII National Conference of Geotechnics** was held in Venice from 11 to 13 June, which was an opportunity to present the scientific article: **“Soil deformation monitoring related to the**

**construction of a railway tunnel: example of the Brenner Base tunnel”** written by A. Tamburini - IMAGEO Srl; P. Cancelli, G. Bragonzi, A. Mocchi - Studio Cancelli Associato; S. Cappelletto - BBT SE; S. Colonnelli - CAE S.p.A.

The **Brenner Base railway tunnel is 55 km long and will connect Italy with Austria.** The link consists of two single-track main tunnels, with three connections per kilometre between the two bores. **The tunnel system has a total length of 260 km.** As part of the design, the possible **subsidence** caused by any groundwater drainage and the possible consequences on surface structures and infrastructure were quantified. **Geodetic monitoring networks** were installed to identify the occur-





rence of such phenomena at an early stage.

The **Val di Vizzo network** presented in this article is an example of integrated soil movement monitoring. The area hosts an aquifer consisting of quaternary glacial deposits bounded downstream by a rocky threshold where the Novale hydroelectric dam is located. Subsidence forecasting studies identify this area as a likely location for subsidence of up to a decimetre in size.

The **monitoring consisted of a total of two robotic stations with 59 rods and five automatic GNSS stations** around the study area. **Every six months, geometric precision levelling was carried out to independently verify the results of the automatic measurements.** To detect any ab-

normal behaviour early, the automatic data was compared with predefined thresholds on both absolute and differential displacements over time and space, with reference to strategic structures on the surface. The article covers the criteria used to define the thresholds in relation to the need to trigger corrective actions in order to manage any anomalies.

**It also presents the results of the monitoring and the strategies adopted to cleanse the measurements from external disturbances related to meteorological-climate effects and the instability of the physical network.**

To find out more about CAE's contribution to implementing the project [click here](#). ■

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# The Global Hydrometeorological Excellence Awards 2025



CAE is proud to announce that it has been shortlisted for the Global Hydrometeorological Excellence Awards 2025 in two categories:

- Best Forecasting & Early Warning Solution
- Outstanding Innovation in Automatic Weather Stations (AWS)

The Global Hydrometeorological Excellence Awards is the first-ever awards ceremony dedicated to recognising the world's leading contributors in meteorology, hydrology, and climate services. Hosted by Varysian, this landmark event will bring together global leaders, public and private sector professionals, and cutting-edge innovators in the field. The awards ceremony will take place on Monday, October 13th, in Vienna. Stay tuned! ■

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