START ENGINEERING JSCo.

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Employer:	SOFIYSKA VODA — JSCo.
Project:	"Beli Iskar" Dam - Repair works - stage 1
Subproject:	Instrumentation system of the Dam
Main contractor:	"Start engineering" JSCo.
Kinds of activities:	Design (hardware and software), specification and delivery of equipment, installation and commissioning
Performance:	November 2002 - February 2003

Beli Iskar Dam is constructed in the valley of Beli Iskar river, in Rila Mountain and is mainly used for water supply of Sofia city. The dam is concrete gravity type, max height 51 m and crest length 533 m. Crest Elevation is 1878.70 (above the sea level).

Short description of the project:

The project was performed by specialists of "Start engineering" JSCo. on the basis of preliminary design "Instrumentation system" of Energoproect — Hydroenergetika" EAD and specific requirements of the employer.

The Instrumentation system comprises three independent subsystems:

- Meteopark, where air temperature and humidity are being measured, as well as barometric pressure, intensity of solar radiation, precipitation. The data is gathered in microprocessor station CR10X of *Campbell Scientific, Inc. USA*

- System for monitoring of the dam which comprises:
  - level gauge for the water level of the dam
  - seepage measuring weirs, which measure the infiltrated water flow, passed through the membrane, concrete and drainage curtain under the dam
  - piezometers, which monitor the water head in the dam body
  - direct and inverted pendulums for horizontal displacements of the dam crest and foundation
  - thermometers for the concrete temperature
  - jointmeter for surveillance of opening and closing of joints

The sensors for dam condition (with the exception of the pendulums and the jointmeter) are of vibrating wire type, having proven high reliability and security, production of **GEOKON** USA . The signals from all sensors are gathered in four commutators with multiplexers (MUX), located in drainage gallery. From each MUX through a common cable the signals are sent to the Central Measuring Station.

- Seismic system for registering of earth fluctuations, consisting of a GPS antenna and three accelerometers, two of which are interconnected. The seismic equipment is from ***GeoSIG*** Switzerland.

Multiplexers

Accelerograph

The equipment for the meteopark and the instrumentation system for monitoring the dam are supplied by GEOKON USA .

The cabinet with the central measuring station Micro10 (based on CR10X) of Campbell Scientific, Inc. USA is installed in the newly erected building for the purposes of the instrumentation system. The data gathered there are sent through serial interface to the Operator's station — HP OMNIBOOK XE 4500 and is used by means of MultiLogger2 Canary.

The red device is portable Readout Unit GK-403 (GEOKON) for direct readout of the sensor values from the MUX themselves.

Micro10, HP OMNIBOOK XE 4500 and GK-403

The meteorological data gathered in CR10X, also through a serial interface, are being handled and processed by means of PC200W.

GeodaS is the software, by means of which records of seismic events are being taken out of the accelerographs.

Micro10 is powered by rechargeable battery 12V, which is being charged by mains rectifier.

CR10X in the meteopark is also powered by rechargeable battery 12V, which on its part is being charged by a solar panel during the daytime.

Due to the increased danger of damages in the presence of seasonal lightning activity and problems with the power supply, the microprocessor equipment is provided with two-stage overvoltage protections.

A new survey network was constructed for monitoring the displacements of outside points of the dam and for monitoring the bottom silts.

The team