Motorola and a Hydro-Power Dam In Thailand

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Background

Dams are man's way to control available water resources for flood prevention and to provide for irrigation and the generation of electric power.

If not properly controlled, dams can cause disastrous flooding and seriously upset the environment. The delicate balance of plants and animal life could be irretrievably destroyed. Dam operators must learn how to fine tune the sluice system that controls the amount of water that powers the generators or is released as overflow. If not enough water is released, the build-up of accumulating water from monsoons, rain storms and raging rivers could cause the dam to burst, releasing torrents of water over a wide area. Without a proper alarm and warning system, the flooding could cause massive destruction to lives and property.

The Pak Mun Dam

Motorola recently completed the installation, in Thailand, of a dam control system, based on the MOSCAD. The installation was made at the Pak Mun hydropower project, that created the first river run-off reservoir in Thailand. The dam was built across the lower Mun-Chi River at Ban Hua Heo in northeast Thailand, approximately 40 km from the Laotian border. It is run by the Electricity Generating Authority of Thailand (EGAT). The Main Control Center (MCC) was installed at the Sirindhorn dam, that provides 45 MW of electricity, located approximately 10 km from the Pak Mun dam.

The Pak Mun dam was designed with several generators for the generation of 105 MW of electricity. Basic field data, such as water level and flow are transmitted by a Rosemount SCADA, system via wire lines to the control center where operators, monitoring the SCADA could manually control the sluice gates to the generators and to the overflow gates. Almost from the beginning, the dam project was criticized by environmentalists and local villagers, who felt the dam could severely upset the delicate environment and presented an additional danger, should it burst as a result of the seasonal monsoons.

Motorola's System

Motorola engineers designed a control system that would quiet the fears of the environmentalists and would have the capability of automating water flow control for the efficient generation of electricity while preventing flooding as a result of seasonal monsoons. Should, however, there be any danger of flooding, the system would warn the operator to ensure sufficient time for taking appropriate action.

The Motorola MOSCAD based system was divided into two operational stages. The first is the accumulation of historical statistical data, such as rainfall and river water flow and level. The data is gathered from remote sensors, located at hydrometeorological stations run by the Thai Royal Irrigation Department (RID), National Energy Administration (NEA) and Electricity Generating Authority of Thailand (EGAT). In the second stage, the system will use the accumulated data along with current information to predict necessary actions to be taken in normal dam operation and issue sufficient warning in emergencies if necessary.

MOSCAD RTUs, equipped with proper sensors, installed in rivers upstream from the dam collect data that is transmitted to the Field Interface Unit (FIU), a MOSCAD unit at the MCC. Many of the RTUs are located in remote and difficult to reach places. Some are therefore equipped with a seven-day backup battery while the others have

a solar panel. The RTUs process the data before transmission. One example of this processing, is calculating water discharge by means of the discharge equation stored in the RTU. FIUs periodically interrogate the RTU for data and the RTU will initiate reports to the FIUs about unusual events such as excessive rainfall, dangerously high water level or RTU malfunctions.

Motorola Customized Software

Motorola integrated and customized software runs on a PC platform in a Windows environment. It consists of the following packages:

- IGC/M - Motorola
- FIX/DMACS - Intellution
- EXCEL - Microsoft
- TIS – EGAT
- AXS4 DDE Server – Rosemount

Data from RTUs is relayed by radio, using Motorola MDLC protocol, to the Main Control Center (MCC) at the dam site. This control center is a PC, loaded with a suite of software programs integrated and customized by Motorola. The relayed data is collected by the IGC/M software periodically and by contention. The data is transferred to the Intellution FIX/DMACS software package, which converts the data into historical files, for reports or graphs and provides a user-friendly graphic interface for the operator. For example, the operator gets a graphic representation display of the dam or sites, with current water level - rising or receding. The software was customized by Motorola to meet the special requirements of EGAT.

Microsoft EXCEL (Visual Basic and macros) applications were upgraded by Motorola to request data from FIX/DMACS through the Dynamic Data Exchange (DDE) channel and use this data to issue periodic historical six-day reports in ASCII file format.

TIS Software

The files are accessed by the TIS software and the results of the TIS calculations are sent to the Rosemount SCADA, via the AX-S4 DDE server. Actual upstream and downstream data are relayed from the Rosemount SCADA to FIX/DMACS, through the DDE channel. The data is stored and monitored by the operator, so that essentially, all data is stored and available from the MCC. The program, routing and storing were customized by Motorola.

The TIS program supplies flood forecasting data, controls dam operation and predicts water level and discharge three days in advance, while using the data of the previous six days that it periodically receives from the MOSCAD RTUs.

Next Stage

Gradually, the system itself will control the water flowing through the dam and the entire electricity generating process. This will be done by EGAT, through the optimization of its TIS Mathematical Model. The model will be optimized through the accumulation of all the data from the Rosemount and MOSCAD systems, over a period of a few years, using tools provided by Motorola.

The objective is to provide total system control of water flow, to maintain the area's sensitive environment while providing efficient electric power.

Because of Motorola, no one is afraid of the big dam.