GeoWatch

July 2002, Issue 16

GeoSIG

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Foreword from the CEO

The Seismological Society of America was holding the 97th annual meeting this April in Victoria, British Columbia in Canada (www.seismosoc.org). GeoSIG participated the exhibition and demonstrated the TREMOR prototype running on internet based CDPD network. During meeting sessions, feedback from potential users and experts in the field of instrumentation was our main interest. I would like to summarize the three outcomes in brief:

First, the TREMOR uses a MEMS (microelectro-mechanical systems) based accelerometer with less than 30 µg noise, utilizing a silicon based sensor providing this noise floor. The 'silicon' accelerometer breakthrough in the field of seismological and earthquake engineering is about to happen.

A second factor influencing the instrumentation field is the internet. Not only communication, but also interconnection of instruments can be achieved while the setup is by far easier when compared with the standard modem approach.

Point number three is a very pleasant one; it is the successful cooperation between USGS and GeoSIG within the TREMOR project. Within a Cooperative Research and Development Agreement (CRADA) the two organizations merge their specific know-how, leading in state of the art instrumentation. With the demonstration of the TREMOR prototype during the SSA 2002 Annual Meeting an important milestone was achieved, which is the result of the outstanding effort spent by John Evans (USGS) and Patrick Camina (GeoSIG).

Christoph Kündig

GeoSIG Provides Industrial Seismic Protection Equipment for Tianwan NPP, China

In cooperation with JSC "SNIIP-SYSTEMATOM", Russia and Scientific Production Company Vulcan - our representative in Russia and CIS, GeoSIG manufactures the instruments of the Industrial Seismic Protection System (ISPS) for the Safety Emergency Protection Subsystem of Tianwan Nuclear Power Plant in China.

Figure 1. Location of the NPP

The plant is located in Lianyungang and is one of the largest nuclear power projects in the country. The yearly generation of electricity of the two-unit plant is projected to be 14 billion kWh. The expected operation start dates are 2004 and 2005 for the two units consecutively.[1]

The ISPE is intended for the generation and transfer of discrete protection signals to emergency protection equipment for reactor shutdown at exceeding of established thresholds in specified monitoring points, as well as for the registration of seismic influences at NPP reactor facility.

Figure 2. A view from an ISPE sensor with stainless steel housing.

ISPE for one NPP unit consists of 14 channels with dedicated seismic sensor and recorder. 8 channels will be used for protection whereas the remaining 6 for information. There will exist two monitoring points, the

information from which will be used for reactor shutdown. Further, there will be four other monitoring points for information purposes.
In this context GeoSIG supplies force balance accelerometers in stainless steel housings as well as customized GSR-18 seismic recorder rackmount units.

The units feature 2 different alarm thresholds, as well as test and equipment fault opto-coupler output signals. All instruments have to pass through EMC, seismic and climatic qualification tests, based upon the customer's requirements.

The recorders are housed in 6 HU 19 inch industrial EMC housings. All inputs and outputs have been designed for maximum overvoltage protection and RF immunity. In parallel to event recording, all channels data is sent in a stream to computers for further archiving and analysis. The DSP (digital signal processor) in the recorder activates the trigger, based upon customized algorithms, well-adjusted to the specific application.

1: More information about the Tianwan NPP can be reached at CAEA web site, http://www.caea.gov.cn/english/peaceful1.htm

Istanbul Earthquake Early Warning and Early Response System Acquired the Temporary Acceptance

In the previous issues of the GeoWatch, the progress of one of the few and multi-dimensional projects for metropolitan earthquake early warning and early response, have been reported. The multipurpose system which was under installation and commissioning by GeoSIG in a Joint Venture with Electrowatt Engineering; for Bogazici University Kandilli Observatory and Earthquake Research Institute (KOERI), is completed and temporary acceptance is granted.

This major network is the first comprehensive instrumentation for Istanbul towards seismic disaster relief as well as risk mitigation (initially as a trial). The network will also contribute substantially to the scientific data accumulation for a better understanding of the seismic hazard on the less-known western portion of the North Anatolian Fault (the blue strip in figure below) in the Marmara Sea; and susceptibility of the 15 million city towards an expected large earthquake.

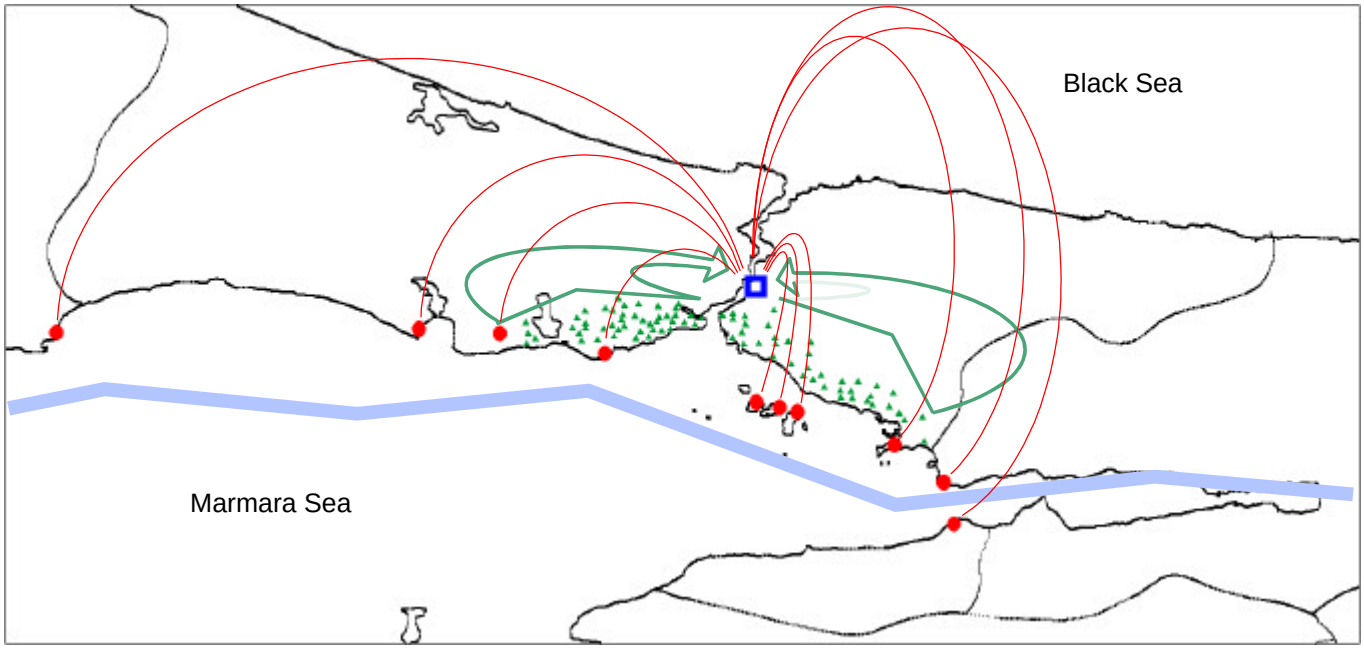

Figure 3. Illustration of the overall EWER system layout. (This over-simplified sketch does not represent the actual technical layout)

The above sketch illustrates the simplified layout for the station distribution and communication methods. The red dots indicate the early warning stations for which spread spectrum telemetry will be used to transmit data to the data center in KOERI. It is worthwhile to mention that the spread spectrum communication is possible through three repeaters. The green dots stand for the early response stations which will utilize Global System Mobile (GSM) services to communicate with the center.

The comprehensive spread spectrum network employing the latest technology achieves point to point communications at distances of approximately 100 km. The radio links for the network have been carefully evaluated both theoretically and on site by GeoSIG. Theoretical analyses consisted of extensive use of digital topographical databases and electromagnetic radiation pattern analyses (Fresnel zones versus topographical obstacles) to obtain clean communication paths. Performing on site link evaluations on two distinct occasions (which were reported in detail in previous issues of GeoWatch) yielded the best possible locations for quality communication throughput. After combining the results of the mentioned analyses with the available/permissible candidate locations, best final spots are identified for the stations as well as the repeaters which are the essential parts of the communication system. All on site analyses were conducted under supervision and actual performance of

experienced communication specialists from GeoSIG, with significant support from KOERI.

Computers in the main data center operate the state of the art GeoDAS software developed by GeoSIG soft-

Figure 4. Main Data Center in KOERI during installation.

ware team. Innovative and modular structure of the software yields a versatile and powerful tool for data acquisition from GeoSIG instruments.

GeoDAS performs data acquisition from the stations as well as remote setup of the stations via the dedicated communication link, i.e. spread spectrum telemetry or GSM, utilizing bi-directional links. Channel drivers are designed to work asynchronously and independently as separate tasks of the main communication process.

Real-time continuous data streams and state of health information are displayed for the early warning stations, for which also setup can be conducted. GeoDAS also offers tools for preliminary data processing especially for the telemetry channels from the on-line stations to acquire statistical data describing the system performance and the quality of the signal.

The communication for the early response stations is event or user triggered (dial-up). The transmission is possible using the SMS as well as the data channel of GSM. GeoDAS monitors the station and communication status via periodical state of health checks, and displays the latest state using the SMS. Furthermore, recorded waveforms are available for inspection and analysis after downloading through the data channel. Remote station setup is again conveniently available through the dial-up connection.

Furthermore GeoDAS keeps continuous statistics of the overall system operations.

Highlights from the ARTeMIS Seminar, June 13-14 in Glattbrugg, Switzerland

The seminar "Learn to do output-only modal testing and analysis using the ARTeMIS Extractor software" is held in GeoSIG premises in Glattbrugg, Switzerland on June 13-14, 2002.

Mr. Palle Andersen, CEO of Structural Vibration Solutions ApS (SVS) was visiting to carry out the lecture for which the organization was conducted in coordination between GeoSIG Ltd. and Dr. Reto Cantieni from rci dynamics, who has been working in the structural analysis field for many years.

Figure 5. Mr. Palle Andersen during the seminar.

The purpose of the Seminar is to provide the participants with an introduction to the state of the art of modal identification for systems where only the output is known. Traditional modal testing requires the measurement of controlled forces used to excite the structure. In damage detection, and in cases of large structures in operation, it is difficult or in many cases even impossible to produce, control and measure such input forces. In these cases, modal identification can be carried out based on measured responses only.

The seminar was divided in two days where the first focused on the theory and practice in using this technology and in using the SVS output-only modal analysis software called ARTeMIS Extractor. The second day was intended for individual training of the participants in using ARTeMIS Extractor with their own measured data.

Seven participants attended the seminar, primarily from the Zurich area and they all received a time limited license of ARTeMIS Extractor as well as a comprehensive set of course notes.

All the lectures were held on the first day. First Mr. Andersen gave an introduction to the output-only modal analysis technology and described the differences to the traditional modal analysis technology. Then he continued explaining about how to make good output-only measurements and what kind of signal processing is required for this purpose. After lunch the participants were lectured in the different modal analysis techniques available in ARTeMIS Extractor and they tried using the software themselves on measured data.

GeoSIG Monitoring System Detected the First Instrumental Tectonic Event in Lithuania [1]

As also reported in the new GeoSIG webpage, www.geosig.com, the Ignalina nuclear power plant (INPP) in Lithuania is instrumented and monitored with GeoSIG equipment under the name SMS.

"Seismological Monitoring of Lithuania" project is being conducted by Geological Survey of Lithuania (LGT). Data of Seismological Monitoring System (SMS) of INPP are being collected and processed within the project framework. Seismic stations of SMS were reported to be entered into the international after the efforts of LGT.

52 distant, 3 regional and 1 local events were detected and localized. The only local event was detected on 4th of September, 2001, 19:40. Seismogram of this event can be seen in Figure 5. Local magnitude of this earthquake was reported as 2.1 and it was registered by one seismic station Salakas (ISAL) only.

It was found that epicenter of the event should be located in a distance of approximately 80 km and azimuth of approximately 302° from the station ISAL; no seismic signal was found on the record of the most distant station Did iasalis (IDID).

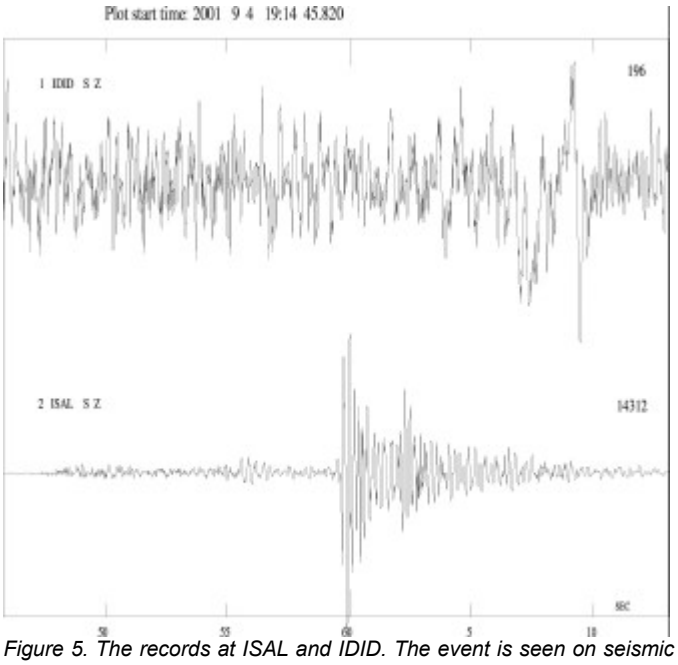

Figure 5. The records at ISAL and IDID. The event is seen on seismic station ISAL. No seismic signal could be revealed from the background noise on the record of station IDID. Figures above the traces on the right indicate maximum amplitudes in counts.

1. Information and data are the courtesy of Mr. Andrius Pacesa of LGT.

New GeoSIG Website is Now Online (www.geosig.com)

The new and innovative web site for GeoSIG Ltd. is up on the Internet with the new address www.geosig.com.

Furthermore, all e-mail addresses for GeoSIG have been updated with the extension ".com" instead of ".ch".

This innovation on the web page reflects the enthusiastic and dynamic company profile as well as will provide better tools for all customers and affiliates with an enhanced and interactive tool to further benefit from GeoSIG services.

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Please Note:

Due to summer holidays our offices will be closed from 27th July until 11th August 2002