GeoWatch

October 2005, Issue 27

GeoSIG

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Keynote

Scope: GeoSIG Production

In this issue of the GeoWatch, we focus mainly on our Production Facilities.

GeoSIG Ltd. Production Department is located in Cugy, in the vicinity of Lausanne, Switzerland. Our well-experienced crew is able to manufacture 60 instruments per week including any and all customizations. Our manufacturing and testing procedures have been recently optimized to enhance our capabilities. Some of these optimizations are described here briefly.

Among many other small to large scale projects, we recently have supplied state-of-the-art instruments for the GERI, IITR and NEIS projects, which stand out due to the customized properties of the instruments. Thus short descriptions of each of these projects are presented.

Increasing demand for our instruments around the world has persuaded us to apply advanced project and production management with specialized tools developed by our own experts, to be able to maintain our responsiveness to each new inquiry and our effectiveness for each ongoing project.

GERI Project, India

Project Review

Gujarat is a state of India that lies on the western end of India as seen in Figure 2, and is located in a highly seismic area. Recently GeoSIG was awarded with a tender to provide Digital Strong Motion Accelerographs for the Gujarat Engineering Research Institute (GERI). The tender was for the supply, installation and commissioning of Seismological Instruments and their Accessories for establishment of a Network of Observatories and Strong Motion Accelerographs for Seismological studies in Gujarat. GeoSIG has teamed up with its long-term affiliate Güralp Systems Ltd., which has supplied the seismological equipment in the scope of this tender. The instruments are meant for measuring the free field ground acceleration in the event of an earthquake. The objective is to acquire and process the ground acceleration data for seismological and engineering applications.

Supplied instruments are from the 18-Bit GSR-18 lines, with internal AC-63 force balance accelerometer, 32 MB Flash memory, precise GPS timing, external landline modem and highly redundant power autonomy. Furthermore a complete Data Retrieval and Processing Central Equipment as well as a number of Field Data Retrieval Systems are supplied. (Figure 1).

Our well-experienced and highly competent representative in India; Gannon Dunkerley & Co. Ltd., Mumbai, is performing all installation and commissioning activities as well as organizing all delivery inspection, site acceptance testing and training tasks.

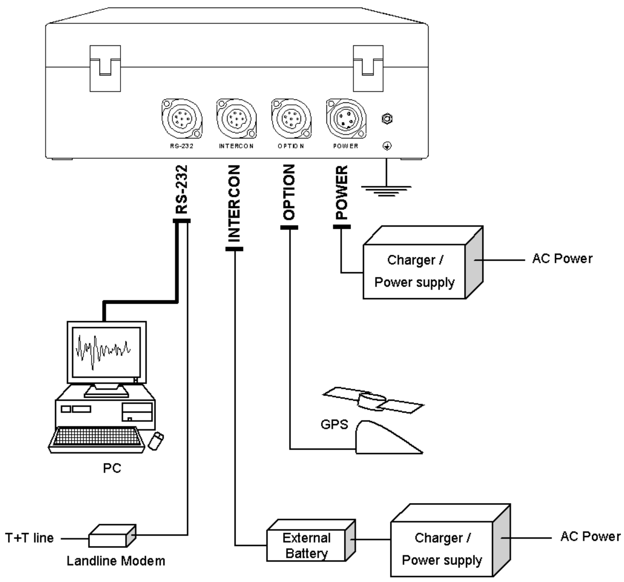

Figure 1. System Topology for GERI Project.

IITR Project, India

Figure 2. Map of States and Union Territories of India.

[IITR](#) is situated at the foothill of the Himalayas, in Hardwar district, within the state of Uttaranchal (Figure 2).

The Department of Earthquake Engineering is the only one of its kind in India and amongst a few in the world and was established in 1960 as School of Research and Training in Earthquake Engineering. The department has undertaken programs of seismic instrumentation in the country with a view to have better understanding of the ground motion characteristics and seismicity of various regions. The instruments provided here are to be deployed within the project entitled "National Strong Motion Instrumentation Project" sponsored by Department of Science and Technology, Government of India under its Mission Mode Program on Seismology.

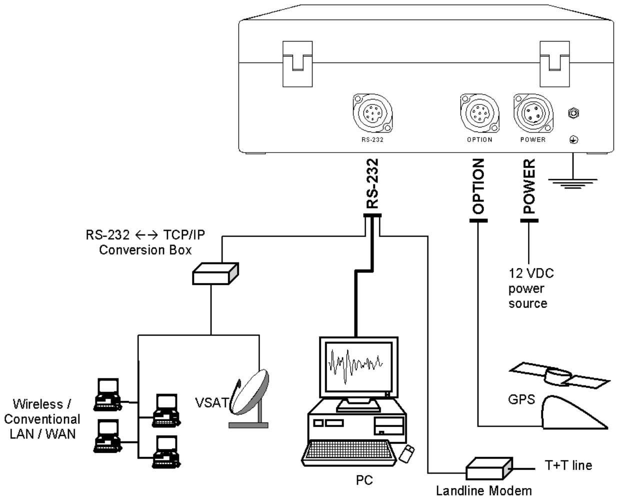

Figure 3. System Topology for IITR Project.

Task of IITR

The Indian Institute of Technology Roorkee (ITTR) has its foundations in the Roorkee College, which was founded in 1847, to train technical manpower for making the Ganga Canal. It was the first Engineering College in the entire British Empire at that time.

NEIS Project, China

Project Review

The Client for this Project is NEIS (National Earthquake Infrastructure Service, China Earthquake Administration - CEA (Former China Seismological Bureau - CSB)). The NEIS Project is concerned of instruments that will record strong motion and convert the data to Intensity Scales. New modules were developed for GSR-18 to achieve the Intensity Scale feature. This is a good example on our capability of putting together all the modules for different instrument types.

The recorder is referred as the "Intensity Recorder" as it displays the calculated intensity on its LCD that the intensity does not have to be an exact value with many variables. Thus the intensity calculation takes place in the Recorder.

More detailed technical explanation can be seen under the "Technical Point" topic, here in this issue of GeoWatch.

In this Project, the Intensity Recorder contacts the center through Modem/TCP/IP and transmits earthquake parameters such as PGA and Intensity.

Also GeoDAS has been updated for this new implementation. This also can be seen under the "Technical Point" topic under "Intensity Settings" paragraph.

Training on 3rd October, 2005

Figure 4. CEO Christoph Kündig and Chinese colleagues in the training session.

At the beginning of October our CEO, Christoph Kündig, went to Beijing for training session that was held for this project. Mr. Kündig was very pleased about the interest that was shown by the attendees. They were very focused on the topics and the training meetings were very successful.

Burn In

We apply strict quality control standards in our production line. This dedication to achieve the highest quality has persuaded us to further improve the speed and complexity of our product post-manufacturing tests. Thus we have designed and built industrial burn-in cabinets to be able to test several instruments simultaneously and automatically during a test period within a uniform environment.

Currently the complete functionality of 60 GeoSIG instruments can be tested in tandem. A total of 5 cabinets have been built and each of them supports up to 12 instruments. All stations are connected to a central computer through a TCP/IP Ethernet connection and each can be continuously monitored.

The tests performed during the burn-in process reflect fundamental and realistic field situations, which consists of but not limited to:

- AC power failure simulation and check,
- Event simulation with real and configurable shaking applied to the cabinets,
- GPS test with intentional signal losses.
- Comprehensive Self Test of instrument.

During this intensive testing period, if any instrument generates any failure, it is taken out from the burn in facility back to the production test department and carefully examined to find out and repair the failure source. At the end of the burn-in period (several days) a file containing the compilation of the test results is automatically issued.

Figure 5. Burn In Cabinets

Multifunctional Tester, (Automatic Testing)

In addition to the newly automatic Burn-In system, GeoSIG has invested in Automatic Testing Equipment.

Using a special version of our GeoDAS software, standard acquisition modules are used to perform test and calibration under control of custom made scripts (Figure 6). Specific interfaces have been designed to connect and adapt the acquisition modules to various devices under test (sensor, recorders, cables…).

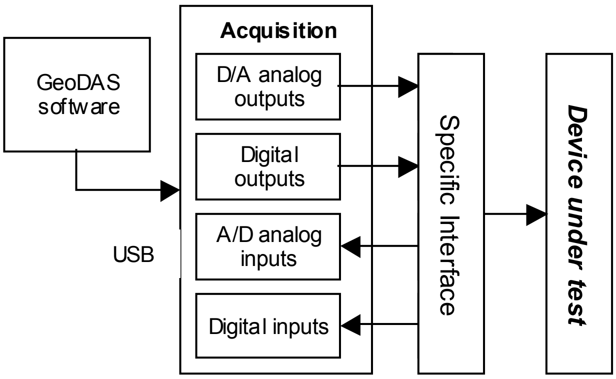

Figure 6. Automatic Testing

By the use of standard acquisition module and our software we have been able to introduce many of these systems in our company. The Automatic Testing is not only used for production, but also for product qualification and during design phase. It has the flexibility to adapt quickly to new product or test requirements.

By example, computer controlled tilt table is now in use for static measurement along with dynamic FFT response analysis for sensor acceptance. Many test during design that would have been highly time consuming can now be done in a simple way and produce results with a higher confidence.

The major benefits are:

- Repetitions of tests several time to verify results.
- Introduction of new time consuming test.
- Development of non-standard test specific to our products.
- Improvement of documentation of test results.
- Acceptance of products can be performed at a higher level of processing (FFT, calculated data, etc…).
- Early testing of sub-components.

Major Component Suppliers

Since GeoSIG manufactures large variety of instruments in high quantities every year, it is imperative to achieve and sustain high levels of quality and standards in each and every instrument.

While several of our components are built in house, we rely on well-experienced Swiss suppliers for some of our components.

Hadimec AG

Hadimec AG is our major Printed Circuit Board (PCB) supplier that manufactures our PCB's from the prototype level up to the mass production level, following our needs and specifications. Their services include the procurement of all material, SMT- and TH- PCB assembly, the assembly of a complete PCB and the testing according our specifications.

Phoenix Mecano Komponenten AG

Phoenix Mecano Komponenten AG is our major Housing supplier for majority of our instruments. They also supply us customized housings or housing/mechanical components as required.

Güralp Systems Ltd.

Güralp System Ltd is a well-known manufacturer of broadband seismometers, associated data acquisition and storage modules and of related products for a wide range of weak motion applications.

Factory Acceptance Tests

Figure 7. Attendees of FAT for GERI Project

Some of our clients would like to have Factory Acceptance Tests before shipment of their instruments, in order to get acquainted with the systems they will be receiving and to make sure that their instruments have all the functionality they wanted to have.

We had recently hosted the experts of our valued clients from India for the previously described GERI and IITR projects. Within the context of GERI project, regarding the seismological equipment, Guralp Systems Ltd. was also present to support us for their FAT of their part.

The picture on the left is taken during one of these FAT, in which Mr. Johannes Grob (President, GeoSIG Ltd.), Dr. Mukat L. Sharma (Associate Professor, IITR, Dept. of Earthquake Engineering), Dr. Talhan Biro (Projects and Marketing Manager, GeoSIG Ltd.), Dr. Cansun Güralp (President, Guralp Systems Ltd.), Dr. Ashok Kumar (Associate Professor, IITR, Dept. of Earthquake Engineering), Mr. Serge Rudaz (Technical Director, GeoSIG Ltd.) are seen from left to right, together.

Technical Point: PGA vs INT

Introduction

Since the NEIS Project is concerned of instruments that will record strong motion and convert the data to Intensity Scales, new modules were developed for GSR-18 to achieve the Intensity Scale feature for this project.

The Intensity level was initially set to the 12 level of MSK as a default setting. The idea is that the instrument gets these 12 levels (actually they are 11 only because the last one is open upwards) from GeoDAS in Unit Gal. The CWB intensity scale implementation was used with two changes:

- more levels,
- and user adjustable levels.

When an event is recorded the Intensity is evaluated from the real pgas (offset is removed).

Intensity Settings

This setup page is available only for the GeoSIG Intensity Recorders. These instruments are capable of calculating intensity levels of recorded seismic signals. They deliver this information to GeoDAS, which logs it to the intensity file for further processing by external software tools. This functionality is enabled by setting the option "Retrieve and log intensity information" in the Work Options of corresponding recorder.

The Intensity level was initially set to the 12 level of MSK as a default setting. Table of the Intensity Levels specifies up to 12 levels of intensities, which can be adjusted by users as their choice.

Usually Roman digits represent intensity levels but client can change this Intensity indication style if Latin digits are preferable.

One single file contains all the information about all the stations.

In GeoDAS one can optionally select to:

- contact the stations after some time
- continuous connection
- contact the stations (after selectable time) which were not calling in after at least one was calling in
- whether the data files should be downloaded or not

Valid units in the channel full-scale configuration are 'g', 'mg', and 'gal'.

Table 1. The Intensity levels according to the set relationship.

Levels	MSK	Related PGA	
		[g]	[gal]
0	I	<= 0.0015g	(1.5 gal)
1	II	<= 0.0037g	(3.6 gal)
2	III	<= 0.0087g	(8.5 gal)
3	IV	<= 0.020g	(20 gal)
4	V	<= 0.050g	(49 gal)
5	VI	<= 0.120g	(120 gal)
6	VII	<= 0.270g	(265 gal)
7	VIII	<= 0.650g	(640 gal)
8	IX	<= 1.540g	(1510 gal)
9	X	<= 3.700g	(put full scale value)
10	XI	<= 8.700g	(put full scale value)
11	XII	> 8.70g	(put full scale value)

As a default setting to be used in (MSK) calculations was according to the following formula that was selected as an initial relationship:

I = 2.667 * log (PGA[g]) + 8.5

e.g. A = 2.667, B = 8.5

The calculated values according to this formula are given in Table 1.

For display the type of scale can be chosen between Latin numbers starting with 0 (0, 1, 2, …) or Roman starting with 'I' (I, II, III, …).

In all these applications, the relationship (including the soil conditions) can be set as the user defines it.

There are a lot of studies on PGA vs. Intensity calculations in the world. They differ from region to region as the parameters depend on the site and building stock properties. This should always be taken into account by the user while setting their own relationship values.

IA-1: OpenFileReport #5010, Geological Survey of Canada, Pacific Division

Introduction

Sheri Molnar, Andreas Rosenberger, John F. Cassidy, Garry C. Rogers, and John Ristau have published the Open File Report #5010 of Geological Survey of Canada, Pacific Division. A short preliminary summary from this report before completion was given in GeoWatch 25.

The Abstract of this Open File Report is as follows:

Digital Accelerograph Recordings of the July 15 and 19, 2004 Earthquakes, west of Vancouver Island

Two earthquakes of M_W=5.8 [M_L=5.5] and M_W=6.4 [M_L=6.1] occurred on the 15th and 19th of July 2004, respectively, approximately 30 km off the west coast of Vancouver Island. They were shallow strike-slip fault earthquakes (~12 km focal depth). Both earthquakes were felt across Vancouver Island and as far east as the Sunshine Coast (~200 km) and the greater Vancouver region (~300 km). The M_W 5.8 earthquake showed observable waveforms on 34 of 60 Internet Accelerograph instruments and triggered two non-communicating (stand alone) strong motion instruments. The M_W 6.4 earthquake showed observable waveforms on 41 of 60 Internet Accelerograph instruments and triggered three noncommunicating strong motion instruments. The largest peak horizontal ground accelerations recorded were 6.19 cm/s^2 and 13.78 cm/s^2 for the M_W 5.8 and M_W 6.4 events, respectively. This data set is significant because it includes the first widespread earthquake recordings by the new Internet Accelerograph instruments. In this Open File Report the authors present time series plots of the acceleration, and velocity data from the 15th and 19th July 2004 earthquakes. Tabulated station parameters and peak accelerations are given together with maps of the network configuration showing the locations of recorded time series. A sample of stations on the Lower Mainland and in Victoria show a variation in the level of ground shaking based on local site conditions.

Singapore Representative

GeoSIG Ltd. has now a representative in Singapore.

You can contact Ryobi Geotechnique Pte Ltd. for any inquiries in Singapore.

Detailed contact information is as follows:

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Production Manager Ricardo Araujo, New Apprentice Yanick Ungricht

Ricardo Araujo

Ricardo is our Production Manager, responsible of coordinating all of the administrative production tasks as well as the full technical production organization. He is further involved in Engineering issues, mostly regarding production issues. His proficiency is on Numerical and Analog electronics, micro-controller programming (Assembler, C), CAD, Linux computing and project management.

Ricardo has been with GeoSIG since 1998 and has contributed significantly in many accomplishments GeoSIG has achieved. His invaluable contributions and hardworking efforts are most appreciated.

Yanick Ungricht

Yanick has joined the GeoSIG family recently as an Electronic Apprentice studying in BMS (Berufmaturitätsschule), Zurich with an intention to attend the Fachhochschule to study Electronic engineering. We warmly welcome Yanick and hope that he will have an efficient education and training period in GeoSIG.

The "Col de Balme/France Earthquake" of 8th September 2005

Introduction

GeoSIG Ltd. has been operating a number of seismic stations in its R&D lab. in Echallens, close to GeoSIG Production Department in Cugy, both in the vicinity of Lausanne (Figure 8).

One of these stations, named "EH2" have recorded the Col de Balme / France earthquake of 08.09.2005, 11:27:17.4 UTC. In this issue we report this record in conjunction with Schweizerischer Erdbebendienst (SED, Swiss Seismological Service) report, which consists of waveforms from 6 Swiss stations as shown on Figure 8 and Figure 9. In Figure 8, the 6 Swiss Stations are marked green and Station EH2 is marked as circled red.

Station EH2

The station consists of a GSR-24 Seismic Recorder and a CMG-5T Triaxial Force Balanced Accelerometer. According to SED the magnitude of the Col de Balme / France earthquake is calculated as M_L=4.9, whereas the location is at 46.031 N – 6.884 E. The same earthquake was also reported on USGS and EMSC (European Mediterranean Seismological Centre) with M_L=5.1.

The GeoSIG station and recording details are as follows:

Location of EH2 station:
CH-1040 Echallens

Coordinates: 46.7N – 6.8E

Altitude: 621m

Recording
Datastream by GeoDAS

As seen in Figure 10, the peak acceleration value is around 1mg.

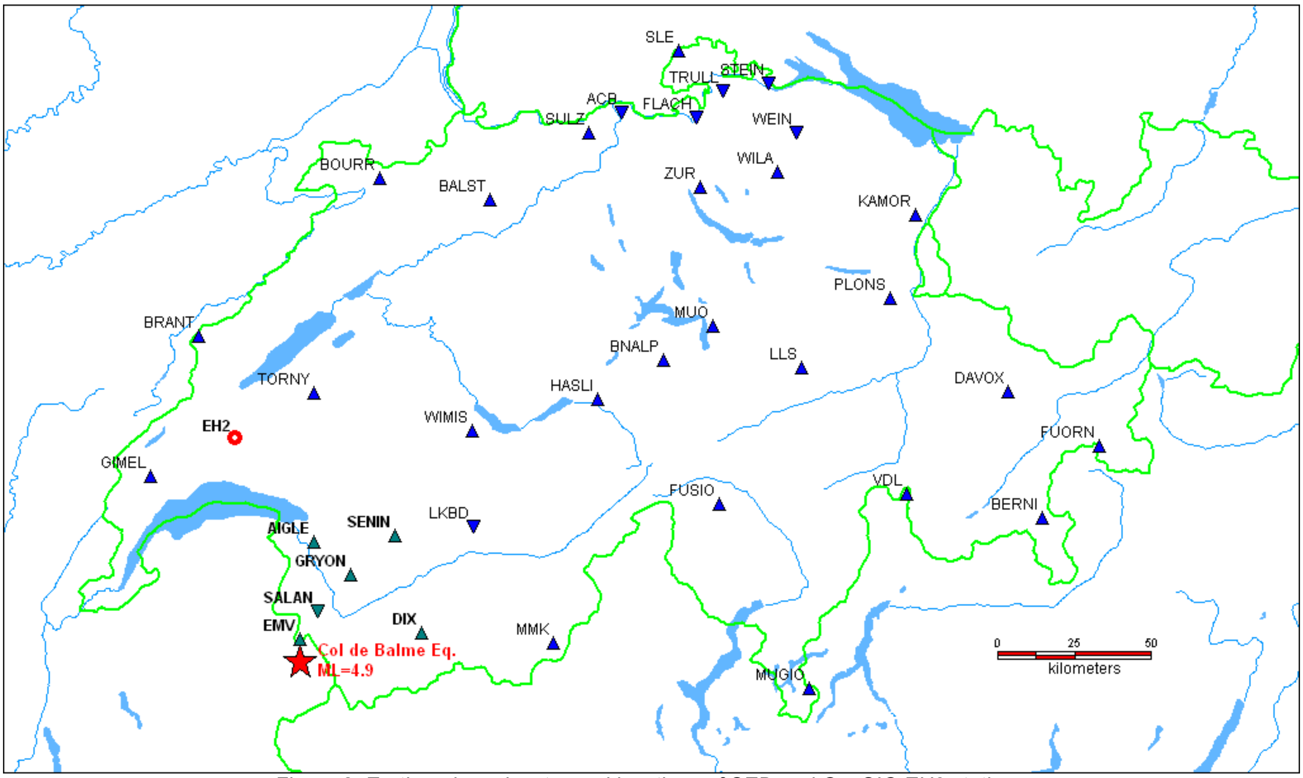

Figure 8. Earthquake epicenter and locations of SED and GeoSIG EH2 stations.

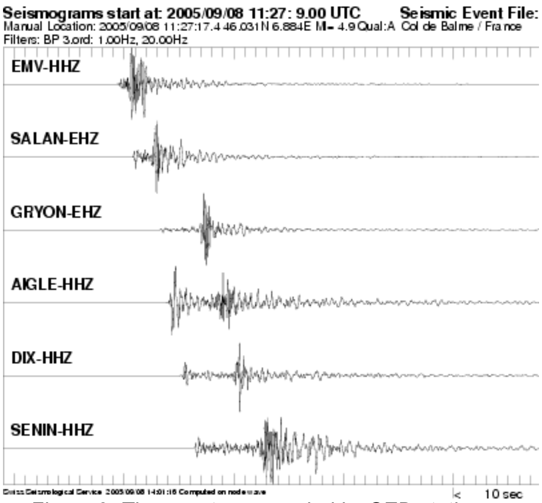

Figure 9. The event as recorded by SED stations

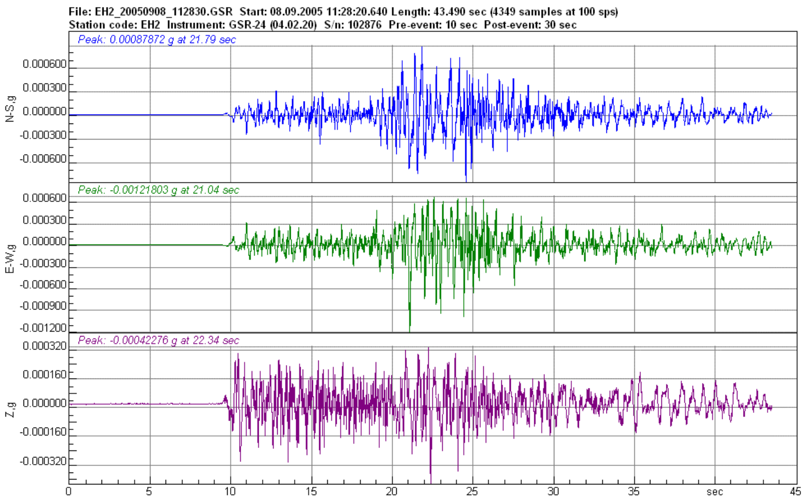

Figure 10. Recording of EH2 during the same time frame.

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