

New seismic reflection and other geophysical equipment available to CREWES

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ABSTRACT

A new 600 channel seismic system with support equipment has been purchased by the University of Calgary and will be available for seismic experiments by research groups including CREWES. A multi-channel resistivity system has also been acquired to assist with characterization of subsurface target properties.

INTRODUCTION

The University of Calgary has acquired a new 600 channel Aries seismic system to be used for research projects, including time-lapse monitoring of sites involving coal bed methane production and CO₂ injection for enhanced oil recovery. This system will be available to research groups for use on other projects as well. The purchase of this equipment was made possible by a grant from the Government of Alberta and a one million dollar donation from Nexen Inc. Both single-component and three-component geophones are included with the system, allowing for up to 200 3-C stations to be recorded. As well as the Aries system, a 120 channel Geometrics Geode system has been purchased for portable applications, and for downhole geophone monitoring at time lapse sites. To provide more information on the subsurface properties, and as part of the research set, a 96 electrode resistivity system was included in the infrastructure purchase. To support these systems, a GPS system consisting of 3 receivers with radio modules for RTK corrections for accurate location information has been added. As the seismic source for research surveys, an Envirovibe has been purchased, but not yet delivered. Trucks and trailers have been purchased for housing instruments and for field program deployment.

THE SEISMIC EQUIPMENT

The Aries system

The 600 channel Aries system was purchased new from Geo-X Ltd in Calgary. The main components of the system are:

- SPMLite Aries seismic recording unit
- 75 Aries remote acquisition module (RAM) boxes
- 75 single component cables
- 20 three component cables
- 10 Aries line tap boxes
- 120 batteries

- 650 SM24 10Hz single component geophones (from I/O Sensor)
- 210 SM24 10Hz three component geophones (from I/O Sensor)

As well as these, assorted baseline cables, jumper cables and splitters are available to provide either 2D or 3D spread configurations. All other support equipment necessary to maintain the system was also purchased. The SPMLite is housed in a dogbox on a Ford F450 truck with both battery and generator power available. For massive data storage and in-field processing, a Pentium computer with 1.25TB of disk is also installed in the recording truck.



FIG.1. Unpacking Aries RAM boxes.

The Geode system

The Geode system was purchased from Geometrics to provide a more compact package to handle the downhole part of the time-lapse studies. At one site there are 24 channels (8 levels of three component geophones) and at another site there are 120 channels (40 levels) to be recorded during surface seismic surveys as part of the data set. This will provide a more complete image of the target for periodic data differencing. The

Geode system consists of 5 24-channel boxes with a ruggedized laptop computer for control and data recording, and 5 connecting cables and batteries.



FIG. 2. One of the Geode units with the control computer.

The source

For research projects of the type for which this equipment was purchased, i.e. fairly shallow targets such as CO₂ injection in coal zones, a small, high frequency vibrator source was chosen. This provides the best repeatability both in signature and location between successive surveys. The particular model selected is the Envirovibe made by Industrial Vehicles International. This unit has a hold-down mass of 15,000 Pounds (66,000 N) and a frequency range of 10Hz to 300Hz.

Source control

For source control, the VibPro system from Pelton was chosen, as it provides compatibility with most of the companies using vibrators for seismic acquisition, thus making it simple to use multiple larger vibrators for more standard seismic surveys. The VibPro controller also provides an interface for the ShotPro blaster for dynamite shooting.

OTHER EQUIPMENT

The resistivity system

A 96 electrode resistivity system has been purchased to provide apparent resistivity and induced polarization data for subsurface characterization, particularly for environmental surveys. The transmitter unit is a VIP-3000 time and frequency domain IP transmitter. This can provide up to 5KW of output. The receiver is a Syscal Pro unit with expansion to 96 channel capability.



FIG. 3. The Syscal resistivity unit.

The GPS

For accurate surveying and location information a GPS system using RTK (real time kinematic) is required. This can provide position accuracy to within a few centimeters. The system chosen was the Sokkia receiver made by Novatel. One deciding factor for this choice is the ability of this receiver to give sub-meter accuracy in a single receiver stand-alone mode using the new CDGPS correction information. For most surveys, three receivers are used: one at the RTK base location, the second as the survey rover for flag locations, the third on the vibrator for source location during acquisition.



FIG. 4. The GPS being used at the 2005 Geophysics Field School.

Vehicles

To transport and deploy the equipment, four trucks have been purchased. Two are Ford F350 pickups to be used as line trucks and for equipment transport, the third is a Ford F450 with the recorder dogbox installed, along with a 7.5KVA generator for power, and the fourth is a Ford F550 for vibrator support (tools, parts and fuel).

A Honda 350 ATV is available for spread maintenance, dynamite shooting and other off-road access requirements.



FIG. 5. The recording truck with the Aries system installed. One of the other support trucks is towing the EWG 5 source in the background.



FIG.6. Aries spread at the 2005 Geophysics Field School.

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