

Ex. PGS 1041

(EXCERPTED)

**LEAST SQUARES FILTERING AND TESTING FOR
POSITIONING AND QUALITY CONTROL DURING 3D
MARINE SEISMIC SURVEYS**

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RESEARCH OBJECTIVES AND SCIENTIFIC RESULTS EXPECTED

The overall aim of the project has already been outlined, namely to develop a general, integrated and rigorous approach to the positioning and quality control in real time of marine seismic networks. In order to achieve this, emphasis has been placed on a number of objectives

- Determination of an optimum general mathematical description of the streamer shape by preliminary fitting of streamer models to compass data.
- Acquisition of a formal description of the geometry of the whole configuration by integrating all positioning data types into a single functional model.
- Computation of the real-time position and quality measures of any point deployed in a seismic network by adopting a Kalman (or other) filter as the basic stochastic process.
- Test the integrated model for appropriateness and for its sensitivity to detect and identify expected biases in the raw data by incorporating a uniform testing procedure.
- Assessment and testing of the correctness of the mathematics and the feasibility of the associated algorithms in terms of convergence, solubility and computational efficiency by preparing software for the various parts of the process and testing with real offshore data.
- Refinement of functional and stochastic models based on detailed analysis using alternative model hypotheses.

The results are tested mathematical models, in the form of computational algorithms, for the following

- The shape of the seismic streamers.
- The dynamics of 3D seismic configurations during data collection.
- The real-time positions and quality measures for offshore seismic surveys.
- The effect of the network geometry and the relative stochastic properties on seismic network positioning and quality control.

issues such as multi-source, multi-streamer acquisition. Four types of records have been defined (CENSUS User's Guide, 1994)

1. *Header records* - This type of records holds similar information as the header files of UKOOA P2 formats.
2. *Point position records* - These records are used to identify the point being positioned. The most common are, source fired (S), vessel (V, P1/90 only), and tailbuoy (T, P1/90 only). The source records contain also information such as line number, shotpoint number, date/time and water depth.
3. *Receiver records* - Receiver records contain information such as receiver ID flag, receiver position (easting and northing), and cable depth.
4. *Relation records* - This type of records is an extension to the format and is used to prevent the pointless repetition of unchangeable information for different shots.

In addition to the UKOOA format other exchange data formats have been developed such as, SEG P1 (1983) as well as industry standard formats such as, the Shell's SPS format, the Advance Geophysical's ProMAX database format and the Green Mountain's MESA format.

1.5.2 Geophysical Contractors' Navigation and Binning Systems

It is a general conclusion from the discussion so far that the trend seems to be a movement of the seismic industry towards faster multi-tasking integrated software and central processing units (UNIX based workstations). Almost all major geophysical contractors/companies have developed (and continuously improve) their own navigation and binning/processing systems to meet this demand. The main characteristics of these systems are outlined bellow

1. During acquisition usually some of the data are synchronized with shot time (as compass azimuths and network acoustics), and some are recorded at the sensor time (Syledis, GPS, RGPS).
2. Storage at the UKOOA P2/91/94 formats and real-time graphic display of acquisition is a common practice.
3. Some systems, as GIN 2000 developed by CGG, compute source and receiver positions based on least squares algorithms for the various networks of the spread

(vessel-buoy, relative head and relative tail networks as well as streamer shape). Other systems, as TotalNet, developed by WESTERN ATLAS, implement integrated network solutions by means of a Kalman filter.

4. Quality control, including monitoring of the quality of the recorded data (setup, configuration, spread geometry, data integrity, and statistical analysis) is an essential feature in today's systems.
5. On-board binning systems provide real time monitoring of CMP distribution throughout a 3-D survey. Also, most binning systems' capabilities include, flex binning, editing and rebinning algorithms.

In Table 1.1 a list of the navigation and binning systems of some major geophysical contractors is given.

Contractor	Navigation System	Binning / Processing System
WESTERN	WISDOM II	FLEX QC / CNAVCHK
GECO / PRAKLA	TRINAV	TRINAV / QC
CGG	GIN 2000	GIN 2000
DIGICON	MAGNAVOX 200 / SCOPE III	BIRDOG

Table 1.1 Contractors' navigation and binning/processing systems

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