OR-532

SS02 MSS
T/32P and T/33P
Final Navigation Data

Contains

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Navigation Processing Report

By

MULTIWAVE GEOPHYSICAL COMPANY

SANTOS SS02 2D

SORELL BASIN, AUSTRALIA

M.V. Polar Duke

DECEMBER 2002

1. INTRODUCTION

This report concerns the processing and mapping of navigation data recorded by M.V. Polar Duke on the SANTOS SS02 2D Prospect, Sorell Basin, Australia. The data was acquired during December 2002.

The data was processed onboard the Vessel by operators Leif Olav Saetenes and A. Allen using FGPS's (Fast Geophysical Positioning Solutions) proprietary software, *SeisPos* and *P1Tools.* Descriptions of this software are provided below in this report.

2. PROCESSING SUMMARY

For each line segment the following steps were taken:

- **Check P2/94 header and correct errors**

All data files were loaded onto hard disk. All log files, spreadsheets and diagrams were examined to determine which lines and shot ranges were to be processed. P2/94 headers were examined to determine if any corrections or alterations were required.

- **Input line and create database**

Each line was imported into the *SeisPos* Database and the necessary manual observations were created to enable front-end positioning. As the vessel has no front-end positioning for the streamer, a manual range was created from the centre of the vessel stern to the streamer head. This range would be used in the processing in association with the front streamer compass data. Tests have shown that using compass data gives a more realistic result than using gyro or course made good.

The vessel had RGPS positioning on the tailbuoy, but due to the lack of an acoustic tie to the tail end of the streamer, a manual observation was added between the last hydrophone group and the tailbuoy, such that any tail-end stretch was absorbed into the residual of this observation.

After entering the Manual Observations for the first line, a set of defaults was saved, which could be imported into subsequent lines.

3. MAGNETIC DECLINATION

For the Northern portion of the Survey, the vessel used a Magnetic Variation of +11.70 degrees, calculated at Position 040°40'00.000"S 143°10'00.000"E.

For the Southern portion of the Survey, the vessel used a Magnetic Variation of +12.33 degrees, calculated at Position 041°15'00.000"S 144°00'00.000"E.

Computed by GeoMag V2.2.0.0 for 2002-15-12, and confirmed by ship's Charts. These values were entered into the *Spectra* Integrated Navigation System.

As each line was loaded into *SeisPos*, the presence of any changes in the P2/94 header was checked, so as to determine whether all default nodes/observations should be loaded.

- **Precondition data interactively using appropriate gating and filtering**

Default processing parameters were applied, relating to interpolation, extrapolation, de-spiking and minimal filtering. All individual observations were then viewed on screen to determine whether any manual editing was required, or whether it was necessary to modify gating and filter parameters.

- **Adjust network**

On completion of Pre-conditioning, each line was network adjusted, to produce positions for all network nodes and receivers. During network adjustment the computed positions were viewed via an on-screen graphical display.

- **QC**

QC checks were then run on the computed positions. Any anomalies were inspected and where necessary adjustments were made to the filtering and editing. If alterations were required, the network adjustment was repeated, followed by a repeat of the QC checks.

A comprehensive set of QC plots was configured, and used for visual inspection. Delta Cross-course plots were scaled with a fixed scale, highlighting any spikes in the processed data set.

- **Output P1/90 final dataset**

When satisfactory results were obtained, P1/90 data files were output for each line.

P1/90 files were produced on GDA-94 datum (X= 0, Y= 0, Z= 0), Transverse Mercator, GRS 80 Spheroid, (SMA 6378137.000 I/F 298.257222100) shot spacing based on Great Circle at 37.5m with all receiver records.

The *P1Tools* QC software was used as a further check of the processed results, and to confirm the integrity of the final P1/90 files. All final processed P1/90 files were written to CDR.

4. DATA QUALITY

Echosounder

In general, interpolation and extrapolation of depth data were limited to 100 seconds. A minimal median-reject gate was used with a 30-second window to remove spikes. Any apparent spikes that remained were investigated to determine whether further action was required. A 30-second averaging filter was typically used on the depth data.

Streamer Compasses

Steamer compasses performed well. A compass calibration check was performed on each compass data set prior to processing the line. Results were good.

Interpolation and extrapolation were limited to 100 seconds. A 60-second Median Reject filter with a threshold of 2 degrees was used to de-spike the data, after which an averaging filter with a 30-second window was used to smooth the data. On lines that showed increased compass noise, the averaging filter was increased to 60-seconds.

Streamer Depth Sensors

Depth Sensors performed well and streamer depth control was good.

Interpolation and extrapolation were limited to 100 seconds. A 60-second Median Reject filter with a threshold of 2m was used to de-spike the data, after which an averaging filter with a 30-second window was used to smooth the data.

Gyro Compasses

Gyro response was good.

A 60-second Median Reject filter with a threshold of 1 degrees was used to de-spike the data. A 5-second smoothing filter was applied to the gyro, allowing accurate positioning of the Centre Stern node that was being used with manual ranges to position the streamer head.

DGPS

DGPS data was generally of good quality.

There were 2 DGPS data sets available. Difference plots of the Latitude and Longitude between the two systems were monitored throughout the acquisition of the data.

Data were processed in Rate of Change mode. A 30-second filter with a threshold of .2 m/sec was generally used to de-spike the data. A ROC filter with a 30-second window was used to produce final processed data.

RGPS

RGPS pods were installed on two of the gun strings, and also on the tailbuoy. The Active Tailbuoy was operational for Sequence numbers 001-008.

The Active Tailbuoy was not operational for Sequences 009-XXX. On these Sequences, Compass Modelling of the Streamer worked well.

Data quality was generally good. Median reject filters with a 60-second window and reject level of 2 were generally used for both range and bearing observations. A 30-second averaging filter was applied to smooth the data.

5. LINES PROCESSED

Line Summary : Santos SS02, Sorell Basin, Australia							
7200 meters streamer configuration							
Seq No.	Line Name	Direction	FSP	FPSP	LCSP	LSP	COMP/INC
1	SS02-01-001	056°	1001	1001	1961	2065	Complete
2	SS02-03-002	239°	1999	1999	1001	897	Complete
3	SS02-05-003	059°	1001	1001	2033	2137	Complete
4	SS02-07-004	239°	1967	1920	1001	897	Complete
5	SS02-09-005	059°	1001	1001	2002	2106	Complete
6	SS02-11-006	239°	2020	2020	1726	1726	Incomplete
7	SS02-11-007	239°	1831	1725	1168	1154	Incomplete
8	SS02-11-008	239°	1273	1167	1001	897	Complete
9	SS02-13-009	059°	1001	1001	1926	2055	Complete
10	SS02-15-010	238°	2342	2342	1001	897	Complete
11	SS02-17-011	059°	1001	1001	2202	2306	Complete
12	SS02-08-012	333°	2447	2447	1001	897	Complete
13	SS02-06-013	153°	1001	1001	1672	1776	Complete
14	SS02-02-014	331°	1660	1660	1001	897	Complete
15	SS02-04-015	152°	1001	1001	2128	2232	Complete
16	SS02-19-016	059°	1001	1001	2084	2188	Complete
17	SS02-21-017	238°	2100	2100	1001	897	Complete
18	SS02-10-018	147°	1001	1001	3049	3153	Complete
19	SS02-12-019	328°	2882	2882	1001	897	Complete
20	SS02-23-020	238°	2240	2240	1001	897	Complete
21	SS02-25-021	058°	1001	1001	2010	2022	Incomplete
22	SS02-25-022	058°	1905	2011	2185	2289	Complete
23	SS02-27-023	239°	1859	1844	1825	1825	DNP
24	SS02-27-024	239°	1859	1859	1001	897	Complete
25	SS02-29-025	061°	1001	1001	1880	1984	Complete
26	SS02-31-026	242°	1904	1904	1001	897	Complete
27	SS02-33-027	064°	1001	1001	1863	1967	Complete
28	SS02-35-028	244°	1856	1856	1001	897	Complete
29	SS02-37-029	065°	1001	1001	1845	1949	Complete
30	SS02-39-030	245°	1850	1850	1001	897	Complete
31	SS02-41-031	066°	1001	1001	1550	1654	Complete
32	SS02-16-032	328°	2123	2123	1001	897	Complete
33	SS02-14-033	151°	1001	1001	1106	1106	DNP
34	SS02-14-034	151°	1001	1001	1900	2004	Complete

6. CONCLUSIONS

The overall data quality was good.

7. SOFTWARE DESCRIPTIONS

7.1. SeisPos

SeisPos is an interactive processing and quality appraisal system for positioning of marine seismic streamer surveys. The package operates on the Windows NT platform. The following modules are used:

- Input: reads the data stored in UKOOA P2 format and compiles a log of warnings. Implicitly alerts the user of format integrity problems. Stores all data in a proprietary format relational database.
- Precondition: Applies user defined gating, filtering and interpolation/extrapolation parameters to all data and presents interactive time series plots enabling quality appraisal and manual editing and rejection. All raw data is *read only.*
- Adjust: performs a fully integrated weighted least squares adjustment of the positioning network. This includes LS estimates of streamer rotation and stretch, and revised compass offsets and bearings for the interpolation of receiver group positions based on the concatenation of circular arcs between all nodes (compass or other) along the streamers. The adjustment computation outputs final node coordinates and corrected compass positions and bearings along with QC data using a staged process enabling the survey line to be processed in as many sections as may be required according to data quality.
- Output: Interpolates receiver group positions and outputs selected records to file in UKOOA P1/90 format.
- QC: Allows analysis and manipulation (comparisons, rate of change etc.) of time series plots of all data and adjustment statistics (coordinates, error ellipse semi-major axes, processed observations, SDs, residuals, rotation, stretch, unit variance, redundancy, number of iterations, shot time and distance interval).
- Database: Allows analysis, editing and textual output of all header and data tables stored in the database at all stages of the process.

7.2. P1Tools

P1Tools is a quality appraisal and utilities package for the QC of final data stored in UKOOA P1/90 format. The package operates on the Windows NT platform. The modules incorporated are:

- QC Nodes: enables time series analysis of shot to shot user specified node movement along orthogonal and radial axes. Outputs summary statistics to csv file.
- QC Offsets: enables time series analysis of shot to shot user specified node offsets along orthogonal and radial axes. Also provides integrity check for the type and number of nodes, the source firing sequence and the shot point range. Outputs summary statistics to .csv file.
- Compare: enables time series analysis of position differences for user specified nodes between two P1/90 data-sets along orthogonal and radial axes. Outputs summary statistics to .csv file.
- Extract: outputs user selected data to ascii file for further analysis and third party software use.
- Replay: Two-dimensional replay of the vessel, source, receiver groups and tailbuoy.