

449001

8/86



**Geomex Surveys**

AMOCO AUSTRALIA PETROLEUM COMPANY

REPORT

ON

POSITIONING OF RIG

"DIAMOND M. EPOCH"

ON

PELICAN-5 LOCATION

IN

BLOCK T-22-P

OR-357C

BASS STRAIT, AUSTRALIA.

Dated: January 1986

Report No. K110/86/AM

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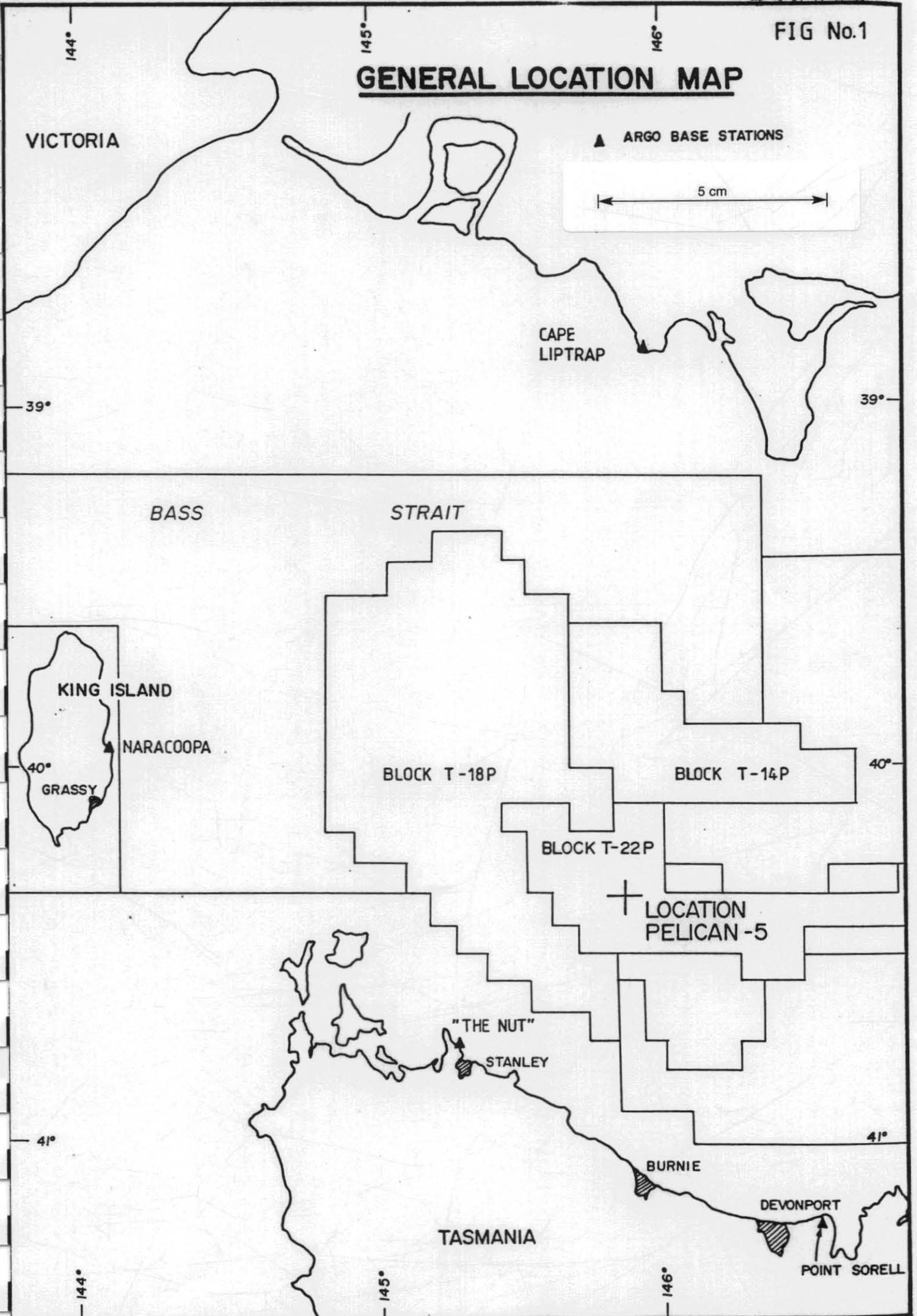
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# GENERAL LOCATION MAP



1      INTRODUCTION

GEOMEX SURVEYS (AUSTRALIA) PTY. LTD. was contracted by AMOCO AUSTRALIA PETROLEUM COMPANY, to carry-out the positioning of the drilling rig "DIAMOND M. EPOCH" over their "PELICAN No. 5" location in permit T-22-P of the Bass Strait, Australia.

An integrated acoustic system was used to guide the rig onto location on 26th December 1985, and determine its final position with relation to an array of acoustic transponders. Verification of the rig's position was determined with a geodetic satellite receiver.

The rig's drill-stem position as determined by a final fix with acoustics on 27th December 1985, is given below as the accepted well co-ordinates:

Latitude:      45° 20' 43.472" South  
Longitude:    145° 51' 49.296" East

This position is 3.9 metres on a bearing of 30.7 degrees from the intended location.

The final rig heading was 232 degrees.

2 PERSONNEL, EQUIPMENT AND LOGISTICS SUPPORT2.1 Personnel

Personnel engaged in the operation of positioning the "DIAMOND M. EPOCH" were as follows:

<u>Name</u>	<u>Position</u>	<u>Period</u>
G. Harries	Party Chief/Surveyor	23/12/85-07/01/86
D. Knowles	Navigation Engineer	23/12/85-30/12/85.

2

PERSONNEL, EQUIPMENT AND LOGISITICS SUPPORT (Cont'd)2.2 Equipment

The following equipment was employed to conduct this rig positioning:

Integrated Acoustic Positioning System

- Two - HP 9836 computers with VDU displays
- Two - HP 2671G printers
- One - Range Meter RM 201
- One - Telecommand unit TT 201
- One - Interface module IM 100
- One - Power supply unit PS 100
- One - Acoustics towfish
- Two - Acoustics modules AM 121
- Two - Tow cables
  - Associated cabling
  - Oceano spares.

Navigation Satellite System

- One - Mx 1107 RS satellite receiver
- One - Marine antenna with cabling
  - Set of Magnavox 1107 spares
  - Data-com interfaces

Geodetic Satellite System

- One - Mx 1502 satellite receiver
- One - Antenna system with cabling.

2 PERSONNEL, EQUIPMENT AND LOGISTICS SUPPORT (Cont'd)2.3 Logistics Support

The drilling rig "DIAMOND M. EPOCH" and vessel "M/V LOMBARDINA CREEK" were used during the course of the rig positioning to provide work facilities and accomodation for the survey personnel.

Logistics support was also provided by the GEOMEX SURVEYS base in Perth.

3

CHRONOLOGICAL RECORD OF EVENTSMonday 23rd December 1985

18.00 D. Knowles and G. Harries arrive in Devonport for mobilisation.

Tuesday 24th December 1985

07.00 Start mobilisation of equipment onboard "M/V Lombardina Creek".

17.00 Inform Harbour Authority departure time at 24.00 hours.

24.00 Depart Devonport for "PELICAN-5" location.

Wednesday 25th December 1985

06.00 Approaching location to check on navigation system.

08.00 Navigation signals good.  
Decision to go and anchor in shallow water and standby for rig "DIAMOND M. EPOCH" to pick up anchors.

15.15 Drop anchor.

21.00 Pick-up anchor and proceed to location.

Thursday 26th December 1985

05.00 On location and preparing to deploy marker buoys.

06.30 Deploy acoustic fish and check navigation.

08.20 Deploy No. 1 gate buoy.

08.58 Deploy No. 2 gate buoy.

09.40 Deploy anchor No. 2 marker buoy.

09.58 Deploy anchor No. 6 marker buoy.

11.07 'Diamond M. Epoch' deployed their No. 6 anchor.

11.35 Anchor No. 2 on seafloor.

11.47 Inform 'Diamond M. Epoch' that they require to move 20 m. at 326°.

15.25 Anchor No. 3 on seafloor.

16.20 Anchor No. 7 on seafloor.

17.45 Anchor No. 4 on seafloor.

19.42 Anchor No. 5 on seafloor.

3 CHRONOLOGICAL RECORD OF EVENTSThursday 26th December 1985 (Cont'd)

- 20.05 Anchor No. 8 on seafloor.
- 21.24 Anchor No. 1 on seafloor.  
'Diamond M. Epoch' informed that to be on proposed location rig must move in a N.E. direction for approximately 36 m.
- 22.00 Demobilise equipment onboard "M/V Lombardina Creek" and transfer to 'Diamond M. Epoch'.

Friday 27th December 1985

- 00.30 Mobilise equipment onboard 'Diamond M. Epoch'.  
No final position taken at this time, as rig anchors are reported to be slipping and extra anchors required.
- 03.00 Re-running anchors.
- 19.00 Rig ballasting down.
- 23.27 Final position taken and rig master informed of final position.  
Requested that satellite position be carried out to obtain confirmation.

Saturday 28th December 1985

- After twenty (20) hours of obtaining satellite positions using Mx 1502 satellite receiver, a preliminary satellite position of the drill-stem was confirmed.
- 24.00 Transfer to "M/V Lombardina Creek" after demobilising acoustic equipment to proceed to previous rig position at KOORKAH-1 to recover transponders.

Sunday 29th December 1985

- 06.00 Arrive on KOORKAH-1 location to recover transponders.
- 07.00- Five (5) acoustic transponders recovered from  
12.00 the KOORKAH-1 location. Two (2) transponders failed to surface on command. These being transponder S/Nos. 675 and 579.
- 13.00 Proceed to TILANA-1 location.
- 17.00 Enable transponder S/N 595 and position over it, but unable to recover transponder.

CHRONOLOGICAL RECORD OF EVENTSSunday 29th December 1985 (Cont'd)

- 19.00 Depart TILANA location for 'Diamond M. Epoch'.  
22.30 Within anchor pattern of 'Diamond M. Epoch'.  
G. Harries transfers to rig with satellite receiver 1107 and antenna.  
23.30 "M/V Lombardina Creek" departs 'Diamond M. Epoch' for Devonport.

Monday 30th December 1985

- 03.00 Commence recording satellite passes on Magnavox 1107 receiver, while continuing to record on Magnavox 1502 receiver.  
08.00 "M/V Lombardina Creek" arrives in Devonport with D. Knowles onboard.  
All equipment de-rigged from vessel and held in Devonport.

Tuesday 31st December 1985

- 09.00 D. Knowles departed Devonport.  
11.00 Satellite receiver 1502 de-rigged after recording five (5) satellite passes.  
Continue to record passes on Magnavox 1107 receiver.

Wednesday 1st January 1986

Demobilise satellite receiver 1107 after receiving thirty (30) passes.  
Both satellite receivers packed for transportation to Hobart.  
G. Harries departed rig for Devonport.

Thursday 2nd January 1986

Survey equipment unable to be transported by helicopter, so loaded onto vessel for transportation to Hobart.  
G. Harries organising survey equipment in Devonport.

CHRONOLOGICAL RECORD OF EVENTS (Cont'd)Friday 3rd January 1986

Survey equipment in transit to Hobart.  
G. Harries organising and packing remaining  
survey equipment in Devonport.

Saturday 4th January 1986

Supply vessel docked in Hobart and survey  
equipment unloaded.

Sunday 5th January 1986

Survey equipment in Hobart.

Monday 6th January 1986

Survey equipment loaded onto a truck in Hobart.

Tuesday 7th January 1986

Survey equipment arrived Devonport.  
G. Harries stored satellite receiver Mx 1107  
in Devonport and despatched satellite receiver  
Mx 1502 to Perth.  
G. Harries departed Devonport.

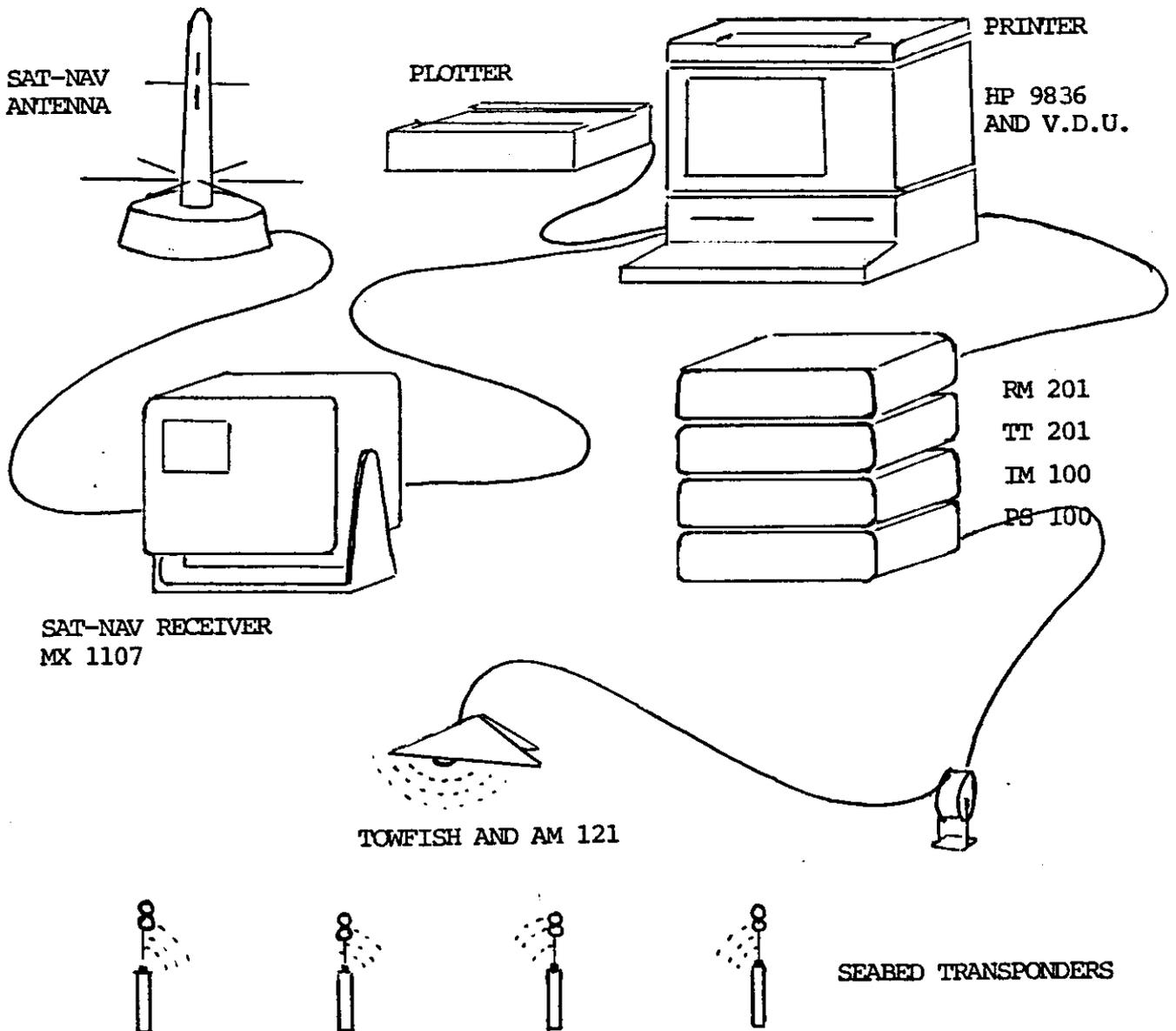
4 SURVEY METHODS AND PROCEDURES

4.1 Satellite-Acoustic Positioning System

4.1.1 Mode of Operation

The integrated satellite-acoustic positioning system employed on this project is manufactured by "OCEANO INSTRUMENTS" and comprises a low frequency long baseline acoustic system linked to a "MAGNAVOX" transit-satellite receiver, and integrated through a 'HEWLETT PACKARD' desk-top computer with V.D.U. displays for navigation.

The configuration of equipment is illustrated below:



SURVEY METHODS AND PROCEDURES4.1 Satellite-Acoustic Positioning System4.1.1 Mode of Operation (Cont'd)

The acoustic system itself is made up of four (4) basic onboard units, a range meter, a tele-command unit, an interface module and a dedicated 24 v. D.C. power supply which controls the type and coding of interrogation signals emitted from an acoustic module mounted in a streamlined towfish and suspended over-the-side of the survey vessel. The transponder units laid in an array on the seabed receive the common interrogation frequency and reply on their own individual frequencies. These are received by the acoustic module and passed back to the onboard units where the time between signal transmission and reception is recorded, and processed to display the range in metres to each transponder.

The satellite navigation receiver is a Mx 1107 R.S. dual-channel survey receiver and with its marine antenna is a stand-alone system. The reason for its choice is its dead-reckoning facility through the entering of vessels course and speed, and its ability to display position in real-time. These facilities are enabled through a data-com interface and allow direct hand-shaking with the desk-top computer to assist with the positioning, and calibration of the acoustic transponder array on the seabed.

The desk-top computer is a HP 9836 with inbuilt V.D.U. display and sufficient memory and interface modules to communicate with the satellite receiver and acoustics range meter, for the software to perform the relative and absolute calibrations of the acoustic transponder array, the navigation

4 SURVEY METHODS AND PROCEDURES

4.1 Satellite-Acoustic Positioning System

4.1.1 Mode of Operation (Cont'd)

and tracking of a vessel, the display and recording of position data, and all other functions that are required of a real-time navigation computer system.

SURVEY METHODS AND PROCEDURES4.1 Satellite-Acoustic Positioning System (Cont'd)4.1.2 Procedures

The acoustic positioning system was first installed onboard the "M/V Lombardina Creek" in Devonport on 24th December 1985, to sail at 24.00 hours that evening and check the acoustic transponder array installed around the PELICAN-5 location.

These transponders were deployed and calibrated from the vessel "R/V Sprightly" during November 1985, when a site investigation survey was conducted around this location. The calibration of the transponder array was conducted with reference to both satellite and argo positioning systems, as detailed in our Report No. K108/85/AM. However, as the seismic in this area was conducted with relation to the argo positioning system, the results of the calibration by this method was chosen in preference to ensure continuity in positioning the drilling rig.

Transponder co-ordinates as determined by the Argo calibration are as follows:

<u>S/No.</u>	<u>Code</u>	<u>Easting</u>	<u>Northing</u>
540	12	403645.43 m.	5534726.79 m.
650	15	404869.58 m.	5533132.38 m.
551	9	402861.09 m.	5534113.89 m.
587	4	404084.95 m.	5532514.29 m.
552	14	402063.29 m.	5533499.16 m.
530	1	403284.42 m.	5531905.80 m.

SURVEY METHODS AND PROCEDURES4.1 Satellite-Acoustic Positioning System4.1.2 Procedures (Cont'd)

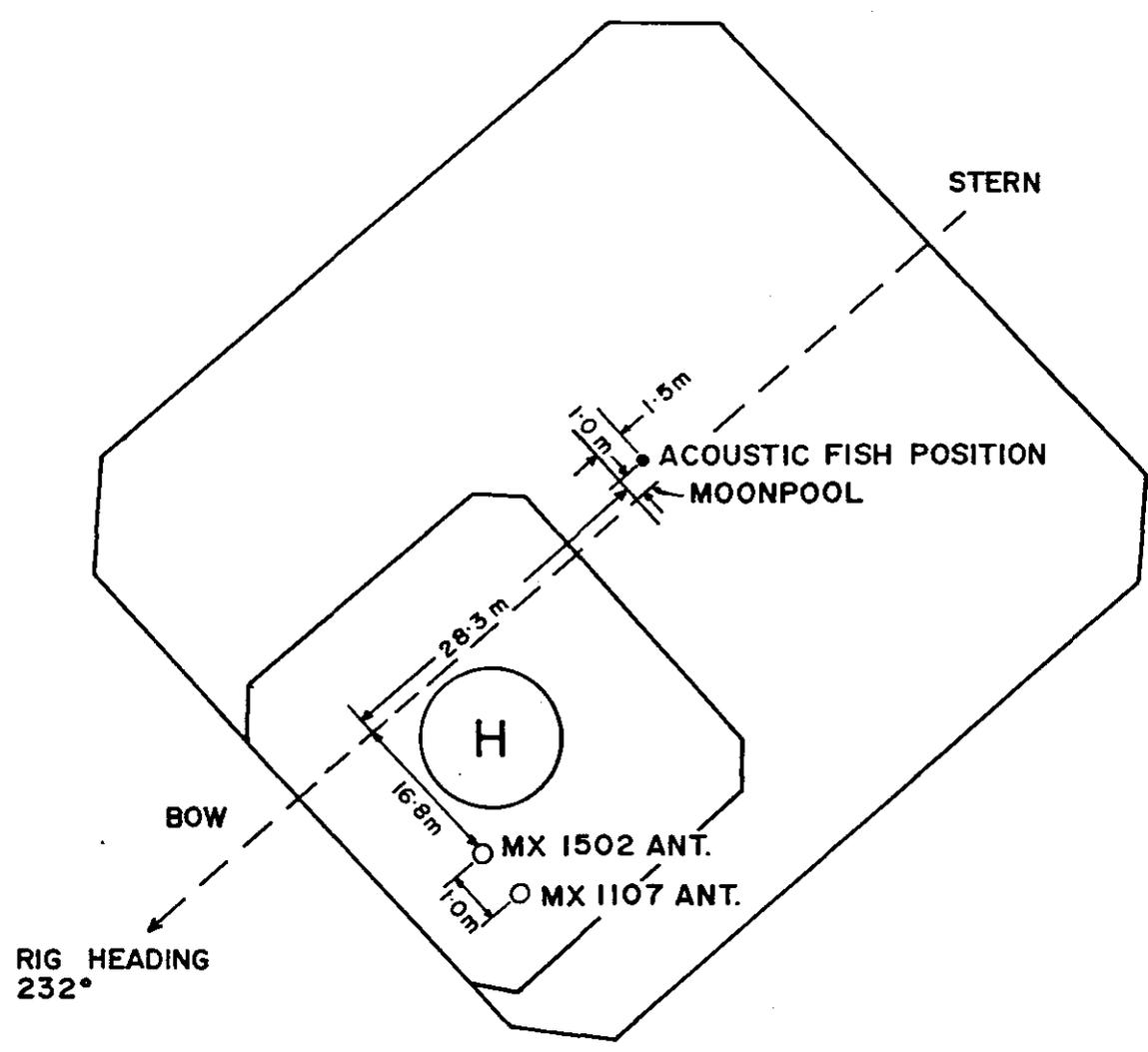
The acoustic position system onboard the vessel was used to lay four (4) marker buoys; two (2) gate buoys and one (1) each marking positions 2 and 6. On the rig's approach to location, the vessel was then used to spot the positions for each of the other rig's anchors.

Once the rig had deployed all anchors the acoustic positioning system was transferred from the vessel and the acoustic transducer lowered through the rig's moon-pool, see Figure 2. The rig's position was then able to be monitored from onboard while various anchors were tensioned and the rig's position adjusted over location.

A final fix as the rig's position was obtained at 23.15 hours on 27th December 1985, after the rig had ballasted down over location.

FIG. No. 2.

OFFSET DIAGRAM OF RIG  
DIAMOND M. EPOCH



Not to scale.

4.2 Satellite Positioning System4.2.1 Mode of Operation

A geodetic satellite receiver was provided to verify the rig's final position. This system comprising a MAGNAVOX MX 1502 complete with antenna and cable.

The system operates by monitoring the change in frequency, or doppler effect, of the 400 MHz and 150 MHz frequencies transmitted by each of the five (5) transit satellites circling the earth in polar orbits.

Orbital data and time are received from each satellite with an up-dated message every two (2) minutes. Interpolation of the satellite's position monitored with the change of received frequencies will provide a line of position on which the receiver lies. The recording of data from a number of satellites will therefore provide the position of the receiver. The greater the number of good satellite passes recorded, the greater the accuracy of the results.

4 SURVEY METHODS AND PROCEDURES4.2 Satellite Positioning System (Cont'd)4.2.2 Procedures

The geodetic satellite receiver was installed on the rig's helideck and recorded satellite passes from 23.30 hours on 27th December 1985, until 11.00 hours on 31st December 1985, during which time fifty-one (51) satellite passes were recorded.

The navigation satellite receiver after being used to assist with the recovery of transponders on the KOORKAH-1 location, was also installed on the rig's helideck, and recorded satellite passes from 03.00 hours on 30th December 1985, until 10.00 hours on 1st January 1986, during which time thirty (30) satellite 3D passes were recorded.

Both sets of satellite data were recorded on WGS 72 spheroid and were transferred to the Australian National Spheroid using the following datum shifts:

Cartesian Shifts: WGS 72 to Australian National  
Spheroid

$$\Delta X = +124.2 \text{ m.}$$

$$\Delta Y = + 28.8 \text{ m.}$$

$$\Delta Z = -137.2 \text{ m.}$$

See Figure 2 for configuration of satellite recording equipment onboard drilling rig.

4 SURVEY METHODS AND PROCEDURES (Cont'd)4.3 Geodetic Parameters

All position results are based on the following geodetic parameters:

Spheroid	:	Australian National
Datum	:	Australian Geodetic
Projection	:	UTM Zone 55
Central Meridian	:	147° East
Semi-major Axis	:	6378160 m.
Flattening	:	1/298.25
Heights	:	In metres on the Australian Height Datum.

RESULTS

The rig was initially guided onto the "PELICAN-5" location, anchors deployed and adjusted over the proposed well co-ordinates using the acoustic positioning system, with transponders having been calibrated with relation to the same Argo system that had been used to conduct seismic in this area.

A final fix on the rig's position was recorded using acoustics after all anchors had been tensioned and the rig ballasted down on 27th December 1985.

Verification of this position was provided by recording satellite passes using the geodetic receiver Mx 1502. The navigation receiver Mx 1107 was also run to provide additional information.

Details of the position results are herewith provided.

5.1 Acoustic Position

The final acoustic position for the drill-stem was recorded after the rig had finished ballasting down over location at 23.15 hours on 27th December 1985. A mean of ten (10) sets of readings using all six (6) transponders was applied as the acoustic transducer was deployed through the centre of the moonpool, to give position results as follows:

- Latitude: 40° 20' 43.472" South
- Longitude: 145° 51' 49.296" East
  
- Easting; 403 494.3 metres
- Northing: 5 533 269.5 metres.

This position is 3.9 metres on a bearing of 30.7 degrees from the intended location.

5 RESULTS (Cont'd)5.2 Geodetic Satellite Position

The final geodetic satellite position was determined as a result of recording fifty-one (51) satellite 3D passes by 11.00 hours on 31st December 1985. See Appendix for list of satellite results and scatter plot.

This gave a position for the antenna in WGS 72 spheroid of:

Latitude: 40° 20' 39.016" South  
 Longitude: 145° 51' 53.078" East  
 Height: 20.23 metres.

Transferring from WGS 72 to ANS spheroid using the following datum shifts:

$\Delta X = +124.2$   
 $\Delta Y = +28.8$   
 $\Delta Z = -137.2$

The co-ordinates for the antenna in ANS spheroid are as follows:

Latitude: 40° 20' 44.250" South  
 Longitude: 145° 51' 49.115" East  
 Easting: 403 490.335 m.  
 Northing: 5 533 245.466 m.

Offsetting 32.9 metres on a bearing of 21.3 degrees between antenna and drill-stem. The rig's drill-stem position is given as follows:

Latitude: 40° 20' 43.262" South  
 Longitude: 145° 51' 49.639" East  
 Easting: 403 502.3 m.  
 Northing: 5 533 276.1 m.

This position is 14.1 metres on a bearing of 45.3 degrees from the intended location.

5 RESULTS (Cont'd)5.3 Navigation Satellite Position

The final navigation satellite position was determined as a result of recording thirty (30) satellite 3D passes by 10.00 hours on 1st January 1986.

This gave a position for the antenna in WGS 72 spheroid of:

Latitude: 40° 20' 39.00" South  
 Longitude: 145° 51' 52.32" East  
 Height: -5.1 metres.

Transferring from WGS 72 to ANS spheroid using the following datum shifts:

$\Delta X = +124.2$   
 $\Delta Y = +28.8$   
 $\Delta Z = -137.2$

The co-ordinates for the antenna in ANS spheroid are as follows:

Latitude: 40° 20' 44.234" South  
 Longitude: 145° 51' 48.356" East  
 Easting: 403 472.425 m.  
 Northing: 5 533 245.730 m.

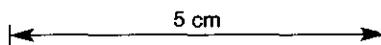
Offsetting 33.4 metres on a bearing of 19.8 degrees between antenna and drill-stem. The rig's drill-stem position is given as follows:

Latitude: 40° 20' 43.218" South  
 Longitude: 145° 51' 48.851" East  
 Easting: 403 483.7 m.  
 Northing: 5 533 277.2 m.

This position is 14.0 metres on a bearing of 322.1 degrees from the intended location.

# DIAGRAMATIC COMPARISON OF THE DRILL STEM POSITION BY DIFFERENT POSITIONING SYSTEMS

SCALE 1 : 500



5 533 300 N

5 533 280 N

5 533 260 N

5 533 240 N

5 533 220 N

403 460 E

403 480 E

403 500 E

403 520 E

403 540 E

○ MX 1107

○ MX 1502

○ ACOUSTIC

○ PROPOSED LOCATION

6

CONCLUSIONS

The proposed location co-ordinates for the well PELICAN-5 in permit T-22-P of the Bass Strait, were supplied by AMOCO AUSTRALIA PETROLEUM COMPANY as:

Latitude: 40° 20' 43.58" South  
Longitude: 145° 51' 49.21" East

Figure 3 shows the respective position co-ordinates as determined by acoustics, geodetic satellite receiver and navigation satellite receivers for the final position of the DIAMOND M. EPOCH's drill-stem over this location.

The co-ordinates as determined by the acoustic positioning system with transponders calibrated with reference to the Argo navigation system, are put forward as the accepted final co-ordinates for this well, as they bear direct relationship to the Argo positioning used to conduct the seismic in this area.

These final accepted position co-ordinates for the rig's drill-stem are as follows:

Latitude: 40° 20' 43.472" South  
Longitude: 145° 51' 49.296" East  
Easting: 403 494.3 metres  
Northing: 5 533 269.5 metres

This position is 3.9 metres on a bearing of 30.7 degrees from the intended location.



G.H. MOUNTENEY

Hydrographic Surveyor

APPENDIX A

SATELLITE DATA & PLOTS

## APPENDIX A : LIST OF 3D GEODETIC SATELLITE POSITIONS FOR FINAL FIX

Pass No.	Latitude (South)	Longitude (East)
1	40° 20' 39.350"	145° 51' 52.303"
2	40° 20' 39.074"	145° 51' 52.680"
3	40° 20' 38.918"	145° 51' 52.295"
4	40° 20' 38.620"	145° 51' 52.619"
5	40° 20' 38.976"	145° 51' 53.028"
6	40° 20' 38.855"	145° 51' 53.097"
7	40° 20' 38.955"	145° 51' 53.164"
8	40° 20' 38.927"	145° 51' 53.093"
9	40° 20' 38.863"	145° 51' 53.142"
10	40° 20' 38.898"	145° 51' 53.437"
11	40° 20' 38.899"	145° 51' 53.408"
12	40° 20' 38.824"	145° 51' 53.361"
13	40° 20' 38.771"	145° 51' 53.378"
14	40° 20' 38.783"	145° 51' 53.374"
15	40° 20' 38.767"	145° 51' 53.312"
16	40° 20' 38.783"	145° 51' 53.327"
17	40° 20' 38.811"	145° 51' 53.289"
18	40° 20' 38.876"	145° 51' 53.238"
19	40° 20' 38.911"	145° 51' 53.220"
20	40° 20' 38.940"	145° 51' 53.160"
21	40° 20' 38.983"	145° 51' 53.153"
22	40° 20' 38.995"	145° 51' 53.177"
23	40° 20' 39.000"	145° 51' 53.152"
24	40° 20' 39.029"	145° 51' 53.154"
25	40° 20' 39.039"	145° 51' 53.142"
26	40° 20' 39.042"	145° 51' 53.127"
27	40° 20' 39.069"	145° 51' 53.112"
28	40° 20' 39.046"	145° 51' 53.189"
29	40° 20' 39.046"	145° 51' 53.196"
30	40° 20' 39.014"	145° 51' 53.250"
31	40° 20' 39.004"	145° 51' 53.237"
32	40° 20' 38.994"	145° 51' 53.218"
33	40° 20' 38.973"	145° 51' 53.260"
34	40° 20' 38.949"	145° 51' 53.209"

Pass No.	Latitude (South)	Longitude (East)
35	40° 20' 38.983"	145° 51' 53.189"
36	40° 20' 38.976"	145° 51' 53.169"
37	40° 20' 39.022"	145° 51' 53.152"
38	40° 20' 38.916"	145° 51' 53.227"
39	40° 20' 38.905"	145° 51' 53.196"
40	40° 20' 38.934"	145° 51' 53.234"
41	40° 20' 38.924"	145° 51' 53.218"
42	40° 20' 38.911"	145° 51' 53.201"
43	40° 20' 38.922"	145° 51' 53.191"
44	40° 20' 38.945"	145° 51' 53.217"
45	40° 20' 38.919"	145° 51' 53.209"
46	40° 20' 38.923"	145° 51' 53.122"
47	40° 20' 38.906"	145° 51' 53.111"
48	40° 20' 38.942"	145° 51' 53.040"
49	40° 20' 38.929"	145° 51' 53.050"
50	40° 20' 38.972"	145° 51' 53.030"
51	40° 20' 38.970"	145° 51' 53.032"

LATITUDE IN SECONDS

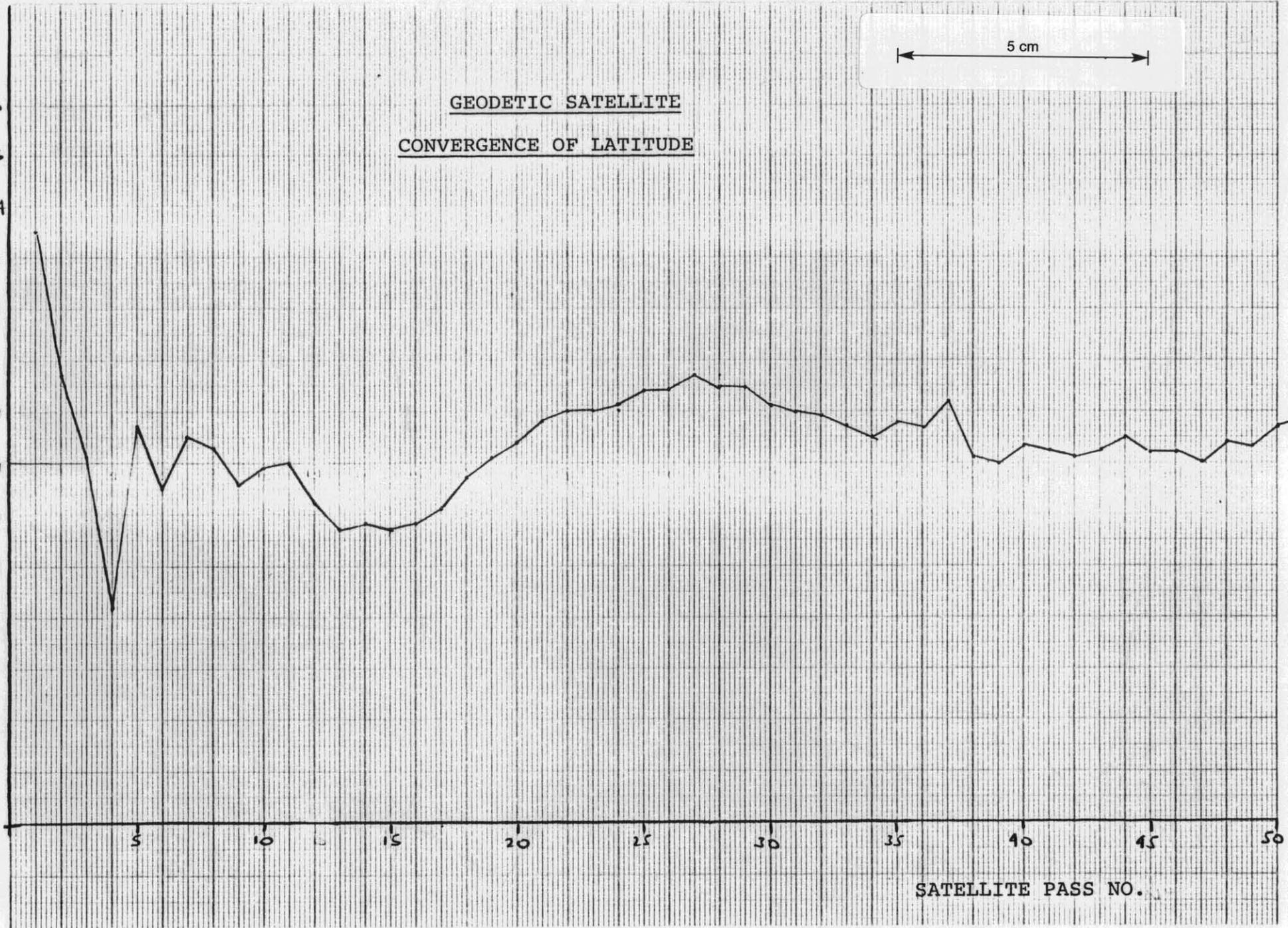
39.6  
39.5  
39.4  
39.3  
39.2  
39.1  
39.0  
38.9  
38.8  
38.7  
38.6  
38.5  
38.4  
38.3  
38.2

GEODETIC SATELLITE  
CONVERGENCE OF LATITUDE

5 cm

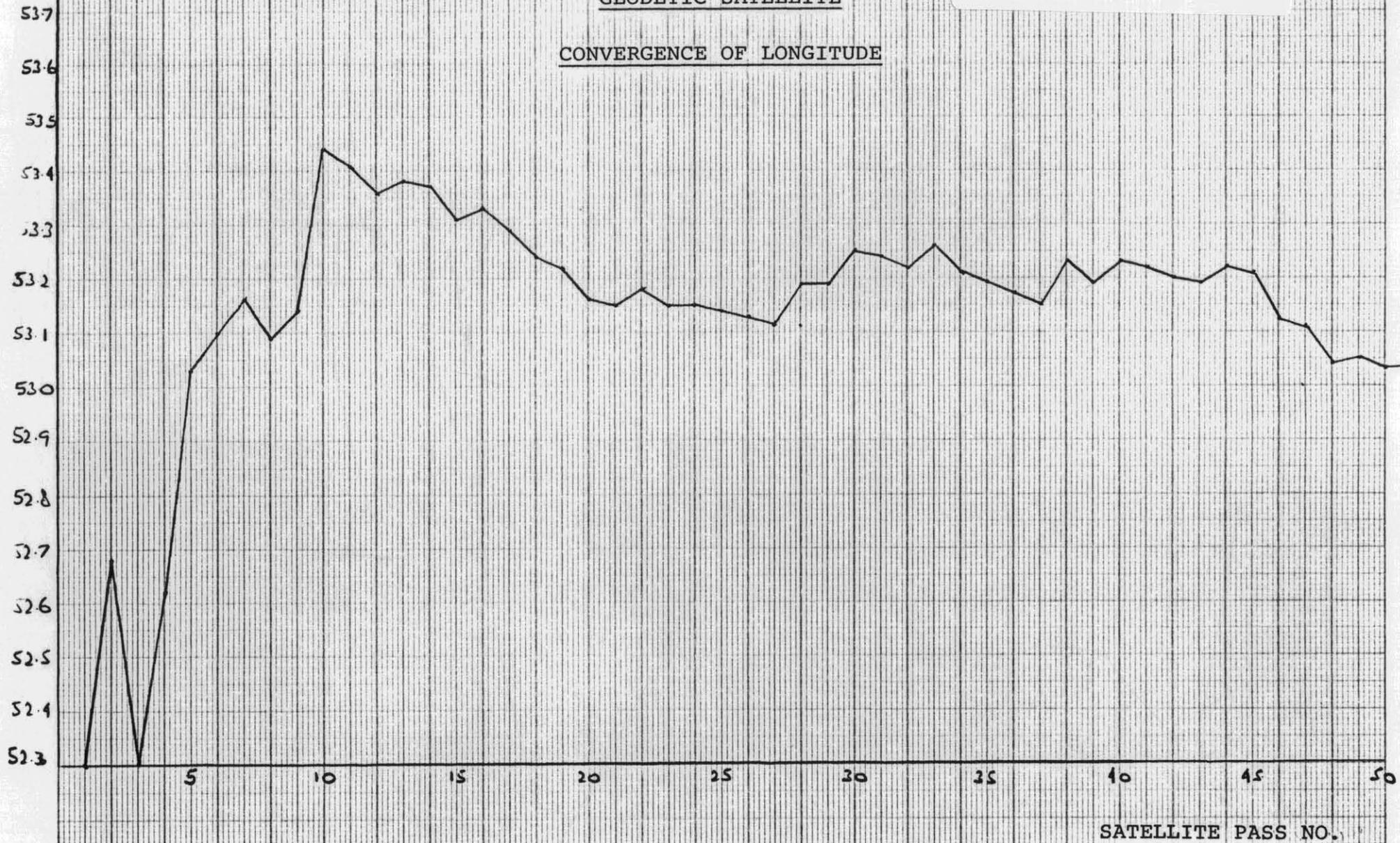
5 10 15 20 25 30 35 40 45 50

SATELLITE PASS NO.



449031 1mm Squares

LONGITUDE IN SECONDS



449032 1mm Squares

APPENDIX B

COMPUTATIONS FOR SATELLITE 3D POSITIONS

APPENDIX B : SATELLITE 3D POSITION (1502 SATELLITE RECEIVER)

Final position of satellite antenna ('Diamond M. Epoch') WGS 72:

Latitude: 40° 20' 39.016" South  
 Longitude: 145° 51' 53.078" East  
 Height: 20.23 metres.

Spatial co-ordinates of satellite antenna in WGS 72:

X = -4 029 374.563  
 Y = 2 731 709.154  
 Z = -4 107 198.822

Shift from WGS 72 to ANS:

$\Delta$  X = +124.2  
 $\Delta$  Y = + 28.8  
 $\Delta$  Z = -137.2

Spatial co-ordinates of satellite antenna in ANS:

X = -4 029 250.363  
 Y = 2 731 737.954  
 Z = -4 107 336.022

Converting spatial co-ordinates to ANS co-ordinates:

Latitude: 40° 20' 44.250" South  
 Longitude: 145° 51' 49.115" East  
 Easting: 403 490.335 m.  
 Northing: 5 533 245.466 m.

Satellite antenna to drill-stem:

Distance : 32.9 metres  
 Bearing : 21.3°

Final '3D' drill-stem location (ANS):

Latitude: 40° 20' 43.262" South  
 Longitude: 145° 51' 49.639" East  
 Easting: 403 502.3 m.  
 Northing: 5 533 276.1 m.

APPENDIX B : SATELLITE 3D POSITION (1502 SATELLITE RECEIVER)  
(Cont'd)

Final location to proposed:

Distance : 14.1 m.

Bearing : 225.3°.

APPENDIX B : SATELLITE 3D POSITION (1107 SATELLITE RECEIVER)

Final position of satellite antenna ('Diamond M. Epoch') WGS 72:

Latitude: 40° 20' 39.000" South  
 Longitude: 145° 51' 52.320" East  
 Height: -5.1 m.

Spatial co-ordinates of satellite antenna in WGS 72:

X = -4 029 348.807  
 Y = 2 731 713.311  
 Z = -4 107 182.049

Shift from WGS 72 to ANS:

$\Delta X$  = +124.2  
 $\Delta Y$  = + 28.8  
 $\Delta Z$  = -137.2

Spatial co-ordinates of satellite antenna in ANS:

X = -4 029 224.607  
 Y = 2 731 742.111  
 Z = -4 107 319.249

Converting spatial co-ordinates to ANS co-ordinates:

Latitude: 40° 20' 44.234" South  
 Longitude: 145° 51' 48.356" East  
 Easting: 403 472.425 m.  
 Northing: 5 533 245.730 m.

Satellite antenna to drill-stem:

Distance: 33.4 metres  
 Bearing: 19.8 degrees

Final '3D' drill-stem location (ANS):

Latitude: 40° 20' 43.218" South  
 Longitude: 145° 51' 48.851" East  
 Easting: 403 483.7 m.  
 Northing: 5 533 277.2 m.

APPENDIX B : SATELLITE 3D POSITION (1107 SATELLITE RECEIVER)

(Cont'd)

Final location to proposed:

Distance	:	14.0 metres
Bearing	:	142.1 degrees.

APPENDIX C

FINAL ACOUSTIC POSITION

AND

TRANSPONDER PARAMETERS

## FINAL POSITION - PELICAN 1

Acoustic position number	1056	Calculated position	: 403496.3	5533271.2	10.0	*
Time	: 01:28:03	Estimated position	: 403495.8	5533268.2	10.0	*
Status	: 411111					
Error	: 5.79E+00					
Transponder responses	: 1420.	1389.8	1014.7	993.8	1429.6	1414.3
Acoustic position number	1057	Calculated position	: 403495.4	5533270.1	10.0	*
Time	: 01:28:13	Estimated position	: 403496.5	5533269.6	10.0	*
Status	: 111111					
Error	: 5.37E+00					
Transponder responses	: 1425.6	1389.9	1014.7	994.1	1428.9	1414.3
Acoustic position number	1058	Calculated position	: 403495.0	5533269.7	10.0	*
Time	: 01:28:23	Estimated position	: 403496.3	5533271.1	10.0	*
Status	: 111111					
Error	: 5.75E+00					
Transponder responses	: 1420.8	1391.4	1014.7	994.2	1428.8	1414.1
Acoustic position number	1059	Calculated position	: 403496.5	5533271.4	10.0	*
Time	: 01:28:33	Estimated position	: 403497.1	5533272.3	10.0	*
Status	: 111111					
Error	: 5.95E+00					
Transponder responses	: 1421.0	1391.5	1015.2	994.1	1429.3	1414.1
Acoustic position number	1060	Calculated position	: 403496.0	5533271.1	10.0	*
Time	: 01:28:43	Estimated position	: 403496.7	5533271.7	10.0	*
Status	: 111111					
Error	: 5.55E+00					
Transponder responses	: 1423.2	1389.7	1015.4	994.1	1429.1	1414.2
Acoustic position number	1061	Calculated position	: 403492.7	5533271.0	10.0	*
Time	: 01:28:53	Estimated position	: 403493.0	5533271.6	10.0	*
Status	: 141111					
Error	: 5.48E+00					
Transponder responses	: 1420.4	1389.7	1014.5	993.6	1429.7	1414.2
Acoustic position number	1062	Calculated position	: 403491.9	5533270.4	10.0	*
Time	: 01:29:03	Estimated position	: 403489.6	5533271.0	10.0	*
Status	: 141111					
Error	: 5.44E+00					
Transponder responses	: 1420.7	1389.8	1015.6	994.1	1427.6	1413.9
Acoustic position number	1063	Calculated position	: 403491.4	5533270.5	10.0	*
Time	: 01:29:13	Estimated position	: 403489.8	5533270.3	10.0	*
Status	: 141111					
Error	: 5.51E+00					
Transponder responses	: 1420.8	1390.1	1014.6	994.0	1428.7	1413.3
Acoustic position number	1064	Calculated position	: 403490.9	5533269.7	10.0	*
Time	: 01:29:23	Estimated position	: 403490.2	5533270.8	10.0	*
Status	: 141111					
Error	: 5.33E+00					
Transponder responses	: 1420.7	1390.0	1014.6	994.0	1428.8	1414.3

APPENDIX C : FINAL ACOUSTIC POSITION

449040

Acoustic position number	1065					
Time	: 01:29:33	Calculated position	: 403492.5	5533271.0	10.0	*
Status	: 141111	Estimated position	: 403490.7	5533270.2	10.0	
Error	: 5.51E+00					
Transponder responses	:	1420.2	1390.1	1014.6	994.1	1429.3 1413.8
Acoustic position number	1066					
Time	: 01:29:43	Calculated position	: 403492.0	5533270.7	10.0	
Status	: 141111	Estimated position	: 403492.1	5533270.9	10.0	
Error	: 5.46E+00					
Transponder responses	:	1420.3	1390.0	1014.8	994.0	1429.2 1414.0
Acoustic position number	1067					
Time	: 01:29:53	Calculated position	: 403496.4	5533271.6	10.0	*
Status	: 111111	Estimated position	: 403496.8	5533272.1	10.0	
Error	: 5.85E+00					
Transponder responses	:	1421.2	1389.9	1014.7	994.0	1429.1 1414.7
Acoustic position number	1068					
Time	: 01:30:03	Calculated position	: 403495.4	5533270.9	10.0	*
Status	: 111111	Estimated position	: 403499.5	5533272.0	10.0	
Error	: 5.84E+00					
Transponder responses	:	1421.4	1389.9	1014.6	994.1	1429.5 1414.1
Acoustic position number	1069					
Time	: 01:30:13	Calculated position	: 403495.2	5533272.3	10.0	*
Status	: 111111	Estimated position	: 403498.9	5533272.6	10.0	
Error	: 5.72E+00					
Transponder responses	:	1420.8	1390.1	1014.6	998.5	1428.8 1413.8
Acoustic position number	1070					
Time	: 01:30:23	Calculated position	: 403494.0	5533271.4	10.0	
Status	: 111111	Estimated position	: 403497.3	5533272.5	10.0	
Error	: 5.59E+00					
Transponder responses	:	1420.3	1391.6	1014.6	994.3	1428.9 1414.6
Acoustic position number	1071					
Time	: 01:30:33	Calculated position	: 403496.1	5533271.4	10.0	*
Status	: 111111	Estimated position	: 403496.6	5533271.6	10.0	
Error	: 5.51E+00					
Transponder responses	:	1421.1	1390.0	1014.9	993.9	1429.8 1414.1
Acoustic position number	1072					
Time	: 01:30:43	Calculated position	: 403495.5	5533270.8	10.0	*
Status	: 111111	Estimated position	: 403500.2	5533274.7	10.0	
Error	: 5.48E+00					
Transponder responses	:	1420.0	1390.0	1014.5	994.1	1436.6 1422.2
Acoustic position number	1073					
Time	: 01:30:53	Calculated position	: 403496.2	5533271.3	10.0	*
Status	: 111111	Estimated position	: 403497.9	5533272.9	10.0	
Error	: 5.79E+00					
Transponder responses	:	1421.3	1390.2	1014.7	994.0	1429.6 1414.0
Acoustic position number	1074					
Time	: 01:31:03	Calculated position	: 403495.6	5533270.8	10.0	*
Status	: 111111	Estimated position	: 403495.8	5533271.6	10.0	
Error	: 5.89E+00					

APPENDIX C : FINAL ACOUSTIC POSITION

449041

Transponder responses : 1421.0 1390.6 1014.6 994.2 1428.8 1414.1  
 Acoustic position number : 1075  
 Time : 01:31:13 Calculated position : 403495.6 5533271.9 10.0 \*  
 Status : 111111 Estimated position : 403494.6 5533271.2 10.0  
 Error : 5.84E+00  
 Transponder responses : 1420.7 1392.4 1014.6 994.2 1429.2 1415.0

MEAN OF \* 403494.8 5533271.2  
 OFFSET TRANSDUCER  
 TO CENTER OF DRILL -0.5 -1.7  
 FINAL POSITION 403494.3 5533269.5

TRANSPONDER CHANNEL AND POSITION

	channel	valid	easting	northing	depth	delay
Transp. 1	12	1	403682.5	5534684.8	72.0	15.0
Transp. 2	15	1	404877.0	5533068.0	72.0	15.0
Transp. 3	9	1	402887.0	5534086.	72.0	15.0
Transp. 4	4	1	404081.1	5532464.0	72.0	15.0
Transp. 5	14	1	402078.0	5533486.6	72.0	15.0
Transp. 6	1	1	403269.4	553187.0	72.0	15.0

Divers data concerning ship and RM configuration

RM type (101, 201 or 203) 201  
 Is the depth of the AM constant? (1 - yes, 0 - no) 1  
 Depth of the AM (in meters) 10  
 Delay on the RM (in milliseconds) 15  
 Velocity listed on the RM (m/sec) 1504  
 Distance AM -> antenna (ant. forwards = +) 0  
 Distance AM -> antenna (ant. right = +) 0  
 Maximum speed of ship (m/sec) 5  
 Minimum speed of ship (m/sec) 0  
 Maximum tolerated error (m) 6  
 Interrogation period (sec) 10

CRT graphics data

East origin 403442  
 North origin 5533216  
 How many meters to the screen width? 100

Acoustic position

WELL SITE #5  
DECEMBER 1985  
ENTIRE LOCATION :-

APPENDIX C : FINAL ACOUSTIC POSITION

ABSOLUTE PARAMETERS

449042

GEOGRAPHICALS		U.T.M
145 Degs 51'49.209" East		403 492.30 East
40 Degs 20'43.578" South		5 533 266.20 North

External printer data

Address of external printer (0 if none available) ex. 701  
Perforated paper ? (yes = 1 , no = 0)

701  
0

Enter as many layers as needed and press CONT

	Depth	Velocity
At the surface	0	1506.85
Breakpoint 1	11	1506.41
Breakpoint 2	21	1505.88
Breakpoint 3	30	1505.17
Breakpoint 4	41	1503.62
Breakpoint 5	51	1503.61
Breakpoint 6	61	1501.57
Breakpoint 7	70	1501.57
Breakpoint 8	77	1501.77
Breakpoint 9	0	0.00
Breakpoint 10	0	0.00
Breakpoint 11	0	0.00
Breakpoint 12	0	0.00
Breakpoint 13	0	0.00
Breakpoint 14	0	0.00

Geodetic parameters

Semi major axis (m) 6.37816E+6  
Flattening (1/F) 298.25  
UTM central meridian 147  
Indicate the hemisphere (1 = north , -1 = south) -1

TARGET POSITION

Target easting 403492.3  
Target northing 5.5332662  
Target depth 0

EXTERNAL PLOTTER DATA

Plotter type (0 = no plotter; 1 = HP9872; 2 = CPS30) 0  
Plotter address (0 if no plotter) ex : 705 0  
Long axis length (in cm) (=38 for 9872) 0  
Short axis length (in cm) (=25 for 9872) 0  
Margin to be left below plot (in cm) 0  
Scale (m/cm) (eg 1/5000 = 50) 0  
Tick mark interval (meters) 0  
or East origin (P1 for 9872) 0  
or North origin (P1 for 9872) 0  
Orientation of long axis (deg) (=90 for 9872) 0

APPENDIX C : ACOUSTIC TRANSPONDER PARAMETERS

Transponders deployed on location PELICAN-5:

Transponder	S/N	Channel Frequency	Bit 0	Bit 1	Enable	Disable	Release
1	551	12	12	10	33	34	36
2	540	15	12	10	21	22	25
3	650	9	03	01	77	78	79
4	587	4	13	10	67	68	69
5	552	14	12	10	43	44	46
6	530	1	12	08	73	74	76