

FUGRO SURVEY AS

REPORT ON
GYRO CALIBRATION, DGPS AND
TAIL BUOY VERIFICATION
FOR
MV PACIFIC TITAN
AT
SEMAYANG WHARF
BALIKPAPAN, INDONESIA

Survey Period: August 2007

Report Number: K1483 Rev 0

Client Reference:

0	Final	Anto Sinaga	Arief Faisal	Pim Peerebom	15 August 2007
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REPORT AMENDMENT SHEET

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1. ABSTRACT

Fugro Survey Pte Ltd through its subsidiary in Indonesia, PT Fugro Indonesia was contracted by Fugro Survey AS to carry out the following services for their survey vessel MV Pacific Titan at Semayang Wharf, Balikpapan, Indonesia on 07 up to 08th August 2007.

- DGPS System Verification
- Gyro Calibration
- Tail Buoys Verification

All co-ordinates quoted within this report are in metres and referred to WGS 1984 Spheroid and Datum

1.1 Summary of Results

The results are summarized and tabulated as follows:

a) DGPS System Verification

System	Easting (m)		Northing (m)	
	C - O	Std Dev.	C - O	Std Dev.
Port GPS Antenna	-1.4	0.4	1.6	0.2
Stbd GPS Antenna (Primary)	-1.4	0.4	1.6	0.1

b) Gyro Calibration

Cal. #	Heading	Gyro 1 HS 50		Gyro 2 AD 100	
		C - O	Std Dev.	C - O	Std Dev.
August 7	15.3	1.1	0.8	2.2	0.2
August 8	191.9	1.6	0.8	2.2	0.6
Mean		1.35	0.8	2.2	0.4

c) Tail Buoys System Verification

System	Degrees °		Distance (m)	
	Mean	Std Dev.	Mean	Std Dev.
Pod1260	3.19	1.76	-0.55	2.10
Pod1314	1.49	1.08	2.05	1.05
Pod1411	1.45	4.32	-1.96	0.98
Pod1503	-3.68	3.34	0.73	1.22
Pod1511	-0.56	4.07	1.91	2.85
Pod1518	0.82	0.33	0.32	0.38
Pod1575	1.33	1.69	1.14	0.71
Pod2041	-0.11	2.28	2.00	1.89

2. PROJECT DETAILS

Client : Fugro Survey AS

Contractor : FUGRO SURVEY Pte. Ltd.

Project : Gyro Calibration, DGPS System and Tail Buoys Verification

Vessel / Barge : MV Pacific Titan

Location : Semayang Wharf, Balikpapan, Indonesia

Equipment : Total Station – Sokkia SET4B

Personnel : Anto Sinaga (Surveyor)
Bambang Setiawan (Surveyor)

Date : 07th – 08th August 2007

3. SURVEY PROCEDURES

3.1 Survey Stations

There are 2 reference survey station (2 numbers with WGS 1984 coordinates system) at Semayang Wharf Balikpapan, Indonesia. They are FUGRO 3 and FUGRO 4 ([Refer to Appendix A](#)). This point must be transferred due to far away from vessel. We make 2 help point near the vessel (P2 and P4) so that we could be shot prism on the vessel easily. P4 was used as instrument set-up location and P2 as the backsight (prism target). Details position of reference point and help point above as follows:

No.	Point_Name	Coordinates			
		Geodetic Coordinates		Grid Coordinates	
		Latitude	Longitude	Easting (m)	Northing (m)
1	FUGRO 3	01°16'14.2952 S	116°48'24.2996 E	478501.312	9859555.337
2	FUGRO 4	01°16'13.6253 S	116°48'24.9706 E	478522.046	9859575.907
3	P2	01°16'21.3263 S	116°48'19.9359 E	478366.480	9859339.450
4	P4	01°16'23.5496 S	116°48'19.7757 E	478361.536	9859271.189

3.2 Position of Target Prism

On board the barge, four prisms were installed with masking tape, one at port GPS Antenna, one at starboard GPS Antenna (DGPS system and tailbuoys verification), and two at along starboard side of the vessel (Gyro calibration). The starboard GPS antenna was used as primary GPS antenna.

3.3 Calibration Procedures

The DGPS verification checks and gyro calibrations were conducted in difference time. The Total Station was set up at P4 and referenced to P2 as backsight ([Refer to Appendix C](#)). Range and bearing measurements were observed to the prisms installed on board the barge, same survey procedure was used for both gyro calibration and DGPS verification checks. At the same times, DGPS antenna positions and the gyro readings were logged by vessel chief navigator.



4. GEODETIC PARAMETERS

The survey work was defined and computed in the following Geodetic and Projection system:

Global Positioning System Geodetic Parameters	
Spheroid:	World Geodetic System 1984
Datum:	World Geodetic System 1984
Semi major axis:	a = 6 378 137.000 m
Inverse Flattening:	$1/f = 298.257\ 223\ 563$
Project Projection Parameters	
Grid Projection:	Universal Transverse Mercator
UTM Zone:	50 S
Central Meridian:	117° 00' 00" E
Latitude of Origin:	0° 00' 00" N
False Easting:	500 000 m
False Northing:	0 m
Scale factor on Central Meridian:	0.9996
Units:	metre



5. COMPUTATIONS

The positions of prism target were computed from the total station range and bearing measurements in relation to the coordinates of the reference points (P4). These computed positions were then used as a basis for comparison with the observed readings from vessel DGPS system and gyros.

The details of the results are shown on the following pages:

DGPS SYSTEM VERIFICATION												
Vessel		Pacific Titan				Projection		UTM				
Location		Semayang Port, Balikpapan				Spheroid		WGS 84				
Job Number		K-1483				Sem Major axis (m)		6378137.000				
Date		07 August 2007				Inverse flattening		298.257 223.663				
Instrument		Sokkia				Origin Latitude		0 °				
Observer		Aris Siliaga/Bambang				Origin Longitude		117 ° E				
Local Time		+8 hours				Scale Factor		0.9996				
Instrument Station		P4				Easting :		478361.54 m				
Latitude of Station		1 ° 16 ' 23.5496 " N				Northing :		9859271.19 m				
Longitude of Station		116 ° 48 ' 19.7757 " E				Easting :		478366.48 m				
Reference Object		P2				Northing :		9859339.45 m				
True Bearing to R.O.		4 ° 8 ' 32.0000 "										
FIX	SGHT	LOCAL TIME	GEODIMETER			CALCULATED (SURVEY)		OBSERVED (GPS)		C - O		
			"	'	"	DISTANCE	EASTING	NORTHING	EASTING	NORTHING	dE (m)	dN (m)
1	GPS Airt Port Side	12:39:42	312	36	55	23.04	478345.75	9859287.97	478347.8524	9859286.56	-2.1	1.4
2	GPS Airt Port Side	12:43:44	312	36	30	23.04	478345.75	9859287.97	478347.7065	9859286.71	-2.0	1.3
3	GPS Airt Port Side	12:45:29	312	40	25	23.03	478345.78	9859287.98	478347.4043	9859286.27	-1.6	1.7
4	GPS Airt Port Side	12:48:26	312	43	15	23.06	478345.77	9859288.02	478347.4	9859286.20	-1.6	1.8
5	GPS Airt Port Side	12:50:13	312	43	15	23.07	478345.76	9859288.02	478347.49	9859286.00	-1.7	2.0
6	GPS Airt Port Side	12:53:06	312	33	20	23.00	478345.76	9859287.93	478347.61	9859286.00	-1.8	1.9
7	GPS Airt Port Side	12:54:46	312	33	40	23.02	478345.75	9859287.94	478347.37	9859286.22	-1.6	1.7
8	GPS Airt Port Side	12:57:46	312	37	20	23.05	478345.75	9859287.98	478347.62	9859286.22	-1.9	1.8
9	GPS Airt Port Side	12:58:41	312	35	05	23.05	478345.74	9859287.97	478347.01	9859286.66	-1.3	1.3
10	GPS Airt Port Side	13:00:24	312	31	05	23.00	478345.75	9859287.92	478346.81	9859286.32	-1.1	1.6
11	GPS Airt Port Side	13:04:14	312	37	35	23.04	478345.75	9859287.98	478346.79	9859286.70	-1.0	1.3
12	GPS Airt Port Side	13:06:42	312	30	10	23.01	478345.74	9859287.92	478346.65	9859286.47	-0.9	1.4
13	GPS Airt Port Side	13:08:46	312	30	25	23.04	478345.72	9859287.94	478346.81	9859286.48	-1.1	1.5
14	GPS Airt Port Side	13:10:18	312	33	10	23.04	478345.73	9859287.96	478346.4	9859286.53	-0.7	1.4
15	GPS Airt Port Side	13:12:53	312	36	50	23.02	478345.76	9859287.96	478346.55	9859286.65	-0.8	1.3
16	GPS Airt Port Side	13:14:19	312	36	50	23.04	478345.75	9859287.97	478347.08	9859286.31	-1.3	1.7
17	GPS Airt Port Side	13:16:35	312	43	15	23.07	478345.76	9859288.02	478347.25	9859286.57	-1.5	1.4
18	GPS Airt Port Side	13:17:55	312	42	10	23.09	478345.74	9859288.03	478346.83	9859286.62	-1.1	1.5
19	GPS Airt Port Side	13:21:45	312	48	05	23.10	478345.77	9859288.07	478347.01	9859286.66	-1.2	1.4
20	GPS Airt Port Side	13:29:23	312	39	10	23.09	478345.73	9859288.02	478347.54	9859286.09	-1.8	1.9
Mean (C - O) =										-1.4	1.6	
S. D. =										0.4	0.2	

FUGRO SURVEY AS

Report on Gyro Calibration, Tailbuoys and DGPS Verification on M.V. Pacific Titan
At Semayang Wharf, Balikpapan, Indonesia



DGPS SYSTEM VERIFICATION												
Vessel	Pacific Titan					Projection	UTM					
Location	Semayang Port, Balikpapan					Spheroid	WGS 84					
Job Number	K-1483					Semi-major axis (m)	6378137.000					
Date	07 August 2007					Inverse flattening	298.257223563					
Instrument	Sokkia					Origin Latitude	0°					
Observer	Anio Sinaga/Bambang					Origin Longitude	117° E					
Local Time	+ 8 hours					Scale Factor	0.9996					
Instrument Station	P4											
Latitude of Station	1° 16' 23.5496" N					Easting :	478361.54 m					
Longitude of Station	116° 48' 19.7757" E					Northing :	9859271.19 m					
Reference Object	P2					Easting :	478366.48 m					
True Bearing to R.O.	4° 8' 32.0000"					Northing :	9859339.45 m					
FDX	SIGHT	LOCAL TIME	GEODIMETER			CALCULATED (SURVEY)		OBSERVED (GPS)		C - O		
			°	'	"	DISTANCE	EASTING	NORTHING	EASTING	NORTHING	dE (m)	dN (m)
1	GPS Aft Starboard Sht	12:41:18	315	39	10	21.40	478347.72	9859287.53	478349.582	9859286.08	-1.9	1.5
2	GPS Aft Starboard Sht	12:44:20	315	36	25	21.39	478347.72	9859287.51	478349.7107	9859285.93	-2.0	1.6
3	GPS Aft Starboard Sht	12:46:28	315	41	35	21.39	478347.74	9859287.54	478349.4619	9859285.99	-1.7	1.5
4	GPS Aft Starboard Sht	12:49:18	315	41	20	21.42	478347.72	9859287.56	478349.3552	9859285.64	-1.6	1.9
5	GPS Aft Starboard Sht	12:51:23	315	39	05	21.41	478347.71	9859287.54	478349.0936	9859285.95	-1.4	1.6
6	GPS Aft Starboard Sht	12:54:01	315	31	30	21.36	478347.71	9859287.47	478349.0406	9859285.82	-1.3	1.7
7	GPS Aft Starboard Sht	12:55:41	315	34	55	21.39	478347.71	9859287.51	478349.4324	9859285.60	-1.7	1.9
8	GPS Aft Starboard Sht	12:57:36	315	34	10	21.40	478347.70	9859287.51	478349.4951	9859285.76	-1.8	1.8
9	GPS Aft Starboard Sht	12:59:36	315	36	10	21.40	478347.71	9859287.52	478348.9724	9859285.90	-1.3	1.6
10	GPS Aft Starboard Sht	13:01:10	315	32	00	21.35	478347.72	9859287.47	478348.9440	9859285.91	-1.2	1.6
11	GPS Aft Starboard Sht	13:04:59	315	34	35	21.37	478347.72	9859287.49	478348.6669	9859286.07	-0.9	1.4
12	GPS Aft Starboard Sht	13:06:25	315	34	40	21.35	478347.73	9859287.48	478348.8211	9859285.96	-1.1	1.5
13	GPS Aft Starboard Sht	13:09:37	315	33	35	21.40	478347.70	9859287.51	478348.4258	9859285.91	-0.7	1.6
14	GPS Aft Starboard Sht	13:11:05	315	29	10	21.38	478347.69	9859287.48	478348.7058	9859285.93	-1.0	1.5
15	GPS Aft Starboard Sht	13:13:37	315	34	40	21.40	478347.70	9859287.51	478348.7534	9859285.88	-1.1	1.6
16	GPS Aft Starboard Sht	13:15:37	315	41	15	21.39	478347.74	9859287.53	478349.0136	9859285.96	-1.3	1.6
17	GPS Aft Starboard Sht	13:17:12	315	41	15	21.44	478347.71	9859287.57	478348.9817	9859286.11	-1.3	1.5
18	GPS Aft Starboard Sht	13:20:34	315	45	40	21.46	478347.71	9859287.61	478348.9642	9859285.94	-1.3	1.7
19	GPS Aft Starboard Sht	13:22:21	315	47	25	21.47	478347.72	9859287.62	478348.9684	9859286.07	-1.3	1.5
20	GPS Aft Starboard Sht	13:30:45	315	45	00	21.47	478347.70	9859287.61	478348.8654	9859285.62	-2.2	2.0
Mean (C - O) =										-1.4	1.6	
S. D. =										0.4	0.1	

FUGRO SURVEY AS

Report on Gyro Calibration, Tailbuoys and DGPS Verification on M.V. Pacific Titan
At Semayang Wharf, Balikpapan, Indonesia



GYRO ALIGNMENT CHECK / CALIBRATION									
Vessel		Pacific Titan			Projection		UTM		
Location		Semayang Port, Balikpapan			Spheroid		WGS 84		
Job Number		K-1483			Semi-major axis (m)		6378137.000		
Date		07 August 2007			Inverse flattening		298.257223563		
Instrument		Sokkia			Origin Latitude		0 °		
Observer		Bambang/Anto			Origin Longitude		117 ° E		
Local Time		+ 8 hours			Scale Factor		0.9996		
Instrument Station		P4					Vessel Gyro		
Latitude of Station		1 ° 16 ' 23.5496 " N			Easting :		478361.5360 m		
Longitude of Station		116 ° 48 ' 19.7757 " E			Northing :		9859271.1890 m		
Reference Object		P2			Easting :		478366.4800 m		
True Bearing to R.O.		4 ° 8 ' 32.0000 "			Northing :		9859339.4500 m		
Obs	Sight	Local Time	Azimuth Observation		Observed Horizontal DISTANCE	Vessel Heading (Degrees)		(Deg) C-O	
			Horizontal ° ' "	Vertical ddd.mmmss		CALC	GYRO		
	R.O.		4	8	32				
1	Bow	13:35:41	302	23	30	90.0000	14.69	14.9	1.8
	Stem		228	54	20	90.0000	22.12		
2	Bow	01:36:56 PM	302	25	45	90.0000	14.70	15.0	1.9
	Stem		228	58	25	90.0000	22.12		
3	Bow	01:40:04 PM	302	19	50	90.0000	14.70	15.0	1.9
	Stem		228	54	15	90.0000	22.13		
4	Bow	01:41:04 PM	302	14	10	90.0000	14.68	15.0	1.9
	Stem		228	59	00	90.0000	22.13		
5	Bow	01:43:30 PM	302	17	25	90.0000	14.72	15.1	2.0
	Stem		229	01	55	90.0000	22.12		
6	Bow	01:45:33 PM	302	16	55	90.0000	14.71	15.1	2.0
	Stem		228	51	25	90.0000	22.14		
7	Bow	01:46:42 PM	302	17	15	90.0000	14.72	15.1	2.0
	Stem		228	58	25	90.0000	22.11		
8	Bow	01:47:55 PM	302	20	25	90.0000	14.72	15.2	2.1
	Stem		228	48	45	90.0000	22.15		
9	Bow	01:50:04 PM	302	34	05	90.0000	14.70	15.2	2.1
	Stem		228	52	05	90.0000	22.16		
10	Bow	01:51:15 PM	302	10	05	90.0000	14.72	15.3	2.2
	Stem		228	57	15	90.0000	22.11		
11	Bow	01:53:16 PM	302	17	05	90.0000	14.72	15.3	2.2
	Stem		229	03	15	90.0000	22.14		
12	Bow	01:54:22 PM	302	26	15	90.0000	14.71	15.3	2.2
	Stem		229	00	00	90.0000	22.07		
13	Bow	01:55:39 PM	302	27	05	90.0000	14.72	15.4	2.3
	Stem		229	05	20	90.0000	22.10		
14	Bow	01:57:05 PM	302	24	40	90.0000	14.74	15.4	2.3
	Stem		229	06	45	90.0000	22.10		
15	Bow	01:58:22 PM	302	22	15	90.0000	14.75	15.4	2.3
	Stem		229	03	20	90.0000	22.12		
16	Bow	01:59:22 PM	302	24	45	90.0000	14.75	15.5	2.4
	Stem		229	08	00	90.0000	22.10		
17	Bow	02:00:38 PM	302	22	25	90.0000	14.75	15.5	2.4
	Stem		229	02	35	90.0000	22.12		
18	Bow	02:02:00 PM	302	17	50	90.0000	14.75	15.6	2.5
	Stem		228	58	25	90.0000	22.14		
19	Bow	02:03:18 PM	302	18	35	90.0000	14.74	15.6	2.5
	Stem		229	05	00	90.0000	22.10		
20	Bow	02:06:05 PM	302	20	20	90.0000	14.75	15.6	2.5
	Stem		229	04	05	90.0000	22.10		
Mean (C - O) =								2.2	
S. D. =								0.2	

Correction for Gyrocompass = 2.2 °

FUGRO SURVEY AS

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GYRO ALIGNMENT CHECK / CALIBRATION										
Vessel	Pacific Titan			Projection	UTM					
Location	Semayang Port, Balikpapan			Spheroid	WGS 84					
Job Number	K-1483			Semi-major axis (m)	6378137.000					
Date	07 August 2007			Inverse flattening	298.257223563					
Instrument	Sokkia			Origin Latitude	0 °					
Observer	Bambang/Anto			Origin Longitude	117 ° E					
Local Time	+ 8 hours			Scale Factor	0.9996					
Instrument Station	P4						Vessel Gyro			
Latitude of Station	1 ° 16 ' 23.5496 " N			Eastings :	478361.5360 m					
Longitude of Station	116 ° 48 ' 19.7757 " E			Northings :	9859271.1890 m					
Reference Object	P2						Eastings :	478366.4800 m		
True Bearing to R.O.	4 ° 8 ' 32.0000 "			Northings :	9859339.4600 m					
Obs	Sight	Local Time	Azimuth Observation		Observed Horizontal DISTANCE	Vessel Heading (Degrees)		(Deg) C-O		
			Horizontal ° ' "	Vertical ddd.mmss		CALC	GYRO			
	R.O.		4	8	32					
1	Bow	01:35:41 PM	302	23	30	90.0000	14.69	14.9	13.6	1.3
	Stern		228	54	20	90.0000	22.12			
2	Bow	01:36:56 PM	302	25	45	90.0000	14.70	15.0	13.9	1.0
	Stern		228	58	25	90.0000	22.12			
3	Bow	01:40:04 PM	302	19	50	90.0000	14.70	15.0	14.3	0.7
	Stern		228	54	15	90.0000	22.13			
4	Bow	01:41:04 PM	302	14	10	90.0000	14.68	15.0	13.4	1.7
	Stern		228	59	00	90.0000	22.13			
5	Bow	01:43:30 PM	302	17	25	90.0000	14.72	15.1	14.2	0.9
	Stern		229	01	55	90.0000	22.12			
6	Bow	01:45:33 PM	302	16	55	90.0000	14.71	15.1	14.9	0.2
	Stern		228	51	25	90.0000	22.14			
7	Bow	01:46:42 PM	302	17	15	90.0000	14.72	15.1	15.5	-0.3
	Stern		228	58	25	90.0000	22.11			
8	Bow	01:47:55 PM	302	20	25	90.0000	14.72	15.2	14.1	1.1
	Stern		228	48	45	90.0000	22.15			
9	Bow	01:50:04 PM	302	34	05	90.0000	14.70	15.2	13.9	1.3
	Stern		228	52	05	90.0000	22.16			
10	Bow	01:51:15 PM	302	10	05	90.0000	14.72	15.3	15.5	-0.2
	Stern		228	57	15	90.0000	22.11			
11	Bow	01:53:16 PM	302	17	05	90.0000	14.72	15.3	14.1	1.2
	Stern		229	03	15	90.0000	22.14			
12	Bow	01:54:22 PM	302	26	15	90.0000	14.71	15.3	13.8	1.5
	Stern		229	00	00	90.0000	22.07			
13	Bow	01:55:39 PM	302	27	05	90.0000	14.72	15.4	14.9	0.4
	Stern		229	05	20	90.0000	22.10			
14	Bow	01:57:05 PM	302	24	40	90.0000	14.74	15.4	14.1	1.3
	Stern		229	06	45	90.0000	22.10			
15	Bow	01:58:22 PM	302	22	15	90.0000	14.75	15.4	13.9	1.6
	Stern		229	03	20	90.0000	22.12			
16	Bow	01:59:22 PM	302	24	45	90.0000	14.75	15.5	14.7	0.8
	Stern		229	08	00	90.0000	22.10			
17	Bow	02:00:38 PM	302	22	25	90.0000	14.75	15.5	14.0	1.5
	Stern		229	02	35	90.0000	22.12			
18	Bow	02:02:00 PM	302	17	50	90.0000	14.75	15.6	13.2	2.4
	Stern		228	58	25	90.0000	22.14			
19	Bow	02:03:18 PM	302	18	35	90.0000	14.74	15.6	14.1	1.5
	Stern		229	05	00	90.0000	22.10			
20	Bow	02:06:05 PM	302	20	20	90.0000	14.75	15.6	13.1	2.5
	Stern		229	04	05	90.0000	22.10			
						Mean (C - O) =	1.1			
						S. D. =	0.8			

Correction for Gyrocompass = 1.1 °

FUGRO SURVEY AS

Report on Gyro Calibration, Tailbuoys and DGPS Verification on M.V. Pacific Titan
At Semayang Wharf, Balikpapan, Indonesia



GYRO ALIGNMENT CHECK / CALIBRATION										
Vessel	Pacific Titan			Projection	UTM					
Location	Semayang Port, Balikpapan			Spheroid	WGS 84					
Job Number	K-1483			Semi-major axis (m)	6378137.000					
Date	08 August 2007			Inverse flattening	298.257223563					
Instrument	Solkia			Origin Latitude	0 °					
Observer	Bambang/Anto			Origin Longitude	117 ° E					
Local Time	+ 8 hours			Scale Factor	0.9996					
Instrument Station	P4						Vessel Gyro			
Latitude of Station	1 ° 16 ' 23.5496 " N			Easting :	478361.5360 m					
Longitude of Station	116 ° 48 ' 19.7757 " E			Northing :	9859271.1890 m					
Reference Object	P2			Easting :	478366.4800 m					
True Bearing to R.O.	4 ° 8 ' 32.0000 "			Northing :	9859339.4600 m					
Obs	Sight	Local Time	Azimuth Observation		Observed Horizontal DISTANCE	Vessel Heading (Degree)		(Deg) C-O		
			Horizontal ° ' "	Vertical ddd.mmm		CALC	GYRO			
	R.O.		4	8	32					
1	Bow	10:01:56 PM	347	40	40	90.0000	35.69	191.8	189.7	2.1
	Stem		354	49	00	90.0000	54.94			
2	Bow	10:04:01 PM	347	38	25	90.0000	35.73	191.7	189.7	2.0
	Stem		354	45	50	90.0000	55.03			
3	Bow	10:06:34 PM	347	38	00	90.0000	35.70	191.4	189.7	1.7
	Stem		354	40	15	90.0000	55.00			
4	Bow	10:08:37 PM	347	33	25	90.0000	35.70	193.7	189.7	4.0
	Stem		355	28	00	90.0000	54.95			
5	Bow	10:11:03 PM	348	23	00	90.0000	35.75	192.3	189.7	2.6
	Stem		355	28	05	90.0000	55.01			
6	Bow	10:14:02 PM	348	19	50	90.0000	35.71	192.4	189.7	2.7
	Stem		355	28	35	90.0000	55.05			
7	Bow	10:16:10 PM	348	22	05	90.0000	35.71	192.4	189.7	2.7
	Stem		355	30	20	90.0000	55.02			
8	Bow	10:18:51 PM	348	21	35	90.0000	35.69	191.4	189.8	1.6
	Stem		355	06	25	90.0000	54.99			
9	Bow	10:20:49 PM	347	55	10	90.0000	35.75	191.4	189.7	1.7
	Stem		354	48	45	90.0000	54.99			
10	Bow	10:22:36 PM	347	45	35	90.0000	35.72	191.7	189.7	2.0
	Stem		354	50	15	90.0000	55.01			
11	Bow	10:25:53 PM	347	44	05	90.0000	35.70	191.6	189.7	1.9
	Stem		354	49	05	90.0000	55.02			
12	Bow	10:27:49 PM	347	41	10	90.0000	35.70	191.6	189.7	1.9
	Stem		354	45	45	90.0000	55.00			
13	Bow	10:29:40 PM	347	40	40	90.0000	35.71	192.0	189.7	2.3
	Stem		354	53	30	90.0000	54.98			
14	Bow	10:31:55 PM	347	43	05	90.0000	35.70	192.1	189.7	2.4
	Stem		355	00	15	90.0000	55.05			
15	Bow	10:33:30 PM	347	51	15	90.0000	35.70	191.8	189.7	2.1
	Stem		354	57	25	90.0000	55.01			
16	Bow	10:35:17 PM	347	50	50	90.0000	35.70	192.0	189.7	2.3
	Stem		355	01	00	90.0000	54.97			
17	Bow	10:37:20 PM	347	53	35	90.0000	35.70	191.5	189.7	1.8
	Stem		354	51	50	90.0000	55.03			
18	Bow	10:39:21 PM	347	41	10	90.0000	35.68	191.6	189.7	1.9
	Stem		354	47	45	90.0000	54.99			
19	Bow	10:41:05 PM	347	35	10	90.0000	35.70	191.1	189.7	1.4
	Stem		354	32	25	90.0000	55.01			
20	Bow	10:42:59 PM	347	21	25	90.0000	35.69	191.8	189.7	2.1
	Stem		354	40	20	90.0000	55.04			
						Mean (C - O) =		2.2		
						S. D. =		0.6		

Correction for Gyrocompass = 2.2 °

FUGRO SURVEY AS

Report on Gyro Calibration, Tailbuoys and DGPS Verification on M.V. Pacific Titan
At Semayang Wharf, Balikpapan, Indonesia



GYRO ALIGNMENT CHECK / CALIBRATION									
Vessel	Pacific Titan			Projection	UTM				
Location	Semayang Port, Balikpapan			Spheroid	WGS 84				
Job Number	K-1483			Semi-major axis (m)	6378137.000				
Date	07 August 2007			Inverse flattening	298.257223563				
Instrument	Sokkia			Origin Latitude	0 °				
Observer	Bambang/Ano			Origin Longitude	117 ° E				
Local Time	+ 8 hours			Scale Factor	0.9996				
Instrument Station	P4						Vessel Gyro		
Latitude of Station	1 ° 16 ' 23.5496 " N			Easting :		478361.5360 m			
Longitude of Station	116 ° 48 ' 19.7757 " E			Northing :		9859271.1890 m			
Reference Object	P2			Easting :		478366.4800 m			
True Bearing to R.O.	4 ° 8 ' 32.0000 "			Northing :		9859339.4500 m			
Obs	Sight	Local Time	Azimuth Observation		Observed Horizontal DISTANCE	Vessel Heading (Degrees)		(Deg) C-O	
			Horizontal ° ' "	Vertical ddd.mmss		CALC	GYRO		
	R.O.		4	8	32				
1	Bow	10:01:56 PM	347:40:40	90.0000	35.89	191.8	189.5	2.3	
	Stern		354:49:00	90.0000	54.94				
2	Bow	10:04:01 PM	347:38:25	90.0000	35.73	191.7	190.3	1.4	
	Stern		354:45:50	90.0000	55.03				
3	Bow	10:06:34 PM	347:38:00	90.0000	35.70	191.4	191.4	0.0	
	Stern		354:40:15	90.0000	55.00				
4	Bow	10:08:37 PM	347:33:25	90.0000	35.70	193.7	191.0	2.7	
	Stern		355:28:00	90.0000	54.95				
5	Bow	10:11:03 PM	348:23:00	90.0000	35.75	192.3	189.9	2.4	
	Stern		355:28:05	90.0000	55.01				
6	Bow	10:14:02 PM	348:19:50	90.0000	35.71	192.4	189.9	2.5	
	Stern		355:28:35	90.0000	55.05				
7	Bow	10:16:10 PM	348:22:05	90.0000	35.71	192.4	190.8	1.6	
	Stern		355:30:20	90.0000	55.02				
8	Bow	10:18:51 PM	348:21:35	90.0000	35.89	191.4	191.3	0.1	
	Stern		355:06:25	90.0000	54.99				
9	Bow	10:20:49 PM	347:55:10	90.0000	35.75	191.4	190.8	0.6	
	Stern		354:48:45	90.0000	54.99				
10	Bow	10:22:36 PM	347:45:35	90.0000	35.72	191.7	190.4	1.3	
	Stern		354:50:15	90.0000	55.01				
11	Bow	10:25:53 PM	347:44:05	90.0000	35.70	191.6	188.7	2.9	
	Stern		354:49:05	90.0000	55.02				
12	Bow	10:27:49 PM	347:41:10	90.0000	35.70	191.6	189.8	1.8	
	Stern		354:45:45	90.0000	55.00				
13	Bow	10:29:40 PM	347:40:40	90.0000	35.71	192.0	189.8	2.2	
	Stern		354:53:30	90.0000	54.98				
14	Bow	10:31:55 PM	347:43:05	90.0000	35.70	192.1	190.5	1.6	
	Stern		355:00:15	90.0000	55.05				
15	Bow	10:33:30 PM	347:51:15	90.0000	35.70	191.8	190.8	1.0	
	Stern		354:57:25	90.0000	55.01				
16	Bow	10:35:17 PM	347:50:50	90.0000	35.70	192.0	189.4	2.6	
	Stern		355:01:00	90.0000	54.97				
17	Bow	10:37:20 PM	347:53:35	90.0000	35.70	191.5	189.6	1.9	
	Stern		354:51:50	90.0000	55.03				
18	Bow	10:39:21 PM	347:41:10	90.0000	35.88	191.6	190.5	1.1	
	Stern		354:47:45	90.0000	54.99				
19	Bow	10:41:05 PM	347:35:10	90.0000	35.70	191.1	190.2	0.9	
	Stern		354:32:25	90.0000	55.01				
20	Bow	10:42:59 PM	347:21:25	90.0000	35.89	191.8	190.3	1.5	
	Stern		354:40:20	90.0000	55.04				
						Mean (C - O) =		1.6	
						S. D. =		0.8	

Correction for Gyrocompass = 1.6 °



TAIL BUOY VERIFICATION (S/N 1314)																
Date	: 07th August 2007					Datum/Spheroid	: WGS84 / WGS84									
Vessel	: Pacific Titan					Semi-major axis	: 6378137									
Job Number	: K 1483					Inverse flattening	: 298.2572236									
Location	: Semayang Wharf					Projection	: UTM Zone 50 S									
Instrument	: Sokkia Set4B					Origin Lat	: 0° 00' 00" N									
Observer	: Bambang/Anto Sinaga					Origin Long	: 117° E									
LST -> UTC Offset	: -8.0 hrs					Scale Factor	: 0.9996									
Inst. Station	: P4					DGPS Ant. In use:	: HP (Starboard Antenna)									
Latitude of Station	: 01° 16' 23.5496" S					Easting	: 478361.536		Scale Factor	: 0.999811						
Longitude of station	: 116° 48' 19.7757" E					Northing	: 985927.189		Convergence	: (-) 00° 00' 16"						
Reference Object	: ISN 13661					Easting	: 478366.480									
Bearing to R.O.	: 04° 08' 32" G					Northing	: 9859339.450									
Pod S/No.	: 1314					Easting	: 478363.533									
Pod Height	: -0.66					Northing	: 9859323.611									
Obs	Time (LOC)			Grid Brg/Dist			Computed Prism		Height	Computed		Observed		C-O		
	hh	mm	ss	hh	mm	ss	mtrs	East		North	Ant.	Brg	Dist	Brg	Dist	Brg
1	15	59	26	319	43	12	21.666	478347.528	9859287.718	11.53	24.057	41.155	21.264	35.000	2.793	6.155
2	16	1	6	319	50	57	21.646	478347.579	9859287.734	11.53	24.000	41.121	23.969	39.800	0.031	1.321
3	16	1	47	319	52	34	21.646	478347.586	9859287.741	11.53	23.993	41.112	24.048	39.300	-0.055	1.812
4	16	2	19	319	39	27	21.636	478347.530	9859287.680	11.53	24.032	41.187	23.575	38.900	0.457	2.287
5	16	2	56	319	52	33	21.656	478347.580	9859287.748	11.53	24.006	41.108	23.782	38.900	0.224	2.21
6	16	3	34	319	40	27	21.636	478347.535	9859287.684	11.53	24.028	41.182	24.204	39.300	-0.176	1.88
7	16	4	1	319	31	54	21.656	478347.481	9859287.664	11.53	24.088	41.220	24.008	39.200	0.080	2.02
8	16	4	22	319	41	37	21.666	478347.521	9859287.711	11.53	24.063	41.163	22.748	40.700	1.315	0.46
9	16	5	5	319	40	31	21.646	478347.529	9859287.692	11.53	24.041	41.177	21.528	39.400	2.513	1.78
10	16	5	31	319	40	57	21.676	478347.511	9859287.716	11.53	24.079	41.163	21.385	39.400	2.694	1.76
11	16	5	58	319	38	34	21.686	478347.493	9859287.714	11.53	24.101	41.172	21.958	39.500	2.143	1.67
12	16	6	20	319	41	7	21.676	478347.512	9859287.717	11.53	24.078	41.162	23.206	39.300	0.872	1.86
13	16	6	40	319	39	23	21.666	478347.510	9859287.702	11.53	24.072	41.175	22.211	39.200	1.861	1.98
14	16	7	17	319	41	17	21.676	478347.513	9859287.718	11.53	24.078	41.161	21.522	39.500	2.556	1.66
15	16	7	48	319	42	11	21.676	478347.517	9859287.721	11.53	24.074	41.156	21.578	39.000	2.496	2.16
16	16	8	14	319	41	17	21.666	478347.519	9859287.710	11.53	24.064	41.165	21.327	38.900	2.737	2.27
17	16	8	41	319	40	23	21.676	478347.508	9859287.714	11.53	24.081	41.166	21.610	38.700	2.471	2.47
18	16	9	3	319	39	32	21.686	478347.498	9859287.718	11.53	24.098	41.166	22.038	38.600	2.060	2.57
19	16	9	52	319	40	25	21.676	478347.509	9859287.714	11.53	24.081	41.166	22.447	39.200	1.634	1.97
20	16	10	9	319	42	2	21.676	478347.516	9859287.721	11.53	24.075	41.157	22.889	38.800	1.186	2.36
							Mean	478347.524	9859287.712	11.530	24.059	41.162	22.565	39.030	1.495	2.13
							Std. Dev.	0.028	0.020	0.000	0.032	0.025	1.062	1.1	1.081	1.05

Note: The prism was set up on HP (Starboard antenna)
 Unless stated otherwise, all bearings are true and distance are slope true distance.



TAIL BUOY VERIFICATION (S/N 1411)																	
Date		: 07th August 2007					Datum/Spheroid		: WGS84 / WGS84								
Vessel		: Pacific Titan					Semi-major axis		: 6378137								
Job Number		: K 1483					Inverse flattening		: 298.2572236								
Location		: Semayang Wharf					Projection		: UTM Zone 50 S								
Instrument		: Sokkia Set4B					Origin Lat		: 0° 00' 00" N								
Observer		: Bambang/Anto Sinaga					Origin Long		: 117° E								
LST--> UTC Offset		: -8.0 hrs					Scale Factor		: 0.9996								
Inst. Station		: P4					D/GPS Ant. In use		: HP (Starboard Antenna)								
Latitude of Station		: 01° 16' 23.5496" S					Easting		: 478361536				Scale Factor				
Longitude of station		: 116° 48' 19.7757" E					Northing		: 9859271189				0.999811				
Reference Object		: ISN 13661					Easting		: 478366480				Convergence				
Bearing to R.D.		: 04° 08' 32" G					Northing		: 9859339450				(-) 00° 00' 16"				
Pod S/No.		: 1411					Easting		: 478363942								
Pod Height		: -0.65					Northing		: 9859323804								
Obs	Time (LOC)			Grid Brg/Dist			Computed Prism		Height	Computed			Observed		C-O		
	hh	mm	ss	hh	mm	ss	mtrs	East		North	Ant.	Brg	Dist	Brg	Dist	Brg	Dist
1	14	31	33	319	45	23	21.666	478347.539	9859287.727	11.53	24.464	41.468	21.043	44.700	3.411	-3.232	
2	14	32	12	319	47	11	21.666	478347.548	9859287.734	11.53	24.447	41.469	17.539	44.200	6.908	-2.741	
3	14	32	48	319	44	56	21.676	478347.530	9859287.732	11.53	24.468	41.467	19.888	42.400	4.580	-0.933	
4	14	33	23	319	42	43	21.676	478347.520	9859287.723	11.53	24.477	41.479	28.517	42.000	-4.040	-0.521	
5	14	44	44	319	45	12	21.666	478347.538	9859287.726	11.53	24.464	41.469	24.275	42.100	0.179	-0.63	
6	14	45	7	319	45	46	21.666	478347.541	9859287.728	11.53	24.462	41.466	21.212	43.500	3.240	-2.03	
7	14	45	41	319	39	26	21.676	478347.504	9859287.710	11.53	24.490	41.497	22.667	42.600	1.823	-1.10	
8	14	46	11	319	49	15	21.666	478347.568	9859287.742	11.53	24.438	41.447	21.801	42.700	2.637	-1.25	
9	14	46	42	319	50	52	21.666	478347.565	9859287.749	11.53	24.432	41.439	22.041	42.600	2.391	-1.16	
10	14	47	27	319	43	15	21.666	478347.535	9859287.710	11.53	24.449	41.484	22.530	43.200	1.919	-1.72	
11	14	47	58	319	41	22	21.666	478347.520	9859287.710	11.53	24.469	41.490	22.235	43.200	2.234	-1.71	
12	14	48	19	319	44	43	21.666	478347.536	9859287.724	11.53	24.466	41.472	18.604	43.600	5.852	-2.13	
13	14	48	51	319	45	14	21.666	478347.538	9859287.726	11.53	24.464	41.469	20.486	43.300	3.968	-1.83	
14	14	49	12	319	42	53	21.666	478347.527	9859287.716	11.53	24.463	41.482	19.169	43.200	5.294	-1.72	
15	14	49	55	319	43	22	21.666	478347.516	9859287.734	11.53	24.488	41.471	26.591	43.400	-2.103	-1.93	
16	14	50	37	319	45	34	21.666	478347.540	9859287.727	11.53	24.463	41.467	30.056	43.600	-5.603	-2.13	
17	14	51	1	319	40	53	21.666	478347.517	9859287.708	11.53	24.471	41.493	19.344	43.700	5.127	-2.21	
18	14	51	47	319	43	11	21.676	478347.522	9859287.725	11.53	24.475	41.476	19.640	43.700	4.835	-2.22	
19	14	52	31	319	45	14	21.666	478347.538	9859287.726	11.53	24.464	41.469	29.400	44.800	-4.946	-3.33	
20	14	53	40	319	41	17	21.666	478347.519	9859287.710	11.53	24.469	41.491	33.216	46.100	-8.747	-4.61	
							Mean	478347.533	9859287.725	11.530	24.461	41.473	23.013	43.430	1.448	-1.96	
							Std. Dev.	0.015	0.011	0.000	0.015	0.015	4.322	1.0	4.319	0.98	

Note: The prism was set up on HP (Starboard antenna)
 Unless stated otherwise, all bearings are true and distance are slope true distance.



TAIL BUOY VERIFICATION (S/N 1503)																
Date	: 07th August 2007					Datum/Spheroid	: WGS84 / WGS84									
Vessel	: Pacific Titan					Semi-major axis	: 6378137									
Job Number	: K-1483					Inverse flattening	: 298.2572236									
Location	: Semayang Wharf					Projection	: UTM Zone 50 S									
Instrument	: Sokkia Set4B					Origin Lat	: 0°00'00" N									
Observer	: Bambang/Anto Sinaga					Origin Long	: 117° E									
LST--> UTC Offset	: -8.0 hrs					Scale Factor	: 0.9996									
Inst. Station	: P4					DGPS Ant. In use	: HP (Starboard Antenna)									
Latitude of Station	: 01° 16' 23.5498" S					Easting	: 478361.538					Scale Factor	: 0.999811			
Longitude of station	: 116° 48' 19.7757" E					Northing	: 9859271.189									
Reference Object	: ISN 13661					Easting	: 478366.480					Convergence				
Bearing to R.O.	: 04° 08' 32" \odot					Northing	: 985939.450					(:) 00° 00' 16"				
Pod S/No.	: 1503					Easting	: 478363.562									
Pod Height	: -0.66					Northing	: 9859323.623									
Obs	Time (LOC)			Grid Brg/Dist			Computed Prism		Height	Computed		Observed		C-O		
	hh	mm	ss	hh	mm	ss	mtrs	East		North	Ant.	Brg	Dist	Brg	Dist	Brg
1	15	3	38	319	41	35	21.686	478347.501	9859287.734	11.53	24.134	41.173	25.991	38.800	-1.857	2.373
2	15	3	51	319	40	12	21.686	478347.495	9859287.728	11.53	24.140	41.180	26.104	39.000	-1.964	2.180
3	15	4	4	319	42	32	21.686	478347.512	9859287.730	11.53	24.117	41.172	21.590	40.500	2.527	0.672
4	15	4	23	319	41	22	21.686	478347.500	9859287.733	11.53	24.135	41.174	21.930	40.700	2.205	0.474
5	15	4	47	319	41	53	21.686	478347.509	9859287.728	11.53	24.120	41.175	21.622	41.100	2.498	0.08
6	15	5	3	319	43	22	21.686	478347.516	9859287.734	11.53	24.114	41.167	25.873	39.900	-1.759	1.27
7	15	5	22	319	41	31	21.686	478347.507	9859287.726	11.53	24.121	41.177	29.080	40.400	-4.959	0.78
8	15	5	59	319	40	14	21.686	478347.501	9859287.721	11.53	24.126	41.184	29.046	40.600	-4.920	0.58
9	15	6	20	319	37	37	21.686	478347.489	9859287.710	11.53	24.137	41.198	28.650	40.300	-4.513	0.90
10	15	6	48	319	36	25	21.686	478347.483	9859287.705	11.53	24.141	41.205	28.487	40.400	-4.346	0.80
11	15	7	32	319	35	47	21.686	478347.480	9859287.703	11.53	24.144	41.208	28.775	41.400	-4.631	-0.19
12	15	8	2	319	36	11	21.686	478347.482	9859287.704	11.53	24.142	41.206	29.778	40.500	-5.636	0.71
13	15	8	39	319	35	47	21.686	478347.480	9859287.703	11.53	24.144	41.208	28.991	39.800	-4.847	1.41
14	15	9	10	319	37	19	21.686	478347.487	9859287.709	11.53	24.138	41.200	28.239	40.700	-4.101	0.50
15	15	9	46	319	40	47	21.686	478347.504	9859287.723	11.53	24.124	41.181	35.146	44.500	-11.022	-3.32
16	15	10	17	319	40	49	21.686	478347.504	9859287.723	11.53	24.124	41.181	28.807	38.700	-4.683	2.48
17	15	11	2	319	39	2	21.686	478347.496	9859287.716	11.53	24.131	41.191	30.352	40.800	-6.221	0.39
18	15	11	35	319	39	23	21.686	478347.497	9859287.717	11.53	24.130	41.189	26.387	39.300	-2.257	1.89
19	15	12	8	319	38	22	21.686	478347.492	9859287.713	11.53	24.134	41.194	30.207	40.800	-6.073	0.39
20	15	13	20	319	39	56	21.686	478347.500	9859287.720	11.53	24.127	41.186	31.181	40.900	-7.054	0.29
							Mean	478347.497	9859287.719	11.530	24.131	41.188	27.812	40.455	-3.681	0.73
							Std. Dev.	0.011	0.011	0.000	0.009	0.013	3.345	1.2	3.343	1.22

Note: The prism was set up on HP (Starboard antenna)
 Unless stated otherwise, all bearings are true and distance are slope true distance.



TAIL BUOY VERIFICATION (S/N 1511)																
Date	: 07th August 2007					Datum/Spheroid	: WGS84 / WGS84									
Vessel	: Pacific Titan					Semi-major axis	: 6378137									
Job Number	: K 1483					Inverse flattening	: 298.2572236									
Location	: Semayang Wharf					Projection	: UTM Zone 50 S									
Instrument	: Sokkia Set 4B					Origin Lat	: 0° 00' 00" N									
Observer	: Bambang/Anto Sinaga					Origin Long	: 117° E									
LST -> UTC Offset	: -8.0 hrs					Scale Factor	: 0.9996									
Inst. Station	: P4					DGPS Ant. In use	: HP (Starboard Antenna)									
Latitude of Station	: 01° 16' 23.5496" S					Easting	: 478361.536		Scale Factor							
Longitude of station	: 116° 48' 19.7757" E					Northing	: 985927.189		0.999811							
Reference Object	: ISN 13661					Easting	: 478366.480		Convergence							
Bearing to R.O.	: 04° 08' 32" G					Northing	: 985939.450		(-) 00° 00' 16"							
Pod S/No.	: 1511					Easting	: 478363.569									
Pod Height	: -0.65					Northing	: 9859323.603									
Obs	Time (LOC)			Grid Brg/Dist				Computed Prism		Height	Computed		Observed		C-O	
	hh	mm	ss	hh	mm	ss	mtrs	East	North		Ant.	Brg	Dist	Brg	Dist	Brg
1	15	21	43	319	41	17	21.686	478347.506	9859287.725	11.53	24.143	41.161	22.400	40.200	1.743	0.961
2	15	22	19	319	41	17	21.686	478347.506	9859287.725	11.53	24.143	41.161	21.704	40.300	2.439	0.861
3	15	22	46	319	41	31	21.646	478347.533	9859287.696	11.53	24.089	41.176	26.756	35.200	-2.667	5.976
4	15	23	13	319	41	46	21.656	478347.528	9859287.704	11.53	24.102	41.171	27.765	34.800	-3.663	6.371
5	15	23	47	319	41	47	21.646	478347.535	9859287.697	11.53	24.088	41.175	28.097	34.500	-4.009	6.67
6	15	24	9	319	40	23	21.646	478347.528	9859287.691	11.53	24.094	41.182	20.100	43.700	3.994	-2.52
7	15	24	32	319	40	1	21.646	478347.526	9859287.690	11.53	24.095	41.184	20.710	43.000	3.385	-1.82
8	15	24	56	319	41	44	21.646	478347.534	9859287.697	11.53	24.089	41.175	20.944	42.500	3.245	-1.33
9	15	25	28	319	39	56	21.646	478347.526	9859287.689	11.53	24.096	41.185	34.019	41.300	-9.923	-0.12
10	15	25	52	319	40	16	21.646	478347.527	9859287.691	11.53	24.094	41.183	29.780	39.200	-5.686	1.98
11	15	26	10	319	39	37	21.656	478347.518	9859287.696	11.53	24.110	41.182	19.274	41.400	4.836	-0.22
12	15	27	17	319	39	52	21.646	478347.525	9859287.689	11.53	24.096	41.185	16.708	33.900	7.388	7.28
13	15	27	43	319	38	14	21.646	478347.518	9859287.682	11.53	24.102	41.194	24.745	37.700	-0.643	3.49
14	15	28	7	319	38	7	21.646	478347.517	9859287.682	11.53	24.103	41.194	25.346	38.200	-1.243	2.99
15	15	28	35	319	39	23	21.666	478347.510	9859287.702	11.53	24.124	41.179	25.504	38.500	-1.380	2.68
16	15	28	52	319	39	46	21.646	478347.525	9859287.689	11.53	24.096	41.185	25.627	38.900	-1.531	2.29
17	15	29	33	319	40	2	21.646	478347.526	9859287.690	11.53	24.095	41.184	26.504	39.700	-2.409	1.48
18	15	30	14	319	41	42	21.656	478347.528	9859287.704	11.53	24.102	41.171	23.662	40.600	0.440	0.57
19	15	30	53	319	41	42	21.646	478347.534	9859287.696	11.53	24.089	41.175	26.153	40.800	-2.064	0.37
20	15	31	19	319	41	12	21.646	478347.532	9859287.694	11.53	24.091	41.178	27.572	41.000	-3.481	0.18
							Mean	478347.524	9859287.696	11.530	24.102	41.179	24.663	39.270	-0.561	1.91
							Std. Dev.	0.009	0.012	0.000	0.016	0.009	4.065	2.8	4.069	2.85

Note: The prism was set up on HP (Starboard antenna)
 Unless stated otherwise, all bearings are true and distance are slope true distance.



TAIL BUOY VERIFICATION (S/N 2041)																	
Date	: 07th August 2007						Datum/Spheroid	: WGS84 / WGS84									
Vessel	: Pacific Titan						Semi-major axis	: 6378137									
Job Number	: K1483						Inverse flattening	: 298.2572236									
Location	: Semayang Wharf						Projection	: UTM Zone 50 S									
Instrument	: Sokkia Set4B						Origin Lat	: 0°00'00" N									
Observer	: Bambang/Anto Sinaga						Origin Long	: 117° E									
LST--> UTC Offset	: -8.0 hrs						Scale Factor	: 0.9996									
Inst. Station	: P4						DGPS Ant. In use:	HP (Starboard Antenna)									
Latitude of Station	: 01° 16' 23.5498" S						Easting	478361.536	Scale Factor	0.999811							
Longitude of station	: 116° 48' 19.7757" E						Northing	985927.1189									
Reference Object	: ISN 13661						Easting	478366.480	Convergence	(-) 00°00' 16"							
Bearing to R.O.	: 04°08' 32" G						Northing	985939.450									
Pod S/No.	: 2041						Easting	478363.538									
Pod Height	: -0.66						Northing	985932.598									
Obs	Time (LOC)			Grid Brg/Dist			Computed Prism		Height	Computed		Observed		C-O			
	hh	mm	ss	hh	mm	ss	mtrs	East		North	Ant.	Brg	Dist	Brg	Dist	Brg	Dist
1	11	36	21	319	37	7	21.666	478347.499	9859287.693	11.53	24.095	41.178	28.308	42.600	-4.213	-1.422	
2	11	36	55	319	37	44	21.666	478347.502	9859287.695	11.53	24.093	41.175	28.308	42.600	-4.215	-1.425	
3	11	37	26	319	38	23	21.666	478347.505	9859287.698	11.53	24.090	41.171	28.308	42.600	-4.218	-1.429	
4	11	37	55	319	38	12	21.666	478347.504	9859287.697	11.53	24.091	41.172	28.308	42.600	-4.217	-1.428	
5	11	38	32	319	39	29	21.666	478347.511	9859287.703	11.53	24.086	41.165	25.310	39.200	-1.224	1.97	
6	11	38	57	319	38	48	21.666	478347.507	9859287.700	11.53	24.089	41.169	23.136	37.200	0.953	3.97	
7	11	39	27	319	40	14	21.666	478347.514	9859287.706	11.53	24.083	41.161	22.587	37.200	1.496	3.96	
8	11	40	19	319	38	50	21.666	478347.507	9859287.700	11.53	24.089	41.169	21.914	37.900	2.175	3.27	
9	11	40	54	319	39	21	21.666	478347.510	9859287.702	11.53	24.087	41.166	22.023	37.700	2.064	3.47	
10	11	41	28	319	38	19	21.666	478347.505	9859287.698	11.53	24.091	41.171	22.209	37.000	1.882	4.17	
11	11	41	59	319	40	12	21.666	478347.514	9859287.706	11.53	24.083	41.161	22.300	37.700	1.783	3.46	
12	11	42	30	319	37	40	21.666	478347.502	9859287.695	11.53	24.093	41.175	22.577	38.300	1.516	2.87	
13	11	43	24	319	37	56	21.666	478347.503	9859287.696	11.53	24.092	41.174	22.857	38.600	1.235	2.57	
14	11	44	3	319	38	15	21.666	478347.505	9859287.698	11.53	24.091	41.172	23.319	38.500	0.772	2.67	
15	11	44	47	319	39	21	21.666	478347.510	9859287.702	11.53	24.087	41.166	22.894	38.400	1.193	2.77	
16	11	46	15	319	37	14	21.666	478347.500	9859287.693	11.53	24.095	41.177	23.402	38.700	0.693	2.48	
17	11	46	49	319	38	27	21.666	478347.506	9859287.698	11.53	24.090	41.171	23.805	38.800	0.285	2.37	
18	11	46	21	319	39	34	21.666	478347.511	9859287.703	11.53	24.086	41.165	23.756	39.000	0.330	2.16	
19	11	47	28	319	38	18	21.666	478347.505	9859287.698	11.53	24.091	41.172	23.676	39.300	0.415	1.87	
20	11	48	18	319	39	17	21.666	478347.510	9859287.702	11.53	24.087	41.166	24.903	39.500	-0.816	1.67	
							Mean	478347.507	9859287.699	11.530	24.089	41.170	24.195	39.170	-0.106	2.00	
							Std. Dev.	0.004	0.004	0.000	0.004	0.005	2.279	1.9	2.278	1.89	

Note: The prism was set up on HP (Starboard antenna)
 Unless stated otherwise, all bearings are true and distance are slope true distance.



TAIL BUOY VERIFICATION (S/N 1260)															FUGRO	
Date	: 08th August 2007					Datum/Spheroid	: WGS84 / WGS84									
Vessel	: Pacific Titan					Semi-major axis	: 6378137									
Job Number	: K 1483					Inverse flattening	: 298.2572236									
Location	: Semayang Wharf					Projection	: UTM Zone 50 S									
Instrument	: Sokkia Set 4B					Origin Lat	: 0° 00' 00" N									
Observer	: Bambang/Anto Sinaga					Origin Long	: 117° E									
LST -> UTC Offset	: -8.0 hrs					Scale Factor	: 0.9996									
Inst. Station	: P4					DGPS Ant. In use	: HP (Starboard Antenna)									
Latitude of Station	: 01° 16' 23.5496" S					Easting	: 478361.536		Scale Factor							
Longitude of station	: 116° 48' 19.7757" E					Northing	: 985927.1189		0.999811							
Reference Object	: ISN 13661					Easting	: 478366.480		Convergence							
Bearing to R.O.	: 04° 08' 32" G					Northing	: 9859339.460		(-) 00° 00' 16"							
Pod S/No.	: 1260					Easting	: 478370.284									
Pod Height	: -0.66					Northing	: 9859344.145									
Obs	Time (LOC)			Grid Brg/Dist				Computed Prism		Height	Computed		Observed		C-O	
	hh	mm	ss	hh	mm	ss	mtrs	East	North		Ant.	Brg	Dist	Brg	Dist	Brg
1	12	11	39	323	7	57	34.364	478340.919	9859298.681	11.53	32.862	55.490	27.129	56.200	5.733	-0.710
2	12	12	1	323	7	46	34.234	478340.995	9859298.575	11.53	32.755	55.536	26.788	56.400	5.967	-0.864
3	12	12	29	323	8	1	34.230	478341.000	9859298.574	11.53	32.750	55.534	29.149	57.300	3.601	-1.766
4	12	12	54	323	7	55	34.230	478340.999	9859298.573	11.53	32.750	55.535	28.540	56.100	4.210	-0.565
5	12	13	5	323	7	46	34.234	478340.996	9859298.576	11.53	32.755	55.535	30.555	57.700	2.200	-2.16
6	12	13	40	323	11	51	34.232	478341.029	9859298.598	11.53	32.738	55.499	28.909	56.600	3.829	-1.10
7	12	14	46	323	9	57	34.364	478340.935	9859298.693	11.53	32.875	55.471	27.818	53.700	5.057	1.77
8	12	15	3	323	10	44	34.230	478341.022	9859298.590	11.53	32.740	55.510	28.234	54.100	4.506	1.41
9	12	15	30	323	8	32	34.225	478341.007	9859298.573	11.53	32.743	55.531	27.597	51.300	5.146	4.23
10	12	16	7	323	11	25	34.232	478341.026	9859298.596	11.53	32.739	55.503	30.736	56.000	2.003	-0.50
11	12	16	42	323	7	52	34.230	478340.999	9859298.573	11.53	32.750	55.536	27.523	54.200	5.227	1.34
12	12	17	13	323	9	11	34.225	478341.012	9859298.577	11.53	32.740	55.526	31.888	56.700	0.852	-1.17
13	12	17	58	323	12	35	34.227	478341.038	9859298.599	11.53	32.730	55.494	32.055	59.400	0.675	-3.91
14	12	18	12	323	8	48	34.228	478341.007	9859298.577	11.53	32.745	55.528	32.048	59.200	0.699	-3.67
15	12	18	43	323	10	42	34.225	478341.024	9859298.586	11.53	32.735	55.512	31.990	58.600	0.745	-3.09
16	12	19	36	323	7	41	34.230	478340.997	9859298.572	11.53	32.751	55.537	31.126	58.300	1.625	-2.76
17	12	20	9	323	8	33	34.229	478341.005	9859298.576	11.53	32.747	55.530	29.164	56.800	3.583	-1.27
18	12	21	25	323	9	52	34.228	478341.016	9859298.583	11.53	32.741	55.518	29.838	53.800	2.903	1.72
19	12	22	18	323	12	2	34.229	478341.033	9859298.597	11.53	32.734	55.498	30.523	54.200	2.211	1.30
20	12	23	48	323	7	45	34.229	478340.998	9859298.571	11.53	32.750	55.537	29.777	54.700	2.973	0.84
							Mean	478341.003	9859298.592	11.530	32.756	55.518	29.569	56.065	3.187	-0.55
							Std. Dev.	0.029	0.034	0.000	0.039	0.020	1.744	2.1	1.763	2.10

Note: The prism was set up on HP (Starboard antenna)
 Unless stated otherwise, all bearings are true and distance are slope true distance.



TAIL BUOY VERIFICATION (S/N 1518)																
Date	: 08th August 2007						Datum/Spheroid	: WGS84 / WGS84								
Vessel	: Pacific Titan						Semi-major axis	: 6378137								
Job Number	: K 1483						Inverse flattening	: 298.257 2236								
Location	: Semayang Wharf						Projection	: UTM Zone 50 S								
Instrument	: Sokkia Set 4B						Origin Lat	: 0° 00' 00" N								
Observer	: Bambang/Anto Sinaga						Origin Long	: 117° E								
LST -> UTC Offset	: -8.0 hrs						Scale Factor	: 0.9996								
Inst. Station	: P4						DGPS Ant. In use	: HP (Starboard Antenna)								
Latitude of Station	: 01° 16' 23.5496" S						Easting	478361536	Scale Factor							
Longitude of station	: 116° 48' 19.7757" E						Northing	9859271189	0.999811							
Reference Object	: ISN 13661						Easting	478366480	Convergence							
Bearing to R.O.	: 04° 08' 32" G						Northing	9859339460	(-) 00° 00' 16"							
Pod S/No.	: 1518						Easting	478370005								
Pod Height	: -0.66						Northing	9859344178								
Obs	Time (LOC)			Grid Brg/Dist			Computed Prism		Height	Computed		Observed		C-O		
	hh	mm	ss	hh	mm	ss	mtrs	East		North	Ant.	Brg	Dist	Brg	Dist	Brg
1	12	27	44	322	35	42	34.483	478340.601	9859298.565	11.53	32.833	55.632	31.937	56.300	0.896	-0.668
2	12	28	2	322	35	32	34.234	478340.740	9859298.382	11.53	32.605	55.710	31.975	56.100	0.630	-0.390
3	12	28	21	322	35	42	34.230	478340.743	9859298.380	11.53	32.600	55.710	32.086	56.000	0.514	-0.290
4	12	28	48	322	35	39	34.230	478340.743	9859298.379	11.53	32.601	55.710	32.127	55.700	0.474	0.010
5	12	29	13	322	34	17	34.234	478340.730	9859298.374	11.53	32.610	55.721	31.932	55.600	0.678	0.12
6	12	29	42	322	33	45	34.232	478340.727	9859298.369	11.53	32.609	55.727	32.115	55.300	0.494	0.43
7	12	30	16	322	35	12	34.226	478340.742	9859298.373	11.53	32.598	55.715	32.075	55.300	0.523	0.42
8	12	30	39	322	34	32	34.230	478340.734	9859298.373	11.53	32.605	55.720	31.996	55.300	0.609	0.42
9	12	31	7	322	35	34	34.225	478340.745	9859298.375	11.53	32.596	55.712	31.978	55.300	0.618	0.41
10	12	31	48	322	36	23	34.232	478340.748	9859298.385	11.53	32.600	55.703	31.965	55.200	0.645	0.50
11	12	32	15	322	36	12	34.230	478340.747	9859298.383	11.53	32.599	55.705	31.660	55.100	0.939	0.60
12	12	32	53	322	34	23	34.225	478340.736	9859298.368	11.53	32.600	55.723	31.573	55.300	1.027	0.42
13	12	33	27	322	35	34	34.227	478340.744	9859298.378	11.53	32.598	55.712	31.272	55.300	1.326	0.41
14	12	33	59	322	35	12	34.228	478340.741	9859298.375	11.53	32.600	55.715	31.213	55.200	1.387	0.51
15	12	34	25	322	35	56	34.225	478340.748	9859298.377	11.53	32.595	55.709	31.209	55.100	1.386	0.61
16	12	34	51	322	34	22	34.230	478340.733	9859298.372	11.53	32.605	55.722	31.303	55.000	1.302	0.72
17	12	35	25	322	35	34	34.229	478340.743	9859298.378	11.53	32.600	55.711	31.394	54.900	1.206	0.81
18	12	36	14	322	36	21	34.228	478340.750	9859298.382	11.53	32.596	55.704	31.956	55.200	0.640	0.50
19	12	37	43	322	35	22	34.229	478340.741	9859298.377	11.53	32.601	55.713	32.028	55.300	0.573	0.41
20	12	38	23	322	34	22	34.229	478340.734	9859298.371	11.53	32.604	55.722	31.996	55.300	0.608	0.42
							Mean	478340.734	9859298.366	11.530	32.613	55.710	31.8	55.4	0.824	0.32
							Std. Dev.	0.032	0.043	0.000	0.052	0.020	0.332	0.4	0.329	0.38

Note: The prism was set up on HP (Starboard antenna)
 Unless stated otherwise, all bearings are true and distance are slope true distance.



TAIL BUOY VERIFICATION (S/N 1575)																
Date	: 08th August 2007						Datum/Spheroid	: WGS84 / WGS84								
Vessel	: Pacific Titan						Semi-major axis	: 6378137								
Job Number	: K1483						Inverse flattening	: 298.2572236								
Location	: Semayang Wharf						Projection	: UTM Zone 50 S								
Instrument	: Sokkia Set 4B						Origin Lat	: 0°00' 00" N								
Observer	: Bambang/Anto Sinaga						Origin Long	: 117° E								
LST--> UTC Offset	: -8.0 hrs						Scale Factor	: 0.9996								
Inst. Station	: P4						DGPS Ant. In use:	HP (Starboard Antenna)								
Latitude of Station	: 01° 16' 23.5496" S						Easting	478361.536	Scale Factor							
Longitude of station	: 116° 48' 19.7757" E						Northing	9859271.189	0.999811							
Reference Object	: ISN 13661						Easting	478366.480	Convergence							
Bearing to R.O.	: 04°08' 32" G						Northing	9859339.460	(-) 00°00' 16"							
Pod S/No.	: 1575						Easting	478368.878								
Pod Height	:-0.66						Northing	9859344.364								
Obs	Time [LOC]			Grid Brg/Dist				Computed Prism		Height	Computed		Observed		C-O	
	hh	mm	ss	hh	mm	ss	mtrs	East	North	Ant.	Brg	Dist	Brg	Dist	Brg	Dist
1	13	2	41	322	6	47	34.423	478340.396	9859298.357	11.53	31.786	55.477	29.876	55.100	1.910	0.377
2	13	3	13	322	6	43	34.234	478340.512	9859298.207	11.53	31.597	55.542	30.079	54.500	1.518	1.042
3	13	3	46	322	7	34	34.230	478340.522	9859298.209	11.53	31.590	55.536	30.931	54.400	0.659	1.136
4	13	4	1	322	6	11	34.230	478340.511	9859298.200	11.53	31.595	55.548	30.991	54.300	0.604	1.248
5	13	4	53	322	8	1	34.234	478340.523	9859298.214	11.53	31.593	55.530	32.552	53.700	-0.969	1.83
6	13	5	32	322	7	23	34.232	478340.519	9859298.209	11.53	31.593	55.537	32.150	54.100	-0.557	1.44
7	13	5	58	322	7	44	34.226	478340.525	9859298.206	11.53	31.586	55.536	32.150	54.100	-0.564	1.44
8	13	6	27	322	8	12	34.230	478340.527	9859298.212	11.53	31.588	55.530	32.150	54.100	-0.562	1.43
9	13	6	53	322	8	21	34.225	478340.531	9859298.209	11.53	31.582	55.530	32.993	54.100	-1.411	1.43
10	13	7	44	322	9	29	34.232	478340.535	9859298.222	11.53	31.585	55.518	30.760	54.700	0.825	0.82
11	13	8	23	322	8	8	34.230	478340.526	9859298.212	11.53	31.588	55.531	29.164	55.200	2.424	0.33
12	13	9	12	322	8	33	34.225	478340.532	9859298.211	11.53	31.582	55.529	29.164	55.200	2.418	0.33
13	13	10	34	322	9	21	34.227	478340.537	9859298.217	11.53	31.581	55.521	29.164	55.200	2.417	0.32
14	13	11	23	322	7	35	34.228	478340.523	9859298.207	11.53	31.588	55.536	29.164	55.200	2.424	0.34
15	13	12	18	322	8	33	34.225	478340.532	9859298.211	11.53	31.582	55.529	29.164	55.200	2.418	0.33
16	13	13	55	322	7	3	34.230	478340.518	9859298.205	11.53	31.592	55.540	31.038	53.700	0.554	1.84
17	13	14	34	322	7	46	34.229	478340.524	9859298.209	11.53	31.589	55.534	29.337	52.800	2.252	2.73
18	13	15	31	322	8	23	34.226	478340.529	9859298.212	11.53	31.585	55.529	30.467	53.600	1.128	1.93
19	13	16	58	322	9	6	34.229	478340.534	9859298.217	11.53	31.584	55.522	26.195	55.100	5.389	0.42
20	13	17	25	322	2	22	34.229	478340.481	9859298.176	11.53	31.608	55.583	28.005	53.600	3.603	1.98
							Mean	478340.517	9859298.216	11.530	31.599	55.532	30.274	54.395	1.325	1.137
							Std. Dev.	0.031	0.034	0.000	0.044	0.019	1.685	0.7	1.688	0.71

Note: The prism was set up on HP (Starboard antenna)
 Unless stated otherwise, all bearings are true and distance are slope true distance.

A. SURVEY STATION INFORMATION



FUGRO-3 VIEW TO NORTH



FUGRO-3 VIEW TO WEST



FUGRO-4 VIEW TO NORTH



FUGRO-4 VIEW TO WEST

STATION DESCRIPTION

PT. FUGRO INDONESIA		NAME OF AREA : SEMAYANG FORT, BALIKPAPAN	
STATION ESTABLISHED BY : PT. FUGRO INDONESIA RE-OCCUPIED BY : SURVEY METHOD : STATIC DIFFERENTIAL GPS		JOB NO : L-1901 FOR : PT FUGRO INDONESIA DATE : FEBRUARY 2007	
DETAILS SKETCH			
		STATION NAME : FUGRO-3	
STATION MARKINGS : 		WITNESS POINTS : 	
DATUM		STATION VALUE	
SPHEROID : WGS84		LATITUDE : 00° 16' 14.292" S	
DATUM :		LONGITUDE : 116° 48' 24.298" E	
SEMI-MAJOR AXIS (a) : 6378 137.20 m		HEIGHT ABOVE SPHEROID : 56.30 m	
SEMI-MINOR AXIS (b) : 6356 752.31 m		EASTING : 478 501.2 m	
PROJECTION : UTM		NORTHING : 9 668 558.37 m	
SCALE FACTOR AT CLC (k) : 0.9996			
CENTRAL MERIDIAN : 117° E			
PROJECTION : UTM			
ZONE : 50 SOUTH			
PROJECTION : UTM			
SCALE FACTOR AT CLC (k) : 0.9996			
CENTRAL MERIDIAN : 117° E			
FALSE EASTING : 500,000 m			
FALSE NORTHING : 10,000,000 m			
PHOTOGRAPHS : 			
NO DATUM SHIFT WAS APPLIED			

STATION DESCRIPTION

<p>PT. FUGRO INDONESIA</p> <p>STATION ESTABLISHED BY : PT. FUGRO INDONESIA RE-OCCUPIED BY : SURVEY METHOD : STATIC DIFFERENTIAL GPS</p>		<p>NAME OF AREA : SEMAYANG PORT, BALIKPAPAN</p> <p>JOB NO : 1-1001 FOR : PT FUGRO INDONESIA DATE : FEBRUARY 2007</p>	
<p>DETAILS SKETCH</p>		<p>DATUM</p> <p>Spheroid : WGS84 DATUM : WGS84 SEMAYANG-01 (A) : 6378137.20 m SEMAYANG-01 (B) : 6389752.31 m PROJECTION : UTM SCALE FACTOR AT CLM (A) : 0.9998 CENTRAL MERIDIAN : 117° E PROJECTION : UTM ZONE : 48 SOUTH PROJECTION : UTM SCALE FACTOR AT CLM (A) : 0.9998 CENTRAL MERIDIAN : 117° E FALSE EASTING : 500,000m FALSE NORTHING : 10,000,000m</p>	
<p>STATION MARKINGS :</p>		<p>STATION NAME : FUGRO-4</p> <p>STATION VALUE</p> <p>LATITUDE : 201° 49' 15.8253" S LONGITUDE : 117° 48' 24.8706" E HEIGHT ABOVE SPENCERD : 26.910m EASTING : 478 022.040m NORTHING : 1 829 375.070m</p>	
<p>WITNESS POINTS :</p>		<p>PHOTOGRAPHS :</p> <p>NO DATUM SHIFT WAS APPLIED</p>	



B. DAILY SURVEY REPORTS

DAILY OPERATION REPORT		
Client : CGG Veritas		
Location : Semayang Port, Balikpapan		

VESSEL : MV Pacific Titan	DATE : 06 th August 2007
PROJECT : Gyro Calibration and DGPS Verification	JOB No. : K1483

FROM	TO	SUMMARY OF OPERATIONS
		(Time UTC+8)
0700		Fugro personnel departed from Soekarno-Hatta Airport, Jakarta.
	0900	Fugro personnel arrived at Sepinggan Airport, Balikpapan.
	1000	Fugro personnel arrived and check in at Grand Mustika Tiga Hotel
		Standby due to Pacific Titan is not alongside at Semayang Port
1850	1900	Fugro personnel met Mark Brittain and Pauls PAUL STAFFORD
2100	2200	Reconnaissance of the field Semayang Port

EQUIPMENT	STATUS	PERSONNEL	TITLE
Total Station Sokkia Set 4B	Standby	Anto Sinaga	Surveyor
Tripod x 3	Standby	Bambang	Surveyor
Measuring Tape	Standby		
Prism x 6	Standby		
Tribrach x 3	Standby		
Labtop PC	Standby		

PT Fugro Indonesia	CGG Veritas	DOR No
 Anto Sinaga Surveyor	 Paul Stafford Chief Navigator	K1483-01



DAILY OPERATION REPORT



Client : CGG Veritas
Location : Semayang Port, Balikpapan

VESSEL	: MV Pacific Titan	DATE	: 08 th August 2007
PROJECT	: Gyro Calibration and DGPS Verification	JOB No.	: K1483

FROM	TO	SUMMARY OF OPERATIONS
		(Time UTC+8)
0700	0900	Continue Processing Data.
0900	0930	Fugro personnel depart to Semayang Port
0945	1000	Set up equipment for Gyro Calibration
		Start Gyro Calibration
1000	1100	Continue Gyro Calibration (second side)
1100	1130	Processing Data at Vessel and Report to Mr Pauls <i>STAFFORD</i>

EQUIPMENT	STATUS	PERSONNEL	TITLE
Total Station Sokkia Set 4B	Operational	Anto Sinaga	Surveyor
Tripod x 3	Operational	Bambang	Surveyor
Measuring Tape	Operational		
Prism x 6	Operational		
Tribrach x 3	Operational		
Labtop PC	Operational		

PT Fugro Indonesia Anto Sinaga Surveyor	CGG Veritas Pauls STAFFORD Chief Navigator	DOR No K1483-03
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MONTHLY PERSONNEL / EQUIPMENT SUMMARY REPORT

CLIENT : CGG Veritas
 BARGE / VESSEL / RIG : MV Pacific Titan

MONTH : AUGUST

PAGE 1 of 1
 YEAR : 2007



PROJECT : GYRO CALIBRATION AND DGPS VERIFICATION

JOB No. : K-1483

PERSONNEL/EQUIPMENT NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	REMARKS			
Survey Equipment (Fugro Indonesia)																																			
Total Station Sokkia Set 4B																																			
Tipods x 3																																			
Measuring Tape																																			
Prism x 6																																			
Tribrach x 3																																			
Laptop PC																																			
Survey Personnel (Fugro Indonesia)																																			
Ario Sinaga (Surveyor)																																			
Bambang (Surveyor)																																			
				</																															

C FIELD DIAGRAM



