

Kongsberg Underwater Technologies
Lynnwodd, WA,

98110 Lynnwood

Attn.: Ned Eliassen

YOUR REF.:

OUR REF.:
0404143-05000436

DATE:
Stavanger, 11 March 2005

DIMENSIONAL SURVEY.

R/V KILO MOANA.

**EM120 TX/RX, EM1002, EA-500, HPR POSITION, WATERLINE, IMU,
GRANITE BLOCK, ANTENNAS, REFERENCE POINTS.
SURVEYED IN BRISBANE, WEEK 9 - 2005.**

Please find enclosed our report concerning the subject above.

In the report we have given a recommendation that the point number markings for the coordinate reference points in the sonar room should be refreshed.

We suggest that You too should highlight that for the ship owners
These reference marks can be very useful in the future.

Yours sincerely
for Blom Maritime AS

Odd Rune Olden

Encl. : Dimensional survey report, doc. No. 0404143-005000261

DOCUMENT TITLE DIMENSIONAL SURVEY <u>R/V KILO MOANA.</u> EM120 TX/RX, EM1002, EA-500, HPR POSITION, WATERLINE, IMU, GRANITE BLOCK, ANTENNAS, REFERENCE POINTS. SURVEYED IN BRISBANE, WEEK 9 – 2005.		DOCUMENT REFERENCE 0404143-05000261
CLIENT Kongsberg Underwater Technologies	PURCHASE ORDER NO.	PAGE 1 of 4

CONTENTS

1. GENERAL
2. PERSONNEL
3. EQUIPMENT
4. WORK PROCEDURE
5. SURVEY RESULTS
6. COMMENTS

ENCLOSURE 1

SURVEY RESULTS

TRANSDUCERS, IMU, GRANITE BLOCK, ANTENNAS, DRAFT MARKS

ENCLOSURE 2

SURVEY RESULTS

COORDINATE REFERENCE POINTS

0	FOR USE	05000261	10-Feb-05	ORO	EIF	KA
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1. GENERAL

The purpose of the visit onboard R/V Kilo Moana while it was dry docked in Brisbane week 9 – 2005, was to carry out some measurements of the transducers onboard. The following objects and tasks were surveyed, performed and are reported herein :

- Position, flatness, heading, pitch, roll of the EM120-TX frame as installed.
- Position, heading, pitch, roll of the former installed 120-RX module array.
- Position of EA-500/38kHz, EA-500/12kHz, EA-500/200kHz, hole for HPR.
- Position, pitch, roll of EM1002.
- Position, heading, pitch, roll of the IMU sensor in the sonar room at port pontoon.
- Position, heading, pitch, roll of the Granite block in the sonar room at port pontoon.
- Position of 7 different antennas.
- Heading between the two GPS antennas at top fore mast.
- Elevation of the draft marks on hull related to the reference plane under the pontoons.
- Set out and marking of coordinate reference points onboard for future use.
- Establishment of a common coordinate reference system onboard the ship.

2. PERSONNEL

The survey work were performed by Senior Surveyor Odd Rune Olden with assistance from from Kongsberg Underwater Technologies representatives on site.

3. EQUIPMENT

The following equipment were used:

Leica TDM5005 Totalstation, serial No. 438355
 Fabricator’s Certificate expiry date: 18 January 2007.

Various minor survey equipment (e.g. receiver prism, targets, rulers, steel tape, etc.)

4. WORK PROCEDURE

The ship was supported on blocks under the pontoons in the drydock during the survey.

Generally, all positions of points are obtained by measuring bearings and distances from the Totalstation(the measuring instrument) to a receiver prism placed onto the point.

This was done from several set ups with the Totalstation, measuring to many common points from each set up which make it possible to transform all measurements from one set up over to another set up.

DIMENSIONAL SURVEY. R/V KILO MOANA, SURVEY OF EM120 TX/RX, EM1002, EA-500, HPR POSITION, WATERLINE, IMU, GRANITE BLOCK, ANTENNAS, REFERENCE POINTS. SURVEYED IN BRISBANE, WEEK 9 – 2005.				
REV. NO.	REV. DATE	DOCUMENT REFERENCE	PURCHASE ORDER NO.	PAGE
0	10-Feb-05	0404143-05000261		2 of 4

The connection between points at “outside” of the ship and the points in the sonar room was obtained through the hole in the bottom on the port pontoon where the new ADCP transducer should come.

Afterwards, all measured points were calculated into one common coordinate reference system for the ship. The reference plane was determined by levelling many points spread around under the pontoons, as this is the design baseline.

All reported positions in this report are therefore related to the same coordinate reference point and to the same reference axis.

Therefore, the common coordinate reference system onboard is defined as follow ;

- **The reference plane is the best fit plane under the pontoons.**
- **Positive X-axis is pointing forward.**
- **Positive Y-axis is pointing towards starboard.**
- **Positive Z-axis is pointing up.**
- **X=0 is on aft side of the hull at the stern.**
- **Y=0 is on best fit centreline between the two pontoons.**
- **Z=0 is in level with the best fit plane under the two pontoons.**

5. SURVEY RESULTS

See the attached enclosures no. 1 and no. 2.

From our point of view, there is no big inclinations of the transducers under the ship or of the IMU sensor in the sonar room.

During our stay we received some “Accuracy Control Condition Reports”, obviously issued by the yard but with no information concerning report number, time for survey, description of references or similar actual information.

According to the positions reported in those, it seem so that our X=0 reference(which is on aft side of hull at stern) is a few centimeter further aft than the zero-reference they have used. The Y-reference seem to be equal to them within 2 centimeters. The Z-reference seem to be equal to them within 1 centimeter.

Our general survey accuracy for positions is +/- 2 millimeter.

6. COMMENTS

The survey temperature during the survey was +30 degrees Celsius. That is also the reporting temperature, no scaling to another reference temperature has been done.

The coordinate reference points in the sonar room at port pontoon are established with reflex targets and the belonging number to each point is painted onto the bulkheads/ceiling with a permanent marker.

DIMENSIONAL SURVEY. R/V KILO MOANA, SURVEY OF EM120 TX/RX, EM1002, EA-500, HPR POSITION, WATERLINE, IMU, GRANITE BLOCK, ANTENNAS, REFERENCE POINTS. SURVEYED IN BRISBANE, WEEK 9 – 2005.				
REV. NO.	REV. DATE	DOCUMENT REFERENCE	PURCHASE ORDER NO.	PAGE
0	10-Feb-05	0404143-05000261		3 of 4

Still, the day this was done was a day with relative high humidity so the markings did not show very well.

Therefore we recommend, as soon as possible, somebody onboard the Kilo Moana to go down and refresh the point numbers. The points are identified with numbers from no. 201 to no. 214 written beside each reflex targets.

The granite block in the sonar room which is supposed to be a reference for future installations will, in our opinion, give too short base lines for accurate measurement. We suggest that the coordinate reference points that we established in the sonar room is a better reference for such purposes.

The new ADCP transducer under port pontoon was not installed during our stay.

No further comments to the results.

DIMENSIONAL SURVEY. R/V KILO MOANA, SURVEY OF EM120 TX/RX, EM1002, EA-500, HPR POSITION, WATERLINE, IMU, GRANITE BLOCK, ANTENNAS, REFERENCE POINTS. SURVEYED IN BRISBANE, WEEK 9 – 2005.

REV. NO.	REV. DATE	DOCUMENT REFERENCE	PURCHASE ORDER NO.	PAGE
0	10-Feb-05	0404143-05000261		4 of 4

ENCLOSURE 1
SURVEY RESULTS

TRANSDUCERS, IMU, GRANITE BLOCK,
ANTENNAS, DRAFT MARKS

General comments

General survey accuracy for a random position is
+/- 2mm.

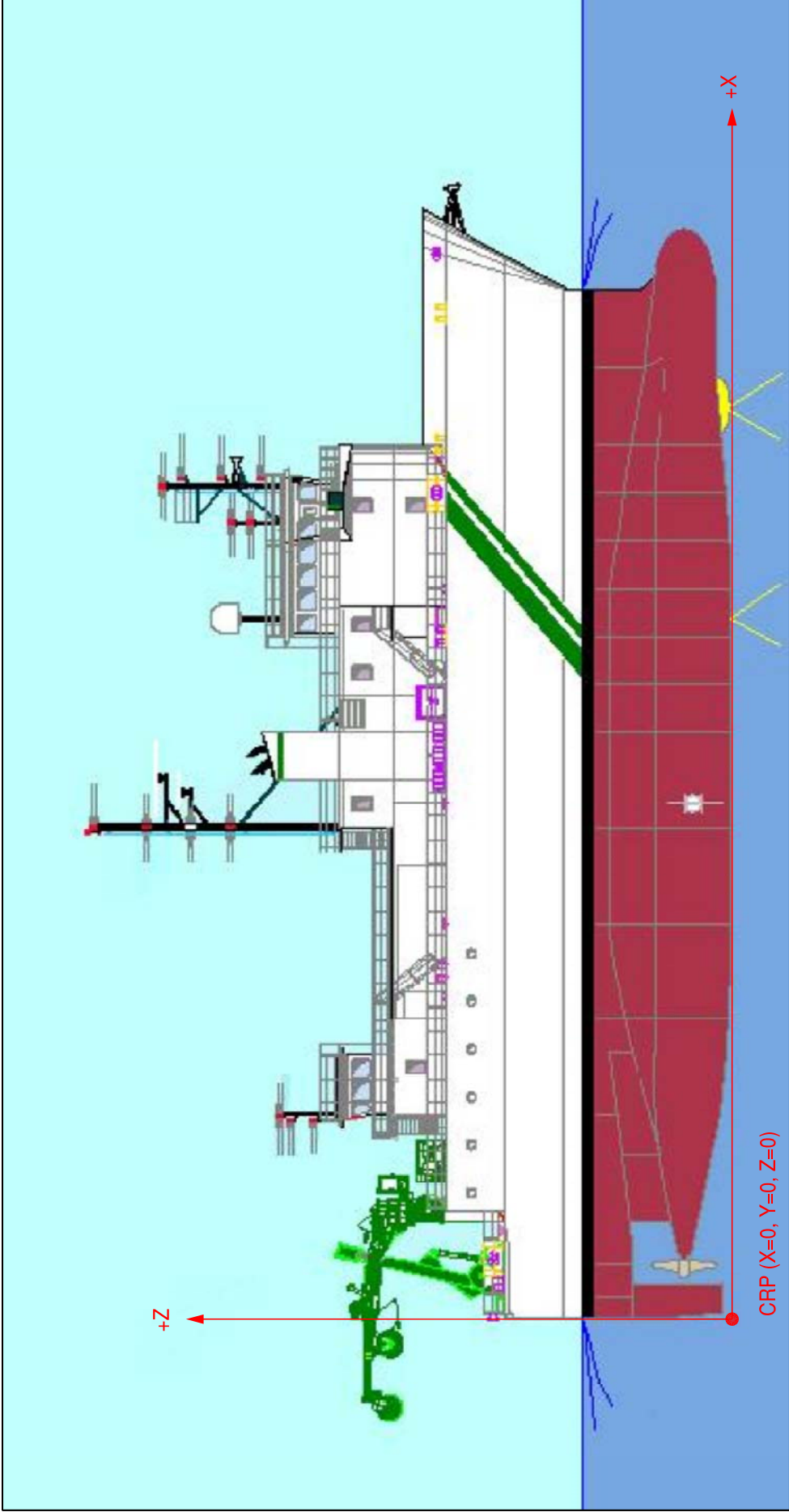
Probable survey accuracy for pitch, roll and heading for
the IMU and the Granite block is +/- 0.05 deg.

Probable survey accuracy for pitch, roll and heading of
Transducers is generally +/- 0.02 deg. but for the EM1002
it is +/- 0.1 deg.

All coordinates and dimensions are in meter U.N.O.

All angles/bearings are in degrees(360 deg. system)

Reporting temperature is +30 degrees Celsius.



NOTE:

- SURVEY TEMPERATURE IS 30° CELSIUS

0	FOR USE/INFO
REV. NO.	REASON FOR ISSUE

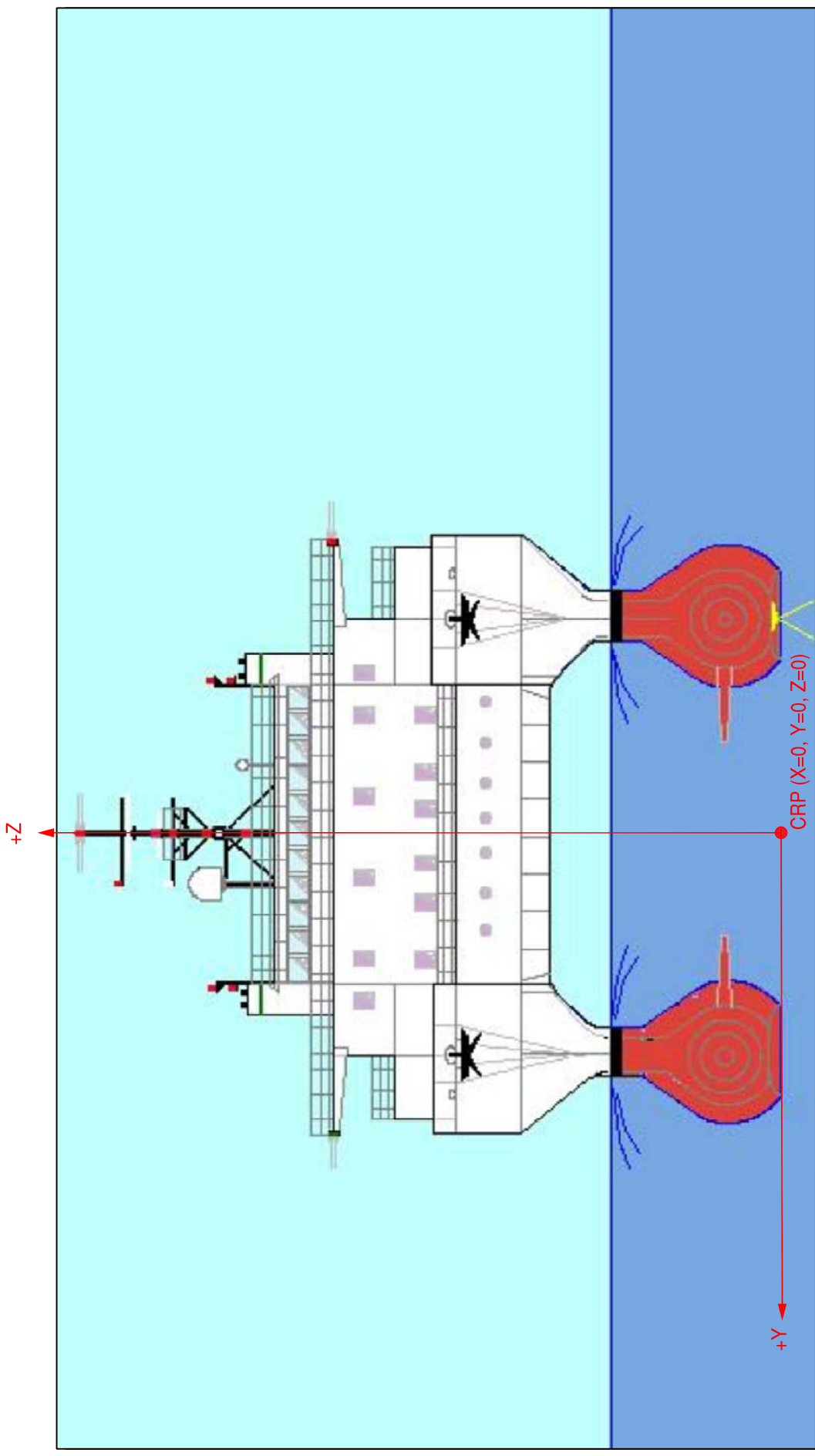
05000261	00261011	08.03.05
DOC. NO.	FILE NO.	REV. DATE

TH	ORO	EIF	KA
DRAWN	PREPARED	CHECKED	APPROVED



DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	1 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	SIDEVIEW				



NOTE:

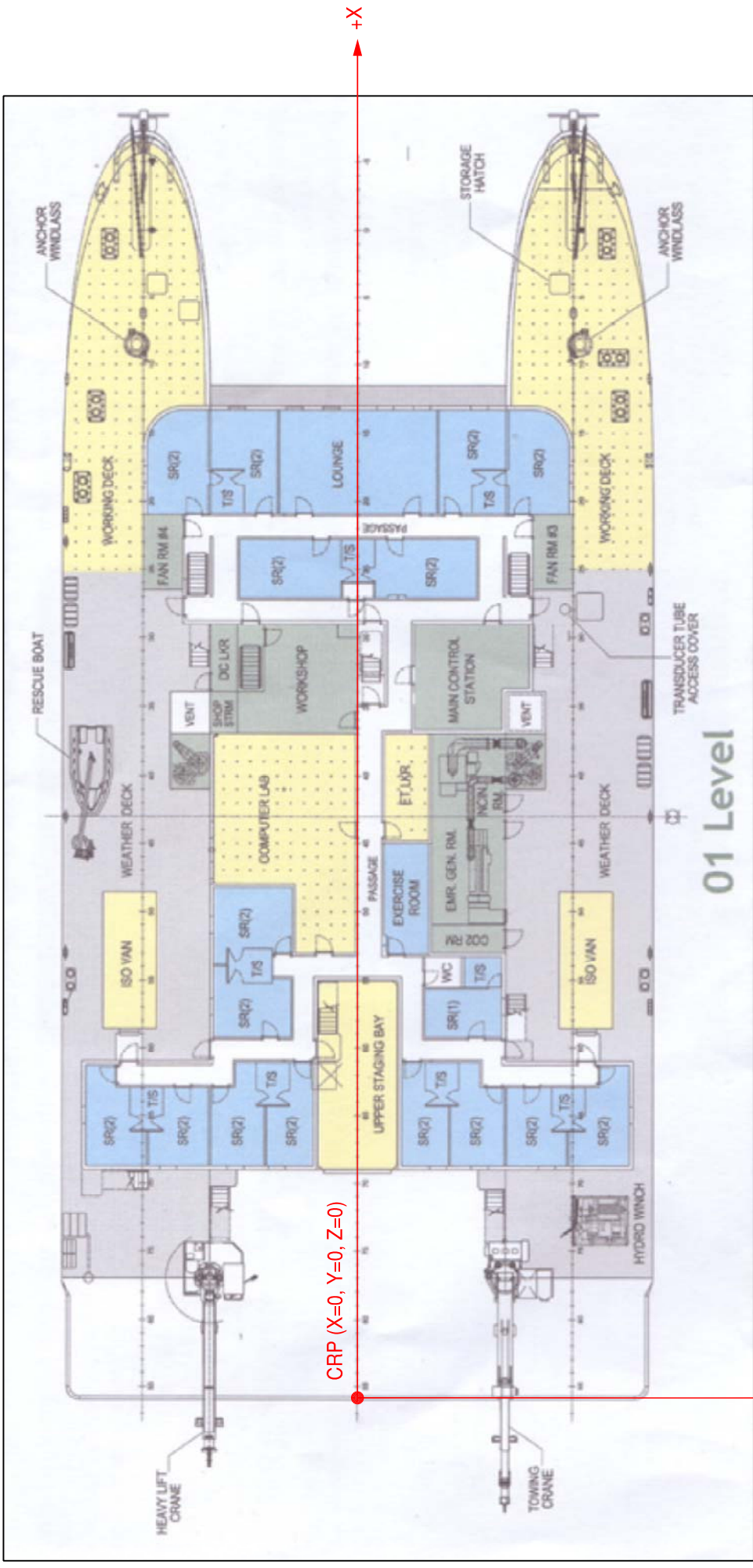
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REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	2 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	FRONT VIEW				



01 Level



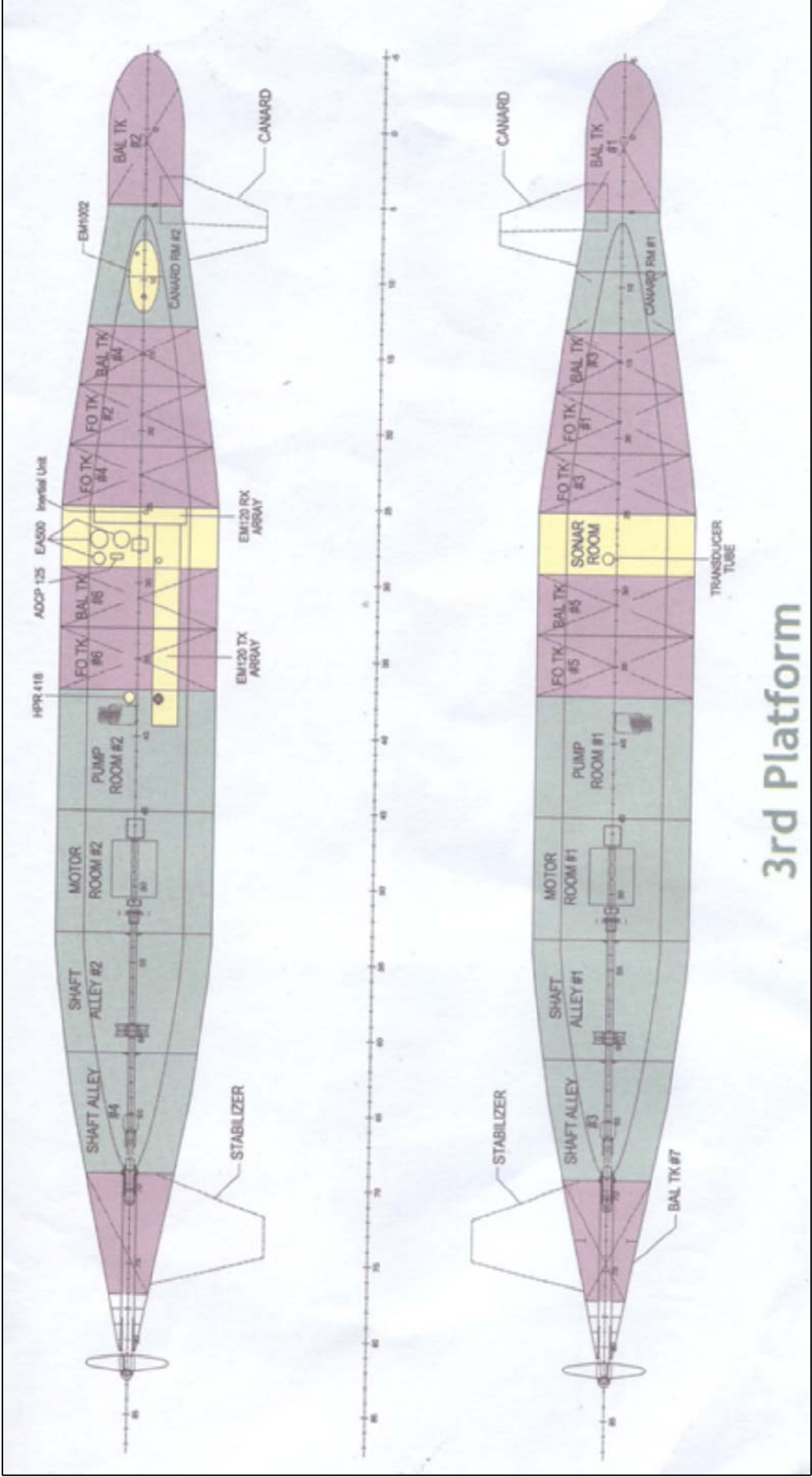
DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	3 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	LEVEL 01				


NOTE:

- SURVEY TEMPERATURE IS 30° CELSIUS

0	FOR USE/INFO	05000261	00261031	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



3rd Platform

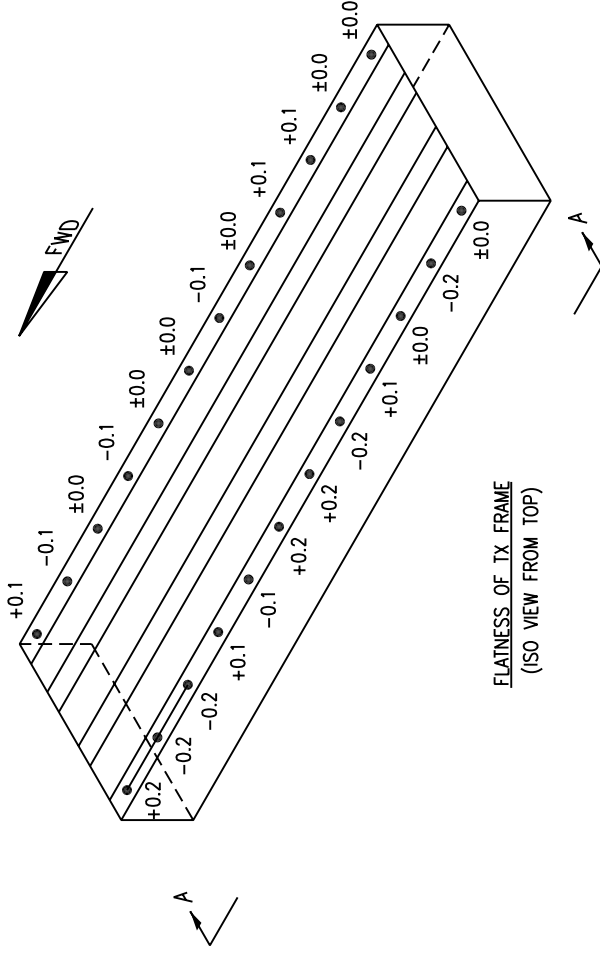
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CLIENT KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE 0404143-05000261/ENCL.1	PAGE 4 of 15	REV.
PROJECT R/V KILO MOANA	CONTRACT NO.	WO/CALL OFF NO.	REV.
LOCATION BRISBANE, AUSTRALIA	REF. DRAWING NO.		
TITLE 3rd PLATFORM			
05000261_00261041	08.03.05	TH	ORO
FILE NO.	REV. DATE	DRAWN	PREPARED
DOC. NO.		CHECKED	APPROVED
0	FOR USE/INFO		KA
	REASON FOR ISSUE		

NOTE:

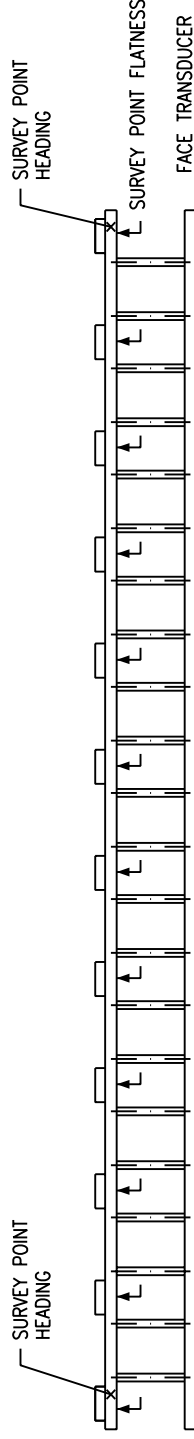
- SURVEY TEMPERATURE IS 30° CELSIUS



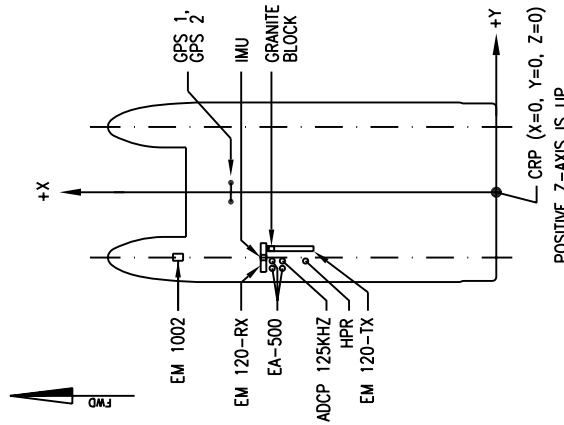
LOOKING FWD/UP



FLATNESS OF TX FRAME
(ISO VIEW FROM TOP)



SECTION A - A
(TYP. SIDEVIEW OF FRAME)



KEY PLAN

NOTES:

- ALL DIMENSIONS IN MM FROM A BEST FIT PLANE (DISREGARDING TRUE PLANE)
- MEAN OF ALL POINTS IS SET TO ZERO
- + IS A HIGH POINT, - IS A LOWER
- / SURVEY POINT FLATNESS
- PROBABLE SURVEY ACCURACY FOR FRAME FLATNESS ±0.1MM
- SURVEY TEMPERATURE IS +30° CELSIUS



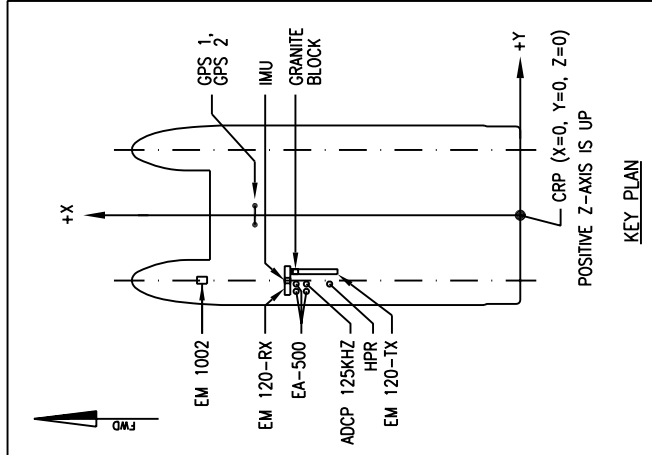
DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	5 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	EM 120 - TX, FLATNESS OF FRAME AFTER FINAL ADJUSTMENT				

0	FOR USE/INFO	05000261	00261051	08.03.05	TH	ORO	EIF	KA	APPROVED
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED	



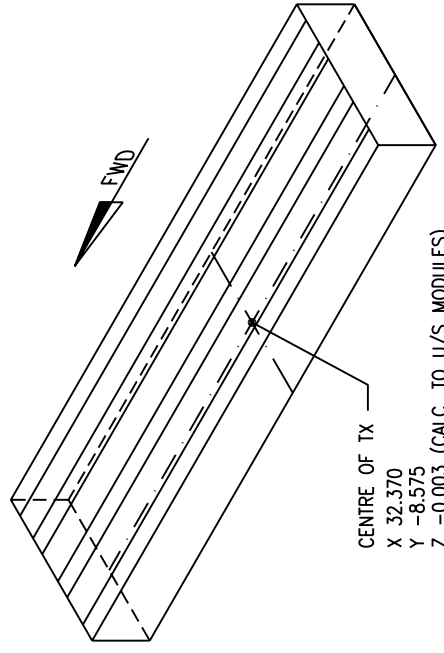
LOOKING FWD/UP



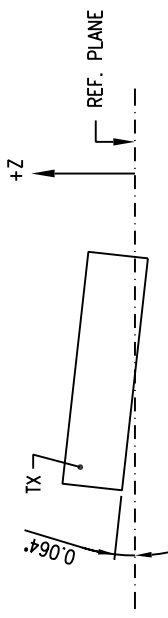
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REV. NO.	REASON FOR ISSUE

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DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED

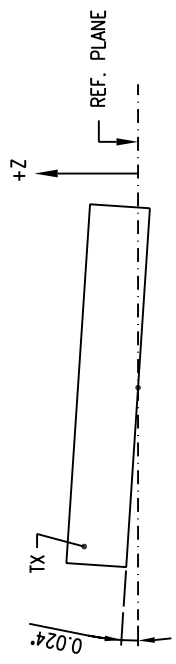
- NOTES:
- COORDINATES IN METER
 - ANGLES IN DEGREES
 - PROBABLE SURVEY ACCURACY ±0.02'
 - SURVEY TEMPERATURE IS +30° CELSIUS



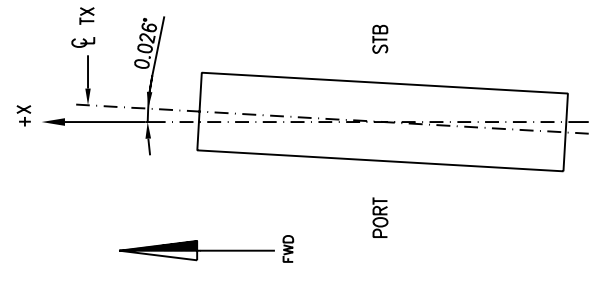
ROLL - LOOKING AFT




PITCH - LOOKING TOWARDS STB



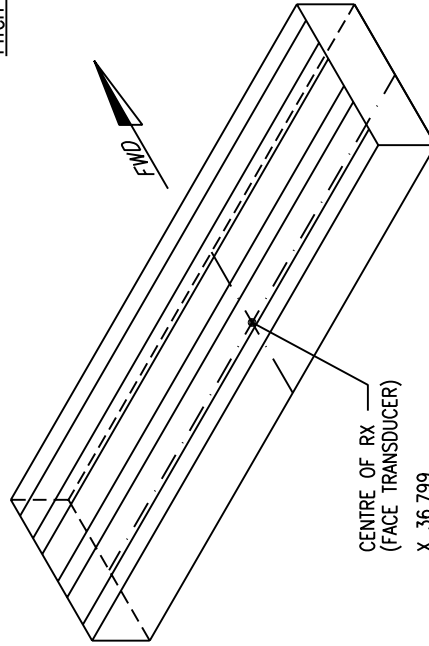
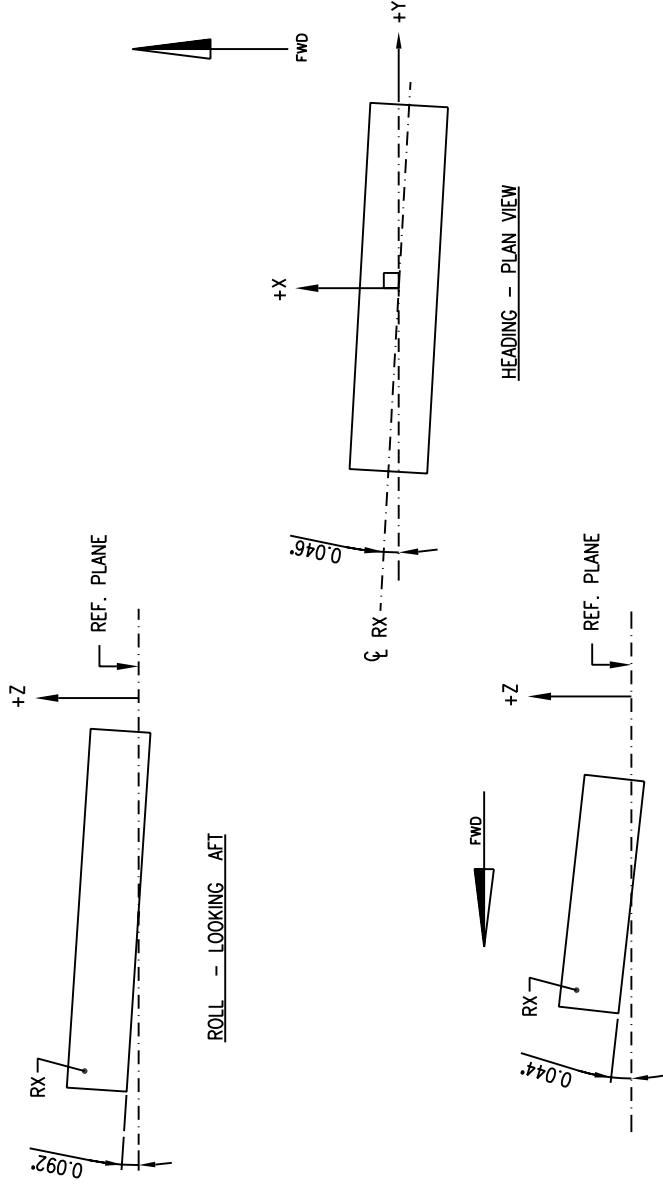
HEADING (YAW) - PLAN VIEW



		DIMENSIONAL CONTROL	
		CLIENT	DOCUMENT REFERENCE
KONGSBERG UNDERWATER TECHNOLOGIES		0404143-05000261/ENCL.1	PAGE 6 of 15
PROJECT		R/V KILO MOANA	CONTRACT NO.
LOCATION		BRISBANE, AUSTRALIA	REF. DRAWING NO.
TITLE		EM 120 - TX, POSITION, HEADING, ROLL, PITCH OF FRAME	REV.

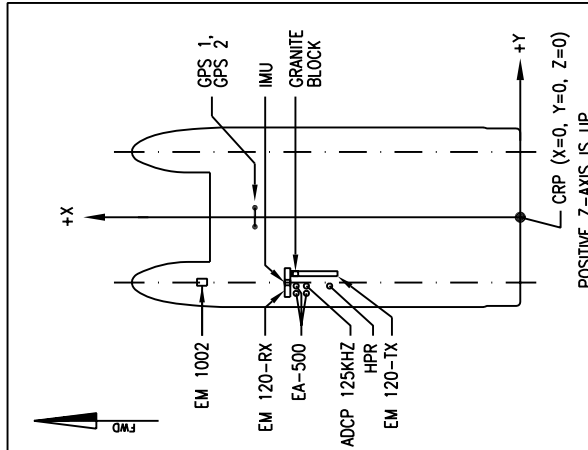


EM 120-RX
LOOKING FWD/UP



POSITION OF RX

CENTRE OF RX
(FACE TRANSDUCER)
X 36.799
Y -9.747
Z -0.004



KEY PLAN

NOTES:

- COORDINATES IN METER
- ANGLES IN DEGREES
- PROBABLE SURVEY ACCURACY ±0.02'
- SURVEY TEMPERATURE IS +30° CELSIUS

0	FOR USE/INFO	05000261	00261071	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED

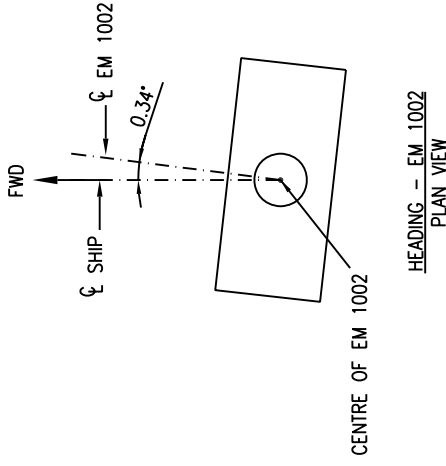
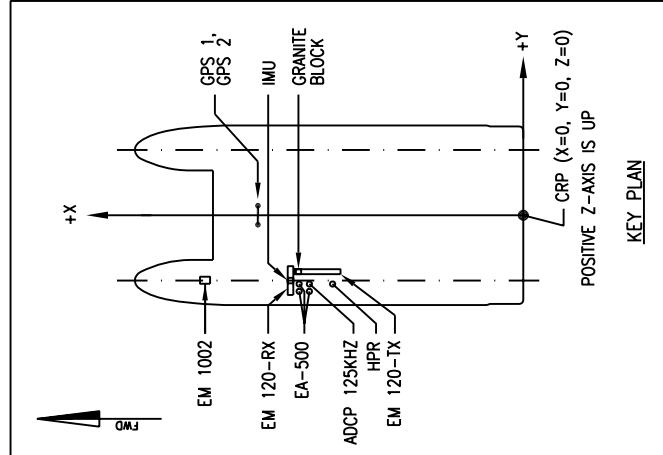


DIMENSIONAL CONTROL

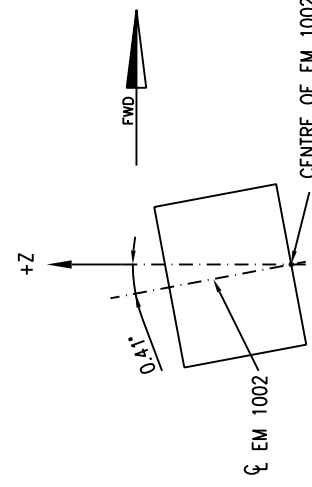
CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	7 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	EM 120 - RX, POSITION, HEADING, ROLL PITCH U/S MODULES				



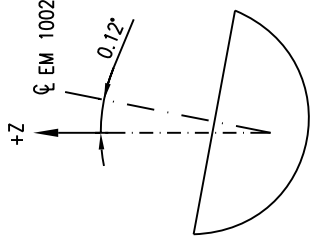
LOOKING TOWARDS PORT



BOTTOM CENTRE OF EM 1002
 X 46.814
 Y -9.745
 Z 0.054



ROLL - LOOKING FORWARD



NOTES:

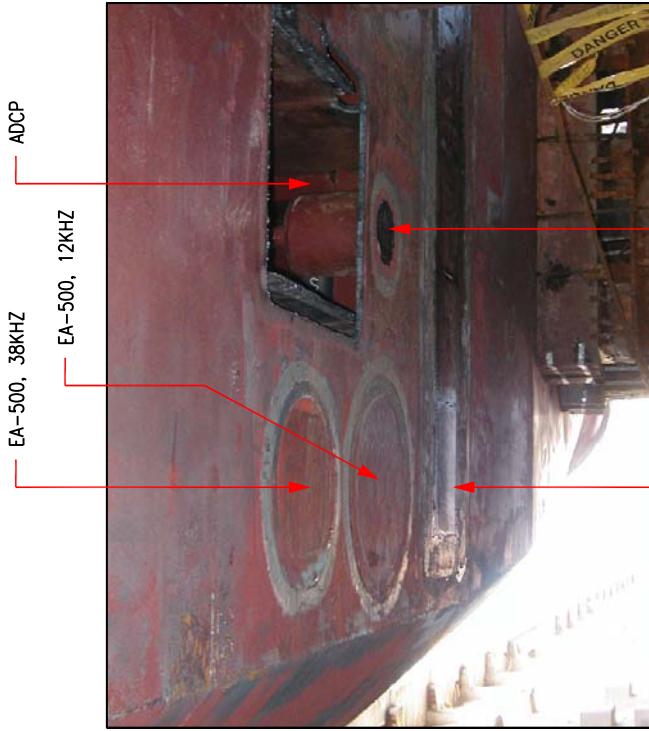
- COORDINATES IN METER
- ANGLES IN DEGREES
- PROBABLE SURVEY ACCURACY $\pm 0.1^\circ$
- SURVEY TEMPERATURE IS $+30^\circ$ CELSIUS



DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	8 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.			WO/CALL OFF NO.
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.			REV.
TITLE	EM 1002 - POSITION, HEADING, PITCH, ROLL				

0	FOR USE/INFO	05000261	00261081	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



EA-500, 38KHZ

EA-500, 12KHZ

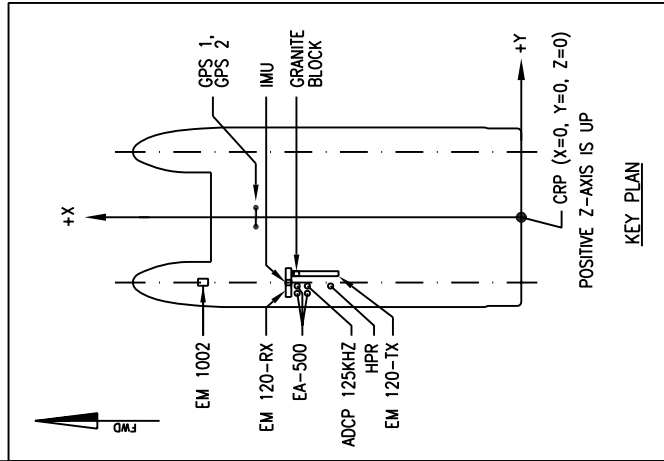
ADCP

EM 120-RX

EA-500, 200KHZ

EA-500, 200KHZ

LOOKING FWD/UP

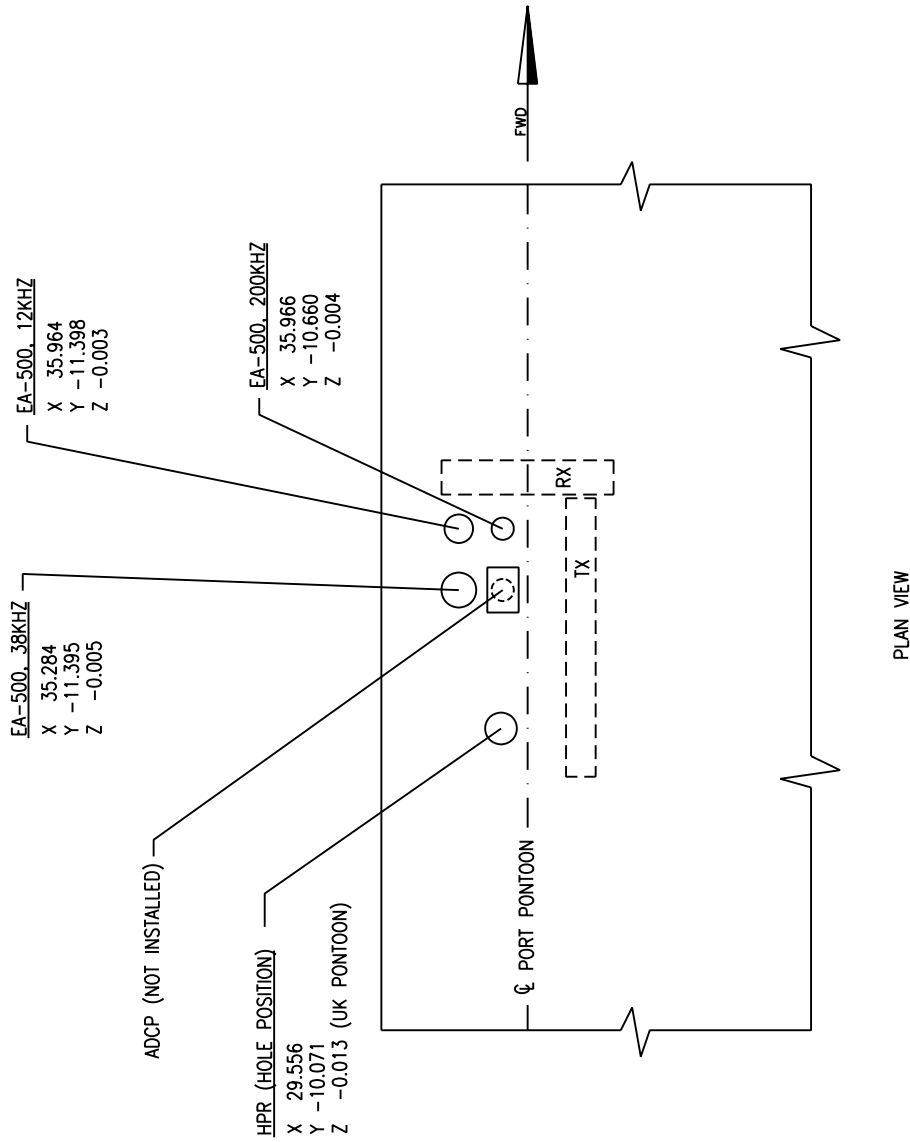


KEY PLAN

NOTES:

- COORDINATES IN METER
- ANGLES IN DEGREES
- SURVEY TEMPERATURE IS +30° CELSIUS
- SURVEY ACCURACY ±2MM

0	FOR USE/INFO	05000261	00261091	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



PLAN VIEW

EA-500, 38KHZ
X 35.284
Y -11.395
Z -0.005

EA-500, 12KHZ
X 35.964
Y -11.398
Z -0.003

EA-500, 200KHZ
X 35.966
Y -10.660
Z -0.004

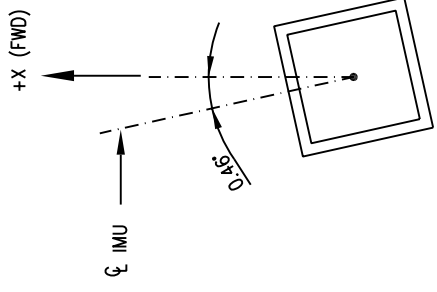
HPR (HOLE POSITION)
X 29.556
Y -10.071
Z -0.013 (UK PONTON)

ADCP (NOT INSTALLED)

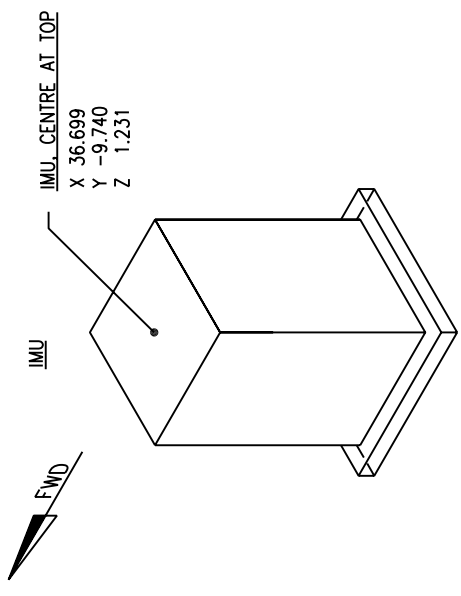


DIMENSIONAL CONTROL

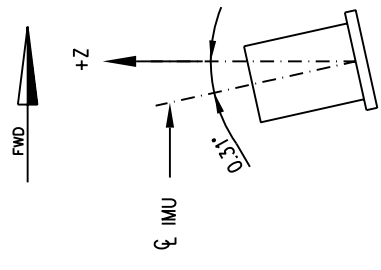
CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	9 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	POSITION OF TRANSDUCERS, UNDERSIDE PORT PONTON				



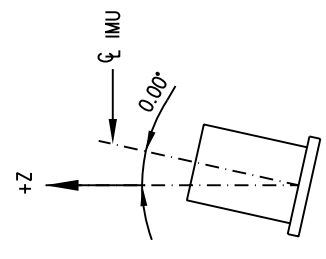
HEADING
TOP VIEW



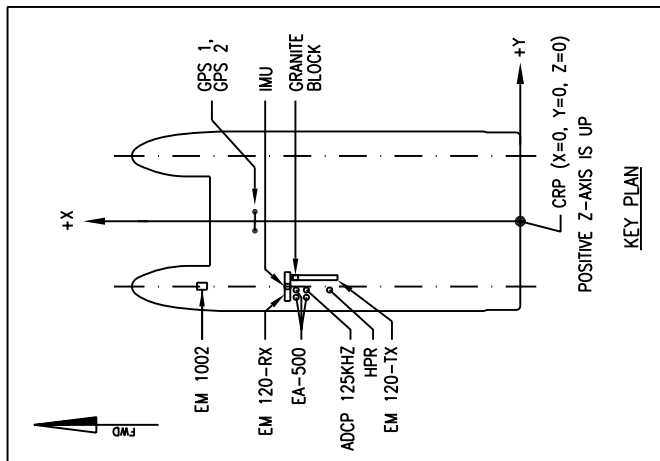
IMU CENTRE AT TOP
X 36.699
Y -9.740
Z 1.231



PITCH
LOOKING TOWARDS PORT



ROLL
LOOKING FORWARD



KEY PLAN

NOTES:

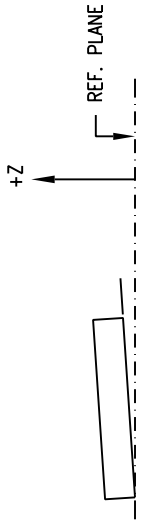
- COORDINATES IN METER
- ANGLES IN DEGREES
- PROBABLE SURVEY ACCURACY ±0.05'
- SURVEY TEMPERATURE IS +30° CELSIUS



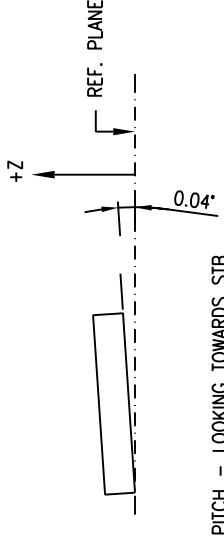
DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	10 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	IMU - POSITION, HEADING, PITCH, ROLL				

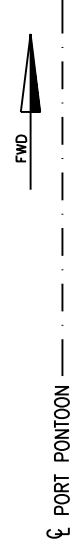
0	FOR USE/INFO	05000261	00261101	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



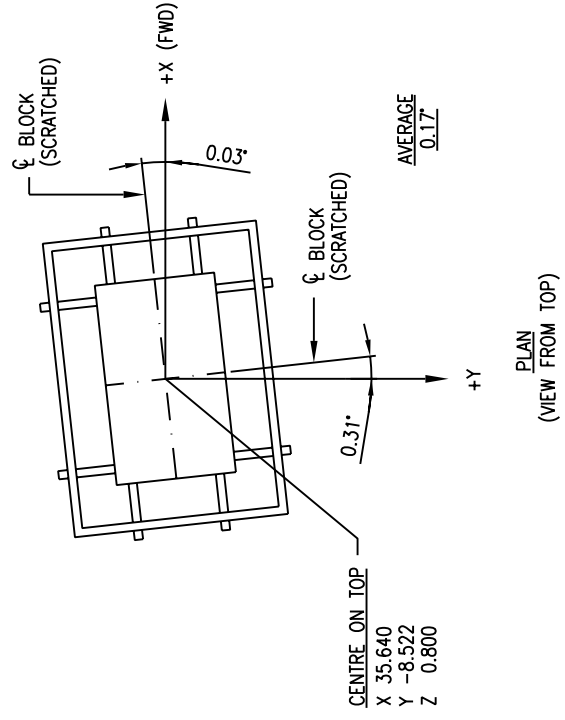
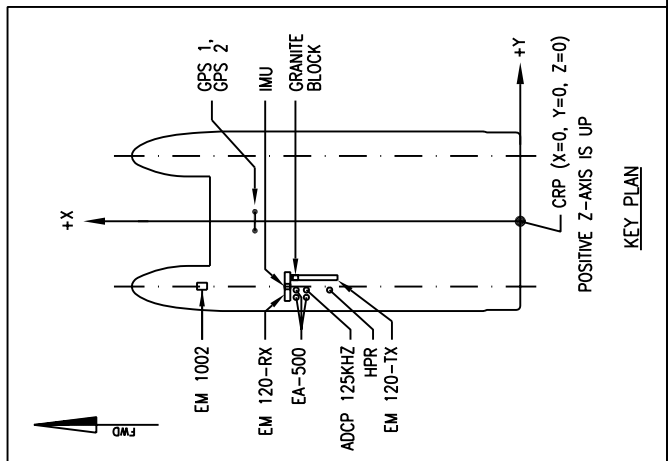
ROLL - LOOKING AFT



PITCH - LOOKING TOWARDS STB



PORT PONTOON



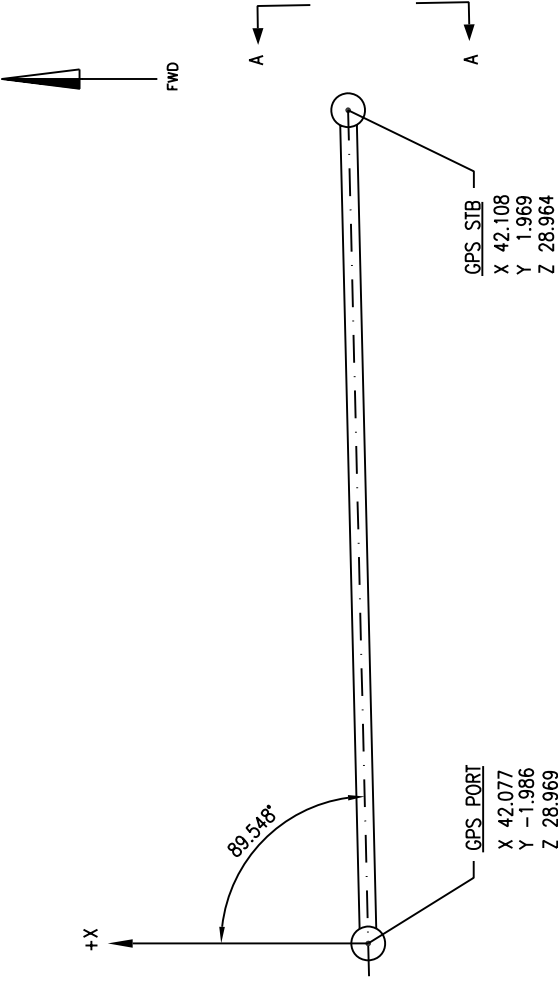
NOTES:
 - COORDINATES IN METER
 - ANGLES IN DEGREES
 - PROBABLE SURVEY ACCURACY ±0.05'
 - SURVEY TEMPERATURE IS +30° CELSIUS



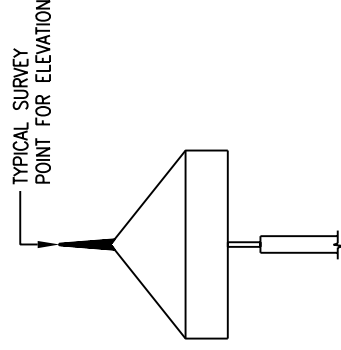
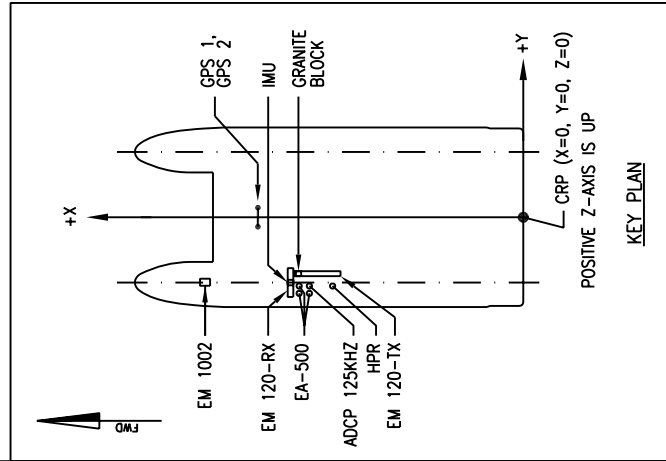
DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	11 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	GRANITE BLOCK IN SONAR ROOM, PORT PONTOON				

0	FOR USE/INFO	05000261	00261111	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



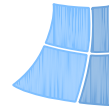
TOP FORE MAST
(LOOKING FWD)



SECTION A - A

NOTES:

- COORDINATES IN METER
- ANGLES IN DEGREES
- PROBABLE SURVEY ACCURACY ±0.05'
- SURVEY TEMPERATURE IS +30° CELSIUS



DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	12 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	GPS ANTENNAS, TOP FORE MAST				

0	FOR USE/INFO	05000261	00261121	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED

TRUETIME
X 42.942
Y -1.564
Z 24.103

ASHTECH
X 42.893
Y -3.353
Z 24.125

ASHTECH
X 42.896
Y -4.559
Z 24.132

ASHTECH
X 39.382
Y -4.564
Z 24.143

ASHTECH
X 42.897
Y -5.781
Z 24.133



PORT SIDE WHEELHOUSE ROOF
(LOOKING FWD)



DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	13 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	ANTENNAS, PORT SIDE TOP WHEELHOUSE				

0	FOR USE/INFO	05000261	00261131	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED

NOTES:

- COORDINATES IN METER
- PROBABLE SURVEY ACCURACY ±2MM
- SURVEY TEMPERATURE IS +30° CELSIUS

P-CODE
 X 42.883
 Y 2.555
 Z 24.261

"UNKNOWN"
 X 42.977
 Y 5.015
 Z 24.164



STB_SIDE_WHEELHOUSE_ROOF
 (LOOKING FWD)

NOTES:

- COORDINATES IN METER
- PROBABLE SURVEY ACCURACY ±2MM
- SURVEY TEMPERATURE IS +30° CELSIUS

0	FOR USE/INFO
REV. NO.	REASON FOR ISSUE

05000261	00261141
DOC. NO.	FILE NO.

08.03.05	TH
REV. DATE	DRAWN

ORO	TH
PREPARED	DRAWN

EIF	KA
CHECKED	APPROVED

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	14 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	ANTENNAS, STB SIDE TOP WHEELHOUSE				

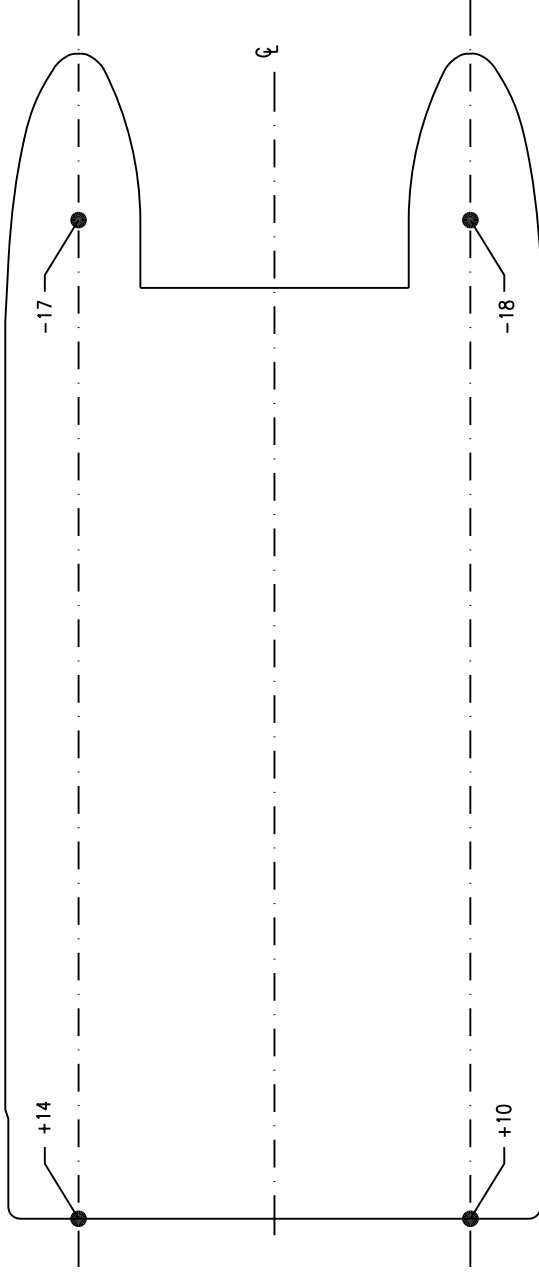


DIMENSIONAL CONTROL

REF. AT UNDERSIDE FIGURES
(NOT THE PAINTED BORDER)



PORT BOW
(LOOKING TOWARDS PORT)



ELEVATION DEVIATIONS RELATED TO BEST FIT REFERENCE
PLANE AT U/S PONTOONS (BASELINE)



NOTES:

- DIMENSIONS IN MM
- SURVEY ACCURACY ±2MM
- SURVEY TEMPERATURE IS +30° CELSIUS
- FIGURES SHOW DEVIATION FROM THEORETICAL ELEVATION. MINUS MEANS THE MARK IS TOO LOW, PLUS MEAN IT IS TOO HIGH RELATED TO U/S PONTOONS

DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL.1	PAGE	15 of 15
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	

0	FOR USE/INFO	05000261	00261151	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED

ELEVATION DEVIATIONS ON THE 25 FEET DRAFT MARKS

ENCLOSURE 2

SURVEY RESULTS

COORDINATE REFERENCE POINTS

General comments

General survey accuracy for a random position is
+/- 2mm.

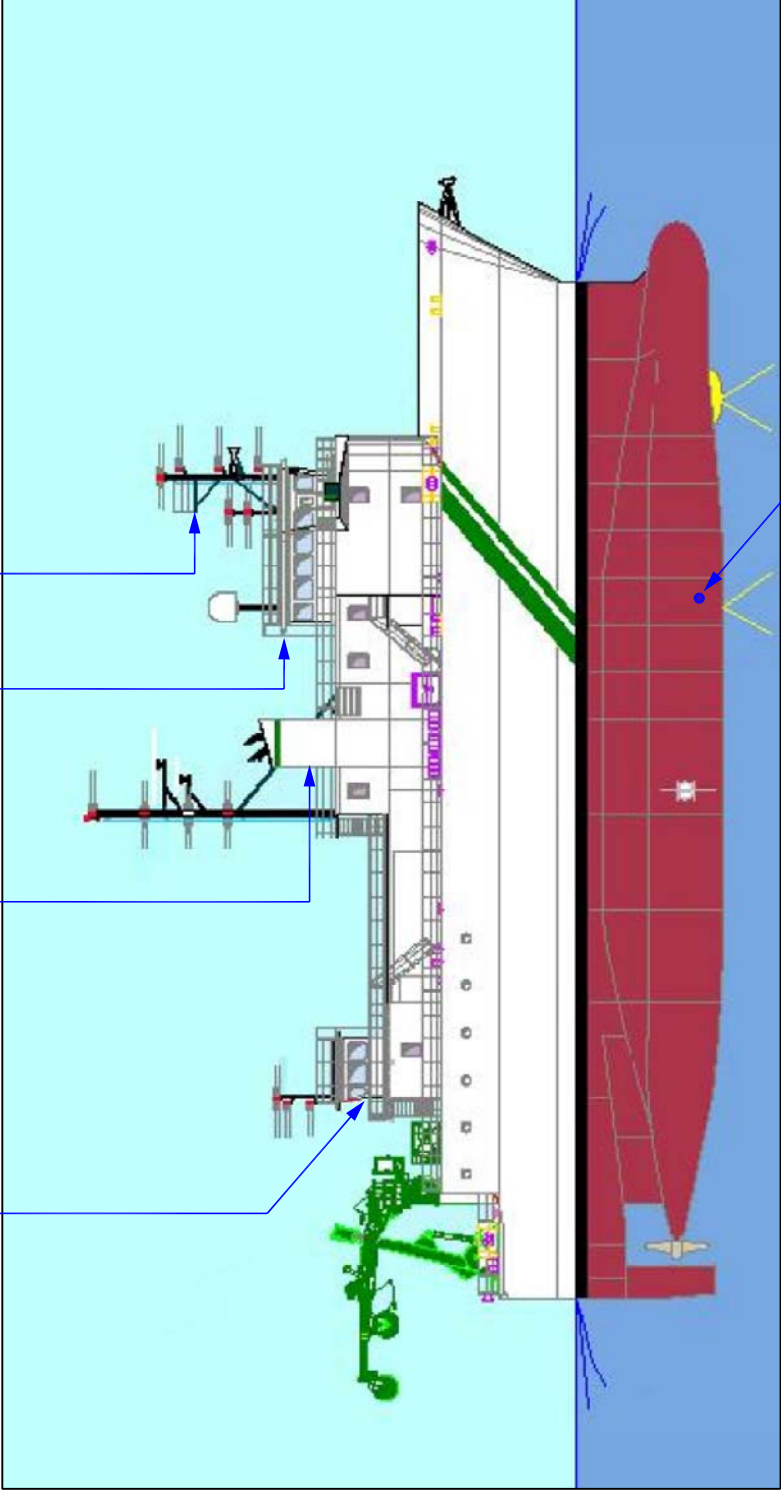
Probable survey accuracy for pitch, roll and heading for
the IMU and the Granite block is +/- 0.05 deg.

Probable survey accuracy for pitch, roll and heading of
Transducers is generally +/- 0.02 deg. but for the EM1002
it is +/- 0.1 deg.

All coordinates and dimensions are in meter U.N.O.

All angles/bearings are in degrees(360 deg. system)

Reporting temperature is +30 degrees Celsius.



REF. POINT 401, 402

REF. POINT 403

REF. POINT 404, 406

REF. POINT 405

REF. POINTS 201-214
IN SONAR ROOM AT PORT PONTOON

POINT	X(FWD) m	Y(STB) m	Z(UP) m	DESCRIPTION / LOCATION OF POINTS
401	40,700	-1,178	27,422	REFLEX TARGET. AFT SIDE TOP FORE MAST
402	40,725	1,172	27,414	REFLEX TARGET. AFT SIDE TOP FORE MAST
403	34,357	-3,719	22,528	REFLEX TARGET. AFT SIDE WHEELHOUSE ROOF
404	27,440	-6,767	21,544	REFLEX TARGET. AFT SIDE PORT CHIMNEY
405	10,409	-1,851	18,286	REFLEX TARGET. AFT SIDE CRANE HOUSE
406	27,416	6,731	21,569	REFLEX TARGET. AFT SIDE STB CHIMNEY

NOTE:

- SURVEY TEMPERATURE IS +30° CELSIUS

REV. NO.	FOR USE/INFO	REASON FOR ISSUE
0		

DOC. NO.	FILE NO.	REV. DATE	TH	ORO	EIF	KA
05000261	00261012	08.03.05	DRAWN	PREPARED	CHECKED	APPROVED



DIMENSIONAL CONTROL

CLIENT	KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE	0404143-05000261/ENCL. 2	PAGE	1 of 7
PROJECT	R/V KILO MOANA	CONTRACT NO.		WO/CALL OFF NO.	
LOCATION	BRISBANE, AUSTRALIA	REF. DRAWING NO.		REV.	
TITLE	LOCATION OF COORDINATE REFERENCE POINTS				



CLIENT KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE 0404143-05000261/ENCL. 2	PAGE 2 of 7
PROJECT R/V KILO MOANA	CONTRACT NO.	WO/CALL OFF NO.
LOCATION BRISBANE, AUSTRALIA	REF. DRAWING NO.	REV.
TITLE REFERENCE POINT 401 AND 402		

REF. POINT 401

X 40.700
Y -1.178
Z 27.422

REF. POINT 402

X 40.724
Y 1.172
Z 27.414



FORE MAST ON TOP WHEELHOUSE
(LOOKING FWD)

0	FOR USE/INFO	05000261	00261022	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



CLIENT KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE 0404143-05000261/ENCL. 2	PAGE 3 of 7
PROJECT R/V KILO MOANA	CONTRACT NO.	WO/CALL OFF NO.
LOCATION BRISBANE, AUSTRALIA	REF. DRAWING NO.	REV.
TITLE REFERENCE POINT 403		

REF. POINT 403

X 34.357
Y -3.719
Z 22.528



AFT SIDE WHEELHOUSE ROOF
(LOOKING FWD)

0	FOR USE/INFO	05000261	00261032	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



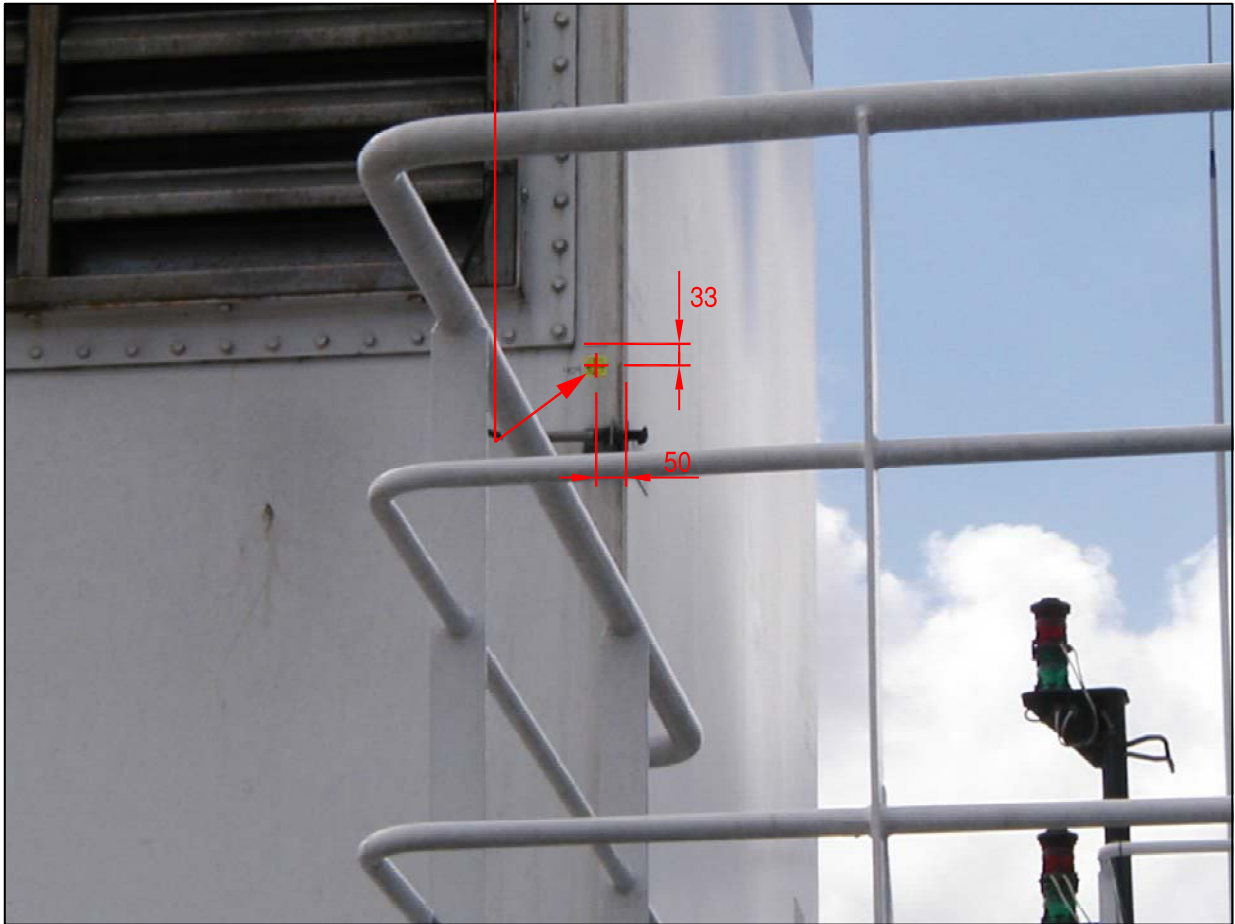
CLIENT KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE 0404143-05000261/ENCL. 2	PAGE 4 of 7
PROJECT R/V KILO MOANA	CONTRACT NO.	WO/CALL OFF NO.
LOCATION BRISBANE, AUSTRALIA	REF. DRAWING NO.	REV.
TITLE REFERENCE POINT 404		

REF. POINT 404

X 27.440

Y -6.767

Z 21.544



AFT SIDE PORT CHIMNEY
(LOOKING FWD)

0	FOR USE/INFO	05000261	00261042	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



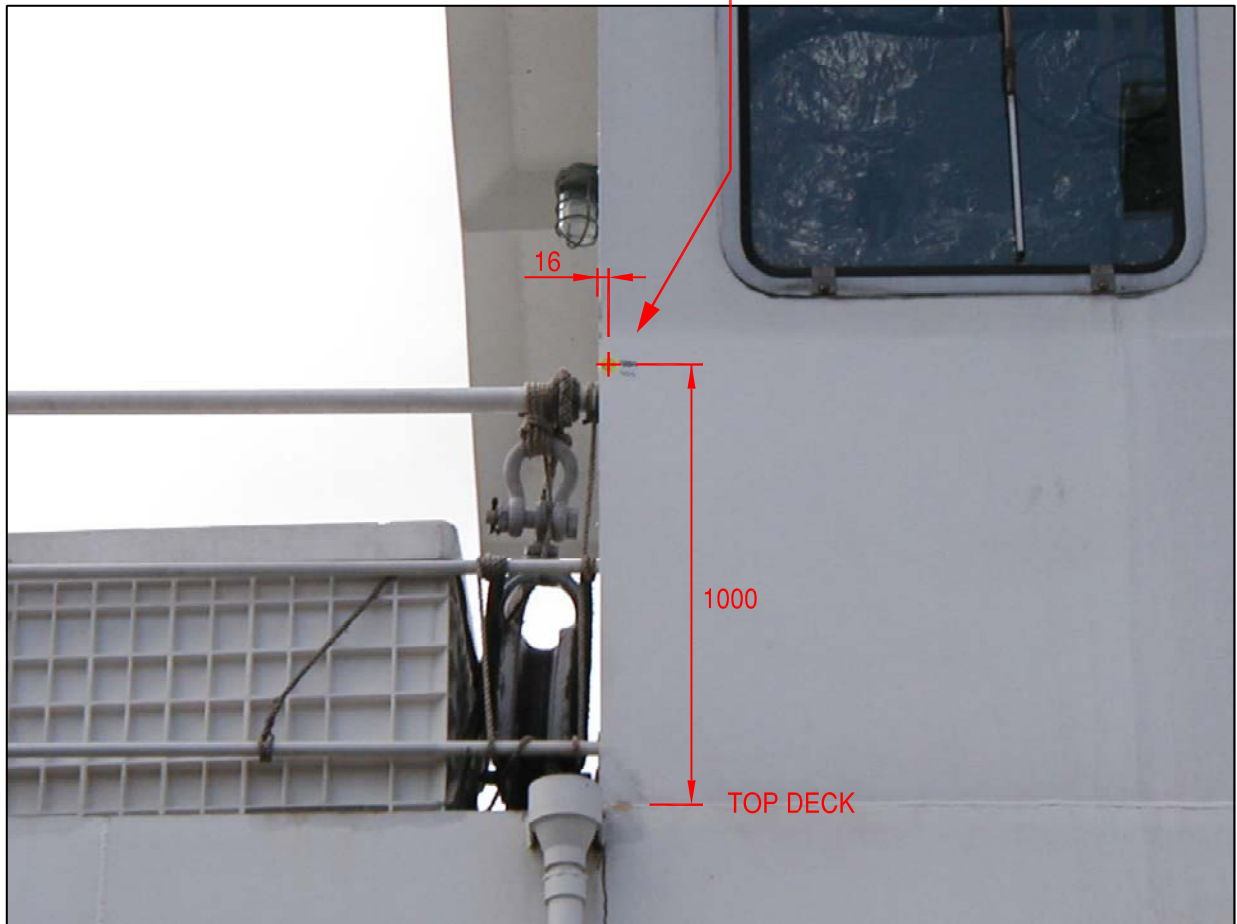
CLIENT KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE 0404143-05000261/ENCL. 2	PAGE 5 of 7
PROJECT R/V KILO MOANA	CONTRACT NO.	WO/CALL OFF NO.
LOCATION BRISBANE, AUSTRALIA	REF. DRAWING NO.	REV.
TITLE REFERENCE POINT 405		

REF. POINT 405

X 10.409

Y -1.851

Z 18.286



AFT SIDE CRANE HOUSE
(LOOKING FWD)

0	FOR USE/INFO	05000261	00261052	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



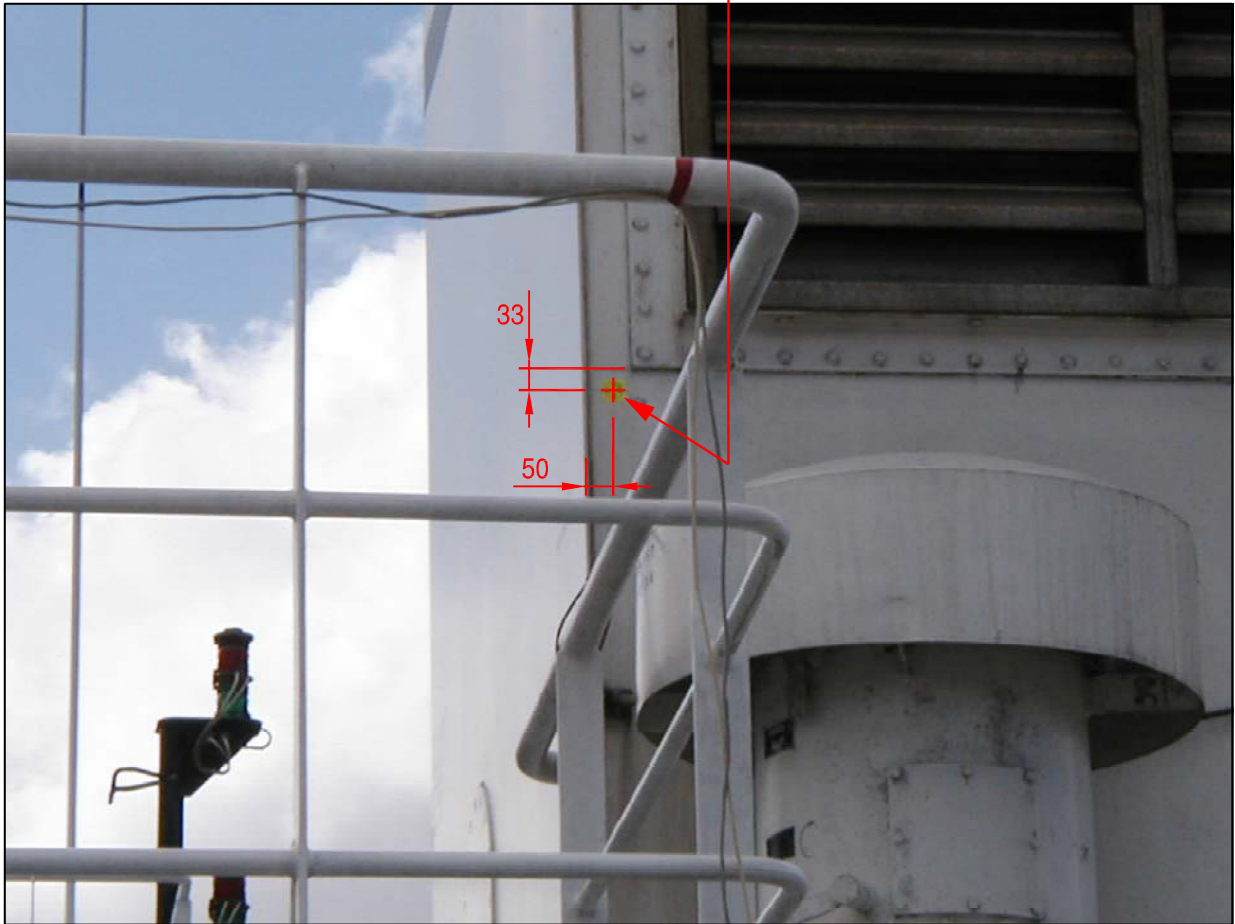
CLIENT KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE 0404143-05000261/ENCL. 2	PAGE 6 of 7
PROJECT R/V KILO MOANA	CONTRACT NO.	WO/CALL OFF NO.
LOCATION BRISBANE, AUSTRALIA	REF. DRAWING NO.	REV.
TITLE REFERENCE POINT 406		

REF. POINT 406

X 27.416

Y 6.731

Z 21.569



AFT SIDE STB CHIMNEY
(LOOKING FWD)

0	FOR USE/INFO	05000261	00261062	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED



CLIENT KONGSBERG UNDERWATER TECHNOLOGIES	DOCUMENT REFERENCE 0404143-05000261/ENCL. 2	PAGE 7 of 7
PROJECT R/V KILO MOANA	CONTRACT NO.	WO/CALL OFF NO.
LOCATION BRISBANE, AUSTRALIA	REF. DRAWING NO.	REV.
TITLE COORDINATE REFERENCE POINTS, SONAR ROOM PORT PONTOON		

POINT no.	X(FWD) m	Y(STB) m	Z(UP) m	DESCRIPTION / LOCATION OF POINT
201	37,145	-12,794	3,229	REFLEX TARGET ON BULKEAD/CEILING
202	37,101	-12,328	3,683	REFLEX TARGET ON BULKEAD/CEILING
203	36,992	-11,861	4,573	REFLEX TARGET ON BULKEAD/CEILING
204	35,655	-12,345	3,661	REFLEX TARGET ON BULKEAD/CEILING
205	35,541	-11,892	4,582	REFLEX TARGET ON BULKEAD/CEILING
206	35,352	-11,119	4,480	REFLEX TARGET ON BULKEAD/CEILING
207	35,375	-10,230	4,478	REFLEX TARGET ON BULKEAD/CEILING
208	36,117	-10,267	4,580	REFLEX TARGET ON BULKEAD/CEILING
209	35,016	-10,744	4,580	REFLEX TARGET ON BULKEAD/CEILING
210	36,920	-9,667	4,374	REFLEX TARGET ON BULKEAD/CEILING
211	36,817	-10,917	4,575	REFLEX TARGET ON BULKEAD/CEILING
212	36,452	-11,435	4,580	REFLEX TARGET ON BULKEAD/CEILING
213	36,920	-9,695	2,609	REFLEX TARGET ON BULKEAD/CEILING
214	36,530	-9,164	4,473	REFLEX TARGET ON BULKEAD/CEILING

NOTES:

THE REFERENCE POINTS ARE REFLEX TARGETS WITH NUMBERS ON BULKHEADS/CEILING, MOSTLY AT THE PORT PART OF THE ROOM.

0	FOR USE/INFO	05000261	00261072	08.03.05	TH	ORO	EIF	KA
REV. NO.	REASON FOR ISSUE	DOC. NO.	FILE NO.	REV. DATE	DRAWN	PREPARED	CHECKED	APPROVED