

REPORT Rev-1 Final Report

RV Sally Ride AGOR-28

EM124 TX/RX, EM712 TX/RX, SBP, ADCP

ORTHOGONAL COORDINATE SURVEY

May 12 thru May 27, 2021

Bay Ship & Yacht Co. in Alameda, CA



Prepared By:

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Reporting- F.M. Turner,

Survey Personnel May 22- 27, 2021 F.M. Turner, Robert Howard
Reporting- F.M. Turner & Michael Holmes

Revision	Date	Comment
"0"	6/2/2021	Initial Release
1	6/22/2021	Fig 3, Removed "Granite" added axis, Table 1:Hydrns ,Seatex MRU and SEAPATH antenna Rev XYZ to Phase Center, added @ Phase Ctr to Main Lab MRU and Trimble, Table 6- Updated Ref Block & Hydrns, Main Lab MRU , SEAPATH and Trimble

Description of Project

This report summarizes coordinate measurement data taken on the R/V SALLY RIDE during several trips from May 12, 2021 thru May 27, 2021. The survey work was performed at Bay Ship & Yacht Co. in Alameda, CA after the vessel had been lifted out of the water in a floating drydock..

Trip 1 (May 12 – 17, 2021): Coordinate measurements were taken to characterize the vessel and create a temporary reference coordinate system for reporting azimuth, pitch, and roll. Pitch, Roll and Azimuth were established from the ship's keel.

IMTEC personnel then proceeded to carry on surveying requested features around the ship.

Trip 2 (May 22 – 27, 2021): Transducer frames were installed and shimmed to Kongsberg specified flatness tolerances and surveyed to establish pitch, roll and XY position. Final elevation values were obtained at the transducer faces after installation.

Additional features requested by Scripps representative were surveyed during this trip:

- All transducer seachests (including 2 spares that are not being used at this time). Azimuth values for the seachests (since none of the actual transducers were installed) were obtained by creating circle centers for each and measuring to a bolt oriented in Fwd direction for reference. SBP was not yet installed so XYZ location / Azimuth, Pitch & Roll was established by surveying the corners of frame on inside of hull plate.
- Moon Pool, Aft Crane mounting base bolts, Stbd side cranes (center of each overhead door), several antennas atop pilot house and main mast, 3 MRU's, center of foundations for (2) Big Eye Binoculars, and (6) existing benchmarks from original ship construction.
- Granite Block was aligned to ship's Azimuth, Pitch and Roll and then Chockfast Epoxy was poured to hold it in place. Ship's Azimuth line was then scribed down the center.
- The new Reference Block was also shimmed as close as possible to match the Granite block Pitch and Roll and also adjusted to 0 degrees Azimuth. Azimuth was set to zero but due to use of shims and configuration of adjustment, the Pitch and Roll were set as close as possible to the Granite Block, deviations noted in Element Table.
- Several reference marks in the form of Sokkia adhesive targets were placed atop the pilot house main mast as requested for future use by ship personnel.

3-D Coordinate Measurement Equipment

Temporary "benchmarks" or reference points were placed throughout the vessel as required to allow for re-locating the instrument to a new position or "Station" and tie all of the data to the common coordinate system for comparison.

The measuring system used for this final inspection report is one of several owned by The IMTEC Group, Ltd. The NET 1200 total station, S/N 110350 was calibrated, traceable to N.I.S.T. and in accordance with A.N.S.I. Z-540-1, at the Sokkia USA Factory Service Center February 26, 2021.

Vessel Coordinate System see Figures 1 and 2

X Axis is positive forward
Y Axis is positive to starboard
Z Axis is positive down

Roll is positive starboard side down/ port side up
Pitch is positive with forward side (bow) up/ aft side down
Heading is positive with forward side to starboard, negative with forward side to port.

FIGURE 1

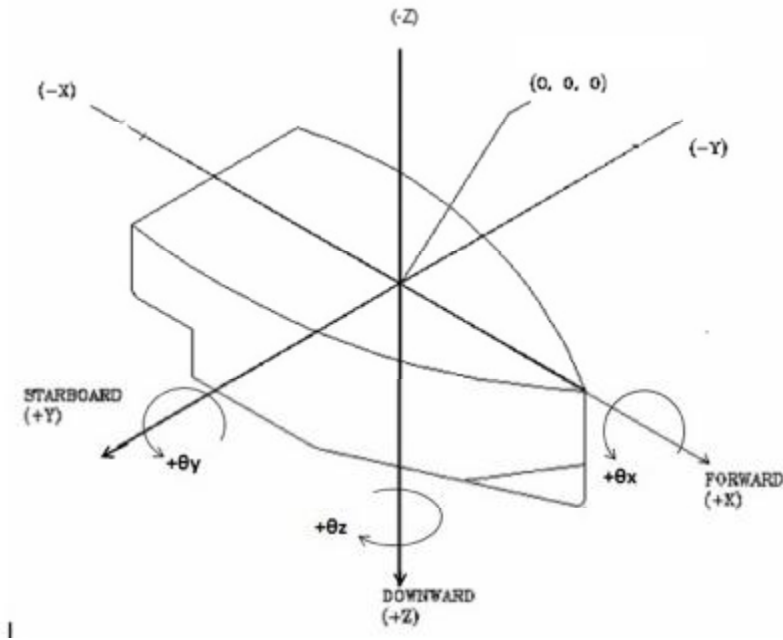
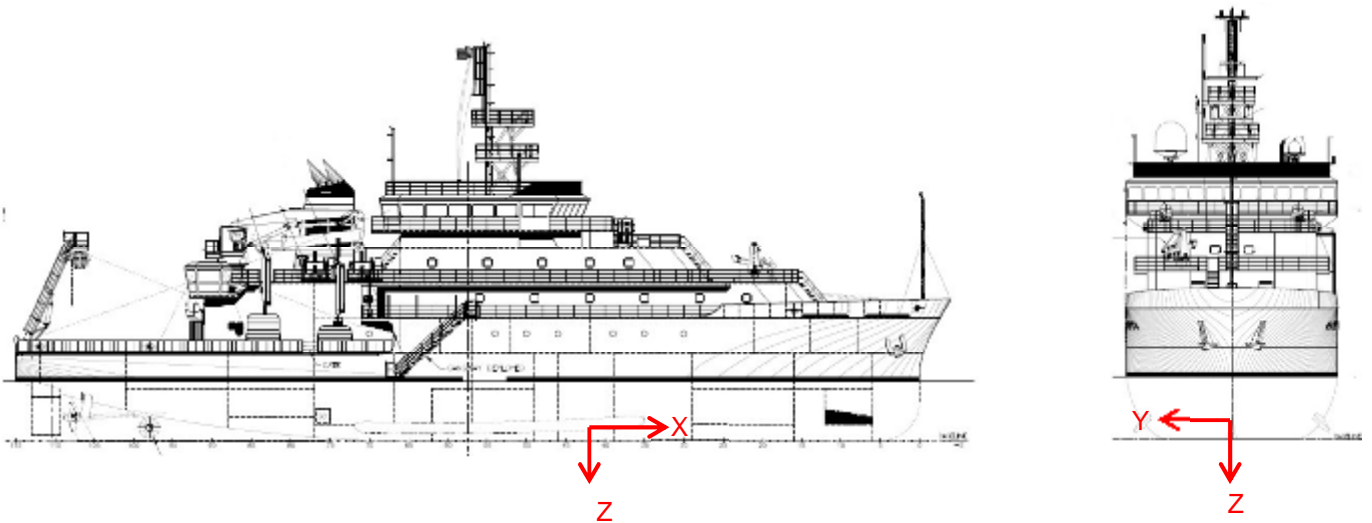


FIGURE 2



FIGURES 3 – REFERENCE BLOCK (X, Y, Z ORIGIN)

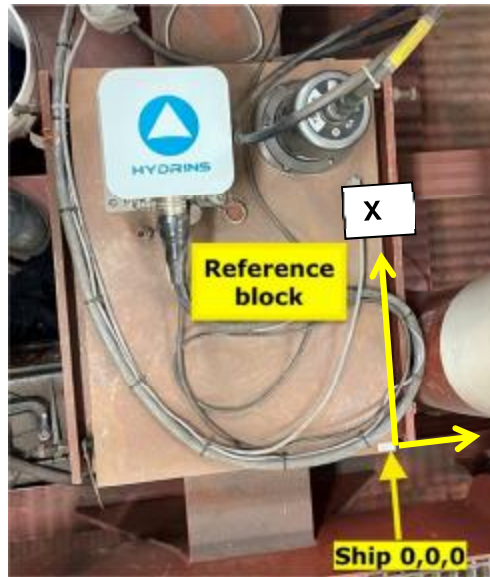


FIGURE 4-HULL FEATURES

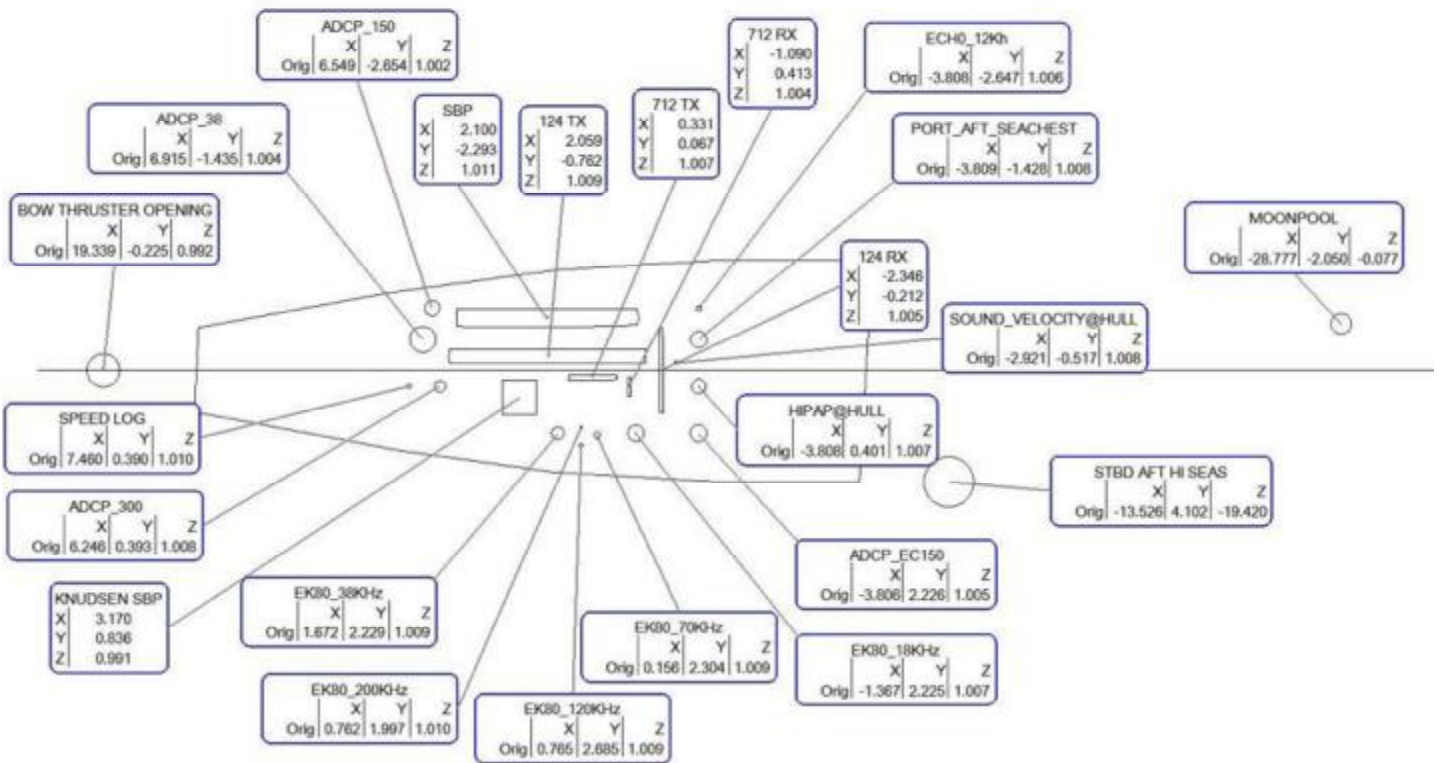


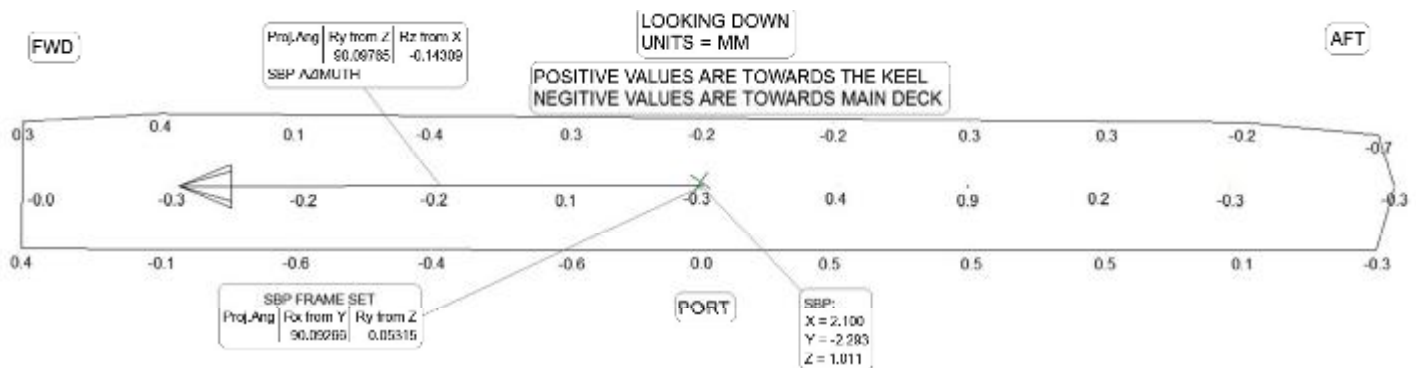
TABLE 1 R/V SALLY RIDE ELEMENT COORDINATE SUMMARY MAY 2021			
ELEMENT	COORDINATE (METERS)		
	X+ Fwd	Y+ Stbd	Z+ Down
GRANITE BLOCK	3.490	-0.233	-0.054
REF BLOCK STBD AFT	0.000	0.000	0.000
REF BLOCK PORT AFT	0.000	-0.458	0.001
REF BLOCK PORT FWD	0.610	-0.459	0.001
REF BLOCK STBD FWD	0.610	0.001	0.001
REF BLOCK CENTER	0.304	-0.229	0.000
IMU	NOT INSTALLED		
SBP29 @ Array	2.100	-2.293	1.011
124TX @ Array	2.059	-0.762	1.009
124RX @ Array	-2.346	-0.212	1.005
712TX @ Array	0.331	0.067	1.007
712RX @ Array	-1.090	0.413	1.004
HIPAP 501 retracted position	-3.808	0.401	1.007
HiPAP 501 deployed position			
Echo 12 KHZ	-3.808	-2.647	1.006
PORT I/B SEACHEST (Spare)	-3.809	-1.428	1.008
PORT SEACHEST	-21.270	-6.592	-1.022
STBD SEACHEST	-20.853	6.312	-0.948
STBD O/B SEACHEST	21.330	1.464	0.058
Bowthruster	19.339	-0.225	0.992
INCUBATOR PUMP	17.774	1.164	-3.136
O/B UNCONT SEAWATER PUMP 1	16.625	1.987	-3.145
I/B UNCONT SEAWATER PUMP 2	16.631	1.568	-3.145
Ship ops echosounder	Hull, covered by keel block		
Ship ops speed log	7.460	0.390	1.010
ADCP EC150	-3.806	2.226	1.005
EK80 18 KHZ	-1.367	2.225	1.007
EK80 70 KHZ	0.156	2.304	1.009
EK80 200 KHZ	0.762	1.997	1.010
EK80 120 KHZ	0.765	2.685	1.009
EK80 38 KHZ	1.672	2.229	1.009
Knudsen SBP	3.170	0.836	0.991
300 KHZ ADCP	6.246	0.393	1.008
38 KHZ ADCP	6.915	-1.435	1.004
150 KHZ ADCP	6.549	-2.654	1.002
BRIDGE FATHOMETER	3.195	-3.367	1.008
PORT CAMERA	-2.281	-2.479	1.065
STBD CAMERA	-2.280	2.051	1.063
Valeport Thru-hull SVS retracted position	-2.921	-0.517	1.008
Valeport Thru-hull SVS deployed position	At Hull penetration Could not operate		
^{Rev-1} MRU - Hvdmins (@ Phase Center)	0.490	-0.328	-0.087
^{Rev-1} MRU - SEATEX 5+ (@ Phase Ctr)	0.511	-0.111	-0.017
MRU MARKEY WINCH	-22.460	3.471	-9.127
Sea-Bird hull temperature sensor	-2.973	-0.112	0.909
BGM-3 sensor	0.821	1.944	-3.411
MOONPOOL	-28.777	-2.051	-0.077
MOONPOOL ON AFT DECK	-28.762	-2.047	-5.768

TABLE 1 R/V SALLY RIDE ELEMENT COORDINATE SUMMARY CONT			
ELEMENT	COORDINATE (METERS)		
	X+ Fwd	Y+ Stbd	Z+ Down
STBD FWD A FRAME BOLT	-41.787	3.822	-5.857
PORT FWD A FRAME BOLT	-41.782	-4.270	-5.850
PORT AFT A FRAME BOLT	-44.367	-3.395	-5.853
STBD AFT A FRAME BOLT	-44.370	2.941	-5.863
MET uncontaminated seawater output	-16.682	-1.140	-7.747
MAIN LAB MRU ^{Rev-1} (@ Phase Ctr)	-16.630	-0.567	-7.675
FWD CRANE DOOR CTR	-19.942	3.510	-5.759
AFT CRANE DOOR CTR	-25.412	3.433	-5.750
PORT BIGEYE CTR	4.725	-5.089	-13.970
STBD BIGEYE CTR	4.728	4.655	-13.961
Ship ops Sperry gyro 1	-4.949	-0.494	-14.534
Ship ops Sperry gyro 2	-4.949	0.058	-14.533
IBS DGPS #1	No access or not installed		
IBS DGPS #2	No access or not installed		
DP SPOTBEAM	No access or not installed		
DP IALA	-7.613	5.649	-19.373
DP DGPS	No access or not installed		
PORT DGPS	-3.711	-7.087	-19.282
STBD DGPS	-5.326	6.606	-21.819
Hemisphere GPS	-30.976	4.594	-13.156
^{Rev-1} Seapath Novatel. fwd (@ Phase Ctr)	-4.201	-7.036	-21.379
^{Rev-1} Seapath Novatel. aft (@ Phase Ctr)	-6.701	-7.059	-21.406
Trimble BD982 antenna, fwd	-4.533	6.636	-21.339
Trimble BD982 antenna, aft	-6.278	6.644	-21.342
End Run Sonoma n12 GPS antenna	-15.713	3.916	-19.183
STS Shakespeare 5237-XT cellular antenna	-11.753	1.070	-19.573
white antenna 1 FWD	-11.460	1.415	-19.484
white antenna 2 AFT	-11.922	1.491	-19.484
WaMoS Rutter radar antenna	-1.517	1.958	-20.351
STS FA-30 Shakespeare 5396-AIS	-6.935	-1.768	-24.260
Ship ops X-band radar	-4.245	-0.219	-22.349
Ship ops S-band radar	-5.017	-0.237	-24.618
MET radiometer platform	25.768	-0.277	-18.084
MET aspirator/sensor area			
FWD Port HiSEAS NET	-3.770	-2.924	-18.724
AFT STBD HiSEAS NET	-13.526	4.102	-19.420
STBD AFT SAILOR ANTENNA	-10.325	5.590	-19.208
PORT FWD SAILOR ANTENNA	-3.222	-7.030	-20.290
ADCOCK ANTENNA	-0.830	0.089	-19.875
PORT ANTENNA MOUNT/STAND	-6.361	-4.695	-19.543
BM AFT PORT	-41.249	-6.628	-5.777
BM AFT CTR	-41.247	-0.224	-5.781
BM AFT STBD	-41.244	6.177	-5.777
BM MID STBD	-27.871	6.173	-5.762
F'CSLE DECK BM	15.068	-0.233	-11.201
FWD DECK BM	25.097	-0.215	-8.463
MAIN MAST BASE	-7.892	-0.214	-18.066
PORT LIGHT BASE	-5.482	-6.827	-18.052
PORT LIGHT TOP	-5.443	-6.873	-21.170
STBD LIGHT BASE	-5.469	6.404	-18.049
STBD LIGHT TOP	-5.414	6.447	-21.150
AFT MAST BASE	-15.149	2.000	-18.035

All transducers are reported at the ducer face or the hull penetration, whichever was present at time of survey

TABLE 2-R/V SALLY RIDE PITCH, ROLL AND HEADING SUMMARY MAY 2021			
ELEMENT	INCLINATION		HEADING
	Pitch	Roll	Azimuth
GRANITE BLOCK	0.03091	0.07007	-0.13221
REF BLOCK STBD AFT	0.03190	-0.05012	0.08083
SBP29 @ Array	0.05315	0.09266	-0.06438
124TX @ Array	0.01464	-0.05843	0.04905
124RX @ Array	-0.07127	0.02768	0.00828
712TX @ Array	-0.11892	0.24866	0.10896
712RX @ Array	-0.23292	0.05495	0.00885
Ship ops speed log	0.28408	0.53964	0.09590
ADCP EC150	0.04624	-0.40108	0.51098
EK80 18 KHZ	0.05236	0.23237	
EK80 70 KHZ	-0.22568	-0.17103	0.38003
EK80 200 KHZ	-0.75351	-0.44612	0.58793
EK80 120 KHZ	0.28062	-0.31144	-1.03039
EK80 38 KHZ	0.29226	-0.17432	
Knudsen SBP	-0.02721	0.06409	-0.23317
300 KHZ ADCP	0.15342	0.16436	
38 KHZ ADCP	-0.19460	0.37551	
150 KHZ ADCP	-0.06102	-0.41174	
MRU - Hydrins (On Ref Block)	-0.07201	-0.09964	-0.00539
MRU - SEATEX 5+ (On Ref Block)	-0.27193	0.07645	0.09571
MRU MARKEY WINCH	-0.28792	-0.41872	0.56455
MRU - SEAPATH Seatex 5+ (lab)	0.08245	0.08513	-0.12474

FIGURE 5- SBP FRAME FLATNESS AS INSTALLED



Measurement Precision and Uncertainty

Uncertainties are reported to be:

Point to Point, any element or target within the vessel survey to another element or feature in the survey.

X, Y, & Z \pm 2.0 mm

Region to Region, i.e., Reference block 02 level antennas and Reference Block to gondola features:

X \pm 4.0 mm

Y \pm 4.0mm

Z \pm 4.0 mm

The expected angular precision is analyzed to be:

Azimuth: $\leq 00^{\circ} 00' 30''$

Pitch: $\leq 00^{\circ} 01' 00''$

Roll: $\leq 00^{\circ} 01' 00''$

Figure 6 – Antenna and Mast Features

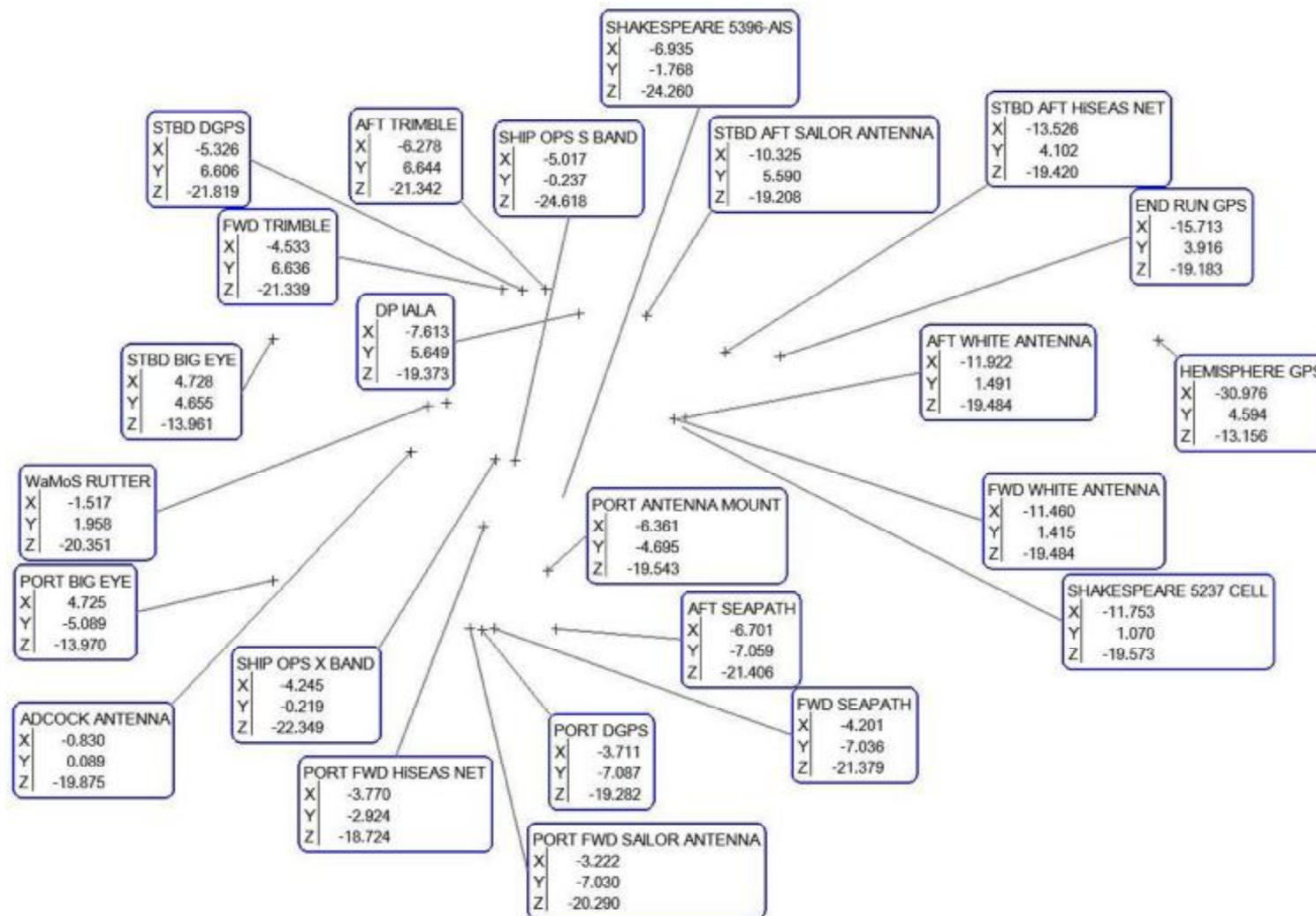


TABLE 6- IMAGES OF ELEMENTS SURVEYED

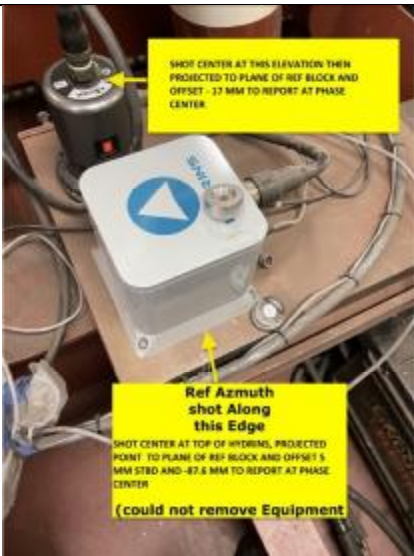





		
<p>REF BLOCK & HYDRNS</p>	<p>MAIN LAB MRU</p>	<p>MAIN LAB SEAWATER OUTPUT</p>
		
<p>MARKET WINCH MRU</p>	<p>HULL TEMP SENSOR</p>	<p>SPERRY GYRO</p>

TABLE 6 CONTINUED







 <p>CAMERAS</p>	 <p>ADCOCK</p>	 <p>AFT STBD HISEAS</p>
 <p>AFT STBD SAILOR</p>	 <p>DP IALA</p>	 <p>END RUN</p>

TABLE 6 – CONTINUED






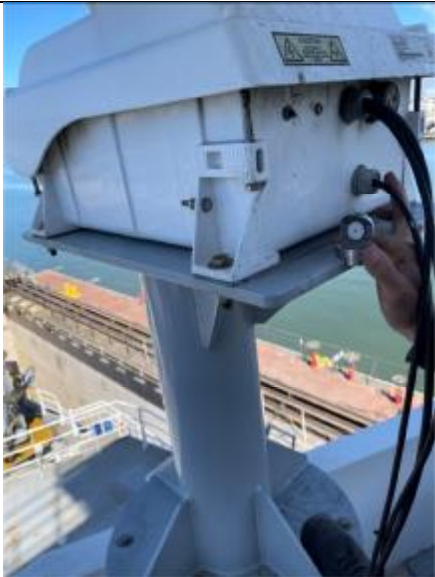
 <p>Top center shot and reported</p>	 <p>Shot and reported here</p>	 <p>Shot and reported here</p>
<p>FWD MAST</p>	<p>HEMISPHERE GPS</p>	<p>PORT DGPS</p>
 <p>Shot and reported here</p>	 <p>Reported center here</p> <p>Rotated to make circle</p>	
<p>PORT FWD SAILOR</p>	<p>RUDDER AND BASE</p>	<p>RUDDER BASE</p>

TABLE 6- CONTINUED







 <p>Center reported here</p> <p>Rotated to make circle</p>		 <p>Shot at this elevation, Offset - 65mm to report at phase center</p>
<p>S BAND</p>	<p>SBAND BASE</p>	<p>SEAPATH</p>
 <p>Shot and reported here</p>	 <p>Shot and reported here</p>	 <p>FWD/AFT SHOT HERE, ELEV OFFSET 0.0885M TO REPORT AT PHASE CENTER</p>
<p>SHAKESPERE 5237 & TWO WHITE</p>	<p>STBD DGPS</p>	<p>TRIMBLE</p>

TABLE 6- CONTINUED





X BAND



X BAND BASE



SEAWATER PUMPS

	
CERTIFICATE OF CALIBRATION	
MODEL: NET1200	
MANUFACTURER: Sokkia	
SERIAL NO.: 110350 CERTIFICATE NO.: CL168859	
<p>This certifies that the above referenced instrument has been inspected and calibrated by the Topcon Sokkia Service Department. At the time of the completion of this service, Topcon Sokkia certifies that the above stated instrument meets or exceeds all factory specifications and tolerances for instrument parameters and performance of this instrument model. This certification is valid for a 12-month period from the calibration date shown below.</p>	
<p>All distance measurement parameters were tested and adjusted using factory calibration jigs and with the 10 Meter Calibration Rail whose accuracy is traceable to the National Institute of Standards and Technology (NIST) via Mutual Recognition Agreement. All angle measurement parameters were tested with a NIST traceable optical collimation system, using accepted collimation and adjustment procedures. The quality system addresses and conforms to ANSI/NCSL Z540-1 and ISO/IEC 17025-2005 (and, as a result ISO 9001 or ISO 9002). See individual sets of data for temperature and pressure.</p>	
<i>This certificate shall not be reproduced without the written approval of Topcon Sokkia.</i>	
CUSTOMER NAME: IMTEC GROUP LTD (sf)-INDEPENDENCE	
CUSTOMER ADDRESS: 17533 E 36th Street CT 5	
CUSTOMER CITY/STATE/ZIP: INDEPENDENCE, MO 64055	
DATE CALIBRATED: 2021/02/26	DATE RECALIBRATION DUE: 2022/02/26
SIGNED: <u>Larry W. Lipton</u>	DATE: <u>2/26/2021</u>
TITLE <u>Service Technician</u>	
YES NO	
<input type="checkbox"/> <input checked="" type="checkbox"/>	Is this a new instrument?