

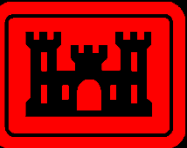
USACE Norfolk District S/V Adams II

Technical refresh



White Glove Delivery

Norbit WBMS Hull Mount



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Original Hull Mounted System, Reson 8101



RESON SeaBat 8101
installation on Survey
Vessel Adams II
(Norfolk District)

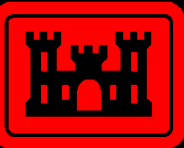
RESON SeaBat 8101 with
fabricated for-and-aft conical
fairings



*From Hypack Training slide



The ADAMS II: launched in 1997 with a Reson 8101 hull mounted on the keel of the vessel. Upgraded to 7101 in 2012. Retired with Norbit WBMS in 2016.



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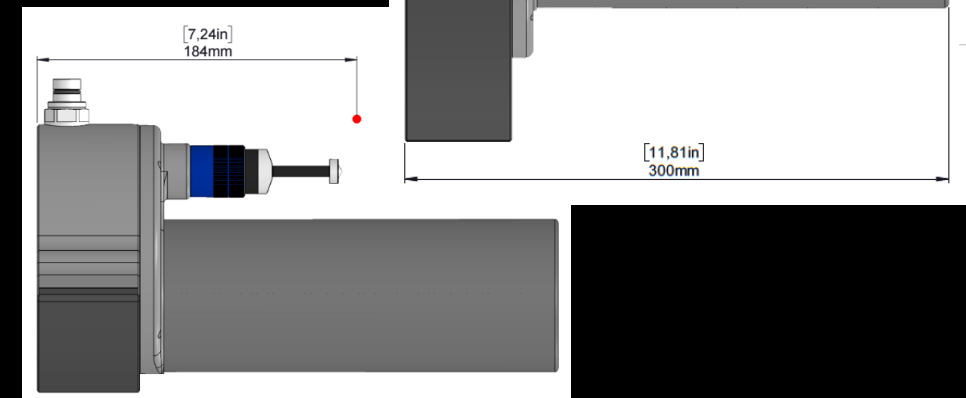
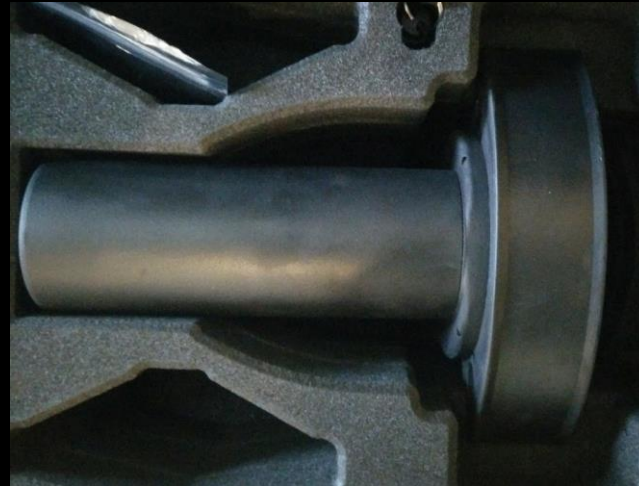
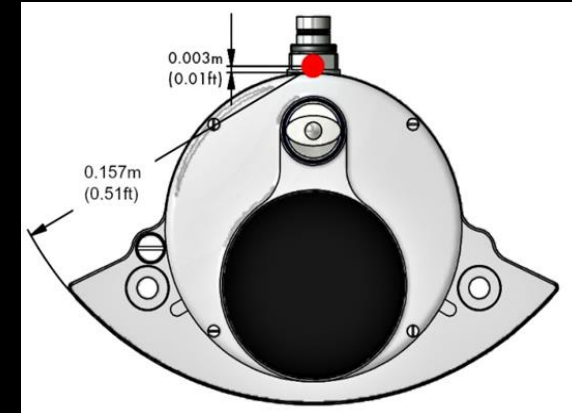


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Reson Replacement – Norbit WBMS w/1° Tx

Norbit WBMS Features

- Curved receiver array
- Titanium corrosion free housing
- Small beam angles:
 - 200kHz 1.8° X 1.9°
 - 400kHz 0.90° x 0.95°
 - 550kHz 0.65° x 0.69°
 - 700kHz 0.51° x 0.54°
- Swath width anywhere, any size within 210°
- Native FM with 80kHz bandwidth
- Integrated AML SV Xchange probe
- Single thru hull cable
- Compact topside
- Anti fouling paint factory applied
- Safe transit speed: max 30knts

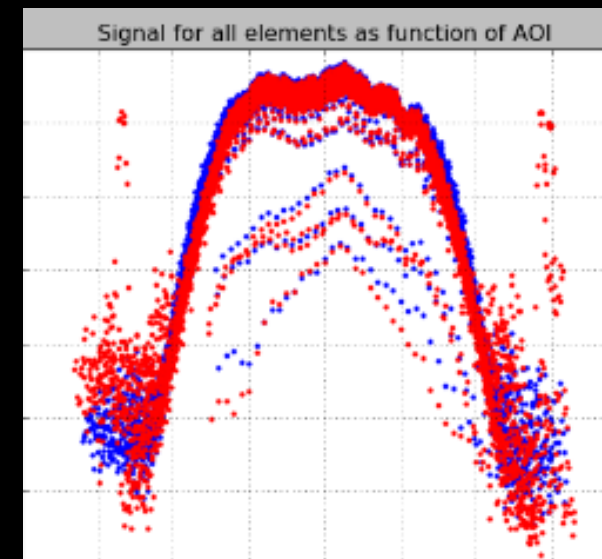


Antifouling Paint Testing

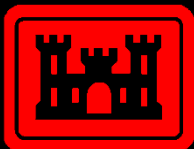
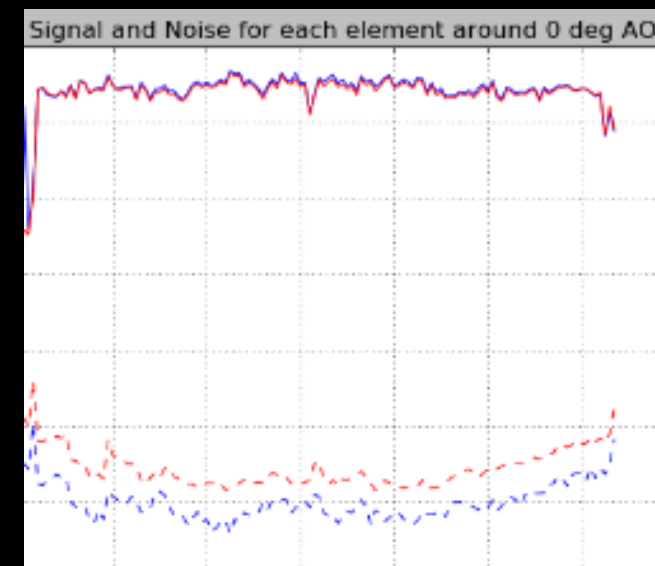
Significant antifouling paint testing @ Norbit - no performance loss.

Graphs show signal for all elements, blue before paint and red after paint.

Antifouling paint improves long term performance by inhibiting marine growth, reduces time between haul outs



Titanium WBMS prior to painting



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Fairing Construction

Radius of Norbit WBMS matches that of retired Reson 7101.

Seahorse Geomatics utilized design engineering team at Norbit to modify the existing 7101 fairing to fit the WBMS.

Modifications included the following

- Joining the two aft fairings into one
- Filling in the upper section of the center mounting bracket between the sonar and the hull
- Enlarging the holes in the forward fairing allowing better water flow over the SV sensor.

Fabrication and modification carried out by Dishman Fabrications of Yorktown Virginia. This group is highly recommended for any such work.

Seahorse personnel painted the fairing pieces with marine antifoul paint.

Original Fairing



Modified and freshly painted fairing



Norbit WBMS Mounting

Single cable connection for power, bathymetry and surface sound speed data.

The small size of the WBMS allows it to be securely attached to the vessel with two stainless steel bolts.

5200 was applied around the sonar to smooth out any potential cavitation points in the fairing as well as to reduce gaps to aid in water flow.



Removal of Orphaned Cables

Over the years many system have come and gone aboard the Adams II. Many of the cables have not, creating a rats-nest.

Seahorse Geomatics removed over 500 linear feet of unused cable. More than 10 separate unused cables were removed from the roof alone.



A tidy cable tray with only needed cables.

Just starting to remove the cables



IMU Mounting

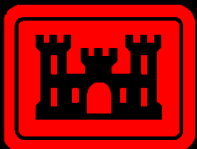
IMU previously mounted to wood held up by thin metal struts.

IMU mounting area thoroughly cleaned and prepped prior to installation

Seahorse Geomatics and Dishman Fabrication designed new mounting plate utilizing 3/8th aluminum allowing the IMU to sit over the top of the singlebeam which is located less than 2ft from multibeam sonar.



Seahorse personnel diligently prepping the IMU mounting



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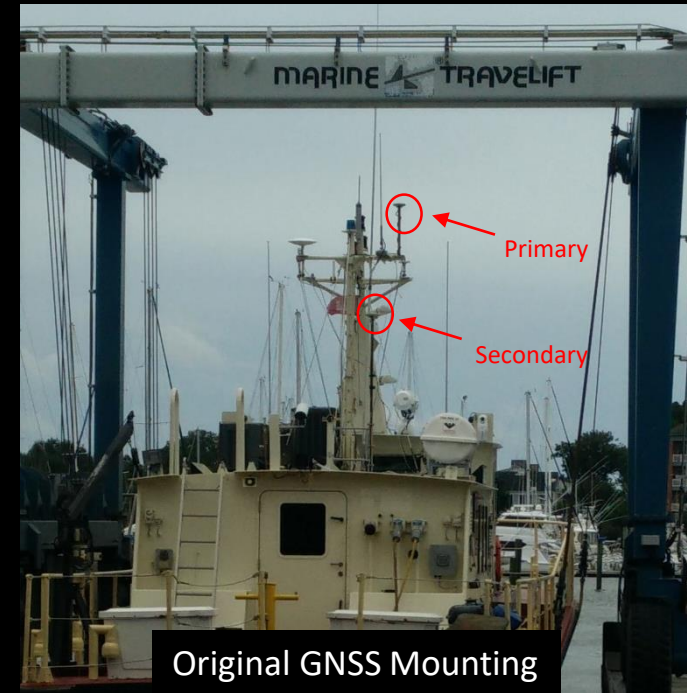
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Applanix GNSS Antenna Mounting

Two problems that were identified for the original GNSS antenna mounting.

- 1) The antennas were vertically separated by more than a meter
- 1) The aft antenna was mounted on a two meter rod and not ridged with respect to the forward antenna and IMU.

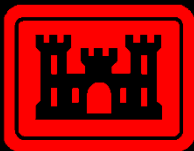
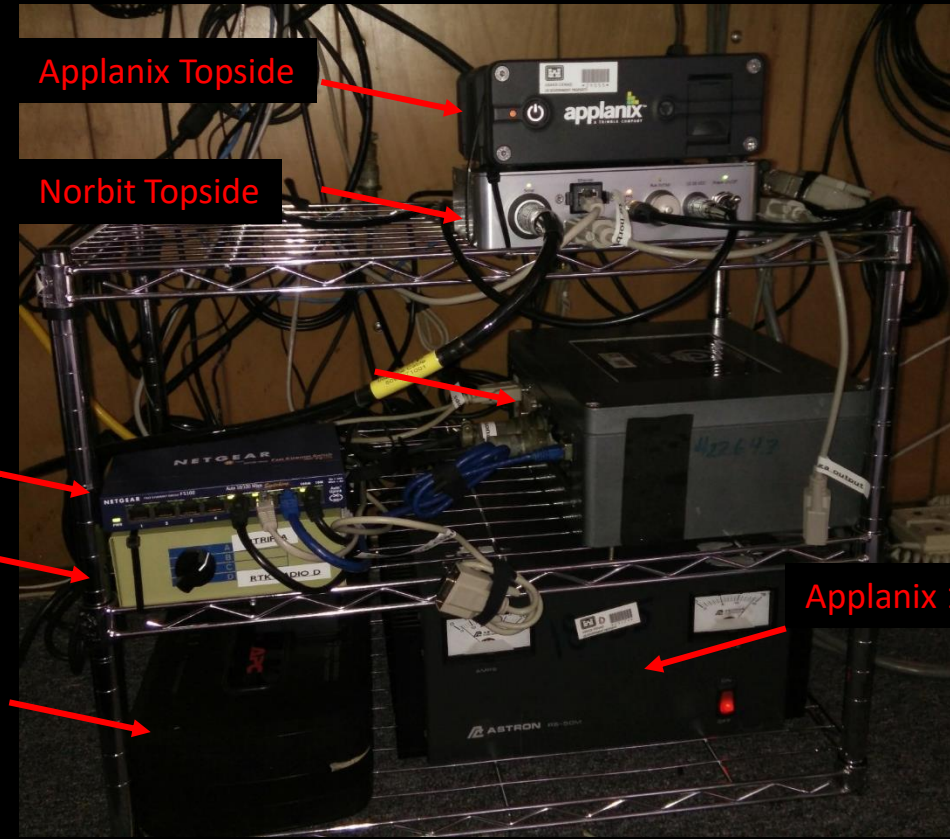
Seahorse designed an antenna mount addressing these problems. The new antenna mount was secured to the two masts on the vessel and raised the antennas above any obstructions that may interfere with GNSS reception.



Survey Station – Equipment Rack

Removal of large Reson topside allowed for significant space savings.
Both the Norbit topside and the Applanix topside occupy less than a quarter of the shelf space.

All system are connected through a network switch with a single network connected to the acquisition PC.



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Survey Computer

The Norbit WBMS requires minimal computer processing during acquisition. However Hypack 2016a has a better processing experiences when more RAM and a faster processor is available on the computer.

To fill the role of both acquisition and processing , a Lenovo P70 was chosen. The computer allows the Norfolk district to seamlessly switch between acquisition and processing, decreasing the time to deliverables.



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Survey Station – Computer Station

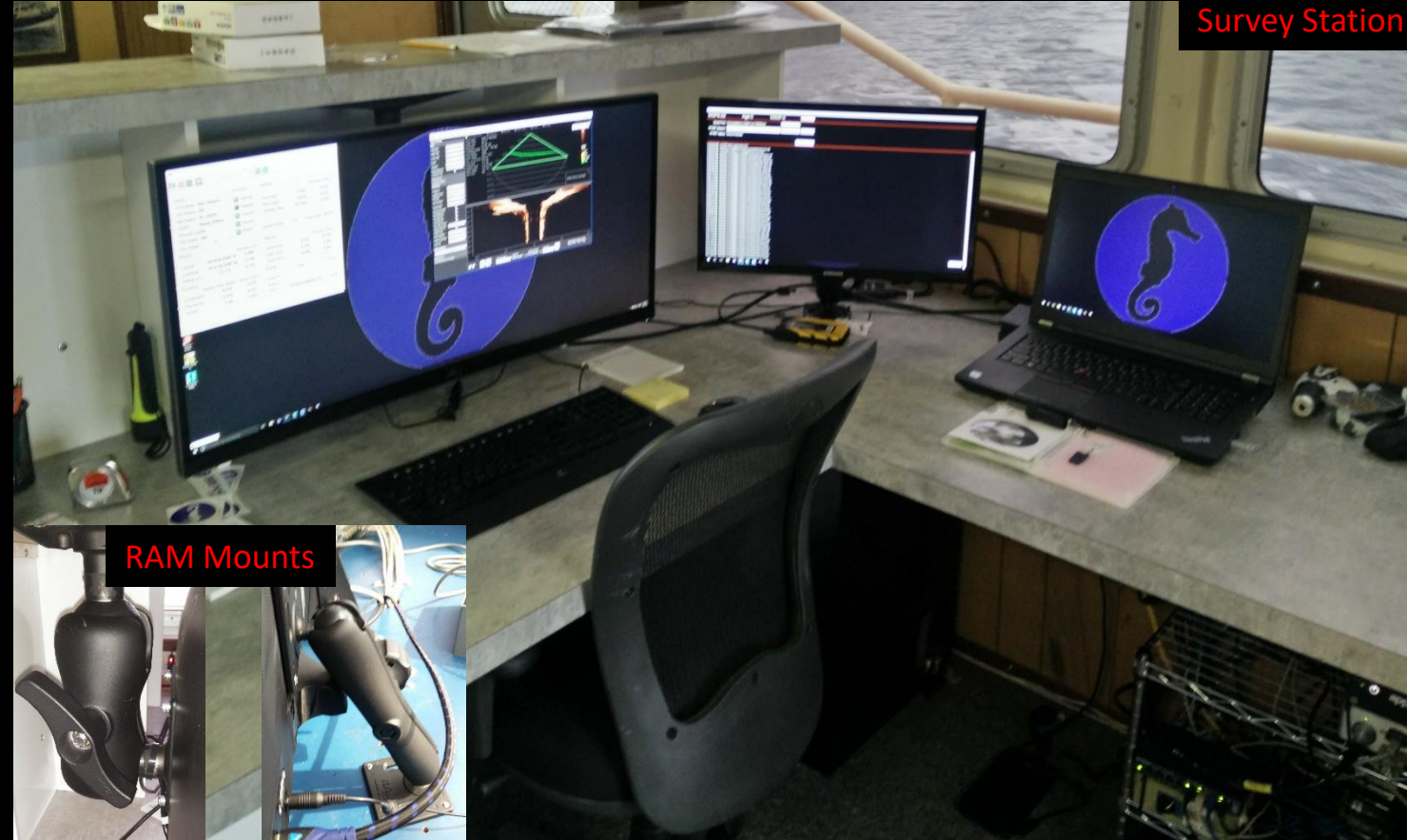
Laptop secured to docking station for fast removal.

New displays were added to the survey station and the wheel house.

- Dell 34" curved monitor
- Three Samsung 22" monitors (two for helm)

Operators have the option to use the laptop screen as a 3rd display or close it, using the 2 main displays.

The displays are secured to the vessel using RAM, ball and socket, mounts. These mounts securely hold the screens in place yet still allows for minor adjustments. During heavy seas the screens remain in place allowing for a safer working environment.



Survey Systems Tool Bag

Finding the right tool or spare hardware can be a headache.

Seahorse provides a customized tool bag. Included are all needed tools and spare/backup parts that the crew of the Adams II may need for their survey systems.

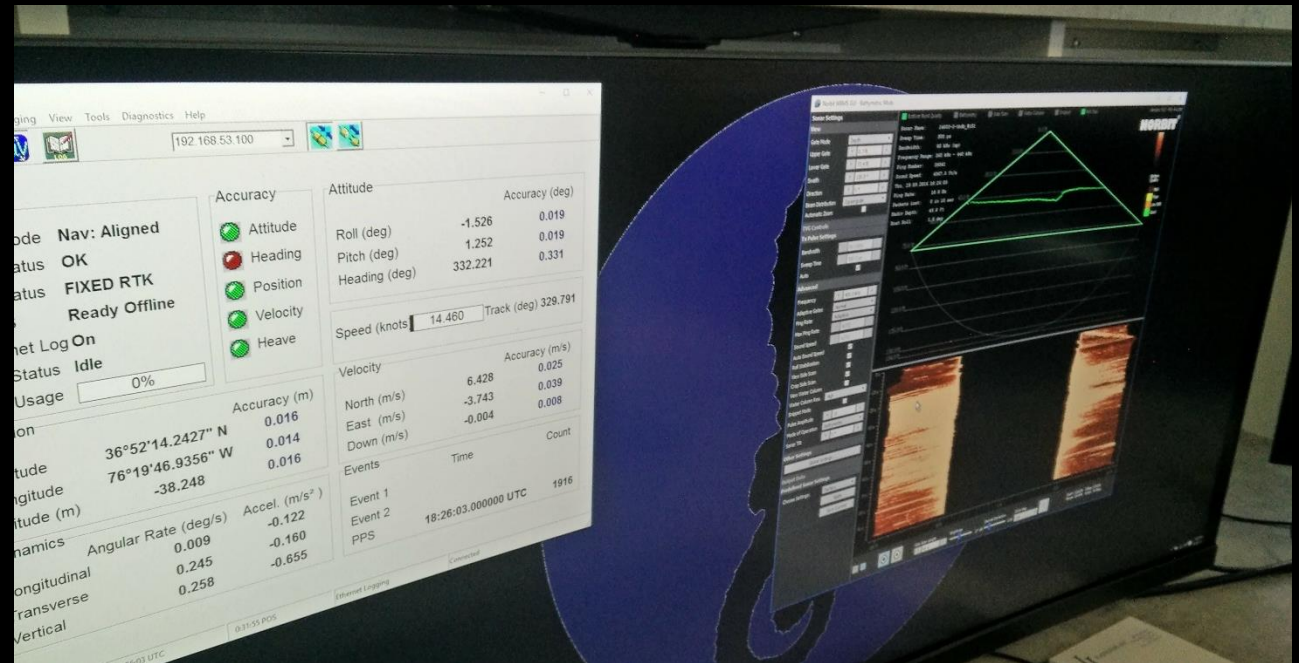


Performance – Speed Test

To determine the operating envelope of the WBMS onboard the Adams II a speed test was conducted. The test consisted of incrementally increasing the vessel speed and monitoring for 3 primary items.

- 1) Bathy data blowouts indicating that cavitation is occurring around the sonar.
- 2) Loss of outer beams indicating that bubble sweep down could be affecting the SNR of the outer beams.
- 3) Loss in surface SV readings indicating that bubbles are accumulating inside the fairing obstructing the SV sensor from proper measurements.

Speed test results indicated that there was no cavitation, bubble sweep down or loss of SV readings and therefore no speed limitation on vessel operations.



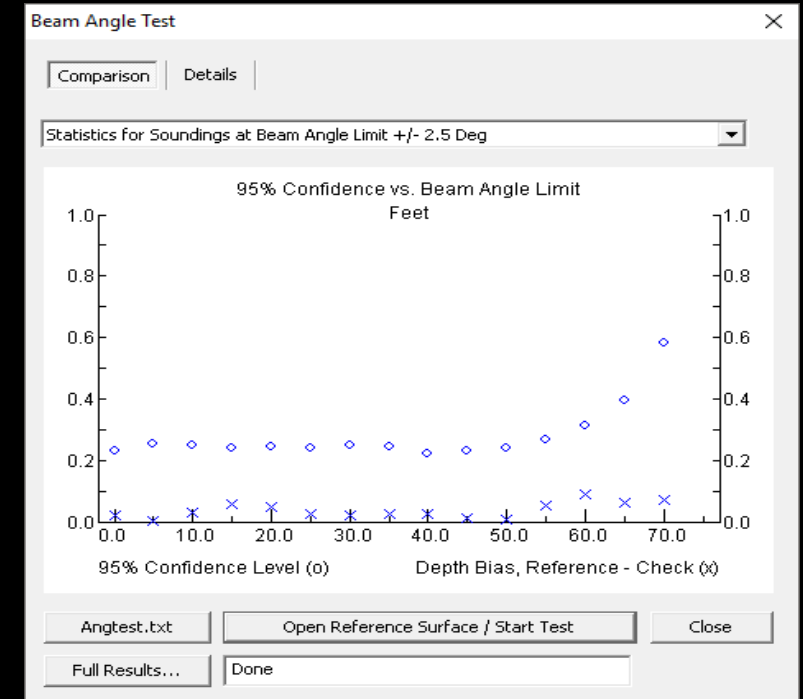
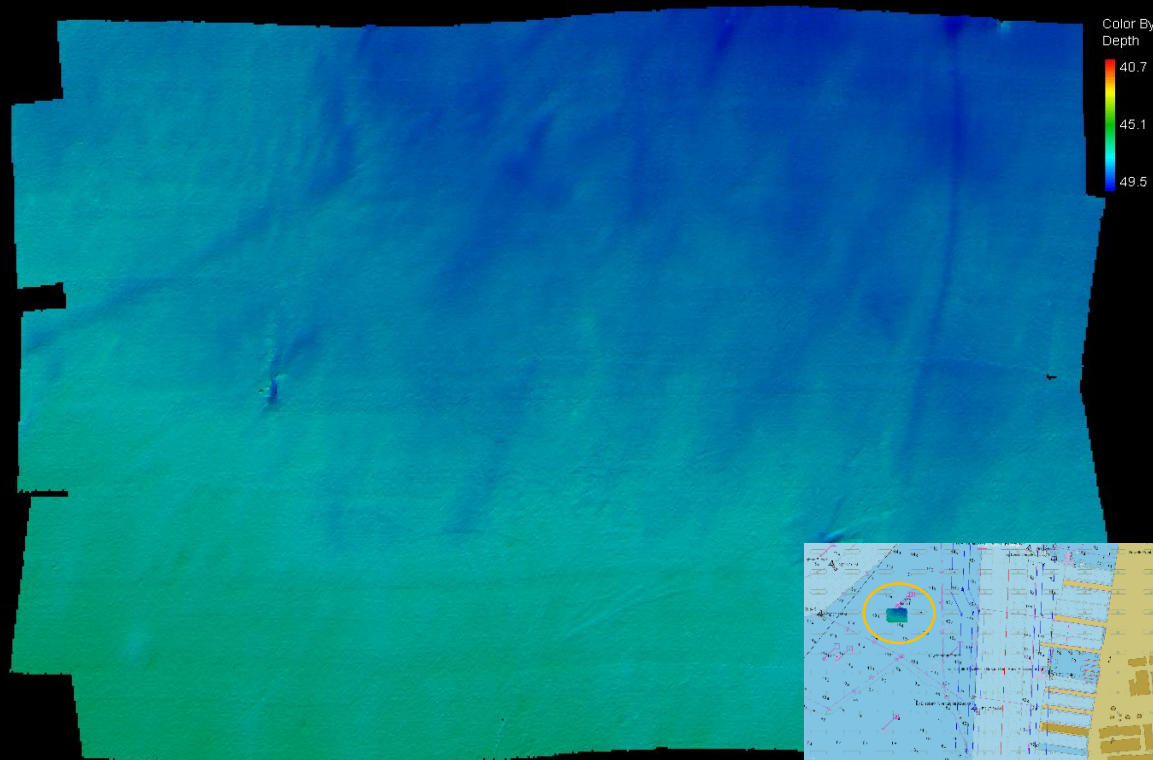
Surface Soundspeed vs Vessel Speed



Performance – Beam Angle Test 400kHz

To assess system performance a series of beam angle tests were conducted in approximately 50ft water depth.

System bias was <0.1ft and uncertainty at 95% confidence was <0.6ft allowing the USACE to utilize a 140° swath angle



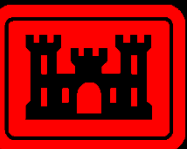
+/- Beam Angle Limit	Max Outlier	Mean Diff	Std Dev	95% Confidence
0	0.49	0.02	0.12	0.23 ***
5	0.46	0.00	0.13	0.25 ***
10	0.53	-0.03	0.13	0.25 ***
15	0.46	-0.06	0.12	0.24 ***
20	0.43	-0.05	0.12	0.24 ***
25	0.39	-0.03	0.12	0.24 ***
30	0.49	-0.02	0.13	0.25 ***
35	0.46	-0.03	0.12	0.24 ***
40	0.43	-0.02	0.11	0.22 ***
45	0.43	0.01	0.12	0.23 ***
50	0.49	0.01	0.12	0.24 ***
55	0.65	0.05	0.14	0.27 ***
60	0.92	0.09	0.16	0.31 ****
65	1.05	0.06	0.20	0.40 *****
70	1.97	-0.07	0.30	0.58 *****
75	0.00	0.00	0.00	0.00

Requirements for a Successful Hull Mount.

Proper preparation and planning are vital for a successful hull mount. There are many item that should be considered prior to commencing a hull mount

- Detailed vessel drawings
- Cable runs for a single sonar cable, GNSS antenna cables and IMU cable
- Thru hull for sonar cable
- Thorough understanding of vessel dynamics for sonar placement determination
- Ridged mounting for GNSS antennas and IMU
- Design and implementation of a hydrodynamic fairing allowing smooth water flow over the sonar

Seahorse Geomatics, partnering with Norbit and Dishman Fabrication provides professional, white glove services. From napkin conception through project completion, Seahorse Geomatics personnel assure a survey ready deliverable.



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