USCGC HEALY WAGB-20
Final Report
RD Instruments Inc. Ocean Surveyor 75 kHz
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This report outlines the tests performed, and the results of Harbor and Sea testing of the Ocean Surveyor ADCP 75 kHz. The testing was done in open ocean and Puget Sound region of Seattle Washington.

Dock Side Acceptance Tests For an Ocean Surveyor ADCP and WorkHorse Mariner ADCP

Introduction

The following checks should occur at Dock Side prior to performing the Sea Acceptance Tests. These tests will verify the Ocean Surveyor (OS) and WH Mariner (WHVM) ADCP is ready for the Sea Acceptance Tests and confirm the peripherals attached to the ADCP.

The following table will capture all basic system and installation specific information.

INFORMATION	DETAIL
Company Name	United States Coast Guard
Primary Contact	Dave Forcucci
Vessel Name	USCGC Healy, WAGB-20
Vessel Length	422 feet
Vessel Weight	20,000 tons
System Frequency	75kHz
System Serial Number	
Transducer Serial Number	
Transducer Cable Length	50 meters
Transducer Mounting Angle (Bow, 45 Starboard, 45 Port, etc.)	Midships, on the beam, 45° Starboard
AC Power Input (i.e. UPS, 110, 220, 50hz, 60hz)	UPS, 110 volts, 60Hz
Computer Type (i.e. P3 500mHz, Intel)	P4 Pentium
Operating System (i.e. 95, 98, NT)	Win2000
Comports available on Computer	1,3,4,5,6
Network Card	Yes
Hard Drive Space	40 Gbytes
RAM	256 Mbytes
RDI Programs Installed (i.e. VMDAS, DUMBTERM, etc.)	RDI tools, WinADCP, VMDAS

The following table lists items that are to be connected and verified.

CONNECTION VERIFICATION	INITIAL
ADCP Electronics Rack or Table mounted	
ADCP computer comport and baud rate	
ADCP Transducer Cable Resistance Check (required only if connectors have been attached on site)	
Heading Gyro Input RMS input confirmed (if available) Enter voltage _____	
Heading Gyro Input turns ratio (if available) Enter ratio _____	
ADCP Gyro Interface board configured (if required)	
Heading Gyro Connected to Rack Mount Electronics (if used)	
Tilt Gyro Input RMS input confirmed (if available) Enter voltage _____	
Tilt Gyro Connected to Rack Mount Electronics (if available)	
Navigation Interface Model	
Navigation String, Baud Rate, and Computer comport	
NMEA Heading Input Model (indicate if source is same as navigation interface)	
NMEA String, Baud Rate, and Computer comport	
NMEA Tilt Input Model (indicate if source is same as navigation or heading interface)	
NMEA String, Baud Rate, and Computer comport	
ASCII Output requirement (indicate comport and baud rate)	
Speed Log Output requirement (indicate comport and baud rate)	
Other Miscellaneous Information	

Dock Side OS and WHVM ADCP Tests

The OS and WHVM ADCP interfaces directly to the computer and to external gyros. The following tests will confirm the connection of the ADCP Transducer.

Platform Testing Setup

The vessel should be tied to the dock or at anchor. The transducer should be in water. All other sonar devices and equipment should be turned off.

ADCP Testing Setup

The OS ADCP electronics chassis should be connected to the transducer, and AC Power connected to the electronics chassis. The WHVM deck box should be connected to the ADCP and AC Power connected to the deck box. The Gyro connection may or may not be connected at this point.

Computer Setup

The RDI DUMBTERM program should be running, communications port setting (F5) to match the connection to the PC and OS and WHVM ADCP baud rate requirements (default 9600,N,8,1).

The following sequence of commands sent should be sent after powering up the ADCP electronics chassis. These commands will wake up the ADCP (<BREAK>), initialize the ADCP (CR1), and save the initialization (CK).

<BREAK> press the end key
CR1
CK

The following command should be sent to test the receive circuitry of the ADCP. This test will confirm that the system is receiving any interference terms and if the 4 receive channels are responding equally.

PT3

The response from the ADCP should be similar to the following:

>PT3
Correlation Magnitude:

Lag	Bm1	Bm2	Bm3	Bm4
0	1.00	1.00	1.00	1.00
1	0.69	0.72	0.77	0.67
2	0.32	0.36	0.36	0.34
3	0.10	0.09	0.09	0.15
4	0.10	0.05	0.08	0.10
5	0.07	0.03	0.05	0.05
6	0.04	0.02	0.03	0.08
7	0.04	0.06	0.04	0.06

RSSI: 12 6 10 9

ACTUAL RESULTS FROM THE PT3 TEST:
>pt3
Correlation Magnitude:

Lag	Bm1	Bm2	Bm3	Bm4
0	1.00	1.00	1.00	1.00
1	0.87	0.89	0.81	0.82
2	0.57	0.63	0.42	0.45
3	0.26	0.34	0.15	0.15
4	0.06	0.16	0.07	0.06
5	0.12	0.21	0.05	0.05
6	0.23	0.31	0.01	0.04
7	0.30	0.41	0.02	0.02

RSSI: 58 73 52 55

The following command should be sent to test the receive bandwidth circuitry of the ADCP. This test will confirm that the system transducer is connected and if the 4 beams are responding equally.

PT6

The response from the ADCP should be similar to the following:

> PT6
Receive Bandwidth:
.....

Expected	Bm1	Bm2	Bm3	Bm4
3840	3922	3910	3824	3853

ACTUAL RESULTS FROM THE PT6 TEST
>pt6
Receive Bandwidth:
.....□ □□ □□ □ □ □□ □□ □ □ □□ □

Expected	Bm1	Bm2	Bm3	Bm4
7680	5437	4801	7207	7245

Dock Side ADCP Test Results Sheet

Fill in the table below based on the Dock Side ADCP tests run.

TEST	RESULT PASS/FAIL
PA Test Passes	**>pa** **RAM test.....PASS** **ROM test.....PASS**
PT3 Test correlation values at lag 5 and greater are less than 0.50	**FAIL**
PT6 Test received bandwidth for each beam is within +/- 20% of the expected bandwidth	**FAIL**

Dock Side Peripheral Tests

The ADCP requires (at minimum) input for heading (true north) and for position fixes (GPS). Additionally, the ADCP can make use of pitch and roll data to correct for the tilt.

Heading can be input directly to the OS electronics chassis or the WHVM deck box from an external synchro gyro or stepper gyro. Heading can also (or instead of) be input and combined with the ADCP data in the computer software VMDAS. This heading input is done through the communications port of the computer with the NMEA 0183 string $HDT and $HDG.

If the gyro connection is used for the heading input then the Gyro Interface Board must be first configured to match the platform's gyro output. Follow the instructions in the OS or WH Mariner Technical Manual on how to setup the Gyro Interface Board.

Pitch and Roll data can be input directly to the OS electronics chassis or the WHVM deck box through an external synchro gyro. Pitch and Roll can also (or instead of) be input and combined with the ADCP data in the computer software VMDAS. This heading input is done through the communications port of the computer with the RDI proprietary NMEA string $PRDID.

If the gyro connection is used for the tilt input then the Gyro Interface Board must be first configured to match the platform's gyro output. Follow the instructions in the OS or WH Mariner Technical Manual on how to setup the Gyro Interface Board.

Navigation data can only be input combined with the ADCP data in the computer software VMDAS. This navigation input is done through the communications port of the computer with the NMEA proprietary strings $GGA and $VTG.

Platform Testing Setup

The Gyro, Navigation, and Pitch/Roll sensors should be attached to the appropriate place on either the OS electronics chassis, the WHVM deck box or the computer communication port. The devices should be on and should be stable (in the case of gyros this may require a spin up time of up to 12 hours).

ADCP Testing Setup

The OS ADCP electronics chassis should be connected to the transducer, and AC Power connected to the electronics chassis. The WHVM deck box should be connected to the ADCP and AC Power connected to the deck box. The Gyro connection may or may not be connected at this point.

Computer Setup 1 Testing Gyro Connections Directly to the ADCP

The RDI DUMBTERM program should be running, communications port setting (F5) to match the connection to the PC and ADCP baud rate requirements (default 9600,N,8,1).

The following sequence of commands sent should be sent after powering up the ADCP electronics chassis. These commands will wake up the ADCP (<BREAK>), initialize the ADCP (CR1), and save the initialization (CK).

<BREAK> press the end key
CR1
CK

Sensor Confirmation OS or WHVM ADCP

The following command should be sent to test the gyro input to the OS electronics chassis.

PC2

The response from the ADCP should be as follows:

```
>PC2
Heading    Pitch     Roll      Temperature
 (ext)      (ext)    (ext)      cts     degs
 000.0     +00.0     +00.0     243E     23.9
```

*Note the Heading, Pitch, Roll information displayed when testing the WHVM ADCP will be the internal sensors of the ADCP. To test the external gyro heading, pitch, roll of the WHVM ADCP view the LCD display on the front of the deck box and confirm the proper heading, pitch, and roll information is displayed.

ACTUAL RESULTS FROM THE PC2 TEST

>pc2

Heading (int)	Pitch (int)	Roll (int)	Temperature cts	degs				
000.0	+00.0	+00.0	0A19	09.4	000.0	+00.0	+00.0	0A01

Computer Setup 2 Testing Navigation Connections to the Computer

The RDI DUMBTERM program should be running, communications port setting (F5) to match the connection to the PC and the Navigation Devices baud rate requirements. Confirm that the Navigation Device NMEA string is viewable and the $GGA string is present.

ACTUAL RESULTS FROM THE GPS PORT TEST

```
>$GPGGA,145358.648,4733.6583,N,12232.0941,W,1,06,1.3,019.2,M,017.5,M,,*70
$GPGGA,145359.648,4733.6583,N,12232.0939,W,1,06,1.3,019.0,M,017.5,M,,*7C
$GPGGA,145400.648,4733.6583,N,12232.0939,W,1,06,1.3,019.0,M,017.5,M,,*77
$GPGGA,145401.648,4733.6583,N,12232.0939,W,1,06,1.3,018.9,M,017.5,M,,*7E
$GPGGA,145402.648,4733.6583,N,12232.0939,W,1,06,1.3,018.9,M,017.5,M,,*7D
```

Computer Setup 3 Testing Heading Connections to the Computer

The RDI DUMBTERM program should be running, communications port setting (F5) to match the connection to the PC and the Navigation Devices baud rate requirements. Confirm that the Navigation Device NMEA string is viewable and the $HDG string is present. Note, that the data for this information may appear on the same communications port as the navigation data or on a separate input port.

NOTE: Heading for the Healy is sent to the Deckbox via syncro interface. This test is not applicable

Computer Setup 4 Testing Heading Connections to the Computer

The RDI DUMBTERM program should be running, communications port setting (F5) to match the connection to the PC and the Navigation Devices baud rate requirements. Confirm that the Navigation Device NMEA string is viewable and the $PRDID string is present. Note, that the data for this information may appear on the same communications port as the navigation data or on a separate input port.

NOTE: Heading for the Healy is sent to the Deckbox via syncro interface. This test is not applicable

Dock Side Peripheral Tests Results Sheet

Fill in the table below based on the Dock Side peripheral tests run.

TEST TYPE	TEST CRITERION	RESULT PASS/FAIL
External Gyro Connection Test	Verify that the Gyro inputs for Heading, Pitch and Roll (if included) are reasonable for the platform's attitude. The Temperature reading should match the expected water temperature at the transducer.	**PASS**
External Heading NMEA Connection Test	Verify that the Navigation Device NMEA string is viewable and the $GGA string is present.	**PASS**
External Heading NMEA Connection Test	Verify that the Navigation Device NMEA string is viewable and the $HDT or $HDG string is present.	**N/A**
External Heading NMEA Connection Test	Confirm that the Navigation Device NMEA string is viewable and the $PRDID string is present.	**N/A**

ADCP Dry Dock Acceptance Test Results Sheet

Fill in the table below based on the Dry Dock ADCP tests run.

TEST	RESULT PASS/FAIL
PT3 Test correlation values are reasonable for in air results.	**N/A**
PT6 Test received bandwidth values are reasonable for in air results.	**N/A**

Fill in the table below based on the Dock Side peripheral tests run.

TEST TYPE	TEST CRITERION	RESULT PASS/FAIL
External Gyro Connection Test	Verify that the Gyro inputs for Heading, Pitch and Roll (if included) are reasonable for the platform's attitude. The Temperature reading should match the expected water temperature at the transducer.	**PASS**
External Heading NMEA Connection Test	Verify that the Navigation Device NMEA string is viewable and the $GGA string is present.	**PASS**
External Heading NMEA Connection Test	Verify that the Navigation Device NMEA string is viewable and the $HDT or $HDG string is present.	**N/A**
External Heading NMEA Connection Test	Confirm that the Navigation Device NMEA string is viewable and the $PRDID string is present.	**N/A**

The above tests confirm the ADCP is performing acceptable and is ready for the Water Trials.

_____

RD Instruments Field Service Engineer Signature **Date**

_____

Customer Representative Signature **Date**

_____

Printed Customer Representative Signature **Date**

SEA ACCEPTANCE TESTING OF A OCEAN SURVEYOR ADCP AND WORKHORSE MARINER MOUNTED ON A MOVING PLATFORM

Introduction

This procedure is intended to test the ADCP at sea. This procedure assumes that the DockSide Testing procedure has been run and that all of the items have passed or been confirmed to be operational. The following tests will not obtain favorable results unless all of this work has been performed.

The reason for Sea Acceptance Testing is that although the DockSide Tests confirm the ADCP is operational they do not confirm that the system is able to perform to its specifications. The performance of any ADCP relies greatly upon the installation into any platform. Therefore, the system must be tested at sea to understand the effects of the platform on the ADCP performance.

At Sea Testing includes tests for Acoustic Interference, Profiling Range, and Profiling Reasonableness testing. For each of these tests the following Equipment and ADCP setup requirements are recommended.

Equipment Required

Ocean Surveyor 38kHz, 75kHz, or 150kHz ADCP or WH Mariner 300kHz ADCP
Computer
VMDAS Program
WINADCP Program
Navigation Interface Connected
Heading Interface Connected

VMDAS Setup Table

Short Term Average	5 minutes
Long Term Average	10 minutes

ADCP Setup Table

OS 38 ADCP	OS 75 ADCP	OS 150 ADCP	WH 300 Mariner ADCP
WP0	WP0	WP0	WP1
NP1	NP1	NP1	WS0400
NS2400	NS1600	NS0800	WF0600
NF1600	NF1000	NF0800	WN065
NN065	NN065	NN065	BP001
BP001	BP001	BP001	BX2000
BX20000	BX15000	BX10000	WD111100000
ND111100000	ND111100000	ND111100000	TP000060
TP000300	TP000150	TP000100	TE00000120
TE00000600	TE00000300	TE00000200	EZ1111111
EZ1020001	EZ1020001	EZ1020001	EX00000
EX00000	EX00000	EX00000	ED00000
ED00000	ED00000	ED00000	

Interference Testing

The ADCP transmit and receives acoustic signals from the water. If other sonar devices are operating on the platform at the same time as the ADCP it is possible for those signals to bias the ADCP data. Therefore, all ADCPs must be tested to ensure that they are not receiving interference from other sonar equipment on board the vessel.

The following Interference Test will determine if there is interference from other devices on board the vessel.

Platform Testing Setup

This test requires that the platform be in water deeper than the ADCP's maximum expected profiling range. Use the following table to determine the minimum water depth required.

OS 38 ADCP	OS 75 ADCP	OS 150ADCP	WH Mariner 300 ADCP
1200 meters	1000 meters	800 meters	300 meters

Minimum Water Depth Requirement

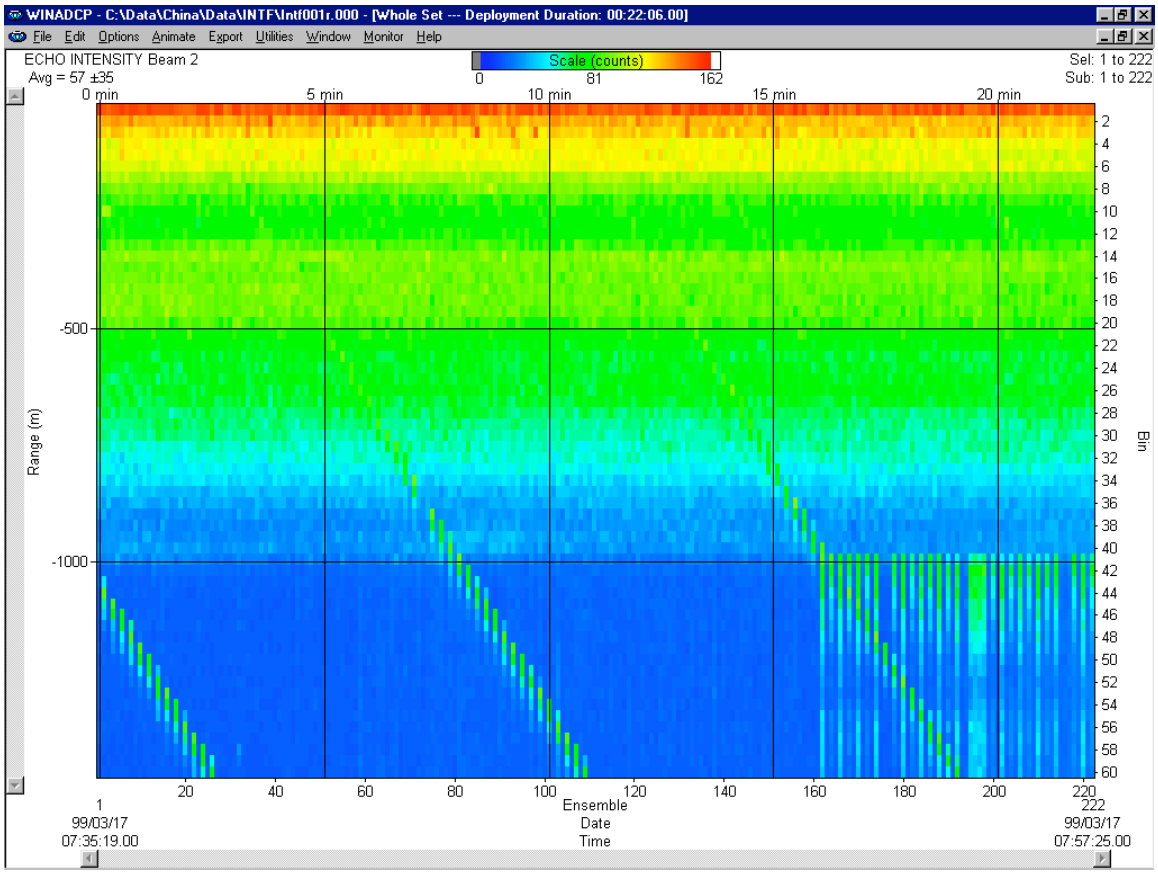
Platform speed for this test is drifting. The motors may be running if required for platform safety. The test sequence starts with ALL sonar and non-essential electronic equipment turned off. Only the ADCP should be on for the first test. This test establishes a base line for the interference and is critical to the rest of the tests. After a 10 minute period the first sonar device is turned on, transmission started, and the data is reviewed for interference terms. At the end of this 10 minute period the first sonar device is turned off and the next sonar device is turned on and started pinging for 10 minutes. This process repeats for each of the sonar devices.

Computer Screen Display Setup

The RAW data (*.ENR files) being collected by the VMDAS program is displayed in the WINADCP program contour plots for echo intensity data. This data will show the single ping return levels.

Interference Results Sheet

If there is an interference term the echo intensity data will show spurious echo intensity jobs. An example of what an interference term may look like is shown in the Figure below.



The interference term appears as the periodic green blocks in the data set. The interference is some what lost in the upper part of the profile however it can be seen clearly seen once the system reaches the noise floor (point where there is no longer signals being returned from the water).

Interference terms such as above seen anywhere in the echo intensity profile data will result in a bias to the ADCP data. On the following page is a table to log the Interference Test Results.

Device Type and Manufacturer	Operating Frequency	Pass or Fail
ADCP only -- No Sonars or Equipment Running	**75 kHz**	**PASS**
Sea Beam, Multi beam	**12 kHz**	**FAIL**
Doppler Speed Log	**300 kHz**	**PASS**
Bathy	**3.5 kHz**	**FAIL**
Bathy	**12 kHz**	**FAIL**
Knudsen (same transducer as Bathy)	**3.5 kHz**	**FAIL**
Knudsen (same transducer as Bathy)	**12 kHz**	**FAIL**
RDI BB150 ADCP	**150kHz**	**FAIL**

Interference Test Results Table

Water Profile Range Testing

The range of any ADCP is directly dependent on the level of backscattering material in the water, the transmit power into the water, the received sensitivity, and the level of the background noise.
Each of these effects the range of the system in different ways but in the end can result in reduced or extended range as follows.

The ADCPs transmit power and receive sensitivity are fixed based however these may be effected by installation of an acoustic window in front of the transducer. A window will absorb sound both transmitted by the ADCP and the sound returned from backscatter in the water.

The volume of the backscatter in the water will effect the range also. All specifications for range assume that there is a certain amount of backscatter in the water. The backscatter volume is not controllable in any way.

The background noise changes as the platform's speed increases or decreases. There are 2 types of noise created by the moving platform; first, there is the noise due to propeller and engines; and second, there is the noise created by the rushing water across the platform and ADCP transducer.

This test is used to determine the effects of the background noise on the range of the ADCP. This information can be used to determine the optimum speed of the platform to obtain the desired range required.

Platform Testing Setup

This test requires that the platform be in water deeper than the ADCP's maximum expected profiling range. Use the following table to determine the minimum water depth required.

OS 38 ADCP	OS 75 ADCP	OS 150 ADCP	WH Mariner 300 ADCP
1200 meters	1000 meters	600 meters	200 meters

Minimum Water Depth Requirement

Platform course for this test is a continuous straight line. The speed of the platform will be varied during this test. At each speed the system will be set to collect data for a minimum of 10 minutes. The following table lists the recommended speeds.

Speed 1	Drifting
Speed 2	3 knots
Speed 3	6 knots
Speed 4	9 knots
Speed 5	12 knots
Speed 6	Maximum Speed

Platform Speed

Computer Screen Display Setup

The Tabular Display of the Long Term Average data (10 minute averages) will be viewed in the VMDAS program.

Range Results Sheet

The data collected in the long term average (10 minutes) tabular display will be used to determine the maximum range of the ADCP. The maximum profiling range of the system is determined by locating the last valid bin and then using that ping to determine the range. To determine the last valid bin the following criterion is used:

- The last bin must be above the bottom side lobe area
- the bin must have a percent good value above 25%
- the correlation value for at least 3 beams must be above the threshold of 120 counts

Locate the last valid bin for each of the speeds and fill in the table below.

Platform Speed	Last Valid Bin Number	Range to Last Bin	Average RSSI Value at Last Bin	Date and Time of Measurement
0	**34**	**562.86**	**48**	**29/03/02, 18:28**
3	**34**	**562.86**	**47.75**	**18:38**
7	**33**	**546.83**	**47.25**	**18:48**
8	**33**	**546.83**	**46.75**	**18:58**
11	**32**	**530.83**	**48**	**19:08**
16	**31**	**514.85**	**48**	**19:18**

Notes:

- Platform Speed must be input as a measurement from the Bottom Track (if in range) or the GPS speed.
- Range to Last Bin is calculated as follows: ((bin size) * (last bin number)) + (NF command)
- Average RSSI Value at Last Bin is the average of the 4 beams RSSI values in the last bin number
- Date and Time of Measurement is used to review these values during playback of the data

The results from the above test should be compared to the specified nominal range of the system. Assuming that there are sufficient scatterers in the water, the acoustic window is not attenuating the signal, and that that the platform background noise is variable there should be a speed at which the nominal range of the system is obtained.

Bottom Tracking Testing

The bottom tracking capability of the OS ADCP varies depending on the type of bottom (hard, soft, rock, sand, etc.), the slope of the bottom, and the speed of the vessel (background noise).

Before testing the Bottom Track capabilities the Water Profiling Range Test must be performed. Through the results of this test determine the platform speed in which the range to the last valid bin obtained the specified nominal range of the OS ADCP frequency being used.

Record the velocity here **16 knots** .

If it was not possible to reach the specified nominal range then determine the speed at which it allowed the best range possible. Calculate the percentage of the nominal range that was obtained by the system.

Record the velocity here **N/A** .

Record the percentage of range obtained here **N/A** .

Platform Testing Setup

The key to this test is to operate the system in an area where both the minimum and maximum bottom tracking range can be obtained. The platform will travel over water that is very shallow (<10 meters) to very deep (greater than the maximum bottom track range). It does not matter if the water starts deep and goes shallow or vice-versa.

The course of the platform should be a relatively straight line. The platform speed should be no greater than the velocity recorded above.

Computer Screen Display Setup

View the raw data display of the VMDAS bottom track display window.

Bottom Tracking Reasonableness Results Sheet

Viewing the bottom track velocity data record the maximum and minimum average of the bottom track depths.

Beam Number	Minimum Depth (meters)	Maximum Depth (meters)
Beam 1	**24.91**	**779.82**
Beam 2	**24.20**	**756.66**
Beam 3	**24.44**	**818.43**
Beam 4	**24.67**	**748.94**

A pass condition is if the maximum depth of the OS system is equal to the specification for the nominal bottom track range. Note, if the system was not able to water profile to the nominal range then the bottom track should be reduced to no more than the same percentage as the water profile loss. If the bottom track did obtain the complete range and the water profile did not then it is likely that there is insufficient backscatter in the water to obtain the specified range.

Ringing Testing

The ADCP transmits an acoustic pulse into the water. The main lobe of this pulse bounces off particles in the water and the signals returned from these particles are used to calculate the velocity of the water. The main lobe of the transmitted pulse is what we are using to process and calculate a velocity. The transmitted pulse, however, is made up of many side lobes off the main lobe. These side lobes will come in contact with metal of the transducer beam itself and other items in the water.

The energy from the side lobes will excite the metal of the transducer and anything bolted to the transducer. This causes the transducer and anything attached to it to resonate at the system's transmit frequency. We refer to this as "ringing". If the ADCP is in its receive mode while the transducer is ringing then it will receive both the return signals from the water and the "ringing". Both of these signals are then processed by the ADCP. The ringing causes bias to the velocity data.

All ADCPs "ring" for some amount of time. Therefore, each ADCP requires a blanking period (time of no data processing) to keep from processing the ringing energy. Each ADCP frequency has a different typical ringing duration. Therefore a blanking period (time of not processing data) is required at the beginning of each profile. The blanking distances required for the typical ringing period for each ADCP frequency is shown in the following table.

Frequency	Typical Blank Period for Ringing
38kHz	16 meters
75kHz	8 meters
150kHz	6 meters
300kHz	4 meters

Ringing will bias the velocity estimation to a lower value than it should be. However, when the platform motion is removed from the water profile data it will appear as a large velocity, which is the opposite of what it is really doing. This effect is caused because the vessel motion portion of the water profile data has been biased low.

Platform Testing Setup

The key to success on this test is that the water velocity and direction not change over the entire test period of 120 minutes. This test requires that the platform be within the ADCP bottom tracking range so that valid bottom track can be used. Use the following table to determine the optimum water depth range required.

OS 38 ADCP	OS 75 ADCP	OS 150 ADCP	WH Mariner 300 ADCP
300-600 meters	200-400 meters	100-200 meters	100-200 meters

Water Depth Requirement

Platform speed should be held to as fast a speed as possible without loosing any bottom tracking data for a period of 30 minutes. Typically, this will be a speed of 6-9 knots. Some experimentation may be required to find the maximum bottom track speed for the given depths above.

Computer Screen Display Setup

The Magnitude and Direction Profile Display of the Long Term Average data (10 minute averages) will be viewed in the VMDAS program.

Ringing Results Sheet

Viewing the Long Term average of the magnitude and direction profile data look for unreasonable shears from bin 1 to bin 2 to bin 3 and so on. If an unreasonable shear is seen this is most likely ringing and your blanking needs to be increased by the following formula:

(bin size) * (last bin number with ringing) * 0.80

Record the results of the ringing tests in the following table.

Total Blanking Period Required*	**8 meters**

*The total blanking period is typical blanking period plus the increased blanking period required.

The above value should be used to change both the WF and NF (for the OS ADCP only) commands in all configuration files for the ADCP.

Transducer Alignment Test

The mounting alignment of the BB transducer to the relative position of the heading input from the vessel is critical in the velocity estimates made by the BB ADCP. If either of these are not known and corrected for it will result in both directional and velocity estimate errors water the velocity data.

It is possible to confirm if the transducer alignment is correct by collecting data over the same water in several different directions. If the transducer is aligned then the both the magnitude and direction of the currents will appear the same in all directions that the platform travels.

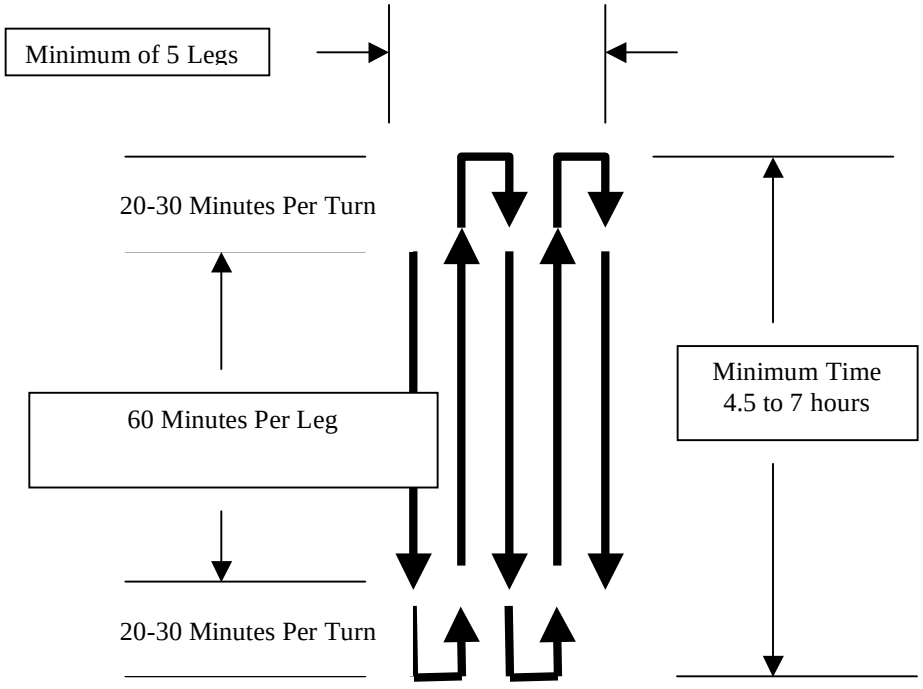
Platform Testing Setup

The key to success on this test is that minimal water velocity and direction change over the entire test period. The following test will take a minimum of 5 hours to collect. This length of time is required in order to obtain enough data samples to reduce the noise sufficiently. This test requires that the platform be within the ADCP bottom tracking range, so that valid bottom track can be used, and that reliable GPS data be available (DGPS is recommended). Use the following table to determine the optimum water depth range required.

OS 38 ADCP	OS 75 ADCP	OS 150 ADCP	OS Mariner 300 ADCP
300-600 meters	200-400 meters	100-250 meters	80-160 meters

Water Depth Requirement

Platform speed is to be held at a constant speed. Any speed between 5 – 10 knots is acceptable, however once a speed is selected then the vessel should maintain that speed during the entire course. The course for this test contains a minimum of 5 legs. Each leg must be a minimum of 30 minutes long (1-2 hours per leg is the optimal time). The course of ship travel is shown in the below figure. All data must be collected in beam coordinates



Computer Screen Display Setup

View the VMDAS ship track display of bin 3 with the bottom track reference. The Long Term Average (5 minute averages) data should be viewed.

Transducer Alignment Results Sheet

A pass condition is if the velocities in each of the ship track plotted directions has the reasonably the same magnitude and direction. It is common to see some wild velocity magnitude and directions. This happens as a result of the effects of the turn on the gyro heading device or the latency of the heading updates for a GPS heading input.

If the direction of the currents is not the same in each of the directions then it will be necessary to enter in a transducer misalignment angle. The 5 minute averages of both GPS and Bottom Track Direction are compared in at least 2 of the legs traveled. An average direction along each leg is calculated for both the GPS and Bottom Track data. The difference in the average directions is the misalignment angle.

Record the results of this portion of the Transducer Alignment with Bottom Track Reference with the formula:

Misalignment Angle = (GPS Average Direction) – (Bottom Track Average Direction)

Misalignment Angle Required	**44.79 Degrees**

Changing the transducer alignment angle, reprocessing the data, and finally playing back the same data file again allows you to confirm if the misalignment angle correction is correct. A pass condition is if the velocities in each of the ship track plotted directions has the reasonably the same magnitude and direction. It is common to see some wild velocity magnitude and directions.

Record the results of the verification of the Transducer Alignment with Bottom Track Reference:

Alignment Verification	**PASS**

Change the data display reference from bottom track to the navigation data in the VMDAS program. A pass condition exists if little to no change in the velocity magnitude and direction occurred when switching to the navigation data reference

Record the results of this portion of the Transducer Alignment with Navigation Reference:

Navigation Verification	**PASS**

ADCP Sea Acceptance Test Results Sheet

Interference Testing

TEST	RESULT Interference Found Yes/No
Interference Testing	**YES**
This test only states whether interference is present. If interference is found then the equipment causing the interference must not be operated with the ADCP or user must synchronize the ADCP and the other device so that interference is avoided. Interference does not result in a failure of this Sea Acceptance Test. This test is for operational information only.	

Water Profile Range Testing

TEST	RESULT: Range Pass/Fail Specifications
Range Testing	**PASS**
This test determines which speed the ADCP will provide profiling range to the factory specification. Ship speed, backscatter in the water column, ship motion, and other environmental factors will effect the range of the system. The ADCP is considered to be passing this test if it either meets the profiling range specification at least at a single speed and/or the range is reasonable given the other conditions.	

Bottom Tracking Range Testing

TEST	RESULT: Range Pass/Fail Specifications
Range Testing	**PASS**
This test determines which speed the ADCP will provide bottom tracking range to the factory specification. Ship speed, backscatter in the water column, ship motion, and other environmental factors will effect the range of the system. The ADCP is considered to be passing this test if it either meets the profiling range specification at least at a single speed and/or the range is reasonable given the other conditions.	

Ringing Testing

TEST	RESULT Range of Ringing
Ringing Test	**8 meters**
This test determines the minimum blanking required. The results of this test do not determine a pass/fail condition but only the minimum setup requirements for proper operation.	

Transducer Alignment Testing

TEST	RESULT: Transducer Alignment Angle
Transducer Alignment Test	**44.79**
This test determines the transducer alignment angle required. The results of this test do not determine a pass/fail condition but only the setup requirements for proper operation.	

The above tests confirm the ADCP is performing acceptable and is ready for operation.

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RD Instruments Field Service Engineer Signature **Date**

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Signed Customer Representative Signature **Date**