VM-ADCP
Standard Operating Procedures (SOP)

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Vessel Mounted - Acoustic Doppler Current Profiler (VM-ADCP)

SOP	Configuration File Selection
1.0.0	

PURPOSE
To select and copy the RDI VMDas configuration files.

Performed By	

SOP TASKS

1. The VM-ADCP is controlled through RDI's VMDas software from PCLAB02. First make a new data directory under 'c:OCEANO/RDI', for example 'c:OCEANO/RDI/ALBOREX_May_2014/'. This is where you will point the VmDAS software to write your collected data files.

2. Locate your preferred historical water track and bottom track initialisation files (.ini files). The initialisation files setup the processing parameters that you wish the VmDAS software to apply; for example 'ALBOREX_May2014_WT8m.ini' and 'ALBOREX_May2014_BT8m.ini' in directory 'c:OCEANO/RDI/OS150Khz Configuration files'. These example initialisation files are set to :-

   Transducer depth = 2 m
   Blank beyond Transmit = 8 m (As determined in the acceptance trials)
   Number of bins = 50
   Bin Thickness = 8 m
   Lo-Res long range (narrowband) mode
   Bottom tracking = on (Bottom tracking = off in 'ALBOREX_May2014_WT8m.ini' file)
   Maximum bottom track distance = 400 m (N/A in 'ALBOREX_May2014_WT8m.ini' file)
   Ping as fast as possible
   EA Heading alignment set to -45.50
   STA files = 120 second ensembles
   LTA files = 600 second ensembles

   amongst many other parameters.

3. Locate your preferred historical VM-ADCP command files (.txt files). These files contain the instructions sent to the VM_ADCP electronics firmware, importantly they contain the depth independent water column salinity value to be assumed during data collection. See, for example, 'OS150BB&NBDEF_rleal_2BT.txt' in 'c:OCEANO/RDI/OS150Khz Configuration files'. It should be noted that setting water column salinity to 38.0 from its default value of 35.0 only makes a very small difference to the apparent depth of the specified depth bins; sound speed increases by only $\sim$ 1 m s^{-1} for every 1 psu in salinity. Furthermore, in the western Mediterranean summer there is a strong near surface thermocline in which the temperature sensor of the VM-ADCP transducer will record much higher temperatures than the majority of the water column, and again, sound speed increases by $\sim$ 1 m s^{-1} for every 1 °C in temperature.

4. These files should be copied to file names relevant to the current campaign on which you are embarking and saved in 'c:OCEANO/RDI/OS150Khz Configuration files'. **THE ORIGINALS SHOULD NOT BE ALTERED OR DELETED**.

5. There is no requirement for bottom track recording of data at every opportunity, but once a day or 2 or 3 times during the cruise over long flat < 200 m continental shelves (in this region of the Mediterranean ~100 m is more likely) would be desirable.

QUALITY ASSURANCE TASKS	QA FORM
Task 1. Ensure the original configuration files are left unaltered. Task 2. Ensure the copied configuration files are relevantly named and saved. Task 3. Use bottom tracking in sensible water depths occasionally during the campaign	

Vessel Mounted - Acoustic Doppler Current Profiler (VM-ADCP)

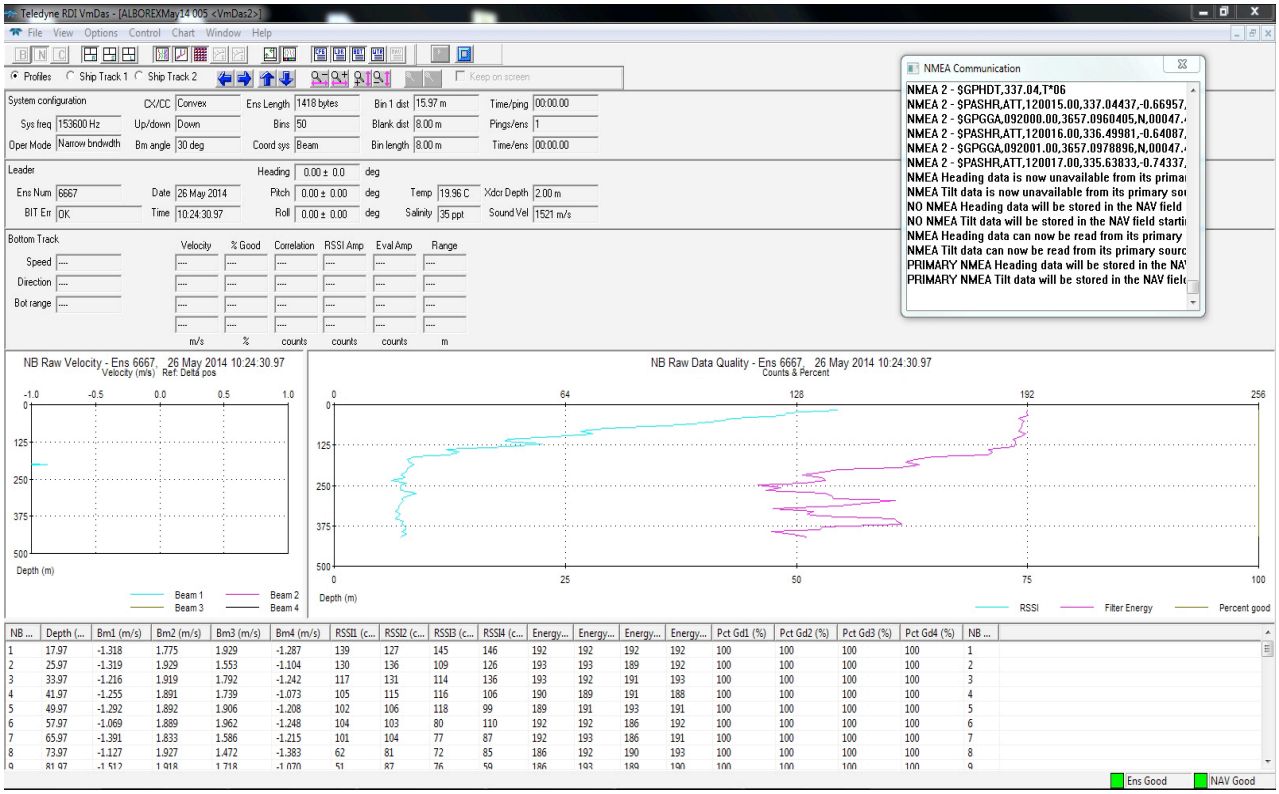
SOP	Configuration file loading and modifying
2.0.0	

PURPOSE
To modify the RDI VMDas configuration files.

Performed By	

SOP TASKS

1. Start VmDas;



2. Under the 'Options' menu select 'Load', choose the ****.ini file that you copied under SOP1.1.1 (directory 'c:OCEANO/RDI/OS150Khz Configuration files'). As discussed in SOP 1.1.1, this file contains most of the commands in ascii text format sent to the VM-ADCP including the calibration heading offset angle and the amplitude scale factor.

3. Under the 'File' menu you can select 'Save As' to create further copies of the ****.ini file

4. Under the 'Options' menu select 'Edit Data Options' (this opens the main 'Program Options' menu from which most of the control parameters can be set)

5. Select menu item 'Communications'. Check that the ADCP is set to COM3, and that NMEA1 and NMEA2 are set to COM9 and COM10. It does not matter which way round COM9 and COM10 are as they both come from the Ashtech ADU800 3D GPS system, it is simply **important that NMEA1 and NMEA2 are not set to the same COM port, and are set to COM 9 or COM 10.**

6. Select menu 'ADCP Setup'. Within this menu make sure that the ADCP Setup from 'Use File' option is checked, select 'Browse' and find for example the ****.txt command file copied/created under SOP 1.1.1 (directory 'c:OCEANO/RDI/OS150Khz Configuration files'). As discussed in SOP 1.1.1, this file contains an abbreviated set of commands, importantly it contains the assumed salinity value that does not seem to appear in the .ini initialisation files. The ****.txt file can be modified in a text editor outside of VmDAS to set the water column salinity for example, this cannot be set in VmDAS. An example file is as follows:-

SOP TASKS

```
; Restore factory default settings in the ADCP
cr1

; set the data collection baud rate to 38400 bps,
; no parity, one stop bit, 8 data bits
; NOTE:  VmDas sends baud rate change command after all other commands in
; this file, so that it is not made permanent by a CK command.
cb611

; Set for broadband single-ping profile mode (WP), fifty (WN) 4 meter bins (WS),
; 8 meter blanking distance (WF), 390 cm/s ambiguity vel (WV)
WP00001
WN050
WS0400
WF0800
WV390

; Set for narrowband single-ping profile mode (NP), sixty (NN) 4 meter bins (NS),
; 8 meter blanking distance (NF)
NN060
NP00001
NS0400
NF0800

; Disable single-ping bottom track (BP),
; Set maximum bottom search depth to 400 meters (BX)
BP000
BX04000

; output velocity, correlation, echo intensity, percent good
WD111100000

; 1 seconds between bottom and water pings
TP000100

; Two seconds between ensembles
; Since VmDas uses manual pinging, TE is ignored by the ADCP.
; You must set the time between ensemble in the VmDas Communication options
TE00000200

; Set to calculate speed-of-sound, no depth sensor, external synchro heading
; sensor, no pitch or roll being used, no salinity sensor, use internal transducer
; temperature sensor
EZ1020001

; Output beam data (rotations are done in software)
EX00000

; Set transducer misalignment (hundredths of degrees)
EA-04550

; Set transducer depth (decimeters)
ED00020

; Set Salinity (ppt)
ES38

; save this setup to non-volatile memory in the ADCP
CK
```

SOP TASKS

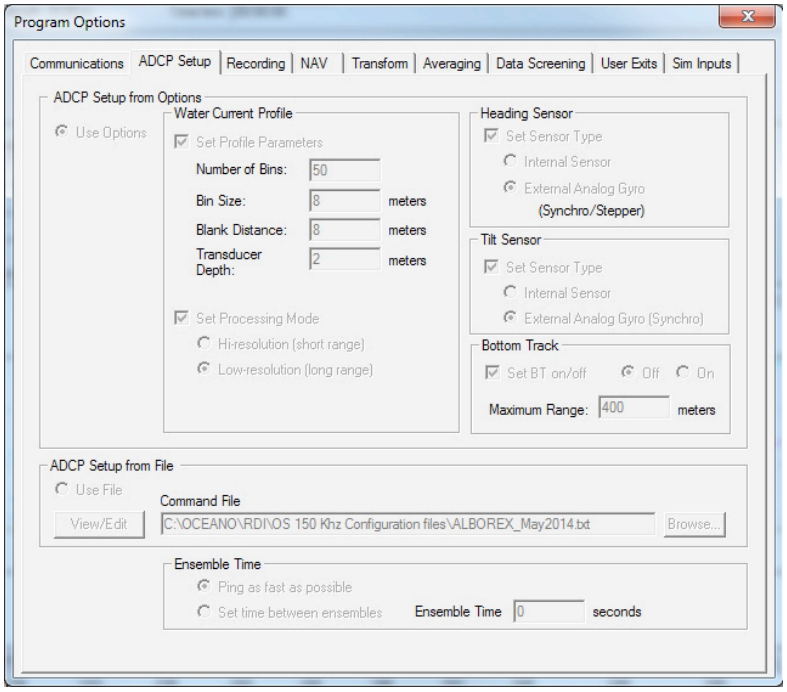
7. The amplitude scale factor also cannot be modified through the VmDAS software. Again, a text editor needs to be used, but this time to edit the ****.ini file. This is a much longer file, an example of the part of the ****.ini file that needs to be edited is show below:

[Transformation Options]
XformToEarth=TRUE
Allow3Beam=TRUE
BinMap=TRUE
BeamAngleSrc(0:auto,1:man)=0
ManualBeamAngle=30
HeadingSource(0:adcp,1:navHDT,2:navHDG,3:navPRDID,4:manual)=6
NMEAPortForHeadingSource=2
ManualHeading=0
TiltSource(0:adcp,1:nav,2:man)=4
NMEAPortForTiltSource=2
ManualPitch=0
ManualRoll=0
SensorConfigSrc(0:PRfixed,1:Pfixed,2:auto)=2
ConcavitySource(0:convex,1:concave,2:auto)=2
UpDownSource(0:dn,1:up,2:auto)=2
EnableHeadingCorrections=FALSE
SinCorrectionAmplitudeCoefficient=0
SinCorrectionPhaseCoefficient=0
MagneticOffsetEV=0
BackupMagneticOffsetEV=0
AlignmentOffsetEA=-45.5
EnableVelocityScaling=TRUE
VelocityScaleFactorForBTVelocities(unitless)=1.0110
VelocityScaleFactorForProfileAndWTVelocities(unitless)=1.0110
EnableTiltAlignmentErrorCorrection=TRUE
TiltAlignmentHeadingCorr(deg)=0
EAOptionSource=TRUE
TiltAlignmentPitchCorr(deg)=0
TiltAlignmentRollCorr(deg)=0
[2nd Band Transformation Options]
EnableVelocityScaling=TRUE
VelocityScaleFactorForProfileVelocities(unitless)=1.0110
[Backup HPR NMEA Source Options]
EnableBackupHeadingSource=FALSE
BackupHeadingSource(0:adcp,1:navHDT,2:navHDG,3:navPRDID,4:manual,5:PASHR,6:PASHR,ATT,7:PASHR,AT2)=0
NMEAPortForBackupHeadingSource=-1
BackupManualHeading=0
EnableBackupTiltSource=FALSE
BackupTiltSource(0:adcp,1:nav,2:man,3:PASHR,4:PASHR,ATT,5:PASHR,AT2)=0
NMEAPortForBackupTiltSource=-1
BackupManualPitch=0
BackupManualRoll=0

Note 1: It is necessary to enable velocity scaling (change FALSE to TRUE) as well as putting in the scale factor, it is also necessary to repeat this under the '2nd Band Transformation Options', these lines are highlighted in yellow above.

Note 2: In most applications the correct amplitude scaling factor **will always be within a few percent** of 1.0000.

SOP TASKS

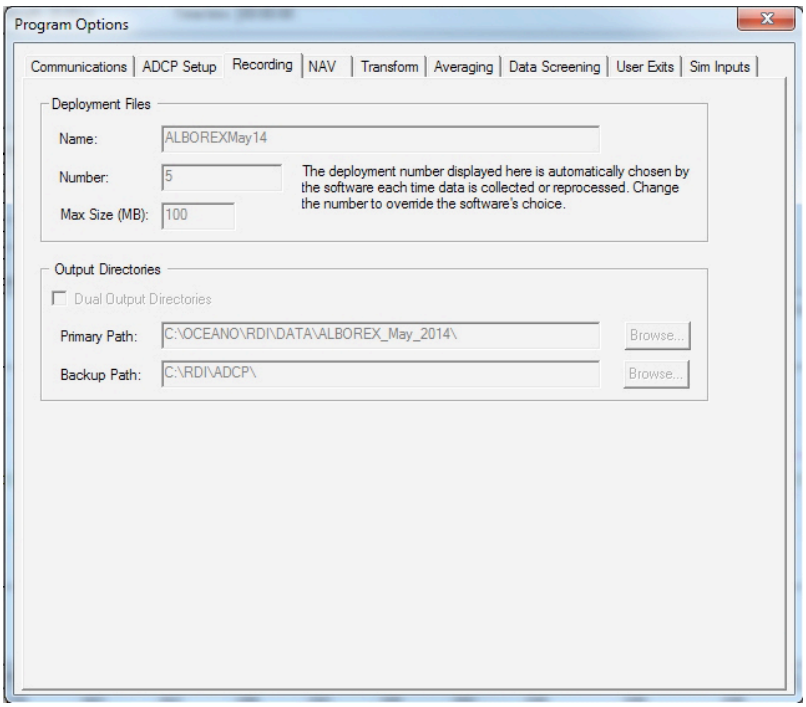


ADCP Setup Tab

8. Select the command file and click 'OK' to return to the ADCP Setup, the path and command filename will be displayed in the Command file window (setting the 'Use File' and providing the command file. When data collection starts, the ****.ini file will instruct the software to send all commands in this selected command file to the ADCP);

9. Check the 'ping as fast as possible' option button on the same menu screen;

10. Select menu 'Recording' (this allows changing of the deployment name and the directory to which data is written, very often this is the only menu that needs to be altered);



Recording Tab Setup

SOP TASKS

11. Type in a clearly relevant 'Name' for the cruise data files (up to 128 characters can be used), see SOP 6.0.0 task 2.

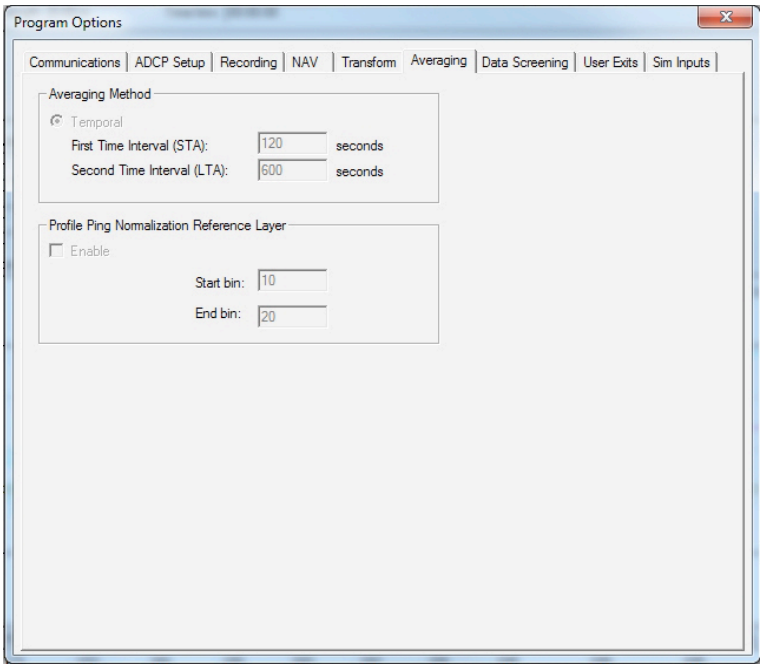
12. Select the first file number, e.g. 1, although see SOP 3.0.0 if this is not the beginning of survey;

13. 'Max Size (mB)' refers to the raw data file size (A full 24 hours recording will require approximately 35 mB);

14. 'Dual Output Directories' should only be used if 2 hard drives are in use;

15. 'Primary Path', select the directory that will contain the ADCP data, which should already have been created (SOP 1.0.0);

16. Select menu 'Averaging'. In this window the smoothing of individual raw velocity profiles to separate long and short period average profiles is determined, this averaging is best achieved on time rather than distance;



17. Set the 'First Time Interval' to 120 seconds;

18. Set the 'Second Time Interval' to 600 seconds;

NOTE: AS THE RAW DATA IS SAVED, AVERAGING CAN BE DONE AT ANY TIME INTERVAL DURING THE POST-PROCESSING STAGE.

19. Leave 'Reference Layer Averaging' as set;

20. Select menu 'User Exits' and check that 'Launch WinADCP' is not selected;

21. If a detailed real-time picture is required, select 'Launch WinADCP' and ensure the path to WinADCP.exe is provided, WinADCP will open at the start of data collection and the 'Data File To Open' tells Win ADCP which type of data to use and the 'Refresh interval (sec)' will tell WinADCP how often to check (note that if data collection is stopped, WinADCP will remain open and when data collection is restarted another session will be run so make sure Win ADCP is closed when data collection stops);

22. Ensure none of 'Advanced User Only' boxes are selected; Click 'OK' to accept your setup;

23. Select menu 'NAV'. Navigation input should be set to read GPGGA from NMEA1.

SOP TASKS

24. Select menu 'Transform'. Heading input should be set to read PASHR,ATT from NMEA2

25. If required, Tilts input should also be set to read PASHR,ATT from NMEA2.

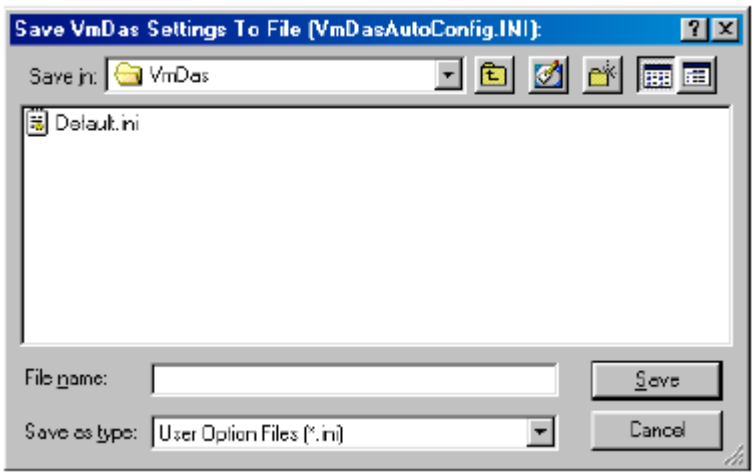
26. Under menu 'Options' select 'Save As' to save setup with your ****.ini file name or a new initialisation file name if required;

27. Return to menu 'Options' and select 'Edit Data Options' menu;

28. Select 'ADCP Setup' and change the command filename to your preferred command filename '****.txt';

29. Click 'OK';

30. Under menu 'Options' select 'Save As' to save this setup, provide a suitable filename for the new .INI file, click 'Save';



31. Repeat the above tasks for pairs of both water track and bottom track setup files.

QUALITY ASSURANCE TASKS	QA FORM
1. Ensure that original .ini files are not overwritten and create back-up copies of the new .ini files if required. 2. Ensure that original .txt files are not overwritten and create back-up copies of the new .txt files if required. 3. Ensure that NMEA1 and NMEA2 navigation and heading data are being read from the Ashtech ADU800 system on COM ports 9 and 10.	

SOP	VM-ADCP data collection
3.0.0	

PURPOSE
To start the VM-ADCP for a new survey operation.

Performed By	

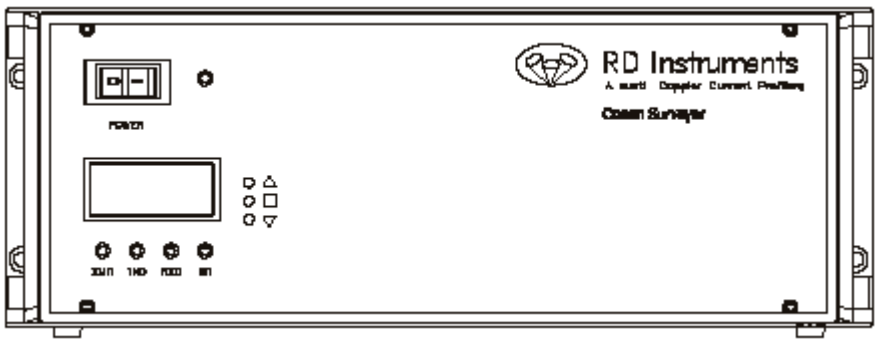
SOP TASKS

1. During data collection it is important that a log is kept of VM-ADCP operation. A standard log sheet has been developed (Annex A), both in electronic and paper format, that includes fields for all the necessary information. A new log sheet should be filled in for each 'start – stop' period, of VM-ADCP operation. This 'start – stop' period refers to the period between clicking 'Go' and 'Stop' in the VmDas control menu (see tasks 12 and13). Parameters to be logged are:

   a. Sequential log sheet number;
   b. Date and cruise information;
   c. Geographical region of operation;
   d. .ini and .txt files in use;
   e. Name and path supplied for data storage;
   f. Time of ADCP start;
   g. Filename on ADCP start;
   h. Position (lat and long) on ADCP start;
   i. Time of ADCP stop;
   j. Filename on ADCP stop (normally the same as g, it will change automatically if files exceed the set maximum file size);
   k. Position (lat and long) on ADCP stop;
   l. Comments on conditions during data collection: e.g. type of survey, typical vessel speed, sea state, weather, any notable oceanographic features (including time), any additional comments on ADCP performance.

2. The electronic copies of these log sheets should be kept in the same directory as the ADCP data, and should always accompany the ADCP data files; i.e. on transfer to Socib DCF. In addition, while all the ADCP setup information is included in the stored .VMO data files, copies of the .ini and .txt command files should be placed in the data directory prior to transmission to Socib DCF.

3. Switch on the power to the ADCP (top left hand corner of the RDI Electronics Chassis) and to PCLAB02.



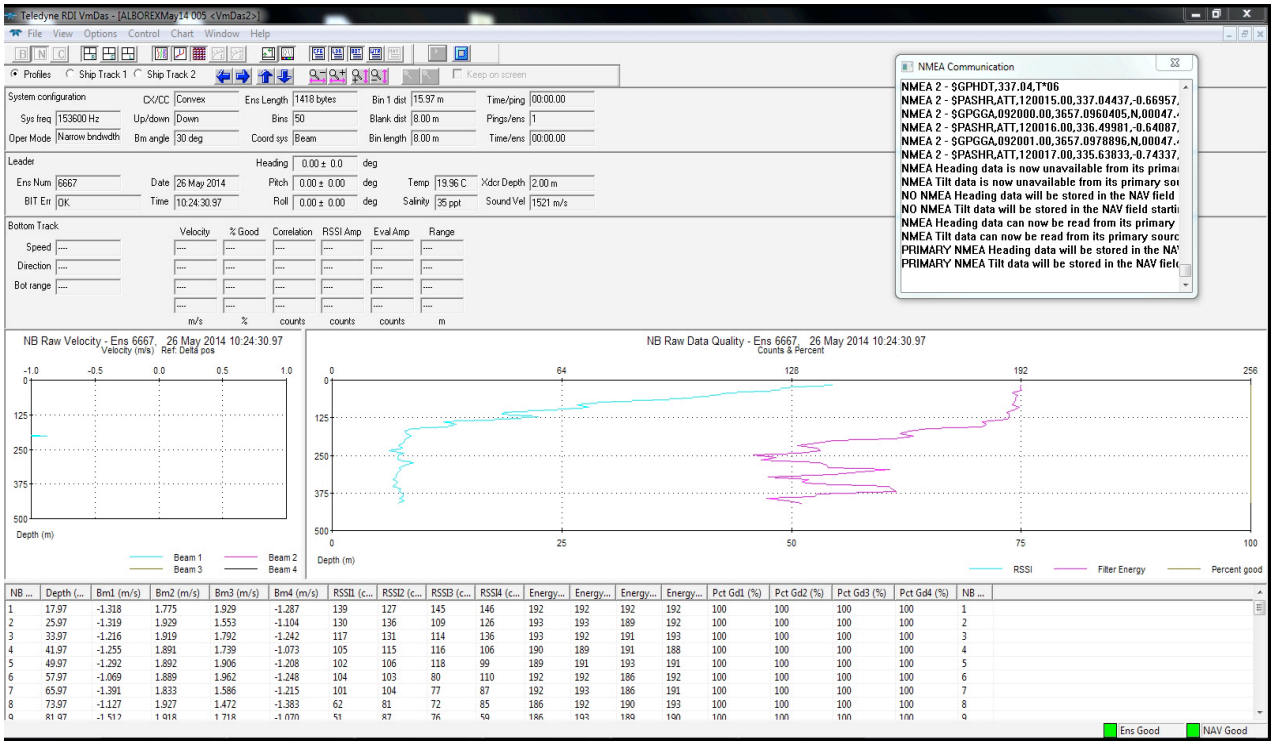
Electronic Chassis Overview (Front View)

4. Start Windows Explorer and create a directory into which the ADCP data is to be recorded (see SOP 1.0.0 task 1).

5. On completion of boot-up and log-on, a terminal program may be run if required, this allows a number of system tests to be undertaken (SOP 5.0.0); running this program will provide some basic diagnostic information if the ADCP fails to operate correctly here (SOP 4.0.0. task 1).

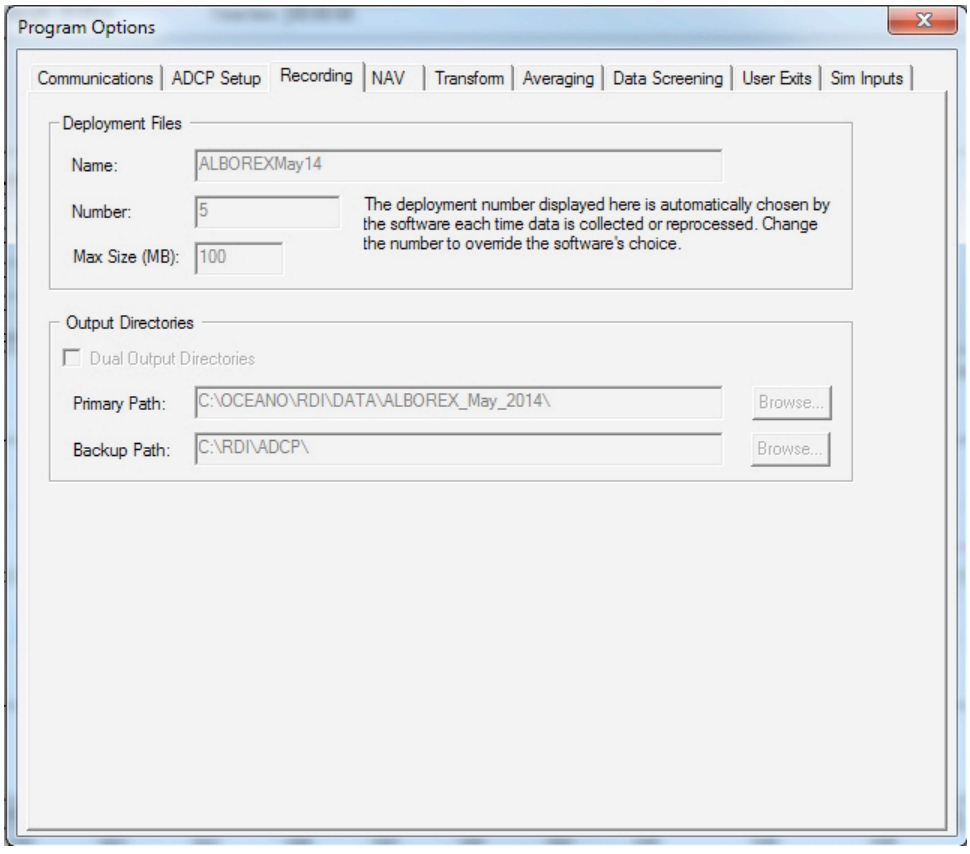
SOP TASKS

6. Start VmDas and under the ‘File’ menu select ‘Collect Data’.



7. Under the ‘Options’ menu select ‘Load’. Choose the appropriate ****.ini file, created in SOP 2.0.0.

8. Under the ‘Options’ menu select ‘Edit Data Options’ to open the main ‘Programs Options’ menu then select ‘Recording’.

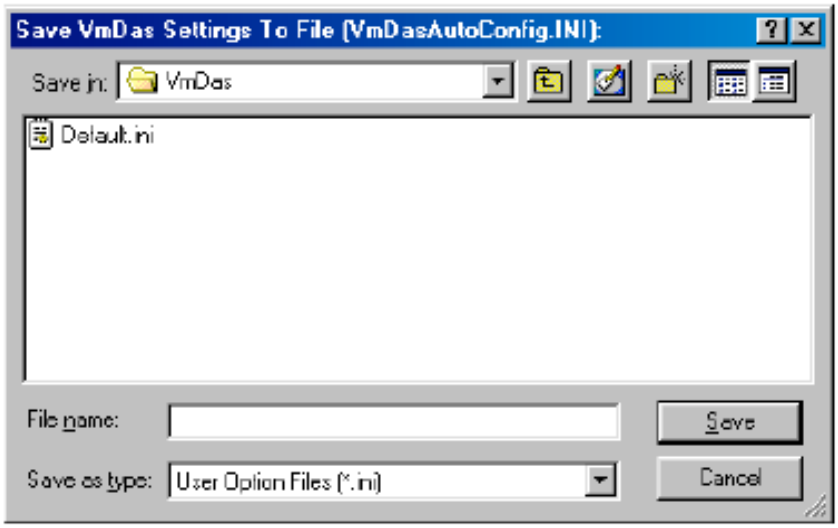


SOP TASKS

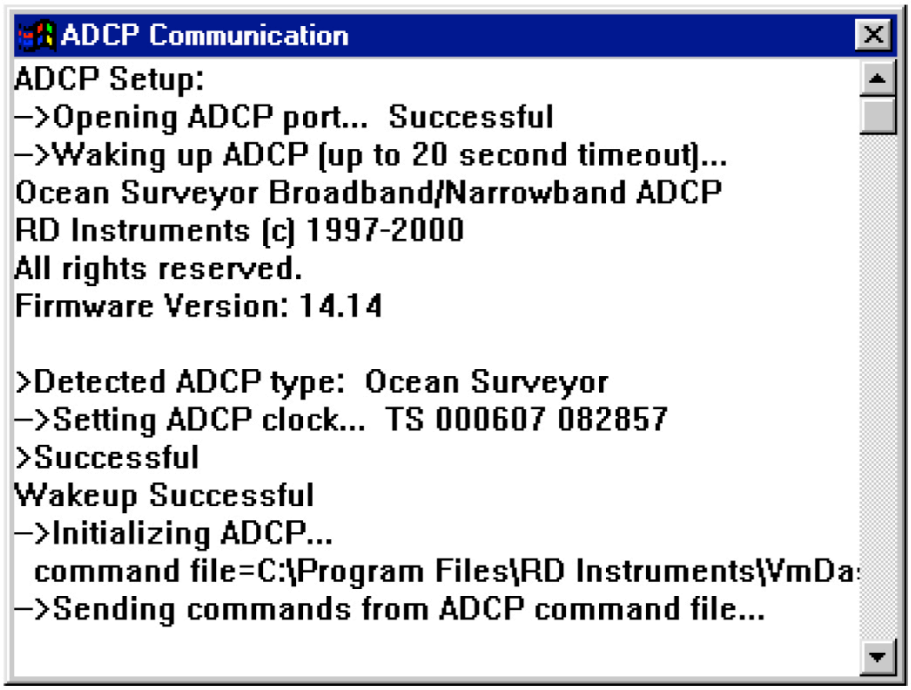
9. Type in the identifying name to be used for all data files in this survey, see SOP 1.0.0. Ensure the increment number is 0 (if this is the restart of a survey or data recording then this should be set to the next sequential number from the last set of files recorded).

10. In 'Primary Path' enter the name of the directory created in task 2 above. Then 'OK' to accept the setup.

11. Under the 'Options' menu select 'Save As' to save the setup. The new .ini file should be named in accordance with the conventions in SOP 1.0.0, (do not type in the .ini extension, this will be added automatically). Click 'Save'.



12. In 'Control' menu, click 'Go'; data collection should now begin. Complete your ADCP event log with all the required details. The ADCP communication and NMEA window will open and show the commands from the command file being sent to the Ocean Surveyor and the Ocean Surveyor's response, e.g..



ADCP Communication Window

SOP TASKS
13. To stop data collection or cycle data files, go to the 'Control' menu and click 'Stop'. 14. When it has been necessary to change to a different setup file, perhaps to change between water and bottom track modes, or when it has been necessary to restart the data acquisition after a power failure, in these cases the VmDas incremental file number will need to be manually set to the next number in sequence from the last recorded files (see task 7). 15. When data from separate operations are recorded during the same survey, for example where a survey is split by another type of data gathering exercise, the gathered periods of ADCP data may need to be clearly identified. 2 options are available: a. Each period can be stored in its own directory with an identifying name: i. At the end of each period select 'Control' and 'Stop'; ii. Follow SOP 1.0.0. b. Use the VmDas software to increment the file number for each new period: iii. At the end of each period select 'Control' and 'Stop'; iv. The data will be saved to the same directory and same file name structure but the VmDas will increment the number of the file.

QUALITY ASSURANCE TASKS	QA FORM
1. Ensure the correct ***.ini file is selected. 2. Ensure a sensible and relevant filename structure has been used. 3. Ensure the correct directory has been selected for writing the data files and initialisation files. 4. Task 1. Ensure a sufficiently detailed log of events around the operation of the ADCP is kept. 5. Task 2. Ensure events log is stored in the same directory as the ADCP data and that the log sheet is rendered to Socib DCF.	

SOP	Problem Solving
4.0.0	

PURPOSE
Data collection problems during ADCP operations.

Performed By	

SOP TASKS

1. If the ADCP fails to respond to the initial start up, the following should be conducted:

    a. Power down the ADCP and the pc, check all accessible leads (port connections into the back of the pc, connections into the back of bridge units) are firmly in place. Restart the pc and check that power is being supplied to the ADCP, then restart the ADCP;
    b. If the ADCP still fails to start, close and restart VmDas. Select 'File' and 'Collect Data' then select 'Options' and 'Load' and load another or a default '.ini' file, if the ADCP operates this indicates that there is a fault in the preferred '.ini' file; create another, see SOP 2.0.0 (if necessary also a command file, SOP 1.0.0), using the back up copies of both files;
    c. If the ADCP continues to fail, run a terminal program and acquire a log file of instrument tests (SOP 5.0.0), and contact RDI with the results if necessary.

2. Heavy pitching can create larger currents than expected with bias velocities in line with the ship's course. Whilst the ADCP can in principle be set up to use the 3-d GPS input signal to correct for this (pitch and roll input under the 'Transform' tab), the signal was historically considered too noisy, however the new Ashtech ADU800 system fitted to SOCIB appears to work well. Slow down to reduce pitching motion.

3. In areas of low zooplankton populations the ADCP may not get sufficient backscattered signals to make good current measurements, this may vary with depth and so holes in the current profile or an apparently much reduced range may be seen; attempt the following:

    a. To overcome such gaps in the raw data files it will be necessary to decrease the number of depth cells and increase their thickness, perhaps to as much as 16 m (SOP 1.0.0 and 2.0.0)
    b. Profile gaps in the long term average (.lta) or short term average (.sta) files can sometimes be improved simply by increasing the averaging time for these files (SOP 2.0.0);

4. Partial loss of a section of the velocity profile near the thermocline can be caused by high concentrations of gelatinous organisms absorbing the acoustic energy. A further option to the above is to open 'Data Screening' in the 'Program Options' menu and change the 'percent good' value to 50%. This runs the risk of significantly degrading the quality of the data, it should be a last resort and should be changed back again as soon as environmental conditions allow.

QUALITY ASSURANCE TASKS	QA FORM
1. Ensure a logical fault finding process has been followed.	

SOP	VM-ADCP system tests
5.0.0	

PURPOSE
To test the VM-ADCP instrument.

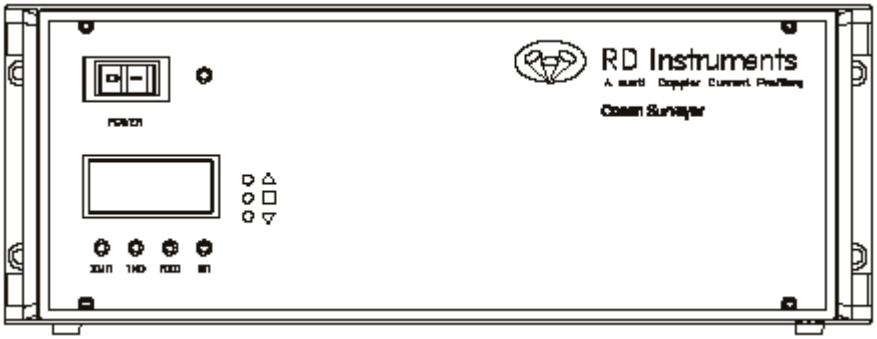
Performed By	

SOP TASKS

NOTE: THIS TEST SHOULD BE CARRIED OUT PRIOR TO EACH VESSEL DEPLOYMENT AND AFTER EACH VESSEL DEPLOYMENT.

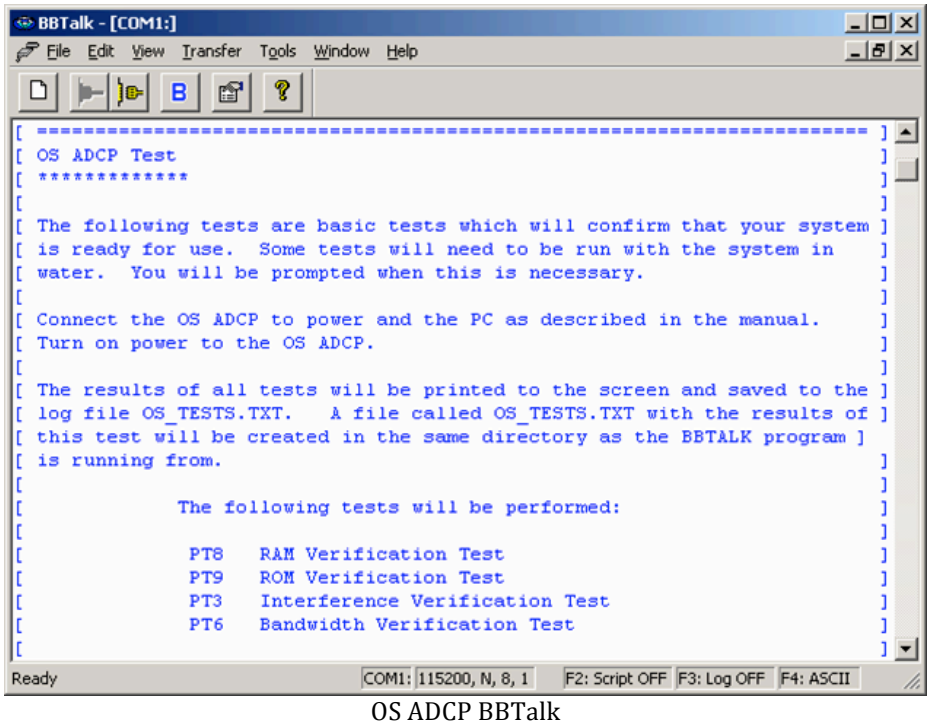
1. The following RDI tests are used to confirm the connection of the Ocean Surveyor Electronics Chassis to the transducer and the correct operation of the ADCP instrument mounted in the hull of the vessel.

2. Turn on the power to the OS ADCP Electronic Chassis unit.



Electronic Chassis Overview (Front View)

3. Start a terminal programme, and connect to COM port 3, 9600 baud rate in '8 N 1' bit format.
.



OS ADCP BBTalk

SOP TASKS

4. Press <F2> and run the script file TestOS.txt. The results of the tests will be printed to the screen and saved to the log file OS_RSLTS.txt.

NOTE: PRINT AND SAVE A COPY OF THE OS_RSLTS.TXT FILE. USE THESE TEST RESULTS AS A "BASELINE" VALUE FOR FUTURE COMPARISON OF THE PT TEST VALUES.

5. An example of the OS_RSLTS.txt printout is outlined below. If TestOS.txt does not exist, the individual tests can be run by typing in the command at the beginning of each output shown below, i.e. PS0, PT3 and PT6 in the command line window shown above. The following example results were recorded in December 2012.

NOTE: THE BUILT-IN TESTS REQUIRE THE TRANSDUCER FACES TO BE IMMERSED IN WATER. IF NOT SOME OF THE TESTS MAY FAIL.

Display Systems Parameters

This tells the ADCP to display specific information about the ADCP. For example:

```
>PS0
Frequency:              153600 Hz
Configuration:          4 BEAM, JANUS
Transducer Type:        Round 32x32
Beamformer Rev:         A02 or later
Beam Angle:             30 degrees
Beam Patten:            Convex
Orientation:            Down
CPU Firmware:           23.17
FPGA Version:           AA
Sensors:                Temp
```

Verify the information is consistent with that which is known about the setup of the system on the vessel. If PS0 does *not* list all the sensors, there is a problem with either the communications to the transducer assembly of a problem with the motherboard.

Interference Verification Test

This test checks receive-path characteristics, checks for interference signals in the processing circuitry, and checks gain values. A message similar to the following should appear

NOTE: COMPARE THESE TEST RESULTS WITH THE DOCKSIDE TESTS DONE WHEN THE SYSTEM WAS FIRST INSTALLED, IF AVAILABLE.

```
>PT3
Correlation Magnitude:
Lag   Bm1    Bm2    Bm3    Bm4
0     1.00   1.00   1.00   1.00
1     0.81   0.81   0.79   0.81
2     0.42   0.41   0.37   0.43
3     0.12   0.11   0.07   0.14
4     0.02   0.00   0.04   0.03
5     0.01   0.01   0.02   0.01
6     0.02   0.02   0.01   0.02
7     0.02   0.03   0.03   0.03

RSSI: 23 19 18 14
PASSED
```

Interference Test Pass/Fail Conditions – The ADCP pings without transmitting and displays the result of an autocorrelation function performed over 8 lag periods. Ideally, high correlation at near-zero lags, and then decorrelation as the lags get longer. High correlation values at longer lags indicate interference is present.

NOTE: PT3 TEST IS CONSIDERED TO HAVE PASSED IF THE CORRELATION VALUES AT LAG 5 AND GREATER ARE LESS THAN 0.50.

SOP TASKS

Bandwidth Verification Test

This test measures the receive bandwidth of the system.

NOTE: COMPARE THESE TEST RESULTS WITH THE DOCKSIDE TESTS DONE WHEN THE SYSTEM WAS FIRST INSTALLED, IF AVAILABLE.

A message similar to the following should appear

```
>PT6
Receive Bandwidth:
……..
 Expected      Bm1      Bm2      Bm3      Bm4
 ------------  -------  -------  -------  -------
 15500         15174    15154    15167    15147

PASSED
```

NOTE: THE PT6 TEST IS CONSIDERED TO HAVE PASSED IF THE RECEIVED BANDWIDTH FOR EACH BEAM IS WITH ±20% OF THE EXPECTED BANDWIDTH.

Testing is now complete.

QUALITY ASSURANCE TASKS	QA FORM
1. Run a terminal window connection to verify the VM-ADCP is functioning correctly 2. Keep a copy of the test results to build up a history of the instrument's performance	

SOP	VmDAS file names
6.0.0	

PURPOSE
To become familiar with file names for future playback, re-processing and visualisation.

Performed By	

SOP TASKS

1. During data collection, VmDas outputs 10 data files, with different file extensions detailed below. The largest of these files, the .ENR, .ENS and .ENX files will reach around 30-35 megaBytes (mB) each in size over a 24 hour data recording period.

2. Data files produced by VmDas during **data collect** mode have the following filename format:

   UserInputCampaignNameNNN_00000N.Ext; where:

   UserInputCampaignName is a user-entered name for the cruise files (up to 128 characters), see SOP 2.0.0, this name should clearly identify the survey being carried out and be recognisable by the SOCIB DCF. The NNN is the deployment number (this increments automatically by one with each 'stop'/'go' cycle), see SOP 3.0.0 for notes regarding changes to deployment number and restarting data acquisition. The 00000N is the file sequence number, which is automatically incremented when otherwise a file would be overwritten, normally the sequence number would be 000000.

   The file extensions, .Ext, have the following meaning:

   i. .ENR – original raw ADCP data, an RDI binary file;

   ii. .LTA – contains ADCP data and navigation data, averaged over the long term period (usually 10 minutes SOP 2.0.0), an RDI binary file;

   iii. .STA – contains ADCP data and navigation data, averaged over the short term period (usually 2 minutes SOP 2.0.0), an RDI binary file;

   iv. .ENS – ADCP data after having been screened for return signal amplitude (RSSI) and correlation by VmDas. Also has navigation data records merged into the ensembles from the .NMS file (RDI binary);

   v. .ENX – ADCP single-ping data (plus navigation data) after having been vertically bin-mapped, transformed to Earth coordinates, and screened for error velocity, vertical velocity, and false targets. This data is ready for user averaging if the .STA and .LTA files are not preferred (RDI binary);

   vi. .N1R – contains raw navigation data (GPS position data), a text file;

   vii. .N2R – contains raw navigation data (roll/pitch/heading information), a text file;
   (Note. The .N1R and .N2R extension files are simply the recorded NMEA strings for navigation and roll/pitch/heading (RPH) data);

   viii. .NMS – Binary format navigation data file after having been screened and pre-averaged (RDI binary);

   ix. .VMO – The option setting used for collecting the data (text file);

   x. .LOG – ASCII file containing errors found in NMEA, ASCII Ensemble Output, or ADCP communications.;

   RDI binary files can be read, processed and converted to ASCII text files using WinADCP. The navigation text files can be viewed using a standard text editor.

WARNING: NO ATTEMPT SHOULD BE MADE TO EDIT ANY OF THE ABOVE FIILES AND NO CHANGES BE SHOULD BE MADE TO THE FILENAMES.

QUALITY ASSURANCE TASKS	QA FORM
1. Ensure a consistent and clearly identifiable filename nomenclature is used.	

SOP	Data processing and data display (VmDAS and WinADCP)
7.0.0	

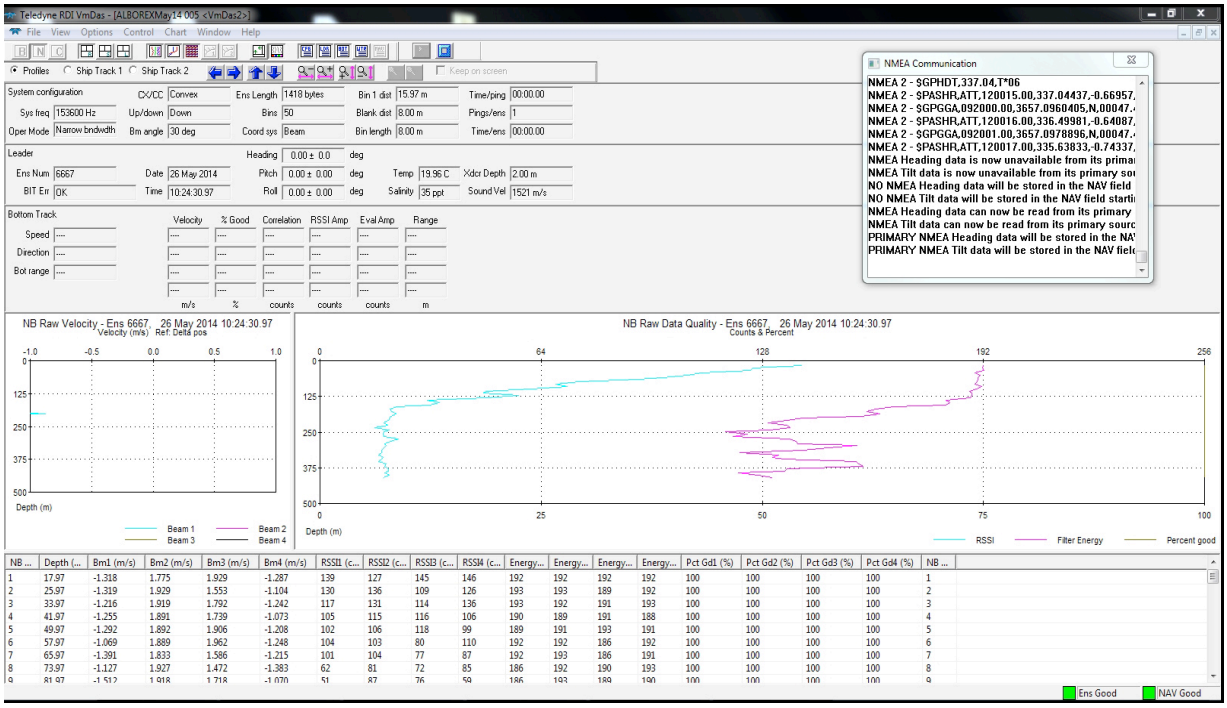
PURPOSE
To view VM-ADCP data previously collected or being collected in real time

Performed By	

SOP TASKS

1. To playback data in VmDAS:

   a. Start VmDAS. Click **File, Playback Data;**



VmDas Playback

   b. Browse and locate the data file for the data you wish to view. Click **Open**;

   c. **NOTE**. VmDAS will automatically search for *.ENR, *.ENX, *.STA, and *.LTA files (SOP 6.0.0);

   d. On the Playback Tool Bar, click Play.

2. Data can be reprocessed in VmDAS, by clicking on **File, Reprocess Data**. VmDAS then asks for the .VMO file for the original data processing controls (SOP 6.0.0). After selecting the .VMO file the user can then enter a new .ini file or modify the commands in the command windows to reprocess the data; for example this may be necessary to apply different calibration values (see SOP 2.0.0), or to apply additional heading, roll or pitch offsets determined during post collection data analyses.

3. VmDAS generates 'reprocessed' data files, which have a similar filename structure with an additional 3 number group that increments each time reprocessing is conducted on the original file. VmDAS gives the reprocessed control file the extension .VMP.

4. Data can be viewed in a more user friendly manner using WinADCP. To playback data in WinADCP

   a. Start WinADCP;

SOP TASKS

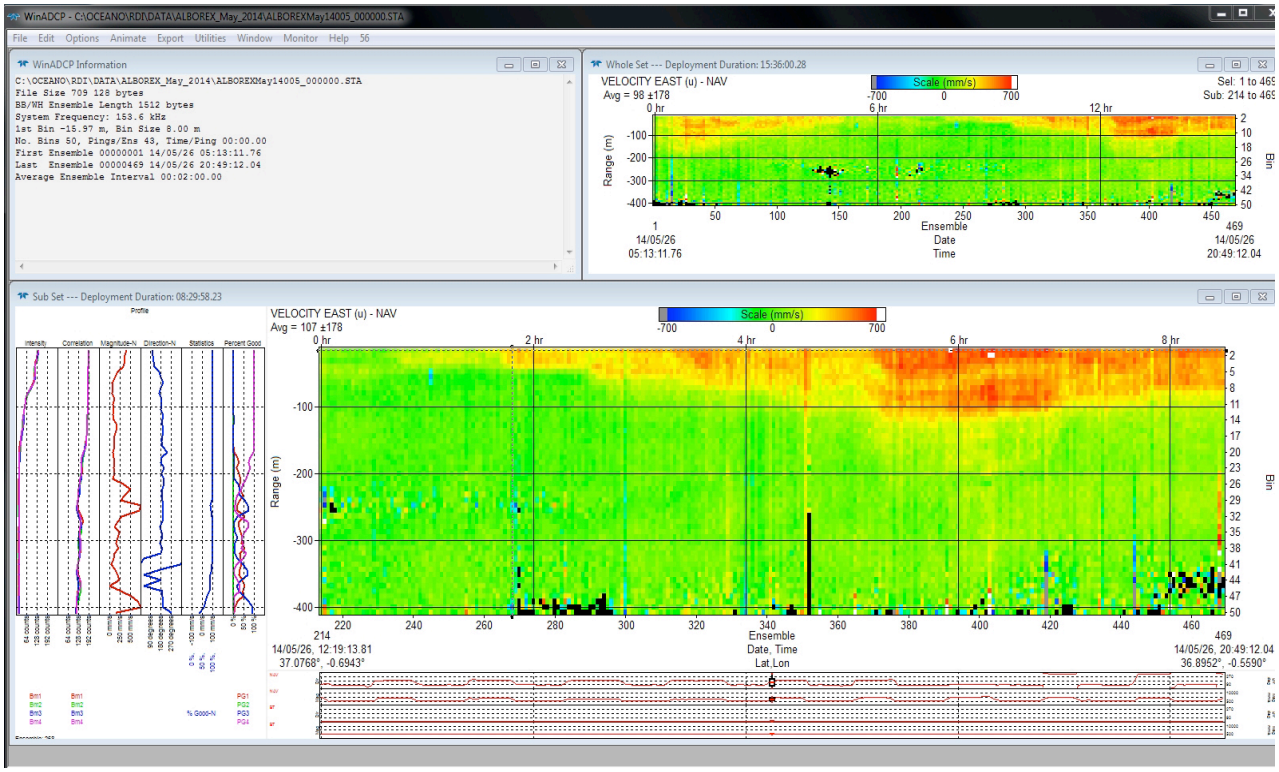
b. Click **File**, **Open**. Browse and locate the data file for the data you wish to view. Click **Open**. This will load the *.ENR *.ENX, *.STA, or *.LTA file you wish to view;

c. Under **Options** choose the chart types and variables that you wish to view.

d. Real-time display of current data collection can be achieved, by opening one of the currently recording VmDAS files. After choosing the viewing parameters that you wish to see in WinADCP, click on **Monitor**, choose a sensible refresh period in seconds, e.g 120 seconds for .LTA files, click **ON** and the display will update automatically as new data are collected and processed by VmDAS.

e. Historical files can also be played back in an animated mode by selecting **Animate**. Select from Contour/Profile/Series and click **Go**. The time series of the ADCP data will now be animated (don't quite see how this is helpful though !).

f. A typical monitoring WinADCP playback screen is shown below.



QUALITY ASSURANCE TASKS	QA FORM

SOP	Calibrating the VM-ADCP orientation (amplitude scale factor and mis-alignment angle)
8.0.0	

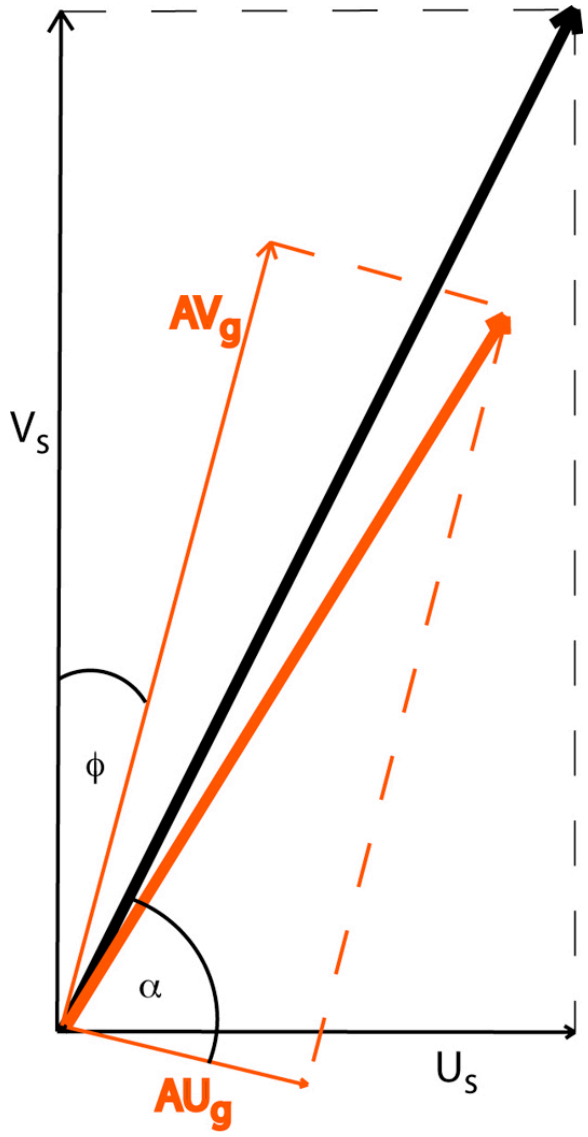
PURPOSE
To calibrate for the VM-ADCP mounting in the vessel hull

Performed By	

SOP TASKS

1. The VM-ADCP current profiles calculated and recorded in VmDAS are determined relative to earth coordinates when the ADCP is linked to the correct operation of a 3-D GPS system, and is fully calibrated for its mounting in the vessel hull.

2. In the following diagram, let us consider AU_g and AV_g the velocity components of the bottom past the VM-ADCP as measured by the VM-ADCP, and U_s and V_s the velocity components of the vessel from GPS navigation data.



Now trigonometry tells us that.

$$\frac{V_S}{U_S} = \tan(\alpha - \phi) = \frac{\sin(\alpha - \phi)}{\cos(\alpha - \phi)} = \frac{\sin\alpha\cos\phi - \cos\alpha\sin\phi}{\cos\alpha\cos\phi + \sin\alpha\sin\phi}$$

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but, $\cos\alpha = \frac{U_g}{\sqrt{U_g^2 + V_g^2}}$ and, $\sin\alpha = \frac{V_g}{\sqrt{U_g^2 + V_g^2}}$;

therefore, $\frac{V_S}{U_S} = \frac{V_g\cos\phi - U_g\sin\phi}{U_g\cos\phi + V_g\sin\phi}$.

If we cross multiply, divide through by $\cos\phi$, and re-arrange, we can show that the mis-alignment angle ϕ is given by

$$\tan\phi = \frac{V_g U_S - U_g V_S}{V_g V_S + U_g U_S}$$

Now we observe also that

$$U_S = AU_g\cos\phi + AV_g\sin\phi,$$

and

$$V_S = AV_g\cos\phi - AU_g\sin\phi,$$

$$\therefore \quad \tan\phi = \frac{V_g\left(AU_g\cos\phi + AV_g\sin\phi\right) - U_g\left(AV_g\cos\phi - AU_g\sin\phi\right)}{V_g V_S + U_g U_S};$$

which, after expanding, simplifying, dividing through by $\sin\phi$ and inverting both sides, gives the amplification factor, *A*,

$$A = \frac{\left(V_g V_S + U_g U_S\right)}{\left(U_g^2 + V_g^2\right)\cos\phi}.$$

3. These equations are already incorporated in example and historical excel calibration spreadsheets that can be found in the /OCEANO/RDI/Example Calibrations Spreadsheets folder.

4. In WinADCP, open the bottom track file that you wish to use for a calibration. Select **Export** and choose ancilliary data, Select a minimum of heading, east and north bottom track velocity components, bottom depth and east and north navigation velocity components. Choose file type TXT and click on **Write File**.

5. Open the file you have exported from WinADCP in Excel and paste the relevant velocity data into an example excel calibration spreadsheet that can be found in the /OCEANO/RDI/Example Calibrations Spreadsheets folder.

6. To improve the calibrations and reduce the statistical error standard deviation values, restrict your input velocity pairs to those at reasonable constant vessel heading, vessel speed and bottom depth

QUALITY ASSURANCE TASKS	QA FORM

SOCIB Balearic Islands Coastal Observing and Forecasting System

SOCIB VM-ADCP Log Sheet (May 2014)

B/O SOCIB

150 KHz RDI Ocean Surveyor VM-ADCP

Date:	**Voyage ID:**	**Sheet no.**
Geographical Region:		
.ini file:	**.txt command file:**	
Deployment filename:		
Primary Path:		
Secondary Path (if dual disk data collection):		
ADCP GO	**ADCP STOP**	
Time:	**Time:**	
Latitude:	**Latitude:**	
Longitude:	**Longitude:**	
First file:	**Last file (if different):**	
Additional Information *(refer to earlier sheets if appropriate to avoid repetition)*		
Survey Type:	**Typical vessel course/speed:**	
Sea state:	**Wave height:**	
Other instrumentation?		
Notes:		