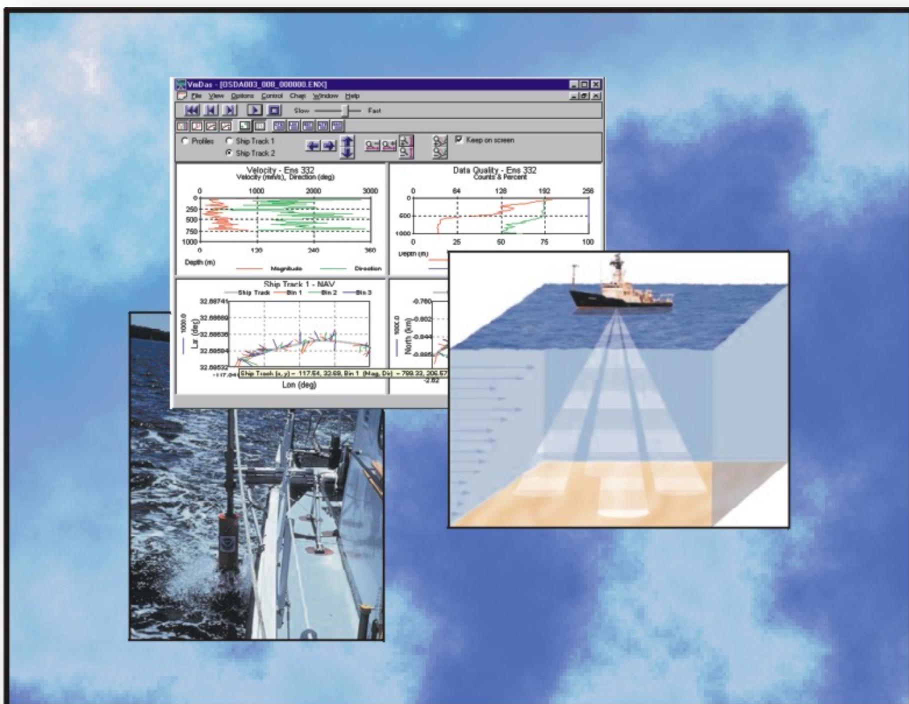
VmDas

User's Guide

Ver. 1.46.5



P/N 95A-6015-00 (May 2012)

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Revision History

May 2012

- Manual updated to VmDas version 1.46.5
- Added Using the Custom NMEA Feature
- Updated styles and fonts used in manual

January 2009

- Manual updated to VmDas version 1.46

NOTES

VmDas User's Guide

1 Introduction

VmDas is a software package for use with Teledyne RD Instruments (TRDI) Vessel Mount Acoustic Doppler Current Profilers. This software package supports the Broadband, Workhorse, and Ocean Surveyor PD0 Binary Output Data Formats for data collection, replay, and reprocessing.

1.1 How to Contact Teledyne RD Instruments

If you have technical issues or questions involving a specific application or deployment with your instrument, contact our Field Service group:

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24 Hour Emergency Support +1 (858) 842-2700

1.2 Conventions Used in this Guide

Conventions used in the *VmDas* User's Guide have been established to help you learn how to use *VmDas* quickly and easily.

Windows menu items are printed in bold: **File** menu, **Open**. Items that need to be typed by the user or keys to press will be shown as **<F1>**. If a key combination were joined with a plus sign (**<ALT+F>**), you would press and hold the first key while you press the second key. Words printed in italics include program names (*VmDas*, *BBTalk*) and file names (*Test001r.000*).

Code or sample files are printed using a fixed font. Here is an example:

```
WorkHorse Broadband ADCP Version 16.XX
TELEDYNE RD INSTRUMENTS (c) 1996-2002
ALL RIGHTS RESERVED
>
```

You will find two other visual aids that help you: Notes and Cautions.

NOTE. This paragraph format indicates additional information that may help you avoid problems or that should be considered in using the described features.

CAUTION. This paragraph format warns the reader of hazardous procedures (for example, activities that may cause loss of data or damage to the ADCP).

1.2.1 Abbreviations

The following abbreviations are used in this manual.

ADCP – Acoustic Doppler Current Profiler

BB – Broadband

BT – Bottom Track

DVL – Navigator

NB – Narrowband

OS – Ocean Surveyor

OO – Ocean Observer

WH – Workhorse

UN – Unknown

1.3 System Requirements

VmDas requires:

- Windows XP® or Windows 7®
- Pentium III 600 MHz class PC (higher recommended)
- 1GB of RAM (2GB or more RAM recommended)
- 50 MB Free Disk Space plus space for data files (A large, fast hard disk is recommended)
- Minimum of one serial port; number of ports is dependent on the application (High Speed Serial Port recommended)
- Minimum display resolution of 1024 x 600, 768 color
- CD-ROM Drive
- Mouse or other pointing device
- An Ethernet card if network I/O is desired

NOTE. *VmDas* can use up to six serial ports in some configurations.

1.4 Software Installation

To install *VmDas*, do the following.

a. Insert the compact disc into your CD-ROM drive and then follow the browser instructions on your screen. If the browser does not appear, complete Steps “b” through “d.”

b. Click the **Start** button, and then click **Run**.

c. Type **<drive>:launch**. For example, if your CD-ROM drive is drive D, type **d:launch**.

d. Follow the browser instructions on your screen.

2 Software Overview

VmDas is a software package used to collect real-time ADCP heading, pitch, roll, and GPS data. *VmDas* can also play back data and re-process data that is collected with *VmDas*.

VmDas collects raw-beam data, heading, pitch, and roll data from internal sensors or external sensors and transforms the data to earth-coordinates. The software also creates short term and long term averaged PD0 data files as well as saving the data on a back up share (drive).

VmDas has the option to screen ADCP data, for example, for error velocities, correlation, or RSSI; use three beam solutions if a beam or bin should be marked bad in a profile, and bin mapping. More details about three beam solutions and bin mapping can be found in TRDI's Broadband Primer.

VmDas version 1.44 and older has a backup NMEA port. As an example, this means that *VmDas* can record NMEA data from two GPS devices and one heading device or two heading devices and one GPS device.

For the Ocean Surveyor product, the software can collect and display narrow-band, broadband and bottom track (interleaved), as well as displaying a ship-track reference to bottom-track or GPS data.

The default Command files presented in the VmDas Quick Start Guide will work for most conditions. There may be cases where the user needs to create a special command file (see Command Files and ADCP Configuration).

2.1 Creating a Data Option File

In the following, you will be creating a Data Option file that will be used to program both the ADCP and *VmDas* software processing.

The *VmDas*, *WinADCP*, and *RDI Tools* software should be installed on your computer as outlined in Software Installation. Connect the ADCP to a computer as shown in the ADCP Technical Manual, and apply power to the ADCP.

a. Start *VmDas*. Click **File**, **Collect Data**.

b. Click **Options**, **Load**. Select the Default.ini file. Select **Open**.

c. Click **Options, Edit Data Options.** See Data Options Screens for details on each tab. Once you have set all the parameters, click **OK** to exit the **Edit User Options** screens. When **OK** is clicked, *VmDas* checks the new options for consistency. For example, it is not allowed to use the same serial port twice on the **Communications** tab. If *VmDas* finds an error, it will display an error message box and refuse to close the **Edit Data Options** dialog box. You may either correct the error(s), or use **Cancel** to abandon all changes to the options.

d. Save the Data Option file by clicking **Options**, **Save As**. Enter a file name for the *.ini file that you have just created. This *.ini file will save the setup in all of the tabs including the path to the command text file. You can use this same method in case you wish to create several different setup files for the same machine. As an example, you could create a command text file that has a 6-meter bin size. You might save this to a text file with the name *BB150BIN6M.txt* and call the *.ini file *6METER.ini*. You could then create another command file and *.ini file with a 16-meter bin size with the same concept. Then when you want to actually use the proper command file you just have to select the *.ini file you intend to use.

2.1.1 Setting up Data Options

When data collection or data reprocessing is started, the current data options tell *VmDas* how to collect and process the data.

- Data options are not used for playing back data. Editing them is not allowed in playback mode.
- *VmDas* stores the current data options. They persist until changed, even if *VmDas* is closed and restarted without saving the Data Option file.
- If the current set of data options is not satisfactory, they must be changed before starting data collection or data reprocessing. Once collection or reprocessing has started, it must be stopped before changes can be made.
- Current settings can be viewed at any time by selecting **Options**, **View Data Options**.
- The current data options can be replaced with a set of data options stored in an **.INI* (a set of data options saved to a file), **.VMO* (the option settings used for collecting the data), or **.VMP* file (the option settings used for reprocessing the data). The current options can be edited.

Saving Data Options

When the current data options are changed, the old version is overwritten. To keep from losing a set of options, they should be stored in a file by clicking **Options**, **Save As**.

- The **Save As** option is available only when options have been edited but not saved in a file.
- Choose a file name that suggests the purpose of this set of data options. *VmDas* will add the **.INI* extension to the name. No extension should be supplied by the user.
- Whenever data collection starts, the current data options are automatically saved in a **.VMO* file.
- Whenever reprocessing starts, the current data options are automatically saved in a **.VMP* file.
- All of these files are stored as standard Windows **.INI* files. They are easy to read with a text editor. Editing them directly is not recommended.

Error Messages

Some options or combinations of options are illegal. *VmDas* detects some of these bad settings and refuses to allow them to be saved or to exit the menu.

- Clicking **OK** on the **Edit Data Options** dialog box causes *VmDas* to do a consistency check and save the new settings as the current data options if no errors are found.
- The check is also done when starting data collection.
    - If an error is found, a message describing the error will pop up and no changes will be saved. The user can either correct the problem, or cancel editing and lose all changes made.

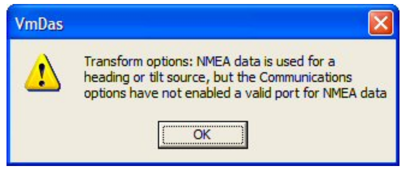

Figure 1. Example Error Message

Loading Data Options

On the **Options** menu, click **Load**. By default, only INI files are displayed. VMO files can be displayed by choosing them in the **Files of type** box. To display VMP files, choose all files in the **Files of type** box.

> **NOTE.** To return to the factory default setting, select the *Default.ini* file.

View the Current Data Options

On the **Options** menu, click **View Data Options**. The same dialog opens as when editing, but no changes can be made. You can view the data options in the Playback mode.

2.1.2 Setting up Display Options

The Display Options determine how data is displayed.

- They can be set for modes that display data (playback and collect).
- They can be changed at any time when one of those two modes is active, whether or not data is being played or collected.
- Graphs or charts may be erased and re-plotted because of changes to these options, but it makes no change to the data itself.
- In reprocess mode, data is not displayed, so there are no settings to determine how it is displayed.

Edit Display Options

Click **Options**, **Edit Display Options** to display a tabbed dialog box from which you can change the display options. Click the **Reference** tab to select the display units, or the velocity reference to use for profiles. Click the **Ship Track** tab to select the ship position source and the profile bins to use for the current stick plots. Click **OK** when done or use **Cancel** to abandon all changes to the display options.

Reference Tab

When you click the **Reference** tab (Figure 2) in the **Display Options** dialog box, the following display units and velocity reference settings are displayed and may be changed.

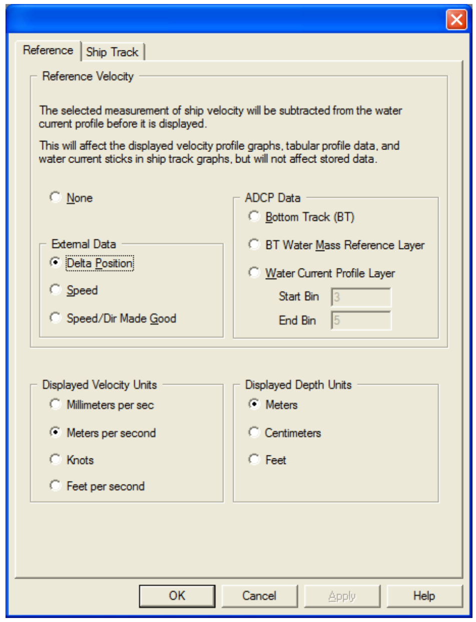

Figure 2. Reference Tab

Velocity Reference - Choose between **None**, **Bottom Track**, **Bottom Track Water Mass Reference Layer**, **Water Current Profile Layer**, **Delta Position**, **Speed**, and **Speed/Dir Made Good**.

- **Bottom Track Water Mass Reference Layer** refers to the water-reference layer output that some ADCP instruments output along with the bottom track data. This layer is only available from BroadBand and WorkHorse ADCPs. This data is collected and recorded by these ADCPs only when the BK command is set to collect Water Mass Layer and the BL command has been set to select the section of water that will be measured to record a speed through the water. This speed through the water is stored in a separate location in the bottom track data. Enabling this feature will reference all of the profile velocities to this recorded speed through the water. This feature is typically enabled, only when the bottom track is not possible and navigation data will not be collected.

- The **Water Current Profile Layer** is setup as an independent water layer to reference the averaged data in either the STA or LTA files. The user should set this to a number of consecutive bins that will represent only the vessel motion (i.e. that has as little real water motion as possible). The **Start** and **Stop** bins selected will all be averaged together to produce a single speed through the water. This speed through the water is stored in a separate location in computer RAM. If not used it is discarded and not recorded. Enabling this feature will reference all of the profile velocities to this recorded speed through the water. This feature is intended for use when there is no bottom track or navigation data available.

- **Delta Position** calculates a reference velocity as delta position divided by delta time, where the position data is obtained from the NMEA GGA message. The position used in the calculation is the first and last GGA position received in each ADCP data interval.

- **Speed** calculates a reference velocity from speed and direction, obtained from the NMEA GGA or VTG message, by resolving them into East and North components.
- **Speed/Dir Made Good** calculates a reference velocity from speed-made-good and direction-made-good, which is in turn calculated from the averages of position and time, as received in the NMEA GGA or VTG messages, for each ADCP data interval.

Velocity Units - Choose between millimeters per second, meters per second, knots, or feet per second for all displayed velocity data.

Depth Units - Choose between meters, centimeters, or feet for all displayed depth data.

Ship Track Tab

When you click the **Ship Track** tab (Figure 3) in the **Display Options** dialog box, the following settings are displayed and may be changed. Click **OK** when done or use **Cancel** to abandon all changes to the display options.

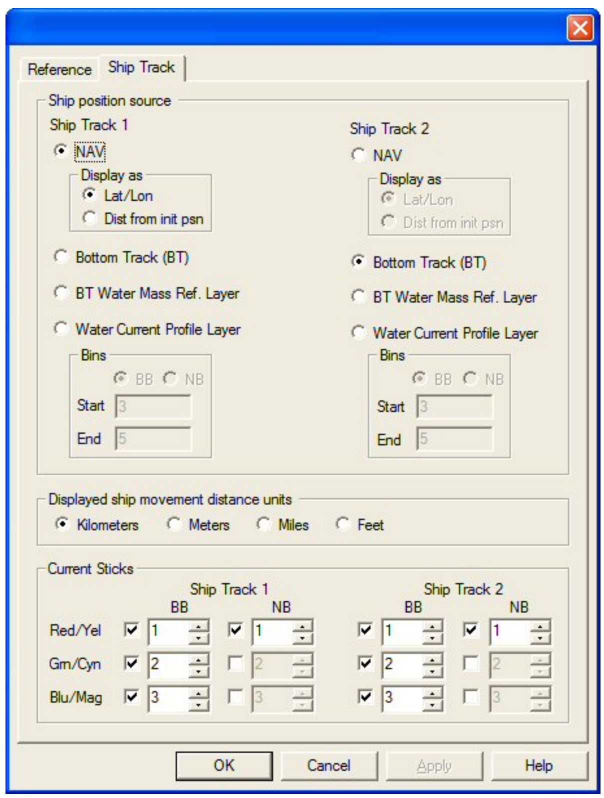

Figure 3. Ship Track Tab (Data File Contains BB and NB Data)

Ship Position Source - For each ship track plot, choose between **NAV**, **Bottom Track**, **Water Mass Reference Layer**, and **Current Profile Layer**.

- If **NAV** is selected, the last NMEA GGA position received in each ADCP data interval is used to calculate the ship track, and can be displayed as a Lat/Lon position, or as a distance from the initial position received within an ADCP data interval.

- If **Bottom Track (BT)** is selected, the ADCP bottom track velocity data are integrated to calculate a ship track.
- If **Bottom Track Water Mass Reference Layer** is selected, the ADCP water reference layer data are integrated to calculate a ship track. This layer is only available in the BroadBand and WorkHorse ADCPs. This data is collected and recorded by these ADCPs only when the BK command is set to collect Water Mass Layer and the BL command has been set to select the water depths to collect a speed through the water. The delta speed and delta time between consecutive averaging intervals is then used to calculate a distance traveled and direction and plotted on the Ship Track graph. This feature is typically enabled only when the bottom track is not possible and navigation data will not be collected.
- If **Water Current Profile Layer** is selected, the layer velocity is defined to be the average of the range of profile bins selected as the velocity reference, and that velocity is integrated to calculate a ship track. This layer is setup as a totally independent water layer to reference the averaged data in either the STA or LTA files. The user should set this to a number of consecutive bins that will represent only the vessel motion (i.e. that has as little real water motion as possible). The **Start** and **Stop** bins selected will all be averaged together to produce a single speed through the water.

  The delta speed and delta time between consecutive averaging intervals is then used to calculate a distance traveled and direction and plotted on the Ship Track graph. This feature is typically enabled only when there is no bottom track or navigation data available.

> **NOTE.** If **Bottom Track (BT)**, **Bottom Track Water Mass Reference Layer**, or **Water Current Profile Layer** is selected, the ship track is shown as a distance from the initial position, where the initial position is 0,0.

Chart units for distances - Choose between Kilometers, Meters, Miles (statute), or Feet.

Current Sticks - Choose to display up to three current sticks at each ship position, and select which profile bin each stick represents.

> **NOTE.** Changes made to the **Ship Track** tab may require that the ship track be re-plotted. *VmDas* will issue a warning before accepting these changes. If the ship track must be re-plotted, the ship track is erased. Plotting continues from the current position.
>
> When collecting data, this means it is a good idea to settle on desired configurations early. Once erased from the display, the Ship Track cannot be redisplayed until the deployment files are played back.

Change Chart Properties

Whenever you right-click on any profile plot, a pop-up property menu (Figure 4) is displayed from which you can change many attributes for the profile graphs.

Profile Plots

- *How do I manually set the ranges for the plot axes?* Select the **Axes** tab. On the right, click the tab that contains the attribute that you want to change for the axis, in this case **Scale**. On the left, click on the label of the axis you want to change. On the right, enter new numbers for **Max** and **Min** and click **OK** or **Apply**.

CAUTION. Manually changing the plot axes may cause unpredictable results. Use the **Graph Toolbar** to adjust the plot axis.

- *How do I put symbol markers on my data points?* Select the **Chart Styles** tab. On the right, click the **Symbol Style** tab. On the left, click on the label for the series you want to mark (i.e. **Style1**, **Style2**, etc.). Click the box labeled **Shape** and select a shape for the symbol. Click the box labeled **Size** to set the size of the symbol. Click the **Name** box to set the desired color for the symbol. Click **OK** or **Apply**. Note that from the **Chart Styles** tab you can also set the line width, pattern, and color of each line in the graph.

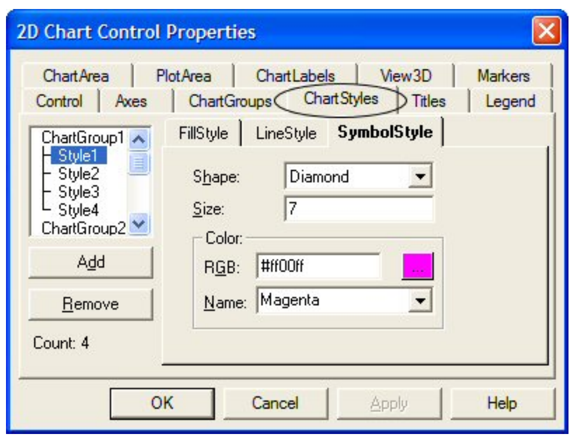

Figure 4. Chart Control Properties

Ship Track Plots

- *How do I manually set the ranges for the plot axes?* Right-click the ship track plot and click on **Properties** (Figure 5). Click the **Plot Area** tab. Manually enter values for **Left**, **Right**, **Top**, and **Bottom**. On this property page, you may also change the font, turn on or off the grid lines and set their style, and change the aspect ratio method. Click **OK**.

CAUTION. Manually changing the Ship Track plot axes may cause unpredictable results. Use the **Graph Toolbar** to adjust the plot axis.

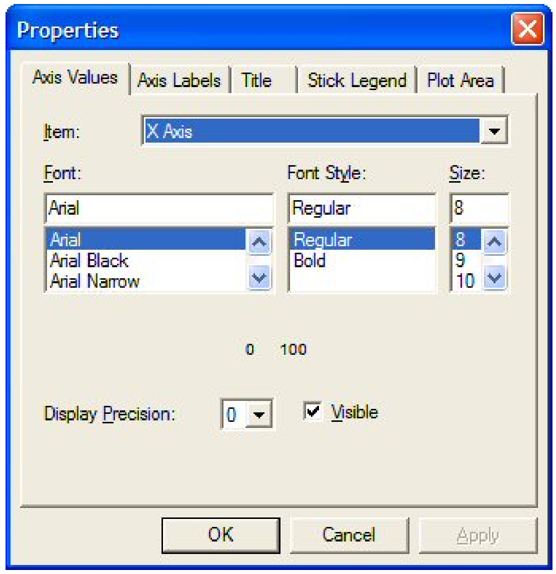

Figure 5. Ship Track Properties Dialog

2.2 Data Options Screens

Click **Options**, **Edit Data Options** to display a tabbed dialog box from which you can change the program options.

- Communications (see Communication Tab)
- ADCP Setup (see ADCP Setup Tab)
- Recording (see Recording Tab)
- NAV (see NAV Tab)
- Transforms (see Transform Tab)
- Averaging (see Averaging Tab)
- Data Screening (see Data Screening Tab)
- Users Exits (see Users Exits Tab)
- Simulated Inputs (see Simulated Inputs Tab)

2.2.1 Editing the Data Options

On the **Options** menu, click **Edit Data Options** to display a tabbed dialog box. Options in the **Edit Data Options** can only be changed before collecting data or before reprocessing data. When *VmDas* is collecting or processing data, the options can only be viewed.

- Clicking **OK** causes *VmDas* to do a consistency check and save the new settings as the current data options.
- On an illegal setting, a pop up message will describe the error and no changes will be saved. The user can either correct the problem, or cancel editing and lose all changes made.

- Editing data options saves them as the current options, not in a file (see Saving Data Options).

NOTE. If the save to a file step is skipped, the current options still persist until changed, even if *VmDas* is closed.

2-2.2 Communication Tab

When you click the **Communications** tab in the **Program Options** dialog box, the following communications settings are displayed and may be changed to match the communication parameters to those of the device you have connected to the computer.

Select first the item you want to configure (top left quadrant) e.g. ADCP input or NMEA 3 input, then go the “Set Communication Parameters” quadrant and then enable or disable the selected port and the click on the button “Set” to apply the new settings.

The top right quadrant shows the settings the software will use.

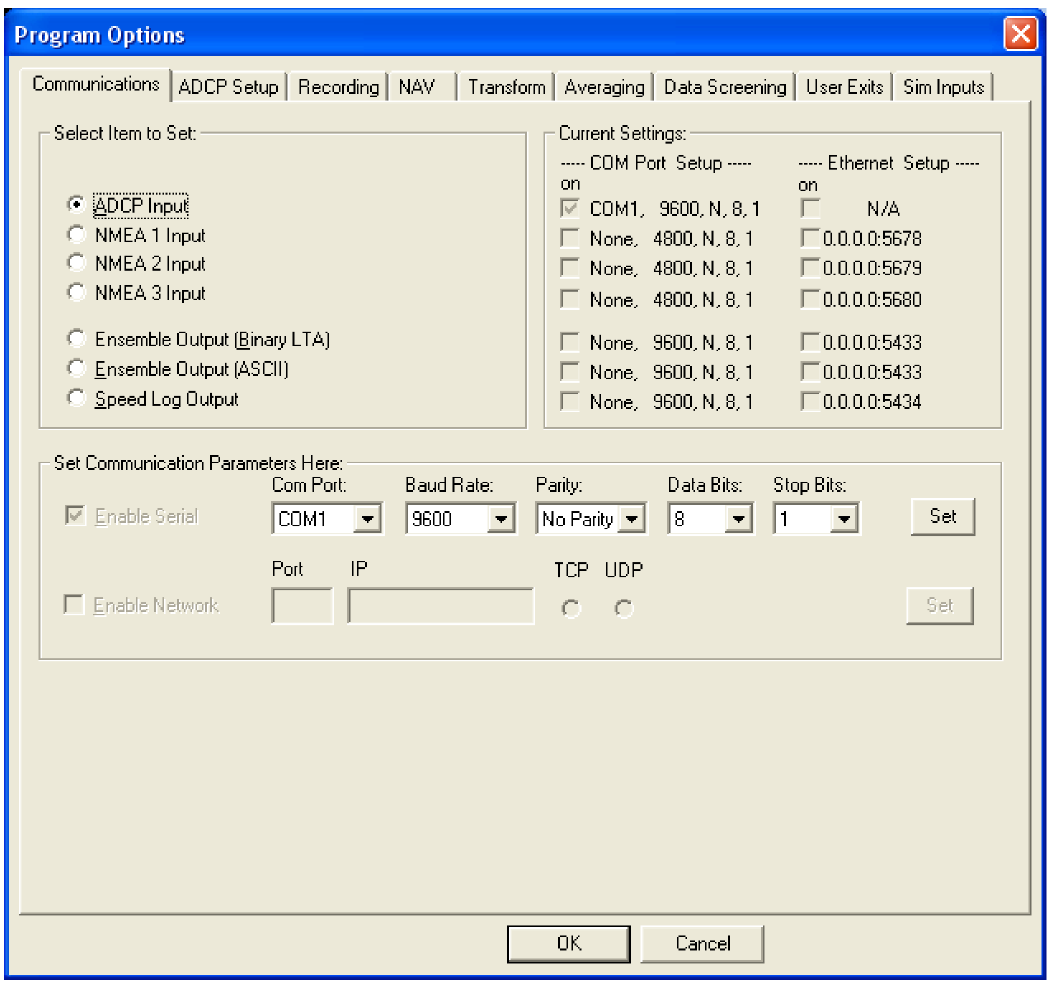

Figure 6. Communications Tab

NOTE. If the same serial-port is selected twice, the software will not let the user continue to next tab unit the setting is changed.

VmDas can collect data from one to four input serial ports. When collecting data, ensembles must be read from the ADCP input port. The NMEA input ports can collect NMEA data if desired. If the NMEA ports are used see Reading NMEA Data for details on which sentences are accepted.

Enabling an input port instructs *VmDas* to listen for data at that port, to log all data received to a file, and to generate error messages if data is not received. *VmDas* enforces some rules for input port options.

- Duplicate or invalid COM ports cannot be specified for active ports.
- NMEA options on the **Nav** or **Transform** tab will only be able to use NMEA ports enabled on the **Communications** tab.
- Enabled NMEA ports will log all data they receive in an N1R, N2R, or N3R file. The user can choose to save GGA or VTG data in the navigation data (see Binary Navigation Data Format) on the **NAV** tab (see NAV Tab).

VmDas can write data to up to three output serial ports and up to three TCP/IP/UDP ports.

VmDas can provide up to three optional real time outputs through serial ports, Ethernet ports, or both.

Enabling an output port instructs *VmDas* to write data to that port whether or not anyone is listening.

Ensemble Output (Binary LTA) provides long term averaged ensembles. This output is a copy of the LTA output file.

Ensemble output (ASCII) converts binary ensembles to an ASCII format. If this port is enabled, the data to be written must be selected in the **Set Ensemble Output Configuration Here** box.

Speed Log Output produces NMEA messages containing ship speed information from short-term averaged data. Data is output at the same rate as the short-term average.

Set Ensemble Output Configuration Here

The settings in the **Set Ensemble Output Configuration Here** box are needed only if **Ensemble Output (ASCII)** is selected and either **Enable Serial** or **Enable Network** is checked (see Figure 7).

- **Data Select** - *VmDas* produces several output files with binary ensembles. **Data Select** chooses one of these files as the source of ensemble data for ASCII output. Some of the data in the binary source will be extracted, converted to an ASCII format (See Output ASCII Ensemble Data), and written out the output port.
- **Data Type Switches** - Select the type of data to send to the ensemble-out device during data collection. Check the appropriate checkbox for each type of

data you want sent to the ASCII ensemble-out port. The **Navigation** box will have no effect if the **Data Select** box contains ENR. Navigation data is not present in the raw ENR files. **Navigation** data comes from NMEA inputs. The navigation and ensemble data are merged to produce ENX, STA, and LTA files.

- **Velocity Switch -** If the **Velocity** box is checked, the **Start Bin** and **End Bin** boxes in the **Output** column set the bins that will be added to the ASCII ensemble velocity data.
- **Velocity Ref -** If the **Velocity** box is checked, the **Velocity Ref** box can be used to remove ship velocity from the velocity profile. Other velocities, such as bottom track, are not changed.

  If **Velocity Ref** is set to **None**, velocities are unchanged.

  If **Velocity Ref** is set to **Bottom**, the velocity from the bottom track field, if present, is subtracted from the velocity of each bin.

  If **Velocity Ref** is set to **Water Current Profile Layer**, the average velocity of a water layer is subtracted from the velocity of each bin. The **Start Bin** and **End Bin** boxes in the **Profile Layer** column select the bins that makes up the water layer.
- **Output Start/End Bin -** Lets you select the portion of the ADCP profile (depth cell range) to send to the ASCII ensemble-out port.
- **Profile Layer Start/End Bin -** Lets you select the bin (depth cell) range for the Water Current Profile Layer velocity reference.

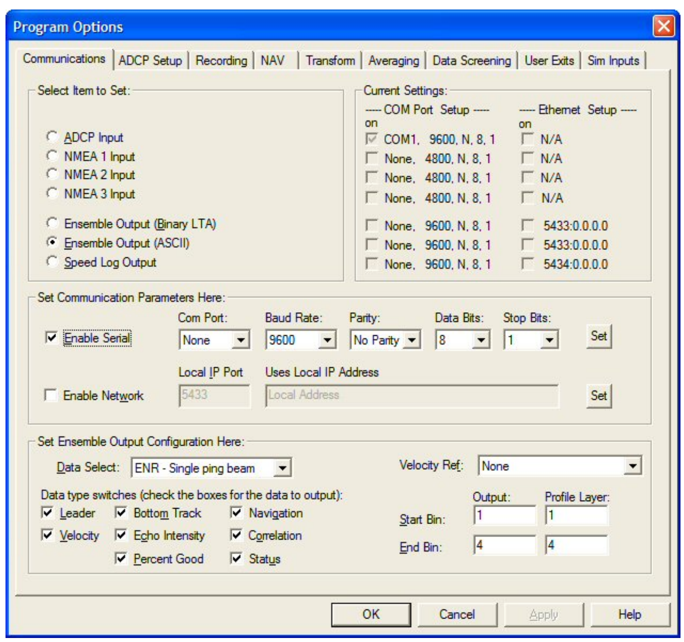

Figure 7. Communications Tab - Ensemble Output (ASCII) Selected

Set Speed Log Output Configuration Here

If the **Speed Log Output** box is selected and either **Enable Serial** or **Enable Network** is checked, the **Set Speed Log Output Configuration Here** section lets you select the following parameters for the speed log output only (see Figure 8).

- **Data Select -** Lets you select between STA Short-term averaged Earth or LTA Long-term averaged Earth as the output source.
- **Water Reference Layer Source -** Lets you select the reference velocity to subtract from the profile output. Water Current Profile Layer sets the reference velocity to the average of the user-defined bin range in the "Profile Layer" column, and causes the reference velocity to be subtracted from the profile before data output. Bottom Track Water Mass Reference Layer sets bottom track as the reference velocity, and causes the reference velocity to be subtracted from the profile before output.
- **Start/End Bin -** Lets you select the bin (depth cell) range for the Water Current Profile Layer velocity reference.

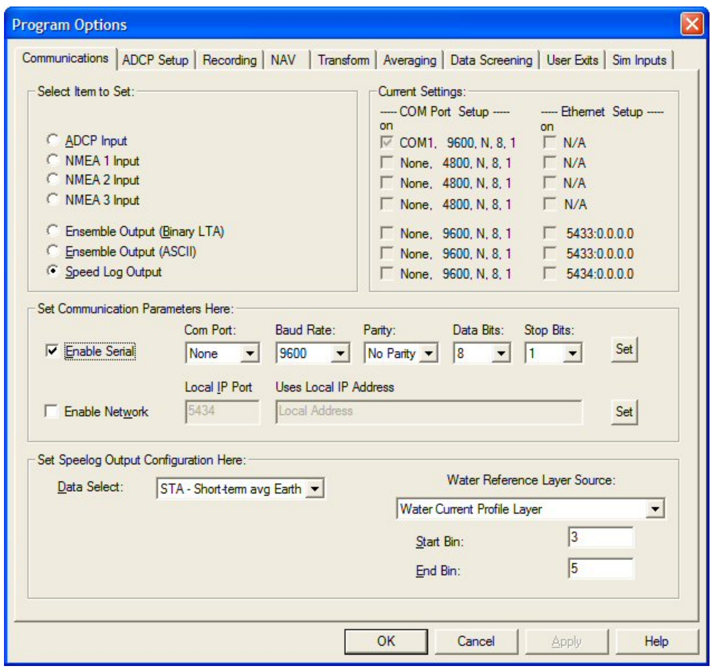

Figure 8. Communications Tab - Speed Log Output Selected

> **NOTE.** If the start and end bins are out of range (e.g., the ADCP ensemble contains 40 bins, and you set the Output Start Bin = 1 and the Output End Bin = 50), *VmDas* automatically adjusts the output bin range to the ADCP ensemble (i.e., Output End Bin = 40).

Suggested Setting.

The parameters set in the ADCP input port should match the ADCP wakeup serial port settings. TRDI recommends that the ADCP wakeup serial port settings be set at 9600 BAUD, no parity, 8 data bits, and 1 stop bit.

The NMEA 1, 2, and 3 ports read NMEA data. The NMEA 0183 standard specifies 4800 BAUD, no parity, 8 data bits, and 1 stop bit. Never the less, many ships use 9600 BAUD, and some may use faster rates.

NOTE. Advanced users can change the ADCP serial port parameters with a command file. Those parameters are used only while collecting data. When data collection stops, the serial port settings the ADCP uses will return to their wakeup values.

VmDas automatically changes the PC serial port when the ADCP serial port changes.

2.2.3 ADCP Setup Tab

Use this dialog box to setup the ADCP. Select either **Use Options** to set the ADCP commands on this tab or select **Use File** to use a command file (see the *VmDas* Quick Start Guide for a description of each command file).

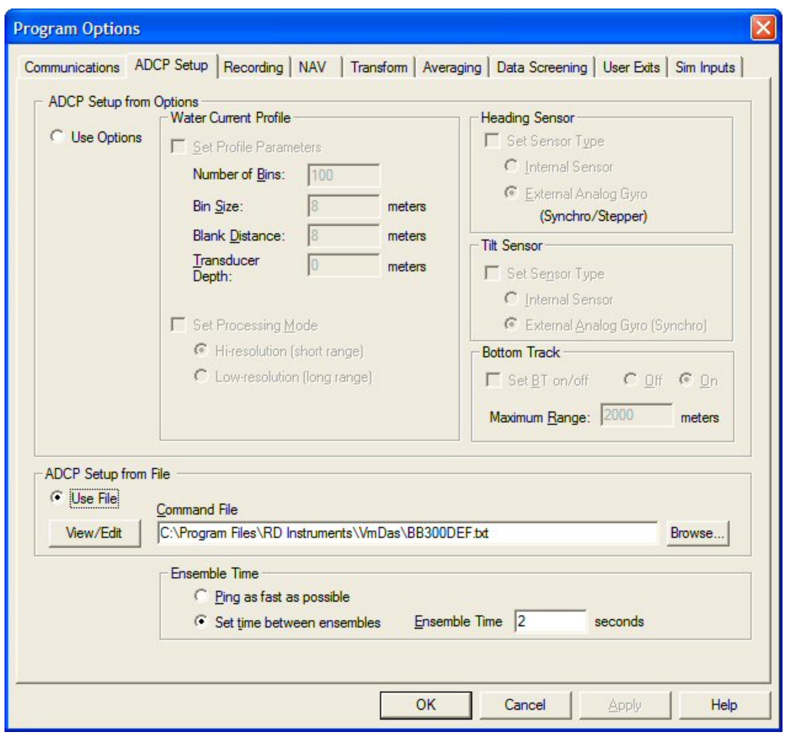

Figure 9. ADCP Setup Tab

Ensemble Time is set on this tab for both **Use Options** and **Use File**. Select the **Set time between ensembles** button to specify a ping interval (see Table 1). Select the **Ping as fast as possible** button to let the processing and I/O time dictate the ping rate.

Table 1: Ensemble Time

Frequency (kHz)	With Bottom Track (sec)	Without Bottom Track (sec)
38	4	2
75	2	1
150	1	1
300		
600	Select **Ping as Fast as possible**	
1200		

> **NOTE.** See Detailed ADCP Initialization for details on how the ADCP commands are generated and sent to the ADCP.

To set the ADCP commands using this dialog box, select the **Use Options** button.

- Select the **Set Profile Parameters** box in the **Water Current Profile** section to set the following parameters; **Number of Bins** (WN), **Bin Size** (WS), **Blank Distance** (WF), and **Transducer Depth** (ED).
- Select the **Set Processing Mode** box to switch between high and low resolution modes.
- Select the **Set BT on/off** box to enable or disable bottom track pings (BP1) and set the maximum search range (BX command).
- Select the **Heading Sensor Set Sensor Type** box in this section to switch between using the ADCP's internal sensor or an external analog gyro (synchro/stepper) (EZ command).
- Select the **Tilt Sensor Set Sensor Type** box in this section to switch between using the ADCP's internal sensor or an external analog gyro (synchro) (EZ command). When this box is not checked, the default ADCP setup will be used.

To set the ADCP commands using a command file, select the **Use File** button. Enter the name of an ADCP command file in the **Command File** box, or click the **Browse** button to navigate to a file using a **File Open** dialog box. This should be a text file with one ADCP command per line, and can have any valid ADCP commands. The contents of this file will be sent to the ADCP during initialization.

> **Suggested Setting for First Time Users.**
>
> Select the **Use File** button in the **ADCP Setup file** area and click the **Browse** button under the **Command File** window. Select one of the default command files (see the Quick Start Guide and Command Files and ADCP Configuration) and click Open.
>
> Set the **Ensemble Time** as shown in Table 1.

> **NOTE.** The ADCP automatically increases the Time per Ensemble if ((WP + NP + BP) x TP > the setting in **Set time between ensembles** box).

2.2.4 Recording Tab

The Recording property page allows you to set the deployment name and path to where the data files are recorded.

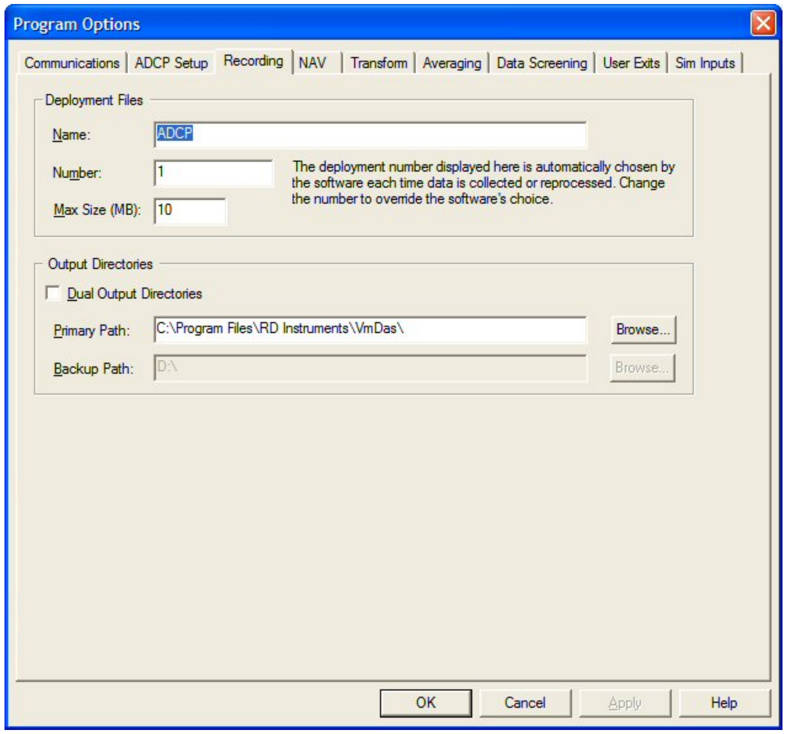

Figure 10. Recording Tab

Enter a name that identifies your deployment. This name is used as part of the file-name for each file that is part of this deployment (see File Naming Conventions).

Normally, you do not need to enter a starting **Number** as the software handles it automatically. This deployment number is used to identify the specific data collection run, and becomes part of the filename of each data file recorded for the deployment. If you do not enter a deployment number, the software will automatically assign one for each deployment.

Enter the desired **Maximum File Size**. Each file type in your deployment will be limited to the specified size. Each file has a sequence number as part of the file name and as each recorded file reaches the specified size limit, the sequence number will be incremented and a new file started. It is not recommended to set the **Maximum File Size** greater than 10MB as larger files will slow data processing considerably.

For example, a data files produced by *VmDas* during **data collect** mode has the following file name: RDI000_000001.enr, where:

RDI	is the user-entered name for the deployment,
000	is the deployment number (changes with each stop/restart),
000001	is the file sequence number, which is incremented when the specified maximum file size is reached, and
enr	is the file extension, and reflects the type of data in the file is raw data

Enter the **Primary Path** where the raw, intermediate, and processed data files are to be stored. Clicking the **Browse** button to the right of the **Primary Path** edit box will allow you to browse your computer to select a folder to record to. You will be presented with a **Choose Directory** dialog box (see Figure 11), which will have the default path of *C:\Program Files\Teledyne RD Instruments\VmDas* selected. Select the primary path (note the directory must already exist) and click **OK**.

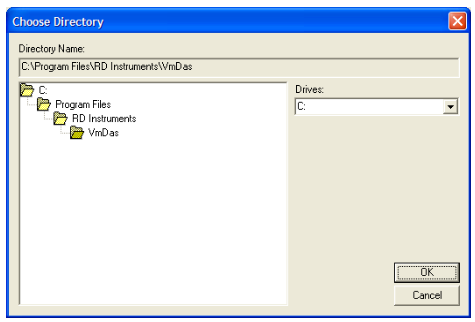

Figure 11. Choosing the Path

Check the **Dual Output Directories** box to create two copies of the raw data files and to allow a backup path to be entered. If this box is not checked, only the **Primary Path** is enabled.

Enter the **Backup Path** where optional backup copies of raw data and option files are stored. These files are not used for data processing. They are available in case the primary files are lost. If the backup copies are needed, copy them to the primary directory and reprocess them to create intermediate and processed data files.

Suggested Setting.

Enter a file name that identifies your deployment.

Select the primary path (note the directory must exist already; *VMDAS* does not create it, except for the default path already entered).

2.2.5 NAV Tab

Use the **NAV** tab to decide whether or not to save GGA or VTG data in the NAV field of the ENS, ENX, STA, and LTA files. Choose which enabled ports to read it from on the drop down list. Only enabled ports appear in the drop down lists.

You can enable a backup source for GGA or VTG by checking the **Enable Backup** box. If you choose a backup source, the primary source will be put into the NAV field. If primary data becomes invalid, backup data will be saved in the NAV field instead.

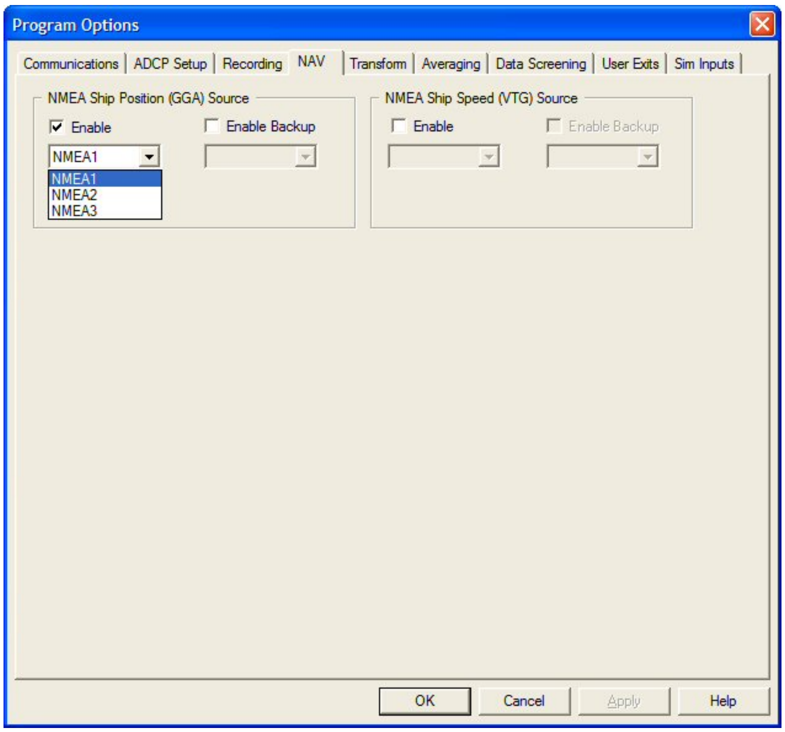

Figure 12. NAV Tab

The following examples are allowable: A user might select identical data from the same port as the primary and backup source for an option.

- Select **HDT** from **NMEA 1** as the primary heading source, and **HDT** from **NMEA 2** as the backup.
- Select **HDT** from **NMEA 1** as the primary heading source and **HDG** from **NMEA 1** as the backup.

NOTE. If the primary data drops out, there may be a problem with the instrument, cable, or data. For best results, select another message from a different source as backup.

2.2.6 Transform Tab

VmDas reads single ping beam coordinate data from the ADCP. *VmDas* transforms the data to earth coordinates and averages it. How the transformation is done depends on details of the geometry of the ADCP, sensors, and the platform they are mounted on (see Note About Conventions for more insight). Use this screen to select the **Heading Source**, **Tilt Source**, **Heading Sensor Magnetic/Electrical Connections**, and **ADCP Alignment Correction**.

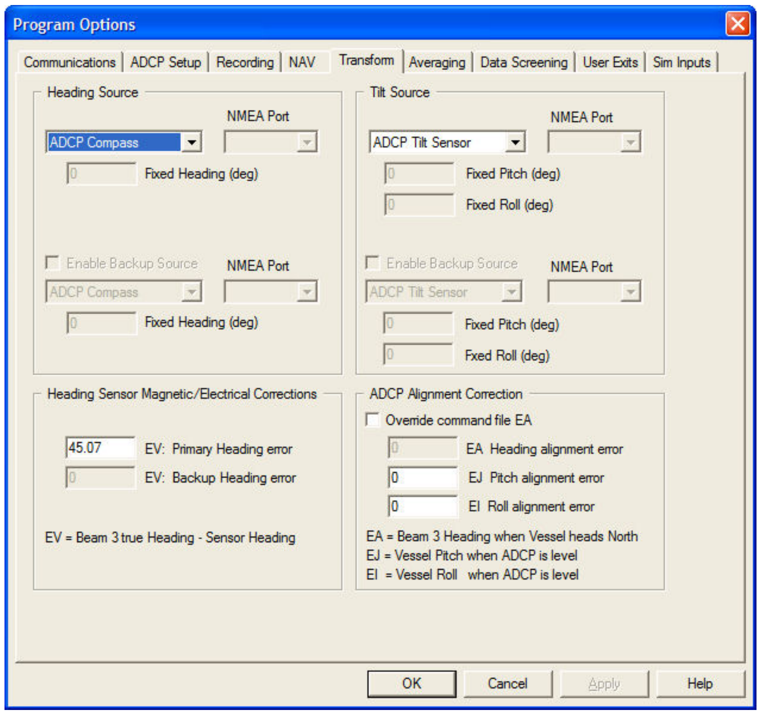

Figure 13. Transform Tab

VmDas stored the heading, pitch, and roll information from the ADCP in the ADCP leader data ID. Additionally it can store heading, pitch, and roll sensor data from a NMEA device in the NMEA data ID. This means that your data can contain information from both a direct connection to the ADCP and from an external input (NMEA). The **Transform** tab allows you to select which of these are actually used in the transformation.

Heading and Tilt Sources

VmDas can accept heading and tilt data from five sources.

- ADCP internal sensors
- External sensors (gyro) connected directly to the ADCP
- Fixed heading and tilts entered in the ADCP with a command file
- External NMEA sensors connected to the PC
- Fixed heading and tilts entered as options in *VmDas*

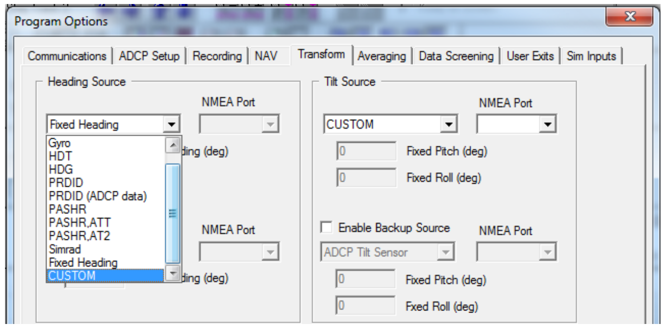

Figure 14. Transform Tab Heading Source

For the first two data sources, heading, pitch, and roll data are obtained from the variable leader of the ADCP ensembles. Select the **ADCP Compass** heading option and the **ADCP tilt Sensor** tilt option to use them in your transformation.

To use a *VmDas* generated fixed input for Heading Pitch, and Roll, select **Fixed Heading** and/or **Fixed Tilts**. Once selected, enter in the fixed heading or tilts you require. This information will be stored in the *VmDas* configuration file.

To use an external sensor input that produces data in NMEA format, select the heading or tilt option that contains the NMEA sentence you wish to read and the **NMEA Port** (NMEA1, NMEA2, or NMEA3). External sensor NMEA data is stored in the NMEA data ID.

NOTE. NMEA data is read through up to three serial ports. These serial ports must be configured on the **Communications** tab (see Communication Tab). Selecting NMEA data on the **Transform** tab without configuring the **Communications** tab serial ports results in an error. *VmDas* will not allow the options to be saved until the error is corrected.

NOTE. The NMEA HDG sentence contains magnetic heading, together with variation and deviation corrections. *VmDas* calculates true heading of the ship from this. When this sentence is the heading source, the only heading correction needed is a heading alignment error if the ADCP is not aligned with the ship.

NOTE. For information on using the CUSTOM option, see Using the Custom NMEA Feature.

Heading Sensor Magnetic/Electrical Connections

EV – Primary Heading Error. This is variation, the angle between magnetic north and true north. It is used to correct the heading from magnetic heading sensors. For degrees west, enter a negative value for EV and a positive value for east. For example, a magnetic variation of 3.5 degrees west should be entered as -3.5 for the EV value.

EV – Backup Heading Error. If the **Enable Backup Source** for the Heading is enabled, then you can enter a **Backup Heading Error**.

ADCP Alignment Correction

EA – Heading alignment error. The Heading Alignment Error is the angle between the forward axis of the ADCP and the forward axis of the ship or other platform onto which it is mounted. The EA command is used to correct the heading when the heading describes the attitude of the ship. EA is the heading of the ADCP's beam 3 when the ship is level and headed north. EA is positive if beam 3 is to the starboard. For Example, the ADCP is mounted in place on a moving ship. The Y-axis has been rotated 45 clockwise (+45) from the ship's centerline. Enter **45** in the **EA: Heading align error** box. To enter an **EA Heading Alignment error**, first enable the **Override command file EA** box.

EJ – Pitch alignment error. EJ is the pitch of the ship when the ADCP is level. For example, the amount of rotation that the ADCP's Y-axis is physically offset from the ship's starboard axis is 2 degrees. Enter **2** in the **EJ Pitch alignment error** box. The tilt correction is positive if the Y-axis is to the starboard.

EI – Roll alignment error. EI is the roll of the ship when the ADCP is level. For example, the amount of rotation that the ADCP's X-axis is physically offset from the ship's starboard axis is –1.2 degrees. Enter **–1.2** in the **EI Roll alignment error** box. The tilt correction is positive if the X-axis is to the starboard.

NOTE. To verify the EV, EA, EJ, and EI corrections, do the Water Profile Reasonableness Test as shown in the ADCP Technical Manual Test section.

NOTE. If reprocessing data and heading corrections are enabled, EA, EB, and EV commands in a command file will have no effect. If tilt corrections are enabled, EA, EI, and EJ commands will have no effect. *VmDas* will issue its own EA0, EB0/EV0, EI0, and EJ0 commands after the command file has been sent to the ADCP.

NOTE. If an ensemble contains EA and EV information in its fixed leader, *VmDas* will apply the corrections in addition to other corrections entered in the Transform page.

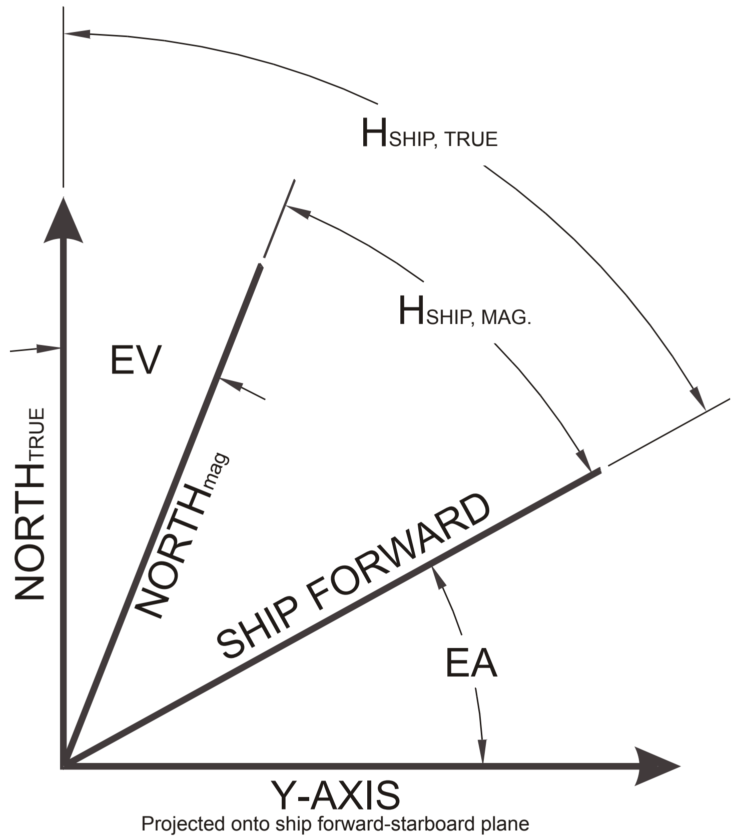

Figure 15. Y-Axis Alignment

Note About Conventions

VmDas needs the attitude (Heading, Pitch, and Roll) of the ADCP to obtain true water and bottom east and north components. However, heading, pitch, and roll devices sometimes describes the attitude of the ADCP an other times they describe the attitude of the ship or other platform that the ADCP is mounted on. Sometimes heading is magnetic, sometimes true. *VmDas* can accept any of these.

When describing the attitude of a ship, heading is the angle between the forward axis and true or magnetic north. Actually, the projection of the forward axis on the horizontal plane is used. This usually makes very little difference in practice. Pitch and roll describe the tilt of the mast.

Pitch is positive if the bow is higher than the stern. Roll is positive if the port side is higher than the starboard side. As seen from above, a clockwise rotation of the ship makes the heading increase.

When describing the attitude of an ADCP, the ADCP takes the place of the mast. Beam 3 marks the forward axis. If beam 3 points north (slanted up or down), then the heading is zero. It does not matter whether the system is concave or convex, or whether transducer 3 is on the north or south side of the instrument. Therefore, your attitude input must reflect the attitude of the ADCP, which may or may not be the same as the ship.

An ADCP uses the same sign conventions as a ship. The "bow" is always the beam 3 side. The "stern" is the beam 4 side. Port and starboard are marked by beams 1 and 2, but which is which changes when the ADCP is rotated from up facing to down facing.

Facing up or down, an ADCP has a positive pitch if the "bow" (the beam 3 side) is higher than the "stern" (beam 4). Roll is positive if the port side is higher than the starboard side. Heading increases as the forward (beam 3) axis rotates in a clockwise direction.

Pitch and roll should always be near zero in relation to the ship. An ADCP has an internal sensor to tell whether it is facing up or down. It sets an up-facing/down-facing flag in the system configuration field of the fixed leader in each ensemble. *VmDas* reads this flag and corrects internally before doing the transformation to earth coordinates.

The unit for all angles is degrees.

2.2.7 Averaging Tab

The Averaging property page allows you to set the Ensemble Averaging interval and Reference Layer Averaging properties.

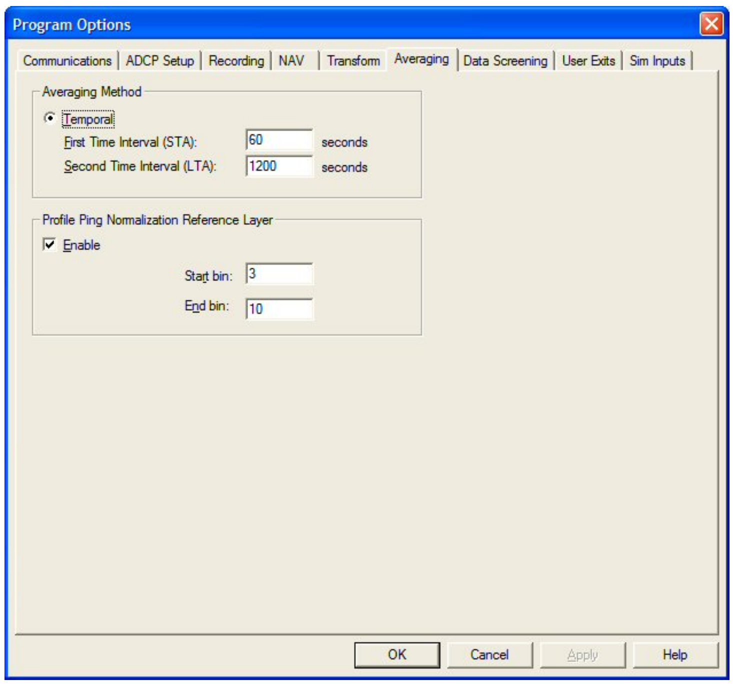

Figure 16. Averaging Tab

Enter the **Temporal Averaging** short-term averaging in the **First Time Interval (STA)** box. Use the short-term average to get updates more frequently for data quality checks. The **First Time Interval (STA)** is what we refer to as the Short Term Average (which will become file name with a *.STA extension).

Enter the long-term averaging period in the **Second Time Interval (LTA)** box. Use the long-term average to get your intended results. The **Second Time Interval (LTA)** is what we refer to as the Long Term Average (which will become file name with a *.LTA extension).

Enable the **Profile Ping Normalization Reference Layer** checkbox to turn ON or OFF the reference layer averaging feature. Using a Reference Layer helps removes biases caused from accelerations on platforms or ships. To set up a Reference Layer, you must set the **Start Bin** and the **End Bin** to use as the "meaning" reference layer.

Noise, introduced by platform accelerations, can overwhelm the velocity measurements. We have found keeping track of velocities relative to a stable reference layer can improve the data in such cases. As an example, suppose we have a four-ping ensemble. Because signal amplitude falls off with distance, the deeper bins will have more of the data flagged as bad. Bad data are not included in averages. As a result, the average profile might be erratic when the percent good is low. In the data below, a constant profile is assumed for bins 20 to 22, yet the average of good data shows it to be sheared.

	Ping #				
	1	2	3	4	
Bin	**Velocities**				**AVG #1**
1	5	6	18	19	12
2	3	4	16	17	10
↓	↓	↓	↓	↓	↓
20	bad	bad	bad	16	16
21	2	bad	bad	bad	2
22	bad	bad	15	bad	15

Bins 1 and 2 have all good data; and in this example, are used as the reference layer. Averaging these bins for each ping gives a reference velocity of:

```
       Ping #:             1   2    3    4
Layer Average:             4   5   17   18
Mean Layer Average = 11 : (4 + 5 + 17 + 18) / 4
```

When the layer average is subtracted from the velocities within each ping the data become:

Bin	Velocities				Average #1	Average #2
1	1	1	1	1	1	12
2	-1	-1	-1	-1	-1	10
↓	↓	↓	↓	↓	↓	↓
20	bad	bad	bad	-2	-2	9
21	-2	bad	bad	bad	-2	9
22	bad	bad	-2	bad	-2	9

The last column, Average #2, gives a better picture of the velocities at the deeper bins than the algorithm for obtaining AVG #1.

NOTE. When using a reference layer, use bins in the upper part of the profile and bins that have a high percent good (more than 85%). If you select a bad bin range, the averages will be wrong and data will be bad.

Suggested Setting.

You will be collecting three different files and will be able to view all three during real time data collection. The first file is the raw data input, which is *single ping* data. The selections for the other two files are based on your time input values here. The **First Time Interval** is what we refer to as the Short Term Average (which will become file name with a *.STA extension). The **Second Time Interval** is what we refer to as the Long Term Average (which will become file name with a *.LTA extension). You can set these to any times you like and they may even be the same value.

2.2.8 Data Screening Tab

Click the checkboxes for the data screening options you wish to enable. When a box is checked, its associated edit box becomes enabled, and you may enter a threshold value for screening the data.

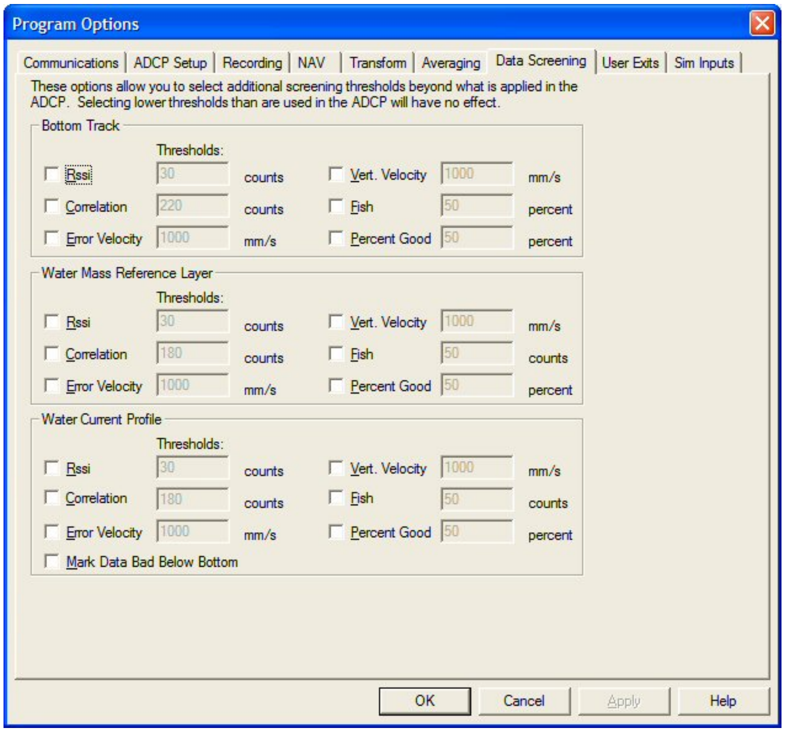

Figure 17. Data Screening Tab

For **RSSI** (amplitude), **Correlation**, and **Percent Good** screening, the threshold value represents a minimum allowed value. For example, if you set the RSSI threshold to 35 counts, then any beam with an RSSI value below 35 counts will be discarded and not used in the processed data. RSSI and correlation screening for each beam are performed on the raw data. Percent good screening is performed on the averaged data.

For **Error Velocity** and **Vertical Velocity** screening, the threshold value represents a maximum allowed value. For example, if you set the **Error Velocity** threshold to 1500 mm/s, then any transformed ensemble that has an error velocity greater than 1500 mm/s will be discarded and not used in the processed data. **Error Velocity** and **Vertical Velocity** screening are performed on the transformed data, before averaging.

For **Fish** screening (also known as false-target detection), the threshold used for bottom track is based on percentage, and the water track ping and profile ping is based on counts.

Check the box labeled **Mark Data Bad Below Bottom** to have the software mark bad all profile bins that fall below the sea bottom. The formula is LastGoodBin = (ShallowestBeam) * (COS (BeamAngle)) + (BinLength).

NOTE. The ADCP has its own internal thresholds. Setting thresholds on this page that is lower than those used by the ADCP will have no effect.

While it is possible for advanced users to modify the ADCP command file to disable some of the internal thresholds, this practice is not recommended. *VmDas* is designed to do those checks. It allows you to change them when you reprocess the data. This gives you the maximum flexibility.

Suggested Setting.

You are able to screen data based on the items in this menu and the thresholds you decide during real-time or when reprocessing. This screening will affect what is displayed on the screen and what data is recorded to the *.STA and *.LTA files. *The original raw data will be unaffected by what is setup here.* For real-time data collection, we recommend you only enable **Mark Bad Below Bottom**. You can reprocess data later and change the settings in this screen to see what the effect is on the data.

2.2.9 Users Exits Tab

User exits are hooks at various points in the processing where the user can modify the data with an external program. The external user application needs to be written so that it will keep trying to look for the appropriate file names, which will not exist until *VmDas* creates them some time after starting the program. It then needs to monitor the file size to determine when new data is available, and it has to observe the same file size limits specified for *VmDas* and automatically advance to the next file in the sequence when the size limit is reached.

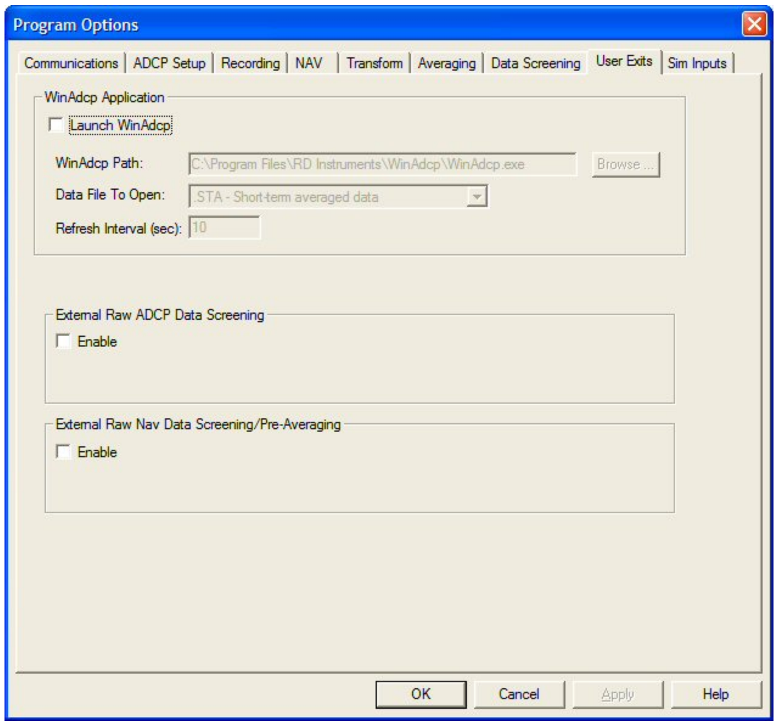

Figure 18. Users Exits Tab

Click the **Launch WinADCP** checkbox to have *VmDas* automatically start the *WinADCP* application in monitor mode when data collection is started. When in monitor mode, *WinADCP* will periodically refresh its displays from the data recorded by *VmDas*, and will allow you to view time series and contour graphs of the data. From the *WinADCP* application menu, you can exit the monitor mode to change the *WinADCP* setup, and then reenter the monitor mode to continue the data updates. The *WinADCP* application must be installed on the computer for this option to work.

Enter the *WinADCP* program file name in the **WinADCP Path** box, including the entire path for the directory in which it resides. *VmDas* uses this information to find the *WinADCP* application. Alternatively, you may click the **Browse** button to navigate using the **File Open** dialog.

Select which type of data to view with *WinADCP* using the **Data File to Open** box. Choose from single-ping beam data (ENR), single-ping screened beam data, single-ping Earth data (ENX), short-term averaged data (STA), or long-term averaged data (LTA). Once data collection has started, you can use the *WinADCP* application menu to open a different file type if desired. Just remember to exit the monitor mode in order to make the change, then reenter monitor mode to continue the automatic data refreshing.

Enter the number of seconds that *WinADCP* should wait between screen refreshes in the **Refresh Interval (sec)** box.

NOTE. When you press **Stop**, *VmDas* leaves WinADCP open so that your data screen does not disappear. A consequence of that is if you have *WinADCP* enabled as a User Exit, and click **Go**, **Stop**, **Go** in *VmDas*, it will cause a second instance of *WinADCP* to run.

Click the **External Raw ADCP Data Screening** checkbox (see VmDas User Exits and Figure 33) to give an external user-supplied program access to the raw ADCP data before the initial screening. The user-supplied program is expected to read raw ADCP ensemble data from the .ENR file and write the modified ensembles to an .ENJ file. This occurs before *VmDas* performs its data screening (does not bypass it), and if additional screening by *VmDas* is desired, it may be enabled.

Click the **External Raw Nav Data Screening** checkbox (see VmDas User Exits and Figure 33) to give an external user-supplied program access to the raw NMEA data. Normally the *VmDas* NMEA data screening logic reads data from the .N1R/N2R/N3R raw NMEA data file, screens the data and averages the data between ADCP time stamps, then writes the averaged data out in binary format to a .NMS file. When this user exit option is enabled, the user-supplied program is expected to read data from the .N1R/N2R/N3R files, and write the modified data to an .N1J, N2J, N3J, or text file with the same NMEA format. The *VmDas* NMEA data screening and averaging functions will then read the NMEA data from the .N1J (N2J or N3J) file instead of the .N1R (N2R or N3R) file.

NOTE. The last two user exits are enabled by clicking on their associated checkboxes in the **User Exits** tab. However, *VmDas* does not currently support automatic launching of these user exits. They must be launched independently before selecting **Go** on the **Control** menu in *VmDas*.

Suggested Setting.

If you want to view the data using *WinADCP*, select the **Launch WinADCP** box. Enter the path to the *WinADCP* program using the **Browse** button. *VmDas* will automatically enter the default path. Select what file you want to view in the **Data File to Open** drop-down list. Select a **Refresh Rate** equal to your STA or LTA file average. The *WinADCP* program will check *VmDas* for new data based on the **Refresh Rate.**

2.2.10 Simulated Inputs Tab

Use the simulated data files to help learn how to use *VmDas* or to test the User Exits.

> **NOTE.** Enabling the simulated data will automatically disable the serial port communications setting for the corresponding items on the communication setup tab.

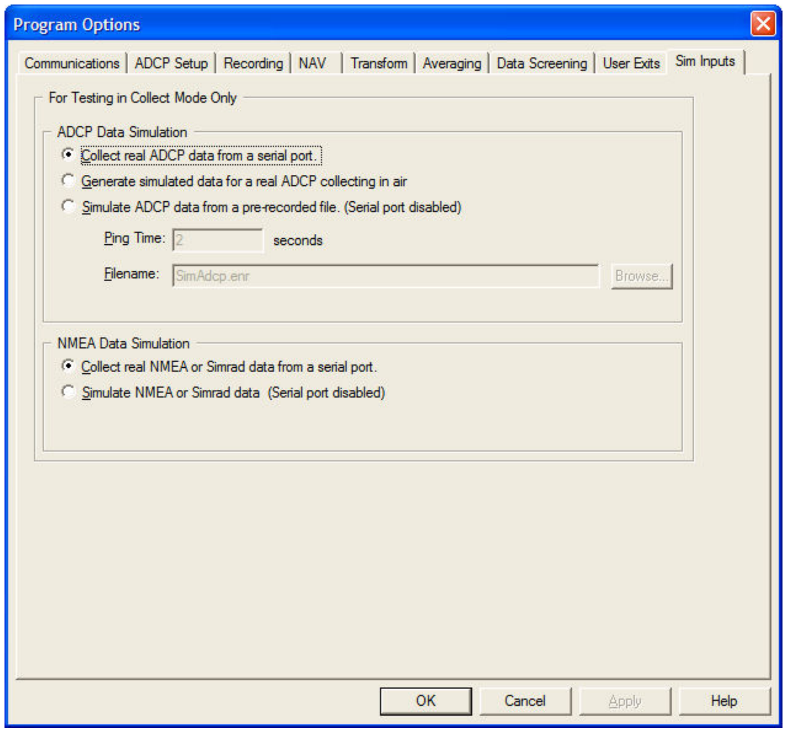

Figure 19. Simulated Inputs Tab

ADCP Data Simulation

There are two simulation modes for the ADCP data.

Simulate ADCP data from a pre-recorded file (Serial port disabled) – When you select this simulation mode, you collect data from an ENR file: *VmDas* pretends it came from an ADCP. You need not have an ADCP connected to do this. When this mode is selected, you cannot setup the serial ports on the **Communications** tab. Changing settings on the **ADCP Setup** tab is allowed, but it does not change the simulated data "collected" from the file. When data collection starts (start simulating), the serial port is not opened. Instead, the file is read. *VmDas* will end the simulation when it reaches the end of the file.

Generate simulated data for a real ADCP collecting in air – The second ADCP simulation mode is much more realistic than the first mode. It "collects" data at your desk. Running an ADCP in air gives you bad data: this simulation mode replaces it with fake, but valid, data. You need an ADCP to use this mode.

On the **Sim Inputs** tab, check the radio button labeled **Generate simulated data for a real ADCP collecting in air**.

CAUTION. OS and OO systems should not ping with their transducers in air. For these systems, this simulation mode can be used with the transducer disconnected from the deck box.

Configure the serial port on the **Communications** tab and set the options on the **ADCP Setup** tab as if really collecting data. When collection starts, *VmDas* sets up the serial port, configures the ADCP, and begins collecting data. As *VmDas* reads each ensemble, it looks for the profile velocity, NB profile velocity, and BT fields. *VmDas* substitutes fake data into the fields it finds. The ensembles with fake data are written to the ENR file.

The BB and NB velocity profiles are set to

Bin	Beam 1	Beam 2	Beam 3	Beam 4
1	100	-100	0	0
2	101	-101	1	-1
3	102	-102	2	-2
↓	↓	↓	↓	↓

For bottom track, bottom and water track velocity is set to

Beam 1	Beam 2	Beam 3	Beam 4
0	0	1000	-1000

Range to the bottom is set to

Beam 1	Beam 2	Beam 3	Beam 4
10100	10200	10300	10400

Percent good is set to

Beam 1	Beam 2	Beam 3	Beam 4
100	100	100	100

All velocities are mm/s. Range to the bottom is cm. Percent good is percent.

NMEA Data Simulation

NMEA/Simrad simulation mode lets *VmDas* read data from the NMEA ports without controlling the NMEA/Simrad instruments. No instruments are used in this mode.

On the **Sim Inputs** tab, check the **Simulate NMEA or Simrad data (Serial port disabled)** radio button. Choose what ports to "collect" NMEA or Simrad data on the **Communications** tab. Configure the port as normal, but the only configuration that matters is whether the port is enabled. Enabled ports will be available as data sources on the **NAV** and **Transform** tabs as usual.

When collection starts, a configuration dialog appears for each enabled simulated port. The user can change the type of data or content of the data at any time by changing settings in the dialog and clicking **Update** (see Figure 20). Click the **Data Setup** button to go to the **Simulated Ship Setup** screen (see Figure 21).

NOTE. The user can move the dialogs, but not hide them.

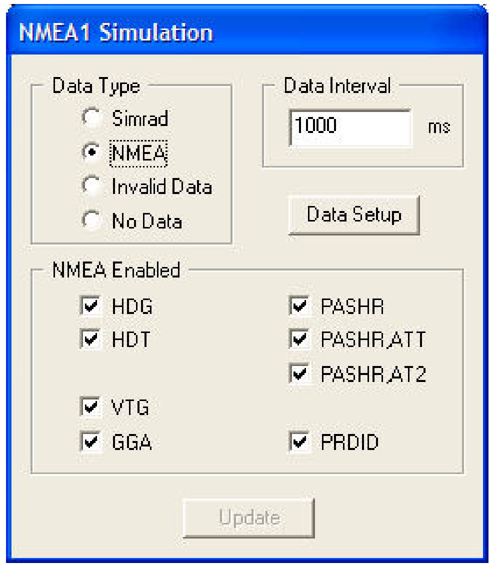

Figure 20. NMEA Simulation Settings

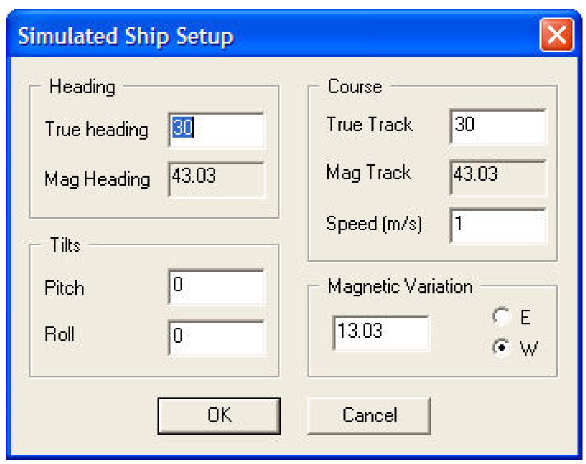

Figure 21. Simulated Ship Setup Screen

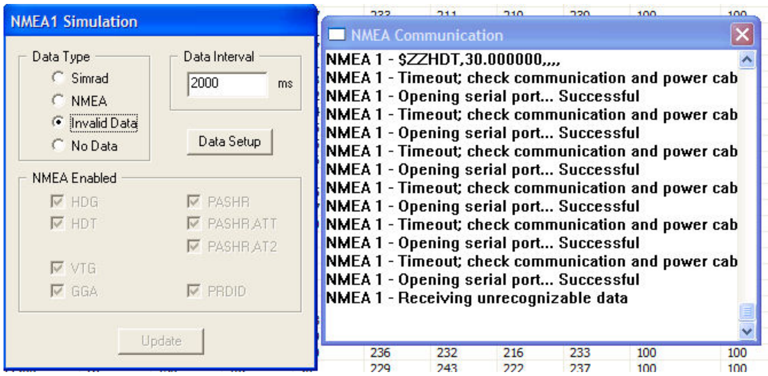

Figure 22. Simulating Invalid Data

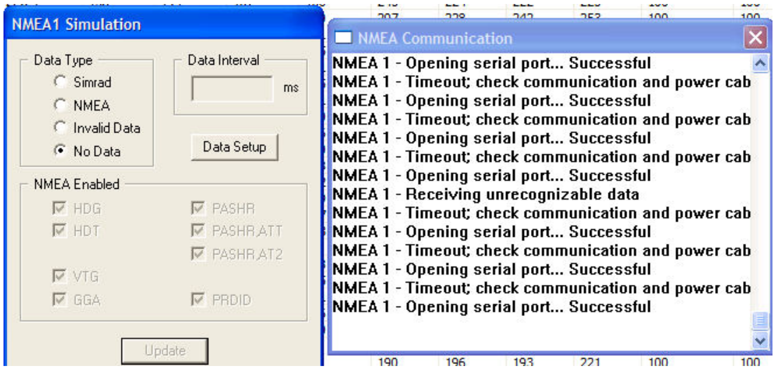

Figure 23. Simulating No Data

3 Command Files and ADCP Configuration

This section describes how to create a command file. To use an existing command file, see ADCP Setup Tab. Command files provide a way to configure the ADCP with user-selected commands as data collection begins. This provides the advanced user with more control than is possible by having *VmDas* configure the ADCP from user selected options.

3.1 Example Command Files

VmDas ships with several example command files, described in the VmDas Quick Start Guide.

- These command files are usable as they are. They will configure an ADCP with reasonable general-purpose settings.
- Each command file is intended for a specific ADCP. There are example files for Broadband, Workhorse, and Ocean Surveyors. Navigators should start with a Broadband file and edit it as described in the next section.
- For *VmDas* purposes, an Ocean Observer is the same as an Ocean Surveyor.

3.2 Creating Command Files

To create a new command file, do the following.

a. Make a copy of one of the default command files (see the Quick Start guide) and give it a new name. *VmDas* expects command files to have a txt extension, but other extensions can be used.

b. Open the copy in *NotePad®* or a similar type of text editor. Do <u>not</u> use editors such as *WordPad®* or word processors such as *Word®* or *WordPerfect®* because they add hidden characters to the file for formatting.

c. Edit the commands as needed. Refer to the ADCP Technical Manual for detailed information on each command.

d. You may want to add or edit commands, but most commands should not be deleted. Deleting a command leaves the configuration dependent on the ADCP's command default setting. This can cause the configuration to change unexpectedly if the command file is used with a different ADCP or the same ADCP with a new firmware version.

e. Save the file.

f. Test the new command file with the ADCP that the file is intended to configure. The ADCP ***<u>must</u>*** be in water.

> **CAUTION.** NEVER ping an Ocean Surveyor/Observer while the transducer is in air. This will damage the electronic chassis.

Open *VmDas* in data collection mode. Edit the options and set the command file as described in the ADCP Setup Tab. Begin collecting data. If data collection starts normally and *VmDas* begins displaying data (even bad data), the test is passed.

g. If any command causes an error, *VmDas* will stop the initialization process and start over. This cycle will repeat indefinitely. If this happens, stop data collection and use *Notepad*® to look in the log file. An error message will pinpoint the offending command.

3.2.1 Command File Basics

A command file provides instructions to the ADCP for profiling setup, bottom track, and ADCP sensor source (internal such as the flux-gate compass or external such as the synchro or stepper gyro input). The following describes how to create or modify a command file.

- A command file should contain only ASCII characters. Each line should end with a Carriage Return.
- Use an ASCII text editor (e.g. *Notepad*®) to create a command file.
- Every line in a command file should be a command, a comment, or blank.
- Lines starting with a ';' (semicolon) are comments and will not be sent to the instrument.

NOTE. The default command files have comments that explain the function of each command. It is a good idea to keep the comments and edit them when you make command changes.

- ADCP's mostly use the same set of commands, but there are minor differences. Consult the ADCP technical manual for a particular ADCP for details of its commands.
- Commands are not case sensitive.

The following shows the printout of the default command file OS38BBDEF.txt.

```
;----------------------------------------------------------------------------\
; ADCP Command File for use with VmDas software.
;
; ADCP type:     38 Khz Ocean Surveyor
; Setup name:    default
; Setup type:    High resolution, short range profile(broadband)
;
; NOTE:  Any line beginning with a semicolon in the first
;        column is treated as a comment and is ignored by
;        the VmDas software.
;
; NOTE:  This file is best viewed with a fixed-point font (eg. courier).
; Modified Last: 12August2003
;---------------------------------------------------------------------------/

; 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), forty (WN) 24 meter bins (WS),
; 16 meter blanking distance (WF), 390 cm/s ambiguity vel (WV)
NP0
WP00001
WN040
WS2400
WF1600
WV390

; Enable single-ping bottom track (BP),
```

```
; Set maximum bottom search depth to 2000 meters (BX)
BP001
BX20000

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

; Three seconds between bottom and water pings
TP000300

; Six 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
TE00000600

; 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)
EA00000

; Set transducer depth to (decimeters)
ED00000

; Set Salinity (ppt)
ES35

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

3.2.2 Commands that Should be in a Command File

ADCP's mostly use the same set of commands, but there are minor differences. Consult the technical manual for a particular ADCP for details of its commands. In addition, some commands are not appropriate for all ADCP's. For example, only the Ocean Surveyor understands commands such as NP, EI, and EJ. They will cause errors if sent to other kinds of ADCP's.

For TRDI recommendations on which commands should be used with which ADCP, check the example command file for the ADCP.

Restore Factory Defaults

CR1

It is a good idea to restore the ADCP to the known factory default configuration before starting. CR1 should be the first command in the file.

Data fields

WD

Edit this to turn on or off each kind of data to record in the output file.

Profile

WP, NP, or both

For *VmDas* to perform correctly, command files must set the ADCP for single ping data. This means either a WP1 or NP1 or both (this is new in *VmDas* version 1.44) command(s) must be present if velocity profile data is desired. For no profile data, WP0 or NP0 must be set in the command file.

The Navigator only recognizes the WP command if the current profile feature is installed. It should not be in command files intended for Navigators without this upgrade.

Command files for Ocean Surveyors should include NP1 or NP0. Other ADCPs do not recognize this command, and should not have it.

WS, WF, WN, WV (or NS, NF, NN for Ocean Surveyors using the NP1 command)

These commands configure the velocity profile. Edit these to fit the ADCP and deployment. Omit them for ADCPs that do not have water pings.

Bottom Track

BP

For *VmDas* to perform correctly, command files must set the ADCP for single ping data. This means a BP1 command must be present if bottom track data is desired, or BP0 if not.

Some Workhorses do not recognize the BP command unless they have the Bottom Track upgrade installed. It should not be in command files intended for Workhorses without this upgrade.

BX

This sets the maximum bottom tracking depth the ADCP will use. Edit it to fit the ADCP and deployment.

Some Workhorses do not recognize the BX command unless they have the Bottom Track feature upgrade installed. It should not be in command files intended for Workhorses without this upgrade.

Timing

TP

This sets the time between bottom track and water pings. It is the only timing command that normally needs to be in the command file.

TE

This is not needed since *VmDas* does single pinging; it and other timing commands have no effect. It is present so that a user reading the file will see it, read the accompanying comment, and understands that timing is controlled by the ADCP Setup tab in the options.

Coordinate Transformation

EX00000

VmDas requires the data to be in beam coordinates. *VmDas* will then transform the data to earth coordinates. *VmDas* will over-write any EX values to EX00000 in the ADCP command text file.

NOTE. The automatically generated EX00000 command is not stored by the CK command. If the ADCP were to be used with another program without setting the EX command in the command file, it would not have the same configuration.

External Sensors

EZ

The EZ-command tells the ADCP to use data from a manual setting or from an associated sensor. When a switch value is nonzero, the ADCP overrides the manual E-command setting and uses data from the appropriate sensor. If no sensor is available, the ADCP defaults to the manual E-command setting in instrument coordinates regardless of the coordinate frame parameter of the E-command setting. The example command files contain either EZ1020001 for shipboard use or EZ1111111 for a stationary deployment (such as Oil Rig platforms). Edit this command as needed.

ED

The ED command sets the transducer depth. Edit this to fit the ADCP and deployment.

Store to Nonvolatile Memory

CK

This command stores the ADCP's current configuration in the ADCP's nonvolatile memory, so that the ADCP wakes up in the same state after being shut down. All commands above CK in the command file (except CB, see below) will be permanently stored. Commands sent after the CK command will not be saved. Make sure CK is the last command in the command file.

VmDas sends commands after the command file is done. These commands are not stored in non-volatile memory.

Serial Port Configuration

CB

This command configures the ADCP's serial port. *VmDas* watches for the CB command and provides the special handling that it needs.

First, *VmDas* reads the CB command before sending it to the ADCP. After the command is sent, *VmDas* configures the PC serial port to match the ADCP. Communication is not lost.

Second, it is very important that the ADCP wake up with its serial port in a known state. This state need not be the same as a high-speed configuration desired for transmitting.

VmDas provides for keeping the wakeup and data collection serial port configurations separate. *VmDas* does not send the CB command immediately upon reading it in the command file. The CB command is sent after all other commands in the command file are sent. This means that the CB command will never be saved because it is sent after the CK command. *VmDas* will not change the wakeup serial port configuration.

3.3 How VmDas uses Command Files

When **Use File** is selected in the **ADCP Setup** tab, the commands in the command are sent to the ADCP. The same command file can be used for several deployments. Whenever data collection starts, *VmDas* copies the current options into a VMO file. This includes the path and filename of the command file, if any. The command file itself is not copied into the VMO file.

When data collection starts, *VmDas* sends commands to the ADCP to configure it. *VmDas* creates some of the commands. Others are taken from the command file, if the options are set to do so. *VmDas* may edit the commands in the command file before sending them to the ADCP, as described in Detailed ADCP Initialization.

VmDas creates a log file (extension LOG) whenever data collection is started. This file contains the commands sent to the ADCP, the replies returned by the ADCP, and some auxiliary information such as time stamps.

When configuring an ADCP, *VmDas* sends commands one at a time, and waits for a response after each line. If *VmDas* does not receive a response or the response is an error message, initialization fails. *VmDas* will start initialization over again. *VmDas* will keep trying until it succeeds or the program is stopped.

3.4 Detailed ADCP Initialization

3.4.1 Choosing Setup Parameters

As *VmDas* begins collecting data, it configures the ADCP by sending it commands. Which commands are sent depends partly on options the user selects and partly on the type of ADCP.

The major choices the user makes are in the ADCP Setup tab of the options dialog. The primary choice is **Use Options** or **Use File**.

Selecting **Use Options** activates more user options. *VmDas* creates commands from the options.

Selecting **Use File** causes *VmDas* to configure the ADCP by reading commands from a command file, as described earlier in this section.

Either way, *VmDas* adds commands of its own. Some commands depend on options the user has selected or the type of ADCP connected. It should be noted that *VmDas* will override a command in a command file if it will setup the ADCP in such a way that it would conflict with *VmDas* ability to process the data. The following sections explain the specific commands that are over written.

Manual pinging

VmDas always generates a CF 0111x command, where x indicates that the last bit is unchanged from its current setting. This bit controls the recorder.

This setup places the ADCP in a Manual Ensemble mode. A Manual Ensemble mode means that *VmDas* controls the timing of ADCP ensembles and therefore the TE and TP commands are ignored. *VmDas* sets up the ADCP for single ping Water Profile and single ping Bottom Track (if Bottom Track is required). Because of this setting, the ADCP ensemble can be thought of as a ping and thus manual pinging.

Beam Coordinates

VmDas always generates an EX00000 command. This places the ADCP in Beam Coordinates. With the ADCP in Beam Coordinates, *VmDas* is able to perform the transformations to Earth Coordinates. The advantage of this is *VmDas* can interface with external Heading, Pitch, and Roll sensors and therefore it can be setup to use either the internal or external input for this information.

Heading and Tilt Corrections

Depending on options the user has selected and the type of ADCP, *VmDas* may generate EA0, EB0, EV0, EI0, or EJ0 commands (EV0, EI0, and EJ0 are generated for Ocean Surveyor with recent firmware only).

The EA0 and EB0 or EV0 commands are generated only if setting up from options (not a command file) and the heading corrections options are disabled. The EI0 and EJ0 commands are generated for Ocean Surveyor systems if setting up from options.

3.4.2 Detailed ADCP Initialization Procedure

When configuring an ADCP, *VmDas* automatically does the following.

a. Open the serial port using the settings from the **Communications** tab.

b. Send a break. The ADCPSoftBreak field in the INI file [ADCP Port Options] section is used to alter the type of a break *VmDas* sends through the ADCP port. When the field is set to FALSE (default) a Hard Break will be sent. If the field is set to TRUE, then a Soft Break composed of "===\r" will be sent.

c. Interpret the ADCP's response to the break to determine what kind of ADCP is present.

d. For **OS**, Initialize the ADCP time to the PC time with a TS command.

e. If a command file is selected, copy it to the ADCP one line at a time with the following caveats.

    - Letters are converted to upper case.
    - Comments (lines starting with ;) are ignored.
    - CS (Start Pinging) and CZ (Power Down) commands are not sent.
    - Baud rate commands (CB) are held until all other commands in the file have been sent
    - After each line, a check is done for an error message from the ADCP. If one is found, no further commands from the file are sent. Initialization will start over.
    - Immediately after sending a CB command, change the PC serial port parameters to match the CB command.

f. For **BB, WH,** and **NV**, read the beam-to-instrument transformation matrix. Write it to a log on the hard disk.

g. If **Use Options** was selected on the **ADCP Setup** tab *VmDas* will generate commands based on user selections and send them to the ADCP. User options are enabled and disabled by check boxes on the **ADCP Setup** tab (see ADCP Setup Tab). If the check box is unchecked, the **ADCP Setup** tab will not generate the commands, and the current ADCP settings will be used.

Bottom track

- If the **Set BT On/Off** check box is unchecked, nothing is sent.
- If **Off** is selected, BP0 is sent.
- If **On** is selected, BP1 and a BX command created from the **ADCP Setup** tab maximum range is sent.

Processing Mode

- If the **Set Processing Mode** check box is unchecked, nothing is sent.
- Different commands are sent to different types of ADCP, as shown in the tables below.
- If Hi-resolution (short range) option is selected, the following commands are sent.

Command	Command Description	ADCP Type
NP0	NB mode Pings per Ensemble	OS
WP1	Pings per Ensemble	OS,BB,WH, NV
WM1	WT Profiling Mode	BB,WH, NV
WB0	Mode 1 WT Bandwidth	BB,WH, NV
WV650	WT Mode 1 Ambiguity Velocity	BB
WV480	WT Mode 1 Ambiguity Velocity	WH, NV
<none>		All others

- If Low-resolution (long range) option is selected, the following commands are sent.

Command	Command Description	ADCP type
WP0	Pings per Ensemble	OS
NP1	NB mode Pings per Ensemble	OS
WP1	Pings per Ensemble	BB,WH, NV
WM1	WT Profiling Mode	BB,WH, NV
WB1	Mode 1 WT Bandwidth	BB,WH, NV
WV330	WT Mode 1 Ambiguity Velocity	BB, WH, NV
<none>		All others

Profile Parameters

- If the **Set Profile Parameters** check box is unchecked, nothing is sent.
- For BB, WH, NV type of ADCPs or OS in high-resolution mode, the following commands are constructed and sent.

Command	ADCP setup tab data source
WN	Number of Bins
WS	Bin Size
WF	Blank Distance
ED	Transducer Depth

- For OS in low-resolution mode, the following commands are constructed and sent.

Command	ADCP setup tab data source
NN	Number of Bins
NS	Bin Size
NF	Blank Distance
ED	Transducer Depth

h. Send commands for flow control, heading and tilt corrections, and coordinate transformations.

Flow Control

- This command is always sent.
- The current CF setting is read from the ADCP. A new command is generated using the last bit (the recorder bit) of the current setting.
- CF 0111x is sent.

Heading and Tilt Corrections

- If the user has selected **Use Options** on the ADCP Setup tab of the options, he does not intend to send his own commands. *VmDas* will send EI0 and EJ0 if appropriate for the ADCP, as shown below.
- If the user has selected **Use Options** and disabled tilt corrections, *VmDas* will send EA0 and EB0/EV0.
- If the user has selected **Use File**, but has enabled **Heading Corrections** on the Transform tab, the user does not intend to send EA, EB, or EV commands. *VmDas* will send the appropriate ones.
- If the user has selected **Use File** and has enabled **Tilt Corrections**, the user does not intend to send EA, EI, or EJ. *VmDas* will send them, as appropriate.

Command	Command Description	ADCP Type
EA0	Heading alignment correction	All
EB0	Magnetic variation	All except OS with recent firmware
EV0	Magnetic variation	OS with recent firmware
EI0	Roll alignment	OS with recent firmware
EJ0	Pitch alignment	OS with recent firmware

Coordinate Transformation

- Beam coordinates. EX00000 is always sent.

4 Reprocessing Data with *VmDas*

Reprocessing data allows you to change the settings in the **Averaging** and **Data Screening** tabs to see what the effect it has on the data. You are able to screen data based on the items in these menus and the thresholds you decide during real-time or when reprocessing. This screening will affect what is displayed on the screen and what data is recorded to the *.STA and *.LTA files. *The original raw data will be unaffected by what is setup here.*

a. Start *VmDas*. Click **File**, **Reprocess Data**.

b. Browse and locate the *.vmo file for the data you wish to reprocess. For this example, select the *SAMPLE002_000000.VMO* file. Click **Open** (see File Naming Conventions).

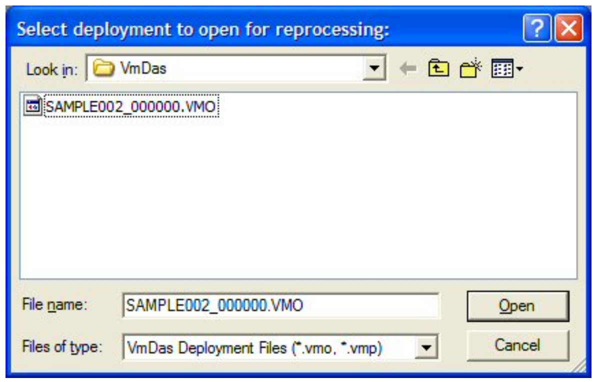

Figure 24. Select VMO File

c. Click **Options**, **Edit Data Options**.

d. Click the **Recording** tab (see Recording Tab).

- Verify the **Name** of the data set matches the **.VMO* file you wish to reprocess.
- Verify the **Number** of the data set matches the **.VMO* file you wish to reprocess.

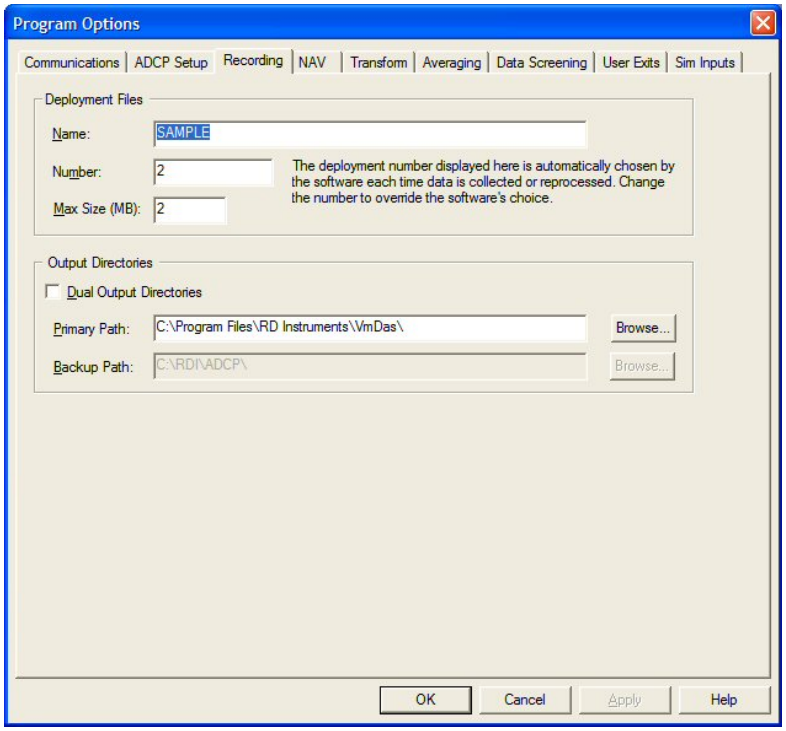

Figure 25. Reprocessing Data – Recorder Tab

e. Click the **Transforms** tab (see Transform Tab).

- The **Heading Source** needs to be selected for the input you intend to use. If you will use the gyro heading being fed into the ADCP real time then leave it selected to ADCP.
- The **Tilt Source** needs to be selected for the input you intend to use.

f. Click the **Averaging** tab (see Averaging Tab).

- Enter a time value for the **First Time Interval.** This is the Short Term Average (which will become file name with a *.*STA* extension). Enter a time value for the **Second Time Interval.** This is the Long Term Average (which will become file name with a *.*LTA* extension). You can set these to any times you like and they may even be the same.

g. Click the **Data Screening** tab.

- You are able to screen data based on the items in this menu and the thresholds you decide. This screening will affect what is displayed on the screen and what data is recorded to the *.*STA* and *.*LTA* files. The original raw data will be unaffected by what is setup here.

h. Click **OK** to exit the **Edit Data Options** screen.

i. Save the User Option file by clicking **Options**, **Save As**.

- Enter a file name for the *.ini file that you have just created.

j. To start data reprocessing, on the **Control** menu, click **Go**. You should see the Ensemble number increase on the Processing Bar during reprocessing. If the Processing Bar is not visible, Click **View**, **Processing Bar**. When reprocessing is done, you will see the message "Done!" next to the toolbar.

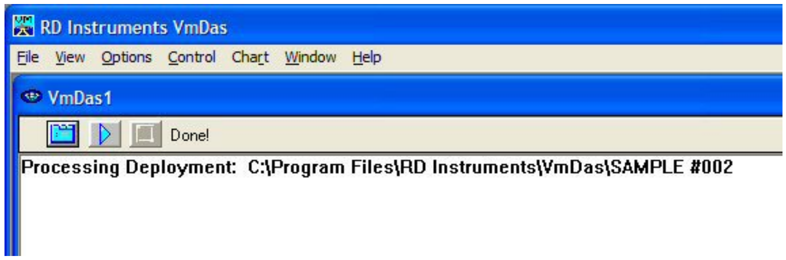

Figure 26. Reprocessing Done Message

NOTE. No data is displayed when reprocessing data. Playback the data file to see the results.

NOTE. *VmDas* versions 1.44 and above adds version information to the configuration files. If no configuration information is present when *VmDas* reprocesses a deployment, *VmDas* assumes that the configuration files are old. In this case, it sets new options to values that mimic older versions of *VmDas*.

Older versions of *VmDas* do not generate or recognize the options for *.N3R files. The new choices requires that the options to be saved in *VmDasAutoConfig.ini*, the deployment VMO files, and reprocessed VMP configuration files. Older versions of *VmDas* will take NAV and RPH NMEA data from their accustomed files for reprocessing.

5 Playback a Data File

a. Start *VmDas*. Click **File**, **Playback Data**.

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

> **NOTE.** *VmDas* will automatically search for *.enr, *.enx, *.sta, and *.lta files.
>
> In order to view files that use other naming conventions, the user can either type the file name directly into the **File name** field of the **Open File** dialog box, or click in the **Files of type** box to select the **All files (*.*)** filter from the drop-down list.

c. On the Playback Tool Bar, click **Play**.

d. Use the **Window Toolbar** to display the desired graphs and then click the **Resize** button to arrange the graphs. See the Quick Start Guide for more information on the Toolbars and displays.

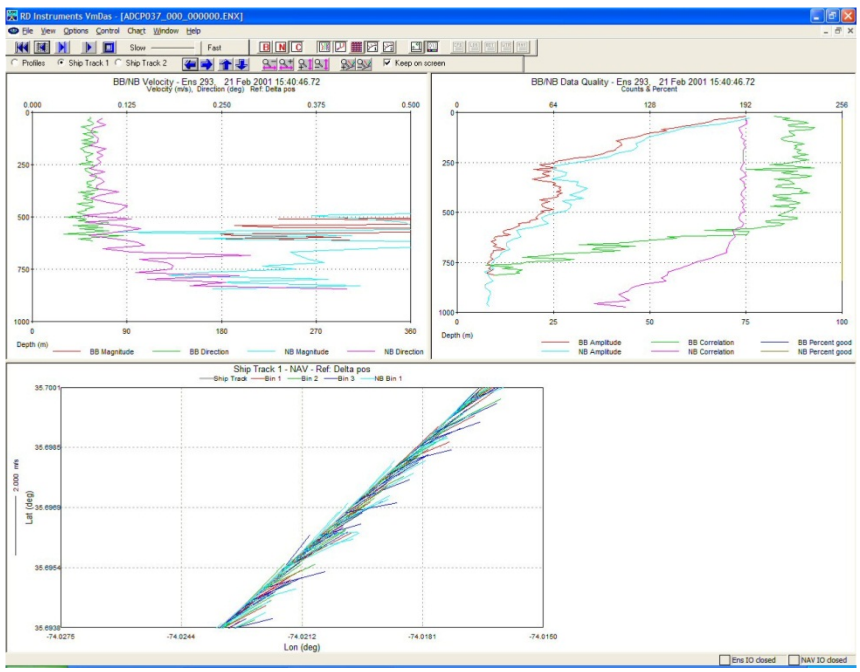

Figure 27. Playing Back a Data File

6 Turnkey Mode

When *VmDas* is started in the turnkey mode, a message box appears to prompt the user to start collecting data. After 30 seconds, or on confirmation, *VmDas* begins collecting data automatically.

Syntax – "C:\program files\Teledyne RD Instruments*VmDas*.exe" /autostart

For example, if a computer operating system has *VmDas* with the /autostart switch in the startup folder, *VmDas* will open with a message box asking if it is OK to start collecting data when the computer is started. The user clicks **OK** or waits 30 seconds for the message box to time out. *VmDas* will close the message box, open a document in data collect mode, and begin collecting data. If the user clicks **Cancel**, *VmDas* exits.

Figure 28. VmDas Shortcut in the Startup Folder

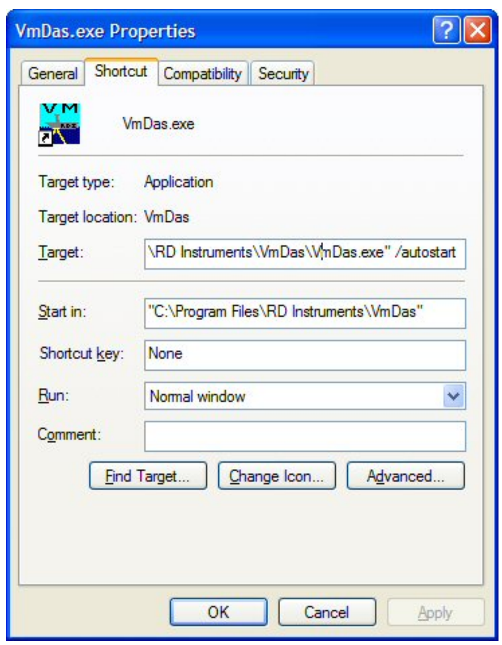

Figure 29. Shortcut Properties

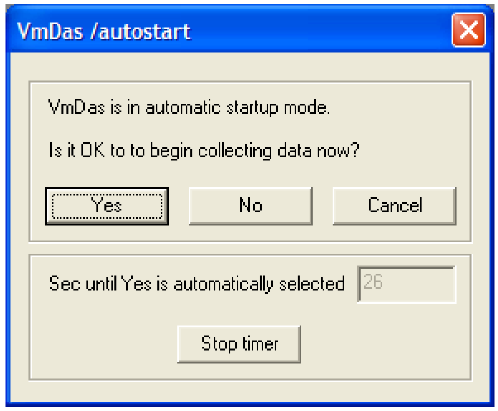

Figure 30. Autostart Dialog

NOTE. Turnkey mode only works on startup. Once data collection has started, *VmDas* reverts to normal operation. It will not enter turnkey mode again until closed and restarted with the /autostart switch. If a second document is opened with the **File**, **Collect Data** menu, the user must use the **Control**, **Go** menu item to start data collection. It will not happen automatically.

7 Disable a Beam

All ADCPs transmit signals into the water and receive the echoes backscattered from this transmission. Situations do arise, however, where very large backscattering (other than the normal scatters), can occur. Examples are structures, cables, other instruments, etc. In these situations, the user has to take care to make sure that these scatters do not interfere with the normal operation of the ADCP. In some cases, however, it may not be possible to avoid having objects blocking a beam. In this situation, the beam may be disabled.

a. Exit *VmDas*.

b. Open the *C:\Windows\VmDasAutoConfig.ini* file in NotePad® or a similar type of text editor. Do <u>not</u> use editors such as WordPad® or word processors such as Word® or WordPerfect® because they add hidden characters to the file for formatting.

c. Locate the **[Expert only options]** line (see Figure 31).

d. Edit the **TurnedoffBeam=0** line to **TurnedoffBeam=*x*** where x equals the beam number to turn off (1, 2, 3, or 4). Setting x to 0 enables all beams.

e. Save the *VmDasAutoConfig.ini* file.

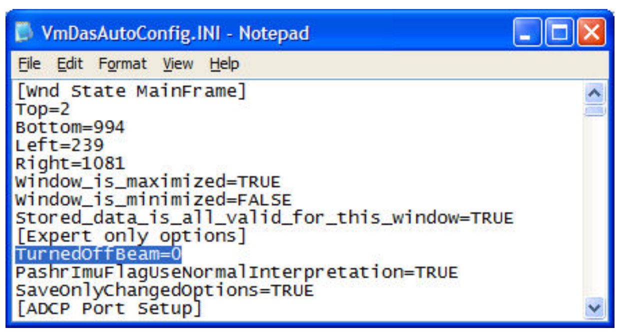

Figure 31. Disable a Beam

8 *VmDas* and NMEA Data

VmDas can read in, decode, and record ensembles from an ADCP and NMEA data from some specific (i.e. GPS and attitude sensors) external devices. *VmDas* stores this data in the raw NMEA data files (N1R, N2R, and N3R) (leaving all original data input in its original format) and in a combined, averaged data file. *VmDas* uses all of this data to create different displays for the user.

As well as being able to input NMEA strings to *VmDas*, it can produce NMEA output strings of speed log information. The speed log contains VDVBW (ground/water speed), VDDBT (depth), VDHDT (Heading True), and VDZDA (UTC Time and Date).

8.1 General NMEA Data Format

Much of the following information was abstracted from the NMEA 0183 standard. Discussion is limited to NMEA strings that *VmDas* understands. All NMEA messages are ASCII strings with the general format as shown in Table 2.

Table 2: NMEA Data Format

String	Description
$	HEX 24 – start of sentence
<Address field>	Approved address fields consist of five characters defined by the NMEA 0183 standard. The first two characters are the TALKER identifier. The next three characters identify the message. The proprietary address field consists of the proprietary character “P” followed by a three-character Manufacturer’s Mnemonic Code, used to identify the TALKER issuing a proprietary sentence, and any additional characters as required. (*VmDas* accepts any two valid characters as the TALKER identifier in approved address fields.) (Teledyne RD Instruments uses the TRDI Mnemonic Code for proprietary address fields, even though it is assigned to Radar Devices. *VmDas* also uses the unassigned ADC Mnemonic Code for its own data files).
[“,”<data field>] . . . [“,”<data field>]	Zero or more data fields, each preceded by a “,” (comma, HEX 2C) delimiter. The number of data fields and their content are determined by the address field. Data fields may be null (contain no characters). The comma delimiter is required even when a data field is null.
[“*”checksum field]	Checksum The checksum is the 8-bit exclusive OR of all characters in the sentence, including “,” delimiters, between but not including the “$” and the “*” delimiters. The hexadecimal value of the most significant and least significant 4 its of the result are converted to two ASCII characters (0-9, A-F) for transmission, The most significant character is transmitted first.
<CR><LF>	HEX 0D 0A – End of sentence

Data Fields

Detailed descriptions of each message *VmDas* uses are provided below. These descriptions use format specifiers for data fields. The meanings of some of the formats are listed in Table 3.

Table 3: Data Fields

Field	Description
hhmmss.ss	A mixed fixed/variable length time field. 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds, and a variable number of digits for decimal-fraction of seconds. Leading zeros are always included for hours, minutes, and seconds to maintain fixed length. The decimal point and associated decimal-fraction are optional if full resolution is not required.
x.x	A variable length integer or floating numeric field with optional leading and trailing zeros. The decimal point and associated decimal-fraction are optional if full resolution is not required. (example: 73.10 = 73.1 = 073.1 = 73). A negative sign "-" (HEX 2D) is the first character if the value is negative. The sign is omitted if value is positive.
hh	A fixed length HEX number. The most significant digit is on the left.
a aa aaa etc.	A fixed length alpha field. This type of field contains a fixed number of upper-case or lower-case alpha characters. In all strings recognized by *VmDas*, all these fields have a length of one character.
x xx xxx etc.	A fixed length numeric field. This type of field contains a fixed number of numeric characters (0 - 9). Some fields allow negative values. If needed, a negative sign "-" (HEX 2D) is the first character, increasing the length of the field by one. The sign is omitted if value is positive.
A	A single character status field. A = Yes, Data Valid, or Warning Flag Clear. V = No, Data Invalid, or Warning Flag Set.
Other single letter	A single character field with fixed content. The letter is the content of the data field. When used below, the HEX value of the letter is also given.

NOTES. Spaces should not be used anywhere in these NMEA strings. Spaces may only be used in variable text fields. No NMEA string recognized by *VmDas* uses a variable text field.

If data is not available or unreliable, a null field is used. A null field is a field with no characters in it. When a null field is present, two delimiters (comma, *, or <CR>) are found side by side. A null field does NOT contain the zero character (HEX 30), the ASCII NUL character (HEX 00), a space (HEX 20), or other character.

VmDas ignores some fields when it decodes messages. The fields it reads are explained in NMEA Input.

8.2 NMEA Input

The messages *VmDas* reads are standard GGA, HDG, HDT, VTG messages, and the TRDI proprietary PRDID, PASHR, PASHR,ATT, and PASHR,AT2 messages.

VmDas NMEA data files will contain the TRDI proprietary PADCP message. *VmDas* generates this message and uses it internally. It is expected to be of no use externally, and is not transmitted to other devices. It is stored in the *.N1R, *.N2R and *.N3R data files.

8.2.1 GGA – Global Positioning System Fix Data

Time, position, and fix related data for a GPS receiver.

$__GGA,hhmmss.ss,llll.ll,a,yyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh<CR><LF>

Table 4: GGA NMEA Format

Field		Description
1*	hhmmss.ss	UTC of position - 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds, and a variable number of digits for decimal-fraction of seconds. Leading zeros are always included for hours, minutes, and seconds to maintain fixed length. The decimal point and associated decimal-fraction are optional if full resolution is not required.
2*	llll.ll	Latitude - Two fixed digits of degrees, 2 fixed digits of minutes, and a variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to maintain fixed length of the first 4 chars. The decimal point and associated decimal-fraction are optional if full resolution is not required.
3*	a	Latitude hemisphere. N or S.
4*	yyyy.yy	Longitude - 3 fixed digits of degrees, 2 fixed digits of minutes, and a variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to maintain fixed length of the first 5 chars. The decimal point and associated decimal-fraction are optional if full resolution is not required.
5*	a	Longitude hemisphere. E or W.
6*	x	GPS Quality indicator: 0 = fix not available or invalid 1 = GPS fix 2 = Differential GPS fix 3 = GPS PPS Mode, fix valid 4 = Real Time Kinematic. System used in RTK mode with fixed integers 5 = Float RTK. Satellite system used in RTK mode, floating integers 6 = Estimated (dead reckoning) mode 7 = Manual Input Mode 8 = Simulator mode This shall not be a null field.
7	xx	Number of satellites in use, 00 – 12, may be different from the number in view
8	x.x	Horizontal dilution of precision
9	x.x	Antenna altitude above/below mean-sea-level (geoid)
10	M	HEX 4D. Units of antenna altitude, meters
11	x.x	Geoidal separation. The difference between the WGS-84 earth ellipsoid and mean-sea-level (geoid), "-" = mean-sea-level below ellipsoid.
12	M	HEX 4D. Units of geoidal separation, meters
13	x.x	Age of Differential GPS data. Time in seconds since last SC104 Type 1 or 9 update, null field when DGPS is not used.
14	xxxx	Differential reference station ID, 0000-1023

* This field is used by *VmDas*.

8.2.2 HDG – Heading, Deviation, and Variation

Heading (magnetic sensor reading), which if corrected for deviation, will produce Magnetic heading, which if offset by variation will provide True heading.

$__HDG,x.x,x.x,a,x.x,a*hh<CR><LF>

Table 5: HDG NMEA Format

Field		Description
1*	x.x	Magnetic sensor heading, degrees
2*	x.x	Magnetic deviation, degrees This field and the following direction field are null if deviation is unknown.
3*	a	Direction of magnetic deviation. E or W.
4*	x.x	Magnetic variation, degrees This field and the following direction field are null if variation is unknown.
5*	a	Direction of magnetic variation. E or W.

* This field is used by *VmDas*.

To obtain Magnetic Heading:

a. Add Easterly deviation (E) to Magnetic Sensor Reading.

b. Subtract Westerly deviation (W) from Magnetic Sensor Reading.

To obtain True Heading:

a. Add Easterly variation (E) to Magnetic Heading.

b. Subtract Westerly variation (W) from Magnetic Heading.

8.2.3 HDT – Heading – True

Actual vessel heading in degrees True produced by any device or system producing true heading.

$__HDT,x.x,T *hh<CR><LF>

Table 6: HDT NMEA Format

Field		Description
1*	x.x	Heading, degrees True
2	T	HEX 54

* This field is used by *VmDas*.

8.2.4 VTG – Track Made Good and Ground Speed

The actual track made good and speed relative to the ground.

$__VTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>

Table 7: VTG NMEA Format

Field		Description
1*	x.x	Track, degrees true
2	T	HEX 54
3*	x.x	Track, degrees magnetic
4	M	HEX 4D
5	x.x	Speed, knots
6	N	HEX 4E
7*	x.x	Speed, km/hr
8	K	HEX 4B
9	a	Mode indicator A=Autonomous mode D=Differential mode E=Estimated (dead reckoning) mode M=Manual input mode S=Simulator mode N=Data not valid This shall not be a null field.

* This field is used by *VmDas*.

8.2.5 $PASHR - Heading, Pitch, and Roll

Heading, pitch, and roll from multiple GPS receivers

$PASHR,hhmmss.ssss,xxx.xx,T,RRR.RR,PPP.PP,HHH.HH,a.aaa,b.bbb,c.ccc,d,e,*hh<CR><LF>

Table 8: PASHR NMEA Format

Field		Description
1	hhmmss.ssss	UTC time of data
2*	xxx.xx	True vessel heading 0 – 359.99 degrees
3	T	True T
4*	RRR.RR	Roll -90.00 to +90.00 degrees, Roll is positive for starboard down
5*	PPP.PP	Pitch -90.00 to +90.00 degrees, Pitch is positive for bow up
6	HHH.HH	Heave -99.00 to +99.00 meters
7	a.aaa	Accurracy roll, 0 to 9.999 degrees
8	b.bbb	Accurracy pitch, 0 to 9.999 degrees
9	c.ccc	Accurracy heading, 0 to 9.999 degrees
10	d	Flag Accur hdg, 0=No aiding, 1=GPS aiding, 2=GPS and GAMS aiding
11*	e	Flag: IMU, 0=Satisfactory, 1=IMU out

* This field is used by *VmDas*

NOTE. Ashetec uses PASHQ and PASHR for many purposes. Table 8 is not a complete description of the PASHR format; it is a complete description of the PASHR sentences *VmDas* uses. In general, PASHQ is a query to an instrument and PASHR is the reply. *VmDas* uses only PASHR, PASHR,ATT, and PASHR,AT2. It does not use PASHQ sentences.

8.2.6 $PASHR,ATT - Global Positioning System Attitude Data

Heading, pitch, and roll from multiple GPS receivers

$PASHR,ATT, ,ssssss.s,hhh.hh,ppp.pp,rrr.rr,mmm.mm,bbb.bb,r<CR><LF>

Table 9: PASHR,ATT NMEA Format

Field		Description
1	ATT	Identifies this as a PASHR,ATT string
2	ssssss.s	GPS receive time, seconds of week
3*	hhh.hh	Heading, degrees
4*	ppp.pp	Pitch, degrees, Pitch is positive for bow up
5*	rrr.rr	Roll, degrees, Roll is positive for starboard down
6	mmm.mm	Baseline rms error (BRMS), meters
7	bbb.bb	Measurement rem error (MRMS), meters
8*	r	Altitude reset flag, 0=good attitude, 1=bad attitude or rough estimate

* This field is used by *VmDas*

8.2.7 $PASHR,AT2 - Global Positioning System Attitude Data

Heading, pitch, and roll from multiple GPS receivers

$PASHR,AT2,ssssss.s,hhh.hh,ppp.pp,rrr.rr,mmm.mm,bbb.bb,r,l,ddd,P<CR><LF>

Table 10: PASHR,AT2 NMEA Format

Field		Description
1	AT2	Identifies this as a PASHR,AT2 string
2	ssssss.s	GPS receive time, seconds of week
3*	hhh.hh	Heading, degrees
4*	ppp.pp	Pitch, degrees, Pitch is positive for bow up
5*	rrr.rr	Roll, degrees, Roll is positive for starboard down
6	mmm.mm	Baseline rms error (BRMS), meters
7	bbb.bb	Measurement rem error (MRMS), meters
8*	r	Altitude reset flag, 0=good attitude, 1=bad attitude or rough estimate
9	l	Last state, 0=No search in progress, >0=Start from last completed state
10	ddd	Each digit is number of double differences for V12, V13, V14
11	P	PDOP

* This field is used by *VmDas*

8.2.8 $PRDID

TRDI defines a proprietary NMEA message that contains ship heading, pitch, and roll data.

$PRDID,x.x,x.x,x.x,*hh<CR><LF>

Table 11: PRDID NMEA Format

Field		Description
1*	x.x	Vessel Pitch, degrees. Pitch is positive for bow up
2*	x.x	Vessel Roll, degrees. Roll is positive for starboard down
3*	x.x	Vessel Heading, degrees True

* This field is used by *VmDas*.

NOTE. $PRDID pitch and roll are not the standard gimbaled pitch and roll. They are simple tilts of the mast. In most cases, the difference is small. *VmDas* ignores the difference.

8.2.9 Reading NMEA Data

NMEA input is required in all moving vessel open ocean data collections. However, *VmDas* can just collect ensembles from an ADCP. If NMEA data is to be used, options must be set in the communications tab to configure the serial ports to read the data (up to three serial ports are available).

Enabled ports will log all data they receive in an N1R, N2R, or N3R file. Timestamps will be added to synchronize the file with ensembles.

The user can enable ports so that data is logged with timestamps, and decide independently whether or not to save GGA or VTG data in the NAV field. Choose which enabled ports to read the data from on the **Transform** tab. Only enabled ports appear in the drop down lists.

The user may choose to enable a backup source for GGA or VTG. If you choose both, normally the primary source will be put into the NAV field. If the primary data becomes invalid, backup data will be saved in the NAV field instead. GGA and VTG are independent choices. Primary and backup for each are independent choices.

NOTE. The GGA - PC clock offset is calculated independently for primary and backup data. If the backup GGA data goes into the NAV field, the backup offset goes with it.

VmDas internally generates PADCP messages and adds them to both log files. These messages are expected to have meaning only to *VmDas*.

8.2.10 Using the Custom NMEA Feature

Use the custom NMEA feature to create custom decoder files for NMEA heading, pitch, and roll (HPR) data. This feature is available in VmDas 1.46.6 and higher.

When you install *VmDas,* the installation copies the following example files to the *C:\Users\your name\AppData\Roaming\VmDas* folder:

- *CustomNmea.txt* file for the Septentrio NMEA data string $PSSN
- *Septentrio NMEA Attitude_sample3.txt* example NMEA data file
- *Septentrio NMEA Data File Format.pdf* explains the Septentrio data format

Setup

The following explains how to use the custom decoder files for NMEA HPR data.

> **NOTE.** In order for the Custom NMEA feature to work, the heading, pitch, and roll all must be decimal degrees (i.e. XXX.XX). For the pitch and roll to work, they must be within ±180 degrees AND positive pitch when the bow is higher than the stern and positive roll when the port is higher than the starboard.

a. Copy the text file *CustomNmea.txt* to a folder of your choice.

b. Inside the text file just copied, add the decoder sequence for the NMEA data you are using. For example, the Septentrio NMEA data string is shown below:

```
$PSSN,HRP,160059.00,170610,283.480,41.693,1.852,0.006,0.007,0.011,06,4,2.0,E*34
```

The Custom NMEA decoder string for the above data string appears below:

```
$PSSN,,,,H,R,P,,,,,,,
```

- The first field in the decoder file is the NMEA header for the data string "$PSSN,". Note the comma is included.
- Following the NMEA header, enter a comma for each field that you are going to skip. In this example the first three fields following the $PSSN are skipped (HRP,160059.00,170610,) and the last six fields are skipped.
- Enter an H, P, or R for the field that corresponds to the heading, pitch, or roll data. In this example, the data is organized by Heading, Roll, and Pitch.

c. Start *VmDas* and open the Program Options **Transform** tab. To get to the Program Options Transform tab:

1. Click the **File** menu.
2. Click **Collect**.
3. Click **Options**.
4. Click **Edit Data Options**.
5. Click the **Transform** tab.

d. Click the drop down menu for the **Heading Source** and/or **Tilt Source** and select **CUSTOM** (see the green circles on Figure 32).

e. Set the path for the *CustomNmea.txt* file you created in Step "a" (shown in the red circle on Figure 32).

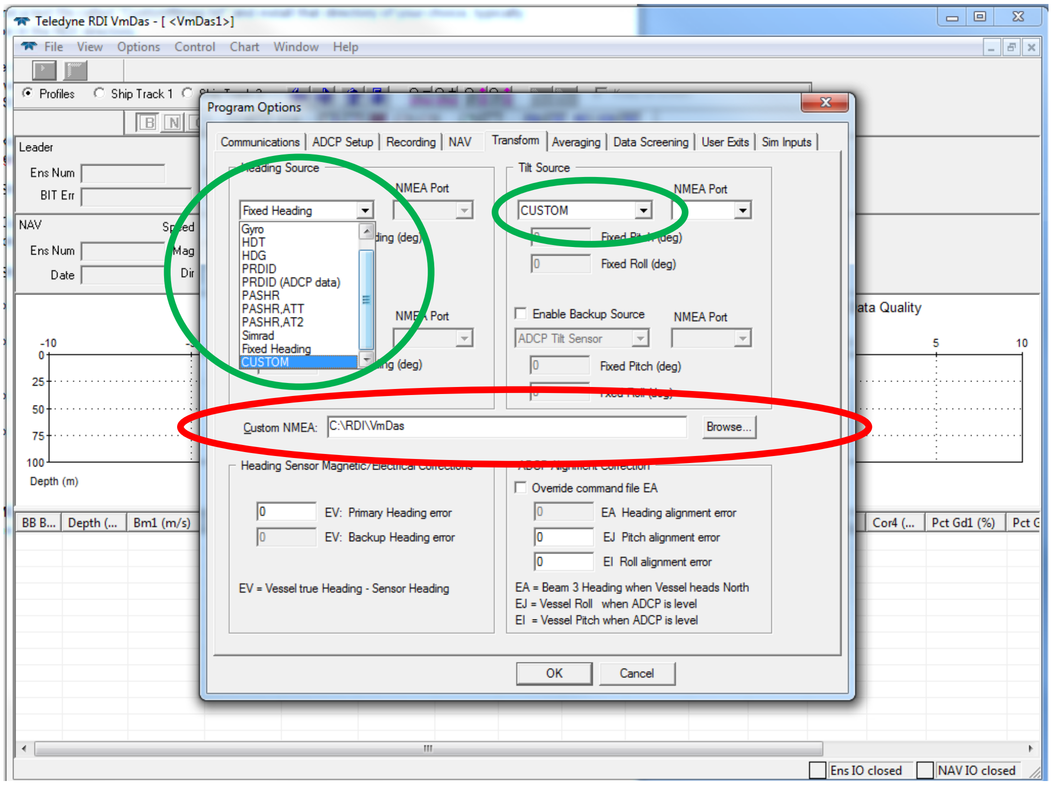

Figure 32. Using the Custom NMEA Feature

8.3 NMEA Output

8.3.1 $VDDBT – Depth Below Transducer

Water depth referenced to the transducer

$VDDBT,x.x,f,x.x,M,x.x,F*hh<CR><LF>

Table 12: VDDBT NMEA Format

Field		Description
1	x.x	Water depth, feet
2	f	HEX 66
3	x.x	Water depth, Meters
4	M	HEX 4D
5	x.x	Water depth, Fathoms
6	F	HEX 46

8.3.2 $VDHDT – Heading – True

Actual vessel heading in degrees True.

$VDHDT,x.x,T*hh<CR><LF>

Table 13: VDHDT NMEA Format

Field		Description
1	x.x	Heading, degrees True.
2	T	HEX 54

8.3.3 $VDVBW – Dual Ground/Water Speed

Water referenced and ground referenced speed data.

$VDVBW,x.x,x.x,A,x.x,x.x,A*hh<CR><LF>

Table 14: VDVBW NMEA Format

Field		Description
1	x.x	Longitudinal water speed, knots. "-" = astern.
2	x.x	Transverse water speed, knots. "-" = port.
3	A	Status: water speed, A = Data valid, V = Data invalid.
4	x.x	Longitudinal ground speed, knots. "-" = astern.
5	x.x	Transverse ground speed, knots. "-" = port.
6	A	Status: ground speed, A = Data valid, V = Data invalid.

8.3.4 $VDZDA – Time and Date

UTC, day, month, year, and local time zone.

$VDZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh<CR><LF>

Table 15: VDZDA NMEA Format

Field		Description
1	hhmmss.ss	UTC
2	xx	Day, 01 – 31.
3	xx	Month, 01 – 12.
4	xxxx	Year
5	xx	Local time zone description. –13 to 13 hours. The number of whole hours added to local time to obtain GMT. Zone description is negative for East longitudes.
6	xx	Local time zone minutes description. –59 to 59 minutes. The number of whole minutes added to local time to obtain GMT. This permits a finer resolution time zone description than is possible using hours alone. The sign is the same as the hour time zone description. *VmDas* produces a null field here.

8.3.5 Writing NMEA Data

VmDas writes strings formatted as described in the NMEA 0183 standard to a serial port, a TCP/IP port, or both.

NOTE. This is not in keeping with NMEA standards. The NMEA 0183 standard specifies strings are to be transmitted through a serial port. The NMEA 2000 standard is being developed for transmitting similar data over a network. *VmDas* does not support the NMEA 2000 standard.

8.4 Internal NMEA Messages

TRDI defines a proprietary NMEA message for *VmDas* internal use only that contains *VmDas* internal timing information.

8.4.1 $PADCP

This message is stored in the *VmDas* N1R, N2R and N3R extension data files as a time stamp. The $PADCP is generated by *VmDas*.

$PADCP, ens,yyyy,xx,xx,xx,xx,ss.ss,x.x*hh<CR><LF>

Table 16: PADCP NMEA Format

Field		Description
1	ens	Ensemble number. A variable length integer numeric field without leading zeros.
2	yyyy	Year, 4 digits, PC local time.
3	xx	Month, 01 – 12, PC local time.
4	xx	Day, 01 – 31, PC local time.
5	xx	Hours, 00 – 23, PC local time.
6	xx	Minutes, 00 – 59, PC local time.
7	ss.ss	Seconds and hundredths, 00.00 – 59.99, PC local time.
8	x.x	PC clock offset from UTC in seconds. –86399.99 to 86399.99. *VmDas* keeps track of the date/time of GGA messages by recording the date/time according to the PC clock when the message is read, and calculating the offset between the times in the PC clock and the GGA message. If the clock offset is added to a GGA message time, the result is a local PC time, The offset corrects for the difference in time zone between local PC time and GGA time (UTC) and any errors because the two clocks are not perfectly synchronized. If no GGA messages have been read, this field is null.

NOTES. This message is used to synchronize ensemble data and NMEA data.

The year, month, day, hour, minute, and second fields describe the time that a ping command was sent to the ADCP.

The ens field contains the number of the ensemble generated by the ping command.

8.5 Further Information About NMEA Strings

Users who need full details about NMEA data strings can find more information in the NMEA 0183 standard, available from the National Marine Electronics Association at.

P O Box 3435	252-638-2626 (voice)	nmea@coastalnet.com (e-mail)
New Bern, NC	252-638-4885 (fax)	http://www.nmea.org/ (web site)
28564-3435		

9 *VmDas* Outputs

VmDas can output Ensemble, Speed Log, and ASCII data out the serial port or through an Ethernet port.

9.1 Ensemble Output Data

Long term averaged ensemble data is output in the TRDI standard binary ensemble (PD0) output format.

a. On the **File** menu, click **Collect Data**.

b. On the **Options** menu, click **Edit Data Options**. If you have created a User Option File, click **Load**.

c. On the **Communications** tab, select the **Ensemble Output (Binary LTA)** button.

d. To output the data to a serial port, click the **Enable Serial** box, and configure the serial port parameters, then click the **Set** button to apply the new configuration. Verify that the new settings appear in the **Current Settings** section.

e. To output the data to a network port, click the **Enable Network** box, and set the **Local IP Port** number. *VmDas* will be the server, and the local machine's IP address will be used automatically. After data collection has started, a remote client can request a TCP/IP connection using the specified port number and the IP address of the computer running *VmDas* to receive the data.

9.2 Speed Log Output Data

Speed log data output consists of the NMEA VBW and DBT messages, and is calculated from the short-term averaged data. Use the following procedure to enable speed log data output.

NOTE. Speed log data is not stored to a disk file. It is only sent to a serial port and/or an Ethernet port.

a. On the **File** menu, click **Collect Data**.

b. If you have created a User Option File, on the **Options** menu, click **Load**. Choose your file and click **OK**.

c. On the **Options** menu, click **Edit Data Options**.

d. On the **Communications** tab, select the **Speed Log Output** button.

e. To output the data to a serial port, click the **Enable Serial** box, and configure the serial port parameters, then click the **Set** button to apply the new configuration. Verify that the new settings appear in the **Current Settings** section.

f. To output the data to a network port, first choose an IP port number. *VmDas* uses 5434 by default, which should be fine for most users. Remote clients will need to know the IP port number and the IP address of the computer running *VmDas* to receive data.

   Click the **Enable Network** box, and set the **Local IP Port** number. *VmDas* will use the local machine's IP address automatically. Click the **Set** button to apply the new configuration. Verify that the new settings appear in the **Current Settings** section.

After data collection has started, a remote client can request a TCP/IP connection using the specified port number and the IP address of the computer running *VmDas* to receive the data.

Tips for Advanced Users

Advanced users can get more control over the Speed Log data by using the following tips.

Speed Log data will only be output if the serial and/or Ethernet port(s) are configured for that purpose.

- If a port is configured for speed log output, speed log output will be produced. If there is no data or the data is invalid, the NMEA messages will indicate that they contain invalid data.

The data will only be received if something is listening to the port(s). This requires a cable and usually a second computer.

- One device may listen to a serial port. When sending speed log data out an Ethernet port, *VmDas* is a TCP/IP server and supports up to 100 clients.

Speed log data is calculated from ensembles in the short-term averaged data. There will be one VBW and one DBT message for each short-term average ensemble.

- To control the time between messages, on the **Options** menu, click **Edit Data Options**, choose the **Averaging** tab, and change the **First Time Interval**.

The speed log will contain valid data only if the ADCP is configured to produce the data. The data comes from the bottom track field in the short-term average data.

- The VBW message will contain water speed data only if the ADCP has been configured to produce water reference layer data. The BK and BL commands are useful here.
- The VBW message will contain bottom speed data only if the ADCP has been configured to produce bottom velocity data. The BP command is useful here.
- The DBT message will contain depth data only if the ADCP has been configured to produce bottom track range data. This data is present whenever bottom track data is being produced, and the bottom is in range. The BP and BX commands are useful here.
- The Options on the ADCP Setup tab can override the BP and BX commands in a command file. To use the ADCP defaults for these commands or to set them from a command file, the Set BT On/Off box must be unchecked.

9.3 Ensemble Output (ASCII) Data

ASCII-out files contain a fixed format of text. You can then use these files in other programs (spreadsheets, databases, and word processors).

a. On the **File** menu, click **Collect Data**.

b. On the **Options** menu, click **Edit Data Options**. If you have created a User Option File, click **Load**.

c. On the **Communications** tab, select the **Ensemble Output (ASCII)** button.

d. To output the data to a serial port, click the **Enable Serial** box, and configure the serial port parameters, then click the **Set** button to apply the new configuration. Verify that the new settings appear in the **Current Settings** section.

e. To output the data to a network port, click the **Enable Network** box, and set the **Local IP Port** number. *VmDas* will be the server, and the local machine's IP address will be used automatically. After data collection has started, a remote client can request a TCP/IP connection using the specified port number and the IP address of the computer running *VmDas* to receive the data.

f. In the **Set Ensemble Output Configuration Here** section, check the box for each type of data within the ensemble that you want output. In the **Data Select** box, select the desired data source. In the **Velocity Ref** box, select the desired reference velocity to be applied to the profile data. In the **Output** column, select the desired depth cell range to output by setting the **Start Bin** and **End Bin**. If **Water Current Profile Layer** is selected as the velocity reference, then in the **Profile Layer** column, select the desired depth cell range to use as the reference velocity by setting the **Start Bin** and **End Bin**.

9.3.1 ASCII Ensemble Output Format

This section explains the format of the data sent from the ADCP to the ensemble-out serial device after each ADCP ensemble. Sending ensemble-out data is an option in the **Options**, **Program Options**, **Communications Setup** menu. You set the communications protocol and select the data to send to the ensemble-out device through the **Communication** options. Ensemble-out data are in ASCII with fixed field lengths.

The transmission of ensemble-out data occurs after *VmDas* finishes recording ADCP data after each ADCP ensemble. The next section shows a sample ensemble-out data transmission. The first byte in the ensemble-out data stream is a START OF TEXT (^B) byte. This byte is also known as STX, ASCII character 2, or Control-B (^B). *VmDas* always sends the STX byte when data transmission begins. After the STX byte, *VmDas* sends a 2-byte flag that represents the data type that will be sent next. See Ensemble-Out Data Format Description for an explanation of all the flags and associated fields used in the ensemble-out data stream.

9.3.2 Sample Ensemble-Out Data Transmission

```
^B 0      96 91 10  2  9 54 30<CR/LF>
 1   4   4   1   4     0     0     0     0<CR/LF>
       6   -1375     -38      33<CR/LF>
     -23   -1453      -2      -3<CR/LF>
      85   -1465     -44     -52<CR/LF>
      49   -1464     -76      30<CR/LF>
 2   4 4   1   4<CR/LF>
     128     119     133     142<CR/LF>
     129     103     120     110<CR/LF>
     117     133     141     142<CR/LF>

     134     141     134     127<CR/LF>
 3   4 4   1   4<CR/LF>
     167     155     159     168<CR/LF>
     162     151     149     161<CR/LF>
     154     145     137     154<CR/LF>
     146     138     130     152<CR/LF>
 4   4 4   1   4<CR/LF>
     100     100     100     100<CR/LF>
     100     100     100     100<CR/LF>
     100     100     100     100<CR/LF>
     100     100     100     100<CR/LF>

 5   4 4   1   4<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 6  0  0  0  10  100  25  25  2  0  0  0  0  5000  25  0  0  0  2500  0  0  0  35  1480<CR/LF>
 7  2  4<CR/LF>
     -33   -1414     -62  -32768<CR/LF>
     833     878       0     783<CR/LF>
 8  13856000 -324937000    634   4786    425    470<CR/LF>

^C^B 0      97 91 10  2  9 55 00<CR/LF>
 1   4   4   1   4     0     0     0     0<CR/LF>
```

```
       7   -1373     -40      29<CR/LF>
     -19   -1456      -1      -4<CR/LF>
      89   -1462     -46     -51<CR/LF>
      48   -1466     -73      34<CR/LF>
 2   4 4   1   4<CR/LF>
     121     123     130     139<CR/LF>
     127     100     122     114<CR/LF>
     130     135     140     141<CR/LF>

     130     140     138     129<CR/LF>
 3   4 4   1   4<CR/LF>
     167     156     153     166<CR/LF>
     163     155     147     162<CR/LF>
     156     143     138     153<CR/LF>
     147     140     132     151<CR/LF>
 4   4 4   1   4<CR/LF>
     100     100     100     100<CR/LF>
     100     100     100     100<CR/LF>
     100     100     100     100<CR/LF>
     100     100     100     100<CR/LF>

 5   4 4   1   4<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 -32678 -32678 -32678 -32678<CR/LF>
 6  0  0  0  10  100  25  25  2  0  0  0  0  5000  25  0  0  0  2500  0  0  0  35  1480<CR/LF>
 7  2  4<CR/LF>
     -31   -1420     -58    -768<CR/LF>
     840     862     845     850<CR/LF>
 8  13857000 -324938000    634   4787    426    471<CR/LF>

^C
```

9.3.3 Ensemble-Out Data Format Description

Each ASCII ensemble-out data stream begins with a **Start Of Text** code <^B> and ends with an **End Of Text** code <^C>. *VmDas* identifies each data type with an integer flag. At least one space separates the fields within each data type. Each line of data ends with a carriage return <CR> and line feed <LF> sequence.

Table 17: Ensemble-Out Data Format

Flag	Field	Description
0	1	Flag 0 identifies the ensemble number just processed by the ADCP and the date/time that data collection for the ensemble began. The fields identified by this flag contain:
	2	The ensemble number just processed by the ADCP.
	3	The year data collection began for this ensemble.
	4	The month data collection began for this ensemble.
	5	The day data collection began for this ensemble.
	6	The hour data collection began for this ensemble.
	7	The minute data collection began for this ensemble.
	8	The second data collection began for this ensemble.
1	1	Flag 1 marks the start of velocity data. *VmDas* scales the water current velocity data in millimeters per second (mm/s). A value of -32768 indicates bad or missing data. *VmDas* lists water profile velocity data in columns beginning with the next output line. The fields identified by this flag contain:
	2	The number of bins selected for transmission.
	3	The number of beams used by the ADCP to collect the data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The first bin selected for transmission in the Communication options.
	5	The last bin selected for transmission in the Communication options.
	6	The east(+)/west(-) water-current velocity of the reference layer if VELOCITY REF is set to BOTTOM or MEAN (Communication options).
	7	The north(+)/south(-) water-current velocity of the reference layer if VELOCITY REF is set to BOTTOM or MEAN (Communication options).

Continued Next Page

Table 17: Ensemble-Out Data Format (continued)

Flag	Field	Description
	8	The up(+)/down(-) water-current velocity of the reference layer if VELOCITY REF is set to BOTTOM or MEAN (Communication options).
	9	The error velocity of the reference layer if VELOCITY REF is set to BOTTOM or MEAN (Communication options).
	10	Column data for the east(+)/west(-) water-current velocities for the bin range selected in the Communication options.
	11	Column data for the north(+)/south(-) water-current velocities for the bin range selected in the Communication options.
	12	Column data for the up(+)/down(-) water-current velocities for the bin range selected in the Communication options.
	13	Column data for the error velocities for the bin range selected in the Communication options.
2	1	Flag 2 marks the start of correlation magnitude data. A value of -32768 indicates missing data. *VmDas* lists correlation data in columns beginning with the next output line. The fields identified by this flag contain:
	2	The number of bins selected for transmission.
	3	The number of beams used by the ADCP to collect the data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The first bin selected for transmission in the Communication options.
	5	The last bin selected for transmission in the Communication options.
	6	Column data for the Beam #1 correlation data for the bin range selected in the Communication options.
	7	Column data for the Beam #2 correlation data for the bin range selected in the Communication options.
	8	Column data for the Beam #3 correlation data for the bin range selected in the Communication options.
	9	Column data for the Beam #4 correlation data for the bin range selected in the Communication options.
3	1	Flag 3 marks the start of echo intensity data. *VmDas* scales echo intensity data in ADCP counts. A value of -32768 indicates missing data. *VmDas* lists echo intensity data in columns beginning with the next output line. The fields identified by this flag contain:
	2	The number of bins selected for transmission.
	3	The number of beams used by the ADCP to collect the data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The first bin selected for transmission in the Communication options.
	5	The last bin selected for transmission in the Communication options.
	6	Column data for the Beam #1 echo intensity data for the bin range selected in the Communication options.
	7	Column data for the Beam #2 echo intensity data for the bin range selected in the Communication options.
	8	Column data for the Beam #3 echo intensity data for the bin range selected in the Communication options.
	9	Column data for the Beam #4 echo intensity data for the bin range selected in the Communication options.

Table 17: Ensemble-Out Data Format (continued)

Flag	Field	Description
4	1	Flag 4 marks the start of percent-good data. *VmDas* scales percent-good data in percentage points (0-99). A value of -32768 indicates bad or missing data. *VmDas* lists percent-good data in columns beginning with the next output line. The fields identified by this flag contain:
	2	The number of bins selected for transmission.
	3	The number of beams used by the ADCP to collect the data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The first bin selected for transmission in the Communication options.
	5	The last bin selected for transmission in the Communication options.
	6	Column data for the Beam #1 percent-good data for the bin range selected in the Communication options.
	7	Column data for the Beam #2 percent-good data for the bin range selected in the Communication options.
	8	Column data for the Beam #3 percent-good data for the bin range selected in the Communication options.
	9	Column data for the Beam #4 percent-good data for the bin range selected in the Communication options.
5	1	Flag 5 marks the start of status data. See *VmDas* STA and LTA Output Data Format for information on how status data are scaled. A value of -32768 indicates bad or missing data. *VmDas* lists status data in columns beginning with the next output line. The fields identified by this flag contain:
	2	The number of bins selected for transmission.
	3	The number of beams used by the ADCP to collect the data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The first bin selected for transmission in the Communication options.
	5	The last bin selected for transmission in the Communication options.
	6	Column data for the Beam #1 status data for the bin range selected in the Communication options.
	7	Column data for the Beam #2 status data for the bin range selected in the Communication options.
	8	Column data for the Beam #3 status data for the bin range selected in the Communication options.
	9	Column data for the Beam #4 status data for the bin range selected in the Communication options.
6	1	Flag 6 marks the start of leader data. The fields identified by this flag contain:
	2	The minutes portion of the time between pings as set by the TP-command.
	3	The seconds portion of the time between pings as set by the TP-command.
	4	The hundredths of seconds portion of the time between pings as set by the TP-command.
	5	The number of pings per ensemble as set by the WP-command.
	6	The number of depth cells (bins) as set by the WN-command.
	7	The depth cell (bin) length in centimeters as set by the WS-command.
	8	The blank after transmit in centimeters as set by the WF-command.
	9	The ADCP profiling mode as set by the WM-command.

Table 17: Ensemble-Out Data Format (continued)

Flag	Field	Description
	10	The Built-In Test result code from the last ADCP ensemble.
	11	The sensor source as set by the EZ-command.
	12	The available sensors as read by the PS1-command.
	13	The low correlation threshold as set by the WC-command.
	14	The error velocity threshold in mm/s as set by the WE-command.
	15	The percent-good minimum as set by the WG-command.
	16	The average ADCP pitch (tilt 1, x-axis) angle in hundredths of degrees (e.g., -70 = -0.7°) during the ADCP data ensemble. This value comes from the internal pendulums or external gyrocompass.
	17	The average ADCP roll (tilt 2, y-axis) angle in hundredths of degrees (e.g., 430 = 4.3°) during the ADCP data ensemble. This value comes from the internal pendulums or external gyrocompass.
	18	The average ADCP heading angle in hundredths of degrees (e.g., 7707 = 77.07°) during the ADCP data ensemble. This value comes from the internal flux-gate compass or external gyrocompass.
	19	The average water temperature in hundredths of degrees C (e.g., 1711 = 17.11°C) at the transducer head during the ADCP data ensemble.
	20	The standard deviation (accuracy) of heading data in degrees during the ADCP data ensemble from the compass.
	21	The standard deviation (accuracy) of pitch (tilt 1, x-axis) data in tenths of degrees (e.g., 15 = 1.5°) during the ADCP data ensemble from the pendulum/gyrocompass.
	22	The standard deviation (accuracy) of roll (tilt 2, y-axis) data in tenths of degrees (e.g., 5 = 0.5°) during the ADCP data ensemble from the pendulum/gyrocompass.
	23	The salinity value in parts per thousand from the ADCP (ES or EZ-command).
	24	The speed of sound value in m/s from the ADCP (EC or EZ-command).
7	1	Flag 7 marks the start of bottom-track data. A value of -32768 indicates bad or missing velocity data. A zero indicates bad or missing beam range data. The fields identified by this flag contain:
	2	The number of lines of bottom-track data sent. This value corresponds to the number of ROWS of data beginning with the next output line.
	3	The number of beams used by the ADCP to collect the bottom-track data. This value corresponds to the number of COLUMNS of data beginning with the next output line.
	4	The east(+)/west(-) bottom-track velocity in mm/s.
	5	The north(+)/south(-) bottom-track velocity in mm/s.
	6	The up(+)/down(-) bottom-track velocity in mm/s.
	7	The bottom-track error velocity in mm/s.
	8	The Beam #1 range in meters to the bottom/surface, excluding ADCP depth.
	9	The Beam #2 range in meters to the bottom/surface, excluding ADCP depth.
	10	The Beam #3 range in meters to the bottom/surface, excluding ADCP depth.
	11	The Beam #4 range in meters to the bottom/surface, excluding ADCP depth.
8	1	Flag 8 marks the start of external navigation data collected by *VmDas*. A value of 2147483647 indicates bad or missing latitude/longitude data. A value of -32768 indicates bad or missing data for all other fields. The fields identified by this flag contain:
	2	Navigation device latitude in thousandths of seconds.
	3	Navigation device longitude in thousandths of seconds (-324937000 = W90°15'37").

Table 17: Ensemble-Out Data Format (continued)

Flag	Field	Description
	4	Navigation device speed in mm/s.
	5	Navigation device course in hundredths of degrees (4786 = 47.86°).
	6	The east(+)/west(-) navigation device velocity in mm/s.
	7	The north(+)/south(-) navigation device velocity in mm/s.

10 *VmDas* User Exits

The User Exit options in *VmDas* are hooks at various points in the processing where the user can modify the data with an external program.

- The first User Exit option selects a *VmDas* data file to be displayed using *WinADCP*.
- The second User Exit option allows a program to adjust RAW ADCP data that *VmDas* put in the *.ENR file.
- The third User Exit option allows a program to adjust RAW NMEA data that *VmDas* put in the *.N1R and *.N2R file.
- The fourth User Exit option allows a program to perform coordinate transformations.

For example, a User Exit could be used to translate all or part of a non-supported NMEA string (e.g. Ashtech's $GPPAT position and attitude NMEA string) into a supported string (e.g. Teledyne RD Instruments $PRDID NMEA string).

NOTE. The last three user exits are enabled by clicking on their associated checkboxes in the **User Exits** tab. However, *VmDas* does not currently support automatic launching of these user exits. They must be launched independently before selecting **Go** on the **Control** menu in *VmDas*.

10.1 Tips and Tricks to Creating User Exit Programs

There are many non-supported NMEA string formats for position, heading, and pitch/roll devices. In order to use a non-supported NMEA string with *VmDas*, the user needs to create a User Exit program. The User Exit program needs to do the following:

- Opens the .N1R (or .N2R) file for input (the file may not exist right away, so it must clear the error condition and keep trying).
- Creates the .N1J (or .N2J) file for output.
- Read characters from the file until an end of line is found. It has to handle the fact that it will often see an End-Of-File condition, because the data may not be there yet, but it must clear the error condition and keep trying. The best way to do this might be to check the file status in a loop to get the current file size and detect when it changes.
- Each time it has read a complete line, decode and convert the non-supported NMEA string into a $xxHDT string (the first two letters could be anything, as *VmDas* doesn't care about the device ID).
- Write the new $xxHDT string out to the .N1J (or .N2J) file
- Repeat

This program can be written in any of several ways:

- DOS-type program written using Borland C, or Turbo Pascal, or other programs.
- Windows console program
- Visual Basic program
- Visual C++ program

In other words, you can use any development tool that can create a program that will read and write disk files on a PC running the Microsoft Windows® operating system.

10.2 Example 1 - Modifying Raw ADCP Data

VmDas writes the ADCP raw data into a file with the naming convention *.ENR. The format of this data is the ADCP raw binary data. The data file *.ENR is normally read in by the *VmDas* screening and filtering stage of the software. The output of this screening and filtering is then written into a file with the naming convention of *.ENS. A user can set an option (via the **User Exit** tab) that will instruct the *VmDas* program to read in a file with the naming convention of *.ENJ instead of the *.ENR file.

This allows the user to write their own program which can modify the data inside the *.ENR file in any way as long as they write the data back out into a file with the same original data format as the *.ENR file except they rename the file *.ENJ. The *VmDas* program will read in the *.ENJ file and screen and process it as it would have the *.ENR file.

An example of why a user may want to do this is that the user wishes to screen the heading data that is read directly by the ADCP gyro interface board and output to the *.ENR data file. The user could write a program that would read the heading data from the *.ENR file and compare that heading data to the heading in the NMEA data file *.N1R (or *.N2R). The user can then decide based on an algorithm they write which heading is more accurate to use. The user would then take the heading they chose to use and write this new heading value into the raw ADCP ensemble file *.ENJ, being sure to modify the ADCP checksum for that ensemble as required. The *VmDas* would read in the *.ENJ file because the user had selected the User Exit Option for RAW ADCP Data Screening.

10.3 Example 2 - Modifying Raw NMEA Data

VmDas writes the NMEA raw data into a file with the naming convention *.N1R or *.N2R (depending on which NMEA device we are working with). The format of this data is ASCII and is in the same format as what is transmitted by the users NMEA device (with one exception). That exception being we add an ADCP mark (or time tag) string $PADCP. The *.N1R (or *.N2R) data file is normally then just converted to binary and stored in a file with the naming convention *.NMS. A user can set an option (via the **User Exit** menu) that will instruct the *VmDas* program to read in a file with the naming convention of *.N1J (or *.N2J) instead of the *.N1R (or *.N2R) naming convention.

This allows the user to write their own program which can modify the data inside the *.N1R (or *.N2R, *.N3R) in any way as long as they write the data back out into a file with the same original data format as the *.N1R (and if collected *.N2R or *.N3R) file except they rename the file *.N1J (and if N2R is collected the file *.N2J). When the user turns on the **User Exit** option **External Raw Nav Data Screening/Pre-**

Averaging the *VmDas* program will read in the *.N1J (or *.N2J) file convert it into the binary file with the naming convention of *.NMS.

An example of why a user may want to do this is that the user wishes to decode pitch and roll data from a NMEA string that the *VmDas* does not currently decode. The user can write a program that would read in the data from the *.N1R file (or *.N2R) and create a string that is read by the *VmDas* program from the data available in the NMEA strings.

An example of this is seen when using an Ashtech device that outputs pitch and roll data in the string $GPPAT (not supported) and $GPASHR (supported). *VmDas* does not currently decode the $GPPAT proprietary NMEA string. The user could write a program that would take the data from the Ashtech NMEA strings and write them into the TRDI propriety NMEA string $PRDID. The TRDI NMEA string contains heading, pitch, and roll data and is decoded by the *VmDas* program. The format for this string is as follows:

```
$PRDID,ppp.pp,rrr.rr,hhh.hh@   or
$PRDID,-ppp.pp,-rrr.rr,hhh.hh@
```

Where:

@ = carriage return, line feed
h = heading
p = pitch
r = roll

10.4 Example 3 - Transformation

The *VmDas* program normally reads in the contents of the binary file *.ENS and performs a beam to earth coordinate transformation. This beam to earth coordinate transformation is performed using the users selections for where to obtain attitude information such as heading, pitch, and roll (the choices being either the raw ADCP leader data or the raw NMEA data). Using this attitude information *VmDas* will transform the data from beam to earth using TRDI's standard matrix table conversion and then writes this data to the file *.ENX.

The *VmDas* program does allow the user to perform their own coordinate transformation routine. The user would select the **User Exit** option of **External Transformation**. This choice would disable the *VmDas* coordinate transformation routine and the user would have to create their own being sure to write the data out in correct format to a data file with the *.ENX naming convention. This is important as the next routines of the *VmDas* program will be reading in the *.ENX data for averaging, displaying, and recording in the *.STA and *.LTA files.

An example of why a user may want to do this is that the user may have purchased a special TRDI ADCP that does not have the standard 4-beam Janus configuration. Many times these systems do not come with a coordinate transformation algorithm built into them. The user is responsible for this conversion.

Special Notes. Included in the **Transformation** routine are the following functions. If the user chooses to perform their own Transformation, they must ensure that these functions are also covered. A description of how TRDI performs this transformation is included in the Coordinate Transformation Booklet (available on TRDI's web site).

- Selection of the attitude sensor (based on the user input during Edit Data Options)

- Apply Heading Corrections
- Apply Beam Angle Corrected Matrix table (read from the ADCP)
- Bin Mapping
- Three Beam Solutions
- Mark Data Bad Below Bottom
- Error Velocity Screening
- Vertical Velocity Screening
- Percent Good Calculations and Screening

10.5 User Displays

The *VmDas* program has its own display modules built in. The *VmDas* program reads in the raw ADCP files (*.ENR), short-term average files (*.STA), and long term average files (*.LTA) and displays this data in either a Tabular, Profile, or Ship Track plot.

The files *.ENR, *.STA, and *.LTA are available to be read by other programs such as *WinADCP* during real time data collection. This allows a user to create their own software package to display, or output the data in any way they would like. The only restriction is that when reading in the data file they must leave the data file open (or in a shared condition) so that *VmDas* may continue to access the file and update it with the new ensembles.

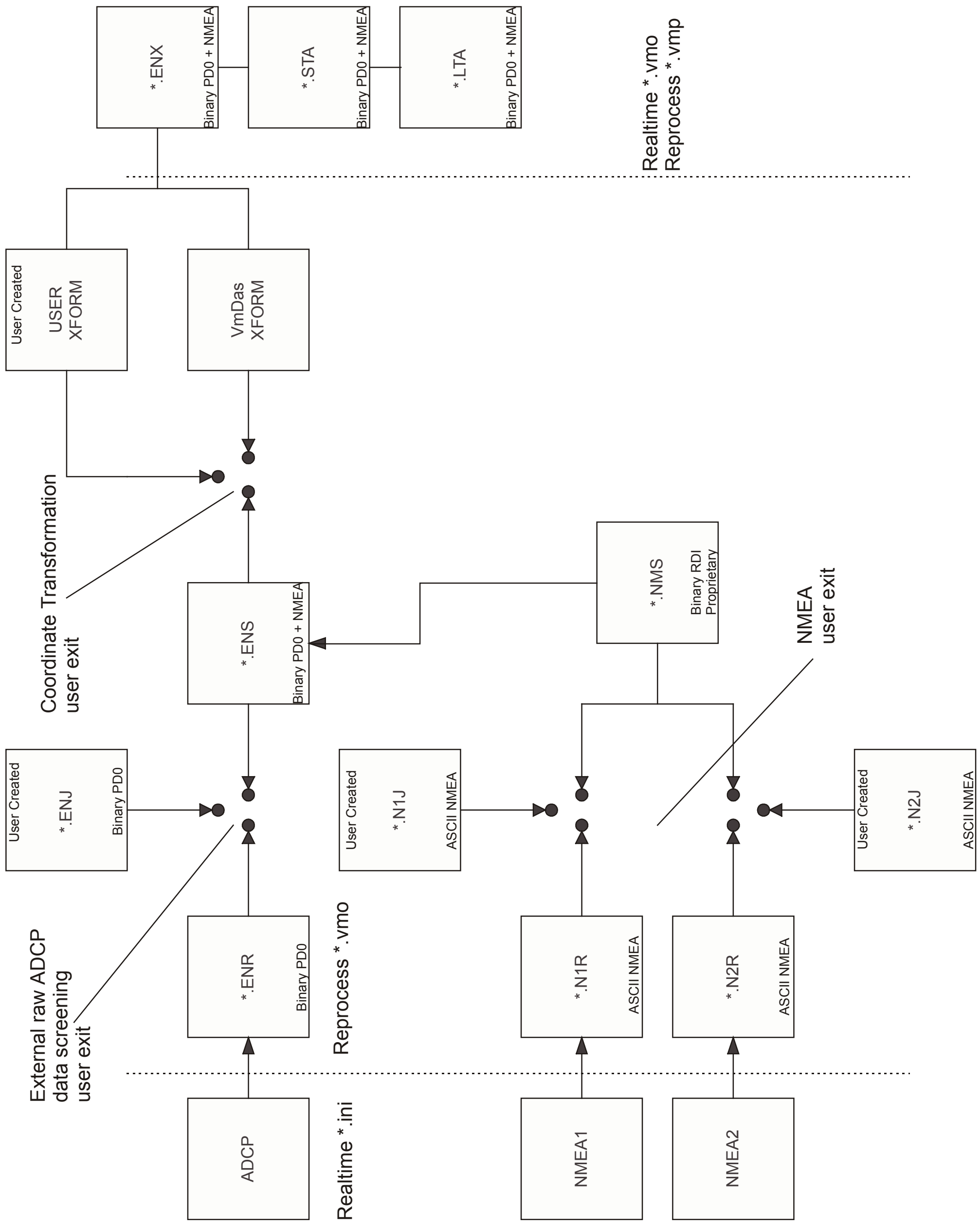

Figure 33. User Exits

11 File Naming Conventions

Data files produced by *VmDas* during **data collect** mode have the following filename format: DeployName000_000000.Ext,

Where:

DeployName	is a user-entered name for the deployment (up to 128 characters),
000	is the deployment number (changes with each stop/restart),
000000	is the file sequence number, which is incremented when the specified maximum file size is reached, and
Ext	is the file extension, and reflects the type of data in the file

Reprocessed files have a similar format: DeployName000_000_000000.Ext,

Where:

000	Represents the reprocessing number, and gets incremented each time the same raw data is reprocessed. The other fields are the same as for the data collect mode format, and identify the raw data source that was reprocessed.

The file extensions have the following meaning:

.ENR	Raw ADCP data file (see your ADCP Technical Manual Commands and Output Data Format guide for the output data format).
.LTA	ADCP (plus Navigation Data (see Binary Navigation Data Format)) data that has been averaged using the long time period specified in the **Options**, **Edit Data Options**, **Averaging** tab.
.STA	ADCP (plus Navigation Data (see Binary Navigation Data Format)) data that has been averaged using the short time period specified in the **Options**, **Edit Data Options**, **Averaging** tab.
.ENS	ADCP data after having been screened for RSSI and correlation by *VmDas*, or adjusted by the user via a User Exit. Also has Navigation Data (see Binary Navigation Data Format) records merged into the ensembles from the .NMS file.
.ENX	ADCP single-ping data (plus Navigation Data (see Binary Navigation Data Format) after having been bin-mapped, transformed to Earth coordinates, and screened for error velocity, vertical velocity, and false targets. This data is ready for averaging.
.N1R, .N2R, .N3R	Raw NMEA data files (text files)
.NMS	Binary format NAV data file after having been screened and pre-averaged.
.VMO	The option settings used for collecting the data (text file).
.VMP	The option settings used for reprocessing the data (text file).
.ENJ	ADCP raw data after adjustment by a user-exit application.
.N1J, .N2J, .N3J	Raw NMEA data after being adjusted by a user-exit application.
.LOG	ASCII file containing any errors found in NMEA, ASCII Ensemble Output, or ADCP communications. The **.LOG* file is saved to the same path as set in the **Recording** tab.
VmDas.LOG	ASCII file containing the name and path of the last used VMO file. On Windows XP® computers, this file is now located in C:\Program Files\RD Instruments\VmDas. In previous versions of VmDas, the file was located on the root directory. For Vista® computers, the path is C:\Users\User Login Name\App Data\Local\Virtual Store\Program Files\RD Instruments\VmDas.

12 ADCP Output Data Format and *VMDAS*

This section shows the format of the *VmDas* Navigation data when using an ADCP. This output can only be binary.

The ADCP binary output data buffer contains header data, leader data, velocity, correlation magnitude, echo intensity, percent good, and a checksum. The ADCP collects all data in the output buffer during an ensemble. The *VmDas* program writes this ADCP output into the *.ENR files (see File Naming Conventions). The *.ENR file format is described in the ADCP Technical Manual, Commands and Output Data Format guide.

The Navigation data is inserted before the checksum (and reserved bytes) when *VmDas* saves the ENS, ENX, STA and LTA files. Figure 34 show the sequence in which the *VmDas* program creates the ENS, ENX, STA and LTA files that make up the binary output buffer. Figure 35 shows the format of the binary Navigation Data. Table 18 lists the format, bytes, fields, scaling factors, and a detailed description of every item in the binary navigation output buffer.

Always Output	**HEADER**
	FIXED LEADER DATA
	VARIABLE LEADER DATA
WD-command WP-command	**VELOCITY**
	CORRELATION MAGNITUDE
	ECHO INTENSITY
	PERCENT GOOD
BP-command	**BOTTOM TRACK DATA**
See Binary Navigation Data Format	**NAVIGATION DATA** (92 BYTES)
Always Output	**RESERVED**
	CHECKSUM

Figure 34. ENS, ENX, STA and LTA Binary Output Data Format

NOTE. For a full description of the Binary Output Data Format (i.e. Header, Fixed Leader Data, etc.), see the ADCP Technical Manual Commands and Output Data Format guide. This guide is also available in Adobe Acrobat Reader pdf format on TRDI's website and on the documentation CD sent with your system.

12.1 Binary Navigation Data Format

Figure 35. Binary Navigation Data Format

BIT POSITIONS

BYTE	7	6	5	4	3	2	1	0	
1	NAVIGATION ID								LSB 00h
2									MSB 20h
3	UTC DAY								
4	UTC MONTH								
5	UTC YEAR								LSB
6									MSB
7	UTC TIME OF FIRST FIX								LSB
8									
9									
10									MSB
11	PC CLOCK OFFSET FROM UTC								LSB
12									
13									
14									MSB
15	FIRST LATITUDE								LSB
16									
17									
18									MSB
19	FIRST LONGITUDE								LSB
20									
21									
22									MSB
23	UTC TIME OF LAST FIX								LSB
24									
25									
26									MSB
27	LAST LATITUDE								LSB
28									MSB
29									LSB
30									MSB

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Continued from Previous Page

Byte	Field	
31	LAST LONGITUDE	LSB
32		MSB
33		LSB
34		MSB
35	AVG SPEED	LSB
36		MSB
37	AVG TRACK TRUE	LSB
38		MSB
39	AVG TRACK MAGNETIC	LSB
40		MSB
41	SPEED MADE GOOD	LSB
42		MSB
43	DIRECTION MADE GOOD	LSB
44		MSB
45	RESERVED	
46		
47	FLAGS	
48		
49	RESERVED	
50		
51	ADCP ENSEMBLE NUMBER	LSB
52		
53		
54		MSB
55	ADCP ENSEMBLE YEAR	LSB
56		MSB
57	ADCP ENSEMBLE DAY	
58	ADCP ENSEMBLE MONTH	
59	ADCP ENSEMBLE TIME	
60		
61		
62		
63	PITCH	LSB
64		MSB

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Byte	Field	
65	ROLL	LSB
66		MSB
67	HEADING	LSB
68		MSB
69	NUMBER OF SPEED AVG	LSB
70		MSB
71	NUMBER OF TRUE TRACK AVG	LSB
72		MSB
73	NUMBER OF MAG TRACK AVG	LSB
74		MSB
75	NUMBER OF HEADING AVG	LSB
76		MSB
77	NUMBER OF PITCH/ROLL AVG	LSB
78		MSB
79	AVERAGE TRUE VELOCITY NORTH	LSB
80		MSB
81	AVERAGE TRUE VELOCITY EAST	LSB
82		MSB
83	AVERAGE MAGNETIC VELOCITY NORTH	LSB
84		MSB
85	AVERAGE MAGNETIC VELOCITY EAST	LSB
86		MSB
87	SPEED MADE GOOD NORTH	LSB
88		MSB
89	SPEED MADE GOOD EAST	LSB
90		MSB
91	PRIMARY FLAGS	LSB
92		MSB

See Table 18 for description of fields

NOTE. This data is output in this format only by the *VmDas* program in the ENS, ENX, STA and LTA data files.

12.2 Navigation Data Format – Detailed Explanation

These fields contain the Navigation Data. This data is only recorded in the ENS, ENX, STA, and LTA files created by the TRDI Windows software program *VmDas*. The LSB is always sent first. The ADCP Technical Manual has descriptions of commands used to set these values.

Table 18: Binary Navigation Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	ID Code	Stores the sum of velocities identification word (2000h).
5-6	3	UTC Day	This field contains the UTC Day.
7-8	4	UTC Month	This field contains the UTC Month.
9-12	5,6	UTC Year	This field contains the UTC Year, i.e. i.e. 07CF = 1999
13-20	7-10	UTC Time of first fix	UTC time since midnight; LSB = 0.01 seconds
21-28	11-14	PC Clock offset from UTC	PC Time – UTC (signed); LSB = milliseconds
29-36	15-18	First Latitude	This is the first latitude position received after the previous ADCP ping. LSB = approx. 8E-8 deg (32-bit BAM) In the BAM (Binary Angular Measure) format, the most significant bit of the word has a weight of 180 degrees, and you keep dividing by 2 as you proceed to the right. The lease significant bit for a 32-bit BAM is about 8E-8 arc degrees ($180/2^{31}$), or just under 1 cm of longitudinal distance at the equator, where 1 arc minute = 1 Nautical mile. If you interpret the BAM word as an unsigned number, the range is 0 to (360-LSB) degrees, and if you interpret the BAM as a signed number, the range is –180 to 180-LSB) degrees. The least significant bit for a 16-bit BAM is about 0.0055 degrees ($180/2^{15}$). Some 32-bit BAM examples are: **UNSIGNED** 0x40000000 90 degrees 0x80000000 180 degrees 0xC0000000 270 degrees 0xFFFFFFFF 360 degrees minus one LSB degrees **SIGNED** 0x40000000 90 degrees 0x80000000 minus 180 degrees 0xC0000000 minus 90 degrees 0xFFFFFFFF minus one LSB degrees
37-44	19-22	First Longitude	This is the first longitude position received after the previous ADCP ping. LSB = approx. 8E-8 deg (32-bit BAM)
45-52	23-26	UTC Time of last fix	Time since midnight UTC; LSB = 1E-4 seconds
53-60	27-30	Last Latitude	This is the last latitude position received prior to the current ADCP ping. LSB = approx. 8E-8 deg (32-bit BAM)

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Table 18: Binary Navigation Data Format (continued)

Hex Digit	Binary Byte	Field	Description
61-68	31-34	Last Longitude	This is the last longitude position received prior to the current ADCP ping. LSB = approx. 8E-8 deg (32-bit BAM)
69-72	35,36	Avg Speed	Average Navigational Speed mm/sec (signed)
73-76	37,38	Avg Track True	Average True Navigational Ship Track Direction LSB = approx. 0.0055 deg (16-bit BAM)
77-80	39,40	Avg Track Magnetic	Average Magnetic Navigational Ship Track Direction LSB = approx. 0.0055 deg (16-bit BAM)
81-84	41,42	Speed Made Good (SMG)	Speed calculated between navigation positions. LSB = one mm/sec (signed) The Speed Made Good (SMG) and Direction Made Good (DMG) quantities are calculated from the navigation fixes that enter the system between ADCP outputs, and are calculated as follows: IF: aLat(i) = the average of the latitudes of the nav fixes in interval I aLon(i) = the average of the longitudes of the nav fixes in interval I Ta(i) = the average of the time of validity of the nav fixes in interval I dLat = the difference in average latitude between averaging intervals dLon = the difference in average longitude between averaging intervals VelMGn (i) = the velocity made good in the East direction for interval I VelMGn (i) = the velocity made good in the East direction for interval I LatToDist (dLat) is a function that converts delta Latitude to a distance LonToDist (dLon) is a function that converts delta Longitude to a distance Smg (i) = speed made good in interval i Dmg (i) = direction made good in interval i THEN: dLat = (aLat (I-1) – aLat (i)) dLon = (aLon (i-1) – aLon (i)) VelMgn (i) = LatToDist (dLat) / (Ta(i-1) – Ta(i)) VelMge (i) = LonToDist (dLon) / (Ta(i-1) – Ta(i)) Smg(i) = sqrt(VelMgn(i)^2 + VelMGe(i)^2) Dmg(i) = atan(VelMge(i) / VelMGn(i))
85-88	43,44	Direction Made Good (DMG)	Direction calculated between navigation positions. LSB-= approx. 0.0055 deg (16-bit BAM)
89-92	45,46	Reserved	Reserved for TRDI use.

Table 18: Binary Navigation Data Format (continued)

Hex Digit	Binary Byte	Field	Description
93-96	47,48	Flags	Describes the validity of the data. Each bit has represents a separate flag and has its own meaning 1=true, 0=false. The flag bits are defined as follows: bit 0 = Data updated bit 1 = PSN Valid bit 2 = Speed Valid bit 3 = Mag Track Valid bit 4 = True Track Valid bit 5 = Date/Time Valid bit 6 = SMG/DMG Valid bit 7 = Pitch/Roll Valid bit 8 = Heading Valid bit 9 = ADCP Time Valid bit 10 = Clock Offset Valid bit 11 = Avg True Velocity North & East Valid bit 12 = Avg Mag Velocity North & East Valid bit 13 = Velocity Made Good North & East Valid bit 14 = Reserved bit 15 = Reserved
97-100	49,50	Reserved	Reserved for TRDI use.
101-108	51-54	ADCP Ensemble Number	This field contains the sequential number of the ensemble to which the data in the output buffer apply. Scaling: LSD = 1 ensemble; Range = 1 to 4,294,967,296 ensembles
109-112	55,56	ADCP Ensemble Year	This field contains the ADCP year, i.e. 07CFH = 1999
113-114	57	ADCP Ensemble Day	This field contains the ADCP day.
115-116	58	ADCP Ensemble Day	This field contains the ADCP month.
117-124	59-62	ADCP Ensemble Time	Number of seconds since midnight; LSB=1E-4 seconds
125-128	63,64	Pitch	Pitch angle. LSB- = approx. 0.0055 deg (16-bit BAM) Pitch is positive when bow is higher than stern.
129-132	65,66	Roll	Roll angle. LSB- = approx. 0.0055 deg (16-bit BAM) Roll is positive when the port side is higher than the starboard side.
133-136	67,68	Heading	Heading input. LSB- = approx. 0.0055 deg (16-bit BAM)
137-140	69,70	Number of Speed Samples Averaged	The number of speed samples averaged since the previous ADCP ping.
141-144	71,72	Number of True Track Samples Avg	The number of True Track samples averaged since the previous ADCP ping.
145-148	73,74	Number of Magnetic Track Samples Avg	The number of Magnetic Track samples averaged since the previous ADCP ping.
140-152	75,76	Number of Heading Sam-ples Averaged	The number of Heading samples averaged since the previous ADCP ping.

Table 18: Binary Navigation Data Format (continued)

Hex Digit	Binary Byte	Field	Description
153-156	77,78	Number of Pitch/Roll Samples Averaged	The number of Pitch/Roll samples averaged since the previous ADCP ping.
157-169	79,80	Avg True Vel North	Average speed and average track True are the magnitude and direction of a velocity vector. Average True Velocity North and East are the north and east components of this vector. Scaling: mm/sec (signed)
170-182	81,82	Avg True Vel East	
183-195	83,84	Avg Mag Vel North	Average speed and average track magnetic are the magnitude and direction of a velocity vector. Average magnetic Velocity North and East are the north and east components of this vector. Scaling: mm/sec (signed)
196-208	85,86	Avg Mag Vel East	
209-221	87,88	Speed MG North	Speed Made Good and Direction Made Good are the magnitude and direction of a velocity vector. Speed Made Good North and East are the north and east components of this vector. Scaling: mm/sec (signed)
222-234	89,90	Speed MG East	
235-247	91,92	Primary Flags	Tells if valid data came from a primary or backup NMEA port. Each bit is a separate flag and has its own meaning. Bits are undefined if their data is invalid. If valid 1 = Primary, 0 = Backup. Bit 0 = Reserved Bit 1 = PSN ↓ Bit 9 = ADCP Time Valid Bit 10 = Clock Offset Valid Bit 11 = Average True Vel North and East Valid Bit 12 = Average Magnetic Vel North and East Valid Bit 13 = Speed Made Good North and East Valid Bit 14 = Reserved Bit 15 = Reserved

NOTE. Bytes 79 through 92 were added in *VmDas* version 1.43.

13 Software History

Version 1.46.5.

- Fixed a bug in VMDAS that caused the tilt data to be recorded incorrectly in the STA and LTA files.
- Added *CustomNMEA.txt* file for H, P, R input.
- Fixed a problem that caused $PADCP tag to randomly appended to file, causing a corruption.

Version 1.46.

- Added Vista compatibility.

Version 1.45 (Internal TRDI release).

- Added capability for UDP network Navigation string.
- Fixed condition where the wrong Date/Time was displayed in the .STA/.LTA NAV window. NAV time in the data file was correct.
- Added soft break capability.
- Added average speed calculations using GGA (previously only VTG was used).

Version 1.44.

- Added ability to decode both NB and BB data formats when collecting with an Ocean Surveyor/Observer.
- Added ability to decode Simrad attitude data format.
- The average Navigation East and North Velocities were added to the NMEA data format.
- Added ability for user to set the time out delays for initial wake up sequence and wait between commands.
- Fixed the problem with playing back files with "_"character at the end of the root name.
- Increased the number of NMEA input ports.
- Fixed problem with sending EA command and doing software EA adjustment.
- Fixed 600DEF.txt and 1200DEF.txt files.

Version 1.43 (Internal TRDI release).

- Binary Navigations data format in ensembles extended from 78 bytes to 92 bytes.
- Added the ability to use backup NMEA ports
- Fixed errors handling GGA times
- Fixed problem where log file grows huge

Version 1.42.

- Fixed problem with TE0 and TP0 always sent

Version 1.41.

- Fixed improper error validation of the PASHR validity byte
- Fixed problem with errors in the PASHR sentence are stated to be errors with the PRDID sentence

Version 1.40.

- Fixed the problem with the year being set to number bigger than 100.
- Changed format of displaying a date.
- Changed Copyright dates in About box.
- Fixed problem with names with too many underscores.
- Tied up Speed Log output rate to LTA.
- Fixed the problem with reprocessing that would stop at end of first N2R file.
- Fixed problem with OS when Use Options for low-resolution mode would send W commands instead of N commands.
- Changed the time out message for ADCP and NMEA devices.
- Changed equatorial radius and flattening to match WGS-84 standard.
- Improved speed of reprocessing the data.
- Added ability to select an ENS file to the drop down list for the WinADCP read file selection.
- Fixed typo in WH600def.txt file.
- Added Reference Layer source selection in Speed Log output.
- Changed the names of the averaging intervals on the Averaging Tab.
- Removed the grayed out spatial averaging interval selections from the Averaging tab.
- Removed the grayed out Application Selection items in the User Exit tab.
- Changed version number string to match new standard.
- Fixed the problem with program crashing when Bottom Track was selected as reference in ASCII out and Bottom Track was not available.

- Added ability to use COM port above 9.
- Added ability to pass a file name for playback on the command line.
- Fixed problem with internal heading to be more than 360 degrees.
- Activated “Preview” button under "ADCP Setup from File" and renamed it to “View/Edit”.
- Made Reference Layer labels consistent.
- Disabled display of serial product number if not necessary.
- Added sending of “CR1” command before any other commands.

NOTES