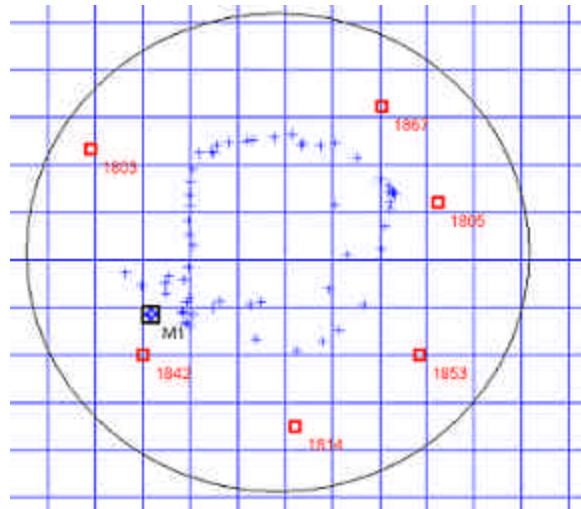


DiveBaseä

RangeNav

Windows Application Software

Reference Manual



1st Edition
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1. Introduction

The RangeNav system including the surface station software was designed to be very user friendly. The essential software functions and their use are described in the RangeNav™ operator's manual. The operator's manual in conjunction with some experimentation suffices to understand the most significant software capabilities and their use. This manual serves as a supplemental reference. It describes the function of all software functions, sorted by their menu locations. Scan over it to learn all the capabilities of the software, or use it to understand the capabilities and use of a specific software function.

2. The Main Menu

This section describes RangeNav™'s main menus at the top of the main window (File, Array, etc). It will give you the function of each menu drop-down list.

2.1. File Menu

Use this menu to call up a record file for replay, start, stop and delete records etc.

Option	Function
Replay Track Record	Replay a recorded track for study. Select the desired track record (.trk file) in the file browser
Switch to Realtime Mode	Changes back to real-time tracking mode from replay mode
Load Array Survey Data	Loads a previously acquired and saved listening station array survey data set. This an alternative to conducting a new array survey if you know that your listening stations have not moved (i.e. they are well anchored) since that survey. Using the same survey data for all tracking operations provides better repeatability and consistency of the track records.
Delete Logs	Calls up a file browser that lets you delete log files that are no longer needed. Specify the files to be deleted in the browser window.
Delete Raw Records	Calls up a file browser that lets you delete raw record files (.dat files) that are no longer needed. These files contain the actual 'raw' communications received from the listening station array. Their use is primarily for bug documentation purposes. Specify the files to be deleted in the browser window.
?Save Raw Records	Click on this option to start or stop saving the raw tracking data. Desert Star may ask you for some raw records if you are reporting a bug.
File Record Paths	Allows you to designate what folder (other than the default) you want tracking files to be saved in
New Track Record →	Start saving a new track record (.trk file). You can select either automatic or custom name assignment. Automatic names consist of the

	file start time and date. Use a custom name instead to describe the operation shown by this file.
Pause Track Recording	Allows you to pause but not end track recording, such as when nothing of interest is happening.
Exit	Closes the software

Table 1: File Drop-Down Menu

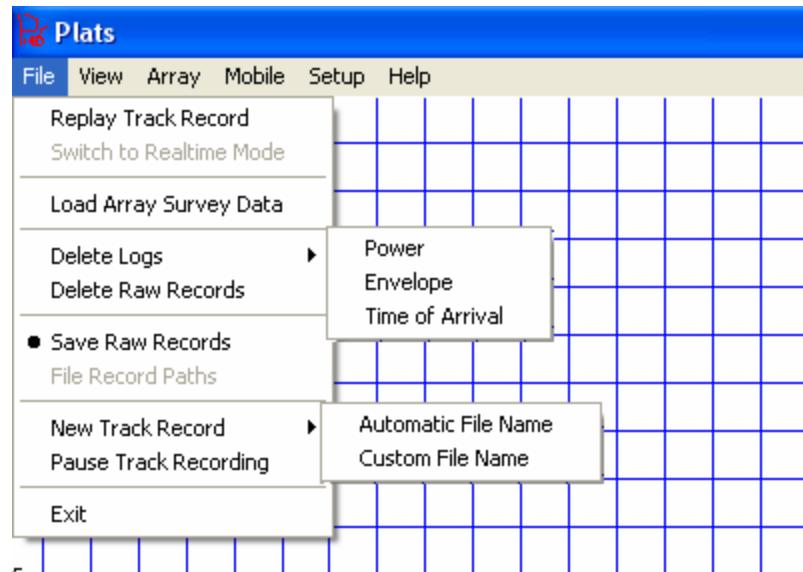


Figure 1: File Drop-Down Screen Shot

2.2. View Menu

View menu functions adjust the tracking display. In most cases, your menu selection will activate a cursor function such as pan or zoom. These functions are identified by the ? symbol in the table. Several functions are also available through keyboard commands, which are listed in the table. You need only to hold the “control” button and press the stated letter.

Option	Function
?Pan	Ctrl+P Select to pan the display in any desired direction. Left click and drag the display with the cursor as needed.
?Zoom	Ctrl+Z Select to zoom the display in/out. Use left click or '+' to zoom in. Use '-' to zoom out. The '-' and '+' keyboard commands can be used at all times, even when the zoom function is not selected on the menu.
?Rotate	Ctrl+R Rotates the display including the grid lines in directions needed. Left click and hold, move mouse clockwise or counterclockwise. A pie chart appears during rotate to illustrate the operation.
?Measure	Ctrl+M Measure distances between any two points. Left click on the start point, then hold and drag to the end point. A circle chart with numerical distance and direction (degrees) will appear.
Reset Rotation	Resets the display rotation to the default (zero degrees)
Settings	This allows you to view and set the exact screen settings numerically. Everything changed in here are viewing options: grid size, color, screen background and text color, and various others
Show Replay Controls	Brings up the replay controls (play, stop, rewind, etc) This is in case you accidentally or on purpose dismissed the controls in replay mode.

Table 2: View Drop-Down Menu

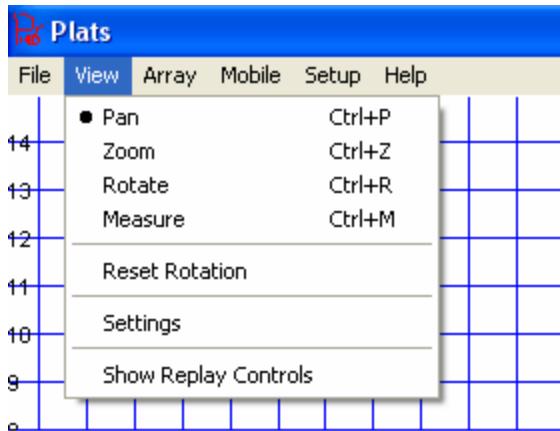


Figure 2: View Drop-Down Screen Shot

2.3. Array Menu

The Array menu options are related to the group of listening stations, i.e. the array. Here is where you power up the array, initiate a listening station position survey, and perform various other tasks defined in the table below.

Option	Function
Status	No function yet; for future use
Acoustic Receiver Settings	Adjust the detection threshold and post ping reception blackout period of all pingers. These options are for fine tuning the detection of pingers, and their use is explained in the Operator's Manual.
Power Control	Calls up the array electric power control and monitoring window. The power control and monitoring functions and techniques are explained in the Operator's Manual.
Signal Envelope	Calls up the acoustic signal envelope display window. This window is used for example to conduct an ambient noise test or to watch the pinger signals. Practical use is explained in the Operator's Manual.
Time of Arrival	Displays the ping time of arrival window, which provides numerical information regarding the detection of pings. This window is sometimes useful to monitor array performance. For example, a valid signal from a pinger that transmits once per second should show up at the same position (microseconds) within each 1 sec interval. If detection times are random, the station is picking up noise and the detection threshold should be raised.
Survey Relative	This calls up the listening station array survey window. A listening station position survey must be conducted before tracking operations

	can proceed. The Operator's Manual explains how this is done. Refer to the following sub-chapter for a description of the menu options available in the array survey window.
Load Array Survey Data	Loads previous array survey data. When you know the listening stations have NOT moved locations, use this option for best data consistency. This function is identical to one of the same name in the file menu.

Table 3: Array Drop-Down Options/Functions

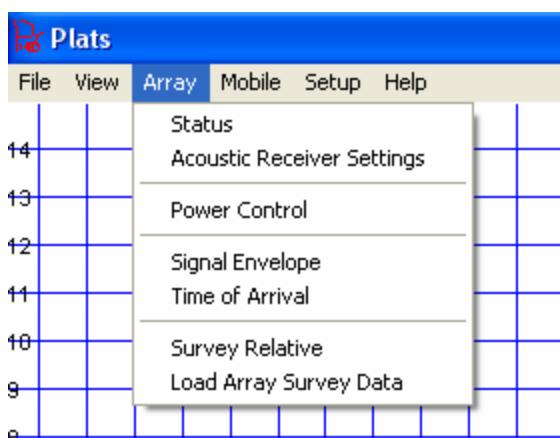


Figure 3: Array Drop-Down Screen Shot

2.3.1. Survey Window Menu

The survey window is called up by selecting **Array->Survey** from the main menu. Its function is to initiate and execute a position survey of the listening stations in preparation for tracking. The survey process is described in the RangeNav™ Operator's manual.

The following tables describe the pull-down menus of the Array Survey window.

File Menu

Option	Function
Load Survey	Load a saved survey (see next option) for use in tracking. Use this option to use 'your best' survey result for all tracking operations if you know that the location of the listening stations has not changed. Calls up a file browser.
Save Survey	Save the current survey results. Use to have the survey available for later tracking operations. Calls up a file browser.
Clear Survey	Clears the current survey result so that you can initiate a fresh survey. If you don't do this, then any data that has previously been collected will be maintained and influences the average of all measurements that constitute a survey.

Clear Array	Clears the array definition, i.e. the system will ‘forget’ which stations are in the array. You can do this to clear the screen of old and confusing data, perhaps left-over from a previous tracking operation.
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Filter Menu

Option	Function
Settings	<p>Call's up a window \to define the filter settings used in the computation of listening station locations from the inter-station distance measurement results of the survey:</p> <ul style="list-style-type: none"> • Minimum Range: Inter-station distance measurements less than this amount will be ignored. Set this parameter to the minimum plausible station distance to reject false measurements that may occur due to acoustic noise in the environment. Set this value to 5m or more. • Maximum Range: Same as above, but rejects measurements that are too large to be plausible or reliable enough for use. Use a setting of around 2-4 times your nominal station spacing. • Minimum Avg Signal Strength: Rejects distance measurements between stations with a signal strength less than this dB number. Weak signals also may be unreliable, and thus should not be considered in the survey. We recommend a setting of 110 dB, or different if supported by your tests. • Maxim Stdev: If the set of distance measurements between a given station pair exceeds this standard deviation, then the measurement will not be used in the position computations. High standard deviations indicate that a measurement is unreliable, perhaps because the direct acoustic path between the stations is obscured and only sporadic reflected signals are received. Use a setting of not more than 5m, less to follow more stringent quality controls. • Minimum Number of Range Measurements: If less than this number of measurements are available for a station pair, then the data will not be used. Use to ensure sufficient averaging. Minimum recommended setting is three measurements.

Adjustments Menu

Option	Function
Transform	<p>Used to transform the location of the array on the northing/easting grid, such as to convert from the array relative results of an acoustic survey to UTM coordinates. This pops up a window that provides you with two tabs and a few options.</p> <ul style="list-style-type: none"> • Translate Tab: Shifts the entire array by the specified distance along the North-South and East-West axis. Hit Apply after defining your translate, Clear to revert to the original setting, or Center followed by Apply to center an array around 0,0. • Rotate Tab: Rotate the array by the specified angle. Enter the number and hit Apply, or hit Clear to return to the original setting.
Guess Unknown Depth	Hit this button to allow the system to ‘guess’ the depth of stations that did not report a depth sensor measurement, such as due to a defective depth sensor. The guessed depth will be the average depth of the stations before and after the one with a missing depth. If several stations in a row have a missing depth, a similar linear interpolation applies.

View Menu

Option	Function
Toggle Range Circles	Toggles the range circles that provide a visual illustration of the software's matching of a listening station to the intersections of the circles that describe the results of the range measurements to other stations. In theory, all range circles should intersect at the location of the station, but in practice measurement errors mean that the circles intersect in an area. A smaller intersect area indicates higher quality range measurements. To operate, select the listening station for which you want to see the circles in the array survey window, and toggle the range circles on.

2.4. Mobile Menu

The Mobile menu is pleasantly brief. The only options are clearing the position track in order to 'clean' your screen, and the choice of pinger Position Estimation Filter settings.

Option	Function
Position Estimation Filter →	Settings → change different settings to filter out pings that show up in random/far-out locations. Position filtering is important to obtain a clean track. Refer to the Operator's Manual for details.
Clear Track	Clears the track that the pinger has made so far

Table 4: Mobile Drop-Down Menu

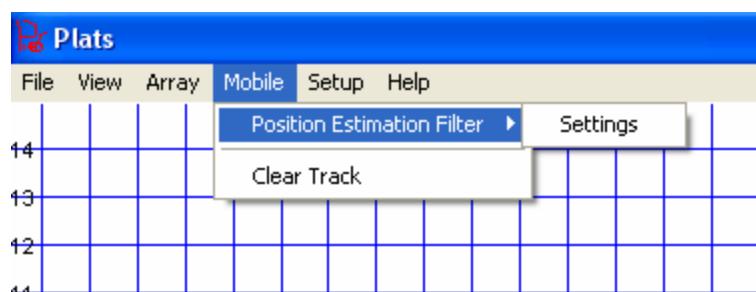


Figure 4: Mobile Drop-Down Screen Shot

2.5. Setup Menu

The Setup menu is used to update the listening station firmware, set Acoustic Channel Definitions for pinger detection, and do other tasks. These functions are essential to tracking operations and as such are described in the Operator's Manual. Here is a list of all options.

Option	Function
Input/Output Connections	Specify the COM port through which the STM-100 connects to the array, a COM port to be used to export tracking data to other systems in real-time, and COM ports to import and export other sensory information or data types related to the tracking operations.
Acoustic Channel Definitions	The acoustic channels must be defined to match the pinger transmit parameters in order to track a pinger.
Sound Speed	Provides three means to estimate the sound speed: A constant speed, a constant temperature and salinity which is used to compute a depth dependent speed of sound, and input of a CTD (conductivity and temperature vs. depth) profile used to estimate sound speed at any depth.
Update Firmware	Update new firmware or re-install old firmware to the listening stations and the STM-100 junction box.

Table 5: Setup Drop-Down Menu

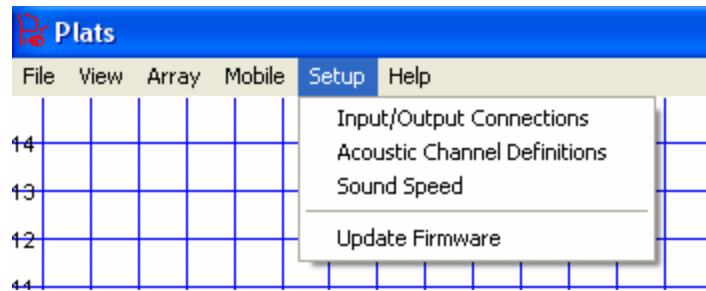


Figure 5: Setup Drop-Down Screen Shot

3. File Formats

RangeNav™ stores the full tracking record in a text file with a .trk extension. In addition, select data such as times of arrival can also be stored in log files, which are text files with a .log extension. These files are available for analysis of your tracking data using your own software tools. Figure 6 shows a portion of a .trk file as it appears in Notepad.

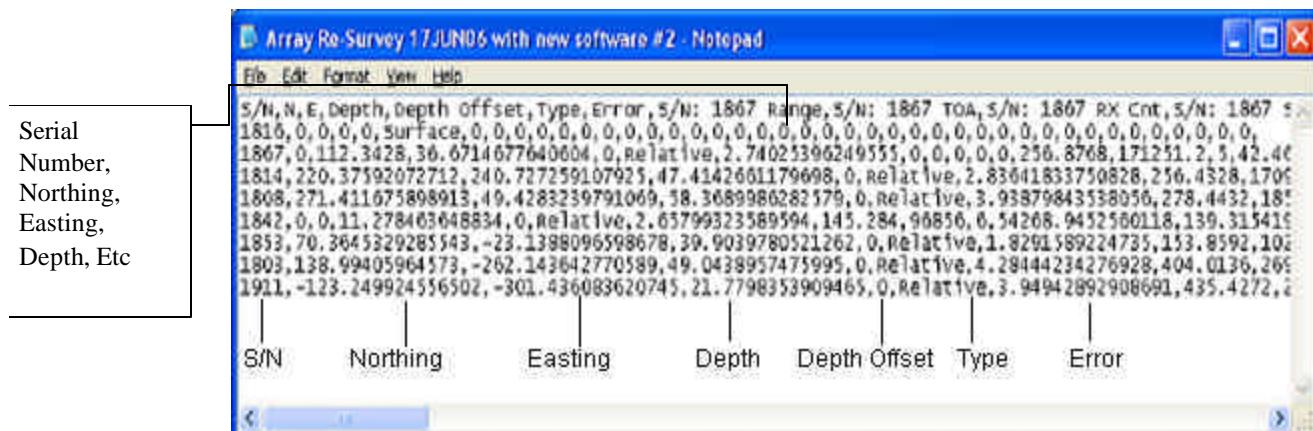


Figure 6: How To Read Array Survey Data

Use the following examples to interpret the **.log** files.

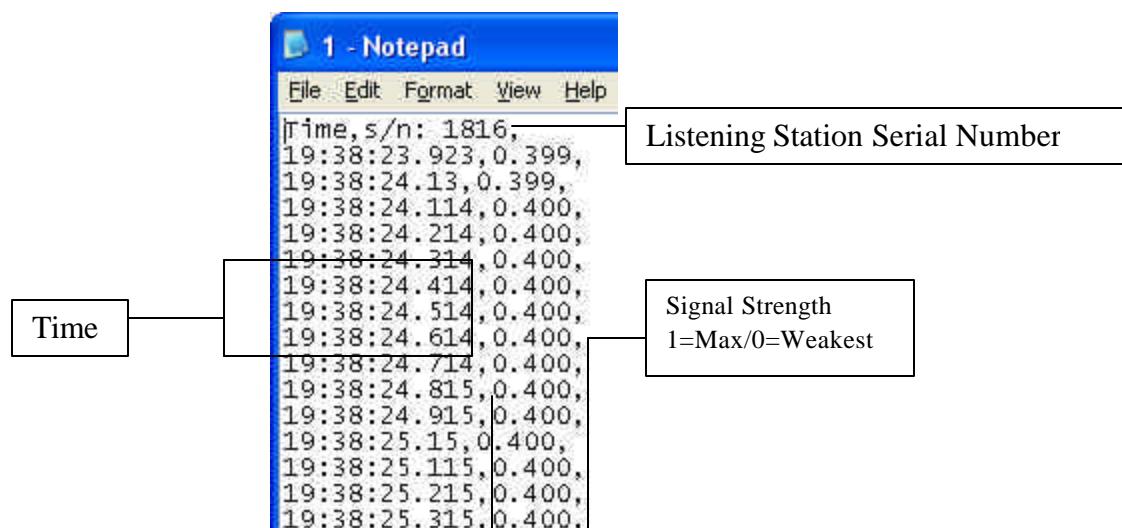


Figure 7: Signal Envelope .txt File

In the signal envelope log, you only see two different items for each listening station. You first see the time "hours:minutes:seconds" with time to a resolution of 0.001 seconds. Then you see the signal strength itself. On the relative scale, scale 0 is the weakest and 1 is the maximum signal strength. The top line or the log provides the interpretation and station serial number sequence.

```

application_power - Notepad
File Edit Format View Help
Time, Current Phase, Current Neutral, s/n: 1816, s/n: 1826, s/n: 1824, s/n: 1819, s/n: 1818, s/n: 1825, s/n: 1803,
23:50:4.580, 0.120, 0.108, 438.863, 442.503, 426.384, 427.424, 424.824, 415.464, 404.545,
23:50:5.592, 0.117, 0.103, 441.983, 446.143, 425.344, 422.744, 429.504, 413.904, 414.424,
23:50:6.593, 0.120, 0.108, 441.463, 433.144, 418.584, 422.744, 430.024, 418.584, 407.665,
23:50:7.595, 0.122, 0.105, 448.743, 437.823, 427.944, 424.304, 422.744, 410.785, 413.904,
23:50:8.646, 0.115, 0.103, 441.983, 437.304, 413.904, 428.464, 438.343, 415.984, 402.465,
23:50:9.658, 0.122, 0.105, 437.823, 438.863, 417.024, 963.004, 425.344, 417.024, 1064.400,
23:50:10.699, 0.117, 0.103, 438.863, 443.023, 417.024, 420.664, 421.704, 419.104, 411.304,
23:50:11.891, 0.122, 0.115, 438.343, 431.064, 430.544, 420.664, 427.944, 1064.400, 404.025,
23:50:12.43, 0.120, 0.103, 441.463, 447.703, 420.144, 423.784, 424.824, 417.544, 414.944,
23:50:14.224, 0.120, 0.098, 437.304, 437.823, 425.344, 423.784, 428.984, 417.544, 405.585,
23:50:15.586, 0.120, 0.103, 440.423, 433.664, 419.104, 426.384, 425.344, 414.944, 405.585,
23:50:16.648, 0.120, 0.105, 444.063, 433.144, 418.064, 419.104, 420.144, 428.464, 408.185,
23:50:17.649, 0.122, 0.105, 434.704, 437.823, 417.544, 429.504, 426.384, 678.574, 408.185,
23:50:18.651, 0.122, 0.103, 437.304, 430.024, 417.024, 425.344, 426.384, 412.864, 408.705,
23:50:19.652, 0.120, 0.108, 443.023, 433.664, 416.504, 420.664, 423.264, 409.225, 406.105,
23:50:20.694, 0.122, 0.112, 437.823, 434.184, 418.584, 419.104, 433.144, 409.745, 406.625,
23:50:21.885, 0.120, 0.103, 441.983, 455.224, 413.904, 424.824, 436.784, 414.424, 1064.400,
23:50:22.887, 0.122, 0.125, 0.110, 438.863, 441.463, 419.624, 418.584, 424.304, 409.745, 408.705,
23:50:24.28, 0.122, 0.105, 443.023, 444.583, 412.344, 420.664, 423.784, 415.984, 410.785,
23:50:25.210, 0.120, 0.105, 438.343, 439.383, 419.104, 421.144, 421.184, 436.264, 407.665, 415.984,
23:50:26.582, 0.120, 0.108, 439.383, 437.304, 417.544, 422.224, 432.104, 417.024, 404.025,
23:50:27.644, 0.120, 0.103, 438.863, 488.262, 415.464, 429.504, 422.224, 412.344, 403.505,
23:50:28.695, 0.120, 0.108, 435.744, 437.304, 420.144, 423.264, 425.344, 926.605, 398.825,
23:50:29.696, 0.120, 0.108, 439.903, 573.538, 413.384, 419.104, 425.344, 413.904, 409.225,
23:50:30.888, 0.122, 0.105, 440.943, 452.383, 418.064, 420.664, 437.304, 434.184, 411.304,
23:50:32.30, 0.120, 0.105, 441.983, 442.503, 419.104, 424.824, 421.704, 417.024, 405.585,
23:50:33.31, 0.120, 0.108, 434.184, 437.823, 423.264, 416.504, 423.784, 417.544, 408.185,
23:50:34.32, 0.120, 0.105, 441.983, 442.503, 419.104, 424.304, 421.184, 407.145,
23:50:35.33, 0.120, 0.105, 441.983, 442.503, 419.104, 424.304, 421.184, 407.145,
23:50:36.34, 0.120, 0.105, 441.983, 442.503, 419.104, 424.304, 421.184, 407.145,
23:50:37.35, 0.120, 0.105, 441.983, 442.503, 419.104, 424.304, 421.184, 407.145,
23:50:38.36, 0.120, 0.100, 445.103, 437.823, 418.584, 425.864, 425.344, 422.744, 422.744,
23:50:39.651, 0.120, 0.100, 444.063, 438.343, 419.104, 424.304, 420.664, 420.144, 406.105,

```

Figure 8: Power Array .txt File

This is quite easy to read as well. The first column is the time; the second and third correspond to the phase current (Ampere) and neutral current (Ampere) respectively. The next columns are the supply rail voltages measured at the individual listening stations. The first line provides the interpretation and list of listening station serial numbers.

Other log files may be added in future software versions. If not listed here, refer to the first line of a log file as the key for interpretation.

4. DiveBase RangeNav™ Computer Requirements

- At least 1GB of free hard drive space
- At least 512 MByte of RAM
- Supported & Tested Operating Systems:
 - Windows XP Service Pack 2
 - Newer version of Windows will be tested as they become available and reach a reasonable state of maturity (target: 1 year). Please inquire with Desert Star Systems.
 - Older versions of Windows including Windows XP (no service pack), Windows 2000 etc. may work but are not tested by Desert Star Systems.

Caution about using old & overloaded computers

Desert Star's experience has shown that the reliability of Windows machines declines as more application software is installed, or as they progress in age. These problems are often very hard to diagnose. We recommend that a dedicated surface station computer with a fresh Windows installation is used for RangeNav™ operations in order to maintain maximum reliability.

While Desert Star does offer tech support to get RangeNav™ running on your old jalopy, we will most definitely charge for it and it will probably cost more than just buying a new machine ;)