Wheelhouse Operation Manual

For Use with the Raven/Starlink Portable Marine Navigation System

November 23, 2010

Aerostar International, Inc. is a subsidiary of Raven Industries, Inc.

See document, RavenContactInfo.pdf, for contact info.

NOTES:
This manual shows screens of systems equipped with heading. The vessel icon can have both a COG vector and a heading vector. If you system does not have heading, the heading vector will not appear.

Starlink, Inc., was acquired by Raven Industries in December of 2001. Raven Industries retains the Starlink name for many of its products.

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History

The Starlink Portable Navigation System was developed in close cooperation with ship pilots. Hundreds of Starlink Portable Navigation Systems are currently in use. Many of the systems have been in the field for years with excellent performance reviews. The following organizations are either using or evaluating the system:

- The Pilots' Association for the Bay and River Delaware
- Maryland Pilots' Association
- Virginia Pilots' Association
- Maritrans
- Canadian Coast Guard
- Northeast Marine Pilots
- Sandy Hook Pilots' Association
- Penobscot Bay & River Pilots Association
- St. Lawrence Seaway Pilots
- Western Great Lakes Pilots' Association
- Hornblower Marine Services (High Speed Ferry)
- MITAGS in Maryland (Marine Training Facility)
- Charleston Branch Pilots' Association
- Houston Marine Pilots
- San Francisco Pilots

System Operational Characteristics

The Starlink Portable DGPS System uses DGPS (Differential Global Positioning System) technology to provide ship pilots with a reliable and simple-to-use navigational tool. This system uses the U.S. Department of Defense GPS (Global Position System) and the U.S. Coast Guard's differential radio beacon system to provide sub-meter position accuracy

The system is highly configurable. There are over 170 software-configurable options, which are pre-configured by Raven to meet the exact needs of a given pilots' association.

The system also uses highly accurate surveyed data for the channel center line and channel edges provided by the US Army Corps of Engineers. Aids to navigation are provided by the U.S. Coast Guard.

Screens have been designed to provide the exact information the pilots have requested, without any extra clutter.

One important feature of the system is that it displays its operational status, including normal operation and alarm conditions. The system may be affected by interference and various conditions that may limit the accuracy of the system. These are reported by the operational status built into the system. Wind, fog, rain, and other types of precipitation usually have no affect on the operation of the system.

The above system includes dual antenna heading.

Hardware

Depending on system components, the system weighs between 12 and 17 pounds, and is transported in a single soft back pack or hard case containing:

- Starlink DGPS unit contains 2-channel Beacon Receiver and 10-Channel GPS Receiver
- Starlink TBA-2M GPS/Beacon Mini Antenna with Clamp
- Laptop Computer (particular model changes as laptops change)
- 50 or 75-foot Antenna Cable
- Versatile AC power supply which operates on all ship AC power
- Interface Cables
- Dual antenna heading systems use 2 GPS receivers and 2 antennas.

Wheelhouse Program Features

Wheelhouse runs on the laptop computer, which is connected to a Starlink DGPS unit. The pilot selects various screens and control functions on the laptop computer. These screens and control functions provide the pilot with navigation information.

The system software is comprised primarily of the Wheelhouse program and the data files it uses. The data files are encoded (not user-modifiable) to maintain consistency within a given pilots' association. The data files contain highly accurate information acquired from the US Army Corps of Engineers and the US Coast Guard.

Some Wheelhouse features are:

- Ship icon showing position and direction of travel on the chart
- Ship scaling – ship is drawn to scale
- Graphical display of the route, with various features such as buoys, bridges, channel edges, and so forth
- Shares position and heading data with companion NOAA charting program, using only one PC com port
- Shares ship's dimensions and antenna offset with companion NOAA charting program
- Record, replay, rewind, fast-forward, and erase recorded trips
- Mark a position with a single keystroke (one use: 'man overboard')
- Display of RTCM Type 16 Messages
- Color annotation lines
- User-definable annotations
- Range circle (Varible radius from center of vessel)
- Graphical display of tracked satellites
- Detailed beacon and GPS data
- Vector continuously indicates where the ship will be in a certain amount of time
- Estimated time of arrival for a particular waypoint or for the last waypoint on the route
- Anchorages
- Diagnostics screen for use by service engineer and pilots in the beta test program
- Operational status alarms and optional audible alarm
- Display warning when an invalid reference station is being received (Optional)
- Position accuracy about 1 meter
- Cross track distance
- Speed over the ground
- Distance to the next waypoint/turn
- Bearing to the next waypoint/turn
- Course over the ground
- Time to the next waypoint/turn
- Satellite information
- Differential GPS correction information
- Dilution of precision information
- Waypoint name and range name
- Latitude and longitude
- GPS synchronization of Local Time
- Set Time and Date

Definitions

GPS

GPS is a satellite-based global navigation system created and operated by the United States Department of Defense (DOD). Originally intended solely to enhance military defense capabilities, GPS capabilities have expanded to provide highly accurate position and timing information for many civilian applications.

An in-depth study of GPS is required to fully understand it, but not to see how it works or appreciate what it can do. Twenty four satellites in six orbital paths circle the earth twice each day at an inclination angle of approximately 55 degrees to the equator. This constellation of satellites continuously transmits coded positional and timing information at high frequencies in the 1.5 Gigahertz range. GPS receivers with antennas located in a position to clearly view the satellites, pick up these signals and use the coded information to calculate a position in an earth coordinate system.

GPS is the navigation system of choice for today and many years to come. While GPS is clearly the most accurate worldwide all-weather navigation system yet developed, it still can exhibit significant errors. GPS receivers determine position by calculating the time it takes for the radio signals transmitted from each satellite to reach earth based on "Distance = Rate x Time". Radio waves travel at the speed of light (Rate). Time is determined using an ingenious code matching technique within the GPS receiver. With time determined, and the fact that the satellite's position is reported in each coded navigation message, by using a little trigonometry the receiver can determine its location on earth.

Position accuracy depends on the receiver's ability to accurately calculate the time it takes for each satellite signal to travel to earth. This is where the problem lies. There are primarily four sources of errors which can affect the receiver's calculation. These errors consist of :

(1) ionosphere and troposphere delays on the radio signal

(2) multi-path interference and Radio Frequency Interference (RFI)

(3) receiver clock biases

(4) orbital satellite (ephemeris) position errors

Note: Selective Availability (SA) used to be a major source of error, and was cancelled by differential corrections. Since the government turned off SA, this is no longer a source of error. But professional users still need differential corrections, which allows the position to be sub-meter as opposed to about 10 meters of error.

DGPS

DGPS works by placing a high-performance GPS receiver (reference station) at a known location. Since the receiver knows its exact location, it can determine the errors in the satellite signals. It does this by measuring the ranges to each satellite using the signals received and comparing these measured ranges to the actual ranges calculated from its known position. The difference between the measured and calculated range is the total error. The error data for each tracked satellite is formatted into a correction message and transmitted to GPS users. The correction message format follows the standard established by the Radio Technical Commission for Maritime Services, Special Committee 104 (RTCM-SC104) These differential corrections are then applied to the GPS calculations, thus removing most of the satellite signal error and improving accuracy. The level of accuracy obtained is a function of the GPS receiver. Sophisticated receivers like the Starlink Invicta 210 series can achieve accuracy on the order of 1 meter or less.

DGPS Unit

The Starlink Portable Navigation System may use more than one type of DGPS (Differential Global Positioning System) unit. The DGPS unit must be a Starlink Invicta , or possibly some other future Starlink DGPS unit. Dual antenna heading systems use 2 Starlink receivers.

Multi-Path Interference

Interference of the GPS signal often caused by the bouncing or reflecting of the signals from surrounding objects. Its effect is similar to "ghosting" on a television screen. It occurs when some of the signals arriving at an antenna have followed an indirect path. A signal taking the longer path gives a larger distance measurement to the satellite. This means that it also gives an inaccurate carrier phase value. It can be the most serious error to affect GPS positioning. While some multi-path conditions cause errors of a few centimeters, others cause errors of a few meters. Bad multi-path conditions can cause a short static session to fail completely.

Radio Frequency Interference (RFI)

RFI is interference from devices, including all types of radio transmitters, which emit electro-magnetic waves in the radio frequency range.

Set Up General Information

The optimum place to install the computer is on a forward shelf or bridge window so that when looking at the RADAR, you can also see the computer display. The antenna location to Port or Starboard should be chosen by location of the power outlet and which side the ship will dock. If possible, the antenna should be placed on the opposite side from the side it will dock. This helps lessen the chance of people accidentally pulling the antenna cable loose and/or blocking the antenna view while standing on the bridge wing.

Care should be taken to tape or place the antenna cable out of harm's way for the night watch. The doorway should have proper protection for this cable. Stow the DGPS unit away early enough to avoid the last-minute rush prior to leaving the vessel, when the antenna cable might get in the way.

When boarding and leaving the vessel, the DGPS unit back pack should be monitored by the pilot for proper fastening prior to hauling or lowering the back pack.

Notes

- The antenna is waterproof but the Invicta GPS receiver and computer are not.
- It should take less then 5 minutes to install or remove the Starlink Portable Navigation System.
- When operating the system, ensure that the green power light is on for the computer. This means you have power supplied to the DGPS unit and computer. If the keyboard keys have no effect on the screens (which would be a rare case), re-start the computer.
- The computer battery may have been deliberately removed to make it easy for a pilot to detect DGPS unit loss of power. The battery could cause the computer to display your last position, even though the DGPS unit was powered down.
- If the laptop has a battery and AC power fails, a warning will appear. If you press F3, the operational status message will indicate that AC power has failed.
- The DGPS unit does not show other traffic, except for other vessesl carrying SEND, so the pilot's visual lookout and the RADAR are as critical as ever in knowing the positions of other vessels.

Set Up Steps For a Single Antenna System

In general, the steps are:

- Set up the computer, but do not plug in the power adapter.
- Set up the antenna.
- Connect the antenna to the DGPS unit.
- Plug in the computer.
- Turn on the computer.

When the computer is plugged in, power is supplied to the receiver, even if the computer is off. It is undesirable to put power on the receivers without the antenna properly connected.

Detailed setup steps:

1 – Find a stable and dry place in the wheelhouse for the receiver and computer. Place the back pack there and remove the computer and attached DGPS unit. Do not apply power until the antenna have been set up.

2 – Attach the antenna clamp to the antenna. (Disregard if you have magnetic mount antenna.)

3 – Connect the coaxial cable to the antenna.

4 – Place the antenna outside the wheelhouse as far from obstructions as possible. Avoid other antennas or electrical devices. Do not mount the antenna on or near a Gyro Repeater. Clamp the antenna mount to a railing or other secure structure. The top of the antenna should be horizontal. If the ship has an awning or framework for an awning, try to mount the antenna outside the framework. Usually the farther out on the bridge wing you place the antenna, the less the antenna is obscured by the ship, and more satellites will be visible to the antenna.

5 – Run the coaxial cable from the antenna to the DGPS unit receiver and connect the cable to the antenna coupling of the receiver. IMPORTANT: the antenna cable must be connected to the antenna and the receiver BEFORE the power supply is plugged in. If you do not follow this procedure, beacon frequency selection by the DGPS unit may take an additional 10 minutes. Be careful that the wheelhouse door does not close on the cable and cut it. TIP: a 6-inch piece of garden hose slit down the middle and placed over the cable, or a piece of wood taped to the cable will keep the door from slamming on the cable.

6 – Connect the power supply cable to the DGPS unit and plug the power supply into the A.C. outlet. CAUTION: USE ONLY 100-240 VOLTS A.C.

Whwin and WhIP

There are 2 versions of Wheelhouse: Whwin and WhIP. Whwin communicates directly with the GPS receiver and does not require SendClient. WhIP does not communicate directly with the GPS receiver, and requires SendClient. SendClient communicates with the GPS receiver and with the SendServer, if there is an internet connection. WhIP and SendClient can work with or without an internet connection. Using WhIP and SendClient without an internet connection is equivalent to using Whwin. Whwin could be discontinued except that some users prefer one program rather than two programs.

Both Whwin and SendClient can communicate with the GPS receiver either via a standard serial port or via an Ethernet interface to the GPS receiver. The Raven 360S and 360D receiver models use an Ethernet interface to the GPS receiver(s).

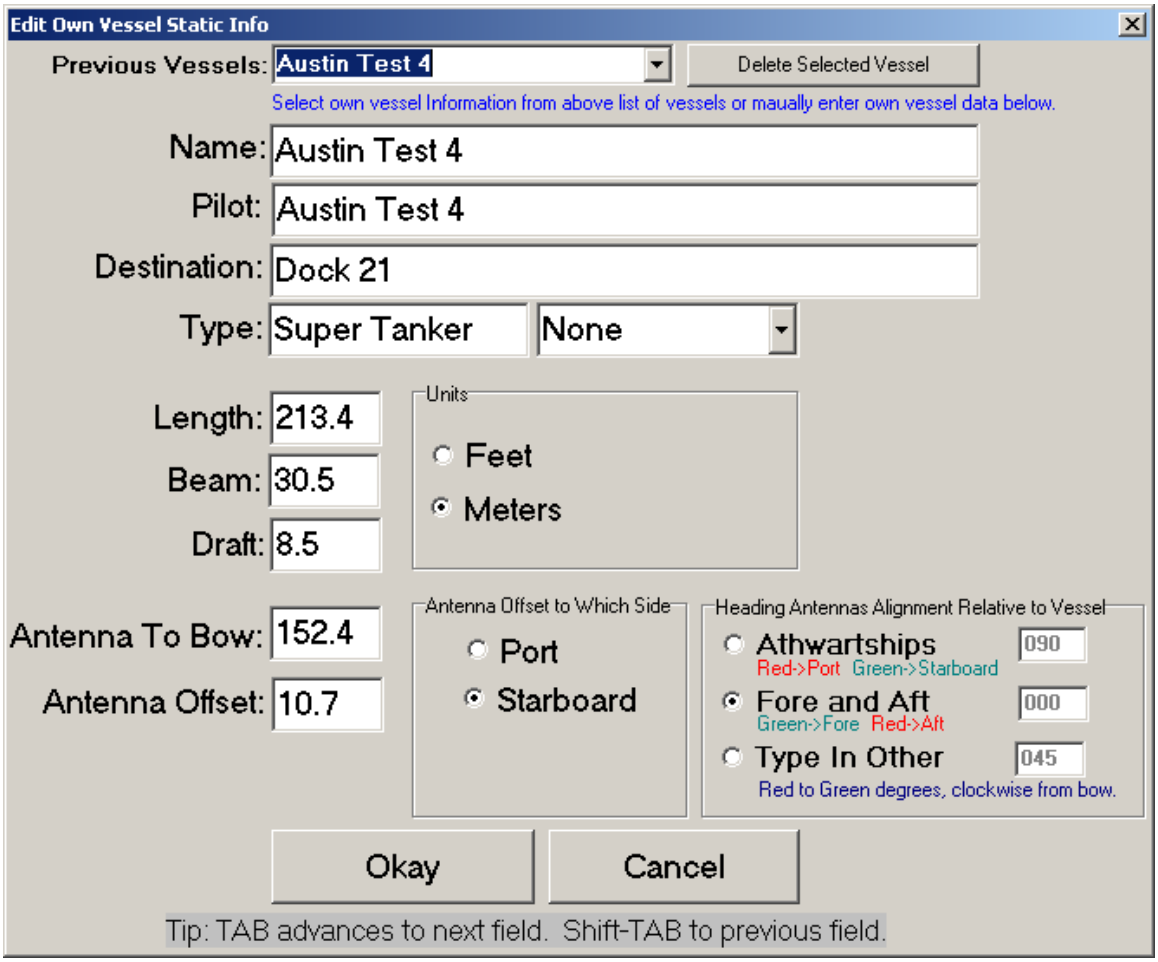
WhIP automatically starts SendClient. If the system is dual-antenna heading, WhIP also automatically starts DIH (Dual Invicta Heading). When you exit WhIP, it automatically closes any programs that it started.

Any system, such as dual-antenna heading, that requires the laptop to communicate with multiple serial devices, up to 4, will need to use WhIP and SendClient connected to a 360S or 360D via Ethernet.

Setup for the Dual Antenna Heading System

In general:

- Set up the computer, but do not plug in the power.
- Set up and connect the antennas, plug in the power adapter, turn on the computer.
- Start WhIP and wait for a fix.
- Select SendClient from the taskbar.
- Select Edit Own Vessel Static Info and enter vessel data and antenna orientation with respect to the vessel. The screen for doing this is shown below.



The SendClient 'Edit Vessel Static Info' screen . Dual antenna heading systems use WhIP/SendClient.

SETTING UP THE DUAL ANTENNAS

Follow the same general steps to set up dual antennas for a heading system as for the single antenna system. Make sure the last step you do is to plug in the computer. Remember that when

the computer is plugged in, power is applied to the receivers. The receivers should not be powered up without the antennas properly set up and connected.

Mount the antennas athwartships with the red antenna to port and the green antenna to starboard. Alternatively, mount the antennas fore-and-aft with the green antenna fore. You may also mount the antennas in any other alignment that may be necessary. The alignment is not critical, but you must enter a correction for any alignment in SendClient. You can specify either Athwartships, Fore/Aft, or Other in 'SendClient | Edit Own Vessel Static Info'.

Make sure the antennas are at the same height and the ball-chain between them does not sag. The distance and height difference between the antennas are critical. Even an inch matters. You can correct a height difference of a few inches using the double ball-joint mount to lower one antenna.

Make sure that the antennas have the same attitude. They should both be upright; but, if they are not exactly vertical, any tilt should be the same for both. Likewise, both antennas' connectors should point in the same direction.

When entering Vessel Static info in SendClient, select one of the following three:

Athwartships - Red antenna to Port, Green to Starboard
Fore/Aft - Green antenna fore, Red antenna aft
Other - Red to Green degrees, clockwise from bow.

ANTENNA OFFSET from vessel centerline is with respect to the RED antenna.

Also note the 'LARD' acronym:

L - The antennas must be LEVEL with each other.
A - The antennas must have the same ATTITUDE.
R - The antennas must have the same ROTATION.
D - The antennas must be the correct DISTANCE apart.

Pack Up

The system should be packed up in the reverse order of set up. It is very important that the power supply be unplugged before any other wires are disconnected. In general:

- Shut down the computer.
- Unplug the computer.
- Disconnect the antenna cable(s).
- Roll up the cable(s) and dismount the antenna(s).

General Operation

Once you have set up the system, as described earlier, you are ready to operate the Wheelhouse program. Do the following:

- Turn the computer on.
- Depending on the configuration, the computer will either boot to the Wheelhouse disclaimer screen or the Windows desktop.
- If the Wheelhouse disclaimer screen appears, press 'Y' to proceed into Wheelhouse.
- If the Windows desktop is displayed, select the appropriate desktop icon to run Wheelhouse.
- Usually, the first Wheelhouse screen displayed will be the **Safety Reminder Screen** (disclaimer). To operate the system you must agree to the terms of this screen by typing 'Y'. If you do not agree, terminate the program by typing 'Q' to quit. If the system has just been installed or updated, the Raven License Agreement will appear. This screen will not appear on subsequent starts if the user accepts the agreement.
- If your system is configured for it, the next Wheelhouse screen will be the **Antenna Offset Screen**. This screen prompts you for the side and distance from the center of the ship of the antenna placement. Type the values and press Enter.
- After the Antenna Offset Screen comes the **Route Menu Screen**. Select the desired route from this screen.
- If your system is configured for it , the **ETA Waypoint Screen** comes next. Select the desired ETA Waypoint from this screen.
- Next comes the Wheelhouse **Chart Screen**. Once you get to this screen, the following functions are available to you:
  - F1 - Chart
  - F2 - Cross-Track Error
  - F3 – Operational Status
  - F4 – Cog/Sog (Course Over Ground/Speed Over Ground) in Large Numbers
  - F5 – Settings, such as vessel dimensions
  - F9 - Diagnostics Screen
  - F10 – Minimize Wheelhouse: you should always press F10 to minimize Wheelhouse prior to selecting any other program, such as the NOAA charting program. F10 signals Wheelhouse it is okay for other programs to have the 'foreground' window. If you do not press F10 and select another program, then Wheelhouse will take the foreground back from that program.
  - F11 - Advanced Control Functions
  - F12 – Control Functions Menu
  - ESC - Route Menu
  - If you are using WhIP/SendClient, once you have advanced to the chart screen (F1 screen), press F10 to minimize, and then on the SendClient screen, click on 'Edit Own

Vessel Static Info' and either enter the vessel's static info or select the vessel's static info from the Previous Vessels drop down box.

Windows Operation Tips

When you turn on your system, it will boot to the Windows desktop or will automatically start Wheelhouse, depending on how it is configured. The Windows desktop will have a ship icon for Wheelhouse and another icon for a NOAA charting program.

To run Wheelhouse and the NOAA charting program simultaneously, do the following:

- Start Wheelhouse by double left-clicking its icon.
- Answer Y to the Safety reminder screen if you agree with its terms.
- Enter the antenna offset.
- Select a route and advance to the chart screen.
- Press F10 to minimize Wheelhouse.
- Start the NOAA charting program by double left-clicking on its icon.
- You can use Alt-Tab to switch back to Wheelhouse, but you must always press F10 to minimize Wheelhouse before selecting any other program.

To learn how to work with program windows, from the task bar select Start, Help, Search and type in 'manipulating windows' and press Enter. (The task bar is the horizontal bar at the bottom of the screen). Click on 'Manipulating windows in Windows' which appears in the list box .

You can select a running program by any of the following methods:

- Click on the program icon on the task bar.
- While holding the Alt key down, press tab successive times until the desired program is selected in the pop-up selection window. Then release the Alt key.
- If you have a touch screen you can touch the program icon on the task bar.

IMPORTANT: If you are pressing keys, but the program window is not responding to them, it could be that the window does not have keyboard input focus. Make sure the program is selected by one of the methods above, and try pressing keys again. If the program window is selected, but still does not respond, press Control-Alt-Delete to see a list of running tasks. If 'not responding' appears along side the program of interest, select that program and press the 'End Task' button. Then go to the desktop and start the program again.

Heading Operation

The Starlink system can get heading from dual antennas and GPS receivers, or it can get heading from the vessel's gyro for certain fixed installations.

- If heading messages are present, Wheelhouse will change the display format of the F1 and F2 screens to a format that includes heading.
- The scaled vessel will point in the direction of the heading, not the COG.
- A green heading vector will be displayed along with the red COG vector. You can toggle the vectors on and off using the H key, allowing heading only, COG only, or both.
- You can use Alt-H to enter a reference heading from the ship's gyro for systems getting heading from the ship's gyro. It is better not to use Alt-H for systems getting heading from dual antennas. Use the up/down arrows to trim heading for either type of system.

You can make heading adjustments from the Wheelhouse Program, as follows.

ADD A CORRECTION FOR A STEADY-STATE HEADING ERROR
Up Arrow - Each press adds a half-degree to the computed heading.
Dn Arrow - Each press subtracts a half-degree to the computed heading.

The heading system inherently has no long-term bias. Although from moment to moment there will be some errors in its reading, these will always average to zero over time. Thus the longer that you see a consistent error to one side or the other, the surer you can be that it is due to antenna alignment, which you can correct using the Up/Down arrows without moving the antennas.

If you observe that the heading consistently disagrees with the ship's gyro by the same small amount, say 6 degrees or less, you can use the up or down arrows in Wheelhouse to trim out the error by adjusting the correction in half-degree steps.

CORRECT A WRONG HEADING
F7 - The current heading is wrong: compute a new heading. (Use rarely)
If F7 does not correct a wrong heading, quit WhIP and then restart it.

It is possible for the heading software to choose the wrong solution, particularly at startup or after an interruption in operation. These wrong solutions are characterized by obvious, substantial heading error and should not be corrected by the up-down arrows, since the system will eventually find the correct solution, making any correction that you entered appear as an error in the opposite direction. Instead, you can tell the system that it has the wrong solution by pressing the F7 key to force it to look for another solution. It should be a rare occasion when you need to use the F7 key. The F7 key is sometimes referred to as the 'Punish Key'.

Wrong Heading Solution for Dual Antenna Heading Systems

The heading system works by finding the heading that best agrees with the GPS signal phases at the two antennas. There is usually only one such heading, but there is no certainty that there will not occasionally be more than one good interpretation. Note the following:

1) The system is most vulnerable to choosing a false heading, if one exists, when it is first turned on. After it has operated for a few minutes with the right solution, it comes to prefer that one to any other that might appear for a while.

2) A turn more sudden than is reasonable on a ship can confuse the heading system into jumping to a wrong solution. Also, loss of the satellite signals, as by shadowing, during a more sedate turn, can seem like a sudden turn when the signals re-appear.

3) False solutions tend to last only a few minutes. As the satellites move across the sky, the accidental geometry that caused the false solution changes, but the correct solution remains. Turning the antennas (that is, the ship) will have a similar effect in killing false solutions.

4) The heading system should work with any angle of antenna alignment. However, the system assumes that the antennas are aligned with the keel of the ship in computing its results. Misaligning the antennas causes a constant offset from the correct heading, which can be removed either by trimming the heading or by synchronizing the heading to the course (assuming no cross-current). If the system has a large heading error when the antennas are aligned with the vessel centerline, then it is better to wait a few minutes until the system finds the right solution before making any trim corrections. A large correction made too hastily will probably become a large heading error later when the system moves to the correct heading solution.

5) The heading system uses phase information from 2 GPS receivers to determine heading. If there are fewer than 5 usable satellites per receiver, the system may not generate any heading information. Furthermore, the usable satellites must be the same ones for each receiver.

Heading Accuracy for Dual Antenna Heading Systems

The root-mean-square heading accuracy is about 1.5 degrees. This means that the error will often be less than 1.5 degrees, but can frequently be more than that, but rarely much more. In entering corrections, you should be aware that a correction entered when the error is momentarily large will cause persistent errors in the other direction later. Most of the heading error is due to small differences between the phase-shift patterns of the two antennas, which would ideally be identical. This means that the instantaneous error will move back and forth as the moving satellites and the actual heading changes of the ship expose different parts of the antennas' reception patterns to the incoming signals. Therefore, the longer you are able to compare the heading with the reference to which you want to correct it, the better you will be able to judge when the GPS heading is at the middle of its error swing, which is of course the best time to make the correction.

You can enter a reference heading into the system as often as seems necessary. So if you should enter the reference heading at a bad time, you can always enter it again.

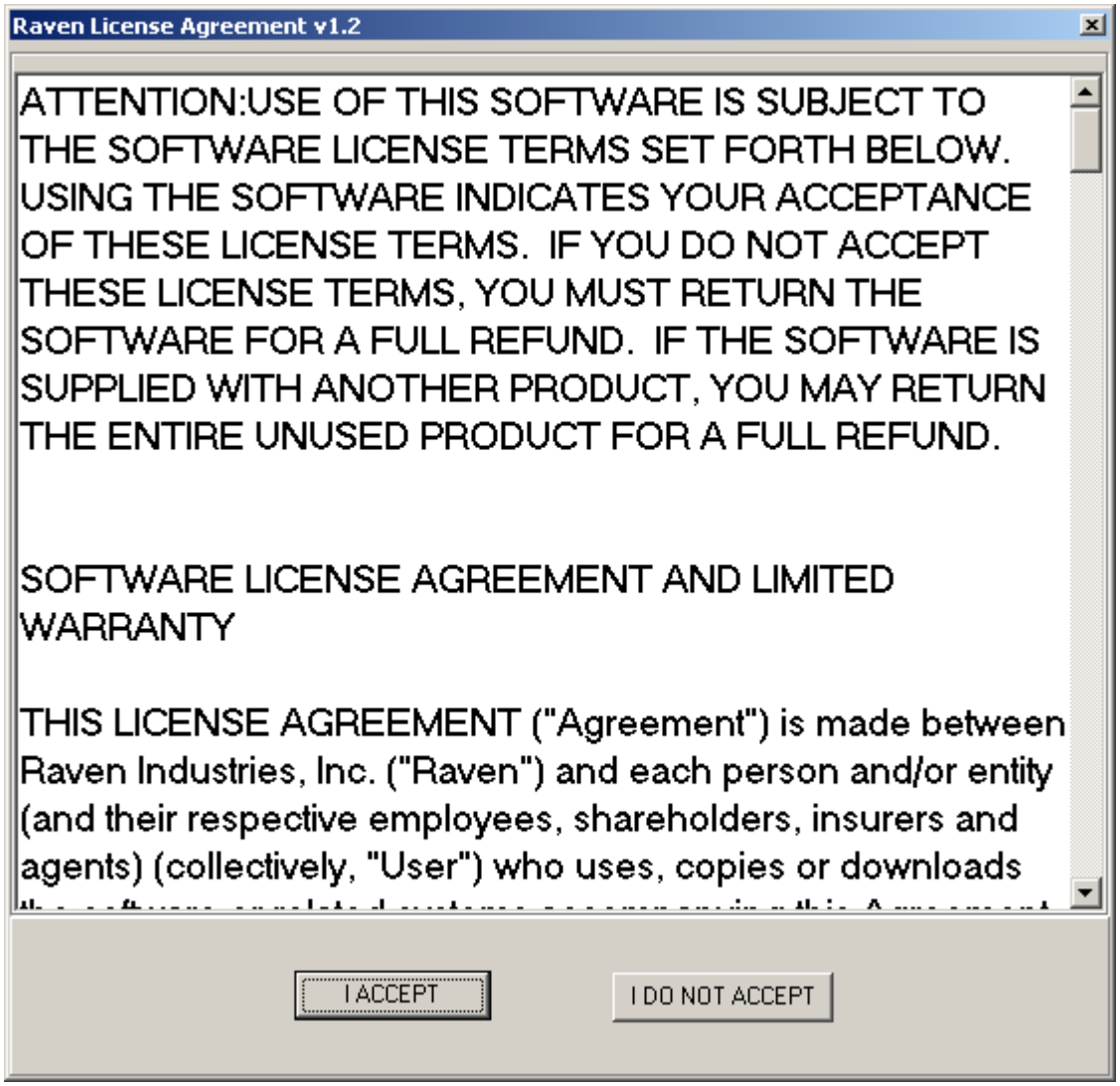
Dangers of Installing Third Party Software

It is possible to render your system inoperable by installing additional software. This is because the new software may modify Windows systems files. Raven recommends that you do not install any additional software on your pilot system laptop. If you do install additional software on your system, be prepared to deal with unexpected problems.

Updating Wheelhouse Files Via Email

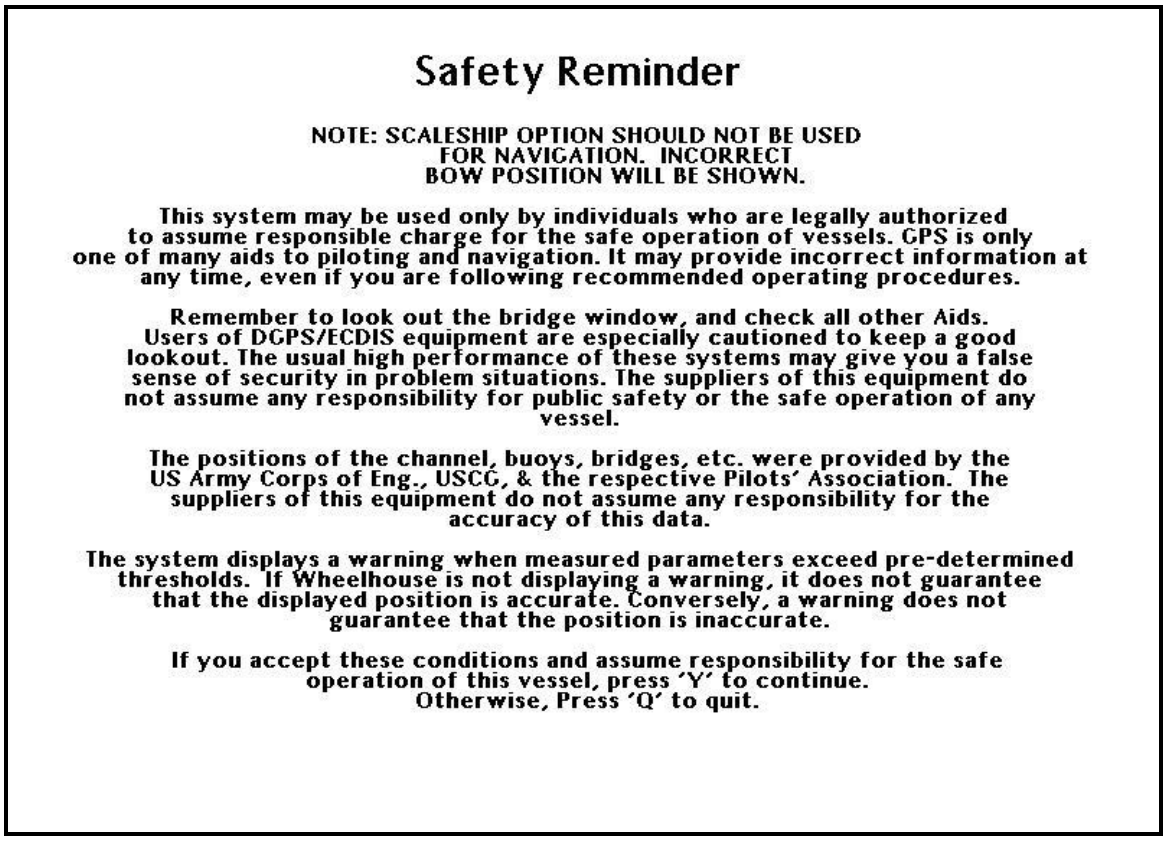
The email will contain a description of the changes and the new version of data set and/or Wheelhouse program. Left click on the attachment and select 'Open.' This will run the attached install file and update your Wheelhouse files.

Raven License Agreement



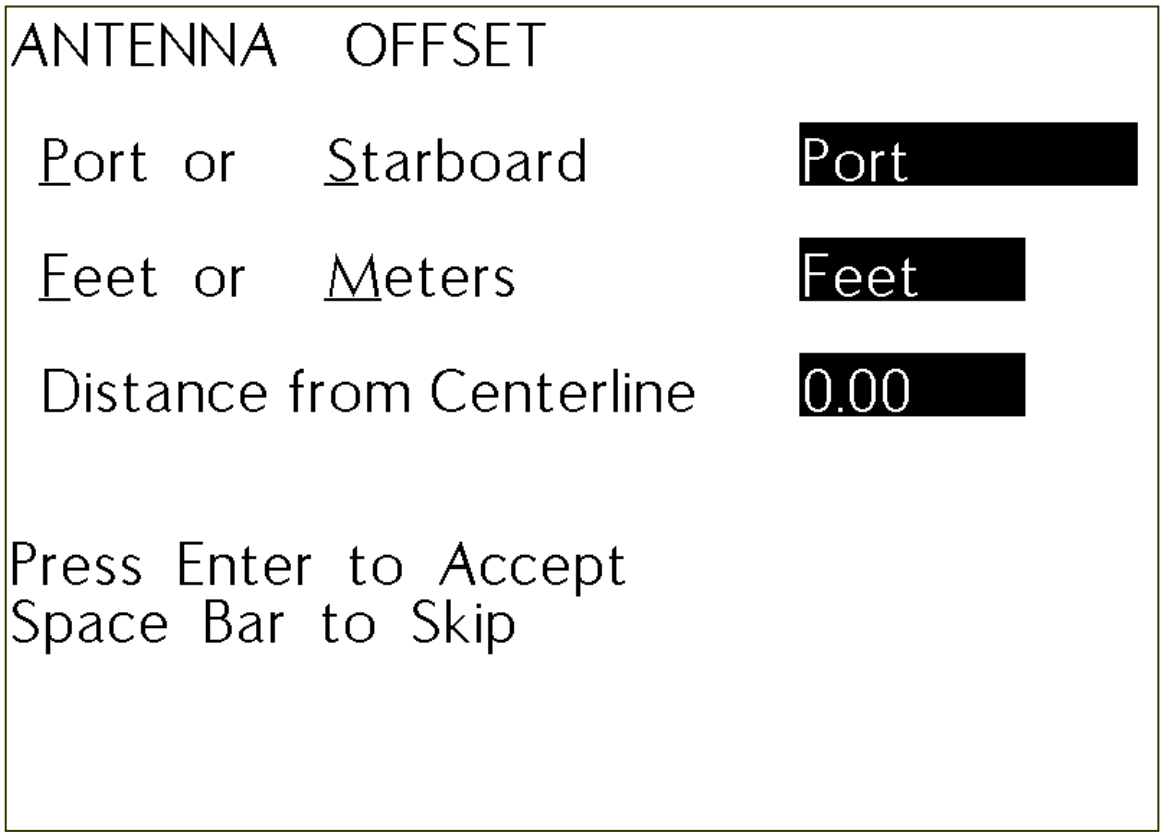
The Raven License Agreement appears only after a new installation of Wheelhouse. If the user accepts the agreement, it will not appear for subsequent starts of Wheelhouse.

Safety Reminder Screen



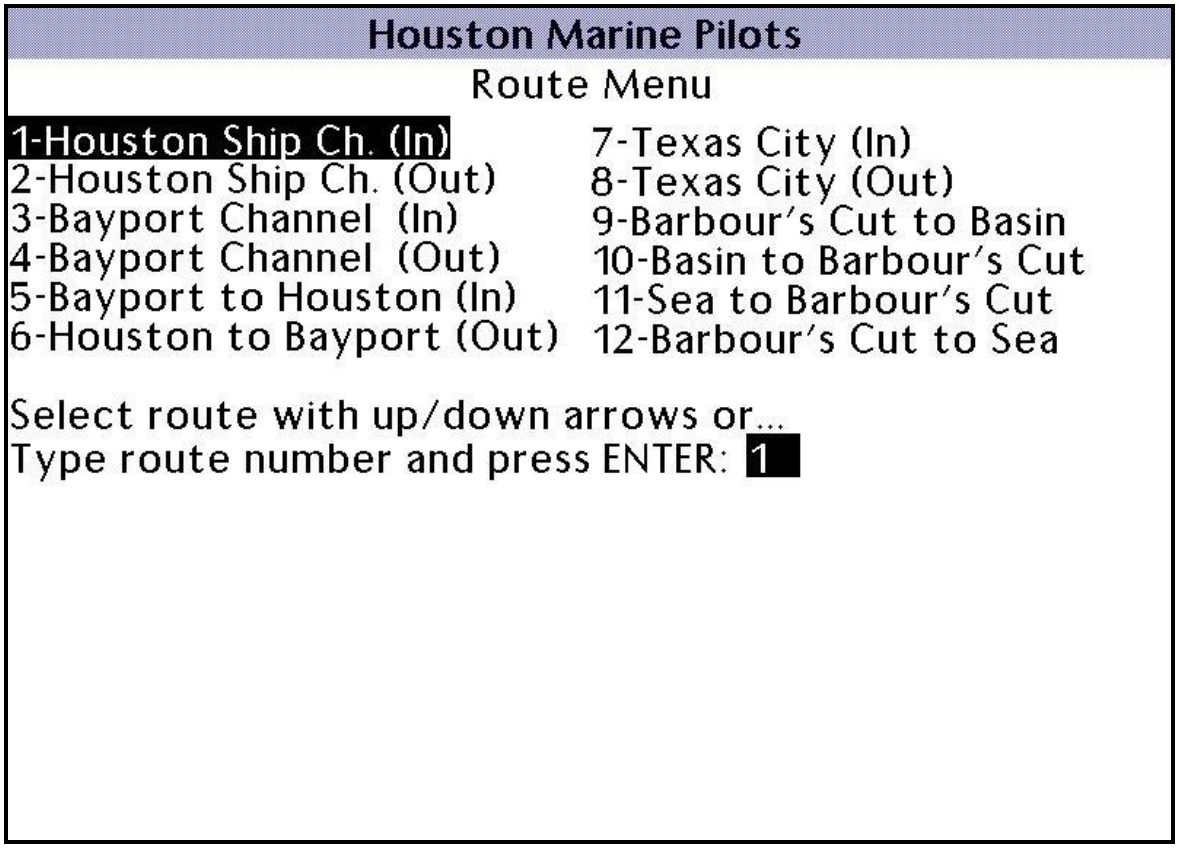
If the Raven License Agreement has been accepted in a previous Wheelhouse start, the first screen displayed will be the **Safety Reminder Screen**. To operate the system you must agree to the terms of this screen by typing 'Y'. If you do not agree, terminate the program by typing 'Q'.

Antenna Offset Screen



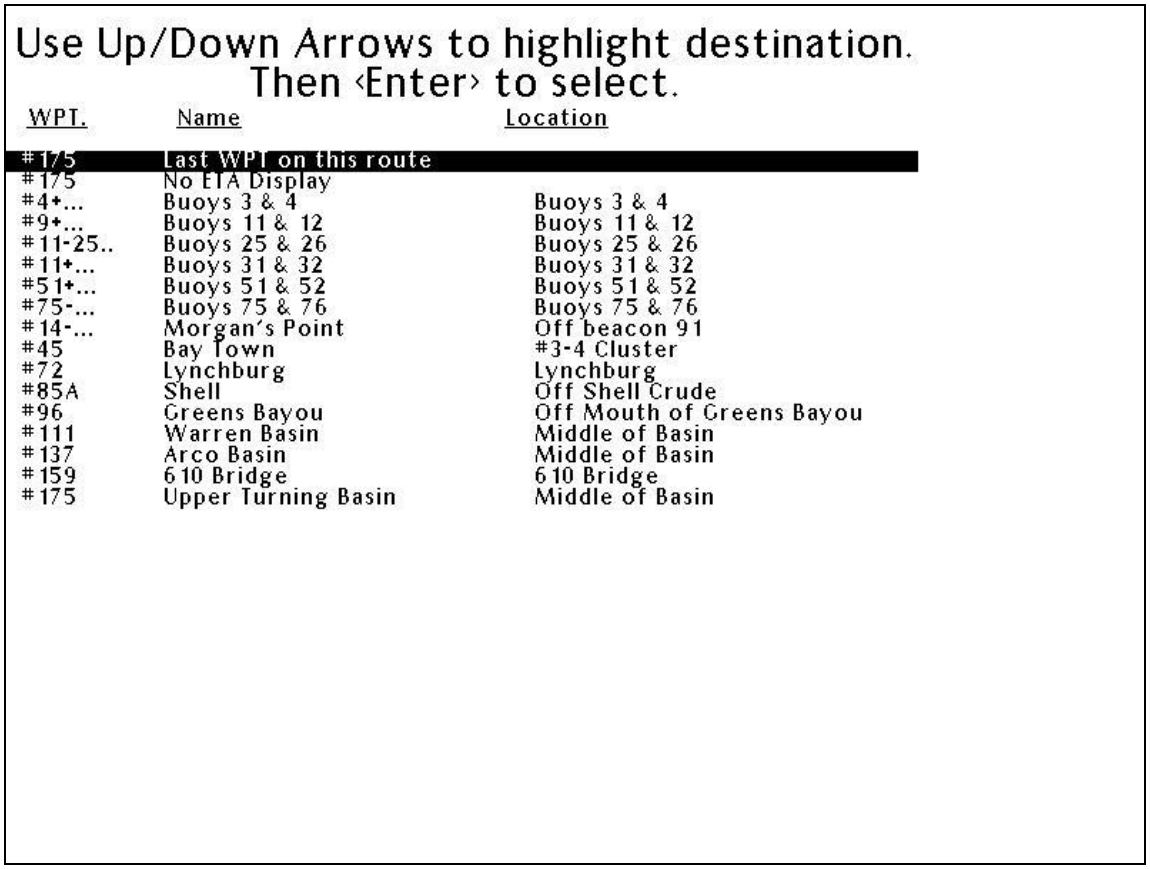
If your system is configured for it, the **Antenna Offset Screen** will appear after the Safety Reminder Screen. This screen prompts you for the side and distance from the center of the ship of the antenna placement. Type 'P for Port or 'S' for Starboard, 'M' or 'F' for Feet or Meters, and then a numerical value for the offset and press Enter. Wheelhouse/IP systems do not show this screen at startup, as users are expected to enter this value from SendClient.

Route Screen



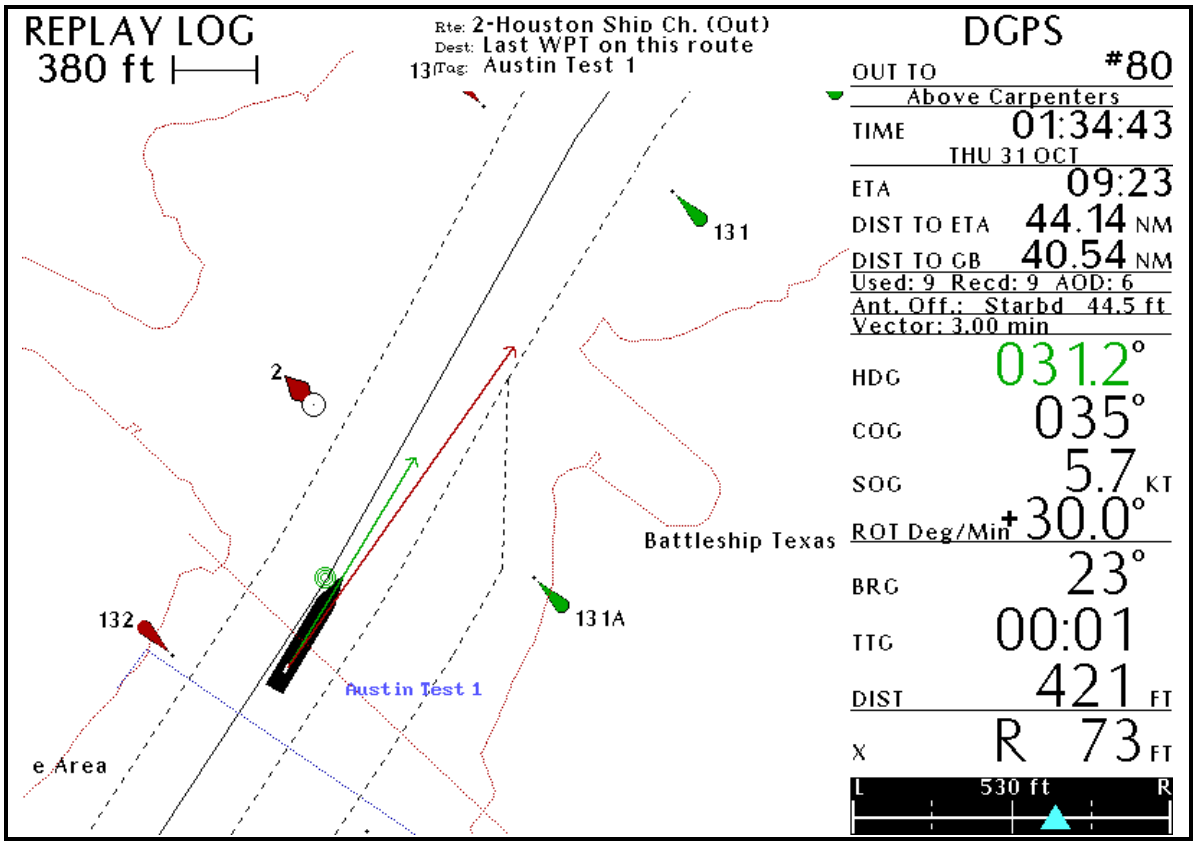
The **Route Screen** displays a menu of routes from which you must select the desired route. The program will not operate properly if you select a route different from the one you are traveling. Specifically, the cross-track error value will be wrong. (The cross-track error can also be wrong if the selected waypoint is not the next waypoint.) When replaying a log file, you must also select the correct route. If you need to change the selected route, press ESC to display the route menu.

ETA Waypoint Screen



ETA waypoints allow you to select a waypoint for which you would like an Estimated Time of Arrival displayed on the F1 screen. If your computer is configured for ETA waypoints, a menu of ETA waypoints will be displayed after the route menu. From this menu, select the waypoint for which you desire an ETA computation. If your computer is not configured for ETA waypoints, the ETA displayed on the Chart (F1) Screen is the ETA for the last waypoint on the route.

Chart Screen (F1)



On the F1 Screen, Control Functions and Advanced Control Functions are active. You may want to look at the CONTROL FUNCTIONS SCREEN (F12) and the ADVANCED CONTROL FUNCTIONS SCREEN (F11) sections of this document now.

The chart screen is divided into three areas: the Route Area, the Data Panel, and the Cross-Track Error Indicator. These are described below.

Route Area

The route area can be viewed at 16 different 'zoom' levels. Press U to zoom up and D to zoom down. You can zoom out to view the entire route, or you can zoom down to view details, such as buoys or the position of the ship relative to the channel.

The ship icon is displayed on the route. The ship may be drawn to scale if your system is configured for it and you have selected it.

The waypoint selection circle is green when the selected waypoint is the next waypoint on the route. It is red when the selected waypoint is not the next waypoint on the route. You can use N (next) and P (previous) to manually select a waypoint. You can manually select a waypoint that is several waypoints away to determine the distance and time to that waypoint. . Press the HOME key to set the waypoint selection circle to the next waypoint on the route.

Data Panel

The data panel consists of the following items:

- The operational status at the upper right of screen displays either DGPS, NOCOM, NOPOS or NOFIX, WARNING, RTCM, or WAIT.
  - NOCOM means the system has not established communication with the GPS receiver.
  - NOPOS or NOFIX means the the GPS receiver is not computing a position.
  - DGPS means the system is in Differential GPS mode, and the position information is accurate.
  - 'WARNING' means there is some condition which is limiting the accuracy of the system. Press F3 to select the Operational Status Screen to get an English description of this condition.
  - 'RTCM' means the system has received an RTCM message from the beacon reference station. Select the Operational Status Screen (F3) to view this message. Press 'x' to clear the visual and audible alarms.
  - 'CHART MODE' means you can move around on the chart and enter user annotations during navigation (most systems are not configured to allow this).
- If you are replaying a log file, then 'REPLAY LOG' will appear in the upper left corner of the screen. If you are recording a trip for later replay, then 'LOGGING' will appear in the upper left corner of the screen.
- The currently selected waypoint name and range name. If the range is not the range the vessel is on, the range name is displayed in inverse video.
- The local time and date. Local time is synchronized to GMT time, and is automatically adjusted for your time zone and daylight savings time.
- The GMT time, if configured.
- ETA indicates the estimated time of arrival at either the last waypoint on the route or , if configured, the currently selected ETA waypoint.
- The Used /Received satellites display can give you an early warning that you will soon have less than 5 satellites, should you notice the Used value decreasing. The system cannot guarantee accuracy with less than 5 usable satellites. This is why it is important to place the antenna where it has an unobstructed view of the sky. Note: the system may be receiving satellites which are not usable. For example, if the satellite is too low on the horizon, it is not usable.
- BCN, SS, SNR, AGE indicate beacon frequency, beacon signal strength, beacon signal to noise ratio, and age of beacon data. The beacon receiver provides differential corrections to the satellite data received by the GPs receiver. Additional beacon reference station data, such as the reference station ID, is available on the Operational Status Screen (F3).
- If configured and selected, the Vector indicates the number of minutes from the current vessel position to reach the tip of the vector arrow at the current speed. This value is extrapolated from the current speed and COG, and is exact only if the current speed and COG are constant for the amount of time projected.

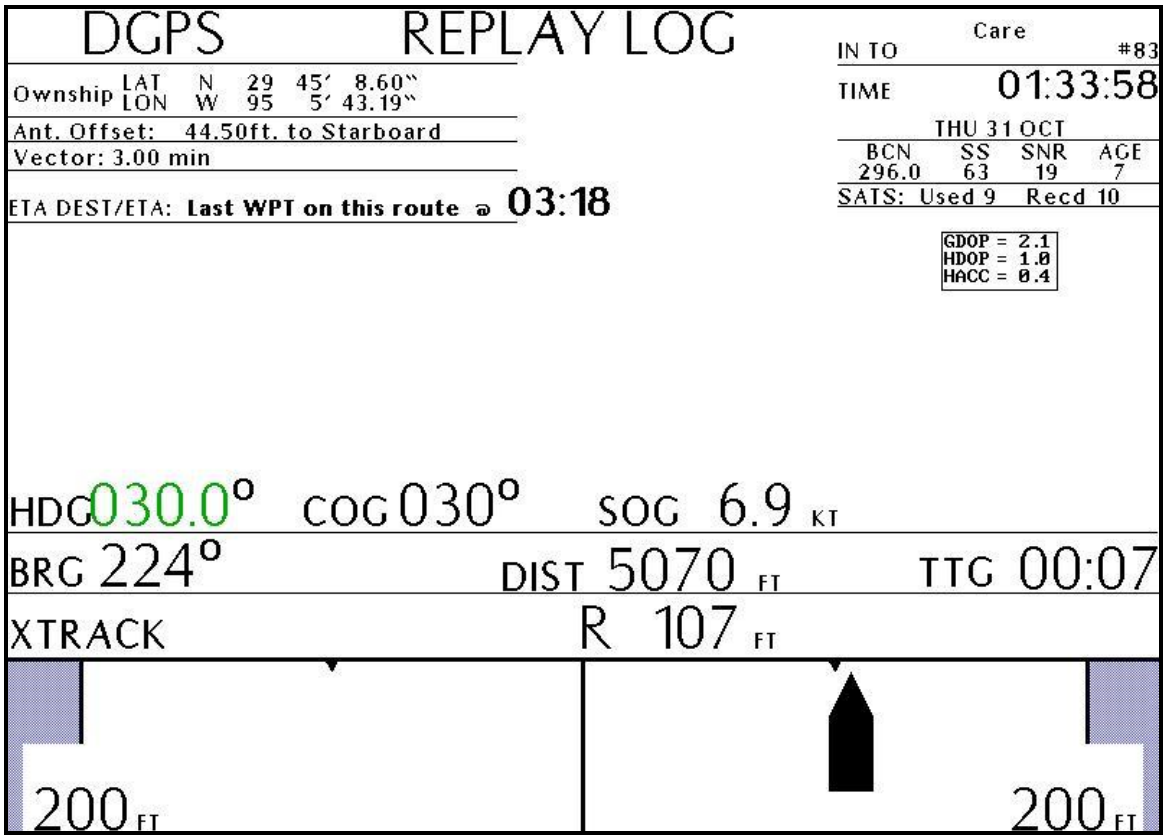
- 'Ant. Off.' , if configured, indicates the offset of the antenna from the centerline of the vessel. This value is important because the system displays the vessel relative to the location of the antenna. The offset value is preceeded by 'P' for Port or 'S' for Starboard.
- The TTG display indicates the 'Time To Go' in minutes to the next selected waypoint. If you manually move the waypoint selection circle (N = Next, P = Previous), the TTG value will change.
- BRG indicates the bearing in degrees to the selected waypoint.
- COG indicates the 'Course Over Ground' of the vessel.
- DIST indicates the distance to the selected waypoint.
- SOG indicates 'Speed Over Ground' of the vessel.
- X indicates the cross-track error, or the distance the vessel is from the center of the channel, and whether it is to the left (L) or right (R) of the center of the channel.

Cross-Track Error Indicator

The Cross-Track Error Indicator at the bottom of the Chart Screen displays the width of the channel , and graphically indicates where the ship is relative to the center and edges of the channel.

IMPORTANT: If the waypoint selection circle is red, the cross-track indicator will not be correct.

Cross-track Screen (F2)



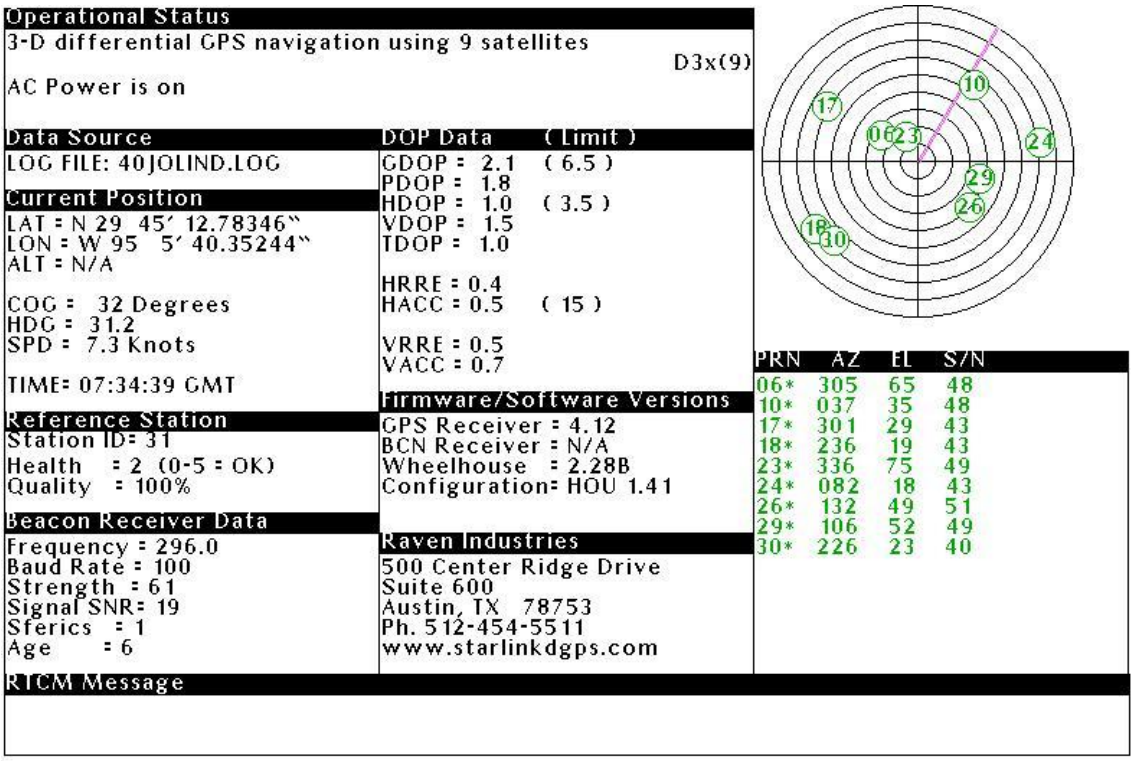
This screen is designed to allow the pilot to view easily from a distance the vessel's position relative to the center and edges of the channel . At the bottom of the Cross-Track Screen is a large graphical indication of where the ship is relative to the center and edges of the channel. The large numbers to the far left and far right of the cross track display indicate the distance from the channel center to the channel edge. Depending on configuration, either 'ticks' or dashed lines divide the cross-track display into quarters.

Other information of this screen:

- The operational status is displayed in the upper left of the screen. This value means the same as when displayed on the Chart Screen. Refer to the Chart Screen description.
- If you are replaying a log file, then 'REPLAY LOG' will appear in the top center of the screen. If you are recording a trip for later replay, then 'LOGGING' will appear in the top center of the screen.
- The currently selected waypoint name and range name. If the range is not the range the vessel is on, the range name is displayed in inverse video.
- The local time and date. Local time is synchronized to GMT time, and is automatically adjusted for your time zone and daylight savings time.
- The GMT time, if configured.

- ETA indicates the estimated time of arrival at either the last waypoint on the route or , if configured, the currently selected ETA waypoint.
- BCN, SS, SNR, AGE indicate beacon frequency, beacon signal strength, beacon signal to noise ratio, and age of beacon data. The beacon receiver provides differential corrections to the satellite data received by the GPS receiver. Additional beacon reference station data, such as the reference station ID, is available on the Operational Status Screen (F3).
- GPS dilution of precision values, GDOP, HDOP, VDOP, and TDOP are displayed. If one of these values exceeds its configured tolerance, it will be displayed in red.
- The latitude and longitude of the ship is indicated. If configured, and you press M, the latitude and longitude of the vessel at that time will be displayed in addition to the current position of the ship. This is useful in the event of 'man overboard'. You can press Alt-M to remove the marked position from the screen.
- If configured and selected, the time to reach the tip of the vector at the current speed is displayed. The vector is displayed on the Chart Screen as an arrow extended from the front of the vessel.
- 'Antenna Offset', if configured, indicates the offset of the antenna from the centerline of the vessel. This value is important because the system displays the vessel relative to the location of the antenna.
- BRG indicates the bearing in degrees to the selected waypoint.
- COG indicates the 'Course Over Ground' of the vessel.
- DIST indicates the distance to the selected waypoint.
- The TTG display indicates the 'Time To Go' in minutes to the next selected waypoint.
- SOG indicates 'Speed Over Ground' of the vessel.
- X indicates the cross-track error, or the distance the vessel is from the center of the channel, and whether it is to the left (L) or right (R) of the center of the channel.

Operational Status Screen (F3)



The following items are displayed on the Operational Status Screen:

- The **Operational Status** window contains an English description of the condition causing the visual alarm. A visual alarm exists when the Operational Status on the Chart and Cross-Track screens reads anything other than 'DGPS'. If the message appears in red, some condition other than 'DGPS' is occurring, and the system accuracy cannot be guaranteed.

  Also appearing in the operational status window is a shorthand description of the GPS mode and satellites being used. For example, 'D(3)x8' means Differential, 3 dimensions, 8 used satellites.

- The **Data Source** window indicates the source of the data. As of this writing, the source should say Invicta 210.

- The **Current Position** window contains the latitude and longitude of the vessel's current position, as well as altitude(ignore altitude as it is geoidal and not processed for MSL reference), Course Over Ground, Speed, and GMT time.

- The **Reference Station** window displays the reference station ID, Health, and Quality.
  - If configured, the system will display the station ID in red if it is not in the approved list of reference station Ids for your area. Some systems that operate in many areas allow any value here.

- If the station health exceeds 5, it will be displayed in red.
  1-5 = OK, 6 = unmonitored, 7 = unhealthy
- The station quality is displayed as a percentage of a given volume of successfully decoded messages.

- The **Beacon Receiver Data** window contains the reference station frequency, baud rate, signal strength, signal to noise ratio, sferics, and age of data.

  The signal strength should be 20 or more. If the SNR is 10 or more, you should have good reception unless the sferics is high.

  The sferics is a measure of 'impulse' electrical activity interfering with reference station reception. The 'pops' and 'clicks' caused by lightning when listening to an AM radio station are examples of this type of interference. The spark plugs from a running gasoline engine can also radiate impulse noise. Normal is less than 500, high is 501-30,000. Usually, this type of interference does not cause data errors, but you should try to reduce this type of noise by moving the antenna, if possible.

  Care is required in evaluating the effect of sferics. For example, sferics can be high while SNR is also high, indicating sferics is not affecting reception. However, if SNR is low and sferics is high, it is likely that sferics is affecting reception.

  The age of data value should not be higher than 10 (seconds).
- The **RTCM Message** window contains the last RTCM message received from the reference station until the new message replaces it or the program is terminated.
- The **DOP Data** window contains DOP data, range residual error, horizontal and vertical accuracy data. Items with pre-configured limits turn red when their limit is exceeded.

  These items are defined as follows:
  - GDOP – Geometric Dilution of Precision, computed from HDOP, TDOP, and VDOP.
  - PDOP – Position Dilution of Precision, computed from HDOP and VDOP.
  - HDOP – Horizontal Dilution of Precision
  - VDOP – Vertical Dilution of Precision
  - TDOP – Time Dilution of Precision
  - HRRE – Horizontal Range Residual Error - This error is computed only when there are at least 5 satellites used in the position computation. HRRE is a measure of how well the actual satellite measurements match the derived solution in the horizontal direction. It is a relative indicator of position uncertainty in the horizontal direction similar to, but not the same as, HDOP.
  - HACC – Horizontal Accuracy, computed from HDOP and HRRE, used to detect multi-path and RFI (Radio Frequency Interference) events. HACC is a unitless value that is designed to detect errors NOT caused by satellite geometry (DOP error), primarily multi-path and RFI. Wheelhouse combines HDOP with HRRE for all used satellites to compute a value that is then compared to a pre-programmed alarm threshhold value, usually set at 20. The Wheelhouse formula for the HACC displayed on the F3 Screen is:

HACC = HRRE*SQRT(n/(n-4)), where SQRTsquare root and n=number of sats

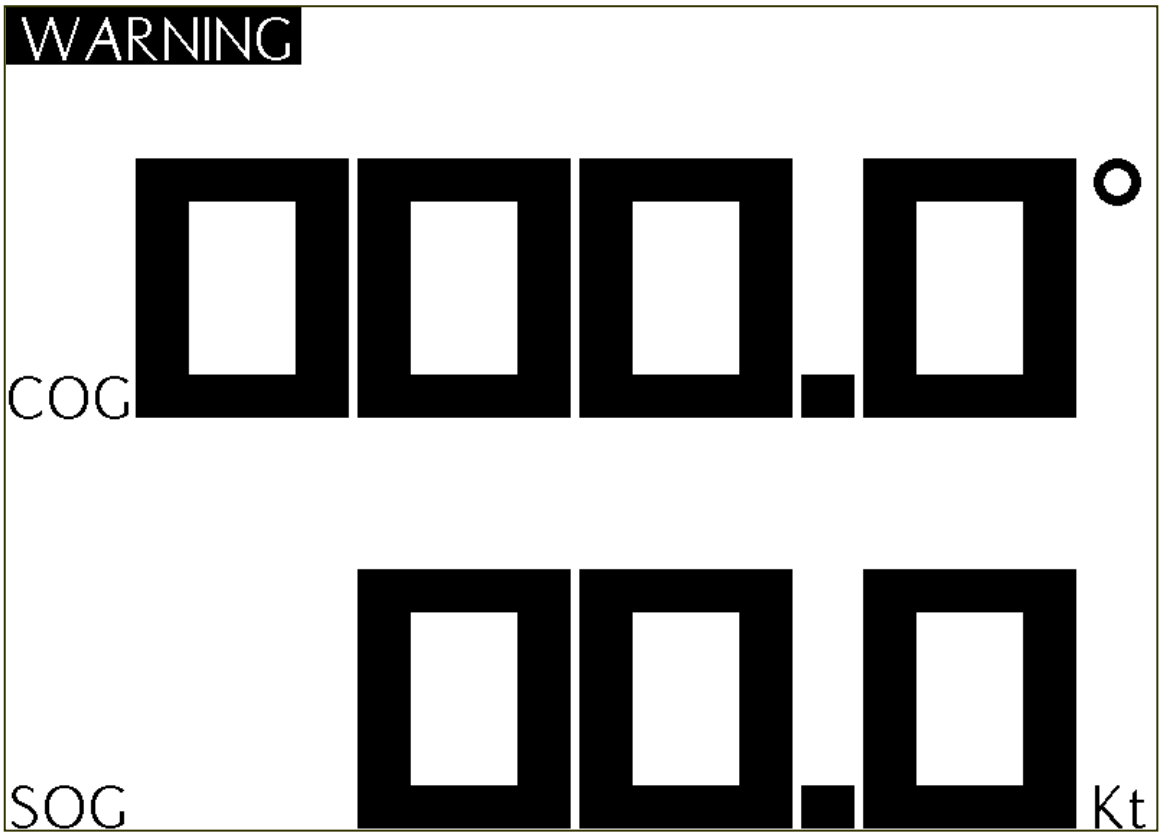
If the HACC value exceeds the threshold, an alarm occurs. The user should consider position information unreliable during the alarm.

- VRRE – Vertical Range Residual Error – This error is computed only when there are at least 5 satellites used in the position solution. VRRE is a measure of how well the actual satellite measurements match the derived solution in the vertical direction. Wheelhouse only displays this value, but does not otherwise use it.
- VACC – Vertical Accuracy, computed from VDOP and VRRE. Wheelhouse only displays this value, but does not otherwise use it.

- The **Firmware/Software Version** window displays:
  - the firmware version for the GPS receiver
  - the firmware version form the beacon receiver, if applicable
  - the software version for the Wheelhouse program
  - the data set configuration version being used by the system (surveyed route data)
- **Satellite Map** - Satellites and their identification numbers are displayed on a grid of concentric circles. The circles advance from 0 to 90 degrees in 10-degree increments from the outside to the center. The center of the circles represents directly overhead or 90 degrees, and the outer-most circle represents 0 degrees, or the horizon. Satellites which are being used in the position solution are green. Those not being used are red. The satellite map can be useful in determining that the antenna cannot 'see' part of the sky.

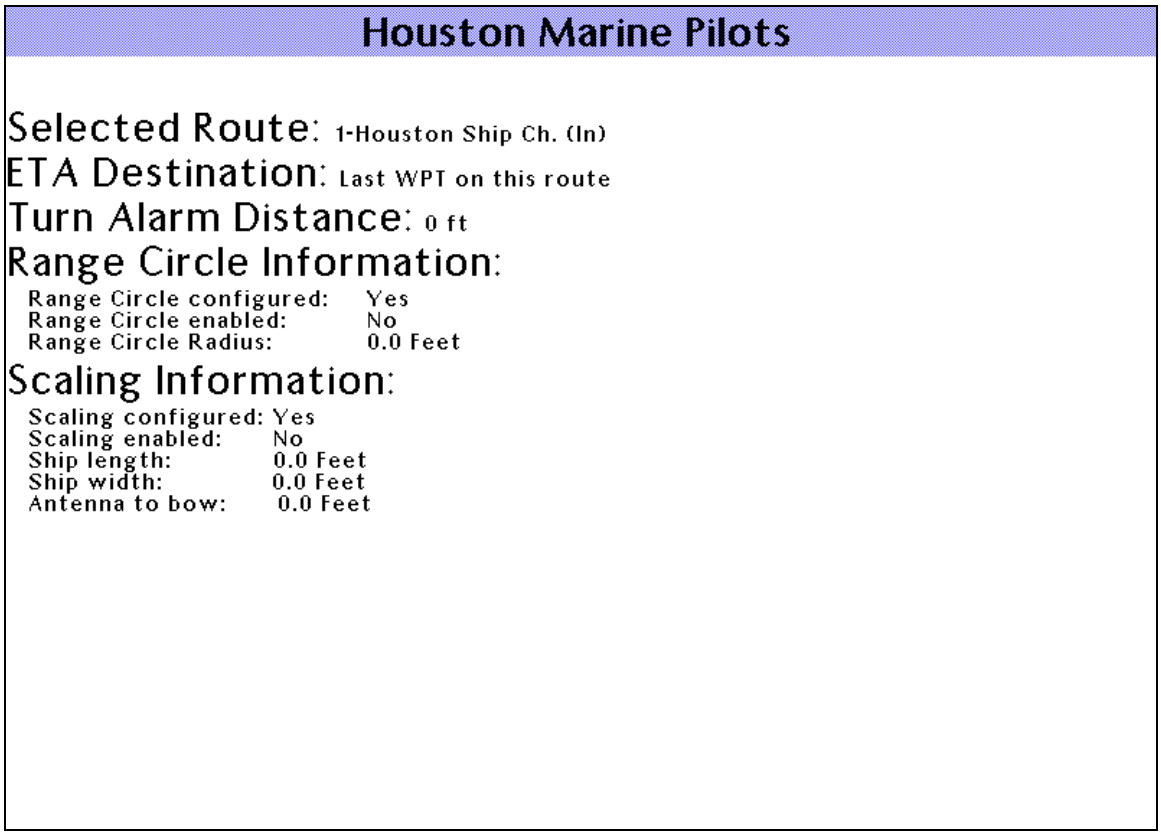
  The purple line extending from the center of the Satellite Map represents the Course Over Ground.
- **Satellite Data** – The satellite data appears beneath the satellite map, and includes the satellite identification number (PRN), azimuth (AZ), elevation (EL), and signal-to-noise ratio (S/N). If an asterisk appears by the PRN, the satellite is being used in the solution, and the satellite is green. If no asterisk appears by the PRN, the satellite is not being used, and the satellite is red.

COG/SOG Screen (F4)



This screen allows the pilot to view the COG (Course Over Ground) and the SOG (Speed Over Ground) easily from a distance. This screen might be used during docking or tight maneuvering. Keep in mind that the COG is not accurate at speeds less than 0.5 knots . IMPORTANT: At speeds of 0.5 knots or less, Wheelhouse will freeze the COG value on the screen because any changes are considered unreliable at such a low speed.

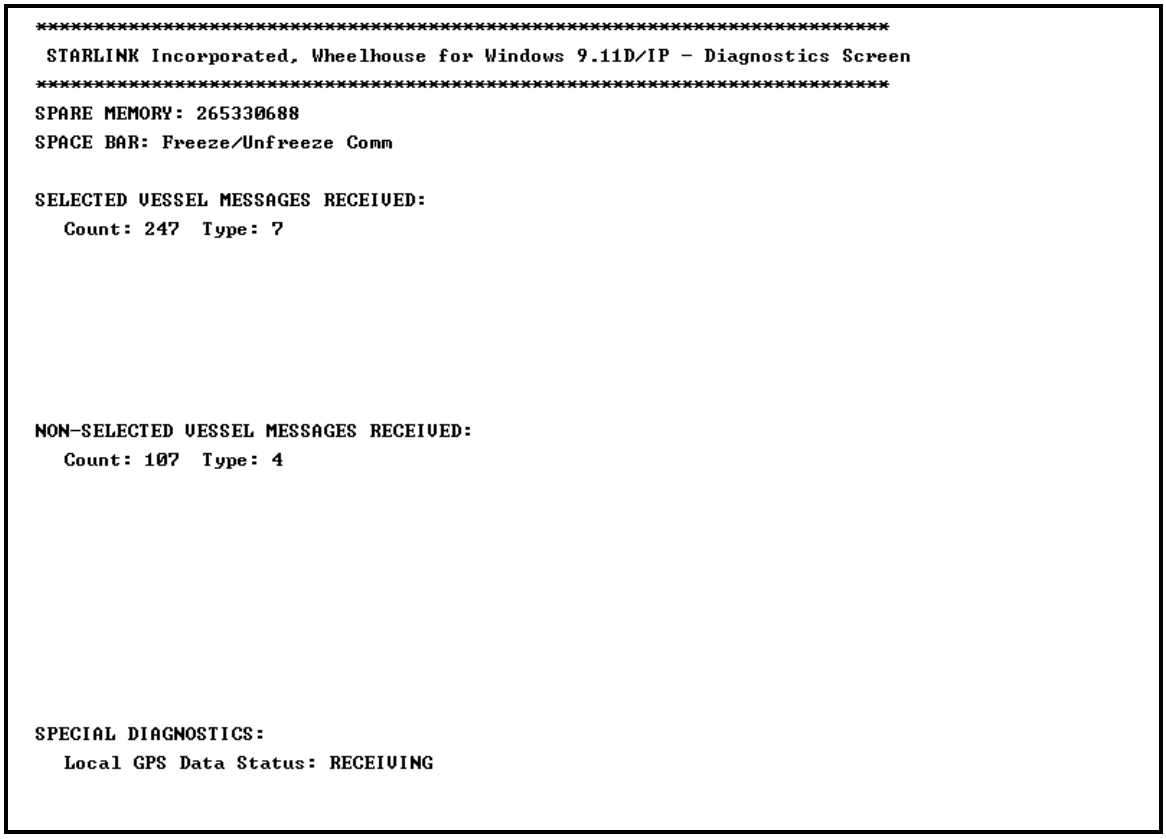
Settings Screen (F5)



The following items are displayed on the Settings Screen:

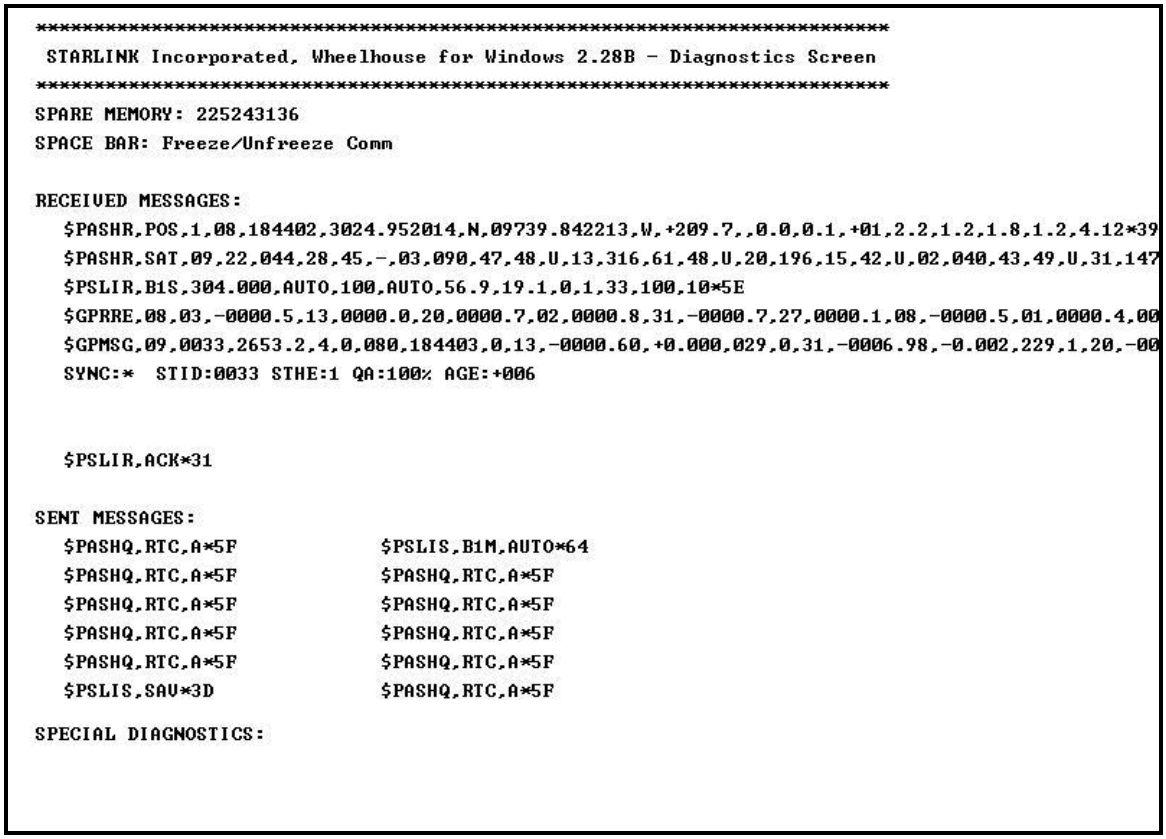
- Selected Route – the route you selected from the Route Menu (press ESC to display the Route Menu)
- ETA Destination – The destination for which the Estimated Time of Arrival will be computed. If your system is configured to have an ETA Waypoint menu, you selected this destination from the ETA Waypoint menu that appears after the route menu.
- Turn Alarm Distance – This is the distance from the waypoint at which the turn alarm will sound. If this value is 0, then no turn alarm will sound.
- Range Circle Information – A future change to the program will replace turning circles with a range circle. The user will specify the radius of the radius of the circle from the center of the vessel.
- Scaling Information – If you enter the ship's dimensions, a scaled icon of the ship will be displayed on the F1 chart screen. IMPORTANT: Unless you have heading installed on your system, you should not consider that the ship icon's heading on the screen accurately represents the heading of the ship. Without specific input from a heading device, the ship icon is pointed in the direction of the COG, which will frequently be the ship's heading, but not always.

Diagnostics Screen (F9), Wheelhouse/IP



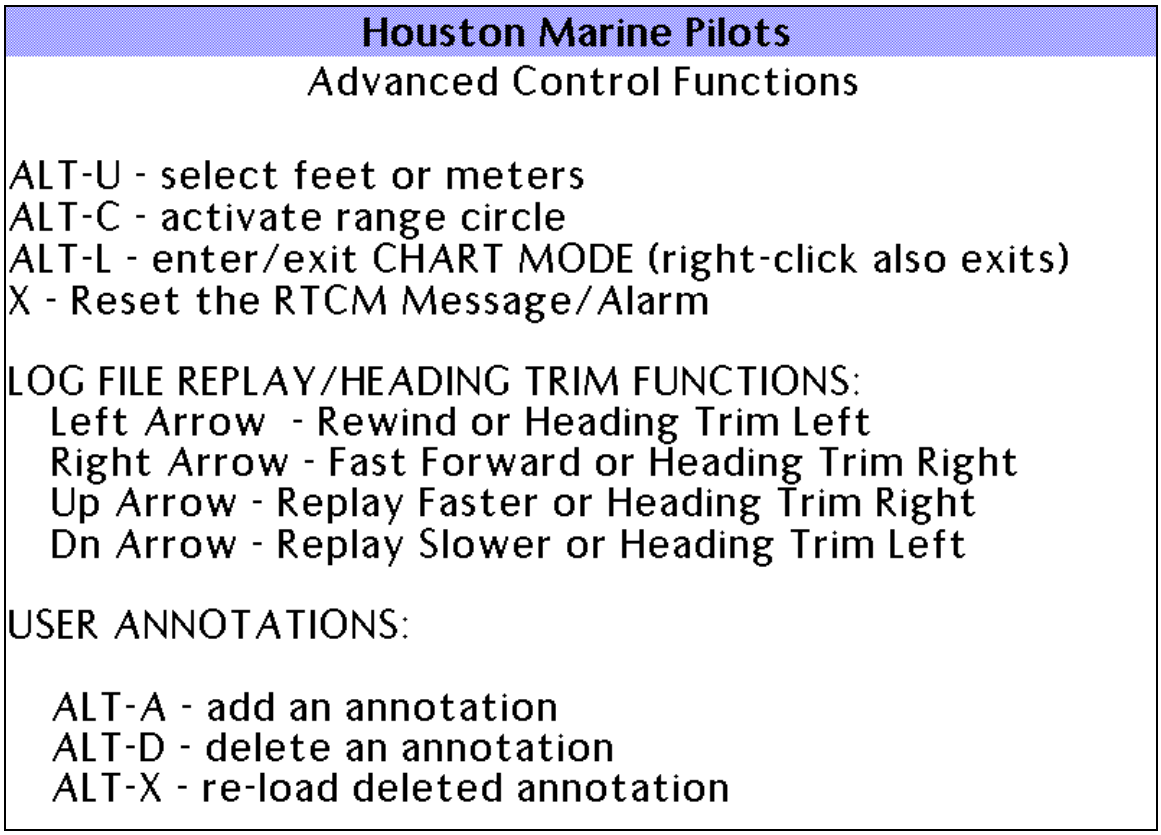
This screen allows the pilot to view the status of the communication channel to the GPS receiver. This screen is displayed by Wheelhouse/IP. The actual raw messages to and from the GPS receiver are viewble from 'SendClient | View | Own Vessel GPS Data'.

Diagnostics Secreen (F9), Wheelhouse



This screen allows the pilot to view the raw messages to and from the GPS receiver. This screen is displayed by Wheelhouse, while a different screen is diplayed by Wheelhouse/IP.

Advanced Control Functions Screen (F11)

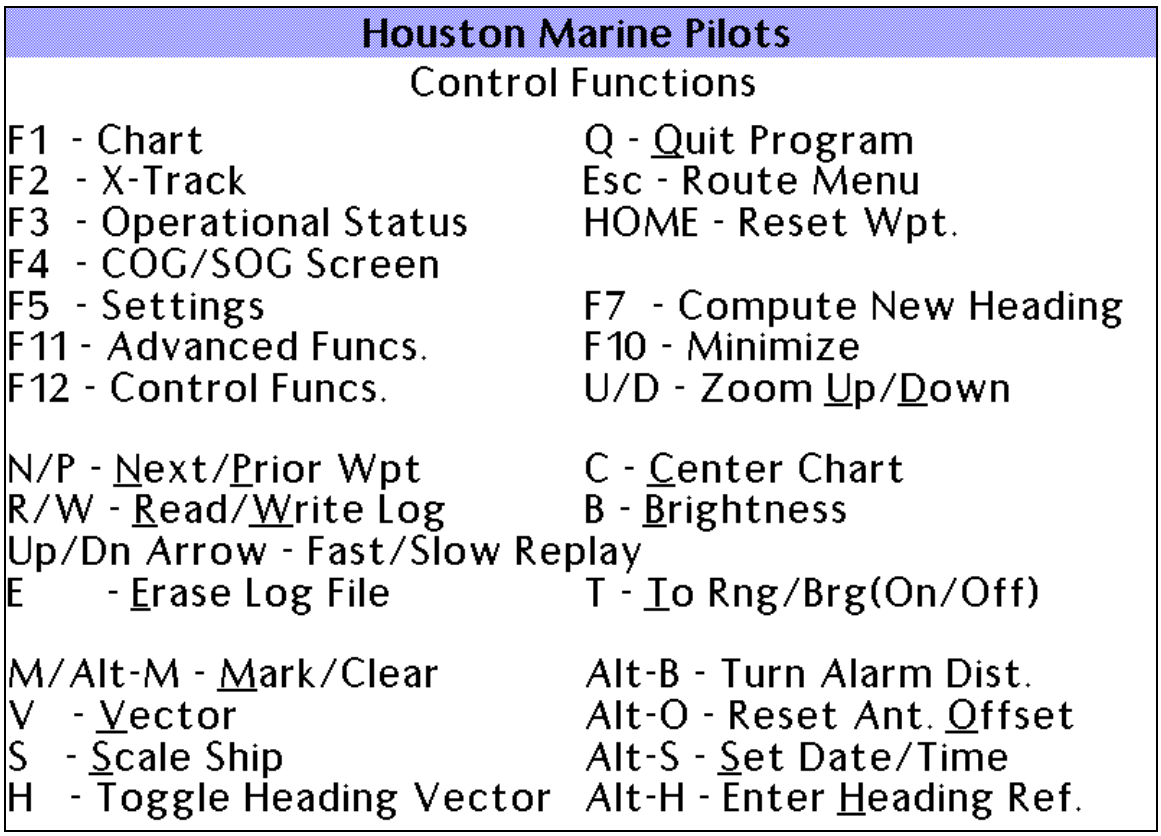


The following list includes all of the possible selections on the Advanced Control Functions Menu. Your computer may not be configured for all of these options. Furthermore, your system may be configured such that some of these functions appear on your Control Functions Screen (F12) instead of this screen.

- Alt-U – select feet or meters. Use this function to change the default entry units for the Antenna Offset and Ship Scale data-entry screens.
- Alt-S – set data and hour. Note that the local PC minutes and seconds are always synchronized to the satellite time. Some systems may not be configured to synchronize the hour. Those systems that do synchronize the hour also display GMT and have been pre-configured to include time zone information for automatically adjusting for DST (Daylight Savings Time).
- V – Add time-projection Vector to the chart – When selected you are prompted to enter a time value in minutes. The Chart Screen will then draw an arrow that extends that amount of time out ahead of the ship. Use this feature to estimate where you will be in a certain amount of time at a give speed.
- T – To Range and Bearing Icon – When on the Chart Screen select this function and position the mouse to get a read out the range and bearing to a selected position from the vessel's current position. Press T again to turn off this function.

- X – Reset the RTCM Message/Alarm – Use this key to turn off the RTCM visual and audible alarms.
- Alt-A - Add a user-defined annotation. Note: The annotation doesn't get written to file until you change routes or exit Wheelhouse.
- Alt-D – Delete a user-defined annotation.
- Alt-X – Reload a user-defined annotation from file.
- Alt-C – Activate variable range circle. The range circle can only be activated when ship scaling is on. (The F11 Screen may show 'Turning Circles', but a future version of Wheelhouse will replace turning circles with a variable range circle.)
- Alt-L – Enter Chart Mode. In Chart Mode you can move the cross-hair mouse cursor and then left click to select a portion of the chart to view. If you press Alt-A, you can enter an annotation at the location of the cross-hair cursor. To exit Chart Mode, right-click or press Alt-L again.

Control Functions Screen (F12)



The following list includes all of the possible selections on the Control Functions Menu. Your computer may not be configured for all of these options. Furthermore, your system may be configured such that some of these functions appear on the Advanced Control Functions Screen (F11) instead of this screen.

- F1 – Chart – select this screen to view the vessel's position on the chart.
- F2 – X-Track – select this screen for a large view the vessel's position within the channel relative to the channel center line and edges.
- F3 – Operational Status – select this screen to see DGPS unit information, the operational status message, the RTCM message, and other info.
- F4 – COG/SOG – select this screen to get a large view of the COG (Course Over Ground) and SOG (Speed Over Ground).
- F5 – Settings Screen – displays such values as vessel dimensions
- F7 – Compute New Heading – for dual antenna heading systems only

- F10 - Wheelhouse will make itself the foreground window automatically if you switch to another Windows program without first pressing F10. Wheelhouse behaves this way to prevent other programs from seizing the foreground from Wheelhouse. IMPORTANT: Always minimize Wheelhouse using F10 prior to switching to another program.
- F11 – Advanced Functions – Select this screen to get a menu of advanced control functions.
- F12 – Control Functions – Select this screen to get a list of control functions. If you hit an undefined key, this screen will also appear.
- U/D – Zoom Up/Down – If on the Chart Screen, changes the view magnification level. If you want greater detail, zoom down. If you want to see a larger area, zoom up.
- N/P – Next/Prior Waypoint – If on the Chart Screen, you can use N to manually select the next waypoint or P to manually select the previous waypoint. This can be useful in determining the TTG (Time To Go) to a waypoint that is not the next waypoint. When the selected waypoint is not the next waypoint, it is red, otherwise, it is green. Note: when the selected waypoint is not the next waypoint, the cross-track error indicator is not correct.
- HOME – Reset Waypoint - Use the Home key to automatically select the next waypoint relative to the current vessel position.
- C – Center Chart – Use this key to redraw the chart so that the greatest amount of the route ahead is visible. Pressing the SPACE bar will also center the chart.
- B – Brightness – Use this key to toggle between night colors and day colors.
- Q – Quit – Use this key to exit the Wheelhouse program.
- ESC – Route Menu – Displays the route menu for selection of a different route. You can hit enter or ESC again if you decide not to change the current route.
- R/W – Read/Write Log – Use R to read or playback an existing log file. Press R again to stop playing back. Use W to write (record or log) the current trip. Press W again to stop recording (logging)the trip. Note: Logging uses about 600,000 characters of disk space per hour. Make sure you have enough disk space to log your trip. You might want to erase log files you no longer need. See the E function, below.

  If you are running WhIP and SendClient, you can start a log file two ways: either by pressing W from WhIP or by pressing the Start Local Logging button on the SendClient screen. You can stop the log file by pressing W again, or the SendClient Stop Local Logging button. Unlike Whwin, WhIP automatically names the log files according to the format DDMMYY_HHMMSS.LOG, where DD=day, MM=month, YY=year, HH=hour, MM=minute, SS=second of start of log file. With WhIP, you should replay a log file by selecting SendClient | File | Replay Log file. WhIP and SendClient do not place the artificial limit of 16 log files that Whwin does.

  Some systems are configured for Continuous Logging, where you cannot prevent the system from logging. These systems prompt the user for a voyage number at start up. The log file name is automatically chosen according to the format: `NNN_DDMMYY_HHMMSS.log where NNN=voyage number, DDMMYY=day,month,year, and HHMMSS=hours, minutes, seconds.`

- E – Erase Log File – Use E to erase a log file. When you select this function, a list of existing log files will be displayed.

- Alt-O – Antenna Offset – Select this function to change the antenna offset relative to the centerline of the vessel.
- M – Mark Position –Pressing M will cause the marked latitude and longitude to be displayed on the Cross Track Screen (F2). This is useful in marking a position for some reason, such as 'man overboard'. Each time you press M the marked position is displayed on the screen and written to the text file 'mark.dat' . The time and date of each marked point is also written to mark.dat. You can mark multiple locations and they will all be saved in mark.dat. You can later review these locations by reading 'mark.dat' with a text editor such as Microsoft notepad.
- Alt-M – Clear Marked Postion – Remove the latitude and longitude from the Cross Track Screen (F2) that was placed there by pressing M.

Visual Alarms

The operational status on the Chart Screen and the Cross-Track Screen always displays one of the following visual alarms: DGPS, WARNING, RTCM, or WAIT. You can select the Operational Status Screen (F3) to get an English description of the operational status. The possible descriptions are:

DGPS
"3-D differential GPS navigation using x satellites"

NOCOM
"No response from DGPS unit"

NOPOS or NOFIX
"Position data not available"

WARNING
"COM1 not initialized"
"Beacon ID being received is not in approved list"
"The GPS engine is not in differential mode"
"High HACC and DOP"
"High HDOP and GDOP"
"High HDOP"
"High GDOP"
"High horizontal accuracy error"
"Too few satellites to determine accuracy"
"Beacon health exceeds 5: unmonitored or unhealthy"
"AC Power is off"

RTCM
"RTCM message received - press 'X' to clear alarm"

CHART MODE
"Move cross-hair cursor to location on chart to view chart or enter annotation"

NOTE: Some systems may be configured for a full screen alarm. For these systems, when an alarm condition occurs, the entire screen will display a pre-configured alarm word, such as 'ATTENTION!!'.

Audible Alarm

If your system is configured for it, the audible alarm will accompany visual alarms.

When a visual alarm first occurs, the system waits for a pre-programmed number of seconds before turning on the audio alarm. A typical pre-programmed delay value is 10 seconds.

If the visual alarm goes away before the delay is elapsed, the audible alarm will not occur.

If the visual alarm exists after the delay has elapsed, audio will be produced for a pre-programming duration. A typical pre-programmed duration is 20 seconds.

If the audio expires or is cancelled, it will not be activated again until the visual alarm condition terminates and then another instance of a visual alarm occurs.

If an existing visual alarm changes type, it does not cause a new audio alarm. For example, if the alarm changes from "Position data not available" to "High GDOP", this will not generate a new audible alarm. To get a new audible alarm the system has to go to a 'no alarm' condition first.

The RTCM audible alarm has no delay value and its own duration value. It occurs when an RTCM message is first received, and is cancelled when the user presses 'x'.

What to Do When Visual Alarms Occur

COM1 not initialized

The COM1 hardware has probably failed. Return the laptop PC for service.

Beacon ID being received is not in approved list

A geographically remote beacon with a frequency in the beacon receiver's scan list is stronger than any local beacon. The remote beacon is identified by the fact that its ID is not in the approved list pre-configured into the Wheelhouse data set for your operating area. (Some systems may be configured without an approved list.) Position accuracy cannot be guaranteed, but may still be useful. The condition will clear when you start receiving from a beacon in your area.

Position data not available

The DGPS unit cannot compute a position. The system may be in the process of acquiring satellites or the system may be experiencing RFI if it has 5 or more satellites. (See satellite map on F3 screen.) If the condition persists, check antenna connections at the antenna and at the GPS receiver. Make sure the antenna has a good view of the sky. If none of these steps resolves the problem, call Raven Tech Support.

No response from DGPS unit

The laptop PC is not getting a response from the DGPS unit. Check to see that the power light on the DGPS unit is on and that the data cable from the DGPS unit to the computer is connected.

The GPS engine is not in differential mode

The system is not receiving beacon corrections. Refer to the beacon data window on the F3 screen for information regarding the beacon receiver. If the problem persists, try running the beacon configuration program (mrbcfg). If the problem still persists, return the system for service.

High HACC and DOP

Position accuracy is not reliable. The system is likely experiencing multi-path or RFI. This condition should almost never occur . If the antenna is in an optimal location, wait for the condition to clear. Otherwise, move the antenna to an optimal location.

High HDOP and GDOP

Position accuracy is not reliable due to poor satellite geometry. If the antenna is in an optimal location, wait for the condition to clear. If the antenna is not in an optimal location, moving it might allow acquisition of more satellites, removing the DOP problem.

High HDOP

Position accuracy is not reliable due to poor satellite geometry. . If the antenna is in an optimal location, wait for the condition to clear. If the antenna is not in an optimal location, moving it might allow acquisition of more satellites, removing the DOP problem.

AC Power is off

Check AC Power outlet, power cords, and data cables. The reason for checking the data cables is that power and data are both in the same cable for many systems.

Disclaimers

WHEELHOUSE WARNINGS
The system displays a warning when measured parameters exceed pre-determined thresholds. If Wheelhouse is not displaying a warning, it does not guarantee that the displayed position is accurate. Conversely, a warning does not guarantee that the position is inaccurate.

DATA SET USAGE
Raven produces the Raven/Starlink Marine Navigation System, which uses differential GPS (DGPS) and highly accurate map data. These systems show the waterway channel centerline and channel edges along with various navigation aids. Raven normally receives this data from the user, such as a ship pilot organization, which in turn receives it from the controlling organizations such as the US Army Corps of Engineers and the US Coast Guard. Reception of the data through the user is an important part of the Raven system as it insures that the users have control over what is displayed by Raven software. It also places the responsibility for the data with the user, the only entity qualified to manage it.

Raven is not liable for the accuracy or usability of the data displayed in the navigation system, since that data is provided and controlled by the user. Raven's function with respect to the data is limited to editing it under direction. This effort is similar to a secretary writing a letter for their supervisor.

For evaluation purposes, Raven may sometimes collect data using raster charts, which may not have come directly from the user, and/or is not surveyed data. Users accept full responsibility for this type of data.

Users of the Raven Marine Navigation system understand that the data is not provided with any guarantee of accuracy or warranty of usability. Raven provides the data at the request of the user and cannot be held liable for the damages that might result.

Update History

Rev G, 11/23/2010, Bonnie Winston
Updated to Raven Aerostar logo.

Rev D, 03/23/2009, Dale Gambill
Updated logo. Replaced contact info with reference to contact info. Updated logo on title page.