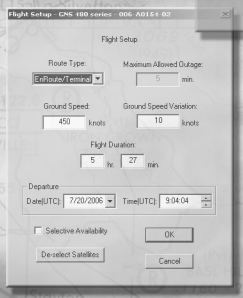
Garmin Route Planning

User's Guide



GARMIN™

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History of Revisions

October 2003 Original Release
November 2006 560-0180-01 Rev A

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Introduction

The Garmin Route Planning software is a PC-based tool that will assist you in flight planning including Oceanic/Remote airspaces. It will generate a route file or files and allow you to predict if the flight can be made. In order for a flight to be made, the ability to detect and exclude a faulty satellite must be available. It is permitted for a satellite to be unavailable, but for no more than a period of time specified by the route spacing.

System Requirements

This manual assumes that you have a basic understanding of Windows and can comfortably navigate in the Windows environment. If you need further help in understanding the basics of Windows, please refer to your Windows user's guide.

Minimum

Computer	486, or more powerful PC with CD drive
Operating System	Windows 2000, or Windows XP
Memory	8 Mb of RAM
Hard Disk	About 4 Mb of free space for programs, report files, and the database

Connection to the internet for file updates is required

Installation

The installation progress will be shown on the screen.

CD-ROM

1. Insert the CD-ROM in appropriate drive on your computer.
2 .The installation program should automatically start. If it does not start automatically, perform the following steps:
3. Click on the "**Garmin Route Planning**" selection.
4. Then select "**Install Route Planning Software**" and follow the directions.
5. Or, you may install the program from the root directory on the CD.
   Click **START**.
   Click **RUN**
   Type "***x:\setup.exe***" where x equals the drive and directory of your product CD.

The installation program will create a directory and necessary subdirectories to put the files for Garmin Route Planning.

Starting Garmin Route Planning

A new Program Group with program icons has been created for the Garmin Route Planning program. Double-click on the Garmin Route Planning icon to start the program.

NOTE: *A Nav database is installed by the install CD. Before this program is run for the first time, it is helpful to obtain and install an updated Nav database via the internet.*

Exiting Garmin Route Planning

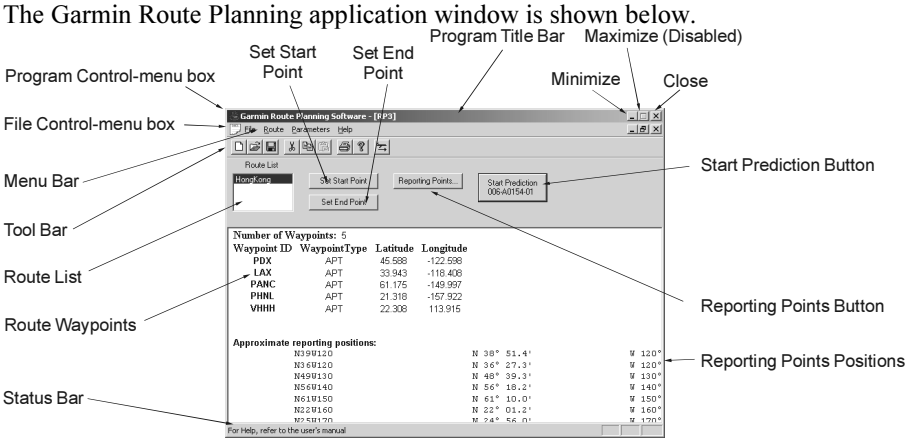
1. From the File menu, choose **Exit**. You may also double-click on the Control-Menu box to exit, or click on the "x" in the upper right corner. .
2. If you haven't saved the file that you are working on, you will be prompted to save it.

Uninstalling Garmin Route Planning

1. In the Garmin Route Planning Program Group, double-click on the Uninstall icon.
2. Choose **Yes** to uninstall all of the Garmin Route Planning components. Choose **No** to retain the program.

Application Window

The Garmin Route Planning application window is shown below.



Program Title Bar

The Program Title Bar shows the title of the program and the name of the currently open route file.

Program Control-Menu Box

Click on the Program Control-Menu box  to display a menu of commands you can use to manipulate the Garmin Route Planning program window. To open the Control menu, click on the Logo to the left side of the Program Title bar.

File Control-Menu Box

Click on the File Control-Menu box  to display a menu of commands you can use to manipulate a file window. To open the Control menu, click on the page icon on the left side of the Menu bar.

Maximize/Minimize Buttons

The Maximize and Minimize buttons are the two arrow buttons on the top right corner of a window. Click on the **Maximize** button to enlarge a window to its maximum size. Click on the **Minimize** button to reduce a window to an icon.

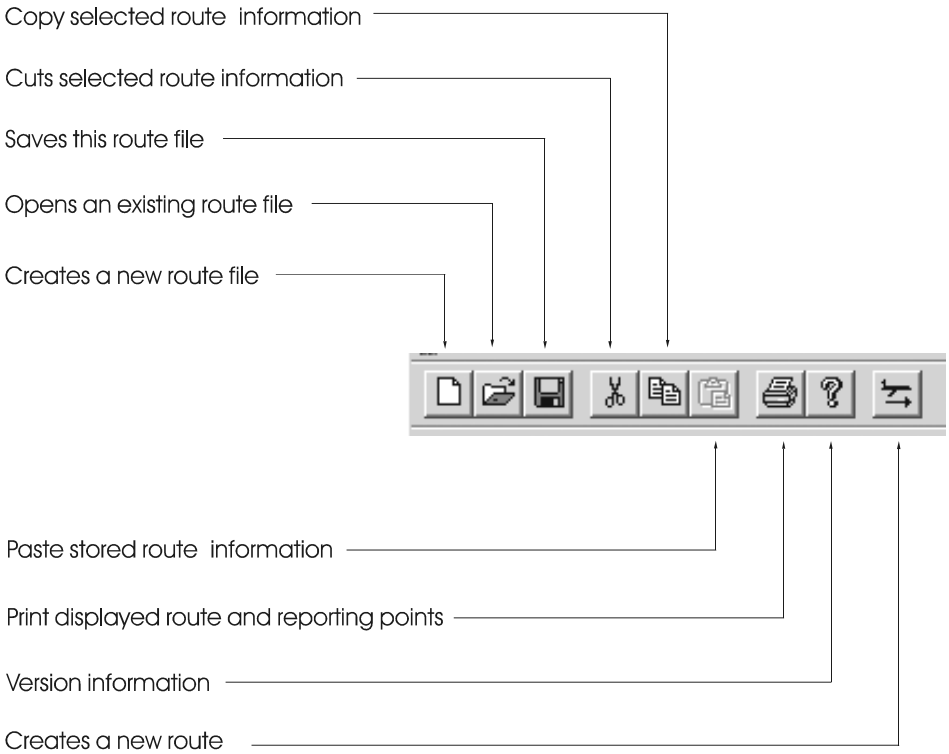
Menu Bar

The menu bar shows the list of functions available in Garmin Route Planning. Click on the menu item with the mouse to view the functions available for each menu item.

The available functions on the Menu Bar are: File, Route, Oceanic, Parameters, and Help. A full description of each function is given in the Reference section of this guide.

Tool Bar

The toolbar provides shortcuts to the most used functions. While all functions are available from the menu bar, the tool bar buttons provide quick access to important functions.



Status Bar

The Status bar is located at the bottom of the Garmin Route Planning window. The Status Bar displays a description of the action the currently highlighted tool bar selection will perform. Click and hold the left mouse button to view the description.

Typical Order of Operations

The following steps are typical when using the Garmin Route Planning program.

- Start program
- Obtain a Navigation Database file (included)
- Select your Navigation Database file (see page 19)
- Define or edit a Route (see page 14)
- Set Start and End Points (see page 17)
- Start Prediction program (see page 19)
- Set Departure Date and Time (see page 27)
- Perform Flight Setup, (see page 28)
- De-select (Exclude) Satellites (see page 29)
- Enter average Ground Speed (see page 28)
- Calculate FDE Prediction (see page 31)
- Review the Prediction Results (see page 32)

Obtaining a Navigation Database

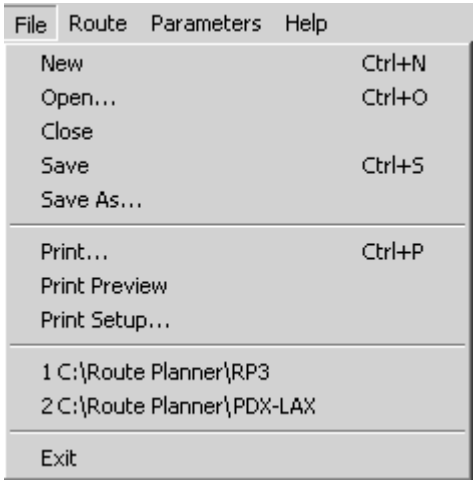
The Navigation database is an aid in creating routes. This database file contains world-wide information on airports (with runways longer than 5,000 feet), VORs, NDBs, and Intersections. The database is included on the disk with the program. A Nav database is not required, but does simplify the creation of routes. If a database is not available or the desired waypoints are not included in the database, waypoints must be the “USER” type. You then must specify the waypoint name, latitude, and longitude.

Garmin Route Planning Menus

This section provides detailed information on the functions available with Garmin Route Planning.

File Menu

The File menu is where you perform the file operations for Garmin Route Planning. You can create a new route, edit an existing route file, add routes to an existing file, open an existing file, save a file, rename a file, print prediction results, preview printed results, setup a printer, select a recently used route, and exit the program.



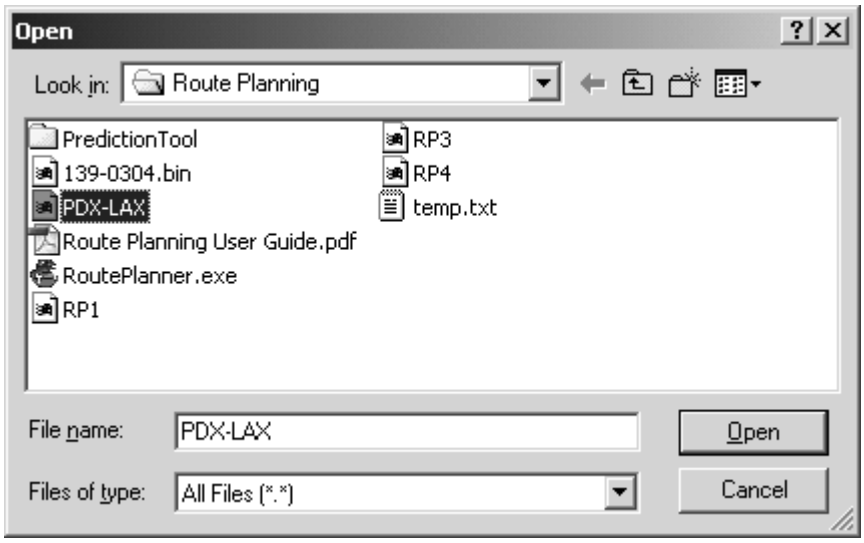
New

The **New** menu item  creates a new file.

1. Click on **File**.
2. Click on **New**.
3. Start adding routes to your new file.

Open

Use the **Open** menu item  to open a file that you have already created. You can also use the Open icon on the toolbar. You may have multiple route files opened at the same time.



1. Click on **File**.
2. Click on **Open**.
3. Click on the "Look In" pull down list to select the drive and directory where you store your projects.
4. Select the project with the mouse.
5. Click on the **OK** button or you can also double-click on a file name to quickly load that file.

Close

Selecting the **Close** menu item will close, or exit, a file that you have opened. If you have made any changes to the file, the program will ask you to save, not save, or cancel the close action you have started and return to the main window.

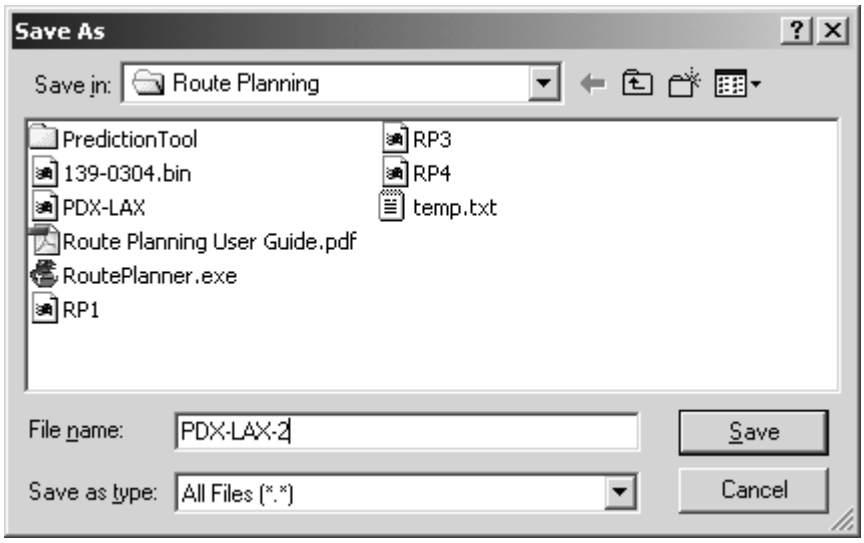
Save

The **Save** selection will save the current file. You can also use the Save icon on the toolbar.

1. Click on the **File** menu item.
2. Click on **Save** to save your displayed file. The same name and file location are maintained.

Save As

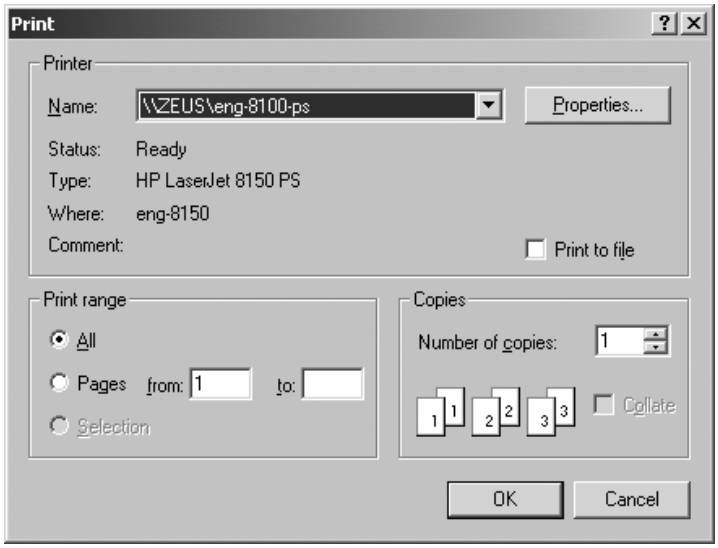
Saves the current file after you choose a new name or directory.



1. Click on the **File** menu item on the Menu bar.
2. Click on **Save As**.
3. Choose a filename. Type a file name of up to eight characters and up to a three letter extension. The default is no extension.
4. Choose the folder or directory where you want to store your file.
5. Click on **OK** when you have finished your choices.

Print

Print the current route and any reporting points. You may also use the Printer icon  .

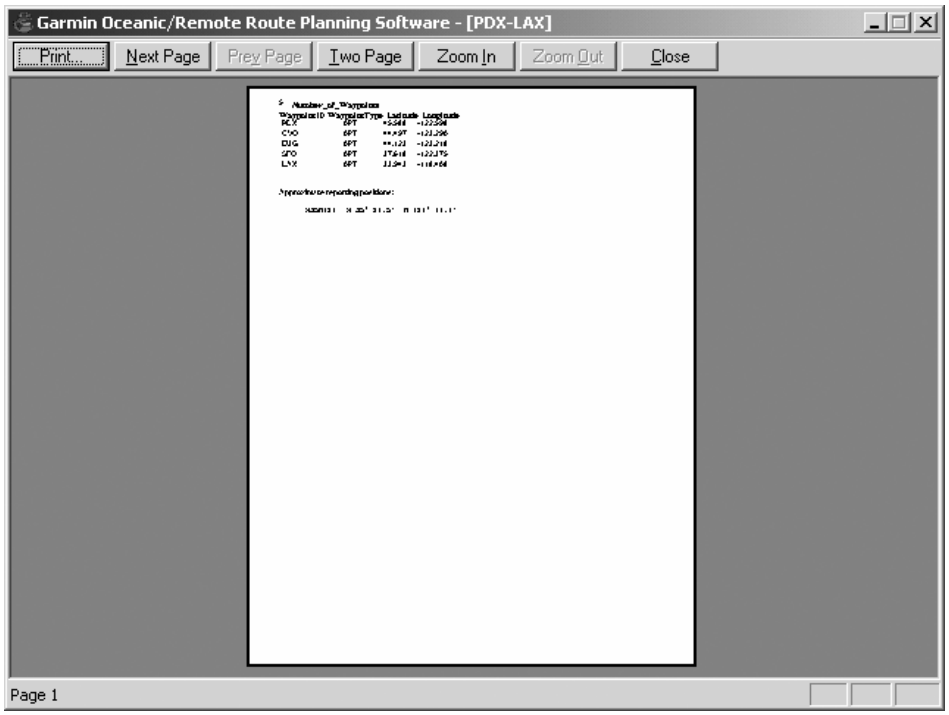


1. Click on the **File** menu item on the Menu bar.
2. Click on Print. Click on **OK** to print your route and any reporting points, or continue with the following steps for more detailed actions.
3. Select one of the **Print range** options: all or selected pages.
4. Select the desired Properties after pressing the **Properties** tab.
5. Select the number of copies to print.
6. Click on the **OK** button to print the file.

Print Preview

Display the current route prediction results as it would look when printed.

1. Click on the **File** menu item on the Menu bar.
2. Click on **Print Preview**. View your document as it will look if printed.
3. The cursor changes to a magnifying glass when it is over the document area. Click once to zoom in and click again to zoom out .
4. Buttons are available at the top of the window. Press **Print** to print the report immediately. Click on **Next** or **Previous Page** to navigate through your report. Click on **Two Page** to display two pages side by side. Click on Zoom In or Out to change magnification. Click on **Close** to return to the main program window.



Print Setup

Setup your printer as you would like your printouts to be formatted.

1. Click on the **File** menu item on the Menu bar.
2. Click on the **Print Properties** selection to access the options available for your printer.

Last Used Routes

The names of the last routes (up to four) that were saved are displayed at the bottom of the File menu. Click on the route name to instantly open it.

Exit

This selection exits the program. You will be asked to save your route files, if you have not already done so. You may also double-click on the Control-menu box to close the program. Click on the X at the top right of the screen to exit the program.

Route Menu

The Route function allows you to manage the routes that are contained within a route file. Each route is named and contains a series of waypoints. The waypoints in the route are defined by a type, ID, and Lat/Lon. After creating a route, you can add, insert, change, or delete the waypoints in the route.

Undo

This selection undoes the last action.

1. Click on the **Route** menu item on the Menu bar.
2. Click on the **Undo** selection to undo the last action. If **Undo** is grayed, there is no action to Undo.

Redo

This selection repeats the last action that was “undone.”

1. Click on the **Route** menu item on the Menu bar.
2. Click on the **Redo** selection to Redo the selection. If **Redo** is grayed, there is no action to Redo.

New

The **New** selection creates a new route in the current route file. You may also click on the New Route icon on the Toolbar.

1. Click on the **Route** menu item on the Menu bar.
2. Click on the **New** selection to create a new Route.

Edit

The **Edit** selection allows you to modify the selected route in the Route file. Double-clicking on a route name will also take you to the Route Information screen for editing.

1. Use the mouse to highlight the route you want to edit. Double-clicking on the route name takes you to the Route Information screen.
2. Click on the **Route** menu item on the Menu bar.
3. Click on the **Edit** selection to edit the Route.

Cut

The **Cut** selection deletes the selected route and places it into the clipboard.

1. Use the mouse to highlight the route you want to Cut.
2. Click on the **Route** menu item on the Menu bar.
3. Click on the **Cut** selection to cut the route and place it in the clipboard.

Copy

1. Click on the **Copy** selection to copy the highlighted route.
2. Use the mouse to highlight the route you want to copy.
3. Click on the **Route** menu item on the Menu bar.
4. Click on the **Copy** selection to copy the selected route into the clipboard.

Paste

Click on the Paste selection  to insert a copied or cut route from the clipboard into another route file.

1. Place the cursor where you want to paste the route from the clipboard.
2. Click on the **Route** menu item on the Menu bar.
3. Click on the **Paste** selection to paste the route from the clipboard.

Delete

Click on the **Delete** selection to delete the selected route without saving the route to the clipboard.

1. Use the mouse to select the route you want to delete.
2. Click on the **Route** menu item on the Menu bar.
3. Click on the **Delete** selection to delete the route.

Transfer Routes Between Route Files

You may transfer routes between route files by one of the following methods:

1. Copy the **Route** file to a new file name.
2. Open a Route file and use the **Save As** function to save it as a new file name.
3. Cut or Copy a route from one file, open a different file, and then paste the route into the file.

Main Application Window Details

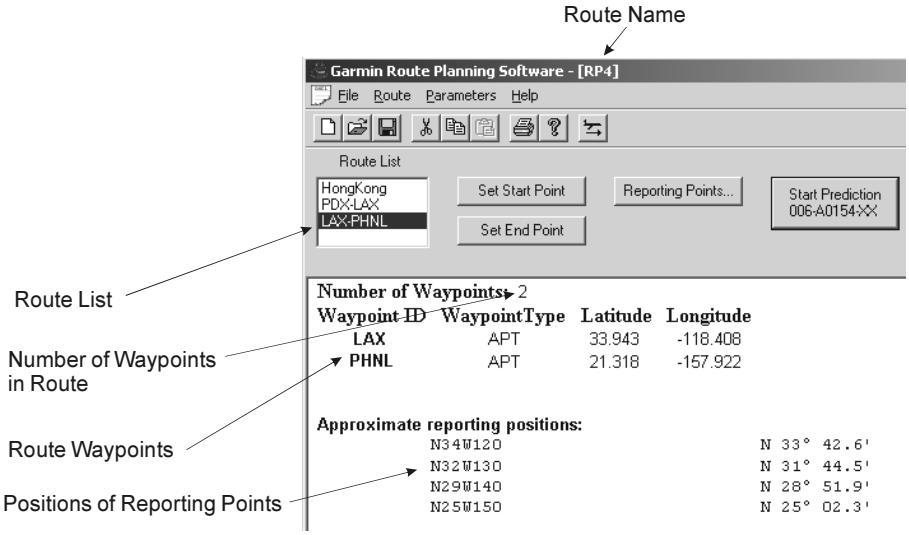
The following information provides detailed information about the parts of the Main application window.

Route List

The Route List contains the list of routes that are saved in the displayed Garmin Route Planning file. Clicking on a route in the Route List will display the waypoints and data selected for that route. You may double-click on the desired route in the Route List to edit the route information.

Route Data

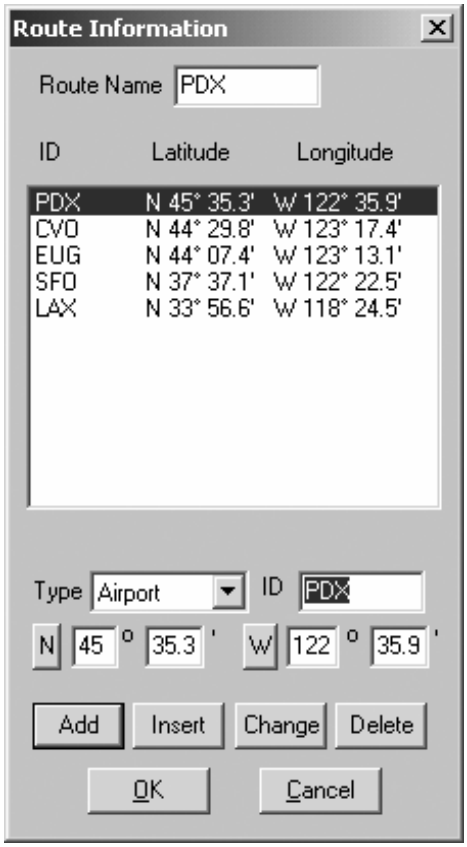
The Route Data shown on the main program screen reflects the information specified for the selected route along with estimated reporting positions. The Route Data is not editable on this display, but may be changed for each route by selecting that route, then selecting **Edit** from the Route menu item or double-clicking on the desired route in the Route List.



Defining a Route

The Route Information window is displayed when you select the **Route-New** menu selection, double-click on a route name, double-click on a route's waypoint, or click on the **New Route** toolbar icon.

This window presents the data entry fields required to define the route for the prediction calculations. The fields will contain route information if a route was selected for editing. The route name and waypoint information will be blank for a new route.



Use the **TAB**, **Up arrow**, and **Down arrow** keys to move from one screen field to another. The combination of **SHIFT-TAB** moves the cursor in the reverse direction. Up to 256 waypoints may be specified per route.

Clicking on the **OK** button accepts the route as specified. Clicking on the **Cancel** button disregards any modifications made since this screen was displayed and returns control to the main application window.

Route Name

You may specify a route name when you create a route or edit the route name of an existing route. Changing the route name does not create a new route with the new name. Route names are limited to nine characters.

Route Waypoints

The list is in the order of use and includes the identifier and Lat/Lon position. The waypoint window will permit scrolling when the number of waypoints exceeds the space available.

Waypoint Type and ID

Enter route waypoints by type and ident. If a database is being used, pressing the **TAB** key after specifying an airport, VOR, NDB, or intersection ident causes the program to extract the latitude and longitude coordinates for the given ident and type and populate the latitude and longitude fields. You are not permitted to modify latitude and longitude coordinates of waypoints in the database. If multiple waypoints have the same ident, the program will display a Select Waypoint window so you can select the correct waypoint for your route. Waypoint IDs are limited to six characters.

NOTE: *If a Waypoint Type other than "User" is selected and the specified ident is not in the database file, the program will change the type to "User." The program will also determine if a User waypoint with the same ident has already been defined. If there is an existing User waypoint with that ident, the coordinates for the waypoint will be retrieved. If there is no User waypoint by that ident, the coordinates will be set to N 0'0.0" E 0' 0.0".*

Waypoint Lat/Lon

The Latitude and Longitude coordinates for the waypoint used in the route. When the hemisphere identifiers (N, S, E, W) are highlighted, the Enter key toggles between the two selections for that hemisphere (N or S, E or W).

Specify user-defined waypoints by selecting the "user" type and entering an ident. Pressing the **TAB** key after specifying a user waypoint ident will cause the program to fill the latitude and longitude fields with the coordinates retrieved from the user waypoint file. You may modify the coordinates of user waypoints. If the program can not find a matching ident, the program assigns coordinates of 0 degrees latitude and 0 degrees longitude.

Add Waypoint

The **Add** waypoint button inserts the waypoint at the end of the route.

Insert Waypoint

The **Insert** Waypoint button inserts the new waypoint above the selected waypoint.

Change Waypoint

The **Change** Waypoint button changes the waypoint information to match the information in the waypoint edit fields.

Delete Waypoint

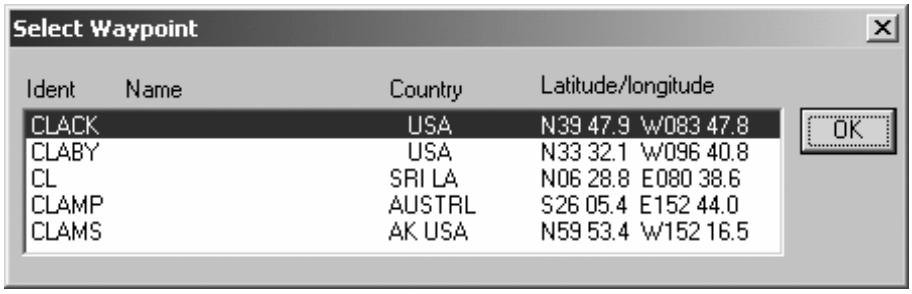
The **Delete** Waypoint button deletes the selected waypoint record and "moves" subsequent waypoint records up.

Select Waypoint Window

The following window is displayed when multiple waypoints have the same identifier, user waypoints excluded. The window may be scrolled when the number of waypoints exceeds the amount that can be displayed in a single window. The following information is available in the Select Waypoint window for each of the idents:

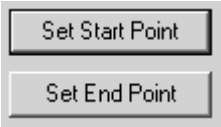
1. Ident
2. Ident/Facility name
3. Country
4. Latitude/Longitude coordinate

You can then select the desired waypoint by highlighting the waypoint or moving the highlight bar with the **Up/Down arrow** keys. Then, click on **OK** with the mouse or press the **Enter** key.

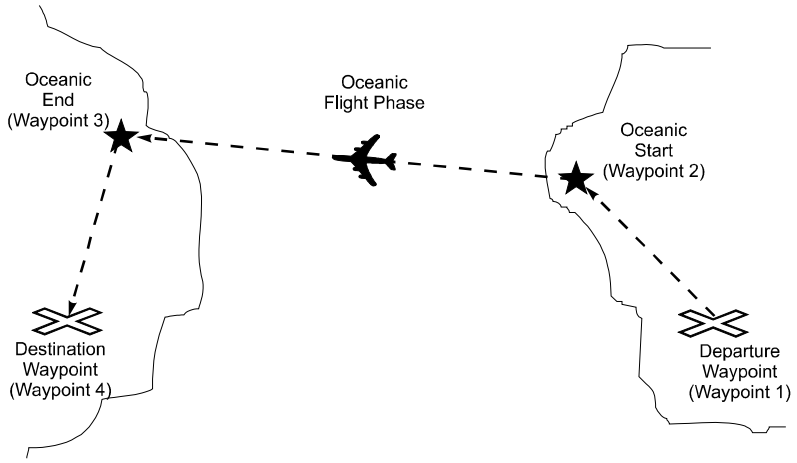


Setting Start and End Points (Oceanic)

The Set Start and End Points selections allow you to select the starting and ending waypoints that define the Oceanic/Remote portion of the flight. The launch status for Oceanic/Remote flights are made on the portion of the flight that is bound by the Start and the End waypoints.



NOTE: *For prediction purposes only, the waypoints that define the Oceanic/Remote portions of the flight must be entered into the route. Other waypoints may be specified, but are not required for the prediction functions.*



Set Start Point

Select the starting waypoint for the portion of the flight plan that begins the Oceanic/Remote flight phase. More waypoints may exist in the flight plan that precede this waypoint over land. The default is the first waypoint in the route. You must already have created the route before selecting the starting waypoint.

1. Click on the **Set Start Point** button on the main program page.

2. The route waypoint list will be displayed. Click on the waypoint where the Oceanic/Remote phase begins to highlight it.

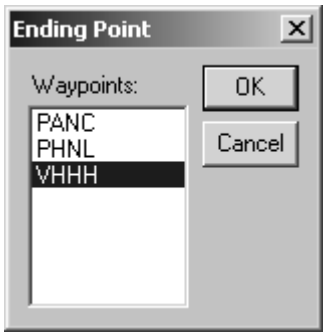
3. Click on **OK**.

Set End Point

Select the ending waypoint for the portion of the flight plan that ends the Oceanic/Remote phase. More waypoints may exist in the flight plan that continue over land. The default is the last waypoint in the route. You must have already created the route before selecting the end waypoint.

1. Click on the **Set End Point** button on the main program page.

2. The route waypoint list beyond the start waypoint will be displayed. Click on the waypoint where the Oceanic/Remote phase ends to highlight it.



3. Click on **OK**.

Start Prediction

The Start Prediction button will begin the Oceanic/Remote prediction calculations for the selected route.

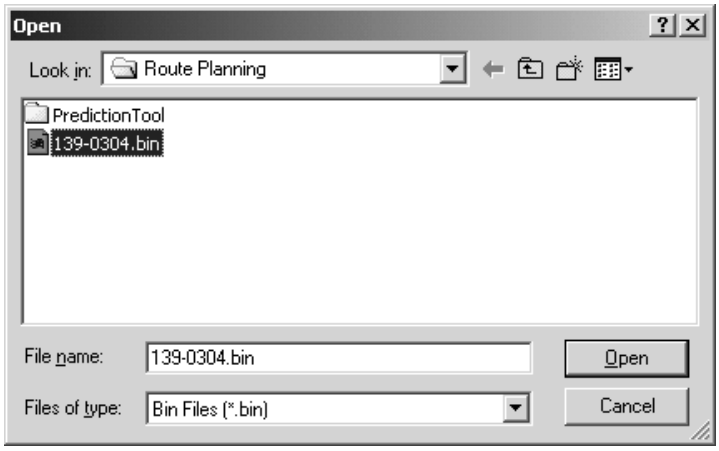
1. Click on the **Start Prediction** button on the main program page.
2. The prediction program will .

Parameters Menu

The Parameters Menu item allows you to select a database or locate the prediction program. Locating the prediction program only needs to be done the first time this program is used.

Nav Database

The Navigation Database is a library of waypoint information used for entering waypoints into a route. When a database is not used, waypoints must be entered manually. You only need to select the Nav Database: the first time that you use the Garmin Route Planning program, if the database file name changes, or the database file location changes. The use of a database is optional. A database file is included with the Garmin Route Planning program.



Help Menu

Version information for Garmin Route Planning is accessed by clicking on the Help menu.

About...

1. Click on **Help**.

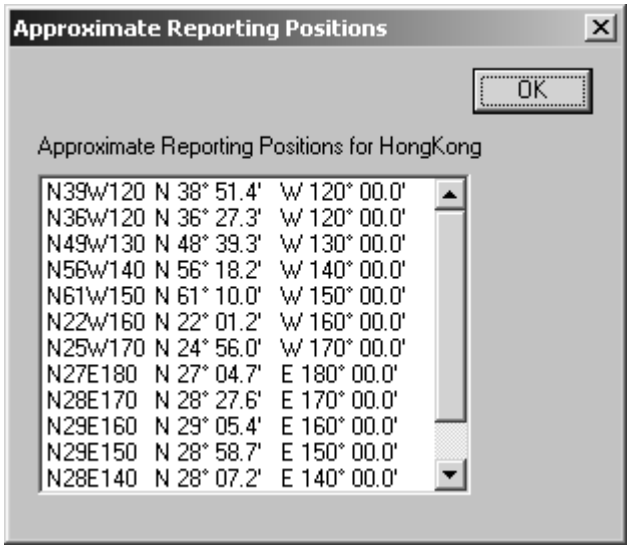
2. Click on "**About...**". Version information is provided about Garmin Route Planning.

Reporting Points

Clicking on the **Reporting Points** button causes the screen shown below to be displayed with the route name and calculated reporting points for the route.

Reporting points are defined as the latitude (and longitude) at each 10 degree longitude increment around the globe along the proposed flight. Reporting points are assigned names that are generated by appending the longitude hemisphere and degree to the latitude hemisphere and degree (i.e. N39W120).

The Garmin Route planning program determines the latitude for each 10 degree longitude increment and presents the reporting point name, latitude, and longitude as shown below. This information is also available on the main application window below the route waypoints.



FDE Prediction

WAAS RAIM/FDE Prediction Program instructions

***NOTE**: These instructions assume the user has experience operating the G1000 with GIA 63W, the GNS480, or the applicable GNS 400W/500W Series Unit and is familiar with the operation of RAIM and FDE.*

Fault Detection and Exclusion (FDE)

The GARMIN G1000 with GIA 63W, the GNS480, and the GNS 400W/500W Series products incorporate Fault Detection and Exclusion (FDE) features, satisfying the requirements of TSO-C145a, TSO-C146a, and "GPS Oceanic/Remote Navigation" per FAA AC 20-138A Appendix 1.

FDE consists of two distinct parts: fault detection and fault exclusion. Fault detection (RAIM) detects the presence of an unacceptably large pseudorange error (and presumably, position error) for a given mode of flight. Fault detection is synonymous with RAIM (Receiver Autonomous Integrity Monitoring). Upon the detection of a fault, fault exclusion follows and excludes the source of the unacceptably large pseudorange error, thereby allowing navigation to return to normal performance without an interruption in service. FDE functionality is provided for oceanic, en route, terminal, and non-precision approach phases of flight. The FDE functionality adheres to the missed alert probability, false alert probability, and failed exclusion probability specified by TSO-C145a/146a.

The WFDE Prediction Program (006-A0154-01, 006-A0154-02, and 006-A0154-03) is designed for use with TSO-C145a/TSO-C146a approved, WAAS-(Wide Area Augmentation System) certified Garmin products. These products include:

- GPS 400W, GNC 420W, GNC 420AW, GNS 430W, GNS 430AW
- GPS 500W, GPS 500W TAWS, GNS 530W, GNS 530W TAWS, GNS 530AW, GNS 530AW TAWS
- GNS 480
- G1000 with GIA 63W

Pre-Departure Verification of RAIM/FDE

A RAIM or FDE prediction must be performed prior to departure for the following types of flight plans:

- An FDE prediction is required for Oceanic/Remote operation where GPS is to be the primary source of navigation per FAA AC 20-138A Appendix 1.
- A RAIM prediction is required for all other flight operations in accordance with local aviation authority guidelines for TSO-C129a equipment, as required by an Aircraft Flight Manual limitation placed on Garmin G1000 with GIA 63W, GNS 480, and GNS 400W/500W Series products. Examples of such operations include navigation of U.S. Area Navigation (RNAV) routes, Standard Instrument Departures (SIDs), or Standard Terminal Arrival Routes (STARs) per FAA AC 90-100 "U.S. Terminal and En Route Area Navigation (RNAV) Operations".
- A WAAS satellite visibility prediction is required for all LVAV/VNAV or LPV approach as required by an Aircraft Flight Manual limitation placed on Garmin G1000 with GIA 63W, GNS 480, and GNS 400W/500W Series products.

Prior to departure, the operator must use the WFDE Prediction Program supplied with the applicable trainer or route planning software to demonstrate that there are no outages in the capability to navigate on the specified route of flight. The WFDE Prediction Program determines whether the GPS constellation is robust enough to provide a navigation solution for the specified route of flight.

Running the FDE Prediction Program

Trainer and route planning software for WAAS-certified Garmin products include a WFDE Prediction Program to meet the FDE requirements for GPS as a primary means of navigation for Oceanic/Remote operations (reference FAA AC 20-138A Appendix 1). The Oceanic/Remote flight phase occurs when the flight plan will place the aircraft more than 200 nautical miles from the nearest airport. All operators using a Garmin WAAS-certified unit as primary means of navigation in oceanic/remote areas under FAR parts 91, 121, 125 and 135 must utilize the WFDE Prediction Program prior to conducting a flight in these areas.

Prior to navigation on U.S. RNAV routes, SIDs, and STARs (reference FAA AC 90-100) all operators of Garmin WAAS-certified units must utilize the WFDE Prediction Program to determine RAIM availability.

All operators of Garmin WAAS-certified units should utilize the WFDE Prediction Program to determine WAAS satellite visibility when planning an LNAV/VNAV or LPV approach.

The detection function (of Fault Detection and Exclusion) refers to the ability to detect a satellite failure which can affect navigation. The exclusion function refers to the ability to exclude one or more failed satellites and prevent them from affecting

navigation. The WFDE Prediction Program allows the pilot to specify the planned departure date/time, route type, ground speed, ground speed variation, and maximum allowable outage. When provided through NOTAM or other sources, GPS satellites with known failures can be excluded through the program's setup function.

To use the WFDE Prediction Program, begin by entering the intended flight plan into the applicable trainer software (G1000 Trainer or GNS 400W/500W Trainer) or the Garmin Route Planning software for the GNS 480. The WFDE Prediction Program uses this information to analyze satellite coverage along the intended route of flight.

NOTE: *A flight plan must be created and activated (using the Route Planning software) prior to running the WFDE Prediction Program. The WFDE Prediction Program only works with the currently active flight plan. Follow the software instructions to create and activate a flight plan. Software and instructions are available via the Garmin website at www.garmin.com.*

Start FDE Prediction

1) Make sure the Route Planning software is running and the desired flight plan is active.
2) Click on the 'Start Prediction' button after setting up the route (Figure 1).

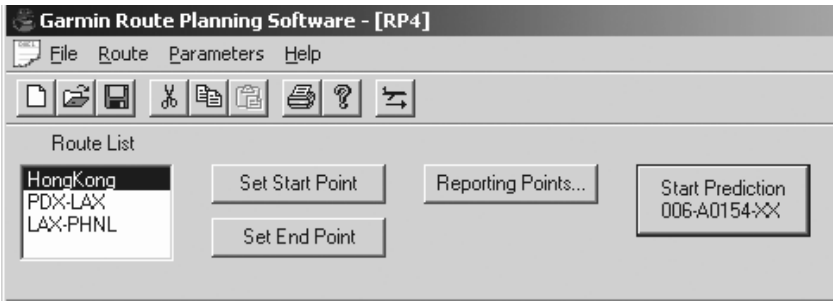


Figure 1 Start Prediction Program Options

NOTE: *If the WFDE Prediction Program has not been used previously, or has not been run recently, a series of pop-up messages (Figure 2) may precede the WFDE Prediction Program window. Follow the on-screen instructions to download new data from the internet. The download time is normally very short (nearly instantaneous), but may vary with internet connection. See the 'Updating/Changing the Almanac and Configuration Files' section of this document for details.*

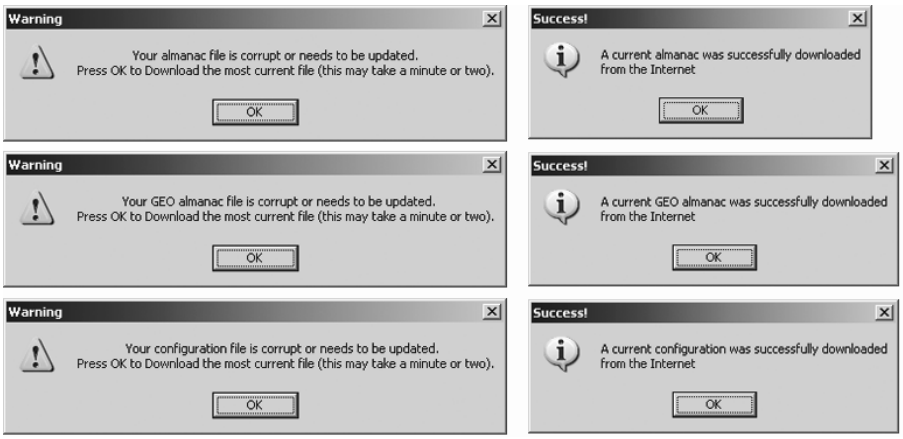


Figure 2 Possible Update Messages

4) The WFDE Prediction Program window appears (Figure 3) listing the flight plan waypoints, selected antenna, and the current date/time as the departure time. It is important to verify that the displayed route is correct before proceeding with the prediction. Reference Table 1, and verify the correct Garmin part number (006-A0154-0X) appears at the top of the screen. If the part number is incorrect, see the 'Configuration Files' section of this document.

NOTE: *If the route of flight requires an alternate airport, multiple predictions may be required (one for the primary and one for the alternate) to verify RAIM and/or WAAS satellite visibility availability at the primary and the alternate approach.*

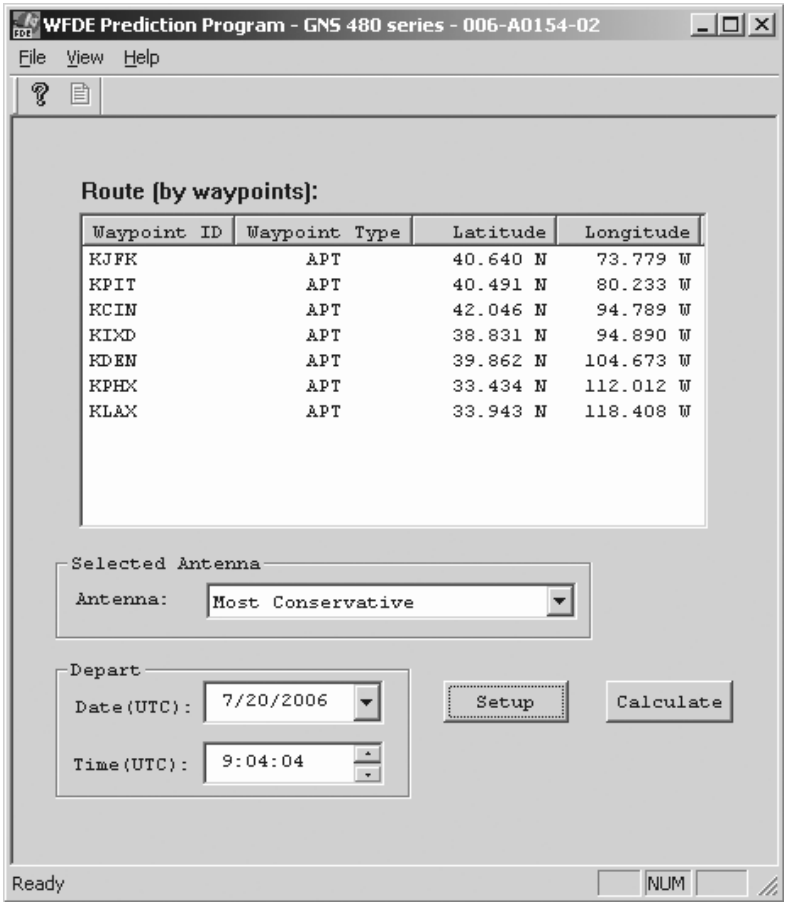


Figure 3 WFDE Prediction Window

Select Antenna

Make sure that the selected antenna matches the antenna installed on the aircraft that will fly the flight plan. To change the selected antenna, click the down arrow next to the 'Antenna' field. A pull-down list appears listing the available antennas. If the correct antenna is not known, select 'Most Conservative' for the most restrictive mask angle of the antenna options.

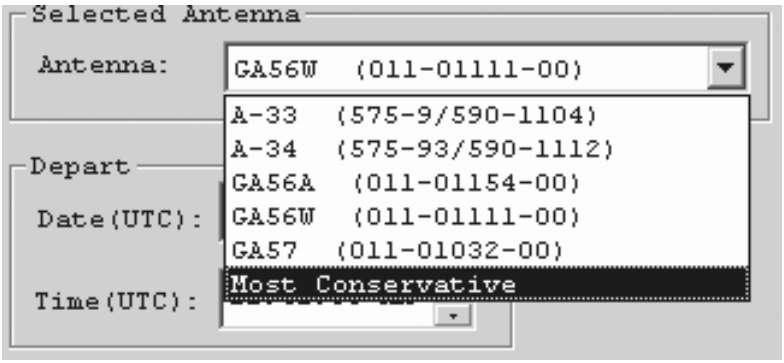
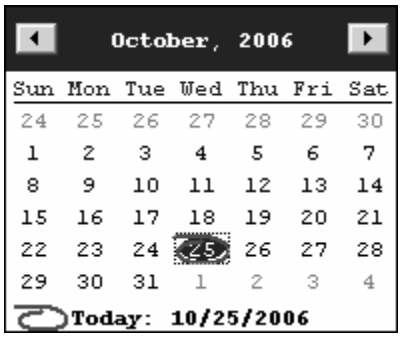


Figure 4 Antenna Pull-Down List

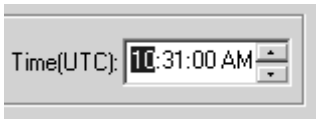
Set Departure Date

To change the departure date, click the down arrow next to the 'Date (UTC)' field. A calendar window appears. Click the left or right arrows to select a different month (if desired), then click the desired date. The departure date can also be changed in the Flight Setup window.



Set Departure Time

To change the departure time, click the hours, minutes, or seconds fields next to the 'Time (UTC)' field. Click the up or down arrows (or type in desired time) to change the displayed time. The departure time can also be changed in the Flight Setup window.



Flight Setup

To change the planned route type, average ground speed, ground speed variation, maximum allowed outage, flight duration, Selective Availability conditions, or to deselect satellites, click the 'Setup' button. A setup window is displayed (Figure 5). Click the field for the desired item, then enter the desired value. Table 2 describes the Flight Setup Window options.

Flight Setup Window Options	
Route Type	Oceanic -For Oceanic/Remote only operations. En route/Terminal - For all other operations.
Maximum Allowed Outage (Time)	This field defaults to 5 minutes when Oceanic is the selected route type. This field is set to default and 'greyed out' (not selectable) when En route/Terminal is the selected route type.
Ground Speed (Avg)	Enter expected average ground speed for flight.
Ground Speed Variation	The ground speed variation setting will vary with the selected route type. The default is 100 knots for Oceanic and 10 knots for En route/Terminal route types. The program automatically runs multiple predictions for a range of ground speeds based on this setting.
Flight Duration	This field is calculated from the entered ground speed and route information; or the flight duration can be entered, and the program will calculate the average ground speed.
Departure Date and Time	Enter date and time (in UTC format) of departure, this info can also be entered into the main screen of this program.
Selective Availability	Simulates Selective Availability conditions when box is checked (normally left unchecked).
De-select Satellites	Click on the De-select Satellites button to view the Selected Satellites window, see following instructions.

Table 2

NOTE: *The maximum allowed outage time for Oceanic flights vary according to the specific route. The pilot must determine the proper allowed outage time to be used for the prediction.*

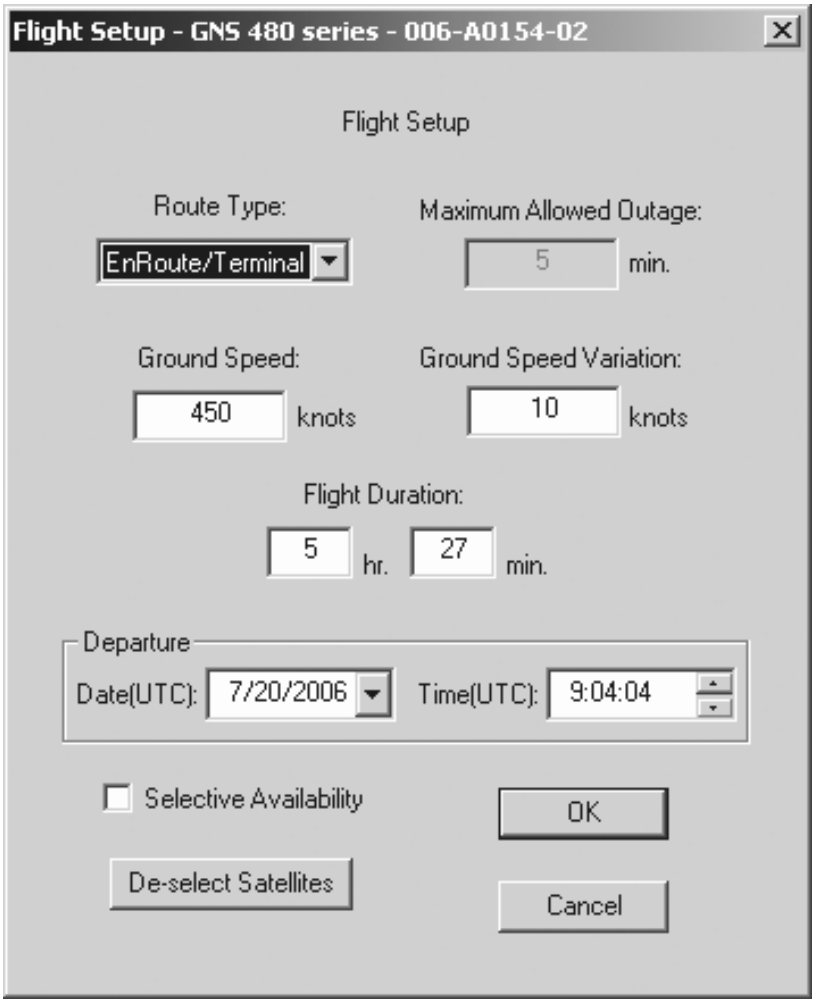


Figure 5 Flight Setup Window

Deselect Satellites

To deselect satellites from the setup window, click 'De-select Satellites', then clear the box adjacent to any satellite that should not be used in the prediction (Figure 6). WAAS satellites are not listed in the Selected Satellites Window. Always check for NOTAMs (regarding satellite availability) as well as using the Prediction Program to ensure Approach availability at the destination.

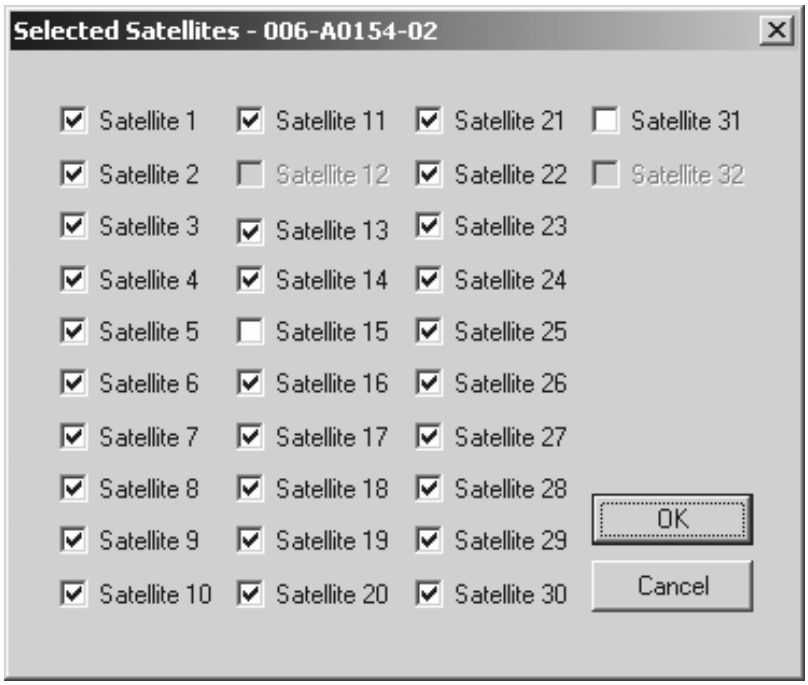


Figure 6 Selected Satellites Window

NOTE: *Satellites that are unavailable will be 'greyed-out' with no check marks. Satellites with 'Poor Health' will default to unchecked status.*

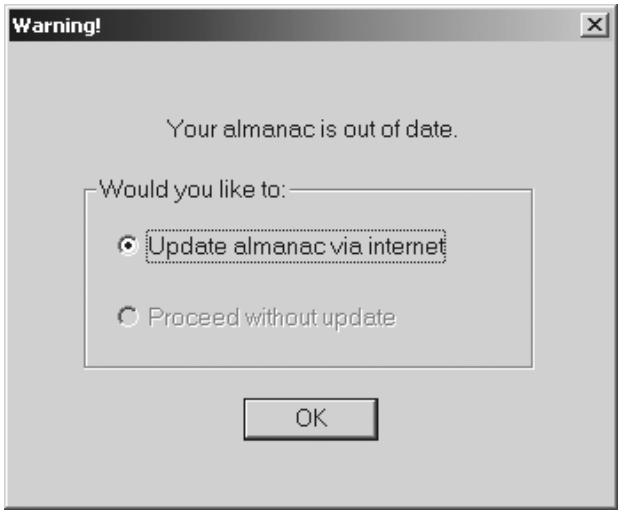


Figure 7 Almanac Warning

NOTE: *To ensure accuracy of results, the almanac data used for the RAIM and FDE predictions must be recent. If the information is out of date, the WFDE Prediction Program will automatically prompt the user to update the almanac data (Figure 7). An internet connection is required to use this feature (see following instructions).*

Calculate FDE Prediction

1) To calculate RAIM, FDE availability, and WAAS satellite availability; select the 'Calculate' button from the main WFDE Prediction Program window (Figure 3). A 'Calculation is complete' message will appear when the prediction is complete (Figure 8).

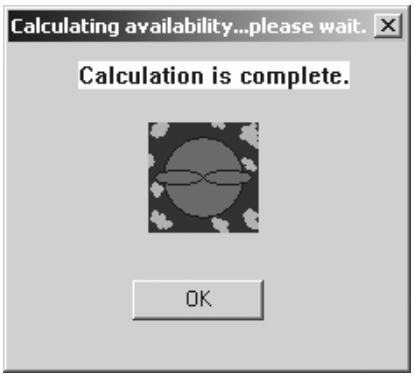


Figure 8 Calculations Complete Screen

2) The GPS/FDE Availability Results screen (Figure 9) appears after clicking the OK button on the 'Calculation is complete' message screen. The results can be viewed or printed for later reference.

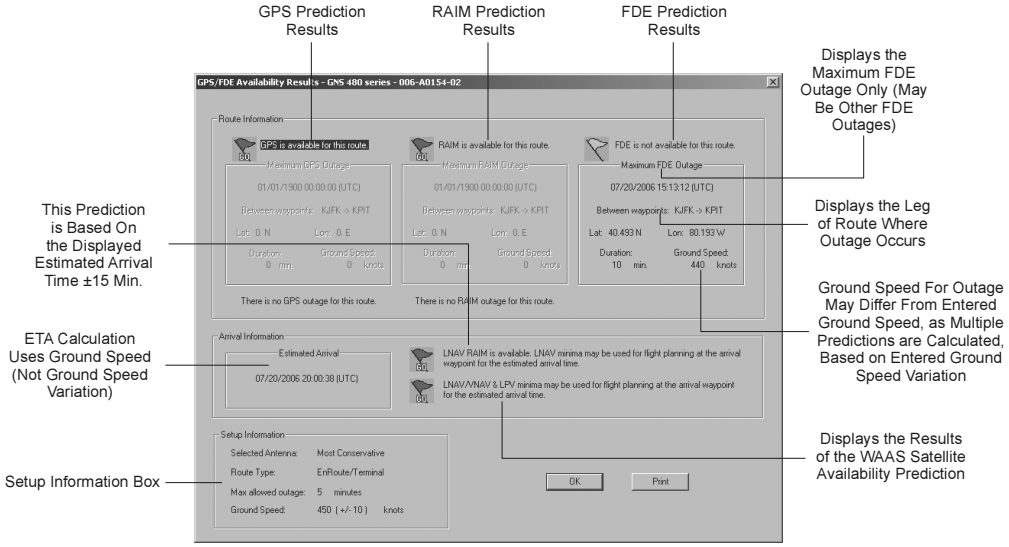


Figure 9 GPS/FDE Availability Results Screen

Viewing the RAIM and FDE Prediction Results

1) Select the View menu from the main WFDE Prediction Program window. The results also appear automatically after clicking the OK button on the 'Calculation is complete' message screen.
2) Select Results. A window will appear showing the calculation results (Figure 9).
3) To print the calculation results, click the Print button.

Printing the RAIM and FDE Prediction Results

1) Press the **Print** button in the lower right section of the display.

   Or

1) While the Prediction Results page is open and selected (the title bar is highlighted). On your keyboard, press and hold the **Alt** key and then press the **Print-Screen** key. This copies the Prediction Results page.
2) Open an application such as Word, Paint, etc.
3) Paste the copied page into the application by pressing the **Ctrl** and **V** keys at the same time.
4) Print the page with the pasted information. You may need to change the page orientation to Landscape to print on a single sheet of paper.

Interpreting the FDE Prediction Results

The GPS/FDE Availability Results screen provides either a 'GO' or 'STOP' status for the GPS, RAIM, FDE, LNAV RAIM, and LNAV/VNAV & LPV minima availability. A yellow flag is a possible result for an FDE prediction for a non-Oceanic prediction. (see Figure 10)

A 'GO' status indicates that there are enough satellites available during the flight to meet the requirements of that category.It is possible to have multiple FDE Availability outages during the flight and the status may still be a 'GO', as long as none of the outages exceeds the selected maximum allowable outage.

Figure 10 Prediction Results Icons

A 'STOP' status is the result of a predicted loss of satellite availability. An FDE Availability or RAIM availability failure occurs when sufficient satellites are not available for a period longer than the maximum allowable outage (as selected in the Flight Setup page and viewed in the Setup Information box on the GPS/FDE Availability Results screen) and will produce a 'STOP' status.

A yellow flag indicates an FDE outage in a non-Oceanic (Enroute/Terminal) type prediction. Because FDE availability is not required for Enroute/Terminal operations the yellow flag is only a caution to the pilot indicating that there may be an FDE outage when flying the flight plan. The selected flight plan may be flown despite the caution flag. A 'STOP' status can appear in the FDE outage section only when an Oceanic prediction results in an FDE outage.

More satellites are needed to provide FDE availability than are needed for RAIM. More satellites are needed to provide RAIM availability than are needed for basic GPS availibilty. A GPS Availability failure occurs when there is the loss of the ability to compute a position. This is expected to be accompanied by a an FDE availability failure and a RAIM availability failure.

- For Oceanic/Remote navigation predictions the displayed result should be 'FDE is available for this route'. In the event of a predicted outage, the flight should be delayed, canceled, or re-routed where FDE requirements can be met.
- For U.S. RNAV routes, SIDs, or STARs navigation predictions, the displayed result should be 'RAIM is available for this route'. In the event of a predicted outage, the flight should be delayed, canceled, or re-routed where RAIM requirements can be met.

- For LNAV approach at the arrival waypoint predictions, the displayed result should be 'LNAV RAIM is available'. In the event that LNAV RAIM is not available, flight planning should include an approach that is not based on GPS navigation equipment.
- For LNAV/VNAV or LPV approach at the arrival waypoint predictions, the displayed result should be 'LNAV/VNAV & LPV minima may be used for flight planning at the arrival waypoint for the estimated arrival time'. In the event of an 'LNAV/VNAV & LPV minima should not be used for flight planning at the arrival waypoint for the estimated arrival time' result, flight planning should include an approach that has at least LNAV minima (if based on GPS navigation equipment) or an approach that is not based on GPS navigation equipment.

NOTE: *Since (due to unforeseen circumstances) actual departure times often differ from planned departure times, it is good practice to perform predictions for several possible departure times.*

Suggestions to change the result of a failed flight plan prediction:

1) Alter the departure date and time.
2) Alter the route of flight.
3) Verify any deselected satellites. It is possible that some satellites unavailable for a previous prediction are now available.
4) Update the almanac, especially if it is more than three months old.
5) Use the correct antenna selection (if 'Most Conservative' was used).
6) For Oceanic/Remote operations, determine the actual maximum allowed outage and use for the prediction (instead of the 5 minute default setting which is generally shorter than the actual allowed outage time).

Updating/Changing Almanac and Configuration Files

Almanac, GEO Almanac, and Configuration Files

To ensure that each is current, the Almanac, GEO Almanac, and Configuration Files are automatically checked each time the program is started. If the program finds any of these files to be out of date, it will automatically update the file via the internet. A provision has been made to update these files manually, if needed.

Manually updating the Almanac, GEO Almanac, and Configuration files:

1) From the main WFDE Prediction Program window, select the Help menu (Figure 11).

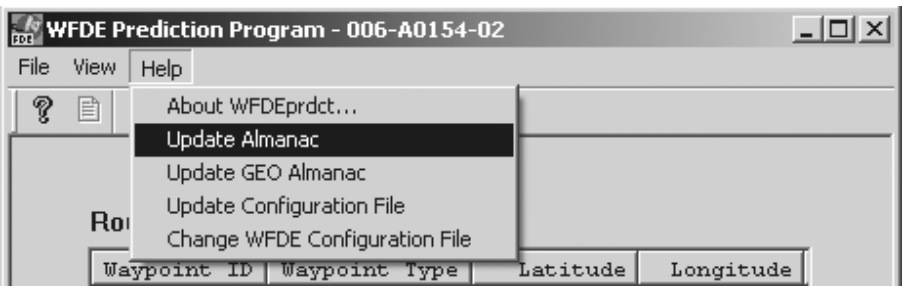


Figure 11 Help Pull-Down Menu

2) Select Update Almanac, Update GEO Almanac, or Update Configuration File. The program automatically searches the internet and downloads the most recent data.
3) A pop-up window appears to confirm that the data has been downloaded. Click the OK button to return to the WFDE Prediction Program.
4) The file has been updated.

Configuration Files

The WFDE Prediction Program may be used with several different Garmin software programs. Each program uses a specific configuration file to run the WFDE Prediction Program. If the user has multiple Garmin programs loaded, the user must verify that the configuration file currently in use is correct for the Garmin product that will be used to navigate the flight plan. Generally speaking, most users will not need to change the configuration file, although a provision has been made to update these files manually, if needed.

Changing the WFDE Configuration File:

1) From the main WFDE Prediction Program window, select the Help menu (Figure 11).
2) Select 'Change WFDE Configuration File'.
3) A pop-up window appears. Click the OK button to allow the program to download new configuration files via the internet. When the configuration files have been downloaded, a 'Configuration Select' pop-up window appears.
4) Click the down arrow to view the pull-down list of available configuration files (Figure 12). Select the file corresponding to the Garmin product that will be used to navigate the flight plan.

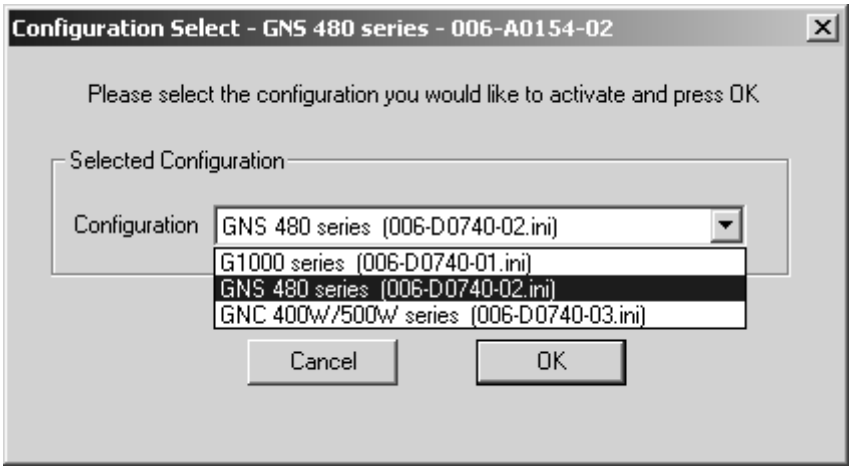


Figure 12 Configuration Select Window

5) Click the correct file name on the pull-down list, then click the OK button.
6) The configuration has been changed. See Figure 3 and Table 1 to verify the correct part number appears on the WFDE Prediction Program window

Glossary of Navigation Terms

A

Azimuth: an arc, as measured clockwise from true or magnetic north.

B

Bearing (BRG): The direction to any point, usually measured in degrees relative to true or magnetic north.

BIN: The file extension for a Garmin AT supplied binary database file.

C

Class II Airspace: Airspace that is out of the range of land-based navaids. Class II airspace includes areas both remote (over land) and over water.

Constellation: A group of stars or objects, such as satellites, in the heavens.

Coordinates: Values for latitude and longitude that describe a geographical point on the surface of the earth.

D

Database: A collection of data structured in such a way as to allow quick and convenient access to any particular record or records.

Degree: 1/360th of a circle.

Departure: The first waypoint in the active route.

Departure Date: The date of departure for the flight as entered in the route file for the purpose of calculating prediction results.

Departure Time: The time of departure for the flight as entered in the route file for the purpose of calculating prediction results.

Destination: The last waypoint in the active route.

E

Elevation: The angle of a GPS satellite above the horizon.

Elevation Mask Angle: See *Mask Angle*.

Excluded Satellites: See *Satellite Exclusion List*.

F

FDE: Fault Detection and Exclusion. A method to detect a satellite failure (via RAIM algorithm), determine which satellite failed, exclude that satellite from the position solution, the capability to determine that the correct satellite was excluded, while still being able to detect any other satellite failure.

Fix: A geographical location determined by either visual reference or by electronic navigation aids.

Flight Plan: A series of two or more waypoints.

G

Global Positioning System (GPS): Also known as NAVSTAR. A constellation of satellites launched by the U.S. Department of Defense into six orbit lanes (four satellites per plane) at an altitude of 10,898 nm above the earth.

Greenwich Mean Time (GMT): See Universal Time Coordinate (UTC).

Ground Speed (GS): Speed of travel across the ground. In aviation, the relation between ground speed and air speed is affected by the prevailing winds. The estimated ground speed for the Oceanic flight phase as entered in the route file for the purpose of calculating prediction results.

H

HDOP: Horizontal Dilution of Precision. *See Dilution Of Precision.*

I

Identifier: A name, typically abbreviated, assigned to a waypoint. The identifier may consist of numbers and alpha characters, up to six in length. For example, the airport identifier for Los Angeles International Airport is LAX.

K

Knot (kt): A unit of speed equal to one nautical mile per hour.

L

Latitude (Lat): Any line circling the earth parallel to the equator, measured in degrees, minutes, and seconds north and south of the equator.

Longitude (Lon): Any line from the North to the South Pole, measured in degrees, minutes, and seconds of a circle, east or west of the Prime Meridian (Greenwich, England).

M

Magnetic North: The region, some distance from the geographic North Pole where the earth's magnetic lines concentrate. A magnetic compass points to the magnetic north.

Mask Angle: The Mask Angle describes a cone looking up towards the GPS satellites. The angle is the elevation in degrees above the horizontal plane below which satellite signals will be ignored.

Meter (m): A metric distance measurement equal to 39.37 inches.

Minute: 1/60th of a degree.

N

Nautical Mile (nm): A distance measurement equal to 6,076 feet, or 1.15 statute mile. One nautical mile is also equal to one minute of latitude.

Nav Database: a Garmin AT supplied binary database file. The Nav database is not supplied with the Garmin Route Planning program. The Garmin Route Planning database file is included on the product CD. Otherwise, you may call Customer Technical Support.

NAVSTAR: The name given to GPS satellites formed from the acronym for **NAV**igation **S**ystem with **T**ime And **R**anging.

Non-Directional Beacon (NDB): A low frequency/medium frequency navigation aid sending non-directional signals that can be used for navigation.

O

Oceanic Flight Phase: The portion of a flight that travels over water or a remote region, that is beyond the range of terrestrial navaids (Class II airspace).

P

PDOP: Position Dilution of Precision. *See Dilution of Precision.*

R

RAIM: Receiver **A**utonomous **I**ntegrity **M**onitoring. A method of predicting possible system accuracy errors that may be caused by bad satellite data. The RAIM algorithm requires that more satellites are available and usable than required for a normal GPS position fix.

Remote: Areas that are over land, but out of the range of land-based navaids. Remote airspace is designated as Class II airspace.

Reporting points: The latitude (and longitude) at each 10 degree longitude increment around the globe along the proposed flight. Reporting points are assigned names that are generated by appending the longitude hemisphere and degree to the latitude hemisphere and degree (i.e. N34W40).

Route: The series of waypoints that embodies a flight plan from a departure to a destination waypoint.

Route Name: The name of a route (collection of waypoints) within the Route file. A number of routes may be contained within a single route file.

Route Spacing: The distance in nautical miles to adjacent tracks on either side of the flight.

S

Second: 1/60th of a minute of a degree.

Statute Mile: A distance measurement equal to 5,280 feet or 0.87 of a nautical mile.

T

Three-dimensional (3D) Position Fix: A position fix defined by latitude, longitude, and altitude.

Time Interval: The time interval between prediction checkpoints as shown in the report file for the purpose of calculating prediction results.

Time of Prediction: The date and time when the prediction calculation is performed.

Time Zone: the time zone offset from UTC time.

U

Universal Time Coordinate (UTC): Greenwich Mean Time, or the time at the Prime Meridian in Greenwich, England. Also referred to as Zulu time.

V

Very High Frequency Omnirange (VOR): Navigational aid that transmits signals such that a receiver can indicate its current radial or bearing from the transmitter.

W

Waypoint: A navigation fix used in area navigation and defined by latitude and longitude coordinates.

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