

OpenCPN Basics for Instructors & Students V5.6.2

by JCF

OpenCPN, a free open-source chart display application, is used in all of the Marine Navigation series and it gives students an opportunity for hands on learning experiences. The primary goal is for students to become familiar with electronic charting displays and functions. It provides functionally found on the most advanced Multifunction Displays. **While OpenCPN is an extremely powerful navigation application, offering many features for planning and navigating routes on waterways, the first Marine Navigation courses covers only some features used in the course. Students will learn to download charts, place and manipulate waypoints, create routes and to extract information useful for planning and navigation.**

The Basics Step 1: downloading and installation

Downloading: Type “<http://opencpn.org/>” into your internet browser and press “Enter”. From the OpenCPN Home page, select “Downloads” from the menu bar at the top of the page and “Click”. The Download Directory page will appear and you should “Click” the first item, “OpenCPN Latest Release”. When the “Download OpenCPN” page opens, select the software for your personal computer's operating system, “Windows, Mac, etc.”.

Installing: Once the download is complete, find the OpenCPN file in your computer's Download Folder and follow the procedure for installing apps on your computer. For Windows computers this usually is a matter of double clicking the executable file and following the on-screen instructions. Windows security will ask “If you want to allow this app from an unknown publisher to make changes to your computer” and you do.

For Apple computers, OpenCPN will be recognized as an app from an unidentified developer. To override this, Control-click the app, choose Open from the menu, and in the dialog that appears, click Open. Enter your administrator's name and password when prompted. The app is now saved as an exception to your security settings, and you can open it in the future by double-clicking it, just as you can any authorized app.

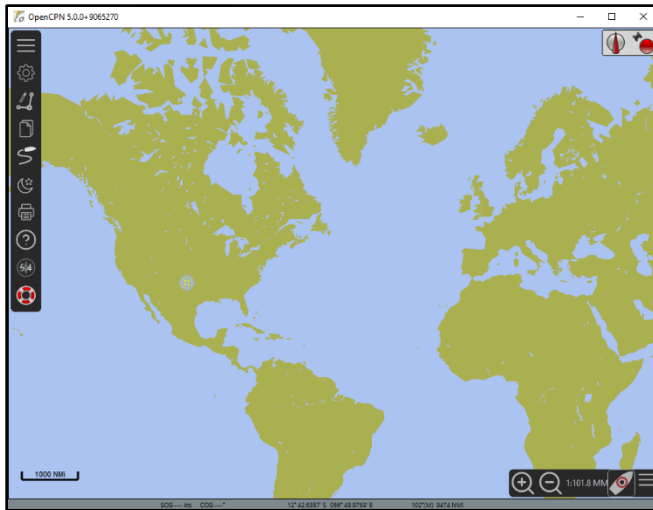
Get to know the OpenCPN window

Double click the OpenCPN desktop icon



and the app should open in a window that looks similar to one of these below:


For Windows

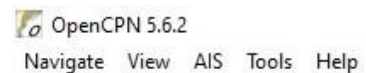


For Apple



OpenCPN functions pretty much the same in either the Windows or the Mac environments.

The outlines of the Americas and other continents are the pre-installed base map and it offers no useful details. Let's become familiar with the vertical tool panel in the upper left corner and the OpenCPN User Manual. In the tool panel, click the  and then near the bottom of the popup click "Help". From the menu near the top of the Webpage, under "*Local Offline OpenCPN User Manual*" click "*OpenCPN First Use*", to see how the online help files work. For the full Internet User's Manual click "*OpenCPN Complete Online User Manual, Internet access required.*" You may want to add this page to your Bookmarks or Favorites in your browser for quick Internet reference to the full manual.



The upper part of the screen gives you a menu not needed now.











Navigate lets you select some on-water navigation options, *View* provides some on-screen options, *AIS* manages AIS target display options and *Help* takes you to help options as above.



<= In the upper right corner, you see North up (blue arrow) or Course up (red arrow, shown) and if you have GPS input green bars, as show, shows you have GPS location input but if no GPS input a Red Ball indicates no GPS signal.

The vertical tool bar, on the top left gives users access to many useful functions.

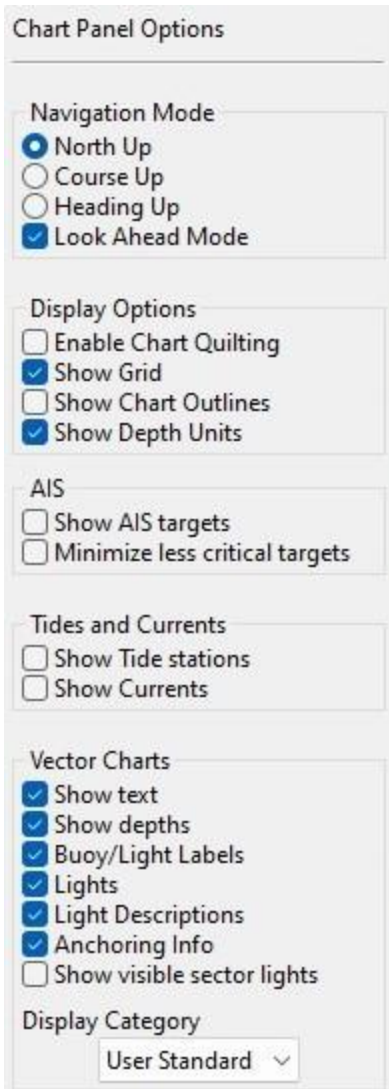
The icon bars:

	<= Hide/ Show this icon bar
	<= Options icon
	<= Create Route icon
	<= Route & Mark Manager icon
	<= Enable/Disable trails to continuously track the boat's position
	<= Change Color Scheme for Day and Night screen mode
	<= Print the chart
	<= About OpenCPN & online help
	<= WMM magnetic variation-only shows if WMM plugin is enabled
	<= Drop MOB marker that will lead you back and is difficult to erase for safety reasons


The lower right toolbar gives Zoom in/out, chart scale, click on ship to center the display on GPS location if a GPS is attached, or manual ship location if there is no GPS input.



Clicking on the right most “Hamburger” (three horizontal lines) gives a “Chart Panel Options” popup shown below.

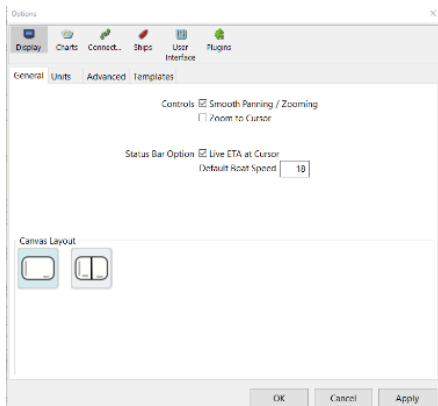


- <= North up if no GPS input and for planning
- <= Lets you see 2/3 ahead and 1/3 astern, when moving
- <= Quilting smoothly connects two or more charts (off now)
- <= Show L and Lo grid, if needed
- <= **Chart outlines show which charts are available**
- <= Show Feet or Meters on the display
- <= See AIS targets on the screen with CPA and time of CPA
- <= Do not show stationary (anchored or docked) AIS targets
- <= Show tide stations on the display
- <= Show current arrows, etc.
- <= Show text on display
- <= Show depths
- <= Show buoy labels, coastal
- <= Show lights
- <= Show lights descriptions
- <= Show anchoring info
- <= Show light visible sectors
- <= Display= BASE, STANDARD, ALL, or USER STANDARD

Now let's focus on the Options icon in the Left Tool bar, and the gear icon: 

Click the Options gear icon, and the window below appears. At the top, click Display and then click General. **For now, just note that under the General tab, you can change the speed of your**


boat and you will need to change speed throughout the Marine Navigation series.

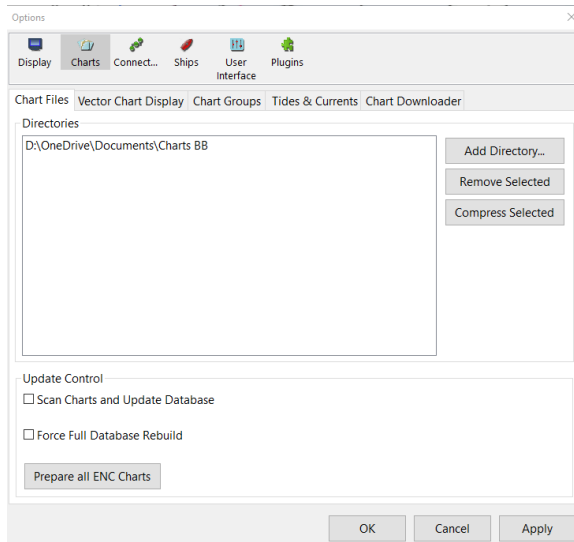


Click the green, Plugins icon, then click the WMM plugin to disable automatically setting magnetic variation for use on the Bowditch Bay chart which has a frozen -15° variation for problems. Now come back and click the Units tab and select Nautical miles and Knots. Finally, click the “Apply” button at the bottom right of the window and then click “OK” to return.

Getting Charts

Now it is time to get some charts we can use. First, create a new folder on your computer's hard drive and name it "Charts". Be sure to remember where the folder is on your computer. For the first chart go to [USPS.org](https://www.usps.org) > Login > Committees > Committees L-Z > Navigation > Marine Navigation > Marine Navigation/Piloting Downloads and under Bowditch Bay Chart for use with OpenCPN click "Bowditch Bay chart". This will download a "bb001_1" (Kap) zip file. On your computer create a new folder under the Charts folder and name it "Training". Drag the downloaded file from your computer's "C:\users\username\Downloads" folder into the new Charts\Training folder. Now double click to unzip the file.

In the OpenCPN window, click the Options icon  and click the Charts icon, at the top of the window. In the window that appears click the Add Directory button and navigate to the Training folder on your computer and Click Apply, then OK.

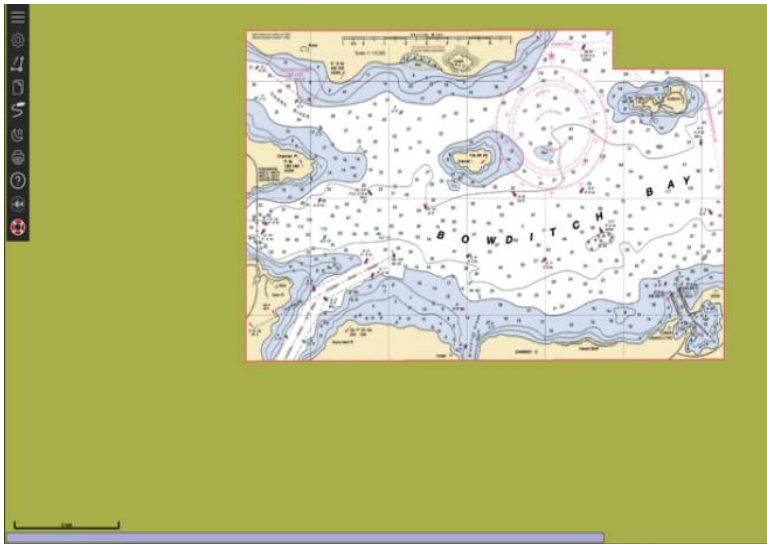


The Chart window should look somewhat like this picture except C:\Charts\Training instead of the Charts BB shown.

Click OK and the OpenCPN base should reopen.

Now you should notice a red speck on the outline map of the United States, in the North East. Click the Zoom In button (+) in the lower right. Keep clicking the Zoom In until a blue bar appears at the bottom of the window. Click the blue bar and the chart should appear as shown below. Note the

blue bar changed colors to gray.



Keep zooming to get the desired size for the chart. (Alternately, place the cursor on the map near the red speck and use the mouse wheel to zoom in until the blue bar appears. To add the L and Lo scales click the lower right hamburger to get the Chart Panel Options popup and uncheck “Enable Chart Quilting” to work with just one chart.

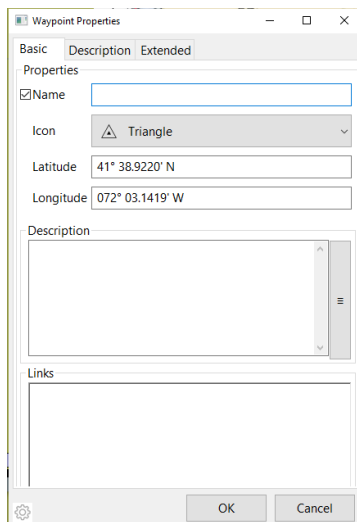
Waypoints



Users can place waypoints anywhere on a chart with the click of the mouse. Using the Bowditch Bay chart, move the cursor to the lower left of the Bowditch Bay chart and right click and this popup menu will open.

Note that there are several options when you right click and this screen will be referenced several times throughout this document whenever you are instructed to right click in the chart area.

From the popup menu, click Drop Mark. Now notice the waypoint appears as a small triangle where the cursor was pointing. The waypoint symbol actually contains quite a bit of information.



Move the cursor to the triangle and double-click the left button. The Waypoint Properties menu left, appears and with the Basic tab selected, users can name the waypoint, change the symbol and refine its position by editing the Latitude and Longitude.

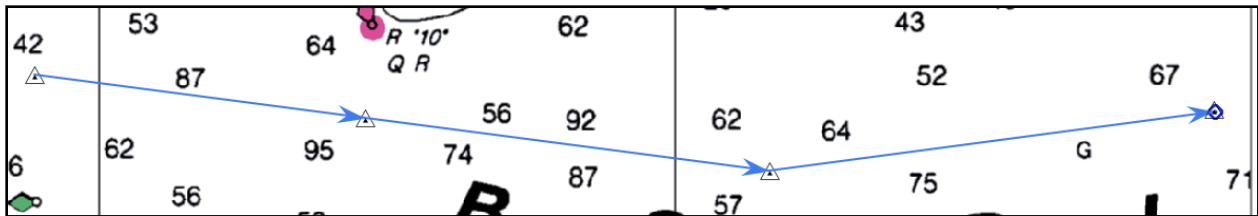
Now randomly place three or four more waypoints about two inches apart, moving toward the right side of the Bowditch Bay chart.

Routes

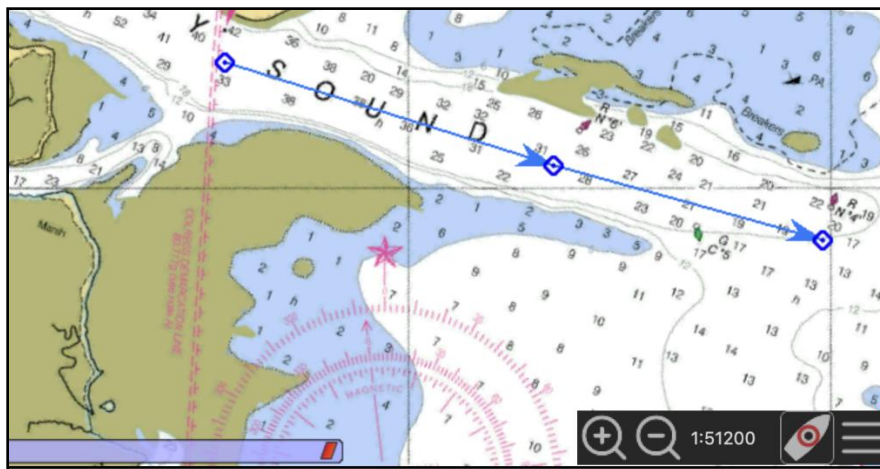


Select the Route Tool from the vertical menu at the top left.

When the cursor is moved over the chart, notice that it becomes a Pencil. **Place the Pencil on the first waypoint symbol on the left side of the chart and left click on the mouse.** When the popup menu asks, “Use nearby waypoint?”, select Yes. If you do not place the pencil near a waypoint, the computer will place another waypoint to use for the route. You will need to End the Route by carefully right clicking on the last waypoint and click on End Route or press “ESC”. **Now move the Pencil to next waypoint by moving the mouse (Do not hold the left button down) and repeat the procedure until reaching the last waypoint. At the last waypoint, carefully right click or “ESC” and select End Route. You should have a route trace similar to the one below:**



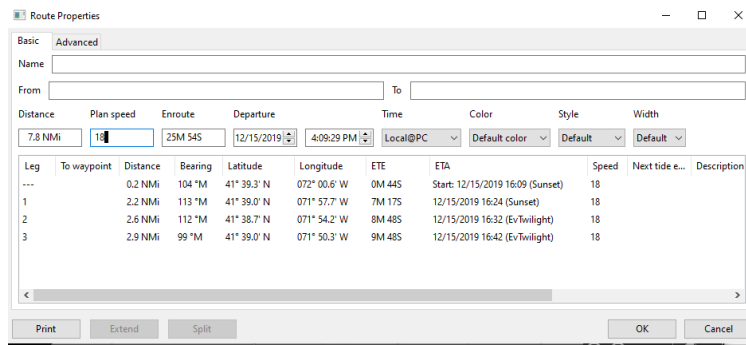
Another way to create a route is select the Route Tool, click where to begin and move the Pencil to the end of the first leg and click. Continue this procedure to the end of the route. The route should appear similar to the one below. Note the different waypoint symbols used in this technique. This method is sometimes referred to as “Point and click” route creation.



Route Properties

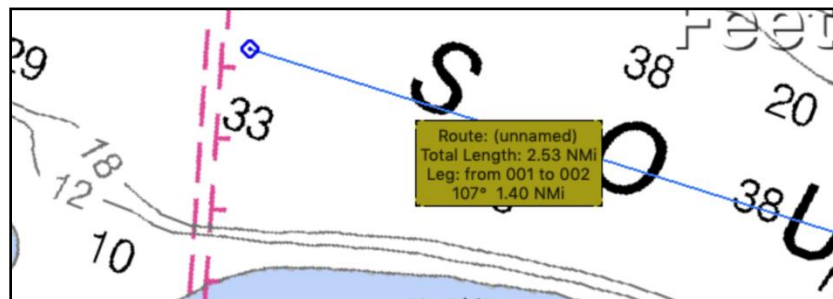
Route information, like waypoint information, is available by positioning the cursor on the route

trace or line and double-clicking the left mouse button. Or you can right click and select Route Properties from the popup menu. The menu window below will appear:



Again, notice this menu allows users to customize or personalize each route by naming the route as well as entering a description of where it begins and ends. Other important information is the distance and heading for each leg, the latitude and longitude of each waypoint and estimated travel time required relative to the speed that is entered under Plan speed.

Users may also get quick route information by hovering the cursor on the route line and reading the pop-up menu.



Interpreting the Route Properties Table

Distance	Plan speed	Enroute	Departure	Time	Color	Style	Width
7.8 NMi	18	25M 54S	12/15/2019	4:09:29 PM	Local@PC	Default color	Default

Leg	To waypoint	Distance	Bearing	Latitude	Longitude	ETE	ETA	Speed	Next tide e...	Description
---		0.2 NMi	104 °M	41° 39.3' N	072° 00.6' W	0M 44S	Start: 12/15/2019 16:09 (Sunset)	18		
1		2.2 NMi	113 °M	41° 39.0' N	071° 57.7' W	7M 17S	12/15/2019 16:24 (Sunset)	18		

A portion of the Route Properties is shown above. The row of boxes across the top show:

Distance: is the Total Distance from the beginning Waypoint to the end of the route and is shown in units selected on the Options Menu. **Nautical Miles (NM)** is the unit used for USPS courses, but inland statute miles is used.

Plan speed: the speed that is planned for this route and is the speed unit chosen in the Options menu, and can be entered with one decimal place, such as 6.8. **Knots** is the unit used for USPS courses, but inland mph is used.

Enroute: This is the expected time to travel from the beginning Waypoint to the end of the route based on the speed shown in Plan Speed. **When the total time is less than one hour, the time used to answer questions about expected travel time should be rounded up or down and written as whole minutes for USPS courses.**

Departure: The departure date and time will not be used in Marine Navigation as the short distances of routes, at one time, caused errors in Estimated Time of Arrival (ETA).

Time: The time shown is the default time taken from the PC's internal clock.

Color, Style, and Width: These options will normally be the default options. Changing these values may be done for information **but returned to default settings before all exams.**

The items within the lower box show:

Leg: This is the portion of the route between Waypoints, starting at the beginning of the route to the end. Normally there will be one less leg than the number of Waypoints.

To Waypoint: If the Waypoints have names assigned, then the name of each Waypoint will be listed in the order of the route from beginning to end. If the route is created using the "point and click" method or waypoints were not named, the software will assign numbers to the Waypoints.

Distance: This is the distance between two Waypoints corresponding to the Leg number shown to the left. The units are as selected in the Options menu, normally Nautical Miles, except for inland use, including tenths of a mile accuracy.

Bearing: This is the bearing between waypoints (see course). **This column will not be used in Marine Navigation unless specified otherwise.**

Latitude: This is the Latitude of the Waypoint expressed in degrees, minutes and tenths of minutes (can be changed) and hemisphere North or South.

Longitude: This is the Longitudes of the Waypoint expressed in degrees, minutes and tenths of minutes and direction East or West.

ETE (Estimated Time Enroute): This is the estimated time to travel from one Waypoint to the next (Leg) of the route based on the speed shown in leg Speed. **When this time is shown in minutes and seconds, the time should be rounded up or down for each leg if estimated travel is required for multiple legs for USPS courses.**

ETA (Estimated Time of Arrival): **This column may not be used in Marine Navigation, unless specified, as the short distances of routes, at one time, created errors in Estimated Time of Arrival.**

Now click on the “Maximize Box”, in the upper right of the Route Properties box, if needed, to show additional data discussed below.

Speed: The speed shown normally should be the same as Plan Speed expressed in Knots or mph and is used to calculate travel time between Waypoints (Leg). Individual leg speeds can be adjusted (slower in narrow channels, etc.) if needed.

Course: This is the course to steer from one Waypoint to the next Waypoint in the route.

Other Items: **Blank columns are not used in Marine Navigation.**


Distance	Plan speed	Enroute	Departure	Time	Color	Style	Width
7.8 NMi	18	25M 54S	12/15/2019	4:09:29 PM	Local@PC	Default color	Default

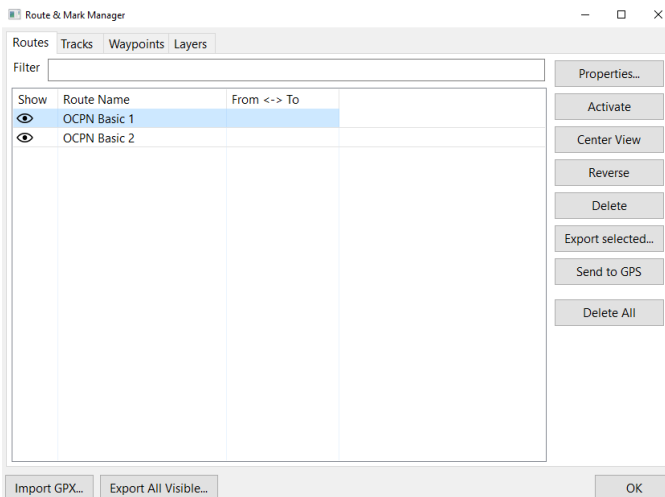
Leg	To waypoint	Distance	Bearing	Latitude	Longitude	ETE	ETA	Speed	Next tide e...	Description
---		0.2 NMi	104 °M	41° 39.3' N	072° 00.6' W	0M 44S	Start: 12/15/2019 16:09 (Sunset)	18		
1		2.2 NMi	113 °M	41° 39.0' N	071° 57.7' W	7M 17S	12/15/2019 16:24 (Sunset)	18		

The Information shown in the red boxes above relate to the location of your vessel, primarily used when using OpenCPN for navigation underway. Due to the short routes used in Marine Navigation, at one time, the use of the vessel may create errors and should be ignored.

The first distance for leg --- is the distance from the current ship position to the first waypoint. You can Right Click NEAR BUT NOT ON the first waypoint and select “Move Boat Here” to minimize this first distance.

Route, Waypoint Housekeeping

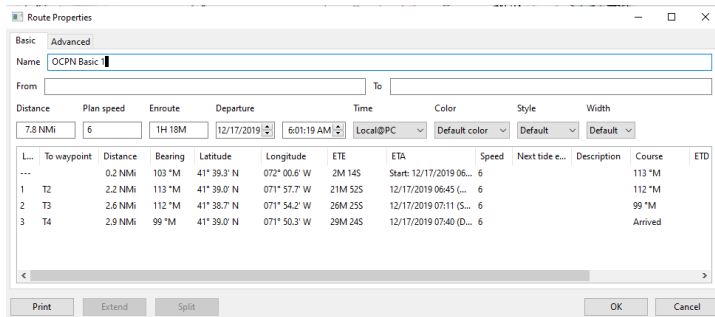
The Route & Waypoints Manager is used for deleting routes or waypoints, exporting-importing, and hiding routes. Users can access this tool by clicking the Route Manager icon  in the vertical tool bar or from the Tools menu.



Named Waypoints are used to create routes in USPS courses to provide repeatable answers from all students. As Routes are created, Waypoints should be named to make it easy to find them later in the Route and Mark Manager. When opened, the window left is displayed.

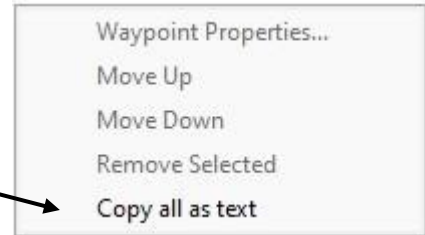
Click the new Show all routes box to show all of the routes available. Double-Click a route, such as OPCN Basic 1, or click Properties button on the right to display the

properties for this route.



The route properties may be printed using the “Print” button in the lower left, that will print the Route Properties, but this printed form is not used in the Marine Navigation course. Instead, use this procedure to make a route properties list for this course:

Right Click on any of the lines in the route and then click “Properties”. Next right click inside the displayed properties box to get this popup. Then click “Copy all as Text” in this pop-up menu.



Now create a blank spreadsheet file in Excel or Open Office, and paste the properties into the A1 cell. After adjusting column widths to improve readability, the file should look somewhat like this:

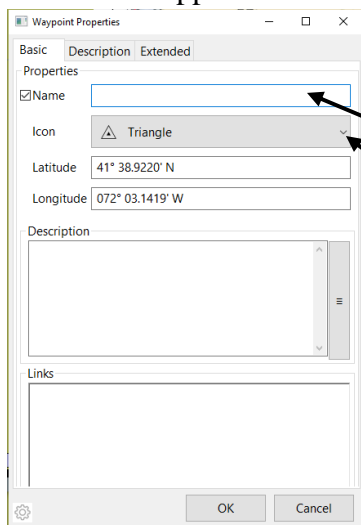
OCPN Basic 1											
Name	OCPN Basic 1										
Depart From											
Destination											
Total distance	7.8 NMI										
Speed (Kts)	6										
Departure	#####										
Time enroute	1H 18M										
Leg	To waypoint	Distance	Bearing	Latitude	Longitude	ETE	ETA	Speed	Next tide	Description	Course
---	T1	0.2 NMI	103 °M	41° 39.3' N	072° 00.6' W	2M 14S	Start: 12/17/2019 06:00	6			113 °M
1	T2	2.2 NMI	113 °M	41° 39.0' N	071° 57.7' W	21M 52S	12/17/2019 06:45	6			112 °M
2	T3	2.6 NMI	112 °M	41° 38.7' N	071° 54.2' W	26M 25S	12/17/2019 07:11	6			99 °M
3	T4	2.9 NMI	99 °M	41° 39.0' N	071° 50.3' W	29M 24S	12/17/2019 07:40	6			Arrived

Save the file for use later. The columns and rows can be rearranged to provide a more usable form, such as the recommended format shown below.

OCPN Basic 1							
Name	OCPN Basic 1						
Depart From							
Destination							
Total dista	7.8 NMi						
Speed (Kt)	6						
Departure	#####						
Time enro	1H 18M						
Leg	To way	Distance	Course	Latitude	Longitude	ETE	Speed
---	T1		113 °M	41° 39.3' N	072° 00.6' W		6
1	T2	2.2 NMi	112 °M	41° 39.0' N	071° 57.7' W	21M 52S	6
2	T3	2.6 NMi	99 °M	41° 38.7' N	071° 54.2' W	26M 25S	6
3	T4	2.9 NMi	Arrived	41° 39.0' N	071° 50.3' W	29M 24S	6

This form can be printed as needed and provides a valuable record to use during navigation of the route. Creation of spreadsheet files of route properties may be required for the Marine Navigation exam.

Waypoint properties were briefly discussed above. One way to quickly access Waypoint Properties is to double-click when the cursor is pointing to a waypoint. A Waypoint Properties screen will appear as shown below.



When this pop-up is shown, the name can be added by typing in the top line; the icon can be changed by clicking on the down arrow in the icon box and select one of your choices, as instructed during the course; and the Latitude and Longitude can be changed by deleting all or part of the numbers and inserting the new numbers. Click OK to save the changes. The name of the waypoint and any changes to the icon will show on the chart (if “Hide Waypoint Names” in the route popup is not enabled) and in the Route Properties.

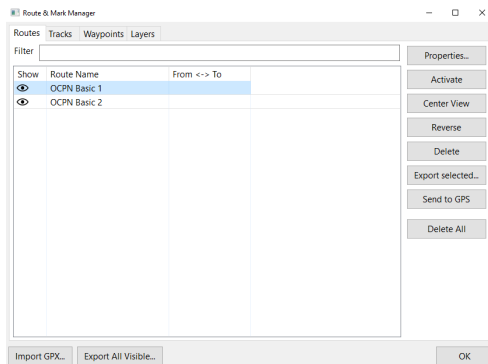
Unnecessary routes can be deleted by either placing the cursor on a route leg, right clicking and select “Delete” or while in Route & Mark Manager, clicking on a route and selecting “Delete”. In either method, users will be asked to confirm that the route should be “Deleted”.


Unnecessary waypoints can be deleted by Right clicking on a waypoint symbol and selecting “Delete”. **The waypoint is deleted without asking to confirm deletion! Be careful when deleting waypoints to minimize mistakes!**

One of the advantages of using OpenCPN or other computer charting programs is that you can export and import route data to and from other computers or to navigation systems. The file format generally used to import, and export routes is the GPX format, (GPS eXchange Format). To import or export the GPX files, they must be saved in a file on the computer for access. For navigating with a multifunction display using the GPX data, the GPX file will most likely need to be saved to a micro-SD card to be imported to the MFD.

To save a GPX file, select a route from the Route & Mark Manager list and click “Export selected Routes.” In the window that appears, name the file and select the folder where it will be saved. Click “Save”. The route is now stored on the computer for future use, sending to another boater or to a navigation system. **This GPX export may be used for sending student work to the instructor or grader for checking.**

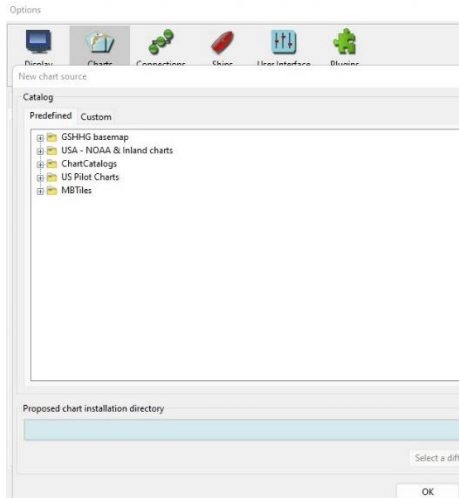
To Import a route, click the Import GPX button in the lower left corner. Find the desired GPX file, that must be stored on your computer, select the file and then click “open”. The route should now appear in the Route & Mark Manager list and on the chart.



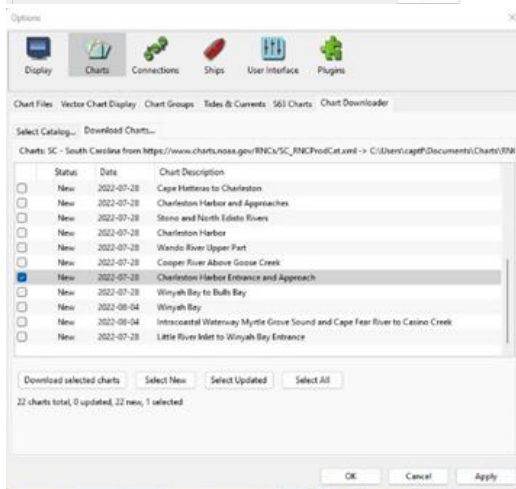
Sometimes, the chart screen may get crowded if a lot of routes have been created. One method to simplify the chart display is to “Hide” routes. When “Hidden”, the route information is not lost, but it is not displayed. With the Route & Mark Manager open, as left, click on the eye” icon  and a red X will appear over the eye icon indicating the route is hidden from the chart display.

Downloading NOAA Charts

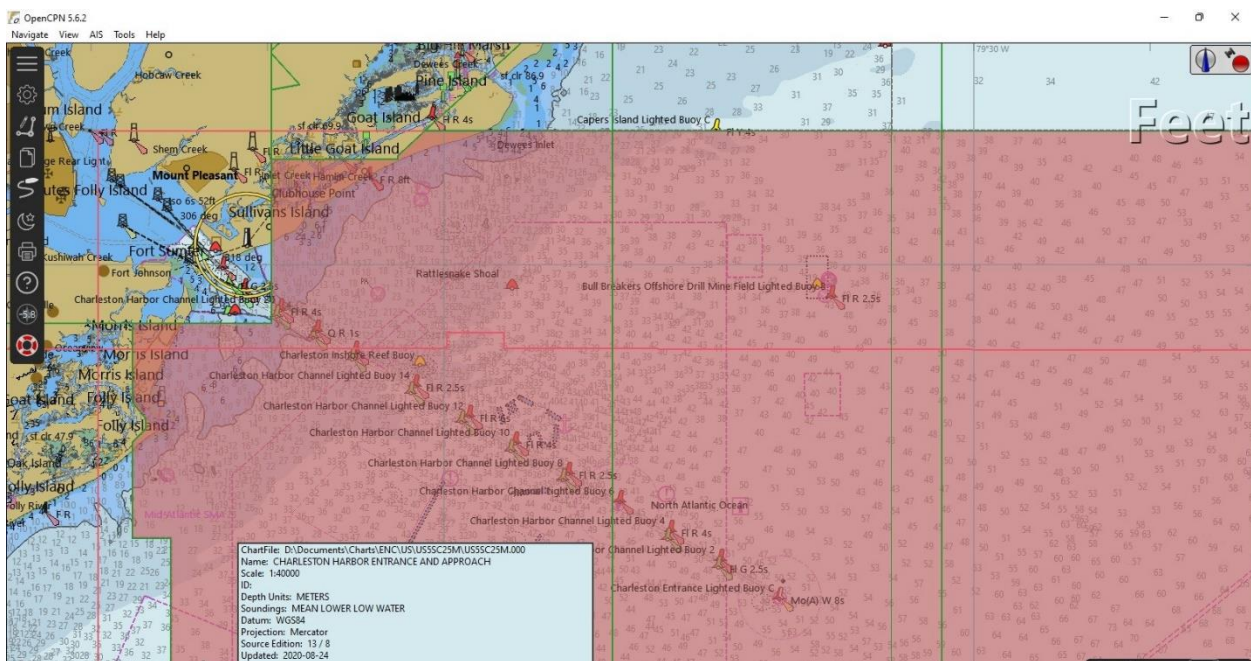
The OpenCPN Chart Downloader provides a quick method for acquiring many charts. Free NOAA charts cover the US and parts of the Bahamas. Free USACE inland IENCs cover inland rivers. These charts can be easily updated. Foreign, S63, charts require a fee and an access code. Users must be connected to the Internet for the Chart Downloader to work. To access this function, click Options => Charts and then the Chart Downloader tab. Next you will need to access the chart Catalogs screen.



Click the Add Catalog button and this left screen should appear. Click the USA – NOAA & Inland Charts and then the ENC or RNC as needed folder and then by the States folder and a list of the states will appear. You can download all coastal charts or download individual charts. After you add a catalog, you will be asked to (Please update first), highlight the catalog you need and click “Update”. Now in the state chart folder click “Select All” or “Select None” as needed then click charts needed and click “Download selected charts” and after the download finished then click “Apply” and then “OK”.



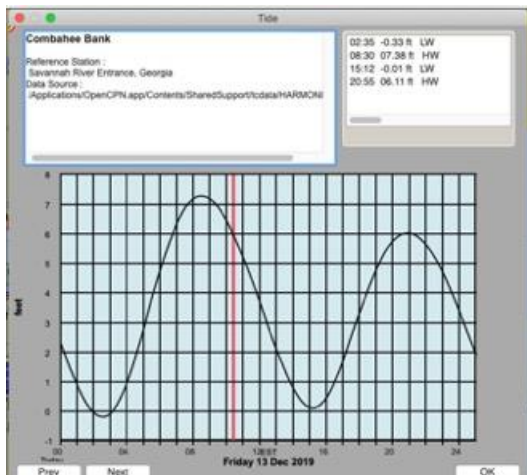
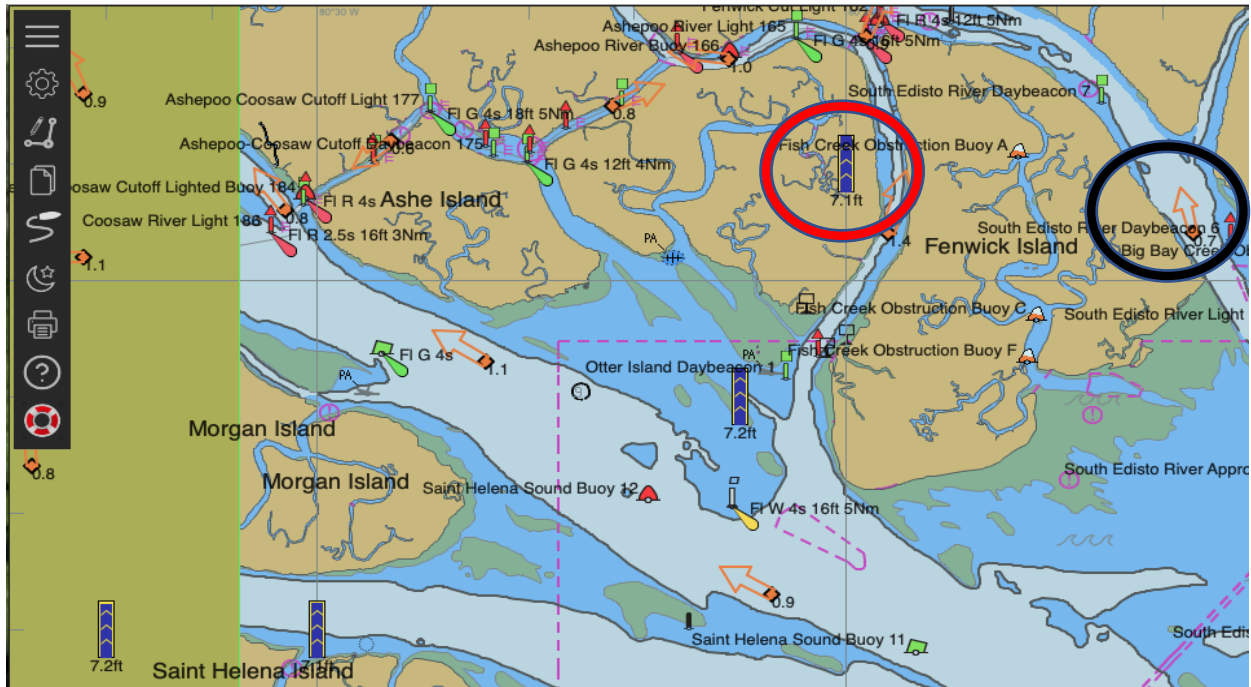
In preparation for the Charts Basics Practicum, students should download the “Charleston Harbor Entrance and Approaches” chart. Scroll down and click SC-South Carolina and OK. In the list of charts that appears in the bottom window of the Chart Downloader screen, select the Charleston harbor chart and click the Download selected charts button. After the download, click Apply and OK. If you scroll over to South Carolina and zoom properly and hover on the correct bar at the bottom of the screen it will highlight the chart selected as shown below.



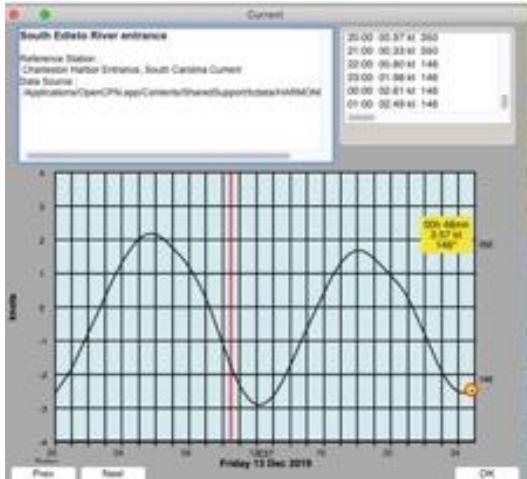
Since paper charts and RNCs are going away we suggest you use the ENC as shown here instead of the RNC for the Charleston Harbor area.

Tide and Current Information

OpenCPN includes Tide and Current information for planning and navigating. Click the lower right hamburger and then beside “Tides” and “Currents”. Once selected, tide symbols, red circles, and current symbols, black circles, appear on the chart as shown below.



The tide symbols show the state of the tide cycle at the time. Right click the tide symbol for 24-hour tide information as shown left.



Current symbol points in the direction of the flow. Right click for 24-hour information as shown left.

For inland river charts add the IENC U37 Product Catalog and the IENC Buoy Products Catalog and then click Download Charts and select the chart you need like “Tennessee (Donaldson Light to Head of Navigation) river miles 606.0 – 652.0” for the Knoxville area. Now select the IENC Buoy Products Catalog, click Download Charts and download “3UABUOYS” for the CG Buoy locations.

If you load the Knoxville chart mentioned, buoys and set four range rings you should see the chart below when you zoom in on Knoxville. I have a route, blue line loaded.

If you click on the **okm** mileage icon the river mile will be indicated. Daymarks and daybeacons will have a river mileage indicated on the chart.

If you right click on a bridge, you may see a line drawing, showing clearance information, especially for sailors with tall masts.

