

## Introduction:

These are optional review questions and answers for the USPS release of the Electronic Navigation course. A thorough understanding of the facts and concepts covered is suggested for students before taking the USPS course completion exam.

This US release *uses* the Text developed by the Canadian Power and Sail Squadrons (CPS/ECP), and their PC-based electronic learning tools, including the chapter quiz module.

Each AMERICAN final exam question may offer several multiple choice answers that seem right and you really have to think about the options to choose the right one. An important difference from other USPS exams is that the questions DO NOT come from chapter homework or the quiz module, but are fresh questions that students have not seen before.

The US release of this course eliminated Chapters 13 and 15 from, and added Appendix 8 to the material that will be on the final exam. The final exam questions have been tailored accordingly.

As noted in the Instructor Notes, there are questions in the final exam that relate to the Canadian text's Appendix 8 about AIS, even though elsewhere in the text it says the material in the appendixes will not be in the exam.

Conversely, no exam questions have been derived from Chapters 13 or 15. But be warned that certain topics in Chapters 13 and 15 are also covered in other chapters, and as such may be in the exam.

Below is a very thorough set of RECOMMENDED review questions and answers that cover our final exam subject matter in detail.

## Chapter 1. Introduction to GPS

1. What do the letters GPS stand for?

Answer: GPS is an acronym for the Global Positioning System. It was originally designed and built for the U.S. Military.

2. Do other countries have GPS-like systems?

Answer: Yes, Other countries have similar systems.

- a. GLONASS is from Russia.
- b. Galileo is the global navigation satellite system (GNSS) that is currently being created by the European Union (EU) and the European Space Agency (ESA)

3. What are the parts of the Global Positioning System?

Answer: All satellite based navigation systems have three major components:

- a. The space segment or satellites
- b. The ground segment or control stations
- c. The user segment or the devices that are installed in vehicles and vessels

4. How does GPS work?

Answer: GPS units depend on satellites to provide information that enables the receiver/computer device to compute the device's location. Doing this multiple times per second generates data points that enable generation of distance, speed, time and direction. Basically, GPS is used to find your location (position) and the information above, and, to provide a precise way to go from your current position to a second (and more) position.

5. Are all GPS devices the same? Are there GPS standard displays?

Answer: GPS device manufacturers follow no standards for definitions of terms or for the presentation of computed results, thus each manufacturer's device may use terms and display items differently. The only common denominators are time and positions. Settings may enable the user/owner to choose what units and displays the device shows.

6. What is navigation?

Answer: Navigation is defined as the science of finding your way from one position to another.

7. Is it required to carry paper charts in the USA?

It is recommended but NOT REQUIRED.

8. What are common manufacturers' definitions of navigation terms?

Answer:

- Heading: the direction your boat is pointing (although some GPS manufacturers will say it is the direction you are travelling)
- Course: the direction you are travelling or want to travel
- Track: the path you have been taking (breadcrumb trail)
- However, some GPS manufacturers state track is where your boat is going (like a train)

9. Which government agency in the United States is responsible for marine charts?

Answer: In the United States, the government agency responsible for both paper charts and free digital charts is the National Oceanic and Atmospheric Administration.

10. What kind of charts do the GPS devices use if they have the capability to display charts?

Answer: Chartplotters, computers, and tablets/smartphones use digital charts. Paper charts are just that, charts printed on paper or plastic.

11. What are the advantages of raster or vector charts?

Answer: Raster charts are identical to paper charts so no relearning or interpretation is needed. Vector charts are produced in layers so users can turn on and turn off (via settings) how much information is presented. For example, text and onshore details can be turned off. Depth contours can be customized. Marinas and other info can be included or not.

12. How many satellites does your GPS need to receive to find only your latitude and longitude? How many for altitude?

Answer: Your GPS needs to receive three satellites to find only your latitude and longitude. Four (4) are required to find altitude (elevation). Usually, a GPS will 'see' and receive signals from more than four.

## Chapter 2. How to use a GPS

## 1. Are GPS devices simple?

Answer: GPS devices are sophisticated electronic units and need to be protected and cared for like all sensitive electronic instruments.

## 2. When hooking up a GPS antenna to the chartplotter it is or is not ok to cut the cable?

Answer: it is not ok to cut the cable. Coil up the excess and hide it within the boat.

## 3. How quickly will my GPS find my location?

Answer: When turned on for the first time, tens of seconds to a minute or more may go by while the device self calibrates finds satellites and performs computations. This is a cold start. When recently used, a GPS may start up more quickly as it has its location in its memory. This is called a warm start and may take much less than a minute down to only seconds for full functionality.

## 4. How do I interact with my GPS?

Answer: Each GPS manufacturer provides a display and user interface (control buttons). They may vary considerably from one brand to another. A set-up or settings mode may allow you to customize units, displays, and symbols to your personal liking. This is true for example of: distances, positions, local time, true or magnetic directions, depths and speeds. Display icons and colors may be selectable as well.

## 5. How can I learn how to use my GPS?

Answer: The best approach for familiarization with a GPS is to read and follow the user/operational manual. You may find YouTube videos or instructor taught courses that explain how the devices work, too.

## 6. What is the MOB button?

Answer: Almost all GPS units have an MOB (man overboard) button. When pressed the immediate position is saved and all other navigation services stopped so the person in the water can be returned to and rescued.

## 7. What about those small, handheld GPS devices?

Answer: Small, handheld GPS units have become more capable. Many offer small screen with charts or chart like displays often in color.

## 8. What about smartphones and tablets?

Answer: Many smartphones and tablets now have GPS devices built into them and function well as GPS devices.

## 9. What about the larger, dedicated GPS units?

Answer: Larger GPS devices may show raster and/or vector charts, bottom topography, images of the devices surroundings (based on memorized photographs) and many more optional details.

## 10. What is the chart datum and why is it important to me?

Answer: The chart or map grid must be selected correctly if the positions computed within the device are to line up with paper charts and/or the real world geography. Your GPS chartplotter should be set to the same datum as your paper charts.

## 11. What are the primary chart datums in the USA?

Answer: In the USA NAD83 and WGS84 are basically identical and interchangeable.

## 12. What is interconnectivity and why is it important?

Answer: GPS devices may be connected to other devices such as radios, AIS, computers, smartphones, and tablets. Interface protocols may have to be selected. Typical protocols are NMEA 0183, NMEA 2000.

13. What is the NMEA-2000 plug and play standard for and what is it called.

Answer: NMEA-2000 is a standard that enables multiple devices to be connected into a network, the network that connections are made to is known as the backbone.

### Chapter 3. Types of GPS Units

1. What different kinds of GPS devices are there?

Answer: There are handheld, bracket or cradle mounted and permanently mounted devices. Handhelds are powered by batteries and independent from you boat's electrical system. This makes handhelds good backup devices.

2. What options are available to the boater?

Answer: There are many different device sizes and screen size options. More sophistication and larger screen sizes usually come at higher cost.

3. How else can I get access to GPS?

Answer: There are smartphone, tablet, laptop and even desktop computers either with built-in GPS units or capable of interfacing with one wirelessly or via cables.

4. Why are larger screens better?

Answer: Larger screen sizes are better for chartplotters or split screen (screens showing charts, radar, AIS and depth sounders or fish-finder display as each function takes up screen "real estate" and the size is important for readability.

5. Are all devices similarly priced?

Answer: More capabilities and larger screens come with higher prices.

6. Can anyone use a GPS without any training?

Answer: Yes, but GPS navigation proficiency depends on user knowledge of navigation fundamentals.

7. What does the GPS device's internal computer do?

Answer: GPS units perform computations similar to dead reckoning with the exception that satellite-based positions are used as the onboard device moves over the water rather than extrapolated or estimated position. And they do this multiple times per second providing the boater with highly accurate positions and time-speed-distance-direction computations.

8. In the USA is there a standard for selecting units of latitude, longitude and depth?

Answer: There is not but it is recommended to use degrees, minutes, tenths of a minute, and depths in feet

## Chapter 4. Waypoints and Routes

### 1. What are waypoints?

Answer: Waypoints (WP) are positions selected by the boating user to denote desirable locations, enroute checkpoints, destinations, in water dangers, and other user-describable and definable features.

### 2. What information does the boater get from using WP and selecting one via GO TO or including the WP in a Route?

Answer: The boater will see the bearing to the WP, the boat's speed and distance to the WP. There may also be an estimated time enroute (ETE) or estimated time of arrival (ETA), and the boat's heading which may be different from the bearing.

### 3. How are WP named?

Answer: When a Waypoint is selected / designated, it will receive a default name and/or number. Most devices and software allow the user to name them. WP may be named by the user using any personal system that helps identification and/or memory of the WPs.

### 4. What are routes?

Answer: At least two (2) waypoints can be joined to form a route. Route are paths the user can navigate the boat along (the same as a course). Multiple waypoints may be joined to form a complete route with start, several checkpoints or turns, and a destination. Thus, a route is a path with two or more waypoints. Routes are collections of waypoints (minimum of two) that enable your GPS device equipped vessel to safely and efficiently navigate from one WP to another or along an entire string of WP.

### 5. Why are routes useful?

Answer: Routes may be named and saved for reuse.

### 6. How do you get or generate routes?

Answer: Routes may be set up by naming a new route and selecting/using existing waypoints to build it. Another method using graphical methods enables the user to advance the cursor over the digital chart from any starting point and selecting safe stepping stone positions as waypoints. These waypoints will then be associated with the current route and may be available for use as stand-alone waypoints or for reuse and insertion into additional routes.

### 7. What about going back along the same route?

Answer: Routes may be reversed or inverted enabling following the route in the opposite direction.

### 8. How does a boater select WP?

Answer: WP may be entered as latitude/longitudes (not recommended) or graphically via a cursor moved over the desired position and pressing a mark/save/enter button, and also when the vessel is over a desired position again by pressing a mark/save/enter button.

### 9. What does WP and Route management mean?

Answer: WP and routes may be entered, saved, edited, named and renamed. They may be transferable to other devices.

### 10. Do all manufacturers enable route building and management the same way?

Answer: Different manufacturers enable waypoint selection and route construction different ways. The better devices and/or apps provide flexibility and several methods for the user to use.

### 11. How many waypoints and/or routes can I store?

Answer: It depends on your device and software. Chartplotters come with limitations on the number of waypoints and routes that may be stored. More modern units generally provide adequate memory for many waypoints and routes. Laptop and desktop computers enable much more computer storage.

12. What kind of things can I store with computer-based navigation software?

Answer: Laptop and desktop computers usually enable far more storage for waypoints and routes and may add additional fields for notes, pictures, extensive waypoint names, and so forth.

13. Is it safe to put waypoints directly on top of buoys and beacons as we did in basic navigation courses?

Answer: No, users should never put waypoints used for navigation directly on top of an aid to navigation. In some circumstances such as limited visibility or night cruising, doing so may cause your boat to strike one. However, when waypoints are used to mark hazards, they should be put as near to the safe edge of navigable water as possible.

14. Is there an order to the way waypoints are entered into a route?

Answer: The use of waypoints in routes depends on the waypoints being entered in the correct order of progression as your boat moves along from one waypoint to the next. Sometimes routes may be reversed and used to return in the opposite direction. Care should be taken by reviewing all routes in advance of starting one to ensure the direction and sequences are what you want.

15. How much can I depend on my GPS?

Answer: Prudent navigators will not depend solely on a single GPS device and will confirm progress and positions by monitoring visible aids to navigation, landmarks, and/or radar contacts. Best practices require that you carry a second or even third GPS device should there be equipment or electrical system failures or differences in position reporting.

16. What is a highway screen?

Answer: Highway screen images show your vessel moving along a virtual highway with your course in the middle (the centerline) and your user-selected safe passage boundaries on the outer edges of the highway. The display gives the impression of a vehicle driving down a highway over the centerline.

17. What happens if my vessel drifts off the centerline?

Answer: Some GPS devices provide alarms which warn the navigator when the vessel crosses the boundary and leaves the pre-planned highway.

18. What kind of alarms are there?

Answer: Alarms may be by audible sound, or flashing screen images, or both. Boundary alarms may also be present as cross track error or course deviation indicator views. These are numbers describing the distance of your vessel from the course line and on which side of the line your vessel is located.

19. Why are these highway screens and XTE displays useful?

Answer: Highway screens and cross track error views are particularly useful and important for precision navigation through dangerous channels, or to avoid getting off course during times of limited visibility and night operations.

20. What is the most common GPS error?

Answer: It is human error: inputting coordinates incorrectly or choosing incorrect waypoints or not proofing the safety zones and depths associated with a route.

21. Is the GPS compass reliable?

Answer: Only when the boat is moving forward. When stopped, the GPS may provide erroneous directions.

## Chapter 5. Navigation

### 1. What are some useful Definitions?

Answer:

- a. Bearing: a direction measured from your boat toward a buoy, beacon, landmark, destination, another vessel, etc. Bearings can be taken in true, magnetic and relative degrees depending on units chosen and user preference.
- b. Track: the path your boat has actually taken (also known as the breadcrumb trail), or, some manufacturers use this to mean the track you plan to take, almost the same meaning as course and similar to a train following a track.
- c. Heading: the direction your boat's centerline is pointing toward.
- d. Course: the direction and line you want your boat to move along from point A to point B
- e. Course Made Good (CMG): the net result of your boat's movements from point A to point B (for example in sailboats the CMG does not include tacking paths)
- f. Speed Made Good (SMG): the net result in speed of total distance divided by total time (does not include tacking paths.)
- g. Velocity Made Good (VMG): the instantaneous speed your boat is making toward its destination; useful in sailboats for optimizing tack headings
- h. Estimated Time Enroute (ETE): how long it will take for you to travel from your starting or current position to the destination
- i. Estimated Time of Arrival (ETA): what time it will be when you arrive at your destination.
- j. All definitions need to be checked in your device-specific operator's manual.

### 2. What is speed through the water?

Answer: It is how fast the boat is moving with respect to the water and not the ground. Comparing speed through the water to speed over the ground may indicate that currents and/or winds are influencing your boat's progress.

### 3. What does the GOTO or GO TO button do?

Answer: GOTO: is an operation where the user picks a waypoint or destination and presses the GOTO button. The device then computes the direction and distance to the WP and time enroute or of arrival if the boat is underway.

### 4. What is Cross track error and correction?

Answer: Cross track error (may be called CDI or XTE) is how far your boat is away from your chosen course line. Correction is accomplished by steering the vessel in the direction of the course line; the severity of the error may assist determining the severity of the needed correction. Cross track error may indicate the severity of wind and current acting to displace your boat from your desired course. Severe displacement may put your boat into unsafe waters. Bird-dogging or lazy chasing of the bearing to the WP may cause your boat to cross into unsafe waters. Careful following of the highway screen or route or minimizing the XTE or CDI will work to eliminate this risk.

## Chapter 6. The Electronic Chart

## 1. What are electronic charts?

Answer: Charts that display on chartplotters, computers, tablets, and smartphones. Electronic navigational charts may be denoted ENC.

## 2. How are they installed and stored on my device?

Answer: All ENC are digital charts that are stored in computer memories or on chips inserted into chartplotters and computers.

## 3. Who produces ENC in the USA?

Answer: The responsible agency for charts in the USA is the National Oceanic and Atmospheric Administration or NOAA, a branch of the Department of Commerce.

## 4. Where can I obtain ENC?

Answer: ENC are free on the internet. Paper copies made from them are available by private companies. Private charting companies make and sell raster and vector charts. Not all of these companies or their chart products are quality controlled by the government. Thus, caution is necessary as the risk of errors in some charts may exist.

## 5. What are raster charts?

Answer: Raster digital charts are scanned images (basically photocopies) of paper charts. Any zooming that takes place does not alter the density of information and printed items and lettering will zoom to whatever zoom factor is selected making them too small when zoomed out and too large when zoomed in.

## 6. Where do I look on a chart for important information about the chart?

Answer: All charts whether paper or digital should provide chart numbers and title block information.

## 7. What are vector charts?

Answer: Vector charts are digital charts that are made by digitizing information on paper charts or from new information. Vector charts are made by computers programs that read information in built in "lookup tables" (invisible to the user) and turn the information into chart images by internal mathematical formulas. Vector charts are created by professionals (cartographers) using special digitalization software.

## 8. What is the difference between raster and vector charts?

Answer:

- Raster charts require huge amount of memory and storage memory as they are essentially pictures of paper charts.
- Vector charts use efficient stored memory files of tables and mathematical formulas to build the chart images from the tabular information. Raster charts take at least 8-times more memory than vector charts.
- Vector charts take up less computer storage.
- Vector charts are frequently built in layers so users have options as to what display items to turn on and off.
- Vector charts may allow you to select your preferred depth unit (feet, meters, fathoms) rather than settle for a paper chart-derived unit that cannot be changed. The depth datum (reference for sea level or low tide) may be selectable with vector charts.

- Vector charts are more expensive to produce and cost more to the navigator consumer. The advantages generally outweigh the cost.
- Optional layers on vector charts may provide information on marinas, vessel traffic lanes, buoys and beacons, interpolated depth contour lines.

9. What is Chart # 1?

Answer: Both the USA and Canada issue booklets titled Chart 1 in which all of the regions and charts of different scales for them are listed and described. Chart 1 also provides definitions and descriptions of the symbols used on the charts.

10. What does ECDIS stand for?

Answer: ECDIS stands for Electronic Chart Display and Information System. This is a generic term for the systems used to display electronic charts for navigation purposes.

11. What is a pixel?

Answer: Pixel is an abbreviation for picture element. This is the smallest unit of information available on a digital chart and is a limiting factor for zooming in with raster charts. When zoomed in too much the image will become blocky and the pixel squares will begin to show. Information cannot be added or subtracted from pixels.

12. What are the layers available in vector charts?

Answer: Vector charts may be produced with digital "layers". This enables the user to select what is shown and to see fonts and chart items that scale as the chart is zoomed in or out. More information is usually available than on raster charts and you may tailor it.

13. Who is responsible for charts in the United States?

Answer: the National Oceanic and Atmospheric Administration provides digital raster and vector charts at no cost. Updating the charts requires downloading the most recent set. Older chart sets should be deleted from your chartplotter and/or computer to avoid confusion.

14. What is the World Chart (sometimes called the Base Chart)?

Answer: Most chartplotters and some laptop navigation software only provide free world charts or base charts. These are provided for the user to review and select the available (usually for purchase) chart sets that you will need for your particular boating region and areas. World and Base charts are not intended for navigation.

15. Can I navigate using World charts or base maps?

Answer: World charts or base maps do not provide any details and cannot be used for navigation.

16. What is a major advantage of vector charts?

Answer: Vector charts consume less chartplotter and computer memory than raster charts.

## Chapter 7. Electronic Navigation

1. What is the biggest advantage of using a chartplotter or computer navigation program on your boat?

Answer: The real time display of your boat in the electronic chart image. With this the user instantly sees the waters, depths, hazards, and landforms around him. With additional features like radar and AIS, the user also sees objects not visible to the naked eye especially in conditions of limited visibility and in the case of AIS the vessels nearby along with their name, size, speed, direction, destination, call sign, and even pictures of the other vessels.

2. What are screen orientations and why is this important?

Answer: Different navigators choose different screen orientations. There are three orientations:

- a. North up – North remains pointed at the top of the screen no matter what heading the boat is taking
- b. Course up – the direction of the intended course is pointed at the top of the screen
- c. Heading (Track) up – the direction that the centerline of the boat is pointing is pointed at the top of the screen. This view is identical to the normal radar heading up view.

3. What does it mean to zoom in and out and why is this important?

Answer: When using chartplotters without a split screen, users should frequently zoom in and out to see both close in and “big picture” views. With vector charts this may make the difference between seeing submerged dangers or not seeing them. Use your zoom buttons or pinch your touchscreens.

4. What are waypoints?

Answer: Go back and review the questions and answers for Chapter 4.

5. Can I use buoys and beacons as waypoints?

Answer: Aids to navigation (ATON) such as buoys and beacons should not be chosen as waypoints because of the danger of striking them during limited visibility conditions. Always pick a waypoint nearby but to the seaward or safer-water-side of the ATON.

6. What are routes and how can they help me navigate?

Routes are made up by stringing together waypoints from a start WP to a finish WP with as many intermediate WP as are necessary to ensure safe and efficient navigation.

7. Is there a name for the distance between waypoints?

Answer: The distances between WP are named legs.

8. How can I see, use, edit and manage my routes?

Answer:

- Most chartplotters will show a table of each route showing the WP used, the leg distances and bearings between the WP, the cumulative distance ending with the total distance for the route.
- Routes are editable. WP may be added, deleted, and moved. Care should be taken when doing this “on the fly” as the chance for error will increase.
- Routes may be navigated in both forward and reverse directions, care should be taken to select the correct direction when starting.
- If starting from a position other than the beginning WP, care must be taken when initiating the route as the electronic navigator inside the unit may think you want to return to the first WP. Similar care is needed when a route is broken off intentionally and restarted from intermediate positions.
- As the route is followed, WP will appear in front and when arrived at, an optional sound or flashing display may indicate arrival. At that time the next WP will become active and the distance and bearing toward this new WP along with any ETE or ETA will update as well.

9. What will I see as my boat follows the route?

Answer: You will see your boat’s image follow the route line drawn by the chartplotter on the electronic chart. Also, you may see boxes with information such as:

- Direction to steer

- Bearing and distance to the next waypoint
- Cross Track Error
- Total distance covered
- VMG = Velocity Made Good
- SOG = Speed Over Ground
- ETA = Estimated Time of Arrival
- ETE = Estimated Time Enroute

Chapter 8. Chapter 8 is the Canadian chartplotter exercise. This may be skipped and your instructors may substitute a USA local waters version.

#### Chapter 9. Limits of Accuracy

1. What is the guaranteed accuracy of GPS?

Answer: The historical “guaranteed” accuracy of the civilian GPS system is 328 feet or 100 meters, 95% of the time. (That is 5% of the time it could be worse than that.)

2. What is today’s standard accuracy?

Answer: Standard GPS accuracy is 50 feet or 15 meters. Most modern 2005 and newer units are Wide Area Augmentation System enabled and provide accuracy to 10 feet or 3 meters.

3. What is DGPS and what did it do?

Answer: DGPS or differential GPS was an early version of improving accuracy from 328 feet to 10 to 15 feet. This was superseded by WAAS and is no longer used.

4. What is WAAS and how is it important to me?

Answer:

- WAAS stands for Wide Area Augmentation System
- Three special satellites are located over the equator
- They receive signals from about 25 ground stations
- The satellites rebroadcast the correction signals

5. How do I know if I have WAAS and can use it?

Answer:

- If your GPS has WAAS (most new ones do) they receive the WAAS correction signal
- WAAS provides an accuracy of better than 10 ft (3 meters) (That is your Position plus or minus 10 feet)
- Three WAAS satellites can be received over most of the Western Hemisphere
- WAAS is significantly better than the older DGPS system

6. Which factors can affect my GPS position?

Answer:

- Satellites being slightly away from where they are supposed to be
- Atmospheric conditions
- Electrical charges and lightning
- Solar flares

- Multipath phenomena
- Most importantly, the geometry of the satellites being used by the onboard GPS device.

7. What is DOP?

Answer: Dilution of Precision (DOP) is an indicator shown on some GPS devices that the satellites being used are not in positions optimal for best accuracy. This can also result from choosing a poor location for mounting your devices GPS antenna. DOP should be a small value. A large value means your computed position may not be as accurate as you think it is.

## Chapter 10. Enhanced Chartplotters and Data Integration

1. What is data integration?

Answer: Connecting multiple devices together and displaying various data as overlays on your electronic charts. Typical overlay data includes radar, sonar, AIS, fluxgate compasses, VHF radios and autopilots.

2. Can I overlay radar returns on my chartplotter? What should I be concerned about?

Answer: Chartplotters and computers that integrate (or overlay) charts and radar images in the same window require that both images be set to the same scale so the images overlay properly

3. Why is data integration useful?

Answer: Data integration lets you see at a glance many different data streams at once, for example, as your boat progresses along your route you also can see radar returns, water depths, and AIS information about other vessels nearby.

4. What else can be integrated?

Answer: With the right sensors your chartplotter can also be an instrument panel and show engine and tank information, weather information, etc. Some units even allow you to control your music systems.

5. What if my chartplotter loses its GPS fix but still is turned on and shows a compass direction?

Answer: The loss of a fix may be due to satellites obscured by buildings, cliffs or trees, or indicates a failure of the GPS processor. The compass direction may come from a connection to a flux gate (also known as an electronic) compass.

## Chapter 11. Tablets.

1. What is a tablet?

Answer: A small hand held but mountable computer that is battery powered and portable. Examples are Apple iPads and Samsung Android tablets. There are many more from other manufacturers.

2. What are tablets good for? Can I use my tablet for navigation? Are all tablets the same?

Answer: Tablets usually belong to a family of operating systems. The most frequently encountered are Apple's iOS, Google's Android, and Microsoft's Windows operating systems. Software that runs on one operating system may or may not run on another operating system. Tablets do make excellent backup navigation systems.

3. Are all tablets and navigation apps equally good?

Answer: Tablets are highly versatile and can be used for multiple functions. Some tablet navigation programs are as high quality as those found in dedicated, stand-alone chartplotter. Others are not and users are cautioned to find out before using their tablets for navigation.

4. How can I connect my tablet to other computers, chartplotters and instruments?

Answer: Tablet connectivity to other computers, chartplotters, radars, and other devices may be via WiFi, via Bluetooth, and/or via USB cables. Connectivity is tablet specific.

5. What can I transfer between my tablet and chartplotter or computer?

Answer: Tablets enable the transfer of charts, waypoints, routes and other files to and from computer via various means. One method is via email attachments, another is via a cloud program, yet another is via a program call a file manager that resides on both the tablet and computer thereby enabling the transfer of data between a tablet and a computer and in some cases to stand alone chartplotters.

6. Will all tablets allow navigation information transfer?

Answer: Again, some computer-based and tablet-based navigation software programs may enable transfer of data, charts, waypoints, and routes to chartplotters either wirelessly, via memory cards, or via USB cables. You need to know your tablet, your apps, and your other chartplotter/computer.

7. What else can I use my tablet for?

Answer: Tides and currents, weather, storage of logs and manuals, boater reference guides, and much more.

## Chapter 12. Cruise Planning at Home

1. What is another great advantage of electronic navigation?

Answer: The ease of planning and simulating a cruise at home and then transferring all the information to your boat's chartplotter. Similarly, after the cruise you can transfer the data from the chartplotter to review at home.

2. How can I connect my chartplotter to my home computer?

Answer: Many chartplotters can be connected to computers with one or more of the following.

- USB cable
- SD cards
- Proprietary chips with a reader
- WiFi
- Bluetooth

3. Can I take my chartplotter home?

Answer: Yes, if it is portable and you have a power supply for it.

4. Are there other ways to plan between home and the boat?

Answer: Yes, most tablets use navigation "apps" that enable chartplotter-like navigation and connect to onboard, permanently mounted chartplotters via WiFi or Bluetooth. All navigation information and sometimes chartplotter control can be transferred bidirectionally and exercised.

### Chapter 13. Emulators – THIS CHAPTER IS NOT TESTED

1. What are emulators? What can I do with one?

Answer: An emulator works similarly to a simulator, that is, shows you what a device looks like and how you can input to it and what your inputs do to it, in other words it's like having the device run on your computer without buying the device. Some manufacturers provide emulator software so prospective buyers can try out and "exercise" the device they are considering purchasing before they buy it.

### Chapter 14. Chartplotter Features

1. How can I learn more about my GPS?

Answer: Take courses like this one. Read the manual that came with it. Look up YouTube videos or surf the web for tips and trick for your specific device.

2. What do I need to be aware of?

Answer: There are no national standards. Each manufacturer uses terms and displays information in their own unique way. Understand that the data displayed comes from charts and government sources and has to be refreshed – annually is preferred. Photos and depth contours may change. Hazards may change. Tides and currents may not be as depicted.

3. What is MOB? How do I use the MOB button?

Answer: Almost all known GPS devices and chartplotter will react when a man overboard (MOB) button is pressed by immediately storing the position and asking for additional input. This MOB waypoint can be used to return the boat to the victim. Most devices break off navigation to the next waypoint to enable quick return of the boat to the man overboard victim.

4. What happens when I press the MOB button?

Answer: When a user presses the MOB button, any previous navigation is cancelled and direct navigation to the MOB position is started.

5. What are dynamic navigation aids?

Answer: Some chartplotters and computer navigation software will present dynamic navigational aids, which are aids to navigation (such as buoys and beacons) on the device that show color and flashing patterns matched to the real aids.

6. What is a Route Check feature? What is auto-routing?

Answer: Route checking is available on more sophisticated chartplotters. It is software that pretends to run along your chosen route and looks for hazards or obstacles that you may have overlooked. Auto-routing is a sophisticated feature that allows the boater to enter the starting or first waypoint and the ending or last waypoint and then calculates all the intermediate waypoints to guarantee a safe passage. CAUTION: always give these autoroutes a sanity and quality check before using and following them.

7. What is customization?

Answer: The ability to select what data items are shown and how they are shown. This is useful to make your displays understandable at a glance. Also, it is easy to have too much information shown. Customization enables you to turn off display items that are not needed at the moment.

8. What are alarms?

Answer: Many chartplotters enable you to turn on or off alarms for things like the following.

- Anchor alarm (are you dragging anchor)
- Too much Cross Track Error
- Arrival alarm (you have reached a waypoint)
- Shallow water

9. What does the status screen show?

Answer: Dots in a display with three rings. The rings are as follows: the outer ring represents the horizon. Satellites there are not too useful. The middle ring represents satellites about 45° above the horizon. These are the best for position finding. The smallest or inner ring represents satellites directly overhead. These are intermediate in value for position finding.

10. What are tracks and trip logs?

Answer: Tracks can be turned on or off. A track is a record of the actual positions your GPS has been determining. It is the so-called “breadcrumb” trail. Trip logs on the other hand let the boater record trip distances travelled and fuel burned along with average speed and time calculations.

## Chapter 15. Other Uses for GPS – THIS CHAPTER IS NOT TESTED

1. What else can I use my GPS for?

Answer: All kinds of other features are available on more recent devices (post 2000) such as:

- Sun and Moon data
- Tides data
- When moving, highly accurate directions useful for determining compass deviation
- Compensation for winds and currents when the highway screen is used.
- Current data if a speed over water capability is available
- Sailing tack line optimization using VMG
- Controlling other devices that are connected to your GPS

## Chapter 16. AIS – Automatic Information Systems (text appendix 8)

1. What is AIS and what is it good for?

Answer: Automatic Information System: An international system for governments and coast guard-like entities to track commercial vessels.

2. How does AIS work?

Answer:

- AIS uses VHF radio signals
- AIS enables ship identification and location for:
  - Traffic management and collision avoidance
  - Ship tracking for National Security
  - Collision avoidance with other vessels, offshore platforms and Aids To Navigation
- AIS information supplements marine radar and has advantages over radar

3. What frequencies are used by the AIS?

Answer: AIS uses VHF frequencies. Channels 87B and 88B are dedicated to the system. Channel 70 may also be used within the system. Other channels are possible as directed by the Coast Guard.

4. What information does AIS provide?

Answer:

- Collision Avoidance tracking data, especially
- Unique identifier for each vessel
- Vessel position, course, speed, and rate of turn
- As set up: Closest Point of Approach between own vessel and other vessels

5. Do I have to have AIS on my boat?

Answer: No, it is optional for recreational boats. But it is required under the International Maritime Organization's International Convention for the Safety of Life at Sea (SOLAS) for ships that make international voyages and whose gross tonnage is 300 or more, and all passenger ships regardless of size.

6. Why should I want AIS on my boat?

Answer:

- AIS is not direct view dependent like radar
- AIS can show vessels behind obstructions or shoreline features
- Easier to interpret than RADAR
- AIS provides collision avoidance data and great situational awareness
- AIS provides MMSI\* numbers of vessels
- Useful to call them on your VHF-DSC radio

7. How does it operate?

Answer: AIS is an electronic messaging system. It broadcasts primarily on VHF channels 87B and 88B (sometimes channel 70 is used for other data). AIS needs a VHF antenna, a GPS antenna or source, sensor data such as gyrocompass, rate of turn, speed. AIS transponders broadcast at regular intervals the following data items.

- Essential data: Vessel Identifier, Position of GPS antenna, speed, and navigational status (underway, anchored, turning)
- Other "static" (non-motion dependent) information, such as the vessel name and VHF call sign, photos, etc., that are programmed when installing the equipment

All AIS equipped ships and land stations receive the same information and information is displayed on screens or chartplotters, showing the other vessels' positions relative to your vessel in much the same manner as a radar display.

8. What are AIS' limitations?

Answer: AIS uses VHF radio frequencies so the range is similar and dependent on antenna height of both the transmitting and receiving antennas (usually less than 25 NM). An emerging technology is the use of satellites for AIS position reporting.

9. What are the two (2) primary classes of AIS?

Answer: There are two classes of AIS transponders: Class A and Class B. Class A (large commercial- and all passenger ships) transmit with 12.5 Watts of power. Recreational boats with Class B transponders transmit with 2.0 Watts of power.

10. What is the difference between commercial, radio-based AIS and smartphone or tablet apps that claim to show AIS?

Answer: Most AIS displays running on smartphone, tablets and portable computers receive AIS contact information via the internet. These are for reference only and may not be dependable especially in remote areas away from cell towers. True AIS depends on an independent radio receiver or transponder installed on your boat and with its own antenna and power supply. Some modern radios include AIS displays as these units receive and display the true AIS broadcast signals.