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# ELECTRONIC NAVIGATION INSTRUCTOR NOTES

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Based on Canadian Power and Sail Squadron Notes dated 23 Sept. 2012

JULY 4, 2014

## Electronic Navigation Instructor Notes

### OVERVIEW

These guidelines introduce EN Course details to instructors. They assume the instructor will have achieved the USPS AP grade and also has practical experience using electronic navigation devices. Ideally an EN Course instructor will have completed the USPS Marine Electronics Part III course and is experienced teaching the 'How to Read a Nautical Chart', and 'Using a GPS' seminars.

This course teaches effective use of Electronic Navigation devices including the NavStar Global Positioning System, ChartPlotter or other marine navigation computers, and the Automatic Identification System (AIS). It is structured to be taught to beginning boaters with no specific pre-requisites. However, course materials do not thoroughly cover traditional charting skills taught in our Piloting and Advanced Piloting classes. A section below suggests a course of study to prepare to teach this class.

Instructors should emphasize the fact that all data in the student text and glossary cannot be covered during class. They must study the material and experiment with course tools at home and be prepared to ask questions during class sessions. Also, you should expect your students may own and want to ask questions on a ChartPlotter you have not studied and thus be prepared to fend off questions on specific models. You cannot realistically be expected to know the ins and outs of every brand and model. An early demonstration of typical ChartPlotter controls (buttons or menu systems) using a PC based emulation tool can both introduce basic concepts and help the student associate with the controls on their device.

The CD release provides leading edge electronic learning techniques that are being applied using computers in schools. Most tools provided on the CD are managed through the central **ElectronicNavigation.exe** program. Instructors should demonstrate it and describe how to load CD contents to their PC. Student text Appendix 7 provides details on using the CD on a Mac computer. For homework assignments students should read and study the assigned Sections before using the program for homework tests.

Certain points of Canadian law and regulation, Canadian terms, and metric units are stressed in the student text but don't apply in US waters. Also, there are inconsistencies in the text where terms applying to a specific device were used in a broader context. These issues are corrected for US students through USPS developed errata, glossary and exam documents.

1. The "**Errata for CPS Electronic Navigation 1st Edition.pdf**" identifies specific changes to student text. It is recommended that each student make the errata text changes before studying each Section.
2. The "**Electronic Navigation Glossary.pdf**" consolidates data from student text appendixes 3 and 5; and adds additional definitions of terms to further define terms. The errata document recommends this document be used instead of these two appendixes.
3. The USPS final exams are modified to eliminate these issues.

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### USPS EM COURSE MATERIAL

#### Electronic Navigation Course (EN Course) Materials:

- CPS “Electronic Navigation” Student Textbook. 1<sup>st</sup> Edition 2013.
- Student CD Containing:
  - “Errata for CPS Electronic Navigation 1st Edition.pdf”
  - “Electronic Navigation Glossary.pdf”
  - An automated Student Homework Tool w/ Instructions. Homework is accessed by a button on the main menu, and offers questions on each Section. The sequence for each Section is presented in random order and with randomly arranged answers. In response to a wrong answer, the program provides the correct one, and an explanation excerpted from the text.
  - MapTech “Chart Navigator” Version 5.06 w/ Manual
  - CPS developed “Simulator” program that illustrates certain aspects of GPS for student experiments.
  - A “Treasure Hunt” game for students initially learning geographic coordinates and Route/Waypoint navigation.
  - ChartPlotter Emulator program for student experiments
  - PowerPoint presentation for each section of textbook are accessible through the automated tool.
- Additional Instructor Material at EMSCom web page or the equivalent on the new website
- These “Instructor Notes”.

#### Electronic Navigation Student Text Outline

The student manual contains 15 sections and 9 appendices. All material will not be used. The USPS EM Course consists of the following sections. Corresponding PowerPoint files are provided to teach each section.

- Section 1 Introduction to GPS
- Section 2 How to use a GPS
- Section 3 Types of GPS units
- Section 4 Waypoints and routes Global Positioning
- Section 5 Navigation
- Section 6 The Electronic Chart
- Section 7 Electronic Navigation
- Section 8 Electronic Charting on a Computer
- Section 9 Limits of accuracy
- Section 10 Enhanced ChartPlotters
- Section 11 Tablets
- Section 12 Planning Your Cruise at Home
- Section 14 Chartplotter Features
- Section 16 Automatic Identification System (AIS) (Using Text from Appendix 8)

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Of the remaining 8 appendixes the following are recommended to students:

- Appendix 1: Latitude and Longitude. Additional detail on geographic coordinates that many students will already understand.
- Appendix 2: Buying a GPS.
- Appendix 4: Useful References
- Appendix 6: Position Plotting Sheet
- Appendix 7: This Course's CD
- Appendix 9: Bluetooth, Wi-Fi, 3G, 4G, Satellite

### Excluded Material

The following Sections and appendices are not used for the USPS Course:

- CPS is in the process of re-writing Section 15. In current form it is useful for student reference after completing the course.
- Section 13 is not taught and will not be used for test questions. However, the contents and the corresponding ChartPlotter Emulator program are available for student experiments. Also, we recommend instructors utilize an emulator as a demonstration tool. In addition to the provided CP390 program, Standard Horizon has several more modern emulation programs available for free download from <http://www.standardhorizon.com/?cmd=DisplayProducts&DivisionID=3&ProdCatID=84>.
- Appendixes 3 and 5 are fully replaced by the CD file "Electronic Navigation Glossary.pdf".
- There are a number of paragraphs or figures in the manual that are printed with a grey background. Data from these sections are not included in exam questions.

### PowerPoint Files

Each student text section is supported by a PowerPoint file available on the CD. PowerPoints are a great teaching aid. For student home study they serve as a section outline. For classroom conversations minimize possibility that topics will be overlooked. Clearly they should not be simply read. They keep the lesson on track.

The USPS provided PowerPoint files are a composite. First, the CPS provided material was modified to accommodate errata changes. Then available USPS material was added to supplement graphics and enhance presentation. This baseline, a "Work-in-Process", has completed an internal USPS review. It will be delivered on the course CD and also managed on an USPS.org EMSCom web page or the equivalent on the new website to accommodate any needed enhancement. Instructors are encouraged to monitor the USPS WEB site and download any updates.

## INSTRUCTOR & COURSE PREPARATION

### Instructors

As a first preparation step we suggest a thorough study of student text and PowerPoint files, followed by reading the suggestions in the “TEACHING RECOMMENDATIONS” section below. Then a thorough review of the errata and glossary documents. We have attempted to utilize a large portion of the CPS provided materials and only correct essential issues.

Sound cruise planning is the hallmark of any form of navigation. This course intends to teach piloting using GPS tools and we suggest instructors stress the following methodical approach to planning any cruise:

1. Evaluate chart to understand water being cruised
2. Identify start and destinations and create beginning & ending waypoints
3. Try a GOTO straight course and note that it typically does not work due to obstacles or other issues
4. Add and name intermediate waypoints to create a safe route with course lines between waypoints
5. Note bearings and distances to surrounding objects from each waypoint for en-route monitoring
6. Cruise with the goal to minimize XTE by adjusting HEADING to keep XTE at zero.

Always remember all steps above apply equally to paper chart navigation or GPS chart plotter navigation

You will recognize a high level of repetition among the CPS provided text sections and also between this course and other USPS courses and seminars. The major difference between the course and our P & AP courses is the (almost) complete elimination of traditional piloting techniques. You will have students taking this class who have not studied piloting! You may also have classes with a mixture of experienced pilots or navigators and students with no practical experience. While discussions of traditional techniques are inevitable, we encourage that they be kept to a minimum. You should treat the traditional piloting techniques as beyond the scope of this course so that you stay on track. Teach this material with a focus on sound chart study, route planning and using the GPS based tools. Then encourage newer students to take our piloting classes as a next step.

### Additional Study

For several reasons, we are suggesting a reading list for instructors beyond the course material. First, we expect many students will have already experimented with using GPS navigation tools and have specific questions not planned within this course.

They will be focused on their own device and will want to relate each concept discussed to that device's capability. It is clear that we cannot be expected to understand all GPS/ChartPlotter models from all manufacturers. Also we cannot be expected to know details and issues with the several electronic chart providers. But it is also clear that we should be in position to help those students figure out how to use other resources to find answers.

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It is also expected that some students will be taking this class with expectations they will learn enough about available devices to make sound purchasing decisions. They will be looking to us for advice and will expect a limited amount of guidance.

Also, some of our instructors will not be fully experienced with this subject matter and will need additional resources to fully understand concepts. Several reasons. They may not have had opportunity to cruise using electronic navigation components! Or, they may have focused on teaching traditional navigation techniques with little emphasis on GPS or other tools.

And last, class conversations will probably extend beyond this course material! We are thus suggesting several other documents and WEB sites for additional reading:

### Global Navigation Satellite Systems (GNSS)

- “GPS for Mariners” 2nd Edition – Bob Sweet
- Existing satellite navigation systems are identified at <http://en.wikipedia.org/wiki/GNSS>
- Assisted GPS Concepts at <http://www.wpcentral.com/gps-vs-agps-quick-tutorial> and [http://en.wikipedia.org/wiki/Assisted\\_GPS](http://en.wikipedia.org/wiki/Assisted_GPS)

### GNSS Augmentation

- WAAS - [https://www.faa.gov/about/office\\_org/headquarters\\_offices/ato/service\\_units/techops/navservices/gnss/waas/](https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/waas/)
- [http://en.wikipedia.org/wiki/GPS\\_augmentation](http://en.wikipedia.org/wiki/GPS_augmentation)

### AIS

- AUTOMATIC IDENTIFICATION SYSTEM OVERVIEW page at <http://www.navcen.uscg.gov/?pageName=AISmain>
- An overview of AIS at [http://en.wikipedia.org/wiki/Automatic\\_Identification\\_System](http://en.wikipedia.org/wiki/Automatic_Identification_System)
- IMO GUIDELINES FOR THE INSTALLATION OF A SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEM (AIS) at <http://www.imo.org/OurWork/Safety/Navigation/Documents/227.pdf>

### Charting

- “How to Read a Nautical Chart” – Nigel Calder
- “Weekend Navigator” – Bob Sweet

### Electronic Charting:

- The US National Oceanic and Atmospheric Administration (NOAA) web pages describe the variety of electronic nautical chart products they produce. Page <http://www.nauticalcharts.noaa.gov/staff/chartspubs.html> can be used as a TOC of recommended pages.
- Garmin Blue Charts at <https://buy.garmin.com/en-US/US/maps/on-the-water-maps/c452-c455-p1.html>
- Navionics charts at <http://www.navionics.com/en>
- C-Map charts at <http://ww1.jeppesen.com/main/corporate/marine/lightmarine/gb/>

### Marine Navigation Networks

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- RayMarine – SeaTalk and other at <http://www.raymarine.com/view/?id=3011>
- Furuno – NavNet at [http://www.furunousa.com/Press\\_Releases/NavNet%20Network%20Release.pdf](http://www.furunousa.com/Press_Releases/NavNet%20Network%20Release.pdf)
- Garmin – Instruments at Demonstrations <http://www8.garmin.com/learningcenter/on-the-water/instruments/>
- NMEA 0183 - <http://fort21.ru/download/NMEAdescription.pdf>
- NMEA 2000 - <http://www.nmea.org/Assets/2000-explained-white-paper.pdf>

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### SUGGESTED COURSE AGENDAS

We are recommending two methods of presenting and demonstrating the material, 'Deliver Sections in Numerical Sequence' and 'Structured Presentation Order'. Both assume 2 hour class sessions, however instructors are at liberty to deliver the material in any chosen order. Members with extensive electronic navigation knowledge may audit the course by reading the material in any sequence and taking the final examination.

We have not included the optional 'Treasure Hunt' game in these class schedules. The game would be especially useful if class students have little or no experience entering routes and waypoints into a GPS/ChartPlotter device. If needed we suggest it be conducted after the 3<sup>rd</sup> week in these schedules.

#### Deliver Sections in Numerical Sequence

Some text sections, especially the lower numbers, are structured to build upon knowledge gained from prior sections. This agenda assumes the student needs to understand data in all prior sections before beginning study of the next section. It groups presentation material into two hour class segments.

##### Week 1.

Distribute the Electronic Navigation materials

- Describe materials on CD
- Describe installation steps
- Demonstrate the ElectronicNavigation.exe. Focus on:
  - The homework programs
  - Using the Simulator
- Present Section 1 - Introduction to GPS
- Present Section 2 - How to Use a GPS
- Homework Assignments

##### Week 2.

- Review Homework
- Present Section 3 - Types of GPS
- Present Section 4 - Waypoints and Routes
- Present Section 5 - Navigation
- Homework Assignments

##### Week 3.

- Review Homework
- Present Section 6 - The Electronic Chart
- Present Section 7 - Electronic Navigation
- Homework Assignments

##### Week 4.



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- Review Homework
- Discuss Section 8 and Demonstrate Electronic Charting on a Computer using MapTech Chart Navigator
- Present Section 9 - Limits of Accuracy
- Homework Assignments

### Week 5.

- Review Homework
- Present Section 10 - Enhanced ChartPlotters
- Present Section 11 – Tablets
- Present Section 12 - Planning your Cruise at Home
- Homework Assignments

### Week 6

- Review Homework
- Demonstrate a ChartPlotter Emulator
- Present Section 14 - Chartplotter Features
- Present Section 16 – Automatic Identification Systems (Appendix 8)
- Review Assignments

### Week 7

- Review of Course
- Administer Examination

## Structured Presentation Order

Presentation / demonstration order is changed to group similar topics into the same class session. Again the class sessions are intended to fit a two hour period.

### Week 1.

Distribute the Electronic Navigation materials

- Describe materials on CD
- Describe installation steps
- Demonstrate the ElectronicNavigation.exe. Focus on:
  - The homework programs
  - Using the Simulator
- Present Section 1 – Introduction to GPS
- Present Section 2 - How to Use a GPS
- Homework Assignments

### Week 2.

- Review Homework
- Present Section 3 - Types of GPS

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- Present Section 6 - The Electronic Chart
- Present Section 4 - Waypoints and Routes
- Homework Assignments

### Week 3.

- Review Homework
- Present Section 5 – Navigation
- Present Section 7 - Electronic Navigation
- Homework Assignments

### Week 4.

- Review Homework
- Present Section 12 - Planning your Cruise at Home
- Discuss Section 8 and Demonstrate Electronic Charting on a Computer using MapTech Chart Navigator
- Present Section 9 - Limits of Accuracy
- Homework Assignments

### Week 5.

- Review Homework
- Present Section 14 - ChartPlotter Features
- Demonstrate a ChartPlotter Emulator
- Homework Assignments

### Week 6

- Review Homework
- Present Section 10 - Enhanced ChartPlotters
- Present Section 16 – Automatic Identification Systems (Appendix 8)
- Present Section 11 – Tablets
- Homework Assignments

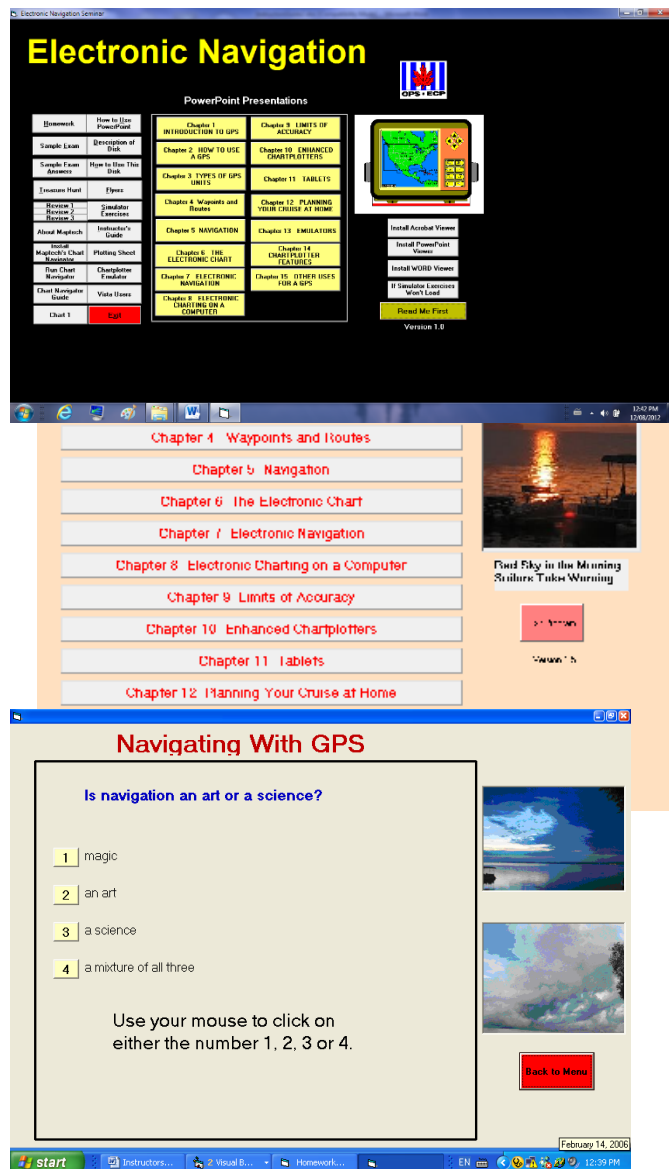
### Week 7

- Review Homework
- Review of Course
- Administer Examination

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## TEACHING RECOMMENDATIONS

### Course Introduction



During the first session distribute the Electronic Navigation manual and the related CD. Demonstrate the CD, and concentrate on how to use the homework program and how to install the Simulator.

### The Homework program.

Click on the Homework button. You will see the following screen . . .

If in the above example you click on Section 5, Navigation, the following screen appears.

The student is asked a question and is offered four possible answers. Select an answer by doing a left click on the number 1, 2, 3 or 4.

In this example, the student selected answer '1' which is wrong. The correct answer comes up and, in some cases, there is a short explanation. If the correct

answer had been chosen, the word correct would appear. Click on the “**Next Question**” button and continue until all the questions for a given Section are finished. When the exercise is completed, the screen shows the number of correct and incorrect answers as well as the percentage that were that were correct. The student is invited to re-do the questions that were answered incorrectly and it is a good idea to redo them.

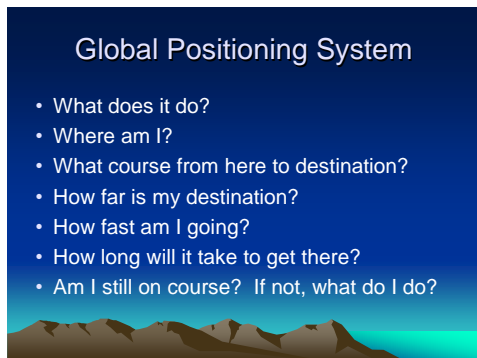
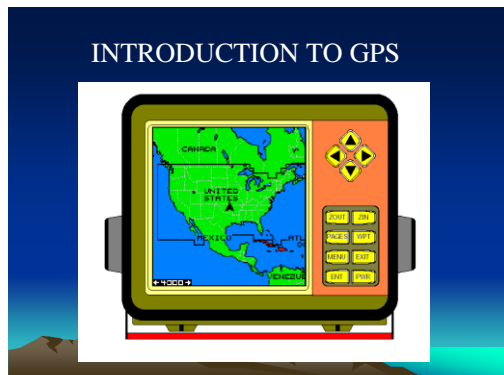
The instructor should show the Simulator briefly. Explain that it has four sections and that at the appropriate time in the classes these will be demonstrated.

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## Section 1 Introduction to GPS

Electronic Navigation begins with an introduction to the basics of GPS, compares electronic navigation to traditional methods and describes both the space and land segments of the GPS systems. Briefly, this section shows how to use a GPS on your boat. Material such as the history of GPS is printed with a shaded background so we suggest it not be covered in class. Explain to the students that the shaded portions of the manual are for general knowledge and will not be used for examination purposes. You should suggest that students read each Section at home to pick up information not covered during a class.

Start with the PowerPoint for Section 1 (some of the slides are shown here).



who need to learn more to stay after the class and you will explain it further. Also advise them that a brief explanation [is](#) found in Appendix 1 in the manual.

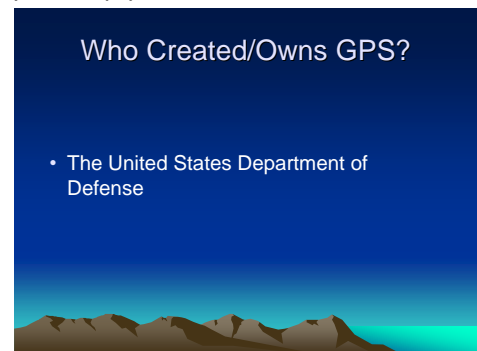
The students have the same CD as does the Instructor. This allows them to know what Sections to read if they miss a lesson. It also provides them with the same PowerPoints they would have seen had they attended that class.

## Section 2 How to Use a GPS

Emphasize the need to use the correct datum and why.

Section 2 has a lot of material in it. Make sure that students know that this section has more material than can be covered in class and that home study is important.

Figure 2.1 of the manual shows the status screen. Its action can be demonstrated by selecting the Chartplotter of the Simulator. As that program starts, students can see how satellites are found on the status screen and how the signal strength indicators display. Point out how the overhead satellites appear first and usually have



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greater signal strength than those nearer the horizon. Let the students see how the GPS Simulator demonstrates acquiring position.

Demonstrate how the zoom in and zoom out buttons work and demonstrate the MOB button.

Emphasize the concepts of horizontal datum, the fact that WGS84 is the default for GPSs but that some charts use other datums. Have them underline in their manual on page 19 that NAD83 is equivalent to WGS84. Explain that the two are interchangeable for all practical purposes.

Describe/demonstrate the simulator program for CD to prepare students to experiment at home.

- Emphasize the Course Deviation Indicator section of the simulator. It teaches the principles of Cross Track Error. The use of a computer and the use of a projector greatly will enhance the Instructor's ability to present these concepts.
- Emphasize the VMG section of the simulator. Explain the value of VMG to sailors. Make sure that students understand that VMG is important to sailboats and may be useful to powerboats when tacking is needed due to weather conditions. The VMG section of the simulator demonstrates not only VMG but also the relationship between relative wind direction and a sailboat's speed through the water. Sailors will be especially interested in the polar diagram in the instructions of the simulator and how that information is duplicated in the action of the simulator.
- This will be useful to people who want to understand the relationships between relative wind, VMG, and speed through the water. Here you want to emphasize that a GPS shows speed over the ground, not speed through the water.

### Section 3                      Types of GPS

This is a very short Section. If time permits, include it. It can be easily read at home.

It helps if you can show samples of a handheld GPS and a ChartPlotter. If a tablet and a smartphone with a navigational program is available to show the students, that will enhance the presentation.

### Section 4                      Waypoints and Routes

Concentrate on Global positioning (sections 4.2) and Waypoints and Routes (sections 4.4 and 4.6). Advise students and, if possible, demonstrate that these concepts are on the simulator program.

During this session students should take latitude and longitude readings. If it is possible to find a paper chart covering your area use it to find your current position. Use the largest scale possible. Classes held at a yacht club will have a distinct advantage over many other locations because it is likely that there will be a chart of the area and you should be able to demonstrate global positioning using a paper chart. If your class is located away from an area that is located on a chart, you may be able to use a topographical map.

Once you explained waypoints and the four basic methods of entering them onto the GPS or ChartPlotter, explain how to combine waypoints into routes. Explain activating and running a route then discuss the dangers (section 4.10).

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### Section 5                      Navigation

You are now into the navigational concepts of GPS. The most important portion of Section 5 is learning the Navigational screen (also called the Highway screen). The Navigational section of the GPS simulator is devoted to this section and it is important that students understand how to interpret the screen. If possible, demonstrate this screen by using a computer with or without a projector. If demonstration is not practical, concentrate on the drawings in Section 5.

The students should know the definitions in section 5.1. Explain that some GPSs will have different definitions. Some navigation courses consider track to be their intended path, a line drawn from point A to point B. Most GPSs consider track to be the path you have been taking (whether desired or not). Make sure students know what heading means to mariners (the direction the boat is pointing) and that a GPS cannot show this; only a compass can do that. Make students aware that many brands of GPS say 'Heading', but are really showing the course.

Explain that CMG (Course Made Good) should be considered as a straight line from your starting point to where you end up and does not take into account the various twists and turns that you have taken. CMG cannot be considered until AFTER you have arrived at some location.

The same applies to SMG (Speed Made Good). It is calculated by considering the time it took from the start of your journey until you reached the destination. It is factored along with the CMG. In other words, both CMG and SMG are based on NET results, not how far you travelled to get to the destination. Nor are they based on how fast you went at times, only the net result of total time and net distance.

Review this by using the ChartPlotter Simulator. Emphasize that once off course, you can either return to the original course or create a new course by heading directly towards the waypoint. In both cases, you must consult the chart to make sure that you are not going to run into hazards.

### Section 6                      The Electronic Chart

The "Errata for CPS Electronic Navigation 1st Edition.pdf" document makes significant changes to this student text section. The CPS writer who created this text described outdated methods of creating vector nautical charts and used terminology that does not directly map to current NOAA and other national hydrographic office terms.

It is strongly recommended that instructors study NOAA material on current methods used to create Raster (NOAA RNC) and Vector (NOAA ENC) charts. They are both directly managed and updated by NOAA from a wide range of source data including input from the USPS/NOAA Cooperative Charting Program. Instructors should be able to describe electronic products freely available from NOAA.

Instructors should also be capable of describing raster and vector charts:

- A raster chart is picture of a Hand Drawn nautical chart with limited data about the picture to include 1) the geographic coordinates of the picture's outer edge, 2) the datum used to draw icons on the chart, 3)

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the name and release date of the chart, and 4) the magnetic variation on a specific date, and the yearly variation change rate.

- A vector chart is a database (a list) of objects (the shore line, the depth sounding, the aids to navigation, the underwater objects, etc.) that exist within the area of the chart. Vector chart files are read by the ChartPlotter and converted into a graphical object that's displayed on the display.

Explain that the CD includes two PC tools that display electronic charts. The Maptech Chart Navigator described in Section 8 uses raster charts and the ChartPlotter emulator described in Section 13 uses vector charts.

Make sure that the concept of horizontal datum is understood and that failure to use the right datum can result in serious problems.

Have students examine text figures 6.5 and 6.7 and display PPT cells 44-46 go note that successive magnification reveals more and more detail in a vector chart (but not in a raster chart).

### Section 7                      Electronic Navigation

This Section introduces several concepts that relate to both ChartPlotters and charting programs on computers. Explain North Up, Course Up and Track Up. Emphasize that a device manufacturer's product may not match these Course Up or Track Up definitions.

Section 7.4 expands on the need to examine routes to make certain that they are safe, and how to make corrections if needed.

### Section 8                      Electronic Charting on a Computer

This Section examines a PC software navigation system using the MapTech Chart Navigator program. Advise students who have completed other USPS courses using a MapTech product that this software version may be different, and that the package of software and raster charts for Canadian waters were provided through CPS as an integrated package. Ensure they understand the packaged charts are outdated and may be inaccurate and must not be used for real cruises. Advise the students that they can download current raster charts from NOAA and then use this program for real life route planning.

Remind students the exercise details included in student text is deleted by the errata document. Students should ignore that exercise and also the exercise details in the original CPS Section 8 PowerPoint file.

The errata document deletes all of section 8.6. That text and corresponding exercise unsuccessfully attempts to utilize both the science and art of planning a route. It attempts to include many dead reckoning concepts while explaining the MapTech software. They did not actually create a route using the MapTech Route tool. We suggest it not be actually used in a presentation.

We suggest the instructor study and learn the MapTech Chart Navigator software and include a demonstration during a class session. Our goal is to demonstrate effective route planning at home and the transfer routes and waypoints. The instructor should demonstrate the software during a class session.

Explain that a wide variety of PC software navigation programs are available, and that we are using the free MapTech software as an example. Several other more capable programs are available and could be used in the

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demonstration instead of MapTech. Students should investigate them prior to investing time learning the MapTech program. Suggested Programs:

- “Costal Explorer” from Rosepoint Navigation
- “TimeZero Odyssey” (or “The Admiral”) from Nobeltec
- “MAX Pro” from Jeppesen
- “GPSNavX™” or “MacENC™” from GPSNavX
- “Marine 5” from FUGAWI

The demonstration will exhibit typical features available in many computer based navigation system and describe how raster charts function in computer based navigation systems. To support this demonstration we have an instructor training video available for download from the USPS.org EMSCom web page or the equivalent on the new website. It thoroughly describes both Chart Navigator and Raster Chart features. At the instructors option the video may be used as the demonstration.

### Section 9 Limits of Accuracy

This Section explains the degree of accuracy that we can expect from the current GPS system. It includes information on DGPS (not used by most pleasure craft operators) and, more importantly, WAAS. Be sure to observe the calculated accuracy level that many GPSs show on the screen.

Point out to the students that when they used the Navigation<sup>al</sup> simulator program on the CD, the word WAAS appeared on the screen. Beside the word ‘WAAS’, a distance that changes from time to time also appeared. That distance was the estimated accuracy that the GPS calculated at that time. If it said 40 meters, the GPS was probably accurate to within 40 meters.

Make sure that the students understand that the WAAS satellites are in geostationary orbit over the equator and that their signals are received throughout the United States and probably can be received in the southern portions of Canada.

Emphasize the various type of accuracy that may be expected from different types of GPSs. Explain the difference between Guaranteed Accuracy and Standard Accuracy. You may advise students that the U.S. has declared that they will not re-institute Selective Availability, but we do want the students to know what it was because there is always the possibility that the US could change that decision.

Students should be aware that numbers like Standard Accuracy, Guaranteed Accuracy and the accuracy obtainable with WAAS are likely to be on examinations.

### Section 10 Enhanced ChartPlotters

The tendency today is for manufacturers to include more and more features in even their lower priced ChartPlotters. Increased sales volume has resulted in lower prices. Competition has forced manufacturers to offer more features.

Manufactures are pushing the concept of integration in order to increase sales. Some ChartPlotters are being offered with other devices (depth sounders, VHF radios) combined into a single unit.



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This Section mentions the idea of integrating GPS with radar, with sonar, with a fluxgate compass, with AIS. It is a good idea to discuss briefly the concept of NMEA protocols (section 2.17) in conjunction with this Section.

### Section 11            Tablets

If you have access to a tablet with a navigational 'app', you can show this to the class.

Instructors should understand the significant cost advantages tablets offer over traditional expensive charting systems. They should also recognize that most tablets utilize "Assisted GPS" features that are sometimes not available outside of cell phone towers. Also the tablet devices have not been engineered to function in humid environments.

Explain that the program one buys MUST be compatible with operating system of the tablet (e.g., Apple's OS, Android, Blackberry, and Windows).

### Section 12            Planning your Cruise at Home

This Section discusses an example of a device that allows your home computer to display the detailed charts that can be used in a ChartPlotter. The software and interface tool described in this Section can transfer data to all ChartPlotters that use Jeppesen C-Map electronic charts. It may be used in two different ways. It can function as a computer plotting program displaying C-Map charts on the computer screen and it can also allow the transfer of routes and waypoints into a computer chip that can be read by a ChartPlotter.

Advise students that most (probably all) ChartPlotter manufacturers have a preferred PC based program that easily can format Route and Waypoint data for transfer into their ChartPlotters, and explain that CPS and USPS are not particularly recommending any brand. We are simply describing an example of what is available.

Comfortably studying a chart in the convenience of your home and creating routes and waypoints has many advantages over attempting to directly enter the data into the ChartPlotter device. People buying a ChartPlotter should consider available software before purchasing a hardware device.

### Section 13            Emulators

A ChartPlotter Emulator is a computer program that demonstrates all aspects of the real ChartPlotter device. It allows the user to press the buttons of the device to create a waypoint or activate a route. Buttons can also control the menu system where many configuration details of the device are stored. This Standard Horizon CP390 Emulator provided on the student CD is bundled with C-Map demonstration charts of Canadian waters including the Georgian Bay. The exercise specified in the text and PPT files creates and executed a simulated cruise in these waters.

The emulator and this chapter are not formally included in student curriculum. We strongly believe a student should not be required to learn details of a product that would not directly help them in future cruises. We do however believe that a demonstration of this emulator would be beneficial.

## Electronic Navigation Instructor Notes

We suggest the instructor study and learn to use the CP-390 and include a demonstration during a class session. It exhibits many leading edge ChartPlotter features. The combined device buttons and internal menu system are excellent examples of how a student would go about learning to operate their own device.

The demonstration would display examples of vector charts. To support this demonstration we have an instructor training video available for download from the USPS.org EMSCom web page or the equivalent on the new website. At the instructor's option the video may be used as the demonstration.

As an alternative, instructors may choose to download an emulator for a different product to present an even more leading edge system. If so, the instructor should be prepared to obtain electronic chart files to support the demonstration. You may follow the recommended steps in this section as a minimum and as time permits show additional features.

### Section 14              ChartPlotter Features

Paragraphs in this section often repeats data already read. It is an excellent summary!

Also, the paragraphs sometimes do not specify if a feature is achieved from a ChartPlotter feature or from data included in the electronic chart loaded into the device. We suggest that you emphasize those issues as you discuss each presentation cell.

Explain that every manufacturer provides different features and that they may name similar features differently from other manufacturers.

### Section 15 – Other uses for GPS

Section 15 is not included in the USPS EN Course!

### Section 16 - Automatic Information System

Text for Section 16 is in Appendix 8. Power Point slides are titled Section 16. USPS test questions include several on this section.

## HOMEWORK RECOMMENDATIONS

### Homework (week 1)

Students must initially work at home to fully install CD provided files and ensure the "ElectronicNavigation.exe" program is functional. It will then be used to execute the homework programs for text sections through the remainder of the course. Also

- Have student review (or initially study) the geographic coordinate system. Latitude and longitude will be used during many conversations and they should be comfortable relating a coordinate to a position on a nautical chart.
- Have the student experiment with the Simulator' Velocity Made Good tool.
- Have the student run the homework program for the sections they study.

## Electronic Navigation Instructor Notes

### Homework (Remaining Weeks)

- Student should run the homework program each week for the sections studied.