UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support Schools
PSC Box 20041
Camp Lejeune, North Carolina 28542-0041

MTCC 4407

STUDENT OUTLINE

PRECISION LIGHTWEIGHT GPS (GLOBAL POSITIONING SYSTEM) RECEIVER (PLGR)

LEARNING OBJECTIVES:

a. Terminal Learning Objectives: Given a requirement to supervise a tactical convoy, Land Navigation Using Pressicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, navigate a course using the PLGR, per the references. (35XX.03.08)

b. Enabling Learning Ojectives:

(1) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel, vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, install the batteries, per the references. (35XX.03.08a)

(2) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel, vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, power up the PLGR, per the references. (35XX.03.08b)

(3) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel, vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, acess the STATUS field, per the references. (35XX.03.08c)

(4) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel, vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, access the set up screen, per the references. (35XX.03.08d)

(5) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel,

vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, activate the waypoint menu, per the references. (35XX.03.08e)

(6) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel, vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, enter waypoints, per the references. (35XX.03.08f)

(7) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel, vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, edit waypoints, per the references. (35XX.03.08g)

(8) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel, vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, select desired NAV mode, per the references. (35XX.03.08h)

(9) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel, vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, perform position fixes, per the references. (35XX.03.08i)

(10) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel, vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, determine range, azimuth, and elevation difference to waypoint, per the references. (35XX.03.08j)

(11) Given a requirement to supervise a tactical convoy movement using land navigational devices, support personnel, vehicles, Land Navigation Using Presicion Lightweight Global Positioning System (GPS) Receiver (PLGR), and the references, turn off the PLGR, per the references. (35XX.03.08k)

OUTLINE

1. DESCRIPTION AND CAPABILITIES OF THE GPS

a. Description. The GPS is a satellite based, radio navigational system that interfaces with ground, air, or sea based receivers called Precision Lightweight GPS Receivers (PLGR's) (AN/PSN-11) or Positioning Location Reporting System

(PLRS) to provide accurate position, speed, distance, and bearing of other locations.

(1) The GPS consists of a constellation of twenty-four satellites that are in orbit around the earth. For accurate data, the PLGR must track at least four satellites.

(2) GPS will assist the user in performing such missions as siting, surveying, tactical reconnaissance, artillery forward observing, close air support, navigation, amphibious operations, mechanized maneuvers, and electronic warfare operations.

b. Capabilities. When satellite reception is complete the GPS provides worldwide, twenty-four hour, all weather, day or night coverage. The GPS has the following capabilities:

(1) When crypto variable keys are entered, the GPS can locate the position of the user within sixteen meters.

(2) GPS can also determine the distance and direction from the user to a programmed location, or the distance between two programmed locations called waypoints.

c. Limitations. The GPS navigational signals are similar to light rays, so anything that blocks light will reduce or block the effectiveness of the signals. The more unobstructed the view of the sky, the better the system performs.

2. DESCRIPTION OF THE GPS AN/PSN-11 RECEIVER

a. The AN/PSN-11, PLGR is a hand-held, lightweight, battery-powered, vehicle mounted personal navigation system that receives data from GPS satellites and computes 3-dimensional (3D) position, velocity, time, and navigational data for the user. The PLGR requires line of sight access to the satellite signals, access to the sky.

b. Description and Function of the PLGR Controls and Indicators

(1) The first item you will notice when you pick up the AN/PSN-11 is the display screen. The display screen is a backlit, four-line, sixteen- character, LCD screen. The contents on the screen are determined by the keys that are depressed and user selected options.

(2) Beneath the display screen is the twelve-block keypad. The keys on the keypad are used to turn the receiver ON and OFF as well as access the various operational modes. The

keys on the keypad are used to access the functions of the PLGR as follows:

(a) ON/BRT. Depressing this key once will turn the AN/PSN-11 on. Pressing the key a second time will turn on the backlight of the display screen for use in night operations.

(b) UP and DOWN keys. These keys are used to change display pages, change numeric/alphabetic field values, and activate various functions.

1 When holding the BRT key and either the UP or DOWN key, the user can adjust the intensity of the backlight of the display screen.

2 These keys also have a speed scroll function; continued pressing of either key will cause the scrolling of the field values or functions to speed up.

(c) LEFT and RIGHT arrow keys. These keys are used to move the cursor from field to field in the display. The cursor appears on the display screen as a blinking field. These keys also have an auto repeat function when continually depressed.

(d) MENU: Pressing the MENU key displays the system menu. The menu consists of two pages, with eleven options to select from and a twelfth option of CRYPTO if the PLGR is loaded with crypto logic. To select the second page of the menu, press the MENU key a second time. The options are selected by using the LEFT and RIGHT arrow keys to highlight the desired option and then using the UP key to activate that option.

(e) WP (Waypoint). Pressing this key brings up the waypoint menu display. There are eight options for the WP menu. Use the LEFT and RIGHT arrow keys to highlight the desired option and then use the UP key to access that option.

(f) POS (Position). Pressing this key will bring up the user's present position, time, date, day, mode, speed, and satellite tracking status on the display screen. This selection has three pages to display the various information.

(g) NAV (Navigate). Provided there are waypoints programmed into the PLGR, the NAV key, when pressed, allows the user to navigate with the AN/PSN-11. There are a number of options for this mode.

(h) CLR/MARK. This key has two functions. The first function is when the key is pressed one time, the user can enter his present position as a waypoint. The second function is used when this key and the NUM LOCK key are pressed at the same time, this enables the user to zeroize the AN/PSN-11.

(i) OFF. When the OFF key is pressed the receiver will power down after a thirty second countdown display. If the OFF key is pressed a second time the receiver will be turned off instantly. You can also terminate the power down countdown by depressing the ON/BRT key; by doing this the PLGR will automatically return to the last mode used.

(j) NUM LOCK. This key has two functions. The first function, when the NUM LOCK key is depressed one time, will lock out all the functions of the the keys discussed up to this point and allow the user to enter numbers in fields by depressing the appropriate key for that number. The second function, as was previously mentioned, is used in conjunction with the CLR/MARK key to zeroize the AN/PSN-11.

(3) On the right side of the AN/PSN-11 is the integral antenna. The antenna can be swiveled for the best signal reception while the display screen is held at the best viewing angle.

(4) Located on the top right side is the KOI-18/KYK-13/SINCGARS (J1) connector.

(a) When this connector is connected to a SINCGARS compatible radio, time fill data will be provided.

(b) When connected to a KYK-13, Electronic Transfer Device, or a KOI-18, General Purpose Type Reader, crypto can be loaded.

(5) To the left of the SINCGARS connector is the battery compartment. One of the following three battery configurations can be used to provide the power needed to operate the PLGR.

(a) AA Alkaline. This configuration requires eight AA alkaline batteries used in conjunction with a special battery holder insert. This setup is non-rechargeable, and has a minimum life of four hours.

(b) BA-5800/U. This is a one-time use, non-rechargeable, lithium battery. This configuration requires one battery with a ten hour minimum life.

(c) Nickel Cadmium. This is a reusable, rechargeable battery. It has a minimum life of one and a half hours. When the AN/PSN-11 is connected to an external power source the battery can be recharged within thirty-six hours.

(6) On the left side of the AN/PSN-11 is the handle. The handle is designed so the left hand is inserted between the handle and the unit. With the unit held this way, the left thumb is free to operate the keypad.

(7) At the bottom of the AN/PSN-11 is the memory battery cover. The 3.6 volt lithium battery is replaced by removing the cover and battery and installing the new battery. This is a non-rechargeable battery with a one year life expectancy. When this battery is replaced a primary battery source must be installed so that all operating parameters input by the user will be retained. If the memory battery is replaced without primary power source installed in the unit all operating parameters of the AN/PSN-11 will be reset to the default values preset by the manufacturer and crypto data (if entered) will be lost.

(8) Located on the back of the AN/PSN-11 on the top left hand side is the J2 connector. Flip open the protective cover and this will give the user access to Input and Output (I/O) options via a two way serial port.

(9) The next connector is the J3 connector located beneath the J2 connector. Opening the cover gives the user access to the external helmet or remote antenna connector.

(10) The last connector on the back of the unit is the J4 connector. It is located beneath the J3 connector and is used for connecting the battery charger, external AC power, or external power input.

3. NAVIGATING WITH THE AN/PSN-11

a. Prepare the AN/PSN-11 for operation

(1) The first step in the preparation of the AN/PSN-11 receiver for operation is to install the batteries in the battery compartment.

(a) First, unscrew the battery cover, tilt the unit upside down, and remove the old battery from the AN/PSN-11. Remember, that if a lithium battery has been used it must be handled as hazardous material and disposed of properly. Check local SOP's for the procedures for the disposal of hazardous materials.

(b) Next, install the fresh battery or batteries in the battery compartment according to the PLGR configuration for either the nickel cadmium, lithium, or AA batteries.

(c) Now make sure that the edge of the battery pack and the mating O-ring in the unit are free of dirt before attempting to connect the battery cover.

(d) With the unit free of dirt, screw the battery cover onto the unit until the battery cover is hand tight.

(e) Finally, if you are using a battery that has been previously used, you should reprogram the battery usage display under the status selection. This will be discussed in our next section.

(2) Next, press the ON/BRT key. This will power up the PLGR, and allow the receiver to start tracking satellites. Since we are turning the receiver on, the following should occur:

(a) A brief screen test pattern will appear.

(b) The next screen that comes up will show the copyright notice, the software and hardware version number, and the nomenclature of the unit.

(c) The third screen shows the unit's self test results, and the battery usage status as time used and time left.

(d) The final screen that comes up will show the last computed position that the receiver has stored into its memory.

(3) Next, press the MENU button, this will bring up the first page of the menu. If the STATUS field is not blinking, use the LEFT arrow key to move the cursor to the STATUS field and the press the UP key. This will allow you to review self test results, reset battery usage time, access input/output (I/O) information, check on satellite search/tracking information, satellite signal/health conditions, special satellite information, and self test messages. To access the various pages press the DOWN key. This mode has seven pages.

(a) Page one, system information.

1 Line 1 - GPS status. This field displays "good" or "<3SV." To give accurate positioning the PLGR must track four satellites. At least three satellites are needed for a two-dimensional position fix.

2 Line 2 - Self-test results. This is the result of the power-on or commanded self-test. This line will display "Self-Test OK" or "Self-Test Fail."

3 Line 3 - Antenna source. This line will show "Internal Antenna" or "External Antenna" as determined by the user configuration.

4 Line 4 - Power source. This will display either "Battery power" or "Vehicle power," depending upon the actual power supply.

(b) Page two, Battery status. The information on this page shows the type of battery system being used to power the unit and how much life is left in the battery, depending upon the type of battery and the accurate entry of the time used.

1 Line 1 - Battery selection. The user must activate this field to input the battery type used. Either BA-5800/U or AA alkaline. The unit will automatically sense and display Ni-Cad if it has been installed.

2 Line 2 - Battery type. The unit will automatically display the battery nomenclature that was selected from the information on line one, either rechargeable or non-rechargeable.

3 Line 3 - Time used. This is the amount of time the battery has been used. If a fresh battery has been installed use the RST (Reset) field to reset the USED time to 0000. If a used battery is installed activate this field and set the time according to the amount of time (life) the battery has been used.

4 Line 4 - Time left. This line will show the calculated amount of battery life remaining, according to the information on line three.

(c) Page three, I/O (Input/Output) status. This page covers information for input/output data for the AN/PSN-11.

(d) Page four, satellite tracking status. This page will display the status of four of the five satellites that the PLGR is trying to track or is tracking. To display the status of the fifth satellite, press the RIGHT arrow key.

1 Line 1. The number of the satellites that are currently being tracked or searched for.

2 Line 2. The strength of the signal being transmitted from the satellite. Twenty-five to 50 dB (decibel) are good, thirty-four dB is the best.

3 Line 3. The code of the signal being transmitted. There are three codes: CA, P, or Y.

4 Line 4, satellite status: I-interference, R-recovery, S-searching, or T-tracking.

(e) Page five. Visible satellite status. Depending on the number of "visible" satellites, there may be more than one page five. To access the other pages press the DOWN key, there are enough continuous pages to include all information for all "visible" satellites.

1 Line 1. The ID numbers assigned to specific visible satellites.

2 Line 2. The health of each satellite identified on line one, either OK or Bad.

3 Line 3. The azimuth of each satellite in degrees and relative to true north.

4 Line 4. This line will display the elevation angle of each satellite and whether the satellite is ascending or descending by the direction of the corresponding arrow.

(f) Page six. This page is an encrypted message from the satellite control center, if one has been sent. This message is only "readable" by personnel with the ability to de-crypt the message.

(g) Page seven. This last page consists of self-test messages. If a message is displayed, consult the user's manual and determine if the unit must be turned in for maintenance.

(4) To access the setup screen, press the MENU key and activate the setup field. The setup screen allows the user to set operating parameters for the PLGR according to his requirements. The parameters can be changed by using the LEFT and RIGHT arrow keys to activate the appropriate field and the UP and DOWN keys to make the actual field selection. Normally the communications section will have already programmed the appropriate information. However, it is a good idea to check this information when you receive the equipment. Also, certain situations may dictate that you change the information such as a

sudden change in operating areas. The setup screen has seven pages that will display the following information:

(a) Page one, Setup Mode. This page has four lines to determine power consumption and satellite signal selection.

1 Line one. Line one displays the operating mode selected by the user. The different types of modes and their descriptions are as follows:

a STBY (Standby) for reduced power consumption. The unit will stop tracking satellites after a position fix has been obtained.

b TIME to display time-only.

c AVG (Averaging) to determine a precise position (the unit must be stationary for this function to perform correctly).

d FIX (Quick-fix). The unit will determine a position and automatically power down.

e CONT (Continuous). The unit will provide continuous position updates to the user. This mode consumes the most power.

f TNG (Training). This mode simulates a course and is used in conjunction with the tutorial in the user's manual.

2 Lines two and three - mode description information.

3 Line four - SV-TYPE. The user can program the PLGR to receive either MIXED for all satellite signals or Y for encrypted signals. The unit must have crypto variables loaded or the unit will only receive mixed signals.

(b) Page two, Setup Units. This page is used to determine the coordinate system, distance, and angle units.

1 Line one - Coordinates and distance units. There are seven coordinate selections for this line, however since the application for this unit is for the military we will select either the MGRS-New or MGRS-Old. To determine our selection refer to second character of the 100,000 meter square identifier for the area you are operating in. If the character is either an X, Y, Z, select the Old field, if any other characters of the alphabet are shown select the New field. The

second field of this line refers to the velocity and distance units that we need to navigate. Select the metric field since we measure units on a map with the metric system.

2 Line two - Elevation units and reference. This is the type of units the user will want to measure elevation in. There are two selections, meters and feet. Select meters because elevation on the military map is measured in meters. The second selectable field on this line is how elevation is measured on the map you are using. Look on the marginal information on your map to make this determination. The two selections are MSL for mean sea level and DTM for datum. Most military maps measure elevation from mean sea level so make the appropriate field selection from this information.

3 Line three - Angle units. This last line contains two selectable fields. The first is how the user wants to measure his angle units, either degrees or mils. Artillery uses mils so our selection for use with the compass will be deg for degrees. The second field determines how we will determine our north reference. Again we are using this as an aid with the compass so our selection will be Mag for magnetic north.

(c) Page three, Magnetic variation. This page will allow the user to enter the magnetic variance for the area that he is operating in. This information can be found on the map but the PLGR can also calculate the variance automatically. The selection for our use on this page will be "Calc" for the unit to calculate the variance automatically.

(d) Page four, Setup options. This page will allow the user to customize his position and waypoint pages, there are three lines to this page.

1 Line one - Elevation hold mode. The two selections for this field are automatic and manual. The automatic mode will enable the system to display the elevation as accurately as possible when there are at least four or more satellites being tracked and the geometry between the satellites is good. If less than four satellites are being tracked or the geometry is bad, the user can select manual and enter the elevation from the map.

2 Line 2 - Time reference. The time for the GPS is measured from Greenwich Mean Time (GMT/0 degrees longitude). You must know which time zone you are operating in to input the actual offset time. This information will normally be obtained from the Battalion S-4. Use the LEFT or RIGHT arrow keys to move the cursor to the time line then use the UP or DOWN keys to select the local time offset. For example the east coast of the

U.S. is -5 therefore you would input: LOC=Z-5:00. When in daylight savings time enter -4.

3 Line 3 - Error display format. The errors for distance, elevation, and time can be displayed in real units such as meters, miles, feet, kilometers and so forth, as a Figure of Merit (FOM) or a Time Figure of Merit (TFOM). FOM's and TFOM's use symbols to represent margins of error, if the unit is in this mode, the user will have to know what those characters represent. For our purpose we will use the ± to represent real units and real time.

(e) Page five. This page allows the user to select the operating area datum and to control the automatic off timer. This page has two lines to program.

1 Line 1 - Datum name. Datums are sections of the earth's surface that are mapped mathematically. The earth is divided into fifty-one datums. The datum for the area you are operating in is found in the marginal information of the standard military map. Use the LEFT and RIGHT arrow keys to move the cursor to the datum line and then use the UP and DOWN keys to select the appropriate datum.

2 Line 2 displays the datum label field associated with line one. This is a display line only and cannot be altered.

3 Line 3 - Automatic off timer. The automatic off timer is used to conserve battery power. The selections are OFF, 15-sec, 5-min, or 20-min. According to the last keystroke entered, the timer, if activated, will start the countdown and power down after the programmed time has been reached. If another keystroke is entered during the countdown, the timer will reset and begin again. If the timer selection is off then the unit will stay on continuously.

(f) Page six, Data port. This page is used for the input/output (I/O) options. This is used in conjunction with data port interface and will not be covered in this class.

(g) Page seven, Automark mode. The automark mode is used to periodically "wake up" the PLGR and have it perform a position fix and store it as a waypoint.

b. Entering Waypoint Data Into the AN/PSN-11.

(1) The first step for entering waypoint data in the AN/PSN-11 is to press the WP key, this will activate the waypoint menu. Select the enter field with the LEFT or RIGHT arrow key

and activate the mode with the UP key. This mode will enable you to enter data for up to nine hundred ninety-nine waypoints and each waypoint will have an accuracy of a ten digit grid coordinate (one meter). All waypoint data will be contained on two pages for each waypoint.

(a) Page One. This page defines the waypoint and it has four user alterable lines.

1 Line 1 - waypoint number and label. The waypoint number can be any number 01 - 999. The label is a name or group of numbers, letters, or characters that can be assigned to the waypoint for ease of reference. The name can be any alpha-numeric title, up to ten spaces. The LEFT and RIGHT arrow keys are used to activate the appropriate box and the UP and DOWN keys to choose from the letters, numbers, or characters.

2 Line 2 - MGRS (Military Grid Reference System). This information must be input to properly navigate to the selected waypoint. In the marginal information on your map, located in the grid reference box, you will find the grid zone designator. Use the L/R and INC/DEC switches to program the correct designator. The second part of this line shows the coordinate system selected in the setup and is non-alterable.

3 Line 3 - square and coordinate. The square is the 100,000 meter area of the map you are navigating to. The identifier is found in the grid reference box, beneath the grid zone designator. The square is a two character designator, example: TP. The coordinate is the actual ten-digit grid coordinate obtained by basic military map reading. The LEFT/RIGHT and the UP/DOWN keys are used to select the fields and change the characters and numbers.

4 Line 4 - elevation. The fourth line is the altitude of the selected waypoint. This information must be entered manually by the user. The altitude is read from the contour lines on the map and entered into the PLGR in the same manner as all other data. This information is not needed to complete the waypoint data. In the motor transport field you may not need this information, so you may leave this field empty. The second part of this line contains a clear (CLR) selection that will allow the user to clear all data from the waypoint and begin over again.

a To save the way point data, use the RIGHT arrow key to position the cursor on the "P" located at the right corner of the display screen and press the UP key, this will save the waypoint data into the memory. To enter other waypoints,

move the cursor back to the waypoint designator field and change the designator number.

b When this is done, the label will appear as "UNUSED" and all field values will be shown in the default mode. Remember, that each individual waypoint must be saved into memory.

(b) Page two, Waypoint datum and magnetic variance page. This page allows for the entry of the datum and the magnetic variation associated with the waypoint. There are four lines on this page of which three lines can be programmed by the user.

1 Line 1 - Waypoint number and datum. This line shows the waypoint number that the user assigned to that specific waypoint and the datum label where that waypoint is located. The datum is the only alterable field for this line. Remember that the datum for the desired waypoint is found in the marginal information on the map.

2 Line 2 - Datum identifier. This line displays the datum name that is associated with the label the user selected for that specific waypoint.

3 Line 3 - Magnetic variance. The magnetic variance can be entered manually on this line or left with no magnetic variance. If no value is entered then the variance will be calculated automatically. When the waypoint is located in a different 100,000 meter square from your current position enter the magnetic variance for the area the waypoint is located in.

4 Line 4 - Coordinate system. This line shows which system you desire to locate your waypoint. We will select MGRS-New for navigating with the military map. The second part of this line contains a CLR (Clear) command to erase any information from this page. Use this page to clear the fields and reprogram the correct information. Changing screens will automatically save the second page of the waypoint information.

(2) Waypoints that are already stored into the PLGR can be edited by selecting the EDIT mode from the waypoint menu. When this is done the user may select the waypoint number he wishes to change and then enter the new information in the same manner as in the ENTER mode. If you enter and store information that is unrecognizable to the PLGR, such as an incorrect grid zone designator or square identifier, a message will appear on the screen as "WPxx Not Defined."

c. Navigate From One Position to Another Using the AN/PSN-11

(1) The first step in using the AN/PSN-11 to navigate is to press the NAV key. When you select the NAV mode, the PLGR will automatically return to the most recently used screen in the NAV mode.

(2) If the desired screen is not visible when you select the NAV mode, press either the NAV or UP key until the first page of the navigation screen is displayed.

(3) In each navigation mode, you only need to enter the destination waypoint. The AN/PSN-11 will automatically display the data you will need to navigate from your present position to the desired waypoint.

(4) There are three navigational modes: Slow, 2D Fast, and 3D Fast. Along with the navigation modes there are five methods of navigation: Direct, CRS TO, CRS FROM, RTE, and APPROACH. It is necessary to be familiar with each of the four screens as they all look similar. We will discuss the first two modes and the first four methods; the 3D Fast mode and the APPROACH method are used for navigation and parachuting operations and will not be covered in this class. You must remember that when selecting a navigation mode, an appropriate navigation method must also be selected. We will first discuss the 2D Fast mode along with the four methods.

(a) 2D Fast, Direct. This mode and method will allow the user to navigate to any of the desired waypoints in a straight line from the user's present position. The user can use this mode and method for navigation by foot or vehicle movement. This mode has four pages of information.

1 Page 1, Mode and waypoint.

a Line 1 - Mode and method. This line displays the options the user selected to navigate. If the user desires he may change either the mode, method, or both.

b Line 2 - Waypoint and label. The waypoint that the user desires to navigate to will be displayed on this line along with its associated label. This line is also alterable by the user.

2 Page 2. This page gives the user the information needed to navigate to the desired waypoint. This page has four lines of information. None of the fields are changeable by the user.

a Line 1 - Waypoint label and estimated position error. This line shows the label that the user has assigned to the waypoint being navigated to and shows the estimated position error (EPE) of the calculations made by the PLGR. The position error will either be shown as a Figure of Merit (FOM) or in real units, depending upon what the user programmed under the setup options.

b Line 2. The first part of line 2 shows the azimuth from your current position to the waypoint being navigated to. The second field of this line shows the ground speed of the unit/user. If the ground speed is less than 1.5 KPH, then this line will read N/A for both fields.

c Line 3. The third line shows the current azimuth that the user/unit is traveling on. To navigate to the designated waypoint, lines two and three should read relatively close to each other.

d Line 4 - Steering angle. This line shows the angle that the user needs to move to get back onto the desired course to the waypoint. Direction of travel will be shown as an arrow pointing left or right.

3 Page 3. Page 3 contains information that the user can use to predict time, range, and accuracy of navigation. This page has four lines that cannot be altered.

a Line 1 - RNG (Range). This line will show the range that the user has to travel to get to the designated waypoint. As you get closer to your destination the range should continually decrease.

b Line 2 - TTG (Time-to-go). The time-to-go is a time that is computed by the GPS using the range and velocity to predict the elapsed time until arrival at the destination waypoint. The time-to-go will not calculate unless the speed of the receiver is 1.5 KPH or greater. Once the destination waypoint is selected and the receiver/user is traveling at the required rate of speed the TTG will automatically compute and be displayed. The TTG will display a maximum of 99 hours, 59 minutes, and 59 seconds. If the speed of the receiver/user drops below 1.5 KPH, then the TTG will display an N/A.

c Line 3 - ELD (Elevation difference). The elevation difference will show the vertical distance, up or down, from your present position to the selected waypoint.

d Line 4 - MMD (Minimum miss distance). When the speed of the receiver is above 1.5 KPH, the GPS will compute the minimum distance that the user will miss his target by if he continues on his present azimuth. If the speed of the unit/user falls below 1.5 KPH this field will show N/A.

4 Page 4. This final page gives additional navigation information that the user may need. Page 4 has four lines of data.

a Line 1. This line shows the destination waypoint and the estimated position error.

b Line 2 - SR (Slant range). The slant range is the distance between the user/unit to the designated waypoint, with the elevation difference factored in. This line will also show N/A if the destination waypoint does not have an elevation entered.

c Line 3. The third line shows the current AZ (azimuth) that the user/unit is traveling on.

d Line 4 - ELA (Elevation angle). This line displays the angle, up or down, from the user's present position to the destination waypoint. This line will show N/A if the destination waypoint does not have an elevation entered.

(b) 2D Fast, Course To. This mode and method is used to navigate along a desired course into a destination waypoint. This mode and method can be used to navigate from the user's present position into a designated area such as an entry route.

1 Page 1, Mode and waypoint. This page has three lines.

a Line 1 - Mode and method. Line 1 displays the options the user selected to navigate. If the user desires he may change either the mode, method, or both.

b Line 2 - Waypoint and label. The waypoint that the user desires to navigate to will be displayed on this line along with its associated label. This line is also alterable by the user.

c Line 3. This line will display the desired azimuth that the user wants to travel on. This line is user alterable so you may input the desired course.

2 Page 2. This page gives the user the information needed to navigate to the desired waypoint. This

page has four lines of information. None of the fields are changeable by the user.

a Line 1 - Waypoint label and estimated position error. This line displays the label that the user has assigned to the waypoint being navigated to and shows the estimated position error (EPE) of the calculations made by the PLGR. The position error will either be shown as a FOM or in real units, depending upon what the user programmed under the setup options.

b Line 2. The first part of this line shows the azimuth from your current position to the waypoint being navigated to. The second field of this line shows the ground speed of the unit/user. If the ground speed is less than 1.5 KPH, then this line will read N/A.

c Line 3. The third line shows the current azimuth that the user/unit is traveling on. To navigate to the designated waypoint, lines two and three should read relatively close to each other.

d Line 4 - Cross Track Error (XTE). This line display shows the distance right or left that the user is off his intended course. This will be shown as XTE R for right or XTE L for left. To get back on the desired course move the distance shown, opposite of the cross track error, until four diamonds appear in this field. The diamonds indicate you are on the desired course.

3 Page 3. This page contains information that the user can use to predict time, range, and accuracy of navigation. This page has four lines that cannot be altered.

a Line 1 - RNG (Range). This is the range that the user has to travel to get to the designated waypoint. As you get closer to your destination the range should continually decrease.

b Line 2 - TTG (Time-to-go). The time-to-go is a time that is computed by the GPS using the range and velocity to predict the elapsed time until arrival at the destination waypoint. Remember the time-to-go will not calculate unless the speed of the receiver is 1.5 KPH or greater.

c Line 3 - ELD (Elevation difference). This line displays the vertical distance, up or down, from your present position to the selected waypoint.

d Line 4 - MMD (Minimum miss distance). This is the distance that the user will miss his target by if he continues on his present azimuth.

4 Page 4. This final page gives additional navigation information that the user may need. Page four has four lines of data.

a Line 1. This line shows the destination waypoint and the estimated position error.

b Line 2 - SR (Slant range). The slant range is the distance between the user/unit to the designated waypoint, with the elevation difference factored in. This line will display N/A if the destination waypoint does not have an elevation entered.

c Line 3. The third line shows the current azimuth that the user/unit is traveling on.

d Line 4 - ELA (Elevation angle). This line displays the angle, up or down, from the user's present position to the destination waypoint. This line will show N/A if the destination waypoint does not have an elevation entered.

(c) 2D Fast, Course From. This mode and method is used to navigate along a desired course away from a designated waypoint.

1 Page 1, Mode and waypoint. This page has three lines.

a Line 1 - Mode and method. Line 1 displays the options the user selected to navigate; if the user desires, he may change either the mode, method, or both.

b Line 2 - Waypoint and label. The waypoint that the user desires to navigate away from will be displayed on this line along with its associated label. This line is also alterable by the user.

c Line 3. The desired course from the destination that the user wants to travel on will be displayed on this line. This line is also user alterable so you may input the desired course.

2 Page 2. This page gives navigation information to move away from the desired waypoint. This page has four lines of data. None of the fields are changeable by the user.

a Line 1 - Waypoint label and estimated position error. This line shows the label that the user has assigned to the waypoint being navigated to and shows the estimated position error (EPE) of the user/unit.

b Line 2. The first part of this line will show the azimuth that the user is presently on. The second field of this line shows the ground speed of the unit/user. Remember, if the ground speed is less than 1.5 KPH, this line will read N/A.

c Line 3. The third line shows the current azimuth that the user has defined as his route of travel. To navigate away from the designated waypoint, on the desired course, lines two and three should read relatively close to each other.

d Line 4 - XTE (Cross Track Error). This display shows the distance right or left that the user is off his intended course. This will be shown as XTE R for right or XTE L for left. To get back on the desired course move the distance shown, opposite of the cross track error, until four diamonds appear in this field. The diamonds indicate you are on the desired course.

3 Page 3. This page contains information that the user can use to see the range from the waypoint and elevation difference. This page has two lines that cannot be altered.

a Line 1 - RNG (Range). This is the range that the user has traveled away from designated waypoint.

b Line 2 - ELD (Elevation difference). This line will show the vertical distance, up or down, from the designated waypoint to your present position.

4 Page 4. This final page provides additional navigation information that the user may need. It has four lines of data.

a Line 1. This line displays the waypoint that the user is navigating away from and the estimated position error of the user/unit.

b Line 2 - SR (Slant range). The slant range is the distance between the user/unit and the designated waypoint, with the elevation difference factored in. This line will show N/A if the designated waypoint does not have the elevation entered.

c Line 3. The third line shows the current AZ (azimuth) that the user/unit is traveling on.

d Line 4 - ELA (Elevation angle). This line displays the angle, up or down, from the user's present position from the designated waypoint. This line will also display N/A if the designated waypoint does not have an elevation entered.

(d) 2D Fast, Route Leg. In the WP mode the user has the option to define a route using the waypoints entered into the PLGR. The 2D Fast Route is used to navigate along that course. Each leg of the route has four pages of navigational information available to the user.

1 Page 1, Mode and route leg data. This page has four lines.

a Line 1 - Mode and method. The first field of this line displays the options the user selected to navigate; if the user desires he may change either the mode, method, or both. The second field displays the leg of the route that is currently being navigated on.

b Line 2 - Waypoint and label. The waypoint that the user desires to navigate from will be displayed on this line along with its associated label. This line is not alterable, as the user has already defined the leg of the route under the WP ROUTE option.

c Line 3. This is the waypoint and its associated label that the user is navigating to that was defined as the destination waypoint for leg one of the route.

d Line 4 - Direction of travel along the route. The user can determine which way he wants to navigate on the route, either start to end or end to start.

2 Page 2. This page gives the user the information needed to navigate to the desired waypoint. This page has four lines of information. None of the fields are changeable by the user.

a Line 1 - Waypoint label and estimated position error. This line shows the label that the user is navigating to and shows the estimated position error (EPE) of the calculations made by the PLGR. The position error will either be shown as a Figure of Merit (FOM) or in real units, depending upon what the user programmed under the setup options.

b Line 2. The first part of this line shows the azimuth that the user is presently on. The second field of this line shows the ground speed of the unit/user. If the ground speed is less than 1.5 KPH, then this line will read N/A.

c Line 3. The third line shows the azimuth directly between the two waypoints. To navigate to the designated waypoint, lines two and three should read relatively close to each other.

d Line 4 - XTE (Cross Track Error). This display shows the distance right or left that the user is off his intended course. This will be shown as XTE R for right or XTE L for left. To get back on the desired course move the distance shown opposite of the cross track error until four diamonds appear in this field. The diamonds indicate you are on the desired course.

3 Page 3. This page contains information that the user can use to predict time, range, and accuracy of navigation. This page has four lines that cannot be altered.

a Line 1 - RNG (Range). This is the range that the user has to travel to get to the designated waypoint. As you get closer to your destination the range should continually decrease.

b Line 2 - TTG (Time-to-go). The TTG is the time that is computed by the GPS using the range and velocity to predict the elapsed time until arrival at the destination waypoint. Remember the TTG will not calculate unless the speed of the receiver is 1.5 KPH or greater.

c Line 3 - ELD (Elevation difference). This line shows the vertical distance, up or down, from your present position to the selected waypoint.

d Line 4 - MMD (Minimum miss distance). This is the distance that the user will miss his target by if he continues on his present azimuth.

4 Page 4. This final page will give additional navigational information that the user may need. It has four lines of data.

a Line 1. This line will show the destination waypoint and the estimated position error of the user.

b Line 2 - SR (Slant range). The SR is the distance between the user/unit to the designated waypoint, with the elevation difference factored in. This line will show N/A if the destination waypoint does not have an elevation entered.

c Line 3. The third line shows the current azimuth that the user/unit is traveling on.

d Line 4 - ELA (Elevation angle). This line will display the angle, up or down, from the user's present position to the destination waypoint. This line will show N/A if the destination waypoint does not have an elevation entered.

e Slow navigation. This mode is used with the four navigational modes previously discussed. It is used when the ground or air speed of the unit/user is below 1.5 KPH. This mode can be applied to navigation over rough terrain or mountains, reconnaissance when movement is slow, or by hovering aircraft. Each method of navigation is reduced to the first two pages of information as in the 2D Fast mode, all other information cannot be computed due to the slow speed of the unit/user. The pages are available and are identical to the associated pages in the 2D fast mode, and the information is interpreted the same.

d. Perform Position Fixes With the AN/PSN-11

(1) By performing position fixes, the user will be able to locate his position with the accuracy of a ten-digit grid coordinate. This will enable the user to identify where he is at within sixteen meters. Remember, this accuracy depends on the number of satellites being tracked, and if crypto keys have been entered into the unit.

(a) First press the POS key. Once again, when the AN/PSN-11 is turned on it begins to track satellites to acquire the user's present position. Also remember that when the PLGR is in the FIX mode, and the unit has acquired the present position, the unit will return to the standby mode and power down after the last keystroke was entered. This mode has three pages, and they are as follows:

1 Page 1, Position information. This page has four lines of displayed information.

a Line 1 - Operating mode and position error. This line shows the operating mode that the user established in the setup mode and the estimated position error. If the unit is not tracking enough satellites to perform the fix, then the estimated position error will be replaced by the word "OLD" as the latest position fix.

b Line 2 - Grid zone designator and coordinate system. This is the actual grid zone designator derived from the Universal Transverse Mercator (UTM) for the area that the user is presently in. The second field shows the coordinate system that the user entered in the setup mode.

c Line 3 - Grid Square and Coordinate. This line displays the actual 100,000 meter square identifier that the user is operating in. The second part of this line is the computed ten-digit grid coordinate where the user is actually at.

d Line 4 - Elevation and reference. This line shows the elevation of your present position and the reference system that the user selected in the setup mode, either MSL or Datum. Be aware that if the PLGR is tracking three satellites, the altitude can be entered manually using the L/R and Up/Dn keys. This is the only line of this screen that can be manually altered. If four of more satellites are being tracked the elevation will be computed automatically.

2 Page 2, Time, date, azimuth, and ground speed.

a Line 1. This is the time according to the local offset the user programmed in the setup mode and the error of the time calculation made by the satellite.

b Line 2. This line shows the day, month, and year and the actual day of the week.

c Line 3 - TRK (Tracking) azimuth. This is the actual azimuth that the unit/user is currently moving on. If movement is less than 1.5 KPH "SPEED TOO SLOW" will be displayed on this line.

d Line 4 - GS (Ground speed). This line will display the actual speed of the user/unit. If the movement is less than 1.5 KPH then this line will be blank.

3 Page 3, Satellite track/search and almanac age.

a Line 1 - Track/Search.

b Line 2. This line displays the ID numbers of the satellites being tracked on the left side of the slash mark and the satellites being searched for on the right side of the slash mark.

c Line 3 - #VIS (Visible SV's) #GOOD (Healthy SV's). The #VIS shows the total number of satellites in the sky that are visible to the unit. The #GOOD is the number of the visible satellites that are in a healthy status.

d Line 4 - ALM AGE. This is the number of days that the satellite data has been stored into the PLGR. The almanac is a map of the sky where the satellites are located during any given time. This is used so that when the unit is turned on it will acquire satellites faster.

e. Determine the Range, Azimuth, and Elevation Difference to Waypoints

(1) The AN/PSN-11 can also determine the range, azimuth, and elevation difference to any of the waypoints that are programmed into the receiver.

(a) To determine the range, azimuth, or elevation difference first press the WP key and select the DIST option. When this screen is accessed you will notice that there are four lines of information.

1 Line 1 - Mode and waypoint selection. The first field displays the distance mode and the second field displays the waypoint that you want to measure from and the waypoint you wish to measure to. This is the only field that the user can change, all other fields are displayed automatically. The LEFT/RIGHT and UP/DOWN keys are used to change the first waypoint to read 00. This will "tell" the PLGR you wish to measure distance to waypoints from your present position. Next, change the second field to the target waypoint that you want to measure distance to.

2 Line 2 - Range. This line displays the range from your present position to the target waypoint.

3 Line 3 - Azimuth. This is the actual azimuth from your present position to the selected waypoint.

4 Line 4 - Elevation Difference. This line shows the actual vertical difference, up or down, from your current position to the selected waypoint. If the waypoints do not have elevation entered then this line will read N/A.

4. ERASE (ZEROIZE) THE AN/PSN-11 MEMORY

(a) There may be times when, for security reasons, you may have to erase (zeroize) the PLGR memory. Caution should be used in making this decision, as this procedure will destroy all data

entered into and collected by the AN/PSN-11 receiver including all crypto keys. Since all data has been erased it will take approximately twenty minutes to begin tracking satellites, reprocess the internal data, and obtain a position fix.

(b) To erase (zeroize) the PLGR memory, press the CLR/MARK and the NUM LOCK keys at the same time. This will bring up the zeroize display. When this display is shown you have two options:

(1) Press the ON key to cancel the zeroize process and bring up the previous display.

(2) Press the OFF key to activate the zeroize, and destroy all data. When the OFF key is pressed a message will come up displaying, zeroize passed or zeroize failed. If the fail message is displayed, perform the zeroize process again. When a zeroize is performed, all data can be reprogrammed by the user or acquired from satellite data. However, CRYPTO cannot be recovered and must be entered by a CMS custodian.

5. TURNING OFF THE AN/PSN-11.

(a) When not in use the AN/PSN-11 receiver should be turned off to conserve battery life.

(1) First, press the OFF key. When the OFF key is selected the PLGR will display a thirty second countdown message.

(2) You may press the ON key to return the PLGR to the previous display during this countdown without losing any satellite tracking. You may also press the OFF key again to immediately turn the PLGR off.

REFERENCE

TM 11-5825-291-13 w/ch 2, Satellite Signals Navigation Set AN/PSN-11

FM 21-36, Map Reading and Land Navigation