

**LESSON PLAN**

**PART I**  
**COVER SHEET**

**LESSON TITLE:** AN/PSN-11 Precision Lightweight GPS Receiver (PLGR)

**TRAINING METHOD:** Demonstration/Performance

**ORGANIZATIONAL PATTERN:** Topical

**REFERENCES:** Technical Order 31R4-2PSN11-1, Satellite Signals Navigation Sets,  
AN/PSN-11 and AN/PSN-11-(V)1  
31R4-2PSN11-21, Soldier's Guide for the PLGR, May 96, Number 2  
Video-PIN# 613471

**AIDS AND HANDOUTS:** One GPS per two students  
Attachment 1 - NAVSTAR Global Positioning System  
Attachment 2 - Satellite Ranging  
Attachment 3 - AN/PSN-11  
Attachment 4 - GPS Checklist

**LESSON OBJECTIVE:** Given an AN/PSN-11 Precision Lightweight GPS Receiver (PLGR), operator's manual, and a demonstration on the use of the survey meter, the student will correctly perform all of the task steps listed below. During the final course of instruction test, the student must also demonstrate mastery of at least three of the samples of behavior listed below.

**SAMPLES OF BEHAVIOR:**

1. Identify satellite structure as it relates to using the PLGR.
2. Identify the capabilities, uses, and features of the PLGR.
3. Identify the major components of the PLGR.
4. Identify the purpose and functions for establishing waypoints with the PLGR
5. Identify the types of navigation modes used with the PLGR.
6. Identify the purpose of the alert function used with the PLGR.

**SUGGESTED COURSE(S) OF INSTRUCTION:** Disaster Preparedness Support Team  
Engineering Assistants

**STRATEGY:** Readiness personnel conduct several wartime and peacetime taskings that require precise location capabilities. This lesson is intended to describe basic operations of the Global Positioning System. Specific missions and requirements entail a more in-depth study of the T.O. for the different functions. Prior to teaching this class, familiarize and stress to the students all applicable WARNINGS and CAUTIONS outlined in the T.O.

**LESSON OUTLINE:**

- MAIN POINT 1.       WHAT IS THE AN/PSN-11 PRECISION LIGHTWEIGHT PLGR?
- a. The NAVSTAR Global Positioning System (GPS)
  - b. The Navigation Set
  - c. Crypto Basics
- MAIN POINT 2.       HARDWARE AND USES
- a. Components
  - b. Accessories
  - c. Capabilities
  - d. Limitations
- MAIN POINT 3.       AN/PSN-11 PLGR FAMILIARIZATION
- a. Terms
  - b. Control Mode
  - c. Numeric Mode
  - d. Standby Mode
  - e. On-Line Help Display
- MAIN POINT 4.       PREPARING THE AN/PSN-11 PLGR FOR USE
- a. Routine/Daily Checks
  - b. Commanded Self-Test
  - c. Set Up
  - d. Initialization
- MAIN POINT 5.       USING THE AN/PSN-11 PLGR
- a. Waypoints
  - b. Navigation
  - c. Mark Function
  - d. Alert Function
- MAIN POINT 6.       PRACTICAL EXERCISE

## **PART II**

### **TEACHING PLAN**

#### **INTRODUCTION**

**ATTENTION:**

USAF Civil Engineers have taken a step into the future with the exploitation of space capabilities.

**MOTIVATION:**

The positioning and navigational capabilities of the Global Positioning System (GPS) are a force multiplier in many military operations areas. Since it allows all Services to use a common grid, all aspects of air, land, and sea interoperability are vastly improved.

**OVERVIEW:**

In this lesson we will cover the basics of global positioning, and an introduction to the AN/PSN-11 PLGR. We will learn some of the basic programming functions and perform a practical exercise, navigating to at least three known waypoints.

**TRANSITION:**

First, we will start with an introduction to the GPS.

**BODY**

**MAIN POINT 1.  
WHAT IS THE  
AN/PSN-11,  
PRECISION  
LIGHTWEIGHT  
GLOBAL  
POSITIONING  
SYSTEM (GPS)  
RECEIVER - OR  
PLGR?**

a. Global Positioning  
System (GPS)

1) SATELLITES

a) SATELLITE  
CODES

The AN/PSN-11, Precision Lightweight Global Positioning System Rceiver (PLGR), is the hand-held navigation set used by the Air Force to receive signals from the NAVSTAR satellite signaling system, or GPS (Global Positioning System). Before we look at the instrument itself, also referred to as a PLGR (pronounced 'plugger'), let's look at some basic GPS concepts.

The NAVSTAR Global Positioning System (GPS) is a space-based navigation and timing system. A constellation of satellites broadcasts precise signals for use by navigation sets.

**INSTRUCTOR'S NOTE:** Attachment 1 in Part IV shows the NAVSTAR Global Positioning System.

There are 24 GPS satellites in 6 orbits. They orbit the earth twice a day, giving continuous world-wide coverage. There are usually 6-10 satellites (an average of 8) in view to a GPS receiver 99.56% of the time.

**INSTRUCTOR'S NOTE:** Attachment 2, in Part IV, explains satellite ranging.

Each satellite broadcasts the nav data message using a 2-part signal.

	<ul style="list-style-type: none"><li>• <b><u>C/A Code</u></b> (Course/Acquisition Code): identifies the satellites.</li><li>• <b><u>P-Code</u></b> (Precision Code): contains appropriate user information.</li></ul>
b) GPS USE OF CODES	<p>The GPS receiver searches for the C/A code to identify available satellites. Once identified, the PLGR switches to the P-code.</p>
2) GROUND CONTROL SYSTEM	<p>The ground control system tracks the satellites, checks and controls satellite orbits, and updates the satellite nav data message. The satellite range involves measuring the time it takes the satellite signal to travel from the satellite to the ground control system. It consists of <i>monitor stations</i> and a <i>control center</i>.</p>
a) MONITOR STATIONS	<p>Monitor stations are unmanned stations throughout the world. They use GPS receivers to track each satellite. The tracking information is sent to the control center.</p>
b) CONTROL CENTER	<p>The control center uses the tracking information to calculate precise satellite position and satellite clock error for each satellite.</p>
b. THE NAVIGATION SET	<p>The AN/PSN-11 PLGR is designed for battlefield use anywhere in the world. Navigation sets receive and decode signals from satellites.</p>

1) RECEIVING AND  
DECODING  
SIGNALS

The information received is used to calculate a 3-dimensional (3D) position, 3D speed, and exact time data. Using the distance to the 4 satellites, an exact 3D position is calculated.

a) LOCATING AND  
TRACKING

Up to five satellites can be continuously tracked at once. The PLGR locates and tracks satellites, then calculates and displays the accuracy for the best positioned satellites.

b) SURFACE AND  
ELEVATION

The PLGR needs only three satellites to figure the location on the surface of the earth - whether standing still, walking or moving in a vehicle. Four satellites are needed to determine elevation.

2) SELECTING AND  
MAINTAINING  
ACCURACY

Acceptable accuracy is situation-dependent and must be established before the mission. To increase accuracy, you might have to move to a more open area. Obstacles, like buildings, bridges, mountains, dense forest, and walls can mask or block the PLGR antenna and reduce its accuracy.

a) SATELLITE  
ACCURACY

Five satellites are tracked continuously. The four satellites giving the best accuracy are selected by the GPS for position calculation. The fifth can take the place of one of the primary satellites when it goes below the horizon, and a new fifth is picked-up and tracked.

b) RECEIVER'S  
ACCURACY

Either an Estimated Position Error (EPE), or Figure of Merit (FOM) represents the receiver's accuracy. The position accuracy of the GPS decreases as the calculated value gets larger.

- **Estimated Position Error (EPE)**: The EPE can be displayed as a calculated value in either meters, feet, or yards. The receiver can appear inoperative when the value exceeds 5,000 meters.
- **Figure Of Merit (FOM)**: The FOM is displayed in a range of 1-9. The receiver can appear inoperative when the value exceeds 9.

c. CRYPTO BASICS

The US Space Command includes encrypted components in the GPS signal, including the time (positional) error, *Selective Availability* (SA) and *Anti-Spoofing* (A-S) for false or unwanted signals.

1) STANDARD  
POSITIONING  
SERVICE (SPS)

GPS service without a crypto key is called Standard Positioning Service (SPS). SPS receivers use GPS information broadcast in the clear and available to anyone in the world. This information contains built-in errors that limit the accuracy of the receiver. This is a security technique called *Selective Availability* (SA).

- |   |  |
|---|--|
| a) SELECTIVE<br>AVAILABILITY                      | The SA errors are variable and work 24 hours a day. A GPS without crypto variable keys act as SPS receivers. SPS receivers are for civil use.  |
| b) ACCURACY<br>WITHOUT<br>CRYPTO<br>VARIABLE KEYS | The accuracy without crypto variable keys is 100 meters horizontal and 140 meters vertical.  |
| 2) PRECISE<br>POSITIONING<br>SERVICE (PPS)        | Precise Positioning Service (PPS) receivers use the same information as SPS receivers. US military services and some Allies are authorized to have these crypto variable keys.   |
| a) PPS RECEIVER                                   | A nav set with valid crypto variable keys loaded and verified is a PPS receiver.   |
| b) ACCURACY<br>WITH CRYPTO<br>VARIABLE KEYS       | Accuracy of the PPS receiver with crypto variable keys is 10 meters horizontal and 10 meters vertical. Only users who have crypto variable keys can decode the information and get this level of accuracy.   |
| 3) ANTI-SPOOFING                                  | To protect authorized users from hostile attempts to imitate the GPS signals, a security technique, called Anti-Spoofing (A-S) is used. This is an encrypted signal from the satellites that can only be read by PPS receivers. An AN/PNS-11 with valid crypto variable keys loaded and verified reads this encrypted signal and operates in a spoofing environment. |

## **MAIN POINT 2. AN/PSN-11 HARDWARE AND USES**

### **a. COMPONENTS**

#### **1) HANDSET**

##### **a) SCREEN**

##### **b) HANDLE**

##### **c) KEYPAD**

Now that we have looked at the general concept, let's get familiar with the components and uses of the AN/PSN-11.

Equipment includes the handset, a case, O&M manual, power battery, and memory battery, and accessories.

The AN/PSN-11 measures 9.5 inches long by 4.1 inches wide and is 2.6 inches deep. The unit weighs 2.75 pounds with the batteries installed. It operates stand-alone using a prime battery power and integral antenna. It can be used with an external power source and external antenna. Use batteries when in an unmounted field environment.

The unit display screen has 4 lines, each of which can display up to 16 alpha-numeric characters. The selected field is highlighted by flashing.

The set is designed to be carried in the left hand and operated with the left thumb. The handle is located on the left side and is large enough to slide the palm through and cup the instrument in the hand, thumb up.

There are 12 multifunction keys on the pad which turn handset on and off, adjust screen brightness, offer display modes and user options, and allow for data entry.

- |                             |  |
|-----------------------------|--|
| d) ANTENNA                  | The antenna swivels for the best reception while holding the unit at the best angle for viewing the screen.  |
| e) CONNECTORS<br>AND COVERS | <p>The set has three connectors on the rear panel and one on the top to increase capabilities:</p> <ul style="list-style-type: none"><li>• <b>J1</b> Connector provides the ability to load crypto keys from a COMSEC fill device.</li><li>• <b>J2</b> Connector provides for additional interfaces to the set.</li><li>• <b>J3</b> Connector provides for external antenna.</li><li>• <b>J4</b> Connector provides for a battery charger or external power (AC/DC) power input.</li></ul> |
| f) IDENTIFICATION<br>LABEL  | The PLGR is a controlled, pilferable item, and as such must be accounted for when issued to individuals or transferred between units. Each unit has an identification label on the bottom or back.   |
| 2) CASE                     | The case (or personnel case) is used to protect and carry the AN/PSN-11 and accessories. It has pockets for a spare battery, set-to-set cable, and Quick Reference Guide. It may be clipped to the belt or worn over the shoulder with a strap.  |
| 3) O&M MANUAL               | The Operation and Maintenance Manual is separate from the Quick Reference Guide and the Technical Order.   |

#### 4) BATTERY POWER

Always remove the main power battery when returning PLGR for maintenance. Before removing, be sure to zeroize any crypto keys and clear any classified waypoints.

#### **BE CAREFUL - DO NOT:**

- Short circuit lithium batteries
- Try to recharge lithium batteries
- Store lithium batteries at temperatures above 130 degrees F. (54.5 degrees C.)
- Store lithium batteries with other hazardous materials
- Keep lithium batteries near open flame or heat
- Throw lithium batteries into fires
- Open, crush, puncture, or break lithium batteries

**>>EXPLODING LITHIUM BATTERIES  
CAN KILL OR INJURE YOU<<**

#### a) LITHIUM

The lithium batteries are non-rechargeable and are good for approximately 15 hours of operation.

#### b) AA-LITHIUM

These are eight non-rechargeable batteries that last approximately 4 hours.

#### c) NICKEL CADMIUM

The nickel cadmium batteries are rechargeable and are good for only about one and a half (1.5) hours of operation.

5) MEMORY  
BATTERY

A memory battery is used to maintain power to the memory for critical information. The memory battery is replaced annually as part of the periodic maintenance. Leave the memory battery installed when returning PLGR for maintenance.

## b. ACCESSORIES

There are several authorized accessories. Military units receive only those items deemed mission essential. Accessories include:

## 1) ANTENNAS

- Helmet
- Aircraft
- Remote

2) MOUNTING  
BRACKETS

- AN/PSN-11
- Antennas

3) PLGR  
REPROGRAMMING  
KIT4) BATTERY  
HOLDER5) POWER SOURCES  
AND ADAPTORS

- 110v power supply
- AC to DC adaptor

## 6) CABLES

- AN/PSN-11 to AN/PSN-11
- AN/PSN-11 to PC
- AN/PSN-11 to Have Quick
- AN/PSN-11 to SINCGARS
- AN/PSN-11 to Reprogramming Kit

c. CAPABILITIES

Knowing the capabilities of the AN/PSN-11 will help you plan your mission wisely. Let's look at some features and intended uses.

1) FEATURES

- The AN/PSN-11 provides highly accurate, continuous, all-weather, 3-dimensional positions, velocity, and time
- Built in Test (BIT) for troubleshooting
- Tests itself during operation
- Runs on batteries or external power source
- Floats and is water resistant up to 1 meter
- Has 13 pages of on-line help is available
- Stores up to 99 waypoints
- Quick disconnect connectors allow for easy unit replacement
- Produces no signals that the enemy can use to find your position
- Designed for battlefield use anywhere in the world

2) EFFECTS OF  
JAMMING AND  
INTERFERENCE

When a current crypto key is loaded, the PLGR activates a built-in capability to reduce the effects of electronic interference or jamming.

3) MISSIONS

The AN/PSN-11 is great for such missions as:

- Siting
- Surveying
- Tactical Reconnaissance
- Close Air Support

	<ul style="list-style-type: none"><li>• Parachute Operations (including free-falling and para-sailing)</li><li>• Ground-Based Forward Air Support</li><li>• NBC Reconnaissance</li><li>• Force Beddown</li><li>• Downwind Hazard Plotting</li><li>• Plotting Accident Sites</li><li>• Damage Assessment</li></ul>
4) COMPATIBILITY	<p>The PLGR is specifically designed to be compatible with:</p> <ul style="list-style-type: none"><li>• Other electronic and computer systems</li><li>• Night vision goggles</li></ul>
d. LIMITATIONS	<p>The AN/PSN-11 has limiting factors and functions that it is not designed to do. Misuse will not affect the instrument, but could cause a critical mission to fail.</p>
1) ELEVATION	<p>The AN/PSN-11 was designed to operate at elevations ranging from 13.12 feet below sea level to 49,213 feet above sea level (-400m to 15,000m)</p>
2) TEMPERATURE	<p>The AN/PSN-11 was designed to operate at temperatures ranging from -4 degrees F to 158 degrees F (-20C to 70C).</p>

3) HUMIDITY

The AN/PSN-11 can function in relative humidity ranging from 10 to 100%. Possibility of internal damage to electronic components or memory contents increases as the humidity decreases to 0%.

4) LOW JAMMING  
LEVELS

The SPS PLGR (without crypto key) will have difficulty locking-on to and tracking satellite signals at low jamming levels.

5) MEDIUM OR HIGH  
JAMMING LEVELS

The SPS PLGR (without crypto key) will not be able to lock-on or track satellite signals at all during medium to high jamming levels.

6) GRID MAPS

The AN/PSN-11 does not have the capability to support local base crash grid maps

7) BASIC  
SOLDIERING  
SKILLS

The AN/PSN-11 does not replace such skill as:

- Map Reading
- Recognizing Terrain
- Using a Compass

**MAIN POINT 3.  
AN/PSN-11 PLGR  
FAMILIARIZATION**

Now that we have covered some GPS basics and a brief overview of the components and uses, let's get more familiar with the instrument itself.

a. TERMS

Here are the seven most common terms you need to know when using the PLGR:

- |                       |   |
|-----------------------|---|
| 1) FIELD              | An area of the display having a specific type of information. Some fields may be changed, others are for display only.  |
| 2) CURSOR             | Displayed on the display screen as either a blinking field or the double arrow symbol. It shows the current selected field.   |
| 3) SELECT (A FIELD)   | Select a field by using the <i>Left-arrow</i> or <i>Right-arrow</i> key to position cursor on a field.  |
| 4) SCROLL             | Scroll a page or a field by using the <i>Up-arrow</i> or <i>Down-arrow</i> key.   |
| 5) FUNCTION FIELD     | Causes a specific action (function) to be performed. The field is activated by pressing <i>Up-arrow</i> or <i>Down-arrow</i> key. Examples of function fields are: ACTIVATE, CLR, SAVE, QUIT.   |
| 6) ACTIVATE           | Causes a selected function to perform that function. Press the <i>Up-arrow</i> or <i>Down-arrow</i> key to ' <b>activate</b> ' the function.  |
| 7) OPERATION<br>MODES | The <i>mode</i> is the current operational status of the instrument. The keypad operates in either the <i>control mode</i> or the <i>numeric mode</i> . The <b>NUM LOCK</b> key is used to toggle between the two modes. <i>Standby</i> is a non-operational mode that conserves battery power. |

b. CONTROL MODE

Control mode allows access to displays via the **MENU**, **WP**, **POS**, **NAV**, and **MARK** keys. A “**P**” is displayed in the lower right hand corner.

1) ON/BRT Key

The **ON/BRT** key turns the unit on and adjusts the brightness of the screen backlighting.

2) LEFT/RIGHT-  
ARROW KEYS

Moves cursor from field to field in the display. They do not change the value of displayed data. The arrow keys have an auto repeat action when held.

3) UP/DOWN  
ARROW KEYS

Changes display pages, changes number/alpha field values and activates functions.

4) MENU KEY

The menu key displays the system menu. The menu consists of three display pages. Press the MENU key to change pages.

a) MENU PAGE 1

- **STATUS** - provides system, battery, antenna, and satellite information.
- **SET UP** - Allows user to select operating mode, coordinate system, units, and other operating and display parameters.
- **INIT** - allows user to initialize position, time, date, user-defined datum, and crypto information.
- **TEST** - allows the user to command the AN/PSN-11 to self-test.
- **HELP** - brings up the help displays.

## b) MENU PAGE 2

- **DATA-XFR** - allows transfers of set ups, time, waypoints, and satellite data to another AN/PSN-11.
- **SV-SEL** - allows users to include or remove individual satellites for use with the AN-PSN-11.
- **DOP-CALC** - used to command the AN/PSN-11 to calculate the best satellite geometry for a given period.
- **ALERTS** - provides for set up and control of corridor, position error, and buffer alerts.
- **SINGARS** - allows users to load time-fill data into a Single Channel Ground/Airborne Radio System (SINGARS) compatible radio.
- **KOI-18** - allows user to load crypto key data via a KOI-18 COMSEC device.

## c) MENU PAGE 3

- **CUSTOM NAV** - allows user to customize navigation displays.

## 5) WP KEY

Pressing the **WP** key brings up the waypoint menu. The **WP** menu options and functions are:

- **ENTER** Enter the position, identifier, datum, and magnetic variation of waypoints.
- **EDIT** Edit or review the position, identifier datum, and magnetic variation of waypoints.
- **COPY** Copies position, datum, and magnetic variation data from one waypoint to another.

- **SR-CAL** Calculate the coordinates of a new waypoint using slant range, azimuth, and elevation angle or waypoint elevation from either present position or another waypoint.
- **RNG-CALC** Calculates the coordinates of a new waypoint using range, azimuth, and elevation angle or waypoint elevation from either present position or from another waypoint.
- **DIST** Determine range, azimuth, and elevation angle from one waypoint to another.
- **CLEAR** Clear from memory a single waypoint or a range of waypoints.
- **ROUTE** Link together the legs of a route using defined waypoints.

6) POS KEY

Pressing the **POS** Key brings up the position display. The position display is three pages that display current time, position, speed, and satellite tracking status.

7) NAV KEY

There must be waypoints loaded in the AN/PSN-11 when the **NAV** key is pressed.

8) MARK KEY

Used to activate the MARK and Man Overboard (MOB) waypoint selection page.

9) NUM LOCK KEY

Toggles between the control mode and numeric mode.

## 10) OFF KEY

When the OFF button is pressed, a 30-second power-off timer is started. The countdown prevents accidental turnoff.

- Press **ON** to cancel
- Press **OFF** a second time to turn off immediately
- **Take no action** and the unit turns off at the end of the countdown.

## 11) ZEROIZE KEY

The zeroize function is to be used in emergencies to protect mission sensitive data. The zeroize destroys all data entered into or collected by the GPS. Two choices can be made:

- Press **CLR/MARK** and **NUM LOCK** keys at the same time to bring up the zeroize display.
- Press **ON** to cancel the zeroize and return to the previous display.
- Press the **OFF** key to destroy all data in the GPS. This also stops all nav functions.

12) ENTERING DATA  
IN THE CONTROL  
MODE

Use the *Left/Right-arrow* keys to select desired field, then use the *Up/Down-arrow* keys to change the contents.

## a) NUMERIC FIELD

*Up/Down-arrow* key increases or decreases value.

- |                                      |   |
|--------------------------------------|---|
| b) OPTION FIELD                      | <i>Up/Down-arrow</i> keys scroll through options. Once desired option is displayed, use <i>Left/Right-arrow</i> key to leave field.   |
| c) FUNCTION FIELD                    | <i>Up/Down-arrow</i> keys activate the displayed function.  |
| c. NUMERIC MODE                      |   |
| 1) INVALID ENTRY                     | Numeric mode is only used for entering numeric data. This requires the user to toggle between control and numeric modes when entering data on the different menu options. An “N” is displayed in the lower right hand corner of the screen. |
| 2) CLR KEY                           | Invalid entries in the numeric mode will not be accepted and the cursor will not move forward until a valid number is entered.  |
| 3) ENTERING DATA IN THE NUMERIC MODE | The CLR key is only functional in the numeric mode. It moves the cursor to the left to allow wrong entries to be reentered.   |
| a) CURSOR MOVEMENT                   | This mode allows numbers to be entered directly. Cursor automatically moves to the next selectable field when data is entered.  |
| b) INVALID DATA ENTRIES              | The cursor does not move forward without an entry. Press the <b>CLEAR</b> key to move the cursor backward to a previous field.  |
|                                      | Invalid numbers are not accepted and the cursor will not move forward until a valid number is entered.  |

c) UNCHANGING  
DATA

Fields that are not to be changed must be reentered in order to move the cursor forward.

d) LEAVING  
NUMERIC MODE

Press the **NUM LOCK** key to leave the numeric mode without effecting numeric values.

d. STANDBY MODE

The AN/PSN-11 uses the most power when trying to get and track satellites. Changing to standby (STBY) mode saves battery power. This may be done by either pressing and holding the function of the POS key, or by changing the setup mode from the **MENU, SETUP** page.

e. ON-LINE HELP  
DISPLAYS

To access the thirteen on-line help displays, press the *Left-arrow* and *Right-arrow* keys at the same time.

- Use the *Up/Down-arrow* keys to scroll through the help options.
- Use the **EXIT** field to leave the **HELP** Menu.

#### **MAIN POINT 4. PREPARING THE AN/PSN-11 FOR USE**

You should always inspect the AN/PSN-11 PLGR for operability, then customize and initialize it prior to each use. Customizing your display screen and initializing the instrument will streamline your operations in the field.

a. ROUTINE/DAILY  
CHECKS

Routine checks should be done prior to each mission use and daily while in use to ensure serviceability is maintained. Use DA Form 2404 to report equipment damage to supervisors. Routine/daily checks include:

- Cleaning and dust unit.
- Stowing parts that are not going to be used.
- Cover unused receptacles.
- Check for loose, damaged or missing hardware.
- Check unit for dents, scratches, punctures or unreadable data plates.
- Check control keys for cracks, breaks, and missing or unreadable markings. Make sure display window is not cracked or cloudy with moisture.
- Check cables assemblies for cuts, kinks, fraying or broken insulation, and loose or damaged connectors.

1) TURN UNIT ON

Unit must be on to perform remaining steps. (When the AN/PSN-11 is turned on, the settings default to the last values selected.)

a) POWER SOURCE

Install battery or connect to external power supply.

b) PRESS ON/BRT  
KEY

Unit will automatically perform self-test, which takes only a few seconds.

c) ADJUST  
BACKLIGHTING

Backlight default setting is off when unit is turned-on. Backlight drains battery power.

- Press ON/BRT key to turn on backlight.
  - Press and hold the ON/BRT key while pressing the up/down-arrow key to increase or decrease brightness of backlight.
- d) SELF TEST
- A power-on self-test is run each time the AN/PSN-11 is turned on. Unit cannot perform nav or provide position coordinates while self-test is being performed.
- 2) BATTERY CHECK
- When instrument is turned on, the screen briefly reflects battery status. To monitor battery status, check MENU, STATUS. Time left may not be accurate.
- 3) CRYPTO VERIFICATION
- Check menu page 2 for crypto entry on display.
- If crypto is displayed, select crypto. Verify crypto keys are current.
  - If crypto keys are not current, the AN/PSN-11 is SPS only.
  - If crypto is not displayed, the an/psn-11 is SPS only.
- b. COMMANDED SELF-TEST
- 1) INITIATE SELF-TEST
- Unit cannot perform nav or provide position coordinates while self-test is being performed.
- Self-test is automatic when unit is turned on, or may be initiated through the MENU:
- Press MENU key

- Move cursor to TEST with Left/Right-arrow key. Select TEST with Up/Down-arrow key
- Move cursor to ACTIVATE with Left/Right-arrow key. Select ACTIVATE with Up/Down-arrow key.
- Display screen reflects: “Self Test in Progress”
- Following Display test, screen calls for a pressing of keys. Press each key or just the **0** (zero/off) key to by-pass.
- Backlighting brightness test begins and requires you to press **OFF** to quit this portion.
- Unit automatically changes to standby when self-test is complete

## 2) FAILURES

Any unit showing test failures should be returned for maintenance as soon as possible. See section 8.2 in the T.O. for warranty return information.

## c. SETUP

The SETUP display consists of thirteen pages that allow the user to customizing the AN/PSN-11. SETUP display is accessed from the MENU display.

- Press MENU key until SETUP option appears.
- Use the Left/Right-arrow keys to highlight SETUP.
- Use Up/Down-arrow key to select SETUP display and scroll through the pages.

- Once the Up/Down-arrow keys have been used to scroll data choices, press the Left/Right-arrow key until the UP/DOWN arrow symbol appears next to the 'P' in the lower right corner of the display screen. Now the Up/Down-arrow keys can be used to scroll pages again.
- Use Left/Right-arrow keys to highlight data to be changed.
- Use the UP/Down-arrow key to scroll through available data options for the selected field until the desired option is displayed.
- Press MENU key to return to Main MENU when finished.

## 1) SV-TYPE

The first page of the SETUP display reflects the current operating mode of the AN/PSN-11 and SV-TYPE (satellite type) display.

### a) OPERATING MODES

Operating Mode options include:

- **CONT** Continuous Mode: the AN/PSN-11 acquires and continues to track up to five satellites. Changes in the position and velocity are continuously reported. This mode allows full and accurate position, time, track, speed, and steering information. This mode uses the most power.

b) SATELLITE  
TYPE

3) UNITS

a) COORDINATE  
SYSTEM

- **FIX** Quick-fix Mode: the AN/PSN-11 acquires satellites and determines the present position, then automatically changes to standby (STBY) mode. This mode minimizes power usage.
- **AVG** Averaging Mode
- **TIME** Time-only Mode
- **STBY** Standby Mode: the AN/PSN-11 accepts and displays keypad data, but does not acquire or track satellites. This mode also minimizes power usage.
- **2dTNG** Training Mode
- **3dTNG** Training Mode
- **RHRSL** Mission Rehearsal Mode

Satellite Type options include:

- **MIXED** Subject to spoofing
- **ALL-Y** Default setting when crypto/keys loaded

The second page is coordinate system and units selection page.

The coordinate system selected affects the position and waypoint displays. This is relative to the type of map used during an operation. Options include:

- **MGRS-Old** Military Grid Reference System, Old

b) DISTANCE AND  
VELOCITY  
UNITS

- **MGRS-New** Military Grid Reference System, New
- **UTM/UPS** Universal Transverse Mercator/ Universal Polar Sterographic
- **L/L-dm.** Latitude/Longitude in degrees and minutes
- **L/L-dms** Latitude/Longitude in degrees, minutes, seconds
- **BNG** British National Grid
- **ITMG** Irish Transverse Mercator Grid

The distance units selected affects waypoint definition, speed and nav displays, i.e. feet, meters, knots, etc. Options include:

- **METRIC** meters (m), kilometers (k), kilometers per hour (kph)
- **ENGLISH** feet (ft), miles (mi), miles per hour (mph)
- **NAUTICAL** yards (yd), nautical miles (nm), knotts (kts)

5) MAGVAR

The third page of the SETUP display is used to choose the source of the magnetic variation. Options include:

- **TYPE** (calculated, entered, waypoint)
- **UNIT** (degrees, degrees/minutes, mils)
- **DIRECTION** (east or west)
- **VALUE** (displayed only if TYPE=entered)

6) SETUP

The fourth page of the SETUP display is used to customize the displays. Options include:

7) DTM (DATUM/  
AUTO-OFF)

a) DATUM (DTM)

b) AUTOMATIC-  
OFF TIMER

8) I/O DATA  
INTERFACE

a) SERIAL PORT

- **ELEVATION HOLD** (automatic or manual)
- **TIME** (Zulu or local)
- **ERROR** (FOM or distance)

The fifth page of the SETUP display is used to select the datum and to control the automatic-off timer.

There are fifty map datum sets available in the AN/PSN-11.

This option is used to save battery power. Options include:

- **OFF**
- **15 SE**Conds
- **5 MIN**utes
- **20 MIN**utes

The Sixth page of the SETUP display allows the user to select the serial port configuration. It also allows you to select or deselect HAVE QUICK, and to control the one-pulse-per-second (1PPS) mode.

There are three serial port configurations:

- **STANDARD** External equipment
- **INSTR** (Instrumentation) External test equipment

- |                 |  |
|-----------------|--|
|                 | <ul style="list-style-type: none"><li>• <b><u>CUSTOM</u></b> DGPS or NMEA interface only.<br/>see 4) below</li></ul>   |
| b) HAVE QUICK   | Provides exact time information: <ul style="list-style-type: none"><li>• <b><u>OFF</u></b></li><li>• <b><u>ON</u></b></li></ul>  |
| c) 1PPS         | Selects a one-pulse-per-second output: <ul style="list-style-type: none"><li>• <b><u>OFF</u></b></li><li>• <b><u>UTC</u></b></li><li>• <b><u>T-MARK</u></b> (Time Mark)</li></ul>  |
| d) CUSTOM       | <u>The seventh and eighth pages</u> of the SETUP display are only available when this option is selected.  |
| 9) AUTOMARK     | The ninth page of the SET UP display controls the automark mode. Automark is used to periodically 'wake-up' the AN/PSN-11 to do a position fix that is stored as a waypoint. Once the fix is obtained and stored, the unit returns to the previous mode. |
| 10) BULLSEYE    | The tenth page of the SETUP display allows the Bullseye function to be switched ON or OFF. When ON, up to two waypoints can be stored  |
| 11) OPERATOR ID | The eleventh page of the SETUP display allows the entry of a 12-digit, alpha-numeric operator ID.  |

## 12) APPROACH

The twelfth page of the SETUP display allows the user to define an extension to the waypoint navigated to during approach, thus reducing XTE and AZ wandering. The extension allows the AN/PSN-11 to cross a waypoint without circling it.

## 13) REHEARSAL (TUTORIAL FUNCTION)

The last page of the SETUP display allows the user to modify the TUTORIAL function to use a predefined route, instead of the predefined Yuma, Arizona tutorial.

## d. INITIALIZATION

Initializing the AN/PSN-11 reduces time used to determine position, time, date, track, ground speed, and magnetic variations. The first of six **INIT** display pages will be displayed from the **MENU** display:

### 1) POSITION

If the position display is accessed after the unit obtains a good position fix, no initialization is required. Otherwise, enter data for the following:

- POS (initializes position)
- PRECISE (initialize precise position)
- CLR (returns data to original values)
- Coordinate display (see T.O. for formats)
- Elevation (-99999 to +99999)
- Elevation reference (display only)

2) PRECISE  
POSITION

Change **POS** label on line one to **PRECISE**. The entered position must be accurate to 100 meters for a P or Y-code acquisition to be successful.

## 3) TIME AND DATE

If the time and date display is accessed after the unit obtains them, no initialization is required. It only takes the AN/PSN-11 one satellite to know the time. Otherwise, enter the following data:

- **CLR** (returns data to original values)
- **Date** (day-month-year)
- **Time** (hours-minutes-seconds)

4) TRACK AND  
GROUND SPEED

If the initialize track and ground speed display is accessed after the unit obtains them, no initialization is required. Otherwise, enter the following data:

- **CLR** (returns data to original values)
- **Track** (degrees or mils)
- **North Reference** (display only)
- **Speed** (0-999)

5) USER-DEFINED  
DATUM

Two datums, USER1 and USER2, are reserved for user-defined datums. The proper information to be entered in the fields is found in the manual published by the Defense Mapping Agency, or supplied by your Intelligence Officer.

## 6) CRYPTO KEYS

Crypto keys are used to correct false satellite data. There are two versions of this screen, depending on whether authorized crypto keys are loaded. The two different types of crypto keys are:

- Hexadecimal crypto key
- Decimal crypto key

## MAIN POINT 5. USING THE AN/PSN -11 PLGR

### a. WAYPOINTS

Up to 99 waypoints can be entered, stored, and selected as a destination. A route is defined for nav either start-to-end or end-to-start.

The route consists of up to 9 legs (10 waypoints) linked together.

#### 1) CLEARING WAYPOINTS

Press **WP** key and select **CLEAR** option.

- **FROM WP** enter first waypoint to be cleared
- **TO WP** enter last waypoint to be cleared
- Activate by pressing **DOWN ARROW** key while on **CLEAR** option.

#### 2) ENTERING WAYPOINTS

Select **ENTER** on **WP** display page one:

- Enter waypoint number (01-99).
- Enter waypoint label (name the waypoint).
- Enter position coordinates (load coordinates).
- Enter elevation.

### 3) COPY WAYPOINTS

- Use **CLR** to delete an entire entry and return the old position data.
- Use page two to change set up options that apply to the particular waypoint shown.

To copy waypoints:

- Press the **WP** key and then select **COPY** option. The first available waypoint is automatically selected
- Move the cursor to waypoint field and select a desired waypoint to be copied. This brings up a display to copy data from one waypoint to another.
- The bottom of this display gives you the option to either activate it or quit.

### 4) EDIT WAYPOINTS

You can edit an existing waypoint.

- Select **EDIT** option under **WP**.
- Select the waypoint number you want to edit
- Edit data as necessary.

### 5) DEFINE A ROUTE

Defining a route involves two display pages. The first is used to load the individual legs of a mission route, and the second provides a summary of the defined route. You can load up to 10 waypoints using the route option.

- Select the **ROUTE** option under **WP**.
- Load the start and destination waypoint of leg one and save.

## b. NAVIGATION

### 1) MODES

- Change leg one to leg two and load the destination waypoint of leg two and save.
- Repeat these steps until you have a complete route loaded.

There are three *modes* and four *methods* of navigation.

The three modes of navigation are:

- **SLOW**: Used when the operator cannot maintain at least 1 mph, such as hovering in a helicopter, drifting in a boat, or walking in very rough terrain.
- **2D-FAST**: Used when the operator can maintain a minimum of 1 mph such as a normal walking pace, vehicle, or ships.
- **3D-FAST**: Used during air navigation.

### 2) METHODS

The four methods of navigation include:

- **DIRECT**: Used to navigate from present location directly to a waypoint.
- **CRS TO**: Course to navigates along a desired course to a desired waypoint. Crosstrack error will show you how far off you are from the intended track.
- **CRS FROM**: Course from navigates along a desired course away from a destination waypoint and also has crosstrack error.
- **RTE**: Links several waypoints together.

## c. MARK FUNCTION

## 1) MARK KEY

The **MARK** function is used to mark your locations along the route.

Press **MARK** key to show the MARK display page.

## 2) STORE INFO

Press the **MARK** key again to store the current position into the displayed waypoint and return to the previous display.

## 3) CANCEL MARKS

Press **ON** key to cancel **MARK**.

## d. ALERT FUNCTION

Alert functions are found on the second page of **MENU**. Three nav alerts are available:

1) POSITION ERROR  
ALERT

Alerts the user of degraded nav accuracy.

## 2) CORRIDOR ALERT

Alerts the user that present position is outside an entered corridor.

## 3) BUFFER ALERT

Alerts user that present position is inside the entered buffer zone.

**MAIN POINT 6.  
PRACTICAL  
EXERCISE**

You are now finished with the overview of the AN/PSN-11 GPS. Now we will go to the technical order for steps required for performance knowledge.

**INSTRUCTOR'S NOTE:** Refer to T.O. 31R4-2PSN11-1 for steps on setup, initialization, determining locations, entering waypoints, and navigating to waypoints. Attachment 4, in Part IV, gives a summary checklist on these operations.

## **CONCLUSION**

### **SUMMARY:**

Although we covered a great deal of information, we really only scratched the surface of the vast array of tasks you can perform with the AN/PSN-11. Specific missions and tasks will require an in-depth coverage of that area. In this lesson we covered the basics of global positioning, and an introduction to the AN/PSN-11 PLGR. We learned the basic capabilities, features, and components of the system. Then we looked at how to set up and initialize the system, and enter waypoints. We talked about specific functions of the equipment, such as the Alert and Mark function. Finally, we performed a practical application.

### **REMOTIVATION:**

Again, the AN/PSN-11 GPS is a powerful, force-enhancement tool. Air Force units will develop many new uses for the GPS as they become more familiar with its uses and capabilities.

### **CLOSURE:**

This concludes this lesson.

### **TRANSITION:**

(Develop locally to transition to the next topic.)



**PART III**  
**EVALUATION**  
**STUDENT PERFORMANCE STANDARDS**

1. After initialization and set up, determine and give precise location.
2. Enter waypoints from a given location.
3. Navigate to at least three known waypoints.

**TEST ITEMS**

---

1. **LESSON OBJECTIVE:** Identify navigation principals as it relates to using the Global Positioning System.

**QUESTION:** (Multiple Choice)

The GPS navigation is based on a principle that involves measuring the time it takes the satellite signal to travel from the satellite to the nav set. This principle is known as:

- a. satellite ranging
- b. satellite navigation
- c. satellite positioning
- d. satellite signal acquisition

**KEY:** a

**REFERENCE:** Main Point 1

---

2. **LESSON OBJECTIVE:** Be aware of hostile attempts to imitate GPS signals.

**QUESTION 2:** (True or False)

To protect authorized users from hostile attempts to imitate the GPS signals, a security technique known as Anti-Spoofing is used.

- a. True
- b. False

**KEY:** a

**REFERENCE:** Main Point 1

---

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3. LESSON OBJECTIVE: Identify the types of navigation modes and methods used with the Global Positioning System

QUESTION: (Multiple Choice)

What navigation mode is used when the operator can maintain a minimum of 1 mph such as a normal walking pace, vehicles, or ships?

- a. Slow
- b. 2D-Fast
- c. 3D-Fast
- d. Fast

KEY: b

REFERENCE: Main Point 2

---

4. LESSON OBJECTIVE: Identify the capabilities, uses, and features of the Global Positioning System.

QUESTION: (Multiple Choice)

The AN/PSN-11 GPS does NOT have the capability to:

- a. transmit a signal for enemy use
- b. support NBC reconnaissance
- c. support base crash grid maps
- d. support downwind hazard plotting

KEY: a

REFERENCE: Main Point 2

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5. LESSON OBJECTIVE: Recall the total number of waypoints the GPS can store.

QUESTION 2: (Multiple Choice)

How many waypoints can be entered, stored, and selected as a destination?

- a. 9
- b. 99
- c. 999
- d. waypoints can not be stored.

KEY: b

REFERENCE: Main Point 5

---

6. LESSON OBJECTIVE: Identify the purpose of the alert function used with the Global Positioning System.

QUESTION: (Multiple Choice)

Nav alerts are available to alert the user of:

- a. degraded nav
- b. approach to known positions or areas
- c. departure from known position or areas
- d. all of the above

KEY: d

REFERENCE: Main Point 5



## **PART IV**

### **RELATED MATERIALS**

**Attachment 1** - NAVSTAR Global Positioning System

**Attachment 2** - Satellite Ranging

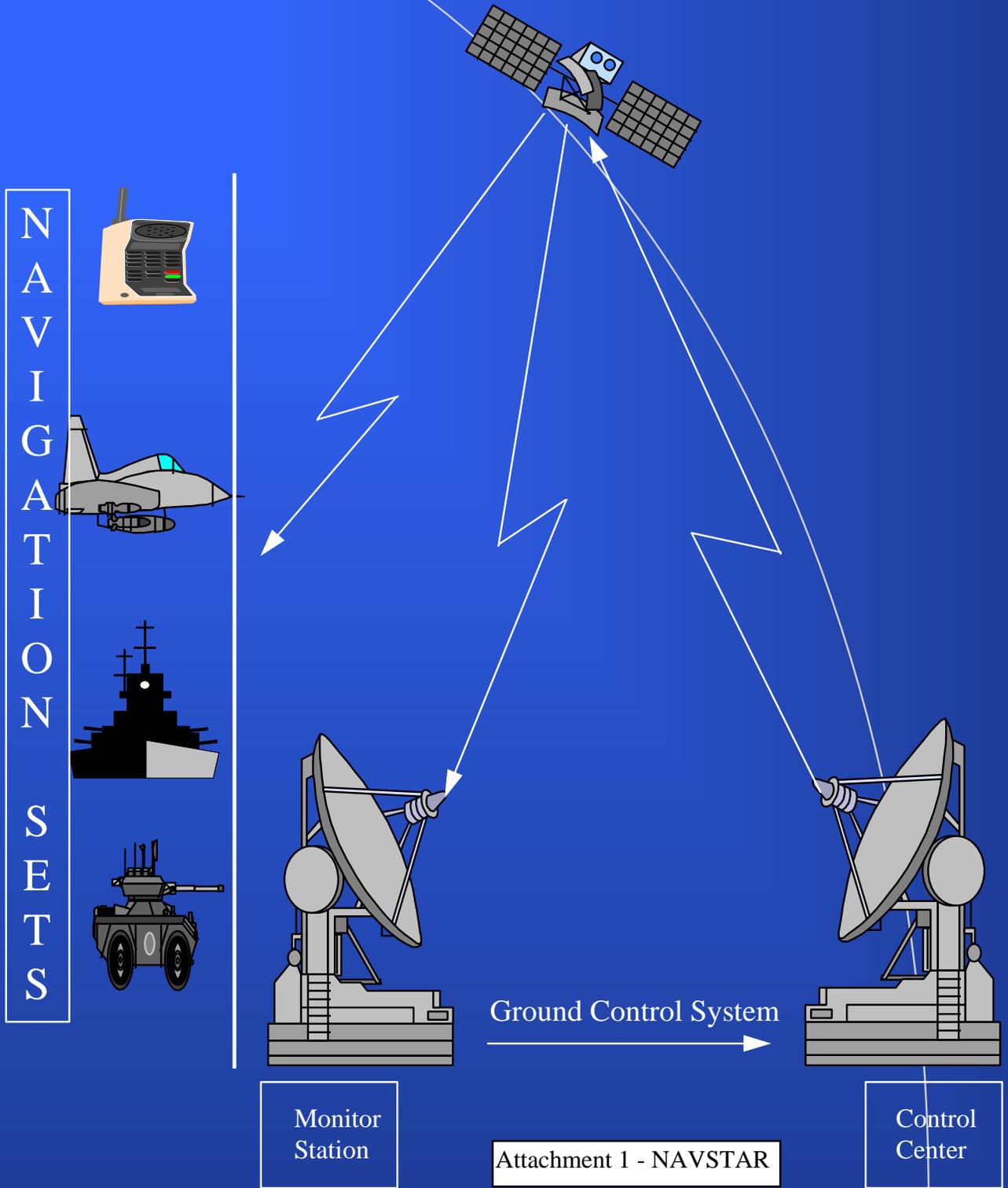
**Attachment 3** - AN/PSN-11

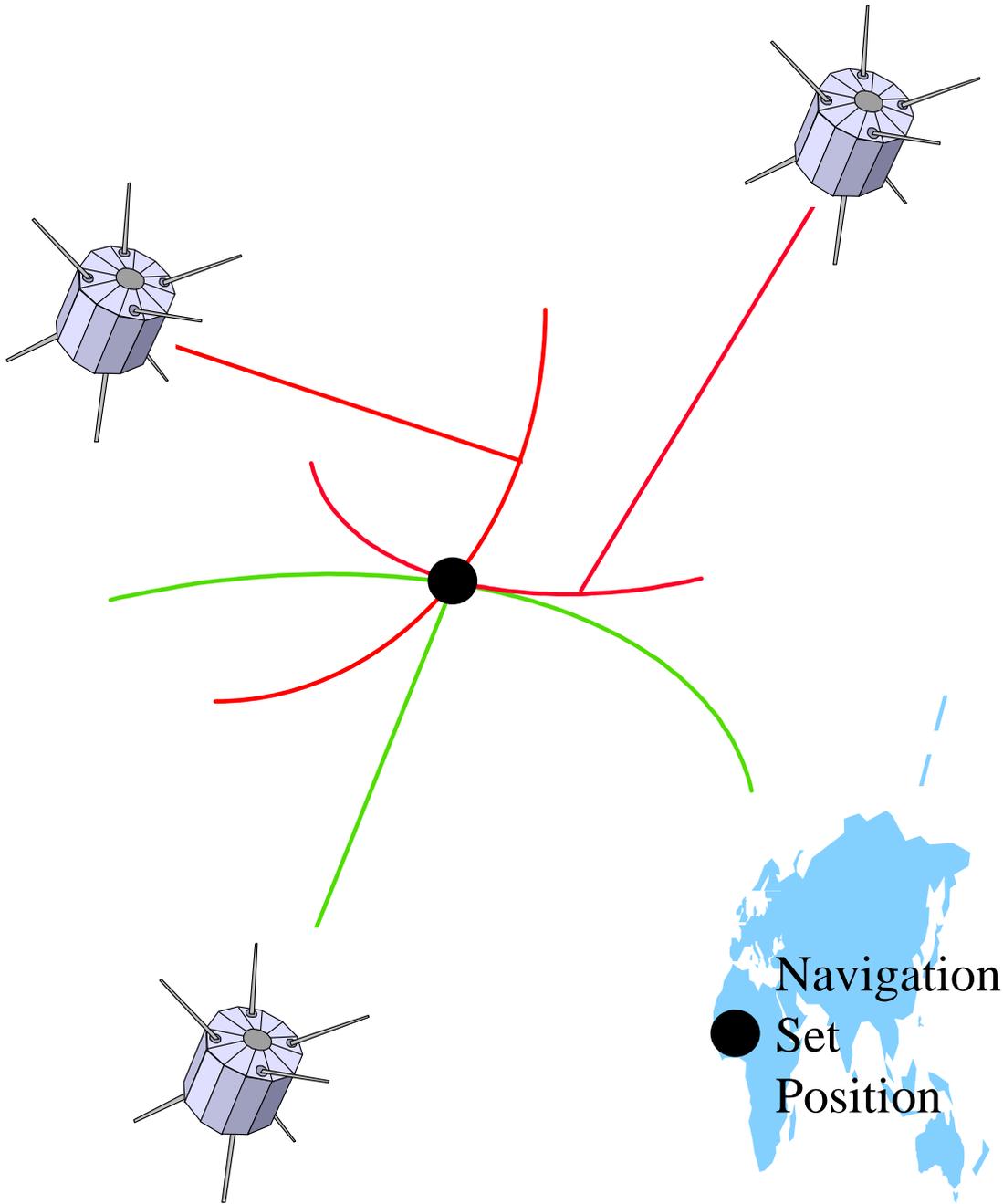
**Attachment 4** - GPS Checklist

**RTP I3** - Finding and Plotting Locations on a Map



# NAVSTAR Global Positioning System





Navigation  
Set  
Position

Attachment 2 - Satellite Ranging



Attachment 3 - AN/PSN-11

**Setup of the AN/PSN-11**

1. Press the [MENU] key
2. Select the [SETUP] option - this is used to prepare the GPS for mission
3. The first of seven [SETUP] display pages will be displayed:
  - Setup Mode Selection - [CONT] mode will continually update position info
  - Setup Coordinate System and Units Selection (MGRS New)
  - Setup Magnetic Variation
  - Setup Display Customization - time as local or Zulu, error FOR, or M/ft
  - Setup Datum and Automatic Timer
  - Setup Data Port
  - Setup Automark Mode

**Initialization of the AN/PSN-11**

1. Press [MENU] key.
2. Select [INIT] option. This prepares the GPS for mission needs.
3. The first page of six [INIT] display pages will be displayed:
  - Initialize position (if needed)
  - Initialize time and date (if needed)
  - Initialize track and ground speed (if needed)
  - Initialize user defined datum (pages 4 & 5)
  - Initialize crypto keys

**WAYPOINTS** - A waypoint is a location of a point on a desired course. Up to 99 waypoints can be loaded on the AN/PSN-11.

**A. Entering Waypoints**

1. On [WP] display page one select [ENTER].
2. The first page for entering and checking waypoints data contains:
  - Waypoint number (01 - 99)
  - Waypoint label - name the waypoint
  - Position coordinates - load coordinates
  - Elevation
  - [CLR] - used to clear out an entire entry and return the old position data.

3. Page two is used to change setup options that apply to the particular waypoint shown.
  - DTM - you can select a datum that is separate from the setup datum
  - L/L-dm - the position coordinates type for the waypoint.

### **B. Clearing Waypoints**

1. Press [WP] key and select [CLEAR] option
  - “from WP” - put first waypoint to be cleared
  - “to WP” - put last waypoint to be cleared
2. Activate by pressing ↓ key while on clear option

### **C. Copying Waypoints**

1. Press [WP] key the select [COPY] option
2. The first available waypoint is automatically selected
3. Move cursor to waypoint field and select waypoint to be copied
4. This brings up a display to copy data - either activate or quit

### **D. Edit and Existing Waypoint**

1. Select [EDIT] option under [WP]
2. Select the desired waypoint number - edit information

E. Defining a Route - The waypoint route display consists of two display pages. The first is used to load the individual legs of a route, and the second provides a summary of the defined route. You can load up to 10 waypoints using the route option.

1. Select [ROUTE] option under [WP] - page one is where you enter data
2. Load the start and destination waypoint of leg one and save
3. Change leg one to leg two and load the destination waypoint of leg two
4. Continue the process until the route is complete

# TRAINING PACKAGE COMMENT REPORT

**RTP**

**RTP DATE:**

For an *immediate response* to your questions concerning subject matter in this Readiness Training Package (RTP), contact the Office of Primary Responsibility(OPR)(TSgt Ron Childs) of the Contingency Training Section at DSN 523-6458 between 0700-1600 (CT), Monday through Friday. Otherwise, write, fax, or E-mail the OPR to make comments, suggestions, or point out technical errors in the areas of: references, body information, performance standards, test questions, and attachments.

**NOTE: Do not use the Suggestion Program to submit corrections for printing or typographical errors.**

**Comments:** \_\_\_\_\_  
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