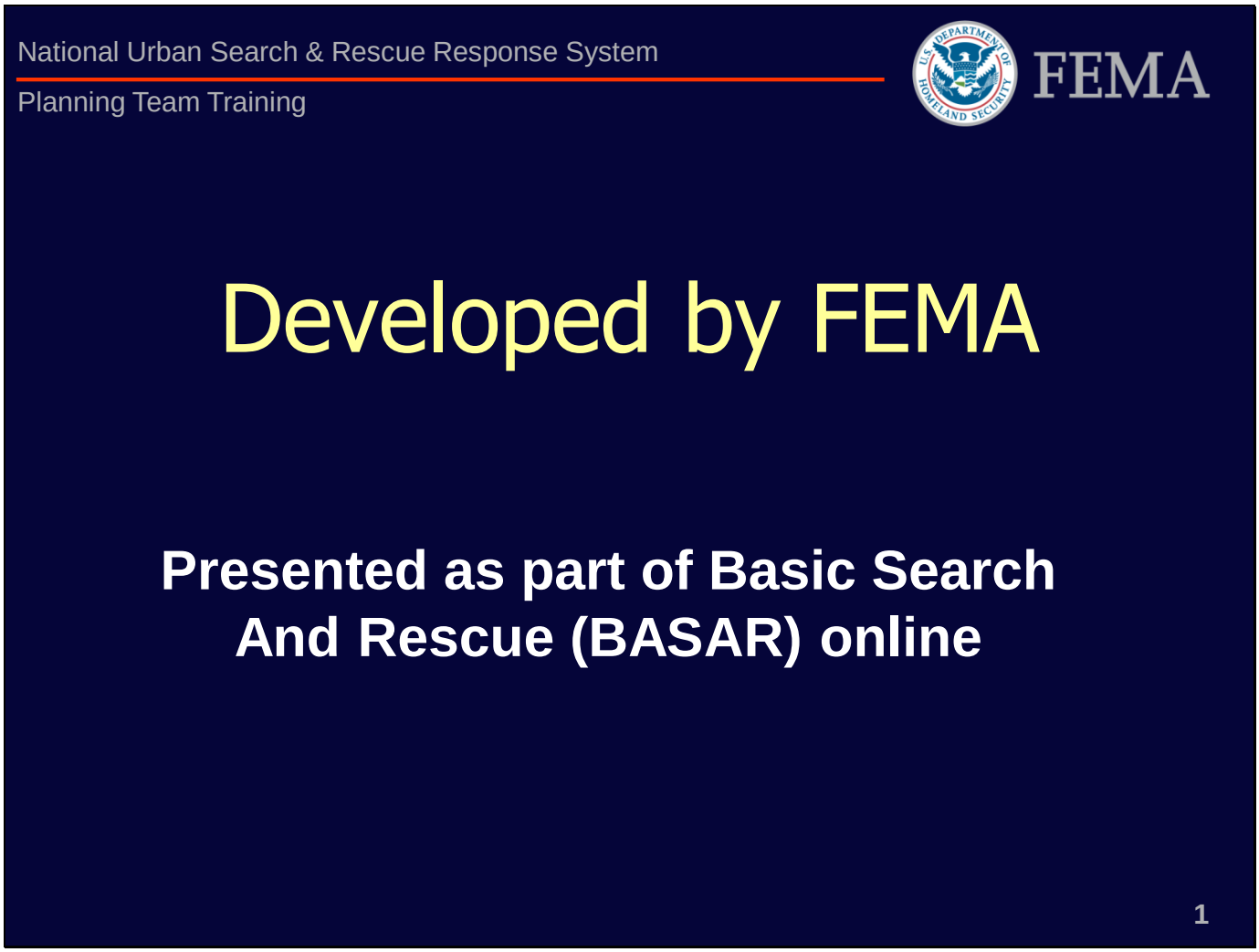


Every GPS hand held device operates a little differently. This course uses a specific model to demonstrate the principles and theories of GPS which then will need to be applied to your specific unit. Frequently, each SAR Unit will prefer a different model based on how they operate and their needs. If you are going to buy one, talk to the experienced searchers on your team about models to consider.


This course is derived from the FEMA course listed and has been modified for use in Search and Rescue.

# Enabling Objectives

- **Identify the basic components of the GPS system**
- **Identify benefits to Search And Rescue**

# This program will cover…

- **Components GPS/NAVSTAR**
- **Features and operation of the GPS unit**
- **Benefits to Search And Rescue**
- **Using a GPS unit in SAR Operations**

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# Basic Components of GPS

- GPS Receiver handheld device is used to communicate with satellites to track position on earth.
- Computer mapping software is used to produce maps with location details downloaded from GPS Receivers.
- GPS use with maps
- GPS use in the SAR setting.

# SAR Benefits

- **Better routing to search area**
- **More accurate gridding and locating clues**
- **Enhanced communications which enables pinpoint accurate location information**
- **Limitations**



Typically during a search the command post team will assign your group to search a specific area and will download that area or key waypoints onto your team leader's GPS unit.

During the search the GPS unit is set to record where you have gone (track on) and the location of any clues or other pertinent information found (waypoints).

Upon completion of the assignment the recorded information is uploaded to the Command Post computer.

For a grid search, the GPS only records where it went and the Command Post will have to estimate where the rest of the team went based on your input. As with any equipment if it is not operated properly the information from it may be degraded or unusable. GPS reception and accuracy is impacted by heavy foliage cover overhead and to some degree by heavy clouds or rain.

# What is GPS?

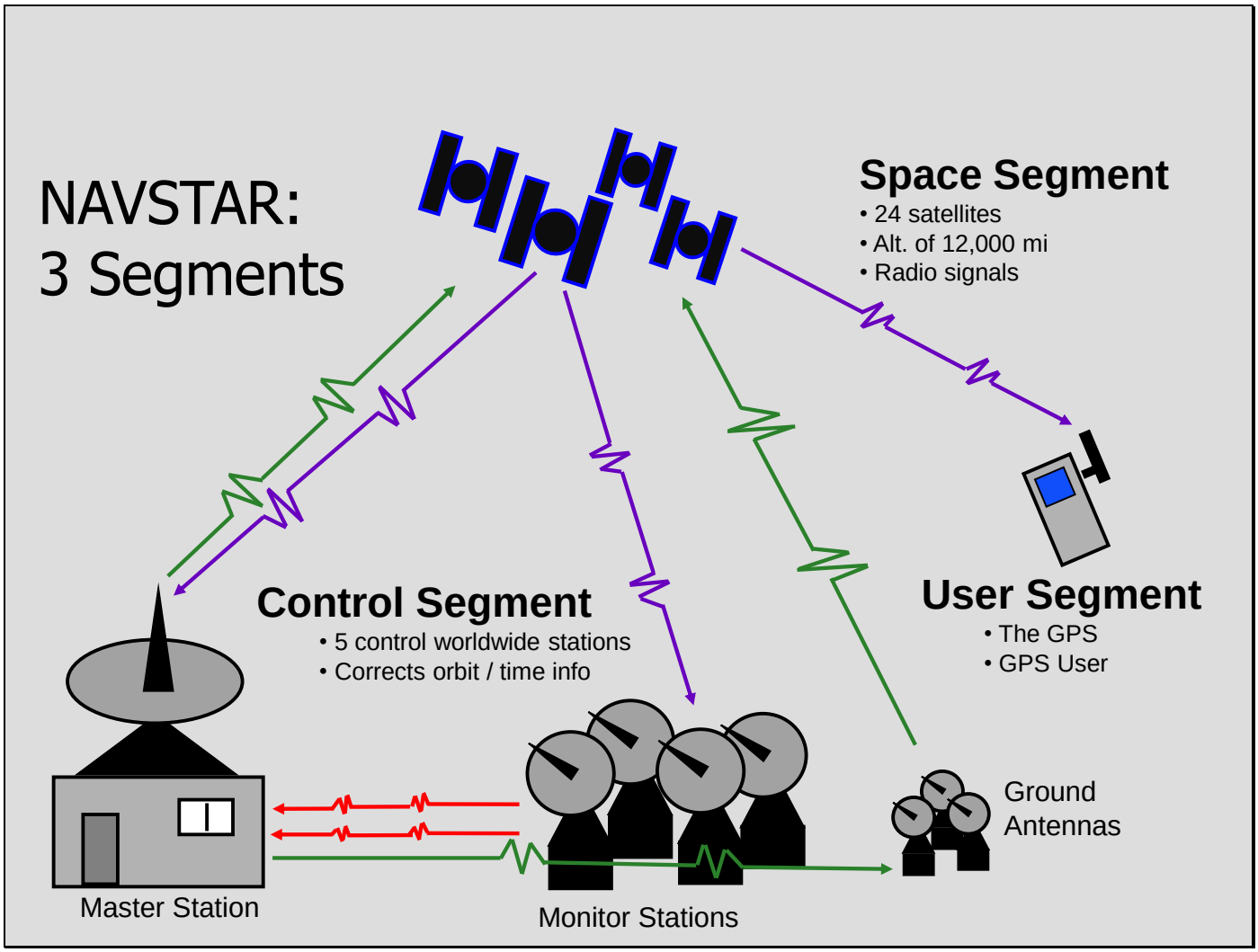
**Global Positioning System is a network of satellites that continually transmit coded information, which make It possible to identify positions on earth by measuring distance from satellites. Those positions are reported in coordinates. (e.g., Lat/Long, USNG, UTM, etc.)**



How positions are reported depends on what the Command Post wants and how you set the preferences on the GPS.

# Four Primary Functions

- **Provides a position and coordinates.**
- **Can calculate distance and direction between any two waypoints, or a position and a waypoint.**
- **Provides travel progress reports, like est. time to waypoint.**
- **Accurate time measurement.**



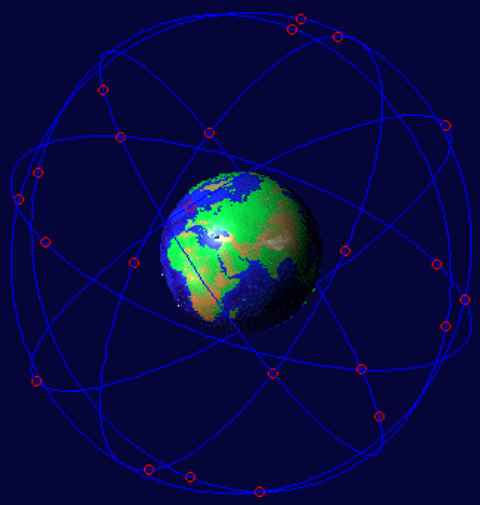

**Three Segments of the Global Positioning System**

The Global Positioning System is comprised of three segments: the Control Segment, the Space Segment and the User Segment. While SAR is focused on the user segment, it is nice to understand a little about how the rest of the systems work.

Your handheld GPS calculates your position based on data it receives from the satellites.

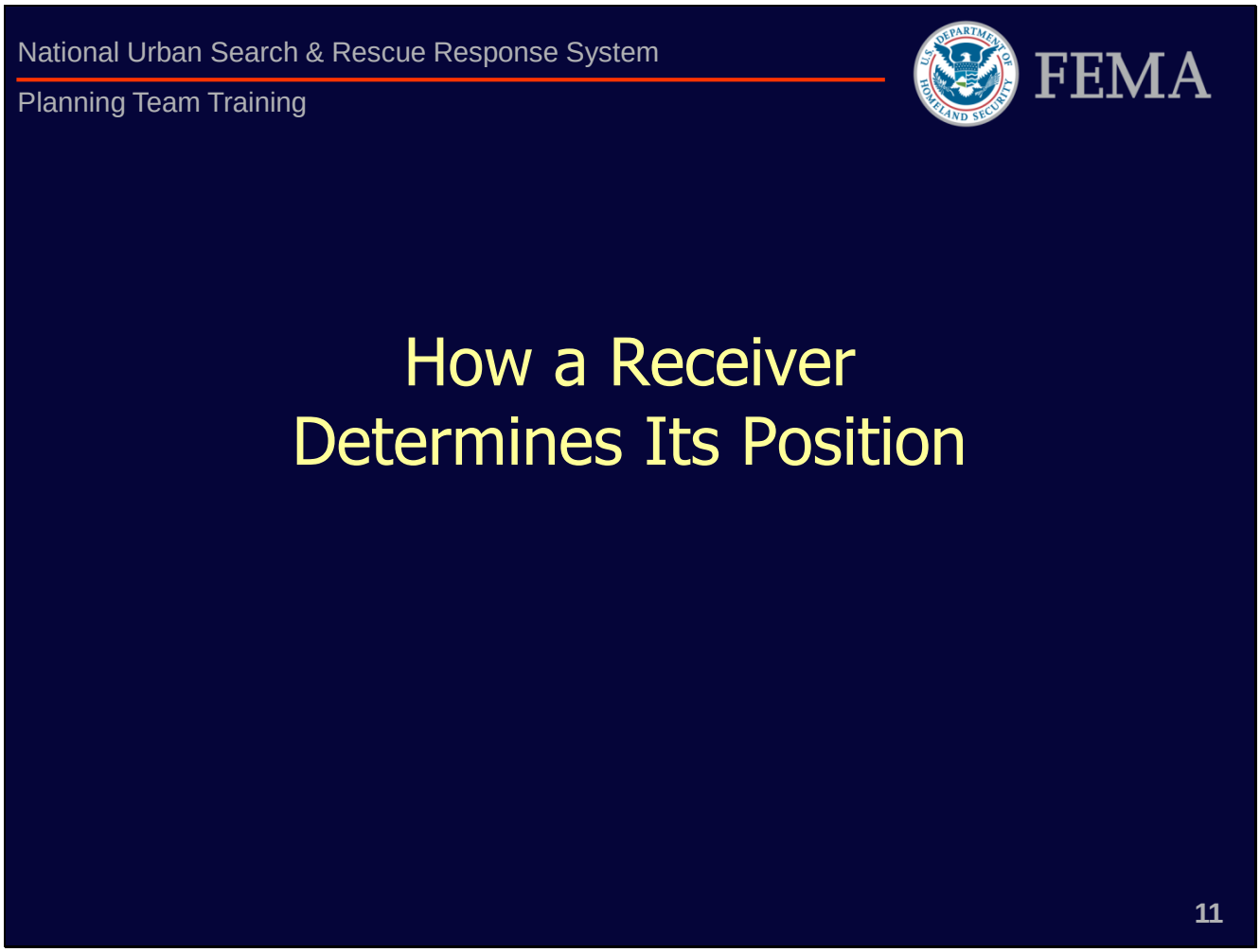
# How Does GPS Work?

- **Start up**
  - **Cold start up is when a unit is started for the first time in a new area or after a long time of no use. It will take longer for the unit to locate & identify satellites taking longer time to usable data.**
  - **The wasted time can be reduced by turning on the GPS receiver prior to use. This way it can get your general location and be usable in a shorter time frame. This is termed a warm start up.**





When responding to a search it is good to turn on your handheld unit a few minutes before you arrive at the Command Post so it has time to settle in and find where it is. This may vary depending on your GPS model, but 5-10 minutes should suffice for most units.

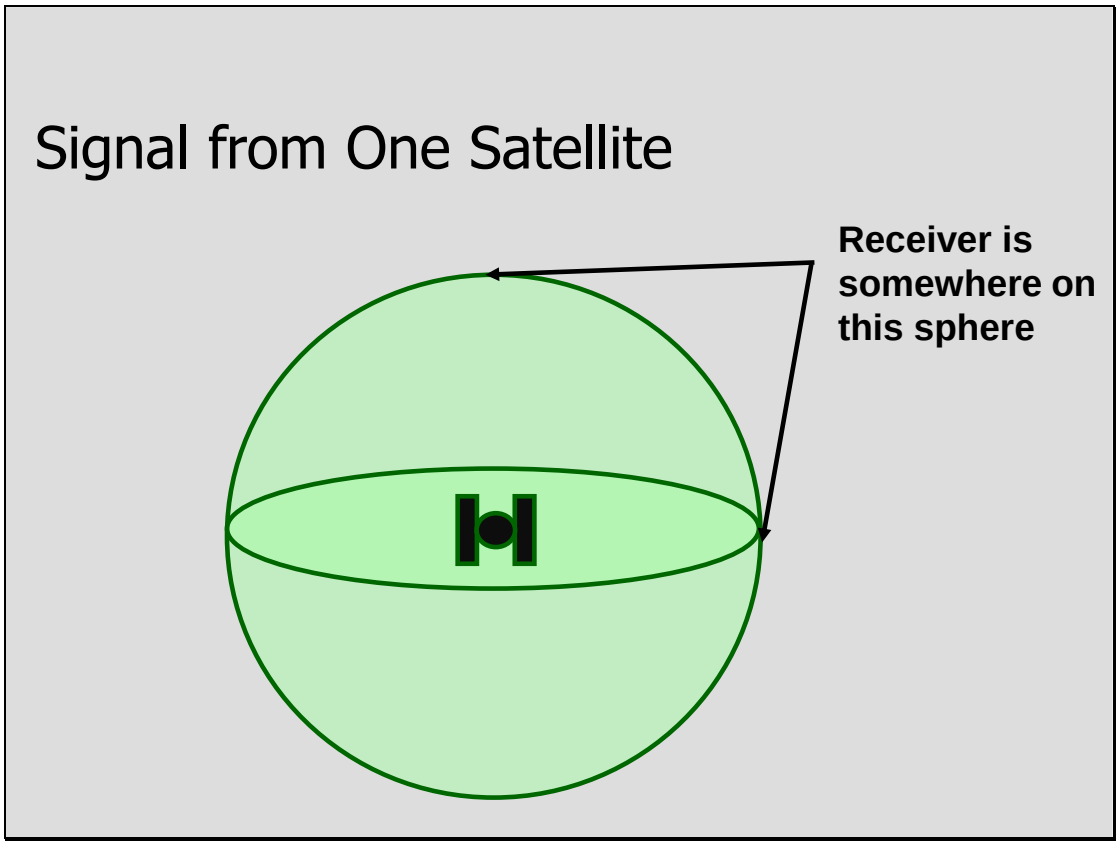



**How a Receiver Determines Its Position**

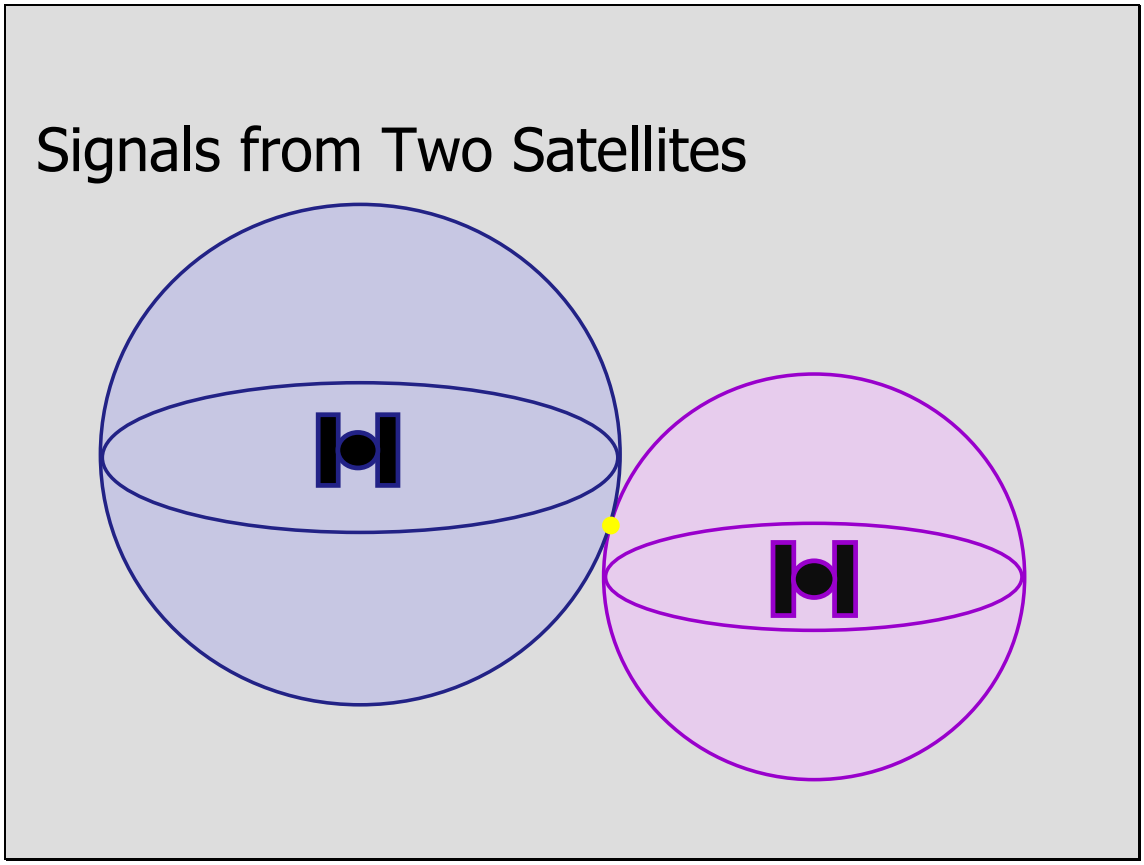
Traveling at the speed of light, each satellite signal takes a brief, but measurable amount of time to reach a GPS receiver. The difference between when the signal is sent and the time it is received, multiplied by the speed of light, enables a GPS receiver to accurately calculate the distance between it and each satellite, provided that several factors are met. Those factors are:

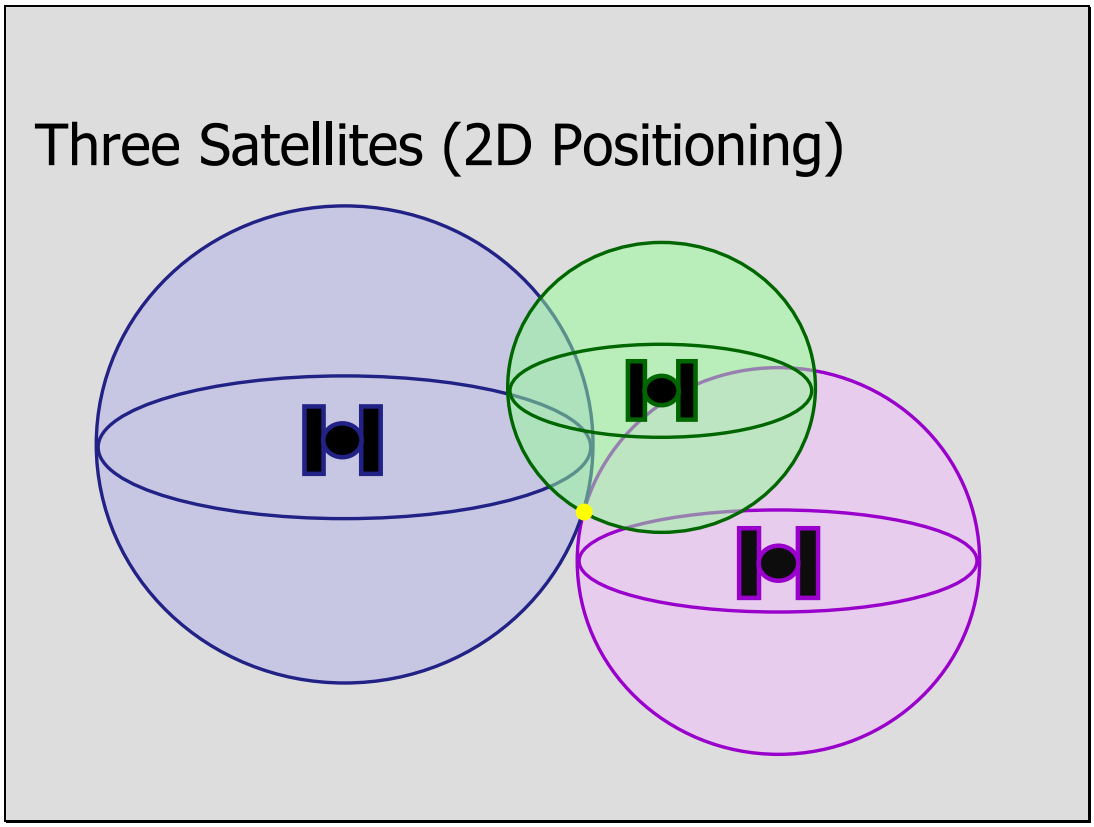
- Good satellite signal lock by the GPS receiver (already covered)
- A minimum of four satellite signals (discussed next)
- Good satellite geometry (discussed later)

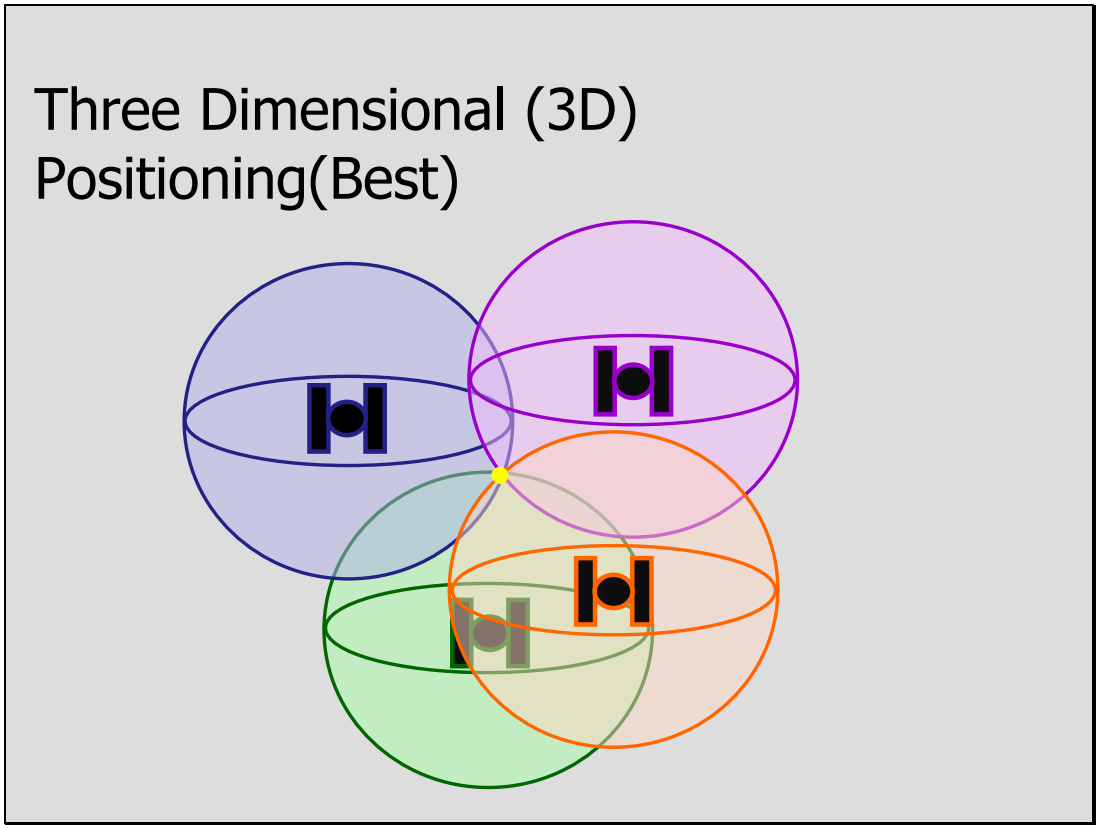
When a GPS receiver is turned on it immediately begins searching the sky for satellite signals. If the receiver already has a current almanac (such as one acquired on a previous outing), it speeds up the process of locating the first satellite signal. Eventually it locates and acquires its first signal. Reading this signal the receiver collects the Navigation Message. If the receiver does not have a current almanac, it must collect a new almanac, which will take about 10 minutes after the first satellite signal is acquired. The almanac is automatically updated during normal use.




In the above graphic, the GPS receiver has calculated a rough location that places it somewhere on the three dimensional sphere, which is actually thousands of miles in diameter. All the receiver can really do at this point is collect system data and search for more satellite signals.






It is important to understand from these slides that the more satellites your hand held unit can lock onto the more accuracy you will get. Although three satellites is functional, four or more provide the level of accuracy we typically want to see in SAR. It is rare in our SAR situations in Vermont that we cannot receive signals from at least 4 satellites. Conditions that prevent that might be very heavy leaf canopy or being in a very narrow and deep canyon.

# Selective Availability (S/A)

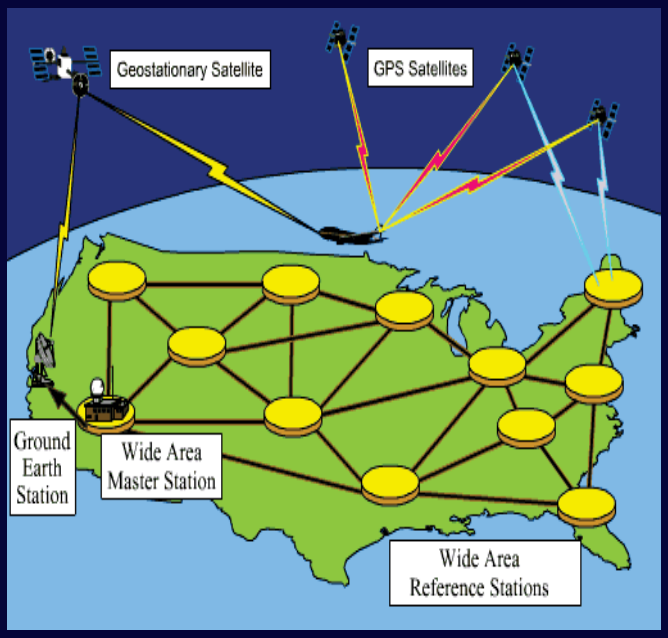
- **Department of Defense placed "dithered" satellite time message to prevent GPS from being used against us. This made the coordinates only accurate to a set area which the military could change as they needed. In May 2000, the Pentagon set S/A to Zero meters error. S/A can be re-activated, by the military, at any time.**



This reduction in accuracy would likely only be used during time of war.

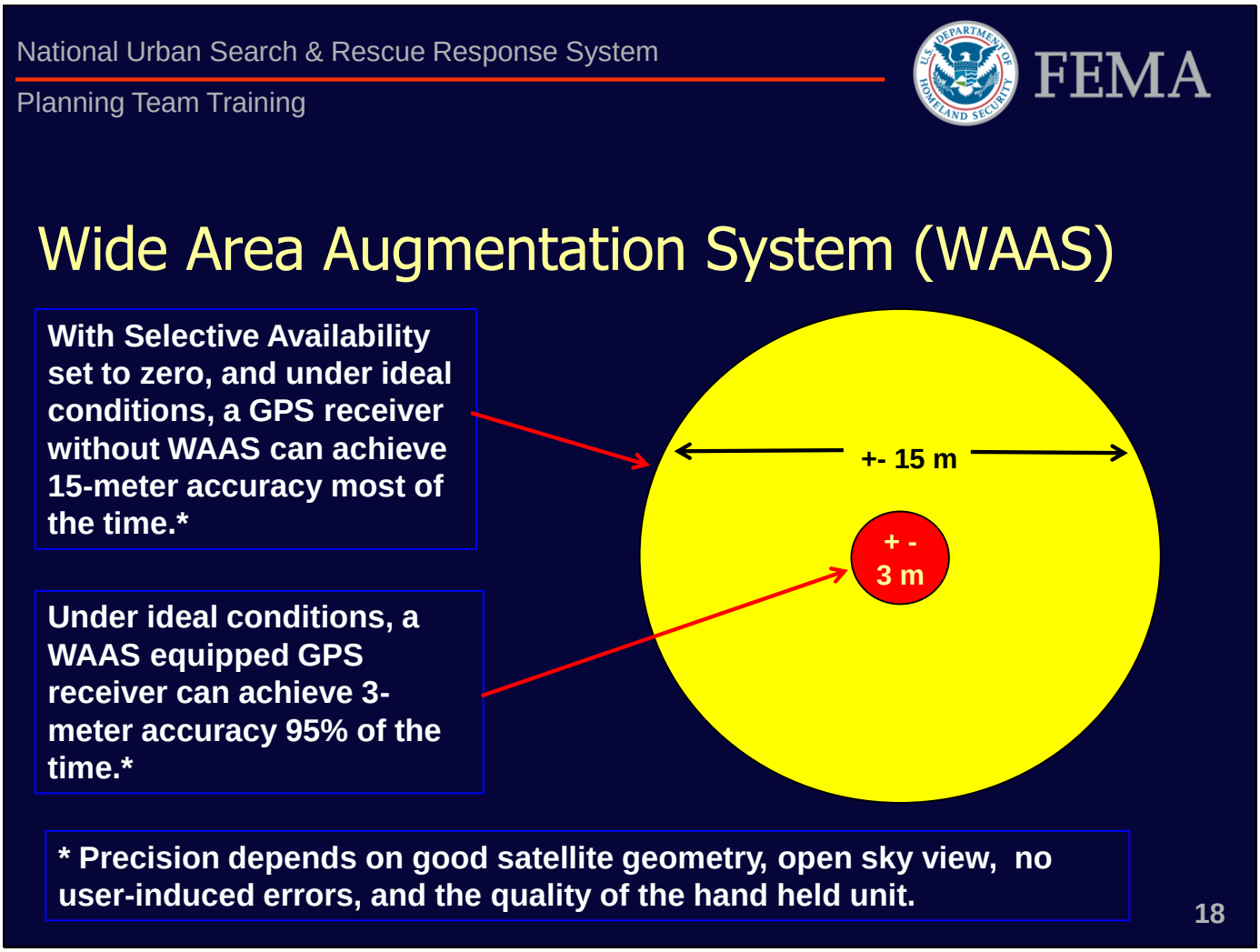
# Wide Area Augmentation System (WAAS)

- **Ground based correction signal**
- **Corrects GPS satellite orbit and clock drift plus signal delays caused by atmosphere**
- **If your GPS is WAAS enabled be sure to have it turned on in the set up**
- **This will give an even more accurate location**



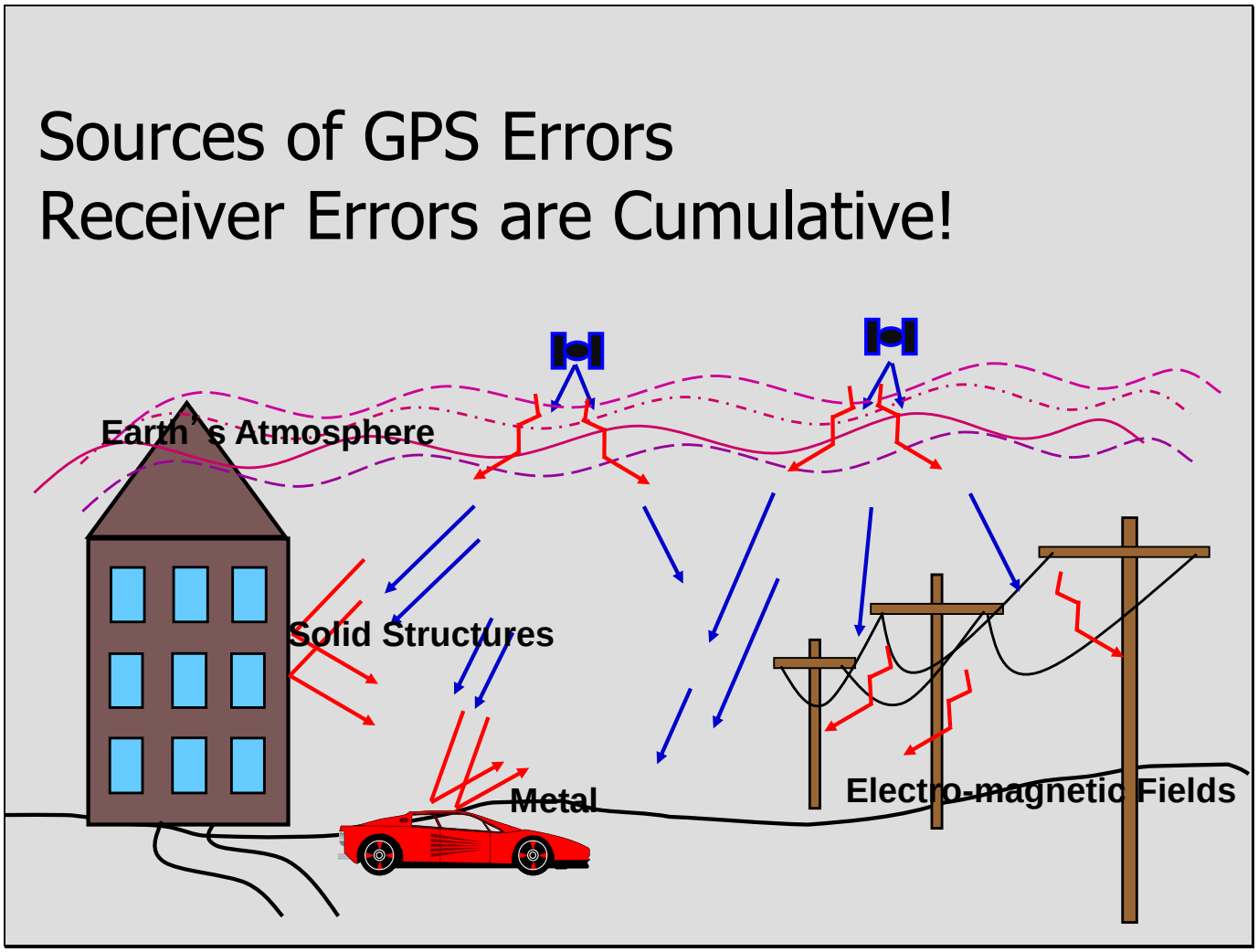



In the set-up function/menu on your GPS look for the WAAS option and be sure it is turned on.




Selective Availability (SA) was the error the military can inject into the GPS signals in time of war that was mentioned earlier.

Ideal conditions rarely happen during searches so accuracy of 3 meters (9 feet) is rare. Most of the time you can expect accuracy to about 15-25 feet which is adequate for our SAR work.




Each source of interference adds a little more error to your unit's accuracy.

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# Sources of Errors

- **Reflections - signals can reflect off of buildings, rocks, and metal objects.**
- **Electromagnetic fields (power lines etc).**
- **Buildings, while inside signal may be blocked.**
- **Best to try and maintain clear view of the sky.**
- **The more obstacles to view sky the higher the likelihood of errors.**

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In SAR you will find that usually you cannot move to get a better signal because your movements are more driven by doing a proper search or locating a clue/search subject.

Many GPS hand held units have an **averaging function** when saving a waypoint that can provide better accuracy. It is a good function to know and use for locating a small or a critical clue.

# Minimizing User Errors

- **Keep GPS away from your body with antenna directed skyward for best reception.**
- **Always verify your GPS is set to the correct DATUM and coordinate system (*This is the biggest cause of errors*).**
- **Always verify you are receiving enough signals before making critical navigational decisions (at least three signals).**

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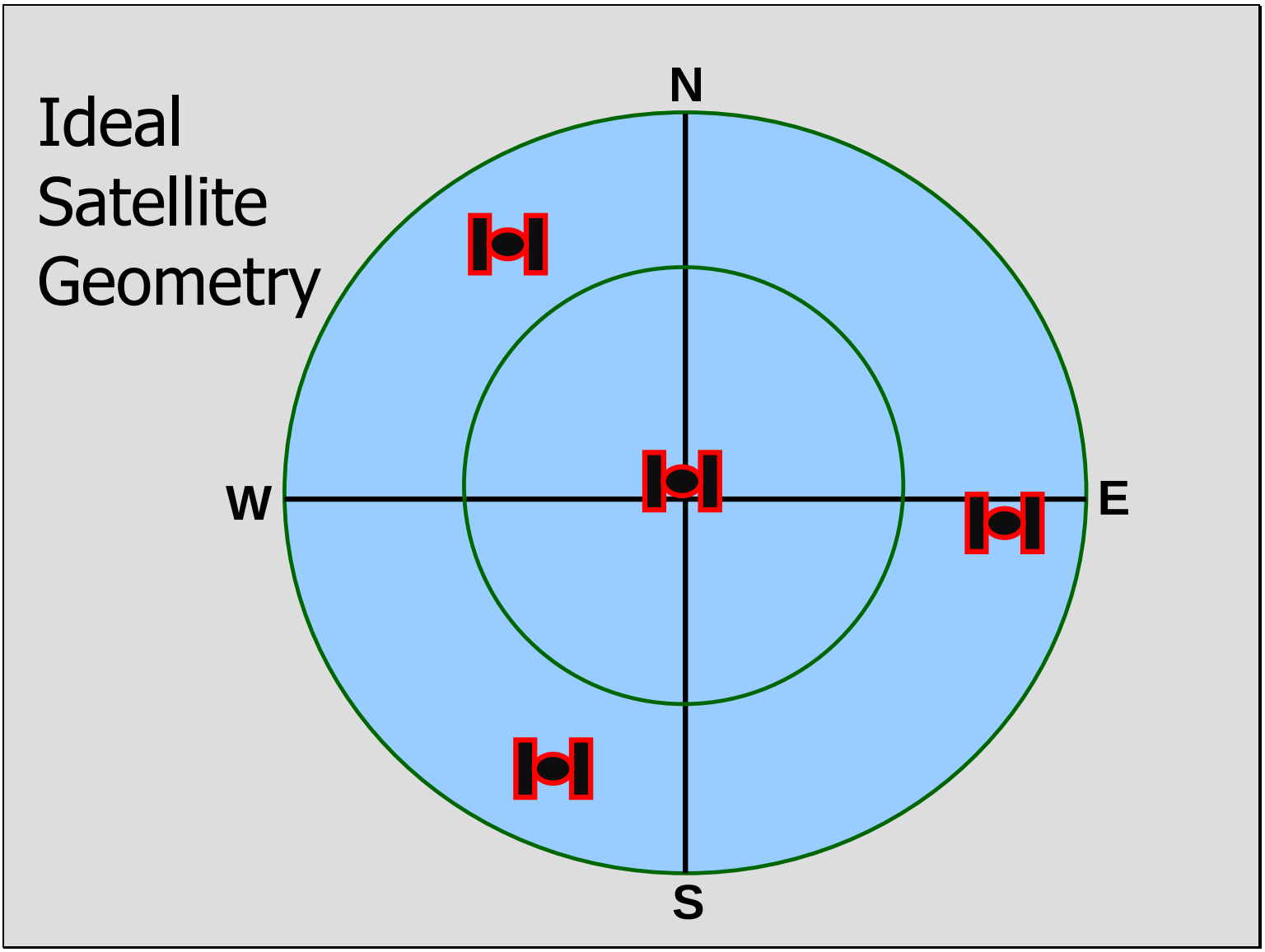
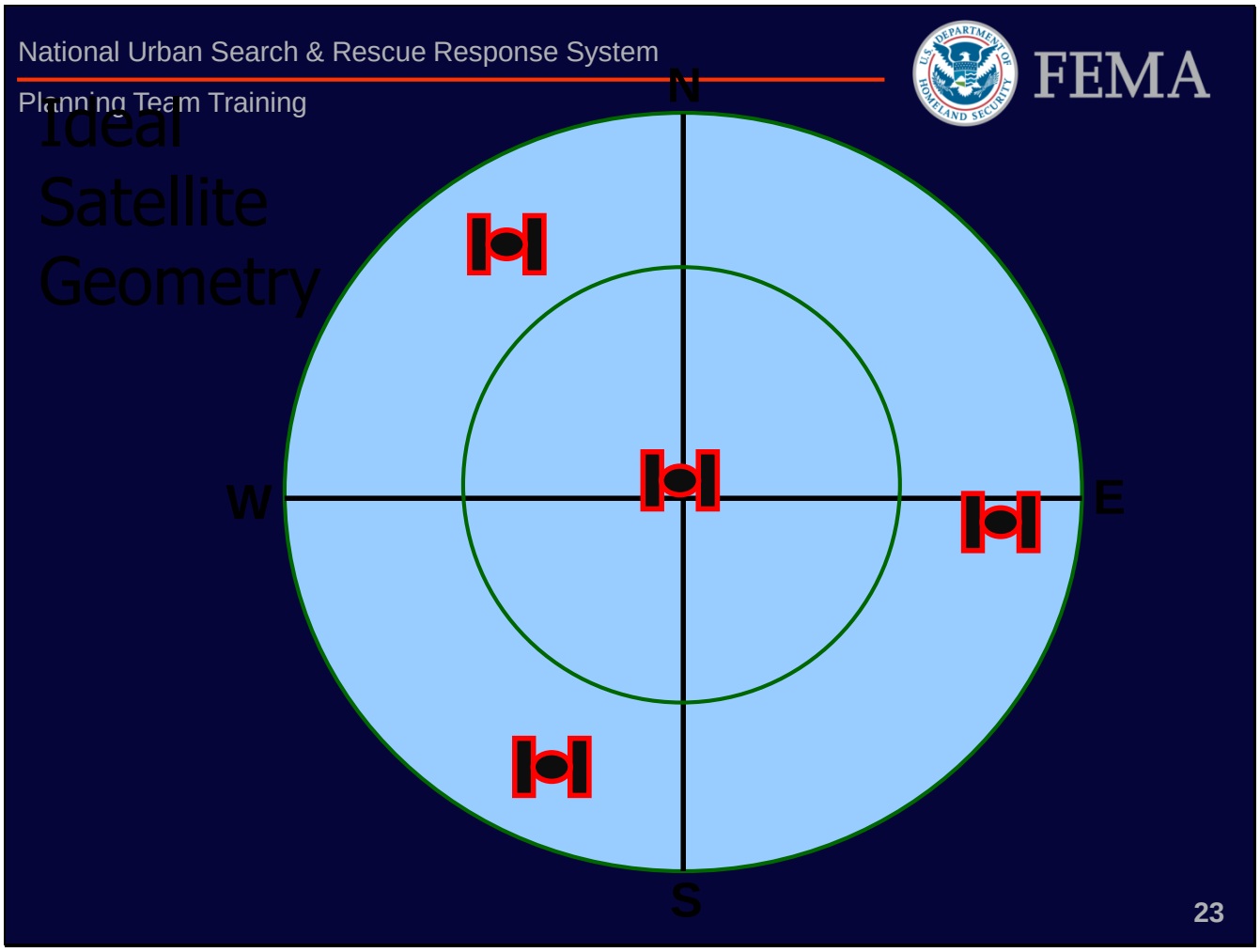
Vermont has standardized the use of WGS-84 for the DATUM so your GPS should be set to that unless instructed otherwise. There will be further discussion on how to do this later in this lesson.




**Ideal Satellite Geometry**
Satellite geometry refers to the positions of satellites relative to each other in space. Dilution of Precision (DOP) is an indicator of the quality of a GPS receiver's triangulated position relative to the quality of the geometric positions of the satellites whose signals the receiver is using. Most handheld units in SAR applications, such as Garmin, use estimated position error (EPE) value in feet or meters, which provides an estimate of the amount of horizontal error caused by satellite geometry.

The outer ring of the circle in the above diagram represents the earth's horizon, the inner ring 45 degrees above the horizon and the center of the cross hair represents the sky directly above the GPS receiver. This representation is typical of most hand held units used in SAR applications. The satellite configuration shown is considered optimal for providing the best 3D positioning because any horizontal error from one direction will be offset by the opposing satellites. The fourth satellite directly overhead improves vertical accuracy.




The best satellite configuration for optimum receiver positioning is one satellite directly above the receiver, and three or more satellites equally spaced around the horizon as shown. In this configuration satellite geometry is very good since distance measurements are from all directions.

The area where all four calculated pseudo-ranges intersect will be much smaller, providing a more precise position (as shown above). The farther apart the satellites are from each other typically the better the geometry. A GPS receiver will choose a minimum of four satellites spread out across the sky rather than four satellites bunched close together in one quadrant of the sky. But it should be noted that many receiver types (Garmin included) always try to provide a position, even a poor position, regardless of satellite geometry. The reasoning is that any GPS position information provided by the receiver is better than no position information. This also explains why GPS receivers will provide a 2D (two-dimensional) position even though that position may be off by a considerable distance on the ground.

Most GPS receivers provide some means of determining satellite geometry, either graphically (as in Garmin receivers), or through satellite position information (as in Trimble receivers). Garmin receivers use a sky view display to show the locations of GPS satellites above the receiver. A user can visually check satellite geometry, as well as the strength of the satellite signals, using Garmin's 'satellite' screen. Other brands of receivers may use a similar or different method of displaying satellite geometry and signal strength. This is more for your information as you have no control over the satellite geometry.

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# Summary

- Satellites have very low power
  - Poor to no reception in buildings or under thick cover
- Be aware of interference and obstructions
- Cold versus warm start-up issues
  - Cold start is first time unit starts in area of operation must locate itself.(Takes longer)
- Always keep extra batteries
- Try to obtain 3D (DGPS) positioning
- Keep a paper map as a backup

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When you deploy on a SAR assignment, ALWAYS carry two sets of extra batteries and a map and compass as a backup.

It is strongly recommended that you switch to lithium batteries in the winter as they perform much better in cold temperatures. As with your handheld radio, you can extend your batteries' life by keeping the GPS warm inside your jacket, if circumstances permit.

Before heading into your assignment check your compass to ensure that at a minimum you always know what direction your emergency 'bail out' direction is in case your GPS fails.

# Basic GPS Training

- **GPS Use**
  - **Proper initial setup**
  - **Basic features**
  - **Key functions and routines**



If you are not familiar with GPS, ask your SAR unit to work with you on using a GPS. This module will give you some invaluable information but hands on is the best way to learn GPS or any navigation.

If you have a GPS available it is strongly encouraged for you to take it out now and follow along for this section duplicating the steps shown on your own GPS.


Although GPS units vary based on model and manufacturer, most will have these basic functions. Familiarizing yourself with your model is critical to your being a safe and effective searcher so practice with it before you arrive at a search.

# Power Considerations

- **Two AA batteries, USB cable, 12v DC adapter**
- **Battery Life: 8-18 hours**
- **Alkaline batteries lose capacity in low temps**
- **Lithium batteries in below freezing temperatures**
- **Extensive use of backlighting, electronic compass, and audible tones significantly reduce battery life**

**Battery Compartment**

**Memory Card Location**

Most handheld units will use 2 AA sized batteries. Make sure you know what yours uses and have spares. Any battery is impacted by the cold, but lithium batteries perform FAR better in cold temperatures. While more expensive they are well worth using during cold weather months. If you can carry your GPS inside a coat during cold weather searches the batteries will last longer.

Battery life will vary greatly based on the temperature and what you are asking the unit to do. The more functions you are running the shorter the battery life. The biggest drain on battery life is the screen display; the GPS itself does not use a lot of power. This is not to say be a minimalist in what you do with your GPS, but rather to know what adds value to your effectiveness in the search. Rather than doing less than necessary, carry more batteries.

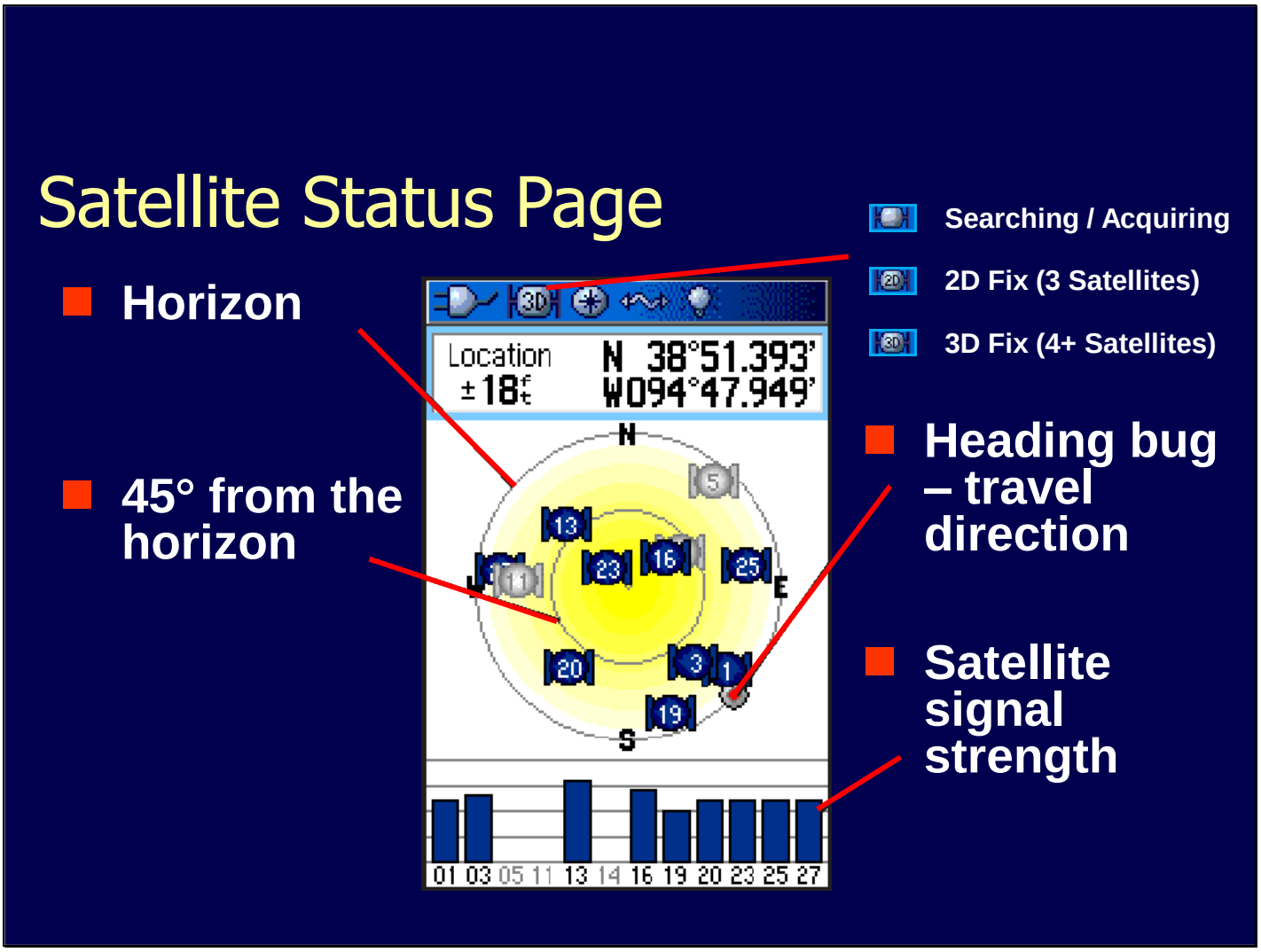
Recalibrate your GPS' electronic compass after you change batteries! Extend the GPS' battery life by using your regular magnetic compass for most navigation needs. This also saves screen time and battery life.


**Turning the GPS On (and off)**

**To turn the GPS on, <u>press</u> and <u>hold</u> the POWER key.**
**(The Garmin 64 series has the power key on the side rather than the top.)**

The Welcome Page will appear while the unit conducts a self-test. Once testing is complete, the Welcome Page is replaced by a page determined by your specific unit then usually the Satellite Status Page
Once a sufficient number of satellites have been located, a “Ready to Navigate” message may appear at the top of the Satellite Status Page. On the example above (center picture) you will see the satellites being received and the strength of each signal, the accuracy, in this case 13 feet and the current LAT/LONG.

**To turn the GPS off, <u>press</u> and <u>hold</u> the POWER key.**

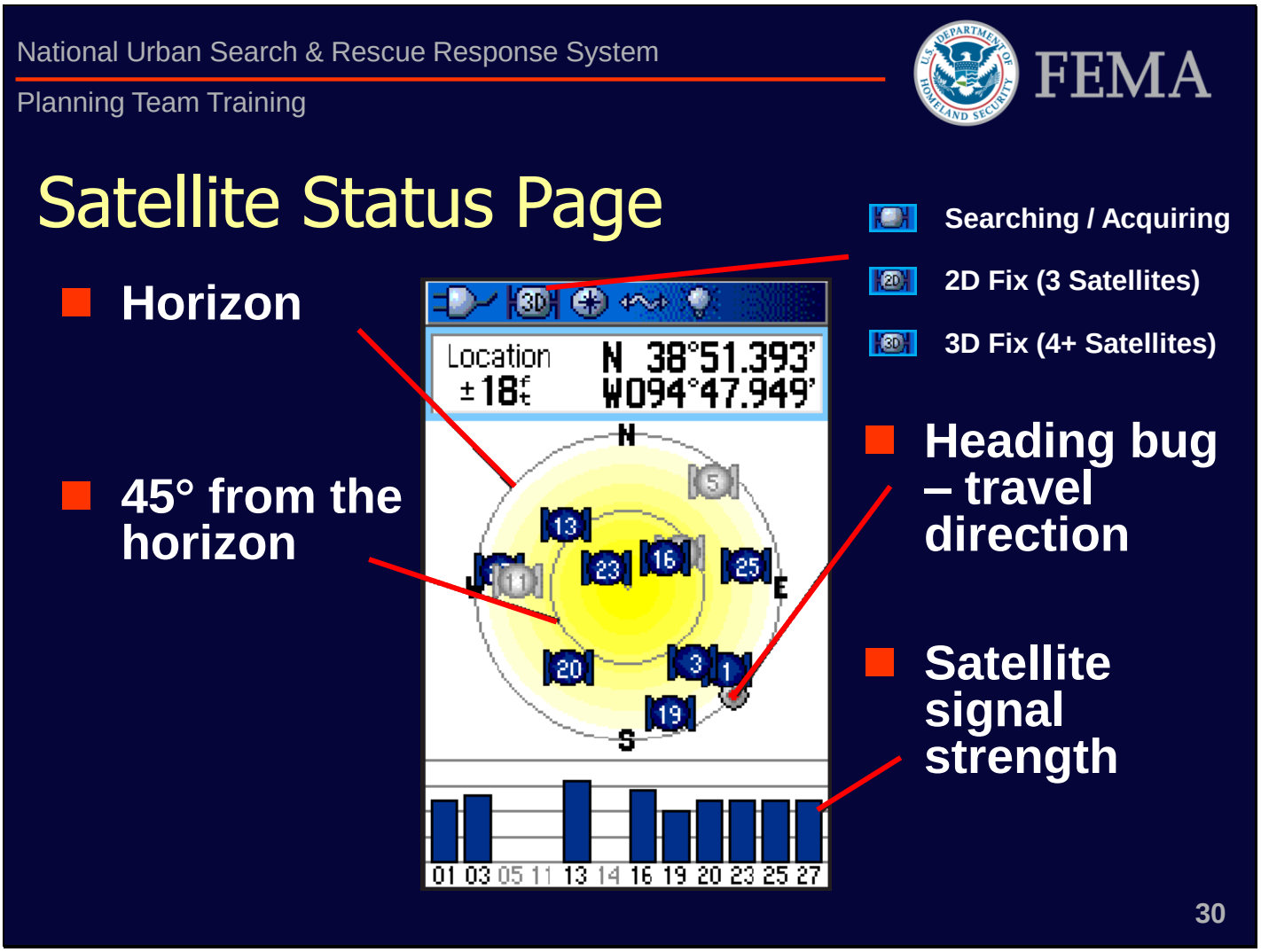



**Satellite Status Page**

The Satellite Status Page appears when the GPS is first turned on (after the welcome screens and warning pages). This page is part of the main page sequence and may be displayed at any time by pressing PAGE (repeatedly) until it appears. The Satellite Status Page includes “sky View” and Signal strength depictions, which show you how well the GPS receiver is doing at any given moment.

The sky view depicts an overhead view showing where the GPS is looking in the sky for each satellite, by indicating direction (azimuth) and elevation (angle above the horizon) The outer circle on the sky view represents the horizon, in all directions. The inner circle represents a 45° elevation above the horizon. Individual satellites are identified by number, from 01 to 32.

The signal strength bars depict relative signal strength from each satellite being received. The taller the bar, the stronger the Signal. Individual satellites are identified by number and correspond to the same satellite number depicted on the sky view. The signal strength bars give you an indication of what satellites are visible to the GPS receiver whether or not they are being used to calculate a position fix, and the signal quality.




The hollow bars indicate the GPS has found the satellite(s) and is collecting data before it can be used for navigation, Solid bars indicate the satellite(s) is ready to use.

**Receiver Status**

Receiver Status is indicated at the top of the Satellite Status Page, directly above the sky view. The status will be shown as one of the following conditions:

**Searching for Satellites**-the GPS is looking for any available satellites in view.

**Locating Satellites**-the GPS is initializing and collecting new almanac data. This process can take up to five minutes, depending on the satellites currently in view.

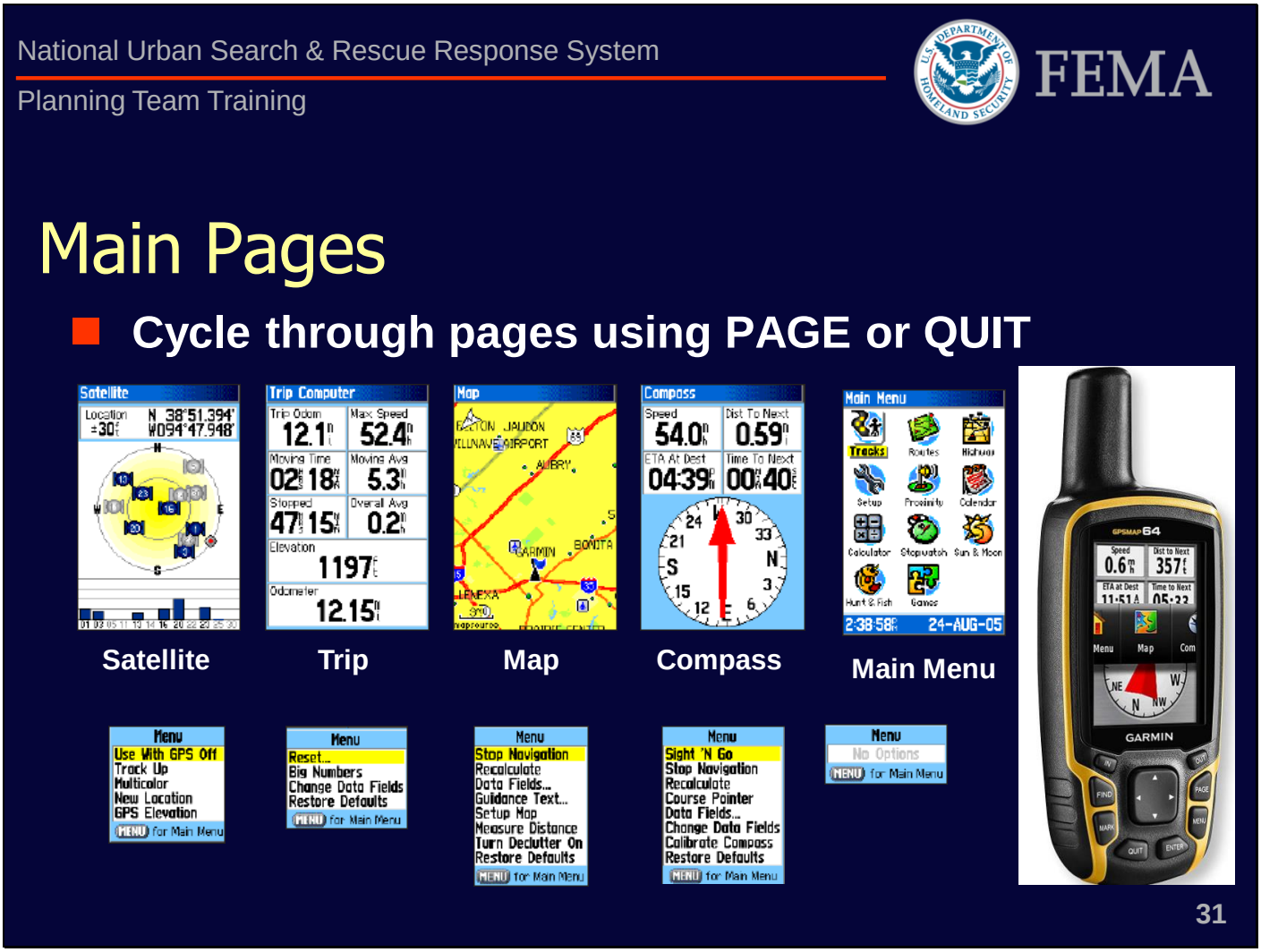
**Acquiring Satellites**-the GPS is collecting data from available satellites, but has not collected enough data to calculate a position fix.

**2D GPS Location**-at least three satellites have been locked onto and a 2-dimensional position fix L latitude and longitude) is being calculated. "2D Differential" will appear when you are receiving differential corrections in 2D mode.

**3D GPS Location**-at least four satellites have been locked onto, and your position is now being calculated in latitude, longitude and altitude. "3D Differential" will appear when you are receiving differential corrections in 3D mode.

**Lost Satellite Reception**-the receiver is not tracking enough satellites for a 2D or 3D fix. This is likely due to obstruction of the antenna or limited coverage of satellites overhead.

**Not Usable**-the receiver is unusable, possibly due to incorrect initialization or abnormal satellite conditions. Turn the unit off and back on to reset the unit. Simulating GPS Reception-the unit is in simulator mode and is not receiving satellite information.




**The 3 Main Pages**

All of the information needed to operate the GPS is found on "pages" (i.e., display screens). If no destination is selected, there are three main pages: Satellite Status, Map, and Trip Information. Press the PAGE key to sequence through the pages in forward order, or use the Quit key to sequence through the pages in reverse order.

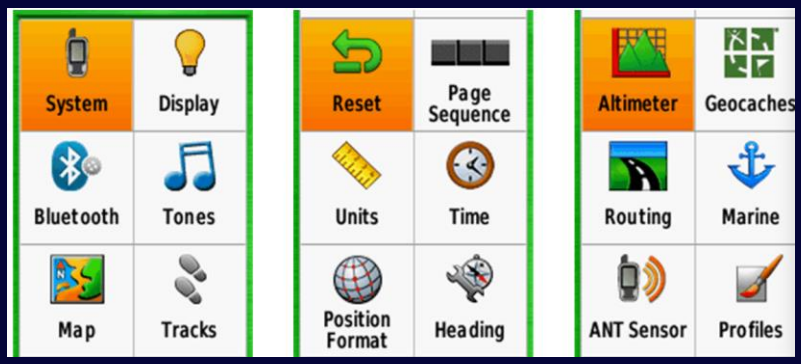
For more advanced users it is possible to customize and add additional features that can be accessed on the ‘pages’.

From most pages if you select “MENU” it will take you to the menu for that page. Many pages allow for further customization. For example on the ‘Trip Computer’ and ‘Compass’ pages you can decide how many data fields are displayed and what information they contain.

# Main Menu

- **Press MENU button twice for Main Menu from any Page**


2 X



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# Main Menu (continued)


GPSmap 60CSx

- Battery Power / Level
- Auxiliary Power
- Searching / Acquiring
- 2D Fix (3 Satellites)
- 3D Fix (4+ Satellites)
- Backlight Usage
- USB Cable Connection
- Electronic Compass On

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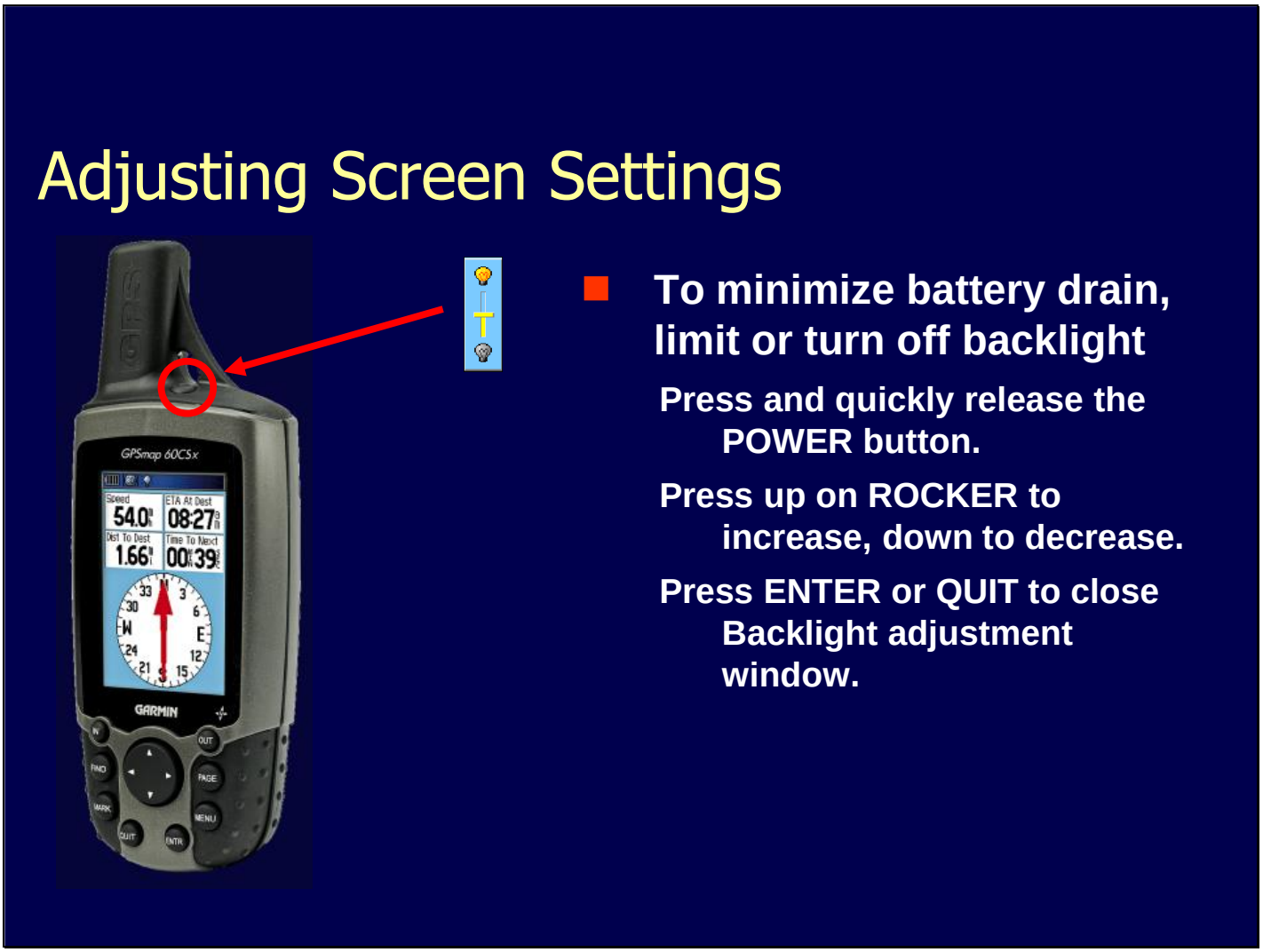
**The Main Menu**

The Main Menu provides you with a directory of the GPS's features and unit settings. From the Main Menu you can mark new waypoints, find existing waypoints, create routes, save track logs, change unit settings, and much more. Several of the Main Menu features will be covered later. Time, date, battery level and backlight status are all indicated at the bottom of the Main Menu.

Again, it is essential to get help on your GPS and practice with it before using it on a search.

GPS units have many many features, some of which are more useful than others for SAR. Focus on getting very comfortable with moving among menus and pages and using the features that are most important which are the ones we will cover in this lesson..



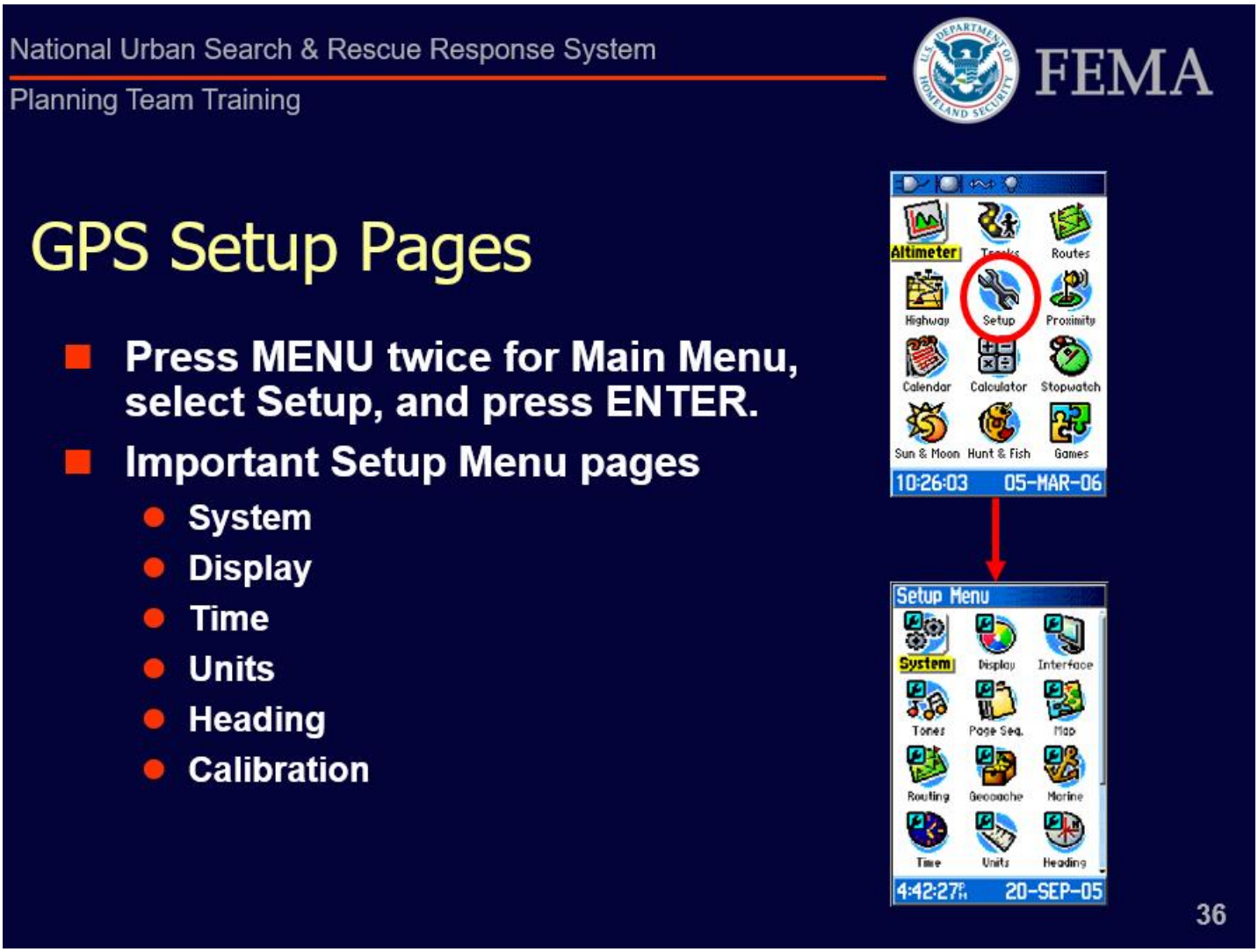

**Adjusting Screen Contrast and Backlighting**

If lighting conditions make it difficult to see the display screen, you can adjust the contrast or turn on the backlight.

To adjust screen contrast and/or backlighting:

1. Press the POWER key momentarily. A pop-up window appears for screen settings.
2. Use the Left/Right portion of the ROCKER KEYPAD to adjust screen contrast.
3. Use the Up/Down portion of the ROCKER KEYPAD to adjust backlighting.
4. Press ENTER or PAGE, to return to the previous screen. Or, press QUIT to cancel the settings.

The lamp icon in the lower left comer of the page indicates backlighting level. When the backlight is off the lamp is shaded grey. When backlighting is on, the lamp icon turns white.
You can also find a setting in 'Setup' for how long the screen stays on after you have last touched a key. Remember that screen time and brightness are the biggest users of battery life.




**THE SETUP PAGES**

This page provides access to sub-menus related to setting up many different features on your GPS.

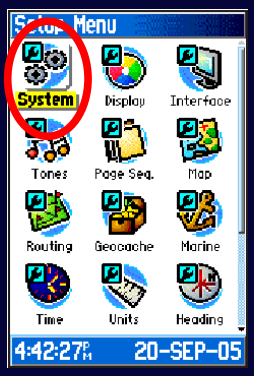
Checking the Setup pages before each mapping mission will ensure that all of your settings are correct and setup properly. The Setup Pages allow you to customize your GPS to your personal preferences. Setups vary from model to model but this provides a representative approach that is typical for many units. If you are new to GPS you will probably want to talk to more experienced searchers for advice as to what they find useful.

<u>Some of the various pages in the Setup Page are:</u>

| | |
|---|---|
| **System** | Mode, Battery; WAAS |
| **Display** | Backlighting, colors (some models) |
| **Time** | Format, Daylight Savings, Zone, UTC Offset |
| **Routing** | Preference, Calculation Method, Calculate For, Avoid |
| **Units** | Distance/Speed, Heading, Heading Display, Elevation |
| **Position** | Format, Map Datum |
| **Pages** | This is where you can customize your ‘pages |

# Setup: System

- GPS
  - Normal – for everyday use
  - Demo – for indoor training
- WAAS
  - Enabled
- Battery Type
  - Alkaline
  - NiMH
  - Lithium
- Proximity Alarms
  - On







**The System Setup Page**

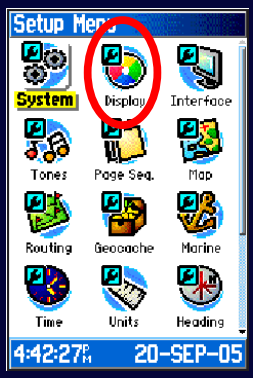
The System Setup Page allows you to select from three different modes of operation: 'Normal', 'Battery Saver' or 'Demo Mode'. Battery Saver and Demo Mode will prolong battery life. Battery Saver reduces the rate of satellite signal sampling and is best for constant speed, straight-line travel. Demo Mode shuts off the satellite receiver portion of the GPS and is best suited for indoor use (e.g., learning to use the GPS or creating manual routes). The GPS cannot be used for navigation guidance when operating in Demo Mode. If you are following along with your own GPS put it in demo mode now.

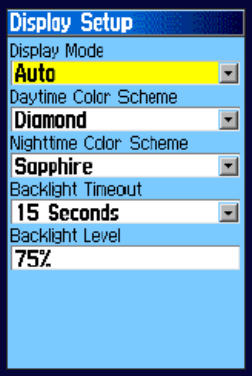
The Battery setting is used to designate the type of batteries currently being use to power your GPS : Alkaline or lithium. This setting ensures accurate readings from the battery level indicator. The Backlight setting determines how long the backlighting will remain on after the last key press. Automatic shutoff times from 15 seconds to 2 minutes are available. Select 'Always On' for continuous backlight operation.

Wide Area Augmentation System (WAAS) capability improves position accuracy in your GPS. When enabled, this feature searches for a WAAS satellite near your location and then receives differential data for correcting the GPS satellite signals. NOTE: Processor-intensive functions, such as automatic route calculations, will run considerably slower when WAAS is enabled. If you experience significant operational delays, disable the WAAS feature.

# Setup: Display

- **Display Mode**
  - **Auto – Switch between Day and Night modes at sunrise and sunset**
- **Backlight Timeout**
  - **On continuous or timed. Setting ignored if external power used.**
- **Backlight Level**
- **Backlight setting will increase or decrease battery life**



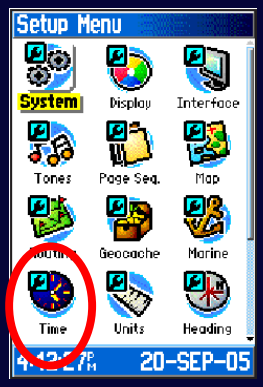


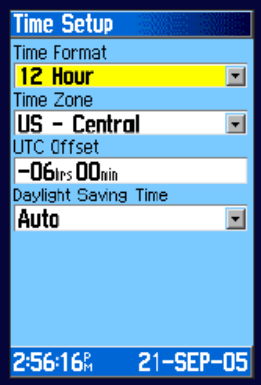

The display settings are largely personal preference.

Just keep in mind that they can have a significant impact on battery life.

# Setup: Time

- **Time Format**
  - **Set to 24-hour format**
- **Time Zone**
  - **Time zone for the area of operations**
- **UTC Offset**
  - **Changes with Time Zone**
- **Daylight Saving Time**
  - **Set to Auto**



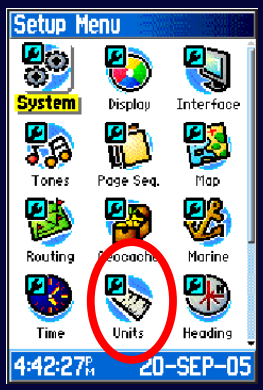


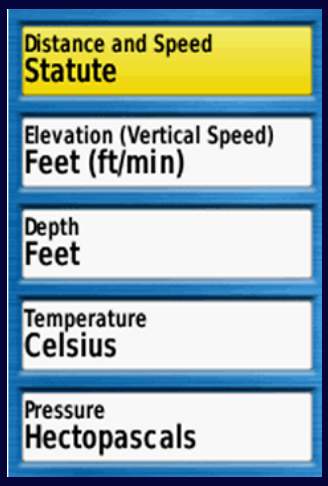

**The Time Setup Page**

The Time Setup Page allows you to select a 12- or 24-hour time format, select your local time zone and enable daylight savings time. The 'UTC Offset' readout indicates the time difference between your local time zone and Coordinated Universal Time (UTC; also referred to as Greenwich Mean Time). Your local time and date is displayed at the bottom of the page. (The Time and date cannot be changed. That information is received from the Satellites).

# Setup: Units

- **Elevation**
  - **Feet or Meters**
- **Distance**
  - **Statute Miles, Nautical Miles, Metric**



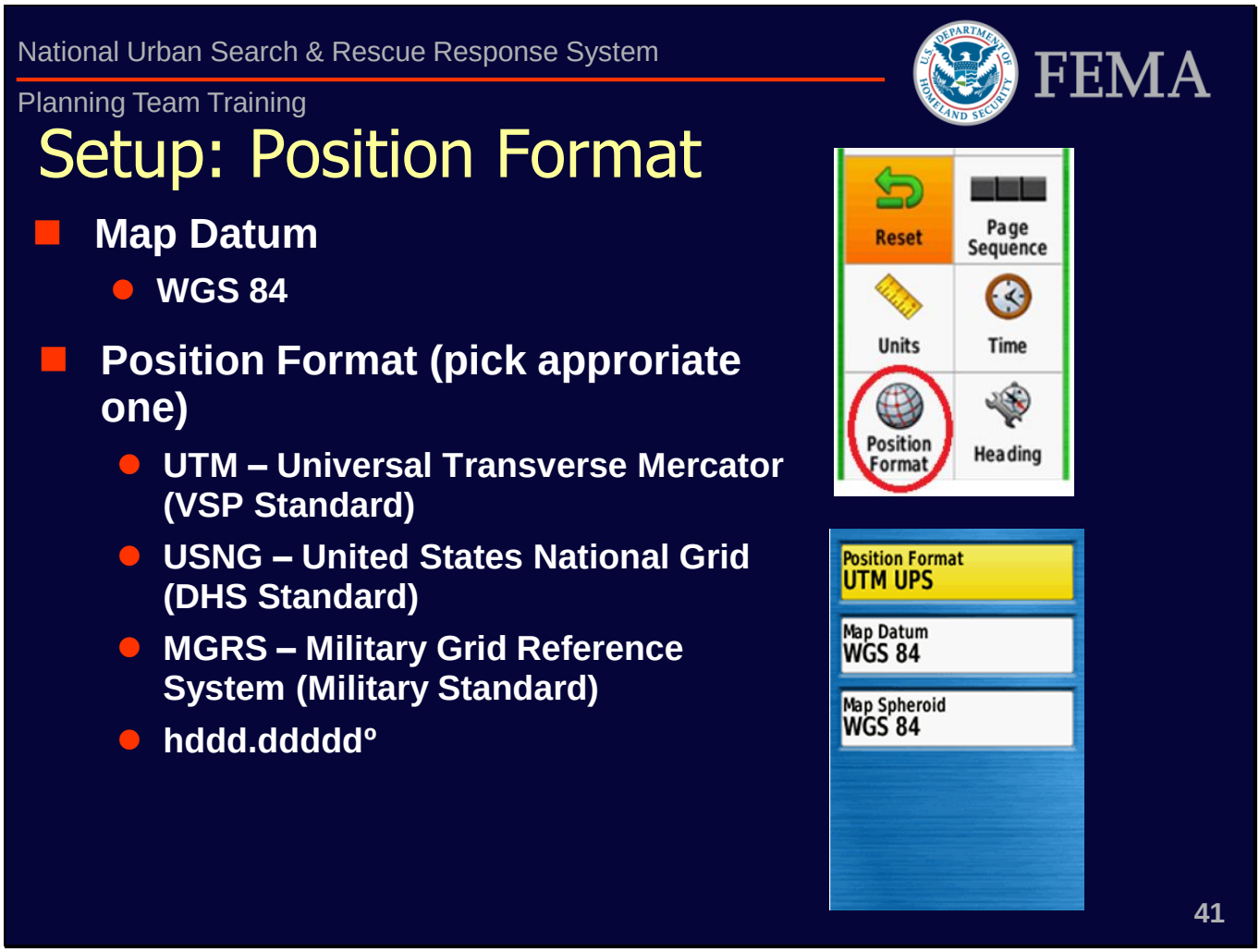






**The Units Setup Page**

***NOTE*** Some GPS units combine the ‘units’ and ‘position format’ settings in one menu location, and others have them in separate locations. However the setting options are generally the same once you find them on your GPS.

The Units Setup Page allows you to select imperial/standard vs. metric measurement. Most people are most comfortable using feet and miles as opposed to meters and kilometers, but it is really personal preference.




**The Position Format Setup Page**

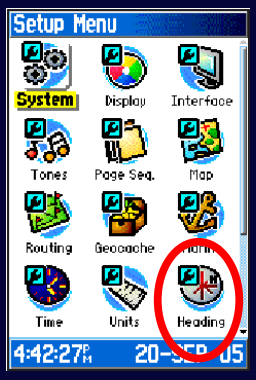
The Position Format Setup Page (sometimes combined with 'Units') allows you to change the format for location readout or select a different map datum.

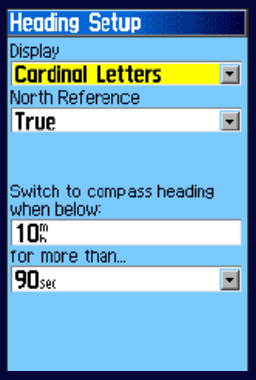
While a comprehensive list of over 100 map datum is available **all searches in Vermont use WGS 84 for the Datum.**
Once this is set on your GPS you should not have to change it again except under unusual circumstances when you may be directed to do so.

Format options include latitude/longitude (in several formats), MGRS, UTM-UPS, and several regional grids which wouldn't typically be used in the US.
Vermont currently has standardized the use of UTM for use in SAR, but there is a movement toward increasing use of USNG (which is very similar).
You should also be familiar with the various lat/long formats. You may get location information in some variation of lat/long (often decimal degrees hddd.dddd°) from a dispatcher or when speaking to a lost party if they look at coordinates on their phone.
You should be comfortable quickly switching back and forth between position formats – it is not unusual to use more than one on the same mission. Using the wrong position format or getting confused among the various forms of latitude/longitude is a frequent sources of errors on SAR incidents.

# Setup: Heading

- **North Reference – Specifies the type or north reference used to calculate your heading**
  - **Set to "Magnetic" or "True"**



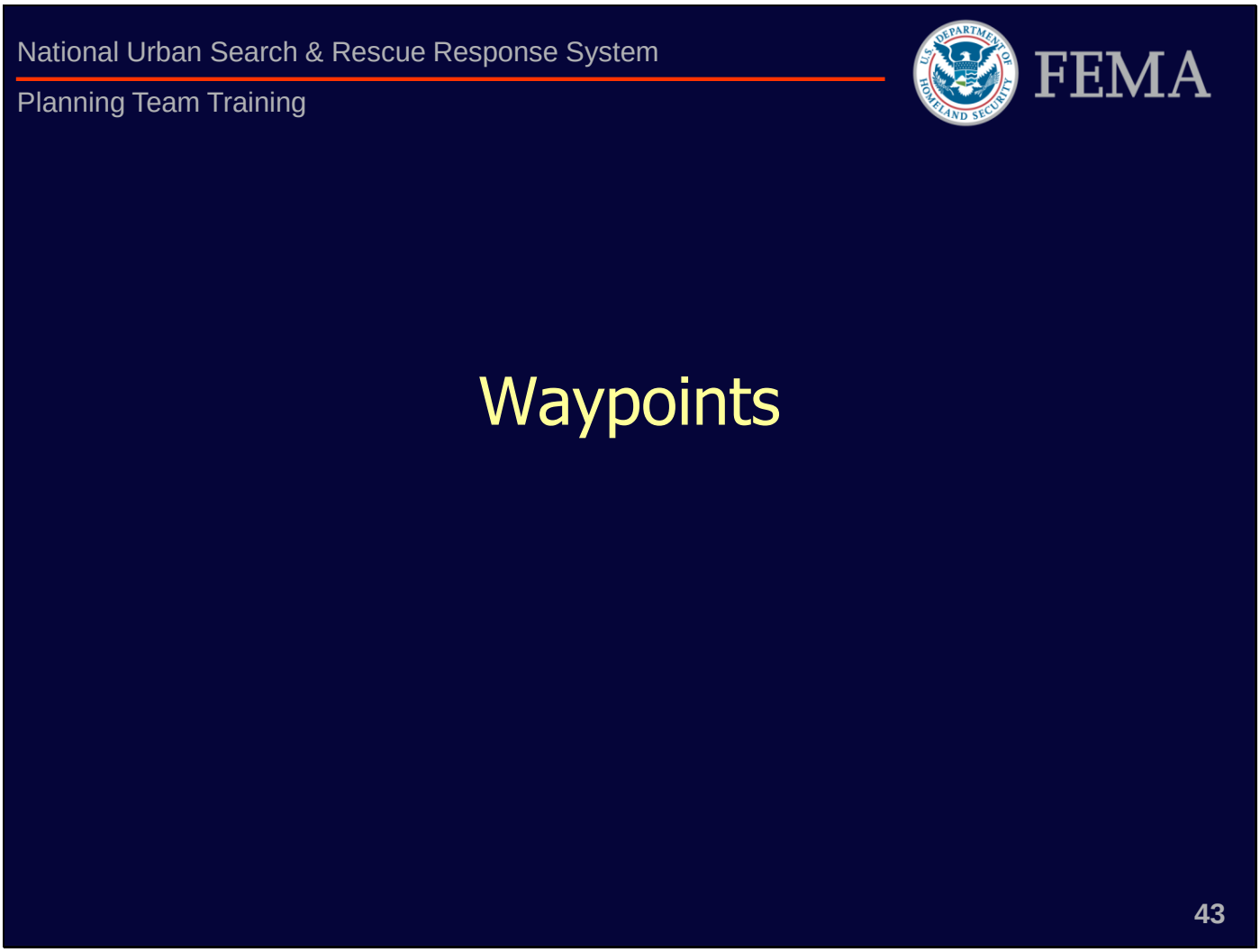






**The Heading Setup Page**

Similar to being able to adjust for your declination on your compass as previously discussed, you can also choose whether to display magnetic or true bearings on your GPS. Know what your unit is set to otherwise it can be very confusing. Most SAR teams standardize how their compasses and GPS units are set up with respect to using true or magnetic bearings. As a general rule if you are using your compass WITHOUT adjusting for declination you should set your GPS to magnetic so bearings on both will be the same. If you HAVE adjusted the declination on your compass then setting your GPS to 'True' will result in compatible readings making it easier to use them in tandem.

**It is very important that you clearly understand this setting!**




Now we will get into the two most critical functions you will use on your GPS during searches. Now we will get into the two most critical functions you will use on your GPS during searches:  waypoints and tracking.

You will use waypoints to record locations of clues or other sites.  You will use tracking so the Command Post can verify the route you followed conducting a search.

Always put a waypoint at your car or starting point before you start a search assignment so you have an easy way back if needed.

# Waypoints

- **Waypoints are locations you record and store in your GPS**
- **Waypoints are created in 3 ways**
  - **Press the MARK key while at a location.**
  - **Create a waypoint on the Map page.**
  - **Enter the coordinates for a waypoint manually.**

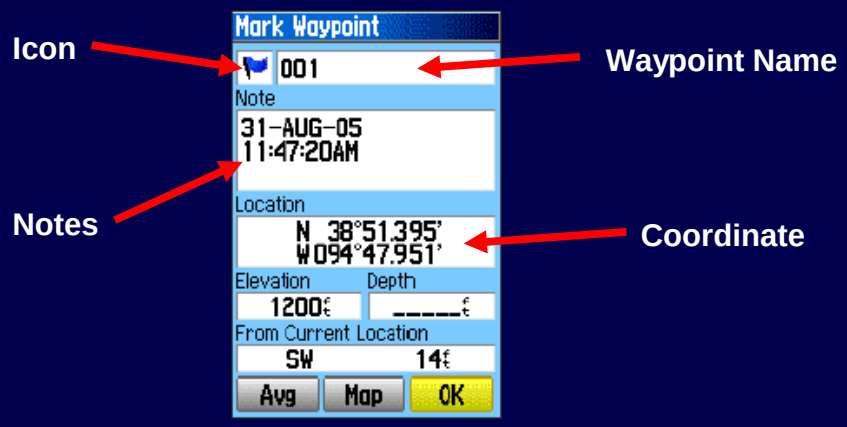



A waypoint is simply a specific location on the earth's surface. They are most typically used in SAR for marking your starting point (so you can always find your way back!), any destinations you may be navigating to, clues you may want to document, and subject location if you find the missing person.

# Waypoints: Mark Current Location

## *Quickest way to mark a waypoint*

- **Press and hold the MARK key until the Mark Waypoint page appears.**
- **To accept the waypoint with the default information, highlight OK and press ENTER.**




Entering a waypoint where you are is just this simple.
To name a waypoint use the rocker to move the highlighting to the waypoint name area and press enter.
It is generally best practice to give each waypoint a unique name so you can remember what it is (e.g. 'car' or 'start' for your starting location, or 'hat' or 'glove' for a clue you locate). The GPS will default to the next available waypoint number and you likely won't remember what waypoint '005' is. You will be provided a keyboard that you may use to name it. When you have the name entered, select ok and it will return to the page you see here and you can select ok to save the waypoint.

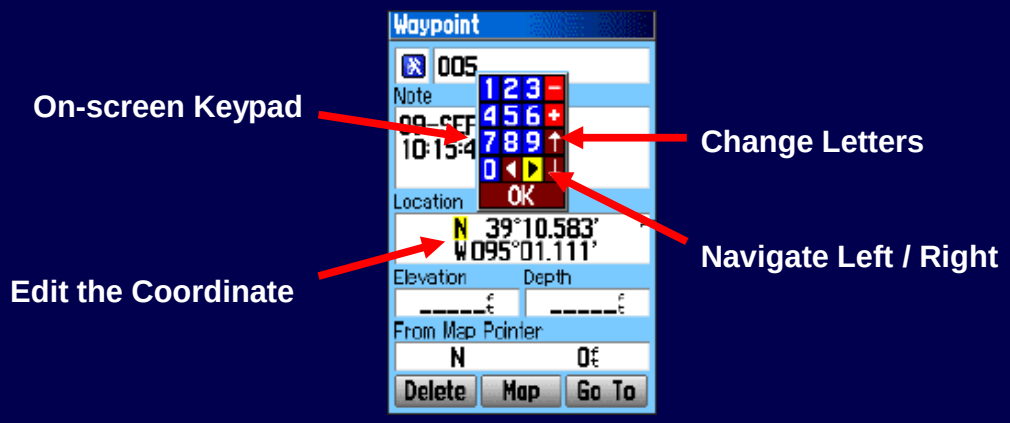
# Waypoints: Mark a Location on Map Page

- **On the Map page, use the ROCKER to move the arrow to the location to mark as a waypoint.**
- **Press and quickly release the ENTER key to capture location and open the information page.**
- **Highlight OK and press ENTER to save.**

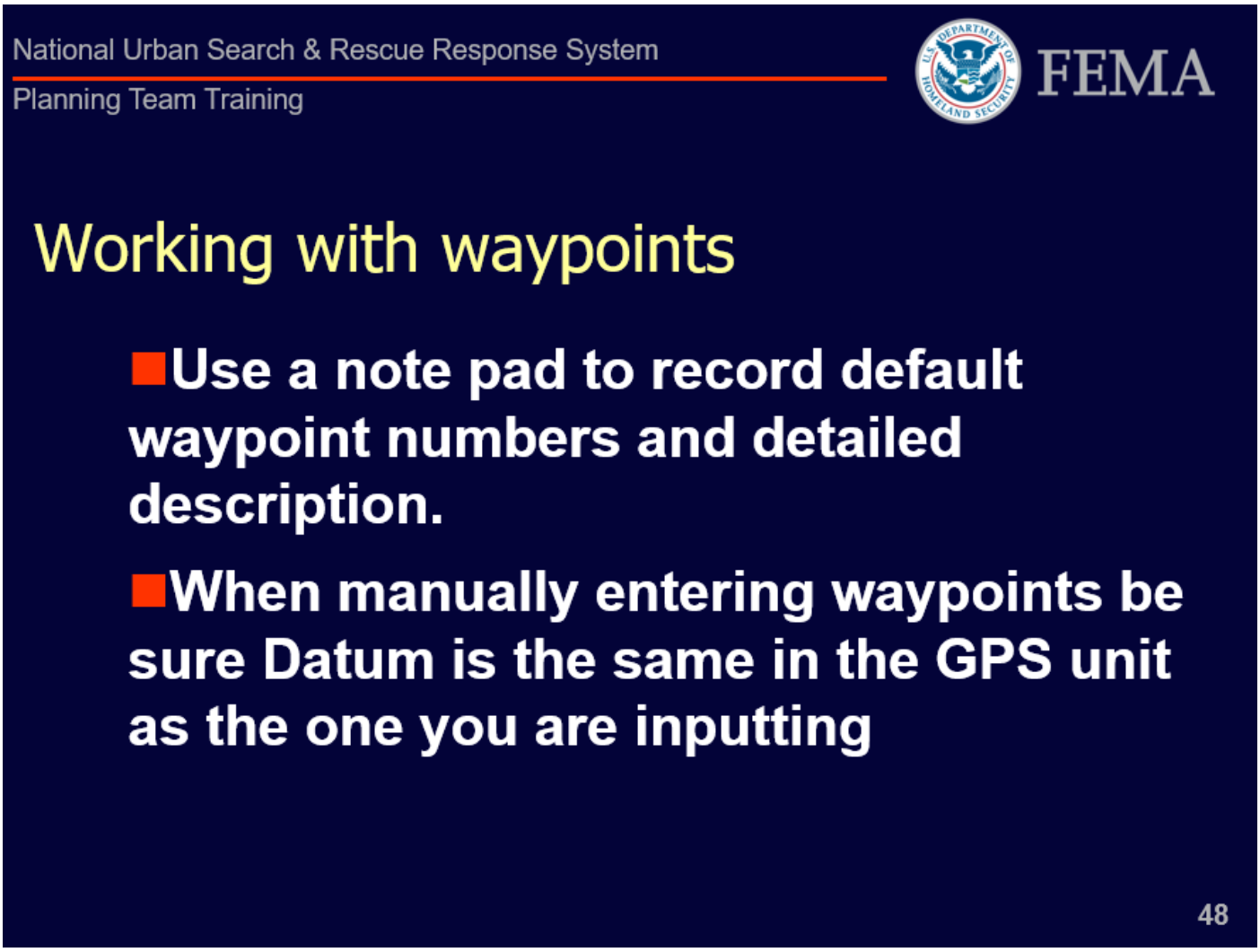

To enter a waypoint somewhere else, follow these steps. You will be able to name the waypoint but since you are not at the site of the waypoint you will not be able to use the "Avg" function.

# Waypoints: Mark Location with Known Coordinates

- **Press and hold the MARK key until the Mark Waypoint page appears.**
- **Use the ROCKER to highlight the Location field. Edit the coordinate with your known coordinate.**
- **Highlight OK and press ENTER to save.**




If you want to enter a waypoint using known LAT/LONG follow these steps. It is just like entering a waypoint where you are except you then go in and change the LAT/LONG numbers in that area of the screen.




If you choose to let the GPS unit number each waypoint you enter, be sure you write down each number and a description so you will have it during your debrief at the Command Post. While it takes a bit longer, giving them names in your GPS as described earlier makes it much easier to find them later and saves the step of writing them down.

If you are entering a LAT/LONG make sure it was derived using the same DATUM you are using.

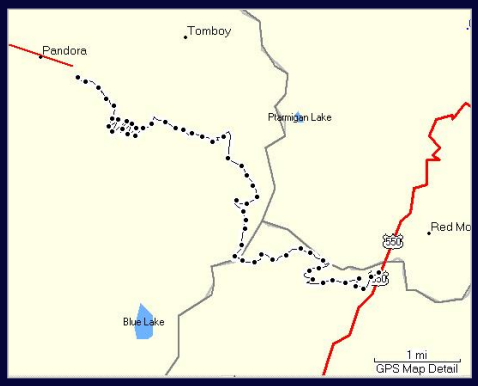

A track is a record of where you have gone with the GPS unit and is critical for the Command Post knowing what has been searched. Before getting your assignment it can be helpful to delete any old tracks on your GPS unit to make it easier on the Command Post personnel and to ensure you don't run out of memory in the unit. As you begin your search, remember to turn on tracking (most teams choose to have tracking turned on as a default setting) and clear the 'Current Track' (IMPORTANT!).

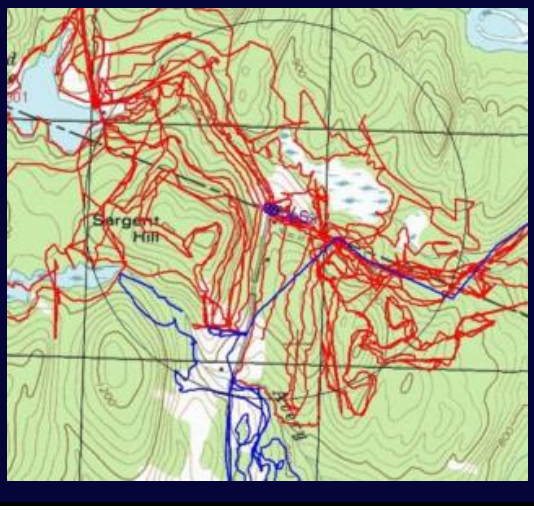
When you finish your assignment (and before returning to the CP) save your track.

While not required, in Vermont we strongly encourage you to change the name of your track to include your name (or call sign), otherwise when the tracks are all collected it can be very hard to determine which track belongs to which searcher.

# Track Log

- **Creates an electronic "breadcrumb" trail or track log while you travel**
- **Each point in the track contains information on time, location, and elevation**

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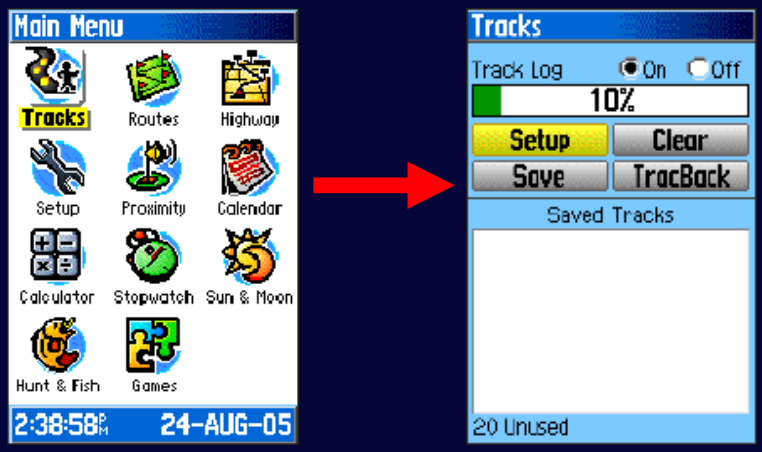
Combining all searcher's track logs on a master planning map shows search managers which areas have been searched and can help identify gaps in coverage.

# Track Log: Access Track Logs

**Press MENU button twice for the Main Menu.**

**Select Tracks and press ENTER.**






This will get you into the track menu.

Since this is a commonly used feature you may want to customize your GPS to include the Track Manager in your 'pages' so it is quicker to access. Check the owners manual or ask a team member for help in doing this.

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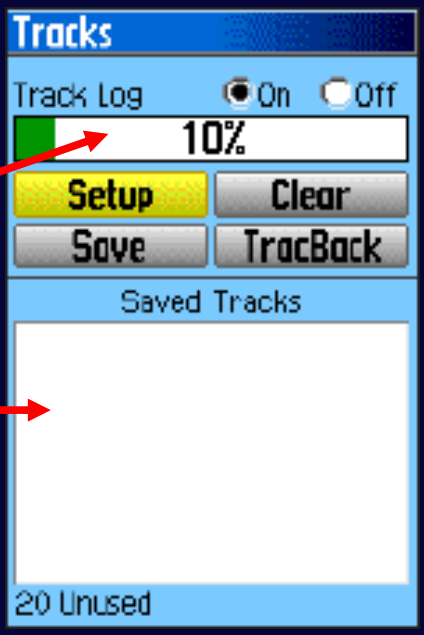
# Track Log: Access Tracks Logs (continued)

- **On/Off toggle**
- **Percentage of memory used**
- **List of saved Tracks**
- **Remaining available logs**

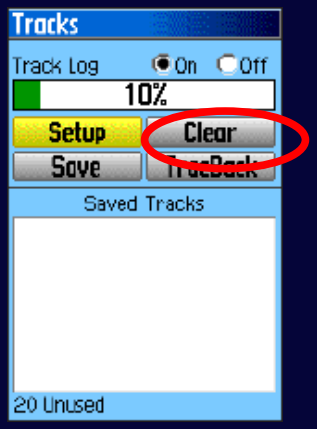





On/Off is how you start and stop the track from recording. Most teams just leave this set to 'on' so your GPS is always tracking.

# Track Log: Clear the Track Log

- **Only clear Track log once it has been downloaded to Plans**
- **Always clear track log before starting a new assignment**
- **Highlight Clear and press ENTER.**
- **Confirmation message appears – Press OK.**






Always SAVE your track when you have completed an assignment and always CLEAR your track log when starting an assignment.

# Introduction to the US National Grid (USNG)

- **Nationally consistent map and grid system.**
- **Provides a seamless reference system across judicial boundaries and map scales**
- **It is a plane coordinates system that is simple enough to be taught and used at a fifth grade level**
- **Developed from the military UTM system**

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The USNG and UTM provide simple and accurate location data as an alternative to LAT/LONG. SAR in Vermont has standardized the use of UTM.

If everyone using the same system this simplifies communications.

USNG uses the same grid system as UTM but is abbreviated and simplified for field use.

USNG uses the same grid system but slightly different terminology than UTM. This section is provided as informational only for those interested as it is not presently in use for SAR in Vermont, however there is a movement among some of the national SAR organizations to use USNG so being familiar with how it works may be helpful.

# U.S. National Grid (USNG) History

- **WW I- military determines grid systems are good and everyone develops their own**
- **WW II-Too many different grids systems.**
  - **Need to develop one common grid system**
- 1945 - 1949: US and British armies develop and implement UTM and Military Grid Reference System (MGRS).
  ***Great success story; Used in combat ever since***



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# U.S. National Grid Datum use

- **The Standard Datum for USNG is NAD83 and should be used unless unable to use.**
  - **NAD83 coordinates shall be designated 18SUJ23480647**
  - **When using NAD83 there is no need to report NAD83 when reporting coordinates**
  - **When using NAD27 note it by placing (NAD27) at the end of the coordinates**

# U.S. National Grid
# What do all the numbers mean????

**A USNG value has three components**

**11S MT 30865 32027**

**Grid Zone Designation:**
**for a world-wide unique address.**

**100,000-meter Square Identification:**
**for regional areas**

**Grid Coordinates:**
**for local areas.**

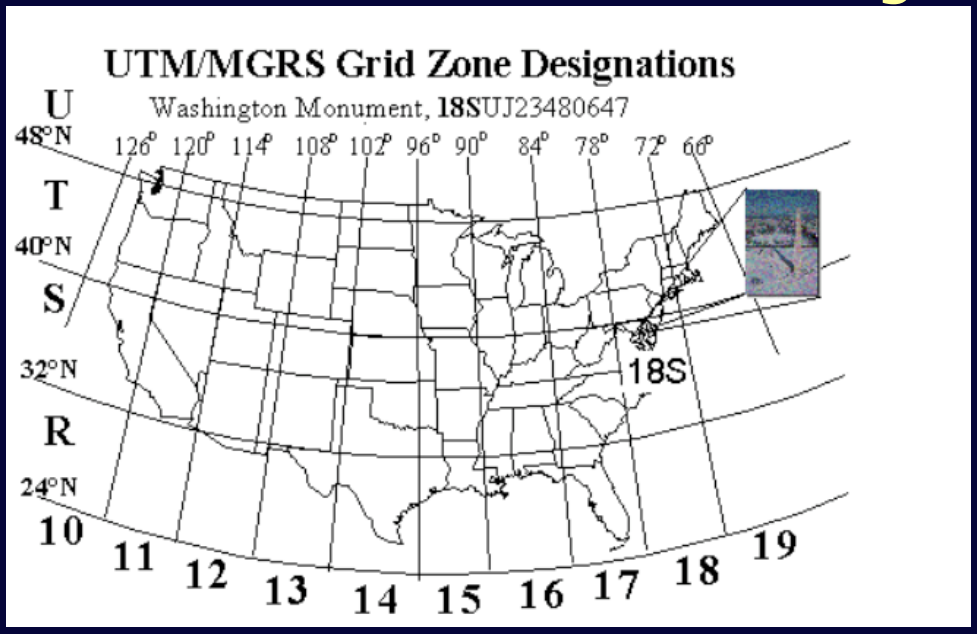




# U.S. National Grid:Grid Zone Designator

- **The GZD's divide the U.S. geographic area into 6 degree longitudinal zones designated by a number and 8 degree latitudinal bands designated by a letter. These zones and bands are taken from the MGRS.**
- **The Continental U.S has**
  - **10 longitudinal zones**
  - **4 Latitudinal zones**
- **11S MT 30865 32027**
  - **11S designates a GZD**

# U.S. National Grid:Grid Zone Designator






Almost all of Vermont is in Grid Zone 18T other than a very small section of 19T in the northeastern corner of the state. (This may sound familiar from our discussion about UTM.)

# U.S. National Grid:100,000-m Square Identification

- **Grid Zone Designators are further subdivided into 100,000 meter Square Identifications. These squares are labelled by a two letter designator so as not to repeat themselves within approximately 1000 miles.**
- **11S MT 30865 32027**
  - **MT is the 100,000 meter Square Identification**



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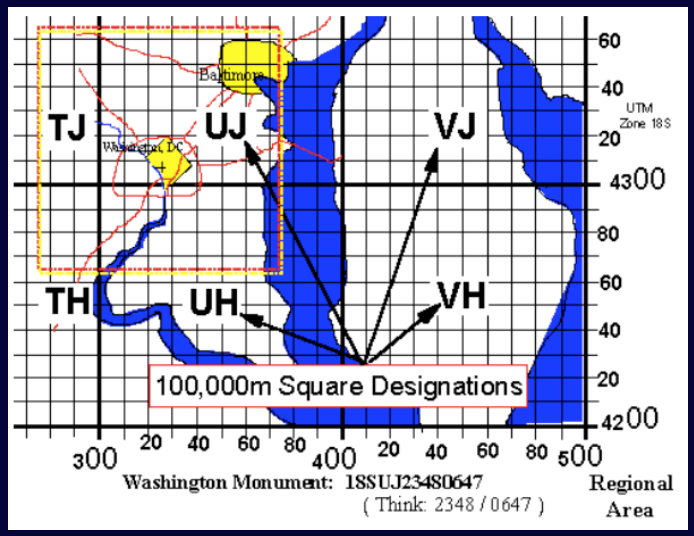
# U.S. National Grid:100,000-m Square Identification



## U.S. National Grid Coordinates

- The position within the 100,000-m Square identification is given by the UTM grid coordinates in terms of Easting (E) first then Northing(N) second.
- The coordinates are always given in an even number then read from left to right with easting first, then northing
- The number of digits used decides the accuracy of the coordinates





## U.S. National Grid Coordinates

- 11S MT 30865 32027
- 30 32- four digits locates within 1km
- 308 320-six digits locates within 100m
  - Football field size area
- 3086 3202-eight digits locates within 10m
  - Modest size home
- 30865 32027-ten digits locates within 1m
  - Manhole cover size

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# U.S. National Grid Coordinates

- **Use the number of digits needed for the accuracy desired.**





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# U.S. National Grid Further information

**The following links have additional information on the USNG.**

- **http://www.fgdc.gov/usng/index.html**
- **http://www.fgdc.gov/usng/educational-resources/USNGInstruct_No1v4_No2_r.pdf**

# Congratulations, you have finished this module

**You may close this window to return to the main course and select another module to complete.**

**Be sure you keep track on your course checklist so you know which modules you have completed**