

Using a Hand Held GPS as a Flight Training Aid

by Wayne Pratt CFI

Ever wonder if those *Turns About a Point* were actually circular, or your track on the ILS was accurate. How well do you track a VOR radial? A record of your flight track can be a helpful training aid, as well has a nice record for a significant mile stone, like your first solo and initial solo cross-country.

Using an inexpensive hand held GPS, Google Earth, and free interface software you can produce a flight record in 3-D in Google earth. Using more advanced techniques you can scan a map, or approach plate, calibrate it with latitude longitude co-ordinates and overlay your GPS ground track.

To start with you need a hand held GPS. Typical models that work are shown in the photo. The GPS on the left is a Garmin non-mapping eTrex costing less than \$80. The one on the right is a Garmin GPS60CSX and is representative of the high end of the hand held models costing around \$350. Both work equally well for this application. Other than cost the only other consideration is connection capability. These devices have either an RS232 or USB interface. If you choose a model with an RS232 interface you will most likely need a USB to RS232 adapter. The reason for this is that newer computers, including notebooks, no longer have RS232 ports. If your GPS has an RS232 port you will need a USB to RS232 adapter. You can get a USB to Serial Adapter at computer stores for about \$40. If your GPS has a USB port all you need is a USB cable with a mini-USB end for the GPS. This article will be written around using Garmin products simply because they have the most universal support when it comes to accessing track logs and waypoints, but these tools will work with most any brand GPS.



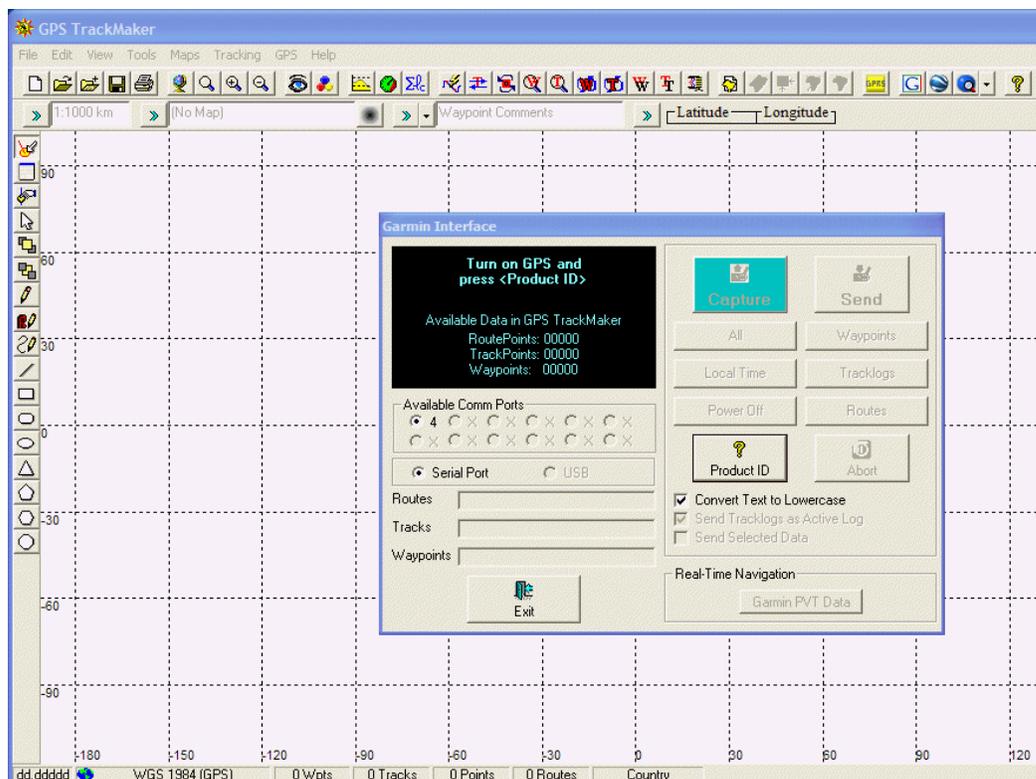
Next you will need Google Earth to visualize your flight recordings on ground based features. If you have Google Earth Plus you can import directly from the GPS. However you will only get the native GPS files and Google Earth will not be able to display altitude information. Google Earth Plus is no longer available from Google. The version that supports full imports is Google Earth Pro and that costs \$400/yr. But you can use the free Google Earth available at <http://earth.google.com/> and free interface software from GPS TrackMaker to achieve full 3-D capability. To get GPS TrackMaker go to <http://www.gpstm.com/downloads.php>. If you are using the USB interface you will also need the USB drivers which you can also get through links on the GPS TrackMaker web site. Go to <http://www.gpstm.com/support.php?article=7> for getting drivers as well as a connection tutorial.

Once you have Google Earth, GPS TrackMaker, and USB drivers you are ready to import your GPS flight logs into Google Earth. But first, you need flight logs. For the most part you just turn on your GPS and

throw it into the back of the aircraft and at the end of the flight retrieve it, turn it off and it will be ready to transfer the recordings when you connect it to you computer. However, a few suggestions will make your recordings more efficient.

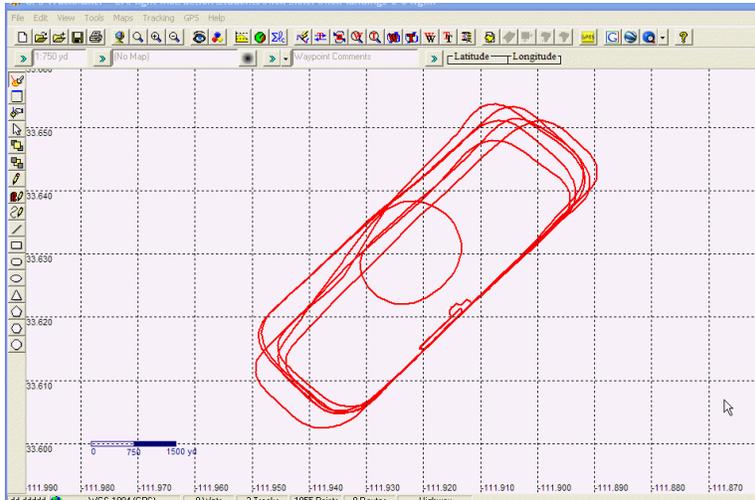
- Clear old track logs by going to the Tracks menu in the GPS before starting a new recording.
- Make sure track log recording is enabled. You will find this control in the same menu as the record clearing function.
- Experiment with the placement of the GPS in your aircraft for obtaining the best signal. If possible avoid putting it above the instrument panel where rough air may bounce the GPS off the windshield causing damage. In a Cessna the baggage compartment has sufficient view of the sky to enable good recordings. In a DA-40 or any composite airplane the GPS can be most anywhere in the cabin.

Once you have a flight record and have turned on and connected your GPS to your PC start up GPS TrackMaker. After you start TrackMaker select **GPS** from the tool bar then **Garmin Interface** and you will see the following.



Next, click on **Product ID**. This will cause the software to scan the available computer ports and find your GPS. Then click on **Track Logs** to upload the GPS records. Finally, click **Exit** to complete the process.

You will then see your tracks centered on the screen on the lat/long grid. If you have a *calibrated map*,



(calibrated maps are discussed later in this article), from any source scanned or imported from the internet can be inserted onto the same grid. This procedure will be in detail later in this article. But, for now we will transfer the track log to Google Earth. The TackMaker screen will appear similar to the following example of a track log from a landing and take off session.

At this point use the *Select Tool* to draw a box around the track log. You will see all the discrete points appear with a highlighted dot. With the track log selected go to *Save As* and save the file as *yourname.kml*. The “kml” extension is important to enable full 3-D in Google Earth.

Once you have completed this step select **3-D View in Google Earth** from the View pull down menu. Google Earth will then automatically open up with your track centered on the screen. In this example, the Google Earth screen will appear as follows:



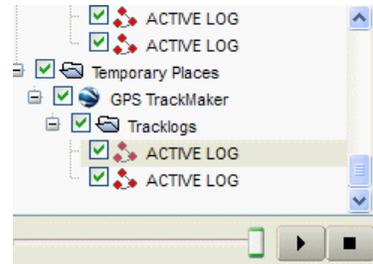
This provides a bird’s eye view of the tracks in the traffic pattern. From this view you will be able to discuss with your flight instructor you tracks and how they compare to the ideal traffic pattern. Google Earth enables you to zoom in or out to any level you choose.

You can see your tracks in 3-D by going to the **Places Window** in Google Earth as shown here and selecting the active track log. If you have several track logs you can verify the one you want by clicking the check mark. If you click the check mark off and you track goes away, you have the correct track log.

When you have the correct log selected *Right Click* on it and select *Properties*. With Properties selected go to the *Altitude Tab*. Enable **Absolute** from the drop-down and click **Extend to Ground** check box.

You may also want to go to the *Color, Style Tab* and pick a color for the *Area* feature and set something in the range of 40 to 50% opacity.

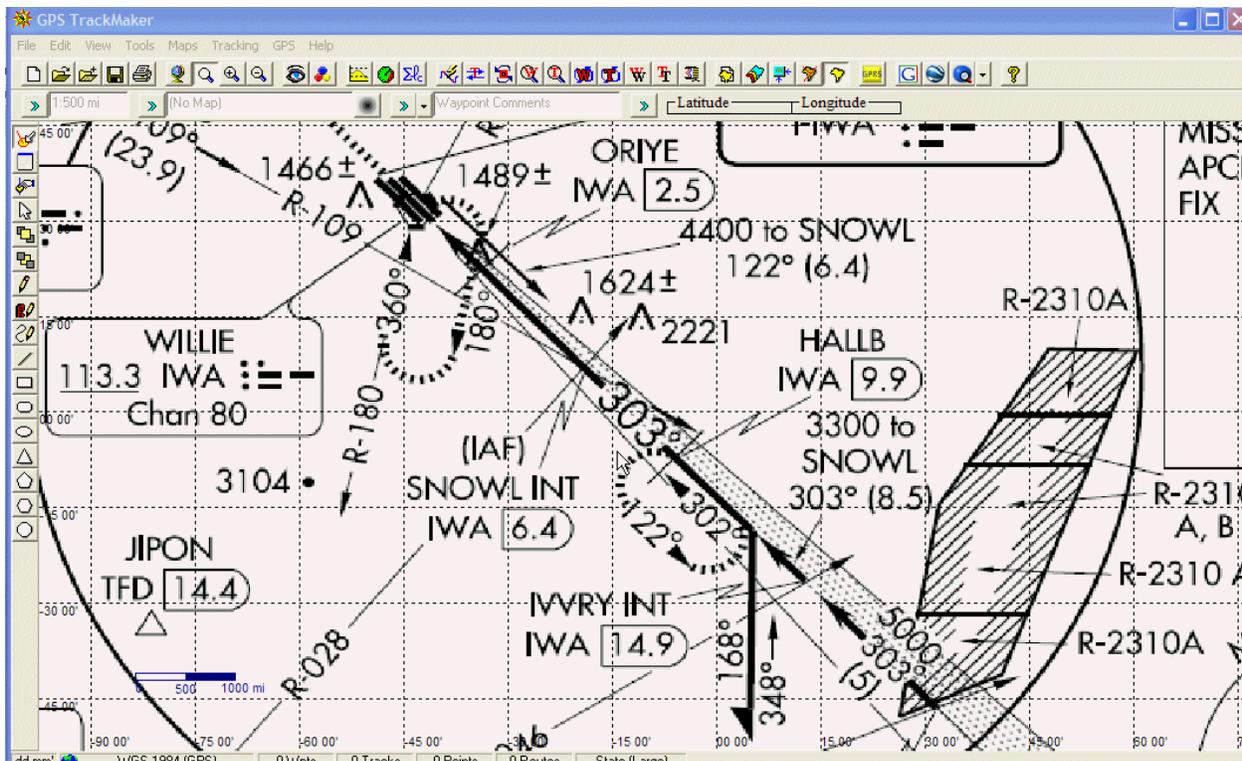
This lets you see through the altitude curtain to the surface features. You can then see the track in 3-D as in the example below:



Using these tools you can examine your flight tracks to almost any level of detail. This is helpful for the ground based maneuvers, traffic pattern, cross-country (including traffic pattern entry), approaches and holding patterns, and any phase of flight requiring ground reference. It is particularly helpful for student solo cross countries as it provides a record that the student can use with the instructor upon return to enable a meaningful critique of the student's performance.

You can also import and *calibrate* scanned chart images in GPS TrackMaker. Calibrating a scanned map establishes the latitude and longitude of at least two points on the scanned image. TrackMaker then scales the image and matches the calibration points to its Lat/Long grid.

As an example, we can take the scanned image of the ILS/LOC30C approach at IWA and insert it into TrackMaker using the **Tools->Insert Map Image** command. You will then see the following screen.

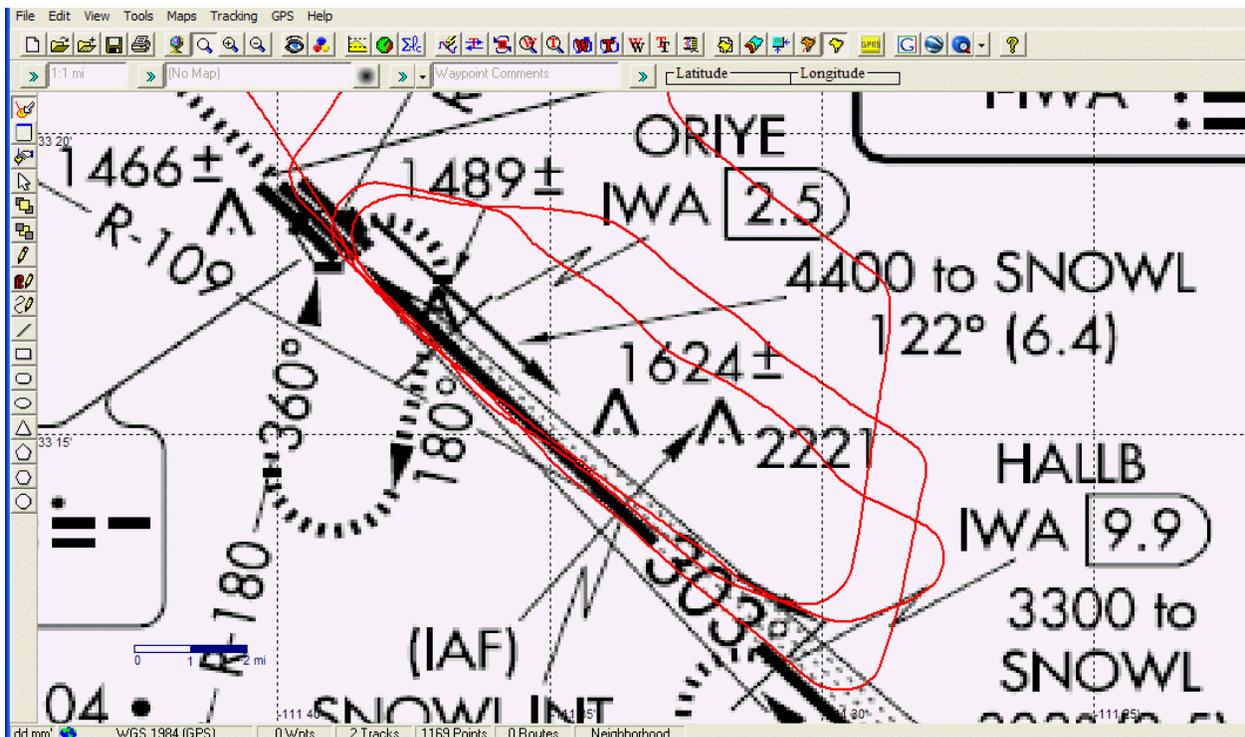


Note that the whole approach plate was not used. Only the portion that will show navigation performance is needed for post flight discussions.

Next, pick two calibration points that can be easily defined and preferably toward opposing corners of the image. This improves the accuracy of the calibration process. In this case the VOR IWA and the airspace fix IVVRY have been selected. You can find the lat/long for these points by going to AIRNAV.COM.

Click on the Calibrate Button shown on the tool bar. You will then get a light blue cross hair. Center the cross hairs on IVVRY and fill in the known coordinates. You should see the input panel shown here. Click OK and repeat the process for the VOR. The image is now calibrated. Save it as a gtm file for future reference. For this example save it as ILS-LOC 30C-IWA.gtm. Now you can overlay your flight record to review how your performance compared to the charted procedure.

The following shows the track for 3 ILS approaches to KIWA30C where the student was given radar vectors to final.



In summary, you can use these tools in many ways to enhance flight training. The post flight discussion for any maneuver, or training flight, requiring ground reference to surface features, navaids, or airspace fixes can be made more relevant when the flight track is visualized against the actual chart or terrain.