

GPS height vs. altitude - Richard Hunt explains

We should all be familiar with barometric altitude universally used within aviation. It determines 'height' from an agreed model of the reduction in atmosphere pressure as you go higher. There is no dependency on other systems, and no potential for jamming as there is with GPS. Unfortunately...

1. The atmosphere does not obediently follow the nice curve described in the model and also changes over time. This is not necessarily a problem as all aircraft use the same method so go up and down when flying the same 'altitude'. The vertical airspace limits similarly move against actual height, but your GPS does not.
2. Not all altimeters are the same. For example, those of you with older analogue altimeters will be measuring a different altitude to those with a modern software based altimeter. This will implement the internationally agreed algorithm; the analogue one will approximate from a voltage curve on an electronic component that looks similar. You may think you are just clear of airspace; your flying brethren may disagree.

GPS height by comparison is very linear and absolute. (GPS can include known errors in lateral position; these are typically not a lot and are usually flagged on the screen.) The location algorithms GPSs use are all identical, the instruments cheap, and 3D tracks can be downloaded. There are, however differences in their sensitivity and accuracy, and in the filters used to determine a stable position.

Filters smooth out errors that arise for a variety of reasons including temporary signal loss. They differ depending on the job they have been designed to do. For example, a hiking GPS can take its time to average a position and does not expect you to suddenly move a great distance; a car satnav filter is set up for vehicles moving at speed through bad signal environments with less concern for height. On signal loss, the effect of the filter may be to keep you moving quite quickly in a direction, placing you somewhere you are not.

So, what can and should you do as a pilot?

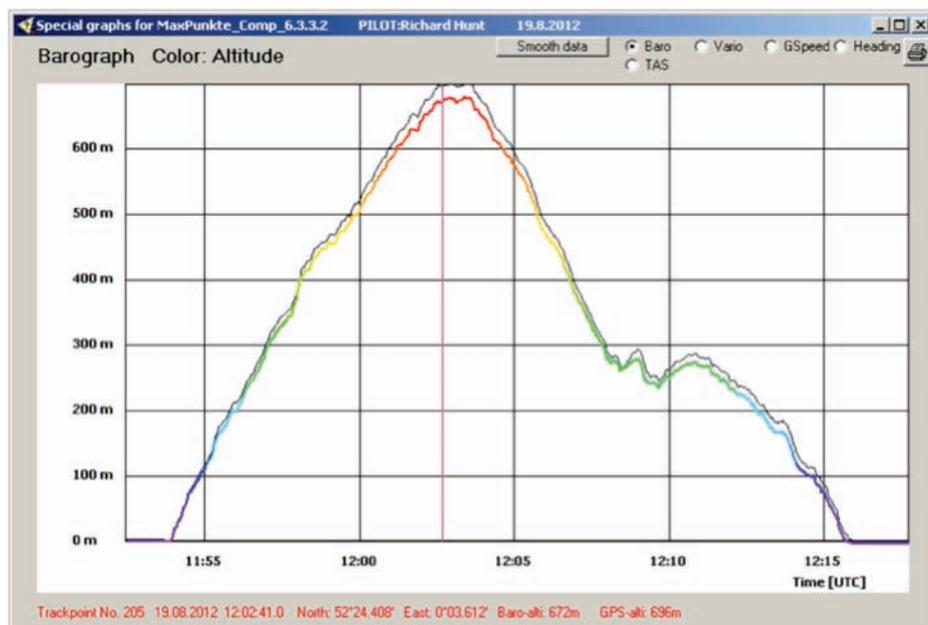
- Use your barometric altitude to keep your vertical distance away from airspace.
- Use your altimeter and not a GPS or PDA for height. If you have an old altimeter, try and get it calibrated and even then allow greater margin from airspace.
- Ensure your altimeter is correctly set at launch.

I very nearly had my points wiped on a task at BOS 3 last year when scoring showed my altitude had briefly nudged into Welshpool ATZ. Ironically this was a result of gliding away from the ATZ we had thermalled above. Having failed to correctly set my launch altitude on my Brauniger, it was reading a couple of hundred feet lower than it should. The difference against the height of launch was obvious so some simple maths subsequently exonerated me. My GPS height was clear.

At the BOS series it is usual to have one person note the height of the hill (using GPS) to which pilots then set their barometric altitude. The GPS height should match with the actual height of the hill so all we are doing here is ensuring everybody's altimeters are initially correct for the day.

GPS flight instruments with integrated altimeters (e.g. Brauniger/Flymaster) will record both the barometric altitude and GPS height in their track

log. This is the only certain way to inspect against airspace as the altitude at that point is then known. As it is not realistic to ask all pilots to change their



The varying difference between altitude and GPS height IMAGE: RICHARD HUNT



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instruments, we need to somehow inspect against GPS height instead.

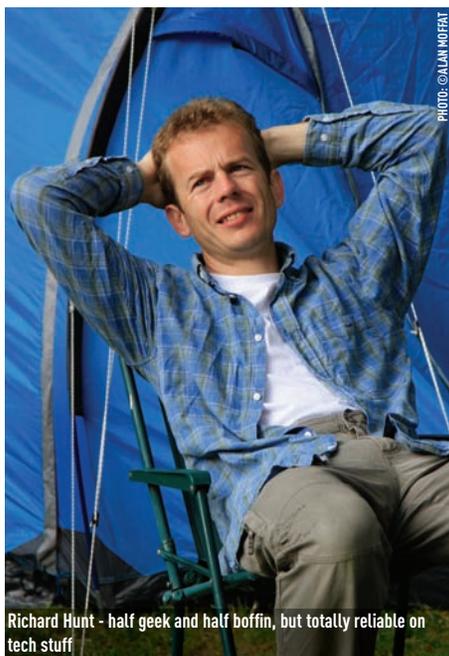
As should have become clear, you unfortunately cannot rely on GPS alone when close to airspace limits. The difference with altitude varies and it is not a simple offset. However, should there be a need for close inspection reference can be made to pilots who do have a log of altitude vs. height for the day. This will take the scorer a period of quiet time to ascertain. So, thirdly:

- Allow both vertical and horizontal margins for GPS position differences

Remember that a single point within airspace incurs penalties, at worst disqualification.

It is always good to be familiar with how your instruments behave. While the rain is lashing down outside over the next few months, have a look at your old track logs. Pay particular attention to jumps in position or height, gaps in the track, and differences between height and altitude. The MaxPunkte program is free and as one of its functions you can produce a barograph like the one shown below (Fig. 1). This is from a Brauniger Compeo track log and illustrates the varying

differences between altitude (coloured trace) and GPS height (black trace).



Richard Hunt - half geek and half boffin, but totally reliable on tech stuff