End of daylight

Who enjoys flying at this time of year? Obviously there's a bit of non-VFR weather, but there are also plenty of cold clear days, no turbulence, and good climb performance. One downside of course is that you don't have as many hours for day VFR flying, and knowing when last light is may be a bit more of a concern. And while it's nice and easy to find start and end of daylight from NAIPS, it's still useful to have an idea of the relationships between clock time, sun time, and the factors that affect length of daylight and EOD.

Local Mean Time (LMT) and Local Standard Time (LST)

When you learnt manual calculations of beginning and end of daylight in your PPL theory, you heard about LMT and LST. Since it's usually end of daylight (EOD) that we're interested in, let's just consider that.

The earth spins 360 degrees in 24 hours, or 15° an hour. So from our vantage point, the sun traverses 15° of longitude in an hour, or 1° every 4 minutes.

LMT, which is what you get off those EOD charts in the AIP or the VFR Guide, is "sun time". The reference point for LMT on the earth is the local meridian of longitude that you're standing on. When the sun is overhead a meridian, it's 1200 LMT everywhere on that meridian. One hour later, it will be 1300 LMT all along that meridian, and 1200 LMT all along the meridian that's 15° west.

LST is "clock time." In WA, which extends east from Dirk Hartog Island (about 113°E) to the border (129°E), the LMT varies by just over an hour (16° of longitude = 16 lots of 4 minutes). But of course that's impractical for everyday use, so LST is the same everywhere in WA (apart from around Eucla), and is better known as Western Standard Time (WST).

The amount of daylight a place gets depends on two factors – time of year and latitude. Everyone knows days are longer in summer, and the higher your latitude (remember high latitude means higher number, not further north), the bigger the difference between daylight hours in summer and winter. For instance, Thursday Island (10°S) gets 13 hours and 30 minutes of daylight at the summer solstice and 12 hours and 16 minutes at the winter solstice – just over an hour's variation throughout the year. The variation in Hobart (considerably higher latitude of 43°S) is more than 6 hours – 16 hours and 31 minutes in summer and 10 hours and 5 minutes in winter. Taking all that to the extremes, daylight hours at the equator don't vary, but the south pole gets a couple of months of 24/7 daylight in summer and a couple of months of night in winter.

Same latitude, different longitude

But what about the effect of longitude? Because Northam (31.6°S) and Forrest (30.8°S) are at pretty well the same latitude, they get much the same amount of daylight on any given day. But the times of EOD are very different. Because we are 8 hours ahead of UTC, and that's based on 120° of longitude, clock time and sun time are only aligned if you're on the 120° meridian. So if you're at Southern Cross (119°E), the sun and clock are almost perfectly aligned, as the sun is pretty well directly north of you when your watch says 12 o'clock. But Forrest is 128°E, which as far as the sun is concerned is 32 minutes east of the "reference" meridian. What that means is that at 1200 on your watch at Forrest, the sun is already 32 minutes gone on its way to setting. But Northam is 116.7°E, which means at 1200 WST the sun is still 13 minutes away from being directly north, and EOD is going to be noticeably later. At the height of summer, last light is 1946 WST in Northam and 1858

WST in Forrest. The total daylight hours are the same, but the start and finish times are quite different. In practice it just means when you plan your around-Australia flight, and you take off from Northam, you can't afford to think "Last light in Northam was 1830 last night, so it'll be the same in Forrest." If you think like that you'd better be current at night and have someone lined up for when the fixed lights fail!

And your calculated last light doesn't factor in hills to the west, which of course is a factor at Northam, and cloud. Next time we have a miserable grey winter day, look up last light on NAIPS, then look outside and see how much earlier it gets too dark for day VFR. It can be a good half hour.

Twilight

According to the AIP, daytime is the time between the start of morning civil twilight and the end of evening civil twilight. Civil (as opposed to nautical) twilight is when the sun is less than 6° below the horizon. The practical point of that is that you can't just look up sunrise and sunset times to work out how much daylight you have for flying. Mind you, using sunset means you're erring on the conservative side, which is more likely to lead to a long and happy life as a pilot.

Incidentally, the term *nautical twilight*, which is when the sun is between 6 and 12° below the horizon, comes from the time when sailors used astro navigation. During this time you can see most stars with the naked eye. These days of course, sailors and pilots still look to the heavens to navigate, the difference being that the navigation aids are in orbit about 20,000 km up, as opposed to light years away.

Another thing you notice up north (depending on how much attention you pay to these things) is that twilight is shorter at lower latitudes. At higher latitudes it goes from light to not so light to a bit darker to almost dark to night over a little while, but in the tropics it goes from light to dark quite quickly. So if you're struggling to get to your destination by last light, and you see it's just starting to get dark, your pucker factor will be higher if your destination is Kununurra than if it's Albany.

Happy winter flying, and remember the basic VFR rule that bar o'clock is 10 minutes before last light!