Bob Grimstead explains how to achieve accurate propeller flight test data

Firstly, let's talk about how to do it.....

Like everything else in flying, you only get good results if you are careful and meticulous. Your flights and figures must be repeatable or they are useless.

I apologise if you find the following insulting, but I'll try to go step by step through the process, just in case anybody is new to it.

First, it is vital to compare like with like. You just cannot compare Fred's standard aeroplane at maximum weight on a hot day with Arthur's modified, big-engined one in mid winter with a nearly empty tank.

If you want to compare propellers, it is really only possible to do so on the same aeroplane – there are just too many variables. For instance, last weekend we flew a formation of four Fourniers and compared our instant airspeed readings. They varied by over ten mph! My British Fournier's electronic tachometer reads more than 400 rpm different from my Australian one's original mechanical one with the same propeller, in identical conditions.

Comparing speeds at anything other than full throttle is fraught with problems, too.

Add in altimeter errors and the varying drags, weights and centres of gravity of different aeroplanes and you will immediately see that you just cannot compare apples with oranges.

And don't even start to think about quoting VSI readings for your climb rate. The VSI (or variometer) is by far the most inaccurate instrument ever devised by man. Climb rates can only be assessed accurately by using your altimeter

and a stopwatch (often in your mobile phone, or your watch's sweep second hand).

When I fly to compare propellers, I try to make both flights on the same day, and quickly one after the other, so the ambient pressure (altimeter setting) is the same, and the temperature is also the same, or very similar. I either fly at maximum weight (with radio, headset, helmet, charts, battery and full fuel plus me, normally dressed, but with no baggage) or at aerobatic weight so that my figures are always directly comparable.

If your spinner won't fit over both propellers you're comparing, leave it off for both flights. I don't know the change in drag effect, but there will be one.

I set 1013 HPa (or 29.92 inches Hg) on the altimeter, to eliminate that variable, and my airspeed checks are always flown at 1,500 feet, the upper limit of my aerobatic display.

To get a true maximum static rpm on the ground, you should be facing exactly ACROSS the wind. Head into the wind and the rpm will be artificially high, and the converse is true if you wish to apply full throttle facing downwind (but why would you?) If your brakes won't hold you against full power, use chocks.

The same is true of a timed climb. It is important to fly in a straight line at a steady airspeed ACROSS the prevailing wind. Otherwise the 'kiting' effect of positive windshear will skew your readings. Those of you who've flown glider winch launches on a breezy day will be aware of this effect.

You should also stay well away from thermals, ridge or wave lift and cloud streets. No cheating now!

Indeed, the more still the air, the more accurate will be your readings, so try to pick a calm day and fly perhaps either early in the morning or late in the afternoon.

Test pilots fly in ISA conditions: pressure of 1013/29.92" and 15° Celsius temperature. For those Americans among us still stuck in the stone age, that's quite a cool day, but I no longer understand Fahrenheit numbers. About 60-65 perhaps?

It is important to hold your airspeed accurately, to within +/- 2 mph/knots, and ideally to climb at you best climb-rate speed (Vy). If your POH recommends a higher airspeed for prolonged climbs, then of course use that.

Climb checks are generally timed from 500 feet, because that gets you out of ground effect and the most turbulent lower levels. It also enables you to establish steady flight at the correct climbing speed and get properly trimmed and settled with the speed dead stable. Simply hit the stopwatch precisely as the altimeter's big hand swings past 500 feet (or any other easily spotted height). Check the height gain after 60 seconds and you will have a useful comparative climb rate.

For a 'proper' propeller test, climb at full throttle for five minutes. Note your height at every minute (or every 30 seconds if you want to be really accurate) and then draw a graph of your points against time. You should of course get a gently sloping curve, as your climb rate drops off with height. If it is accurate enough, you could presumably extrapolate to get your service ceiling (that altitude, with standard altimeter setting, when your climb rate drops off to 100 fpm).

The most important speed check is at full throttle, although partial power speeds might be of personal interest. Again, it is important to get your aeroplane exactly trimmed out, and to let the speed settle. You should fly exactly level (+/- 10 feet) for a MINIMUM of two full minutes before reading your airspeed, to let everything stabilise. If you cannot do that, then you can get an approximate reading by averaging your maximum and minimum speeds as you float up and down around your datum altitude, but this will not be sufficiently accurate for comparison with other props or aeroplanes.