Pitch for Airspeed and Power for Rate of Descent versus Point and Power

So which is it? Warren Canning, Head Advanced Aerospace Concepts, Program Office, Defence Science & Technology Organisation of Australia believes that both techniques are valid but it depends on what you fly as to which is safer and more appropriate.

I was prompted to write this article after a brief discussion on this topic with a fellow Kyneton Aero Club member who thought I was behind the times to fly an approach using pitch to control airspeed and power to control my rate of descent (ROD)/ approach path – *try and fly an ILS like that in a Jet Airliner and you will find out how that is old WWII Air Force thinking* – was his response.

Well firstly I don't fly Jet Airliners with their comparatively large inertia and slow responding engines, both of which tend to make controlling the approach path with elevator and speed with the power lever/s (Point & Power) the most appropriate method. Secondly I don't fly ILSs, rather, I fly light single and twin engine aircraft on visual approaches day and night, with their much lower inertias, faster responding piston engines, and perhaps most importantly, much lower airspeed margins between VSO and VREF, and VREF and VFE – more about that later. *[VFE = Maximum Flap Extension Speed, VREF = Landing Reference Speed, VSO = Stall Speed in Landing Configuration]*

However, the absolute conviction with which my fellow aviator discarded my approach (pun intended) made me reflect on whether I had this all wrong, or whether his argument, that if this is the way the airlines do it then it is the way we should be training from day one, was itself far too simplistic a consideration of the many variables involved. After all, not everyone is heading for a large jet/airline career, and in an analogy there are plenty of examples of Air Forces around the world, including the RAAF, that thought along these lines several decades ago and decided to trial straight-through jet training; only to find that the results were far less optimum than had been anticipated and most, if not all, have abandoned the idea.

If I go back to my initial training, which was on gliders in the early 1970s, I was taught (by an RAAF Mirage Test Pilot who instructed at the RAAF Laverton Gliding Club on weekends) that you used elevator to control the approach airspeed (VREF) and then controlled the glidepath to the touchdown point using varying amounts of airbrake, which in a glider is the equivalent of a power lever. This technique worked perfectly well and kept the approach path and airspeed stable, and is still to my knowledge what is taught in gliding today; something I confirmed with a couple of work colleagues who are both very experienced and current gliding instructors.

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Interestingly, it is also how the Royal Australian Navy (when they had a fixed wing aircraft carrier) and the US Navy teach approaches to a carrier deck; and I was also able to confirm through current RAAF sources, one a Mirage and F-111 Test Pilot, how the RAAF flew approaches in these high speed combat jets. Albeit, that all these military examples use alpha (Angle of Attack) to set attitude. In our case, where the vast majority of light aircraft do not have the capability to display alpha, setting attitude by holding an airspeed is our equivalent.

Fast forward a couple of years to my powered aircraft training and again I was taught to trim the aircraft to the approach airspeed and then use the power lever to control my glideslope to the aimpoint. If a little low increase the power, if a little high reduce the power. This seemed perfectly logical to me and was really just mirroring what I had been taught earlier in gliders. Perhaps that is why it seemed a relatively easy way to fly a stable approach during my training; despite some current texts/ syllabuses arguing it is too hard for a student to learn and it is much easier to teach a new student Point & Power. Easier maybe, although I am not necessarily convinced of that, but is it safer, particularly in a small, low inertia aircraft? On this point, I think back to my involvement in the Ultralight movement in the early 1980s, and the surprising number of serious accidents involving experienced GA and Airline pilots transitioning to Ultralights, experienced yes, but not necessarily in high drag/low inertia aircraft; where mishandling, or an engine out, could result in very rapid loss of airspeed. To me this just reinforces the argument that one size (technique) doesn't fit all.

Further, Point & Power isn't a lot of help when the engine fails. If a pilot has been taught that elevator controls the glideslope, and is not used to flying a trimmed airspeed down final approach, then the need to suddenly revert to trimming, **and keeping to**, best glide speed is going to be a whole lot harder to master, particularly at a time when all of the other pressures of a forced landing are already turning the brain to mush. If below glideslope, the ingrained desire to pull back on the stick to make the desired touchdown point is now going to have exactly the opposite of the desired effect, as the aircraft deviates from its best glide speed there will be a momentary decrease in the rate of descent as the nose is raised, but then the rate of descent will increase markedly as the aircraft slows and heads towards the back side of the drag curve. Pulling back further is only going to exacerbate this until a fully developed stall occurs; a frightening scenario at low level.

This is not only true in an engine out situation; it is important to understand that full power doesn't only result in an aircraft's maximum level flight speed, it also results in its minimum flight speed on the "back side of the power curve". Whenever an aircraft is on the back side of the power curve the more the nose is raised in a misguided attempt to arrest sink rate, the greater the rate of descent will become. This is true because the increase in induced drag is greater than the reduction in parasitic drag. Therefore, there is an increased risk that a pilot trained in Point & Power, when faced with a developing sink rate at low airspeed and high power settings, such as on approach for a short field landing, will instinctively pull back, the more our pilot pulls, the greater the sink rate becomes. If this scenario is allowed to progress, it again logically leads to a fully developed stall.

Now back to my earlier reference to the relatively low margins between VSO and VREF, and VREF and VFE in many light aircraft. If we chose as an example a light aircraft at the lower end of the performance spectrum that has a VSO of 35 KIAS, then VREF in nil gust conditions is VSO x 1.3 or 45 KIAS, a margin of only 10 knots. Further, if we have an aircraft with such a relatively low VSO, we probably also have an aircraft that is relatively light, and has low inertia. Now let's assume we are low on final and have chosen to pitch back up to the glideslope and use the power lever to get the resultant loss in airspeed back. The difficulty is we only have 10 knots between the approach speed and the stall speed, and as we pitch up the low inertia means that the airspeed is going to fall off quickly, now we may well be left with a very small margin above stall unless we have accurately judged the right amount of power to get back to VREF. On the other hand, if we choose to hold the airspeed constant and increase power to get back up to the glideslope, the margin above stall remains at a constant 10 knots, and we only have to make one control adjustment and not two, the inputting of more power. Further, if we get the amount of power required wrong, we can simply add more or less, in the knowledge we are comfortably still flying with a safe margin above stall speed. Yes I can hear all the exclamations about changing power will change the pitch moments and require a corresponding adjustment, however, the reality is in most well designed light aircraft the pitching moments from small changes in power are themselves so small they can be virtually ignored.

Similarly, let's look at the issue around VREF and VFE, let's assume our chosen light aircraft also has a low margin between these, again it is not uncommon for such aircraft to only have a margin of around 10 knots at the full flap position. Now take our pilot that chooses to pitch to the glideslope and put them too high, down goes the nose and up goes the airspeed, again chewing into the margin, perhaps exceeding it before the power lever is retarded enough; particularly, if the approach has been way too high and the adjustment large. However, our pilot that chooses to reduce power to get back down to the glideslope still has that 10 knot margin and again has only had to make one control input to correct the too high an approach. This is equally true in many higher performance light aircraft, where the margin between VREF and VFE may be considerably larger than our nominated 10 knots, but the fact that the aircraft's performance comes from being very clean aerodynamically means that even relatively small amounts of nose down pitch can result in a quickly gaining a substantial increase in speed.

These examples get even worse if you add gusty conditions, if we have a 10 knot gust factor, VREF in our first scenario would be 50 KIAS (VSO × 1.3 + 0.5 gust factor), now let's imagine our pilot pitching up to the glideslope, with the lost airspeed that entails, at the same moment as the wind drops by the 10 knot gust factor, due to inertial lag we will experience a momentary 10 KIAS drop due to the wind speed falling, plus the reduction due to pitching up; things are going to get very ugly very quickly unless the power is advanced at the same time as making the pitch adjustment, and by the right amount. It can also be shown that due to inertial lag a gust factor will increase the risk of exceeding VFE as discussed in the paragraph above when using pitch down to the glideslope in a situation where the wind simultaneously increases by the gust factor.

In conclusion, I suspect most experienced pilots simply use a combination of the 2 methods discussed above and do not even consciously acknowledge which one is dominating a particular approach, which in all likelihood will depend on lots of variables, including wind speed, gust factor, aircraft type, approach type, length of runway, touch down point etc. Further, I openly acknowledge that flying an ILS is in most scenarios going to be easier and more precise using Point & Power and, given these types of approaches are most likely to be flown in aircraft with higher inertia and airspeed margins that is fine. However, I would caution against assuming that this makes Point & Power the best type of approach for everyone, flying all types of aircraft, particularly low inertia/low performance aircraft. Rather, I would suggest that a sound understanding of the pros and cons associated with both methods; along with competency in both techniques, is the most appropriate approach.

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