C185

A Cowboy's Guide to the Cessna 185

These notes are just a collection of thoughts and observations on operating, handling, owning, maintaining and enjoying the Cessna 185. There is very little reference material available for newly-rated pilots or new owners to study on this aircraft, so the following may be of benefit! It is intended to be a useful guide (as opposed to an Aircraft Flight Manual (AFM), which today is written more by lawyers, for lawyers with the sole intention of avoiding legal liability), so may contain advice on some operations that you consider to be ill-advised or outside the normal flight envelope… there really is no substitute for good, common sense –albeit not such a common commodity these days- so don't read these words as encouragement to go beyond your experience and training, your AFM limitations, or for that matter, the letter of the law as promulgated in your AIP.

Sometimes people end up well outside their skills, experience and training, whether intentionally or not. The Cessna 185, in common with most other aircraft, will punish laxity, poor planning and ham-fisted mishandling. The only way to learn to fly one is to get in amongst it, as with all motor skills, but it is often useful to have a little information at your disposal before doing so. That's a lot better than trying to develop your own unique solutions to issues when the situation demands it, and what these notes are intended for –it does not mean you need to try all this stuff on your own! If you must, find a suitably qualified and experienced instructor to guide you.

Since the C-185 is often utilised in short-field and mountain flying operations, these notes are prepared both from that perspective and with that utilisation in mind. That is where my experience was gained -specifically, in the Southern Alps of New Zealand and on commercial operations in Papua New Guinea. My total time on the C-185 is only about 1,000 hours, but covers 30 years as a consequence of travelling to school in one as a kid. During that time, most areas of the flight envelope have been given a look at least, if not pretty thoroughly explored. Don't underestimate the benefit of learning from the experiences of others. The training system in PNG (as in the mountains of Southern NZ) relies heavily on the skills and experience available in their pilot cadre to turn a new pilot into an operational pilot; turning what many pilots would consider abnormal into safely routine, daily operations for average pilots.

There will be no mention of Float or Ski operations, or reference to the C-180 specifically, as I have no experience in these operations. Having said that however, apart from some engine and weight variations, a C-180 can be considered to be largely the same aircraft.

General

The C-185, also known as the Skywagon, is a six-seat, single-engined, general aviation light aircraft manufactured by Cessna. It first flew as a prototype in July 1960, with the first production model being completed in March 1961. The Cessna 185 is a high-winged aircraft with non-retractable conventional landing gear and a tail-wheel. Over 4,400 were built with production ceasing in 1985. Production ceased in large part due to two factors: the demise of the general aviation boom that characterised the post World War II years in the United States, and the growing awareness by insurance companies that tail-wheel aircraft were harder to insure due to their handling characteristics during takeoff and landing. When Cessna re-introduced some of its most popular models in the 1990s, the tail-wheel equipped Cessna 180 and 185 were consigned to the history books and not resurrected. (1)

The C-185 is a development of the C-180, which is itself a development of the C-170, a design which has its origins in the early 1940s and was inspired by the pre-war high-wing Cessna airframes. It is not a state of the art design, but the laws of Aerodynamics and aluminium construction methods have not changed much in the last 50 years anyway!

One of the main reasons for the success of the C-185 is a large engine in a small, light airframe. It has proven to be strong enough for the task and is frequently seen advertised as having a payload equal to the empty weight of the aircraft. This has handling implications, as will be discussed later. The C-210 will go faster, the C-206 has more room, the C-182 is easier to handle and the C-172 is cheaper to run; but a 185 is a good balance of the best attributes of all of those airframes. Best of all they are great fun to fly and are an appreciating asset, which can have quite a low operating cost -if flown properly.

Unlike most of the Cessna model range the C-185 has never changed its basic shape, size or speed. There are a few detail changes in construction over the years, but from a pilot point of view a 185 is a 185, though for some reason, later models seemed to get heavier on the controls and less docile. The 185 can be customised to some extent by changing the configuration to suit the task at hand, by:

- changing main and tail-wheel tyre sizes,
- adding floats or skis,
- installing ‘bubble’ windows,
- engine and/or propeller variations,
- adding a cargo pod,
- altering the rigging on the wings and
- adding leading edge and/or wingtip kits.

As a result the speed can vary by about 20 knots between machines, depending on how they are equipped.

The C-185 is predominantly powered by the trusty old Continental IO-520, but early models used the IO-470 with some airframes more recently retro-fitted with the IO-550. Turbocharged Continental and Lycoming engines can be used, but unless there is a specialist requirement on floats or at altitude, there is not much point, as it is already a well-powered airframe. There is added complication with a turbo as well, which explains why most aircraft with these engines tend to have two of them.

Picketing

A surprising number of rebuilds are the result of aircraft being blown off their pickets - much more so than a nose-wheel aircraft, as at rest, a 185 sits in a flying attitude. Any decent wind can cause problems for the unprepared. In most cases, a decent set of pickets will do the trick, but there have been known cases of the tie-down wing attachment being torn out of the wing in wind-speeds in excess of 40 knots. In these winds and above, given the 'at rest' attitude of the aircraft and wing, substantial lift is generated. One way prevent lift being generated is to raise the tail high enough to achieve a negative angle of attack on the wing. Digging the mains in a few inches by whipping out a couple of sods with a spade and putting the tail-wheel on top of a 12-gallon drum or ute deck should do the trick.

Another way is to put a couple of mattresses on top of the wing with a couple of lengths of wood on top and tie it all down securely. This will destroy the lift on the airfoil. I have never tried either myself. Occasionally when a very strong gale is forecast, it may be neither practical nor possible to move the aircraft –trying something like this just may save the day and the airframe! Certainly the mattress idea in a 40-knot gale is a bit theoretical, but when needs must… A further option is to park the aircraft facing downwind –tail into wind. This does open the possibility of bending a few control rods and/or hinges, but the machine will most likely still be there in the morning. Use the internal control-locks provided and, if possible, find and fit some external control locks also. The parking brake is unreliable and wheel chocks are better put in before you leave one unattended. Always carry them with you.

Another potential problem is damage from windblown material; I have had a cowling quite badly dented because of loose debris. Parking a vehicle in front of your aircraft may help and make sure there is nothing obvious upwind like an un-picketed Piper Cub, tent city of asylum-seekers or Microlight convention about to head your way!

Another hazard your picketed aircraft may be exposed to is stock, mainly cattle. Cattle beasts are very inquisitive and like rubbing on anything handy –your aircraft included! If you go away for a short period thinking it will not be a problem as the cattle are some distance away, most likely on your return, the aircraft will be surrounded and possibly damaged. I know of at least one tail-plane rebuild due to this. The best solution, if you must leave your aircraft unattended in the vicinity of livestock, is to erect a small electric fence and energiser around the aircraft, move the cattle –or move the aircraft!

Loading

Of everything you'll ever do in, with and around your C-185, the most critical is loading. Many of the problems you may face airborne are related to improper loading or securing of your load and can (and should) be resolved before you leave your parking-spot. It's definitely not a matter of just throwing your load in the doors, closing-up and blasting off! There is quite a skill to loading and securing a C-185 properly:

· There is not much room available for the payload,

· The doors (and frames) can be a restriction with large items to be loaded,

· The doors are easily removed for large items of cargo,

· Do not leave the doors open -they are of light construction and a slight breeze from behind will catch them and twist them around the strut. After which they will not close properly and there will be considerable wind noise. Best way to shut them is to open the window, stick a hand out and apply firm pressure from the outside.

· Passengers seem to be of the opinion that their safety in the aircraft will be greatly enhanced by slamming the door just as hard as they are physically able. This of course, deforms the door and causes excessive wear and damage in the latch mechanism. Best idea is to make it absolutely clear to them during the pax briefing that they are not to operate the doors in any circumstance other than an emergency. The doors are shockingly expensive (and almost impossible) to repair properly.

· Stretchers and coffins can just fit between the strut and door-post, hopefully without having to tip them sideways (this can get really untidy). Some models have an additional door behind the baggage door which assists in the loading of lengthy items,

· Beware of long sharp objects: morons will poke these through the windows quite easily and tradesmen are the worst –quite unthinking.

· If there are five passengers and no cargo-pod, put the people in first (smallest in the back) and fling the bags on top. If you can get belts around them all and stay within the aircraft weight limits, you're on a winner! It is possible to get several people in, if they are small enough and don't whinge. Small pyramids of people work well too -my personal record is 13.

· Do not put people in the cargo-pod, this is reputed to be a most unpleasant way to travel and may put the victim off flying altogether.

· Handle everything yourself, or one day some remarkably heavy object like a Caterpillar starter motor or backpack of uranium ore will end up in the aft end without your knowledge…

· When loading the pod, put all the small, heavy stuff right at the front –it'll help with W&B.

· Try and keep small crowds away while loading -they only get in the way and annoy you.

· It may take a couple of tries to work out how to fit all the stuff in.

The big trap is the area aft of the back seat, which can have a large space available in some machines. Use this for light gear like foam mattresses, sleeping bags, polystyrene and Ops managers brains. Have a good think before putting more than a few kilos in there –it's not there as overflow space when the pod and cabin are full!

The consequences of incorrect loading and the subsequent CofG problems with a probable overload can be unmanageable once airborne. A colleague of mine met his end, not so much due to the substantial overload, but the fact that the aft compartment was used to achieve it. Several people shared his fate after control was lost during a turn en-route to the airfield. It either stalled in the turn or entered a spiral dive due to lack of pitch authority. An extreme example, but bear in mind that on a long flight your CofG will move aft (due fuel-burn) so what may have been manageable on take-off may not be a few hours later on landing. On departure with a full load, it is a good idea to check the position of the trim indicator. If it is full forward or close to it and you find you are using forward stick to prevent a pitch-up, consider returning. The aircraft will not fly tail low but will become very sensitive in pitch as the tail-plane becomes more ineffective. It is the same size as that on a Cessna 172, in contrast to the larger C-206 tail-plane -which has the same payload.

Once I flew vegetables out of mountain airstrips to a large international airport. It turned out that I was underestimating weights and with little fuel and a cabin and pod filled to capacity with around 650Kg of freight, there would be an aft CofG problem on landing. What happens is as speed decreases, the control surfaces become less effective so you keep winding-in forward trim -until it runs out. Next flaps come out and further forward stick is required. Finally at around 300ft, full flap is selected and the control yoke meets the instrument panel with a rather distressing thud. Left unattended, you will pitch up, stall, plummet to the ground and die. To avoid this messy scenario, simply get rid of some flap and control will be restored, allowing you to carry on with the landing. I have never explored the option of applying full power to retrieve the situation in a 185, as power provides a further pitch up moment –not finest-kind helpful. Some brave person can feel welcome to try this -it is a sound idea in an Islander with engines mounted high, but a partial flap landing seems to be the best bet in a C-185. In the situation outlined, coming in fast with little flap was not a problem as the runway was about 3 km long, but shorter places may not be so easy. So if you're landing in tricky places with a big load, a good idea is to select required flap and reduce to landing speed early. You'll have time & space to sort it out, if it's getting a bit out of shape. Incidentally, the same principle with use of flap applies to any aircraft. The C-185 will not show any sign of aft loading on the apron (its bum is already on the ground), so lends itself to the odd drama in this area. Most other machines have a nose-wheel so will fall or lean back if not properly balanced and get spotted.

One type of load that can cause surprise is steel pipes or any other heavy stuff sitting low in the cabin, largely out of sight. As the old saying goes: out of sight, out of mind. Twice I have carried pipes and nearly failed to complete a low-level turn clearing stock. I had expected the Aircraft to be light having neglected to take the load into account, since it didn't catch the eye.

As an aside, it is easy to get carried away with low-level manoeuvring in remote areas; be careful out there. It's a major cause of fatal accidents.

Regarding amount carried: the payload with full fuel varies with each aircraft, but most empty weights are around 800Kg, so around 750Kg of fuel, pax and freight can be carried. Most jobs need around 2 hours fuel plus reserves, so say 120Kg, plus a Pilot at around 80Kg, so a ballpark payload figure is 500Kg plus or minus 50Kg. For a long trip, reduce payload by 40Kg per 100NM beyond 250NM. With a cargo-pod and some hefty passengers, max weight will be reached easy enough, especially with full tanks. For a long flight there is a good case for stopping half way for comfort and refuelling as well.

Overloading in an aircraft with no cargo pod or aft compartment is difficult, but with a pod and long-range tanks, it's easy enough. As explained previously, the main problem is it usually goes hand-in-hand with an aft CofG, but there are other issues. Structural ones are load on such things as landing gear, floor, brakes, wings and so on. The mains are strong enough to handle a good load, but the tail-spike will fail, as will the tail-wheel hub and tyre under heavy load. The cabin floor is actually quite weak, unless it has plywood over the top. Early C-185's were used for topdressing in New Zealand and operated in the Agricultural category with an increased max-weight. They all have patches on the wings due to cracks in the skin along the main spar, and usually a few ripples and twists as well. So the extra load must have taken a toll on the structure. The brakes can overheat and the disc itself can shear, taking the attachment bolts with it –not uncommon on the C-207, in part due to the increased aircraft mass. The main problem though is no surprise; if you put too much in the thing it just will not fly very well. It doesn't take much extra to make a difference either: a 5% overload will make a 15% difference to take-off distance etc. I once flew a load of parachutists, two of whom were called Peter -both climbed in when that name was called! The extra 80Kg on top of an already full load led to a substantially increased take-off roll! The aircraft just got light on the wheels and stayed on the ground, until speed built up enough to fly at that weight. Once in the air it is very slow to reach climb speed, but once there, the rate of climb is quite acceptable at low altitudes and cruise speed will be little affected. Really though the cheapest way to carry a heavy load is by means of two light ones. This is especially true for short trips in a 185 where the loading can take longer than the flight.

Remember that once loaded outside the weight and CofG limits, you are in Test Pilot territory and normal assumptions on performance, handling, stall-speeds etc., go out the window. One thing not to leave behind though is fuel, especially on a long flight in ordinary weather. An hour's fuel only weighs around 40Kg and does not cause a CofG problem. When push comes to shove, they will fly if a bit over, but will not run on air. Also on landing from such a flight (~5hrs) you will be 200Kg or so lighter, so weight is not an issue on arrival.

Ground Handling

For generic tail-wheel handling there are articles and books available covering the physics of it in detail, complete with diagrams. Read one (or more!).
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Before-start man-handling can cause damage. The tail-section skins will not always put up with people pushing on them to get the tail around. The forward tail-plane hangs off the trim-jacks, so is nowhere near as robust as it appears. The forward fin skins are very thin and will dent easily. On your own, a rope attached to the tail-spike allows you to steer and pull at the same time, or if necessary, push on the top of the tail-wheel going forward for the same effect. This method allows you to see both wing tips as well. Some later models have grab handles just forward of the tail-plane, which are quite worthwhile and can be installed as a mod.

Starting your aircraft can be an art of itself –especially hot engine starts. Details are in the AFM, so read it. The problem with hot engine starts arises because of fuel vaporisation in the fuel-lines above the (hot) cylinders. To prevent or overcome this, you need to purge the lines, replacing the vaporised fuel with clean, cool fuel from your tanks:

- Throttle fully open (in),
- Mixture to idle cut off, (out) and
- Full electric fuel pump for about ten seconds.

This procedure cycles the heated fuel back through the return pipe and replaces it with cool stuff from the tanks. Then set your throttle and mixture as per the AFM, or anything that works. Crank the engine. Once started, it will most likely die after a few seconds, so be ready to catch it with the electric pump briefly. It should run smoothly from there. Do not over-prime as the excess fuel can gather in the bottom of the cowling and catch fire. If there are leaks in the fuel-system, it may happen anyway. These fuel fires can be hard to spot because they don't make much smoke, so look out for bystanders getting all agitated or check a shadow of the cowling for distortion. If necessary, just keep cranking the engine to suck the flames back inside the induction system. An engine-start is the best solution; it will either suck the flames in or blow them out. On one aircraft this was so common I would post a sentry with a fire extinguisher for hot starts! It is possible to lose the entire aircraft this way but mine never suffered any damage from them.

Flat battery starts:

- Jump-starts from a car are possible and quite easy with a 12-volt system,
- On a 24-volt system, just a single 12-volt battery may be enough to do the trick, or you may need two 12-volt batteries and three jumper-leads; work it out.
- Do not crank the starter too much (15-30 seconds is usually more than enough), it will overheat and burn up. Allow the starter to cool between starting attempts. Details are in the AFM.
- Manual prop (Armstrong) starts are possible, but the big snag is priming the engine if there is not enough power to run the electric pump.
- One trick is to put fuel in the air cleaner for a prime.
- Never try to prop-start your aircraft without assistance! Unless two pilots are present, one to swing and the other inside, there is too much to go wrong, so better left as a very last resort in remote areas.

- If the master switch was left on, but there is enough battery power remaining to get a prime on a cold engine, it will most likely start.
- Armstrong starts on a hot engine are unlikely to be successful.
- If you should find your aircraft and ignition-key are geographically separated, it is possible to remove the earth wires from the magnetos and hand-swing for a start. In this case engine prime will still be available. You will have 'hot' mags however – so best you don't let anyone get too close to your prop after you shut-down!
- Batteries are not at all partial to cold wx! If you operate in cold, frosty locales, the day will come when -as a consequence of the cold- your aircraft will just not start. If you have no ground-power or jump-start facilities immediately available and an Armstrong start is unappealing, try this:
- Prime as for a normal start or possibly just a little more,
- Crank the engine until the battery will no longer push the propeller over the next cylinders' compression (it won't take long!), but do not crank it for any longer than the maximum period indicated in your AFM – we still don't want to burn that starter-motor out,
- Repeat the step above after allowing a 30-60 second cooling period,
- Shut the aircraft down completely –including (especially) the battery Master!!!
- Walk away from the aircraft for 15-20 minutes or so –grab a coffee, check the wx, whatever…
- Have another go at starting it. It just might work.

This wee procedure has saved the day for me on more than one occasion! As you'll already know, dragging current out of a battery generates heat. Drag lots of current out, (as in an engine-start attempt) you generate lots of heat. After your initial start attempts, you walk away to allow the heat generated by the start attempts to permeate throughout the cold-soaked battery… making sense yet? Yup, a warmer battery will give you better battery performance and hopefully more current, probably allowing a good, clean (if slightly sluggish) engine-start. Once you have it running, it won't take long for the engine heat and alternator to make everything copacetic again.

OK, we're running.

Tattoo this on your forehead: Never, never get out of your aircraft with the engine running. Never. Why, says you? Here are a few reasons:

- The most common ground-accident for pilots is walking forward into their own turning blades,
- As stated earlier, Cessna light-single (and some light-twin) handbrakes are crap. Even in mint-condition, they're crap. Do not rely on them alone –ever. Cables fray and sometimes separate, mountings loosen and wear, latch-position mechanisms wear and can vibrate loose… you get the idea,
- Likewise throttle friction-locks can vibrate loose, allowing the vibration to further open the throttle, increasing engine power,
- It's not entirely unknown for unattended aircraft to just wander off on their own, causing all-sorts of stress to any pax that maybe aboard, damage to the aircraft, damage to other aircraft in the vicinity, property and personal damage and untold mayhem –not to mention acute embarrassment and financial stress to the pilot that forgot that particular rule. Ever tried lassoing a moving aircraft?

Once you're inside, strapped in and started up, forward visibility is limited -to the right in particular. Nearly drove into a Cardinal once that was in the blind spot, so it's always best to have a good look around before getting in. Aircraft fitted with the big tyres are worse, especially if they have the original small tail-wheel as well. Be aware of your blind-spots and taxi accordingly.

Steering on a light twin is by nose-wheel steering, supplemented by differential power and brakes. In a C-185, there are only the brakes -and you do rely on them! Lose them and the chances are you will be talking to the Insurance bloke pretty soon. The biggest cause of brake problems is corrosion pitting the calliper barrel. This tears the O-ring and within 50Hrs flying, the fluid will run out and the pedals will go soft. The brake lines themselves can crack or suffer foreign object damage and be broken. Hot brakes don't like being taxied through cold water either. It cracks the brake-pads. It's best to avoid areas of standing water after landing. As mentioned earlier the disk too can fall apart, so give all these areas a thorough inspection before each flight. Don't drag your brakes against power either –that's poor airmanship and mostly avoidable and unnecessary. Don't try to save a few pennies by deferring maintenance on your brakes. It just isn't worth it.

Making turns to the left is a doddle: the P-factor is helping you! Lift the tail, a wee nudge of power and away she'll go! Your crosswind component for taxi is around 25Kts, so at a large airport with a fair distance to go, just getting to the threshold can be a saga. Take it easy.

Some models have stowable pedals. Looking at the crash-comics, it seems these may not be as wonderful as advertised and need to be treated with caution. Remove them, or install fixed ones if necessary for endorsements. The RH side pedals can be jammed by loose objects or cargo in turbulence; it's almost impossible to rectify in flight, so make sure everything is securely stowed.

On a rough field, flaps are best kept retracted until you line-up. With flaps down, an angle is formed between flap and wing, so flexing of the wings may lead to uneven forces being placed on the whole flap-surface via the attachment and activation mechanisms, leading to stress-cracks in the flap trailing-edge.

One of the great advantages of the tail-wheel, is the ability to pivot the aircraft around one main, almost turning in the width of the aircraft, -real handy in airstrip operations and restricted spaces. On concrete or tarmac, be kind to the undercarriage by letting the inside wheel inch forward slightly which allows the tyre to line-up with the rest of the aircraft. This releases the stresses on the tyre, axle and gear-leg that occur otherwise, especially if using big, low-pressure tyres. Next issue relates to the speed of these turns. It is easy and fast to just jump on one brake and she'll do a 180˚ turn in a couple of seconds. Sitting as you are on the pivot point, this seems OK. But, bear in mind that the extremities of the aircraft are 15-20 feet away, undergoing substantial acceleration and deceleration forces (and have a fair bit of inertia) so you are probably creating a fair twisting-moment too. All these forces are coming from directions the aircraft is not really stressed for, especially the tail-spike which will quite probably chose a moment like this to fail. It is twisted by the sideways movement and it was during such a manoeuvre that mine fell off. I have been told that these ground-loop type turns cause as much wear on

the airframe as just about anything else. A mathematician could work it out, but to take a few extra seconds turning around seems easy enough.

Some thoughts on taxiing with a crosswind: a wind from the right is not so bad as brake will hold the tail around, while power used against brake (OK, so there's an exception to every rule…) will also turn the tail into wind. When the wind is from the left, things get a bit harder. At around 15-25kts crosswind -depending on load, slope and surface, the aircraft will not hold straight on brake, so weathercocks into wind. Right hand brake and heaps of power will not bring it around, but due to gyroscopic effects (ask someone else!) a tail-lifting force is produced. Next thing you know, an empty 185 can nose-over, hit the prop and damage the tail on the way back down! Ouch! Two people I know have had this happen to them, so it is not just a theoretical possibility. One option, if attempting a 90˚ right-hand turn, is just make a 270˚ left-hand turn! At one particular airport with a sloping taxiway and the afternoon trade winds, the turn left to go right was the only way! ATC might wonder where you are going at first, but it works and is much less conspicuous than tipping up or going nowhere. Full flap can help ground handling sometimes, depends on the wind. The brakes will heat up on a long taxi and lose effectiveness; sometimes a pause is needed for them to cool. Good news is, not much runway will be needed once you get to it, so head upwind to an intersection if possible and once on the active, just head into wind and go, rather than lining up on the centreline -too hard on real windy days. One thing, due to the fact that they weathercock during a strong gust, I have never heard of one blowing over in the taxi phase.

Take-off

Prior to line-up, check the magnetos, cycle the prop, set the trim, select two notches of flap, push the mixture and prop controls in, check fuel selectors and contents. Really that's it. Everything else is secondary.

There are however, two problems you may face here:

- Leaving the side of the runway still on the ground, and
- Reaching the end of the runway, still on the ground.

As a rule, the take-off phase of flight is a reasonably simple affair -unless the engine stops. In a C-185 however, it is complicated by the ground handling properties and made worse by the use of full power! On an airstrip with poor braking-action and a tail-wind, it may not be possible to control the aircraft in the early stage of the attempted take-off. This is an extreme case and two solutions are to point about 15˚ to the right of the centre line, advance power over a few seconds and hopefully it will line-up (P-factor again) and then have enough speed and prop-wash over the fin to track the runway centreline. Lightly loaded, there can be a case for a reduced-power take-off. After the first few metres, brakes will not be needed so heels on the floor! On a sloping strip, be sure you know where the centre line is -often it cannot be seen from the parking area, so from time-to-time, people spear off over a bank by mistake. A rough field calls for full forward elevator initially to get the weight off the tail wheel. When the tail is lifted there will be a further left-turning moment, so bring the tail up slowly. There is not much need

to raise the tail-wheel more than a foot or so off the ground. Once above 20Kts or so the fin and rudder will be quite effective, but may not really bite until the tail has swung 15˚ or so from the line of travel. This can be quite disconcerting until you get used to it. Control the swing by briefly reducing power, causing a right turn to regain track and then smoothly power up again. With the correct attitude the Aircraft will fly when ready, speed will depend on loading and type of leading edge fitted.

Airspeed and control are more important than achieving an early lift off. Even on a short strip it's better to use all of it and leave the end at a good flying speed, rather than unstick early and flounder along at too low an airspeed. Likewise, speed and control are preferable to vertical clearance over an early obstacle, within reason. The exception is a soft runway or long grass where it is better to get airborne and accelerate level a few feet above the ground, in ground effect.

One case where it is possible to use the entire field-length and depart at minimum flying speed is an elevated field with a drop-off at the end. This is a most useful technique in 'hot and high' conditions, where power is lacking. The entire length can be used for the take-off roll and around 50Kts indicated will be enough to become airborne (just) and clear the end. Pole forward to avoid a tail-strike and gain airspeed. Away from ground effect level flight will not be possible, so expect to lose between 100-400ft, until climb-speed is achieved and the rate of descent arrested. This technique can be dodgy with an aft CofG though -if you're unable to get airborne by the end of the strip, as the thing is lobbed off into space without actually flying at all it may pitch up and stall. In any event the whole concept is better left to the very brave or very stupid.

The length of runway required can vary considerably: from a usable minimum of 250m, light at sea-level, up to around 1000m heavily loaded at altitude. Rough safe distances at MAUW of 600m at sea level increase by 50m per 1000ft gain in density altitude and halved for Pilot-only would be reasonable ballpark figures. Much less, get the performance charts out and have a look at the wind, surface and obstacles. One of the traps is to fly one around light and forget how much runway is needed when loaded. This happens mainly to private owners who may only have a few flights a year at gross and just themselves much of the time. On each take off it is a good idea to select a point where it is safe to abort and stop by the end. This point can only be guessed at by experience, but around 40Kts on the clock by half-way down the field is a good start. On a sloping, one-way field it is not uncommon to be committed to the take-off on leaving the parking bay, so it varies from place to place. One hazard in undeveloped countries is to find indigenous people or pigs on the take-off path and abort the take-off too late. Chances are they will move quickly or cause minimal damage. Same applies when landing but be prepared to leave quickly if you hit one on arrival!

Sometimes performance will be less than expected due to surface state, a wind change, engine snags or just overloading for the conditions. If you're not happy with the way it's developing early in the roll, abandon it. Remember, the far end of the field is a lousy place to realise it may not fly. It is far too late by then and the only hope you have is to keep going and pucker-up: an attempted abort will only result in a crash anyway. So you may as well go in at full power and make a proper job of it.

Flap settings: it is normal to use two notches for take-off. If still on the ground at the end of the field, a further notch will most likely help. There is data to suggest that the wing

favours use of three notches. It would be interesting to do a trial on this. On a large, sealed runway it is likely that zero flap would reduce time to 500ft at climb speed, whilst reducing cockpit workload.

Climb

Once airborne a 185 is very similar any other high-performance Cessna piston single, only nicer to fly. Most of the following comments could be applied just as well to any other Cessna with the naturally aspirated Continental 470-550 series installed. As stated in the book there is strictly no need to reduce power after takeoff. Full power climbs are permitted and the 5-minute, full-power limitation on the IO-520 is only a noise consideration. Common sense suggests that to keep noise, engine wear and fuel consumption down, power is reduced, usually between 100-600ft AGL, or clear of all obstacles. A good climb speed is around 80KIAS, or at the top of the full-flap limit white arc is good, because it's easy to spot at a glance. However 100KIAS can be a good cruise-climb speed if light and down to 70KIAS if trying to clear a ridge without turning. Normal power settings are 24"MP and 2450 RPM. Keep your fuel flow generous in the climb:, the fuel cools the engine and helps prevents cylinder cracking from overheating and lean running. Climb only lasts 10-15 minutes in most cases, so the extra fuel cost is minimal. One operator I knew leaned back to just rich of peak EGT in the climb and ordered new cylinders along with the milk and bread. Another does not touch mixture in the climb at all, has had no trouble with cylinders and reasons 'fuel is cheap'. Personally, I lean back to top of the green, have had no problems with cylinders either, apart from those cracked due to age. Throttle settings have to be opened during the climb until, at around 6000ft density altitude, full-throttle height will be reached. Cowl-flaps should usually be open, although at higher altitudes, they can be partially closed since the engine will be producing less power and the ambient air is much cooler.

Cruise

Cruise altitude will depend on en-route and ATC requirements, wind, and terrain. In theory, full throttle height is most efficient, but in practice there is not much in it between sea-level and about 10,000ft density altitude. Less fuel is used the higher you go, so with favourable tail-winds up high, good ground-speeds and low fuel consumption can be yours. Apart from the savings, this gives very good range as well. Only snag is: without oxygen it is very tiring. A good idea when levelling out is to go a couple of hundred feet above the desired level and slowly descend back to it -this will help acceleration to cruise speed and sometimes allows a few extra knots. Cowl flaps can be closed at TOC and remain there until landing, though some advocate opening them a little, just prior to descent to cool the engine and then close them again at TOD.

Which brings us to engine handling: and haven't there been tens of thousands of pages and millions of words uselessly spent on propounding and defending one Old Wives Tale (OWT) or another on this topic alone… I'll try to keep this as painless as possible.

One of the most persistent OWT's expounds that manifold pressure (MP) measured in inches must always be less than the RPM in hundreds, or the power-plant will immediately blow to pieces under the strain. Briefly, utter nonsense. Were this so, turbocharged, turbo-normalised and super-charged reciprocating engines could not exist. Yet, this nonsense is still taught by many instructors for non-boosted, constant-speed engines. Bear in mind that the turbocharged IO-520 uses the same cylinders and compression ratio of 8:1 as the normally aspirated -520, full power is 34" boost and cruise is at 2800RPM. There is one UAV that has a turbocharged Lycoming and reportedly runs 28" boost and 800RPM!!! Fixed-pitch propeller aircraft usually climb at full throttle with no ill effect.

To further (and finally!) illustrate the nonsense of this OWT, consider this: ISA Mean Sea-Level atmospheric pressure is 1013.2Hpa or 29.92" Hg. Under those same conditions with a normally aspirated reciprocating engine, regardless of what RPM you set, you cannot achieve a MP any more than fractionally in excess of 28". This OWT is based on the premise of the pressure difference between atmospheric and the internal pressure of the engine. Stated simply, the least pressure difference between internal and external pressures occurs when the engine is stopped, and pressures have had time to equalise. Have a look at the MP gauge of a stopped engine sometime –it will be at or very close to the local barometric pressure for your elevation. By the same token, the greatest pressure differential will be seen on an engine running at idle -20"MP difference or more. So how could running an engine at full-throttle (the minimum pressure differential for an operating engine) cause it to catastrophically self-destruct? It's just not logical. There is a wealth of worthwhile information to be found in other publications. (9)

So it would seem over-boosting a 185 engine is not an issue. Indeed having once run them at quite conservative power settings, all that I achieved was filling the valve seats and cylinders with carbon! They lost compression, as the operating temperatures were too low and combustion incomplete. Also, engine wear varies with the square of the RPM. This means an engine operated at 2000RPM will have less than half the wear of an engine operated at 3000 RPM, which seems to suggest that higher RPM will only wear the engine unless some boost is available. In a C-185, high RPM also decreases propeller efficiency; indeed much of the noise at take-off is the propeller tips going supersonic. My point is to question the practice of a cruise power setting of 24/2450; I would now look at using 24/2200 or 25/2300. More important than boost is the mixture setting which, if incorrect will cause engine damage within a very few flights. Too lean will burn valves and crack cylinders, while too rich can reduce range and leave you short at the end of the flight, plus the cost of it. Ensure that there is a functioning exhaust gas temperature gauge to set the mixture with –better yet, you'll have balanced injectors fitted and proper engine-management systems installed so you know what is going on in your engine. Guessing from MP, RPM and fuel-flow may not work -one or more of the gauges may be giving false readings.

On climb, keep fuel flow up and EGT down as discussed earlier, but in the cruise just rich of peak seems to be best. At lower power settings like a steep descent or holding, peak EGT can be used as the engine can then handle it at the lower power setting.

Turbulence can be a worry during cruise and descent, however in a C-185 it is more a matter of discomfort than danger. Most likely due to the use of struts, and in common with all the other Cessna singles with struts, these aircraft are extremely robust. The occupants will give up before the aircraft, as proven by some clown in a C-172 who, equipped with crash helmet, full harness and parachute flew through the wake of a Boeing 727. He came out with bruises and some moderate injuries, but the 172 was undamaged.

One job I flew involved flying in the mountains in gale-force winds. The result was constant moderate to severe chop. It was uncomfortable, but did not appear to loosen any rivets. Neither did the dive through a hole in cloud, which ended up at the red-line in the same conditions. I am not suggesting anybody try these things, just trying to illustrate that the C-185 will stay together, when many other similar aircraft with no struts may not. In fact I doubt a 185 has ever broken up in the air. Within reason then, it is a problem a 185 pilot need not worry about too much, but common sense dictates that when it gets rough, take it easy and slow down.

Do not use rapid control inputs except on the rudder when landing or taking off. Especially in the ailerons at high speed, this can twist the wing and then it will not fly straight. One of the greatest dangers can be from loose objects thrown around the cabin as discussed earlier, so ensure all is tied down securely.

Some points on mountain flying, although it is really a separate topic covered by other material: be very careful when flying down-wind towards high or rising ground -it is very easy to run out of room and hit it. Always leave room to turn away from any high ground ahead. Against all logic, it is possible to lose a great deal of height very quickly indeed. Mountain waves can be insidious. There doesn't need to be exceptionally high winds either and the rapid altitude change can be quite unsettling. If caught in a mountain wave, you can be carried up or down at 1000fpm or much more and feel you have lost control of the aircraft. It is disconcerting. If possible, the best bet is to turn down-wind; the high groundspeed will carry you directly away from the undesirable part of the wave. Even in an empty aircraft at low level it is possible to be forced into the ground unless some action is taken. In a strong mountain wave, heading into it at best climb speed will literally get you nowhere. You might experience it infrequently enough for complacency to set in; for me only once every few hundred hours. Remember that at altitude little excess power is available and the aircraft will have a TAS higher than IAS, so once again leave plenty of room for any anticipated manoeuvring and remember it may not be possible to conduct a brisk, level turn.

Descent

For a normal descent, take your height above the field in thousands of feet and multiply by 3 to get TOD distance from destination in nautical miles. So at 6000ft for a sea-level landing, start your descent at 18NM out and an 800 ft per minute rate of descent will bring you in nicely. Just bring the power back a bit and speed will come up to 140-170KIAS, depending on how the aircraft is set up. In normal use, reserve flying in the yellow arc of the ASI to near-calm days. Comments earlier on turbulence are only included because this is not always possible. Don't forget to gradually reduce MP and enrich your mixture during the descent. Watch your T's & P's too, to avoid shock-cooling your engine. If you have no terrain or ATC descent restrictions, consider a 5:1 descent instead of a 3:1: the lower ROD is easier on the ears and gives a slightly smaller speed increase over a longer time. Parachute dropping pilots have a need to get down faster, as can those mountain-flying or descending through a break in cloud. There are two main ways of doing this: easiest is a straight line descent, just reduce power to around 18"MP and get airspeed up to around 160KIAS. As long as the cowl flaps are closed, this has been proven not to shock cool the engine and it will come down real quick. Second is a spiral descent with full or 3 notches of flap. You might find yourself doing this to get down through a hole in cloud, into a valley. Set the power back to 16"/2000, bring the speed back to 55-65KIAS, put the flap out and roll in about 60˚ AoB. Ideally, it will require full-aft elevator and you then control angle of bank and airspeed with aileron, a low speed spiral dive in other words. It will give a rate of descent of around 2000 FPM and require a very small radius. Snag is quite high G-forces are involved, so it is hard on the body, needs a high degree of concentration and does impose some stress in the aft end. In near instrument conditions, when all you can see is the airfield below in heavy rain or thick smoke, there is danger of becoming disorientated and ending up inverted, so keep a close eye on the artificial horizon or the ground. If cargo is on-board, consider the deck angle or else it may all come forward to meet you. Try not to do this with passengers on board either as they may find it disconcerting. The same method works in larger general aviation aircraft such as the Islander, C-402 and Bandeirante. Also handy if you get caught in an up-draught from a thunderstorm or wave conditions downwind of a mountain range in a gale and in danger of being sucked up into the cloud.

On reaching bottom of descent and joining the circuit, it can be difficult to get speed back to the flap range in the early models. One solution is to fly downwind at 500' instead of 1000' and pull up on the turn to base leg to lose speed. Occasionally someone on the field may complain, but I find telling them to piss off and mind their own business works well. There is no regulation against it. If a cargo-pod and large tyres are fitted, slowing down will not be a problem as the drag cuts into the top speed on descent considerably. In a later model with the 120Kt initial flap speed think about giving it a 10Kt margin, otherwise you risk twisting the rear spar. Downwind just check the mixture is in for a possible go around and on finals push the prop control in. Some open the cowl flaps on final in preparation for go around as well. I figure it is a distraction and an aborted landing is rare enough not to require it, so open them on landing. Like many of these things it is a matter of personal preference.

Landing

Landing is the interesting and lively part of C-185 flying, where from time to time it all goes wrong. For the most part it is simply a skill that requires practice, but the following ideas may help. Consider your landing distance required to be the same as your take-off distance required –that way you'll never try to get into somewhere you can't get out of. Other than that, there are three main areas you need to consider: the touchdown, the slowdown, and ensuring the whole thing stops before the end.

The approach comes first and a normal 3˚ approach applies, regardless of airfield slope. Speed depends on whether a wheel or three-point landing is intended, whether there is a flat or sloping field, type of leading edge and loading. But 65KIAS is a good base figure, plus or minus 10kt, depending on what you are up to. The mathematically inclined can work out stall speed for the weight: use $1.3V_s$ for normal landings or $1.1V_s$ for short landings. Add 1 knot for every 2% slope and half the headwind component to allow for gusts. A little experience will soon allow you to pick a figure out of your nose though.

On the subject of slope, it is possible to land on some impressively steep places with a few in PNG having sections of around 20%. There are few public roads built of any more than 15%, so we are talking steep here! The main points are: practice, normal 3˚ glide-slope, extra speed to cope with a 23% round out, probable max power to make it to the top of the strip once on the ground and having somewhere level enough to park at the top. If it is a 400 metre strip at altitude with a tailwind, expect a 90Kt ground-speed, which requires a strong sphincter, but once used to it, the slope will wash speed off very quickly. In fact, the brakes will hardly be needed and once used to it I worried more about the short, flat, wet places. Visually these types of landings can be quite overwhelming at first, with the combination of high speed and the field disappearing up the top of the windscreen. I mention it because in a single it is good to know what is possible for use in an emergency.

For the inexperienced, the best way to land is the three-point landing. Same technique as a nose-wheel Cessna: just get a few inches above the surface, ease the power and stick back until holding full-aft elevator, then wait until the aircraft gently stalls onto the ground. A small skip is normal, but a big bounce is unlikely, since airspeed is so low by touchdown. It is really quite simple and not much harder than landing a C-172, especially when light. Starters are best to use this method, keep the back seat empty and land on decent sized fields, into wind for the first few hours. Before long they will feel quite confident and wonder what all the fuss is about! In these conditions, it is not hard. Down-sides are forward visibility is limited, it can be hard to touchdown at the desired spot, can damage the tail-wheel area when fully loaded, a gust of wind can loft you back into the air, as can undulations on a rough strip. The latter two and just plain getting it all wrong can cause quite large bounces, often made worse by inappropriate pilot responses. On a very short field, the 3-pointer is best, but requires skill because it is so easy to touch-down short of the threshold or float the length of the strip and run off the end.

The other extreme is the wheel landing where the aircraft is flown onto the ground at a much higher speed in a tail-high attitude. With no nose-wheel to get in the way, once the mains touch, pole forward to reduce the angle of attack on the wings and put the aircraft weight on the mains for optimum braking. Doing so will stop any tendency to bounce, even though flying speed may still exist. Some even touch down with light pressure on the brakes, so that on ground-contact the tail rises automatically, but this can be hard on

the tyres. The tail can be allowed to rise quite high at this stage. With the high speed, a nose-over will not occur, but it may at lower speeds. Touchdown can be reasonably firm as long as the tail is kept high to prevent a bounce. It is possible to get a foot or two above the ground and simply pole forward to achieve a positive landing. Advantages are higher speeds are possible, which is handy at a large airports where you may be pursued down finals by a jet and speed is of the essence.

A desired touchdown point can be selected and landed on quite accurately. Forward visibility is good as is braking with all the weight on the main wheels. In gusts the aircraft is less likely to become airborne again as the required AoA has been reduced by the tail high attitude. The tail assembly is safe from damage -it will not touch the ground until later in the landing roll. Disadvantages are that due to the higher speed the wheeler method can simply use up too much runway, no good for short-field operations. Due to touching down well above the stall, bounces can be high and numerous with heavy impacts from them if it all goes wrong. Harder on the brakes due to higher speeds.

The best compromise is what is best termed a tail-low wheeler or a 3-pointer without the flare and the tail-wheel touching the ground. Approach at say 65KIAS, aiming at a point about 50m into the field. Touch-down will be with the mains at the required point and in a slightly tail-low attitude, because the speed is lower than a classic wheeler. Effect the touchdown as described for the wheeler. You can now get the tail back up and get on the brakes to slow down without floating down the strip like a 3-pointer. It takes practice to do well, but once mastered is a sound way of landing especially on rough strips at MAUW. Allows a reasonably short landing in control, with a moderate risk of a bounce and saves the tail-wheel and spike as they do not touch the ground until later. If kept straight the C-185 will absorb a lot of punishment. One PNG strip gave me a sore back and most other aircraft such as the C-206 and Islander needed much extra maintenance, but it never seemed to bother the C-185. The ski-plane experience with them also bears this out.

As in the take-off, during a x-wind landing the tail may swing around a few degrees before the fin comes into play and catches it. There can be a delicate balancing act between various forces on a crosswind, which can see some quite interesting crab angles. The key is to keep your feet moving and make numerous, small adjustments early to keep on-line. This is one case where rapid and full control movements can be quite appropriate, if needed. Concentrate on the middle distance, not the bit of ground just in front of the aircraft. The tail is best kept a foot or two off the ground for as long as practical, especially if heavy and on a rough strip. The aircraft weight will be on the mains, you'll have better visibility and less chance a flat tail-wheel causing you grief. A three-point landing on a very short field will make this impractical. Seal is much worse than grass -the tyres grab and a touch-down with any crab angle gets interesting. If possible, use the grass and if low-time on-type, keep the back seat empty on seal until you've had a bit of experience. Cross wind technique is the same as for any other aircraft, but the limit is lower at around 12Kts. A wind from the right is much more manageable than one from the left though. By turning into wind on a wide runway at the end of the landing it is possible to handle a much higher limit.

There is no advantage to having an overly tail-high attitude. A risk here is that you will be thrown forward by the deck-angle and onto the brakes. Then the aircraft can tip over, even at quite high speed. Heavy braking should be used early if needed, but towards the

very end of the roll, stay light in the brakes. Excessive use here risks building up material in front of the wheels that can tip the aircraft on its back at very low speed. Interestingly there is no risk of prop strike as such: by the time the prop hits, the machine is already almost vertical and on the way over. Some pilots prefer to dump the flap as soon as positively on the ground to get more weight on the wheels and reduce the chance of a bounce. I find it a distraction at a critical phase of flight, so do not do this.

Over-running the field is the next issue. Causes are using a strip too short for the conditions and load, landing too far down and running out of room, losing the brakes or finding little or no braking available due surface conditions. Down-wind landings are worth avoiding in a C-185. It makes directional control quite difficult in the latter stages of landing and needs a long field. Load will increase the landing distance required, since inertia equals the mass times the velocity squared. The mass of a C-185 can almost double and the approach speed increases as well. Because a small increase in speed means a large increase in landing distance, accurate maintenance of the correct approach speed is critical in the final stages.

Remember that mountain strip you visited alone? It may get to be short at one end with a few mates and a couple of crates of beer on board! Landing at a nominated point on the field should be practiced, even if your runway is long enough not to matter. Then when required, the skill is there. As noted earlier check the brakes are in top order at all times. One big trap is a poor braking surface. Damp clover and lucerne, newly cut crops, moss, hay, saturated turf and wet, smooth seal can all surprise with next to no braking action. Often it is not possible to determine the braking action from the air, so if uncertain have a good look, get the speeds back and don't waste any runway. In these conditions bigger tyres are worst for braking, as they will not dig in and break the surface. As with a take-off, after a certain point there is no option but to land. In bush operations this point can be on turning finals and on a short level strip with a go around it is around the normal touchdown point. Try one on a medium size field and it can be surprising how much room is needed with a full load. Often a landing will go wrong and the pilot will attempt to go around far too late in the game. The result is a higher speed crash that may hurt, where otherwise there would have been a low speed impact or none at all.

As for this bouncing caper, it happens to all of us, even those with thousands of hours on type. Usually the bigger the audience, the greater the likelihood and the greater the magnitude of the bounce! The key issue in a bounce is to recover the aircraft whilst avoiding damage. If the recovery effort gets out of phase with the aircraft bounce-cycle, the bounces will get heavier, higher and more damaging. Be prepared to go-around and start again. If the next landing is a good one, there is no loss of pride and fuel is cheap. On a one-way strip there may be no option but to ride it out because to attempt a go-round risks running out of space. Once did this and ended up with turf in the brake disk, scraped the pod and touched the tail-spike on the tail-cone. That was with the big 8.50 tyres too, so they really are quite robust! The single passenger vacated via the baggage door and fled into the jungle, in spite of the fact this was not the destination. It's difficult to describe how best to recover from a bounce, as there are too many variables. So I will not attempt to do so. Work it out.

Once on the ground it is understandable to relax a bit, especially if it has been a rough trip. A normal response in most aircraft, but a big mistake in a C-185 –that's when she'll bite you in the arse. They will survive positive arrivals and bounces within reason if kept

straight. What does the damage and keeps many rebuild shops busy is C-185's and C-180's that have ground-looped. This occurs in the deceleration phase of the landing, below about 30Kts, and many at quite low speed. The cause is failure to keep the aircraft straight as described in any book on tail wheel handling. Many of the issues mentioned in the taxi and take-off notes arise here as well, but late in the landing-roll it is much more difficult to control and correct, due to the deceleration and loss of aerodynamic control. If the wind is anywhere but directly on your nose, it is going to try to weather-cock your aircraft. Your CofG is behind your mains, but as it weather-cocks it tries to overtake the rest of the aircraft, accelerating into a ground-loop. How fast you are going at the time decides the severity of the event. The only solution is to keep your aircraft straight. Early in the landing-roll, that's easy: you still have effective airflow over your fin and rudder, assisted by differential brakes. Once you decelerate below around 30Kts you lose that aerodynamic control and rely instead only on the differential braking. At times, a little blast of throttle to get some airflow over the fin & rudder may help, but it doesn't do anything to help slow you down!

In a C-185, you're still flying it until its shut-down and on the pickets for the night!!!

Emergencies

There is no change to the standard engine-failure drill for forced landings in a C-185. If you are forced to put-down in a very small clearing or beach, it may be an idea to pole-forward and lock-up the brakes as soon as you are firmly on the ground. The aircraft will flip, but it will stop in a very short distance with relatively little damage. The occupants should be safe from harm with the wing below and the tail-section to absorb any impact. It would take some nerve to actually do this but in theory it sounds like a good idea. Partial engine failures are actually more common. Mainly from magneto failures, cracked cylinders and blocked injectors. In all these cases the engine will run with some vibration, but performance will be affected and it may not be possible to maintain altitude. Remember to use the electric fuel pump if an engine failure occurs, often the problem is the fuel control unit or mechanical pump. Early model C-185's did not have fuel selectors; the only real use was to isolate a leaking tank. So pilots who have flown a machine without them can easily forget they exist, being out of sight as well. It is then possible to fly one which does have them and suffer an engine failure if only one tank is selected. I know this because it happened to me. Even if the mistake is realised and the tanks changed, it takes a little time for the engine to catch again. This is due to the one-gallon header tank on the floor, so check those selectors and maintain your fuel-log.

Maintenance

Some notes on common maintenance snags which often occur. These are mainly related to cylinders, brakes, fuel cells and the tail-wheel:

The cylinder barrels are steel with an alloy head, so after a few thousand hours they can crack around the join and in extreme cases the head can separate completely. There will be significant vibration should this occur and some oil loss, but the engine will still run and allow a landing somewhere -unless you are having a very bad day. The cause is thermal stress, as the different metals expand and contract at different rates when heated and cooled. So it is the *rate* of change of temperature as much as the actual CHT. Use the cowl flaps, sensible mixture settings and try and make smooth changes in power settings. They will still crack with age, despite the best of care and attention. The greatest temperature-change ever is after shutting down with a brisk, cool breeze blowing through the cowling. Close the cowl flaps and consider blocking the front intakes in these conditions. Most likely you will have a plywood bird-blocker for the air intakes anyway. After about 1500hrs, cracks become reasonably common and after about 3000hrs just expect it and have a spare one in the hangar. Oversized cylinders are the worst as the walls are thinner and they are older, which is why they have been bored out. Ideally new ones would be fitted at every full overhaul as Lycoming suggest, and their pots are better than the TCM ones. That would be quite expensive though. The best compromise may be to buy new when one cracks instead of going for a repair. There is not a great price difference now. Mostly these cracks will show up on a compression-test rather than causing problems in flight. It is largely a matter of inconvenience due to downtime and the remote spot fate will force you to land on. I once had a bad vibration in flight and all compressions on landing were good. The cracks can close up again when cooler. That particular cylinder blew 50hrs later and stranded me in a remote area. Be very aware of CO2 poisoning if gas escapes from a cracked cylinder and finds a way into the heating and ventilation system. Once had this and was lucky it was a short flight, it is very insidious and extremely dangerous. So, keep the exhaust, heater system and air hoses in good order too. Mine were very ordinary at the time.

Fuel-cells, caps and drains can be real problem. All C-185's are old enough now to have had trouble with rubber fuel cells. With age, the outlet pipes become hard, crack and leak. Apart from the fire hazard, the mess is considerable. The black stuff in the lining can also peel off and block the fuel system and ripples in the bladders can make it hard to get any water out. When this happens, it is time to install new bladders. They are not much more expensive than reconditioned and a lot cheaper than a crash. Fibreglass tanks are also available. Either way, don't mess around with the old ones when they give trouble, they're just not worth the drama.

The old flush fuel-caps are a hazard. The O-ring can let water in and your aircraft just won't run on water. I took off with a pint of water in the system and the engine stopped 19 minutes later when on high finals, coasted in. The fuel check had revealed 100% water, so it looked clear. Raised caps should be installed by now. If not, do so. They are quite cheap and very worthwhile.

Fuel drains can stick and stay open after checking for water. Standing alone on an airfield on a cold morning with a thumb over the drain and avgas seeping down to the armpit, wondering what to do next is a low point in life. So, keep a spare one on the glove box along with a spanner. Failing that just a stud the right size to block the hole will do.

On rough or soft-field operations the tail-wheel can cause problems. Standard ones are a little small and tend to dig into the ground, and suffer flat tyres. Tail-wheel shimmy can be a major problem. If on landing the panel turns to a blur and the pedals try to break your ankle, that's it. An overhaul of the tail-wheel shim-dampers is the solution. Pilot technique can also reduce this by keeping the tail-wheel off the ground. A larger tail-wheel has many advantages too, beyond the lower likelihood of tail-wheel shimmy - better visibility out the front as well. With no load it is possible to fly to the maintenance base and hardly use a flat tail-wheel. Elevators, brake and power will keep the tail up, even from a standing start to a dead stop. Take care not to tip over though. Also with heavy use the tail spike can fatigue and break. They are hollow, so if stuck find a 3/8" reinforcing rod, weld a plate on one end for a skid and bash the other into the hole. That will get you home.

Some operators fly more than they write. There is little if any advantage in understating hours in a C-185. No airframe components are time limited. Most engines require a top-overhaul at half-life and again at around 1700 hrs. This will usually occur regardless of what is in the books. Often money will be wasted on a worn engine because the logbook says there should be life left in it. The big mistake is to delay oil changes and run over the 50hr limit. With mineral oil, there is a good argument for changing at 30hrs. At this stage it breaks down, goes black, consumption goes up and lubrication properties rapidly reduce. I know an agricultural operator who changes at 30 and the engines are very clean and show little wear at overhaul time. Some modern synthetic oils should be good for more than 30 Hrs. With a quick-drain sump, an oil change is quick, cheap, and can be done by the pilot. In a cool climate where temperatures get below freezing at night a simple oil heater like a light bulb will greatly reduce engine wear on start up. Otherwise it flows like syrup and takes some time to reach the top end. Really cold climates like Alaska are a specialised area I know little about. Apparently they take the oil out at night and keep it warm somehow.

Modifications

As mentioned earlier the C-185 can be customised to suit your needs. If this is carried too far though, it does pose the question of whether it is the right type for the job at all. For example: buy a Centurion for speed or a Beaver for heavy-duty short-field work. For lighter strip-work look at a Piper Cub (a classic!), C-170 if you can find one or even a tail-wheel C-152. An easy to fly personal aircraft with the same performance as a C-185 is the C-182.

The most useful add-on is probably the cargo-pod. These allow room for 6 people and their bags, or just more cargo. Cruise speed is reduced by about 5Kts and more in the descent, where airspeed will not get far into the yellow arc. If it all goes wrong and one of the gear legs is ripped out, the pod will absorb much of the damage that would occur otherwise. If however it is a private machine and you can get all your friends and relatives in the back of a Piper Cub with a spare seat, a pod will not be needed.

Leading edge and wing tip mods come in various shapes and forms. They improve low-speed handling. Most work well; it really depends on whether the extra cost and weight is justified. The old symmetrical leading edge may not be the best on paper, but does give plenty of warning of a stall. Bear in mind that an airspeed of 35Kts, which is possible with these kits, is faster than that, because the indicated and actual airspeeds diverge at these low speeds. Also the stall when it arrives, can be quite sudden. At high-altitude, lower approach speeds cannot be used safely since the power needed may not be available. This is more the realm of the Islander with its 39KIAS stall. Be aware of gusts at low speed. A 20Kt wind at 60KIAS is a third of your airspeed. Come back to 40KIAS, it is half. My point is to question whether an approach much below 60KIAS is a good idea regardless of stall speed. But if used as a safety buffer for bad days, leading edge kits can be a great asset. Would have ended myself in the PNG jungle back in '92 without one. That's a pretty hefty recommendation, come to think of it. Presumably they'll also help the aircraft blow off the pickets in a gale… The only wing mod that does not make sense is flap gap-seals. Fowler flaps work by allowing the air to flow from the top of the wing under the flap, so preventing this does not seem sound. I have doubts about very droopy wing-tips as well -any aerodynamic benefit must seem small after hitting your head on one!

Tyre size can be varied up to 8.50 on the standard rim; speed will be reduced but most useful on soft fields. Go easy on the brakes though, on a sealed runway tyre creep can occur with big tyres at low pressure. Wheel spats increase speed by about 5KIAS and can make up for that lost by a pod. They also keep the bottom of the wing clean and make a good step. But they can harbour quite a bit of mud or ice, adding up to quite a weight. Plus some people think they just do not look right on a C-185. But, the rest of the Cessna range have them. Small tail wheels can be replaced by bigger ones if they are not up to the job and I think stronger tail springs are available as well, have seen one somewhere.

Early models did not come with refuelling steps or handles on the strut and forward of the door-post. These are most useful and well worth adding, saves falling off the strut when nothing else is available. As mentioned earlier, grab handles in the aft end will reduce the chance of ground-handling damage on the skins and elevator.

Inside, just a couple of really handy things: articulated seats in the front allow adjustment from desired position on the ground to see out to that in cruise with the tail up. They go up and down as well making them a must for short, stumpy, sawn off and vertically challenged people. Inertia reel full-harness seat belts for the front, or even just for the pilot side, are worth a look. The passenger can use a fixed full harness and I have used one on the pilot side as well. In a C-185 though, it is essential to be able to reach the flap lever on landing, just when a crash is most likely. A fixed harness does not allow this and has to be loosened off for landing, kind of missing the point. Single diagonal shoulder straps and lap straps only are next to useless. These aircraft have a very strong cabin area in a crash, so proper belts to help prevent head injury are well worth it. In high-risk work and heavy turbulence, a light helmet can have a place if there are no passengers.

Avionics are a matter of choice. With GPS now the basis of may panels, it can be a good GPS/NAV/Comm with a back up radio. Many aircraft are full of old, obsolete nav gear

that often doesn't even work. In my opinion, it clutters up the panel and all needs to be flung out to save weight.

Autopilots may be useful if a great deal of IFR flying is done, but most C-185's tend to be VFR and fly quite straight on their own.

Noise is an issue in the clean-green new century and the C-185 must be about the noisiest aircraft for its size in the world. It is mainly to do with the prop tips going supersonic at high RPM, creating that distinctive scream on take-off. Apparently there is little advantage in the long two bladed props over the 82 inch one. There may be a mod to cut the 86 and 88 inch ones back. For parachute work where noise is a real issue, a modern 3-blade prop offers a significant noise footprint reduction. As do the old 3-blade ones, but these have a slight performance penalty. They offer better ground clearance and with a pod on, may not even touch if a leg is ripped out. Mostly common sense actions such as avoiding built up areas, whinging trampers and keeping the RPM down will help our case and reduce the chance of restrictions. If on the other hand you think 'stuff the poor' and let them go deaf while burning as much of the world's oil as possible, get an 88 inch prop with the 300HP motor. Dunno if it performs any better, but the whole province will know when you are off somewhere. The noise will wake the dead on take-off and climb.

The Missionary Aviation Fellowship has developed two good mods that I have only ever seen on MAF or ex-MAF aircraft. One is an emergency fuel system, which when activated, puts fuel directly into the intake manifold. Thus most of the fuel-supply system failures can be bypassed. It will get you home. The other moves the battery from behind the cabin to the left-hand front of the firewall. The movement in CofG must be considerable and most useful where the aft compartment is used. If flown light, perhaps not a good idea. A C-185 can have a forward CofG with just the pilot on board -not a big problem, but increases the chance of tipping over. The one I knew with a forward mounted battery did just that. These are just some of the mods available. They can all have a place -just beware of gilding the lily, so to speak.

Currency and training

Sometimes, C-185 owners will have a few bad experiences and avoid flying them unless they have to. This is not sound thinking as currency is important. If privately owned the extra cost of flying them is minimal, most only do about 100hrs a year, some less. For maintenance and proficiency reasons it is better to do 100hrs annually at least. The extra cost from say 50-100hrs is not much more than the fuel, since the engine will run out on calendar time and they need an annual anyway. Insurance is a fixed cost and should actually be cheaper for those who fly regularly. Looking at privately owned aircraft in New Zealand, few of them will ever wear out, but the fleet has an abysmal record of landing accidents. Indeed almost all of them have been crashed at some point, supporting a case for better training and currency.

Currency on its own is not much use if the skills being practiced are not appropriate. So training is important, but appropriate training is essential. Most private owners and some CPL's receive little more than a bare endorsement and so blunder along, learning a little more with each fright until they either master it or not. I know this because that is how I learnt to fly them, prompting these notes. Most private owners are quite good pilots and need to be keen on the aircraft to own them, but should consider independent, experienced advice from time to time on how the machine is best flown and used. Properly done this can be a fun and educational thing that will increase confidence. Otherwise it is possible to start doing strange things and not realise if operating alone. Certainly a C-185 is not for the faint-hearted, but once mastered it is really not that difficult and for the most part is great fun.

At the other end of the scale, over-confidence can be a problem. From time to time, some character will decide to `show us what you can do in a 185', but push the limits too far and metal will bend eventually. It is this group that tends to have the very serious, high-speed accidents. Sometimes the question is not whether something is possible or if the pilot has the skill, but if it is a good idea. An example is landing at a marginal spot if a good one is only a few minutes' drive away.

For some reason, fatal accidents are rare. So while the landing accidents go off the graph, the C-185 appears to be one of the safest single-engine piston aircraft. Possibly because a certain amount of skill is needed just to get airborne, so the truly incompetent stay away. Plus it is a strong airframe with good climb performance, but not the high speed in cruise and descent of a high performance retractable that can get people in trouble.

I'll give the soapbox a rest now.

I hope these notes are useful. It is not what you know that will cause trouble, but what you don't know. Above all, enjoy flying these things. That's what it should all be about.

Postscript and DISCLAIMER:

If anyone thinks these notes are useful, use them, add to them, pass them on or whatever. I do not pretend to know all there is to know about the C-185, or flying and my experiences may vary from others. The landing section did not get across what I was after, but that is the best try. I have a boring airline job now and looking at the completed notes, realise it really is a Cowboys guide. I wouldn't attempt those 1,000 hours again and must be living proof that ignorance is bliss, as I enjoyed it all at the time. Now 500hrs can go by without a flicker on the pulse. While intending to be anonymous in case some prick sues me for crappy advice my e-mail is: dsarg@hotmail.com. Due to junk-mail, it may not work.

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9. **Deakin, John.** Pelican's perch. *AvWeb.* [Online] 2009. http://www.avweb.com/news/pelican/182146-1.html.

Most of these reference works are available for purchase via Amazon.com at: http://www.amazon.com.

Additional Web Links:

Australian Cessna 180/185 Club: http://www.skywagon.info

International 180-185 Club: http://www.skywagons.org/

International 180-185 Club –discussion forum: http://www.skywagons.org/forum/ubbthreads.php?Cat=