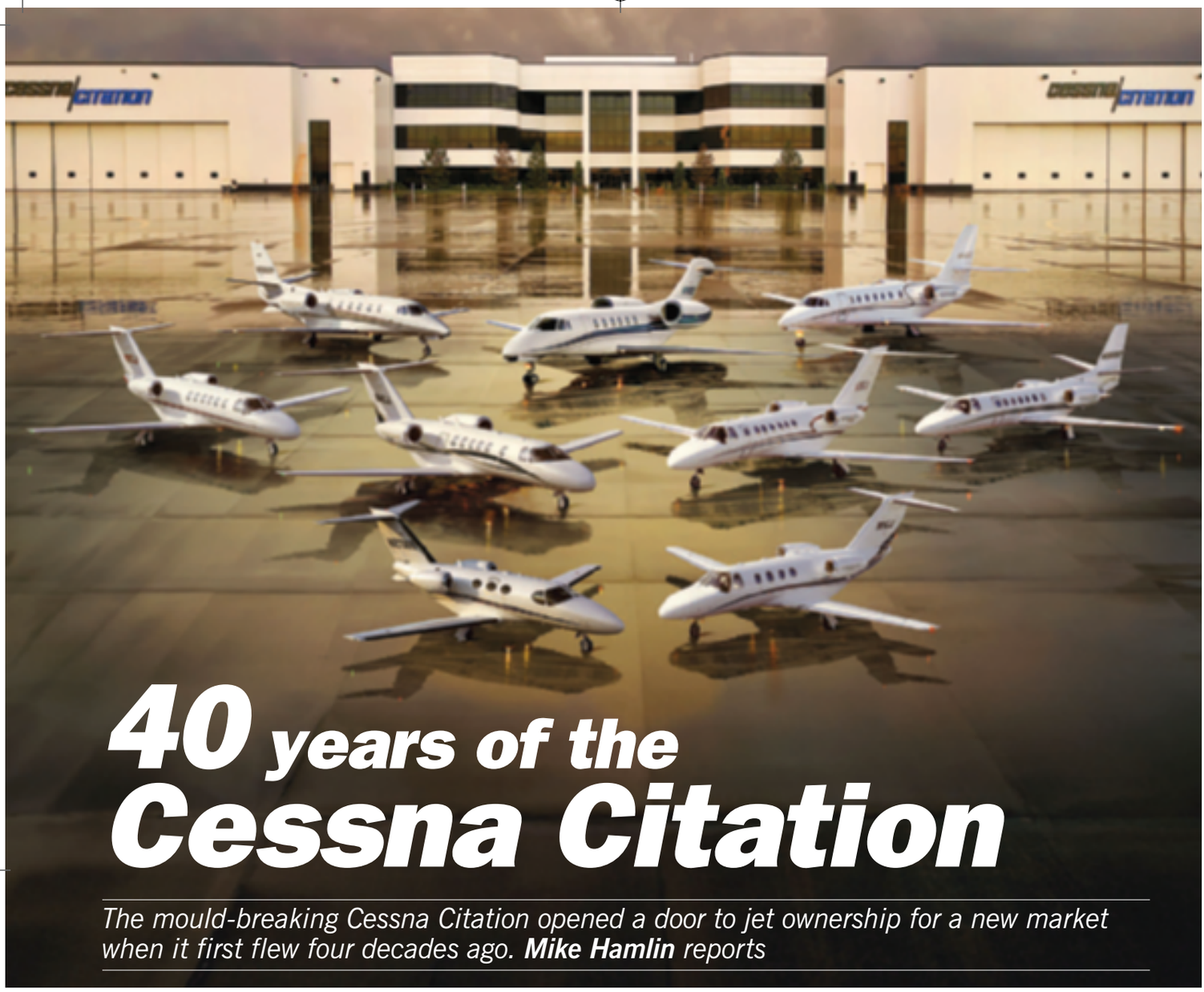

40 years of the Cessna Citation

The mould-breaking Cessna Citation opened a door to jet ownership for a new market when it first flew four decades ago. ***Mike Hamlin*** *reports*

The Cessna Citations are a family in the way that the Addams are a family; they share a name, they spring from the same loins, but you couldn't mistake them even on the darkest of nights. The Cessna philosophy unites them all – make it simple, stable and cheap, start them off with a little one and they'll stick with you when they get rich.

In the 1960s Cessna saw a market for a small, inexpensive jet; you could buy a Lear or an HS125 but they were relatively costly to buy and run. With its high performance, the Lear was a handful for pilots who were stepping up from piston twins. Faster than many of the fighters then in service, it was often flown by pilots who didn't fully grasp the reasons for the limitations in the book – they'd pull the overspeed warning CB (known as the 'go-faster button') and pour on power, only to find that the centre of lift moved too far aft and they got into a Mach tuck, for which the only cure was to lower the undercarriage, although too many didn't know that…

Cessna saw a gap for a personal jet that was not just inexpensive, but stable and easy to fly. It wasn't as much of a gamble for Cessna as it might have been for a start-up. They were already in the jet market with the T37 military trainer, and they used substantial portions of the twin-jet as the base for their first civilian jet, including the straight wings and the undercarriage. The T-37 was to become one of the most successful such aircraft of all time; some 1,250 were built, and the jet was retired from US military service only this year, 55 years after its first flight.

Cessna powered what was at first called the 'FanJet 500' with a pair of Pratt & Whitney J215Ds producing 2,200 pounds of thrust. Nobody remembers where the '500' came from; perhaps '330' would have been better because it was good for 330 knots and FL330. Aimed at the self-fly owner, it was a single-pilot jet with five passenger seats counting the potty, and while the straight wing militated against blistering performance it also made it more forgiving than the swept-wing Lear. The renamed 'Citation 500' first flew in September 1969; when it came to market in 1972 it was priced at $700,000, some $160,000 cheaper than the Lear 23 (and $500,000 less than the 125, with one third of the running costs), and it could be flown by a competent Navajo pilot after a two week training course. The major difference was that

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Top: Citation family includes, at rear, left to right, XLS, Citation X and Sovereign; middle, CJ2, CJ4, CJ3 and Encore; front, Mustang and CJ1
Right top: the T37 military trainer donated its straight wings to the early Citation
Centre right: Citation 500 could be flown by a competent piston twin pilot
Right: the Citation II sold for $1.5 million in 1978

Above: the Citation pilot of 40 years ago would just about recognise the yoke on this Citation X
Left: the Citation V morphed into the Citation Encore in 2000
Right: the Citation X cruises at Mach .92, faster than any civil aircraft now flying

while the Navajo was a three mile a minute machine, the Citation did six miles a minute. Pilots had to get used to planning approaches much further out – they could no longer rely on drag from windmilling props to dump them down. Instead of starting a descent 10 to 15 miles out, 40 or 50 miles was more the ticket. The first 20 hours or so in a Citation was a steep learning curve, but it was soon clear that Cessna had indeed found a gap in the market – they were pushing out 500s at the rate of one a week.

It soon became apparent that the aircraft had one major shortcoming – it didn't have enough wing to get much above FL350. In those days, the airliners were all down between FL290 and FL350, and with the 500 being 100 knots slower than the commercial traffic, it didn't mix well. Cessna knew that boosting the Citation into the high thirties would enable it to file direct most of the time so it created the 501, with 18 inches more wing on either side and better pressurisation. The 501 had a range of 1,200 miles, compared with 1,000 for the 500; what's more it was approved to FL410, well above the CAT, able to plough its own direct furrow. For some reason lost in the mists of time, the 501 designation was soon dropped in favour of 'Citation I'.

Cessna's market research showed that the industry wanted something even bigger, and in parallel with the development of the 500 into the Citation I it was also planning the Citation II, which was four feet longer and had eight seats. It had the same P&W engines, but they were uprated to produce 2,500 lbs of thrust, giving the Citation II a cruising speed of 360 knots. It sold for $1.5 million in 1978, and in its day there was nothing to touch it. More than 700 Citation IIs have been made.

The market was deciding it needed a 400-knot aircraft, so Cessna invested in the design and manufacture of a brand new wing with a fillet against the fuselage which improved efficiency. Its engines still produced 2,500 lbs of thrust, but the bypass ratio was reduced from 2.5 to 2, giving it better high altitude performance. This they called the Citation S/II, and it was one of Cessna's duds, largely because they priced it wrongly. They had to recoup the cost of the new wing and put a $1 million premium on the S/II, but buyers didn't value its 410 knots and better performance that highly. So Cessna added a couple of feet to the fuselage and called it the Citation V, which still had eight seats but provided much more legroom. It also had uprated engines giving 2,900 lbs of thrust, which worked out at a 425 knot cruise at FL430. This was a much more attractive proposition, and once again Cessna found they couldn't make enough. Having sold fewer than 160 S/IIs, Cessna stopped production to concentrate on the V, which is still in production now, 20 years later. Today's price tag is $8.9 million, and more than 800 have been sold. In 2000 Cessna changed the name of the V to the Citation Encore and gave it better engines with 3,400 lbs thrust for virtually the same fuel consumption as the V. The limitation was that famous Cessna straight wing, a proven entity which was Mach limited to 0.755.

While all this was going on, Cessna decided it needed to chase the Hawker 125, so starting in 1983 it designed an aircraft with a swept wing and more powerful Garrett engines (now Honeywell) each providing 3,650 pounds of thrust. They also built a stand-up cabin, 5' 11" tall, and a longer fuselage, and called the plane the Citation III. The III also hit the spot, with more than 100 sold in the first two years, but for some reason Cessna decided to subdivide it into two models, the VI and the VII. The VI was a basic model with few options and little luxury, while on the VII you could have any bell or whistle you wanted. Each VII was a work of art, but it cost you – $9.2 million, compared to $7.4 million for the basic VI. This marketing ploy was only partly successful, with 100 VIIs and 40 VIs sold.

With the VII and VI lines running out of steam, Cessna decided to stop messing about and produce something really sensational. They lengthened the fuselage and added a larger supercritical wing, stuck enormous Rolls Royce engines producing 6,400 lbs thrust each on the back and called it the Citation X. It cruised at Mach .92, faster than any civil aircraft but Concorde, and cost $13.6 million when it came to market in 1996. Since then 300 have been sold and it's still in production – today it'll cost you $21.7 million.

In 2004 they decided to produce a cooking version of the X, adding a somewhat simpler wing. While the new aircraft, the Citation Sovereign, cruised at Mach .78 it was able to operate from shorter runways and had a 2,500-mile range. Powered by P&W, it costs $14 million today, and some 270 have been sold.

Meanwhile, Cessna had kept on thinking about the whole Citation line and decided that it was wrong to forsake the entry-level jet, and the 500 and Citation I needed a similar successor. They took the good points – simplicity of maintenance, stability, low cost – and built them into a new aircraft, smaller and lighter than the 500, powered by Williams engines of 1,929 lbs thrust. This was the CitationJet, and with four seats and a $3 million price tag, it was aimed once again at the self-fly owner. Development potential was built into the CitationJet from the start, and in 2000 it was enhanced by newer avionics and a higher gross weight and called the CJ1. This was closely followed by the CJII, stretched for six pax, with a bigger wing and bigger Williams engines of 2,373 lbs thrust. Both the CJ1 and CJII have sold extraordinarily well – 700 of the former, 450 of the latter – and are still in production. The CJ1 now sells for $5 million, the CJII for $6.8 million.

In 2004 Cessna lengthened it again, made the wing bigger and squeezed 2,780 lbs out of the Williams engines, calling it the CJIII. This is another big seller, with Cessna having shifted 300 of them so far at a price of $8.1

Left: Citation Mustang leads the VLJ field with 160 sold as of December

million, even though most CJIIIs are above 5,700 kg, which makes them two-crew aircraft. The CJIV followed, with more grunt, a bigger wing and room for eight pax before Cessna got the VLJ bug and produced the Citation Mustang, which seems to be the sole remaining VLJ in volume production. Many of the systems in the Mustang were taken from the CJ line, which kept costs reasonable, but the launch in 2006 coincided with the beginning of the downturn and Cessna have sold 160 at a price of $2.8 million.

The recession has certainly thrown a spanner into the Citation line, and Cessna has cancelled plans to produce the Columbus, which was to have been the biggest of the lot. As always, Cessna suffers from the basic jet marketing dilemma, which is that you're only ever producing the right amount of jets for the market for about six months every five years – apart from that period, you're either making too few or too many, and these are expensive calculations to get badly wrong. Nonetheless, the Citation range is certainly the most successful civil jet line ever. Probably half of all 500s produced, and two thirds of Citation Is and IIs, are still flying, a testament to the fact that Cessna got the design right from the beginning. Many of the older jets are being bought up by specialist companies who install new avionics and engines, making them a particularly attractive low-cost option. ■

Personal jets for the masses

How to fly a Cessna Citation, and why you shouldn't, explained by ***Mike Hamlin***

There were private jets before the Citation, but the Cessna broke the mould; small, relatively economical and a joy to fly, it posed no insurmountable difficulties for the Navajo or King Air pilot and could be flown by the owner-pilot. 'Could' and 'should' are two very different things, of course, and I'm firmly of the opinion that when you buy a Citation, it's also worth investing in a well-qualified pilot to fly it for you.

I was asked rather glibly to write something that would allow the accomplished GA pilot, "if he were to find a Citation lying around with the keys in it, to start it up, fly it away and return it safely to the earth." Well, in these circumstances, absolutely the first thing you have to do is to phone up the avionics manufacturer and book yourself onto the Flight Management System course, because if you don't know the FMS you're in deep trouble. This is where a lot of people, and a lot of training courses, go wrong. Flying the aircraft is not difficult; it is viceless, predictable and forgiving. Understanding the engines and airframes, on which great stress is laid in training, is relatively straightforward. But the FMS has quite extraordinary talents, and to use them properly you must be able to play it like Yehudi played the violin. You must know every nook and cranny of it and be practised in bringing its functions together because you are about to enter crowded airspace in which unpredictable things will happen at six miles a minute, where an innocent is a danger to himself and everyone else. Single pilot operations can be very safe, if you know the FMS. The hardest thing, I find, is getting people to make the mental transition from stick 'n' rudder to being the manager of a system that flies an aircraft better than the pilot.

Recently I was flying into Luton in a CJ1 when I was suddenly and unexpectedly asked to go to the Barkway VOR and hold. No use starting to figure out where exactly Barkway lay – I chose 'direct to' BKY, then pushed 'hold definitions' and selected 'hold' - and that was it. Within three seconds of the request from ATC the aircraft was turning onto a new course with the entire hold programmed into the system and, on reaching BKY, it joined the hold with the correct entry. No worrying about how much I had to lay off for drift on the outbound leg and how long the outbound leg should be. That's a very simple example of what I'm talking about – the FMS is your friend, but only if you know which buttons to press. When an unusual request arrives you don't want to start fumbling around for VORs then trying to do a load of mental arithmetic.

It follows that there's a lot more work to do in a Citation before you begin to taxi. Some GA pilots tend to want to get under way as soon as they're strapped in, but there are some complex instrument departures and the FMS can fly them far more accurately than you can. Time invested in fingerwork now will repay you later. At my home base of Luton, for example, a Standard Instrument Departure off 26 turns you left at 500 feet, then right seven miles from Bovingdon, then left again with, often, a step climb up to 5,000 feet. Now that's all going to happen very fast, and if you're not fully prepared you might find yourself roaring through 500 feet still struggling to get the gear up. Altitude busts in the TMA are one of the worst problems we have. But if you've chosen and cross-checked your SID, and backed it up with raw data on the HSI, you just bang on the autopilot on climbout and get the FMS to do the whole thing for you.

Left: the CJ1 was an upgraded CitationJet with more power and a higher gross weight
Above: Mike Hamlin with Citation Encore outside his Luton headquarters
Below: flying the CJ1 starts with a thorough walk-round, like any piston single

That said, the basic airmanship you learned in your PPL course is just as important in a Citation as in a 152, and it starts with a thorough walk-round. Pitot cover off, static vent blanks out, front and rear baggage doors checked; neglecting these can kill you in any plane. Bungs out of the engine intakes. Check the oil – there's a small access panel on each engine – and understand where the level should be, cold and hot. In fact, most jet engines should be checked ten minutes after shut-down when the oil is warm, but there's also a 'cold' mark on the dipstick. Generally speaking if there's oil on the dipstick at all, you're okay. The dipstick is a twist and clip fit, so twist it back then try to pull it out. They've been known to come out in flight, and then you've lost all your oil and one thing leads to another…

There's not a lot to see in the engines. Check the fan blades – they're fairly resilient and can cope with quite a lot of damage before it shows up as excessive vibration, but you should spin the fan and see if it's rubbing on the engine casing. At 30,000 RPM a sparrow can knock a few grammes off a blade, enough to give you an imbalance that will cause the blades to rub and eventually lead on to greater things. Put a blanket on the front of the wing, climb up on it, avoid the 'No Step' areas, and look through the whole engine, checking for loose metal – then do the same looking in the back of the engine. Remove the chocks, climb in, put the parking brake on, turn on the master and the pitot heat, count to ten, then turn them both off. Climb out again and make sure both pitots are warm. Check your tyres for cuts, look for hydraulic puddles, check the lenses on the lamps because they're a bit close to the ground and can get damaged.

Climb in again and shut the door properly… rotate the handle all the way and you'll see green telltales in little Perspex windows that show that all eight locking bolts have engaged. Strap in and have a look around. The visibility is excellent – always was in the Citations, but EFIS has shrunk the panel and given even more window room. Over your shoulder you can see both wings, very useful in icing conditions. You've got the traditional Citation yoke in front of you, but beyond that in a later model Citation lies a beautiful glass panel and below it is an array of buttons for the FMS that would completely baffle a pilot from a generation ago. It all draws a lot of power, but let's assume we have a ground power source and a friendly chap to unhook it. Be sure to switch the avionics off before starting the left engine, because that will draw an awful lot of amps in the Citation and you can cook some expensive kit.

Basic stuff – check rudder pedal adjustments in case the last guy had ten foot legs, put the oxygen mask on and make sure it's plugged in. Sometimes they leak so people disconnect them, don't get caught out… turn the oxygen on and check the pressure, which should move a coloured slide in the plastic window from red to green in the supply pipe. You're going to spend about ten minutes doing basic airmanship checks and making sure that the FMS is properly set up. It seems a long ten minutes for the new pilot who thinks he's being slow, but relax, chill out, and do the job properly. Check the database is up to date, read the data through to ensure it's correct… push the button that changes your HSI colour and shows the data's being delivered from the FMS. Set up your raw data – put the first radial from Bovingdon on the HSI so if there is a GPS failure and the FMS coughs you can push the button and fall back on the VOR. Enter the full SID on the FMS. It's not worth entering your filed route in because you're probably not going that way. Just enter the data to the end of the SID, then go whichever way the ATC wind blows.

I've been flying these aircraft for decades but I always use the checklist, every time. Listen to the ATIS, and not with one brain cell while you're doing other things – be alert for mods to the SIDs like non-standard altitude stops. The 'stop' altitude on a SID may always have been 5,000 ft but, one day, there will be a non-standard stop of 4,000 ft and, if you haven't picked this up from the ATIS because you weren't listening properly, you're are heading for an altitude bust, or something worse, and a mid air collision can spoil your whole day. Set your QNH on both altimeters and make sure they agree, just like in your Aztec. Call for start, and with engine instruments as linear gauges on the Multi Function Display, push the right engine 'start' button until you get the compressor rpm (N2)required for that model, and watch the fan rpm (N1) begin to rise, showing the fan is free. Then lift the power lever over the gate from cut-off to idle, and this will start the igniters and the fuel flow. The batteries are not brilliant – if things look a little slow, stop the show immediately and get the battery recharged before you melt your engine. Remember, the battery has to be well down before the gauge comes off the 24 volt mark. It can be reading almost full with volts when it's lost half its grunt in amps. You can get a simple little charger from an avionics shop that will charge it back up in a couple of hours.

If all goes well, N2 will start to increase, N1, the fan speed, will come alive, and the temperature will go howling up the gauge at high speed. Just when you think it's going to burst through the amber section and run over the redline, it stops and falls back… if it doesn't, you'd better have that power lever back to cut off PDQ. Once the temperature is stable look at the oil pressure, which should be moving slowly into the green. Check that the starter has reversed polarity to become a generator – this shows by the 'Gen Fail' light going out and 28 volts appearing on the ammeter. It can overspeed and even catch fire. N2 overspeeds are less of a problem because here's a bob-weight governor on the N2 shaft that automatically shuts off fuel if that

happens. Repeat for the second engine; by the time you've monitored this process a thousand times and it hasn't gone wrong, you can get a bit blasé, but you have to be ready for trouble every time.

Now turn your avionics on, and after about 20 seconds the GPSs will tell you where they think you are, and you must check their estimate and push a button to accept it if you agree. Start to taxi – check brakes and nose gear steering, then pull up the handles above the power levers and check your thrust reversers. When you line up, it's 'HEFT'. That's HSI and runway direction in agreement; Engines – no amber or red warnings; Flaps to first stage, and Trim set.

Now you're ready to unleash a chain of events possibly completely beyond your control. Move the power levers forward to ensure both engines are spooling up in unison, then advance them to the take-off setting for the day, depending on temperature and

Right: keeping abreast of technology is a full-time job for a professional

altitude. The Fuel Control Unit will supply the correct amount of fuel to the engines, and you're off to the races. Watch the ASI come alive and build much faster than you're used to. Beyond V1 (decision speed), about 95 knots, you're committed to take-off so turn brain from chopping throttle to firewalling it. VR (rotate) comes a few knots later, and V2 (single-engine safety speed) about ten knots beyond that. Positive rate of climb, gear up, flaps up and then settle into your climb speed and anticipate your first turn on the SID. Now remember to engage your autopilot or you are probably heading for an altitude bust. This happens easily if you are distracted by a change of clearance just a few hundred feet before your assigned altitude. If the FMS is doing the thinking you're perfectly on profile, monitoring aircraft performance and the profusion of TCAS returns in the TMA, even on a ten-mile range setting, changing frequency, and most importantly *not busting your ever-changing altitude limits* before being handed to an airways controller and accepting a radar vector to which you turn with the HDG bug while adjusting power to cruise speed.

Hand-flying the Citation in the higher flight levels is like milking a mouse; you need minimum input and maximum concentration on the controls, and you must be perfectly in trim. You should practise this regularly in the simulator because if your autopilot fails over water you may not have the option of descending into thicker air. Fuel flow at 20,000 feet will be twice that at 40,000 feet, and your speed will be slower, so you may not have the range to reach land. In my opinion, not enough people practise hand-flying at altitude. In fact, the simulator is slightly more unstable, so it's good practice, as flying the actual aircraft is a little bit easier.

All the Citations are very docile. A CJ1 will shudder and shake long before it stalls; there's no stick shaker but you'd have to be made of wood to miss the hints. After rumbling and rattling it will wallow into a 3,000 fpm descent, and if you let the yoke go it will recover in a couple of seconds.

Where a lot of new pilots get caught out is in forward planning for the descent. At 90 miles you can be just 15 minutes from landing, and if you're at FL400 you'd need a 2,500 fpm rate of descent the whole way. Jets have very little drag, and leaving the descent too late is a common early mistake. Coming into Luton from the south I'll close the throttles over Boulogne and, providing ATC do not want a constant speed, not touch them again until the outer marker. Standard Approaches (STARs) give you altitude and airspeed limitations, and you have to plan to be at these points in a relaxed way, not screaming down with your airbrakes out, badly placed to get the next section right. A rate of descent of more than 2,500 fpm is uncomfortable for the aft facing passengers. This is when you really need to stay ahead of the aircraft. The upper air controller will descend you to the bottom of his area, then if he's not busy he'll pass you to the lower airspace controller, then you're down to FL120 and you'll get the TMA controllers, then you'll be passed to approach control, and the FMS can do all the work for you. You just monitor proceedings, watch for traffic and be ready for the last-minute change. You can deploy the first stage of flaps at 200 knots, come back when asked to 160 knots – well below the gear limiting speed – then full flap on the ILS, autopilot off in time to get a good feel for the aircraft and the drift, round out and fly level along the runway, and let it land. Nose gear on, brake first then select reverse thrust, because if you do it the other way round and find the brakes have failed, reverse thrust might not stop you on its own and it won't let you go round either. This will all be a bit crash-bang-wallop if you're trying to do everything yourself, but equally it will be a very relaxed process if you've relaxed into flight manager mode. Taxi off, take your time – after landing checks when clear of the runway, park, run through the shut-down checklist, switch off all the electronics before the master, then cut off with the power levers. Covers on, bungs in the engine, chocks, then brakes off, and don't forget to check the oil.

The Citation is a very easy aircraft to fly, but… hire a pilot anyway. Flying at this level is a full-time job. If you're off to a business meeting you've got other things on your mind, aviation is a small portion of what you do, you're not as slick as you might be, you're not up with the changes. A lot of owners fly with the hired help in the other seat. That way you can have most of the fun, and leave the ground hassles to the other fellow. I recommend it.

**Mike Hamlin probably has more experience of Citations than any other British pilot, having dealt in pre-owned Cessna jets for several decades and having flown every marque. See www.hamlinjet.com.* ■

Left: it's easy to get behind the aircraft on take-off if you haven't programmed the FMS to do the hard work