

# Inflight Report: Cessna Citation VII

World-class craftsmanship and world-class performance make this airplane the best of the Citation Breed.

By **RICHARD N. AARONS**

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Well over 1,000 Citations ago, some jet pilots were reluctant to accept Cessna into the turbine world. Most of these skeptics conceded that Cessna knew how to build little, high-wing, recip-powered personal airplanes, but what, they asked, did the Wichita company know about building high-tech, turbine-powered business transports?

The fact that Cessna had plenty of experience building jet trainers for the U.S. Air Force didn't seem to count with these die-hards. They suspected there was something unjet-like about the Citation line; something that should consign Citations to a sort of kiddiejet underclass in a world populated by realjets.

Of course, the vast majority of turbine aircraft managers around the world never bought into this skeptical reasoning. What they did buy into was a huge fleet of Citations—the small, 500-series airplanes and the mid-size 600 series. But despite this vote of confidence from the marketplace, one gets the feeling Cessna executives still are sensitive about those early criticisms, that they choose to push themselves just a little harder with each product evolution to overcome early unflattering and largely untrue images.

Well, Cessna executives can relax—at least for the moment. If, in fact, there was ever a valid question as to the company's ability to build truejet, world-class quality into an airplane, the Citation VII should van-

quish it once and for all. Everything about the Citation VII design and execution reflects competence.

## **FLAGSHIP AIRCRAFT**

The Citation VII is the flagship of the Cessna fleet now. It is a derivative of the successful (more than 200 in the fleet) Citation III and is best understood in terms of improvements to that aircraft.

The design team for the Citation VII project was a bit unusual in that it included many operators of Citation IIIs. CEO Russell W. Meyer and his engineers asked Citation III owners to come up with a wish list; suggestions, if you will, that would bring the 1980s' Citation III solidly into the 21st century. Some of the recommendations were straightforward—better ice and rain removal for the cockpit windows, for example, and a more reliable and maintainable flap system.

Other items on the wish list posed significant challenges. One in particular—"make this airplane go higher, faster and farther from smaller airports"—proved pivotal.

The Citation III is a pretty good performer from home-base airports with runways 6,000 to 7,000 feet long. However, a Citation III based on an airport with 5,000-foot runways runs into climb, payload and range limitations on hot summer days. Addressing this wish-list item required the development of a new Garrett powerplant and what amounted to a full recertification of the aircraft.

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At the same time, Cessna's in-house design team wanted to offer its customers (and prospects) a factory-made interior crafted to the standards of the world's leading outfitting shops. They also wanted to give operators custom-type options for interior structures, woods, fabrics and finishes.

Citation VII development began in May 1990. The flight test article received FAA certification in March 1992, and the first customer delivery was made a month later. B/CA flew the first production aircraft shortly thereafter with Citation pilot Nick Parrott. In fact, we spent the better part of a Sunday with the airplane (N701CD) and really got to know it. The pleasure was ours.

### THE WALKAROUND

As we conducted a first-flight-of-the-day walkaround, we discovered it takes a sharp eye to discern the differences between a Citation VII and a Citation III, at least when you're on the ground. Nevertheless, several minor drag-reduction modifications are visible. The dorsal-fin air inlet, for example, is smaller. New fairings have been added aft of the main gear wheel wells. The outboard thrust reverser stangs have been redesigned, as have the inboard flap fairings. Air cycle machine exhaust outlets are flush mounted, and belly skid rails have been added to comply with the latest gear-up landing requirements. The new engines fit in the old mounts and nacelles, so there's little to see there, but a lot to feel.

The Model VII is powered by a pair of Garrett TFE731-4 powerplants, each of which, at this writing, was rated at 4,000 pounds thrust up to 76°F. Cessna engineers told B/CA they believe the engines are actually producing 4,080 pounds and said they expect approval for 4,120 pounds by mid-summer along with full approval of digital electronic engine control (DEEC) software.

The 731-4 is a hybrid. It uses the fan module from the TFE731-3B (a proven performer at high altitudes) and the power section from the 731-5. The 731-4 powerplant's DEEC is similar to that used in the TFE731-5/5A series. The only modifications to the controller for the Cessna application are in the software.

Digital electronic engine control systems reduce pilot workload while preventing engine limit excursions. Once the pilot sets N<sub>1</sub> (fan speed) for any flight condition from idle to takeoff the DEEC holds near-flight-manual N<sub>1</sub> speed regardless of changes in temperature, altitude or Mach number. Should the DEEC fail, the engine is controlled by conventional hydromechanical fuel metering.

Perhaps the most important function of a DEEC is to protect its engine during takeoff. Pilot technique for commanding takeoff thrust from a DEEC-equipped

engine is simply to push the throttles to the wall, trusting the DEEC to prevent overspeed and overtemp. (Well, almost. The prudent pilot still glances at the engine gauges just in case the DEEC decides to take the afternoon off.)

At the time of our flight, Cessna engineers were putting finishing touches on the DEEC software package, so we used traditional power setting techniques for our pattern work. We did depend on the digital controllers at altitude once the OAT dropped below -15°C. Garrett automatic power reserve (APR) also will be operational in the new software package. But we're getting ahead of our story.

The walkaround is conventional. DEECs and the usual collection of hydraulic, electrical and environmental equipment are in a tail compartment reached through a belly access hatch. Everything you should touch, feel or look at can be reached or seen while your feet are planted firmly on the ramp. Lighting in the compartment is good.

Just forward of the belly hatch on the left side is a 25-inch-wide door opening into a 61-cubic-foot heated cargo area. This space is rated at 700 pounds and its floor is low enough to provide easy access. The baggage compartment hatch opens out and down to a miniature air stair configuration to help you get to stuff that has been pushed to the far access of the compartment.

The Citation VII wing is identical to that used on the Models III and VI. It has a supercritical cross section and spans 53.5 feet. With a 312-square-foot area, it has a relatively low loading of 72.0 pounds per square foot. The wing ] geometry gives the airplane plenty of 1, low-drag lift throughout the envelope, without the use of winglets. Wing leading edges are anti-iced with engine bleed air.

Ailerons provide roll control with the help of outboard spoiler panels on each side. The spoilers begin to move into the slipstream as aileron deflection moves through three degrees.

Cessna's owner-advisors wanted (and got) an improved flap-extension system. Six Kevlar/graphite flap sections are fitted to the Model VII wing, three on either side. Citation VIIs will be equipped, after S/N 13, with a new, Cessna-designed flap controller and a DC-powered flap motor. A redesigned angle gear box has been added for increased durability. This new extension system replaces an AC-powered flap-drive unit, thus eliminating the need for onboard three-phase AC power.

Maintenance costs should drop because the new design has fewer parts and is simpler to troubleshoot. The new flap components will be retrofitted into early Model VIIs and retrofits will be available, eventually, for Citation IIIs and VIs.

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Another operator-driven improvement you can examine during the walkaround is the electrically heated cockpit windows. The windows are a laminate with rain-shedding acrylic coating on the outside surface and an internal heated-glass sandwich.

A few minutes spent inspecting the nose avionics compartment will tell you much about the quality Cessna is putting into its products. All surfaces are primed and painted. Avionics bundles are tagged and keyed to the airplane's own wiring diagrams and service manuals.

Bulkhead connectors are all milspec quality, and test points are exposed for quick line checks.

The avionics suite itself is built around Honeywell's SPZ-8000 dual digital autopilot/flight director system and a companion five-tube, five-by-six-inch EFIS. Attitude information is provided by dual AHZ-600 AHRS. Air data is generated by dual Honeywell digital air data computers. FMS is optional. Our demonstrator was equipped with dual Global Wulfsberg GNS-Xs. Collins provided radio altimeter and all nav, comm and DME subsystems. Honeywell supplies the Primus 870 color radar.

An APU is optional on the Citation VII. The demonstrator is equipped with a Turbomach T-627-40C3A unit. Garrett GTCP36-150 APUs will be available early in the production run. These systems can be used at altitude. Other upgrades include elimination of the cockpit auxiliary heater (it wasn't needed) and the fuselage-tank-full light (nobody ever looked at it). Singlepoint fueling is standard; external lav servicing is optional.

The Citation VII interior is separately priced and fully customized. The accompanying line drawing shows the configuration in the demonstrator. Typical seating includes eight passenger seats. High-density seating plans are available to handle up to 13 passengers.

The execution of this interior is top notch. Cessna designers met their goals, in our opinion. Sliding panels, drawers and bulkheads are substantial and well-mated. Hanging lockers and under-seat drawers in most cabin configurations provide about 20 cubic feet of storage. Passenger seats are firm and generously proportioned. Seat controls are logically arranged and easy to manipulate. This interior can compete with any

### CESSNA CITATION VII DIRECT OPERATING COST CHARACTERISTICS Years 1 through 5 Average Cost

Stage Length (nm)	Altitude (FL)	Block Speed (kts)	Block Fuel Flow(gph)	Direct Cost (\$/nm)
300	370	375	267	\$2.63
500	410	407	243	\$2.30
700	410	419	236	\$2.20
900	410	429	233	\$2.13
1,100	410	435	231	\$2.09
500	410	439	227	\$2.06
1,900	430	427	205	\$2.00
2,100	430	427	204	\$2.00

Source: Cessna Aircraft Company

### CESSNA CITATION VII DIRECT OPERATING COSTS WITH WARRANTY ALLOWANCES

Cessna presents these figures based on a stage length of 500 nm. Fuel costs are based on a Cessna in-house survey of retail prices. Labor rates and parts costs are typical. DOCs reflect flights flown at high-speed cruise power.

	Years 1 through 5 Average Cost
Fuel (243 GPH at \$2.10/U.S. gallon)	\$510.30
Maintenance: Labor (\$53.00 labor rate)	99.11
Material	108.70
Garrett Engine MSP (est.)	209.20
APU Maintenance	8.25
<b>Direct Cost (\$/Hour)</b>	<b>\$935.56</b>
\$/nm (407 kts block speed)	\$2.30
\$/sm (468 mph block speed)	\$2.00
\$/km (754 kph block speed)	\$1.24

Note: Garrett Maintenance Service Plan (MSP) is used instead of engine reserves because MSP costs a guaranteed rate per hour.

Source: Cessna Aircraft Company

### CESSNA CITATION VII FIXED ANNUAL COST

Cessna figures based on reasonable assumptions for average expense.

	Annual Cost
Hangar Rental (\$1,300/month)	\$15,600
Crew (2 including benefits)	15,000
Insurance: Hull	31,500
Liability & Medical	6,700
Recurrent Crew Training	14,000
<b>Fixed Cost (\$/Year)</b>	<b>\$182,800</b>

Note: Insurance hull rate is 0.35% on \$9 million.

Source: Cessna Aircraft Co.

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## CESSNA CITATION VII TOTAL ANNUAL BUDGET (500 Hours Annual Utilization)

		Year 1 Through 5 Average Cost
Direct Cost x 500 hours		\$467,780
Fixed Cost		\$182,800
<b>Total Budget (\$/Year)</b>		<b>\$650,580</b>
\$/nm (203 500 nm)		\$3.20
\$/sm (234 000 sm)		\$2.78
\$/km (377 000 km)		\$1.73

Source: Cessna Aircraft Company

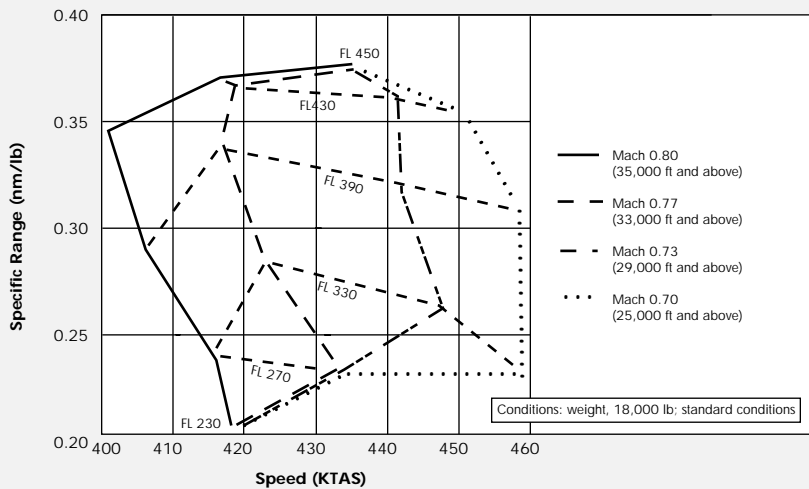
custom interior made today by specialized shops. Cabin-aisle height is a comfortable 5.8 feet. We didn't perform noise tests, but our impression was that the Citation VII cabin noise levels are quite acceptable.

### FLYING THE VII

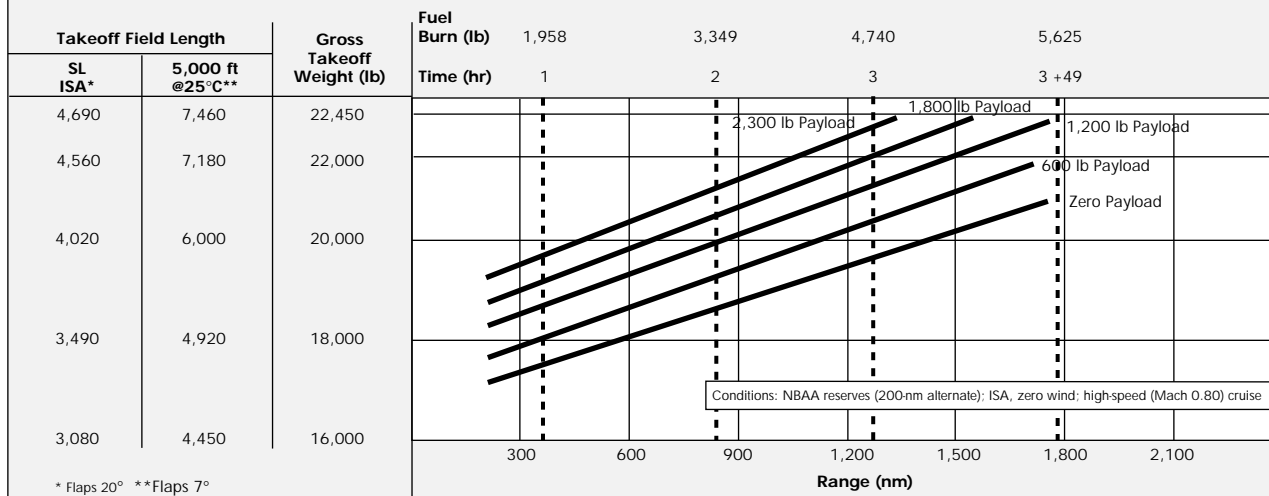
Cessna has led the general aviation industry, in our very subjective opinion, with cockpit design, and the Citation VII's setup continues that tradition of uncompromising excellence. Cessna won the Collier Trophy in 1986 for, among other things, the Citation fleet safety record. It could be argued successfully, we think that a large portion of that safety success has to do with the simplicity of Citation systems and the painstaking organization of the Citation cockpit.

Pilot seats are fully articulated and comfortable. Ground visibility forward and to the sides is good. Each pilot, looking aft, can see the outer half of a wing to ensure taxi clearance. All circuit breakers are on side panels; the overhead is devoid of switches, indicators and the like. As you explore the accompanying cockpit photograph, note the clean groupings. Audio controls are on the lower outboard panels. EFIS indica-

### SPECIFIC RANGE

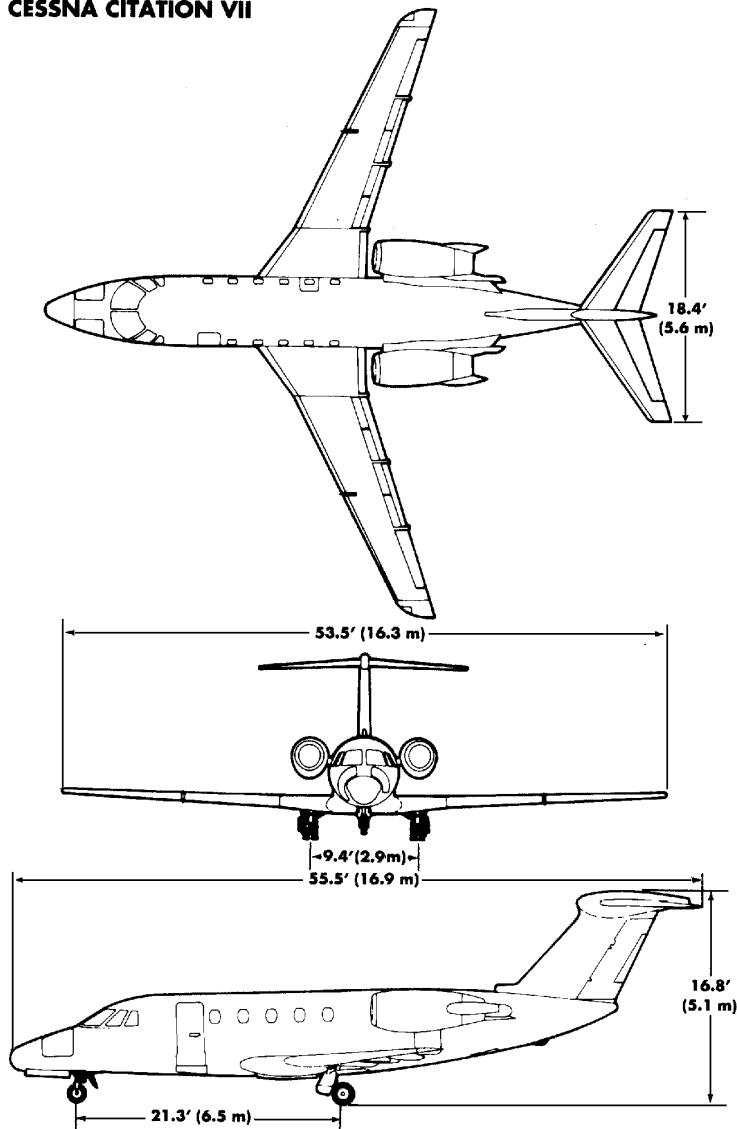


### RANGE/PAYLOAD PROFILE



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tors occupy customary flight instrumentation positions. EFIS controllers are on the center console, along with flight computer/autopilot controllers and GNS-X FMS CDUs.

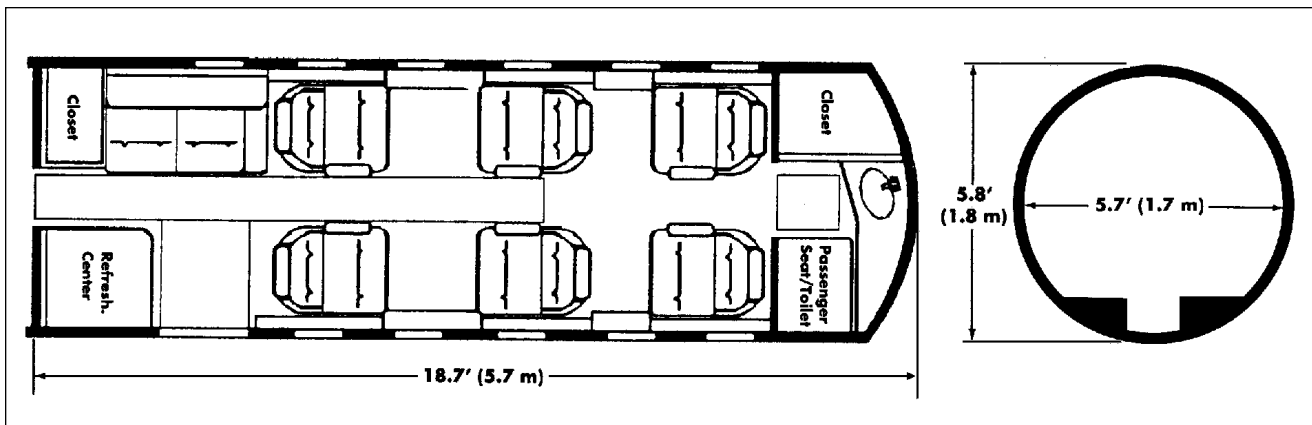
Engine parameters are displayed on the familiar Citation vertical scale instruments. Nav and comm radio control heads are on the center panel, easily reached by either crewmember.

The switch grouping on the lower center panel immediately forward of the throttles will be familiar to pilots of previous 500- and 600-series Citations. Switches are color coded and grouped logically. Similarity between this panel and those of other Citations should minimize crew transition tasks.

Start sequence is fully automated. You simply push the appropriate start button and move the power lever out of its detent when turbine RPM accelerates through 10 percent. Our APU-aided starts were quick and cool.

The Citation VII offers the pilot two ways to steer on the ground: rudder pedal bungees limited to six degrees of nose-wheel displacement and tiller steering with authority to move the nose wheel some 75 degrees left and right of the centered position. Most Model VII pilots will opt to lock the flight controls and use the tiller for taxi operations. Rudder pedal steering is used for the entire takeoff and landing rolls.

The tiller steering system provides



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## SPECIFICATIONS CESSNA CITATION VII

<b>Manufacturer</b>	Cessna Aircraft Co.
<b>Model</b>	CE-650/VII
<b>Equipped Price</b>	\$8,950,000
<b>Description</b>	Twin-jet business transport
<b>Powerplants</b>	
Model	2 GED TFE731-4R-2S
Power	4,000 lbs. ea.
<b>Dimensions</b>	See three-views
<b>Weights (lb/kg)</b>	
Max ramp	22,650/10,274
Max takeoff	22,450/10,183
Max landing	20,000/9,072
Zero fuel	16,500/7,484
BOW	14,200/6,441
Max payload	2,300/1,043
Useful load	8,450/3,833
Max fuel	7,329/3,324
Payload w/max fuel	1,121/508
Fuel w/max payload	6,150/2,790
<b>Limits</b>	
M <sub>MO</sub>	0.835
Transition altitude (ft/m)	36,500/11,128
V <sub>MO</sub> (kts)	330
Pressurization (psi)	9.3
<b>Airport Performance</b>	
Takeoff field length (ft/m)	
Sea level (ISA)	4,690/1,430
5,000 ft (ISA +20°C)	7,460/2,274
<b>Climb (fpm/mpm)</b>	
Rate, all engine	3,921/1,195
Rate, engine-out	830/253
<b>Ceilings (ft/m)</b>	
Certificated	51,000/ 15,549
Service all-engine	43,000/13,110
Service engine-out	22,500/6,860
Max for S.L. cabin	25,000/7,622
<b>Cruise (mid-weight)</b>	
Long-Range	
TAS (kts)	409
Fuel flow (lb/hr)	1,166
Flight level	410
Specific range (nm/lb)	0.351
High-Speed	
TAS (kts)	470
Fuel flow (lb/hr)	1,581
Flight level	390
Specific range (nm/lb)	0.297
<b>Ranges</b>	See graphs

absolute control authority in the tightest situations. A full tiller hardover will generate a turn so tight the inside main wheels actually back up. This agility, coupled with good cockpit visibility, pretty much assures Citation VII crews will be able to extricate themselves from the worst ramp jams.

Remember the old bird-strike-from-the-rear Citation jokes? You can forget them. Indeed, you should get yourself a ride in the Citation VII demonstrator just to try this test: Set the brakes, then allow the engines to accelerate to takeoff power. Now, release the brakes. First, your head snaps aft into the headrest. Then you hang on for the quick ride to the 100-knot airspeed check and on through V<sub>1</sub> to V<sub>R</sub>. (For our 19,000-pound GTOW in 20°C, sea level conditions, the card read 117, 121 and 131. Flaps were at 20°. Takeoff field length was about 4,000 feet.) Even at relatively heavy weights, the ride is as brisk as you'll experience in any business transport. Target deck angle on rotation is 10 degrees. If you intend to stay in the pattern, however, you'll have to come back on the power as soon as you've got the wheels in the well. All this acceleration comes from a respectable thrust-to-weight ratio of 0.356. The Model VII offers a far more exhilarating departure than did the Citations we learned to love a decade ago.

For our evaluation, we headed straight for FL 410. Even with several ATC-commanded pauses, we made FL 330 in 17 minutes and FL 410 at 23 minutes. We had burned 1,020 pounds of fuel. We set the power at 101.5 percent fan speed and let the DEEC watch over the engines. Fuel flow was about 870 pounds per side. Some 30 minutes after departure, we were looking at 0.84 Mach (473 KTAS), with the TAT showing 45°C.

Ten minutes later, we dialed a 900 fpm climb into the FCS and drifted up to FL 450. Some 41 minutes into the flight, we were once again looking at 0.84 Mach. Note the accompanying performance tables. They'll give you an idea of how these numbers translate into normal operations. All the parameters we examined exceeded book performance.

The VII's cockpit is comfortable at altitude. Flight deck noise levels are acceptable. Slipstream and ventilation noise are significant enough to warrant headsets, although conversation at normal voice levels is not at all difficult. Ventilation is good. Heating is uniform.

The Citation VII is a finger-tip airplane at all corners of the envelope. It is responsive and agile, and its controls are well-balanced and harmonized. The aileron system is boosted but easily flown with the boost disengaged. At FL 450, it was possible to induce a mild Dutch roll after disengaging the yaw damper. However, that roll was smoothed out by resting a foot on the

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rudder and stopped dead with the re-engagement of the damper.

Hand flying the airplane at FL 450 presented no unusual challenges. With our ambients, we were able to induce a gentle hum as we reached a Mach buffet boundary at about 1.5 g's. At 45,000 feet and 18,000 pounds gross weight, the margin between highspeed buffet and low-speed buffet under one-g conditions is 85 KIAS. A stick pusher is not required.

The center two spoilers on each wing provide fully modulated drag control in flight. All eight spoiler panels (four per wing) are hydraulically actuated and available for emergency descent and for lift dump after touchdown. We couldn't resist. We coordinated with Center and descended out of FL 450 at 20,000 fpm stopping at 16,000 feet to try slow flight and a few stalls.

The FCS will bring you down automatically if it senses a cabin altitude higher than 13,500 feet at aircraft altitudes above 34,270 feet. All the crew has to do is retard the throttles and put out the boards. The FCS will turn the aircraft 90 degrees from its heading and

descend at VMO minus 10 knots to 15,000 feet where it commands a level-off.

If anything in this aircraft is reminiscent of the old single-engine reciprocating that made Cessna's reputation for better or worse, it's in the stall characteristics. Stalls to a full break in clean and landing configurations were gentle and easily controlled.

We returned to HPN (Westchester County Airport) for an ILS and a couple of VFR circuits of the pattern including a simulated engine failure on takeoff. This airplane is a splendid instrument platform-stable and responsive, with minimal pitching moments with changes in configuration. Its low-slung wing is a floater, but that characteristic and the trailing link gear work together to make landings soft and, with practice, predictable. In short, this Citation is a delight to fly.

Obviously, we were impressed with the Citation VII. If you are a Citation fan, you'll probably believe every word we've written. If you are one of the skeptics, take time to get a demo in this airplane. We bet its performance will make you a believer too. **B/CA**