Cessna Citation XLS

Cessna's successor to the best-selling Excel does everything better.

By Fred George

Photography by Paul Bowen

How do you improve upon Cessna's best-selling Citation Excel? Give it more thrust, better takeoff field performance and improved fuel economy. Bump up its MTOW, thereby enabling it to carry five passengers with full fuel. Give it more range and flat-panel displays. Give the passengers more comfortable chairs and upgrade cabin furnishings. Then price it $188,000 less than a comparably equipped Excel with popular options and christen it Citation XLS.

Upon announcing the Excel at the 1994 NBAA Convention, Cessna quickly booked well over 100 orders. Prospective customers loved the combination of the Excel's Citation III-size cabin and Citation 560 Ultra's peppy performance. After deliveries began in late 1998, Cessna built as many as 80 units per year. But in recent years, strong competition from Bombardier's Learjet 45, particularly the XR model, as well as a record glut of late model used business jets, caused a decline in sales. Even so, Cessna will have built 372 Excel aircraft by the time production ends this June.

To counter this gradual slide, Cessna decided to morph the Excel into a next-generation product with the goal of prolonging its popularity. As business aviation's master of iteration, Cessna once again chose a mild evolutionary approach to create the XLS, which will succeed the Excel in mid-2004. Based on the Excel airframe, itself an evolutionary blend of the Citation 560's wing and systems, Citation III fuselage and Pratt & Whitney Canada PW545 turbofans, the XLS features PW545B engines with redesigned fans that provide more takeoff, climb and cruise thrust.

Glance, please, at the accompanying Range/Payload Profile chart. The final performance numbers are in. The XLS, with a 20,200-pound MTOW, actually will have better takeoff field length performance than the 200-pounds-lighter Excel, already the midsize class leader in airport performance. This is made possible by the XLS's 545B powerplants that offer 4.9 percent more takeoff rated thrust with an airframe that gained only 1 percent in MTOW. The extra thrust is especially effective in shortening the XLS's hot-and-high TOFL distances. With a 5,490-foot TOFL from *B/CA*'s 5,000-foot elevation, ISA+20° airport, the XLS actu-

ally shaves 280 feet off the Excel's FAR Part 25 5,770-foot takeoff field length distance under the same conditions. The XLS, in addition, offers better landing performance than the Excel because Cessna fine-tuned its flight test procedures to achieve shorter stopping distances.

Moreover, the XLS can climb directly to FL 450 at MTOW, if need be, for maximum range. The Excel could climb only to FL 430 at MTOW. The XLS's climb to typical cruise altitudes in the low 40s also is a couple of minutes faster than the Excel and burns less in the process. The new model's four-passenger range is 1,804 nm, or 80 nm more than the Excel carrying the same 800-pound payload. The extra 2-percent cruise thrust, coupled with airframe drag reduction refinements, also will allow XLS operators to fly 20 to 30 knots faster at typical cruise altitudes. Indeed, the aircraft's 0.75 Mach VMO redline frequently will limit cruise speed, rather than available engine thrust. This makes the 430-plus KTAS XLS more competitive with the 0.81 Mach Learjet 45, but the need-for-speed lean Learjet still retains a 25-knot cruise speed advantage. The Learjet 45, however, can't match the XLS's short field performance, a fact that's especially apparent when departing hot-and-high airports.

The Citation XLS has Honeywell's Primus 1000 CDS in the cockpit, an upgrade to the basic Primus 1000 avionics system featuring the 10-by-8-inch flat-panel displays borrowed from Sovereign's Primus Epic suite. The displays offer more viewing area, enhanced map graphics and longer life than CRTs. The Primus 1000 integrated avionics computers have been upgraded to accept Honeywell FMS cards, but the XLS will come standard with a Universal UNS-1Esp FMS because that's what most customers specified for the cockpits of their Excels.

Passengers will notice plenty of minor, but meaningful, upgrades to the interior. The cabin chairs have been redesigned to provide 2 inches more seat cushion width. Standard equipment includes wood veneer cabinetry with high-gloss finish, long-life LED lighting and software-programmable passenger service units. A belted, side-facing seat in the lavatory across from the toilet also is part of the standard package.

The XLS also has numerous upgrades to systems and structure, plus it has more-pleasant ground handling characteristics.

Airframe Structure and Systems

Similar to other production Citations, the XLS primarily is fabricated from high-strength aluminum alloys that are bolted, riveted and hot-bonded together. The circular cross-section fuselage and two-spar wing are built as separate assemblies, which are then joined together by means of conventional "dog bone" fittings plus longitudinal and lateral links. Aluminum also is used for most of the control surfaces. The wing flaps, radome and fuselage fairing are fabricated from composites.

The wing is located low on the fuselage to minimize interference drag and to prevent the spars from intruding into the cabin. The large aerodynamic

An array of 26 vortex generators on each wing helps prevent Mach-induced flow separation over the ailerons, especially important because the XLS cruises higher and faster at heavier weights than the Excel.

fairing between the fuselage and the wing holds the battery and most wheel brake system components.

The basic Excel/XLS airfoil is a mid-1980s vintage, semi-supercritical design that enables the aircraft to cruise up to 0.75 Mach without the need for overall wing sweep. Its strongest suit is takeoff and landing performance. It features moderately swept, wing root gloves with very little camber and thin thickness-to-chord ratios that delay drag rise at higher cruise speeds. The XLS's straight wing, large area, four-panel trailing edge flaps and sprightly thrust-to-weight ratio give it excellent airport performance. Small but effective fairings have been added around the main landing gear wells to reduce drag. This is a prime reason why the XLS can cruise up to 33 knots faster than the Excel with only a 2-percent increase in cruise thrust.

Higher cruise speeds mean the XLS often is operating above the wing's critical Mach number. To counter the effects of Mach-induced flow separation over the ailerons, the XLS has 26 delta-wing vortex generators on the outboard section of the wing that

Wheel fairings under the XLS's wing reduced drag in climb and cruise.

Cessna Citation XLS

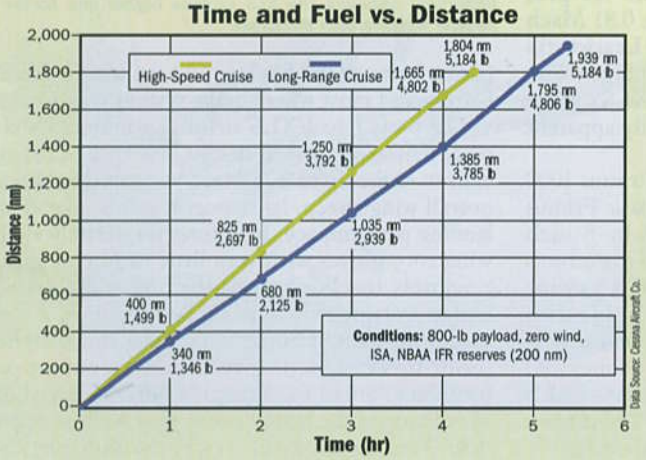
These three graphs are designed to provide a broad sketch of the Citation XLS's performance based upon projections from Cessna's engineering team. Special thanks to Dave Champley at Cessna Aircraft for all his efforts. Do not use these data for flight planning.

Time and Fuel Versus Distance – This graph shows the performance of the Citation XLS at 0.62 Mach long-range cruise and 0.75 Mach high-speed cruise. The numbers at the hour lines indicate the miles flown and the fuel burned for each of the two cruise profiles. The endpoints illustrate that the XLS will fly an additional 135 miles at LRC, but it takes more than an extra hour to get to the destination.

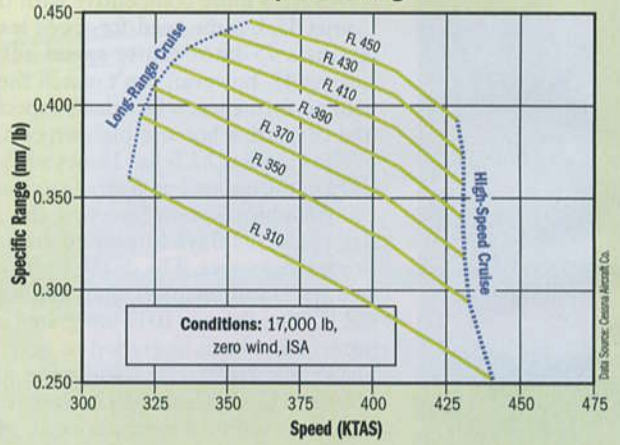
Specific Range – This graph shows the relationship between cruise speed and fuel consumption at representative cruise altitudes for a mid-weight Citation XLS. The graph indicates that specific range varies substantially from FL 310 to FL 450, indicating that the best tradeoff between speed and range is obtained above FL 410. During our evaluation flight we found Cessna's cruise performance estimates to be accurate.

Range/Payload Profile – This graph provides simulations of various trips under a variety of payload and two airport density altitude conditions, with the goal of flying the longest distance at high-speed cruise. Each of the five payload/range lines is plotted from multiple data points supplied by Cessna, ending at the maximum range for each payload condition. The time and fuel burn dashed lines are based on the high-speed cruise profile for a mid-weight airplane as shown in the Time and Fuel vs. Distance chart.

Time and Fuel vs. Distance

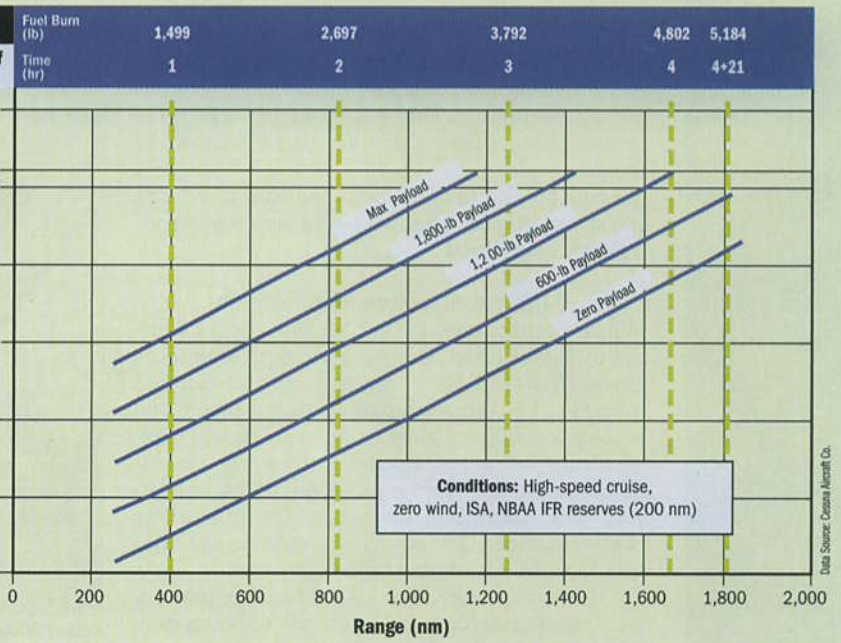


Specific Range



Range/Payload Profile

Takeoff Field Length (ft)		
SL ISA	5,000 ft ISA+20°C	Gross Takeoff Weight (lb)
		21,000
3,560	5,490	20,200
3,490	5,380	20,000
3,220	4,860	19,000
2,960	4,380	18,000
2,770	3,940	17,000
2,780	3,550	16,000
2,695	3,195	15,000

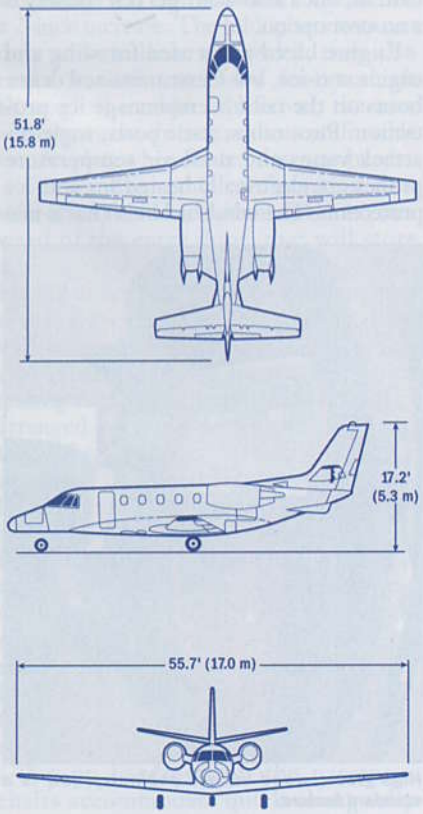


The XLS retains the Excel's leading-edge devices to enhance high angle of attack stability. But it still drops a wing during a full aerodynamic stall.

boost boundary layer energy and thus raise the speed at which flow separation becomes a problem, particularly over the ailerons.

To improve low-speed handling qualities, Cessna fitted the leading edge of the wing with partial stall fences to inhibit span-wise flow; it also added stall strips to stimulate aerodynamic tail buffet.

Cessna designed a two-position, hydraulically actuated horizontal stabilizer to increase pitch control authority when the large area wing flaps are extended. The two-position stab and characteristic ventral, V-shaped fins provide the aircraft with a wider c.g. envelope than otherwise would be possible.



The XLS retains most of the Excel's well-proven systems. The wheel brakes, however, have been upgraded to the Citation Sovereign configuration. This design eliminates the pedal-mounted master cylinders and hydraulic lines in favor of direct mechanical links to the brake metering valve. Pilots take note: Operation of this new-generation mechanical link brake system shares virtually nothing with earlier mechanical link brakes, such as those fitted to the CJ2 and Raytheon Premier I. The XLS brakes feel smooth, progressive, responsive and completely reliable.

Glass windshields, coated with a rain-repellant film, are fitted to the XLS. Left and right opening weather windows provide cockpit ventilation on warm days when the air conditioning is not running. An additional fixed-pane side window is on each side just aft of the weather window.

Preflight inspection can be done in a white suit without any risk of smudges. Oil sight glasses, for instance, eliminate the need to check oil level using dipsticks. The fire bottles have cockpit indicators, so there's no need to preflight them. A detachable light in the aft baggage compartment enables the crew to open an access door and then easily inspect circuit breakers, hydraulic fluid levels, junction boxes and air cycle machine oil level. As we said in our March 1999 analysis of the Excel (page 56), "Leave the ladder and rags in the line shack."

A Honeywell RE-100XL APU, a $210,000 option on the Excel, is standard

Cessna Citation XLS Specifications

B/CA Equipped Price $10,083,258

Characteristics

Seating . . . . . 2+8/10
Wing Loading 54.6
Power Loading 2.53
Noise (EPNdB) 72.4/85.3/93.1

Dimensions (ft/m)

External . . . . . See three-view
Internal
Length 18.7/5.7
Height 5.7/1.7
Width (Maximum) 5.5/1.7
Width (Floor) 3.9/1.2

Power

Engines . . . . . 2 PWC 545B
Output (lb ea) 3,991
Flat Rating OAT°C . . . . . ISA+13°C
TBO (hr) 5,000

Weights (lb/kg)

Max Ramp 20,400/9,253
Max Takeoff 20,200/9,163
Max Landing 18,700/8,482
Zero Fuel 15,100/6,849c
BOW 12,740/5,779
Max Payload 2,360/1,070
Useful Load 7,660/3,475
Executive Payload 1,600/726
Max Fuel 6,740/3,057
Payload With Max Fuel 920/417
Fuel With Max Payload 5,300/2,404
Fuel With Executive Payload 6,060/2,749

Limits

MMO 0.750
FL/VMO . . . . . FL 265/305
PSI 9.3

Climb

Time to FL 370 . . . . . 14 min.
FAR Part 25 OEI Rate (fpm/mpm) . . . 699/213
FAR Part 25 OEI
Gradient (ft/nm, m/km) 352/58

Ceilings (ft/m)

Certificated 45,000/13,716
All-Engine Service 45,000/13,716
Engine-Out Service 28,600/8,717
Sea Level Cabin 25,230/7,690

Certification . . FAR Part 25, 1st Quarter 2004

The sturdy airstair door has a robust handrail and tread lighting for safe boarding at night.

An externally serviced toilet now is standard equipment on the XLS, along with a warm water spigot at the wash basin.

equipment on the XLS. This eliminates the need for a vapor cycle air conditioner. The APU provides plenty of bleed air to the three-wheel air cycle machine to heat or cool the cabin, plus it provides electrical power prior to main engine start. This frees the XLS from being dependent on ground power prior to engine start, if the crew wants to make the cabin comfortable before the passengers' arriving at the ramp.

The XLS's other airframe systems are carried over from the Excel. The primary flight controls are mechanically actuated. The tried-and-true, 500-series "bungee" nosewheel steering links are retained. Electric pitch trim is augmented by a mechanical pitch trim wheel, and there are also aileron and rudder pitch trim wheels.

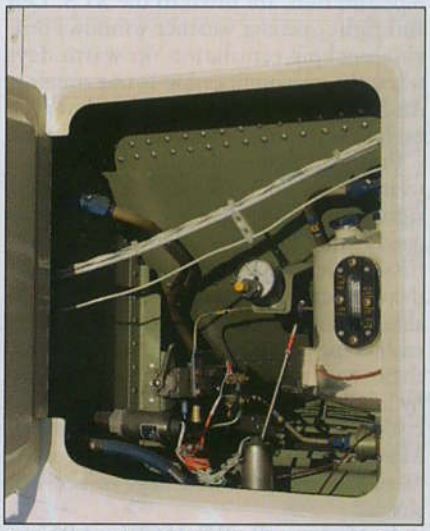
An on-demand, open center hydraulic system powered by engine-driven pumps actuates the thrust reversers, horizontal stabilizer, landing gear, fowler flaps and speed brakes. All hydraulic control valves, except for the thrust reversers, are consolidated on a centralized main manifold. The redesign has 120 fewer hydraulic fittings, and so it's more reliable and weighs less.

Mechanical uplocks hold the gear in the retracted position. Once the gear is extended, internal locks prevent retraction without hydraulic pressure, thus eliminating the need for safety pins when towing the aircraft. A separate, electrically driven hydraulic power pack actuates the carbon-disc wheel brakes. An emergency pneumatic bottle provides pressure for landing gear extension and wheel brake actuation.

The basic electrical system is a 28 VDC split bus design, powered by 300-amp left and right main engine starter/generators and/or the 300-amp APU starter/generator. Small solid-state DC to AC inverters supply electro-luminescent light panels in the cockpit, and a 117VAC, 60-cycle inverter supplies AC outlets in the passenger cabin for laptops, mobile phone chargers and office equipment. Separate AC generators on the main engine accessory cases provide power for electrical windshield anti-ice heat. A 24-volt, 44-amp/hour nickel cadmium battery is standard fit, but a lead-acid "gel cell" battery is a no-cost option.

Engine bleed air is used for wing and engine anti-ice, but Cessna retained deicer boots on the tail for empennage ice protection. Pitot tubes, static ports, angle-of-attack vanes and total air temperature probes are electrically heated for anti-ice protection. The windshield also has a rain

The aft baggage compartment, the most generous in class, is a favorite feature with operators.



Hydraulic system distribution is concentrated in a bay in the left, aft wing root fairing.

High-gloss, wood veneer cabinetry now is a standard feature.

removal blower for clear vision at low speeds.

The cabin is pressurized to a maximum 9.3 psi, resulting in a cabin altitude no higher than 6,800 feet, even at FL 450. A digital pressurization controller automates almost all control functions. A 77-cubic-feet oxygen bottle now is standard equipment, so there's plenty available to comply with Part 91.211 for flight above FL 410.

Left and right wing tanks hold 6,740 pounds of usable fuel. Single-point pressure refueling is standard, and it takes about eight minutes to fill the airplane. Fuel supply to the engines is provided by jet pumps, augmented by electrically driven boost pumps used for engine start, cross feed, APU operation or in the event of jet pump failure.

Outboard armrests have been eliminated and inboard armrests fold out of the way, affording passengers 4 more inches of usable width in the six main passenger chairs.

Passenger Accommodations

The main door measures 24 inches wide by 54.5 inches high and has an integral five-step, illuminated airstair plus a sturdy handrail. A Type II emergency exit is located above the toilet in the lavatory. Notably, an externally serviced lavatory is now standard equipment.

Several improvements have been made to the passenger cabin, most noticeably the BEAerospace (aka Aircraft Modular Products) passenger chairs, inspired by the models used in the Citation Sovereign. The foldup armrests have been redesigned to increase seat cushion width to 20 inches, a 2-inch increase. The foldup armrests not only add available seat width, they also make it easier to move fore and aft through the cabin. Moreover, the new armrests make the seats more comfortable for sleeping when folded down as berths.

The standard cabin configuration consists of a left-side refreshment center, forward of the entry door, that will store catering trays, various beverages, ice, coffee and tableware. Just behind the copilot's seat is a 2-cubic-foot coat closet, along with a two-place divan with a fold-down center armrest and aft armrest. The main seating section of the cabin has six chairs arranged in club and one-half configuration. The two center chairs translate fore and aft on tracks and can swivel and translate out into the aisle for increased elbow and shoulder room. The forward and aft facing chairs are pedestal designs that recline, rotate and translate out from the cabin wall for more elbow room. The fully enclosed aft lav accommodates another 8 cubic feet of carry-on luggage. The vanity basin has a warm and freshwater faucet. Other cabin configurations are available on special order.

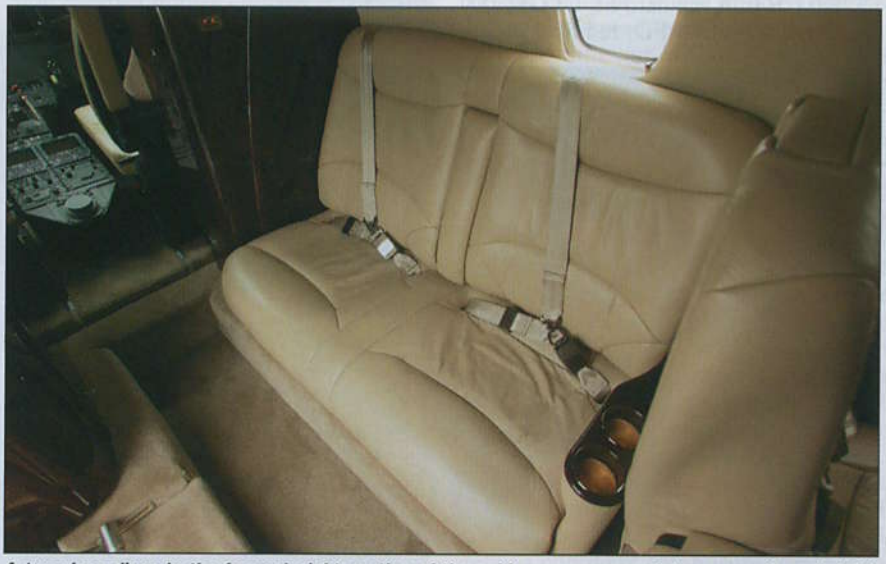
Pop-up headrests on the passenger chairs accommodate quick-change slip covers. AC outlets for laptops and other equipment are standard, along with long-life LED cabin lighting and improved worktables between club seats. The cabinetry now is pin-mounted, making quick work of removing and replacing the furnishings during maintenance inspections. "Smart switches," that can be used at any PSU station, also reduce the maintenance woes because they all have the same part number. Cessna is moving toward MSG3 maintenance accessibility with the XLS's interior design.

The 80-cubic-foot external baggage compartment is one of the XLS's most popular customer features. It has enough capacity to hold golf bags or skis for almost any passenger load.

Cabin options include Aero-M and -I satcom systems, an Iridium phone, AirCell phone and even a conventional air-to-ground radiotelephone. A remote cabin thermostat for the dual zone climate-control system is a no-cost option. A wide variety of audio/visual entertainment systems are available, including individual seat monitors, a moving map system and high fidelity stereo system.

Flying Impressions

In early February, we strapped into the left seat of Excel 560-5313, slated to become XLS 560-5501, which, in October, will be the first production unit delivered to a retail customer. Don Alexander, a senior engineering flight test pilot, was in the



A two-place divan in the forward, right section of the cabin can accommodate a seventh and eighth passenger. An extra seat in the lavatory holds a ninth passenger on high occupancy missions.

The XLS flies higher and faster, with more payload and fuel efficiency than the Excel, its predecessor.

right seat, accompanied by Jon Cooper as safety pilot and two other engineering flight test observers in the main cabin.

The aircraft's BOW was 12,690 pounds, about 50 pounds less than for future production XLS aircraft. With a 712-pound payload consisting of test gear, safety pilot and two observers, plus 5,070 pounds of fuel, the ramp weight was 18,472 pounds. Alexander started the Honeywell RE100 APU, which quickly warmed the cabin on the 16°F Wichita winter day while consuming 105 pph. The APU also provided electrical power for the avionics, enabling us to receive ATIS, copy our ATC clearance and program the FMS.

We made notes about the cockpit configuration. The XLS's DU1080 flat-panel displays provide considerably more information and viewing area than the Excel's DU870 CRTs. A standard fit, L3 GH3000 flat-panel standby PFD, fed by a generously sized emergency battery, eliminates the need for a "wet" compass. Flat-panel display RMU-855 radio management units, providing improved viewing in bright sunlight, also are standard fit. A double-wide console accommodates popular options, such as a second FMS. Above the crew seats, the XLS has been fitted with the Sovereign's hard-shell headliner that's more durable and easier to clean than the Excel's soft headliner.

But the XLS's Primus 1000 CDS layout has plenty of legacy holdovers from the Excel. This is no clean-sheet, next-generation ergonomic cockpit. Lacking EICAS, for instance, the XLS has a three-row 55 annunciator light panel that occupies the center of the glareshield, which thereby prevents the digital flight guidance system (DFCS) controls from being mounted in the ideal heads-up location between both crewmembers. Instead, the DFCS controls are split into three locations: A set of flight director control buttons is positioned atop the left and right PFDs, and the autopilot controls are located aft in the center pedestal. In addition, the landing light switches also are relegated to a spot in the pedestal, behind the throttles rather than close to the landing gear handle or other exterior light switches.

The instrument panel features the Primus 1000, with large-format flat-panel displays borrowed from the Primus Epic suite. But the rest of the panel is a virtual legacy from earlier 560 aircraft.

Ideally, the XLS would have had a fourth DU1080, dedicated to EICAS functions, and dual MCDUs with radio tuning functions. This configuration would have enabled Cessna to re-organize the cockpit to the latest ergonomic standards, in *B/CA*'s opinion. Such large-scale changes, however, also would have considerably raised the nonrecurring engineering cost and development time, thus increasing the selling price to customers.

Running through the pre-start checklist, Alexander chose to compute manually the takeoff V speeds of 101 KIAS for decision speed, 102 KIAS for rotation, 116 KIAS for the V2 takeoff safety speed and 160 KIAS for single-engine en route climb speed, based upon an estimated 18,200-pound takeoff weight and a flaps 15 degrees configuration. Alexander also computed takeoff thrust at 85 percent N1 rpm and takeoff field length at 4,900 feet because of the packed snow. However, the XLS also includes a standard UNS-1Esp FMS Takeoff and Landing Data (TOLD) performance computer that will automatically calculate takeoff and landing V speeds and set the V speed bugs on the PFDs; plus, it will compute target takeoff thrust and runway distance. A performance management computer module also is envisioned for the optional Honeywell FMSes, but the certification date is not yet firm.

Twenty-three minutes after APU start, we taxied out to Runway 1L. The XLS's new wheel brake system has a solid, progressive feel, reminding us of the Sovereign's excellent brakes. It's noticeably better than the Excel's touchy brakes, especially considering the packed snow on the taxiways and runway. The bungee nosewheel steering, actuated by the rudder pedals, is easy to use for plus/minus 20 degrees of steering, though it's not as responsive as wheel master, power steering. Beyond that steering range, differential thrust and braking can be used for tight maneuvering.

The PW545Bs have DEECs that automatically set takeoff thrust when the thrust levers are pushed up to the takeoff detent in the throttle quadrant. When cleared for takeoff, we simply pushed up the power levers through the cruise and climb flats in the quadrant, and then to the takeoff

The standard, double-wide console accommodates a second FMS CDU and other options.

The centrally mounted MFD brings much-needed situational awareness improvements to the XLS.

Honeywell Primus 1000 CDS Avionics

With its 10-by-8-inch DU1080 flat-panel displays borrowed from the Primus Epic suite, the XLS's cockpit seems inspired by the Sovereign's design. Primus 1000 CDS, though, retains the well-proven hub-and-spoke architecture of the original P1000 design, with integrated avionics computers at the heart of the system. The units are now IC-615 boxes that have additional slots for popular peripherals such as basic NZ-2000 FMS cards, a feature conspicuously absent in the original IC-600, which require separate, stand-alone FMS boxes.

The standard package includes Honeywell RCZ-833 and RNZ-850 series Primus II comm/nav/surveillance radios, dual RMU-855 radio management units, dual DADCs, A Primus 880 doppler turbulence detection weather radar, Enhanced GPWS, TCAS II, a three-frequency Artex ELT with nav interface, and a single-channel digital flight guidance system. A single Universal UNS-1Esp with a permanently installed data transfer unit is standard fit, and a Honeywell Primus 1000 FMS is offered as an option. Other options include dual FMS, a second ADF-850 receiver, KHF-1050 high-frequency transceiver, Coltech SELCAL, AFIS or Unilink datalink communications radios, FDR and CVR, and Universal TAWS in lieu of the Honeywell E GPWS box and a Honeywell lightning sensor system, plus a variety of terrestrial- and satellite-based radiotelephones.

detent and the DEECs set thrust.

Acceleration was quite brisk, as one might expect of an aircraft with a 2.3:1 weight-to-thrust ratio at the start of the takeoff roll. We rotated in 2,500 feet, noting light pitch feel forces. As speed increased through 135 KIAS, we retracted the flaps, reduced the thrust to the climb detent and turned on course, settling into the recommended 250 KIAS/0.62 Mach climb schedule, once above Wichita's Class D airspace. While the initial OAT was ISA-10°C at Wichita-Mid Continent Airport (ICT), the weather warmed to ISA passing through FL 300 and then increased to as much as ISA+10°C for the remainder of the climb. Nineteen minutes after takeoff, though, we were level at FL 430, having burned 1,130 pounds since brake release. The aircraft accelerated to 0.732 Mach or 427 KTAS in ISA+8°C conditions while burning 1,220 pph at a cruise weight of 17,500 pounds. Alexander noted that the aircraft easily would have reached its 0.75 Mach VMO redline in ISA conditions, equivalent to 430 KTAS. The Excel, in contrast, can squeeze out only 404 KTAS at the same weight and density altitude.

We then pushed the XLS up to FL 450 at 17,250 pounds. While the aircraft had little difficulty in climbing the extra 2,000 feet, the speed slowed to 402 KTAS and the fuel flow dropped only 100 pph because of the warmer than standard, ISA+9°C conditions. We checked yaw stability and found the XLS to be well damped with the yaw damper turned off. Moreover, when we checked high-speed buffet boundaries, we found the XLS to have more robust margins than the Excel we last flew on a *B/CA* demo flight. This aircraft could be banked up to 44 degrees before high-speed buffet onset.

Descending out of Class A airspace to 15,000 feet for air work, we noted that the XLS has almost identical handling characteristics to the Excel. Extending the spoilers, for example, causes a very slight nose-down pitching moment and a large increase in descent rate, accompanied by a small speed increase. Retracting them has the opposite effect. Notably, the XLS will have an automatic emergency descent mode with the autopilot engaged, similar to the Sovereign and Citation X. Lose cabin pressurization and the aircraft will turn off course and automatically descend to 13,500 feet, assuming the crew pulls back the power levers to keep the speed in check.

The clean stall was preceded by ample airframe buffet prior to stick shaker. If recovery is initiated at the shaker, the XLS retains complete composure. Press it to full aerodynamic stall and there is mild

wing rolloff. And being a 500-series Citation, its stall speeds are slow. At 16,900 pounds, the XLS stalled at 97 KIAS with a clean wing.

Then we slowed and extended the flaps to seven degrees. There is very little pitch change associated with this configuration change because the stabilizer automatically repositions two degrees leading edge down as the flaps extend. Extending the landing gear causes very little pitch change, but further extensions of the flaps cause a mild nose-down pitching moment, easily controllable with back pressure on the yoke and nose-up pitch trim.

The aircraft isn't as well mannered during full stalls in the gear down, flaps 35-degrees landing configuration. As with the clean stall, there is little loss of composure if recovery is initiated at stick shaker, but there's very little pre-stall aerodynamic buffeting. When held into a full aerodynamic stall, there is pronounced wing rolloff. Conclusions? Heed the stall shaker, initiate recovery, and only the crew will know that the aircraft approached its maximum lift coefficient.

Returning to Wichita for pattern work, we asked Approach Control for the ILS Runway 1L. This is when the XLS's Primus 1000 CDS displays showed off their superior traits. The DU1080 PFD's larger attitude indicator display, bigger airspeed and altitude type fonts, and bright contrast ratio made it much easier to read than the older DU870 CRT. The MFDs, though, stole the show because they offer most of the I-NAV functionality of Primus Epic, including full integration of traffic, terrain and flight plan route information. The PFD is used to display imagery from the onboard weather radar. Optional datalink weather, however, will be displayed only on the FMS CDU — not the MFD.

Our first approach was at 16,600 pounds, resulting in a 112 KIAS VREF approach speed. We padded that speed with an extra 5 knots for the gusting winds. There also was some left to right crosswind, so we crabbed down the glideslope toward the touchdown. We kicked in a little wing down, top rudder during the flare and were rewarded with a smooth touchdown. The entire approach and landing reinforced that the XLS is one of the easiest business jets to fly and its trailing link landing gear affords practically the softest, most forgiving touchdowns of any aircraft in production.

We reconfigured for the touch-and-go and departed downwind for a GPS 1L approach. Converting nonprecision procedures into pseudo-ILS approaches is a strong suit for the UNS-1Esp. First it analyzed the aircraft's track and adjusted the procedure turn for wind drift, in this case a holding pattern, to keep us well inside protected airspace. Then, it provided glidepath vertical guidance down to minimums. Having burned down to a weight of 16,300 pounds, our VREF then was 111 KIAS. There's practically no difference between flying a GPS and the ILS approach with FMS VNAV, so the second approach was uneventful.

After a second touch-and-go landing, we entered the VFR traffic pattern for a full stop landing. Using full reverse thrust causes some tail buffet, but it's only needed for landing on relatively short, contaminated runways. Otherwise, just idle reverse will suffice.

Following the full stop landing, we returned to 1L for departure into the VFR traffic pattern. This time, Alexander retarded a throttle after V1 to simulate an engine failure. The XLS, similar to the Excel, has an effective rudder bias system powered by differential engine bleed air pressure. The result is needing to use only light to moderate rudder pedal pressure to maintain coordinated flight during OEI maneuvers. The aircraft was so docile to handle during these maneuvers that we concluded that a Citation 500 or 550 is harder to fly with one-engine-inoperative.

We continued the approach with the simulated left engine inoperative, so dur-

Thrust reversers are effective, but they do shake the horizontal tail at maximum output.

PW545B Engines

The Citation XLS's 4,500-pound thermodynamic Pratt & Whitney Canada PW545B engines are rated at 3,991 pounds of thrust to ISA+13°C for takeoff. The powerplants feature a recambered single-piece fan that turns at about 2 percent higher N1 rpm to produce most of the 4.9-percent increase in takeoff thrust and 2-percent increase in climb and cruise thrust, which is now approximately 950 pounds at 40,000 feet, ISA, uninstalled. The basic engine redline rpm limits remain unchanged, but P&WC engineers opened up the compressor and turbine stages and changed the stagger of the blades to boost the flow to match the fan power requirements. The internal layout of the 545B remains the same as that of the original 545 engine. The N1 shaft has a single-piece, integral blade rotor, titanium fan, an axial flow supercharger stage and two low-pressure turbine stages. The core features two axial and one centrifugal flow compressor stages, a reverse flow annular combustor and a single-stage higher-pressure turbine.

The result is practically no change in bypass ratio, weight or maintenance intervals. Hot section inspection intervals are 2,500 hours and overhaul is due at 5,000 hours. A single-channel DEEC, with a hydromechanical backup, controls engine operation, providing most of the ease of use features and overspeed/overtemp protections of a FADEC.

ing the landing rollout, we used only right engine thrust reverse. This was a little tricky considering the packed snow on the left side of the runway and left-to-right crosswind. It was apparent that minimum thrust reverse was the best technique for directional control and deceleration.

Our total flight time was 2.1 hours and the total fuel burn was 2,280 pounds.

Price and Value

Competition in the midsize business jet market remains fierce, with excellent product offerings from Bombardier, Cessna, Gulfstream and Raytheon. Each of the aircraft used in the composite average of *B/CA*'s Citation XLS Comparison Profile® has its strong suit, be it speed, range, payload, runway performance or cabin comfort.

But the one and one-half hour, 600-nm business trip remains the bread-and-butter mission of the midsize jet, and this is where the XLS excels. It has by far the shortest takeoff field length and can climb directly to its FL 450 service ceiling. Its 600-nm mission block time, although not shown on the Comparison Profile, is within 12 minutes of the faster competitor and within six minutes of the composite average.

When needed, the XLS can fly four to six passengers anywhere in the continental United States with one fuel stop and can fly out of most 4,000-foot runways. Other midsize aircraft need 5,000-foot runways under the same conditions, so the XLS provides access to hundreds more convenient landing facilities. Its standard APU enables the aircraft to operate autonomously without the need for a ground power umbilical. It offers genuine midsize cabin width and height with comfort for six or seven passengers, and nine folks in a pinch. With 80 cubic feet of external baggage space and another 11 cubic feet of luggage storage inside the cabin, the XLS has by far the largest luggage capacity of any aircraft under $13 million. Road warriors can pack enough shirts, socks and suits for a week of business meetings, plus full packs of Callaways and Pings essential to closing key deals on the back nine.

The XLS also is one of the easiest business jets to fly, being particularly slow and docile in the landing pattern. Its long travel, trailing link main landing gear make just about any pilot look like an old pro on touchdown.

The XLS also addresses some of the complaints expressed by Excel operators. The standard APU and air cycle machine, for example, provide far superior cabin cooling compared with the Excel's standard vapor cycle air conditioner. The upgraded wheel brakes provide considerably smoother and more progressive stopping action. The externally serviced toilet, formerly an Excel option and now standard fit on the XLS, has plenty enough capacity for multiple missions, a substantial improvement over the Excel's standard, internally serviced potty.

But some shortcomings remain. Operators who complained about the Excel's two-position horizontal stabilizer, single-wheel main landing gear that's prone to hydroplaning and thrust reverser tail buffet will find the XLS offers no changes to these systems. However, such gripes didn't seem to impact the Excel's popularity and they shouldn't make much of a dent in XLS sales.

Far and away, Cessna's factory service and support for the Excel made it one of the manufacturer's most successful Citations. The XLS will strongly benefit from this legacy because business aircraft operators want reliable transportation, not broken airplanes sitting in hangars awaiting parts and factory technical support.

Other midsize aircraft can carry considerably more payload and they can fly farther than the XLS. Most have greater speed, many offer slightly better fuel-efficiency and some even have larger cabins. But the XLS as total transportation solution, particularly in light of Cessna's unsurpassed factory support, is going to be a tough competitor in its class. Simply put, it provides midsize speed, mobility and utility with the best runway performance and top-notch support. Did we also mention that the XLS has the lowest comparably equipped price in the midsize class? **B/CA**

Cessna Citation XLS Comparison Profile®

(Percent Relative to Average)

Tradeoffs are a reality of aircraft design, although engineers attempt to optimize the blend of capabilities, performance and passenger comfort.

B/CA compares the subject aircraft, in this case the Citation XLS, with the composite characteristics of others in its class, computing the percentage differences for various parameters in order to portray the aircraft's relative strengths and weaknesses. We also include the absolute value of each parameter, along with the relative ranking, for the subject aircraft within the composite group.

This Comparison Profile compares the Citation XLS with a wide-ranging composite group of midsize aircraft including the Bombardier Learjet 45, Gulfstream G100 (née Astra SPX), Bombardier Learjet 60, and Raytheon Hawker 800XP. The Comparison Profile shows that the Citation XLS's cabin comfort indices are about average for the class. Its maximum payload and range with maximum payload are below average, along with its cruise speed and tanks-full maximum range. But its short field performance is by far the best in class. When the XLS's 11-percent lower price is considered, its strengths are more apparent and its shortcomings are diminished.