

Cessna 441 Conquest II

By Edward G. Tripp

Photography by Paul Bowen

Designed for performance and dubbed "Jetprop," the Conquest II overcame early troubles to star again in the nineties.

Cessna entered the turboprop market in 1977 with the CE-441, well after Beech and Rockwell Commander had established themselves in that market segment. Originally trademarked "Conquest," Cessna's AlliedSignal TPE331-8 powered airplane was renamed "Conquest II" in 1983. The 441 was designed for performance and actually outperformed some early Citations in selected parameters. Indeed, some companies offering aftermarket performance mods for today's Conquest fleet say an updated CE-441 can still run head-to-head with the Citation II.

The 441's cabin is large. It can accommodate 11 passenger seats in commuter configuration, and, more typically, six or seven seats in executive configuration. The airplane's long nose has two separate baggage bays, with the avionics rack in the forward bay and the batteries stowed under the rear bay floor. There also is a large baggage area in the aft cabin. The

cabin has a large two-part airstair door, and a wide, three-part door option was available.

The cockpit is laid out in typical Cessna 400 series fashion, reflecting the lessons learned in developing the much-praised Citation cockpit. Pilot seats are comfortable and large and there is good visibility out of the cockpit windows.

Standard avionics, which included an RMI, transponder with encoder, weather radar and a flight control system, was (except for the radar) from Cessna's electronics subsidiary, Aircraft Radio Corp. (ARC). An optional Collins package, which many customers preferred, was available. However, the FCS 1000 flight director was the only FCS available until the very end of production. Ultimately some 15 airplanes went out the door with the Sperry (Honeywell) SPZ-500.

Many turboprops of the day were poor performers between 17,000 and 25,000 feet because of powerplant and environ-

mental system limitations. But, the Conquest II can roll right up to and above FL 300 except in very high temperatures. Early 441's can reach FL 330 in about 25 minutes using a recommended cruise climb of 160 KIAS (130 above FL 250) in ISA standard day conditions after a take-off at a MTOW of 9,850 pounds.

Cruise speed tops out at 276 KTAS. Maximum effort, zero-wind, VFR range is just under 2,000 nm. (See the accompanying specifications.)

The performance of the Conquest extends beyond all-out speed or seats-empty range. It offers flexibility, comfortably handling the more typical (shorter) distances of most business trips and hauling a lot of payload, while still providing near-jet performance to handle longer legs.

Development

A total of 362 CE-441's were manufactured. According to Aviation Data Ser-

The CE-441 horizontal stabilizer (below) was designed with pronounced dihedral to minimize the effects of propeller whirl mode vibration, but failures required significant redesign. Right: The long nose provides generous baggage space and easy access.



vice, Inc. of Wichita, 316 remain on the active registry. Some 203 are registered in the United States. Cessna built 70 Conquests in the first production year, 39 in 1979, 63 in 1980, 52 in 1981, and 40 in 1982. Production was spotty thereafter with 48 manufactured in 1983, 20 in 1984, 19 in 1985 and 11 in 1986, the last production year.

The CE-441 was grounded twice during its first two years in service. Failure of the trim tab actuator jack screws and subsequent elevator flutter led to in-flight airframe failure of the sixth production airplane.

The final fix was a complete redesign of the horizontal tailplane, including thicker skins, a redesigned leading edge and elevators, additional ribs and a second spar in the horizontal stabilizer. The fix included a new aft fairing and dual trim tab actuators. The AD (79-19-13) detailing the modification also required inspection and modification or replacement of the tailcone shelf assembly. The model was re-certificated in 1979. The first 109 production aircraft are 1978 and 1979 models. The AD applied to Serial Numbers 001 to 0106 and to Serial Number 0109.

Cessna worked vigorously to support its customers during the lengthy tail-fix down time, including supplying them with replacement piston twins while the 441 fix was developed. In a big step forward in customer service, Cessna also developed fixes for other shortcomings and frequently picked up much of the cost, too.

During its short manufacturing span, list price of a factory-equipped airplane nearly doubled from \$925,000 to \$1,795,000.

For the 1981 model year, maximum operating altitude was increased to FL 350, beginning with Serial Number 0173.

Cessna offered a high-altitude kit (SK 441-36) to owners of earlier aircraft. At the same time, the single battery switch was changed to individual switches for each of the two nickel cadmium batteries, and a service retrofit kit was made available for this change, as well (SK 441-37).

Operating experience turned up a number of other problems that were addressed during the production run. The engine fuel nozzles, for example, proved troublesome in service, and the combustion chamber was prone to carbon buildup, which not only reduced performance but also could create hot spots that could lead to combustor damage.

Starter/generators and batteries provided less than optimum service in the field. The windows developed a number of problems early on, including delamination, and improved units were developed. Many operators converted to glass windshields.

Cessna made many of the product improvement service bulletins and kits available at no charge to operators.

Among several changes introduced at Serial Number 0260 (during the 1982 model year) was the addition of windshield defog blowers to help handle condensation in the cockpit (SK 441-72). The last major change was the introduction of an engine power management system (PMS) with Serial Number 0340. Service kit SK 441-79 was made available for retrofit.

The End of the Line

There is some question about whether any 441's were actually built in 1986 or whether they were actually inventory built in 1984 or 1985 and carried forward. More important is that Cessna had reached the end of the line for all turbo-prop products except for the single P&WC PT6 powered Caravan. In 1986,

Cessna evaluated a follow-on, economy version of the 441, powered by PT6s. It was not a go then, nor did it pass muster with the dealer organization in the early 1990s when planners again proposed the program. Dealers thought the P&WC-powered version would be a step backwards because, in the words of one, "it couldn't climb, go as fast or as high as the Conquest II."

Despite fairly extensive service problems with the AlliedSignal TPE331-8 engines, there have been only five ADs issued to date. Three—92-02-19, 93-02-19, which superseded the previous AD, and 93-02-01—addressed fuel manifold problems. They all had very short compliance periods. The most recent, 95-16-08, required an extensive review of records and mandatory engine disassembly if any major work had been done by Fliteline Maintenance of Wharton, Texas and two specifically named mechanics, or if any life-limited parts had been supplied by them.

The most recent ADs are blanket ones, affecting many aircraft. AD 97-25-04, requires changes to the AFM to prohibit positioning the power levers below the flight idle stop in flight. Another directive affects operation in icing conditions (See *Intelligence*, April 1998, page 20.)

According to one Conquest specialist, John Berizzi, business development manager at Executive Wings, Inc. of Lakeland, Fla., "AD searches on Conquests are fairly easy. We do a number of pre-buy inspections, and ADs and service bulletins are not big issues. The main questions are whether the customer is getting a good airplane for the price."

Propulsion System

The TPE331-8, rated at 636 shp, and developed for the CE-441, provided excellent performance for the price.



Cockpit design of the Conquest II wins praise from pilots for good layout, generous space. Visibility is good. Original equipment ARC avionics, including analog ARC 1000 flight control system, are weak points.



In typical executive configuration, the cabin can seat six in comfort. Noise and vibration levels, largely generated by propeller wash, and regulation of temperature are regular passenger complaints.

However, reliability issues quickly arose. Fuel nozzle problems and maintenance requirements, carbon buildup in the combustor and performance deterioration in relatively few operating hours due to turbine blade erosion were among operator complaints. (See "Operator Survey," November 1984, page 42). The -8 has short major service intervals—hot section inspections at 1,500-hour intervals and a 3,000-hour TBO. Operators have not liked the high cost of major maintenance, either.

Executive Wings claims to be the pioneer in upgrading the -8 for maintainability and reliability, obtaining two STCs in March 1991. The improvements developed involve exchanging the -8 combustor and turbine with components developed for the TPE331-10 series.

This change addresses another issue, since the -10 includes duplex, two-headed fuel nozzles. At first, the company called its mods the "Super 8 Engine Conversion." It is now trademarked as the "Executive Five Eleven" conversion.

HSI is extended to 2,500 hours; TBO is stretched to 5,000 hours. Among other advantages Executive Wings claims are reduction of HSI costs of from 30 to 50 percent, fuel nozzle maintenance costs cut by as much as 75 percent—from an average of \$8 per hour to \$2—and reduced turbine blade carbon erosion. The -10 first stage turbine wheels are air-cooled. They also are segmented and have replaceable blades. The modification can reduce 441 operating costs up to \$155 per hour compared to a standard 441, according to Executive Wings.

Specifications Cessna Conquest II CE-441

B/CA Equipped Price	\$1,855,010
Bluebook, '98	\$1,520,000
Characteristics	
Seating	1 + 9/9
Wing Loading	32.8
Power Loading	7.9
Noise (EPNdB)	74.0
Dimensions (ft/m)	
External	
Length	39.0/11.9
Height	13.1/4.0
Span	49.3/15.0
Internal	
Length	12.9/3.9
Height	4.3/1.3
Width	4.6/1.4
Power	
Engines	2 ASE TPE331-8
Output	636 shp ea.
TBO	3,000
Weights (lb/kg)	
Max Ramp	9,925/4,501
Max Takeoff	9,850/4,467
Max Landing	9,360/4,245
Zero Fuel	8,500/3,855
BOW	6,209/2,816
Max Payload	2,291/1,039
Useful Load	3,716/1,685
Executive Payload	1,600/726
Max Fuel	3,183/1,444
Payload/Max Fuel	533/242
Fuel/Max Payload	1,425/646
Fuel/Executive Payload	2,116/960
Limits	
MMO	0.55
VMO	243
PSI	6.3
Airport Performance (ft/m)	
TOFL (SL ISA)	2,465/1,118
TOFL (5,000 ft ISA+20°)	3,720/1,687
Cruise	
Long Range	
TAS	259
Fuel Flow	304
Altitude	FL 350
Specific Range	0.85
High Speed	
TAS	293
Fuel Flow	510
Altitude	FL 290
Specific Range	0.57
NBAA IFR Ranges (200-nm alternate)	
Max Payload	
Nautical Miles	1,566
Average Speed	299
Trip Fuel	280
nm/lb	0.66

Berizzi says the initial objective of the conversion was to cut maintenance costs and improve reliability. The substantial performance improvement, including the ability to carry full power to FL 260, up from FL 220 in standard conditions, and an increase in cruise speed of from 25 KTAS to 30 KTAS, were bonuses, he

claims. In September 1997, Executive Wings was FAA approved as a TPE331 overhaul facility. The repair station license covers -1 through -11 series engines.

West Star Aviation of Grand Junction, Colo. approached the -8 in a different way. The company teamed with AlliedSignal in 1992 and obtained an STC to install factory-modified TPE331-

10N engines on the Conquest II. Customer engines are removed at West Star and shipped to AlliedSignal's Phoenix facility for modification and then returned to Grand Junction for installation and final rigging.

West Star's conversion is trademarked as the Dash 10 and offers comparable benefits. Russ Williams, West Star's vice president of business development, says

time-to-climb to cruise altitude improves by eight to 10 percent, cruise speed increases an average of 25 knots and hourly total cost, including reserves, can be reduced by as much as 11 percent. Williams estimates DOCs range from \$300 to \$350 per hour depending on stage lengths, power settings and average fuel costs.

The higher power output at altitude

Mods, Support, Training and ADs

►Propellers—Hartzell initially supplied the original equipment propellers. According to West Star's Williams, Cessna installed McCauley three-blade propellers with Serial Number 0196. Both are 90 inches in diameter.

The Conquest's long nose is an effective transmitter of noise and vibration generated by the props. Depending upon power selection, the noise can be more pronounced in the cabin than in the cockpit.

Blade-tip ground clearance is 10.2 inches. Blade erosion from dust, debris and water is a concern, and so is the possibility of prop strikes when taxiing over uneven ground.

Berizzi of Executive Wings says his company worked with Hartzell to develop four-blade propellers to replace the OEM three-blade units. Tip clearance is increased by 2 1/4 inches. Executive Wings claims an eight- to 10-dB noise reduction in the cabin, decreased takeoff roll (primarily because of faster acceleration from more propeller efficiency), a 400- to 500-fpm rate of climb improvement and a three- to five-knot cruise speed increase. The replacement propellers have a five-year or 3,000-hour TBO.

McCauley has STCed a BlackMac four-blade conversion for the 441. As with the Hartzell replacement props, they can be installed on aircraft powered by either an original -8 engine or the -10 conversion. They offer similar performance and sound reduction improvements. Diameter is 88.0 inches, and McCauley notes that the four-blade conversion reduces flyover noise as well as cabin sound levels. Recommended TBO is the earlier of 4,000 hours or 72 calendar months.

Either conversion is available from both Executive Wings and West Star Aviation. Executive is pricing the Hartzell propeller switch at \$33,900 for aircraft with original McCauley

propellers and \$37,250 for aircraft with Hartzell props. Its conversion price for the McCauley BlackMac is \$37,500. West Star's price for either is \$37,500.

►Batteries—Original equipment batteries are two, 25.5 volt, 22 ampere-hour nickel cadmium units. Marathon Battery Products was the source until Cessna changed to SAFT America with Serial Number 0340. The batteries, called "half-height" by some also provide about half the cranking power of full-size nickel cadmium batteries. Marathon has developed a modification that drops the battery box base to permit installation of full-size nickel cadmium units.

There are lead acid battery conversions. Premier Air Center of East Alton, Ill., offers one that costs \$5,000, or about the cost of a nickel cadmium battery, according to Rick Micacek of Premier. It provides more cranking power and simplifies maintenance. This is important at an airport with marginal service. Premier recommends that operators replace lead acid batteries every two years. They cost approximately \$800 each.

Premier also offers stainless steel exhaust fairings to replace the original equipment overwing exhaust duct. Exhaust heat embrittles the surrounding fiberglass, which then begins to deteriorate, leaving no support or attachment for the exhaust duct. The replacement ducts provide a metal-to-metal structure.

►Other Operational Mods—Both Executive Wings and West Star Aviation offer a number of other modifications. Executive has a reduced-drag wing tip mod (\$5,900) that provides a slight cruise speed increase. The greatest advantage, according to Berizzi, is improved stability at altitude. It also reduces autopilot workload.

West Star Aviation offers a Rock-

well Collins APS-65 retrofit, a digital flight control system and three-axis autopilot that adds a number of features to reduce pilot workload and increase passenger comfort. Features include improved altitude preselect and hold, indicated airspeed and vertical speed hold, and half-bank and soft ride modes. It is certificated to Category II approach standards.

West Star charges \$124,500 to remove the ARC 1000 and install the APS-65. For an operator who is planning to keep a 441, it can pay off economically and operationally.

►Increase Weight Kit—Boundary Layer Research of Everett, Wash. has received an STC to add vortex generators to flying surfaces. The kit permits an increase of ramp weight from 9,925 to 10,240 pounds; max takeoff from 9,850 to 10,165 pounds; and zero fuel weight from 8,500 to 8,815 pounds. Max landing weight remains at 9,360 pounds. Stall speeds increase by one knot at the higher weight: V_s goes from 89 to 90 KIAS and V_{so} from 74 to 75 KIAS. Y_{MC}A remains at 91 KIAS. Kit price is \$5,995 excluding shipping and handling. BLR estimated installation time is three hours. According to Robert de Roche of BLR, the company is evaluating development of a modification to further increase operating weights.

►Noise Control—Cabin noise levels remain a major passenger gripe, while temperature control runs a close second. Both Executive Wings and West Star have developed mods that involve relining the interior of the cabin to deaden sound. Executive Wings says its \$7,200 retrofit reduces cabin noise levels by four to six dB. West Star says its mod costs \$7,500 and involves the removal and replacement of original insulation with sound deadening materials and new insulation. Both firms add inner cabin window

comes at the expense of a seven to 10 percent increase in fuel burned. Both West Star and Executive Wings say reduced block times compensate for the fuel burned, and customer comments support the claims.

Each company offers two conversion options. The first is a continued-time conversion, which could be done if engines were approaching an HSI inter-

val or needed maintenance. West Star's Dash 10 continued-time conversion includes an HSI, a gear box inspection, a functional check of accessories (but no accessory overhaul), new hoses and engine mounts, tests and documentation. West Star charges approximately \$302,000. Executive Wings charges \$267,500 for its continued-time conversion. A fully overhauled, zero-time con-

version costs approximately \$430,000 at Executive Wings and \$454,000 at West Star.

Executive Wings has completed 65 conversions; West Star Aviation had done 150 as of press time. Thus, 68 percent of the fleet has undergone the engine upgrade. The two firms are fierce competitors. Conquest operators interested in upgrading their airplanes are advised to talk to both companies to determine the relative merits.

THE MARKET

Aftermarket suppliers stress the increase in resale value some modifications add, particularly performance and reliability improvements such as the -10 engine conversion. Resale prices would seem to bear out their claims. Williams of West Star stressed to B/CA that the Aircraft Blue Book Price Digest reports an increase of \$18,000 to \$19,000 in the last quarter, with estimated market values of even the oldest aircraft of more than \$1 million, and that these are for TPE331-8-powered aircraft. Williams claims that -10 Conquests are worth from \$250,000 to \$300,000 more than unmodified airplanes.

Conquest specialists think a number of operators are making investments that represent 25 percent or more of the current value of their aircraft because they plan to keep operating them well into the future.

According to numbers offered by Williams, average total time of the 441 fleet ranges from just under 3,700 hours for late model aircraft to nearly 6,200 hours for early serial numbers. With an annual hourly utilization of 308 hours, there is a lot of useful time left for the fleet. The only life-limited airframe element at this point are the aileron hinges, which have a 10,000 hour life. If averages are any guide, it will be more than 12 years before the average high-time airplane approaches 10,000 hours.

The bad news is that the returning appeal and the improvements available for the Conquest II have driven up prices and constrained the availability of aircraft at the same time.

Popularity comes and goes with airplanes just as it does with entertainers. Yesterday's dog is tomorrow's darling, and vice versa. In the current situation, the 441 appears more in the desirable column. As an example, a 1981 model that had depreciated to, or had reached a residual value of—in market demand terms—roughly 64 percent of its original price in 1987 has now climbed back up to 82 percent. B/CA

panes.

West Star also is offering an active noise control system developed by Lord Corp., of Cary, N.C. Trademarked NVX, the system weighs approximately 55 pounds and involves the installation of eight speakers and 16 microphones, plus sensors and other system elements in the cabin. Lord claims its 441 NVX reduces propeller noise in the cabin by 12 dB, or 75 percent. Installed price averages \$35,000, according to West Star.

►Customer Support—According to Steve Charles, director of product support for Cessna's propeller dealer organization, Cessna continues to assign someone to its technical hot line for turboprops. While it is oriented toward the dealer support organization—there are about 20 in the United States—it frequently responds to inquiries from operators. Cessna offers subscriptions to all technical manuals, parts and tool catalogs and bulletins. New subscriptions cost \$275 per year in aerofiche.

►Operator's Group—The Conquest Aircraft Operators Group offers members "a personal knowledge in turbine aircraft operations," a quarterly publication, *Charlie Tango* 425-441, and an annual safety and maintenance conference. Annual dues are \$125 in the United States and \$150 for operators in other countries. The Conquest Aircraft Operators Group, P.O. Box 460, Valdosta, Ga. 31603. Phone: (912) 244-1568; fax: (912) 244-2604; e-mail: JemOps@worldnet.att.net.

►Training—FlightSafety International offers dedicated 441 pilot and maintenance training at its Wichita Cessna Learning Center: (316) 220-3200. Pilot initial training consists of five days of ground school and simulator training with the option of flight

training on the sixth day. Cost is \$7,500. Recurrent training runs for three days and costs \$4,500. Maintenance training runs for 10 days and costs \$3,325.

►Accidents—NTSB records contain 22 CE-441 accidents between May 12, 1983 and March 8, 1997. Nine were fatal. Probable causes range widely from fuel mismanagement (including one accident that occurred during a drug run after the pilot exhausted the fuel supply) to poor decisions or improper procedures during instrument approaches.

►Airworthiness Directives—Major airframe and operational ADs issued on the 441 include:

79-08-07—Propeller anti-icing electrical wiring modification.

79-09-02—Aileron control surfaces drainage.

79-19-13—Elevator trim tab.

80-02-17—Flight manual performance. Data was changed for aircraft through S/N 0097 and replacement of certain fuel control units and related actions.

83-12-03—Battery switch wiring. Inspection and modification as needed of the dual switch wiring.

84-20-02—Nose landing gear actuator rod end replacement.

85-25-11—Nuts (Cessna P/N NAS1291-8). Replacement of the horizontal stabilizer front spar attach bolt retaining nuts with new ones available only from Cessna.

86-24-13—POH/AFM appendix-icing. Revises engine management procedures in icing conditions. This could present operational problems, since it requires activation of the engine ignition override mode, which is time-limited.

92-16-07—Horizontal stabilizer front spar. Applies to all 441's and requires repetitive dye penetrant inspection, at 2,000 hour intervals, of the horizontal

stabilizer forward attach bulkhead for cracks. The structure must be replaced if cracks are found before further flight. Installation of SK 441-103A is terminating action for the repeat inspections.

95-25-10—Replace outflow/safety valve. (Requires the replacement of cabin pressure outflow valves to prevent cracking and depressurization).