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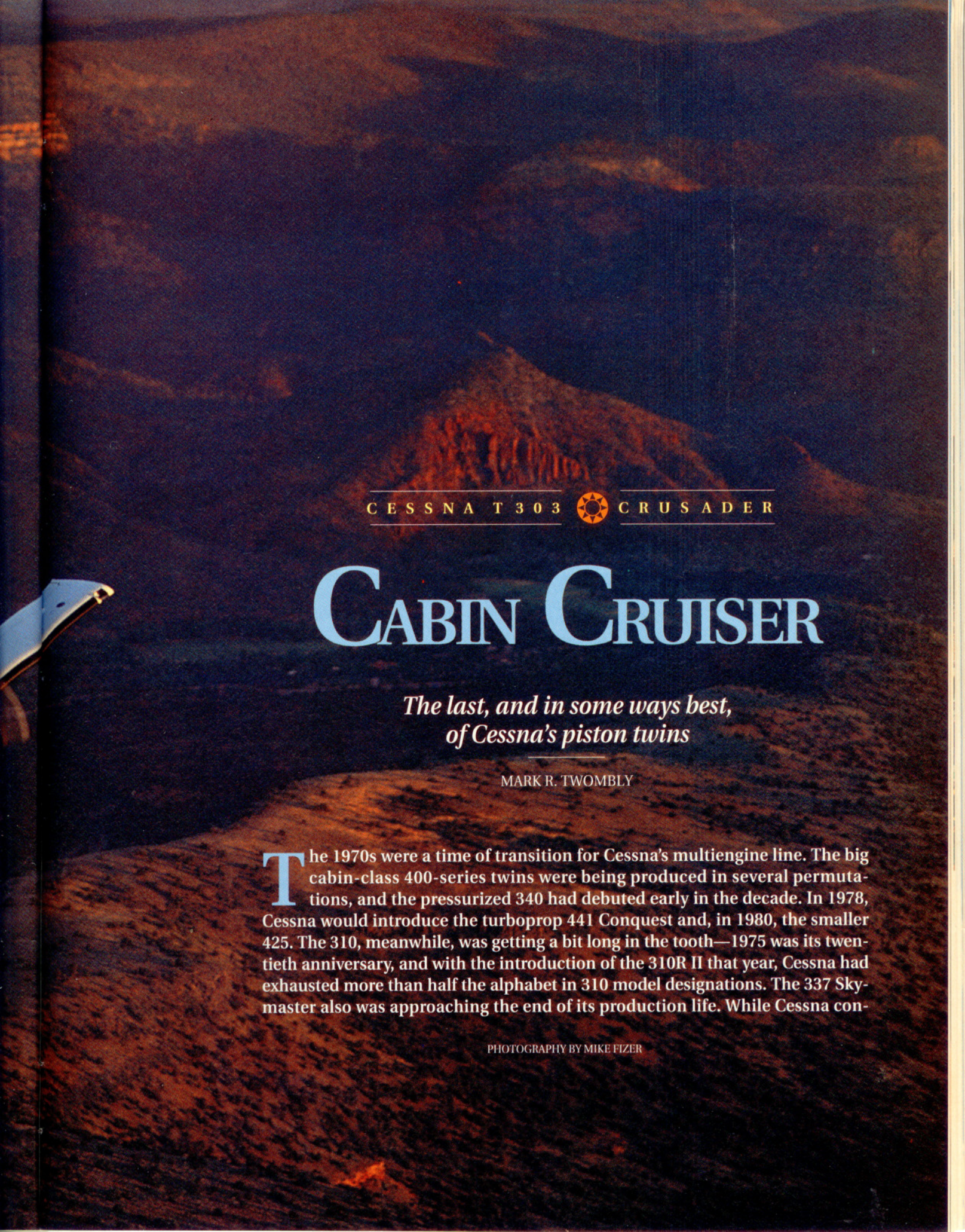

CESSNA T303 CRUSADER

CABIN CRUISER

The last, and in some ways best, of Cessna's piston twins

MARK R. TWOMBLY

The 1970s were a time of transition for Cessna's multiengine line. The big cabin-class 400-series twins were being produced in several permutations, and the pressurized 340 had debuted early in the decade. In 1978, Cessna would introduce the turboprop 441 Conquest and, in 1980, the smaller 425. The 310, meanwhile, was getting a bit long in the tooth—1975 was its twentieth anniversary, and with the introduction of the 310R II that year, Cessna had exhausted more than half the alphabet in 310 model designations. The 337 Skymaster also was approaching the end of its production life. While Cessna con-

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centrated on the upper end of the twin spectrum, Beech's Duchess and Piper's Seminole tapped into a new market for multiengine trainers and small twins. Grumman American even managed to capture a sliver of the pie with its Cougar.

Cessna's reaction was to build a prototype of a new piston twin, the 303. On 1978 paper, it was a good idea. A four-place, baby-cabin-class twin loaded with contemporary touches: bonded wing structure, the latest NASA airfoil shaped for climb and single-engine performance, a clean-sheet-of-paper panel, and an airstair door. The prototype was powered by a pair of 160-horsepower Lycoming engines.

NASA's GAW-2 series airfoil was designed to be accompanied by spoilers and Fowler-type flaps for roll and low-speed control. Instead, Cessna opted to fit the 303 wing with conventional ailerons and single-slotted flaps.

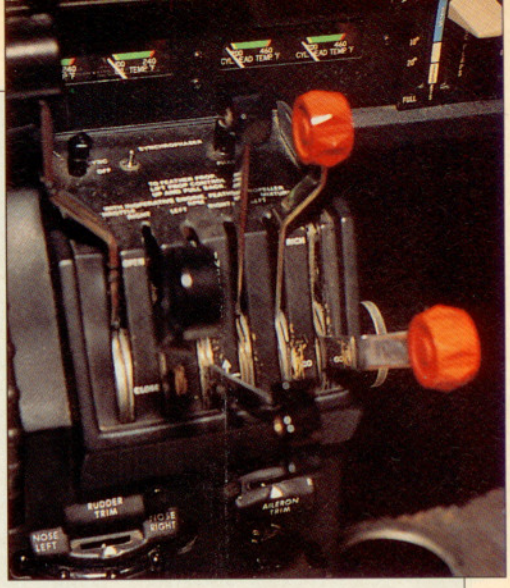
Not surprisingly, given the anemic power and airfoil control surface mismatch, the prototype was a disappointment. Climb and cruise performance were worse than expected, and the airplane had poor single-engine performance. It also handled poorly, despite wind-tunnel tuning of the design.

Some major fixes were in order, beginning with a new wing and more power. Cessna abandoned the idea of developing a small twin to go up against the competition's new entry-level models and instead looked at a Skymaster and 310 replacement. Thus was born the T303 Crusader.

The large cabin was the only major design feature to survive the change in focus. Power went from the 160-hp Lycomings to two 250-hp turbocharged Continentals. A new wing was fitted, essentially the same airfoil as was used on the 310.

The original 303 had a low horizontal stabilizer, but tests showed that the low tail would be a problem on the recast design. The stabilizer would ride in turbulent air flowing off the propellers and wing, making for unacceptable noise and vibration and inadequate stability. Cessna tested every configuration and settled on the distinctive cruciform tail that is the Crusader's signature.

The gestation between first prototype and finished product was long; the T303 Crusader debuted in 1982. It



Handsome describes much of the Crusader, from its overall lines and well-organized metal panel to the trailing-link main gear.

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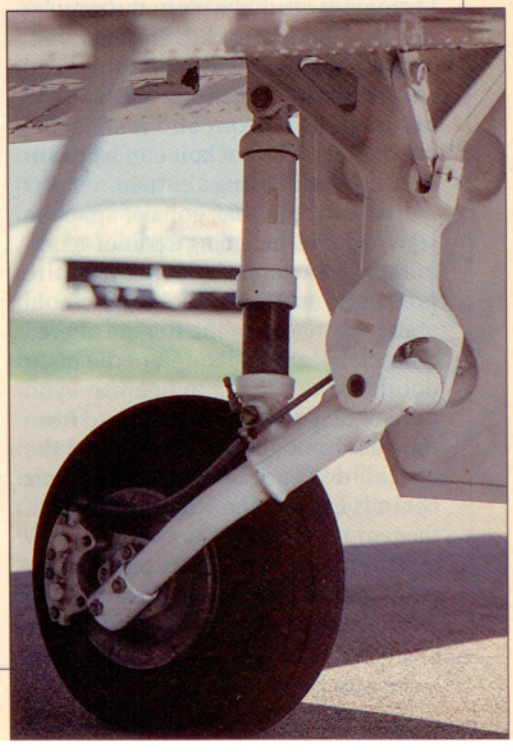
turned out to be a good idea at a bad time. Sales of new-production aircraft, in particular piston twins, were headed for the cellar just as the airplane hit the market. A short two years and about 300 airplanes later, production ceased.

Today, those Crusaders are found in the hands of individual owners, charter operators, and even flight schools. Embry-Riddle University has



a fleet of Crusaders that serves as a mock airline for training students destined for flying careers. In any hands, the appeal of the Crusader is its big-airplane features at light-twin buying and flying prices.

Those features begin with the cabin. Walking up and into a cabin with an aisle sure beats stepping up onto a wing, down into a cave, and then over seats. The Crusader cabin is well designed, considering its dimensions (nearly square—just under 4 feet high and wide). The four cabin seats are comfortable, although a tad narrow. Legroom is adequate given the popular but knee-knocking club arrangement. There is a stow-away worktable, and refreshment cabinets are tucked between the cockpit and rear-facing cabin seats. The cockpit can be partitioned off by drawing a curtain.

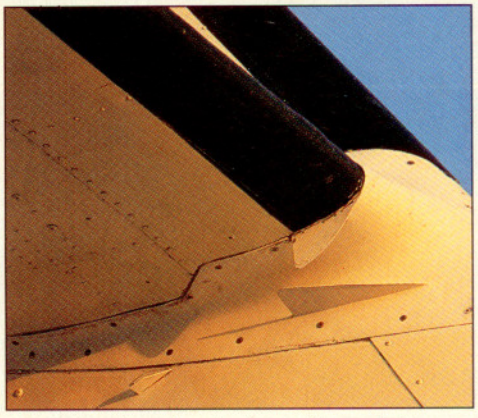
The Crusader has gobs of space to stow baggage, including a pair of generous wing lockers, virtually the entire nose area, and the main baggage hold at the rear of the cabin. Cessna offered an optional cargo door aft of the main door. It's a bit tricky to operate—you have to first disconnect a lanyard from the airstair door—but once it and the airstair door are open, the entire aft cabin is exposed and accessible from the ramp.

The standard avionics package on new Crusaders included Cessna (ARC) RT485 digital-display radios and a 400D autopilot/flight director. Pilots transitioning into the Crusader who have never flown with these Cessna radios may find them to be a little different. One of the fixed-base operations serving Frederick (Maryland) Municipal Airport has a Crusader on the rental line. The first time I flew N1332V, I had to spend a few minutes deciphering the logic behind the tuning and frequency-storage functions of the nav/coms and especially the area nav system. But other than occasional cranky frequency select buttons on the nav/coms and lapses in my own memory on how to set up the RNAV, the radios have performed well.

Vortex generators, flow energizers, and carefully shaped fairing (right) addressed handling woes in light icing conditions.

The Crusader cockpit is superbly designed, definitely one of the best features of the airplane. The large metal panel is artfully shaped and intelligently configured, with plenty of open square footage for additional equipment. Like many Crusaders, 32V was delivered with an optional Bendix RDR-160 color radar.

The dual alternators, dual bus avionics, and electrical system mean that a failure of one alternator or bus isn't a show-stopper; the second automatically shoulders the load. Switches controlling battery and alternators, avionics buses, lighting, and icing



equipment are located on a lower left-side panel above an orchard of pull-out circuit breakers. The fuel selector and crossfeed system is on/off simple. Other evidence of design thought is the emergency gear extension system: Slow to 140 knots indicated airspeed, and put the gear handle down to allow the gear to free fall.

The cockpit is comfortably wide, although on long trips, I've suffered from cramping in my right leg. I think I subconsciously tension the muscles in my right leg to keep from edging off the narrow seat. A half-door on the right side of the cockpit officially functions as an emergency exit; unofficially, it's handy for opening to obtain relief from a broiling cockpit. Visibility out the large, wraparound front windshield is great.

The Crusader I'm used to flying is probably typical of many in the field.

A light twin with heavy-twin aspirations (above). The distinctive cruciform tail is one of the Crusader's identifying features. The horizontal stabilizer rides up and out of wing wake and prop wash.

It is the same airplane today, with the same factory interior and panel as when it left Cessna's Pawnee Division on the East side of Wichita about 10 years ago. The interior is beginning to show its age, and the paint is chipped or worn in spots (it lives outside at hangar-poor Frederick Municipal), but it still is a handsome, inviting presence on the ramp.

Its larger-airplane features notwithstanding, the Crusader still is a light twin. Max ramp weight is 5,175 pounds, about the same as a late-model Piper Aztec and several hundred pounds less than a Beech Baron 58—both of which appear to be smaller than the Crusader. The empty weight of 32V is 3,718 pounds, for a useful load of 1,457 pounds. The two integral wing tanks hold 153 gallons of usable fuel, or about five hours of flying with an hour's reserve. That's generous, but it comes at the expense of payload. Filling the tanks leaves 539 pounds for people and bags. You'd have to sacrifice at least an hour's worth of fuel capacity before even thinking about putting four people aboard.

Like most new-airplane projects, the Crusader was intended to weigh less and carry more than it does. When Cessna's objective shifted from developing a light-light twin to a cabin-class 310/Skymaster replacement, the Crusader began to acquire the accouterments of Cessna's 400-series twins, including interior finishings and heavier but quieter three-blade propellers. Gross weight was increased during the development program to preserve useful load, but the give-back had to come from somewhere. It turned out to be single-engine performance.

A fully loaded Crusader in climb configuration (maximum power, flaps and gear up, and cowl flap open on the good engine) will climb at a rate of about 250 feet per minute on one engine in sea-level, standard conditions, according to Cessna's specifications. In truth, however, don't count on climbing out on one engine in a Crusader except at lower weights. Single-engine handling is helped by counter-rotating props, which means no critical engine, and a low 65-KIAS V_{MCA}.

The Crusader spent an unusually long time in development, partly because the design objectives changed, and partly because some handling problems had to be worked out. Do a careful walkaround, and you'll notice a variety of small fences and other aerodynamic devices, all put there to cure handling ills. One problem was buffeting of the tail when landing with 0 to 10 degrees of flaps. The problem was traced to turbulent air cascading from the inboard portion of the wing and onto the underside of the horizontal stabilizer. That caused loss of down-force. Drooping the wing leading edge inboard of the engine nacelles and adding so-called flow energizers and a wing-fuselage fairing help direct and smooth the airflow over the wing and tail. A buzz felt when flaps were extended to an intermediate setting was cured by putting holes in the flaps beneath the engine nacelles. The rudder buzzed, too,

because of turbulent airflow at the vertical fin/horizontal tail juncture. A fairing took care of that.

Then problems related to deicing equipment surfaced. Cessna began hearing from Crusader operators that, in a descent and with only a small amount of airframe ice, the tail would begin to buzz. Sometimes the airplane would even tuck or pitch down. It took many months, revocation of the airplane's icing certification, and threatened legal action by owners before Cessna was able to identify the problem and solve it. Field inspections showed that some airplanes had poorly installed boots and mis-rigged tail control surfaces. But the larger problem was that, in certain descent configurations in light icing conditions, turbulent air spilling off the stabilizer-fin fairing was buffeting the rudder. In a sideslip, the dirty air could spread across the horizontal stabilizer and pull the elevator down slightly. The fix turned out to be fairly simple: Flow energizers similar to those on the wing were placed vertically and horizontally on the tail, vortex generators were glued to the fin, and the fin-stabilizer fairing was redesigned.

All of the tweaking resulted in a good-handling airplane in most situations. Pitch is a little sensitive, and the Crusader tends to rock and roll in turbulence, making a yaw damper a welcome option. Also, when the center of gravity is toward its aft limit, nose-down trim authority is marginal because of the small size of the elevator trim tab.

The one handling trait that always comes up in conversations about the Crusader is the takeoff. It takes a decent pull on the yoke to unstick the nose, then the airplane suddenly leaps in the air. The pilot quickly has to release some back pressure to lower the angle of attack. I found it takes frequent practice to obtain smooth takeoffs.

The high-mounted stabilizer is not the only culprit here. The wheels and tires are a few inches too far back in relation to the CG. Cessna was aware of the problem but couldn't fix it because to do so would have led to another more embarrassing problem: If bags were loaded into the aft cargo area and passengers then began boarding with no one in the cockpit, the airplane would fall on its tailcone.

Despite the Crusader's beefy trailing-link main gear, I've never been able to consistently grease the airplane onto the runway as I feel I should be able to do. I blame it on sensitive pitch, the placement of the gear, and that high-mounted stabilizer.

Other than those niggling takeoff and landing issues, the Crusader is a pleasure to fly. I find myself nodding in appreciation of the care that went into the design. For example, once the power has been adjusted to the cruise-climb setting of 2,400 rpm, 24 inches, and top of the green for fuel flow (95 pounds per hour, each engine), there is little else to do. The only action required to set up for maximum cruise power as recommended by Cessna (72 percent) is to close the cowl flaps and lean the mixture.

I've found 32V's cruise performance to be close to book. Speeds range from 174 knots TAS at 9,000 feet msl to just shy of 200 knots TAS at 23,000 feet, the highest I have taken it. (It's certified to 25,000 feet.) Block-to-block fuel flow works out to 26 gallons per hour total.

Another nice work-load-reduction feature of the Crusader is the high 175-KIAS limitation on gear and approach flaps extension. It makes it possible to do steep, cruise-airspeed descents or keep-your-speed-up approaches.

Despite their 2,000-hour time between overhauls, the Crusader's engines were not fully mature when the airplane entered the market. Problems including oil leaks, fuel-flow quirks, and turbocharger and exhaust system heat and wear cropped up. A succession of service bulletins and airworthiness directives addressed the problems.

Faster cruise and better weight-carrying capability would be welcomed on the Crusader. Indeed, Cessna had plans to bump the power up to 325 hp a side, but the market went away too soon. It's a shame Cessna didn't have an opportunity to build on the design philosophy that went into the Crusader. Just as it was the progeny of earlier, larger Cessna twins, so too could the Crusader have set the standard for a new generation of smaller Cessna airplanes. □

Cessna T303 Crusader
Current market value:
$123,000–$189,000

Specifications

Powerplants	Teledyne Continental TSIO/LTSIO-520-AE, 250 hp @ 2,400 rpm/32.5 inches
Recommended TBO	2,000 hr
Propellers	McCauley constant-speed, three-blade, 74-in diameter
Length	30 ft 5 in
Height	13 ft 4 in
Wingspan	39 ft .5 in
Wing area	189.2 sq ft
Wing loading	27.2 lb/sq ft
Power loading	10.3 lb/hp
Seats	6
Cabin length	13 ft 7 in
Cabin width	3 ft 11.8 in
Cabin height	3 ft 11.5 in
Empty weight	3,328 lb
Empty weight, as tested	3,718 lb
Max ramp weight	5,175 lb
Useful load	1,847 lb
Useful load, as tested	1,457 lb
Payload w/full fuel	929 lb
Payload w/full fuel, as tested	539 lb
Max takeoff weight	5,150 lb
Max landing weight	5,000 lb
Zero fuel weight	4,850 lb
Fuel capacity, std	155 gal (153 gal usable) 930 lb (918 lb usable)
Oil capacity, ea engine	9 qt
Baggage capacity	aft, 200 lb; nose, 150 lb; wing lockers, 120 lb ea

Performance

Takeoff distance, ground roll	1,275 ft
Takeoff distance over 50-ft obstacle	1,750 ft
Accelerate-stop distance	3,185 ft
Max demonstrated crosswind component	20 kt
Rate of climb, sea level	1,480 fpm
Single-engine ROC, sea level	250 fpm
Cruise speed/endurance w/45-min rsv, std fuel (fuel consumption)	
@ 72% power, best economy 12,000 ft	181 kt/4.8 hr (27 gph/162 pph)
@ 69% power, best economy 24,000 ft	197 kt/5 hr (26 gph/156 pph)
Max operating altitude	25,000 ft
Single-engine service ceiling	13,000 ft
Landing distance over 50-ft obstacle	1,450 ft
Landing distance, ground roll	820 ft

Limiting and Recommended Airspeeds

V_{MC} (min control w/one engine inoperative)	65 KIAS
V_{SSE} (min intentional one-engine operation)	80 KIAS
V_X (best angle of climb)	77 KIAS
V_Y (best rate of climb)	103 KIAS
V_{XSE} (best single-engine angle of climb)	93 KIAS
V_{YSE} (best single-engine rate of climb)	97 KIAS
V_A (design maneuvering)	148 KIAS
V_{FE} (max flap extended)	175 KIAS
V_{LE} (max gear extended)	210 KIAS
V_{LO} (max gear operating)	
Extend	175 KIAS
Retract	150 KIAS
V_{NO} (max structural cruising)	175 KIAS
V_{NE} (never exceed)	210 KIAS
V_R (rotation)	75 KIAS
V_{S1} (stall, clean)	66 KIAS
V_{SO} (stall, in landing configuration)	58 KIAS

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level, gross weight conditions unless otherwise noted.