This is not your father's T-6

The military's newest trainer borrows a familiar name

BY ALTON K. MARSH

Five times between 1992 and 1995 this magazine chronicled efforts to award a contract for a program with a name so boring that narcoleptics had to avert their eyes: Joint Primary Aircraft Training System, or JPATS (pronounced jay´ pats). *Joint* simply means that the Navy and Air Force will use the same airplane, continuing a 60-year tradition of adapting one model for all the services. *Primary* means that this is the first airplane many pilot candidates will ever fly, assuming they had no training prior to entering the service. *Training System* means that the airplane is only the tip of the iceberg. Beneath it lies the heart of the program—the simulators, computerized teaching software, and scheduling systems awarded under a $500 million contract by Raytheon Aircraft, the primary contractor, to FlightSafety Services.

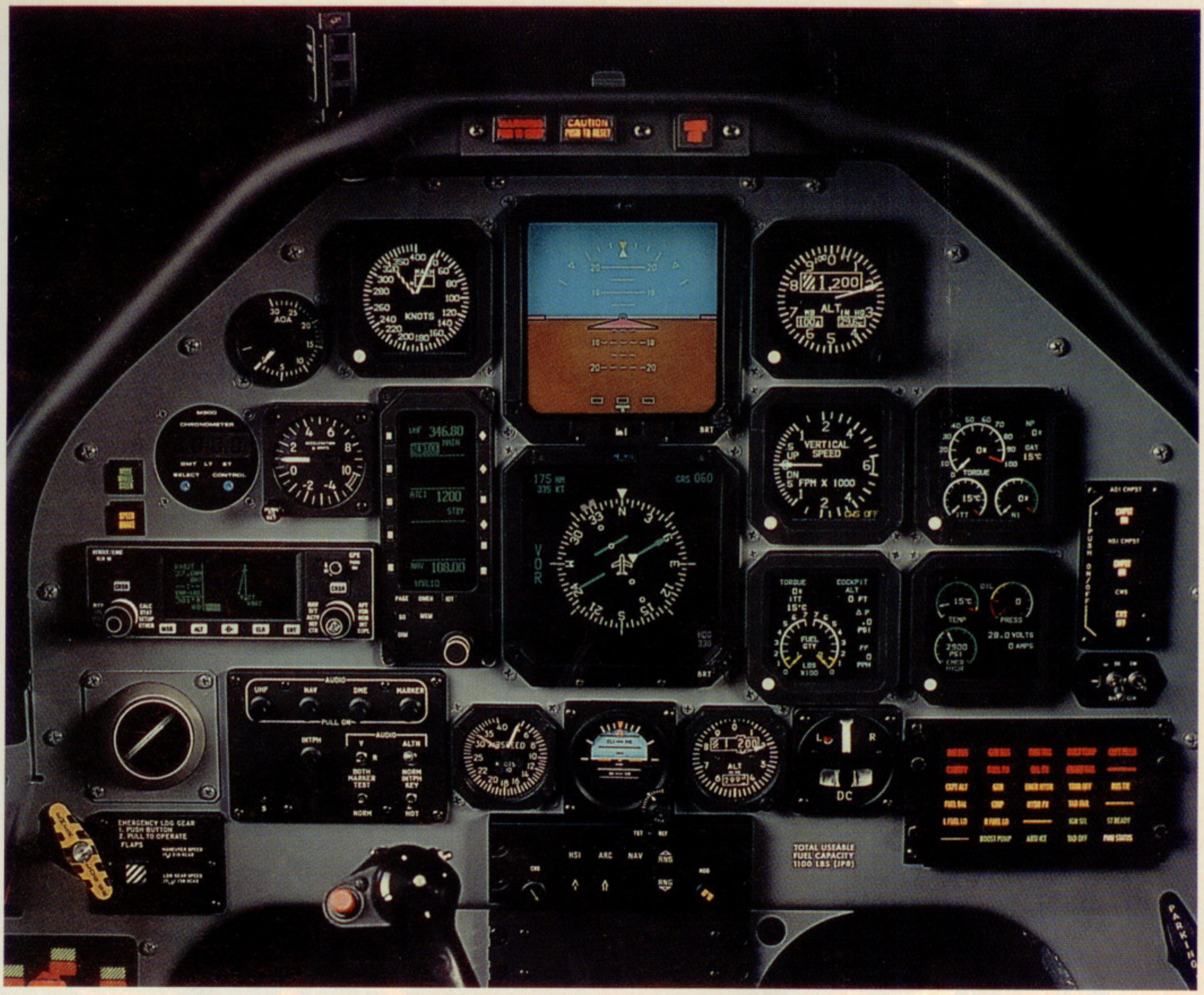
The reason *AOPA Pilot* provides so much coverage of this $5 billion to $7 billion program is that the two leading contractors were both general aviation manufacturers—Cessna Aircraft and Raytheon Aircraft. Additionally, the contract selection was controversial, to say the least. Cessna managers, who offered a twin-engine jet aircraft, thought that they had it locked up. It seemed logical that the Cessna-built T–37B jet now in use by the Air Force would be replaced by another Cessna trainer. In fact, the trade magazine *Aviation Week and Space Technology*—regarded by the aerospace industry as all-knowing—even predicted that Cessna would win, inspiring a similar story in the major newspaper in Wichita, the city where both companies are located. Cessna gloated while Raytheon steamed.

The stories were widely believed—the sort of thinking that a half-century ago led to the erroneous headline "Dewey Defeats Truman." After all, Cessna offered a jet, and Raytheon offered only a turboprop. Who flies props anymore?

But Raytheon officials had reason to be confident, as well. Both the Navy and Air Force used the Beech T–34 Mentor, and it is still in service as the T–34C turboprop with the Navy, where it has a reputation for low-cost operation. It is so economical, in fact, that the Navy will delay use of JPATS aircraft until 2003, while the Air Force will begin using them in 2001. More than 700 will be built.

Unfortunately for Cessna, Air Force procurement officers at Wright-Patterson Air Force Base in Dayton, Ohio, were having difficulty quantifying "best training value," the officers told *Aviation Week*. Unable to define "value" mathematically, they chose instead the aircraft that had the lowest acquisition cost. Asked officially, Air Force spokesmen say only that Raytheon's entry, which the company calls the Beech Mk II, "...met the requirements." Raytheon celebrated its victory over a half-dozen competitors. Cessna officially protested and lost, then parked its trainer prototype in a back lot, where some employees say it awaits the chopping block. Cessna doesn't like to talk about it anymore.

Raytheon managers had a secret. Not only had they based their entry on a proven trainer, the Swiss-built Pilatus



PC-9, but they could make it perform like a jet.

Among the tricks used to make the aircraft perform that way is the Raytheon Aircraft computer in the rear fuselage that constantly adjusts the rudder trim tab. By so doing, it erases most of the torque created by the Pratt & Whitney PT-6 engine's 1,100 horsepower and the 8-foot, four-blade Hartzell propeller—no matter what the flight conditions. With no prop swinging, jets don't exhibit torque the way prop aircraft do. Another computer—this one designed by Pratt & Whitney engineers—eliminates more than half of the 7-second lag between the time the pilot requests full power and the time the engine actually delivers it.

Air Force training officers were concerned that a student would encounter a crosswind during a takeoff run at exactly the time full power—and thus full torque—kicked in, leading to a loss of control. In addition, propeller controls have been combined in a single thrust lever, simplifying the workload.

> **Raytheon officials got the last laugh on aviation writers who predicted the T–6 would lose the JPATS competition.**

When Air Force and Navy officers flew the aircraft, they were also delighted that they could not see the propeller, further creating the illusion of being in a jet. The result is an aircraft that sounds like a jet and flies like a jet.

Thank goodness the boring names are gone. *JPATS* just isn't catchy, while *Beech Mk II* sounds like a business jet with gold faucets in the lav. The military has chosen a new name by which the aircraft will be forever known—the T–6A Texan II—a name based on the original AT–6 Texan World War II trainer. But, as an ad campaign once said, this isn't your father's Oldsmobile.

There are only two ways you'll ever get to fly the nation's hottest new trainer. One is to be an aviation reporter or a top-ranking training officer and take a demo ride, and the other is to join the military. However, you need to be 17 or under this year if you want to train when the T–6A is in use. Let's cut to the chase: You'll find this electronically complex aircraft easy to fly, and you'll like it.

AOPA Pilot was invited to fly the aircraft last February. I had never flown a turboprop or turbine aircraft before, let alone an aircraft with 1,100 horsepower. That put me in the same category with many of the students who will fly it—a good candidate to test its teaching skills.

There is, in fact, an intimidation fac-

tor as you approach the aircraft for the first time. It is a jet, even if it has a propeller out front, and there are more switches and blinking screens than in any average general aviation aircraft. But length and wingspan dimensions are strikingly similar to those of any general aviation aircraft. That first step up onto the wing isn't all that high, and the cockpit is easily entered.

Congress demanded that the cockpit be designed for smaller-frame women as well as men, but the limiting factor is the rocket-powered ejection seat. Martin-Baker ejection seat engineers in England say that they can accommodate pilots from 103 pounds on up. (The prototype flown could accommodate only pilots weighing at least 116 pounds.) When they tried an experiment with an 88-pound person, as some nonpilots in Congress originally demanded, they found that the person was too short to open the canopy.

"I would appreciate it if you would let me eject first, so that I am not burned by your rocket motor," Raytheon Aircraft pilot and former Air Force instructor Jim DeGarmo said. In an ejection, you'll blow right through the canopy, which will be detonated by

Some in Congress, unfamiliar with ejection seats, demanded that it accommodate 88-pound pilots.

a primer cord milliseconds before your face arrives.

A crank between the knees on the center panel adjusts the rudder pedals forward or backward—again, to accommodate both men and women pilots. Bringing them a little farther forward than "comfortable" provides better leverage on the rudder pedals.

Slip into the Raytheon-supplied flight boots and flight suit. Don the helmet, fasten the oxygen mask by using its metal slide bar on the right side, lock down the visor, and suddenly you're John Wayne in *Jet Pilot,* the 1950s movie on late-night TV. The mask induced a bit of claustrophobia, as it does for many pilots new to it. (I readjusted it in flight, and that was a mistake.)

After the canopy is closed, a pin is removed from the ejection seat (it performs the same function as the pin in a grenade) and is stowed in a hole in the canopy handle. Time to go.

Put the throttle in Autostart and push the spring-loaded Start switch forward once; it's just ahead of the Battery switch on the right lower panel. From then on, the start is computer-controlled and will abort in the event of a problem. As the engine speed reaches 45 percent, move the throttle to Idle, and that's it. A satisfying roar indicates that the turbine is lit and ready. Taxi 50 feet to the runway (at the Raytheon Aircraft factory in Wichita) and line up. No engine runup is needed.

Set power to 30 percent, hit the red button on the control stick to switch off nosewheel steering, apply full power, and release the toe brakes. The rudder becomes immediately effective from the blast provided by the propeller.

The view down that long nose, looking like a long-neck Texas beer bottle, is mesmerizing; white runway stripes accelerate toward the aircraft faster than I've ever seen before. Only ounces of right rudder pressure are required to tame the torque from 1,100 horses. The trim-aid device (TAD) computer calculates torque, airspeed, pitch rate, and altitude; compares it with a database of possible rudder-tab settings; and trims to that position. The propeller and fuel controls have been eliminated and are controlled automatically by the thrust lever.

"85 knots," DeGarmo calls out. That came fast, and I finally rotate at 90. The gear handle is just ahead of the throttle on the left, while the flap level is just below and to the right of the throttle. The flaps come up from the Takeoff position, but the pitch attitude remains constant during their movement.

DeGarmo asks for a pitch-up angle of only 5 degrees and a level-off at 800 feet, since Wichita's Mid-Continent Airport airspace overlies Beech Field. That is followed by a quick left turn to remain clear of McConnell Air Force Base. Power is brought back to 80 percent to keep the speed below 250 knots under 10,000 feet. The active-matrix liquid-crystal display shows a picture of an attitude indicator that moves as smoothly as the real thing. (It washes out considerably in bright sunlight.)

Floating out over the Wichita suburbs after takeoff, the T-6A provides a ride that is airliner smooth. The right wing seems a little heavy, so the coolie-hat switch on the stick is depressed and moved to the left to change aileron trim. For elevator trim, slide the same cone-shaped switch forward and back. There's a rocker switch on the forward side of the throttle, under my middle finger, for fine-tuning the TAD. The slip indicator ball is never more than halfway out of center, though, so I eventually ignore trimming the TAD.

Once clear of Class B airspace, DeGarmo calls for a climb angle of 15 degrees and full power. Climbing at 3,600 feet per minute, we reach 15,000

It climbs like a rocket and has impressive speed, all the better to attract and keep new trainees.

feet in 4 minutes, five times faster than the 1950s-technology Air Force T-37 "Tweety Bird." The 3.5-psi pressurization system will keep the cabin at 8,000 feet. The military planners actually wanted 5 psi, but they didn't get it. I loosen the oxygen mask, trying to ease a panicky closed-in feeling, but it begins to slide down my nose, so I tighten it again, accidentally positioning it off the left side of my face. A short time later, I realize I have closed down the right nostril. It is difficult not only to breathe, but sometimes to talk. I decide I can live with it. After all, John Wayne would never have let the mask bother him.

When the aircraft is rolling gently left and right, the controls are quick to respond, but not as light as those found in aerobatic aircraft, such as a Decathlon, Extra 300L, Pitts S2B, or Giles 202. Stalls produce no anxiety at all, breaking gently straight ahead. The TAD must be working like crazy. Time for a loop.

"Umm onna oop now," I tell DeGarmo, trying to talk through the now-misaligned oxygen mask. With the TAD on (there's an On-Off switch on the lower left panel), it should be possible to fly a loop with feet flat on the floor. At 230 kts, I bring the stick straight back with about a 4-G pull, but the aircraft seems sluggish.

Actually, that's an illusion. The problem is the higher airspeed. I am simply drawing a larger loop in the sky than that made in slower aerobatic aircraft previously flown. Now the aircraft is climbing—but straight up, like the space shuttle. And we're still not looping. In an effort to help the aircraft bend over the top, I maintain the 4-G pull well past the point where pressure is normally reduced in any loop to allow the aircraft to "float" over the top. Finally upside down on top of the loop, and still pulling hard, the aircraft begins to shudder. A stall? You bet. The aircraft suddenly torque-rolls right-side up; the loop has ended as an unwanted Immelmann. And here I am in straight-and-level cruise again, a little low on airspeed. The aircraft is only 10 degrees off heading, though, thanks to the trim-assist device.

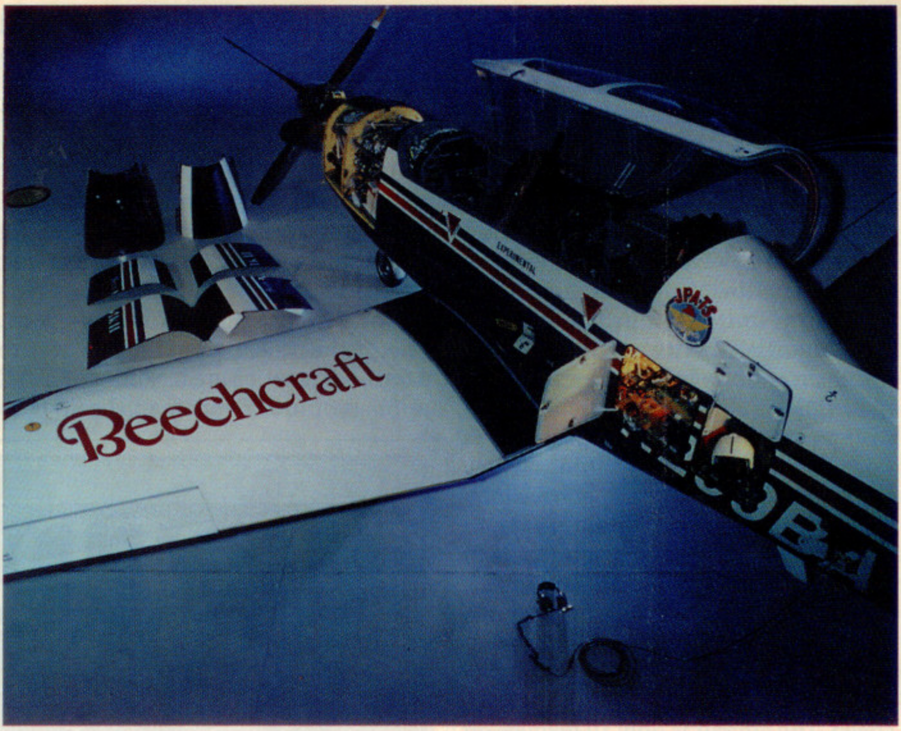
Another loop attempt. This time, I remember that big speed equals big loop. Most of my previous loops in smaller aircraft have required only 900 feet of altitude. This aircraft does 3,000-foot-high loops. (The T–38 jet starts a loop at 500 kts and makes a 10,000-foot loop.) I turn the trim-assist device off, keeping my feet off the rudders once again, but use both hands on the stick to overcome that stiff feeling resulting from deflecting controls into a 230-knot relative wind. The ground disappears beneath the nose, and I turn my attention to the wing to determine when the aircraft is approaching the top of the loop. This time I ease up on stick pressure. Good; we're floating over the top and heading down the back side. Now pull the same amount of Gs used to enter the loop and recover to level flight.

Not bad, except for one thing. Using two hands, I've pulled 5.3 Gs. Just three-tenths of a G more and Raytheon Aircraft has to tear down and inspect this $5 million prototype. (Since it is a prototype, it probably cost many times more than that.) As I had expected, without the trim-assist device, I end up 25 degrees off heading.

It is difficult to spin the T–6A unless the stick is held fully back and the rudder depressed completely to the floor after a stall. Otherwise, it pops right out—not a bad safety trait in a trainer. To prepare for the spin, power is brought to idle and the stick is eased back to maintain altitude. I wait until the airspeed drops near 85 knots or so and lead the spin entry with full left rudder, quickly bringing the stick back the rest of the way. The T–6A turns out to be a speedy spinner.

With half a turn remaining before returning to my original heading, I apply partial opposite rudder and wait to release back pressure until the original heading whirls into view again. There's the other end of the lake we are using as a practice area. Now I apply full opposite rudder and snap the stick to neutral. Too little, too late. I am a full 180 degrees off heading. I try it a few more times and am finally able to stop on a general heading even after a four-turn spin. The trainer has taught me something: Start anti-spin control inputs early.

Next comes inverted flight. Roll left, stop upside down, and push the nose up to find the level-flight attitude. But the aircraft keeps climbing, so I keep lowering the nose. "Thirty seconds," DeGarmo finally says, and I roll upright quickly. The problem is the limited



amount of fuel in the smaller aerobatic tank up front, used only for inverted flight. The real T–6A will have a 45-second inverted capability, but the prototype is limited to 30.

During the preflight DeGarmo had said that the Pilatus PC–9, before the Raytheon Aircraft improvements, would torque-roll upside down before it would recover from an accelerated stall to the right. Not even full deflection of controls could stop the roll. To find out whether the aircraft has been tamed, I slow to about 160 knots, bank into a steep turn, and add Gs suddenly—sure enough, it attempts to flip over on its back; but rapid use of left rudder and left stick does in fact stop it and return the aircraft upright.

Playtime is over, and here I am at 17,000 feet. How to get down? Speed brake out (a door underneath the fuselage that opens downward, creating drag), power nearly to idle, I pitch down to a descent rate of 5,000 fpm at a speed of 200 knots. DeGarmo says that I have stumbled onto what the Air Force calls a penetration descent—one that reduces exposure to ground fire. During that rapid descent, I test the instrument-flying capability of the aircraft and find it easy to hold a heading or to make turns to new headings while continuing the screaming descent.

Ahead lies what for many pilots is the primary test of any new aircraft, the landing.

DeGarmo reminds me that he wants 120 knots on downwind, 110 on base,

Landings are simple once you overcome the tendency to flare high and adjust to the 100-knot approach.

and 100 on final. (Equalization of pressure in the ears does not keep up with the descent, and with my ears stopped up, the only airspeed I hear clearly is 100.) Seeing that I am flying 20 kts too slow in the pattern, DeGarmo has to repeat the correct airspeeds. Landings, as it turns out, quickly prove not to be difficult for the average general aviation pilot, even on that very first one, and require only small throttle adjustments. There is basically one lever to adjust—the thrust lever—which allows more time to focus on maintaining the proper airspeed.

For landing, the Navy uses an angle-of-attack indicator, three lights on the canopy. Basically, they mean you're too hot (fast), too cold (slow), or just right. The Air Force method, however, is to keep the speed on 100 and the aircraft on the visual approach slope indicator, which sounds more familiar.

My first flare is too high, as was the case with several other pilots who took the demo ride before me. It is probably due to the false perspective provided by the needle-shaped nose. The landing is still decent, however.

Now, let's see about that torque at takeoff. Full power. The flaps can be left down, something else that the student does not have to worry about. Three seconds later the engine kicks in, just as on a jet. Pratt & Whitney's power management system eliminates not only spool-up lag, but over-torque and over-temp problems. It is programmed to make the engine perform like those on the Beech T-1A Air Force trainer.

The second and third landings show that I have the landing attitude figured out but need to work on slight ballooning. Still, the touchdowns compare well

Is the Texan II too complex to fly, with its many computers, or do the computers make it too easy?

with those made in more familiar aircraft. There is one final test, however. If I pass it, I can prove that I am better than at least one Navy pilot out there.

Will I blow the tires? The brakes are almost too effective. An experienced Navy commodore, who shall remain nameless, landed after a demo last December and blew a tire. That is easy to do. They are narrow tires off a T-38 jet and have little "give," since they are pressurized to 175 pounds. They can withstand a touchdown descent rate of 780 fpm, which is like coming down a normal 3-degree glideslope and simply not flaring—as a student might. The gear is tough enough to take simulated carrier landings, but I am rewarded with a squeaker. To outdo the commodore, I decide to let it roll all the way to the end of the 4,700-foot runway, avoiding any embarrassment from blown tires.

The fuel difference between the two tanks is only 50 pounds, meaning that the TAD and I must have used the rudder correctly during most of the flight. Earlier demo pilots have reported only a 100-pound difference.

The final verdict? Raytheon Aircraft has created a trainer that the average general aviation pilot can easily master, one the military is already praising. Air

Force JPATS program managers find the airplane to be "like a sportscar," while Navy managers say that it is "fun to fly." Instructors will need about 10 hours of training and 30 hours of ground school to master it.

Some critics say it's too complicated for the poor trainee, but the same comments were made in the 1940s about your father's T–6. No, you don't have to be John Wayne to fly the Texan II. □

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Beech/Pilatus T–6A
Price (depending on quantity built and configuration):
$2 million to $4 million

Specifications

Powerplant	Pratt & Whitney Canada PT6A-68, 1,100 shp
Recommended TBO	4,500 hr
Propeller	Hartzell, four blade, constant speed (2,000 rpm), 96 in dia
Length	33 ft 4 in
Height	10 ft 8 in
Wingspan	33 ft 5 in
Wing area	175.3 sq ft
Wing loading	35.7 lb/sq ft
Seats	2, tandem
Empty weight	4,600 lb
Maximum takeoff weight	6,300 lb
Fuel capacity	164 gal (164 gal usable) 1,100 lb (1,100 lb usable)
Fuel capacity, w/wing tanks	224 gal (224 gal usable) 1,500 lb (1,500 lb usable)
Oil capacity	16 qt
Baggage capacity	120 lb

Performance

Takeoff distance, ground roll	1,400 ft
Takeoff distance over 50-ft obstacle	2,000 ft
Max demonstrated crosswind component	24 kt
Landing distance, ground roll	1,900 ft
Landing distance over 50-ft obstacle	2,400 ft
Rate of climb, sea level	4,000 fpm
Service ceiling	35,000 ft
Maximum level speed, sea level	310 kt
Cruise speed/endurance w/45-min rsv, std fuel (fuel consumption) @ 7,500 ft, 75% power, best economy	230 kt/3 hr

Limiting and Recommended Airspeeds

V_Y (best rate of climb)	140 KIAS
V_A (design maneuvering)	210 KIAS
V_{FE} (max flap extended)	150 KIAS
V_{LE} (max gear extended)	150 KIAS
V_{LO} (max gear operating)	150 KIAS
V_{MO} (max operating speed)	320 KIAS
V_{NE} (never exceed)	320 KIAS
V_R (rotation)	85 KIAS
V_{S1} (stall, clean)	82 KIAS
V_{SO} (stall, in landing configuration)	74 KIAS

For more information, contact Raytheon Aircraft Company, 9709 E. Central, Post Office Box 85, Wichita, Kansas 67201-0085; telephone 316/676-4770.

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.