GOLDEN EAGLE

Giving the propjet salesmen a run for their money

BY MARK M. LACAGNINA

PHOTOGRAPHY BY ART DAVIS

Five years ago I would have been willing to place a small wager, a quarter maybe, that Cessna Aircraft's Model 421, the Golden Eagle, the flagship of the general aviation piston fleet, would have been in mothballs by now, swept aside by new technology and ushered into retirement by the heady whines of a new generation of fuel-thrifty propjets. The superior single-engine capabilities of the new propjets and the incredible reliability of their turbine engines should have knocked the proud old bird right off her roost. At least, that is what the propjet salesmen were saying.

I would have lost that quarter. The propjets have ruffled a few feathers, but the Golden Eagle still is patrolling its territory, the middle altitudes that suit the needs of many corporate and air-taxi operations. Pound for pound, no other airplane can match the 421's fuel-efficiency at altitudes in the high teens and low and middle twenties except, perhaps, the Beech Duke. This is not the best place for the propjets; they like higher, thinner air. Getting there costs an extra quarter of a million dollars up front.

Indeed, it is the newer propjets that have been feeling the sting of the Golden Eagle's talons. In 1981, for instance, deliveries of Cessna's 421

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and Model 425 Conquest I (née Corsair) propjet were matched at 100 each. In comparison, Beech delivered 68 King Air C90s, and Piper shipped 37 Cheyenne Is that year.

The Golden Eagle is different things to different people, depending on where they sit. Pilots like the airplane's straightforward flying characteristics, the well-appointed office and, when properly equipped, its mission capability. Passengers like the so-called wide-oval cabin. There is a lot of room to stretch out and no need to shout to get a message across. The geared engines and the slow-turning propellers are quiet and unobtrusive. And there are plenty of options available to keep the passengers happy.

The 421 has been in production for more than 16 years and has undergone quite a bit of development. It was the second in Cessna's line of 400-series twins, preceded in 1965 by the 411, an unpressurized, 6,500-pounder powered by 340-hp Teledyne Continental GTSIO-520 engines (geared, turbosupercharged, fuel injected, opposed, 520 cubic inches displacement). The 421, however, was on the drawing boards before the 411 was unveiled.

Pressurization of general aviation airplanes was in its infancy at the time, and Cessna designers came up with a tough pressure vessel. It looks very much like the basic structure of the vessel was bandaged in aluminum by a first-year medical student. The idea was that, if in the unlikely event the vessel were ruptured, the resulting tear could not progress very far. Before giving it their blessing, the vessel was subjected by Cessna engineers to more than 25,000 pressurization cycles simulated in a huge water tank, under the watchful eyes of the FAA.

The 421 earned its type certificate in May 1967. The airplane weighed 6,800 pounds at gross and was powered by 375-hp GTSIO-520-D engines with recommended time between major overhauls (TBO) of 1,200 hours. Gross weight was 6,800 pounds, and standard fuel capacity was 170 gallons—100 in the tip tanks and 70 in the wing tanks. Cessna hung a price tag of $160,000 on its new twin (this was $40,000 less than the 421's nearest pressurized competitor, Aero Commander's Lycoming-powered Grand Commander) and sold more than 200 of them during the first 18 months.

The A model appeared in 1969 with a slightly higher maximum takeoff weight and useful load. The 421A also had a seventh seat and an overboost

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relief valve for its turbosupercharger.

There were some big changes in store for the airplane the next year, the least of which were a new model designation, 421B, and the name Golden Eagle. The nose was extended two feet to make more room for baggage and avionics equipment. Wingspan also was increased two feet, and each engine was moved 12 inches farther away from the cabin to reduce noise. Max takeoff weight was increased from 6,840 to 7,250 pounds, useful load from 2,588 to 2,890 pounds. The airplane also received another seat and heavy-duty brakes and wheels.

By 1975, maximum cabin pressure differential had been raised from 4.2 to 4.4 and then to 5.0 pounds per square inch. Max takeoff weight had increased to 7,450 pounds, and the cabin had grown 16 inches to sport a fifth side window. That year, the Federal Aviation Administration granted approval for flight into known icing conditions should the airplane be equipped properly. Maximum rudder travel was increased from 25 to 32 degrees, and Vmc was lowered from 87 to 82 knots.

The Golden Eagle emerged the next year without tip tanks. The wing was totally redesigned from the nacelles outboard. The smooth contours of the new wet wing, holding 206 usable gallons, were achieved with metal-to-metal bonding. For pilots fond of the familiar, rakish tip tanks, the airplane's new appearance may have been somewhat disappointing, but the simplification of fuel management and the improved visibility surely were not. In addition, both the vertical fin and the rudder were lengthened 10 inches to improve single-engine controllability, and the landing gear was rerigged for faster retraction.

The C model was introduced in 1978 with published maximum weights for both ramp and takeoff. This allowed operators to load an extra 50 pounds of fuel for starting, taxiing and runup.

Two years later the 421C arrived, ever so softly, on trailing-link main landing gear. The recommended TBO of the big, geared engines was raised from 1,200 to 1,600 hours.

The fuel-injection system was reworked in 1981. A seventh nozzle was incorporated to prime the engine for starting, and an oil line was routed through the fuel-injection manifold valve. The oil line warms the manifold cavity and helps to prevent the formation of ice crystals. (Addition of anti-icing compounds such as ethylene glycol monomethyl ether, which is marketed under the trade name Prist, and isopropyl alcohol also is approved. However, recommended mixing procedures should be adhered to strictly. If too much alcohol is added to the fuel, for instance, tank sealant materials may begin to deteriorate.)

Golden Eagle production was suspended for 1983. At this writing, Cessna was considering early introduction of the 1984 model, with production to be resumed as early as this fall. Our evaluation airplane, N6787L, is a 1982 model and is typically equipped.

For starters, it is what Cessna calls a Golden Eagle III, which for a base price of $603,900 includes standard items such as a Cessna ARC 800B integrated flight control system; dual 1,000-series communication and navigation radios; a 1,000-series ADF, glideslope receiver, radiomagnetic indicator, DME and area navigation systems; an 800-series transponder and encoding altimeter with alerting and preselect features; a radio altimeter; a Bendix RDR-160 weather radar system; and a cabin air conditioner.

The list price (remember, these are 1982 figures) for N6787L was boosted to $662,175 with a seventh seat, a second transponder, color weather radar display, a known-icing package (heated props, wing and empennage boots, heated windshield and static ports, ice-detection light and fuselage ice-protection plates), a left wing-locker fuel tank, special interior lighting, refreshment center, writing tables and a biffy—to name a few of the major op-

tions. If someone had handed me a blank check, I would have added a radio telephone, $6,820, and a fire detection and extinguishing system, $4,475.

The 421C is a sophisticated and complicated airplane, and quite a bit of time is required to do a good job in preflight preparation. A mechanical rudder gust lock is optional. The engage/disengage handle is mounted on the tailcone, above the stabilizer, and is out of reach for average-size pilots; but the lock pin can be released by lifting the elevator or hauling back on the yoke. The cavernous nose and aft cabin baggage compartments provide loading flexibility, and a thorough weight-and-balance calculation should

be accomplished before each flight. A well-equipped Golden Eagle can carry more than 2,000 pounds of fuel, people and baggage; and the pilot must ensure that the airplane does not exceed the maximum certificated zero-fuel weight (6,733 pounds), maximum ramp weight (7,500), takeoff weight (7,450) or landing weight (7,200 pounds).

There are two ways to start the engines. Standard procedure employs the seventh nozzle in the fuel-injection system. The throttle is cracked and the mixture control is placed in the aft, Ground Start position. The primer is activated for four to eight seconds and held while the starter is depressed. When rpm and fuel flow stabilize, the primer is released and the mixture control advanced to full rich. This worked well for our evaluation airplane's left engine, but the right one for some reason preferred the alternative method. With the fuel mixture full rich, the primer and starter are activated together and released when the engine catches.

I was surprised by the agility the big airplane demonstrated on the ground. I had to pull the throttles all the way back to idle to avoid riding the brakes. The nosewheel steering system, which is operated by the rudder pedals, was adequate for all but the tightest taxi maneuvers.

The pilot's information manual calls for full power, 39 inches and 2,235 rpm, to be applied before brake release. However, when runway considerations are not crucial, wear and tear on the brakes and propellers can be avoided by stabilizing power at 32 inches, releasing the brakes and feeding in full power slowly and smoothly on the takeoff roll. Acceleration is brisk.

An airspeed of 100 knots is recommended for the first 50 feet. Best rate-of-climb speed is 111 knots, which also is the best single-engine ROC speed. Recommended cruise-climb speeds are 115 to 140 knots at 32.5 inches and 1,900 rpm. The handbook provides time-, distance- and fuel-to-climb information for 120 knots. I found this provides good performance, adequate engine cooling and good visibility over the sloping nose.

Experienced 421 operators say the best way to manage the engines is to treat them with tender, loving care (this includes knowledgeable and respectful power management and a comprehensive program of routine maintenance) and to run them hard. Ideally, there should be only four power changes between takeoff and final approach: full power for initial climb; 32.5/1,900 for climb and cruise; 23/1,800 for descent; and 23/1,900 for initial approach. (According to FlightSafety International, a propeller speed of 1,800 rpm can interfere with a glideslope signal.)

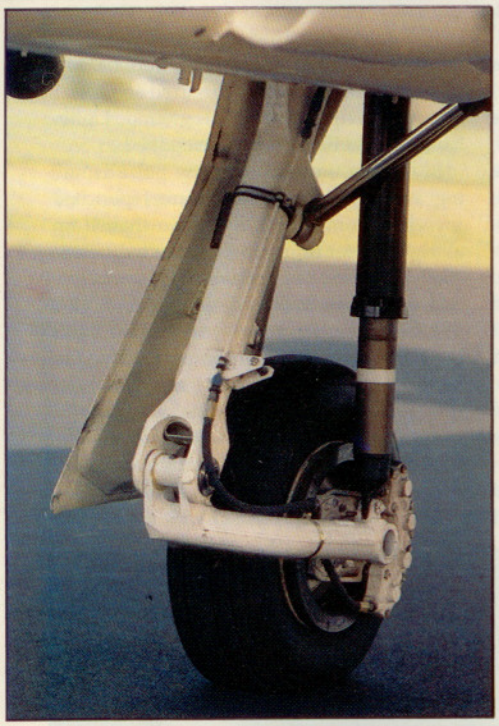
Under standard conditions at a pressure altitude of 25,000 feet, 32.5/1,900 provides a true airspeed of 236 knots and a fuel flow of 257 pounds per hour. (Here I must hedge a bit as I found 1,800 rpm to provide a smoother and quieter flight with little change in performance.) At Flight Level 250, cabin altitude is maintained at a comfortable 9,000 feet. With supplemental oxygen aboard, the airplane may be operated up to 30,000 feet. Cabin altitude up there is 11,950 feet.

At 23/1,800 and 180 knots, the 421C descends about 1,110 fpm while burning about 166 pounds of fuel per hour. Leveling off and dropping 15 degrees of flap provides an initial approach speed of 120 knots. Pull off two inches of manifold pressure, and the airplane will carry that airspeed right down the glideslope. Standard procedure is to use full flaps, some power and 111 knots right into the flare.

The importance of transition training cannot be overemphasized, especially to pilots used to flying lighter twins. The 421's handling qualities defy its size, and power management during approach is critical. On one approach, I inadvertently reverted to some Piper Seneca flying habits and bled too much power off too soon. The Golden Eagle acknowledged this indiscretion with a high sink rate. It took a lot of power to straighten things out.

Pilot staffers flew N6787L on several trips of various stage lengths, in fair weather and in foul. We found the airplane capable, comfortable, stable and exciting to fly. (Just walking up to the big, handsome airplane with keys in hand is enough to get the adrenaline pumping.) It also is a demanding airplane. Taken separately, the various systems are straightforward and relatively simple to manage. Taken together, the systems require a lot of thinking and planning. Initial training with FlightSafety comes with the airplane (see "Dress Rehearsal," p. 42), and we believe strongly that time and money for regular recurrent training should be included in the airplane's operating budget.

We have a couple of rather minor nits to pick with the airplane. One is that the otherwise excellent interior lighting system does not include a suitable map light for the pilots. The lights in the



Cessna 421C Golden Eagle

Base price $489,250

Price as tested $662,175

AOPA Pilot Operations/Equipment Category*:

IFR $575,000 to $650,000

All-weather $665,000 to $692,000

Specifications

Powerplants	2 Teledyne Continental GTSIO-520-N
	375 hp @ 2,235 rpm and 39 in Hg
Recommended TBO	1,600 hr
Propellers	McCauley three-blade, constant-speed, full-feathering, 90 in dia
Length	36 ft 4.6 in
Height	12 ft 11 in
Wingspan	41 ft 1.5 in
Wing area	215.02 sq ft
Wing loading	34.8 lb/sq ft
Power loading	9.9 lb/hp
Seats	6 to 8
Cabin length	15 ft 9.9 in
Cabin width	4 ft 7 in
Cabin height	4 ft 2.9 in
Empty weight	4,668 lb
Empty weight, as tested	5,375 lb
Max ramp weight	7,500 lb
Useful load	2,832 lb
Useful load, as tested	2,125 lb
Payload w/std fuel	1,596 lb
Payload w/full fuel, as tested	721 lb
Max takeoff weight	7,450 lb
Max landing weight	7,200 lb
Zero fuel weight	6,733 lb
Fuel capacity, std	1,280.4 lb (1,236 lb usable) 213.4 gal (206 gal usable)
Fuel capacity, w/opt tanks	1,621.2 lb (1,572 lb usable)
Oil capacity, ea engine	270.2 gal (262 gal usable) 14 qt
Baggage capacity, std	1,500 lb, 82 cu ft
Baggage capacity w/wing locker tanks	1,100 lb, 66.6 cu ft

Performance

Takeoff distance, ground roll	1,795 ft
Takeoff distance over 50-ft obst	2,285 ft
Accelerate/stop distance	3,630 ft
Accelerate/go distance	4,960 ft
Max demonstrated crosswind component	17 kt
Rate of climb, sea level	1,950 fpm
Single-engine ROC, sea level	345 fpm
Cruise speed/Range w/45-min rsv, std fuel (fuel consumption, ea engine)	
@70% power, recommended lean	
15,000 ft	210 kt/840 nm (246 pph/41 gph)
20,000 ft	220 kt/865 nm (246 pph/41 gph)
25,000 ft	231 kt/905 nm (246 pph/41 gph)
@60% power, recommended lean	
15,000 ft	196 kt/925 nm (214 pph/35.6 gph)
20,000 ft	205 kt/960 nm (214 pph/35.6 gph)
25,000 ft	214 kt/1,000 nm (214 pph/35.6 gph)
Max operating altitude	30,000 ft
Single-engine service ceiling	14,900 ft
Landing distance over 50-ft obst	2,300 ft
Landing distance, ground roll	725 ft

Limiting and Recommended Airspeeds

Vmc (Min control w/one engine inoperative)	80 KIAS
Vsse (Min intentional one-engine inoperative)	100 KIAS
Vx (Best angle of climb)	88 KIAS
Vy (Best rate of climb)	111 KIAS
Vxse (Best single-engine angle of climb)	105 KIAS
Vyse (Best single-engine rate of climb)	111 KIAS
Va (Design maneuvering)	151 KIAS
Vfe (Max flap extended) 15°	176 KIAS
45°	146 KIAS
Vle (Max gear extended)	176 KIAS
Vlo (Max gear operating)	
Extend	176 KIAS
Retract	176 KIAS
Vno (Max structural cruising)	201 KIAS
Vne (Never exceed)	240 KIAS
Vs1 (Stall clean)	86 KIAS
Vso (Stall in landing configuration)	77 KIAS

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

**Operations/Equipment Categories are defined in June 1983 Pilot, p. 96. The prices reflect the costs for equipment recommended to operate in the listed categories.*

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pilots' overhead console are weak and distracting. We would like to see the overhead bulb made smaller and more powerful. Perhaps a smaller light also could be fitted under the yoke. We also did not feel comfortable with the instruments provided for leaning engine fuel/air mixtures. The 421C has exhaust gas temperature (EGT) gauges, which simply provide reference points for leaning. Although EGT gauges are less expensive and require less maintenance, we would prefer turbine inlet temperature (TIT) gauges, which provide pilots more useful information.

We encountered one incident that is worthy of mention. During a low, twilight approach in a moderate rainfall, water clung to the windshield and severely distorted forward vision. Editor Ed Tripp was doing the flying at the time and managed to pick out enough visual cues to complete the circling approach and to land. We suspect that the windshield had not been cleaned nor treated properly and was covered by an oily film (the 421 information manual states that only a cleaning solution of isopropyl alcohol and water and an aftertreatment of Turtle Wax, a liquid automotive wax, should be used on an electric windshield). The chief pilots for two fastidious 421 operators—Cessna's Air Transportation Department and Frederick Aviation in Maryland—said their windshields are kept adequately clean simply with water applied by the palm of the hand or with a clean, soft cloth. This also prevents inadvertent application of cleaning agents and waxing compounds not suitable for the 421's windshield.

In the past seven years, seven airworthiness directives have been issued for the 421C. The directives required

GOLDEN EAGLE: DRESS REHEARSAL

When the curtain rises, you'd better be ready.

It is an unusually hot night; the OAT indicates ISA plus 15°C. The 421C is loaded to gross. The runway is only 4,000 feet long, and there is a big hangar off the departure end. According to the pilot's information manual, we should be airborne after using up about 2,100 feet of concrete. Rotation speed is 95 knots. The charts show 4,010 feet for accelerate/stop and (oh, lordy) 12,210 feet for accelerate/go. The manual indicates that I should be able to coax a 240-fpm climb on one engine. That is, if I do everything exactly right. No promises expressed nor implied.

Obstruction lights atop the hangar wink menacingly as I taxi the big piston twin into position on the runway. Okay, if I lose an engine before the gear comes up, I'll put her back down. . .somewhere. (The parking lot on the side of the hangar looks to be clear.) If an engine quits after the gear is on its way up, we'll fly.

I nudge the throttles forward and let the power stabilize at 32 inches manifold pressure. I glance at the instrument gauges. Everything is in the green, so I ease the throttles to the stops and release the brakes. The airplane slingshots forward and the airspeed indicator comes alive: 70. . .80. . .90. I pull the nose 10 degrees above the horizon and snap up the gear. . . .

The airplane lurches like a drunk and veers to the right. I stomp on the left rudder pedal and bring the nose down to the horizon, the wings level. Let's see now, dead foot—dead engine. Yup, it's the right one. I reach for the right throttle. . . . Too late. My ears are assaulted by the agonized sounds of a propeller ripping into the ground. Lights have stopped flashing by. I've crashed.

My palms are sweating, my pulse is racing and my thigh aches where I punched myself in contempt. Other than that, I am all right. I peer imploringly at the indifferent stars above and beg for another chance.

A voice replies, "No sweat. Here we go." I'm back on the runway centerline, and both engines are humming peacefully. The hangar lights are winking. I try again, and this time something in the annunciator panel lights up. No time to figure out what it is. I abort the takeoff with runway to spare. The hangar lights wink. I wink back.

The voice is not finished with me yet. Far

the following: replacement of a fuel hose; inspection and repair of the windshield; reinforcement of seat structures; inspection and repair of seat tracks; replacement of Aerosonic fuel-flow transducers; modification of the ARC 400B autopilot roll and pitch actuators; and resetting the King KFC 200 autopilot roll slip clutch. Service difficulty reports during the past five years have cited problems with pressurization valves; alternators; rudder trim and flap retraction mechanisms; fuel pumps and fuel selectors; wing deice and propeller anti-ice systems; landing gear; engine valves and rocker arms; magnetos; and exhaust and turbocharger systems. It is important to mention that several of the reports noted improper maintenance as causes of the problems.

More than 1,800 Golden Eagles have been delivered in the past 16 years. The only piston twin that matches the 421's size and performance is the Beech Duke. Out of curiosity, I took both airplanes on a paper 600-mile flight, using performance data from their operating handbooks. The Duke edged out the Golden Eagle by one minute, but the 421 burned 24 fewer pounds of fuel during the trip.

Comparing the 421 with the Duke is an academic exercise, since the airplanes compete in different markets. The 421 is used mostly in corporate operations, while the Duke is a favorite among well-heeled private owners.

Since it left the aerie, the Golden Eagle has dominated its territory. There are a few invaders in the works, namely Piper's Mojave and Aerostar 700P. It should prove to be a good battle, but this time I am keeping that quarter in my pocket. □

from it. The voice gives me a third chance, a fourth chance. . .a ninth chance. Each time, I am challenged with unpleasantries. Engines fail before rotation, after rotation and before and after gear retraction. A fuel-flow indicator drops to zero. An oil temperature indicator zooms beyond red line. The annunciator panel lights up like a Christmas tree. Sometimes I do it right. Sometimes I crash. The voice is incessant.

"Here we go." By now, I am shaking like an ELT antenna. The airplane is barely five feet above the runway when an engine fails. I fly it out, bring it around and land. The voice says, "Okay, lunch time." I glance at my copilot/training partner, a corporate pilot whose firm has traded in a 310 for a 421. My exploration of the *period of maximum exposure* on takeoff has left him introspective. After lunch, it will be *his* turn.

The voice is our simulator instructor. It is our second day in FlightSafety International's 421C simulator at the Cessna Learning Center in Wichita. The day before, we practiced steep turns, stalls, takeoffs and landings. There also were a few Vmc demonstrations, as well as instrument approaches to minimums with one turning and one burning. Still to come are icing encounters, pressurization system failures, landing gear glitches, electrical system failures, runaway hydraulic systems and engine fires.

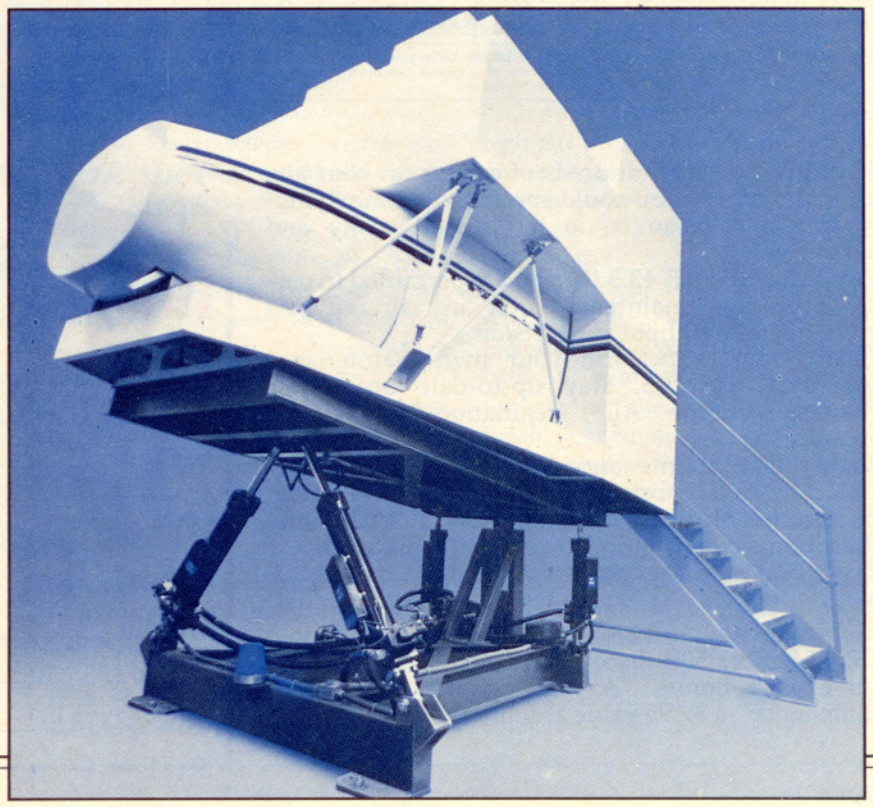
Before the flight simulator, though, there is the classroom. For the first three-and-a-half days of the eight-day "Cessna CE-421C Pilot Initial Qualification" course, a cadre of FlightSafety instructors, armed with an arsenal of visual teaching aids, drilled procedures, systems, limitations, systems and systems into our heads. Our class—a corporate pilot from Louisiana, another from Minnesota, a businessman/pilot from the Netherlands and me—never was given the chance to become bored with Wichita's night life. There was too much homework for that.

In addition to the 22 hours of classroom instruction, the four hours of familiarization in the procedures trainer (a mockup of the 421C's cockpit) and the 15 hours (half in the left seat, half in the right), the course includes actual flight training "to proficiency." Most students are cut loose after two or three hours in the air. After the grueling sessions in the simulator, flying the real thing with everything working properly is a pleasurable anticlimax.

After training with FlightSafety, I flew a 421C about 10 hours. It was a bit disappointing that no glitches occurred, as I was brimming with useful information, spring-loaded and ready for anything. If skills are not used, they fade, however. There are many things that can be practiced safely in the simulator that would prove impossible or fatal to practice in an airplane. If I were flying a 421C regularly, I would visit FlightSafety every six months, at least, to refresh my knowledge and sharpen my reflexes.

How much does it cost? If you buy a 421C, Cessna will put you (or your pilot) and your copilot through FlightSafety initial training free of charge. If not, the cost for initial training is $3,350. For an annual contract price of $2,795, you can return to Wichita every four or six months for recurrent training. This takes three days and comprises nine hours of ground school and six hours in the 421C flight simulator.

Taken at face value, these costs may seem high. But if you stack them up against the costs of owning and operating a 421C and the inestimable value of the people and property transported therein, it is very hard, indeed, to come up with a rational argument against signing up. The company has a favorite saying: The best safety device in any aircraft is a well-trained pilot. The logic is bulletproof. —*MML*



In FlightSafety International's Cessna Golden Eagle flight simulator, pilots can practice emergency procedures and explore performance limits in ways that would be impossible or potentially lethal to attempt in an airplane.