THE BIG EASY

Cleared direct to an airport near you

BY SETH B. GOLBEY

Infrastructure is a term we've heard bandied about with increasing frequency in recent years, particularly in contexts such as "... the United States' declining transportation infrastructure ...." The key event in the development of modern commercial aviation's infrastructure was the birth of the jet age, and the most substantial and fundamental change to that infrastructure was brought about a decade ago by airline deregulation. The promise of deregulation

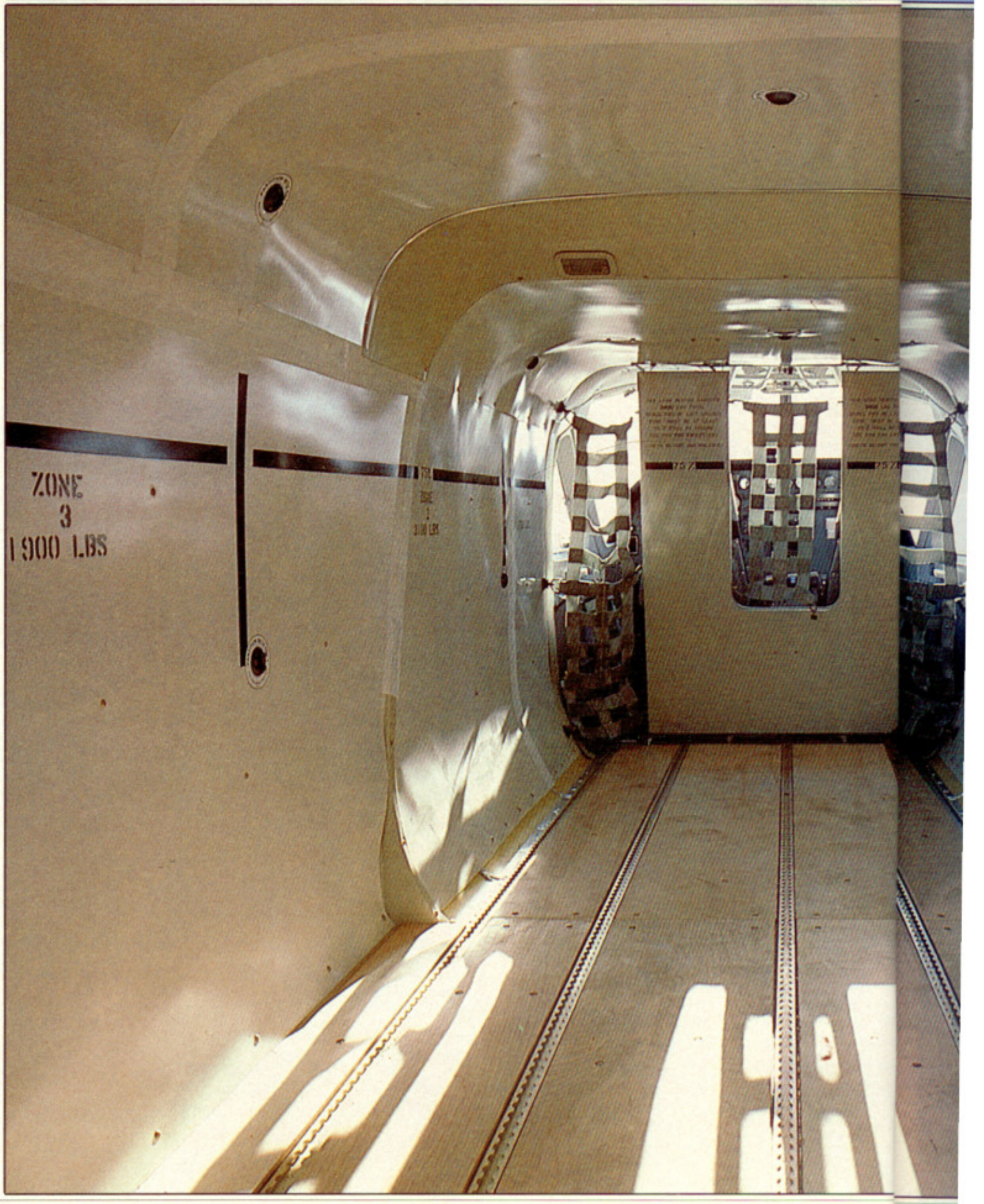
PHOTOGRAPHY BY MIKE FIZER

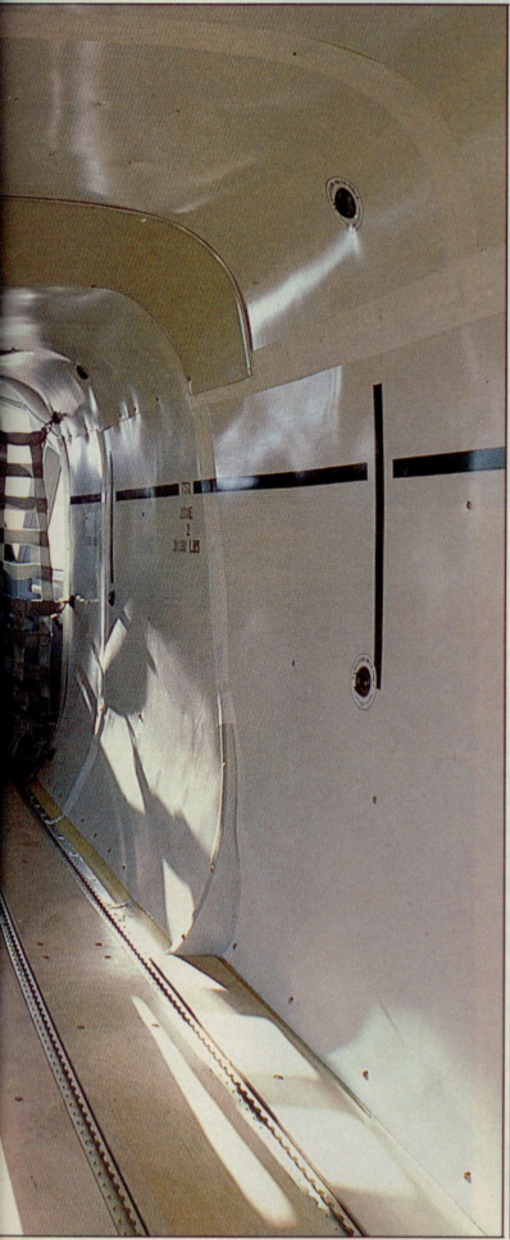
has only been partially met: *Some* communities receive better airline service and *some* fares are lower than before deregulation. The biggest difference under deregulation is that airline travel used to be fun and today, for the most part, it's a pain in the neck. The number of communities served by the larger commercial airlines has been halved since 1978, and delays and congestion have increased dramatically. The irony of deregulation—the aviation infrastructure's big "improvement"—is that small packages receive better airline service in this country today than do human passengers. And more communities receive service from small package carriers than from passenger-carrying airlines.

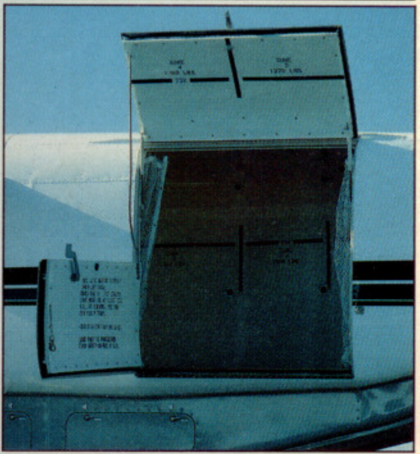
The airplane that has been largely responsible for the burgeoning of the small package industry is a bit of an irony itself. Cessna's Caravan I was conceived as a turboprop replacement for thousands of aging de Havilland Beavers and Otters and Cessna 180s, 185s, and 206s operated worldwide in a multitude of utility applications. But it was the right airplane at the right time for a growing industry led by Federal Express Corporation, which immediately recognized the big bushplane as the foundation for its small package delivery fleet.

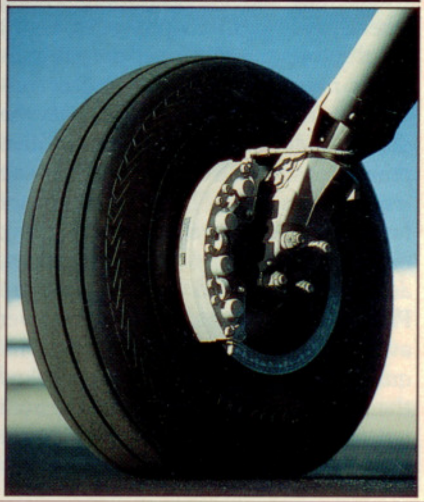
Mechanically, the Caravan I was designed with simplicity, field maintainability, and redundancy in mind.

The Model 208 Caravan I is available with up to 10 seats (including one for the pilot), though in countries that waive the Federal Aviation Regulation Part 23 nine-passenger limit, operators can use up to 14 seats. The fixed-gear 208, which was certified in October 1984, was quickly supplemented by floatplane and amphibious versions (certified in March 1986). Even before the first 208 was delivered, however, FedEx had placed an order for a cargo-optimized model called the 208A (also known as the Cargomaster), which differs from the 208 primarily in having no cabin windows or airstair door and having a belly-mounted cargo pod. FedEx soon discovered that the airplane ran out of cabin space before it reached its maximum takeoff weight restriction, so a









stretched 208B (Super Cargomaster), which features two-foot fuselage extensions fore and aft of the wing and a lengthened cargo pod, was conceived. Deliveries of the 208B to FedEx began in October 1986, and the airplane has become the centerpiece of the FedEx feeder fleet, in no small part because of its better-than-99-percent dispatch reliability. Other operators have realized similar dependability.

The Caravan I is a superb example of what good aeronautical engineers can do when offered a clean sheet of paper and a clear idea of the requirements of a new design. The 208 family flies relatively fast and far, into and out of small, unprepared landing sites, with good economy and excellent mechanical reliability. The airplane is designed for safe and efficient operation by a single, relatively inexperienced pilot (many pilots transition into the Caravan I with only about 1,000 hours total time and little or no turbine experience).

Mechanically, the Caravan I was designed with simplicity, field maintainability, and redundancy in mind. The simplicity can be seen in the fuel selectors (either of the two tanks can be turned On or Off; that's all), the engine's inertial intake particle separator (manually controlled by means of a panel-mounted handle rather than electrically actuated), or the hydraulic system (which exists solely to power the brakes). Field maintainability is enhanced by features such as the easily removable battery on its swing-out tray (for those overnights in cold environments) and the ability to remove and replace the wings outboard of the integral fuel cells with a minimum number of tools. Redundancy is everywhere, from the backup electric flap motor to the mounting flange for an optional spare engine ignition exciter under the cowling (if the main exciter goes bad, just switch the leads to the backup mounted right next to it; a second generator control unit can also be mounted). The airplane's extensive options list enables a buyer to assure redundancy in virtually any system (save for the engine itself) right on down to dual pitot-static systems. Even the wings' lift struts are interchangeable from one side of the airplane to the other.

Power is provided by a rugged and highly reliable Pratt & Whitney Canada PT6A-114 turboprop engine, flat rated at 600 shaft horsepower. This engine is particularly suited to life in the field. Air enters the intake system at the front of the cowl but is routed aft through the inertial separator. The air is forced to make a gentle turn to enter the intake plenum. When particle separation is desired, two doors are closed by means of the manual control mentioned above; this forces the air to make a much sharper turn, so heavier-than-air particles, such as moisture or dust, are discharged overboard through the left side of the cowl rather than entering the plenum. The big Kevlar propeller, built by Hartzell, can be run in feather or reverse on the ground, if needed; the only limiting factor is based on minimizing the flow of hot exhaust gases over the composite cargo pod.

This airplane is built to take a licking and keep on ticking. For example, should the pilot discover that his oil-filled nose gear oleo has lost its oil, he can rely on the beefy drag link spring (structurally identical to the tubular spring steel main gear of the Cessna 172) to take the load until the problem can be rectified. Even with the tire deflated and the strut fully compressed, ground clearance of the wide-chord composite propeller is still 5.63 inches; under normal conditions, 18.13 inches of clearance is standard, and a nose strut extension kit is available, as are oversize nose and main gear tires, to raise the prop even farther.

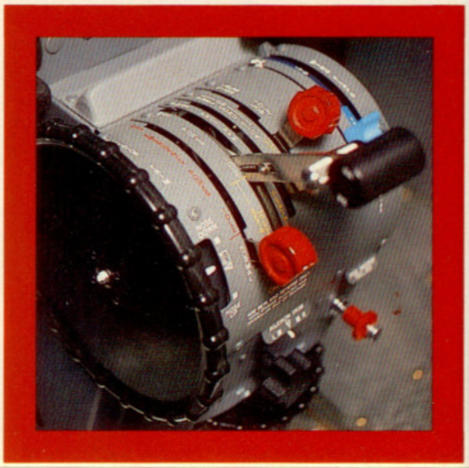
The main gear, too, is designed to take a beating. An intertube structure minimizes bending in fuselage landing gear bulkheads, and, should worse come to worst, the main gear has a tearaway feature to minimize damage to the fuselage.

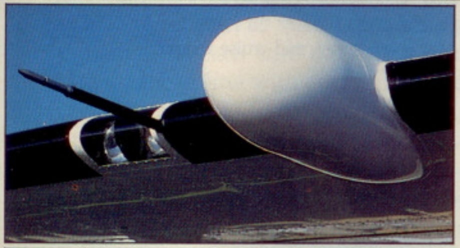
The pilot is the principal beneficiary of Cessna's careful design work; he will like the hinged cowling that allows easy preflight inspection of the engine compartment, and he will be impressed by the logical and orderly arrangement of the cockpit, studded with features such as the four-position selector switch that allows him to monitor generator current, stand-by alternator current, battery charge or discharge current, and system voltage on a single gauge. Simplified diagnostics of the electrical system is a highly desirable feature when you have a 28-volt DC system that uses two general buses, two avionics buses, and a battery bus. A stand-by system using an alternator with its own bus system is a popular option. Redundancy again.

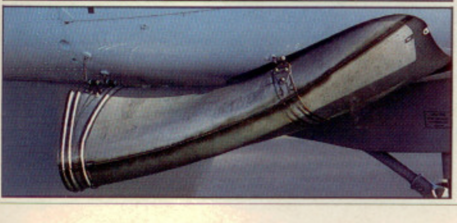
Because the airplane is intended for single-pilot operations, controls and instruments are readily within reach. On

the left sidewall are the avionics power, engine starting, and main electrical switches and circuit breaker panels. In front of the pilot are the flight instruments, and immediately above them is the annunciator panel. Just to the right of this (and just under the glareshield where they can be easily seen during takeoff and approach phases of flight) are the torque and propeller rpm indicators, normally the primary power control instruments. To their right, over the double radio stack, are the other two power control instruments (interturbine temperature, or ITT, and percent of maximum gas generator, or Ng%, rpm), oil temperature and pressure gauges, and fuel flow and quantity gauges. Plenty of room is available for whatever avionics an operator's mission might require, including weather radar. Below the radios, on the center pedestal, from left to right, are the emergency power lever (which provides manual override

Pilots, particularly those with little turbine time, will find the Caravan I to be easy and pleasant to handle.







of the fuel controller), power lever, propeller control lever, fuel condition lever, and flap position indicator and selector. The pedestal also houses the manually operated three-axis trim controls, fire wall fuel shutoff, and fire wall cabin heat shutoff (cabin heat uses bleed air from the engine; bleed air also powers the vacuum system). Light switches and rheostats and controls for the optional full deice/anti-ice system are conveniently positioned to the left and right below the pilot's control wheel. The entire instrument panel consists of modules that are easily removable for service. An overhead panel contains fuel tank selectors, air vents, the oxygen system control, and the backup flap control.

Pilots, particularly those with little turbine time, will find the Caravan I to be easy and pleasant to handle, both on the ground and in flight. The airplane's turning radius allows a 180-degree turn in as little as 63.75 feet (the diameter of the arc described by the outside wing tip), which makes turnarounds on a 50-foot-wide runway or taxiway easy. Speeds used throughout the 208B's flight regime are similar to those of many high-performance piston singles. This equates to a rotation speed (with flaps set at 20 degrees) of 70 to 75 KIAS, climb-out at 85 to 95 knots, cruise climb at 110 to 120 knots, and approach (with full flaps [30 degrees]) at 75 to 85 knots. Maneuvering speed ranges from 148 knots at max gross to 112 knots at 5,000 pounds. Best angle of climb is 73 knots; best rate, 100 knots. Stall speed, flaps up, is 78 knots, and with flaps down, it's 61 knots.

Thoughtful design helps make the pilot's job easier. Surprisingly little right rudder is needed on takeoff, for example; the engine is canted slightly downward and to the right (from the pilot's perspective) to minimize torque and p-factor. Handling is conventional; the manual flight controls are dynamically balanced, so no boost or force gradient is provided, or needed. While roll forces are heavier than pitch forces, spoilers coupled to the ailerons provide positive roll control at even very low airspeeds. Vortex generators on the flap leading edge and a "trailing edge angle" help reduce stall speed and enhance lateral stability. Vortex generators on the horizontal stabilizer enhance nose-down elevator and trim authority. Overall, despite its size, the airplane handles much like a Cessna 210.

Some nice surprises await the pilot transitioning into the Caravan I. The first 10 degrees of flaps (the flaps extend over 70 percent of the wing's trailing edge) can be selected right up to the maximum operating speed of 175 knots; slowing the airplane for approach is no problem. The second and third notches can come in at 150 and 125 knots, respectively. Cessna's air transportation department's chief pilot, Michael R. Mawhirter, demonstrated a technique guaranteed to make friends at busy fields. We approached the runway at cruise speed, reduced the power to flight idle, advanced the propeller to its maximum rpm setting, and started the flaps down. As the airspeed bled off (which it did rapidly), we selected full flaps and lowered the nose to establish a snappy descent at 80 knots. We finished up with a normal flare and reverse thrust once the wheels were on the ground, and the result was an early turnoff from the runway. Just the ticket when there's an airliner on final behind you.

By the end of February, Cessna had delivered 302 Caravan Is (113 208s, 40 208As, and 149 208Bs) and held an order backlog for an additional 160 units; production is continuing at a rate of eight aircraft each month. The vast majority of the aircraft delivered are the landplane version; just seven amphibians and two U–27As (the military designation; these were delivered to the State Department) had been built. Caravan Is are operating in 19 countries and have been delivered to 55 overseas operators. The U.S. Army is evaluating the aircraft in a number of roles, including troop transport, medevac, cargo, surveillance, VIP transport, and forward air control; the U–27A can be equipped with six underwing stations for a variety of stores or armaments.

If the Caravan I looks to some people like a diamond in the rough, it is the jewel in the crown of Cessna's classic high-wing, single-engine airframe series. If the Federal Aviation Administration can ever be convinced to reevaluate its archaic rules proscribing single-engine IFR passenger operations, the Caravan I could revolutionize the commuter/air-taxi industry as it has the small package delivery industry. And that might be the single most profound change to aviation's infrastructure since the introduction of the jet engine. □

Cessna 208B Caravan I
1989 base price: $914,500

Specifications	
Powerplant	Pratt & Whitney Canada PT6A-114 free turbine; flat rated at 600 shp at 1,900 rpm
Recommended TBO	3,500 hr
Propeller	Hartzell composite, constant-speed, full-feathering, reversible, 3-blade, 100-in dia
Recommended TBO	3,000 hr
Length	41.58 ft
Height	14.83 ft
Wingspan	51.08 ft
Wing area	279.4 sq ft
Wing loading	31.3 lb/sq ft
Power loading	14.6 lb/shp
Seats	2
Cabin length	21.33 ft
Cabin width	5.17 ft
Cabin height	4.25 ft
Standard empty weight	4,550 lb
Max ramp weight	8,785 lb
Max takeoff weight	8,750 lb
Max useful load	4,235 lb
Average equipped useful load	4,215 lb
Payload w/full fuel	1,956 lb
Max landing weight	8,500 lb
Zero fuel weight	8,750 lb
Fuel capacity, std	335 gal (332 gal usable) 2,245 lb (2,224 lb usable)
Oil capacity	14 qt
Cargo volume, cabin	340 cu ft
pod	113.8 cu ft
Performance	
Takeoff distance, ground roll	1,575 ft
Takeoff distance over 50-ft obstacle	2,840 ft
Max demonstrated crosswind component	20 kt
Rate of climb	770 fpm
Max cruise speed, mid-cruise weight	
10,000 ft	171 kt
20,000 ft	159 kt
Range; endurance	
max cruise power, 10,000 ft	888 nm; 5.3 hr
18,000 ft	1,062 nm; 6.9 hr
max range power, 10,000 ft	962 nm; 6.4 hr
18,000 ft	1,079 nm; 7.2 hr
Max operating altitude	25,000 ft
Max operating altitude, icing conditions	20,000 ft
Service ceiling	21,900 ft
Landing distance over 50-ft obstacle, no reverse	1,740 ft
Landing distance, ground roll, no reverse	915 ft
Limiting and Recommended Airspeeds	
Vx (best angle of climb)	73 KIAS
Vy (best rate of climb)	100 KIAS
Va (design maneuvering)	148 KIAS
Vfe (max flap extended), to 10 degrees	175 KIAS
10 to 20 degrees	150 KIAS
20 to 30 degrees	125 KIAS
Vmo (max operating)	175 KIAS
Vs1 (stall, clean)	78 KIAS
Vso (stall, in landing configuration)	61 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. □