Business & commercial Aviation
PILOT REPORT

Inflight Report: Canadair's Corporate RJ

A business aircraft designed to make the "corporate commuter" a practical reality.

By FRED GEORGE

December 1992, Document No. 2404 (9 pages)

Stand by for a startling change in the way a business aircraft is justified. Canadair claims its new Corporate Regional Jet (RJ for short) can challenge the airlines head-to-head in a seat-mile cost showdown and win.

Whatever happened to all those subjective intangibles we've heard for decades? Time-honored terms such as "value of executive time" "lost opportunity cost," and "productivity index" are missing from Canadair's RJ marketing materials. That's because the company cuts straight to bottom line operating economics. Canadair salespeople claim a company operating a 24- to 30-seat, business-class configured Corporate RJ will spend less for air transportation on most trips than if it bought coach fare seats on scheduled airlines.

That's a bold claim which invites a close look at the numbers. The RJ versus airlines cost comparison shown in Figure 1 is based on a seat-mile cost of 33 cents. At that rate, the Corporate RJ obviously won't best the bare bones fares of the major airlines on milk runs between hub cities. However, in many regional niche markets, particularly those in which one or two scheduled carriers have little or no competition, the RJ comes out ahead on cost savings. Indeed, in the high travel demand Northeast Corridor the Corporate RJ beats the airlines hands down.

Why look at these specific city pairs in Figure 1? The trips are representative of the air travel patterns of large U.S. companies that could take advantage of a 24- to-30-seat corporate shuttle aircraft.

The seat-mile costs of a 30-seat RJ assume a utilization of 1,000 hours per year. While such annual usage may be modest by airline standards, it represents a lot of flight hours to a company accustomed to on-demand business aircraft operations. A shuttle operation, though, typically might fly two, two-hour legs per weekday that would add up to 1,000 hours in a 50 week period.

Canadair didn't cut corners on estimating the costs involved with operating the Corporate RJ. The projections cover capital costs in the form of lease payments; fixed costs including salaries, insurance, hangar, refurbishment and recurrent training; and hourly operating costs including fuel, maintenance, parts, engine reserves and even catering. Tax incentives are not included in the cost projections.

The time savings associated with a Corporate RJ instead of the airlines may be even more impressive than the potential operating cost savings. The Corporate RJ can fly 30 passengers more than 1,900 nm with NBAA IFR reserves, so the Corporate RJ is much more likely to fly nonstop between non-hub city pairs than the scheduled air carriers. In addition, its 424 knot long-range cruise speed is about 150 knots faster than most

airline turboprops. As shown in Figure 2, the Corporate RJ's speed and direct routing advantages can shave hours off the total trip between two cities.

It's worth noting, however, that the published block airline flight times between some city pairs are padded to account for airport and airspace backups. The Corporate RJ projections do not take such factors into account—partly because business aircraft operators aren't restricted to using congested hub airports.

PASSENGER ACCOMMODATIONS

Viewed from a distance, the Corporate RJ plainly looks like a stretched Challenger 601. Two 10-foot plugs were grafted to the Challenger's fuselage, fore and aft of the center section. All of the additional 20 feet went into the 73-inch-high, 98-inch-wide cabin, thereby increasing its net usable length and volume by more than 70 percent. Many other changes were made to the basic Challenger 601, but none are more apparent to passengers than the increased fuselage length.

Figure 1

Cost Comparison
Corporate RJ Versus Airlines

City Pairs	Distance (nm)	RJ Cost Per Seat at $.33/Mile	Airline Cost Per Seat
Buffalo-Hermosillo	1,759	$580	$708
Detroit-Matamoros	1,209	399	618
Hartford-Philadelphia	170	56	240
Los Angeles-Tucson	390	129	390
Minneapolis-Austin	905	299	360
Newark-Richmond	251	83	260
Saginaw-Houston Hobby	1,022	337	360
White Plains-Rochester	215	71	210
White Plains-Washington	202	67	240

Source: Canadair Aircraft

Figure 2

Trip Time Comparison
Corporate RJ Versus Airlines

City Pairs	Distance (nm)	RJ Cost Non-stop Flight Time	Airline Total Trip Time	No. of Stops
Buffalo-Hermosillo	1,759	4:30	7:15	2
Detroit-Matamoros	1,209	3:10	10:30	2
Hartford-Philadelphia	170	0:43	1:05	0
Los Angeles-Tucson	390	1:15	1:22	1
Minneapolis-Austin	905	2:25	4:35	1
Newark-Richmond	251	0:55	1:13	0
Saginaw-Houston Hobby	1,022	2:42	4:06	1
White Plains-Rochester	215	0:50	1:15	0
White Plains-Washington	202	0:48	1:19	0

Source: Canadair Aircraft

The stretch makes room for 50 coach seats in the airline Regional Jet configuration, mostly in two-by-two chair rows spaced at a 31-inch pitch. We found these seats offer ample leg room—in some cases even exceeding the available space in the coach section of many airliners, particularly those operated in the Northeast Corridor.

Corporate RJs configured as 24- to 30-passenger shuttle aircraft will have singles and pairs of business class seats in 33- inch pitch rows. Corporate and commercial airline RJs will be delivered with a forward galley, aft lavatory, overhead luggage bins, passenger service units plus floor and wall coverings. The RJs destined for airline use will be completed by Bombardier's de Havilland Aircraft subsidiary and delivered ready for service with 50 seats and all customer options installed.

Corporate RJs will be delivered to either of two Canadair-designated completion centers, Innotech Aviation or KC Aviation, with virtually the same interior furnishings, but no passenger seats. Seats and other amenities are provided by the customer, and the completion center will install them.

Most large business aircraft operators are accustomed to a relatively liberal interior completion weight allowance. Corporate RJ buyers will have to watch the weight budget closely, however, if they want to keep the airplane close to its 31,800 pound projected basic operating weight.

Canadair delivers the airplane with durable, lightweight, commercial airline grade wall and floor coverings that may seem Spartan by business aircraft standards. These interior materials, though, help the Corporate RJ stay within its weight budget. They will stand up to heavy passenger traffic in shuttle use better than more opulent furnishings. And best of all, they're included in the base price of the airplane.

TOUGHENED STRUCTURE, SYSTEMS AND ENGINES

The Challenger was the first large corporate aircraft to use a natural laminar flow supercritical wing. The wing was modified for use on the RJ by adding three feet outboard of each aileron, by slightly drooping the leading edge outside of the root section and by extending the section aft of the rear spar by 10 percent. Much of the trailing edge extension goes into the flaps and ailerons.

The larger wing and extra weight of the Corporate RJ result in about the same wing loading as the Challenger 601-3A, making for similar ride characteristics in rough air.

Some of the most obvious systems changes are apparent when looking at the top surface of the wing. Each wing has four spoiler and spoileron panels, instead of two per wing on the Challenger 601. Viewed from root

to tip, each wing has two ground spoiler panels, one flight spoiler and a computer-controlled, fly-by-wire spoileron that's been added to augment roll control. All four panels fully deflect upon wheel spin up after landing to spoil lift and increase drag.

The Challenger has earned high marks from pilots regarding its overall handling characteristics, but many find the pitch control response a bit mushy. That complaint has been fixed in the RJ. The elevator is further aft of the center of gravity because of the fuselage stretch, which gives it more mechanical advantage. Compared to the Challenger, the elevator is 30 percent larger and is actuated by all three hydraulic systems.

The RJ has more doors and exits than a Challenger. The main air stair door is manually opened, but it has an electrically assisted closing mechanism. A 24-inch-by-48-inch galley service door has been added to the right side of the fuselage opposite the entry door. A 43-inch-by-33-inch baggage compartment door has been installed on the left, aft side of the fuselage. Two emergency exits are located over the wings.

The Corporate RJ's 324 cubic foot baggage compartment is accessible in flight through a door in the aft section of the lavatory. Airline versions do not have this feature.

The RJ has an abundance of landing and taxi lights. There are two landing lights in the nose radome, plus a pair of landing and taxi-recognition lights in each wing root. Each wing leading edge has a leading edge inspection light to check for ice. Logo lights are available as an option.

The RJ's systems and engines have been toughened to take the high cycle-per-flight-hour stress of regional aircraft operations. Its undercarriage is considerably beefier than the Challenger's, and it has much heavier rolling stock, including massive steel wheel brakes with almost two-thirds more stopping power than the carbon brakes of the 601. The steel brakes are more than twice as heavy as the carbons, but their cost per landing is much lower because they wear better.

Similar to the Challenger, the RJ has dual nose- and main-landing gear wheels, with different tire sizes. The wiring harnesses to the landing gear of the RJ are more durable to withstand high-cycle operations.

The General Electric CF34 turbofan engines produce 8,729 pounds of thrust each, with a 9,220-pound automatic performance reserve rating, just as in current production Challenger 601 aircraft. The RJ uses the -3A1 version that has been internally toughened to withstand high cycle use and that has a new, lower exhaust emission, machined combustor.

The RJ has single point fueling and an external access, digital fuel/defuel system that allows each tank to be precisely fueled to the desired level. In addition, there are over-wing fueling ports, but using them decreases the fuel capacity by just over 1,000 pounds. Pop out dipstick sight gauges allow the fuel level in each tank to be checked without electrical power.

The engine oil level is displayed on an EFIS screen and there's a remote oil refilling reservoir located in the aft equipment bay.

The RJ is fitted with a standard, large capacity APU with an expanded operational flight envelope. The heftier APU supplies more air to the air conditioning units for ground operations, and it's normally used to pressurize the cabin during takeoff and landing, as we'll discuss later in this report.

Numerous other detail improvements were made to increase reliability, cut down on turnaround time and simplify maintenance tasks. Glass windshields have replaced the acrylic ones, and windshield wipers have been added. The avionics boxes are still contained within the pressure vessel in racks below the cabin floor, but the RJ has a door on the bottom of the fuselage that provides more convenient access to them.

PRO LINE 4 AVIONICS

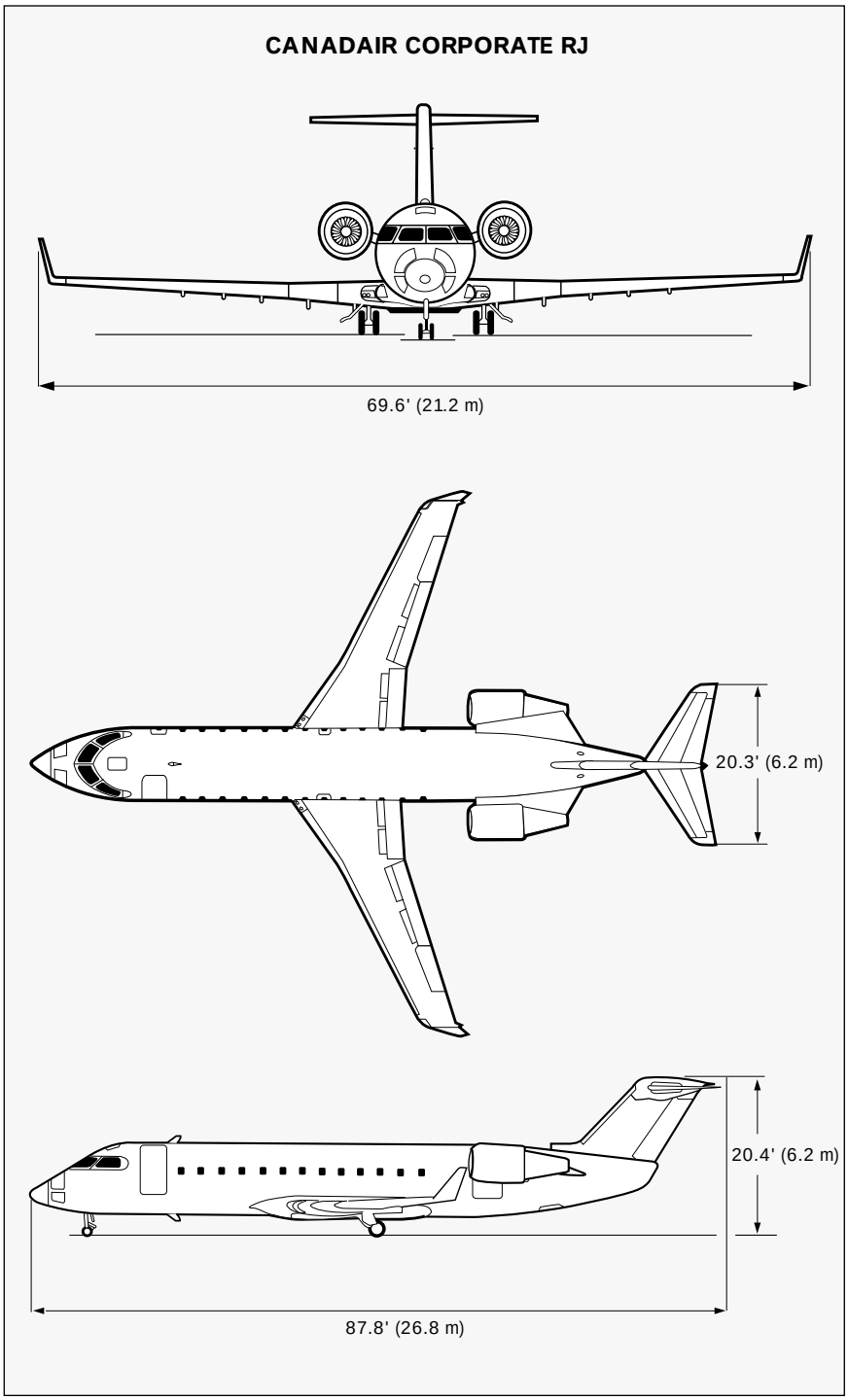
According to Canadair, reliability was the No. 1 factor in choosing an avionics package, and, thus, the firm chose an integrated Collins Pro Line 4 package for the RJ. Because the system is an outgrowth of the Boeing 747-400 and Fokker 100 programs, it's a comparatively mature design and should be free of the growing pains that afflicted the Challenger 601-3A's avionics.

The RJ has the quiet, dark cockpit design of contemporary turbine airplanes. A half dozen, five-inch-by-six-inch CRT screens dominate the panel, providing primary flight, multi-function and engine instrument/crew alerting system displays. The two tubes in the center share EICAS functions. The left screen displays primary engine and systems information. The right tube is used to call up one of 10 secondary functions, such as system synoptic diagrams, avionics maintenance diagnostics or status messages.

The six display tubes are identical. The function of each tube is determined by the rack in which it is mounted. The displays use integral symbol generators. Canadair is pushing for approval of a minimum equipment list that will allow dispatch with five of the six tubes operating, although no certification agency had granted such approval at the time we completed this report.

The standard avionics package includes a dual control WXR-840 solid state weather radar, Collins TCAS, Sundstrand wind-shear detection and ground proximity warning systems, and a single channel, fail passive autopilot.

Among the many current avionics options are the



Collins TWR-850 turbulence detection radar, a third VHF comm transceiver and a third data concentrator unit. The two DCUs are boxes that receive dozens of analog and digital inputs from engine and systems sensors, and convert the information into a digital data stream piped forward to the IAPS box. A third DCU provides essential backup because two are needed for dispatch.

Future avionics options will include single or dual flight management systems, dual Litton Flagship laser inertial reference systems in place of the Collins AHRS, dual MLS receivers, an HF radio and a Flight Dynamics head-up guidance system, such as the one Alaska Airlines crews now use to fly Category IIIa ILS approaches manually. Currently, Canadair doesn't plan to offer an autothrottle system.

The Collins FMS option will be available by mid-1993, but don't expect all of the features found in current production business aircraft right away. Initially, the Collins FMS 4050 will provide horizontal guidance between database or pilot-entered waypoints. The FMS will store a large number of multi-leg flight plans and will be capable of holding pattern guidance. There are no vertical navigation modes in the FMS 4050, though. VNAV is limited to pitch attitude-, airspeed- or vertical-speed-hold to a pre-selected altitude, plus altitude hold.

An enhanced model, the FMS 4100, will be available in mid-1994. The growth version, featuring upgraded software, will have SIDs, STARs and airways. No VNAV capability is planned for the FMS 4100.

Initially, the RJ will be certified for Cat I ILS approaches. Canadair and Collins project Cat II certification soon.

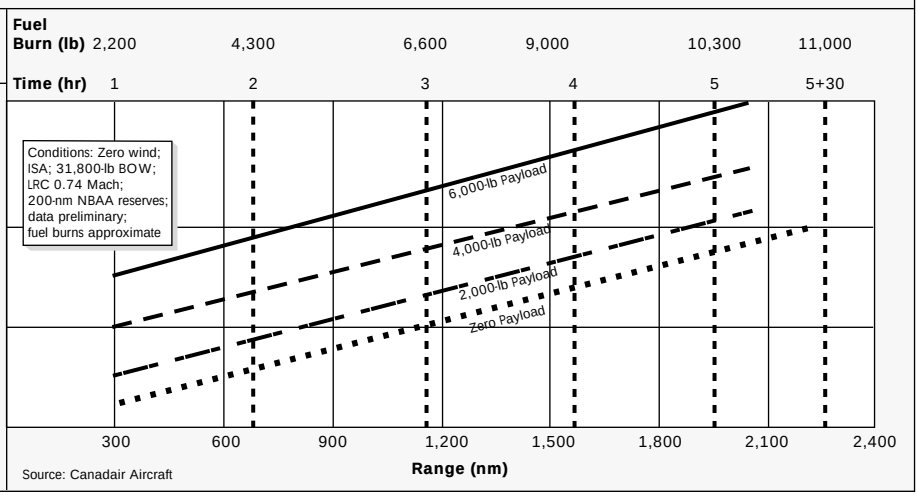
BASIC PERFORMANCE CONSIDERATIONS

At the time we wrote this report, Canadair was still refining cruise performance data, so the AFM contained mainly airport and climb performance numbers. We did notice that the RJ's center-of-gravity envelope is essentially shaped like a box, making it difficult to load it outside of the basic 11- to 35-percent MAC limits.

Some basic thrust-to-weight performance considera-

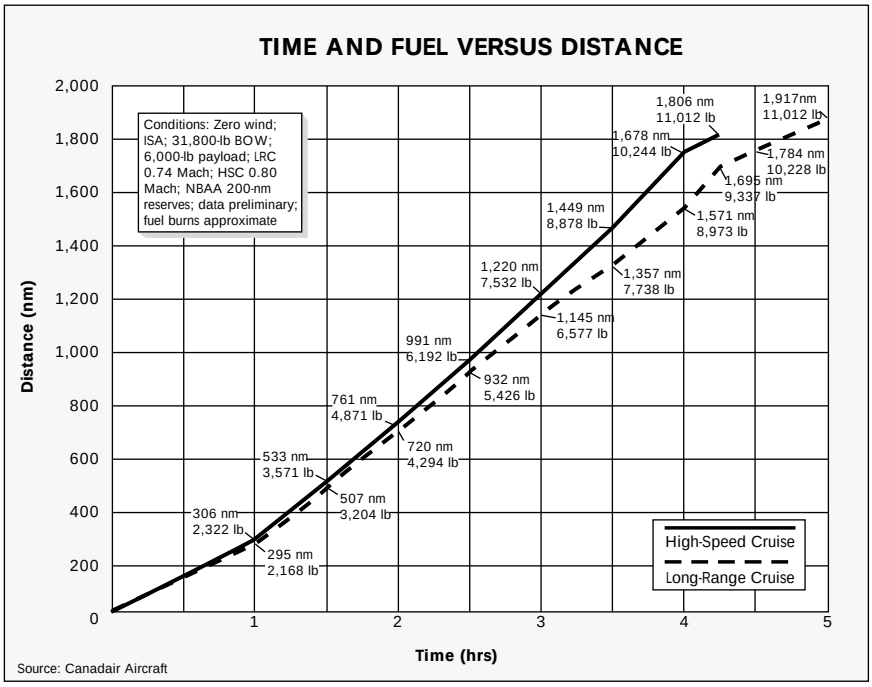
RANGE/PAYLOAD PROFILE

Balanced Field Length		Gross Takeoff Weight (lb)
SL ISA	5,000 ft ISA+20°C	
6.090	12,000	51,000
N/A	N/A	50,000
4,740	7,343	45,000
3,766	5,714	40,000
N/A	N/A	35,000



Source: Canadair Aircraft

tions, however, are worth noting. An empty 30-seat Corporate RJ completed with airline grade furnishings weighs about three tons more than a Challenger 601-3A, and it has the same thrust. The 601 has the most favorable thrust-to-weight ratio of any heavy business airplane. The RJ's extra 5,800 pounds of weight lowers its thrust-to-weight ratio to about average for a business aircraft, but still noticeably better than most turbofan-powered airliners. Still, RJ operators will want to use a fine-point pencil to extract the most from the takeoff performance and range-payload charts.



Source: Canadair Aircraft

Changes in density altitude have a two-fold impact on the RJ's actual thrust-to-weight ratio. First, the engines rely upon relatively high 6.3:1 bypass ratios to economically produce thrust. Second, they are flat rated only up to 737F. The combination of the high bypass ratio and the modest flat rating results in a steep thrust lapse rate as density altitude increases.

Tapping bleed air off the engines during takeoff and landing imposes a thrust-sapping performance penalty that's significant when operating at high weights or at high density altitude airports. For that reason, the flight manual calls for using the APU to pressurize the cabin during takeoff and landing when feasible. Then, the engine bleed air can be turned off to make maximum thrust available from the engines.

Thrust-to-weight ratio has an acute affect on one-engine-inoperative (OEI) climb performance. Figure 3 shows the effect of density altitude on the Corporate RJ's maximum takeoff weight, and, thus, its range with 30 passengers, as limited by the second segment climb requirements. The chart indirectly shows the impact of departing with the engine bleeds turned off.

The "Time and Fuel Versus Distance" chart and the

Figure 3

Maximum Takeoff Weight
(And Range With 30 Passengers)*

Density Altitude (ft)	MTOW (lb)	Runway Required (ft)	NBAA IFR Range (nm)
Sea Level	51,000	6,090	1,917
2,000	51,000	6,800	1,917
4,000	51,000	7,835	1,917
6,000	51,000	9,400	1,917
6,900	51,000	10,000	1,917
8,000	49,557	10,197	1,679
10,000	46,863	9,964	1,200

*Limited by second segment climb requirements. Flaps 20 degrees.
Source: Canadair Aircraft

"Range/Payload Profile" are based on computer projections that should closely approximate the actual performance of the Corporate RJ—even though such numbers aren't yet published in the flight manual.

Figure 3 indicates that the RJ may legally depart at its full structural 51,000 pound maximum gross takeoff weight up to a density altitude of 6,900 feet. If, for example, the RJ were to depart Denver on an ISA+207C day, it could fly 30 passengers 1,684 nm with NBAA IFR reserves. The maximum allowable takeoff weight, and, therefore, the range, would be substantially reduced if the engine bleeds were turned on under the same conditions.

Canadair is developing performance data for 10-degree flap takeoffs. When completed, the change will substantially improve second segment climb performance, thereby allowing the use of the 51,000 pound MGTOW at higher density altitudes.

HANDLING QUALITIES AND HUMAN FACTORS

Strap into the left seat of the Corporate RJ and your first impression is the flight deck's copious volume, just as in the Challenger. There's plenty of room for chart books, clipboards and pilot supplies. Few business aircraft can top the Corporate RJ for pilot comfort.

Since the panel and console are dominated by Pro Line 4 avionics components, we expected to find plenty of human engineering factors, which Collins' engineers consider to be one of the system's strong points. The system earns high marks for its large CRT displays. The PFD and MFD arguably provide a better mix of graphical and alphanumeric information than separate EFIS and analog instruments.

With some crew practice, the two EICAS screens can be made to display a comprehensive array of systems and diagnostic information. Getting the most out of the interactive system synoptic diagrams, though, requires forethought and crew intervention.

The avionics control panels, in our opinion, don't embrace the intuitive, easy-to-use design philosophy of the original Collins Concept 4 gear introduced in the mid-1980s. The flight guidance panel on the glareshield, for example, has 20 controls to push, twist, flick or roll. There's very little tactile differentiation between the closely-spaced knobs that control course, heading, altitude and speed selection. In addition, the FGS panel lacks digital readout windows next to the knobs, a much appreciated feature introduced by the Collins Concept 4 system. All such flight and nav information is displayed on the RJ's EFIS screens.

Other control functions echo this departure from Concept 4 idealism. The left- and right-side weather radar control and display functions are split between console and sidewall control panels. As previously mentioned, the transponder control functions are divided between the radio tuning units and an auxiliary control panel. Because the MFDs lack the line-select keys found on other Pro Line 4 equipped aircraft, those functions are assigned to other control panels

Simply put, a newly transitioning crew will be required to two-step through functions. First, the pilot locates the required knob, switch or key. Then, the eyes are shifted to the appropriate EFIS screen to monitor the effect of moving the control.

None of these cockpit design characteristics are likely to hamper experienced crews. With practice, the avionics system functions will be absorbed into comfortable, well-rehearsed habits. Newly transitioning pilots, however, will have to crack the avionics books in RJ ground school and practice cockpit resource management to get the most out of the avionics system.

Once it's time to go flying, though, the Corporate RJ's positive attributes really show forth. The APU is normally started first to supply AC electrical power to the airplane and to supply air for the two air conditioning packs and engine starting. Alternatively, external electrical and air supply systems may be used for these functions. The APU is rated for flight up to 37,000 feet, although it's limited to 15,000 feet for cabin pressurization. Five transformer-rectifier units convert AC into DC power.

Completing the pre-start checklist is quick partly because most cockpit switches are lighted annunciator buttons that illuminate only when necessary to attract crew attention. Most of the credit, however, for easing

Specifications Canadair Corporate RJ

B/CA equipped price	$18,000,000 (1992 dollars)
Seats	3 + 30
Engines	
Model	2 GE CF34-3A1
Power	8,729 lb ea. (9,200 lb APR ea.)
TBO	6,000 hrs
Design weights (lb/kg)	
Max ramp	51,250/23,247
Max takeoff	51,000/23,133
Max landing	47,000/21,319
Zero fuel	44,000/19,958
BOW	31,800/14,424
Max payload	12,200/5,534
Useful load	19,450/8,823
Max usable fuel	14,305/6,489
Payload w/max fuel	5,145/2,334
Fuel w/max payload	7,250/3,289
Loading	
Wing (lb/ft^2)	98
Power	2.92
PSI	8.3
Limit speeds	
M_{MO}	0.85
V_{MO}	335 KIAS
V_{FE} (approach)	230 KIAS (20° flaps)
V_2	146 KIAS (@ max takeoff weight)
V_{REF}	135 KIAS (@ landing weight, 30 pax, NBAA IFR reserves)
Airport performance (SL, ISA, MGTOW)	
BFL (ft/m)	6,090/1,856
BFL, 5,000 ft, ISA + 20°C (ft/m)	9,910/3,020 (@ 49,630-lb takeoff weight)
Part 91 landing distance (ft/m)	2,640/805 (@ landing weight, 30 pax, NBAA IFR reserves)
Climb performance (fpm/mpm)	
All-engine	3,600/1,097
Engine-out	855/261
Certificated ceiling	41,000/11,278
All-engine service ceiling	36,400/11,095
Engine-out service ceiling	18,300/5,578
NBAA IFR range with 30 pax (nm/km)	1,917/3,550

pilot workload during the sequence of checklist events belongs to the EICAS. The copilot calls up the appropriate interactive systems synoptic diagrams on the secondary EICAS screen to monitor proper checklist event sequence. The EICAS synoptics are highly intuitive and are quite easy to use compared to a conventional array of dozens of gauges, lights and switches. During engine start, for example, the circuits depicted on the electrical system schematic change color to indicate that the engine-driven AC generators have begun to supply power to the aircraft.

The RJ can be maneuvered in tight spots because the steering tiller can move the nose wheels up to 70 degrees either side of center. The rudder pedals provide seven degrees of nose-wheel steering to help keep the aircraft tracking straight when not maneuvering in close.

As the thrust levers are advanced, it's apparent that the high-bypass ratio engines take longer to spool up than older generation, lower-bypass ratio engines in the same thrust class. The target interior noise level for the RJ is 62 to 63 dB SEL which is about nine dB noisier than an executive configured Challenger.

Airport neighbors aren't likely to notice the Corporate RJ. Canadair claims it's the quietest 50-seat airliner in operation, easily meeting FAR Part 36, Stage 3 noise requirements.

The engine's supervisory electronic controls do not automatically set the thrust as would a full authority digital electronic fuel control system. The crew sets the power to the takeoff setting during the early part of the takeoff roll.

The rudder becomes effective at low indicated air speeds. The minimum control speed (ground) is 84 knots, resulting in plenty of yaw control authority for crosswind takeoffs and OEI conditions.

The pitch control forces at rotation were moderate but not excessively light, and the airplane seemed to respond more crisply than the Challenger. At our mid-range operating weight, the takeoff safety speed was 132 KIAS, and at maximum gross takeoff weight, V2 was 146 KIAS. Our initial rate of climb was close to 4,000 fpm.

The RJ's roll control authority was exceptional. The blend of fully powered ailerons and fly-by-wire spoilers produce roll rates that few civil transport aircraft can equal. The roll control effort is well matched to the pitch control forces. The overall impression of yoke feel and control responsiveness reminded us of flying a smaller aircraft with highly refined manual controls.

The aircraft is well damped in both short and long period, pitch and roll modes. In short, it combines exceptional responsiveness and stability.

Passengers, though, will appreciate pilots' use of the

yaw damper. When a rudder pedal is bumped, the RJ responds with a slight adverse yaw-roll movement, or Dutch roll, that's characteristic of many aircraft with winglets. The yaw-roll movement dampens out at high speed in the clean configuration.

The RJ exhibits neutral to slightly unstable yaw-roll characteristics at low speed and high power with landing gear and wing flaps extended. The yaw damper is needed under these conditions.

The turbofan engines' thrust lapse rate becomes apparent in the mid-teens during the climb to cruise altitude—a characteristic that was particularly apparent during our warm day test. Climbing through FL 200, the VSI showed just over 2,000 fpm. It dropped to less than 1,000 fpm at FL 350.

It takes a few minutes to accelerate to the long-range cruise speed of 0.74 indicated Mach number (IMN). However, once at that speed, the thrust levers must be pulled back or the airplane will continue to creep up to 0.80 IMN since it is quite aerodynamically clean for its size.

At a typical cruising altitude of FL 350, the RJ's pitch and roll stability make it pleasant to hand fly, although most pilots will use the autopilot for day-to-day operations. The RJ will cruise comfortably in the mid-30s, but its maximum certificated operating altitude of 41,000 feet is only usable at light gross weights or when temperatures aloft are very cold.

The RJ offers excellent flexibility during the descent. The airspeed scale is redlined at a minimum of 315 KIAS or 0.80 IMN, reaching as high as 335 KIAS or 0.85 IMN in certain sections of the envelope. The flight spoilers are quite effective, and they may be deployed in four increments. Spoiler deployment is unrestricted by airspeed or configuration above 300 feet agl. This is one airline transport that has little trouble going down and slowing down at the same time.

The go down/slow down flexibility also adds to passenger comfort when deploying the large, trailing edge, slotted Fowler flaps. Selecting each increment of flaps at the maximum limit speed causes the airplane to balloon. Slowing to below the flap limit speeds prior to flap extension produces much less pitch and lift change.

On final, we slowed to a landing reference speed of 135 knots with 45 degrees of flaps. The aircraft flight manual predicted an FAR Part 91 no-wind, landing distance of 2,875 feet. In reality, the wind was blowing down the runway at 10 to 15 knots with gusts to 25 knots.

The RJ's generous travel, trailing- link main landing gear make the airplane as easy to land as a Challenger, absorbing plenty of imperfections in pilot technique.

We prepared for a maximum effort stop after touchdown. As the weight-on-wheels switches sensed touchdown and the main wheels spun up, all eight spoiler/spoileron panels popped and the aircraft sank solidly onto the main landing gear. There was no point in attempting to use the cascade-type thrust reversers. The aircraft rolled to a stop in just over 1,500 feet—leaving no time to deploy the reversers. The brake temperature indicators nudged above 120°F.

For more routine landings, the AFM projects that an RJ arriving at its 47,000 pound, maximum landing weight can land in a Part 121 factored field length distance of just over 4,900 feet.

The RJ's handling characteristics during OEI takeoff and landing operations are quite docile—mostly because of its moderate thrust-to-weight ratio, low minimum control speeds on the ground and in the air, and its fully powered flight controls. The simulated loss of an engine at V_1 produces a modest yaw that's easy to counter with moderate rudder pressure. Our OEI climb rate was 1,200 fpm using less than perfect speed control.

One engine inoperative landings are flown at a recommended flap setting of 20 degrees, but the AFM provides for the use of 45 degrees of flaps if runway length is a consideration. The approach is flown at V_{REF} +12 KIAS, resulting in some float during the landing flare and an estimated 25 percent increase in landing distance.

PRODUCT SUPPORT AND TRAINING

Canadair RJ marketers spend even more time talking about product support than they do discussing aircraft performance and operating economics. The RJ is designed to spend much less time in routine maintenance than most business aircraft. The short inspection interval is 300 hours, and the major inspections are spaced at 3,000 and 30,000 hour intervals. The airplane's designed economic repair life is 60,000 hours or 80,000 flights.

The maintenance inspection intervals of Corporate RJs flying 800 to 1,200 hours per year can be more limited by calendar inspection requirements, such as monthly or annual inspection intervals.

Design aspects and specific parts that proved to be reliable in service on the Challenger were carried over into the RJ where feasible. Systems, components and design elements that needed to be changed for reliability, lower life cycle cost or enhanced maintainability were modified or replaced.

The RJ's engines, for example, are configured as left- or right-hand models. That shortens the engine change time from a day and a half to six hours. Virtually all line replacement units may be swapped in 20 minutes or less. The goal is a 99-percent dispatch reliability.

Of the four Challenger Service Centers—Tucson, Montreal, Windsor Locks and Oberpfaffenhofen (near Munich)—Montreal has been chosen initially to support the RJ. It will be equipped with special tools, equipment and maintenance personnel.

The Montreal facility will be complemented by 22 Challenger field service representatives around the world who will be cross-trained to provide both Challenger and Corporate RJ support. Technical support will be available 24 hours a day.

Spare parts will be stored at Challenger warehouses in Detroit, Montreal and Europe. Canadair hopes to keep a tight rein on the price of its own parts and on those provided by outside vendors.

Currently, a Smart Parts program, similar to that associated with the Challenger, is not available, but Canadair may initiate such a program after the delivery of 25 airline and Corporate RJ airplanes. Challenger operators are pleased with the Smart Parts program, according to Canadair.

Airline RJ facilities will be used to provide technical support, technical publications and training for Corporate RJ operators.

Canadair has installed a high-fidelity motion and visual simulator near its Mirabel (Montreal) facility for airline and Corporate RJ operators. We flew the simulator in mid-October, and we were especially impressed with its visual imagery. It's clearly more advanced than what we've seen in most business aircraft simulators.

The quality of the RJ classroom training and published courseware appear to be on a par with airline standards. The classroom sessions are supplemented with self-paced personal computer systems.

Few business aircraft have ever entered service with the Corporate RJ's level of support and bottom-line cost effectiveness. Canadair realizes that the market for Corporate RJs is limited. About 300 corporate shuttles are in service worldwide, and the firm anticipates that two to four RJs per year will be available in the corporate configuration.

As the shareholders of large, publicly-owned companies take a more focused interest in the way such firms are managed, flight departments are bound to be eyed more closely for cost-effectiveness. The Corporate RJ is the kind of business aircraft that's likely to weather well under such scrutiny. Xerox, for example, is quite open in discussing its plan to use Corporate RJs in regular shuttle service between White Plains and Rochester, New York.

Companies that might not need the sole use of a Corporate RJ may form consortiums with other firms to operate such aircraft in shuttle service between several different city pairs. Some firms may find that they can't consistently fill 30 seats on a shuttle, but need a mix of freight, mail and people regularly transported between two or more locations.

The Corporate RJ is a versatile flying workhorse that may not have the most elaborate avionics, an ultra-comfortable executive interior or record-setting performance. But, when it's time to boil down the numbers, the most jaded business aircraft critic will have to concede that the Corporate RJ can compete with the airlines for cost, travel time, productivity and security—and win. **B/CA**