



Photography courtesy of Fairchild Dornier

Fairchild Dornier Envoy 3

A short-haul corporate commuter with a Gulfstream-like cabin

By Fred George

Fairchild Dornier's Envoy 3 Corporate Shuttle is business aviation for the masses. Even though this aircraft's cruise speed seldom tops 400 KTAS, when compared to traveling by airlines, it can shave hours off trips.

Why? It's Business Aviation 101. When computing the actual elapsed time of a business trip, the clock begins upon leaving home and halts with a welcoming handshake at the destination. So when traveling by airline, you have to consider drive time and parking, the newly instituted two-hour check-in rituals prior to departure, airside congestion at major carrier-served airports, snail's-pace luggage handling, and then more drive time at the destination. As a result, on many short-haul trips, a four-wheeled, 0.1 Mach DaimlerChrysler Concorde could beat the four-engine Concorde SST.

When the point-to-point time savings of a corporate shuttle, such as the Envoy 3, is compared to airline service, the corporate shuttle wins hands down. Fill up all the seats on the corporate shuttle and it's also likely to be less expensive per passenger than commercial airfare.

Short-haul indeed is the \$13.5 million Envoy 3 Corporate Shuttle's strong suit. True to Dornier's STOL heritage, the Envoy 3 can operate out of 4,000-foot runways on missions up to 600 nm, enabling it to use close-in general aviation airports. It climbs directly to its FL 350 service ceiling in 17 to 20 minutes and cruises about as fast as a Citation II. The Envoy 3 is slower than most other competitively priced business jets, but it has much better packaging efficiency. While its exterior dimensions are slightly larger than a super-midsize business jet, the Envoy 3's net-usable cabin dimensions are virtually identical to those of a Gulfstream III.

Fuel efficiency is another of the Envoy 3's assets, especially compared to jets with similarly sized cabins. The reason is simple: The Envoy 3 weighs less when full than the G-III weighs when empty. Combine fuel-miserly Pratt & Whitney Canada PW306B turbofans with lower weight and the result is 35- to 40-percent lower fuel consumption on short-range missions.

The Envoy 3, however, isn't only a short-hauler. Glance at the accompanying Range/Payload Profile chart. When needed, the

Envoy 3, fitted with auxiliary tanks, can fly more than 2,000 nm, as indicated by the dashed lines. It just takes a couple more hours to get there than in a Gulfstream.

The cabin interior can be configured with 19 to 32 seats with standard airline galley, overhead bins and lavatory. Another popular configuration features 16 to 22 business-class seats, again in airliner configuration. When outfitted with 12 to 14 seats in executive configuration and high-end furnishings, the Envoy 3 would almost pass for a Gulfstream, except for the lack of the large oval windows.

Regardless of configuration, the Envoy 3 is an airline-toughened workhorse, one that's designed to fly 10 to 12 legs per day, 3,000+ hours per year. More than 100 328JETs will be in airline service by the end of this month. The aircraft has a 50,000-hour/65,000-cycle design life. (Note: The 328JET's certified ceiling is FL 310. For the Envoy 3, each flight above FL 310 up to FL 350 counts as two cycles.) A special low-utilization maintenance program for corporate operators assures that old age won't catch up with the Envoy 3 before the cycles and miles.

The Envoy 3, though, is very much a niche aircraft, one best suited to the corporate shuttle mission. How well it performs this mission is the subject of this report.



The Envoy 3's strong suit is short-haul, small airport operations.

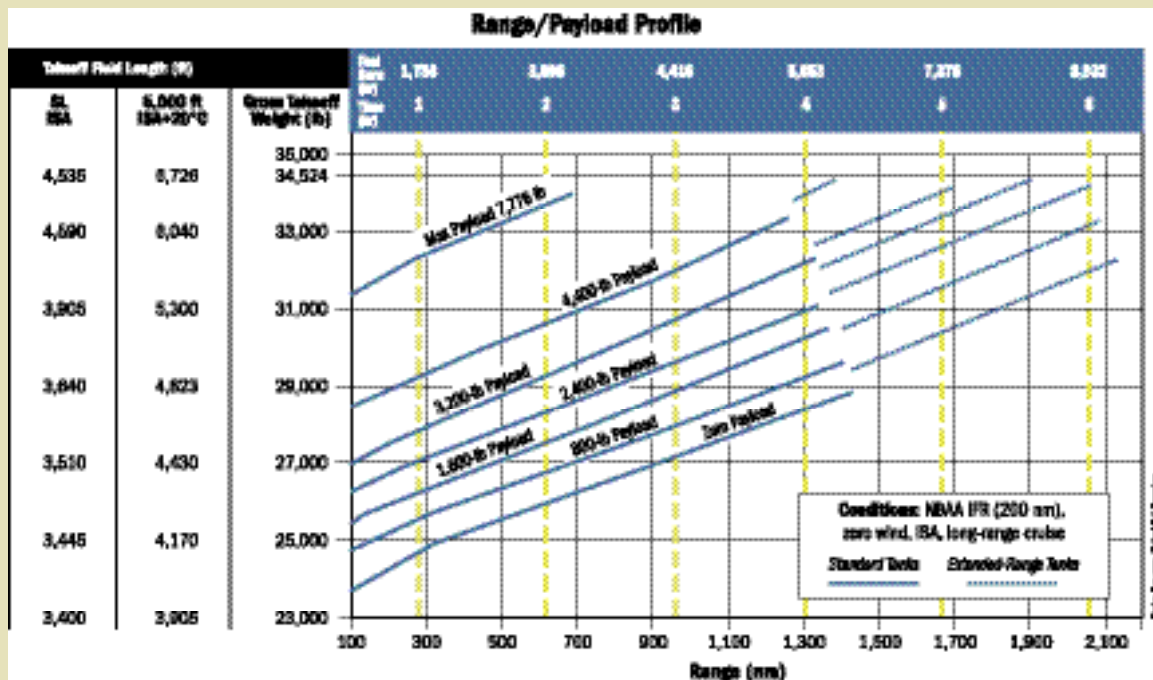
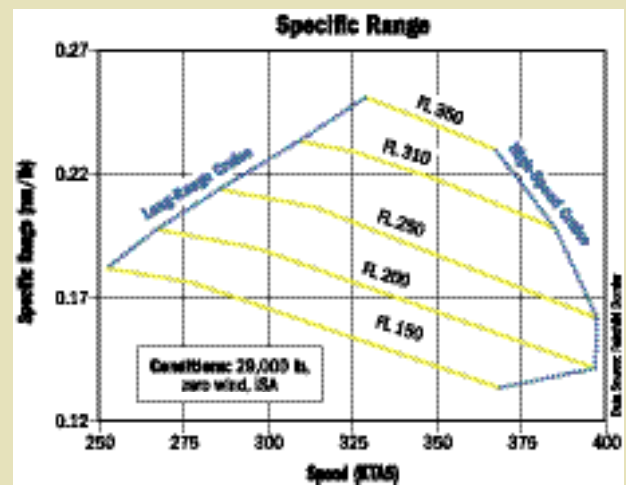
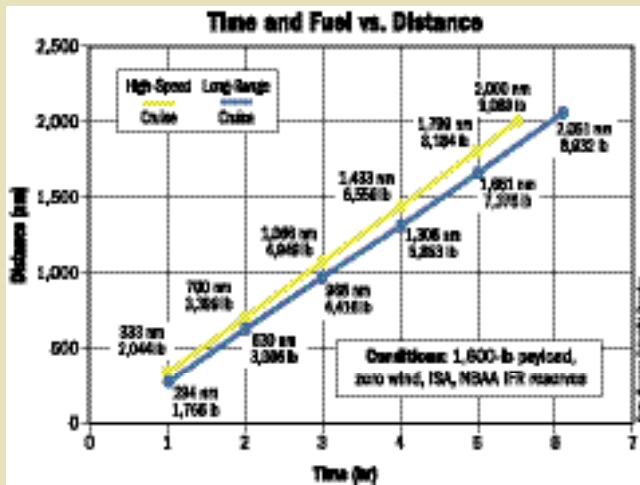
Envoy 3

These three graphs are designed to be used together to provide a broad preliminary view of the Envoy 3's performance. Do not use these data for flight planning. For a complete operational analysis, use the Approved Aircraft Flight Manual, Operational Planning Manual and other flight planning data supplied by Fairchild Dornier.

Time and Fuel vs. Distance — This graph shows the performance of the Envoy 3 long-range cruise and high-speed cruise. The numbers at the hour lines indicate the miles flown and the fuel burned for each of the two cruise profiles. Each of the hour points is based upon specific mission data supplied by Fairchild Dornier.

Specific Range — The specific range of the Envoy 3, the ratio of miles flown to pounds of fuel burned (nm/lb), is a measure of fuel efficiency.

Range/Payload Profile — The purpose of this graph is to provide simulations of various trips under a variety of payload and airport density altitude conditions, with the goal of flying the longest distance at high-speed cruise. The payload lines are plotted from individual mission profiles with several data points, ending at the maximum range for each payload. The time and fuel burn dashed lines are based upon the long-range cruise profile shown on the Time and Fuel vs. Distance chart. The runway distances are computed using flaps 12-degree configuration.



Structure and Systems

The primary fuselage structure, including most of the pressure vessel, is manufactured from conventional, high-strength aluminum. The main entry door is a plug design with integral airstair and step lights. The door measures 5.6 feet by 2.3 feet, qualifying it as a Type II emergency exit. Across from the main entry door on the right side is a 3.0-by-1.7-foot Type III emergency exit. Aft of the wing on the left side of the cabin is an additional Type III emergency exit.

An aft right-side galley service door, measuring 4.1 by 1.7 feet, also serves as a Type II emergency exit. If all else fails, passengers can exit the aircraft through the cabin's aft baggage compartment access door and then out the 4.6-by-3.0-foot baggage compartment door. Pilots can egress through their own overhead emergency exit hatch in the cockpit.

The Envoy 3, a derivative of the Fairchild Dornier 328JET commuter airliner, is Dornier's third aircraft series to have the firm's TNT wing, an abbreviation in German roughly translating into "advanced technology wing." The TNT design has a high-lift, low-drag, medium cruise speed airfoil shape that's light in weight, with large internal fuel volume and low manufacturing cost. The first and second uses of the TNT wing were on the Do228 and Do328 turboprops.

On the 328, the TNT wing provided excellent lift-to-drag up to 335 KTAS and 0.57 Mach cruise speeds. At higher speeds, a strong sonic shock wave forms on the

inboard wing section and drag rises sharply. MMO was limited to 0.59 Mach — too slow for a jet.

To remedy the problem, Dornier engineers lengthened the inboard flap chord, effectively decreasing the overall thickness-to-chord ratio. The proportionately thinner inboard wing raised the indicated airspeed at which the shock wave occurs, thereby reducing high-speed drag rise. This allows the aircraft to cruise up to 400 KTAS and enabled Fairchild Dornier to up the MMO redline to 0.66 Mach.

The centerpiece of the TNT wing's structural design is a monocoque wing box that forms most of each outboard wing section, a feature that eliminates conventional main and aft spars. The box has top and bottom wing panels milled out of thick aluminum plate to produce stressed skins with integral stiffeners. After milling, the top and bottom plates are curved to conform to the desired airfoil shape.

Relatively thin side and end panels are mated to the curved top and bottom sections to form the box. Internal, diagonal cross braces add even more stiffness. The whole assembly has very few fasteners, thereby reducing labor hours.

The inboard section of the wing, which connects the engines and outboard wing to the fuselage, has conventional main and aft stub spars.

Composites are used extensively in secondary structures, such as the nose cone, aft fuselage, tail, wingtips, fairings, control surfaces and even the aft pressure bulkhead — a first for Fairchild Dornier.

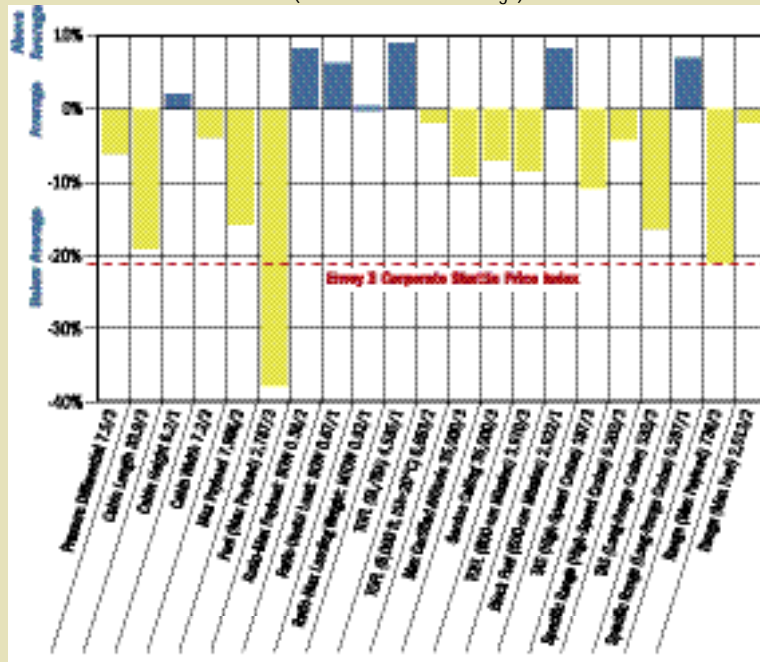
The Envoy 3's fuel system is unique, mainly because of the aircraft's high-mounted, slightly anhedral wing. The feeder tanks are near the tips. The inboard and outboard wing fuel tanks supply the feeder tanks by means of transfer jet pumps. The feeder tanks supply the engines by jet pumps, supplemented by



The Envoy 3's aft luggage bay, also accessible through a door in the aft cabin, has a 229-cubic-foot, 1,653-pound capacity.

Comparison Profile

(Percent Relative to Average)



Tradeoffs are a reality of aircraft design, although engineers attempt to optimize the blend of capabilities, performance and passenger comfort.

In order to portray graphically the strengths and compromises of specific aircraft, *B/CA* compares the subject aircraft to the composite characteristics of other aircraft in its class, computing the percentage differences for the various parameters. We also include the absolute value of each parameter, along with the relative ranking, for the subject aircraft within the composite group.

For this Comparison Profile, *B/CA* included the Fairchild Dornier Envoy 3, Embraer Legacy Shuttle and Bombardier Corporate Jetliner. The Envoy 3's retail price is a considerable discriminator.

DC-powered boost pumps for engine starting, cross feed and jet pump failure. All the jet pumps use high-pressure fuel, bypassed from the engine-mounted fuel pumps, for motive flow. The warmth of the motive flow also eliminates the need for fuel heaters or anti-ice fuel additive.

A single-point pressure refueling port in the right wing leading edge, with selectable

refuel quantity, is used for normal refueling. Alternatively, the aircraft can be refueled through overwing ports by hose nozzles.

The optional \$591,000 extended-range tank kit adds 3,008 pounds of fuel capacity, thus extending range by as much as 600 nm. It also adds 580 pounds of empty weight, which explains why the dashed range lines for the extended-range version on the Range/Payload Profile are offset from the ends of the solid range lines for the standard range configuration. The extended-range kit consists of one forward and two aft conformal fuel tanks atop the fuselage, associated plumbing, fuel probes and electrical boost pumps, plus an auxiliary tank refuel panel in the forward, right landing gear pod. The extended-range fuel system is fully integrated with the EICAS and incorporates a new fuel-control panel on the overhead panel.

The electrical system has both AC and DC generators and main circuits. The engine-mounted, brushless AC alternators produce wild frequency, 115 VAC for high-current draw equipment, such as the main left- and right-side hydraulic pumps, windshield heat and certain anti-ice systems. DC power is used for most of the avionics, battery charging, fuel boost pumps, standby right-side hydraulic pump and lights. Regulated 400 Hz, 26/115 VAC, produced by 300 VA DC to AC inverters are available for certain airline-spec avionics components, such as TCAS and Enhanced GPWS. Two standard 40 AH NiCad batteries are installed, but 43 AH NiCads are a no-cost option. An STC for Concorde sealed lead-acid batteries is under development. Some operators, including some airlines, have already installed Concorde lead-acid batteries on field approvals.

Dual-position lights provide dispatch redundancy. There are 450-watt landing lights in the landing gear pods and two 150-watt taxi lights on the nose gear strut. The package includes ice detection and emergency exit lights, along with top and bottom rotating beacons and wingtip and tail strobe lights. Logo lights are an \$18,500 option.

Left- and right-side hydraulic systems power the landing gear, ground and roll spoilers, wheel brakes, nosewheel steering and wing flaps. One-half of the ground spoilers is operated by each hydraulic system. The left hydraulic system normally powers the landing gear, but the right side also can extend the gear if the left side fails.

The wheel brakes are normally powered by the left hydraulic system, backed up by the right hydraulic system. Emergency braking is available by means of accumula-

tor pressure. The Envoy 3 uses the same MLG wheel pods as the Do328 turboprop. For more stopping power, larger wheels, robust carbon brakes and low-profile tires were fitted to the jet. A brake temperature monitoring system alerts the crew during quick turns if the brakes are too warm after landing for adequate rejected takeoff performance.

The flight controls are manually operated, with roll control augmented by hydraulically powered roll spoilers for enhanced, low-speed roll authority. The Envoy 3 is fitted with automatic ground spoilers, but not flight spoilers. A servo tab on the rudder, which functions only below 160 KIAS, reduces pedal force below 160 KIAS. Above that speed, the servo tab is locked out to prevent overstressing the vertical fin.

Air conditioning is provided by two air cycle machines mounted atop the fuselage, forward of the wing and beneath the aerodynamic fairing. The system features two-zone temperature control, including a limited-range cabin thermostat.

A set-and-forget digital pressurization controller modulates outflow valves to con-

Envoy 3

B/CA Equipped Price \$13,500,000

Characteristics

Wing Loading 80.2
 Power Loading 2.85
 Noise (EPNdB) 71.1/89.8/91.1
 Seating 2+18/32

Dimensions (ft/m)

External See Three Views
 Internal
 Length 33.9/10.3
 Height 6.2/1.9
 Width 7.2/2.2

Thrust

Engine 2 P&WC PW306B
 Output 6,050 lb ea
 Flat Rating OAT°C ISA+20°C
 Inspection Interval OC

Weights (lb/kg)

Max Ramp 34,789/15,780
 Max Takeoff 34,524/15,660
 Max Landing 31,724/14,390
 Zero Fuel 28,814/13,070c
 BOW 20,848/9,456
 Max Payload 7,966/3,613
 Useful Load 13,941/6,324
 Executive Payload 3,600/1,633
 Max Fuel 11,154/5,059
 Payload With Max Fuel 2,787/1,264
 Fuel With Max Payload 5,975/2,710
 Fuel With Executive Payload 10,341/4,691

Limits

Mmo 0.660
 FL/Vmo FL 230/300
 PSI 7.5

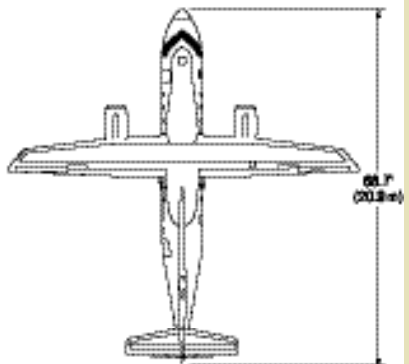
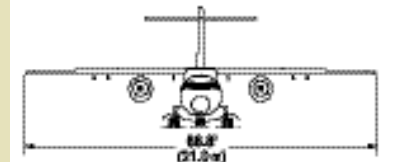
Climb

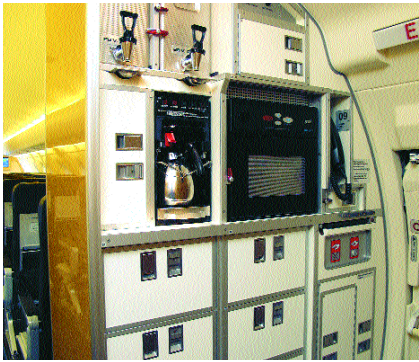
Time to FL 370 NP (FL 350 limit)
 FAR 25 OEI Rate (fpm/MPM) 760/232
 FAR 25 OEI Gradient (ft/nm) 281

Ceilings (ft/m)

Certificated 35,000/10,668
 All-Engine Service 35,000/10,668
 Engine-Out Service 24,700/7,529
 Sea Level Cabin 18,500/5,639
 Certification FAR 25 A 87, 1999
 JAR 25, Change 14, 1999

Envoy 3





Several galley configurations are available. Options include microwave and convection ovens.

control the 7.5 psid pressurization system (6.75 psid for FL 310-certified aircraft). Fairchild Dornier originally planned to offer an optional interface to the FMS for fully automatic pressurization control, but few customers expressed an interest in paying for the engineering costs.

Ice and rain protection is comprehensive and effective. Pneumatic deice boots protect the wing, vertical fin and horizontal stabilizer leading edges. Wild frequency AC is used for anti-ice heaters on the windshields, plus rudder and elevator horns. The angle-of-attack, pitot, total-air-temperature and ice detector probes use DC power for anti-ice heaters. Bleed air is used for engine anti-ice. Windshield wipers are used for rain removal.

Fire protection is another robust system. There are two fire bottles, with remote discharge indicators in the cockpit, for each engine. The APU has its own fire bottle. The lavatory has a smoke detector and its



Business class configuration accommodates up to 22 passengers with room to be productive en route.

own fire bottle. The aft baggage compartment may be rated as a Class C baggage compartment if equipped with the available fire detection and dual bottle extinguishing system, a 66-pound, \$54,000 option. One hand fire extinguisher is installed in the cockpit and two more are located in the cabin.

Two 77-cubic-foot emergency oxygen bottles are installed in the right main landing gear pod with easy access for refilling. The cockpit is fitted with quick-donning masks with inflatable harnesses. Each passenger has a drop-down mask contained in an overhead compartment. Medical oxygen

is available through a port in the cabin overhead.

Cabin Comfort and Passenger Amenities

There are many ways to configure the Envoy 3's 1,183-cubic-foot cabin. One popular configuration is the quick-change interior, which comes with standard airline coach-class seats. In low-density seating configurations, these airline-style interiors may include forward and aft large volume, supplemental luggage closets for passengers' carryon items, such as winter coats, briefcases, hanging bags and laptops.



Except for the large oval windows, the Envoy 3's cabin can be a virtual clone of that of a Gulfstream III, complete with triple seating areas, credenza, work tables and office-in-the-sky equipment.

Laptop power outlets are popular. One operator is configuring an Envoy 3 Corporate Shuttle with a multi-channel air-to-ground phone and data-link system.

Operators may choose to eliminate the overhead luggage bins for more headroom above the seats. If the overhead bins are not installed, they're off the airplane nearly permanently, saving about 63 pounds of empty weight. However, the passenger service units, with reading lights and emergency oxygen masks, remain in place.

Fairchild Dornier's Oberpfaffenhofen and San Antonio completion centers, and AvCraft Completions at Tyler, Texas, offer quick-change interiors that retain the Envoy 3's airline configuration sidewall and floor-mount seat attachment rails. The quick-change kit has a reinforced floor that allows the standard airline seats to be removed so that plinth-base, fully articulating business aircraft seats can be mounted to floor seat tracks. B/E Aerospace, formerly known as Aircraft Modular Products, is a popular supplier of such seats.

The quick-change kits also include modular sidewall panels with integral pull-out worktables, individual video monitors, audio jacks and cup holders.

A 2.2-inch-thick plug may be installed in the offset, dropped aisle to create a flat floor, with 6.0 feet of peak headroom. Most operators choose to leave the airline galley and lavatory installed in either configuration, because of the complexity of changing over the electrical and plumbing systems.

The entire quick-change kit is designed to be installed in one overnight maintenance shift.

Fairchild Dornier completion centers also offer a full executive configuration interior, including a permanently installed, lowered flat floor that adds 195 pounds. This



Quick-change kits include individual video monitors, audio jacks and cup holders.

increases overall headroom by 2.2 inches, but it prevents the aircraft from being resold as an airliner because it's not compatible with airline seat mounts.

In high-altitude cruise, the maximum noise level in 75 percent of the passenger seats does not exceed 78 EPNdB, according to the Envoy 3 product specification. Note well: Noise levels can easily reach the mid-80 dB range during takeoff and climb out in some seats aft of the engines, according to B/CA estimates. Fairchild Dornier offers several optional interior soundproofing packages, ranging in weight from 200 to 400 pounds and costing up to \$226,000. Flight Environments furnishes the heaviest and most effective sound-deadening system.

The Envoy 3 has 229 cubic feet and 1,653 pounds of baggage capacity. The aft baggage compartment, accessible through a large external door with a low sill height, may qualify as a Class C compartment if the optional fire and smoke detection and dual fire-extinguishing bottles are installed. All versions of the Envoy 3 come with an aft baggage compartment access door as standard equipment. Fairchild Dornier officials are exploring whether having the access door may compromise the Class C fire rating of the aft compartment.

Inflight Evaluation

Ben White, Fairchild Dornier's chief demonstration pilot, and Jeff Montgomery, a senior demonstration pilot for the firm, showed B/CA the Envoy 3's features during preflight inspection at Fairchild Dornier's flight operations base in Winchester, Va. Most ground inspection items are done by line service personnel every 14 calendar days, including checking the engine oil levels. Therefore, daily preflight chores are relatively brief, with most items accessible from ramp level, such as air data probes, hydraulic accumulator pressure indicators, and visual tire and leak checks. A short stepladder, however, is helpful for checking the engine inlets and exhausts.

White pointed out that the Envoy 3 has an external panel that allows the APU to be shut down in case of fire. This permits operation of the APU without having a pilot in the cockpit.

Strapping into the left seat of the cockpit, it's apparent that human factors were a high priority for the Envoy 3/328JET engineering team. The cockpit windows are large, providing an excellent field of view. There's plenty of room for navigation chart-book storage and cockpit supplies. The overhead panel design is intuitive.

The demonstrator, configured as a 32-passenger corporate shuttle, had a 20,837-

pound BOW, right in line with numbers quoted by Fairchild Dornier in B/CAs May Purchase Planning Handbook loaded with 7,270 pounds of fuel, the ramp weight was 28,302 pounds. We assumed a takeoff weight of 28,000 pounds for computing takeoff numbers. White plugged the charts for the flaps 12 degrees configuration, a 727-foot field elevation, 25°C OAT and 30.26 altimeter. This resulted in V1 decision and VR rotation speeds of 110 KIAS, a V2 one-engine-inoperative takeoff safety speed of 120 KIAS and a one-engine-inoperative en route climb speed of 147 KIAS. The charted takeoff distance was 3,430 feet.

Reviewing the Approved Flight Manual, we found the takeoff performance charts to be complex, loaded with "what-if" variables, several runway contamination conditions and anti-ice system functions. The FMS has no takeoff and landing performance computer feature, mainly because it requires a second FMS with performance computer for crosschecking. There hasn't been customer demand to develop such a function, Fairchild Dornier officials said.

As a result, B/CA recommends using a laptop- or pocket-PC-based performance computation program, such as Ultra-Nav Aviation or EFB-Pro, to streamline the pre-flight and pre-landing number-crunching processes.

Pre-start cockpit checks are simple and straightforward. White demonstrated use of a weight and balance "whiz-wheel" computer that makes short work of setting trim and checking the c.g. envelope.

FADECs take most of the work out of engine start, terminating the process if a malfunction were to occur. The post-start and taxi checks were brief and logical. We taxied for takeoff on Runway 32 five minutes after engine start. Tight turns require



Airline-style lavatories are available for shuttle configured aircraft.

use of the steering tiller, providing up to 60 degrees of smooth nosewheel steering (NWS) authority. While taxiing, most steering can be done through the rudder pedals that provide up to 10 degrees of NWS. Glancing at the overhead, White reported no failure indications, warning lights dark and normal system annunciator illumination.

Once in position on the runway, White turned off the tiller steering and I pushed up the thrust levers past the cruise and climb throttle quadrant detents to the forward stops. The FADECs set proper takeoff thrust. Initial fuel flow was 2,955 pph per engine.

Acceleration was brisk, we crosschecked 80 KIAS and rotated at 110 KIAS less than 3,000 feet from the threshold. The initial pitch force was moderate, sufficiently light for hand flying, but not oversensitive.

Passing through 400 feet agl, we retracted the flaps and accelerated to 200 KIAS, reducing thrust one click to the climb detent. Holding 200 KIAS for best climb performance. Using a 250 KIAS climb speed outside of Class D airspace may be better for passenger comfort.

We were not disappointed. The Envoy 3 reached FL 310, the maximum altitude for which serial number 3105 is certified, in less than 11 minutes in ISA+7°C to ISA+11°C conditions, having consumed 709 pounds of fuel since engine start.

This was in no small part due to the cooperation of Washington ARTCC, whose air traffic control chores have been considerably more challenging in the wake of recent events. "Thank you, Center," we said several

times during the flight.

Accelerating to 0.64 Mach and 390 KTAS in ISA+8°C at a weight of 27,500 pounds, we pulled the thrust levers back to the second or cruise detent. Fuel flow stabilized at 970 pph per engine.

We found that the Envoy 3's high-speed wing mods work as intended. It was buffet free in wind-up turns to 60 degrees at 0.64 Mach and FL 310. However, we had no opportunity to check high-speed buffet boundaries at the optional FL 350 ceiling.

During high-altitude, high-speed cruise we found roll control forces to be very high — in fact, stiffer than in any aircraft we've evaluated during the past decade.

We also found the aircraft to be exceptionally stable in all three axes, in both short and long period modes. Rudder doublets, for example, are difficult to perform because the aircraft is so well damped in yaw, it stabilizes halfway through the second rudder kick.

While the Envoy 3 has no flight spoilers or speed brakes, a 4,000 fpm descent rate is possible by pulling the thrust levers to idle and maintaining VMO or MMO. This is due to airframe drag. After level-off, speed dissipates rapidly until the aircraft reaches 220 KIAS. Deceleration is slow from 220 KIAS to 170 KIAS, but extending the flaps to 12 degrees at 210 KIAS helps to slow the aircraft. The flaps may be extended to 20 degrees at 180 KIAS for more drag.

Extending the flaps to either of those positions results in a moderate nose-down pitching moment, easily countered by running nose-up trim while the flaps are in motion. Extending the flaps to the full 32 degrees for landing results in very little change in pitch moment. Thrust changes cause almost no attitude change because the engines' thrust vectors are very close to the aircraft's center of gravity.

Stall recovery performance is excellent. If recovery is initiated at the first sign of stall warning stick shaker, the aircraft will recover with no loss of altitude. Pull back on the yoke until stick pusher and the result is a small altitude loss at recovery with no yaw or wing roll-off.

In the landing pattern, the Envoy 3 is as docile as a straight-wing Citation. With an initial landing weight of 26,000 pounds, our VREF landing approach speed was 107 KIAS. The Part 91 landing distance was 2,340 feet.

The Envoy 3's trailing link landing gear makes for smooth touchdowns, and its high wing prevents float in the flare. Rear seat passengers, however, will hear an audible thump at touchdown and soft rumbling from rolling tires unless the aircraft has



Honeywell Primus 2000 Avionics

Primus 2000 is the most advanced avionics system installed in any aircraft in the Envoy 3's price range. It's a model of ergonomic design. Components include five eight-by-seven-inch EFIS tubes, with PFDs and NDs for each crewmember and a central EICAS with full system synoptics, including automatic recall of systems synoptics if a malfunction occurs. The NDs have a vertical profile display that makes vertical navigation easy. The system also includes Primus II radios with flat-panel radio management units that serve as backup EHSI and engine instrument displays, a single NZ-2000 FMS for 3-D navigation, providing glidepath guidance on non-precision approach, and full integration with virtually all aircraft systems, including the engine FADECs and APU.

Primus 2000 uses hub-and-spoke architecture with two integrated avionics computers forming the hubs. All the components, except for the weather radar RTU, are mounted in radio cabinets, just behind the cockpit, for ease of maintenance and protection from temperature and humidity extremes.

The standard package includes dual AHRS, dual micro ADCs, dual comm and nav radios, dual Mode S transponders, dual radio altimeters, single ADF, DME, FMS and Primus 660 weather radar, and Honeywell E GPWS and L3 (formerly Honeywell TCAS 2000) TCAS II. Options include a second FMS (\$160,000), Laser IRS (\$349,000) and Primus 880 Doppler turbulence detection weather radar (\$65,000). As the Flight Dynamics HUD has been certified on the 328 turboprop, it's reasonable to assume it will be made available as an option on the Envoy 3 if enough customers make the request.

supplemental soundproofing installed.

The carbon brakes are quite effective, aided by the automatic ground spoilers. After initial application, the wheel brakes quickly warm up to the most effective operating temperature.

This further increases braking action, requiring a reduction in pedal pressure to maintain uniform deceleration.

One-engine-inoperative (OEI) takeoff procedures are not challenging. While reduced thrust on one engine shortly after V1. The rudder servo tab is very effective at reducing pedal pressure. However, the gearing effect of the servo tab results in relatively long pedal travel, so it's advisable to adjust the seat position carefully before takeoff.

It's also easy to fly the Envoy 3 OEI in the pattern. As with any aircraft having wing-mounted engines, however, it's



Envoy 3 Shop Talk By Dave Benoff

The Do328 was originally designed for the FAR Part 121 environment, and the Envoy 3 Corporate Shuttle takes advantage of its commercial lineage, which includes economic line maintainability.

"Admittedly, the platform was created with airline customers in mind," said Clayton Calihan, Fairchild Dornier's communications director. "Yet, with no design alterations needed to step into the corporate marketplace, the Envoy 3 operates for less per hour than any airplane anywhere near its size and capability, with more reliability and greater comfort."

The Envoy 3's airframe has been designed for more than 3,000 cycles per year, which, according to Fairchild, "translates into added productivity and lower maintenance costs." The high reliability factor is due to the 328 series aircraft having gone through repeated MSG-3 design processes. The MSG-3 reliability-centered maintenance requires a manufacturer to review the economic and maintenance feasibility of an aviation product. If the product does not meet the standards set by its respective committee, then a redesign may be required.

On the initial walk-around you can tell right away that the 328 was set up for the airline environment. There is quick and easy access to most of the components, and Line Replaceable Unit (LRU) methodology is used throughout the design.

The Envoy's wing box is an innovative design, but one that makes corrosion inspection a bit challenging. "The Envoy is loaded with panels, and the typical fuel cell and wing inspection is done with a flashlight and mirror," said Ron Laurence, Fairchild's manager of corporate customer support.

The wing utilizes milled aluminum panels, not unlike those of a honeycomb design, that eliminate the need for standard spars. This is probably why the Phase 5 structural and corrosion part of the inspection takes approximately 257 man-hours to complete. It is assumed that because of the detailed requirements of the Phase 5-6 inspection, that the majority of operators will farm the inspection out.

Conversely, pinpointing mechanical and electrical faults is facilitated by the Integrated Maintenance Test (IMT) program. Using the aircraft's ARINC 429 data bus and the Honeywell Primus 2000 avionics package, the IMT program has made troubleshooting faults easy. In fact, the Envoy 3's maintenance practices have been so simplified that its average maintenance hours per flight hour falls far below 0.9:1.

The IMT is intended to help the operator troubleshoot and maintain the Primus 2000 avionics. It accomplishes this by identifying the faulty LRU or interface, and provides a means for capturing data during flight that can be used to analyze and solve problems. It also provides technicians information that enables them to correct intermittent problems at a support center.

The detection of a subsystem failure during flight mode is stored in the system's non-volatile memory. "The maintenance crew can access all stored flight fault records from the aircraft, and combined with crew squawks and other information, a correlation can be established," said Laurence.

In addition, the Pratt & Whitney Canada PW306B engines use an onboard Engine Condition Trend Monitoring (ECTM) system, which makes it possible to run the engines on-condition. "By utilizing the ECTM system, it is possible to operate the engine at 5,000 hours HSI and 10,000 TBO," said Laurence. However, hard time limits for non-ECTM PW306Bs are 3,000 HSI and 6,000 TBO.

Maintenance training for the Envoy 3 is conducted at the company's San Antonio facility or at the factory in Germany. "We feel training conducted at our facilities offers students a broader learning opportunity, but we can conduct this training at the customer's location, if needed," said Calihan. The maintenance classes last three to four weeks and focus on aircraft systems.

Customer support at Fairchild is conducted on multiple levels and is led by a customer support manager based within the operator's local area. At his or her disposal are field service representatives who can work on location as a troubleshooter and facilitator. Each representative has a regional manager with a core of experts who develop technical solutions and provide AOG mobile

important to stay on top of yaw control with power changes.

Our total flight time was one hour, 25 minutes, and the total fuel consumption was 2,368 pounds.

Cost and Value

Corporate shuttles are getting a lot of attention in the aftermath of recent events, according to aircraft manufacturers B/CA contacted. Shuttles not only save time, they give companies full operational control. There are no strangers among passengers, line service personnel or support staff. A corporate shuttle can also be configured to meet company needs.

Cabin interiors can be configured for high capacity or high comfort during one overnight maintenance shift. Corporate shuttle departures and arrivals are predictable and excuse-free. Travelers can plan

their business schedules with a high degree of certainty.

Worsening airline service is making it easier to justify corporate shuttle operations. Nonstop airline flights are being replaced with multi-stop milk runs. Hub-and-spoke layovers are increasing. The total number of available flights has decreased. And discount airfares have dried up on popular business routes.

Currently, there are three turbofan-powered corporate shuttles in production: the Fairchild Dornier Envoy 3 Corporate Shuttle, Embraer Legacy Shuttle and Bombardier Corporate Jetliner. Glance at the accompanying Comparison Profile chart and you'll find how the Envoy 3 Corporate Shuttle stacks up against its two competitors. The Comparison Profile shows the Envoy 3 at a disadvantage in most areas versus the competition. But, when its

\$13.5-million price tag becomes the reference index, it's a strong performer for the dollar. Nothing in the Envoy 3's price range comes close in cabin size. No aircraft with a comparable cabin has such low direct operating costs. The Envoy 3 also offers short field performance, enabling it to operate out of neighborhood airports, thus bypassing air terminal traffic jams and road traffic. The Envoy 3's 400 KTAS maximum cruise speed, though, makes it unsuitable for frequent long-haul missions in spite of its 2,000-plus nautical mile maximum range with auxiliary tanks.

As a specialty aircraft, the Envoy 3 Corporate Shuttle has few peers. That makes it a strong niche player. If enough operators have need for a large-cabin, short-haul jet aircraft, Fairchild Dornier's Envoy 3 will do well in the corporate shuttle market. B/CA

Envoy 3 Low Utilization Maintenance Program (LUMP):

(Labor Calculated at \$52.00/hour)

Airframe/Systems:

Phase	Interval	Labor Hours	Labor \$	Material \$	Total \$	Task Description
1	2 Weeks	4 Hours	\$208	\$9	\$217	Walk-around tasks, basic checks
2	6 Months	29 Hours	\$1,508	\$614	\$2,122	Phase 1 and full operational/system checks
3	12 Months	54 Hours	\$2,808	\$4,150	\$6,958	Phase 1, 2 and routine inspections
4	24 Months	95 Hours	\$4,940	\$2,360	\$7,300	Phase 1-3 and detailed inspection
5	48 Months	352 Hours	\$18,304	\$2,630	\$20,934	Phase 1-4 and structural/corrosion inspection
6	96 Months	699 Hours	\$37,746	\$3,600	\$41,346	Phase 1-5 and complete open-up/heavy

repairs. Finally, the company is expanding its network of authorized service centers. "We are currently negotiating with several facilities around the world and intend to announce the appointment of several notable and respected companies to work with our customers who contract out their maintenance," said Calihan.

Maintenance Programs and Costs

The Envoy 3's maintenance program is a derivative of the programs designed for the regional airlines. Fairchild offers corporate operators its Low Utilization Maintenance Program (LUMP), which allows maintenance on a calendar basis rather than on a flight hour basis. "We went with this type of program because it permits easier scheduling," said Calihan. "However, it is possible to maintain the Envoy 3 to a flight hour interval if desired."

Currently, only Pratt & Whitney Canada offers a maintenance price protection program — the Eagle Service Plan — for the Envoy 3. However, Fairchild Dornier said it has plans to offer a total maintenance per flight hour, cost protection plan to the corporate operators. "The Fairchild Dornier program would cover all scheduled and unscheduled maintenance on the entire airplane," said Calihan.

The Envoy 3 also uses the Honeywell GTCP36-150 auxiliary power unit. Honeywell offers its APU maintenance service plan for an annual fee of between \$7,400 and \$14,000.

Airframe Scheduled Costs (average 1,000 hours/year):

Year 1, 3, 5, 7 = Airframe, \$14,288 (24 Phase 1s; one Phase 2; one Phase 3); Year 3 HSI due
Year 2, 6 = Airframe, \$21,588 (Year 1 + Phase 4); Year 6 engine overhaul due
Year 4 = Airframe, \$42,522 (Year 2 + Phase 5)
Year 8 = Airframe, \$83,868 (Year 4 + Phase 6)

Powerplant (2 PW306Bs):

Inspection	Interval	Under Eagle Service Plan (ESP)	
		(\$105-\$145 each per flight hour)	Non-ESP (Both)
HSI	3,000 Hours	\$630,000-\$870,000 (Both)	\$280,000
Overhaul	6,000 Hours (OC)	\$1.26 million-\$1.74 million	\$862,000

Parts Sample Prices:

Component	List Price	Manufacturer	Estimated Life
Nose Tire	\$250	Dunlop	500 Landings
Main Tire	\$480	Dunlop	220 Landings
Brakes	\$10,000 (Overhaul)	Dunlop	3,000 Landings (OC)
Generator	\$4,910 (Overhaul)	Auxilec	3,000 Hours
Windshield	\$12,396	Sully	13,000 MTBF