Raytheon Premier I

Nearly midsize cabin at an entry-level price.

By Fred George

Photography by Paul Bowen

Nestle into the passenger compartment of the Premier I, Raytheon Aircraft's $5.2 million entry-level, light turbofan business jet, and you might think it's aimed at the wrong market segment. It's easy to believe you're in a midsize business aircraft, albeit one with one-third less cabin length than most others in the class. Nothing under $10 million offers a larger cabin cross-section.

Thin-wall, composite-sandwich construction makes possible the Premier I's five-feet six-inch cabin width while keeping within the 12,500-pound weight limit for FAR Part 23 normal category aircraft. The sandwich is as thin as 0.81 of an inch, adding six to eight inches of net cross section and 13-percent more cabin volume compared to conventional aluminum semi-monococque construction using stressed skins, frames and stringers.

Raytheon stuck with aluminum for the wing, though, because it weighs less and has more net fuel volume than a composite wing with the same airfoil. Computer-controlled machines are used extensively to build both the composite fuselage and aluminum wing, slashing hundreds of labor hours from the construction process.

Raytheon Aircraft has put to rest the "built for comfort, not for speed" stigma with the Premier I's performance. Block times on typical 300-, 600- and 1,000-mile trips are close to those of midsize aircraft. For instance, Raytheon concedes the Premier I will nose out its own $12 million Hawker 800XP on such missions. Mission fuel burns and direct operating costs, however, are on a par with other light jets because of the Premier I's low-drag aerodynamics and fuel efficient Williams/Rolls-Royce turbofan engines.

Those performance objectives are in keeping with the projections made for the Premier I by Raytheon officials six years ago when the program was officially launched. (See "Raytheon's Revolution," B/CA, October 1995, page 50.)

But the Premier I, as delivered to customers this year, falls short of some other original expectations. Most notably, it gained nearly 1,000 pounds of empty aircraft weight. To compensate, the wing was enlarged six percent to increase fuel capacity by almost 250 pounds. Then, maximum takeoff weight was boosted by 1,200 pounds to carry the extra fuel and empty weight.

Weight gain adversely impacted range/payload performance. The tanks-full, five-occupant range was projected to be 1,500 nm. As delivered, though, the Premier I, fitted with the B/CA equipment list, has a 1,385-nm range with the same payload.

Runway performance also has been affected. In 1995, Raytheon said the Premier I would need only 2,907 feet of runway for takeoff. Today, the standard-day, takeoff field length has grown to 3,792 feet.

Airport density altitude has an even more pronounced effect on runway performance. Departing from B/CA's 5,000 foot/ISA+20°C airport, Raytheon officials claimed in 1995 that the Premier I would need only 4,600 feet of runway. Today, that number has grown to 6,888 feet.

But, there's much more to the Premier I than this brief thumbnail sketch of its performance capabilities. It has, for example, one of the most powerful and capable avionics suites ever installed in a light jet. The Premier I's high-speed aerodynamics are superior to most light jets. Supervisory electronic controls on the engines take the work out of setting thrust during most takeoff, climb and cruise conditions.

The Premier I's construction methods are revolutionary. The aircraft is near the top of its class in systems sophistication.

Structure and Systems

The Premier I was certified in accordance with Part 23 Amendment 52 on March 23, 2001 as a normal category airplane. It also complies with Part 25 transport category aircraft airport performance and ice protection requirements.

The carbon fiber/Nomex honeycomb/carbon fiber fuselage has excellent thermal insulating properties, but it's very rigid, creating acoustical insulating challenges.

Composites also are used for various fairings, doors, engine nacelles, control surfaces and parts of the empennage.

Aircraft windshields are glass for durability. They're coated with rain repellant to eliminate the need for a rain removal system. The passenger windows are stretched acrylic. The 50-inch high by 25.5-inch wide entry door has an integral air-stair and counter-balance springs.

There is a right-side, plug-design, overwing emergency exit that opens inward.

The wing is a Raytheon original design, having 20 degrees of sweep at one-quarter chord and tip-to-tip, wing box construction. Inside, there are six thin spars.

The wing achieves nearly 50-percent laminar flow, even at comparatively high Reynolds numbers. This reduces high-speed drag. Drag rise is modest up to 0.75 Mach, but it rises steeply approaching the aircraft's 0.80 MMO redline as the shockwave forms. High-speed cruise, as a result, is 0.785 Mach — not 0.81 Mach as originally forecast in 1995.

Electrically actuated Fowler flaps with 75-percent span make possible light jet takeoff and landing speeds in spite of the Premier I's relatively small wing area. Notably, the Fowler flaps translate aft when extended so as to increase overall wing area, as well as change the airfoil camber.

The primary flight controls are manually operated through cables and bell cranks, push-pull rods and linkages. Fly-by-wire, hydraulically powered spoilerons augment roll authority, as well as provide speed brake and ground spoiler functions. An electrically powered rudder boost servo reduces pedal force during one-engine-inoperative operations.

A movable horizontal stabilizer and elevator tabs both provide pitch trim in primary and secondary electric trim modes. Primary roll trim is provided by an electrically powered left aileron trim tab. Late in development, Raytheon fitted the aircraft with an electrically powered, separately operated, auxiliary roll trim tab on the right aileron to meet certification requirements for hands-off level flight during one-engine-inoperative conditions. Rudder trim is provided by a conventional electrically powered tab. LCD light-bar pitch, roll and rudder trim position indicators indicate approximate tab positions.

All fuel is contained in wet wing tanks having a usable fuel capacity of 3,611 pounds. An optional SPPR port is available, but it reduces usable fuel capacity by 73 pounds. Anti-icing fuel additive is required.

Jet pumps supply fuel to the engines under most conditions. Left- and right-side electric boost pumps provide fuel pressure for engine starting. A cross-flow system, using a third electric pump, alleviates fuel imbalance between the tanks if needed.

Starter-generators, a conventional 44-amp/hour lead-acid battery and a five-amp/hour standby battery provide electrical DC power to virtually all aircraft systems, including the avionics. The only systems needing AC are the electroluminescent panel lights in the cockpit and the laptop electrical outlets in the cabin.

Engine-driven hydraulic pumps supply 3,000 psi power for operating the landing gear, inside main landing gear doors, spoilerons and wheel brakes. The system uses traditional, non-corrosive MIL-H-5606 red hydraulic fluid — not Skydrol.

The landing gear can be lowered by manually releasing the uplocks. In that instance, the inside main landing gear doors free fall. In the event of a hydraulic failure and prior to engine start, an accumulator provides emergency brake power and parking brake function.

Mechanical links to the rudder pedals provide nosewheel steering. The linkage has positive feedback, in contrast to the spongy feel on some light jets.

Engine bleed air is used for cabin pressurization, cabin heating, wing leading edge and engine anti-ice. Bleed air from the left engine normally furnishes cockpit heat. Bleed air from the right engine normally supplies the cabin with heat.

Notably, when using engine and wing anti-ice bleed air, the two-engine climb gradient drops 3.2 percent and the climb rate is reduced by 1,200 fpm, according to the Approved Flight Manual. One-engine-inoperative performance with bleed-air anti-ice systems in use shrinks by 1.5 percent in gradient and 400 fpm in climb rate.

The Premier I is the first business aircraft to be fitted with an electromagnetic expulsive deicing (EMED) system fitted to the leading edge of the horizontal stabilizer.

Conventional electrical heaters are used for windshield, probe and ice detection sensor anti-icing.

A large capacity, vapor-cycle air-conditioner cools the cabin when both generators

FlightSafety International Simulator Training

The Premier I simulator is Level C qualified, enabling pilots to earn add-on type ratings without having to fly the actual aircraft. Level D qualification is expected late this year, thereby enabling pilots to earn initial type ratings and Airline Transport Pilot ratings in the simulator.

are on the line or when the aircraft is linked to an external power cart. Separate thermostats are provided for the cockpit and cabin. Partially cooled engine bleed air is used for windshield de-fogging. A digital, set-and-forget cabin pressurization controller modulates the 8.4-psi cabin pressurization system, providing a maximum 8,000-foot cabin altitude at FL 410.

Raytheon Premier I

B/CA Equipped Price	$5,258,015
Characteristics	
Wing Loading	55.6
Power Loading	2.72
Noise (EPNdB)	78.8/87.9/92.0
Seating	1+6/7
Dimensions (ft/m)	
External	
Length	46.0/14.0
Height	15.7/4.8
Span	44.5/13.6
Internal	
Length	13.5/4.1
Height	5.4/1.6
Width	5.5/1.7
Thrust	
Engine	2 Wms/RR FJ44-2A
Output/Flat Rating OAT°C	2,300 lb ea/ ISA+13°C
Inspection Interval	2,500
Weights (lb/kg)	
Max Ramp	12,590/5,711
Max Takeoff	12,500/5,670
Max Landing	11,600/5,262
Zero Fuel	10,000/4,536c
BOW	8,240/3,738
Max Payload	1,760/798
Useful Load	4,350/1,973
Executive Payload	1,200/544
Max Fuel	3,612/1,638
Payload With Max Fuel	738/335
Fuel With Max Payload	2,590/1,175
Fuel With Executive Payload	3,150/1,429
Limits	
MMO	0.800
FL/VMO	FL 280/320
PSI	8.4
Climb	
Time to Climb/Altitude	18/FL 370
FAR Part 25 OEI rate (fpm/mpm)	586/179
FAR Part 25 OEI gradient (ft/nm)	298
Ceilings (ft/m)	
Certificated	41,000/12,497
All-Engine Service	41,000/12,497
Engine-Out Service	25,700/7,833
Sea Level Cabin	21,400/6,523
Certification	FAR Part 23 A 52, 2001

Passenger Accommodations

The Premier I's strongest asset is cabin comfort. There is 315 cubic feet of volume in the cabin. Just aft of the entry door, there are four chairs in club configuration with fold-out work tables on each side. These chairs are fully articulating, allowing them to be folded down into a full berth on each side. Aft of the club section, there are two fixed position chairs, better suited to occasional use because of limited legroom and the inability to move the backrest.

The full width, aft lavatory is separated from the cabin by an aft cabin partition and its volume approaches that of a midsize business jet. The potty seat is not certified for full-time occupancy. The flushing toilet is internally serviced.

While the Premier I's cabin is roomy, it's also relatively noisy. The rigid fuselage seems to resonate every sound source, be it the engine sound through the air gap in the cabin door or the rush of air at high cruise speed. The aircraft would benefit from heavier acoustical insulation.

Internal and external baggage volume is generous. A three-cubic-foot closet aft of the right side, standard refreshment center holds 60 pounds of hanging bags. A second 19.9-cubic-foot luggage bay in the aft lavatory accommodates 140 pounds of gear. Outside, there is a 10-cubic-foot, 150-pound capacity baggage compartment in the nose. There is a second 44-cubic-foot aft, left-side external baggage compartment that will hold long items. Cabin options include a choice of five refreshment centers, a B & D flat-panel cabin display, articulating aft chairs, heavier carpet, and various trim/finish upgrades and cabin entertainment systems.

Up front, the cockpit is roomy, although legroom is not generous for tall crewmembers. There is ample navigation chart manual storage. The side armrests are wide enough to accommodate small note pads, but they must be folded up to gain access to the cockpit circuit breakers.

Flying Impressions

Pilots can earn either single or dual pilot type ratings for the Premier I. The aircraft's integral 3-D FMS-3000, plus its avionics and systems sophistication, add in essence an extra, albeit computerized, flight crewmember to the cockpit. Once the pilot masters the aircraft's automation, after takeoff, it's gear up, flaps up, autopilot on and monitor the flight progress until short final.

B/CA asked Raytheon to load the aircraft so that we could fly it at its 12,500-pound maximum takeoff weight during our evaluation flight in late August. The outside air temperature at Wichita's Beech Field "(elevation 1,380 feet) was 32°C, resulting in a density altitude of 3,608 feet.

Demonstration pilot Mark Loyacano walked us around the aircraft.

Most external preflight checklist items are in easy reach, especially if the aircraft is fitted with the optional remote oil-level checking panel. To check the engine fan condition and exhaust duct, though, a ladder is required.

For the flight, Loyacano took the right seat and we strapped into the left. The cockpit's roominess and human-centered design immediately became apparent. RB-6 is equipped with the optional SPPR system, Collins TCAS-4000, Honeywell EGPWS, and various options, resulting in an empty operating weight of 7,982 pounds. With two crew, a safety pilot, two passengers and 3,530 pounds of fuel, the ramp weight was 12,550 pounds. The standard-day, no-wind range under those conditions would have been 1,346 miles, assuming a long-range cruise speed of 0.60 to 0.67 IMN, depending upon aircraft weight.

Takeoff V speeds were 115 KIAS for V_1 takeoff decision speed, 117 KIAS for rotation and 123 KIAS for the V_2 one-engine-inoperative takeoff safety speed. Takeoff field length was 5,616 feet.

The pre-start checklist, while 47 items long, goes quickly because the checks flow around the cockpit, Loyacano explained. Turning on the battery switch powers the MFD, thereby allowing the crew to monitor engine indications and fuel quantity.

Starting is simple. The FJ44-2A engines are fitted with basic electronic control units (ECUs). Pushing the engine start button on the center console initiates the sequence. The ITT redlines on the MFD automatically readjust to the start limits. At 12-percent N2, we advanced the thrust lever and the ECU kept the ITT well within the safe range. At 43.5 percent, the starter disengaged and the generator function became available. The crew must manually reset the generator switches to get the generators online.

With both engines running, generators online and avionics powered, we commenced the pre-taxi checklist, using the electronic checklist on the MFD. This is a lengthy list and takes five to 10 minutes because of the associated BIT checks with various digital systems. Unless the crew performs each item, some digital systems will not be operational during the flight. The FMS-3000 is almost as powerful as some boxes in heavy-iron business jets. That translates into plenty of head-down time both on the ground and in the air.

Once the checklist was complete, we taxied for takeoff.

The wheel brakes do not have a positive feel. Mechanical links from the rudder ped-

The cabin has three windows on each side, mounted for eye-level viewing from the seated position. Dual cup holders, air outlets and reading lights are provided for each seat. An overhead light also is provided for each foldout work table.

als to the power brake control unit activate the wheel brakes. RB-6 exhibited plenty of play in the linkage and it was difficult to modulate braking action smoothly.

The ECUs make it easy to set takeoff thrust. Initial takeoff acceleration was modest, especially in light of the 3,600-foot-plus density altitude. Initial pitch rotation was a bit light, but much improved over the first time B/CA flew the Premier I during flight test development in 1999.

After takeoff, we pulled the thrust levers back to the max continuous detent in the quadrant and the ECUs set the proper thrust. Air Traffic Control constraints prevented a direct climb to FL 410, but the delays provided an opportunity to check handling characteristics. Yaw and roll damping were excellent. Roll effort is proportionate to speed and there is plenty of roll authority available at slow speed, no doubt a result of the spoilerons. Short-period pitch damping was acceptable. We had no opportunity to check long-period pitch damping.

Thirty-three minutes after takeoff, we leveled off at FL 410. There was no need to adjust the thrust during the climb because the ECUs kept the engines within fan and turbine speed, as well as ITT, limits.

At a weight of 11,500 pounds, the aircraft stabilized at 0.75 Mach and 427 KTAS while burning 880 pph in ISA-3°C conditions. The speed was spot on Raytheon's book predictions, but the fuel flow was 50 pph higher than forecast.

The Premier I has exceptionally wide low- and high-speed buffet boundaries at FL 410. Low-speed stall, according to the flight manual, was less than 110 KCAS. At 220 KIAS and 0.75 Mach, the aircraft easily sustained a 60-degree bank turn without high-speed buffet. Indeed, high-speed buffet margins peak at 0.75 Mach at FL 410. These buffet margins mean a safe ride should high-altitude clear air turbulence be encountered. In addition, the wing loading is relatively high, giving the aircraft a smooth ride in rough air.

Descending to FL 310 for a top speed check, the Premier I stabilized at 272 KIAS and 0.73 Mach, resulting in 442 KTAS, at a weight of 11,200 pounds while burning 1230 pph in ISA+11°C conditions. Again, the speed was spot on, but the fuel flow was about 50 pph higher than forecast.

After descending to 15,000 feet for some basic air work, we performed a series of stalls. During any of the stall maneuvers, the aircraft recovered almost immediately, and with complete composure, if recovery was initiated at the first sign of stall-warning stick shaker. If the crew were to choose

Rockwell Collins Pro Line 21 Avionics

The Premier I has the most completely integrated Pro Line 21 avionics system yet installed in a business jet. The standard package includes two large flat-panel displays on the left side of the panel, including a left-side PFD and MFD with "smart" engine gauge indications. In between the two large screens, there is an EFIS display control panel with highly intuitive controls.

The MFS has an electronic checklist feature, but lacks a second-flight-of-day quick turn checklist and pop-up abnormal and emergency procedures checklists.

There is a flight guidance control panel mounted in the glareshield. However, it lacks lighted mode annunciator buttons and numerical read-outs for the heading, course, speed and altitude knobs.

The heart of the system is Collins' Integrated Avionics Processor System (IAPS) box into which nav, sensor, system and engine indications flow and out from which comes flight guidance commands, EFIS data and engine operating parameters. The IAPS also has dual flight guidance computers controlling a single autopilot. Rudder boost is incorporated into the autopilot's yaw damper system.

The standard package includes Collins Pro Line 400 radios, dual air data computers, dual AHRS, single ADF and DME radios, one radio altimeter, a solid-state WXR-800 weather radar and single, full-feature FMS-3000 with integral GPS receiver. A back-up nav/com radio control head controls the pilot-side radios and serves as a clearance delivery radio prior to turning on the master power switch.

Seventy percent of buyers,though, are opting for the three-screen system, a $109,210 option that includes left- and right-side PFDs, along with standby flight instruments. Other options include second FMS-3000 with GPS ($82,645), Collins TCAS 4000 ($152,450), Honeywell EGPWS ($77,565), Collins TWR-850 Doppler turbulence detection weather radar ($32,940), Honeywell KHF-950 HF transceiver ($38,530), dual TDR-94D Mode-S diversity transponders ($41,745), and a variety of cabin entertainment and communications equipment.

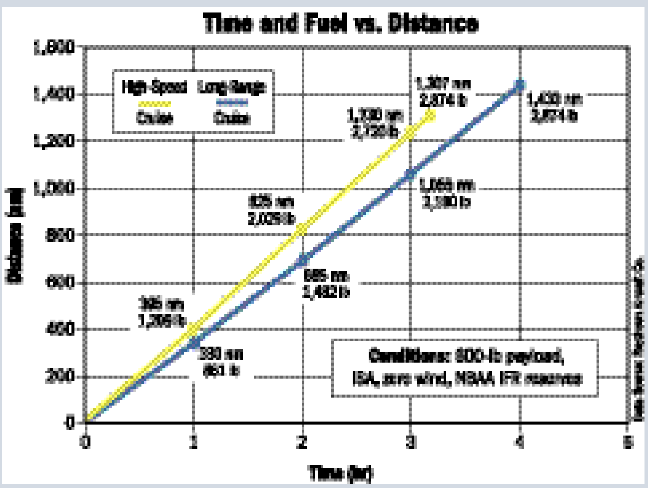
Raytheon Premier I

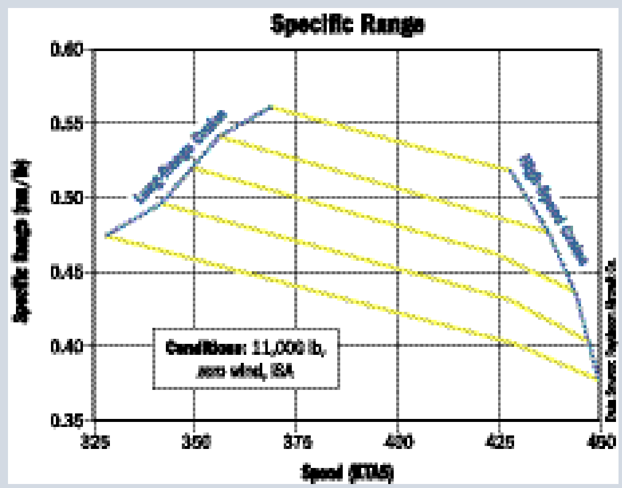
These three graphs are designed to be used together to provide a broad preliminary view of the Premier I's performance. Do not use these data for flight planning. For a complete operational analysis, use the Approved Aircraft Flight Manual, Pilot's Checklist, Pilot's Operating Handbook and other flight planning data supplied by Raytheon Aircraft.

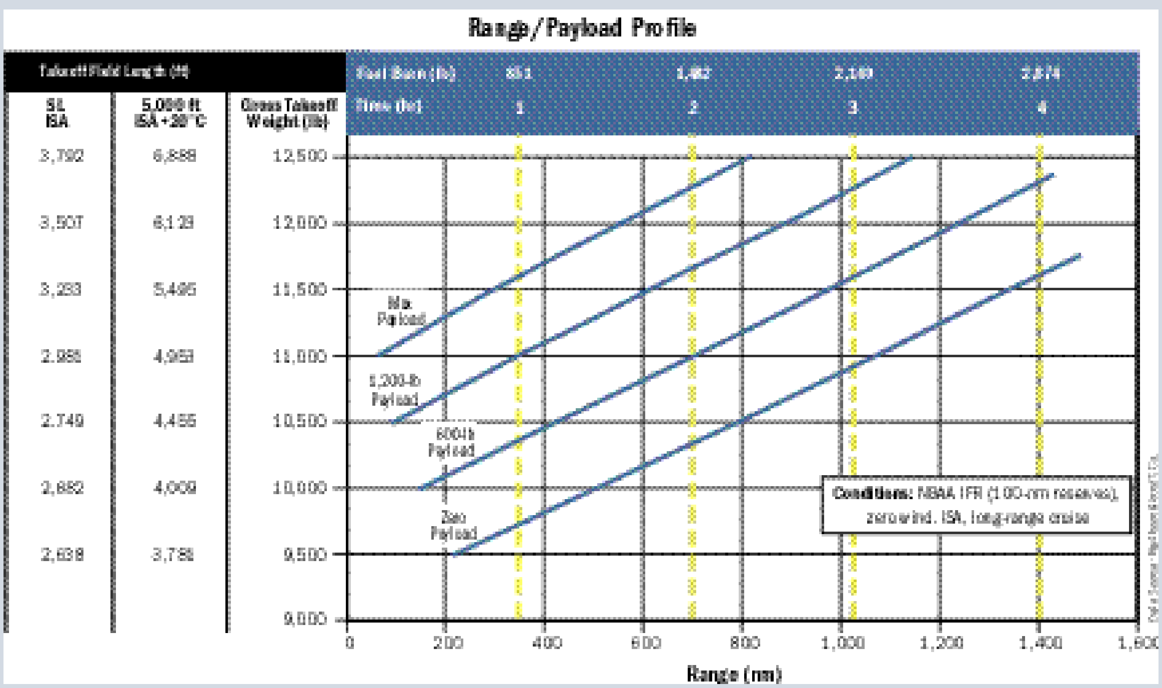
Time and Fuel vs. Distance — This graph shows the performance of the Premier I at long-range cruise between 0.58 and 0.67 IMN depending upon weight,distance and cruise altitude and high-speed cruise, ranging between 0.73 and 0.78 IMN, depending upon weight, distance and altitude. The numbers at the hour 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 contained in the Premier I Pilot's Operating Handbook. While flying the Premier I for this report, we found Raytheon Aircraft's projections for cruise speed to be highly accurate, but fuel flows were slightly higher.

Specific Range — The specific range of the Premier I, the ratio of miles flown to pounds of fuel burned (nm/lb), is a measure of fuel efficiency. The lines are flat between two points because the Pilot's Operating Handbook only contains data for (1) long-range cruise and (2) high-speed cruise. There is a wide range between the Premier I's long-range and high-speed cruise points at FL 410, suggesting the aircraft could cruise more efficiently if its service ceiling were higher.

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 long-range cruise. The four 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 20 degrees for sea-level standard day runways and flaps 10 degrees for *B/CA*'s 5,000 foot, ISA+20°C airport.







to ignore the shaker and pusher in violation of the flight manual, the aircraft's post-stall characteristics would become considerably more colorful.

Configuration changes produce almost no pitch trim change, in keeping with Raytheon's high standards of aircraft handling characteristics. The only perceptible pitch change associated with cycling the speed brakes, landing gear and wing flaps was related to airspeed change.

The engines, though, are mounted well above the center of gravity. Increasing thrust causes the nose to pitch down slightly and mild pitch up occurs with thrust reduction.

It's aerodynamically clean, so landing approaches must be planned as though one were flying a larger, heavier business jet, such as a Learjet 31A. This aircraft doesn't go down and slow down simultaneously.

At 10,500 pounds, the landing reference speed was 114 KIAS and the landing distance was 3,100 feet. Smooth touchdowns take practice in the Premier I. Its straight-leg oleo struts don't soak up imperfection in pilot technique. We found that smooth touchdown and short landing distances were mutually exclusive. The crew has to put weight on the nosewheel promptly in order to activate the lift-dump, ground spoilers.

After landing, we found brake energy is another challenge for the Premier I. The cool down times after a maximum effort, heavyweight landing stop are as long as 90 minutes. And the flight manual charts only provide landing to landing brake cooling intervals — not last-landing to next-takeoff intervals.

Overall impression? The Premier I is a nice airplane to hand fly, but mastering all its systems and automation, along with learning to use its full potential, will take considerable time.

Price and Value

Raytheon plans to recalibrate the Premier I's stall speeds and that could shave off some of the required runway length.

In the interim, operators would benefit from a performance management upgrade to the FMS that would automatically compute V-speeds, runway length and one-engine-inoperative climb performance computations based on aircraft weight, c.g. and airport density altitude. This would enable operators to extract peak performance out of their aircraft and not fret over possibly overloading the aircraft prior to departure.

Seventy percent of Premier I aircraft will be flown single pilot, usually by owner operators who typically carry light payloads on most missions. On two-hour, bread-and-butter hops, the Premier I can operate out of 3,400 foot runways with four passengers, assuming standard day conditions, and fly more than 800 miles at nearly Learjet speeds. Plan on 5,000-foot-plus runways on hot summer days in the Midwest.

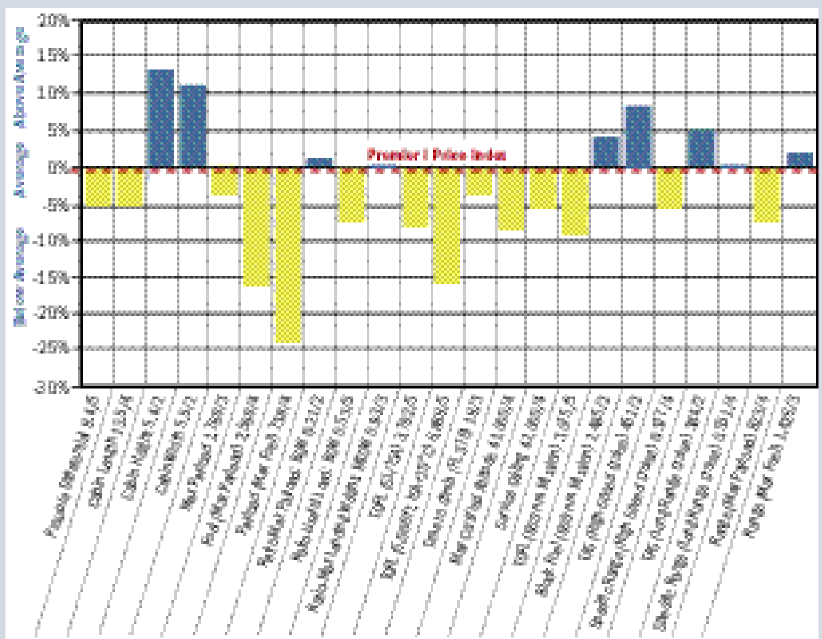
The Premier I indeed faces strong competition from Cessna's Citation CJ2, its archrival. The CJ2, a derivative of the CitationJet, offers more tanks-full payload, more range with max payload and considerably better runway performance. It's also less complex, making it easier to fly single pilot. But, the CJ2's cabin size and cruise speed are no match for the Premier I.

Tradeoffs are a reality of aircraft design. The Premier I has no match in the entry-level market for cabin comfort and cruise speed. If runway performance and tanks-full payload issues aren't a problem for buyers, it will become a strong niche player in the light business jet market. **B/CA**

Seventy percent of Premier I aircraft will be flown single pilot, usually by owner-operators.

Premier I 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 Cessna CJ1, CJ2 and Citation Bravo and the Bombardier Learjet 31A because they are the closest competitors in price. The Premier I's retail price is within two percent of the composite average. The Comparison Profile illustrates the Premier I's advantage in cabin size and cruise speed. It also shows that the Premier I's competitors have runway and range/payload cruise performance advantages.

Premier I Shop Talk

Text & Photography by Dave Benoff

Before Raytheon set off to produce the Premier I, the company had to break down some of the old corporate philosophies. Overcoming the greatest obstacle — the traditional design team composition itself — was accomplished when management added a contingent of full-time maintenance technicians to the group.

"In the past the aircraft performance specifications were established and the engineers designed the aircraft," said Greg Graber, manager-technical support for Beechjet and Premier. "They treated a new design as though it was some sort of secret and after it was out in the field we [technical support] were left to deal with it."

While it is still undressed, you can see the extensive use of composites.

In addition to technicians, the Premier team included tooling and production personnel who employed a reliability centered maintenance (RCM) format to guide their work.

"We used the RCM methodology in the design process but did not have the program formally approved. However we will go through the official MSG-3 process with the Hawker Horizon project," said Graber.

The end result of this marriage between technicians and engineers is an aircraft that has a good balance between functionality and maintainability.

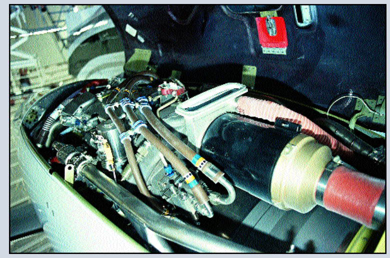
The Walkaround

The Premier I's carbon composite fuselage construction bears close consideration when performing a maintenance evaluation. On the plus side, composite materials are stable, strong and you never have to buck a rivet. On the flip side, if a cold-soaked aircraft has a bird strike, you better have someone who is well-versed in composite repairs.

As far as the remainder of the aircraft is concerned, Raytheon has created a product that is easier to maintain and service than any of its previous models. "We took the best from all worlds," said Bob Hixon, Raytheon customer support systems engineer. "The landing gear is based on the Beechjet design, the fuel system on the 1900 and other systems take advantage of lessons learned on the Hawker." To appreciate these design attributes, take a walk around the aircraft, starting just aft of the nose cone on the copilot's side where the avionics bay is located.

All of the LRU boxes are clearly marked and the wire bundles are packaged in order to aid point-to-point troubleshooting. "Each of the 90-degree connectors passes through a web-like structure and removal of the plugs shell makes it easy to read out pin numbers," said Joe Graziosi, Raytheon's avionics technical service representative.

Continuing aft, the Premier's all-metal wing features a leading edge that uses bleed air distributed through a piccolo tube. The leading edge itself is riveted to the wing structure, making repairs to the surface difficult. Raytheon decided to use rivets rather than screws in order to increase aerodynamic flow, but in the future, this design may change. Even so, there are no components that a technician needs to access in the leading edge.



The ease of engine access and design of the cowl latch system improve the technician's workspace.

The rest of the wing is a standard Raytheon design, including electromechanical controls and Fowler flaps. The only interesting item of note on the flaps is that both a main wheel and a nose-wheel squat switch must be tripped in order for the inboard flaps to deploy.

Just aft of the wing on the copilot's side is the access hatch to the maintenance bay. It is in this area where most servicing of the hydraulic, air conditioning, brake anti-skid and other systems occurs. The hydraulic system uses a quick disconnect service port in the bay so that a mule can hook up to the system.

One problem that could occur in this area is an accidental spill over some control box components. The hydraulic reservoir is located up and out of sight of the bay and the only indication that the system needs servicing is a low-level hydraulic light.

The aircraft electrical system uses a sealed lead-acid battery buss tied by two engine-driven generator GCUs. Since the battery is located at waist level, repair and replacement is a relatively easy process. Raytheon also learned a valuable lesson designing the buss relay system. In the past, relays were hard-mounted to control boards. On the Premier, all of the relays are removable and they are arranged in a circuit-breaker fashion.

Access to the system components appears to be acceptable and the side entry is far better than the "Hell hole" employed in the King Air series.

New to Raytheon aircraft, the Premier features an electromagnetic expulsive deicing (EMED) system on the horizontal stabilizer. Raytheon techs call it the "Thumper." EMED has a thin electrically heated strip used to part the ice and electromagnetic transducers that rapidly (and audibly) thump surfaces to break off ice accumulations. EMED operation is automatic when linked to the Premier I's ice detection system. The system has an initial built-in test that is performed when the STAB switch is placed in the auto position and continues monitoring afterwards.

The nose gear of the Premier includes a fully detachable link for 360-degree taxiing and a nose-gear squat switch.

Opposite the maintenance bay on the pilot's side is the main baggage compartment. There is little to be maintained in this area, unless the heated compartment option is selected. A nose baggage compartment provides additional storage, although heating there is not an option.

The main gear has also been designed to be maintenance friendly. It does not use a conventional down lock but, instead, incorporates an internal lock in the gear actuator. By locating the downlock mechanisms internally, the design avoids typical environmental problems such as icing, corrosion and erosion. In addition, the brake actuating system uses a power brake control valve and because the system uses a separate parking brake accumulator, setting the parking brake is accomplished by merely pulling the brake handle; depressing the toe brakes is not required.

Certified in 1997, the Premier I's Williams FJ44-2A engines use a digital/mechanical engine control and are easily accessed and serviced "on the pylon."

Inside, the Premier improved its window design by using a "Beechjet like" lever-actuated blind rather than polarized windows found on King Airs. The latter can be difficult to see through, are susceptible to scratching and crazing, and take a considerable amount of time to replace. The seats are hard-mounted with four bolts and are easily removed. However, removal is rarely necessary since there are no components under the floorboards, and the only time the interior needs removal is during its structural time-limited inspection.

Raytheon Service

In 2000, Raytheon had some rough going in providing maintenance support of its products. The company began to institute a spares availability program while simultaneously transferring its parts distribution center from Kansas, where the only carrier was FedEx, to Ryder Logistic Support Services in Dallas.

"In January, everything came to a standstill, but now the technical representatives are much more efficient," said Graber. "The problem with this was that the timing was lousy. We could have absorbed one event, but both at the same time wasn't a good thing."

Another problem was Raytheon's reliance on too few centrally located field reps, each of whom was responsible for the full range of Raytheon aircraft models. Now the company has decentralized the field force and divided them into Beechjet -Premier, Hawker-Horizon and piston aircraft representatives.

"This allows us to focus on the owner and become more proactive and less reactive," said Graber.

Raytheon also picked up some new reps, all of whom have worked at the service centers for at least four to five years. However, this means that the company is robbing the centers of some good talent.

Finally, they created a new service engineer position. These are technicians who track field problems from inception to conclusion and determine if there are any QA, supply or technical situations that can be resolved through writing up a service bulletin.

Maintenance Programs and Costs

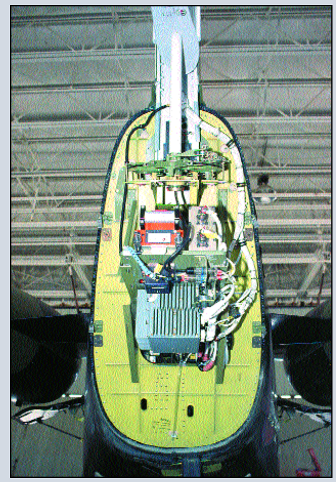
The Premier's maintenance program is based on the popular four individual hourly inspections (200, 400, 600 and 1,200 hours) derived from the Beechjet program. There are also Chapter 4 and 5 items that occur at different time settings – 800, 1,400 and 1,600 hours.

Raytheon provided the following estimates for the maintenance labor required at different inspection periods.

Maintenance Aircraft Hours	Labor Hours
200	40
400	80
600	115
800	89
1,000	40
1,200	295
1,400	48
1,600	87
1,800	115

One-stop shopping for avionics troubleshooting

The Premier also employs a new digital maintenance management service called Factory Aircraft Comprehensive Tracking Systems (FACTS). FACTS is an Internet-based aircraft maintenance system that is available 24/7. The system runs on Raytheon's ERP network system and provides the maintainer with real-time scheduling and planning data. Raytheon said FACTS meets the requirements of FAR Part 91 and 135 and provides reports on maintenance forecasting, aircraft status, aircraft maintenance history and AD/SB compliance.



The brain of the "Thumper" system, located in the tail, provides the signal needed for tail deicing.

The standard warranty on the Premier I is five years on airframe, Raytheon parts and avionics; three years or 1,500 hours on engines; and two years on non-Raytheon parts, paint and interior.

An "Elite" engine total assurance program (TAP) from Williams is available for $162.24 per flight hour and includes all maintenance, excluding FOD and compressor washes, with no pro-rata. Without the TAP plan, Williams International said that the HSI at 1,750 hours is $45,300 and estimate the 3,500-hour overhaul at $178,000.

On the airframe side, Raytheon said with labor and parts (airframe/avionics) the cost should run approximately $152.77 per flight hour. Thus, the overall maintenance cost for the Premier is approximately $315 per flight hour.

Sample prices for chart

Component	List Price	Supplier	Estimated Life*
Nose Tire	$391.20	Goodrich	500 Landings
Main Tire	$688.54	Michelin	250 Landings
Brakes	$7,143.00 (OVH each)	Goodrich	850 Landings
Starter Generator	$4036.56 (OVH each)	Advanced Industries	1,500 Hours
Windshield	$20,692.09	PPG	7 to 8 Years

*Current estimated life subject to change under actual operating conditions.