

Inflight Report

Jetstream 41 Corporate Shuttle

This twin-engine turboprop provides a cost-efficient way to transport 12 to 16 employees between regional locations.

By FRED GEORGE



Charles Pereira

The *Official Airline Guide* is one of the most effective ways to justify the acquisition of a corporate shuttle aircraft. Run your fingers down the pages, and you'll find a list of dozens of smaller cities that have little airline service. The air fares to many of those cities, which have not benefited from the competitive effects of airline deregulation, have skyrocketed. (You will also notice the absence of many cities from the list, meaning that they don't have any airline service.)

With the intent of pleasing your

chief financial officer as much as your passengers, the Jetstream 41 Corporate Shuttle is designed to fill that void in airline service. According to British Aerospace's Jetstream Aircraft, the J41, designed to carry 29 passengers in high-density seating, is smaller and, thus, less expensive to operate than 34- to 50-seat regional airplanes configured as corporate shuttles.

The J41 offers 1,040 cubic feet of volume in a corporate shuttle configuration. Its internal cabin length is vir-

tually the same as that of a Falcon 2000, although the J41 offers four inches less headroom, and its cabin is 17 inches narrower. The wing spar is located below the fuselage, resulting in a recessed aisle that provides an unrestricted five feet, 10 inches of headroom throughout the cabin.

Without a doubt, the J41 corporate shuttle is a niche aircraft; it is tailor-made for 200- to 500-nm stage lengths. The airplane, if the mission called for it, could fly 14 passengers more than 1,400 nm, but Jetstream marketers

Business & Commercial Aviation

COVER STORY



Bud Shannon

The demonstrator's main cabin has six forward-facing chairs and four in a club configuration. The recessed aisle provides five-feet, 10 inches of headroom.

mature, and regional airlines are looking to serve communities with higher passenger loads.

A larger version of a relatively small regional airliner was the result, and it has exceptionally low operating costs. Operating economy is the central thrust in Jetstream's marketing approach toward customers. Terms such as "seat-mile cost," "shared ownership" and "scheduled service between points" are prominently heard during sales presentations to cost-conscious corporate operators.

PASSENGERS AND PAYLOAD

Operators looking at most 12- to 16-passenger business aircraft priced under \$10 million are forced to choose between carrying passengers or payload. In contrast, the J41 has a 5,800-pound maximum payload and enough internal capacity to actually use it. A 170-cubic-foot, pressurized aft fuselage baggage bay with a 1,200-pound capacity is fully accessible in flight. Bulky items can be loaded through the com-

partment's 48-inch by 52-inch cargo door on the left side of the fuselage. Notably, that load won't upset the center of gravity; no tail-support boom is needed during loading.

Another 47.5-cubic-foot, unpressurized, cargo bay is located in the aft section of the aerodynamic fairing under the fuselage. The lower bay is accessible by means of left and right 17-inch by 40-inch doors, and it is long enough to accommodate a ladder as well as lengthy passenger baggage.

Forward of the counter-sprung, manually operated, airstair door is space for carryon items, such as coats, briefcases and presentation materials. Overwing emergency exits are built into the left and right sides.

The J41 corporate shuttle demonstrator is fitted with an impressive 14-passenger interior completed by KC Aviation in Appleton, Wisconsin. By means of special mounting attachments, the interior shell is acoustically isolated from the airframe, thereby reducing interior noise and vibration.

don't tout this capability. James Burk, Jetstream Aircraft's vice president of corporate aircraft sales, explained, "You would be better off using a large corporate jet, if this is your prime mission."

The J41 is an evolutionary development of BAe's successful 19-passenger Jetstream 31 that features a 16-foot fuselage stretch, a scaled-up version of the J31's wing and more powerful engines. Market studies indicated that a growth version was needed because the 19-passenger market is now

INFLIGHT REPORT



A pair of cabin dividers separates the forward and aft cabin sections. The left divider houses a CD player and a VCR.

Also, the demonstrator aircraft is fitted with acoustic dampers that resonate at the frequency corresponding to the propeller beats and, thus, help soak up noise and vibration. The result is an interior that is 10 dBA quieter than the J41 regional airliner, according to Jetstream officials. The firm claims an average cabin sound level of 80 dBA, but the sound level



Bud Shannon (3)

The semi-private, aft cabin has four chairs in club configuration. Large, fold-out worktables help travelers make the best use of en route travel time.

near the propellers is closer to 90 dBA. Future plans call for development of an active noise attenuation system.

Each passenger chair, covered in soft leather, is adjustable in pitch, rake and lateral position. The chairs also rotate on their bases. The demonstrator is configured with two club sections of four seats and six forward-facing seats in the front of the cabin. Worktables help travelers make the best use of their time, and four flat-panel display screens allow video presentations to be done in flight. This flying office also has an air-to-ground radiotelephone with a fax/modem, plus 117 VAC outlets for laptop computer users.

Other features of the cabin include a forward galley, mid-cabin "pyramid" cabinets with storage for small items and a full-width, externally serviced lavatory in the aft cabin.

RUGGED DESIGN FEATURES

When the firm began initial development of the J41, airline operators told BAe that reliability and maintainability were top priorities. These priorities directly benefit corporate operators. The aircraft's design life is 60,000 flights. Only the landing gear has a structural life limit—60,000 cycles.

Component access is excellent. For example, doors in the lower fuselage fairing provide access to the two air-cycle machines, the hydraulic reservoir, electrical equipment and the batteries. Another door on the bottom

side of the tail cone provides access to the oxygen system, cockpit voice recorder and flight data recorder.

Located in the nose, the avionics compartment is accessible by means of left and right doors. The J41 has a single-point refueling port in the leading edge of the right wing, helping to make possible 10-minute turnarounds. Full-service turnarounds take only 20 minutes largely because virtually all the ground-service points are on the right side, allowing unimpeded movement of passengers and baggage on the left side.

Other low-maintenance features include glass windshields with wipers for rain removal, metal propellers, a 28-VDC electrical system and jet pumps in the fuel system. The basic airframe inspection interval is 300 hours, and major inspections are scheduled at 3,000-hour intervals.

The J41's ice-protection system underwent particularly rigorous testing by the U.K.'s Civil Aviation Authority, which smoothed the way for FAR Part 25, Appendix C certification. The J41 is equipped with deicer boots on the wings and empennage leading edges, plus heated anti-ice protection for the props, engine inlets, elevator balance horns, pitot-static systems and angle-of-attack sensors.

BAe claims that less than two staff hours per flight hour are needed to maintain the J41, but that assumes a utilization of at least 800 hours per



Left: A 170-cubic-foot, pressurized aft luggage compartment. Top Center: 47.5-cubic-foot, unpressurized cargo compartment in lower fuselage fairing. Bottom Center: High-intensity, recognition lights on wingtips. Right: Five-blade McCauley propellers.

year. With the lower utilization typical of corporate shuttle operations, the maintenance-to-flight-hour ratio could be slightly higher.

Corporate shuttle operators also benefit from plenty of fleet experience with Jetstream 41s during the past two years. More than 50 of the aircraft have been delivered to regional airline operators and by late February, BAe had chalked up 139 total orders and options from operators in seven countries. Thus, in our opinion, the fleet has reached "critical mass," assuring corporate operators of strong and continuing field support from the manufacturer.

FLYING IMPRESSIONS

Our demonstration flight mirrored the profile of a typical corporate shuttle mission in the northeastern United States. We filed a flight plan from Leesburg, Virginia to Westchester County Airport—next door to our Rye Brook offices.

When first strapping into the J41's cockpit, we found that flightcrews don't have to worry about being "kept out of the control loop" by automatic systems. The J41 is very much a hands-on airplane, fitted with a plethora of manual controls on the overhead panel, instrument panel and center console.

Yet, BAe makes thorough use of lighted annunciator switches and other controls flanked by indicators,

enhancing hand-eye coordination. Exceptions are the EFIS and primary flight instrument controls.

The associated controls, mounted in the glareshield panel, don't have accompanying annunciators or indicators. Pilots must first locate the appropriate knob or switch, then direct their attention to annunciators on the small-format EFIS displays to verify that the control input had the intended effect. However, the autopilot panel does have lighted annunciator switches, providing immediate verification of the intended mode selection.

The J41's pre-start checks are straightforward and after connecting a ground power cart, we ran through the checklists. The cabin can be warmed or cooled to the desired temperature prior to start, if the aircraft is equipped with the optional ground heating and freon air-conditioning systems. An auxiliary power unit may be offered for corporate shuttle customers, but plans have not been finalized.

Ground power for starting is desirable. The single-shaft AlliedSignal TPE331-14 engine needs an ample electrical power source for its 550-amp starter.

After the pilot initiates the start sequence, the engine's integrated electronic control (IEC) regulates most starting functions. (See sidebar.) The IEC ensures that the engine stays within all of its limits during starts in

a wide range of weather and temperature conditions. The engines stabilize at 1,117-prop rpm with the condition levers in the ground position.

Generally, the J41 is easy to taxi, but tight maneuvering takes some practice. A tiller on the left console controls the hydraulically powered nose-wheel steering, but the nose gear pivots beyond the nose gear's mechanical limits when turning sharply. The pilot may need to use differential power and brakes to straighten the nose gear enough to regain power steering.

Departure delays cost us 250 pounds of fuel. The aircraft's weight when we were cleared for takeoff was 21,800 pounds. The J41 has counter-rotating props that minimize VMC and, thus, takeoff V-speeds. Our calculated speeds for V1/VR were 112 KIAS; 118 KIAS for takeoff safety speed.

At rotation, the pitch force was heavy because the main landing gear are far aft of the center of gravity. Once airborne, we found the control pressures to be substantial, though well balanced at cruise speeds.

The J41 handles turbulence well, as manifested by short-term and long-term stability in all three axes. The aircraft's wing loading (68.9) is relatively high for its size, which helps to smooth the ride. The stiff structure, however, transmits the bumps to the fuselage.

After intermediate delays required by ATC, we arrived at FL 210 in 16

ENGINE POWER

AlliedSignal's newest, largest and most-powerful version of its venerable TPE331 turboprop engine powers the Jetstream 41. Ten years have elapsed since the -14 was first certified for use on the Piper Cheyenne IV, so it has had plenty of time to mature. The -14 has grown into a 2,000-thermodynamic-horsepower-class engine that has an exceptional wide temperature margin, allowing it to maintain a normal flat-rated 1,650 shp up to 23°C (73°F) at sea level. An automatic power reserve (APR) feature enables takeoff rated power up to 36°C (97°F).

Jetstream and AlliedSignal are developing a water-methanol injection system, slated for certification this month, that will extend the takeoff flat-rating up to 53°C (127°F). This capability will greatly enhance second-segment, one-engine-inoperative (OEI) climb performance, thereby allowing departures even at high weights. Also, the additional power will appreciably shorten runway distances because the use of wing flaps will be authorized for hot/high departures.

As configured for the J41, the -14 engine is designed to operate at altitudes up to 31,000 feet. The aircraft, though, has a maximum certificated altitude of 25,000 feet, thus reducing potential thermal stress and ensuring long engine life.

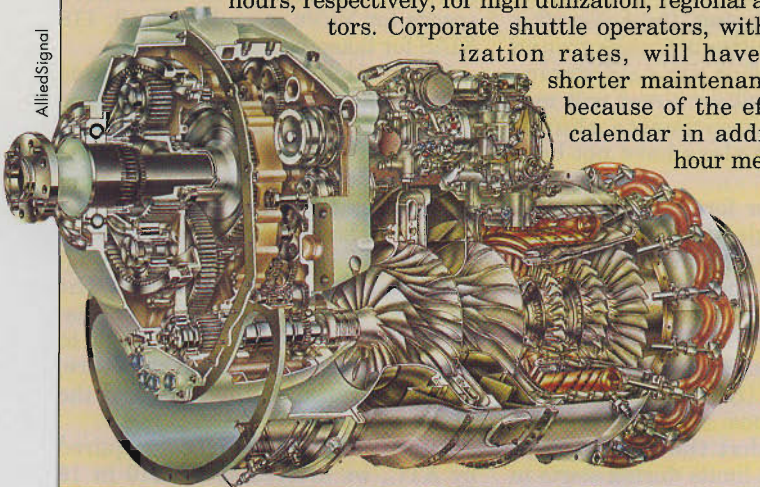
The TPE331 is a single-shaft design, thus the props operate in a relatively constant range of 1,490 to 1,552 rpm in flight. The prop system has an automatic-feathering function triggered by a power failure during takeoff and a negative-torque-sensing function to prevent adverse drag from a windmilling propeller during other phases of flight.

Unlike free turbine designs that have a much wider speed range, the narrow prop rpm range results in more cabin noise. However, the TPE331 has excellent and almost immediate response to small power changes. It also has excellent specific fuel consumption because of its relatively high pressure ratio, resulting in impressively low block fuel burns.

The -14 is fitted with an Integrated Electronic Control (IEC), a digital supervisory and monitoring system that automatically limits torque to 100 percent, controls starting functions and provides a variable red line on the engine temperature gauge that adjusts the limit for ambient conditions. In addition, the IEC provides engine-trend monitoring and exceedance recording. While not intended to be a full-authority digital engine control (FADEC), the IEC assists the pilot in properly setting the power and avoiding over-limit conditions.

At present, the -14 has a hot-section inspection interval of 2,500 hours and a major-period inspection interval of 5,000 hours. Jetstream and AlliedSignal expect to stretch these intervals to 3,500 hours and 7,000

hours, respectively, for high utilization, regional airline operators. Corporate shuttle operators, with lower utilization rates, will have somewhat shorter maintenance intervals because of the effects of the calendar in addition to the hour meter.



AlliedSignal



Perry Bradley

A single-point refueling receptacle in the right wing leading edge allows the aircraft to be pressure-refueled for quick turnarounds.

minutes. The aircraft accelerated to 280 KTAS while burning 490 pph at an OAT of ISA-1°C.

The high-altitude cruise portion of the flight lasted only 13 minutes before we had to start our descent to accommodate the high-density traffic in the New York metropolitan area. The normal and circuitous arrival routing resulted in a flight time of 1+09. The J41's clean aerodynamic form made it easy to bump the 250 KIAS red line in the descent.

Our VREF landing speed at 20,820 pounds was 111 KIAS at flaps 25 degrees. (Jetstream is expanding the certification envelope to include a 35-degree setting which should lower the landing speed.) We found the landing

JETSTREAM 41 OPERATING COSTS

Fixed Operating Costs

Flightcrew	\$113,055
Hangar	\$65,900
Insurance	
Hull (0.4 percent)	\$31,980
Admitted liability (GVS \$500K/seat)	\$5,250
Liability (\$50-million)	\$4,000
Recurrent training	\$20,000
Uninsured damage (0.4 percent)	\$31,980
Navigation charts	\$1,300
Refurbishment	\$53,900
Depreciation (eight year to 20-percent residual)	\$799,500
Total Fixed Annually	\$1,126,865

Direct Operating Costs

Fuel (991.32 lbs/block hr @ \$2.04/gal)	\$301.83
Maintenance	
Labor (2.0 hr/flight hr @ \$55 per hr)	\$110.00
Parts	\$59.69
Engine reserve allocation	\$119.24
Miscellaneous crew expense	\$135.00
Total Direct Hourly	\$725.26

Source: Jetstream Aircraft

gear to be stiff legged at touchdown. Soft landings require some practice; the J41 has no tendency to float, and automatic ground spoilers ensure that full weight stays on the wheels. The total fuel burn for the flight was 1,244 pounds from engine start to shutdown.

During the return trip to Leesburg, we sampled some of the J41's handling characteristics. We found there was little tendency to drop a wing during approaches to clean and dirty stalls—partly because the aircraft is equipped with a stall-warning shaker and a stick pusher that initiates stall recovery.

The J41's one-engine-inoperative (OEI) handling characteristics are quite docile, considering the available horsepower. The rudder pedal pressure, when simulating engine failure at rotation, seemed lower than on

AVIONICS AND INSTRUMENTATION

The Jetstream 41's panel reflects a blend of proven analog systems and new digital technology. Honeywell's SPZ 4500 avionics system features four, five-inch by six-inch EFIS tubes that are used for the EADI and HSI displays. The EADIs provide airspeed and vertical speed displays, but separate analog altimeters flank the gauges. Analog RMIs are located adjacent to the EHSIs.

Shown in the photo, the weather radar indicator is an option as is a fifth EFIS tube—the multi-function display. In the standard four-tube configuration, the EHSIs display weather detected by the Primus 650 weather radar.

Left- and right-side Primus II radio-management units are located low in the center of the instrument panel, along with the optional Universal Navigation UNS-1M FMS. Positioning the FMS vertically in the panel makes it difficult to push the keypad buttons in turbulence, but the center console has no vacant space for optional equipment.

Also, the optional FMS requires relocation of the clearance delivery radio-control head from the copilot's side to the pilot's side of the instrument panel.

The SPZ 4500 package also includes a DFZ-450 digital flight director system, dual attitude-heading reference systems, dual-digital air-data computers, an RT 300 radio altimeter and a yaw damper. Other standard equipment includes a Universal CVR, a Fairchild FDR, AlliedSignal Mk VI GPWS and a Narco ELT.

Look closely at the top center of the glareshield control panel, and you'll see the control panel for the optional, single-channel, three-axis autopilot. The demonstrator also is equipped with an optional GPS sensor—not apparent until you switch on the FMS. Also, TCAS I is available as an option.

The Smiths engine instrument system (EIS) in the center of the panel is worthy of note. This is a "smart" system that uses LEDs for both analog scales and digital displays. It has a variable red-line function that works in conjunction with the TPE331's integrated engine-control computer. Jetstream claims that the digital EIS, lacking the moving parts of conventional steam gauges, is more reliable and less costly to maintain.

Other cockpit features include an automatic pressurization-system controller that only requires an input of landing-field elevation, and three much appreciated, though often overlooked features: well-lighted, yoke-mounted approach plate holders; trim wheels for all three axes; and pencil holders on the glareshield.



Bud Shannon

INFLIGHT REPORT

JETSTREAM 41

These graphs present range, fuel and payload information that is designed to show the capabilities of the Jetstream 41. Do not use these data for flight planning.

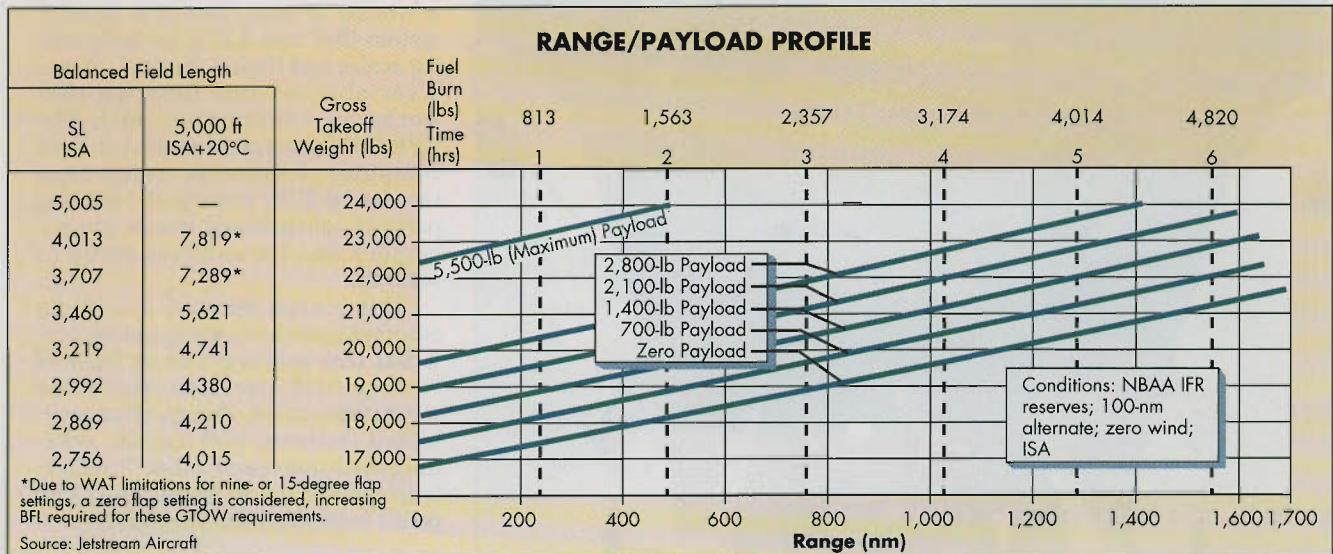
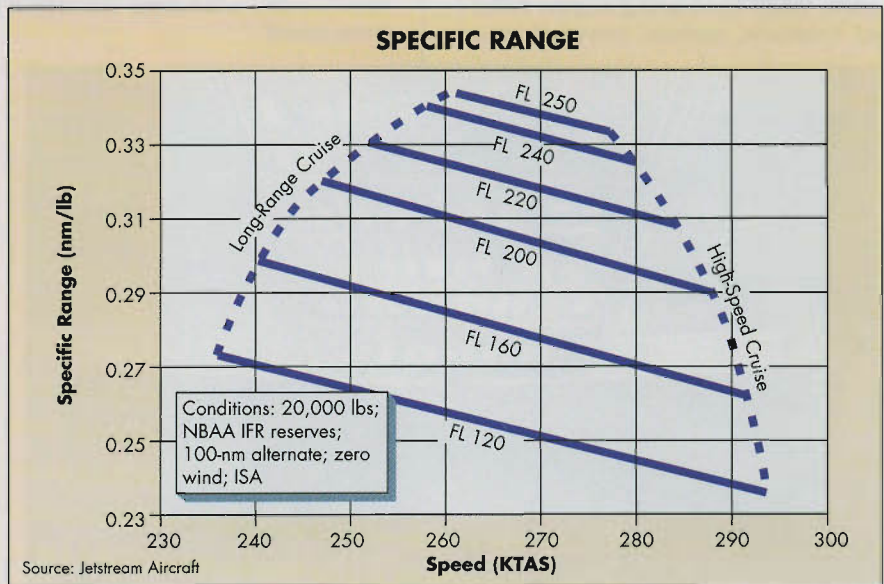
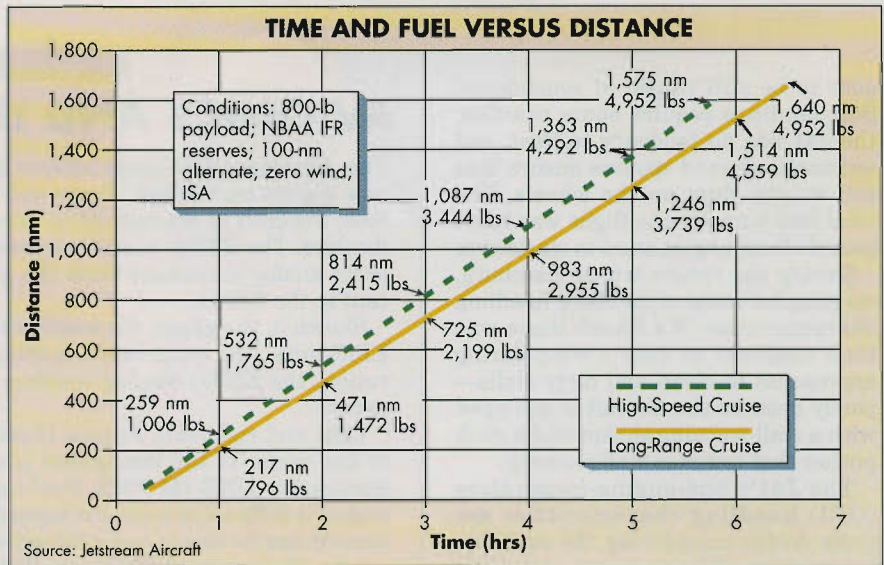
Time and Fuel Versus Distance—This graph shows the plot of two missions: the first flown at high-speed cruise and the second at long-range cruise. The numbers at the hour lines indicate cumulative miles and fuel burned for each of the two profiles. The intermediate points on these lines are accurate only for the full trip. However, they can provide the user with a rough idea of the time and fuel required for trips of intermediate length.

Specific Range—The specific range of an aircraft, the ratio of nautical miles flown to pounds of fuel burned (nm/lb), is a measure of its fuel efficiency. This graph shows specific range values at six altitudes at an intermediate 20,000-pound cruise weight. For example, the specific range at high-speed cruise while flying at FL 250 is 0.334 nm/lb. Notably, the chart also shows that slowing 17 knots to long-range cruise at FL 250 improves specific range by less than three percent.

Range/Payload Profile—The purpose of this graph is to provide rough simulations of trips under a variety of payload and airport density conditions, with the goal of flying the longest distance. A constant 262 KTAS cruise speed at FL 250 was used for the Jetstream 41 at all weights.

The payload lines, which are intended for gross simulation purposes only, are each generated from several points. Time and fuel burns, shown at the top of the chart, only are plotted for the longest mission. For example, payloads up to 2,100 pounds have relatively little impact on the Jetstream 41's maximum range.

Hot-and-high airport conditions, however, may trim more than 1,000 pounds from the maximum allowable takeoff weight. Jetstream Aircraft, however, is working on a water-methanol injection system that will extend the 1,650-horsepower takeoff rating to 54°C (127°F), thereby eliminating most hot-and-high takeoff weight limitations.



PERFORMANCE ENHANCEMENTS ARE COMING

In 1996, Jetstream Aircraft says it will introduce an increase in engine power, revised stall speeds and new flap settings to permit takeoff payload increases. A 2.2-percent increase in thermodynamic engine power, the introduction of a nine-degree flap setting and the revised stall speeds will give typical improvements in takeoff weight of 300 pounds at a hot/high airfield, and 700 pounds on shorter runways in cooler conditions, claims Jetstream. Respective improvements in landing weights are 1,300 pounds for hot/high runways and up to 2,000 pounds for shorter, cooler runways.

In addition, "extra performance options" will be offered for operations "in even more demanding environments," says Jetstream. Under development is a water-methanol system that promises to provide an improvement of 1,100 pounds in takeoff weight in "extreme" hot/high conditions. A 35-degree landing flap setting also will be available for improving landing distances on short runways in cooler climates.

much smaller turboprop aircraft, and plenty of lateral control authority was at hand. The advertised OEI climb rate of 400 fpm appeared to be quite conservative. At our admittedly low test weight, we experienced an OEI climb rate of 1,000+ fpm.

PRICE AND VALUE

Every business aircraft involves trade-offs, and the Jetstream 41 corporate

Perry Bradley



The Jetstream 41's counter-sprung airstair door is easy to open and close.

shuttle is no exception. Passengers won't mistake the J41 for a corporate jet. In trade for giving up high-altitude performance and absolute cabin quiet, operators gain remarkably low operating cost, airline-quality field support and an impressively large cabin. Few business aircraft—at any price—offer more room per passenger, let alone the cavernous baggage capacity.

The Jetstream 41 corporate shuttle is priced at \$7,950,000—including the completed interior and paint—which results in a per-seat cost of less than \$568,000 for the 14-passenger configuration. Operating costs of the J41 also are quite lean, more in line with much smaller turboprops. The J41's airline heritage shows up clearly. This is an aircraft that not only welcomes cost comparison to other business aircraft, but also competes head-to-head with scheduled air carriers for passenger seat-mile cost.

When taking a sharp pencil to J41 numbers, chief pilots and chief financial officers may find they have more in common than they could ever imagine. **B/CA**

The forward equipment bay houses most of the SPZ 4500 remote-mount avionics. Other avionics, such as the CVR, FDR and ELT, are in the aft bay.

SPECIFICATIONS JETSTREAM 41

B/CA Equipped Price	\$7,950,000
Seating	2+12/16
Engines	
Model	2 AlliedSignal TPE331-14GR/HR
Power	1,650 shp ea
Major Periodic Inspection	5,000 hrs
Propellers	McCauley, five-blade, 114-inch
Dimensions (ft/m)	
External	
Length	63.4/19.3
Height	18.4/5.6
Span	60.4/18.4
Internal	
Length	31.3/9.6
Height	5.8/1.8
Width	6.1/1.9
Weights (lbs/kgs)	
Max Ramp	24,110/10,936
Max Takeoff	24,000/10,886
Max Landing	23,300/10,569
Zero Fuel	21,400/9,707
BOW	15,800/7,167
Useful Load	8,310/3,769
Max Payload	5,600/2,540
Executive Payload	2,800/1,270
Max Fuel	5,818/2,639
Payload—Max Fuel	2,492/1,130
Fuel—Max Payload	2,710/1,229
Fuel—Exec. Payload	5,510/2,499
Limits/Speeds	
VMO/MMO	250/0.52
VA	190
PSI	5.7
VMCA	91
V1	116
Vr	116
V2	122
Climb	
All-engine (fpm/mpm)	2,200/671
Engine-out (fpm/mpm)	400/122
Ceilings (ft/m)	
Certified	25,000/7,620
All-engine Service	25,000/7,620
Engine-out Service	14,000/4,267
Sea-level Cabin	12,956/3,949
FAR Part 36 Takeoff Noise Level	76.8 EPNdB

FIRST SIMULATOR OPERATIONAL

The first Jetstream 41 full-flight simulator was commissioned in February at the Reflectone Training Center in Sterling, Virginia, near Washington Dulles International Airport.

The FAA Level-C device was developed by Reflectone. It incorporates six-degree freedom of motion, digital sound and visual systems, and Reflectone's touch-window instructor station. A Harris NightHawk computer is used, along with an enhanced IVEX wide-field-of-view daylight visual system.



Perry Bradley