▶ **ASK FRED**
Send your questions about this article to:
fred.george@penton.com

Cirrus SF50 Vision Jet

Personal jet sets high standards for **cabin comfort** and **cockpit design**

BY **FRED GEORGE** fred.george@penton.com

Pilots and passengers of Cirrus SR20/SR22 single-engine aircraft are going to feel right at home when they belt into the five- to seven-seat Cirrus Vision Jet. It's a considerably larger, but altogether logical, step up from what they've been flying. It's even easier to board, the windows are huge, the floor is flat and cabin width is generous. Up front, the placement of controls, switches and displays follows the same logical layout. The Perspective Touch flight deck, powered by the Garmin G3000, embraces most of the design themes of the SR20/SR22's Perspective+ cockpit.

As with its single-engine piston siblings, the single-turbofan Vision Jet is equipped with a rocket-assisted Cirrus Airframe Parachute System (CAPS) that can be deployed to protect aircraft occupants by slowly lowering the aircraft in the event of an engine failure or loss of control. Twenty-six G tolerant seats cushion the final touchdown, greatly improving the odds that aircraft occupants will survive the crash with no major injuries. CAPS has been flight tested on the Vision Jet during the development program, so Cirrus has hard data to prove that it works as intended.

The SF50 makes no pretense about being a light jet competitor in a niche already dominated by twin-turbofan aircraft made by Eclipse, Embraer, Honda Aircraft and Textron. Instead, it's the first of a new class of "personal" turbofan aircraft that bridges the gap between single-engine piston aircraft and turbine business aircraft, including single-engine turboprops such as the Piper M500/M600, Epic E1000, Daher TBM 910/930 and Pilatus PC-12. Its base price is under $2 million, making it the lowest-priced turbofan aircraft on the market. Its performance, payload and range capabilities are proportionate to its price.

When the aircraft was launched in 2006, Cirrus officials predicted it would be the "lowest, slowest and least-expensive" jet on the market. The planemaker succeeded in spades.

Cirrus's keys to meeting the design-to-cost goals were straightforward and well proven from the onset of the program. Development and certification risks were minimized by using conventional composite construction, a Williams International FJ33-5A engine and virtually off-the-shelf avionics.

What Cirrus couldn't control was program funding. Company owner Arcapita, based in Manama, Bahrain, had a well-rehearsed investment strategy of buy, hold and flip. When the economy took a nosedive in late 2008, it lost its stomach for further investments in general aviation. The Great Recession and its aftermath grounded SF50 development.

The "lowest, slowest and least expensive" jet on the market is well suited for owner/pilots upgrading from the Cirrus SR20 or SR22 piston singles.

PHOTOGRAPHY COURTESY OF CIRRUS

The program languished until April 2012, when China Aviation Industry General Aviation (CAIGA) bought the company and infused it with sorely needed capital. Almost immediately, CAIGA elected to put the Vision Jet back in the air at full speed. Certification and initial entry into service were rescheduled for 2015.

But production quality control and CAPS development snags delayed initial certification until October 2016. By May 2017, though, the FAA had awarded Cirrus its SF50 production certification, paving the way for full-scale customer deliveries to begin.

In spite of the prolonged delays, the Vision Jet's price and performance continue to resonate with Cirrus piston-engine aircraft owners. The firm has racked up more than 600 orders. Production is being ramped up from 30 aircraft in 2017, to 50 aircraft in 2017 and 125 aircraft in 2018.

Airframe and Systems

Low-pressure, low-temperature cure carbon-fiber sandwich construction is used for most major airframe parts. Cirrus's plant in Grand Forks, North Dakota, manufactures components using hand layup of outer carbon-fiber plies, pre-impregnated with resin (pre-preg), sandwiched around honeycomb core material that is then vacuum bagged and cured in low-temperature ovens.

The exception is the wing spar. It's made of pure pre-preg carbon-fiber plies and cured in a high-pressure, high-temperature autoclave for high strength. It's a "black aluminum" structure, typical of what is used on the Boeing 787 and Airbus A350.

The parts made in Grand Forks are shipped as kits to Cirrus' main plant in Duluth, Minnesota, where they are assembled using structural adhesives, cured again in 270F ovens. Quality control is impressive from what we observed at the Duluth plant. The assembly line uses a wide assortment of precision alignment fixtures to maintain tight tolerances and assure structural integrity of the airframe.

High-lift airfoils are used for the wing, emphasizing enhanced low-speed performance over top-end speed. VMO is 250 KIAS and MMO is Mach 0.53, more in line with turboprops than jets. Wing loading is low, which is great for runway performance. The tradeoff is a harsher ride in turbulence at typical cruise altitudes. Normal cruise speed at maximum continuous thrust is just over 300 KTAS. Maximum and normal cruise altitude is FL 280, avoiding the need for RVSM approval and making possible an 8,000-ft. cabin altitude with 6.4-psid pressurization.

While airframe parts mostly are composite, the primary flight control surfaces and trailing edge flaps are aluminum. High-strength metal alloys also are used for landing gear, seat tracks and concentrated stress areas.

The flight controls are mechanically actuated using push-pull rods and bell cranks. Left and right sidesticks are linked to the ailerons and ruddervators on the V-tail, respectively, for roll and pitch control. Rudder pedals provide yaw control through the ruddervators. Yaw and pitch inputs to the ruddervators are mechanically mixed by linkages.

Four-way conical hat-style switches atop the sidesticks provide inputs for electrical roll and pitch trim tabs. The left aileron has a trim tab and the right aileron has a servo tab to reduce roll control force. Each ruddervator has a trim tab. A pitch trim wheel in the center console provides an alternate means of actuating the pitch trim tabs. There is no yaw trim.

Production is being ramped up in Duluth from 30 aircraft in 2017, to 50 aircraft in 2018, and as many as 125 aircraft in 2019.

Twin ventral fins below the dorsal V-tail have electric servo tabs that provide automatic yaw stability augmentation at 200 ft. AGL and below. Above that altitude, autopilot servos linked to the ruddervators provide automatic yaw damping.

The electrically actuated flaps extended to 50% or 15 deg. for takeoff or landing, and 100% or 39 deg. for landing. Gear down/flaps down stall speed at MTOW is 67 KIAS. VSO is 64 KIAS at the 5,550-lb. max landing weight, so VREF at 1.3 VSO is 83 KIAS or lower, in the same range as the SR22. Such low landing speeds eliminate the need for ground spoilers and anti-skid brakes.

An electric motor hydraulic pump (power pack) provides power for landing gear extension and retraction. The power pack only operates while the gear are in transition between

Long travel, trailing link landing gear assure smooth touchdowns. Strong Beringer brakes provide robust stopping power without overheating the discs.

CIRRUS