AVIATION WEEK NETWORK

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Pilot Report: Cirrus Vision Jet

A Game Changer

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James Albright

Like most aviators, I tend to focus primarily on my niche of aviation and perhaps I pay a less attention to things that are outside my day-to-day interests. I am aware of many of the innovations in military fighter aircraft, for example, but I would be hard pressed to tell you

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Cirrus Vision Jet CAPS test deployment.

why an F-22 Raptor can defeat an F-35 Lightning in air-to-air combat or if there is anything like air-to-air combat these days. In a similar vein, while my primary interest is in passenger-carrying aircraft, I can tell you more about recent-generation Gulfstream, Bombardier and Dassault business jets than about Boeing or Airbus airliners. I do, however, pay attention to innovations throughout our industry that can be game changers for all aviation, and that is how I became interested in Cirrus.

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A view of the Vision Jet's cabin.

Cirrus Airframe Parachute System

Many of us were introduced to Cirrus Aircraft and its SR20 and SR22 piston-engine aircraft because of the Cirrus Airframe Parachute System (CAPS), the first FAA-certified whole airframe parachute system. In the event of an emergency, the parachute lowers the aircraft to the ground in a level attitude designed to keep its occupants unharmed. Since its introduction in 1999, CAPS has saved more than 200 lives.

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Cirrus Vision Jet Safe Return Autoland activation button.

As incredible as it may seem to have a parachute for a 3,600-lb. SR22, Cirrus included a larger version for its 6,000-lb. Vision Jet. Cirrus Aircraft was awarded the 2017 Robert J. Collier Trophy for "developing the world's first single-engine personal jet and implementing the Cirrus Airframe Parachute System (CAPS) on the aircraft."

The Personal Jet

Cirrus Aircraft quite boldly claims its Vision Jet is “The Personal Jet Defined”--and for good reason. It has carved out a niche of the market that didn’t exist before but now appears to be here for good. Are there any competitors out there that can beat its performance? The Vision Jet can carry five adults and two children 1,275 nm at 240 kt. or 1,100 nm at 305 kt. Oh, and by the way, it is a jet. With more than 260 aircraft delivered since 2016 and a production rate of 80 new aircraft per year, the industry has taken notice. Commercial customers have discovered the value of the Vision Jet as a charter aircraft and that has caught my interest as well.

Safe Return Emergency Autoland

In 2019, Cirrus added Garmin “Safe Return,” a revolutionary emergency autoland system that enables passengers to land the Vision Jet with just the touch of a button in the event their pilot is incapacitated. Once activated, the autonomous system analyzes terrain and data-link weather to determine the optimal airport for landing, and simultaneously communicates with air traffic control (ATC). The system considers available fuel and weather when selecting an airport and transitions to final approach for the appropriate runway based on ground winds. Safe

Return uses the automatic flight control and autothrottle systems to manage the aircraft’s speed, altitude and path, and then automatically lowers the flaps and landing gear on final approach, lands the airplane, brakes to a stop, and shuts down the engine. Through it all, the system keeps the passengers informed with flight progress and can even help

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The Vision Jet simulator in action.

them to talk directly to ATC.

As Matt Bergwall, Cirrus Aircraft’s director of the Vision Jet product line, said, CAPS will save you if anything goes wrong with the aircraft; Safe Return saves you if anything goes wrong with the pilot. Clearly the company has safety in mind. I had to find out more. Bergwall invited me

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The Vision Center Simulator

The Cirrus Vision Center is at McGhee Tyson Airport (KTYS) in Knoxville, Tennessee. While the aircraft is manufactured in Duluth, Minnesota, the training center in Knoxville is home to classrooms, flight training devices and a full-motion simulator. Instructor Matt Manifold took me through a short

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Vision Center video production studio.

session to see normal flight procedures, steep turns and stalls. The aircraft flies conventionally, with a mechanical sidestick connected to ailerons and the distinctive V-tail. Once we finished, Manifold asked if I felt like seeing the CAPS in action. “Absolutely.”

I had already seen several YouTube videos of CAPS in action with the SR22 piston-engine aircraft and a Cirrus presentation of a test done on a Vision Jet; the simulator gave me an even better view. The one-step procedure is simple: Pull the red handle. The aircraft pitched up briefly to improve our airspeed and attitude for the parachute to eject from the nose of the aircraft and deploy itself. The front strap was immediately in view from the cockpit as two other straps cut through specially designed carbon fiber panels to their anchor points near the wing. Once all three straps were taut, the aircraft returned to a level attitude as we descended at about 1,000 fpm. “Gear?” I asked, as I watched the terrain rise. “No,” Manifold said. “We keep the gear up to prevent puncturing the wing and risking a fuel leak when we contact the ground.” While the force of impact is lessened in the simulator, in actual use it has been more than survivable. In the case of the SR22, whenever the parachute system has been deployed within its envelope, there have been no fatalities and more than half the aircraft have returned to service. Even when deployed at too high an airspeed or too low an altitude, the system has a remarkable record of success.
Pulling that red handle is obviously left for times when no other options are left. CAPS is standard equipment on all Cirrus aircraft and training includes courses in Aeronautical Decision Making (ADM), the system itself, preflight procedures, how to deploy it, and what to do post-deployment.

Training

I was treated to a series of training videos designed to bring new Vision Jet pilots up to speed. Every video seemed to come right out of a Hollywood studio. Anthony Bottini, Cirrus Aircraft director of media productions, emphasized that their goal was to keep every Vision Jet pilot well- trained and eager to learn. The videos far exceed anything I’ve seen from the training vendors I normally use. Bottini said everything from the classroom to the simulator, to ongoing online training is designed to provide a “clear path to success.” Of course, I come from another world: a world of heavy iron where most of the pilots have long resumes of multi-engine, instrument and international jet experience. We tend to be easily jaded by FAA-choreographed syllabuses designed to crank out pilots in large numbers by instructors who do nothing but teach in the classroom or in the simulator. Cirrus does all of this “in house.” From the minute I walked into the training center I realized I was in a different world. It has to be.

The vast majority of new Vision Jet pilots have a private pilot certificate with an instrument rating and will be earning their first type rating. As of this writing, 550 pilots have been trained. Cirrus has also trained a few FAR Part 135 pilots as the Vision Jet has now entered commercial charter service.

The course begins with a flight with an instructor to evaluate instrument skills and design a student-specific training program. Then, at-home training materials are used to allow each student to learn at their own pace. The on-campus training is planned for 10-14 days with five simulator sessions and

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Our aircraft, ready for preflight.

a check ride. A “Jet Readiness” course is optional but is usually taken by most students. The initial pass rate is about 85%. Once the course is completed, pilots are awarded a type rating with a requirement to fly with an instructor for 25 hr. Cirrus provides a mentorship program designed under Part 142 to remove that Part 61.64 restriction. Classroom and simulator instructors double as mentorship instructors. This is very different from the philosophies of the “name brand” trainers, which tend to stovepipe instructors into specific roles. This ensures every instructor has recent and real-world experience.

Flying in the ‘Real World’

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The Vision Jet’s wings, V-tail and ventral fins.

I finished my visit with a flight from Knoxville to Boire Field (KASH), Nashua, New Hampshire. Weather for our departure was almost VFR, for en route it

was often IFR, and for our arrival we would be near minimums. In other words, it was a perfect test to demonstrate the aircraft's IFR flight chops. Bergwall completed the preflight of our "Generation 2+" aircraft as I looked on.

The large clamshell cabin door is on the left and an emergency egress window is on the right side of the aircraft. The pilot's seat moves well out of the way to provide easy access to the two rows of five seats behind the front two seats. The aft five seats and a center console are of modular design, offering users the ability to customize the configuration for each flight. Turning the two battery switches on allowed a quick check of the avionics and other systems, as well as the fuel on board. We had a full load of 296 gal. of jet fuel, which is automatically fed from integral tanks in each wing.

The aircraft is 30 ft. long, has a wingspan of 39 ft., and the tail is 11 ft. high. Standing in front gives a good view of the engine inlet. The Williams International FJ33-FA engine is mounted above the fuselage and produces 1,846 lb. of thrust. Most of the aircraft is manufactured from carbon fiber and the wing structure is seamless. Aluminum ailerons and flaps trail the wings. Preflight inspection of control surfaces, wheels, brakes and tires is typical for an aircraft of this size. On the left side, the inspection includes checking the security of a baggage compartment door.

An aluminum V-tail ruddervator mechanically mixes stick inputs to produce pitch and yaw forces. (The ruddervators deflect symmetrically for pitch control and in opposite direction for yaw control.) All primary flight controls are connected to the control sticks and rudder pedals mechanically using cables, pulleys, bell cranks and push rods. Two carbon-fiber ventral fins mounted below the ruddervators are controlled by a yaw stability augmentation system designed to provide a smoother ride.

Inspection of the right side of the aircraft mirrors the left, with the addition of access to an engine oil inspection port, a 3-gal. windshield ice protection system fluid reservoir and an angle-of-attack vane. The nose has a spray nozzle for the deicer fluid and an enhanced vision system (EVS) camera. A thorough external preflight can be completed in just a few minutes.

Engine Start and Taxi

Strapping into the left seat of the Vision Jet, I was treated to my first look through the largest pilot's windscreen I had seen since my days flying bubble canopies in the U.S. Air Force. The view is not only wide (at least 200 deg. left to right) but also provides good visibility forward from low to high. Two 14-in. color landscape-oriented flight displays--a primary flight display (PFD) and a multifunction display (MFD)--fill most of the instrument panel. Below them are three touchscreen controllers that round out the "Cirrus Perspective Touch+" system by Garmin.

An external ground power unit is rarely needed, and we were ready for engine start just a few seconds after turning the battery switches on. Turning a knob to the "run" position and pressing the start button allowed the full authority digital engine control (FADEC) to control and monitor the start. The engine produces a pleasant hum, which I am certain would delight

anyone more used to a piston engine's rumble, but the fact it is mounted just behind and above the fuselage means a bit more noise in the cockpit. The aircraft is 14 CFR Part 36 Stage 4 compliant, with a maximum noise level of 80.3 during a full flap approach.

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The Vision Jet's primary flight display at cruise flight.

A press of a button below the PFD activates an electronic checklist that makes quick work of all checklists. My first challenge was to learn to taxi using differential braking. I imagine that if you are used to taxiing an aircraft without nosewheel steering and a free-castering nosewheel, you will be at home with the Vision Jet. I am not and had to rely on frequent brake application to point the airplane where I wanted it to go.

Takeoff and Climb

The aircraft's performance computer figured our takeoff weight to be 5,958 lb. and predicted a ground roll of 2,700 ft. on Runway 23L, which is 9,000 ft. long. Bergwall went through a departure briefing, which was novel to me but nicely summarizes the safety capability of the aircraft. "If we have any failures before Vr, apply brakes and then bring the throttle to idle. For an engine failure after that point but before 600 ft., land straight ahead. For an engine failure above 600 ft. but before 2,000 ft., pull the CAPS T-handle. Above 2,000 ft., establish best glide speed."

Once on the runway and cleared for takeoff, I pushed the throttle beyond its first detent to full forward and allowed the FADEC to ensure we had 100% thrust for takeoff. At 85 kt., I pulled back on the stick and watched as the nose obediently climbed to about 5 deg., just inside the flight director's "V-bars" set for the takeoff rotation. I called for "gear up," but Bergwall reminded me, "You can get that." Oh yeah, single pilot.

Considerable nose-down trim is needed during acceleration after takeoff. While electric trim is available on the stick, I found the manual trim wheel more responsive. At 115 kt., I retracted the flaps and a few seconds later

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A look at the Vision Jet's infrared camera enhanced vision system.

reduced the throttle to maximum continuous thrust (MCT). I continued to hand-fly until we approached reduced vertical separation minimum (RVSM) airspace and let the autopilot take over.

The climb to FL310 was comfortable and took about 28 min. in ISA+15C conditions. The view from the pilot's seat is spectacular, almost like flying in a glass bubble. The PFD provides just about all the information you need plus a feature I haven't seen before, something Garmin calls the "pathway" of its synthetic vision system. The pathway provides a series of small magenta boxes starting at infinity, which grow in size as you approach, providing a tunnel visual effect of where the desired course is. While the PFD uses conventional aircraft and flight director V-bars, a flight path marker (FPM) is included. Keeping the FPM flying into those magenta boxes provides assurance you are headed in the right direction.

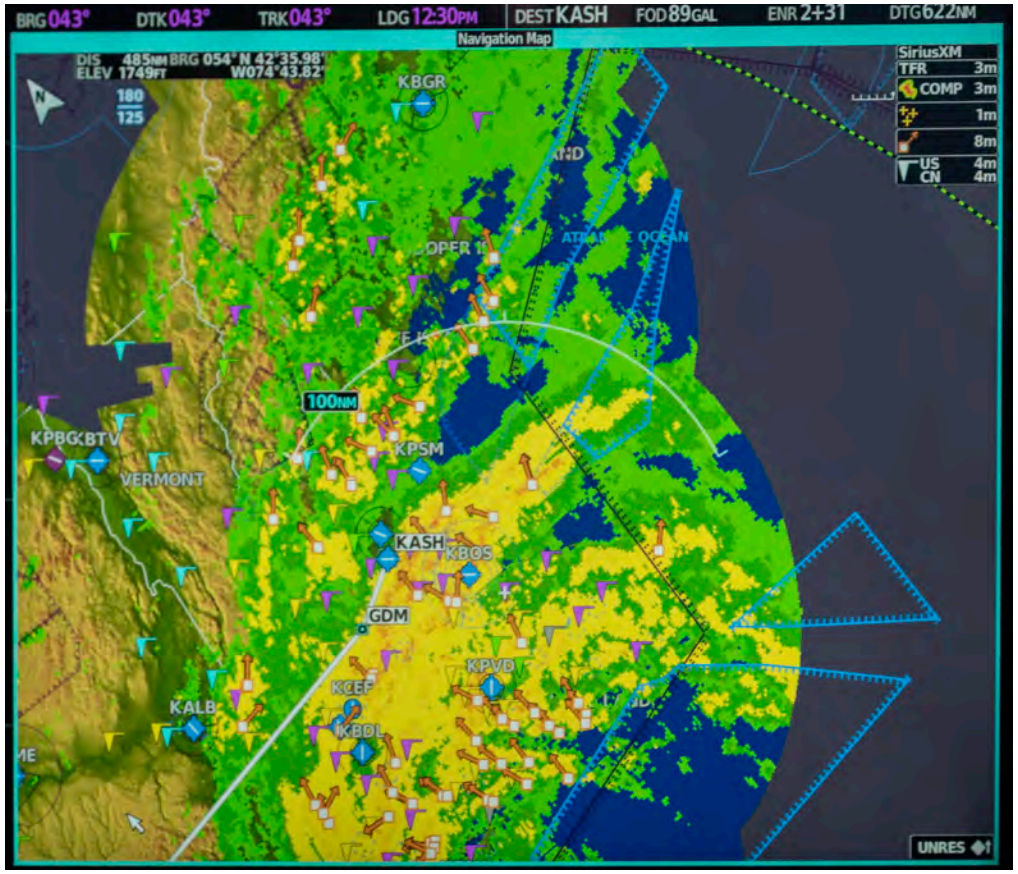
Cruise

With the engine thrust set at MCT we were still well below our maximum velocity and there was little to do other than talk on the radio and ponder the weather. During one of our frequency changes I got one of the digits wrong. Bergwall hit a "Replay" button on one of the touchscreen controllers and we heard a repeat of our frequency assignment again. That is a neat feature I've not seen before.

As we burned fuel at 60 gal. per hour the aircraft gained speed. "Why not pounds per hour?" I asked. "We want to keep it familiar for those coming from pistons," explained Bergwall.

That is a recurring theme in the Vision Jet. The cockpit will be an easy transition from the Cirrus SR22. Many of the switches and instruments are in the same position; even checklist terminology is similar.

As we neared our maximum velocity, I pointed to the airspeed indicator. "You forgot the autothrottle," Bergwall said. I pressed the button and the thrust



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A view of NEXRAD radar imagery for our arrival.

reduced slightly. “What would happen if I forgot and failed to notice?” He explained that the Garmin Electronic Stability and Protection (ESP) system would keep us within attitude, airspeed and AOA parameters. ESP can reduce or increase thrust as well as adjust pitch and roll. The aircraft also has a conventional stick shaker and pusher.

Our original flight plan took us from TYS to HVQ to HNK to GDM, direct to ASH. “That’s not going to last,” I said. Sure enough, we got an amended clearance that would have given the most seasoned Northeast veteran trouble, but the programming chores were almost effortless. Looking at one of the touchscreen controllers and selecting a waypoint offered the chance to load an airway with various points, or the waypoints alone. The touchscreen controllers double as cursor pads, allowing pilots to scroll and resize the map depiction of the MFD.

A Rainy Arrival

The navigation display also offers pilot-selectable Iridium weather products, such as NEXRAD composite radar, airport METAR and TAF reports, winds aloft, NOTAMs and satellite imagery. The onboard 12-in. radar provided a good picture of what we were headed into. There were no icing reports, but we ran with the pitot/static systems heated and the engine anti-icing system activated. The large, unheated windscreen is deiced using fluid dispensed from a nozzle on the nose of the aircraft.

As we neared our top of descent, we picked up the Automated Terminal Information Service (ATIS) weather for Nashua, which reported the ceiling at 400 ft. in moderate rain and a slight crosswind. We set up for the instrument landing system (ILS) to Runway 14 and Boston Center gave us vectors to intercept the localizer and then cleared us for the approach. I

leveled off at the Final Approach Fix altitude of 2,500 ft., still flying at 200 kt., wondering how quickly the Vision Jet could configure for landing. “I’m ready to configure,” I said. “Sure,” Bergwall said while adjusting our speed bug to 150 kt.

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The CAPS T-handle.

I watched the airspeed obediently decrease. I was a little surprised at how nose low our attitude was, about 5 deg. below the zero pitch line (ZPL). As we slowed, the nose came up to just 2 deg. below the ZPL. I selected 50% flaps and watched as the nose dropped 5 deg. in about 2 sec. We stayed glued to the glidepath and as the speed came back, the nose climbed back to 2 deg. below the ZPL. At 120 kt., I repeated that process with 100% flaps. By the time we got to 800 ft. MSL, 600 ft. above the runway, I think we were fairly stable, perhaps a little fast at 90 kt. (Our approach speed should have been at a Vref of 75 kt. plus 10.)

The aircraft remained on course, on glidepath and on speed with little for me to do but scan our progress and search for the runway environment through the rain. At 600 ft. MSL, 200 ft. above minimums, I spotted the Medium Intensity Approach Lighting System and landed the airplane. The rain was bordering on heavy, and the runway was soaked. I took it easy on the brakes, but the aircraft slowed to taxi speed in about half the runway’s 6,000-ft. length. We had the ramp to ourselves as most of the locals were waiting out the weather.

Seasoning a New Generation of Jet Pilots

As we walked away from the aircraft, I concluded that the learning curve would be a gentle one for any pilot with previous jet experience and certainly manageable for a graduate of the Vision Center training program. I told Bergwall that I could see pilots getting lazy in an airplane designed to do so much to make life easier as a single pilot. “We keep a relationship with all our pilots,” he said. “We impress upon them the need to keep learning, and the price of annual recurrent is rolled into aircraft service contracts. Nearly everyone comes to recurrent every year.”

It seems to me a perfect setup for making sure pilots want to keep engaged with their training. Knoxville is centrally located for most Cirrus customers and offers good weather and lots to do when not in class. Anyone willing to invest in an airplane with CAPS and the Safe Return system must clearly be safety oriented. Recurrent training is a part of Cirrus Aircraft's innovative "Jet Stream" program, which replaces the usual myriad maintenance, training, connectivity and other contracts of light jet ownership with a single bill. There is no incentive to skip training.

Is this airplane a competitive threat to Bombardier, Dassault or Gulfstream? Probably not. But at 60 gal. per hour, the economies of a single pilot and the safety features to allay the fears of not having a second pilot, the Vision Jet is clearly inventing its own market.

In the end, I learned quite a bit about the challenges of flying single pilot. I can't imagine a better way to introduce jet aviation to new generations of pilots. But there is something even more important than that. Cirrus and Garmin are leading the way for a new level of safety with their Safe Return Emergency Autoland.

Modern aircraft with fly-by-wire flight control systems and electrically controlled flaps, spoilers, landing gear and brakes should only need some clever software and that magical red button to incorporate their own emergency autoland systems. The challenge will be greater for aircraft with conventional flight control and landing systems, but Cirrus has managed that feat with the Vision Jet.

Cirrus Aircraft has set a new safety standard; it is up to the rest of the industry to catch up.