Cirrus SR22

Clear vision

Forging a new path through the clouds

BY JULIE K. BOATMAN

PHOTOGRAPHY BY MIKE FIZER

Have you ever been to Duluth, Minnesota, in February?

The cross-country skiing is fantastic. The flying weather, not so much.

When the folks at Cirrus Design looked at the SR22 ("Cirrus SR22: Power Broker," May 2001 *Pilot*) and sought ways to improve the high-performance composite airplane, they looked no further than their own agenda.

Ian Bentley, director of sales and support for Cirrus Design, says that when Cirrus looked at its flight department's schedule it found that, especially during the winter months, pilots scrubbed a lot of flights because of the threat of icing conditions. "Ninety percent of those were precautionary cancellations; we didn't go because there was a forecast *chance* of icing conditions or a layer to climb through. So now we expect to get a lot of those flights done," says Bentley.

The SR22's new weapon? The TKS ice-protection system designed by Aerospace Systems and Technologies (AS&T).

While not certified for flight-into-known-icing (FIKI) conditions, the TKS system on the SR22 allows it to safely escape light to moderate icing with a greater margin than an airplane not so equipped. The units have been STCed for other high-performance singles such as the Beechcraft A36 Bonanza (see "AOPA's 2001 Bonanza Sweepstakes: A Technology Bonanza," December 2001 *Pilot*).

The system consists of a thin titanium screen meshed with tiny laser-drilled holes (about 800 per square inch) that is bonded onto the leading edges of the wings and horizontal stabilizer, tubing that leads to the wings and prop hub, and a reservoir that contains the 85-percent ethylene glycol fluid. When the pilot turns the system on, fluid from the reservoir is pumped through the screens on the wings and stabilizer and through a slinger ring onto the prop blades, dissolving ice that has adhered to the airframe and prop.

The TKS reservoir that Cirrus has installed on the SR22 carries three gallons of fluid, enough for one hour of use at the normal rate or 30 minutes of use at the maximum rate—enough to allow the pilot to escape from icing conditions and shed a good amount of ice picked up in the process.


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For FIKI certification, an airplane needs several other components that the SR22 doesn't currently have, such as a heated or deice-equipped windshield and dual pumps for the fluid. It also needs to complete an extensive series of tests to see how well the system sheds ice in flight—not to mention carry a *lot* more than three gallons of glycol.

But even three gallons is a lot of wet—and the system was designed to be, well, not so refined. The slipstream puts the fluid all over the airplane. "It's really messy," says Bentley, "and that takes care of the incidental parts of the airframe" that the titanium screens don't directly seep onto.

In the long run, Cirrus would like to achieve FIKI certification on the SR22, but the company has other improvements to debut first.

All glass (almost)

The most striking change to the latest SR22s involves the further evolution of the glass-cockpit vision that Cirrus has been charging toward since it installed a groundbreaking Arnav multifunction display (MFD) in its first SR20s four years ago.

The SR22 panel now hosts Avidyne's FlightMax Entegra primary flight display (PFD) and MFD. The optional two-panel suite was fashioned in steps, starting with Avidyne's EX5000 MFD that replaced the Arnav MFD (see "Pilot Products: Avidyne EX5000," July *Pilot*). The EX5000 remains the MFD part of the Entegra suite and is compelling in its own right.

But the big news, and the big step in Cirrus' plan, is the PFD (see "The Line: Avidyne Entegra Display Suite," page 77). Avidyne created for Cirrus a 10.4-inch diagonal display split into two views: an electronic flight information system (EFIS) and an electronic horizontal situation indicator (EHSI), both in brilliant color. Most arresting, however, is the 10-inch horizon line created by the EFIS, smack dab in front of the pilot.

The Entegra suite takes up two-thirds of the panel real estate and packs a lot of information. You can glance away from the EFIS to look at the engine instruments and still have the horizon in sight. Cirrus worked very closely with Avidyne in the creation of the PFD.

Alan Klapmeier, president of Cirrus, "shook up" the company when he announced that the new PFD would include a landscape-presentation artificial horizon, according to various employees interviewed at an open house in July. "It's very important to me," says Klapmeier, "as it addresses two critical safety issues: to be able to fight the sense of vertigo and to be able to scan the instruments. I get vertigo easily, and I think I'm fairly typical. A well-trained pilot can obviously do it [scan using conventional instrumentation], but we need to stop expecting people to rise to it. Pilots recognize themselves that IFR is hard work. The difference between three inches, six inches, and 10 inches is a huge safety factor."

In its current installation, three traditional instruments back up the PFD—an attitude indicator, airspeed indicator, and altimeter. The attitude indicator is electrically driven—the SR22 is now an all-electric airplane, with dual alternators and batteries. The first battery supplies power for engine start, and the second battery provides power to items on the essential bus, such as the PFD and one of the Garmin GNS 430 GPS/nav/coms. The single air data attitude and heading reference system (ADAHRS) upon which the PFD relies for attitude and heading information is functionally the same as those found on jet aircraft. However, proving a piece of equipment's durability and reliability takes time, and for now the FAA requires backup instruments for the PFD in the SR22. There is also a certain amount of pilot buy-in that needs to take place before one is willing to trust a PFD exclusively. Pilots can be strange creatures, allured by the new, but still cautious—and loyal to the tried and true.

The Entegra PFD is a $24,500 upgrade to the SR22's "B" configuration, replacing the Sandel SN3308 EHSI, turn coordinator, and vertical speed indicator, and repositioning the attitude indicator, airspeed indicator, and altimeter to the subpanel just below the instrument panel.

Along with the Entegra suite comes another option from Avidyne. The EMax engine and fuel monitoring system began shipping with new SR22s in the third quarter of this year. The system displays engine and fuel system information on the EX5000 MFD. The large screen display shows EGTs (exhaust gas temperatures) and CHTs (cylinder head temperatures) for each of the Continental IO-550-N's six cylinders concurrently—no more scrolling through each cylinder on a 2-inch display. Other engine parameters such as rpm, manifold pressure, oil temperature and pressure, fuel flow, outside air temperature, and electrical bus voltage are displayed. The standard EGT and CHT gauges are removed.

When we flew the SR22 equipped with EMax, one thing struck us right off the bat—no more guessing at what-percent power the engine was running. With full throttle set at 5,000 feet, the display proudly announced we were at 88-percent power, 2,710 rpm, and running 1,500 degrees Fahrenheit EGT and 380 degrees F on the peak cylinder. Cross-checking with the airspeed tape on the PFD, we indicated 165 knots (183 kt true airspeed).

At more sedate cruise settings of 65- and 75-percent power at 8,000 feet, we indicated 147 kt (171 kt true) and 155 kt (180 kt true), respectively. Incidentally, the Cirrus pilots we flew with noted that the airplane seems to lose about 1.5 kt with the TKS in operation. With the TKS off, the additional weight incurred by the system is offset by the extra horsepower Cirrus gained from the 310-horsepower Continental (between 10 and 12 hp) when it added tuned exhaust to the SR22.

Cirrus also offers Goodrich's WX-500 Stormscope lightning detection equipment and Skywatch traffic information, installed on the aircraft we tested. Both are displayed on the MFD.

With time, Cirrus hopes to incorporate a second ADAHRS for redundancy and move toward ridding the panel of the backup instrumentation, though the process will be slow and optional backup instrumentation will certainly remain available, notes Klapmeier.

"Having a backup PFD is the goal," says Klapmeier. "We're to 90 percent of the solution [with the single PFD]" with conventional instruments as a backup system. What Klapmeier calls the ultimate backup, the CAPS (Cirrus airframe parachute system), is already installed. Cirrus has led the way in creating airplanes that offer solutions to a common pilot nightmare, namely loss of aircraft control.

The successful deployment of the standard-equipment CAPS on an SR22 near Grapevine, Texas, in October (see "Pilot Briefing: To Pull or Not To Pull the Chute," page 58) answered in part the lingering question about what happens when the parachute is utilized. "I've had three cases in my life where I would have used the chute [including a midair collision]. These situations never go away," says Klapmeier. Having kids has helped shaped his view. "It's unbelievable how your safety perspective changes."

The CAPS underwent some modification last year when Ballistic Recovery Systems (BRS), the company that produces CAPS for Cirrus, discovered a

The new TKS ice protection system delivers glycol-based fluid through tiny holes–800 per square inch–in the titanium-mesh screen covering the wing's leading edges. Interior refinements include changing the placement of the annunciator panel, the addition of a single-point jack for Bose or other active noise-reduction headsets using the same plug, and more robust cup holders. This SR22 is in the Experimental category while certification of the Entegra system is completed.

problem in the activation cable assembly. Cirrus and BRS issued a service bulletin to correct the problem: To reduce the pull force necessary to activate the rocket that launches the parachute, a clamp was added to the cable immediately behind the handle. Cirrus made similar changes to aircraft on the production line, and subsequently the pull force required to deploy the CAPS has been reduced to about 45 pounds. Each aircraft is tested coming off the line with a dummy igniter in the rocket.

Other service bulletins for certain serial-number runs of the SR22 include flap motor interference with com transmission, incorrect rivets used in some control surface attach points, and a nut that can work loose within the trim cartridge. None of these issues should be a concern on the new SR22s.

On the floor

Cirrus certainly has a vision for its aircraft line. Every choice made, from the Entegra suite to placement of the circuit breakers to the streamlined power lever, echoes the precept of clean design.

The clean-design strategy is part of an overall philosophy at Cirrus. Changes behind the scenes aim at greater efficiency. Over the past two years, the company has overhauled its internal operations. In February 2001, Cirrus laid off nearly 20 percent of its 639-person workforce and made strides toward streamlining its production process, which manufactures SR20 and SR22 models in 11 different configurations on essentially a single production line. In response to ramping up production, Cirrus has rebuilt its workforce to more than 795 employees, adding to its manufacturing and research and development teams, as well as doubling its sales, human resources, and accounting groups.

Change has come through rethinking the process—"lean thinking" the process, according to Stephen Chun, vice president of manufacturing, who came to Cirrus from NUMMI (New United Motor Manufacturing Inc.), a joint venture General Motors/Toyota auto manufacturing plant in California, where he was chief of manufacturing. "We created internal customers at Cirrus," says Chun. Now, instead of thinking of an airplane as one product from start to finish, each of the 51 stations along the production line focuses on delivery of its "product" to the next "customer," or station along the line.

Chun and his former colleague at NUMMI, David Coleal, now vice president of operations for Cirrus, were brought in specifically to change the process, according to Klapmeier. "We wanted to figure out all the different ways to reduce costs, improve the system, with the quality still there—but not in the hands of a lone craftsman," says Klapmeier.

By the end of April 2002, Cirrus had reached a target of completing two airplanes each day and meeting high internal standards along the way. For example, the formal hand-off of a completed wing occurs at 7 a.m. and 11:30 a.m. each business day. Cirrus has also implemented a system using colored flags to signify each station's status, such as a green flag for "everything's OK." Floor supervisors can instantly determine the status of the production line, and send help to those stations requiring assistance or make contingency plans.

By using specific metrics to mark production-line performance over time, Cirrus can easily quantify where improvements have been made. The hours spent to build one aircraft have dropped from 3,320 to 1,906 since the first production model. The first 100 Cirrus production aircraft took 18 months to build. Serial numbers 401 through 500 took less than three months.

That should translate into shorter waiting times for customers. A current Cirrus customer need only wait about five months for an SR22 and nine months for an SR20.


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EXPERIMENTAL

SPECSHEET

Cirrus SR22
Base price: $289,400
Price as tested: $388,450

Specifications

Powerplant .....Continental IO-550-N, 310 hp @ 2,700 rpm
Recommended TBO .....1,700 hr
Propeller .....Hartzell three-blade, 78-in dia
Length .....26 ft
Height .....9 ft 2 in
Wingspan .....38 ft 6 in
Wing area .....145 sq ft
Wing loading .....23.5 lb/sq ft
Power loading .....10.9 lb/hp
Seats.....4
Cabin length .....10 ft 10 in
Cabin width .....49 in
Cabin height.....50 in
Empty weight .....2,250 lb
Max gross weight .....3,400 lb
Useful load .....1,150 lb
Payload w/full fuel .....664 lb
Max takeoff weight.....3,400 lb
Fuel capacity, std.....84 gal (81 gal usable)
.....504 lb (486 lb usable)
Oil capacity.....8 qt
Baggage capacity .....130 lb, 32 cu ft

Performance

Takeoff distance, ground roll .....1,020 ft
Takeoff distance over 50-ft obstacle .....1,575 ft
Rate of climb, sea level .....1,400 fpm
Cruise speed/endurance w/45-min rsv, std fuel (fuel consumption) @ 75% power, best power, 8,000 ft .....180 kt/3.5 hr (110 pph/18.4 gph)
Max operating altitude .....17,500 ft
Landing distance over 50-ft obstacle .....2,325 ft
Landing distance, ground roll.....1,140 ft

Limiting and Recommended Airspeeds

V_R (rotation) .....70 KIAS
V_X (best angle of climb).....78 KIAS
V_Y (best rate of climb).....101 KIAS
V_A (design maneuvering) .....133 KIAS
V_{FE} (max flap extended 16 degrees) .....119 KIAS
V_{FE} (max flap extended 32 degrees).....104 KIAS
V_{PD} (demonstrated parachute deployment) .....133 KIAS
V_{NO} (max structural cruising).....178 KIAS
V_{NE} (never exceed) .....204 KIAS
V_{S1} (stall, clean) .....69 KIAS
V_{SO} (stall, in landing configuration).....59 KIAS

For more information, contact Cirrus Design, 4515 Taylor Circle, Duluth, Minnesota 55811; telephone 218/727-2737; fax 218/727-2148; or visit the Web site (www.cirrusdesign.com).

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level, gross weight conditions unless otherwise noted.

"We have an obligation to make flying as safe as possible for as many people as possible," says Klapmeier. And now those prospective pilots—through whom Cirrus proposes to expand the general aviation industry—don't have long to wait. AOPA

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i Links to additional information about the Cirrus SR22 may be found on AOPA Online (www.aopa.org/pilot/links.shtml).