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Cirrus SR22: Large Capability in a Small Package

By Harry Kraemer | May 1, 2003
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When Duluth, Minn.-based Cirrus Design planned the cockpit for its piston-powered SR22, it sought a panel design that would bring familiarity and comfort to the general aviation (GA) pilot. In short, it sought a "BMW-like" appearance, with a low profile, little clutter and a smooth, flowing contour. Whether or not they visited the German automaker for guidance, the folks at Cirrus succeeded in creating a credible likeness.

Yet behind the SR22's uncluttered, automobile-like panel is an integrated digital avionics package that delivers plenty of capability without undue pilot workload. The conventional six flight instruments are gone, replaced by an all-new primary flight display (PFD) from Avidyne Corp., called the FlightMax Entegra. It's not something you'd expect to see in a single-engine airplane. The center control yoke, furthermore, has been replaced by a side-mounted control stick, enhancing the uncluttered look.

The flat panel, liquid crystal display (LCD) includes an electronic attitude director indicator (EADI), electronic horizontal situation indicator (EHSI), altimeter (with tape), airspeed indicator (also with tape), vertical speed indicator and a moving map, all on a large, high-resolution 10.4-inch-diagonal display. The PFD is backed

up with three electronic flight instruments–airspeed indicator, attitude indicator and altimeter–in the bolster panel below the PFD. To the right of that and above the center console is the user-friendly, 10.4-inch FlightMax EX5000 multifunction display (MFD), which supports data link, as well as lightning, traffic and terrain information.

Cirrus' demands for the SR22 avionics were challenging: the suite had to be dependable, yet not give Cirrus' target customers sticker shock.

The SR22 even has an ice protection option, a feature that is almost unheard of on light, single-engine planes. The new TKS ice protection system, from Aerospace Systems & Technologies Inc.

(AS&T), is a "weeping wing" system that emits a glycol-based fluid to protect the wings, vertical stabilizer and propeller. This would certainly give me an added sense of security when flying instrument flight rules (IFR) during the winter months.

MFD, A Marvel

For the average general aviation pilot the SR22's large MFD is a marvel–and no light GA aircraft has a larger one. Its size makes interpreting information, such as engine performance, weather data, moving maps and terrain information, on the display quite effortless.

At one time, ARNAV Systems Inc. was the only avionics manufacturer producing a 10-inch MFD for small GA aircraft. Cirrus therefore made the ARNAV display standard in both the SR20 and SR22. However, the airframe manufacturer became impressed with Avidyne displays and in 2002 began offering the Lexington, Mass.-based avionics firm's MFD as an option.

Cirrus wanted a state-of-the-art MFD. The company anticipates, for example, the potential of two-way data link communications to send critical engine monitoring data to maintenance personnel on the ground or, perhaps, to make or change hotel reservations in flight. With software upgrades, Cirrus officials reasoned, MFD applications could be virtually endless.

Cirrus initially chose Trimble to supply the nav/coms; however, the radio producer withdrew from the GA market several months prior to the SR22's certification. This left the choice of Bendix/King, Garmin International or UPS Aviation Technologies' Apollo product line. When Cirrus was developing the SR20 and SR22, Garmin aggressively proposed a new nav/com that incorporates GPS and a color, moving map. What's more, the Garmin unit could interface with other systems in the SR22, allowing data overlays. As a flight instructor who checks pilots out on different GPS systems, I have found the Garmin product to be very user friendly and somewhat less intimidating than some other units on the market.

"Besides including a GPS and color moving map, the Garmin 430 can include interfaces for the [Goodrich] Stormscope, traffic information, data link, fuel flow, air data, GPSS [GPS steering], remote DME channeling, RMI [radio magnetic indicator] output, and an RS-232 output data port [for MFDs]," says Judy Cadmus,

president of Avionics Training Unlimited Inc. (www.avtrainingunlimited.com (http://www.avtrainingunlimited.com)), which provides training on Garmin systems.

Cirrus found the Bendix/King radios to be worthy, but opted for Garmin's newer technology and offers Garmin products in two SR22 avionics option packages:

- The "A" package includes a Garmin GNS 430 and a GNS 420 nav/com-GPS combination. It also includes an S-TEC 30 autopilot and an EHSI.
- The "B" package consists of two Garmin GNS 430s, an S-TEC System 55X autopilot and either the Sandel SN3308 EHSI or the Avidyne PFD.

Since FAR Part 23 aircraft, such as the SR20 and SR22, require dual power sources for all critical instruments–electric or vacuum–the Cirrus engineers reasoned that eliminating the vacuum instruments would be logical, especially given the light weight and reliability of electronic instruments. This meant having two batteries and two alternators in the SR22, which also is equipped with two electrical buses. The two batteries comprise a 24-volt, 10-amp-hour starting battery and a 24-volt, 7-amp-hour secondary battery. The starting battery is not only used for starting, but also as an emergency power source in the event of dual alternator failures. The secondary battery supplies essential power in the rare event of a dual alternator and starter battery failure.

For the pilot trained on vacuum instruments, the all-electric panel could bring some anxiety. Understanding this, Cirrus Design engineered an electronic system that is virtually fail-proof. In fact the SR22's system is considered robust enough to incorporate a full authority digital engine control (FADEC) system. Teledyne Technologies' Aerosance company (www.fadec.com (http://www.fadec.com)) has developed the PowerLink TM FADEC, a microprocessor-based engine management system that Cirrus hopes to make available on the SR22 in the near future.

With FADEC, power settings are simple. The pilot merely establishes the throttle setting, and FADEC does the rest. Because of its precise fuel/air mixture control, FADEC almost eliminates damage done to the engine due to improper mixture settings.

Cirrus has always planned for an all-glass cockpit, a feature once reserved for air transport and corporate aircraft. When the technology and the price became suitable for GA aircraft, LCDs became logical for the SR22. Cirrus didn't make a big leap into the all-glass environment, but rather took careful steps, starting with an EHSI and then advancing to the new Avidyne PFD.

Safety was a major factor in the decision to install an electronic flight instrument system (EFIS). The company keeps a "Top 10 Failure Items" list, and vacuum versions of the attitude indicator and HSI made the list. Cirrus expects EFIS reliability will reduce maintenance cost and down time.

In addition to increased reliability, the large glass display gives the pilot a clearer, more vivid picture of the aircraft position and attitude than the typical 3-inch-(7.6-cm) diameter steam gauge display. It provides "virtual VFR" (visual flight rules) in all weather conditions, night or day.

"It was love at first sight," says Mike Radomsky, director and technical advisor of the Cirrus Owners and Pilots Association, referring to the SR22 displays. He found the PFD easy to view, even in direct sunlight. But perhaps more important, Radomsky claims the displays have impacted his "basic attitude instrument flying [because] it's far easier to interpret the information."

When I flew the SR22, with Jon Dauplaise of Cirrus Design, I, too, was impressed by the PFD's quality, clarity and information delivery. It's equal to that of systems costing hundreds of thousands of dollars.

The landscape-format display is divided in half. The upper half contains an airspeed tape on the left side (complete with trend indicators), an attitude indicator in the center, and an altimeter indicator (also with trend indicators) and vertical speed indicator (VSI) on the right side. The display's lower half contains the heading indicator in the center and soft keys (control buttons) running vertically on both sides. The PFD can receive data from either of the two Garmin 430s or 530s and the 55X autopilot. The EHSI on the PFD also supports two RMI needles.

On takeoff, monitoring the "big picture" was easy. The airspeed tape–color-coded in accordance with the pilot's operating handbook/aircraft flight manual–came alive at 20 knots. Just to the right of the airspeed tape, I could monitor aircraft attitude, and to the right of that was my altitude and VSI, all on the same line.

Clear Guidance, Precise Control

Our aircraft was equipped with an air data computer, which presents a data box on the PFD, showing outside air temperature (OAT), true airspeed and ground speed. When I conducted basic flight maneuvers and steep turns, the PFD clearly presented guidance to precisely control airspeed, heading and altitude to plus or minus values nearing zero. I then made an ILS approach and a landing. During the approach, I found it effortless to precisely control airspeed and descent rate. (OAT data has since been deleted from the data box, as redundant to the MFD.)

Information on the PFD appeared natural, in a "T" configuration. My eyes scanned left to right, picking up airspeed, attitude and altitude, all in a line. I then scanned down to localizer and glideslope information, just below, on the HSI. The wind vector information was especially useful throughout the approach and landing.

The SR22 represents a long evolution in cockpit technology, from instruments interfacing with radios to nav radios interfacing with autopilots, to today's fully automated, computerized, fly-by-wire aircraft–now even for the GA pilot. SR22 pilots can access all autopilot functions through soft keys on the PFD's right side. One knob (also on the display's right side) moves all of the "bugs," i.e., altitude, vertical speed, heading and altimeter settings. This simplifies use of the autopilot and assures that the pilot's eyes never have to leave critical flight instruments.

The PFD's integration to the autopilot offers much more. For example, for an altitude change, the pilot simply inserts a new altimeter setting and the autopilot automatically adjusts to, and maintains the new altitude. Minus the interface, the pilot would have to perform three or four cumbersome steps.

SR22s equipped with Avidyne's FlightMax EX5000 MFD also have Emax available. Officially announced at the Experimental Aircraft Association's 2002 AirVenture, EMax is an integrated engine monitoring system and fuel computer that interfaces to both the SR20's Continental IO-360-ES and the SR22's IO-550-N engines. It eliminates guesswork.

EMax gives the pilot a fuel totalizer, a "lean assist" mode (to make sure the fuel mix is not too rich), and a percent horsepower display. Gone are the days of pulling out the old slide rule-like E6B for fuel calculations. EMax can automatically calculate nautical miles per gallon, fuel remaining, fuel to waypoint, and fuel to final destination, based on waypoint inputs.

Besides displaying and monitoring all engine and fuel flow parameters, EMax can log recorded engine data to be downloaded for reference. The aircraft I flew was equipped with Emax, and I was impressed with the three-dimensional-like representation of the analog displays on the FlightMax EX5000 MFD.

In developing the SR22's communications package, Cirrus Design recognized the increasing demand by general aviation pilots for timely information, especially, since many of them use their aircraft for business, as well as pleasure. Both Garmin and Avidyne therefore are developing data link systems. GA pilots then can receive real-time, safety critical information, such as adverse weather and temporary flight restrictions (TFRs). Garmin's data link product, for example, will deliver METARs and NEXRAD (next-generation weather radar) information while also allowing the pilot to send pilot reports. Incorporating an air data computer, the PFD also will provide wind velocity and direction. The wind vector–presented as an arrow and numeric display above the HSI–can be valuable when flying in the traffic pattern or making an approach.

The fully equipped SR22, with its Avidyne displays and advanced, integrated cockpit, puts GA pilots in control of one of the most advanced piston-powered, single-engine aircraft. I would imagine it is to the private pilot community what the BMW is to car buyers.

The Sandel EHSI

Sandel's ColorMap electronic horizontal situation indicator, available with the Cirrus SR22, packs an HSI, radio magnetic indicator (RMI), moving map and WX-500 Goodrich Stormscope display into a single flight instrument. The addition of a three-light marker beacon and GPS annunciator display makes the SN3308 the virtual equivalent of an electronic flight instrument system (EFIS) nav display, but priced and sized for general aviation cockpits, claims Sandel.

Although the unit is packaged in a 3-inch (3-ATI) case, it provides a 9-square-inch display image–more viewing area than most high-end, 4-inch displays, according to Sandel. This is possible, thanks to a liquid crystal display- (LCD) based color projector design that uses the projection screen surface as the front panel, eliminating the unusable area surrounding most LCD and cathode ray tube cockpit displays.

High-speed digital converters make the SN3308 flexible enough to receive signals from general aviation nav receivers, such as the Garmin 400 and 500 series, the Bendix/King KX-155 and -165, and the UPS Aviation Technologies SL 30. The cost is $9,495, plus installation. Visit www.sandel.com (http://www.sandel.com).

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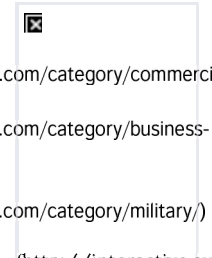

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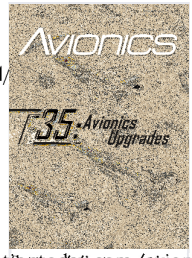

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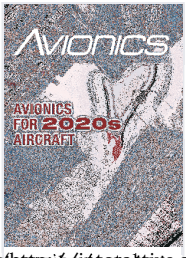

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