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The next generation

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BY THOMAS B. HAINES

PHOTOGRAPHY BY MIKE FIZER

Imagine Mooney MSE performance with Cessna 182 utility at the price of a new Cessna Skyhawk. While adequately describing the new Cirrus SR20, the comparison is not totally accurate. Airframe manufacturers have done a fair job of updating their existing designs with better interiors and modern avionics, but they are constrained by airframe designs more than 30 years old. Newcomer Cirrus Design carries no such baggage. Designers at Cirrus are free to take advantage of all the latest in aerodynamics and materials to build the SR20, which will be the only *truly* new four-seat airplane in some 20 years when it is certified late next year. ■ What the designers have come up with is a four-place, composite, fixed-gear airplane with a 200-horsepower Continental IO-360-ES engine. What's new is a 160-knot cruise on so few horsepower and

an unprecedented emphasis on safety, including a parachute system designed to lower the aircraft safely to the ground in the case of a loss of control.

Although brothers Dale and Alan Klapmeier, founders of Cirrus Design, enjoy pointing out the "newness" of their handsome airplane, they are quick to emphasize that the design is evolutionary, not revolutionary. "We wanted a big, comfortable cabin with reasonable performance. One-hundred-sixty knots isn't the ultimate performance, but it's reasonable; 150 knots seemed like a magic number we had to beat," said Alan, who is president of the company. Dale is executive vice president.

Cirrus Design developed the VK30 pusher kitbuilt airplane in the late 1980s. The brothers stopped accepting orders for the kits in 1993 when they began concentrating on certified aircraft. In early 1995, the company delivered a prototype pressurized, pusher turboprop, the ST50, to a consortium of Israeli companies that plans to certify the design.

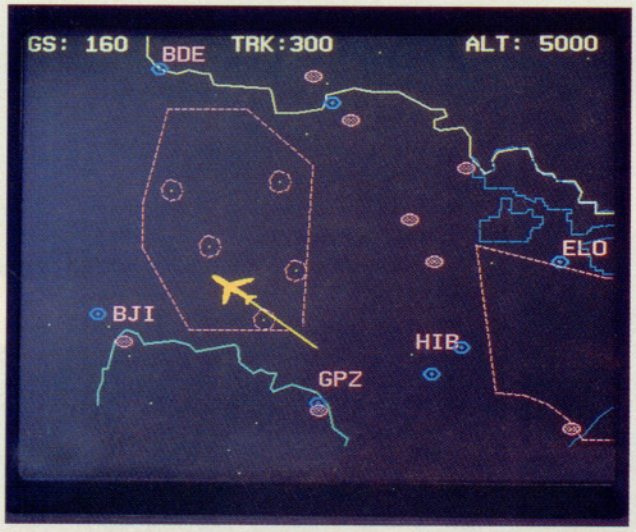
While establishing a company to design and then manufacture a new certified airplane might seem challenge enough for the brothers, both in their mid-30s, the real task is building credibility, according to Alan. "It's a long process of establishing credibility because of so many false claims by other companies over the years. We all know of companies that have surfaced, made great promises, and then promptly faded away."

To establish its reputation, Cirrus has focused on safety and efficiency. If it brings to market all that it has promised, the company and its products will likely succeed.

To further raise its visibility in general aviation, the company participates heavily in industry activities, from the NASA Advanced General Aviation Transport Experiments (Agate) program to the industry revitalization group dubbed GA Team 2000.

Such networking has brought the company a number of subcontracting opportunities. Its biggest such job at the moment is for the military. As a subcontractor for Alliant Techsystems, Cirrus is building 35 Outrider tactical unmanned aerial vehicles (TUAV). The Outrider is a small biplane that the military plans to use to scout out enemy territory. It will be outfitted with a small diesel engine and a passel of camera gear. Up to four Outriders are to be folded up on a trailer pulled behind a Humvee. In only a few minutes a couple of soldiers near the front

The Arnav moving map system provides unparalleled situational awareness. The map shows routes at various scales (below), as well as airport information from the Jeppesen database (bottom).



line should be able to unload, assemble, and launch the vehicle from a clearing a couple of hundred feet long. From there, the unit will follow its programmed course into enemy territory and send back images of the bad guys. After its mission, the Outrider will return to the landing site to be packed back on the trailer and readied for another mission.

Cirrus has already delivered one airframe, which has an aluminum fuselage and composite wings. If the military buys the TUAV concept, Cirrus may well find itself in the Outrider business indefinitely.

The Klapmeiers admit that the Outrider project is paying the bills at the moment, and they are grateful for the work, which is keeping their staff of 40 engineers busy and also providing terrific manufacturing experience to their production staff; in all, the company employs about 100. But the Klapmeiers admit that the subcontracting can be a bit distracting from their true mission: building a new-generation GA airplane.

To keep the SR20 project on track, Cirrus recently hired James Griswold as vice president of engineering. Griswold has worked for many other general aviation manufacturers over the years, and most recently in certification for the FAA. He is best known as the father of the Malibu, the crown jewel in Piper's fleet and one of the most respected new airplane designs of the last 40 years.

After leaving Piper in the mid 1980s, Griswold formed Questair, a now-defunct company that built the two-place Venture and Spirit kitplanes. Aside from their egg-like shapes, the two kitplanes' most unusual attributes are the single-handed, side-mounted control sticks, something the Klapmeiers adapted for the SR20.

The side sticks are also the most unusual aspect of the SR20. And while the side sticks look different from any other flight control system, they seem perfectly natural after only a few minutes of flying. The side sticks are connected through push rods to the ailerons and a torque tube for the elevator. Spring cartridges trim away control forces in lieu of the usual trim tabs. Conventional pedals connect to bell cranks for rudder actuation. A four-direction thumb switch on the stick activates electric motors that change the neutral position of the springs in the cartridges to act as aileron and elevator trim. While it sounds complicated, it's simpler than a conventional flight control system—and the result is a truly remarkable handling airplane.

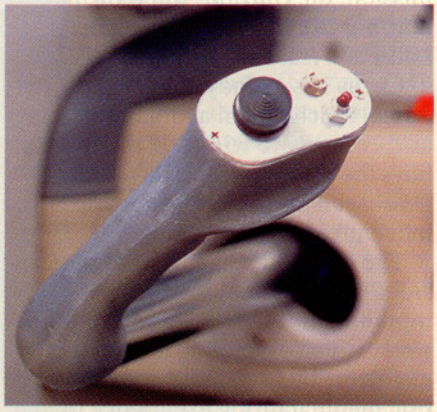
Stick time

While N2, the second preproduction prototype, is a more refined airplane than the first, N1, the Klapmeiers are quick to note that these prototypes are little more than flying wind tunnel models. Nonetheless, the airplanes—which have been flying since March and November 1995—represent the basic performance and handling characteristics of the production airplanes. The company was to start cutting wing parts last month for the production prototype, which will be used for the FAA certification flight tests. That airplane should be flying by late spring.

With the leaves nearing their peak fall colors along the north shore of Lake Superior, we traveled to Cirrus' Duluth headquarters to sample N2. I had flown N1 twice before and was impressed by its stability and smooth flight controls. N2 proved to be just as stable and even smoother and lighter in control feel. The control harmony is good, and control response is snappy enough to interest the most jaded military pilot, including Dean Vogel, VP of research and technology, who is a former U.S. Air Force F–16 pilot. And yet, new pilots—whom Cirrus sees as its primary customers for the SR20—will not feel intimidated by the handling either. With such crisp handling and an excellent view out the big side windows, this is not the sort of airplane in which you will want to do only standard-rate turns. The temptation is to wrack it over to 60-degree banks no matter how small the heading change.

In its recently released specification and description booklet, Cirrus is guaranteeing a 75-percent-power cruise speed of 160 knots true airspeed out of the Continental and the two-blade Hartzell propeller (a three-blade prop is optional). If the certified airplane doesn't meet the specs, deposit holders get their money back. Scuzzy weather throughout our visit prevented us from climbing to the optimum altitude of 6,500 feet. But at 4,500 feet we saw 152 KTAS at about 70 percent power, so 160 knots certainly seems achievable.

In flight, the pilot rests his elbow on the armrest built into the door, allowing the left hand to grasp the stick comfortably. The throttle lever is mounted in the center console, similar to that in the



Cirrus SR20 prototype N2's panel arrangement is familiar and efficient (above). The production interior promises to be more car-like than that of the prototype airplane (left). Perhaps the most unusual feature of the interior is the sidestick controllers (below).

Aerospatiale Caribbean-series airplanes, easily operated by the right hand. The left/right fuel selectors are located just aft of the throttle.

New to N2 is a single lever to control both manifold pressure and propeller rpm, a system that will be standard on the production airplanes. A cable connected to a cam hidden away in the center console actuates the prop governor as the throttle lever is used to adjust manifold pressure. With the throttle all the way forward, the pilot gets full manifold pressure and the maximum 2,700 rpm, which can be used for takeoff and climb. Upon leveling off, the pilot can nudge the throttle back slightly to a detent, which maintains max MP and sets 2,500 rpm for cruise. From there the pilot can pull the lever back farther to adjust MP while maintaining 2,500 rpm until about 21 inches MP is reached. Below that point, rpm also begins to decrease. The system greatly reduces pilot workload and simplifies engine management. The propeller, engine mounts, and soundproofing will all be designed to damp vibrations and noise with the engine turning at 2,500 rpm, which Cirrus believes most pilots will use for cruise.

At the max cruise setting, pilots can expect to use 10 to 11 gallons per hour of the airplane's 60-gallon capacity, providing an 800-nm range with a 45-minute reserve.

For takeoff, Vogel advises me simply to squeeze back on the stick rather than actually pulling it aft. The result is a smooth rotation to the proper climb attitude, rather than an overrotation. Initial climb rates vary between 900 and 1,100 feet per minute, depending upon conditions. The only undesirable flight characteristic of the preproduction prototypes deals with the prominent pitch change with flap movement. Normal takeoffs are made with the slotted flaps set at about 10 degrees. After establishing the climb, the flaps can be retracted—which, on N1 and N2, produces a significant pitch up. Conversely, flap deployment produces a pitch down. The flaps are plenty powerful. To show the effect of the full 38 degrees of flaps, Vogel suggested that I maintain 90 knots and pattern altitude until turning final. With the runway numbers about

Gas struts hold the SR20's two cabin doors open in even the strongest gusts, while at the same time balancing the loads to make closing easy. The wide doors facilitate loading and unloading of the passenger compartment.

to disappear under the nose, he deployed full flaps and pulled the throttle to idle. Down we went, space shuttle-like, at 1,500 fpm and 90 knots, rounding out in time to make a landing on the numbers.

To address the flap characteristics, the production airplanes will have flap travel limited to 30 degrees. In addition, the horizontal stabilizer will be moved aft 8 inches, which should reduce the pitching moment with flap change.

Other changes planned for the production airplane include a 1-inch cabin width increase in the front seat area, to about 48 inches. By comparison, a Mooney cabin is 42 inches wide. The Cessna 182's cockpit is 44 inches.

Built-in safety

Aerodynamically, the production airplanes will get a new leading edge cuff that will result in about a 1-percent increase in chord and cause a slight camber drop from the inboard aileron ends to the wing tips. The intent is to provide a high degree of roll damping in the stall and to assure strong aileron control all the way through the stall. If the airplane always noses over rather than rolling over, no matter how deep the stall, there is little chance of entering a spin.

"This can be one of the most significant increases in safety in all of general aviation," proclaims Griswold. "Ten percent of fatals occur at low altitudes from stalls that roll off and don't give the pilot time to recover." By making it simple for the pilot to recover, Griswold believes many of those accidents can be prevented. "We're going to stake out the general aviation safety arena better than anyone else."

The next step in the Cirrus safety net is the Ballistic Recovery Systems parachute that will be standard in the production models. If a pilot finds himself in a situation from which he doesn't believe that he can recover, he can reach over his head and pull a handle. The system will then deploy a rocket from behind the aft window. The rocket pulls with it a large kevlar-reinforced parachute that will inflate and safely lower the airplane to the ground at about a 15-degree nose-down angle and 1,800 feet per minute. The landing may well destroy the airplane, but everyone inside should survive. The harness lines will be embedded just below the fuselage skin in the roof structure of the airplane.

The parachute system weighs about 40 pounds; the internal airframe structure to handle the deployment loads will demand about another 35 pounds. BRS, which is developing the system for Cirrus and has already certified a similar system for the Cessna 150/152, planned to begin initial testing of the chute in November. Actual in-flight tests on a reinforced N1 are scheduled for next spring.

Four-point harnesses at all four seats provide additional passenger protection, as does dense foam beneath the floor. The foam is designed to crush and absorb G loads during crash landings.

Cirrus brings additional innovation to the cockpit by making the Arnav Systems large moving map display standard on the SR20. The standard Trimble IFR GPS provides position information to the Arnav 10.4-inch diagonal color LCD. The system will monitor engine and electrical systems and automatically bring up an annuciator page if it senses a problem. Otherwise, the pilot typically uses the screen to depict a detailed moving map of his route. The prototype system's only shortcoming is a "north up" limitation. To be truly useful, the system needs to be able to display "track up."

A split electrical bus simplifies things for the pilot if the alternator checks out and leaves all the helpful electronics dark. By flipping one switch, the pilot can shed all of the nonessential electrics, reserving the precious remaining power for the essential equipment.

At least initially, the SR20 will be unique in that it will be the only airplane flying with a full stack of Trimble avionics. Cirrus is the first airframe manufacturer to offer the Trimble products as standard equipment. Included in the standard suite are the IFR GPS, two com radios, a VOR with localizer and glideslope receivers, and a transponder. Trimble will be adding its own faceplate to a PS Engineering audio panel with marker beacon receiver and a four-place intercom with music input.

According to Charles Gunderson, managing director of general and commercial aviation for Trimble's Aerospace Division, the Cirrus deal launches his company's efforts to move into the original equipment manufacturer (OEM) business. "We're an avionics company that is very future oriented. We're very serious about becoming a full-line avionics company," explains Gunderson.

Trimble acquired Terra Avionics earlier this year. Since then it has redesigned and reengineered the Terra products for its Trimble line. The new radios will meet technical standards orders, which the Terra radios did not. The GPS to be offered in the SR20 will be an enhanced version of Trimble's existing TNL-2000 Approach. Among the changes will be an upgrade to a 12-channel receiver from the 2000's nine channels.

The business side

While just certifying a new airplane could keep the Klapmeiers busy, Cirrus is also faced with the need to build production facilities. It currently is housed at Duluth International Airport, in a new hangar building that includes office space and a large development hangar. On August 26 the brothers broke ground in Grand Forks, North Dakota, for a 67,000-square-foot

building that will be used to construct flat subassemblies, such as wings and tail surfaces. Curved parts that can't easily be trucked, such as the fuselage and doors, will be manufactured at the headquarters plant in Duluth. There, a 106,000-square-foot final assembly building is to be constructed in the spring.

Cirrus also has plans for a 30,000-square-foot building in Grand Forks, to be used for final assembly of the SRX, which will be a "fleet" version of the SR20. The SRX will come with a no-options avionics package, no wheelpants, and a Spartan interior. It is designed to be a lower cost airplane suitable for sale to large flight schools.

The SR20, meanwhile, will have a few avionics options, such as HSI, ADF, DME, and autopilot. It will also have two interior options—leather and a less costly cloth variant. The production interior was in the final design stages as this issue went to press; the mockup was scheduled to be unveiled at AOPA Expo in mid-October. Cirrus officials say, however, that the interior will be significantly different from the one in the preproduction prototypes shown here. The interior is reportedly modeled after the 5-series BMW. "We're trying to make the SR20 familiar, as car-like as possible because that's what people are used to," says Alan. He notes that 750,000 people bought luxury automobiles in the United States last year, defined as cars costing more than $40,000. "Can we get 1 percent of them to buy an aircraft instead?" he asks. The resulting 7,500 sales would be more than general aviation has seen in 15 years.

Cirrus Design's headquarters, located on Duluth International Airport, will soon be dwarfed by a new final assembly building to be constructed on the right side of the current facility (above). A modern computer-aided design system (left) reflects the company's emphasis on using the latest techniques.

In order to finance the factory construction and certification of the SR20, the Klapmeiers recently completed three private-placement financing offers. "For the first time ever, Dale and I aren't the sole owners of the company," Alan notes. Almost all of the investors are either pilots or aviation enthusiasts, except for the city of Grand Forks and the state of North Dakota. The funding is sufficient to carry the company through certification and into production.

The business plan calls for first deliveries to occur in late 1997 or early 1998. That same plan calls for the company to sell 1,500 aircraft a year by 2001.

Since the announcement of the SR20 in 1994, Cirrus has said that the airplane would sell for $130,000 in 1994 dollars. By August 1996, when it was able to guarantee performance, the company had logged more than 125 refundable deposits. The price for those option holders was $141,500, on par with the 1994 prediction. About half of those option holders who have flown the airplane have converted to nonrefundable deposits. Those without a reservation must now pay $144,500 for the SR20. The new Cessna 172 with all the options—which, unlike the standard SR20, includes an autopilot, a second nav, and an ADF—retails for $140,700.

With a price per knot of cruise speed of just over $900, compared to its closest competitors' prices of $1,000 to $1,300, the Cirrus blows away about everything else in the market. The Klapmeiers may not think of their pride and joy as revolutionary, but its effect on the general aviation market may well be. □

Cirrus Design SR20
Base price: $144,500

Specifications

Powerplant	Continental IO-360-ES, 200 hp @ 2,700 rpm
Recommended TBO	2,000 hr
Propeller	Hartzell two-blade, constant-speed, 76-inch diameter (three-blade prop optional)
Length	26 ft 3 in
Height	9 ft 3 in
Wingspan	35 ft 7 in
Wing area	135 sq ft
Wing loading	21.5 lb/sq ft
Power loading	14.5 lb/hp
Seats	4
Cabin length	10 ft 10 in
Cabin width	48 in
Cabin height	50 in
Standard empty weight	1,800 lb
Max gross weight	2,900 lb
Useful load	1,100 lb
Payload w/full fuel	740 lb
Fuel capacity, std	60 gal
	360 lb
Oil capacity	8 qt

Performance

Takeoff distance, ground roll	1,100 ft
Takeoff distance over 50-ft obstacle	1,400 ft
Rate of climb, sea level	1,000 fpm
Cruise speed/endurance w/45-min rsv, std fuel (fuel consumption) @ 75% power, best power, 6,500 ft	160 kt/5 hr (60 pph/10 gph)
Service ceiling	16,000 ft
Landing distance over 50-ft obstacle	1,500 ft
Landing distance, ground roll	1,100 ft

Limiting and Recommended Airspeeds

V_A (design maneuvering)	135 KIAS
V_{FE} (max flap extended)	120 KIAS
V_{NE} (never exceed)	200 KIAS
V_{SI} (stall, clean)	65 KIAS
V_{SO} (stall, in landing configuration)	54 KIAS

For more information, contact Cirrus Design Corporation, 4515 Taylor Circle, Duluth, Minnesota 55811; telephone 218/727-2737, fax 218/727-2148.

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