NEW TECHNOLOGY GA:

CIRRUS SR22

Welcome to the 21st Century!

Currently the best-selling single-engined light aircraft in the world, the Cirrus SR22 and its lower-powered SR20 sibling have been at the forefront of a general aviation revolution. *Cirrus*

The need to bring mainstream light aircraft technology kicking and screaming into something resembling the modern era has long existed, but things are finally changing with Cirrus Design's SR20 and SR22 leading the way: composites airframe, glass cockpit, all-electric systems, sidestick controllers, single lever power/propeller control, spacious cabin and high performance - a new generation. And they are selling like hot cakes, proving that new technology in light aircraft does not mean commercial disaster.

THAT THE WINDS of positive change are finally blowing over general aviation is proven by 2003's sales figures: last year, the best-selling fully certified piston-engined light aircraft was the Cirrus SR22 with 355 delivered. Next best was Cessna's ubiquitous 172 Skyhawk (349 delivered), followed by the 182 Skylane (165) and Cirrus SR20 (114), making a total of 469 for the SR20/22 family.

Overall, Cessna still topped the piston-engined sales charts in 2003 with 588 Skyhawks, Skylanes and Stationairs delivered, but there is a very good chance that Cirrus will top Cessna in 2004 as the world's number one single piston-engined light aircraft manufacturer.

When Cirrus flew the prototype of its SR20 in March 1995 there was a high degree of uncertainty involved: any new light aircraft programme is inherently risky regardless of the quality of the product; the aircraft contained a high degree of innovation which many saw as potentially problematic for a traditionally very conservative market; and Cessna was about to re-launch production of some of its piston singles after a decade-long hiatus.

OUTSIDE THE SQUARE

Brothers Alan and Dale Klapmeier felt little need to embrace the traditional when they conceived the Cirrus in 1990. With a background in innovative kit aircraft they were already tuned to 'think outside the square'. Their philosophy in designing the Cirrus revolved around being "unfettered by the stale thinking" of "that's the way it has always been done".

That was applied to all aspects of the design from its composite construction to the installation of a certified aircraft first, the Cirrus Airframe Parachute System (CAPS) which in the case of a loss of control or other emergency will deploy to bring the aircraft back to earth with a relatively light bump.

Deliveries of the 200hp (149kW) SR20 began in July 1999 at which time there were already 325 on order. A telling statistic as to the efficiency of the

SR20 is the fact that despite its fixed undercarriage, its maximum cruising speed of 160kt (296km/h) is some 20kt (37km/h) faster than the similarly powered, narrower cabin and retractable Piper Arrow.

Cirrus's success indicates that perhaps the market was conservative because it simply didn't know any better, it had no viable alternatives to the way light aircraft have always been done.

It has in effect created a new market. In Australia, new SR20s and SR22s are being sold at an average three per month at the moment and of great interest is the fact that the vast majority are being sold to people who have never owned an aircraft before. Many can't fly when they place their order and learn on their new aircraft.

Many of the buyers are business people who appreciate the new technology – especially the glass cockpit – and the high performance. Perhaps they drive a relatively upmarket car and use technology on a daily basis in their working lives. They see the Cirrus as being up-to-the- minute in these areas and wouldn't even consider buying old technology aircraft with analogue instruments and cramped interiors.

The CR20 was originally offered with standard analogue flight instruments and a Avidyne FlightMax multi-function display (MFD). The Avidyne Entegra primary flight display (PFD) was subsequently made available as an option but from the second half of 2003 the full glass cockpit became standard equipment on all models.

Deliveries of the more powerful SR22 with a 310hp (231kW) Continental IO-550-N six-cylinder engine began in February 2001 and this quickly became the best-selling model. Capable of cruising at 180kt (333km/h), it features a modified, longer span wing and increased weights.

A NEW DEAL

Having flown most GA aircraft it was exciting to see there is some light at the end of the tunnel. With most of the GA aircraft fleet sun-bleached, with old brittle plastic in the cabin and even older technology under their equally elderly skins, you can see why people have been leaving the industry and fewer are learning to fly.

The type of aircraft we are about to discuss is a function of necessary technology improvements and cost efficiency which will bring an aircraft to the GA market with increased reliability, reduced maintenance costs, fewer moving parts and cheaper self-testing and modular components.

The design of the whole aircraft is ergonomic and it looks and smells just like a new car. The seats are comfortable, the flight controls do not obscure your

Below: **A close-up of the SR20/22's sidestick control column which affords an uninterrupted view of the instrument panel. The usual push-to-talk and electric trim functions are on the unit.** *Cirrus*

The SR22 offers speed, efficiency, comfort and a glass cockpit which reflects the latest in GA technology. Some 900 have already been delivered in just over three years of production. *Cirrus*

view of the instrument panel, the view outside is one of the best I have ever seen. However, the instrument panel resembles two flat computer screens thanks to the PFD and MFD. The usual clutter of mechanical instruments and gyros is gone.

The upper levels of the aviation industry – both civil and military – has enjoyed this type of display with accurate portrayal of information and better reliability for years. Removal of the vacuum pump system and all its plumbing from the aircraft is a great step forward that was well overdue.

When you turn the system on via the aircraft's master switch there is a short delay before you can move the aircraft whilst the system sets itself up. This is not a bad thing; it allows you to get the aircraft going and do all your after-start checks and so on.

The system will tell you when it's ready and if it's all working OK via its self-test mode. One of the early problems was the readability of the information displayed on the screen under sunny conditions, but this is no longer an issue. During our test flights the displays were easily readable under bright, sunny conditions.

The PFD and MFD design and layout have been developed to be easy to read and achieve an efficient and intuitive transfer of information to the pilot. There are a few small points that perhaps come under the heading of 'personal preferences' – for example, although most pilots love the full width horizon on the large PFD, some dislike it – but compared to the old instruments and displays found in GA aircraft it is by any measure a giant leap forward.

The IFR certified displays replace all the instruments you would normally require. Because the whole system needs electricity to operate it there is redundancy with a dual source of electrical power and as a last resort some analogue instruments for backup (ASI, altimeter and horizon) are on the lower panel, or at least to give the maintenance shops something to do!

How and why is this high-tech system available for such a small aircraft at a price that makes such an impression on the GA market in such a short time?

The heart of the system is the Attitude Heading Reference System (AHRS) developed by Avidyne, which removes the need for a spinning gyro. It is a small box which contains several non-moving gyros and accelerometers. The aircraft also uses an electronic air data computer which uses pressure transducers to measure pilot and static pressure and a temperature probe. These provide the necessary data to calculate airspeed, vertical speed and true airspeed.

The aircraft is also fitted with a flux gate magnetic heading sensor. All these inputs provide an excellent system at an affordable price and accurate enough for the types of aircraft used in general aviation. There are more accurate systems available but the cost is substantially greater for an increase in accuracy that is not required.

The PFD puts all the required information necessary to fly the aircraft in both VFR and IFR right in front of you without the need to scan a large area looking for the information you need.

For example, the indicated airspeed display on the left of the PFD is easy to read at a glance, which is all the time you usually get when flying an approach, for example. As you get near the aircraft's stall speed the coloured bar indicates the situation by becoming red and appearing from the bottom of the tape indicator.

The whole system has been designed to help you fly the aircraft more easily and to a more accurate standard. When you where learning to fly, you will remember the instructor saying "power plus attitude equals performance". This is a good example where the system, by using a trend indicator, tells you six seconds ahead what is going to happen to the aircraft's airspeed, altitude and heading because of the changes you made.

Another feature which is very useful is the real time wind vector which is clearly displayed next to the compass rose. It displays an arrow showing were the wind is coming from and its speed and really takes the guesswork out of trying to figure the wind in all flight modes.

What's the SR22 like to fly? The aircraft is well ahead of any thing in its class. For the computer-savvy generation using a desktop computer flight simulator to practice, they will be flying the aircraft well below the syllabus requirements. The rest of us

Everybody's doing it

THE 'TRADITIONAL' US MANUFACTURERS of light aircraft have no doubt been keenly observing Cirrus's success and seemed to have worked out that offering glass cockpits with their piston singles actually stimulates sales.

Cessna, Piper and Mooney have all recently announced new technology 'integrated cockpits' for their light aircraft. The Cessna Skylane and Stationair and Mooney Ovation2 GX will be offered with the Garmin G1000 system this year, while the Piper Saratoga, 6X and 6XT will have the Avidyne Entegra as fitted to the Cirrus available as an option. Piper plans to eventually introduce glass cockpits across its whole range.

Raytheon has also announced the Beech Bonanza (and Baron twin) will have a glass cockpit option added soon.

GA instrument panel of the future – the Cirrus new technology glass cockpit with its Avidyne primary flight display and multi-function display. *Cirrus*

will see an improvement in our flying skills in a very short time period.

The ease of obtaining information, greater safety through better situational awareness and reduced fatigue because both the aircraft and the displays utilise all the advantages of modern ergonomic design, make flying much more pleasurable.

MAGIC MFD

The second screen in the Cirrus is the Multi Function Display (MFD). The Flightmax EX5000 gives you full control over your navigational planning before departure and en route. Again, the display is easy to read and has all the features you have read about in articles about corporate jets with electronic flight management systems.

The EX5000 provides a pictorial view of your flight situation based on input from the GPS navigation system. It utilises an on-board database for mapping off-route navigation data such as nearby airports, VORs, NDBs, special-use and restricted airspace as well as an extensive terrain, water, and obstacles database.

The MFDs can also display lightning data when interfaced with a Goodrich WX-500 Stormscope sensor. The EX5000 is designed for one purpose, and that is to assist the pilot. It will enable you to gain a level of situation awareness that could not be achieved without this type of technology. The final outcome will be safer, more accurate and fun flying.

There are many different pages that can be displayed on the MFD. To give a few examples: traffic advisory, multi-scale and multi-detailed maps, engine and fuel management, and aircraft check lists, both for normal operations and emergencies.

We are all familiar with the large amount of accurate information we can get out of a GPS. Attach it to a multi-scale, full colour contoured featured map and it becomes something else.

The pilot is able to display other items on the map such as traffic. When we departed Canberra on our flight to Ballarat, air traffic control was most impressed that we had a traffic alert and collision avoidance system (TCAS). They gave us traffic on

CIRRUS SR22

• **POWERPLANT**	One 310hp (231kW) Continental IO-550-N six-cylinder piston engine; three- bladed Hartzell constant-speed propeller of 1.98m (6ft 6in) diameter; fuel capacity 318lt (81 USgal).
• **DIMENSIONS**	Wing span 11.73m (38ft 6in); length 7.92m (26ft 0in); height 2.80m (9ft 2in); wing area 13.46m^2 (144.9sq ft).
• **ACCOMMODATION**	4 seats; cabin width 1.25m (49in), length 3.30m (10ft 10in), height 1.27m (50in); baggage weight 59kg (130lb).
• **WEIGHTS**	Standard empty equipped 1021kg (2250lb); max takeoff 1542kg (3400lb).
• **PERFORMANCE**	Max cruise 180kt (333km/h); initial climb 1400ft (427m)/min; service ceiling 17,500ft; range at max cruise 744nm (1378km); max range at econ cruise over 1000nm (1850km).

The Cirrus Airframe Parachute System (CAPS) is unique in a production light aircraft. This series of shots shows the system deploying from its hatch in the cabin roof after being fired by a handle-activated solid fuel rocket. *Cirrus*

departure but we had already received a report from the TCAS via its traffic sensor. The MFD displays a traffic alert message in the message bar.

Checklists have always been a problem. They get lost, they are difficult to read under certain conditions and you usually keep them on your kneeboard so you not only have to bring your eyes into the cockpit to use them but point them downwards as well. This is not ideal when flying an aircraft or even when still on the ground.

The EX5000 has the entire aircraft checklist ready to be displayed. The position of the MFD is just below eye level and the outside is well within peripheral vision. The checklists are easy to read and logical. You are able to see what you have completed by colour coding and therefore temporarily stopping and then resuming the checklist is not a problem.

Another feature of great assistance is the availability of the emergency checklist at a touch of a button. If you're en route and have a problem all you need to do is call up the emergency checklist. If you want to divert to the nearest airport, up pops the information on all the airports within 60nm (111km) of your present position. Of course, if it all goes completely pear-shaped, there's always the airframe parachute system!

Through the line select keys, you also have access to detailed information about each airport in the database and to view the nearest VORs, NDBs, intersections, obstacles and so on.

Also available on the screen are the five aircraft performance tables/charts. These include airspeeds for normal operations, wind components, takeoff distances, cruise performance and landing distances.

Another problem for many pilots is engine and fuel management. With the EX5000 it is a breeze and you will save money as well. When equipped with the optional engine instrumentation capability, the MFD provides an engine page which is divided into four main sections.

The top section of the pages contains a row of gauges which provides electronically-generated analogue-style and digital readouts of RPM, manifold pressure, per cent power, oil temperature and oil pressure.

There is also the added feature of Engine Instruments – Cautions and Warnings. In order to assist you in monitoring engine health, the MFD will highlight any engine parameters that are not within normal operating limits. Caution zone readings will cause the appropriate annunciation to turn yellow while warning zone readings will generate a red indication.

The page also displays the condition of the dual electrical system it monitors – the electrical bus and alternator. There is a digital outside air temperature (OAT) gauge and an area which gives you all the necessary fuel data by providing information on fuel flow, fuel used, fuel currently remaining (and when you get to your destination) and endurance remaining in your current configuration.

The rest of the page relates to engine management and control. The cylinder head temperature (CHT) display is easy to read and you can see exactly what is going on in each cylinder. The individual temperature of each cylinder is displayed as a

Dieseling ahead

THE ONLY SERIOUS OMISSION from the Cirrus SR22's new technology specification is a new generation powerplant. It still relies on the traditional air-cooled, horizontally opposed, avgas burning piston engine. There is, however, the chance that we will soon see a Cirrus powered by the SMA SR305-230 compression ignition or diesel powerplant.

SMA was formed in 1997 as a joint venture between Aerospatiale (now EADS), Renault and Snecma. The SMA SR305-230 is an air cooled four-cylinder engine of 5-litres (305cu in) capacity which produces 230hp (171kW). It features direct fuel injection, single lever engine/propeller control, integrated engine monitoring, no magnetos or spark plugs and runs on relatively inexpensive jet fuel.

Fuel consumption is 30-40 per cent lower than equivalent piston engines and the initial time between overhaul of 2000 hours will be increased to 3000 hours or 50 per cent more than most conventional engines. The result will be direct operating cost savings of between 30 and 60 per cent per flight hour, depending on the cost of avgas in the country of operation and therefore the fuel consumption/cost savings made.

The SR305-230 first flew in a Socata TB20 Trinidad testbed in March 1998 and European certification was awarded in April 2001 followed by US certification in July 2002. A Supplemental Type Certificate for a Cessna 182 conversion was obtained in September 2003.

Cirrus announced in April 2001 that it was planning an SR305-230-powered model called the SR21 tdi. It is known that a prototype installation has been built and that ground testing has been carried out, but there has been no information released about flight testing as yet. Cirrus originally intended to release the SR21 tdi in late 2003.

When a compression ignition-powered version of the SR20 is produced, it will make the transition from old to new technology complete.

numeric indication above each temperature bar. A white up or down trend arrow will appear above or below this numeric indication to indicate whether a cylinder's temperature is rising or falling.

Exhaust gas temperature (EGT) for each cylinder is displayed as a bar graph with a numeric indication above each bar. Again, a trend arrow indicates where the EGT is heading.

By now you probably believe that you can lean the mixture to the proper setting and gain both performance and fuel economy, but the manufacturer has already thought of that and beaten you to it.

The MFD is equipped with a lean assist function which is used to set the optimum mixture for various operating conditions. The MFD will automatically detect whether the pilot is leaning for best power or best economy and provide visual messages to guide the pilot toward the correct mixture setting.

SUMMARY

It's difficult not to be mightily impressed by the SR22. It offers comfort, speed and a healthy degree of operational efficiency through its modern airframe design and state-of-the-art cockpit. As a means of transporting four people from A to B it is very, very good.

There's not too many production fixed undercarriage light aircraft that can return a 180 knots (333km/h) cruising speed. With the help of a little tailwind, our return flight from Ballarat to Canberra provided the novelty – for this class of aircraft – of seeing more than 200 knots (322km/h) groundspeed.

Apart from the takeoffs and landings, our flights were controlled entirely by the autopilot, this adding to the efficiency of the journey and minimising pilot fatigue. It allowed more time to monitor, plan, look out and simply enjoy the scenery as we flew over it.

Cabin noise levels were lower than average but at the risk of sounding like a headphones salesman, the new generation Bose 'cans' we were using were superb. Very light but with high levels of noise attenuation and audio quality, they will make it very difficult to go back to the heavy old clunkers we've been wearing for years.

The same applies to the Avidyne PFD and MFD. They are simply brilliant, providing extraordinary situational awareness and logic of function. Like anything new, they seem a bit daunting at first but it doesn't take long to work out how to best use them for greatly enhanced safety and efficiency. In combination with the standard Garmin GNS 430 GPS/nav/com avionics and S-Tec/Meggitt autopilot, the cockpit package is an impressive one.

It will also be very difficult to back to old-style instrument panels and old-style light aircraft after the SR22. Things like the single-lever engine/propeller control are items which could and should have been readily available for years.

I have to admit I was expecting (and wanting) to be impressed by the SR22, but its capabilities, its sensible and practical application of technology and its efficiency surpassed those expectations by a large degree. Hopefully, one day soon, all mainstream light aircraft will be like this.

No wonder they're selling so many.

Our thanks to Steve Maltby of Sunland Aviation, the Australian Cirrus distributor, for making the SR22 available to us.