Maximum range (including reserves) is over 800 nautical miles. (CIRRUS DESIGN)

CIRRUS

SR22 TURBO

HOW DO YOU MAKE THE WORLD'S BEST-SELLING LIGHT AIRCRAFT EVEN BETTER? ADD DUAL TURBOCHARGERS, OF COURSE! DAVE UNWIN GETS 'BLOWN AWAY' BY THE LATEST OFFERING FROM CIRRUS DESIGN.

It's been six years since I first flew a Cirrus Design aircraft. It was an SR 20, one of the first in Europe, and I enjoyed a wonderful evening sortie over Lake Constance, with the Swiss Alps providing some stunning scenery.

Since then, the company has expanded to become the biggest manufacturer of piston engine singles. Having flown (and written about) a number of different versions of the 20 and 22 over the last six years, it was my original intention to merely provide an overview of the latest model, which is turbocharged. However, when Sue the Sub (editor) pointed out in her inimitable style that it was just possible not everyone had read the previous reports. I decided that I should write a comprehensive article on the latest aircraft. After all, it is one of the most significant light aircraft currently available.

Needless to say, just about every aviation journalist in the world had been waiting to fly the latest Cirrus since it was revealed to the public at Oshkosh in 2006. However, due to the vagaries of the certification process, it wasn't until the AOPA convention at Palm Springs in November the same year that I finally got a chance to try out the aircraft. Due to the sheer volume of traffic at Palm Springs, we flew from nearby Bermuda Dunes.

During the pre-flight I took a good look around the machine and was extremely impressed by both the very high build quality and the amount of thought that had gone into its design. One of the things that always strikes me about Cirrus aircraft is the width of the wheelbase. For a four-seat aircraft it is incredibly wide. It is also a very low maintenance undercarriage, as both the cantilever sprung mainwheel legs and nosewheel struts are of composite construction. As befits an aircraft that has been designed to cruise long distances at high speed, considerable attention has been paid to reducing drag. For example, the aileron gaps are sealed and all three wheels are closely spatted.

The relatively high aspect ratio wings are also quite interesting as they feature drooped leading edges at about two thirds span. The logic behind this design is that it keeps this part of the wing (and the ailerons) flying after the inboard section has already stalled. I also noted that the wing features two sets of stall strips – one positioned relatively close to the

fuselage and the second situated just inboard of the drooped leading edges. Again, this is to ensure that the inboard section of the wing stalls before the drooped section.

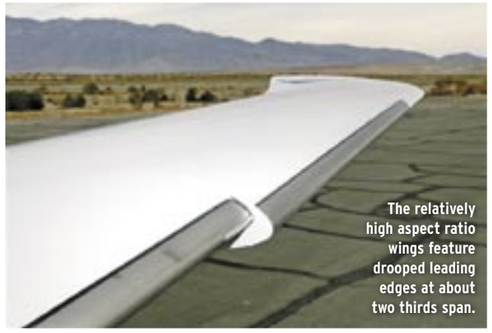
Large span, single-slotted flaps and Frise-type ailerons, which are interconnected to the rudder, complete the wing. Anti-ice protection is provided by a TKS 'weeping wing' system. As the name implies, this system uses an anti-freeze solution, which weeps from Titanium panels mounted on the leading edges of the wings and horizontal stabiliser. A 'slinger' ring on the prop throws de-ice solution onto the propeller blades, windshield and vertical stabiliser.

Although the airframe is predominantly constructed of composite materials, Cirrus has wisely decided to continue using aluminium for those parts most vulnerable to hangar rash, such as the ailerons, flaps, elevator and rudder.

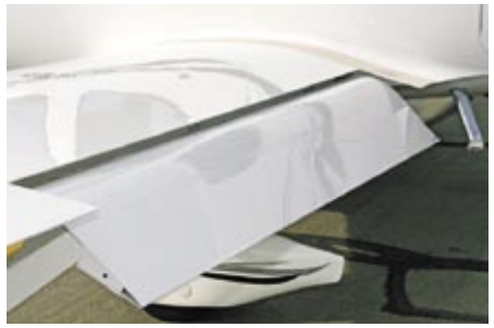
One small yet very neat feature is that the baggage bay has a pocket built into the door, which is perfect for stowing your pre-flight paraphernalia, such as a fuel strainer and a bottle of oil.

Like all brilliant ideas, it is brilliantly simple. I also liked the small window set into the roof of the cabin, just forward of the cover for the CAPS, as it lets light into the baggage area.

What sets the latest Cirrus apart from previous incarnations is – as the name implies – that it is turbocharged. In fact, the correct term is turbonormalised. This means that although the engine is turbocharged, the power available hasn't been increased. What the two turbochargers and dual intercoolers do is ensure that



The relatively high aspect ratio wings feature drooped leading edges at about two thirds span.



the engine continues to produce the same power at altitude as at sea level.

The engine is the same Teledyne-Continental IO-550 as fitted to earlier SR22s, and the maximum power available from the big air-cooled flat-six remains the same at 310hp.

THE TURBO LEAPT INTO THE AIR.

A Hartzell 'Scimitar' prop turns all that power into thrust. The blades are made from a combination of carbon fibre and Kevlar and are incredibly strong. In fact, these new blades are almost as thin at the tips as metal ones. According to Hartzell, the sword shape was chosen because it increases both performance and efficiency by ensuring that each section of the blended airfoil is optimized. This means that while the aerodynamically tailored sweep at the blade tip reduces transonic drag and noise, the blade root is designed to provide maximum airflow into the cowl inlets. Speaking of the cowling, it houses a single high-intensity landing light in the lower section.

Access to the cockpit is excellent. There is a well-positioned grab handle either side of the fuselage and a pair of steps just aft of the trailing edge. A curious anomaly is that the non-slip surface of the wing root walkway is white. This is almost certainly something to do with maintaining a lower temperature of the composite main spar. The doors open wide and are well supported by gas struts. It was particularly pleasing to find that a gentle pull (no need to slam!) closes and simultaneously latches the door in two locations – just like it does in a car. To open the door you simply press a button. The baggage door uses the same system.

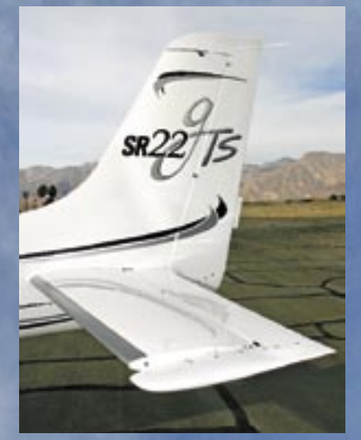
And the automobile analogy continues... upon settling into the very comfortable seat, the overwhelming impression is that the cockpit is more like the interior of a luxury car than that of an aircraft. Leather is used to cover the throttle, side-yoke and seats, which emphasizes the executive appeal. The seats adjust fore and aft over a wide range, and a handy grab handle is situated above the windshield to help you pull yourself forward. The seat tracks are arranged so that the seats angle upwards slightly as they are moved forwards. The front seats can also be adjusted to recline, while the rear seat backs can be folded forward to accommodate bulky objects protruding from the baggage bay.

The cabin is very large, with plenty of room for four adults. Each occupant is provided with a headset socket, and a cup holder, while underneath the armrest between the two front seats is a very useful storage compartment. However, as with just about all four-seaters, if you do put an adult on each seat it is unlikely that you'll be able to fill the tanks, as the useful load is 445kg.

As well as being comfortable, the seats are also very strong (they are designed to take up to 26g), while the cockpit structure features an integral roll-cage.

With my seat set and harness buckled, I began to reacquaint myself with the overall layout of the controls and instruments. As I've found before – overall, it is excellent, although I was slightly disappointed to note that the parking brake knob is still not ideally placed. Personally, I'd put it on the left cockpit wall, below the side-yoke. I'd also prefer the fuel selector to be either 'on' or 'off', and the fuel gauge to be situated on the panel.

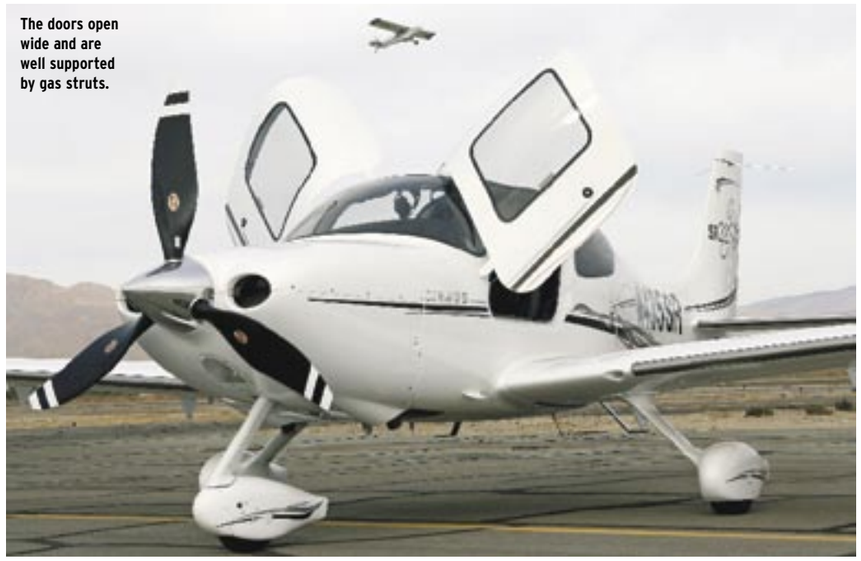
I was surprised that there wasn't an air-conditioning unit, although I subsequently learnt that the turbo installation doesn't leave any room in the engine bay. However, as I soon discovered, the rate of climb is so extraordinary that you're soon up where the air is cool. The oxygen system is integral and appeared to be very straightforward to use as there is just a single on/off switch. It is mounted just to the left of the flap switch on the centre console, where the rudder trim switch and position indicator used to be. The test aircraft had a small gauge that showed oxygen remaining, but on production aircraft this will be replaced by a series of small LEDs. There will also be LEDs to show when oxygen is required (above 12,500ft) and if the system has malfunctioned.



With Cirrus Design's Russ Rothe strapped into the other front seat and photographer Fletch ensconced in the back, it was time to start the engine. Engine starting is perfectly straightforward. Between the seats and to the left of the throttle is a rocker switch. Having pushed the mixture lever to 'fully rich' and the power lever fully forward, simply rock this switch backwards and hold to prime the

Above **Although the airframe is predominantly constructed of composite materials, Cirrus has wisely decided to continue using aluminium for those parts most vulnerable to hangar rash, such as the ailerons, flaps, elevator and rudder.**

Below Right **All three wheels are closely spatted.**



The doors open wide and are well supported by gas struts.

The engine is the same 310hp Teledyne-Continental IO-550 as fitted to earlier SR22s. The blades of the Hartzell 'Scimitar' prop are made from a combination of carbon fibre and Kevlar. Note the single high-intensity landing light in the lower section of the cowling.
(All KEY – Steve Fletcher unless stated)

Upon settling into the very comfortable seat, the overwhelming impression is that the cockpit is more like the interior of a luxury car than that of an aircraft. Leather is used to cover the throttle, side-yoke and seats, which emphasizes the executive appeal.

engine for four seconds, then click it forward to the 'boost' position. The power lever (it's not a throttle, as it controls both the engine and the prop) is then retarded until it is only open about two centimetres and then the starter is engaged.

A flick of the avionics master switch brought the awesome array of avionics on line and we were almost ready to taxi. I say almost, as you should not move until the attitude heading reference system has completed aligning itself. This takes only three minutes and begins automatically as soon as the Master switch is turned on. Another automatic feature is that the aircraft commences downloading real-time weather data from the XM WX satellites as soon as the engine has started.

This machine has incredible avionics, which are almost as good as having a co-pilot (and probably more useful than some I've flown with!) However, all these exotic systems are only useful if used correctly, so while we waited for the attitude heading reference system to finish updating itself, Russ gave me a brief refresher course.

Cirrus Design was the first company to install 'glass cockpit' technology in a piston-powered type, and it has continued to expand and enhance what was already an exceptionally well-equipped aircraft. The test aircraft was fitted with the Avidyne Entegra system, which consists of a flat-panel EXP5000 Primary Flight Display (PFD) and an EX5000 Multi-Function Display (MFD). These have a diagonal size of 26.5cm and are easy to read, even in bright sunlight.

The avionics incorporate a Flight Director (FD) for the FlightMax Entegra. This is shown on the PFD as a 'flying wedge' graphic, and appears whether the aircraft is being 'hand-flown' or is coupled to the autopilot. Basically, the 'flying wedge' shows the aircraft's attitude, while the Flight Director's two 'command' bars indicate the attitude required to maintain the pre-selected course. All you have to do when hand flying is keep the 'flying wedge' up against the inverted 'V' formed by the Flight Director's 'command bars'.

An analogue attitude indicator, ASI and altimeter mounted immediately below the PFD provide a level of redundancy should it fail.

The test aircraft had just about every option available to a Cirrus purchaser, including dual Garmin 430s coupled to an S-TEC 55X- two-axis autopilot, a L3 Skywatch Traffic Warning System, CMax electronic approach plates TAWS terrain avoidance and an XM weather datalink.

As well as the meteorological information supplied by the XM WX Satellites, the Entegra can also show the METARs in plain-English for every airport along the flight route. The EX5000 automatically inserts 'weather waypoints' for legs longer than 100nm, with the AIRMET and SIGMET boundaries depicted graphically. Furthermore, along with the prodigious amount of met information, the Entegra also contains a multitude of other extremely handy features, that can be selected on the MFD. These include quick and easy access to charts for the airport nearest each waypoint in the flight plan, as well as a valuable 'NRST to Destination' page. This makes finding a suitable alternate airport easy, should the weather at your destination be below minimums.

Another feature that is most welcome in these days of increased security is that TFRs and ADIZs are clearly shown on the 'map' page. Although currently some of these functions will only work in the US, it's surely only a matter of time before Europe catches up. Something else that I hadn't seen before was that the engine page on the MFD now shows Turbine Inlet Temperature (TIT) along with the customary EGT and CHT values.

With the attitude heading reference system aligned, it was time to taxi. I really like the Avidyne CMax electronic approach plate system, as you can bring up the airport diagram (including a little aeroplane symbol that is 'you') on the Entegra MFD. Once you've flown with it, you wonder how you ever managed without it (particularly at very busy airports, with multiple parallel runways and lots of taxiways).

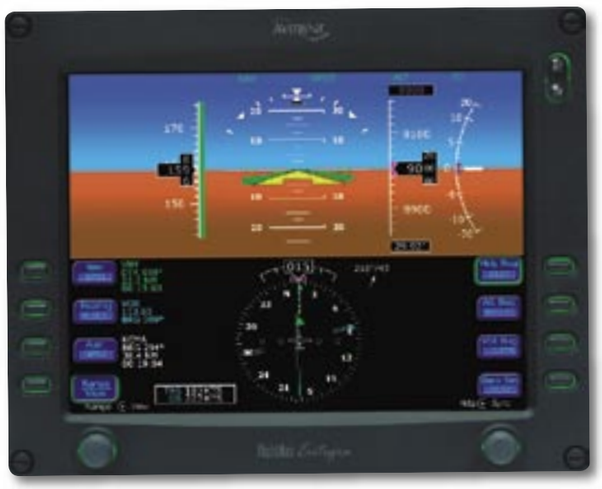
Taxiing out to the active runway revealed very nice ground handling. As with earlier Cirrus aircraft the nosewheel castors, which means steering is mostly by differential braking, although airflow over the powerful rudder also provides some assistance. Fortunately the toe-actuated hydraulic disc brakes have a nice progressive feel.

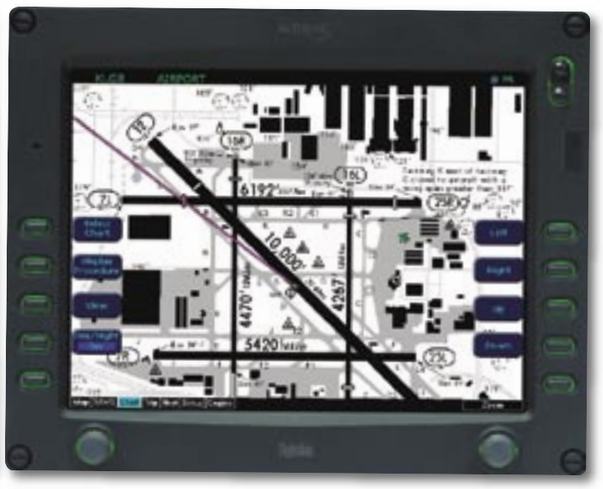
I went through the pre take-off checks at the run-up point. Cirrus has contrived to reduce the pilot's workload by installing an elegant, intuitive electronic checklist, which is displayed on the MFD screen. Basically, having dealt with a specific item (such as setting the trims), you simply confirm that it's been done by pressing a button, before moving on. Cleverly, as you progress through the checklist the 'done' items change colour, consequently it is always perfectly obvious which items have been covered, and more importantly, which haven't.

Cirrus uses side-yoke controllers, so to trim for take-off requires the 'coolie hat' electric trim switch on top of the stick to be used as there are no manual trim controls. The leather-covered handles are mounted on tubes that are square and installed in such a way that an edge is on top. The correct take-off trim positions for both elevators and ailerons are marked on the box section tube, and it is a simple matter to motor the trims to the correct settings. (Why side-yoke? Well, Cirrus has always used this term and not sidestick. This is because, like a yoke, they slide in and out for pitch control, rather than pivoting, as a sidestick does.)

As mentioned earlier, the Turbo is fitted with a single power lever, which incorporates the functions of both the throttle and prop control levers. Although approved for take-offs with the flaps fully retracted, Ed recommended setting them to the 50%

WITH THE TURBO, ENGINE MANAGEMENT IS EVEN EASIER.





Below Left **The avionics incorporate a Flight Director (FD) for the FlightMax Entegra.**

Below Right **I really like the Avidyne CMax electronic approach plate system, as you can bring up the airport diagram (including a little aeroplane symbol that is 'you') on the Entegra MFD.**

CIRRUS SR22 TURBO

DIMENSIONS		
LENGTH	7.92m	26ft
HEIGHT	2.62m	8ft 7in
WINGSPAN	11.73m	38ft 6in
WING AREA	113.46m²	144.9 sq ft
WEIGHTS AND LOADINGS		
EMPTY WEIGHT	1,021kg	2,418lb
MAX AUW	1,542kg	3,400lb
USEFUL LOAD	445kg	982lb
WING LOADING	114.6kg/m²	23.46lb/ft²
POWER LOADING	6.68kg/kW	10.97lb/hp
FUEL CAPACITY	307 litre	67.5 Imp gal
BAGGAGE CAPACITY	59kg	130lb
PERFORMANCE		
VNE	201kts	372km/h
MAX CRUISE (TAS)	211kts	391km/h
STALL	61kts	113km/h
CLIMB RATE	1,300ft/min	6.5m/s
SERVICE CEILING	25,000ft	7,620m
ENGINE		
Teledyne-Continental Platinum Series IO-550-N turbocharged air-cooled flat six producing 310hp (231kW) at 2,700rpm.		
PROPELLER		
Hartzell 'Scimitar Select' three-blade composite constant speed.		
MANUFACTURER		
Cirrus Design Corporation, 4515 Taylor Circle, Duluth International Airport, Duluth, Minnesota.		

Top **The stick-free stability is neutral laterally, positive longitudinally and adequate directionally.** (Cirrus Design)

The low maintenance undercarriage is of composite construction. Note the very wide wheelbase.

(16°) position. This is accomplished by moving the flap-shaped lever located at the base of the avionics stack to the desired setting. An electric motor then extends the single-slotted flaps until they are in place. The position of the flaps is indicated by one of two yellow lights mounted coincident with the flap lever, and the relevant limiting speeds for the various stages of flap are printed next to the lights. When the flaps are fully retracted a small green light illuminates. This is how a flap system should be designed, and I wish more manufacturers would take note.

The rest of the pre take-off checks revealed nothing out of the ordinary, except of course to remove the safety pin from the Cirrus Airframe Parachute System or CAPS. This feature really makes this aircraft stand out from its competitors. If you're having a very bad day (ie another aircraft has just removed a large piece of your tail in a mid-air collision) a firm pull on the red CAPS handle in the roof fires a magnesium charge, which in turn ignites a solid-fuel rocket. This rocket pulls out a parachute, which lowers the aircraft to the ground. Thus far, 22 lives have been saved by the CAPS.

All checks completed, I rolled out onto the runway. Having allowed the Turbo to slowly trundle forward a few feet to ensure that the nosewheel was straight, I smoothly advanced the power lever. As it goes through the detent there is some resistance, requiring a positive increase in the push force for it to travel to the full power stop. As I've noted previously when flying both the SR20 and SR22, as the lever goes through the detent it always sounds as if the pilot is a little clumsy or the prop CSU isn't governing smoothly. This is because as the manifold pressure stabilizes at maximum, the prop speed suddenly jumps by 200rpm.

With 310 eager horses under the cowling I was conscious of the fact that too prompt an application of power could lead to a swing. Consequently as the runway we were using was more than long enough, I decided to open up the engine fairly slowly. As it transpired, the powerful rudder easily coped and as I pushed the power lever to the stop, we accelerated rapidly.

Initially the Turbo revealed a slight preference for the left side of the runway and small dabs of right brake

A TAS OF 196KTS IS PRETTY QUICK FOR AN AIRCRAFT WITH A FIXED UNDERCARRIAGE!

were necessary to track the centreline until the airspeed started to build and the rudder became effective. As the ASI needle swept briskly through 70 knots, I eased the side-yoke back and the Turbo leapt into the air after a ground roll of what I reckon was less than 300 metres. The surface wind was about 10kts from the southwest, ambient pressure 1014.2Mb and the ambient temperature 18°C. As the airport is only 73ft above sea level, the actual atmospheric conditions were pretty close to the International Standard Atmosphere of 15°C and 1013.2Mb at sea level.

Below I noted that we had an IAS of 158kts, while our TAS was 196kts. (Cirrus Design)

I would guess that with three POB, half fuel and a small amount of baggage, we were probably about 140kg below MAUW. Eighty knots was attained within seconds and I flicked the flap switch to the up position and continued accelerating to 120kts. The flaps retracted quickly with only a small change in pitch trim. A reasonable amount of right rudder was required to keep the slip ball centred.

Although Vy is attained at 100kts, Russ suggested that 120 would be better, both for visibility and engine cooling. As I increased speed, the requirement for right rudder reduced, while the VSI continued to show a very healthy rate of climb – in excess of 1,000ft/min. The electric trim for both pitch and roll works very well, although as it is geared quite high the trick is to simply 'blip' the switch momentarily in the appropriate direction. If you actually press and hold the switch you will almost certainly over-trim.

The whole point of having a turbonormalised engine is to get to altitude fast, so I climbed straight up to 12,500ft in just over 12 minutes. Although the aircraft achieves its maximum cruising speed of 211kts TAS at 25,000ft, somehow I don't think that European pilots will fly that high very often. This was one of the reasons I elected to perform the test at what I consider to be a more representative altitude – ie as high as it is prudent to fly without oxygen. I also suspect that the block of airspace between 10,000-25,000ft is probably the least used.

One thing I did notice was the very high fuel flow in the climb – at times in excess of a wallet-draining 135 lit/hr! Russ had told me to keep the mixture full rich, as air-cooled engines actually use unburnt fuel to keep them cool. This is a throwback to when AvGas was 25 cents a gallon, and isn't really compatible with General Aviation in the 21st century. To be fair, the engine did stay nice and cool during the climb – but an awful lot of gas was consumed to achieve it!

Levelling at 12,500ft I set up the aircraft for the cruise. This was very straightforward, as whenever the power lever is set for full thrust the interlinked prop control ensures that the governor maintains maximum prop rpm. As the interlinked throttle/prop control drew the prop rpm down to 2,500rpm I eased the mixture control back until I had 17.5 US gals/hr (which is 66 lit/hr). Now, I particularly liked the 'Lean Assist' function on the Emax fitted to the normally aspirated SR22 GTS that I flew a couple of years back, as it made it very easy to adjust the engine for either 'Best Power' or for 'Best Economy'.

However, with the Turbo, engine management is even easier. All you have to do in the cruise (irrespective of your altitude) is set 2,500rpm and adjust the mixture until the fuel flow is 17.5 US gals/hr. This combination will always produce 85% power, irrespective of the altitude.

I especially liked the fact that the Emax is continually monitoring the fuel consumption and, more crucially, the fuel remaining. This quantity is automatically displayed at each waypoint. The Emax can also show CHT and EGT, power as a percentage and, even nautical miles per gallon! Despite our altitude, it was interesting

Despite the fact that the SR22 has a reasonably high aspect ratio, there is practically no adverse yaw. (Cirrus Design)

Right Visibility in the turn, and throughout every stage of flight, is very good.

that the manifold pressure was steady at 30 inches. The Entegra shows both IAS and TAS, and I noted that we had an IAS of 158kts, while our TAS was 196kts.

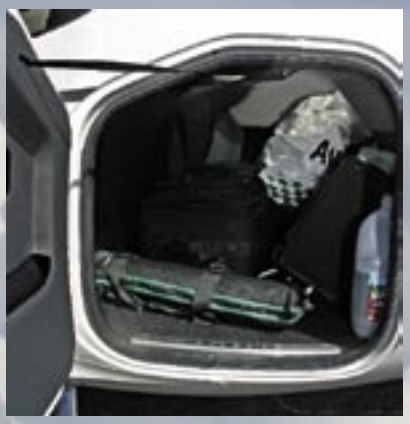
That's pretty quick for an aircraft with a fixed undercarriage!

The SR22 has a maximum wing loading of approximately 115kg/m^2 and even at the relatively high cruise speeds that it can achieve, the high wing loading confers an agreeably firm ride. Maximum range (including reserves) is over 800 nautical miles.

Having disengaged the autopilot, I began a quick assessment of the general handling and stick free stability at altitude. When hand flying, the most important thing is to ensure that the aircraft (any aircraft) is correctly trimmed at all times. The electric trim for both pitch and roll works very well, so there is no excuse for not being in trim. Once correctly trimmed, you only have to apply pressure to the side-yoke, rather than actually moving it any significant amount.

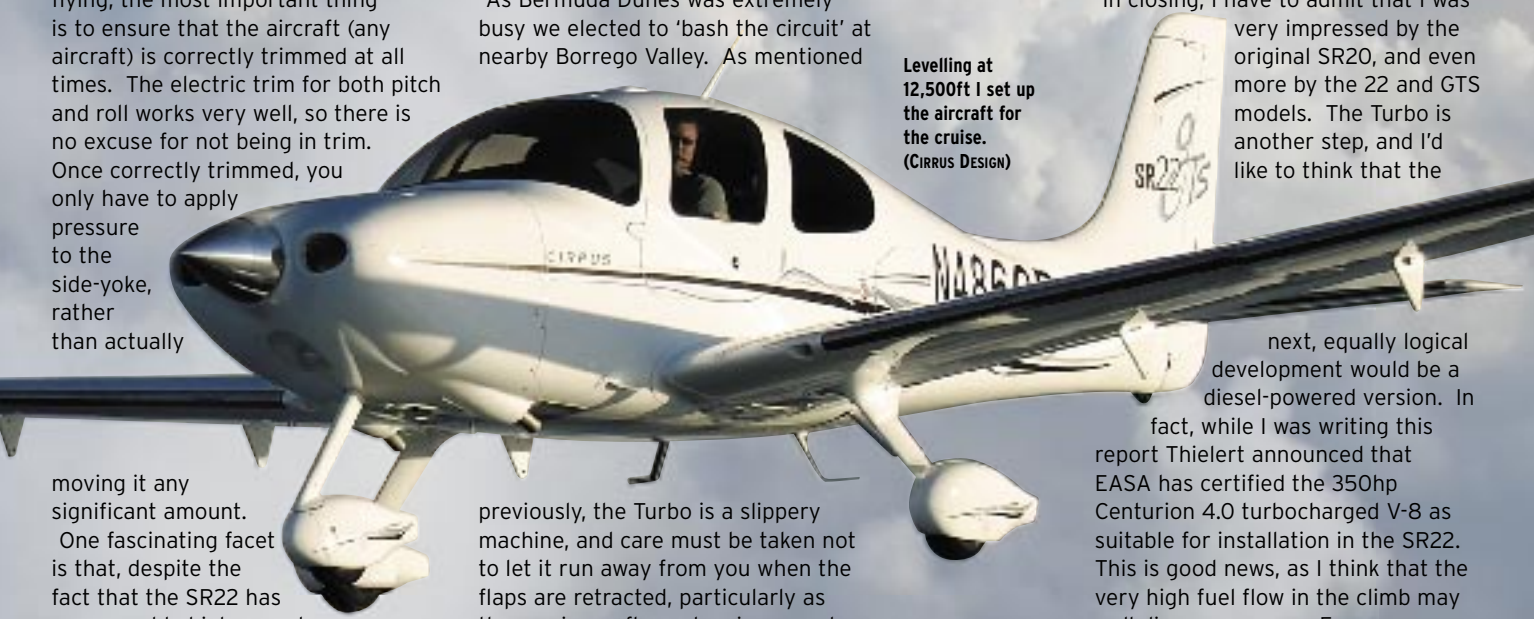
One fascinating facet is that, despite the fact that the SR22 has a reasonably high aspect ratio, there is practically no adverse yaw. This is because the ailerons are interconnected to the rudder, which ensures that only the steepest turns require any rudder input at all. Visibility in the turn, and throughout every stage of flight, is very good. The stick-free stability is neutral laterally, positive longitudinally and adequate directionally. As I was to note in the circuit, it is also extremely speed stable. Control harmony is as it should be, with the ailerons being the lightest and the rudder the heaviest.

Because the SR22 is quite slippery, slowing down to explore the low-speed side of the flight envelope took a while. As the IO-550 is air-cooled and there are no cowl flaps I couldn't help but wonder whether it might benefit from some form of speed brake. Irrespective of the flap setting, stalls in the SR22 are very benign, with adequate pre-stall buffet shaking the airframe before the warning horn starts to bleat. I mentioned earlier in this article that the wing features stall strips and a drooped leading edge, and it was intriguing to note that the ailerons remained fully effective, even when deep in the stall. Conclusive proof that the wing's clever aerodynamics work really well.



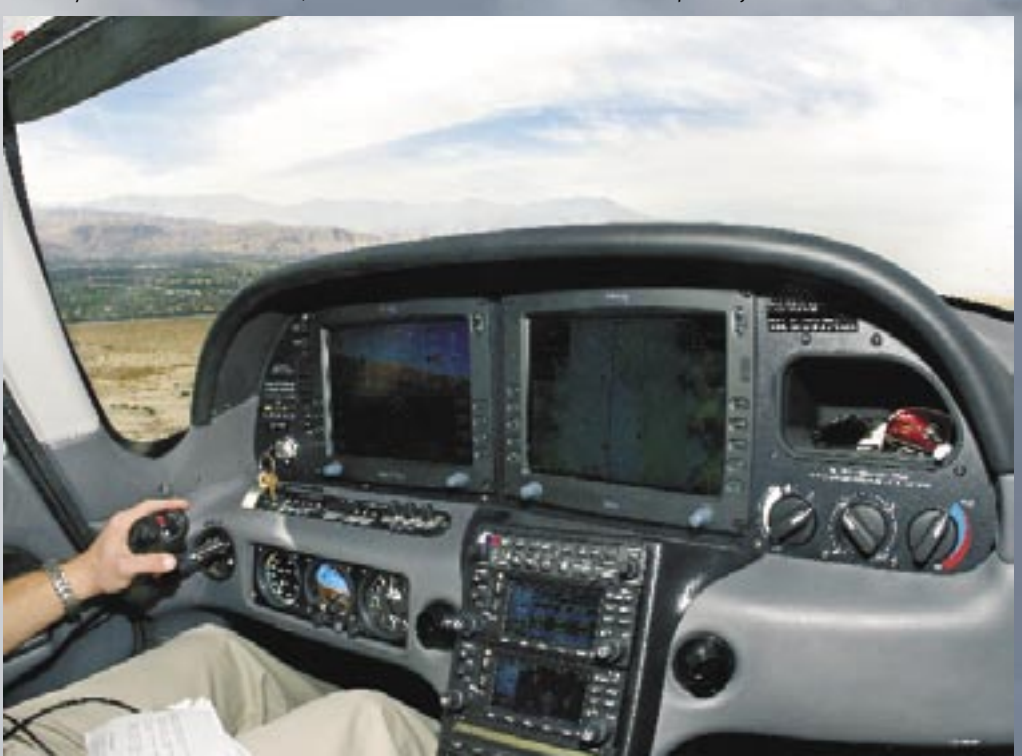
Left The baggage bay can carry up to 59kg.

As Bermuda Dunes was extremely busy we elected to 'bash the circuit' at nearby Borrego Valley. As mentioned previously, the Turbo is a slippery machine, and care must be taken not to let it run away from you when the flaps are retracted, particularly as the maximum flap extension speed is a relatively low 104kts. However, once the air speed has slipped into the white arc and it is safe to extend the flaps they really bite. You can actually feel the deceleration, and with full flap extended, even lowering the nose some way below the horizon failed to accelerate the aircraft. Russ had recommended a speed of 80kts in the circuit, reducing to 75 on short final, and the speed control is so easy that I had absolutely no difficulty in holding the speed *exactly*. A smooth, easy flare and the mainwheels rolled gently onto the tarmac. I quickly reset the flaps to 50%, pushed up the power and the Turbo surged back down the runway and up into the sky. The subsequent circuits at Borrego and the final landing back at Bermuda only confirmed what I already knew – this is a very straightforward aircraft to fly – and to land.



Levelling at 12,500ft I set up the aircraft for the cruise. (Cirrus Design)

In closing, I have to admit that I was very impressed by the original SR20, and even more by the 22 and GTS models. The Turbo is another step, and I'd like to think that the next, equally logical development would be a diesel-powered version. In fact, while I was writing this report Thielert announced that EASA has certified the 350hp Centurion 4.0 turbocharged V-8 as suitable for installation in the SR22. This is good news, as I think that the very high fuel flow in the climb may well discourage some European pilots from buying the Continental-powered SR22. However, like me, they might just be waiting to get their hands on Cirrus Design's eagerly-anticipated jet!



Below Cirrus uses side-yoke controllers. Note the trim markings on the box section tube.