



CFM Shadow

Nothing makes a new type of aircraft quite so much fun to fly as a really snappy take-off and climb. Sitting in the Shadow and giving it full throttle reminded me of my first jet ride: the acceleration is exhilarating, with the aircraft up to 50 mph within seconds and ready to leap off into a climb that makes most light aircraft feel underpowered.

The Shadow works is CAA-approved and is an airy modern building with jigs and machining facilities which enable them to produce almost every part without outside contracting. At present they are producing and selling one machine and two kits per month. The Shadow has full CAA type certification.

Customers have the choice of buying the kit in stages, so spreading the cost over a period, or of buying the aircraft, test flown and complete with a full Permit to Fly. Already there have been sales of eight kits and seven complete aircraft, and a number of these have gone abroad to Australia, Norway, France, Yemen and Portugal. No real effort has yet been made to sell the machine, which has allowed time and experience to be accumulated to ensure that any possible snags both in the aircraft and the kit have been ironed out over the past three years.

The Shadow is a very light pusher aircraft with a high boom and tricycle landing gear. All the controls are quite conventional. The control stick is mounted on the right side of the cockpit with the throttle and choke on the left-hand side; these fall easily to hand. The rudder pedals have heel-operated levers linked to the mainwheel independent braking system. The nose-wheel is fully castoring to facilitate steering on the ground.

With the last machine off the production line delivered just before my visit, there was only the prototype left for me to fly. This had been used for all the certification tests and development

flying and had made over six hundred flights totalling 300 hours. Production machines have a slightly enlarged cockpit to cater for almost any size of pilot, though I found the prototype cockpit very comfortable and at least as roomy as that of many gliders I have flown. Four-point harnesses are standard on the production machines. The canopy is two-dimensionally bent plastic made of polycarbonate and guaranteed unbreakable by the plastics experts; it opens sideways to allow easy access for the pilot.

The rear cockpit is entered by lifting either side panel. Provision is made for full dual controls by the fitting of a stick, throttle and flap lever with rudder pedals mounted in a small bulge in the fuselage floor; this gives more room for the passenger or instructor. The view from the front seat is very similar to that in a modern glider: totally unobscured round to the wing.

The engine controls consist of a very sturdy throttle lever that would do justice to an F-15, a choke control for very cold weather starting, and the magneto switch. The starting is by the usual mowing-machine type of recoil starter, pulling the rope just above the pilot's head. I was told that it is possible to restart in flight. Normally starting is done from outside the cockpit, standing by the nose where the throttle and switches are within easy reach and where the aircraft cannot move forward without first knocking down the pilot or person starting it. A hand primer is fitted in the fuel line, but neither this nor the choke seemed necessary. In spite of the wintery weather it started hot or cold on all four occasions with a single pull of the toggle — an impressive performance for any engine.

The engine is a Rotax 447 two-cylinder two-stroke producing about 40 hp at 7,000 rpm. The propeller is driven through a 2.58:1 gearing so that it turns over at less than 2,000 rpm in normal flight. An elaborate-looking silencer is standard,

and makes the aircraft far quieter than the average light aircraft in flight. Perhaps because of the gearing the engine seems to run more smoothly than most little two-strokes, and it does not seem to worry whether it is running at any speed or idling for fairly long periods. Of course some kind of ear-defenders or radio headset are essential, as the weight limitations do not allow much sound insulation for the cockpits. I wore a normal agricultural pair of ear-muffs, and found the noise level in flight quite acceptable.

The instrument panel has room for more than the essential instruments, and besides the usual ASI, altimeter and vertical speed indicator has a rev counter and a combined cylinder-head temperature and exhaust-gas temperature gauge.

The side stick was a new item for me, but is only of concern for the take-off and the first few seconds of the flight. The only extra problem is in telling when the ailerons are central; this could be made easier with some kind of indent in the middle position when the stick is held right back at the start of the take-off run. Since that position is never used in flight it would be no embarrassment. The rudder is absolutely conventional, although a little lighter than on most aircraft. Taxying in the strong crosswind I had to use wheel brake to stop the weathercocking, which probably would not have been necessary on grass when more power would have been required to keep moving. The aircraft sits firmly on its wheels, and even a rapid swing failed to make it lean even slightly sideways.

I found the wheelbrakes easy to use for taxiing, but not so easy after landing in the crosswind, when I anticipated the swing into wind and then suddenly needed the other brake to prevent running off the other way. Flying a new type normally take extra time to get thoroughly used to the wheelbrakes and steering before trying to fly, as my experience has been that far more

PILOT



*The most impressive thing about this microlight is its speed range: it is happy cruising at 70 mph, has a max speed of 95 mph, and a minimum (with no defined stall) of 38. It is positively stable and handles like any other light aircraft. The view ahead is up to glider standards. Best of all, the Shadow is real fun to fly.
Flight test by Derek Piggott.*

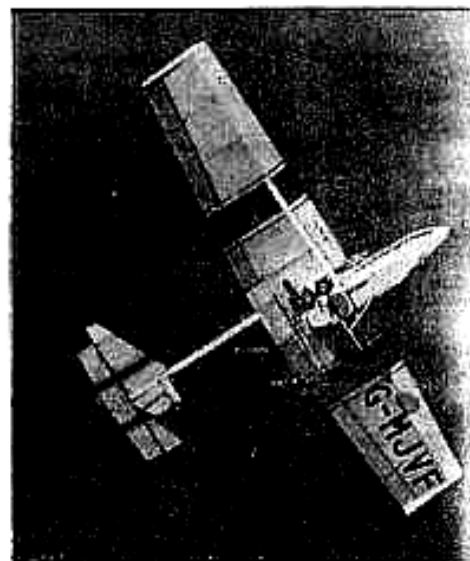


The Shadow is a very light pod-and-boom pusher, with full CAA certification — and conventional three-axis controls via a sidestick controller and rudder pedals. It is offered complete, or in kit form. Three a month are being turned out.

machines get damaged by ground-loops and swings on the ground than by bad landings. However with a nose-wheel ground-loops are out of the question.

Worrying somewhat about the rather nasty crosswind (at the time 10 knots or so at right-angles) I did not make a very good job of the first take-off! In spite of the careful briefing I let the stick forward before the nose-wheel had lifted off the ground, and by the time I had eased back again and glanced at the ASI it was showing over 60 mph. The acceleration is certainly impressive! Remembering my briefing, I made a quick turn into wind at fifty feet for noise abatement, and up she went in an exhilarating climb showing almost 1,000 feet per minute. From that moment I knew I was going to enjoy my flight, and seeing a couple of American A-10s flying nearby I could not help feeling tempted to go chase, for this is the kind of feeling I always get zooming up at a steep angle of climb.

Flying solo and well below the maximum permissible weight, the rate of climb was well above the claimed 700 feet per minute. David Cook mentioned that all the quoted brochure figures



are a little below the actual figures and should be achievable by every machine and not just the prototype. A quite definite backward pressure is needed when climbing; I missed a trim control and the pleasure of having the aircraft in trimmed flight all the time. However with that rate of climb I was soon up at 2,000 feet and high enough to try stalling and attempt to make it spin — which I knew had been found impossible by other pilots.

Because of the very short side-stick and high gearing the aileron control seemed a little heavy for the kind of handling tests I was doing, but very reasonable for any normal flying and for flying across-country. The rate of roll from 45 degrees to 45 degrees at about 60 mph was under five seconds, using full aileron and a moderate amount of rudder to prevent any adverse yaw. Using a large amount of aileron with the rudder locked centrally the adverse yaw is much like that in many gliders, and more than in most light aircraft. However quite reasonable turns can be made without co-ordinating properly, and the average Cessna driver would not find any difficulty — although to get the best results some rudder is needed for the entries and recoveries from turns.

But perhaps the most impressive thing about this aircraft is the speed range. It was very happy cruising at 70 mph at 5,000 rpm with the propeller turning over at less than 200 rpm. It was just about trimmed-out hands-off at that speed, and positively stable, needing very little attention and handling like any other light aircraft. The maximum level speed is stated as 95 mph; this very aircraft still holds the world speed record in the C-1-a/o class.

At my cockpit weight of 170 pounds there is no defined stall. This does not seem to be because of lack of elevator authority, as there is ample elevator power for fully held-off landings and for tight turns at any speed. Even when raising the nose fairly rapidly there is no buffet, and the most that can be induced is a very slow gradual drop of the nose by a few degrees and a higher rate of descent. Under power the slow-speed characteristics are even more impressive. The nose can be pulled right up to a sixty-degree angle, and with full power all that happens is again a very gradual lowering of the nose until a slow climb-away occurs. With full rudder and any position of the ailerons there was still no tendency to drop a wing, and so no possibility of making it spin, a truly unusual performance with positive aileron and rudder control throughout. Flying in this extreme nose-high attitude facing into the wind brought the ground speed down to only a few miles per hour, and with the superb downward view I couldn't help thinking that for use over the countryside the police might do better to have a dozen of these rather than one Optica. Not only could they do the same job, but they could operate from any reasonably smooth farmer's field and at only a fraction of the cost.

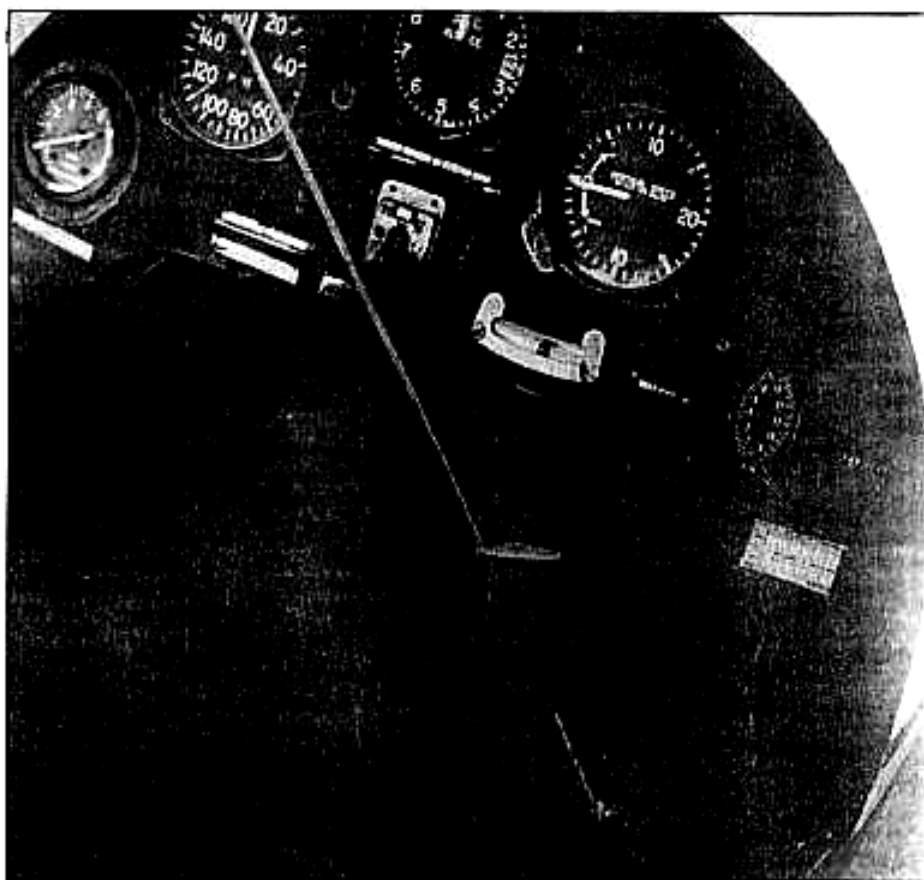
With the flaps lowered the main change is an improvement in the aileron response and a steepening of the approach. I didn't bother with them much on my flight, as there was a stiff crosswind by then and I preferred to limit the drift by having a little higher touchdown speed. The approach seemed typical of any light aircraft but with a far better view ahead. The side-sloping characteristics had been perfectly normal, so I elected to use a wing-down approach at 60 mph. At this speed it was easy to make a well held-off float and a very light touchdown on the main wheels. Opening the throttle again to go around the Shadow leapt off again, and within a few seconds I was up high enough for a low circuit and a second try. This was real fun-flying with no worries about those fends who insist on making

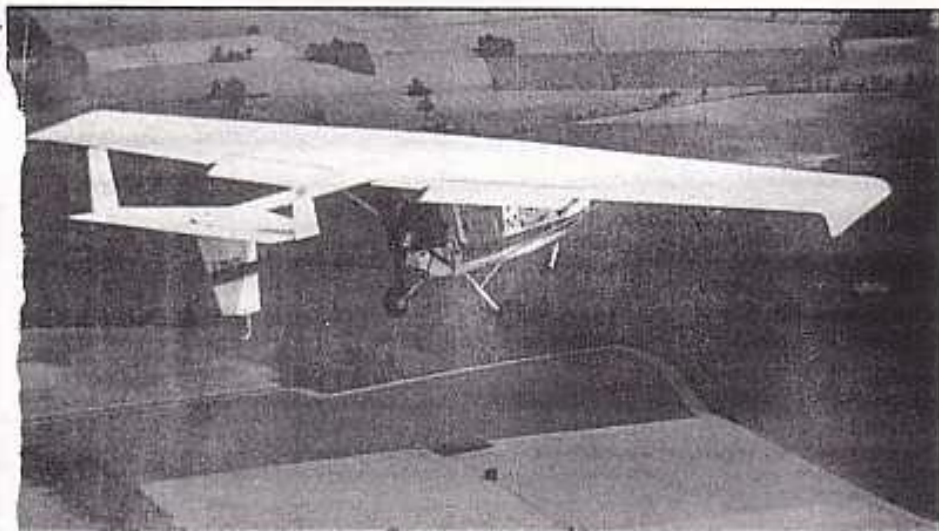
Transport Command circuits, or air traffickers who want radio calls to let them know exactly where you are on the circuit.

One more landing and my treat was over. I taxied in to park near the trailer/hangar and switched off to chat to the designer and originator David Cook.

The Shadow owes many of its aerodynamic features — including the wing aerofoil — to the very successful Volmer Jensen VJ-23 Swing-wing rigid-wing hang-glider. It was with one of these machines fitted with a little two-stroke engine that David Cook became the first person to fly a powered hang-glider across the English Channel, for which he was awarded the Royal Aero Club Bronze Medal for Aviation Achievement. He has had many years experience as chief designer of Richard Garrett Engineering Ltd., as well as much experience in instructing and flying many types of microlight aircraft. Since 1980 he has concentrated all his energies to developing and building the Shadow. In its construction he has used what he considered to be the most appropriate material for the part concerned. Extensive use is made in the main fuselage of fibrelam, a glass and honeycomb sandwich board used for floorboards in many airliners. In the kit this comes computer-cut to shape and ready to glue together. The wing spar is an I-beam using preformed alloy spar caps and a ply web. The whole D-box including the finished spar and fittings comes complete ready to attach the foam ribs. The rear fuselage or boom is a standard alloy tube, and is also finished and jig-drilled at the works. Apparently if you order a completed machine they simply take the next kit out of stores and assemble it!

It would take you approximately 300 man hours to complete the kit version; no special tools or experience is required. Detailed con-





Much of the Shadow's aerodynamics derive from Voimer Jensen's VJ-23 Swingwing, with which Shadow designer David Cook became the first man to fly a powered hang-glider across the Channel. The Shadow's structure is a mix of metal and composites; kit assembly time is estimated at 300 hours. Options include floats, and a trailer-hangar — rigging takes two people about ten minutes.



struction manuals are provided with a photo supplement to help the builder.

You may ask why pay all this money for an aircraft when you could buy a second-hand light aircraft for the same amount? Well, there seem to be various advantages. First, you get a new machine and not a clapped-out fatigued one. It can live in its own trailer/hangar ready to drive out to the airfield — or indeed, any farmer's field which is suitable. Any unobstructed area of about 150 metres would be sufficient once you have become really familiar with the machine. So no hangarage fees and possibly no landing fees are payable — apart from the odd bottle of whisky for the farmer. It can be taken out of the trailer and rigged by two people, and it only takes about ten minutes. The fuselage is just rolled out ready to attach the wings and tail. The wings are very lightweight and not unreasonable for the girlfriend to handle. (Anyway she can have a ride for her trouble!) Any servicing can be done by the pilot, who if he has built the machine already knows every nut and bolt. Similarly with minor repairs, so that running costs come out at about £5 to £10 per hour all in!

The engine life is about 400–600 hours before



a complete overhaul, or if preferred a new engine can be bought for about £750.

Looking at the kit of parts one is reminded of a modern model kit. Most of the major parts are semi-finished and there is only gluing, some fibre-glassing and the covering to do.

During the assembly the work has to be inspected and signed off at four stages by either a PFA or BMAA inspector or by the factory. Help is available if there are any troubles, or of course for an extra £3,850 you can have a completed aircraft.

So what did I not like about the aircraft? Well, I would certainly want to build my own rather than buy it assembled so that I knew all about the structure and could confidently service it. The ailerons are just a little heavy to my taste, but I expect most other pilots would be very happy with them. I did not like the canopy catches: they are better on production aircraft, and now lock the canopy against any push up from inside. It would be nice to have even a crude form of elevator trim, but otherwise it was fine from the flying point of view.

What can you do with the aircraft? Well, it was fitted with crop-spraying equipment and tested by the ICAP at Cranfield for ULV applications. It is obviously suitable for observation and surveillance purposes, and at least one farmer has bought one for rounding-up cattle on his ranch. It can be fitted with floats, and has a good performance flying from calm water sites such as lakes and other inland waters.

But perhaps best of all, it is real fun to fly. All aircraft bite fools, but this one is safer from the risks of stalling and spinning than any other light aircraft I have known. It is just what the doctor ordered to revive the light aeroplane movement!

It would be perfectly safe to do initial training on such a forgiving machine, but for a pilot who is going to fly other types more experience of stalling and spinning would be essential. I would like to teach in it to see just how quickly a student would master it: my guess is that it would not take long.

By the way, it is categorised as a microlight, a dirty word to many pilots. Better to call it a mini light aircraft, for that is what it really is.

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