

Here's one I made earlier



Short of the readies to buy a helicopter? Why not make your own. Pat Malone reports

he'll have spent about £42,000 on a brand new helicopter that runs on mogas, he can do his own maintenance, and he'll be absolutely sure of its integrity because he's lavished seven years of love and attention on it.

Bruce used to own a Schweizer 300 and looked into bringing it with him when he came to Britain from South Africa ten years ago, but was appalled at the level of costs in the UK. "The cost of maintenance is two or three times what it is in South Africa," he says. "Hiring costs are as bad; I was hiring a Beech Baron back home for the price I paid for a Cherokee Warrior at Manston."

For Bruce, a specialist in toxicology and chemical risks in the occupational health field, the solution lay in the DIY field. He has the advantage of being technically competent, being a rebuilder and maintainer of cars and motorcycles – mechanical skills are almost as important in kit helicopter building as a bloody-minded determination to see a project through. "You need only a basic mechanical understanding and you don't have to use specialist tools," he says. "Everything is explained very well, and the support is excellent. Almost anyone could do this."

Bruce, an AME who does JAA and South African medicals, came to the UK in 1999 to work for a chemical company that was moving into the cosmetics field. A fixed-wing and rotary aviator, he had been passionate about flying all his life.

"As a kid I built and flew models and as long as I remember I wanted to fly," he says. "I couldn't really afford to learn. So I thought,

Left: RotorWay's A600 Talon, which shares a common shape with the Exec 162F
Bottom: the kit components come in four stages starting with the plans, and the 4130 chrome-moly steel airframe

We all love helicopters, but you have to admit they ain't cheap. Ownership is an expensive privilege whatever your model, and the cost of hiring a helicopter can make grown men weep. But there is a cheaper – or rather, a less expensive – route to helicopter flight, and that is to knock one up in your garage. Contrary to sniffy popular opinion this is not the refuge

of the desperate, but is the resort of the clever, the capable and the canny. They end up with a nifty piece of kit – safe, speedy, and economical. What's not to like?

Dr Bruce Alexander's RotorWay 162F stands near to completion in his garage near Canterbury. He's got a few finishing touches to add before he has to demolish the back wall, get it out and fly it away. When it's finished

what's the cheapest way to get in the air? The answer was skydiving, so I asked my father, who was an accident surgeon in a gold mine, to sign the indemnity and he refused. He said he would pay for my flying lessons if I got a scholarship to study medicine at university; so I did that. I joined the flying club at Witwatersrand University and learned on a Cherokee 140 and an Arrow.

"Then I had to do two years' National Service, defending the country against the communist menace. I became a military doctor did aviation medicine, and because I was stationed at an Air Force base I got flips in an Impala. When I was up north on Border Duty I got to fly in an Alouette 3 and managed to get some stick time, too. I did my twin rating, Commercial Pilots Licence and Instrument Rating and had more than 1,000 hours P1, and when I got to the UK the CAA looked at that and said, 'Very good, for that we'll give you a single-engine PPL and you only have to do two of the exams.'

"South Africa has a number of commando squadrons with civilian pilots who are co-opted – the Air Force will pay for your training and will also pay you for doing the flying, and that was great! But you had to have access to an





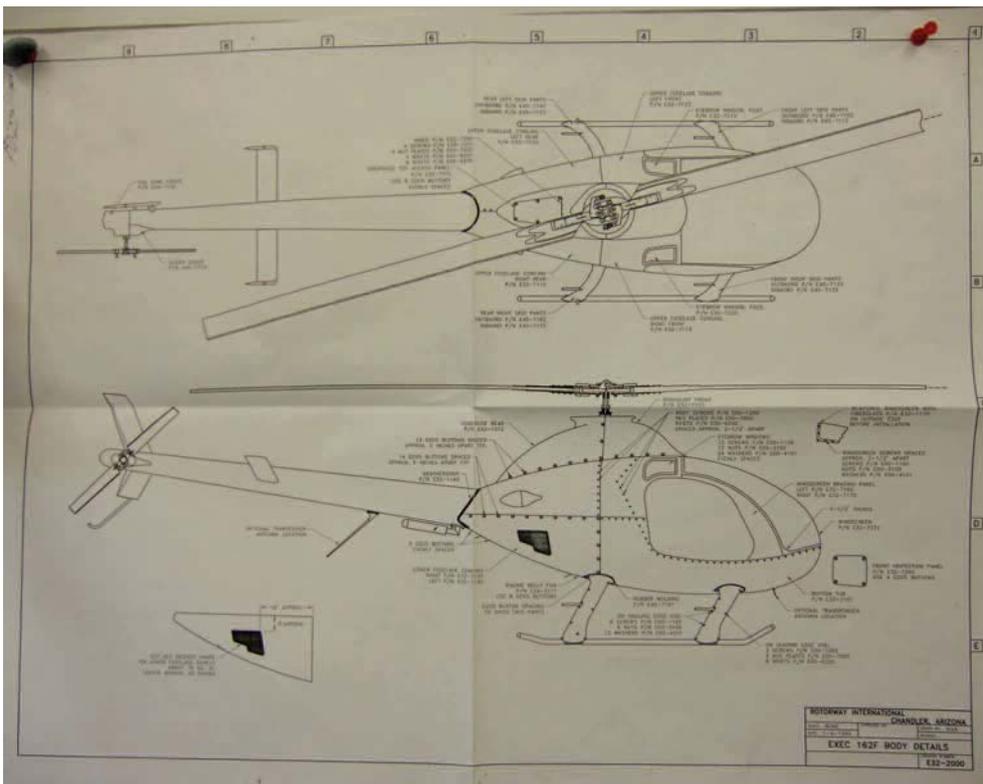
aeroplane. I had a share in a Cessna 210 and later a Seneca and a Maule, and I could get hold of a Cessna 206, a Beech Baron and a Cessna 402. Quite often I was called on to take military brass somewhere, or provide transport to military observers overhead townships.

“As a civilian doctor I had a big rural practice and often spent hours in a Land Rover to get somewhere in the bush where I had to work in a tent, and if it rained sometimes you couldn’t get back at all. So I built an airstrip and bought a Maule, and that worked well, but we opened another clinic in a steep ravine with no room for an airstrip, so I bought the Hughes 300 and my military friends taught me to fly it.

“I loved that helicopter, although a lot of the work I did was hot and high and I had to carry a big heavy bag of medicines around – I always flew with the smallest nurse in the practice. I had very few problems; the fuel pump bearing went once, and I heard it on the pre-flight. The engineer I used was eight hours away in Pretoria, which was difficult. I had a fan belt go, which caused me to lose the alternator, and they used to hang a spare behind the engine because they were always failing. So I dropped the alternator down and fixed the spare on in the bush, and that lasted about two hours because it had been up there for years and got cooked. So I jury-rigged a segmented industrial fan belt and that worked wonderfully. It had a sticky



Top left: Dr Bruce Alexander with his almost-completed Exec 162F in his single-car garage
Left: simplified assembly diagrams for the Exec 162F adorn the garage wall
Above: the RotorWay Talon incorporates a number of upgrades, including a shaft-driven tail rotor



throttle once, when it wouldn’t open fully for lack of lubrication, but I was used to hot and high work and run-on landings.

“But with problems like these, when you have no easy access to an engineer, you become rather more self-sufficient, in a way you don’t see in the UK. I put about 200 hours on the Hughes, loved every minute of it.”

Bruce had always had a mechanical bent. “I rebuilt a little Puch moped when I was 14,” he says. “I moved on to a Suzuki 50 and a 1956 AJS, then rebuilt a 1979 MGB. So I got pretty handy; in England my wife Pippa and my two sons Dylan and Dane each had a 3-series BMW and I had a 5-series and I did the servicing on all of them, which saves a fortune when you think the dealers are asking £120 an hour for labour.”

Aviation costs in Britain made Bruce blanch,

too, so he decided not to bring the Schweizer over but instead to investigate the kit-building world of RotorWay.

The RotorWay story begins in 1961 with an amazing tinkerer called Buford John Schramm who took a Mercury outboard motor off a speedboat, upended it and built a helicopter around it, calling it the Javelin. He survived this experience and learned from it, graduating to Evinrude and eventually Volkswagen engines with an improved model called the Scorpion. This begat the two-seat Scorpion Too, which turned back into the Scorpion when Schramm started making his



Above: Bruce's son's bedroom serves as overspill parts storage - son lives away, fortunately

Top right: binnacle provides sufficient instrumentation for a day VFR helicopter
Right: on Bruce's garage wall, reminders of a previous life of bush flying



own engines, and this in turn morphed into the RotorWay Exec. Schramm sold hundreds of kits, but his company, based in Chandler, Arizona, got into financial difficulties in the 1980s and was bought by an Englishman, John Netherwood, who was himself a RotorWay builder twice over and knew where the holes in the plot were. Under his guidance the marque prospered. He strove to design out of the helicopter the opportunities homebuilders had to do a questionable job, and he was in large measure successful. Netherwood died in 1998 after passing the company on to its employees, and RotorWay – since acquired by an investment group headed by Grant Norwitz, a previous customer – has continued to prosper, selling about 75 helicopters a year and introducing fairly sophisticated new models including the A600 Talon and the Eagle 300T, which has the Rolls Royce RR300 turbine engine that also powers the Robinson R66.

Bruce says: "I'd seen RotorWays in South Africa, and I thought they'd come a long way since the days of the Scorpion with the

Evinrude engine – far enough, I thought, to make the helicopter a serious proposition. I knew I could end up with a new machine at reasonable cost, and do my own maintenance. As it was with the early days of the Robinson helicopters, there's been talk of design problems, but everything I've seen goes back to pilot error or builder omission – particularly to guys not bedding in tail rotor drive systems properly. They stretch, and you have to hover, then adjust, then hover some more, and some people are not meticulous enough about doing these things."

The most critical components are made up in the factory, but in keeping with the

stipulation that 51% of the work must be done by the builder, there's a daunting amount left to do. The kit comes in four stages, each with a broadly similar invoice somewhere north of £10,000. First you get the plans, the 4130 chrome-moly steel airframe, the tail boom, landing gear, engine mount, fins, cyclic, collective and pedals, fuel tank, wheels and sundry small bits. When you've stuck that lot together you get two more crates (and another invoice) containing the rotor hub, main shaft assembly, cabin, oil bath, fan shroud, seats, floor pan and instrument pod. The third stage includes the secondary drive, oil and water cooling systems, tail rotor drive, clutch and



out translates into a big error at the far end of the boom. It took me a whole weekend just to align it, using trestles and plumb bobs aligned along the centreline, and there's no fallback position. But the instructions are very good – there are four manuals, and a set of DVDs.”

You can also get advice from the many online forums that cover rotary wing matters, although you have to be very choosy. “As with many such forums, it's a good rule of thumb that those with the least knowledge have most to say,” says Bruce. “And especially when they're anonymous, they try to make a lot of mischief. I've occasionally picked up useful tips from the forums, but they're a mixed blessing.”

Bruce went as far as making his own spray booth, rigging up curtains and installing extractor fans in the back door of his garage, which incidentally is too small to get the



torque links, fuel pumps, hoses and clamps, flight and engine instruments, wiring loom, and bill. Finally you get the main rotor blades, engine and fadec system, and you're off to the races. RotorWay makes its own engine, a four cylinder, horizontally opposed, fuel injected, water cooled 2.7 litre unit producing 150 to 170 horsepower, depending on who you listen to, on premium unleaded. You can use avgas, but if you do the TBO comes down because it causes lead fouling and other problems.

“Spreading the kit like that reduces the financial pressure,” says Bruce. “I was lucky in that I bought the most expensive components, the engine and the main rotor blades, when the pound was strong. You also get a lot of help from the importers, the Bull brothers – one of them will come and inspect your work at every stage, and finally they'll send their engineer who'll spend a day going over everything and give you a snag list. I'm very happy with the support I've had. I was determined from the start to build this as an

**Top: main rotor blades come finished apart from some track and balance touches
Above: tail boom took a whole weekend to align properly before attachment holes were drilled
Above right: meticulous measurement proves the helicopter will not come out through that door**

absolutely standard helicopter – there are horror stories of people who've ‘improved’ and ‘modified’ the aircraft only to have the CAA take forever to certify it. One chap made a lot of mods, things like adding a Robinson fire extinguisher, which isn't certified for the RotorWay, and the CAA made him unmodify everything, which delayed him getting airborne for nearly a year.”

How much more difficult is it than the engineering work he's previously done? Bruce says: “The difference between building a helicopter and building a car is that you've got to be extraordinarily meticulous and accurate. For instance, when you have to drill holes for mounting the tail boom, you have to get it absolutely right because a millimetre

helicopter out through the main door – the back wall will have to come down. And after seven years, demolition day is in sight. Bruce is now looking at some of the finishing touches like adding the weights to the main rotor blades and tracking and balancing them using electronic equipment with help from the Bull brothers.

The helicopter may fly this summer, but there's no guarantee. “There's no way I'm giving myself a deadline because that could turn it into a chore, make me rush things, maybe feel bad about it,” he says. “I certainly haven't hurried the job. Sometimes I make great progress, sometimes I don't do anything for weeks. At one stage I didn't look at it for a month, but then I was doing two bathrooms in the house at the time.

“I also have to renew my helicopter licence. I haven't flown a helicopter for ten years, apart from flying the demonstrator at the RotorWay factory in Arizona. That was five years after I'd last flown, and it only took me ten minutes to feel comfortable with it again, so I'm not too worried.” →



Here's one I flew earlier

Pat Malone reports

Ten years ago I test-flew a RotorWay Exec 162F for an article in *Pilot* magazine. It was an assignment I approached with some trepidation; the aircraft did not have an amazing safety record, and of course we're all pretty chauvinistic about what we fly and secretly look down on anything else. Not me, of course, but others.

Then as now, RotorWay's British end was run by the Bull brothers, Jonathan and David, from a hangar at Takeley on the edge of Stansted airport. The Bulls were seeking to diversify out of farming; helicopter manufacture was obviously the first thing that sprang to mind. Their instructor was Ian King, a 7,500-hour pilot who flew a Bölkow air ambulance for Bond. I figured that if he was prepared to fly it, who was I to wimp out?

In the event I was pleasantly surprised, both by the handling qualities of the aircraft and by the engineering. A kit helicopter must be less than half complete – the builder must do 51% or the work to qualify – but all of the really hard stuff is done by the factory. The frame is welded, the main blades virtually finished, the rotor mast is ready to fly, and wiring harness complete and ready to hook up. That's not to say that there's no intricate and skilled work remaining.

As to the flying, if you can handle an R22 you'll breeze the 162F, although you'll have to remind yourself how you flew in the pre-governor days, because the RotorWay hasn't got one of those.

Correlation is poor, too, so nifty wristwork is called for, and the throttle is long, with two full fistfuls from idle to max RPM. It has, however, a Fadec – not the Full Authority Digital Engine Control we know and love but RotorWay's own 'Fully Automated Digital Engine Control' which uses 14 sensors to monitor the engine's vital functions including MAP, RPM, ambient air pressure, system voltage, throttle position, fuel flow, ignition timing, injection and water systems and provides the engine with the correct fuel, air and ignition ratios for best performance.

I found the cabin a bit tight and my headset kept scraping the roof; the cockpit is 44 inches across, same as the 22, but there's less headroom. It's airtight compared to the draughty Robinsons, with three-point fixings on the doors, and harnesses are four-point. Gauges low down on the binnacle show voltage, oil temp, oil pressure, water temp and engine RPM in numbers. The tachometer at top left presents ERPM and RRPM in the crossed-needles fashion. The master key is in the roof panel, along with toggle switches for instruments, primary and back-up fadecs, fuel pumps and ignitions. Start button is on the cyclic; water temperature rises to about 160 F before falling back slightly – like the fabled air-cooled submarine, the engine is out of its environment. Clutch is engaged with a T-handle on the firewall behind you – a contortion is needed. On lift-off the helicopter hangs very right-skid-low – the

main rotor spins French-way-round – and the strength of tail rotor drift makes landing across anything less than flat a real challenge. Speed builds quickly, and with two big blokes aboard and half fuel we made 700 fpm at 28" MAP. The 60mph climb attitude felt nose-high. The cyclic did not feel stiff, but I was able to let go of it in the cruise and the helicopter flew straight and true for several seconds. 90mph is a comfortable cruise – at 110mph we were pulling 28 inches and rattling a bit, and Vne is 115mph. There's relatively little inertia and speed drops off rapidly as you raise the nose.

Autorotations were benign for a small helicopter. A full portion of pedal was needed to keep straight on entry, and I found the stick had to be held well forward to maintain 65mph in the descent. Recovery is uneventful as long as you open the throttle first, and keep opening it as you raise the lever.

At the end I tended to agree with Ian King when he said: "There are parallels with the Robinson in its early days when there had been crashes and it was widely said that there was some inherent defect in the machine. The people who shook their heads then are now, almost without exception, flying the Robinson, secure in the knowledge that it's as safe as any other helicopter, and the trouble really lay with pilot training. The RotorWay is a fantastic machine if you don't try to make it do what it's not designed to do." ■

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