



BACKYARD BLITZ

With more and more Australians building their own aircraft, hopes are high there will be some inventors among them, writes Cheryl Jones.

PETER BENNETT ADMITS THAT many of his fellow aviators questioned his sanity. And he knew of the risk of catching AIDS (aviation-induced divorce syndrome) when he embarked on a project to build his own aeroplane.

Bennett, president of the Sport Aircraft Association of Australia, is one of a growing number of Australians spending evenings and weekends in their sheds, working on their creations.

Most, like Bennett, just want a low-cost, high-performance aircraft.

"I got absolutely fed up with hiring an old, broken, expensive aeroplane and not being able to go far in it," he says. "There was very little fun left in flying a hired aircraft.

"I could build an aeroplane with much higher performance for about the same price as I could buy a clunky old certified aircraft."

Others take up do-it-yourself aircraft building to indulge their interest in design, and hopes are high that an engineering breakthrough, or at least some incremental advances, will be made in an Australian backyard.

Amateur building has already spawned Australian aeronautical companies, a couple of them tapping the DIY market in which they had their roots.

"The amateur-built sector is a testbed for new technology," says Bennett, a retired electronics engineer. "It can adopt innovations very quickly. Every aeroplane is a prototype."

There are about 1,000 home-built aeroplanes flying in Australia, according to the SAAA. Bennett says the amateur-built fleet is growing more quickly than the general aviation fleet. DIY aircraft builders come from all walks of life. Many are qualified in engineering or the trades. Others are doctors, lawyers or business managers. All they need are basic handyman skills and a commitment to quality work.

Most amateur-built aircraft are modest, powered by single piston engines, but they extend to jet and turboprop aircraft, and some are even pressurised. Many have more sophisticated avionics than their type-certified counterparts.

Hobby builders can produce a simple wooden aircraft for as little as \$20,000.

"Typically, people spend between \$60,000 and \$100,000," Bennett says, adding that it would cost up to \$300,000 to buy a comparable type-certified aeroplane new.

The record for assembling a home-made aeroplane is a few months. Some aircraft take years to put together. "It depends on the time you have to devote to it," says Bennett, who took 10 years to build his Vans RV6. "But if you put your project too much ahead of your family, it can lead to unwanted results."

Latest vogue Some amateur builders buy components, including engines and wings, separately and piece them together.

The latest vogue is the conversion of automobile engines, such as Ford and Subaru motors, for use in aircraft. The aim is to exploit the advances made in car engines in recent decades, a period during which aircraft piston engine development has stagnated.

The biggest challenge is to gear the car engine down from about 5,000 rpm to between 2,500 and 3,500 rpm, the optimum speed for propellers, says Andrew Ward, CASA's senior air safety auditor (sport



French designed CRIQUET (CRI CRI) is the world's smallest multi engine aircraft. VH-CRI owner C Willis, NSW.

SAAA

aviation).

Another problem is the need to install radiators on the aircraft.

Still, converted automobile engines can be lighter and cheaper than conventional aircraft engines, such as Lycomings, Ward says.

A few hobbyists still work solely from

drawings to build aircraft such as the Corby Starlet, designed by Australian engineer, John Corby, and the Pitts Special.

However, most these days assemble full-scale kit aircraft, such as Vans, Lancair and Glasair models. Some tinker with the designs.

One kit aeroplane – the Jabiru – was born in an enthusiast's shed.

Engineer, Rodney Stiff, of Bundaberg, Queensland, was experimenting with single-seat composite aircraft design in the 1980s during his time off from work at a company producing sugarcane harvesters.

"He'd get them almost to flying stage, see a way of improving them, and start all over again," says Phil Ainsworth, Stiff's business partner.

The two eventually sold their interests in a local engineering firm and launched Jabiru Aircraft.

The company now produces a range of two- and four-seater high-wing, fiberglass aircraft for the local and export markets. Some of its models are type-certified, and available as factory-built aircraft.

Jabiru is shifting around 120 aircraft a year, with half of them sold internationally.

The aircraft are powered by Jabiru's 80 horsepower four-cylinder, and its 120 hp six-cylinder engines. The company is also selling these engines, along with a 180 hp eight-cylinder engine, separately to professional aircraft manufacturers and

kit builders world wide.

Through its sister company, Microair Avionics, Jabiru is branching out into avionics. It is developing a miniature navigation and aircraft identification system for installation on aircraft as part of the ADS-B (automatic dependent surveillance broadcast) air traffic control system, due to come on line next year with the deployment by Airservices Australia of 20 ground stations.

Meanwhile, software engineer and pilot Greg Wooton came up with some ideas for glass cockpits. "It's difficult to keep track of all the gauges. A computer can do that for you 100 times a second," he says.

Wooton set up a company, Adroit Technology, at Temora Airport in central New South Wales, to develop the technology for the amateur and experimental aircraft market.

He says the glass cockpit replaces all the standard flight and engine instruments, and features checklist and GPS information, along with a moving map display.

The screen, he says, is bigger than those on certified glass cockpits. Special software enables users to design their own instrument display panels. And the system, which records flight data, can be used to replay the flight.

Wooton planned to launch the technology, which will cost about \$US5,000 a unit, at the SAAA's Easter fly-in at Wagga Wagga, NSW.

Rules to DIY for

Amateur aircraft building is relatively free of regulations, under policies designed to stimulate innovation.

"The reason we have amateur and experimental regulatory groups is to enable people to reinvent the wheel – so they can do innovative things," says Andrew Ward, senior air safety auditor (sports aviation) at CASA.

"Many innovations by amateurs world-wide have been taken up by professional aircraft builders."

Anyone can build an aeroplane, to any design and using any materials and construction methods.

However, to qualify for registration under the amateur-built aircraft acceptance (ABAA) category, the aircraft has to have had at least half of its fabrication and assembly under-

taken by an amateur. It has to have a maximum take-off weight under 1,500 kg and a seating capacity of four or less. And it has to have been built for education or recreation, not for profit.

"People are not allowed to set up a production line," says David Villiers, head of airframes in CASA's airworthiness standards division. "Production aircraft have to be built under a quality system that ensures you build 30 examples of one type, not one example each of 30 different types."

Only existing designs are now approved under the ABAA scheme. Amateur-built aeroplanes are eligible for an experimental certificate, a designation with no restriction on size and seating capacity, introduced in the late 1990s.

Experimental aircraft also are subject to the major portion (51 per cent) owner fabrication and assembly rule unless they are assembled

from a kit. About 300 aeroplanes are on the Australian experimental register. Ultralight aircraft that meet certain design specifications can be amateur-built, and operated under the control of the Australian Ultralight Federation. These aircraft are exempt from maintenance rules governing aircraft with CASA registration. Pilots must hold AUF pilot qualifications.

To fly a home-made aeroplane under CASA registration, you need an experimental certificate issued by an expert authorised by CASA. The expert is charged with the task of verifying that the aircraft will not pose a safety risk to other people, and sets operating limits for a test period. The limits, which include restrictions on flying over populated areas, minimum weather conditions, and the maximum number of people on board, are removed if the aircraft passes the test. If the aircraft is judged to be dangerous to the public,

Although most of the advances in aircraft design are likely to continue to come from big manufacturers and the military, CASA's Ward thinks there could be something big incubating in suburban Australia.

He points out that Voyager, the aircraft that in 1986 did the world's first non-stop, flight around the globe, was home made.

"And the Wright Flyer was home built."

- FSA will run a feature on ultralights in a future issue.



Kim Jones working on a replica of a Piper Vagabond PA17.

Jones, CASA's aviation safety promotion manager, has been building the aeroplane in his spare time for 10 years. A professional engineer, Jones is working from drawings. He buys the components and materials from distributors in Australia and the United States. He says he likes the Vagabond, a 1948-49 design, because of its responsiveness, big baggage capacity and classic style, with its tail wheel and fabric covering.

The Vagabond is the second aeroplane Jones has built. His first was a Corby Starlet.

HOME-MADE HAZARDS

In December, 2002, a home-built aircraft operating under an experimental certificate crashed during a test flight near Drysdale, Victoria, killing the test pilot and the owner/builder, who was travelling as a passenger.

The Lancair IV-T kit plane came to grief after a deliberately-induced stall forming part of the flight test program resulted in a loss of control.

"The aircraft rolled at the initiation of the stall, and continued to roll as it then descended rapidly, accelerating to approximately 150 kt at an angle of approximately 40 degrees from the horizontal, with low engine power," says the Australian Transport Safety Bureau report on the accident.

"The accident was not survivable."

The owner/builder had modified the aircraft extensively, replacing the piston engine in the original design with a turbo-prop engine.

"The propeller had been modified by removing 20 cm of the propeller tips," the report says.

The report points out that such modifications are allowed, but adds:

"Those design changes were likely to have changed the performance and handling characteristics of the aircraft and the cumulative effect of those changes would have been hard to predict."

The bureau also noted that no significant risk assessment had been undertaken during the construction of the aircraft and development of the test flight program.

"While there was no requirement for an owner/builder to have a risk management process, such a process would have been prudent considering the significant change made to the aircraft," the report says.

And there was no reason for the owner/builder, who held a commercial pilot licence, to be on board during the test flight, flown by a former military pilot,

The test flight was conducted under a special certificate of airworthiness which said: "Only personnel essential for the conduct of the testing may fly on board the aircraft. The carriage of passengers is prohibited."

There have been 215 accidents and 516

incidents involving amateur-built aircraft over the past 10 years in Australia, with most occurring in Queensland and New South Wales, according to ATSB data.

However, it is impossible to tell whether design faults were to blame in any of the cases.

The Sport Aircraft Association of Australia (SAAA) which advises amateur aircraft builders, says most accidents and incidents involving home-made aeroplanes happen during the test flight stage.

However, the association stresses that amateur-built aeroplanes have a very good safety record.

Safety package The SAAA is developing a four-module, safety assistance package for DIY builders.

The builder assistance module, containing information on best practice, aims at ensuring amateur-built aircraft are airworthy.

A flight test module includes hazard analysis methodology, building on the approach used by the United States-based Experimental Aircraft Association.

"It takes the builder through a full flight-test program," says SAAA president Peter Bennett.

The maintenance assistance module, under development, puts owner/builders in touch with LAMEs who can give them the low-down on maintenance. "The law says owner/builders can do their own maintenance," Bennett says. "We want to make sure they don't do it until they know how."

Meanwhile, the association is working with the Aviation Safety Foundation and industry on a pilot proficiency module.

Bennett says the biggest problem is amateurs who fail to ask advice.

But, in his view, building your own aircraft enhances safety.

He says he knows his machine more intimately than he does any on offer at his local flying club.

"I was appalled at how little I knew about the aircraft I had been flying," he says. "I feel better educated now, and I think that leads to safety."

You can visit the Sport Aircraft Association of Australia's website at <http://www.saaa>.

BACKYARD BONANZA



Europa An English design popular with Australian builders. Owner/builder J. Baker SA beside VH-BKR.



Bushby Midget Mustang 11 VH-JAB Owned by G. Brewster, King Island.



Van Grunsven RV-6 VH-JOY Owner/builder B. Holman, WA. Winner of the supreme award – Concours d'Elegance – SAAA national convention 2003.



Falco F8L VH-DJD built by the owner, D. Done, NSW. Of wood construction, this aircraft always attracts interest.



Corby Starlet VH-BIP. Owner/builder L. Jaensch, SA. All Australian, this wood construction aircraft was designed and developed by John Corby, NSW.



Glastar VH-MSK Engine detail. Owned by K. Wickland, Vic.



Wittman Tailwind VH-OWS Recently rebuilt by owner B. Ham. Vic.

PHOTOS AND INFORMATION COURTESY SAAA