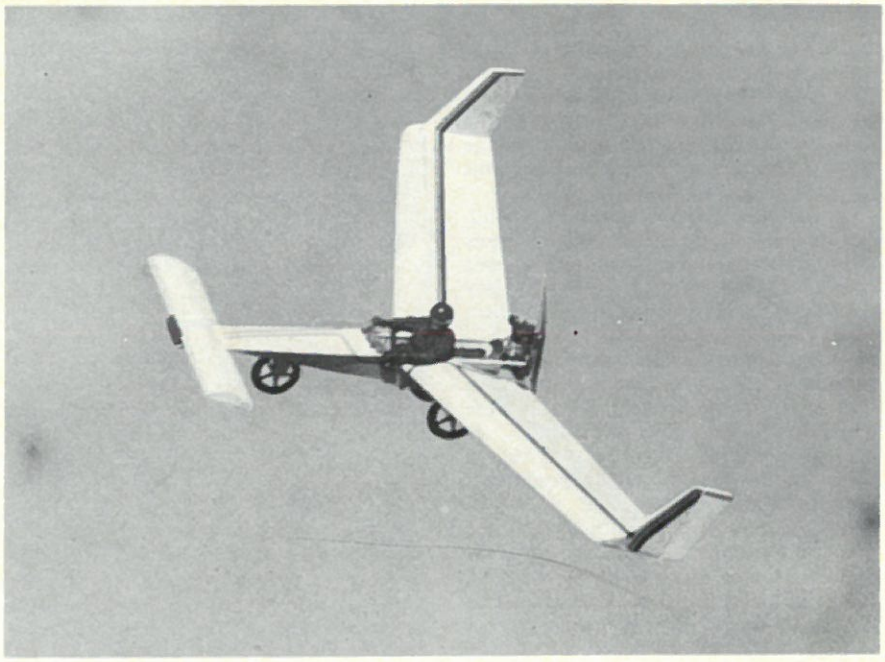


Microlights — the designer's

MICROLIGHTS are to expensive aeroplanes as hang gliders are to exotic sailplanes. They are not a nostalgic attempt to turn the clock back to primitive aircraft of low performance, but demonstrate a determination to obtain a simpler, cheaper, and more personal form of flying than is now possible in conventional aviation. In fact, the current wide range of hang gliders and microlights could not have been effectively produced until Dacron, glass and carbonfibres, styrofoam, and high quality thin-walled aluminium tubing became readily available, or until a generation came of age which considered flying to be just another activity like wind surfing or mountain climbing, using equipment which could be bought in shops.

But although cheaper than ordinary aeroplanes by a factor of at least 10, microlights are by no means aviation's poor relations. Though basically fair-weather, short-range, low-penetration aircraft, they offer a flexibility long forgotten by their big brothers. Many can be flown from grass or water on quick-change styrofoam floats, or from snow using skis weighing 3kg. Most can be transported on a car roof rack if the weather becomes inclement, and almost all have detachable fuel tanks for filling at the local gas station. Some have a cockpit but no floor, so that they can also be footlaunched from a hilltop, while the Trikes go one better by having the pod quickly detachable. This can then be left on the hill while the pilot flies the wing as a hang glider. At present microlights cost between £2,000 to a little over £3,000 complete. Kits are less and in many cases are an assembly rather than a construction job.

There are about 7,000 microlights in the world, and some 200 in Britain, and they are of a wider variety of shapes than has been seen since the early experimental days of aviation. Almost all are single-seaters, though there is an urgent need for a training two-seater. There are types which clearly possess hang glider antecedents, while others display a family resemblance to conventional sailplanes or aeroplanes. There are also those further out on the configuration limb with a strong bias towards canards. Some aircraft are controlled by weightshift and others by "three axis" controls—although there may be fewer than three sets of control surfaces.

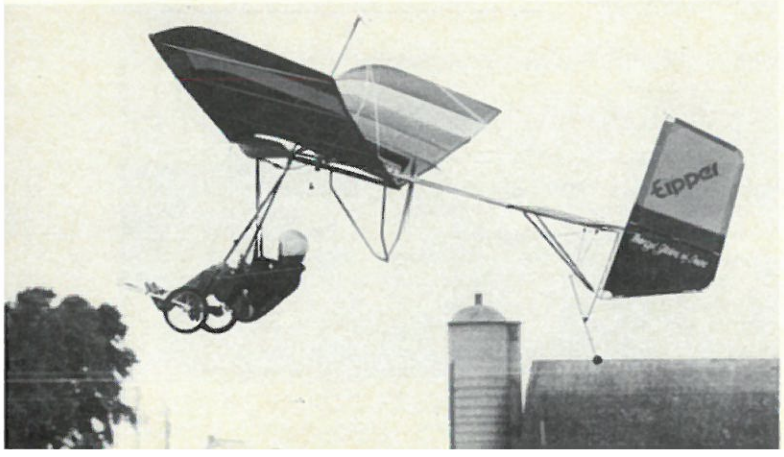
Worldwide there are perhaps 35 manufacturers, some of whom have not previously built aircraft. In Britain there are six, all with hang glider backgrounds. There is plenty of work—and almost too many new ideas. Microlights can be produced remarkably quickly, the elapsed time from sketch to test flight being back to where it was in the Twenties—as little as two weeks in some cases. Because of this capital outlay can be kept low, and there is no need for anything like the extensive pre-production market research undertaken for much more expensive aeroplanes. Nevertheless, any designer has a problem when the choices and alternatives before him seem infinite; and customers have little idea of what they are going to want, or could expect, in two years' time.

However, the design diversity which is a feature of any new development tends, as history shows, to narrow and canalise itself as the consumer (customer is perhaps a better word) manages to define his wants more closely. As an example, it was emphasis on top-level championships which pressured sailplane designers to strive for maximum performance above all else, and which has resulted in gliding becoming a very expensive form of flying. An additional problem facing the microlight designer has been that no clear information existed on what is, or is not, a microlight, to help him confine his specification in any way. It was for this reason that the FAI responded to an urgent request for a definition agreed as:

> A single/two-seat aeroplane having a dry (empty) weight (W) not exceeding 150kg and a wing area in m^2 of not less than W/10 and in no case less than $10m^2$.*

The intention is that a microlight is, and should remain, an aircraft of low kinetic energy, light in weight and slow.

Obviously, any definition, as well as helping the designer to determine his objectives, will also impose limitations. An aircraft of only, say, 100kg weight, including the engine, does not give many freedoms. In broad terms, apart from having to be strong enough, the aircraft can either be basic and with high drag but cheap—or sleeker and more expensive. Whatever compromise is chosen, if the structure is basic it will be difficult to produce other than a low-performance aircraft, particularly in terms of cross country speed. But this is no disadvantage for the pilot, who just wants time in the air. About the only criteria he is concerned with are a reasonable rate of climb and pleasant handling. If the aircraft is built on hang glider principles, of tube and Dacron, this pilot will also have a rugged aircraft, quick and easy to repair and with roof-rack portability. What he will not have is the ability to



Top left *Catto Goldwing (span 30ft, weight 180lb, wing area 128ft²).* **Top right** *Hiway Skytrike (span 33ft, weight 86lb).* **Left** *Quicksilver (span 30ft, weight 135lb)*

◄ ◄ page 1048

could change hands for £500; today it could fetch at least £12,000. All the other surviving Moths and most other vintage aircraft have appreciated even more. Austers are unlikely ever to acquire this sort of mystique, but are appreciating slowly.

All of these types are now enthusiast's aeroplanes, are tailwheel types and demand far more handling finesse than today's aircraft. In return, they are often more enjoyable to fly. Pilot skill is an essential, and if the prospective owner is not used to tailwheels he must be patient while he learns to handle them. With a few exceptions the vintage aircraft is generally more costly to operate in terms of how much performance you get for your money. The dear old Gipsy Major that powered many of yesterday's light aircraft is more expensive to feed and overhaul than its modern counterpart, and has a big appetite for oil. Most of the old aircraft it powers give a low return in speed against today's types on the same power. When fuel was cheap, fuel consumption was less important in operating a light aircraft, but today someone contemplating an elderly aircraft for going places needs to look very carefully at its likely fuel (and oil) consumption.

If you want an aeroplane badly and have time rather than money, then making your own may be the answer. Some ability with wood, metal or glassfibre, working space and, say, a real commitment to at least two years' worth of spare time opens up a veritable galaxy of designs, from a simple wooden single-seater like the Evans VP-1 to the glassfibre Rutan VariEze, one of the most brilliant and fuel-efficient light aircraft of all time. There is an increasing number of fast and practical two-seat touring designs that leave their factory counterparts standing in terms of performance and, often, handling. In some cases kits of parts can be bought to simplify and shorten construction time. Around the world the American-based Experimental Aircraft Association channels homebuilt and other sport flying interest. In the UK the Popular Flying Association is delegated responsibility for the airworthiness of several hundred homebuilt aircraft by the Civil Aviation Authority.

With a homebuilt there is usually no fixed schedule of maintenance checks, the aircraft instead having to pass an annual inspection. Most of the maintenance work is usually done by the owner or owners under supervision, which naturally means a big saving in costs, and these arrangements apply to other light aircraft operated on a Permit to Fly rather than Certificate of Airworthiness. The table shows sample costings for a group-operated aircraft of this kind.

SAMPLE GROUP TWO-SEATER OPERATING COSTS

These are estimated costs for a ten-member group operating a two-seat Jodel aircraft worth around £4,000 on a Permit to fly (see text). They are a guide only, and in practice there could be big differences for individual circumstances.

Fixed Annual Costs	£
Insurance	300
Hangarage	600
Maintenance	400
	£1,300
(Rate per member £130)	
Hourly Costs	
Fuel—4·5 gal @ £2·40/gal	10·80
Oil	·75
Lifed components	2·00
	£13·55

RELATED FLIGHT ARTICLES

Several articles in past issues should interest the prospective aircraft purchaser. See our **International Private Aircraft Directory** (March 14, 1981); **Light aircraft overhaul and maintenance** (December 13, 1980); **Owning a private aircraft** (September 8, 1979); **Is group ownership the key to cheap flying?** (April 1, 1978); **Covering the private pilot's risk** (April 23, 1977).

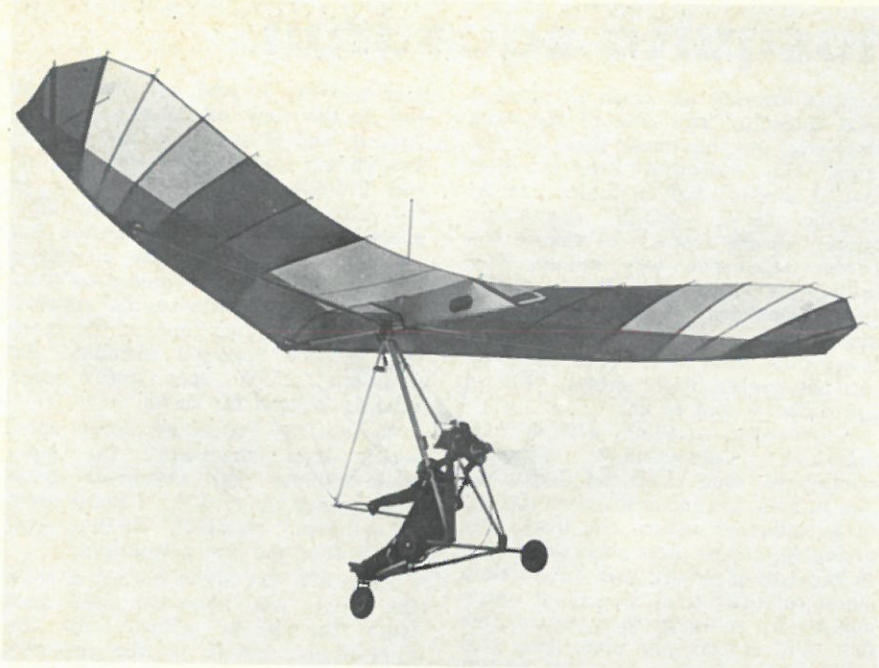
USEFUL ADDRESSES

Aircraft Owners and Pilots Association, 50A Cambridge Street, London SW1V 4QQ; **Civil Aviation Authority,** Airworthiness Division, Brabazon House, Redhill, Surrey RH1 1SQ; **Experimental Aircraft Association,** Box 229, Hales Corners, Wisconsin 53130, USA (EAA European Office is at 13 Stonehills House, Welwyn Garden City, Herts); **Federal Aviation Administration,** Washington DC 20591, USA; **Popular Flying Association,** Shoreham Airport, Sussex.

WHAT DID WE THINK OF THEM?

The following types are among those we have air-tested during the last five years, listed alongside publication dates.

Aérospatiale Rallye	235GT	May 8, 1976
	100ST	May 7, 1977
	Tobago	Sept. 20, 1980
Beech	Bonanza A36	Jan. 15, 1977
	Duchess	June 30, 1979
	Baron 58P	April 5, 1980
	Skipper	Dec. 6, 1980
Cessna	310II	July 10, 1975
	F172N Skyhawk	June 4, 1977
	Pressurised Centurion	Oct. 7, 1978
	Cutlass RG	Oct. 13, 1979
	Skylane RG	Feb. 4, 1978
	152 Aerobat	Nov. 18, 1978
Fournier	RF5	July 17, 1976
Grumman	Cheetah	Oct. 1, 1977
	GA7 Cougar	Aug. 5, 1978
Maule	Lunar Rocket	July 14, 1979
Mooney	M20F	May 15, 1976
	201	June 10, 1978
Mudry	Cap 10	March 25, 1978
Piper	Seneca II	April 10, 1975
	Archer II	June 19, 1976
	Seminole	Jan. 13, 1979
	Tomahawk	July 1, 1978
	Aerostar 601P	Dec. 31, 1977
	Saratoga SP	Oct. 4, 1980
Robin	DR400/140B	Sept. 25, 1976
	Aiglon	Nov. 11, 1978
Rockwell	Commander 112A	Feb. 20, 1975
	Commander 114	April 2, 1977
Siai Marchetti	SF260	Nov. 5, 1977
Sportavia	RS180	Jan. 12, 1980
Vintage	DH Fox & Hornet Moths, Moth Minor	Dec. 24, 1977
	Austers	Nov. 13, 1976



dilemma

By ANN WELCH

make headway against much of a wind, nor any aerobatic capability, though he could probably make some mileage out of thermals.

Perhaps the most important effect of the FAI definition is that it requires a microlight to have plenty of wing, which is a good safety consideration in any recreational aeroplane, again as history has shown. Although the pilot error factor in accident statistics has remained surprisingly constant for many years, there is a fairly strong link between the fatality rate and the kinetic energy of the aircraft when it strikes the ground. The light, slow aeroplanes and gliders of the Thirties were broken with some frequency, but it was not so often that people got killed. Since much microlight flying will, or should, be carried out by young or inexperienced pilots, for obvious reasons, it is important that inadvertent contact with the ground should be made more as a leaf than as a brick. Pilots who want to fly fast will find good opportunities in Formula One racing or by acquiring a P.51.

Until recently there was a shortage of suitable engines for microlights, the mainstay being the McCulloch 101 123 c.c. two-stroke. Now there is an increasing variety and they are also a lot quieter. Although such engines have a good reputation for reliability, are easy to start, and will slow-run satisfactorily, they will be only as good as their maintenance. If a pilot does not have his engine looked after he must not mind if it stops. This is another reason for having plenty of wing, so that a field landing may be made as safely as a basic glider and not like a miniature cruise missile. In terms of piloting techniques forced landings should not be too much of a problem, since with a stalling speed of about 20kt a 200m field is adequate. In fact, much of the pilot's experience is likely to have been gained from meadow operations.

It may seem that within the constraints of light weight, limited power, and a minimum wing area the airframe designer might be too severely restricted in scope. This is not actually so, the bigger problem being one of economic and other priorities. His list might be something like this:

1 Cost (cheapness)
2 Simplicity and ease of repair
3 Nice to handle in the air
4 Portability
5 Mild stall
6 Performance (cross country or soaring)

Or like this:

1 Performance
2 Nice to handle in the air
3 Mild stall
4 Simplicity and ease of repair
5 Cost
6 Portability.

If the designer opts for the first he would probably produce, at the present state of the art, a Trike which can also be flown as a pure hang glider. Alternatively, if he does not want a weight-shift control aircraft, he could build a basic three-axis control aeroplane constructed of tube and Dacron and wire braced, such as the Australian Condor. Both would be to the same priority schedule, but the Condor would have a better "aeroplane" performance while the Trike would have wider scope. Should the designer go for the second priority schedule, with performance first and cheapness last, the possibilities in configuration, constructional methods and materials are enormous, and to list them would treble the length of this article. What is more likely to happen in practice is the inevitable compromise: Nice to handle in the air at the top. Simplicity and ease of repair at the bottom with mild stall, portability, performance, and cost shuffled about in the middle. With this schedule it would now be practicable to use a composite construction instead of tube and Dacron, and perhaps go for a canard configuration. The performance would be better because of the appreciable reduction in profile drag and, because a canard (such as the Goldwing) is much less likely to be blown over on the ground than a lightweight tail dragger, the ease of repair requirement might not need to be so important.

Good handling is subjective to a considerable extent, but when it involves methods of control which seem to some pilots to be contradictory it needs objective thought in application. Control by weight shift is effective, even precise, in the hands of an experienced hang glider pilot, but some do not feel able to cope with it.

Further, in an effort to produce simple controls for dealing with, for example, tip draggers on tailless aircraft, a variety of devices have been introduced ranging from twist grips to hand rudders. Fortunately, customer demand seems to be making it clear that on any aircraft with control surfaces there is considerable merit in the traditional stick and rudder. It is not important what and where the actual surfaces are, but that the stick and rudder should move and produce results in the conventional sense. If adverse yaw is eliminated by spoilers, or even by having no ailerons at all, so much the better. Nor does it matter if the elevator is in front and not at the back. Since weight-shift control is likely to be around as long as there are roll-up flex-wing hang gliders, instructors will have to learn to manage conversion problems, but manually-operated controls should conform to accepted standards.

Although the current delight in microlight flying is primarily to be found as far as possible from the complications of controlled airspace or concrete runways, and without even going anywhere, it will not be long before some pilots want more. If other airsports are anything to go by, club rallies and competitions will appear on the scene and, depending on the form they take, design emphasis will change to suit. It will need wisdom to steer this simple and safe form of flying away from the pylon racing or aerobatic desires of the short term enthusiast who does not realise that speed is very expensive, and for the inexperienced pilot, dangerous. It is part of the designer's dilemma that, for the first time in aviation history, it is not necessary to strive for more and more performance. The old adage of "simplicate and add more lightness" can come in from the cold.

*The CAA is suggesting a maximum wing loading of 10kg/m² (see Private Flight, page 1032).

Anti-mosquito squadron

TWO or three nights a week for half the year the Mosquito Squadron takes off from 200 miles south of Cuba, and goes to war. The aircraft, a Thrush Commander 600 and a Cessna Ag Wagon, have one mission: to do battle against *Aedes Taeniorhynchus*—better known as the Biting Black Salt Marsh Mosquito.

Grand Cayman is the largest island in the British West Indies group, and until a few years ago was best known as a tax-haven. PO boxes still wallpaper the sides of capital Georgetown's post office. Less well known, at least to non-residents, were its mosquitoes, thriving happily in the mangrove swamp which accounts for more than half the area of this Caribbean speck. According to records in the Thirties, fleets of the insect darkened the Sun each morning, and when entomologist Dr Marco Giglioli arrived in 1965, fresh from conquests in British Guyana, one night's catch in one light trap amounted to some 975,000, counted by weight (4lb). Measure that the battle is won is that this year the nightly count is down to between 100 and 150. Above that and the ebullient Doctor scrambles his squadron.

The traditional air war against the mosquito was, and still is, in many parts of the world, waged with larvaecide pellets dropped into the mangrove breeding areas. The drawback, from Giglioli's experience, is that the immature insects can quickly develop immunity to the chemicals. His answer was to develop a whole new approach, designed to kill the adult on the wing. To implement this he turned to the then Britten-Norman subsidiary Crop Culture, in the Isle of Wight, and one of its top spraying pilots, Frenchman Francois Lesieur. Together they blended their twin skills in entomology and flight operations to achieve the answer.

As anyone who has suffered the bite of "no-see-ums" will testify, the insect is rampant just after dark and at sunrise. It is then that they lift out of the mangrove swamps following the sunlight as it dips behind the horizon, coming up again to meet it next morning. The rest of the time they stay put. To catch them on the wing, the Mosquito Control Unit (MCU) aircraft had a choice: to fly in the dark (sunlight disappears quickly in the tropics) or before the island population was awake. This latter proved a shortlived option. Irate islanders objecting to their shattered slumbers even blamed lower milk yields from their cattle on the beleagured flight crews. "Fly in the dark" it had to be.

A secondary problem also became apparent. Conventional spraying equipment, used when the flights began in 1971, produced droplets too big to be effective against the insect. By fitting Micronair atomisers, developed in the Isle of Wight, they found they could cut their total insecticide spray volume by one-sixth to a remarkable five fluid ounces per acre. This was achieved by flying crosswind, at 40ft altitude, allowing the atomised cloud of spray to drift sideways over a 300yd-wide swath. Optimum operational wind speed is in the 15kt band.

Deadly droplets

The ultra-low-volume spray literally filters the insects out of the air. The velocity of the mosquito when it impacts and absorbs the fine droplet of insecticide ensures that the aerial encounter is terminal. The early chemical used was Malathion, but in 1973 the mosquitoes developed some immunity. Since then Naled and Dibrom have achieved a 97 per cent kill ratio. This is about right, according to Giglioli. "The land belongs to man, the swamp to the mosquito," he says. "We don't wish to eliminate them, only make sure they recognise the borders. That way we remain in control."

What are the flying problems associated with the operation? Today's pilots are Dutchman, C. J. Hollender and Mark Hill of Tunbridge Wells. Hill, ex-RAF 254 Squadron (Meteors and Hunters), spends six months a year weaving in and out of trees at 40ft, in the dark, at 110 m.p.h. in the Thrush, and 90 m.p.h. in the Cessna. The Thrush Commander, with its Garrett TPE331 derated to 600 s.h.p., is two years old. The only modifications, apart from the six Micronaires fed from the hopper by an air-driven pump, are extra lights operated from a Christmas-tree-style control column. Three 600W lamps (one in the cowling) provide forward visibility. An additional 150W spot under each wingtip is used for turns.

During the crosswind spray runs, which start downwind, the main obstacles are the casuarina trees which reach up to 80ft. "I know them all by name," says Hill. "As they grow slowly they are not a problem."

Ironically the latest hazard is from the people who have benefited most from the pilots' efforts. As the mosquitoes retreat, so the property developers have swarmed in along Cayman's now idyllic Seven Mile Beach. Building needs tall cranes, and although these must be lowered each night, the largely imported workforce tend to be less than reliable.

Each day the decision to fly that evening is taken at a noon MCU meeting between pilots and the Doctor, once the previous night's light-trap catch has been counted. Supplementing that is what Giglioli calls the "bitch factor": how many complaining calls they have had from sufferers. "Tourists and bankers are not pioneers," he laughs. With more than 150 in a trap the decision is to fly.

While the islanders are now used to the night flights, the increasing numbers of unwary tourists can find their first experience unnerving. The scream from the windmill blades of the Micronaires in their wire cages, emanating from three dazzling lights at roof-top height, is a scarey supplement to their sundowner. Dr Giglioli is a practical scientist to the last, and if he can spend the evening on his verandah, with his shirt off, then he feels it is all worthwhile.

DICK KENNY

Right *Three airflow-driven Micronair atomisers are fitted under each wing.* **Below** *Outward-facing spotlights give pilots a reference on the sea as they turn after each spray run*