FLIGHT LINE

magazine of the BMAA

Sept./Oct. 1981

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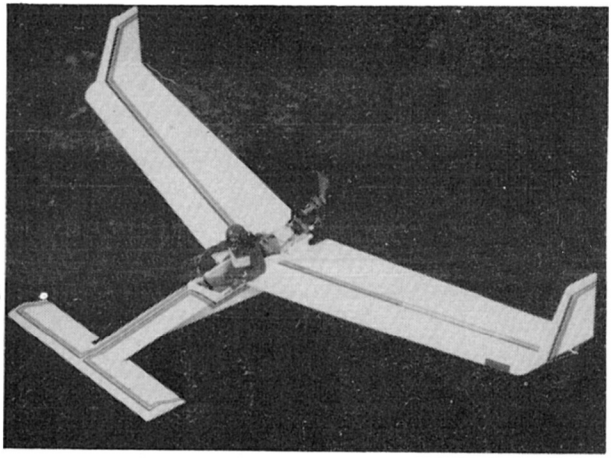

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FLIGHT LINE
magazine of the BMAA

Cover: The N-Flyer, floating around somewhere in California.

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11 SCHOOL HILL
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COMMENTS

From Jonny Seccombe

At the BMAA committee meeting on 30th August I was appointed full time training and development officer for the BMAA up to 30th November, a short period of three months. Over the next 90 days I intend to visit every training establishment, manufacturer, dealer and agent in the UK. I am not coming to snoop or spy or even tell anyone what they have to do, I am coming to sell the BMAA training scheme with the object of getting it implemented and operating at as many places as I can. From the people I have spoken to so far, this move by the BMAA is going to be welcomed by all who have the vision to see that proper pilot training is the key to keeping this sport safe, unfettered and inexpensive.

I would like to appeal to all those with commercial interests to accept me with an open mind, as, I can assure you, I will accept them. To all those students of Microlight flying, past present and future, I appeal to you to do everything in your power to get your Certificate of Competence, it's not that difficult, it teaches you what you need to know and it gives you a purpose in your day to day flying.

To be an instructor you need 25 hours logged time on Microlights and you should have flown four different types. If you don't have the types then I will wish to see a greater number of hours. You will need a recognised aviation qualification, PPL, BGA *or* a BMAA Certificate of Competence. You will need to demonstrate a certain level of experience at instructing.

I am particularly interested in meeting clubs and groups who want to do their own instruction, and I want to appoint a network of Observers across the country who are authorised to sign up task forms. Write to my home address, 34 Nevern Place, London SW5; it's no good trying to telephone me as I'm not going to be home much, and tell me what you are doing!

CHAIRMAN'S AIRWAVES

I had hoped to be able to report more progress to you in our negotiations with the CAA. Unfortunately this is not the case.

We had expressed our displeasure with the proposals made by the CAA earlier this year, and sent an explicit letter making definite suggestions as to how the sport should be run; this led to me and Ann Welch being invited to a meeting with Mr. Roy Worthing (second in command to the Chairman of the CAA) and the Heads of various departments with whom we have had to negotiate.

At this meeting we were treated very courteously, but basically there was little movement in the CAA's position since they feel bound by the CAA Board's decision already reported to us. The BMAA feels that these decisions were reached without any real understanding of microlights and without considering how the CAA could realistically regulate and encourage microlight flying.

Following this meeting, the outline CAA proposal is now as follows:

1. Registration — run by CAA, fee £12.

2. Pilot Competence — suggested system PPL issued through a system of CAA-authorised examiners and instructors, fee now suggested to be £35-£40.

3. Airworthiness — aircraft up to 70kg empty weight would not need a C of A or Permit to Fly, but aircraft over this weight would need a Permit to Fly. The BMAA could be made an approved body for recommending the issue of Permits to Fly but all manufacturers, importers, kit assemblers, repairers etc. would in turn need to be CAA-approved at a fee of £200 each year, plus the increased workload to cover the paperwork. This would be a greater load on the manufacturers and would also mean much more expensive microlights for all BMAA members.

We told the CAA that we were not pleased and said that even at £35-£40 for a PPL it would encourage many more "perpetual students" with a low desire to become fully qualified. We also said that their proposals on the airworthiness side would almost definitely stifle any meaningful development of the already pathetically limited British microlight industry.

However, all is not total gloom: they have accepted our point on the price of a licence (we have suggested £12 maximum and are considering possible action. We also asked them to reconsider their ruling on the Permits to Fly. We suggested that the group of aircraft that were sufficiently light and flew sufficiently slowly (and thus were not significantly dangerous to others aside from users) was in fact the whole group of microlights that fell within the FAI definition of a microlight.

If these points are accepted and we end up with the following regulatory package —

1. **Registration** by CAA, £12 fee
2. **Pilot Competence** PPL £12 fee
3. **Airworthiness** no fixed requirement for Permits to fly or C of A, BMAA to handle airworthiness independently (obviously with technical help and guidance from CAA and ARB) — it would leave only the problem of authorised examiners and instructors; I feel that the BMAA is quite capable of appointing suitable examiners and instructors, but these small points could be sorted out once we had the bare bones of an acceptable system.

Because of these differences of opinion on how microlights should be regulated, your Committee is having difficulty helping the CAA to implement their proposals at the present time. To date, all microlight flying in Britain has been (until recently) illegal, but we have long had an understanding with the CAA that together we were going to be able to find a mutually acceptable way to regulate the sport. This has not yet been achieved but I am still convinced that it is possible, and if we don't stand up for what we are seeking, the CAA will regulate us bit by bit into a system very akin to that for light aircraft and hence out of existence, perhaps only for lack of a true understanding of what is a microlight.

S.H.

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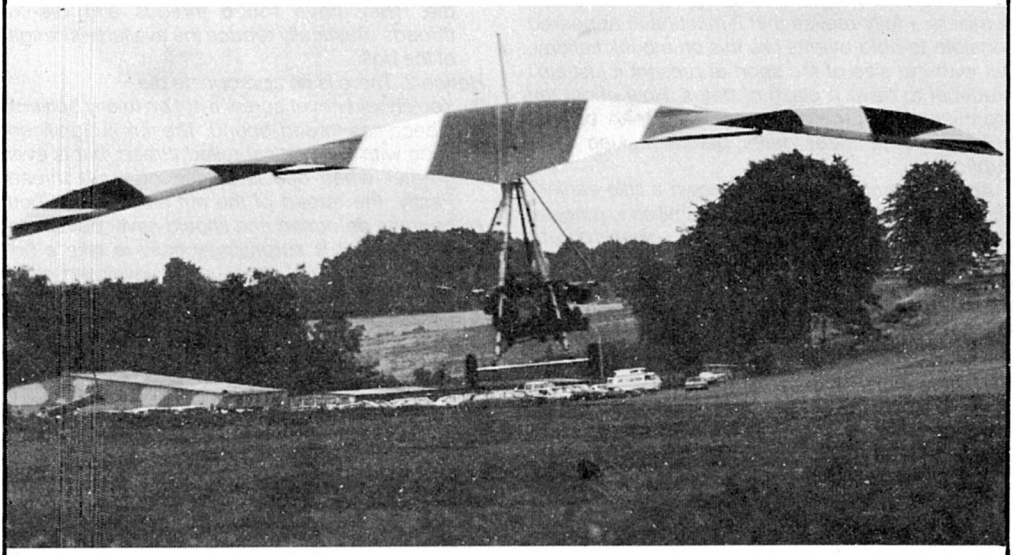

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LETTERS

EVENTS

Dear Sir,

Where was I on July 18/19th? Partaking of the only other love in my life (which I can tell the wife about): motorcycling.

I can certainly appreciate that it must be most sickening after putting in much work to organise a successful event only to have a handful of persons arrive. So what to do?

For a start don't have two such events on the same day! I feel sure that both Popham and the Norfolk Air Race organisers are going to lose out on numbers. I fully realise that it must have appeared sensible to hold events like this on a bank holiday, but with the size of the sport at present it just ain't practical to have a clash of dates. How about the organisers contacting one of the BMAA officers beforehand to clear dates before making them public.

Also why not make dates known a little earlier? Those of us with other interests, families to placate, etc. would find it a whole lot simpler given 10 to 12 weeks notice than the 6 or so weeks before the Langar event. Remember that the Sept 3-/Oct 4 EAA Fall Fly In Tullahoma, Tennessee event was mentioned in the March/April mag., and there's no reason why the yanks should have a monopoly on slick organisation.

Hugh Mason

HAH!

Dear Sir,

As a new member, may I congratulate you on your magazine? I found it a very good read.

I hope you will not ignore the interests of the less affluent, Not everybody gets bitten by the microlight bug and hops straight over to the States to survey the field. Some of us get the microlight bug, travel to the fly-in at Langar and stand around for five hours waiting for something to happen (Dawn to dusk, hah!). (You must have come on the Sunday — Ed.).

Eventually, some of us will spend a large chunk of our life savings on the best second-hand machine we can afford, and who will teach us to fly them? Perhaps one day you will assemble a list of instructors, so that we can simply pick the nearest. (This is being done at the moment — Ed.).

This is the sort of help only the BMAA can give, and ready availability of such information might just prevent a rash of 'teach yourself' idiots from picking up all sorts of bad habits (the 'If Orville Wright did it, I can do it' syndrome).

In the meantime, I can't wait to join you all up there.

L. W. Farrow

PTUBE PHRETTING AND PARTS

Dear Sir,

Whilst Mr. David Thomas's article (July-August '81) will no doubt inspire other people to give their machines a closer examination between flights or at longer intervals, he should be called to task for a couple of bits of bad advice.

The outward fretting is, of course, due to the forces applied by the lifting wires and, to a much lesser extent, by the landing wires, which tend to thrust the wings spars inward.

Mr. Thomas advises threading new aircraft bolts down to a 'critical length' with an 'Appropriate die' and then screwing nylok nuts down to the roots of these new threads. WRONG on all three counts!

1. *You do NOT thread aircraft bolts down with a die. They have* **rolled** *threads and die-cut threads drastically reduce the available strength of the bolt.*

Hence 2. There is no appropriate die.

3. *You should never screw a nut on to any bolt until it becomes thread-bound. The risk is significant even with the original rolled thread, but is even greater when one is talking of a cut thread. Firstly, the thread of the nut and the bolt both become deformed and should never be reused. Secondly, it is surprisingly easy to take a bolt beyond a critical shear-stress level and either snap off the end of the bolt or leave it with some degree of damage and a totally unknown margin of strength.*

The alternative is so much simpler and requires no die. You choose the bolt which is just a little longer — on its plain unthreaded length — than the critical length required. Then fit washers or a small turned spacer to take up any excess, leaving the nut properly on to the bolt with at least one and a half threads showing through. Strictly speaking, because the spars are attached by pivotted joints, these particular bolts should have castle nuts and split pins, but no-one seems to bother much on that score, especially as it is easy to check that the nuts are not unscrewing between flights.

For the benefit of those readers who may be building their own microlights or doing some maintenance or restoration work, I would like to pass on details of the whereabouts of a very useful source of sundry bits and pieces.

The address of the shop in question is: G. G. and M. E. Hinton, The Boat Shop, Fairford, Glos., GL7 4BW and the telephone number is Cirencester 540. The shop is actually located on the main road from Lechlade to Cirencester and is on the Cirencester end of Fairford. It is easy to find; just follow the road through until you see it!

They stock stainless steel bits in profusion; several sizes and with or without brackets. They will even get you alloy yacht-masts, a la Scout leading-edges. One last point in their favour; they seem always to be open!

Peter Lovegrove

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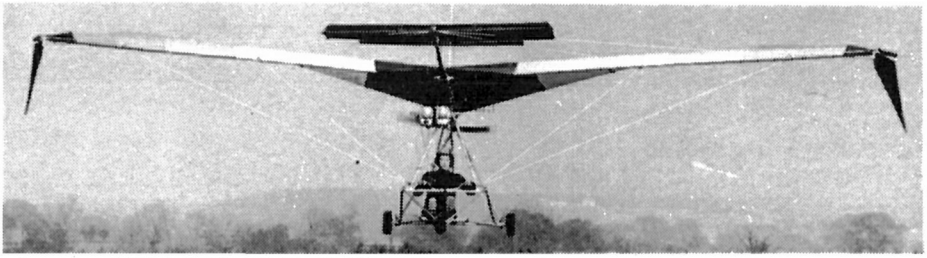

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FLIGHT REPORTS

CROSS COUNTRY BLUES!

By Nick Regan

On the morning of Saturday, 29th August I had an offer from Wally to fly his Eagle from Four Marks to the Fly-In at Popham — a flight across open country of about 10 miles. I thought I'd give it a go, so I phoned Popham control to see whether they were fogged in (they weren't), and to ask them which way they wanted me to land (which they told me).

The fog had cleared at Four Marks so I took the Eagle up for a recce to see what it looked like to the north. It was still quite misty but I could see the ground far enough ahead from 600 ft. to be able to do my first real cross country — so I thought! With the Eagle back down on terra firma, the fuel tank was filled up (2 gallons) and I attached a 1 in. O.S. Map to my leg with a couple of elastic bands. I estimated that the flight would take about 25 minutes and took off for Popham, asking my chase car to stay with me just in case I had to force-land (I worry about those twin Chrysler engines, you know).

It was a lot rougher up there than I liked and I nearly "chickened out". The map reading that I found so easy on the ground was extremely difficult from the air. I couldn't seem to match features from the map to features on the ground. I couldn't see my chase car — I never did see it and he never saw me for the whole flight. Still, probably more by luck than judgement I did fly straight to Popham and landed after 23 minutes flying time.

I was welcomed with an unpleasant disagreement with the owner of Popham, who seems to be under the misguided belief that microlight pilots know everything there is to know about flying procedures. Whereas, in the real world, many of us have a hell of a lot to learn and are learning all the time through practical experience. What had I done wrong? Well, after following the controller's telephoned landing instructions religiously, I'd landed the wrong way! They'd changed ends since I'd been told and had unconsciously assumed that I knew all about signal squares. I didn't, of course. If you don't either, it's a square on the ground with a big letter "T" in it and it tells you which way you should land. You land towards the horizontal bar of the "T". Isn't that great? What a useful device! Learning new things is such FUN!

With that little episode behind me, I had a super first day at Popham and finally took off at 6.30 p.m. to fly back to Four Marks. I had 5 quarts of fuel on board and was looking forward to a quick flight back. After all, the flight to Popham had been no problem. Cross countries? Hah! Easy! Then I got lost!

It was horrific! The visibility was worse than it had been in the morning and the first hint of a problem came when the village I was expecting to appear ahead, didn't. I was bucking a head wind of about 10 m.p.h. I guess and from the map I couldn't recognise anywhere on the ground. I just pressed on with the glow of the lowering sun through the mist out beyond my right wing tip, so that I should be flying south — no compass, see! I was now running out of time, fuel was getting low and to my worried mind the engines were making more nasty noises than they usually do. I kept on thinking that I should land and ask where I was, but no, that would use up too much of my precious fuel. Then I passed over a wood with two roads running through it and thought that that must be easy to see on the map. It took me five minutes to find it, but now, possibly, I knew where I was. If I was right I was way off to the west. Then I saw a large inn down below and found it on the map. I wasn't lost any more and turned off to the east. After about ten minutes I was back in familiar home territory at last and could see the home field ahead of me. I nursed the Eagle gently on to the ground and felt so relieved. I still had enough fuel for about 10 minutes flying left in the tank, but that 40 minutes flight had been nasty.

I don't think I like this cross country lark!

WHAT WENT WRONG?

Well Nicky, you started well. You rang your destination to get the weather which is a legal requirement believe it or not, to get a met forecast that is. You used a 1 inch Ordnance Survey map, good of you to take a map along, that's a legal requirement as well, y'know. Much better to use a ¼ million aeronautical chart though, they have useful things shown on them like controlled airspace, prohibited and danger zones, as well as airfields and hang gliding sites! You did wel working out an estimate and you checked your actual when you landed; very good, but did you realise your tailwind was stronger than forecast? (Yes — Ed.)

You really cocked it up when you arrived didn't you? You should have joined overhead at 2,000 feet above ground level (QFE), looked at the signal square to establish the landing direction and *circuit direction, let down on the dead side, that's the one opposite to the circuit, then crossed the centre of the runway at 500 feet, watching for overshooting traffic below, joined the circuit and landed to the side of the active runway.*

By the way, you don't have to learn it through practical experience and bollockings from aerodrome operators, you can read all about it from CAP 85 and you should know it all before you take to the air.

Things went from bad to worse didn't they? Always take a full tank of fuel with you if weight and c of g allows, there aren't any gas stations in the air.

You didn't work out a flight plan and establish an estimate and you forgot about that stronger than expected tailwind on your way over. If you haven't got one you **must** *establish an accurate track from your departure field and check your times and estimates. Don't rely on the sun, it has a nasty habit of disappearing behind those white fluffy things.*

The map reading — what a laugh! You made the classic mistake of reading from the map to the ground. You must pick up a feature from the ground and then locate it on the map, not the other way round. Even if a village came up when you expected it to, would you have cross checked with another feature from the ground? If you see a railway line, don't just say to yourself "That's interesting, a railway line,' find it on the map. If you do get lost, or even 'uncertain of your position' don't just go blinding hopefully on, you might find yourself over Heathrow and in a lot of trouble. Orbit a land mark until you find it, then when you have identified it, cross check it with another feature. If it's really hopeless, land while you've got plenty of fuel left.

Well you worked it out in the end. Way off to the west were you, that headwind really was stronger than you thought, but you would have found out earlier if you had kept a check on the time against estimates every five minutes.

What a useful lesson in cross country flying, don't give up just because of one bad experience but read a few books on air law and navigation. The guys that write these books have all made the same mistakes themselves. Next time use your watch a bit more, it's the best navigational instrument that's been invented and it really does work!

Soft landings.
Jonny Seccombe

P.S. There's another handy tool at airfields, a wind sock. Have a good look for it, watch it and see what it's doing, then land towards the tail end of it. What was the one at Popham doing when you landed at the wrong end? (It was hanging straight down on my side of the pole — Ed.)

JUST LEARNING?

By Les Chapman

Having a wide experience of flying microlights (very nearly two hours), I decided I was well qualified to train one of my colleagues to fly the Eagle.

An 80 acre field was arranged with the intention of spending a couple of evenings on ground handling followed by controlled 10 ft. hops.

Malcolm had never flown anything in his life but was quite keen and I explained how the machine worked and how to steer it on the nosewheel at low speed holding the frame and progressing to tip rudder control at fast running speed. Plenty of time to explain how to fly it later.

Malcolm set off on his first trundle — bit fast, I thought. "Jesus!" he was suddenly 40 ft. in the air and lurching sideways towards the trees, and I could see he still had his hand on the FRAME! He hung on to full throttle thank God, and flew off in a violent serpentine stall towards the power pylons. "Please turn the bloody thing, Malcolm," I prayed to myself. At this point the girls got out of the car and said, "It didn't take Malcolm long did it?"

"He's not supposed to be up there," I said.

"Oh," they said and wandered back to the car.

By this time Malcolm had sort of turned and was obviously beginning to plan his crash. He had enough sense to know that he should crash in the same direction as take off.

The stalls were noticeably less pronounced as he took a wide swipe at base leg. He cleared the trees and aimed at the middle of the field. He was sitting too far back and was still on half throttle but he was losing height. To say he "landed" it is being over generous but at least he was down.

He sat quite still for a minute or two as I ran towards him.

What happened to my chirpy friend Malcolm of five minutes ago? Who is this ashen jibbering wreck?

One hour and several gins later he was still sitting with those staring imbecile eyes while I wrote out his certificate of competence. That reminds me, I ought to get one of those.

P.S. He actually wants another go.

At this point the girls got out of the car....

Reprinted with acknowledgements to the US
Magazine AOPA PILOT

THINGS TO KNOW WHEN YOU'RE SLOW

Ultralight flight means a new set of aerodynamic rules.

BY THOMAS A. HORNE

At cocktail parties and other social gatherings, being a pilot can yield some definite advantages. Not only can you thrill your audience with carefully manipulated tales of your flying experiences, you casually can delve into the subject of aerodynamics. Authoritative talk on the vagaries of lift, drag, p-factor, stability and whatnot is weighty stuff for the uninitiated. But do not get too carried away with yourself right yet, especially if you plan to do any ultralight flying.

Yes, you have learned the basic principles of flight, and yes, you know the regimes of flight that have the most potential for catastrophe. When it comes to ultralights, though, relationships change, brothers and sisters. Oh, how they change.

We will wager that you learned to fly in a two-seat Cessna or Piper. For the sake of argument, let us say your trainer was a Cessna 152. This happens to be an airplane with a wingspan of 33 feet, a wing area of 160 square feet and, at gross weight, a wing loading of 10.5 pounds per square foot.

An ultralight? You can expect to find wingspans and wing areas approximately identical to those of the 152, but the wing loadings?—get ready. They will be about one or two pounds per square foot, maybe a tad more, if the pilot is on the corpulent side.

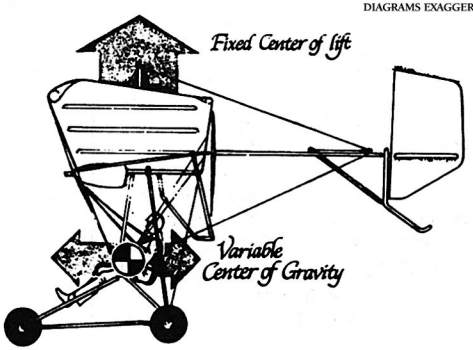
To propel its dainty, 370-pound-or-so mass, the ultralight will rely on engines developing no more than 30 horsepower (as of this writing) with propeller thrust values in the neighborhood of 150 to 250 pounds. You will find top speeds for the ultralight will range anywhere from 30 to 55 knots. At the other end of the ultralight's flying envelope, you will find stall speeds of 15 knots or thereabouts.

So think of it. A huge wing carrying very little weight, traveling very slowly and with a very narrow spread between stall/mush and top end.

Now you are flying along in your little fun machine one thermally or windy, gusty day, enjoying the view and communing with nature and your exhaust resonance. All of a sudden, whoops! Down goes a wing, or you are yanked to greater heights or depths, or yawed silly, or any combination thereof. As you feverishly work your weight fore and aft and correct for your incipiently wild roll rates, you learn of the ultralight's extreme gust sensitivity.

What passed for annoying bumpi-

DIAGRAMS EXAGGERATED FOR CLARITY



The pilot of an ultralight that uses weight shift for pitch control (above), moves his body (also known as the center of gravity) fore and aft of the center of lift to make pitch changes. In a conventional three-axis design (below), the pilot is in a fixed position, and elevators create variable tail-up or tail-down forces to accomplish pitching moments in the ultralight.

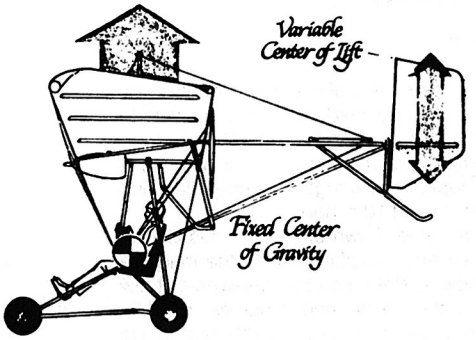


ILLUSTRATION BY NANCY MACTIRE

ness in your old 152 is now a riot of chaotic control movements that is very demanding of the pilot, if any semblance of control is to be maintained. With a light wing loading and a low volume of air passing over the wing, the slow-moving ultralight "feels" gusts and shearing forces much more than the faster-moving 152. And in a wind-shear situation, where there is a sudden loss of headwind component, an ultralight flying near its stall speed quite readily can be in dire straits.

Actually, you could be flying in an ultralight's cruise range and still find yourself in the same situation, if the shearing forces are strong enough. For example, if you were cruising at an airspeed of 22 knots and lost a headwind force of nine knots, you could end up in a stalled condition. This happens quite often when an ultralight pilot descends. On the whole, wind loses its speed the closer you are to the ground. This wind-gradient effect, if it is sudden enough and drastic enough, can put you in or near a stall on what may otherwise look like a very benign day for ultralight flying.

It works the other way, too. A sudden gain of air loads can put undesirable stresses on the airframe. Those are some of the penalties for a light-wing-loading, low-speed flight and a narrow speed range. There are others.

Since there is less air moving over an ultralight's control surfaces, its ability to compensate for the effects of gusts is much, much less than what you have been accustomed to in a light single-engine airplane. When slowing down in preparation for landing, there will be even more of a tendency for the pitch, yaw and roll reaction times to increase, since, as in any airplane, there will be a lag in response to control inputs.

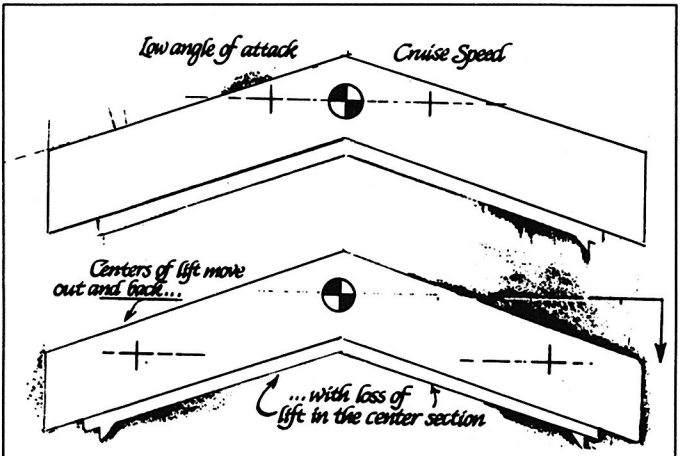
What we really are talking about is control power. Control power is the amount of force available from a given control input. Some control-power methods are more effective than others, but, generally speaking, ultralights have much less control power than what you are used to in your Cessna.

It is not that ultralights require huge amounts of control input to accomplish normal flight maneuvers. They do not. They require very light inputs under calm conditions—sort of like the inputs a pilot would make when flying a hang glider. One or two inches of control travel or weight shift is plenty to obtain moderate attitude changes. Conventional pilots transitioning to ultralights discover this after trying to fly ultralights the way they fly airplanes.

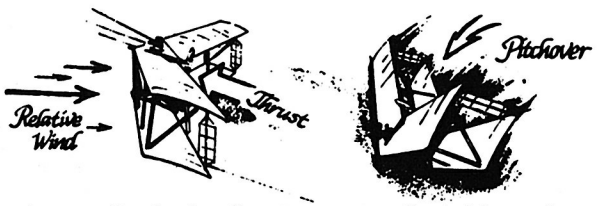
When the wind is right—calm, that is, or blowing no more than a steady six knots with no gusts—you will have plenty of control power. But because of the ultralight's lighter wing loading and slower speeds, there will be less control power available to overcome gusts and other adverse wind effects if they should come into the picture.

A large wingspan with a light wing loading means good things, too. Flying slowly, it is possible to turn a very tight circle with only moderate banking. This helps to capture a thermal quickly and spiral up with it, if this is your inclination. And, being ultralight, you will rise with the thermal at an astonishing rate.

The ultralight works very well in gliding flight, too. Again, some designs are better than others, but glide ratios of from 6:1 to 18:1 can be realized. This usually turns out to be a 200- to 300-fpm descent in a power-off condition, carrying roughly 19 to 24 knots of airspeed. That is comforting to know should the engine ever quit. Two-stroke engines have shown a tendency to conk out unpredictably. But if the pilot can maintain his wits and a gliding attitude, the deceleration forces associated with crashes into most objects will be survivable—provided, of



Swept wings help create pitch in a tailless aircraft because movement of the centers of gravity and lift cause restoring moments. In a stall, the center of lift moves out along the wings. This, and the fact that the center sections of the wings are designed to stall first, results in a nose-down moment at the stall, returning the airplane to normal flight.



A power-on whip stall can be troublesome in a swept-wing, tailless ultralight, especially one with a high thrust line. At the top of the stall, aerodynamic forces have vanished, and the only forces remaining are gravity and thrust. At the pitchover, the center of lift has moved outboard along the wings, causing a tail-up force. As the nose falls through, the thrust of a high power setting can be forceful enough to tumble the aircraft around the lateral axis.

course, that there is enough out in front of the pilot to absorb the impact

All of these scary descriptions about ultralights in rough air probably causes you some justifiable concern about the stability characteristics of these aircraft. Harkening back to ground-school days, you will recall that stability is defined as the capability of an airplane to return to its original, normal flight attitude after being displaced. This displacement can come about as a result of a pilot input, however ill-timed, or (here we go again) gustiness and other malevolent wind conditions. Having less control power to fight displacements from stable flight puts a heavy responsibility on ultralight designers to make the pilot's job easier.

They had better, since ultralights are completely unregulated. *No* prior flying experience is required to fly an ultralight legally; there are no certification requirements for ultralight airplanes; and none of them have ever seen the inside of a wind tunnel. A few have undergone crude static-load testing to determine how many positive and negative G-forces the airframe will sustain. Flight tests, like everything else in the ultralight field, also are unregulated. The designers are free to probe all areas of the flight envelope, but no guidelines exist. This means that the designers also are free not to explore the hairiest regimes of flight; often the outcome of a manufacturer's flight testing "program" only serves as a platform to announce superlatives.

To a man, the designers of today's ultralights are not qualified aerodynamicists. But they have learned a tremendous amount from the work of their predecessors and technical mentors. Some of their innovations for providing stability and control can only be described as ingenious. Those innovations are perhaps, in some cases, not the most efficient means of providing control; but good compromises have been made, given the weight, wing loading and other design restrictions.

For pitch stability, a horizontal stabilizer is used in some designs, complete with elevators.

The Lazair, the Hummer and the Humbug use V-tails with ruddervators. Tail-down aerodynamic forces balance the lift of the wing, and, if a displacement occurs, oscillations are damped by the balancing act that takes place between the wing and the tail.

The influence of Burt Rutan and his canard airplanes—the VariEze, the Quickie, and the Defiant—has made its way into the ultralight world. The American Aerolights "Eagle," the Waspair "Tomcat" and the Gemini "Goldwing" all use a canard arrangement for pitch stability and control.

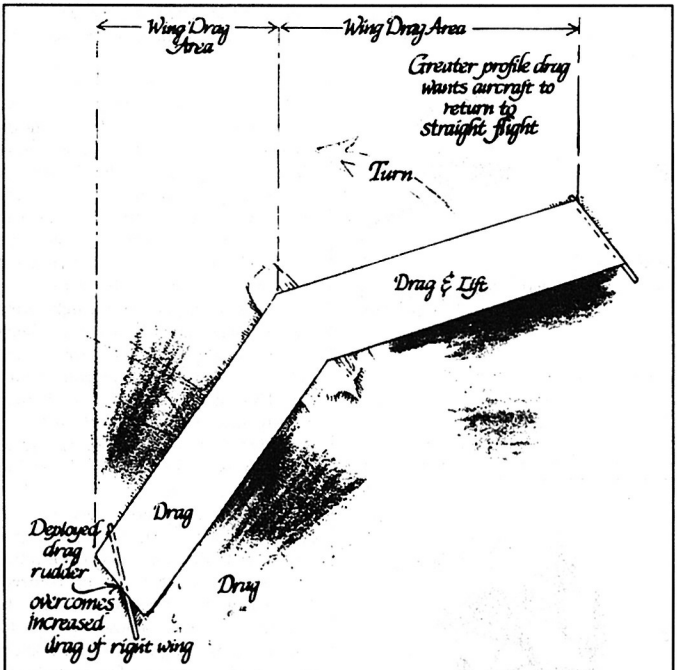
A canard wing is nothing more than a horizontal stabilizer, a stabilizer with elevators or a stabilator mounted in front of—not behind—the wing. The advantage here is that the canard can be set at a higher angle of attack than that of the main wing. If a clumsy, unlucky or foolishly bold pilot should probe the stall regime, the canard always will stall first, pitching the nose downward, and thus correct the condition. Theoretically, this keeps the main wing from *ever* stalling.

Tailless designs? Well, to be blunt about it, tailless designs (or "flying wings"), except for one notable exception—the Kasperwing—probably are not as pitch-stable as they ought to be. This plays into the hands of those traditionalists who argue that an airplane without a tail is an unthinkable contraption. These purists argue that you need a restoring force that only a horizontal stabilizer can provide, because of its relatively long moment-arm from the airplane's center of gravity.

Pitch stability in tailless designs, such as the Pterodactyl Fledgling or the biplane-style Easy Riser, depends on the sweep of the wings. Because the wings are swept, deviations from a normal pitch attitude result in fore- and aft-shifts in the center of lift.

What happens is that the center of lift moves inboard and outboard along the wings whenever a force is exerted; because of the sweepback, this creates a stability of sorts in the pitch axis.

The pilot is much more a part of the



Yaw/roll coupling is used to perform turns in several swept-wing, tailless ultralights. The turn sequence begins when you decide to turn left, so you open the left drag rudder. This causes drag on the left wing, slowing it down and speeding up the right wing. The extra speed creates more lift on the right wing, and it rises as it begins to come around. But as it comes around, form drag comes into play. The directionally stable properties of the swept-wing want the airplane to yaw back to its original heading, so there is hesitation—skidding—until the extra lift of the right wing finally overcomes the drag and the turn is completed.

tailless ultralight's pitch stability, because he constantly must be reacting to displacements in one way or another. The Pterodactyl and the Easy Riser both have a reputation for high pitch sensitivity. In the Easy Riser, for example, the pilot only has one foot of travel in which to make his pitch movements. In both these ultralights, the pilot work load in the pitch axis is high, reflecting their hang-glider heritage and dearth of pitch stability.

The Kasperwing is another, long story, and it is dealt with elsewhere in this issue (see p. 57). The Kasperwing achieves pitch stability through its reflex (upswept-trailing-edge) wing profile, its use of fixed, triangular-shaped horizontal stabilizers at the trailing edge of the wing tips and the sweepback of its wing planform.

Suffice it to say that the wing tips always are developing more lift than the wing roots, so the balance between center of lift (also known as center of pressure) and center of gravity resolves itself with greater ease, and without any significant pilot movements.

Why? Because the reflex profile develops more total lift (positive and negative) than any of the competing designs, creates its own up-and-down stabilizing forces, and is able to keep generating large amounts of lift even at an extremely slow airspeed—even at *zero* forward airspeed. But that is another story.

For stability in the roll axis, ultralights, like any airplane, use wing dihedral. You can tell if an airplane has dihedral by standing in front of it and looking at its wing tips. Are the wings tips higher than the roots? Yes? Good. You have positive dihedral, and, if a gust should cause a rolling moment, the airplane will return to its original position because of air resistance against the lowered wing.

Imagine a piece of paper folded in the shape of a V falling to the ground. Then imagine it is an airplane, with weight in the fold of the V—the rest of the paper would represent the wings and their dihedral. As this V falls, it wants to return, if displaced, to a stable position, with the point of the V facing earthward. That is how dihedral works.

Ultralights need that roll stability, but they also have to be able to turn quickly. So a compromise is made. Ultralights have anywhere from four to seven degrees of dihedral. Your 152 has just under two degrees of dihedral.

In an ultralight rolled by weight shift, there is another complication in gusty conditions. The pilot's weight may not be enough to counteract a wing violently displaced in the roll axis. The pilot's body has limited travel from side to side. 'Ever flown a kite and had a gust of wind send it zooming uncontrollably to one side, causing it to crash to the ground? That is called a lockout in hang-glider jargon.

Imagine an ultralight rolled by weight shift put into a potential lockout situation. Unless the pilot somehow could suddenly gain a few hundred pounds and move his body to the outer reaches of the raised wing, the same thing could happen. So we have to realize the danger of lockout inherent in all weight-shift-for-roll designs. Hang gliders have this potential, too, and a number of these occurrences have caused fatal hang-glider crashes.

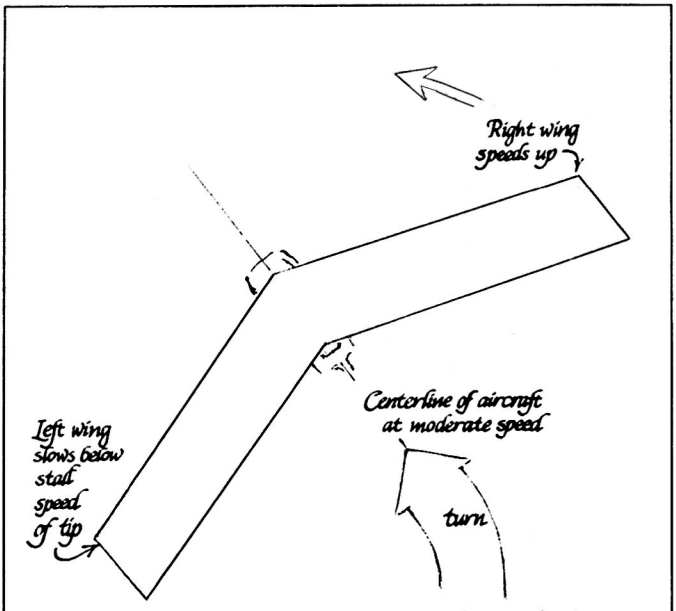
Directional stability is accomplished by a vertical (or V-) tail in conventional ultralights, just as in conventional airplanes. If a deviation occurs in the yaw axis, the vertical stabilizer acts as a weathervane to straighten things out. If an ultralight lacks a vertical stabilizer, the sweep of the wings will have to provide directional stability.

It works like this: You get yawed to the right; more of the left wing's frontal area is presented; drag is produced on that side; and the ship is yawed back to its original heading (more or less). Any airplane with a vertical stabilizer can get along without any sweep in its wings and still have directional stability. But go vertical-tailless, and sweep-back must ye have.

I know, I know. Sweep, dihedral, horizontal and vertical stabilizers are not all that unusual. They commonly are used in many airplanes. But the absence of a vertical tail can complicate matters when tip-mounted drag rudders are used to effect turns in swept-wing ultralights.

Drag rudders are used to bring about a turn like this: Let us say that the pilot decides he wants to turn left—he opens the drag rudder on the left, it presents its surface to the relative wind, and the left wing slows down. There is a large turning moment, because the drag rudder is mounted on or near the wing tip, far from the center of gravity.

But the directional stability charac-



If you bank an ultralight beyond 30 degrees at a slow airspeed, you are asking for an overbanking tendency at best and a tip stall at worst. The inside wing tip can be traveling so slowly that it can stall before the rest of the wing does, in spite of washout.

teristics of the swept wing fights the turning motion, at least in the beginning. The right wing, as it speeds up and presents more of its frontal surface area, creates its own drag and, thus, hesitates in coming around. It wants to return the ultralight to its original heading. Finally, the extra lift from the sped-up right wing overcomes the drag, and the wing comes around.

Inefficient, uncoordinated and crude? Yes, but it does cause turning without the use of complex, weighty systems. To make this method of turning sound more sophisticated than it is, manufacturers call it yaw/roll coupling.

Even less-complex turning methods involve the use of weight shift. The Quicksilver uses this and so do hang gliders. To turn left, lean left. To coordinate the Quicksilver's turn, the pilot's harness is tied to a rudder.

Other designs use ailerons or a combination of ailerons and spoilers, the actions with which we are all familiar. This type of approach means a rudder always must be used to coordinate the turn and counteract adverse yaw.

With all this help, and if you stay out of rough air, what could possibly go wrong, you might ask.

Ah, more scary stories. This time, it is tip stalls and whip stalls. Keep those tips flying! That should be the motto of all ultralight pilots—hang-glider pilots, too, for that matter.

In a very steep turn, the ultralight's inside wing can travel so slowly that its tip can stall. Sure, the designer uses washout—differential angles of incidence along the wingspan—to ensure that the wing roots stall before the tips do. This gives the pilot more warning of an impending stall. And if one occurs, the roots will stall first, pitching the nose down and automatically correcting the situation.

But with the ultralight, things are different in a very steep turn or a wingover. (A wingover is a turn with a bank angle of 90 degrees.) Ultralights, again because of their slow speed, can turn on a dime and give you five cents change. This is a wonderful truism that many pilots prove daily. In a really tight turn, though, the pilot is apt to discover that, in spite of washout, the inside wing is traveling so slowly that the tip will stall *before* the root. What follows could be a nice, tight spiral dive, the classic spin or perhaps even a brief interlude of inverted flight. It all depends, of course, on the ultralight's configuration and design amenities.

Upswept tips and end plates are one way to postpone the occurrence of a tip stall. At slow speeds and high angles of attack, remember, induced drag reaches its maximum. Holding a constant altitude in a wingover creates a lot of induced drag on the down wing. Get enough induced drag and the tip stalls. Over you go.

Induced drag can be visualized as high-pressure air swirling over the wing tips to fill the void left by the lower-pressure air on top of the wing. Use upswept tips, and it will be more difficult for this air to swirl up over the wing tip. The tip keeps flying longer, and the wing is fooled into thinking it is longer than it really is. More lift for less drag at all times, but the real benefit is for those bozos who never have had spin training and who do carefree wingovers to impress either an audience or themselves.

If you are intent on whipstalling a tailless ultralight, we will smile and say good luck.

Whipstalling an ultralight with a conventional tail presents no real potential for catastrophe, but it probably would scare the hell out of you. A whip stall is accomplished by first diving the airplane to a high rate of speed, then pulling up rapidly and holding aft-stick (or -weight, as the case may be) position until the stall comes.

When the stall break comes, it will be a doozy. You go from almost straight up to straight down faster than you can say 'shift.'

A power-on whip stall will set your temples thundering. The ensuing dive as the whip stall is completed calls for a careful pull-out so that G-forces do not pull the airplane apart. If you had any power on through the maneuver, make sure you set it back to idle before you pull out. At all times, be ready for a spin out of the top of a whip stall—one of the wings may stall before the other.

If your ultralight happens to be a tailless, flying-wing design, we will just smile and say good luck. For a worst-case situation, we can think of none worse than a flying wing whip stalled with power-on. When the whip stall comes, the roots of the wing—because of washout—stall first, but the tips keep flying for a short time. The nose pitches forward, as you might expect. But with power on, the propeller thrust adds to the momentum of the pitchover, and, if conditions are right, the ultralight *tumbles* about the pitch axis. In case you had not guessed, this is an out-of-control condition.

Your only hope of recovery is to kill the engine and hope that all the stability factors we have been discussing will return you to some semblance of stable flight. Not having a tail does not help in this respect and neither does the fact that, once upside down, you fall out of your normal control position.

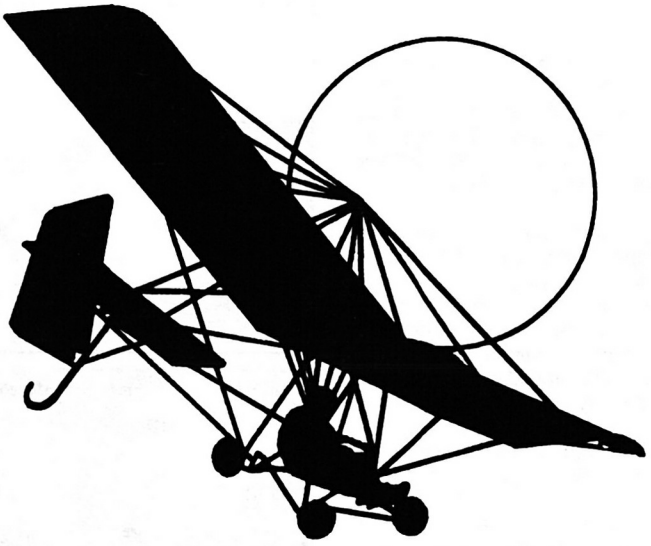
If anything helps, it will be dihedral. A power system with a high thrust line (i.e., a propeller mounted too high above the longitudinal axis of the airplane) can help make this tumbling feat even more probable when doing your whip stalls power-on.

Theoretically, any tailless design is capable of tumbling, because it lacks sufficient damping action, such as what a horizontal stabilizer would provide. Kasperwing claims that its aerodynamics are such that a power-on whip stall, if deliberately uncorrected, results in a series of whip stalls but no catastrophic divergences.

Tumbling, though, is hard to quantify precisely, since certification tests are not required by regulation. Any pilot risking the exploration of this flight regime in a tailless ultralight must know something that others do not—or should have his head examined by the nearest qualified psychiatric institution. Incredible as it may seem, this feat has been done in an ultralight. But never, to our knowledge, intentionally. Sometimes the pilot was able to recover, sometimes not.

Ultralights are by no stretch of the imagination aerobatic machines. You may try some maneuvers and get away with them; then again you may not. We thought you might like to know.

The moral of all this is simple: Keep your wits, do not do anything rash, stay out of rough air, and sit back and enjoy the ride. The ultralight's control methods and flight behavior may seem different to you at first. Like anything, though, you will get accustomed to it. You are, after all, a pilot. □



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ACES LOW

Breen wins Norfolk Air Race in Mirage Mk.II

By Christian Marechal

Like a Snowdonia Deep Sea Diving Club, the Norfolk Hang Gliding Club is something of a contradiction in terms. The hours they log on the ground are more appropriate to a bunch of Norfolk oak trees than to a bunch of flying freaks.

Yet it was to this body of wonderfully wishful thinkers — a sort of aviating flat-earth society — that Fate, with an eye for farcical irony worthy of Voltaire, delegated the responsibility for organising a race in Norfolk for microlight aircraft and powered hang gliders (the NHGC's differentiation, not mine.)

Dear reader, you have been warned.

The NHGC advertised the start for Felthorpe. Terrific. The actual start was Norwich Airport, whence the pilots would race to Shipdham and Snetterton. The **finish** was Felthorpe.

One simple off-track observation task was set for each leg of the fifty mile course.

The day before the race, the local radio station pumped out the news of the weekend's events. There were plenty of fêtes, shows and motorcycle races to choose from. Conspicuous by its absence was the Norfolk Air Race.

The NHGC did, however, manage to slot a small ad. into the Eastern Daily Press. This time they got the take-off point right, but unfortunately the EDP doesn't figure too strongly on the average racing micolight pilot's reading list.

Thus it came to pass that on a hot August Saturday a small knot of EDP readers gathered at Norwich Airport to watch the magnificent men (for there were no women, magnificent or otherwise) take their flying machines off at the scheduled start time of 10.30.

Only six magnificent men had turned up. The other five had gone to Felthorpe. (Quite how six and five add up to Ray Watering's declared "twenty confirmed starters" I'm not sure, even taking into account the fact that both Ray and Greg Thompson scratched at the last minute. They have a unique way with maths in Norfolk, as you will see.)

As 10.30 came and went, we asked the organisers what was happening. They had no idea. Knowing what's happening, it transpired, was not the NHGC's strong suit.

We hung around. Gerry Breen couldn't hack it. He obtained clearance from Norwich ATC for a test flight in the Mirage Mk. II.

What followed tested Gerry's flying skill **and** the aircraft **and** the nerves of everyone on the ground as, in passable imitation of a Fokker shooting up a refugee convoy, he strafed the microlight area of the airfield (except that this Fokker was a Mirage).

The Airport Controller was the first to crack. His pacemaker fizzling and cracking ominously, this

normally kind and avuncular man spluttered that he had never seen such a shocking display. "We'll have complaints about this," he moaned (not from the crowd, though; they loved it). Thus shocked, he disappeared. Presumably into the nearest air raid shelter, or the Norwich General Cardiac Unit.

At 11.26 Graham Ives, the NHGC secretary/chief marshal, briefed the pilots. Someone asked for the race to be held at Shipdham. Explanation: the race sponsor, a Mr. Bunney, wanted photographs of all the aircraft gathered together. "He could have done that here," snapped Mr. Ives. Well, actually, no — he could not: the planes had not been gathered together at Norwich when they were supposed to have been. Any moment now they were going to fly out at one minute intervals — Norwich wanted them the hell out of their airspace. There was no time left for photography. It was suggested that Mr. Ives simply ask the pilots to wait at Shipdham. "No way," he said, sinking his teeth firmly into the hand that was feeding him four hundred quid in prize money. "Once the race is on there's no way to stop it." Clearly he was under the impression that he was organising a race for free fall parachutists.

At 11.39 the first aircraft — a powered hang glider (sic) took to the air. It was a mere one hour nine minutes behind schedule. Just like Concorde. The crowd were going to have to take these aircraft seriously after all.

A little later George Wrzesien's heavily loaded Wrzesien Wrzspecial inched off the runway. The crowd held its breath. The craft battled its weight and drag to a hundred feet. The pilot initiated a cautious turn to port. The crowd breathed a sigh of relief. Unfortunately the sudden local turbulence generated by their mass exhalation caused George to start sinking like a brick. The crowd caught its breath again. It helped: George stopped sinking. He needed some climb. He found it by jettisoning his ground crew, who had been adding some last-minute spit and polish with a view to the Concours

d'Elegance. He hung on to his 360 channel radio and his auxiliary tanks of fuel, but managed to clear the trees at the perimeter. The crowd applauded enthusiastically.

Just when they thought all the drama was over, Gerry Breen took off. With the Kawasaki 440 on full chat he held the Mirage at six inches altitude and 65 mph for the first hundred yards. Then he hauled back on the sidestick and grinned at the crowd as they dropped away from him at about 1000 feet per minute. The crowd yelled. They applauded. They waved.

Gerry waved back. Or was he thumbing his nose at Martin Fielder in his Cuyuna powered all-weight-shift Lafayette?

If Gerry, with his barnstorming style and scarlet flying suit, had come as the Red Baron, Martin was the Invisible Man. Dressed head to toe in spotless white, he taxied the Lafayette to the start. The Cuyuna didn't think much of the Invisible Man act. It spat gobs of black oil onto Martin's snowy suit and helmet, transforming him into an aviating dalmatian and giving him a better chance of winning the Fancy Dress prize.

One by one the rest of the field — a Weedhopper, a Pteradactyl Ptraveller and assorted trikes — buzzed into the air like a flock of truant hover-mowers.

The race was on.

At Shipdham it was off again — at least, temporarily. The pilots, more appreciative than the organisers of Mr. Bunney's money, decided among themselves to do him the courtesy of waiting for him to come and take his photographs (the ungrateful Mr. Ives was nowhere to be seen).

About an hour later, after the race had been re-started, Tim Deeming arrived on the Ptraveller. "Am I the last one in?" he asked. Well yes, he was — very much so. His Robin engine had been playing up. He had made a precautionary landing to give it a kick (you can't kick a Pterror engine from the pilot's seat unless the stitching breaks).

The two Tripacers (Hobson and Hurtley) were going like the clappers. They outstripped all the other trikes, but failed to get on terms with the Mirage. Well, they were in a different class anyway. The Lafayette (which **was** in the big banger class) did its best, but without a double surface wing or control surfaces the poor old powered Quicksilver was no match for the aerofoil and control surfaces of the leader. Martin said he was getting no pitch response. Judging by the Lafayette's landings he was right.

The Mirage stormed into Shipdham way ahead of the others, and that's the way it stayed to the end.

There was always, of course, a chance that the Red Baron might blow it, and at the finish he very nearly did. He made a beautiful bulls-eye landing right in the 'O' of the word 'NORFOLK' on his map. Unfortunately the 'O' marked not the airfield at Felthorpe but the field next door. Gerry waited for the world's press to descend on him. He waited ten minutes. When they still failed to show up, he took off to look for them. He found them the other side of the hedge, in the shaped of a bleached blonde individual by the all too likely name of Wally Webb.

Wally interviewed Gerry live for BBC Radio Norfolk's Wally Webb show. Gerry was so amazed by Wally's hairdo that he mentioned trikes eight times without mentioning the winning Mirage once.

All eleven starters eventually finished.

It was plain for all to see that Gerry had won. Even Wally knew he had. In fact everyone knew — except the Norfolk Hang Gliding Club. They gathered in their time sheets and went to work on them. Only trouble was they had forgotten to bring their O-level mathematician or an abacus.

There was much umming and erring at the judges' table. Two hours dragged by. Three. With nothing to hold their interest (free flying was forbidden until the results were out), the public drifted away and Wally snoozed in his radio car. Luckily the delay gave the Pteradactyl time to arrive before we had all gone home (but credit where credit is due: not only was Tim Deeming's engine off-song, but this was also his first cross-country flight. He did well to finish at all).

The entire population of North Norfolk was called in to help the organisers organise the results. I took a butcher's at the Norwich marshal's time sheet: it had Gerry Breen's departure time as 11.22. I pointed out to the organisers that this was four minutes **before** the pilots' briefing and an equally Einsteinian seventeen minutes before the first aircraft had taken off. They pointed out that they would rather work this out in private.

At 5.45 a jubilant cry arose from the judges' enclave. They had reached a decision: the winner of the 1981 Norfolk Air Race was, um, Gerry Breen. They had cooked up a time for the Mirage of 75 minutes — ten minutes ahead of second-place man Hurtley (who won the trike class).

Freddie Beckett's Weedhopper was an astonishing third overall, officially sixteen minutes behind the winner, and second in class ahead of Martin Fielder (107 minutes).

Of the trikes, Hobson was second to Hurtley, and third was the redoubtable Will Reynolds.

George Wrzesien, a creditable 5th in class, collected the magnificent Concours trophy donated by Arrow Air Services of Shipdham. His trike sports a self-start, and the finish is as nice as Doris Day.

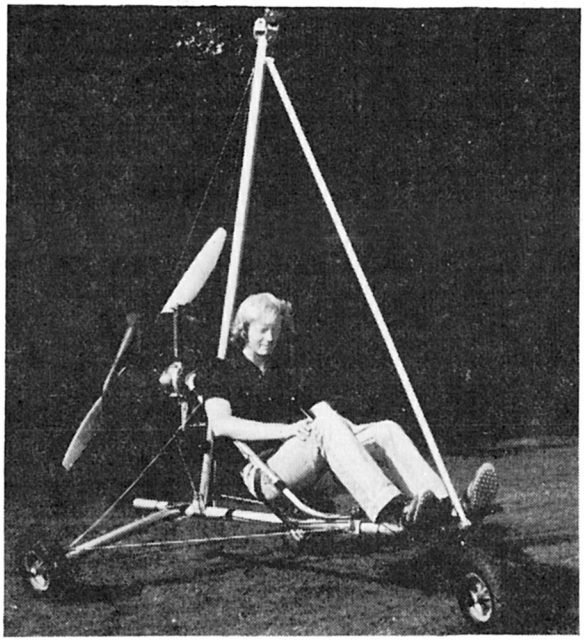
Rumour had it that the organisers were threatening to organise a party that evening. I had had enough of NHGC organisation for one day, so I drove home while Gerry flew the Mirage back with a lady friend on his lap.

It's a great idea, this Norfolk Air Race. But I wouldn't trust the organisers to sit the right way on a lavatory.

Maybe the BMAA should take it over next year — and turn it into a great race too.

TRI-FLYER

KIT-TRIKE



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TECHNICAL TALKING POINTS

NOT JUST A TWISTED STICK

By Tim Williams

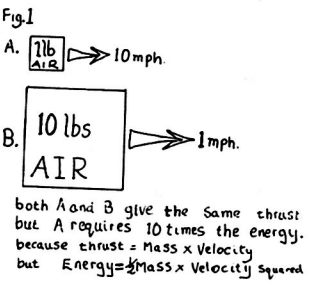
Ten hours of flying with repeated take-offs from rough fields had left our beautiful wooden propeller decidedly gnawed off at the tips. Thrust had dropped off noticeably and something had to be done. The price of a new propeller (from a northern hang-gliding shop) was beyond our humble means and so I set about repairing our original.

Whilst sanding away it dawned on me that I ought to be able to make a prop, "after all it's only a bent bit of wood", I'd made countless childhood model airplane props, most of which had worked.

Many hours of reading and carving and I've found out a little about what goes into designing and making an efficient propeller; perhaps the following information will make your attempts at building one a little less tedious than mine.

Propellers produce thrust by accelerating air in the opposite direction to the intended motion of the aircraft. The efficiency with which your particular engine/propeller combination throws air backwards depends on many factors, let's consider how one could improve the efficiency of an existing propeller.

Fact: It is more efficient to accelerate a large mass of air by a small amount than a small mass of air by a large amount, especially at low air-speeds (see Fig. 1).



Fact: A propeller blade is a rotating wing and has all the problems that wings experience (and more!)

There are six main ways to achieve greater thrust:

(a) larger propeller diameter
(b) more propeller blades
(c) wider propeller blades (increased chord)
(d) increased blade camber (fatter aerofoil section)
(e) higher propeller revolutions
(f) higher angle of attack of blade (pitch)

Considering these in turn:

(a) Increasing propeller diameter

Helicopter rotors are very good propellers, huge static thrust, low revs, high efficiency. Increasing the diamater of your propeller is fine until it starts to contact the ground and important parts of your aeroplane. Straightforward design clearances usually dictate the diameter of the propeller before other considerations. Apart from the danger of hitting things a longer blade must have a higher tip speed (at the same r.p.m.) — this introduces other problems. Longer blades also means heavier blades, higher centrifugal forces and therefore the blade roots need to be stronger.

(b) More propeller blades

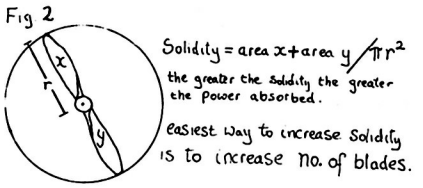
Adding more blades reduces the overall efficiency because each blade has a tip vortex (induced drag). More blades = more tip vortices = less efficiency. There are also airflow interactions and higher profile and skin drag to consider. However, if the propeller diameter is restricted then increasing the number of blades is the best compromise available if one needs to absorb more engine power. Spitfires and Viscounts have this problem but microlights generally don't. The most efficient props have only one blade but they tend to run into problems of weight and vibration due to unbalanced aero-dynamic loads.

(c) Wider propeller blades

Increasing the chord of the propeller blades or increasing the solidity (solidity is the term given to the ratio of total prop disc area to total blade area, see Fig. 2) causes drag problems, lower aspect ratio being the main reason. If one increases the chord without scaling up the whole aerofoil section then this makes the losses even worse. Increasing the drag without a proportional increase in lift is bound to decrease efficiency. But (wait for it . . . another compromise rears its head) if the designer has already reached the limiting diameter and increased the number of blades to four (the usual maximum) then the next best step is to increase the blade chord to absorb and convert the engine power. "Paddle blade" props are the result, many turboprop aircraft show this design feature, inspect a Hercules next time you see one (it's better if they're standing still!), the prop blades have a low aspect ratio.

(d) Increasing the camber (fatter aerofoil section)

Changing the aerofoil to a fatter one usually



results in a poorer L/D ratio, aerofoil shapes for propellers are a compromise (yet again) between strength to resist loads (mainly centrifugal), best L/D to get more thrust (lift) for the same load on the engine and lastly, ease of manufacture. For these reasons the Clark Y aerofoil is most often used, it has a flat bottom which is easier to make, a good L/D and a nice fat section (thickness ratio) making it strong.

Recent experiments by N.A.S.A. have resulted in an aerofoil designated GA(W)-1, this is a laminar flow section with a very high lift coefficient, although drag is higher also (you never get something for nothing). This section may be a good one to try, especially if you have some power to spare. Aerofoil section is of lower importance and has to optimise towards the root of the blade so as to give the necessary cross sectional area for strength.

(e) Higher prop revs

This is the easiest, you just open the throttle more and you get more thrust, but efficiency drops as you're imparting more acceleration to the air, tip speed may go supersonic . . . at about 4,800 r.p.m. a 50 inch propeller will start to meet "the sound barrier", the noise becomes painful (lots of little sonic bangs) and the effiency drops off dramatically. You direct drive bods will know about this and our chairman is making money out of increasing your thrust and preserving your hearing. There is a relationship between the rotational speed of the propeller and the speed of the aircraft, this is known as the advance ratio. The optimum value for the advance ratio for our aircraft is met at well below the 2,000 to 4,000 r.p.m. ranges our props turn at.

(f) Increasing the pitch

This is where it starts to get interesting, there are more arguments about this than any other part of prop design.

The pitch of a propeller is usually stamped on the hub, following the value for the diameter. This figure refers to geometric pitch, best explained by pretending that the air is solid, so a 30 inch pitch prop would screw itself forward 30 inches per revolution. As you will realise, in the real world things are a little different, you'd be lucky to get your 30 inch pitch prop to screw itself forwards by 20 inches even with the aircraft flat out in a dive. The difference between the theoretical and the actual is called slippage, and its value for different airspeeds can be found with a wind tunnel. The degree of slippage depends on the forward speed of the aircraft, so naturally when an aircraft accelerates from rest the slippage will decrease from around 95% (slippage is only 100% when the prop is static!) to about the 25% mark when the aircraft is at cruise speed. Slippage is not related directly to efficiency, a propeller must slip to produce thrust (the proof for this is too lengthy to state here), the lowest figures for slippage of about 12% are found on man-powered aircraft operating under very different conditions (Lower Reynolds numbers). Pitch has to be matched to the r.p.m. at the propeller shaft and the forward speed of the aircraft as well as the horsepower of the engine (higher pitch props absorb more power). Slow aircraft have (generally) low pitch props (25 to 60 inches), fast aircraft have large pitch props (8 to 20 feet). Unfortunately the calculations for pitch rely on experimental data gained for props between certain operating limits, the equations available don't work too well for aircraft flying below 50 m.p.h. with small fast turning props. Intuitive guesswork is the order of the day, working pitch out from scratch is tedious because one needs to take into account things like the state of the airflow entering the prop disc, this is difficult for pusher props.

Right . . . that's all the theory, now for the practical bits. All this information was gained from building lots of props and testing them actually on the aircraft. (Care needed!)

Weight

We discovered this to be an important factor very early on. My first propeller produced lots of thrust (more than the original) but the pilots who tried flying the machine felt (literally) that there was more vibration. The balance was checked and re-checked and the blades inspected for symmetry, etc. Nothing amiss there . . . then an engine bolt fell out . . . back to the drawing board. The answer to the problem is not immediately obvious.

All engines vibrate. Two strokes vibrate a lot. Vibration transmitted to the airframe depends on the compliance (springiness) of the mountings, soft mounts transmit less vibration but allow the engine to jump around more. The propeller is a gyroscope so any angular movement of the axis of rotation will result in a kick at 90 degrees to the input. The heavier the gyroscope and the faster the rotation the worse the effect. With a heavy propeller and soft mountings (the situation we had) the vibration was amplified by the propeller at certain revs. This vibration is particularly harsh and tends to have unpleasant results. Like the tail wagging the dog, the propeller will literally vibrate or move the engine around.

Conclusion: make your propellers light and your engine mountings as stiff as possible.

After seven successful props I've learnt a little about which direction to head in next. I've gone from all-Iroko (a teak-like hardwood) construction to an Iroko core and Douglas Fir outside laminations, this gives a light blade with a hardwood leading edge at the tip where it's needed.

Working the design equations through I came to the conclusion first of all that lowering the pitch was the best way forward. I reasoned that this would increase the engine revs, so allowing the engine to operate at a more favourable part of the torque curve and the lower pitch would give higher static thrust and therefore better thrust for take-off and climb. I

settled on a pitch of 22 inches with a conventional blade planform with a slightly higher aspect ratio and hence lower solidity.

The engine revved like a good 'un, the take off distance was shorter, the climb better but cruise needed full revs and petrol consumption was doubled. I apologise to those people who told me so but there's nothing like exploring the limits of the design envelope for yourself.

Six props later I have a prop which gives better take-off, climb and fuel consumption all with an acceptable vibration level. The reason that my prop is more efficient than the American original is that I had the time to take off those last few shavings of wood to give a better aerofoil section and my blade shape wasn't a compromise to the slave of mass-production, my blade needing more machining to get the edgewise taper. For about 20 hours labour (including design drawing) and the cost of materials I have something which is really good to fly with, gives me satisfaction and a feeling of achievement.

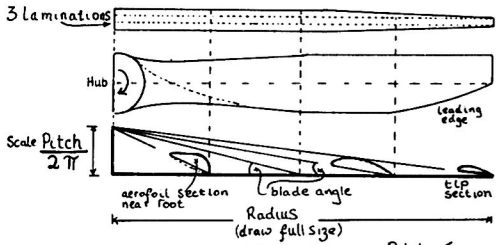
A few tips and ideas

Start by buying Eric Clutton's book "Propeller making for the amateur", it's a good investment even though it is a little more useful to the P.F.A. types with Volkswagen engines.

Take everything the so called "experts" tell you with a grain of salt. Try to find out as much as you can for yourself.

Prepare a good working drawing first, certainly before you go and buy the wood (see Fig. 3).

Fig. 3 Example of a working drawing.
Only 4 blade "stations" shown for clarity, 10 should be used in practice.



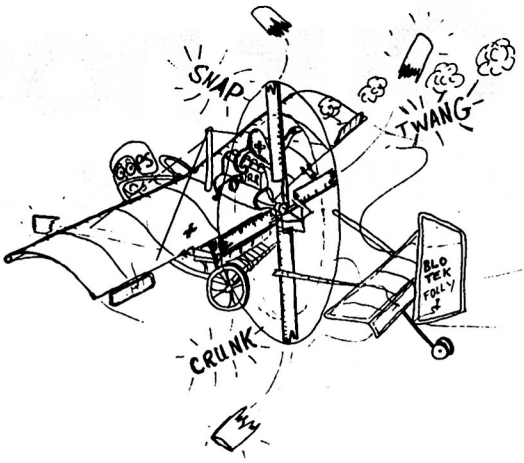
for increased accuracy: Tan blade angle = Pitch / Circ.

Learn how to sharpen chisels, planes, spoke-shaves and saws PROPERLY, you'll need a blunt plane like a prop needs rocks.

Laminated props are best, they have more resistance to warping and splitting. Use AEROLITE 306 adhesive and lots of clamps. The best clamps are made with studding, nuts, washers and lumps of waste wood.

Try to copy an existing blade shape to start with.

As a general rule the maximum blade chord should occur at about 70% radius. The tip chord



should not be less than half the maximum chord, there is evidence to suggest that wide tips are more efficient at low airspeeds.

Curved back leading edges with a sharp front to the section work best, it's surprising how thrust drops when the leading edge becomes chewed up a little.

Pick woods with a high shear strength across the grain and a high tensile strength along the grain. Don't just stick to hardwoods, set up your own strength tests if necessary to find a suitable wood. (Try Elm, Sycamore, Ash, etc.)

Don't make the trailing edges too thin, round them off to about one tenth of an inch diameter.

Check balance at every stage with knife edges and a small diameter steel rod.

Build your own balancing rig.

Use a profile gauge to check your aerofoil sections against your working drawing.

Don't change the design halfway through, if you make a bad slip with the chisel, start again.

Drill your bore holes accurately, there are more props spoiled at this final stage.

Re-check balance after drilling.

Don't be afraid to try new ideas but take care, the forces acting on a prop are large fractions of tons.

Never stand in line with the plane of rotation of the propeller, especially when you are testing it.

Test all your props for static thrust, vibration, blade flexing, on the ground.

Comparative static thrust levels can be measured with bathroom scales suitably positioned.

Wood is still the best material to make small props from, although not ideally suited to mass-production.

Anyone have any bright ideas on how to make a variable pitch prop? Remember it must be light.

If you ever get round to making a wooden propeller you'll find making and owning a "working sculpture" in wood very satisfying.

Our nose grows on you.

Taken at face value, the Eagle is something of an ugly duckling. We have all seen prettier microlights. Most have more attractive noses. Some have smart tails too – whereas the Eagle has no tail at all.

But a safer microlight you have never seen.

Safety: that's the beauty of the Eagle.

Our funny nose has a lot to do with it. The canard wing out front prevents you stalling or spinning. So the Eagle keeps its pecker up in situations which bring lesser microlights down with a bang.

One or two hang gliders have had engines and undercarriages stuck on them of late. However the Eagle is no fledgling microlight where power is concerned. It was born with it. It's an ultra lightweight aircraft designed specifically for power – and designed to be easy to fly.

Well and truly tried and tested, the Eagle is now the biggest-production microlight in the world. With thousands of flying hours behind it.

No wonder Budweiser, the American beer giant, chose the Eagle against all the competition for their microlight display team – and promptly ordered an additional 25 Eagles *a week*, up to a total of *two thousand* Eagles, for distribution to their own dealers.

A few climb-crazy manufacturers are loading their airframes with ever-heavier, ever more powerful engines. Happily the Eagle has precisely the right amount of oomph. Not so much that its power can force it anywhere near its stress limits (8G positive, 2½ negative), but enough for a standard service ceiling of over 12,500 ft and a climb rate of 650 fpm on the Zenoah engine or 450 on the Robin. And it climbs out at a sensationally steep angle. Which means you get out of tight spots without getting into trouble.

Maybe now you're beginning to see just how beautiful the Eagle really is.

A week's instruction – or even a one-day introductory course – will prove it to you.

How do we know?
We have a nose for these things.

Breen Aviation Ltd

Microlite Aircraft Division (Dept. FL)
Enstone Airfield, Oxfordshire.
Enstone (060872) 413/4.

OSHKOSH 1981

(The Experimental Aircraft Association holds its major week-long convention annually at Wittman Field, Oshkosh, Wisconsin. It is attended each year by approximately 13,000 aircraft, and on the first weekend attracts 250,000 spectators! Among the craft are 1,500 home-builts, and over 100 warbirds, 400-odd vintage and classic aircraft and an increasing number of mircolights; from just one ultralight in 1977, the number has increased to 25, 60, 100 and this year 150, generally accompanied by their manufacturers or sales teams rather than by pleasure-flyers, but nevertheless this is probably THE showcase of the American microlight scene. STEVE HUNT was there in the first week of August, for the third year running, and reports on what he found. — Ed.)

Oshkosh was a short week for me this year. I didn't arrive until Monday night (the third day), because Charles and Diana's wedding plus lots of panicking. American tourists frightened of being stranded by their A.T.C. strike meant that there was a drastic shortage of stand-by tickets! Upon arrival I wandered into a brightly-coloured marquee and lo and behold, the first man I met was Mick, formerly of the Ultralight Aviation Centre at Wellesbourne and now running his own shop in California. I thought it must be a good omen for the week to meet another exile from these fair shores as soon as I got there.

The next morning things got going in earnest; the weather played its usual tricks (straight up to 90° and stayed there all day) but owing to some wind there was only a little flying on the Tuesday morning. Microlight flying in previous years had been restricted to 7-8 a.m. and 7-8 p.m., but now there was clearance for an all-morning slot running through to noon or thereabouts, which gave plenty of

(above) The Kolb Flyer.

(above) Steve Hunt driving an original 1910 Curtis Pusher.

time for thermals and turbulence to develop; gusts on the ground and greatly changing windspeeds told me that flying conditions would be — er — interesting. That Tuesday morning, the last microlights to land were a Mirage and a Kolb Flyer, and it was obvious that both these craft could ride the weather much better than many other aircraft present.

Soon after flying stopped, I saw a familiar structure from the past erected over a strange-looking device and realised that Waspair had come along with their "event tent" and Tomcat microlight. (Those from hang gliding will remember Waspair's strange and sudden departure from the U.K. in 1979, until which time they had been one of the largest home hang glider manufacturers.) The Tomcat is indeed a well set-out aircraft and seems very professionally constructed. I saw it fly during the week and it looked a lot of fun — and Robin Haynes and Barry Bourne were doing all the flying! It had a lot of speed and didn't appear to be affected by turbulence but seemed slow to roll and uncoordinated in turns.

This is the year that the microlight industry became important. Production and marketing techniques make it obvious that real numbers are being produced; Quicksilver, the most professional-looking outfit, are working towards 100 aircraft per week, Eagle are close to 200 a month, Mirage are expanding violently and are reported to be building a new 30,000 sq. ft. factory, and quite a few manufacturers are knocking out 30-60 machines per month.

A year ago the Pterodactyl looked like the practical aircraft to have, with good climb rate, speed range and turbulence rejection. This year it had lost none of these good qualities, but so many aircraft

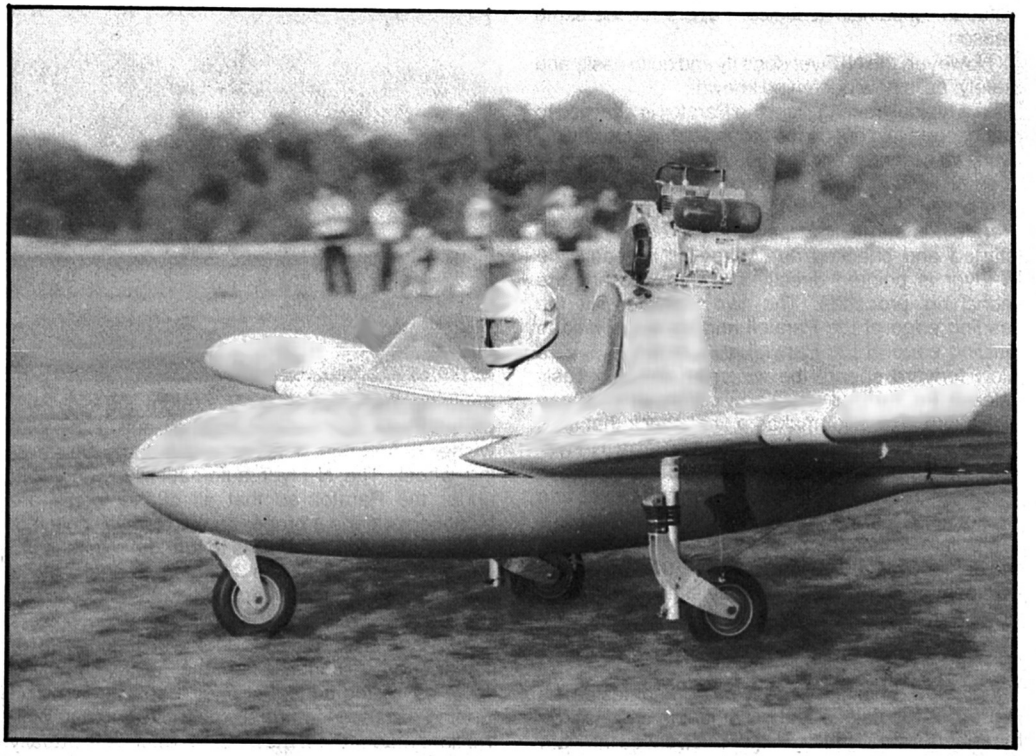
have come along with a more basic aerodynamic package (straight wings and tailplane) that it no longer leads as the most practical aircraft at the show. All the most practical machines were like conventional light planes in miniature which packed away and all had three-axis control — that is, three separate control systems, one in pitch, one in yaw and one in roll (spoilers or ailerons); sometimes the yaw and roll were activated by the same lever (Lazair, Vector, etc.). This group also had either good wing sections and/or plenty of power from 440 c.c. twin-cylinder engines (Cuyuna and Kawasaki). One aircraft, the latest Mirage, had both these features. The pack-up aircraft with good wing sections were the Vector and Hummingbird but both had fairly low power from one or two single-cylinder engines. The other aircraft which sported large motors were the Pterodactyl, Quicksilver and many others, but most of these lacked in other directions — e.g. having single-surface aerofoils, excessive wing twist, crude controls, etc.

As I saw the aircraft at Oshkosh this year, my favourites were the Kolb Flyer, Mirage, Goldwing and Winton Grasshopper, closely followed by the Hummingbird, Vector, Quicksilver MX and Lazair. There were other excellent aircraft which don't necessarily appeal to me, including the Kasper Wing, Mitchell B10 and Pterodactyl Ascender. I had had high hopes of other craft — the Hornet 130 and Mitchell P38 — but for a variety of reasons I wasn't too impressed on close inspection.

I am always prepared to discuss my reasons for holding **my opinions** on various aircraft, and I am always prepared to state an opinion on a craft I have seen. Many microlights in America are just bad copies of other products, and some aircraft manufacturers never seem to get their machines off the ground. For example, it may be hard to believe, but Striplin Aircraft have exhibited their products at Oshkosh for three years and I have never seen any serious attempt to fly any of them! In this case, the British agent assures me that he has a working aircraft.

In general, I retain my view that "Buyer beware!" is a sensible motto with so many craft appearing, and I suggest any buyer makes sure he has faith in any product he is considering, and has also seen flying, the exact type of aircraft before parting with any money — even a deposit could commit you through the small print on the order form!

To summarise, it was once again a most interesting visit and a very worthwhile investment to keep abreast of the latest developments, despite the untimely recovery of the dollar!



(above) The Winton Grasshopper.

N-FLYER FLIGHT

By John D. Nicolaides

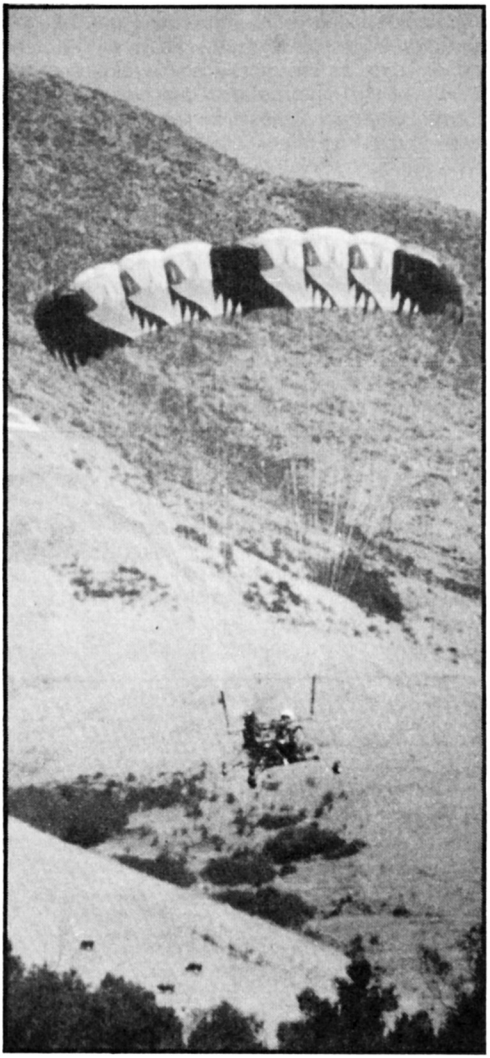
The Nicolaides-Flyer is an unusual flying machine and it has some rather unique characteristics.

The conventional aircraft has a **rigid** wing which is **rigidly** attached to the fuselage; thus, when an airplane pitches the wing pitches with it; when the aircraft yaws, the wing yaws, etc. . . . Also, an aircraft can have static and dynamic stability problems and it can stall and spin. This is not the case with the N-Flyer.

To begin with, the N-Flyer wing is not rigid. This wing, called the Parafoil*, has absolutely no rigid members. It is constructed entirely of cloth and it is rigged and trimmed with lines. In a breeze or in flight it becomes inflated, takes the shape of a wing and flies like a kite attached to each end of the spreader bar. Thus, in flight, on the N-Flyer, the Parafoil is free to pitch, yaw, swerve, etc., with respect to the bar. Also, the vehicle itself, which contains the engine, pilot, etc., is completely free to pitch with respect to the bar. Therefore, with all of these degrees of freedom between the wing and the vehicle it is of little wonder that originally the academic community and government experts stated that the N-Flyer could not fly and that the aeronautical journals refused to publish technical papers for the same reason.

However, the N-Flyer does fly and quite easily and safely, as is now becoming known.

In a typical training flight the Parafoil is attached to the bar and laid out on the ground behind the vehicle with two wingmen at each side holding it down, since a small wind or the prop thrust can lift it into the air like a kite. Next, the entire N-Flyer, including the Parafoil, is carefully inspected. The engine is then started and checked out. When all is ready, the N-Flyer is pointed directly into the wind and the launching proceeds. The two wingmen lift the leading edge of the Parafoil and allow the wind to enter; the pilot increases the thrust so as to provide a slow forward speed; the wingmen simultaneously release the Parafoil which now comes up overhead like a kite. The pilot makes a final check that all is O.K., and then applies full throttle. The N-Flyer quickly comes up to a velocity of 25 m.p.h. and in less than 100 ft. lifts off the ground and climbs at a rate of approximately 500 ft./min. The climb angle is rather large since the flight velocity is so low. Once the desired altitude is reached, say 1,000 ft., the pilot reduces the thrust so that steady state level flight is achieved. At this point the pilot does not have to do



anything; the N-flyer is flying straight and level. Any disturbances are quickly damped out. If the pilot wishes to turn right or left he simply turns the steering wheel. The N-Flyer automatically swings out under the Parafoil so that all of the forces are balanced out and a proper banked turn is achieved. If the pilot no longer wishes to turn, he releases the steering wheel and the N-Flyer is again flying straight. If the pilot wishes to climb or descend, he increases or decreases the throttle. The pilot powers in for a landing and kills his engine on touchdown, or if he wishes, he can also flare the Parafoil by pulling down its trailing edge just prior to touchdown. The landing distance is normally about 10 to 20 ft. With the flare manoeuvre, the landing distance is virtually zero. By continuing to flare after touchdown, the

*Originated, designed, developed and tested by Professor Nicolaides and his students and inspired by Jalbert's small multicell kite. (Also called the Ram Air Wing.)

Parafoil drops to the ground behind the aircraft and the flight is completed. After the flight the Parafoil is packed into its small container bag which is stored in the N-Flyer. The pilot may drive the N-Flyer back to the hanger or to his home if he wishes.

There have been well over 100 flights of the N-Flyer and many thousands of manned deployment and gliding flights of the Parafoil itself. The N-Flyer shown has a weight of approximately 500 lb. *(it could be considerably lighter using Trike technology—Ed.),* a constant flight velocity of 25 m.p.h., and a total engine horsepower required for horizontal flight of approximately 12*, not including propellor efficiency. Both Hirth engines and V.W. engines have been employed. Any suitable engine will do the job if it is properly configured on the vehicle with respect to the Parafoil and the bar (and that's the rub).

It is essential that the combination of engine, vehicle, pilot and Parafoil be properly configured or disaster can occur. There were over 50 bad landings and take-offs before the proper relationships and total design was established.

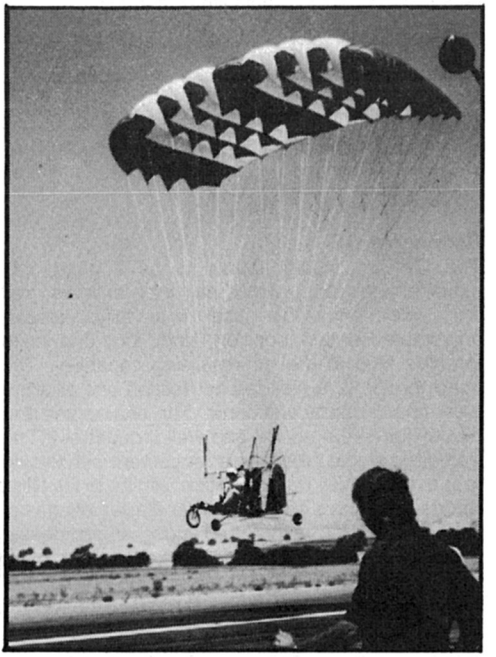
The widespread use of the N-Flyer has been delayed due to the difficulty in finding a proper marketing plan, and also due to various military applications.

Because of the wide range of applications for both the N-Flyer and the Parafoil itself, and more particularly because of the numerous military systems, the detailed technology has been closely held. Even so, some early designs have been leaked and unauthorised jump Parafoils are being made and sold under various brand names.

Military systems, using Parafoils which range in size from less than 1 sq. ft. to over 3,200 sq. ft., have been constructed and flight tested. These systems include both manned and remotely controlled versions. The recovery of both large and small R.P.V.s has also been demonstrated using the N-Flyer concept.

Thus by using the Parafoil deployment techniques demonstrated in R.P.V.s, it is easy to visualise a James Bond type N-Flyer which is driving down the highway. When Agent 007 wishes to fly, he pulls a level and a Parafoil is released which deploys and comes up overhead as a kite. By adding more power the N-Flyer takes off and flies smoothly away.

*By using advanced N-Flyer designs the horsepower may be reduced to less than 6.



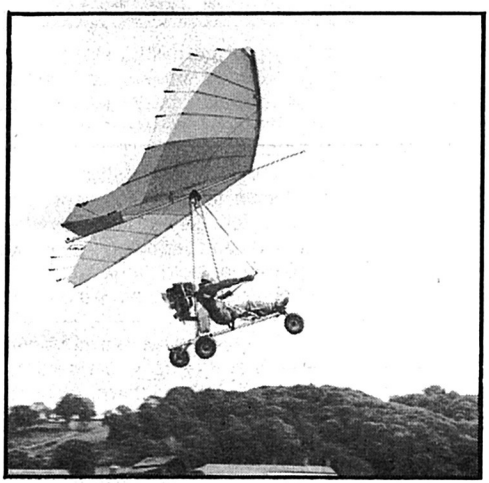
ROAD TEST

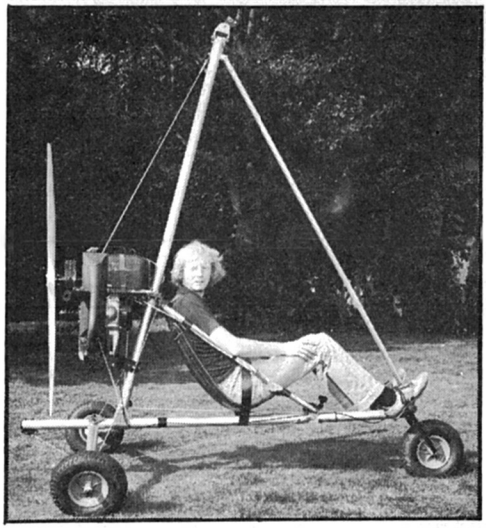
(Manufacturers and importers brave enough to have their microlights independently road tested should contact Paul Bennett, P.O. Box 5, Southfield Road, Hinckley, Leicestershire. Tel. (0455) 632931 (Day) or (0455) 632526 (Home) — Ed.)

Most people know what a trike is, but for those who don't, it is a tricycle type undercarriage incorporating a power unit. This unit is attached simply to the hang point of a suitable hang glider. The trike has a pusher prop with a low thrust line. The general appearance is rather like that of a gyrocopter with the rotorblades replaced with a wing. It is a flex wing machine activated by weight shift. For the purpose of the test I combined the 'Sealand Power Wing' which is a hang glider built primarily for power and has an 85% double surface section. Together with this I coupled Mainair Sports 'Triflyer' which is a single tube trike supplied in kit form.

General

AIRCRAFT — 'Sealander Power Wing' by Flexiform Skysails, Leigh St., Patricroft, Manchester. Price £950 inc. VAT. 'Triflyer' kit trike by Mainair Sports, Shawclough Rd., Rochdale, Lancs. Price £775 inc. VAT.
CONSTRUCTION — Aluminium alloy, Windmaster sailcloth.
POWER UNIT — 250cc Fuji Robin 18.5bhp.
CONTROLS — Flex wing activated by weight shift. Single horizontal control bar. Hand and foot throttles.
FUEL CAPACITY — 2 gallons.
PORTABILITY — Car roof rack.
RIGGING TIME — 20 minutes.





NOISE LEVEL — Low.

Performance — Pilot weight 175lbs

CLIMB RATE — 400ft/minute.
LEVEL FLIGHT SPEEDS (indicated) — 30-45mph
NORMAL CRUISE — 35mph
TOP SPEED — 55mph with 200ft/min sink.
ROLL RATE — Light but with a solid feel to it — no vices.
PITCH RESPONSE — Again light and responsive, easy to maintain a high airspeed without doing a 'Charles Atlas Course'.
STALL CHARACTERISTICS — Fairly stall resistant. If stall occurs due to sheer a conventional stall is incurred and recovery is fast with minimum height loss.

Comments

The 'Triflyer' would appear to be a good unit, especially for those would-be home builders, and the price seems fair also. It is fully foldable, adjustable seating position, both foot and hand throttles plus in the air restarting capability. The hand throttle is a nice ratchet/friction unit allowing easy fine cruise adjustments. The engine unit and mountings seem sound and well thought out. The frame is a single tube type arrangement with folding rear axle for easy transportation, similar to the Ultra Sports 'Tripacer'. The Sealander Power Wing is of bow sprit design with a 148° nose angle, double surface (26 battons!) and a bird like tail. Due to the wide nose angle the wing handles turbulence very well and the braced leading edges allow the wing to maintain its shape even at high speeds.

The 'Trike' unit was originally developed commercially in the U.K. by Hiway Hang Gliders early in 1980. Trikes are still the simplest and quickest to rig microlight available. The advent of fifth generation hang gliders whether they be 'Demon', 'Typhoon', Lighting, Comet of Sabre are now beginning to give the trike good performance specs.

Beside the home build trike mentioned, there are several other ready to fly models which are professionally built, giving equally good performance. It is always advisable before purchasing to get as much info as possible about the machine and the training available on it, so as to assess what would be best for you.

Below is a list of all the UK Trike manufacturers:

Hiway Hang Gliders Ltd.
Sirhowy Hill,
Tredegar, Gwent.

Southdown Sailwings,
82 Goldstone Villas,
Hove, Brighton.

Hornet Microlights,
Bankfoot Mills,
Wibsey Bank, Bradford,
Yorks.

Chargus Gliding Co.,
Gawcott,
Buckingham.

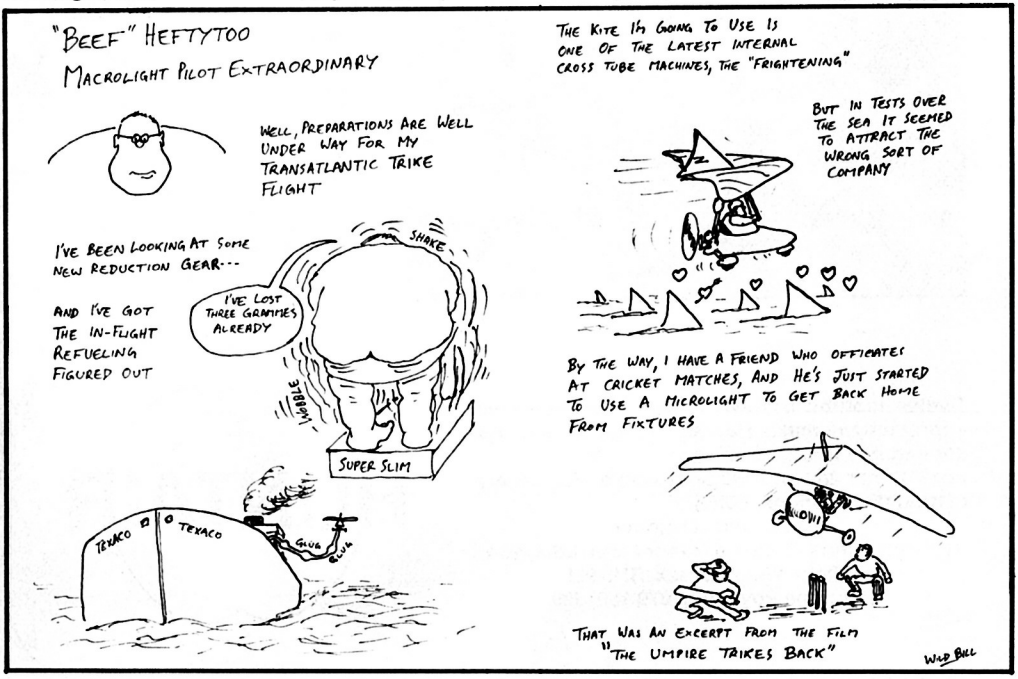
Skyhook Sailwings Ltd.,
Vale Mill, Chamber Rd.,
Hollinwood, Oldham,
Lancs.

Mainair Sports,
Shawclough Rd.,
Rochdale, Lancs.

Flexiform Skysails,
Beddingate Mill,
Legh St., Patricroft,
Manchester.

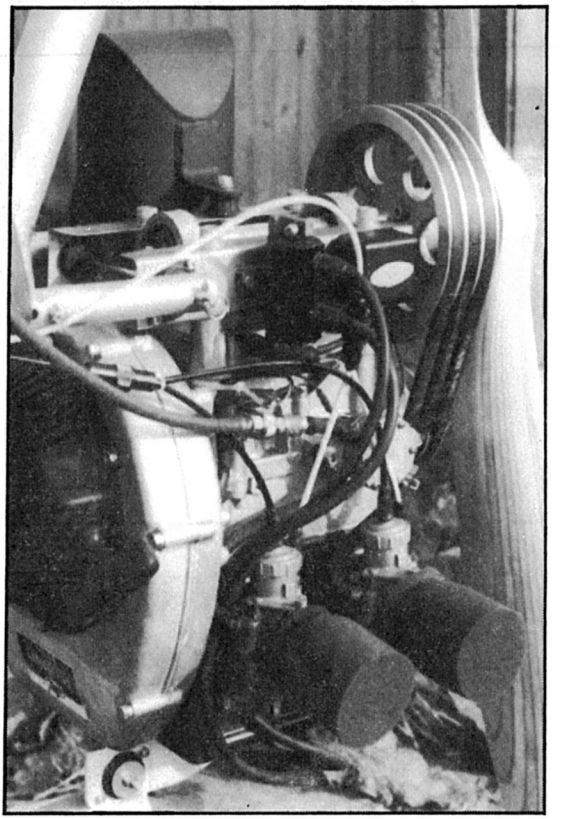
Ultra Sports Ltd.,
22 Albany Villas,
Hove, Brighton.

U.A.S.,
23 Hertford Drive,
Wallasey, Cheshire.



PANTHER 330 TWIN

200 lbs thrust with low noise, low vibration and compact layout



New exhaust design incorporating tubular baffles
New ratios for more thrust
New multi-ply birch props for more thrust
New high-tensile driveshaft, long-life bearings and rigid spacer casting for trouble-free service

Twelve months of development and innovative improvement make Huntair market leaders for dependable thrust systems.
For Panther 250 and 330 units with a wide variety of mounting options, contact:

Steve Hunt at Huntair
Truleigh Sands, Truleigh Manor Farm, Edburton, Henfield, West Sussex, BN5 9LL
Telephone Poynings (079 156) 599

HUNTAIR

THE POPHAM FLY-IN

By Nick Perry

A pleasant meeting, but nothing more.

About 40 aircraft adorned the delightful airstrip and attendance was noticeably up on last year.

As a future Trike owner, I was delighted to see a comparative profusion of coloured triangles enjoying both still and turbulent conditions. The most impressive of these was undoubtedly the dual machine. It was powered by two Solo engines coupled through a common axis driving two contra rotating propellers. It was flown by Len Gabriels of Skyhook fame. He spent most of his time, at no cost to anyone, taking up any spectator that requested a flight. His generous actions and patience will long be remembered particularly by the many fortunate persons who shared the air with him.

Pterodactyls very obviously coped best with the nasty turbulent conditions that Monday's weather brought. That was the day when the whirr of the B.B.C. cameras awoke everyone and within minutes engines were coming to life in all directions. Dave Thomas became a T.V. star and camera man, taking the television cameras aboard his Pterodactyl. He flew in the worst of the weather bringing back good results that were on the screens the following day.

THE GOLD WING FLEW! Not far and not for long, but reasonably well. The Vector did not, Dave Turley must have had his reasons. The Magpie did not — a great disappointment. The Rotec Rally and Scout managed to get airborne but you had to be watching carefully otherwise you would have missed them. The Eagles wafted about and one in particular that flew in caused quite a stir by landing the wrong way early on the Saturday morning. When 'gently' questioned by the airfield owner, the pilot admitted that he did not know what a landing 'T' was! If you are going to use an airfield it is your responsibility to acquaint yourself with airfield procedure.

So we come to general microlight organisation. There appeared to be none apart from an overlong verbal briefing with far too many do's and don'ts to remember. There also seemed to be a lack of communication between the B.M.A.A. and airfield officials. Despite all this and the fact that the microlights were sharing the same land and air with full size aeroplanes on a tricky airstrip, there were no mishaps.

I understand that a constructive B.M.A.A. committee meeting was held on Sunday (?) although it was disturbed by possibly the most interesting highlight of the weekend. Unfortunately, I missed the looks on the faces of the committee members when they were seriously requested to evacuate the contents of the overflowing bogs.

Mr. Jim Espin, Popham's owner kindly donated two trophies engraved with an outline drawing of the Wright flyer. P. Milner who flew in 47 miles from his home in Banstead in Surrey was awarded one for 'The Most Adventurous Flight.' The trophy for 'Best Microlight to Fly', judged by Jim Espin, Trevor Espin and Martin Harvor, was awarded to Dave Blaney for his Goldwing. Some pilots expressed disappointment that there was no form of any flying competition.

As I said, a pleasant meeting, but nothing more.

(above) The Magpie

BOOK REVIEWS

From Tony Fuell

Two books have arrived in the old postbag since the last issue. Interestingly, both claim to be an introduction to the sport and the aircraft, both include a directory of the manufacturers and types of craft, both are American — and there the similarities end!

One is Mike Markowski's "Ultralight Aircraft", available in the U.K. from Robin Laidlaw. The other is Dave Thorne's "Microlight Aircraft Directory" — U.K. availability not yet known. They present an interesting contrast — between the "aviation—establishment" respectability of Markowski, whose handout contains eight lines of close type setting out his qualifications to write such a book, and whose publisher has gone to some considerable lengths to produce a high-quality product; and the "Southern Californian laidback" style of David Thorne, whose company, Aero-Fun Publications, P.O. Box M, Salid, CA95368 (it could ONLY be Californian!), has produced a cheapo A4 sized, plastic-bound thing that looks as if it has been printed on Andrex.

Not that we should get TOO carried away by things like typography and layout, after all it's the content which is important in any book, and in a market which is evolving as quickly as the microlight one, a book which is printed cheaply, in small quantities, and kept up to date by frequent revisions, may be of more use than an expensively produced dinosaur. This fact has not been lost on Thorne, who points out that if his book had been properly typeset in the normal way, it would fill 100 pages or more.

So, what's in these books? Would they be of any use to a novice microlighter in Britain? As readers of previous book reviews will know, I've been bemoaning the lack of a decent introductory handbook to the sport for a long while; particularly one which gave an authoritative review of the aircraft types available, their flying characteristics and performance specs. Could either of the two fulfil this role? You can imagine, that having received my parcel, I settled down with a considerable degree of anticipation.

I turned first to the "directory" sections — in Markowski's book, this is the first section — in Thorne's it is at the back. Here I'd say that while Markowski has included data on only 42 aircraft, as opposed to Thorne's staggering total of 84, Markowski wins hands down not only on the standard of presentation of the information, but on its general usefulness. I mean, no one in the U.K. (except REAL directory freaks) is going to be interested in one-off jobs produced by obscure U.S. backyard companies, discontinued models, and aircraft designs which are rip-offs of other people's work, and these make up quite a lot of the 84 entries that Thorne is so proud of. Markowski has at least done some pruning, and has concentrated on those designs which are likely to be of importance, either because they are of aeronautical interest (Monerai, Minibat, Mitchell U2, etc.) or commercially popular (Eagle, Quicksilver, Fledge, etc.). And he has made some attempts at imposing a logical sequence on the book, the entries covering a series of aircraft where this is necessary. Unfortunately (and understandably) the generally good presentation of data has been let down in one or two places by the fact that Markowski has obviously relied on manufacturer's handouts for performance figures, and some manufacturers are less scrupulous than others about things like climb rates, L/d ratios and the like. A Rotec Rally with an L/D of 7-1? Pull the other one!

Thorne, of course, gets rounds this by not printing any performance details at all, so his directory would only be useful as a source of names and addresses for the manufacturers of types you happened to be interested in. He hasn't organised the information very well either, so the same type keeps cropping up again in different variants: there are several entries for the Easy Riser, for example. And neither of the two pays any attention to the 'trike side of the microlight world: the only entry in Markowski is for the Delta-Wing Phoenix 6D Trike (yes, really!), and the Delta-Wing Trike appears in Thorne on a Viper. So if you're into that side of the sport, forget these directories right now. . . .

But, of course, both books purport to cover the general airmanship side of microlighting as well as the marketplace, and here I found it very difficult to decide which approach I preferred. Here the two books diverge completely in their approaches. Markowski goes for a classical "introduction-to-flight" instructional technique, with a description of a typical ultralight and its parts, theory of flight and basic navigation: the sort of thing that you'd expect to be covered in any good course of instruction. I was a little nervous about some of Markowski's definitions, and his tips on in-flight handling techniques were decided individualistic, to say the least. He recommends the flapping of your trouser legs as a means of determining angle-of-attack, for example. Not that I'd quarrel with his basic thesis, which is that a pilot shouldn't rely entirely on any one thing to tell him how his aircraft is flying, but should get inputs from many sources; but advice like that is very likely to confuse a beginner when he is remembering what he read on the ground while he's halfway into his first flight. This whole section reads very much as if the author has dictated it into a tape-recorder, a technique which ensures that you get a nice, easy-to-read text, but which does tend to lose precision and clarity. On the whole, while I didn't discover any glaring errors, I wouldn't recommend Markowski as a basic handbook of microlight airmanship; one of the standard texts would be better — such as Flight Briefing for Pilots, for

example.

Thorne doesn't attempt any instructional bits at all in relation to actually flying the things, and apart from the "Directory", his book consists of a nice chatty exposition of what microlight aircraft are all about, how to get started, what to look out for, and so on. Quite useful this, I thought, to anyone who didn't know anything about the sport at all. He has some tongue-in-cheek advice as to how to go about actually getting your hands on a second-hand aircraft, and covers in some detail the kinds of designer's compromises which affect the performance of your craft. On the whole, quite an enjoyable approach, and one which might justify the book's cost to an intending purchaser.

Neither author makes any concessions to the international market, of course — all the Air Law references, "useful addresses" and so on are uncompromisingly American in both. This alone limits their usefulness to a potential U.K. purchaser. However I would summarise my views on both books as follows:

Markowski's "Ultralight Aircraft" is well produced, and has a very useful directory of important types. The instructional sections are comprehensive enough, but are likely to be confusing; the book is not totally suitable as a training aid. The section on engines I found interesting, but not very relevant to the U.K. scene. At a price of £6.80 plus 60p P&P it is not bad value for money.

David Thorne's book "Microlight Flying Machines" is cheaply produced, and is intended as a basic guide to the sport and the market. It could do with a great deal of tidying-up, particularly in the "Directory"; and I would avise the author to concentrate more on quality than quantity in this section. The rest of the book is basically serious advice for the newcomer, but written in an accessible and pleasant style. At $10.95 (about £6.00) it is on the expensive side, unless you really happen to need a reference book covering all the obscure microlight types.

And finally, could I put in a quick recommendation — Richard Bach's old book "Biplane" is newly available in paperback (published by Granada at £1.25). You remember Richard Bach — Jonathan Livingstone Seagull, and all that — well Biplane has more to say about the act of flying than any of the microlight books I've seen so far. I do urge you to read it.

DON'T FORGET TO COME TO THE **AGM** ON **22nd NOV.** AT THE CIVIC HALL, WOLVERHAMPTON.

GRAND PRIX COBBLERS!

By Christian Marechal

The Marlborough British Grand Prix souvenir programme contained an astonishing announcement: "aerobatic" and "highly tuned racing machines" (sic) were to provide the pre-Grand Prix microlight aircraft display. Was there some mix-up? A confusion, perhaps, with the Pitts Specials or Formula One air racers? No, there was not. The announcement was accompanied by a clutch of Pteradactyl photographs.

As fascinated as any ignoramus in the crowd, I awaited the take-off of these hitherto top-secret wolves in sheep's clothing with bated breath and galloping envy — the boys from Bristol were clearly going to knock our Eagles clean off their perches. I mean, the best we could do would be tight 360s, whip stalls, wingovers and similar tame stuff. And the Eagle's V.N.E. is only 55 m.p.h. We were about to be blown out of the sky by a pair of microlights with Chevvy V8s **at least,** doing a full heart-stopping display of loops, stall turns, spins, barrel rolls, flick rolls, vertical rolls and God knows what else (cheese and tomato rolls?) — and chances were they'd cap the whole shebang with an inverted pass at Mach 1.

I was pretty psyched out, I can tell you — and I was only doing the commentary. Imagine how our Eagle pilots — Gerry Breen and Julian Doswell — felt. And pity the poor Red Arrows' pilots. It's no mean tribute to their professionalism and discipline that they actually got out of bed that morning.

A hush fell over the crowd as the display was announced. You could have heard a pair of knickers drop. I switched on my mike. (Incidentally, if you think commentating is a cushy number you should try it sometime. Personally I found 20 minutes' rabbiting to a hundred thousand decal-infested rally jackets about as relaxing as flying a Scout into the wake vortices of an F-16.)

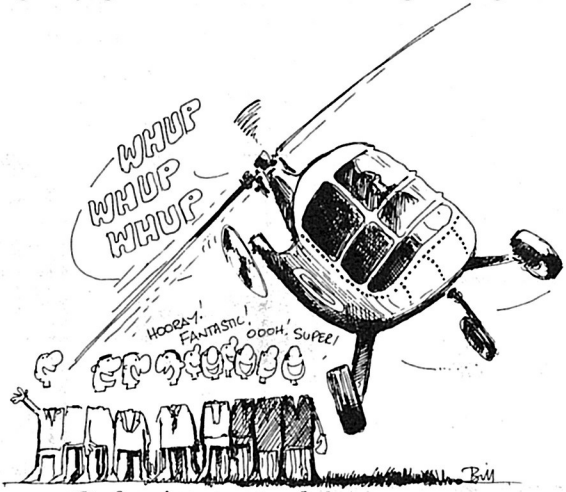
The Pterror moved off first. No messing about — straight into its first aerobatic manoeuvre. This involved a finely-judged ground run over the tarmac, off the edge of the runway and on to the grass. Here the racing pilot deftly pounded the nosewheel into a gulley, which had the startling effect of almost stopping the plane dead in its tracks and, at the same time, hurling it into the air. Undeterred by the moderately gusty wind, the pilot then braved banked turns at, oh, they must have been 15 degrees, and screamed past the enthralled spectators at all of 25 m.p.h. Stirring stuff! The crowd rose to their feet and roared off to the ice cream stalls.

Unfortunately I missed the rest of this sensational performance as, by now, the Eagles were airborne, along with George Wrzesien's wrspecial (Chargus wrtrike, Demon wrwing and Koenig wrzengine). These, of course, are strictly non-aerobatic, "cooking" microlights, so I felt obliged to bolster their comparatively sedate performance with a little razzle-dazzle over the tannoy, leaving our racing colleague's scintillating performance to speak for itself.

The C.A.A. very sensibly insisted that the microlights fly at 500 ft. minimum. However the other flying machines which followed were subject to regulation by some other aviation authority with which I am unfamiliar. Consequently we saw a Navy helicopter come within a whisker of performing a mass lobotomy as it executed extremely radical manoeuvres low over the heads of spectators thronging the paddock area, and the Red Arrows made their seductive passes at 200 ft. over everyone on the infield.

Oh what fun it must be to be regulated by **this** authority! Almost as good as piloting an aerobatic microlight racer.

Will anyone sponsor me for next season? I'll turbocharge the Eagle?



... Performing a mass Lobotomy ...

MICROLIGHT CLUBS

These have normally been formed by members of B.M.A.A. for an area — no commercial interests are represented on this list.

I.O.W.	I. of W. Microlight Club Mike McMillan	Rose Cottage, Clay Lane, Newbridge, Nr. Yarmouth
SOUTH EAST	Wesmac Flying Club Patrick Hassett	Wesmac Flying Club, 1 Woodstock Close, Horsham, Sussex
	Tony Smith's 50 Acres! (flying available to careful and quiet people)	Tony Smith, The Brownbread Stud, Ashburnham, Battle, E. Sussex
	Hants. Flight Training Centre Rob Patterson	Hants. F.T.C., Rob Patterson, 21 Penns Road, Petersfield, Hants.
SOUTH	Wessex Microlights Group Mac Smith	Wessex Microlights Group, c/o Airborne Ltd., 3 Woodlinken Close, Verwood, Dorset
SOUTH WEST	South West Airsports Microlight F.C. Ian Stokes	South West Airsports M.F. Club, Ian Stokes, Barton Ventnor, Launceston, Cornwall
WALES	Monmouth Flying Club Mike Griffiths	Monmouth Flying Club, 25A St. Mary Street, Monmouth, Gwent
	Mid Wales Aero Club Tim Williams or Pat Laverty	Mid Wales Aero Club, Pat Laverty, Heulwen Haf, Talybont, Dyfed
	Artro Flying Club David Walter	Artro Flying Club, David Walter, Rio Turice, Park Road, Barmouth, Gwynedd
LONDON AREA	Stevenage Quiet Outfits Harry Bolt	Harry Bolt, Benington Lordship, Stevenage, Herts. SG2 7BS
	South Essex Skywing Club Dave Lewis	South Essex Skywing Club, Dave Lewis, 10 Dukes Avenue, Grays, Essex RM17 5AQ
	Milton Keynes District Club Bob Moffat	Milton Keynes D.C., Bob Moffat, c/o Chargus Gliding Co., Gawcott, Bucks.
EASTERN	Suffolk Microlight Aircraft Club Terry Aspinall	Suffolk Microlight Aircraft Club, Terry Aspinall, 9 Hillcrest, Knodishall, Saxmundham, Suffolk
NORTH EAST	Lincolnshire Microlight Centre Club Richard Lake	Lincolnshire Microlight Centre, Richard Lake, Lincs. Airsport Ltd., 7 Brigsley Road, Waltham, Grimsby, S. Humberside
MIDLANDS	Oxford Microlight Club Keith Jones	Oxford Microlight Club, Keith Jones, 54 Hayfield Road, Oxford OX2 6TU
	Northants Microlight Flying Club Neil Duncan	Northants M. Flying Club, Neil Duncan, "Gables", Weedon Lois, Towcester, Northants
	Midland Microlight Flying Club Keith Vinning	Midland Microlight F. Club, Keith Vinning, 51 Beechglade, Handsworth Wood, Birmingham B20 1LA
	Kineton Microlight F. Club Miss V. Slater	Kineton M.F. Club, Miss Slater, Blind Lane Cottage, Kineton, Guiting Power, Cheltenham, Glos.
NORTH WEST	The Peak Powered Flying Club Mike Hurtley	Peak Powered Flying Club, Mike Hurtley, c/o Flexiform, Level III, Bedingate Mill, Leigh Street, Patricroft, Manchester
IRELAND	Irish Microlight Aircraft Association Madeleine O'Rainke	Irish Microlight Aircraft Association, Madeleine O'Rainke, Kirra, 6 Wilfield Park, Ballsbridge, Dublin 4
SCOTLAND	Lothian Airsport Flying Group Fl. Off. C. D. Denham	Lothian Airsport Flying Group, 52 Harburn Avenue, Deans East Livingston, West Lothian, Scotland EH54 8NH
	Fordoun Flying Club Mike Duthrie	Fordoun Flying Club, Mike Duthrie, 9 School Road, Fettercairn, Kincardineshire, Scotland

STATESIDE VIEW

From Glenn Brinks

Ultralight Parachutes

Last time, I mentioned that the parachute manufacturers were working on adapting chutes for use with ultralights. One system that seems to work well is to sew some straps on an extra container, with a couple of buckles. Then, the container can be strapped on around your waist, or strapped next to the cockpit and the chute can be hooked into the ultralight at the harness or seat suspension point. When flying a hang glider, the chute can simply be put back in the regular container sewn onto the hang gliding harness. For a bit of extra money, a harness maker could sew up a harness for use with the ultralight, so the pilot could have the option of clipping the chute to the ultralight, or to the harness, in which case the pilot would have to bail out to use the chute. This would be especially good for pilots who also fly conventional airplanes, as it allows the chute to be used the correct way for each type of flying. It isn't necessary for pilots of lighter ultralights, as they will simply clip the chute to the ultralight, so the pilot and ultralight are both suspended from the chute.

Any chute that opens will undoubtedly save your life, but if you are going to hook the chute to the ultralight, use a larger chute to get a slower descent rate. I have a 26 foot chute that should prove adequate, but the ultimate is a new chute just coming on the market. It is a 28 foot R.D.P. (rapid deployment parachute), designed specifically for use with ultralights. It is supposed to open faster than conventional chutes and will give an acceptable descent rate with a load of up to 400lb. In contrast, the R.D.P. designed for hang gliders gives a good descent rate with only a 22 foot canopy. The new one is about 2/3 larger in area. It is expected to cost just over $500.00 and is available from Elsinore Sky Sails, 15524 Grand Ave., Lake Elsinore, Cal. 92330, and from Delta Wing Kites and Gliders, P.O. Box 483, Van Nuys, Cal. 91408.

Speaking of chutes, I watched an ultralight come apart at about 150-200 feet, at a meet in Elsinore. The pilot had about 4-5 seconds from the failure, until he hit the ground. He wasn't carrying a chute, and he didn't survive the crash. With a big ultralight chute, he would have landed softly and walked away. With even the smallest of the hang gliding chutes, he would have landed hard, but he still would undoubtedly have been able to walk or perhaps limp away from the crash. With no chute, he didn't have a chance.

There is also something to be learned from the time involved. Four to five seconds isn't much time if you don't respond instantly. Having a chute won't help if you don't get it out in a hurry. The correct

procedure for chute deployment is Look (at the chute), Reach (grab the chute), Look (for an open patch of sky), Throw (toss the chute at the open space). Say it to yourself as you go through the motions — Look, Reach, Look, Throw. Tie the chute with bungee cords, so it doesn't unpack and practice the deployment from the pilot's seat of your ultralight. You should be able to get the chute out in well under two seconds. After you get the motions ingrained, remove the bungees, put the chute back in its container, and you are now a safer ultralight pilot. Going through the motions once or twice during each pre-flight will help keep you current.

USHGA to Drop Powered Ultralights

Six months ago, the USHGA Board of Directors voted to have the USHGA go into powered ultralights with the full effort of the organization. It was felt that the rapid growth of the ultralight industry would in turn help the growth of the USHGA. There was a lot of controversy surrounding this decision and many members began to write to the magazine and to their directors. The result was that at the board meeting just held, the decision was reversed. Over the next year, the USHGA will eliminate all of its activities and project related to powered ultralights. The one year time period was given so that the ultralight enthusiasts would have time to either take their programs elsewhere or start a new organization. It is not clear yet which course of action will be taken. One program that will be retained by the USHGA is their insurance policy. The policy (optional for members) that covers powered ultralights is the same policy that covers tandem flying on hang gliders, so it will be continued indefinitely.

Fly the winner

By microlight standards the mighty new Mirage Mk. II goes like a bat out of hell. In the Norfolk Air Race (its first public performance) it annihilated the opposition – blowing the Weedhopper into the weeds, travelling much faster than the Ptraveller, making the Lafayette look wet, and spiking all the trikes.

To pilots of conventional aircraft our hellcat is a godsend.

Because for once that tired old microlight sales cliché, "It flies like a real aeroplane old boy" is true.

It has fixed seat, side stick, rudder pedals, left hand throttle. Spoilerons, elevator, rudder.

Its beautifully engineered 440cc Kawazaki twin develops 37 bhp, revs slowly, and is mounted on a beefy new purpose-built keel.

The Mk. II has a high performance double-surface aerofoil, an airframe stressed to 6g positive and 3g negative, and performance figures to match: Cruise, 50 mph; Vmax 60; Vne 75; Vs 24.

It climbs at 1000 feet per minute.

The way it eats the sky, it makes its lesser brethren look like they're off their food.

In the interests of safety, it is available to solo standard 3-axis control pilots only from Breen Aviation – Europe's first and foremost microlight specialists.

Experienced microlight pilots should go solo in a conventional aircraft. It shouldn't take you long, and it's well worth the hassle – as you'll discover on your first Mirage flight.

After all, if you can learn to fly a winner, why fly an also-ran?

Breen Aviation Ltd

Dept. FL, Microlight Aircraft Division,
Enstone Airfield, Enstone, Oxfordshire.
Enstone (060872) 413/4.

SAFETY MATTERS

From Brian Harrison

What Price Power?

There is little doubt that the subject most discussed at pubs, clubs and fly-ins over the past few months has been power and certainly most of the aircraft introduced both here and in America since the beginning of the year are fitted with twin cylinder 2 stroke motors yielding around 30 horse power and over 190lbs thrust. Wherever they are flown these aircraft show superior performance and in particular a better climb out than their predecessors and given that the designs have been thoroughly tested by both experienced and inexperienced pilots then there is little doubt that they offer better overall performance.

Unfortunately most of us may assume on viewing these aircraft that the difference is really only down to the power system fitted and therefore all that need be done is to fit a more powerful engine with less outlay than required to purchase a new machine. This, however, is a serious misconception which if used as the only criteria for fitting a more powerful unit will almost certainly result in serious difficulties and possible injury. The following is a list I have drawn up of the advantages and disadvantages of fitting a more powerful engine:—

Advantages

1. Shorter take off run.
2. Better climb out.
3. Possibly, but not necessarily, higher cruise speed.
4. Lower fuel consumption. A small capacity 2 stroke motor working at high rpm will almost inevitably consume more fuel than a larger engine working at half power.
5. More inertia therefore better penetration.

Disadvantages

1. Heavier engine necessitating C of G change and thrust line check.
2. Higher wing loading, therefore stall speed is increased, sink rate is increased, and L/D is down.
3. New unit may have a different thrust line therefore possible difficulties in power-on power-off pitch control.
4. More power will almost inevitably exaggerate any minor handling problems which existed with the original configuration and may in fact convert a reasonably safe handling aircraft into a less predictable beast.
5. At higher air speeds with a higher wing loading the airframe will encounter greater stress in turbulence than with the original unit.

If, after considering the above, you still feel confident to fit a more powerful engine to your aircraft then may I recommend that it is essential that you first contact the manufacturer of your aircraft and determine whether or not he recommends fitting the unit you have in mind. You will have to give very serious consideration to all the implications, not least of which must be the amount of money you may spend on fitting a unit which is neither approved by the manufacturer nor has been tested in this application by anyone else.

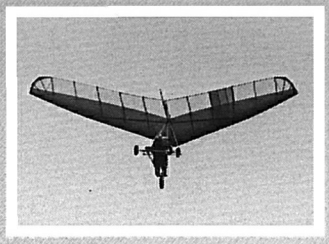
With the above in mind I have received several reports on power related accidents during the past few weeks, two of which are serious and one of which was unfortunately fatal.

Having recently fitted a Cayuna with a reduction system to his Pterodactyl Ptraveller, training committee member David Giles was flying before friends on the day of the Royal Wedding. Eye witnesses report that whilst climbing out — not on full power — David's engine suddenly lost power, whereupon he pushed the stick forward as the aircraft at a high angle of attack, quickly lost air speed. As the nose pitched down with full forward stick the engine suddenly came back to life forcing the aircraft into a fast pitch-over, the aircraft consequently incurred very high stress loadings, broke up and fell to the ground. It is interesting to note that some years ago a detailed analysis of the pitch-over problem associated with hang glider design proved that it was possible for the then current design of hang glider to enter a pitch-over acceleration of 120° in a third of a second and that is no misprint! In fact, the pitch-over can be so fast that eye witnesses will swear that the aircraft did not invert. Current designs of hang glider of course and most microlights utilize information on design gained from this investigation and pitch-overs are certainly not the problem they once were. However, a microlight aircraft which has lost air speed and is subjected to a sudden burst of power will undoubtedly be in a dangerous situation and therefore there is only one rule which must apply to an engine cut or sudden loss of power, that is **SWITCH OFF!** Ideally your ignition switch should be placed within easy reach of the hand and be of the "flick" type. You should always be in a position to cut your ignition quickly if required.

The second accident concerned a Scout which apparently entered turbulence and the aircraft side slipped in from about 400 feet. Those of you who are familiar with the Scout will recognise the fact that it is a neat, inexpensive and unpretentious little aircraft which even with the small power unit flies well in light wind conditions. Being of conventional configuration and of minimal power it is obvious that an A.S.I. is a distinct advantage, if not a necessity, and it is difficult to get quickly out of a stall or side slip by applying power.

Demon and Skytrike

a devilish combination



The combination of Demon and Skytrike represents the industries' first truly high-performance ultralight powered flex wing.

Remember, the Demon you use for conventional soaring fits unmodified straight onto Skytrike.

The high speed and low sink rate performance of the Demon make it the ideal partner for Skytrike Mk 2.

The 250cc engine develops over 130 lbs of static thrust giving an impressive climb rate, quiet running and 1½ hours duration.

Skytrike folds simply for car-top transportation. The entire structure is anodised; tubes bright and fittings black.

Front forks are strengthened and the nose wheel sports a mudguard. The petrol tank is detachable and has a lockable filler cap.

Write for details and information about your local agent to:

Hiway Hang Gliders Limited
Sirhowy Hill, Tredegar, Gwent NP2 4XP
telephone: Tredegar (049 525) 4521

HIWAY

SECRETARY'S LETTER

The date of the AGM in 1981 is NOVEMBER 22nd, 1981. The venue is THE CIVIC HALL, WOLVERHAMPTON, WEST MIDLANDS. Head for the Town Centre where signs for the Civic Hall are well displayed. There is ample car parking within minutes of the Hall.

The meeting starts at 2pm prompt but the Hall will be opened from 9.30 a.m. to permit limited trade displays and viewing. Entry will be by current Membership Cards, please check **NOW** that you still possess yours.

It is hoped to have caterers present, but come prepared. The heating will be on. We also hope to have video films showing before and after the meeting. During the meeting there will be no trade stands operating inside the hall. Althouth there may be space outside the Hall if dealers or schools require this — please contact me soonest if you require space.

It is vital that all members should attend this meeting as we shall be discussing the future of microlight flying as well as reviewing progress over the past 12 months. Your committee has very definite views but needs your support in every way. There will be ample opportunity for you to express your views at the meeting. Constructive criticism only please, as we are still experiencing growing pains throughout the clubs and schools.

We shall need volunteers to help in every way — The AGM gives you the opportunity to stand up and be counted. If you have an idea of how to improve safety standards then let's hear from you.

At least one TWO seater Microlight will be on view at the AGM. Remember the Pilot Certificate of Competence should be obtained before taking friends flying with you. Are you insured yet?

The Fly-Ins at Langar, Popham and Enstone gave enormous encouragement for newcomers to join our ranks. We always welcome new members and our thanks go to Tom Sawyer of Pegasus, Jim Espin of Popham and Gerry Breen at Enstone for opening their PRIVATE airfields to the BMAA. We shall endeavour to raise the standards even higher in 1982 and shall require volunteers from the membership to help in organising flying control and crowd control

FLY-INS are 2 or 3 day events and we wish to encourage all members to go to these, to spend at least one evening camping or caravanning at the venue, only then will you get the full benefit from our dubious weather and ample chance to talk microlights.

Do not leave the family at home — take them with you — with the advent of two seaters — the whole family can enjoy the experience of flight.

The Pilot Certificate of Competence is the target for all Microlight pilots. To obtain this, one has to pass the written exam as well as completing the Task forms A and B and submitting a Medical Declaration to BMAA Secretary plus a £3 registration fee.

To assist in the implementation of this scheme there are at least 26 CFI's plus a number of recognised Observers who are available to assist you to get your Task Forms A and B completed. Our aim is to improve the standards of airmanship continuously and it is up to the membership to support us entirely in this respect.

If you require help in any way to obtain the whereabouts of an Observer of School CFI then ring me on 0654-77235 or 0952-452302. I will then put you in touch. Remember Log books are one way of proving that you have been flying especially if the Club or School CFI has signed and STAMPED your entries.

Jonny Seccombe, our Treasurer, is at the moment, our Travelling Training and Invigilating Officer.

He is touring the country visiting schools, clubs and dealers — coordinating standards and ideas. If you require a visit from him, either contact him direct, or phone me.

We hope to produce Training video films during the next months. Any members who have any video films on Microlights are requested to lend us a copy so that we can produce a film for the AGM. Copy will be returned to you after the AGM unless you wish to donate it to the BMAA.

Large photographs for static stand displays are also needed. CAN YOU HELP? Whilst we are on this subject, have we any members who can produce reasonably priced mobile or static public address systems? We need at least two sets of this equipment, or possibly more so that we can hire them out to the clubs.

At the Fly-Ins we are on hand to meet members, as well as dealing with many thousands of questions we get asked.

In between times we make time to organise T Shirts, Sweat Shirts and the other small items that can help finance the BMAA.

So, if you feel that you can make some contribution towards running the various offices that may come up for re-election, then let's hear from you at the AGM. Please think very carefully before volunteering for tasks that need a lot of time. No one will appreciate you if you fail to complete your allotted tasks in the time given. We are all working to deadlines to continue improvement.

Please bear in mind our main Aim is to promote SAFE, INEXPENSIVE Flying for all.

See you at the AGM?

Ron Bott
20 Church Hill, Ironbridge,
Telford, Shropshire.

CONTACT!

WHAT ABOUT A CHRISTMAS WEEK FLY-IN?? It Seems as though the week between Christmas and New Year is a generally accepted holiday these days, and down in Cornwall it is quite often a period of really calm weather (NOT GUARANTEED!)

If enough people are interested I am prepared to organise a week's fly-in starting on Monday 28th December and finishing on Friday 1st January, which will include a round Cornwall air race. I can arrange bed and breakfast from £4.50 to £9.50 per person per night, and provide hangarage for de-rigged machines. We have a large open airfield at Davidstow with fantastic moorland to fly over. TEMPTED? Ring Ian Stokes of Southwest Airsports on Pipers Pool (056686) 514), and if we get enough support it will be announced in this column in the Nov/Dec issue of Flight Line.

THE MIDLANDS MICROLIGHT CLUB is being formed by Tony Faulkner at Halfpenny Green Airport, nr. Stourbridge. Non flying members are especially welcome. Training aircraft will be available in the near future and anyone interested in attending an inaugural meeting should ring Tony Faulkner on (0543) 79075 or Mike Kendrick (038 488) 418.

WAS IT YOU? If so, would the two Trike pilots who passed over Walton-on-the-Hill, Surrey, on north and south headings in formation on 10/8/81 care to contact a Trike pilot from that village to share site information around the area and arrange a possible rendezvous? Contact: Mark Phillips, 66 Sandlands Road, Walton-on-the-Hill, Tadworth, Surrey KT20 7XA.

£100 REWARD for information leading to the recovery of my stolen Sealander Wing, purple, yellow and white (note purple patch on starboard wing) and Hiway Skytrike with Valmet engine. Contact Ray Howarth on Atherton, Lancs. (0942) 870997.

MICRO ENGINEERING AVIATION of Bristol, are in the process of testing their aerodynamically controlled 2 seater. The tow trials are demonstrating excellent controllability even in gusty conditions. Testing, including load testing, will be complete by the end of October.

ATTENTION ALL SCHOOLS AND CHIEF FLYING INSTRUCTORS. There will be a seminar held at Enstone Airfield on 2nd and 3rd November. If you are a CFI or an aspiring one, you *must* be there. Contact Breen Aviation, Enstone Airfield, Church Enstone, Oxfordshire. Tel: (0873) 810019.

DAVE THOMAS is now rated both C.F.I. and Observer and will undertake observation, tuition and written examination. Venues and dates by arrangement. He is looking for a suitable permanent flying site. Can anyone help? Aldershot, Hampshire (0252) 26182.

CALENDAR

THE BMAA ANUAL GENERAL MEETING, NOVEMBER 22nd AT THE CIVIC HALL, WOLVERHAMPTON, WEST MIDLANDS.
Door open at 9.30 a.m. with films and Trade Displays. Meeting starts at 2 p.m.

SMALL ADS

Small Ads are **free** to members of B.M.A.A., 40 words max. Commercial Small Ads are £2 for each insertion, 40 words max. Please make all cheques payable to B.M.A.A. and send ads to: Flight Line, 11 School Hill, Wrecclesham, Farnham, Surrey.

FLIGHT LINE back issues are still available at 50p per copy plus postage and large envelope. Postage rates are: 1 copy 14p, 2 copies 19p, 3 copies 25p. Quote your 1981 B.M.A.A. Membership No. and contact: Ron Bott, Secretary B.M.A.A., 20 Church Hill, Ironbridge, Telford, Shropshire.

B.M.A.A. PILOT'S LOG BOOKS — 70p each, enclose S.A.E. please. Available from: Secretary, B.M.A.A., 20 Church Hill, Ironbridge, Telford, Shropshire.

SOUTHWEST AIRSPORTS offer holiday training courses on Eagle microlights, also advanced tuition. FREE tuition with each new Eagle purchased. Owners, bring your own machines, overfly the rugged beauty of Bodmin Moor from our airfield in N.E. Cornwall. Further details tel: (056686) 514.

WREXHAM NORTH WALES — Prospective pilots interested in the possibility of a group purchase of a three axis aircraft in above area. Please contact P. R. Allery, Caergwrle 761519 (home) or Wrexham 261906 to discuss.

WANT MORE SPEED FROM YOUR TRIKE? Fly it on my large Gryphon. Very efficient and fast — ideal for power. £275 o.n.o. or will exchange for your old, slow Vortex or Superscorp, etc. Tel: Gerry on (0642) 780533.

PROPELLER MAKING FOR THE AMATEUR. It is cheaper and more satisfying to make your own props. This book tells it all in simple language. Design, drawing, shaping, balancing, repairing, plus experimentals. Revised; £3. Eric Clutton, 92

Newlands St., Stoke-on-Trent ST4 2RF.

MANCHESTER AREA. Anyone interested in forming a Microlight ownership syndicate please contact: Rod Pendlebury on 061-998-5613.

HIWAY TRIKE, 160c.c. Valmet, 5hrs. on engine, new belts, prop. etc., never bent and in excellent condition. £525 o.n.o. for quick sale. Contact Keith (0772) 51957 Office or (0253) 730958 Home.

WHITE EAGLE, the universal power system, two configurations — tractor and pusher, adjustable link between shafts allows full adjustment of propellor thrust line. Shock mounting eliminates all vibration. Weight from 25lb, fits all types of flexible gliders and microlights. **Dealerships available for the Universal Propellor** — new strong, light design. Fits all engines, any diameter with adjustable pitch, thin profile blades, replaceable blades anodized in many colours. 150 in stock, quick delivery. Kolecki, New Aviation Engineering, Box 5078, 16305, Stockholm, Sweden.

TRIKE FOR SALE, new large solar storm with Hiway Skytrike. Only 1 hour's test flying. Absolutely perfect. £1,350 o.n.o. Tel. 01-586 7047.

EAGLE FOR SALE, 10 hrs. flying time. Perfect condition, $2,000. Tel. (0435) 830220 (E. Sussex).

WANTED TRIKE, not 160c.c. engined type, in good condition with or without hang glider wing. Contact Phill on (05305) 2808 (Markfield).

TRIKE FOR SALE (going 3 axis). Two uprights, new Valmet 160 engine and reduction gear, new propellor and shaft, foot plus hand throttle; £400. Will deliver free to port of Harwich or Hull. Tel. Cliff Coumon (direct dialling) 01031-1748-5632 Holland.

250c.c. SKYTRIKE/VULCAN, less than ten hours logged on engine and glider; £1,395. Also **EAGLE MICROLIGHT**, twin engines, under ten hours. Aircraft as new; £1,650. Contact Mike Gardiner on (0243) 512310 office hours.

AUTUMN is in the air in Cornwall and so is the fabulous **GOLDWING**. Call and see our demonstrator, and order your kit or factory built machine at Davidstow airfield in North East Cornwall. Just phone Ian Stokes, Southwest Airsports, at Pipers Pool (056686) 514.

¼ SHARE in Eagle/Fuji Robin available. Based near Horsham, Sussex. Operational flying/workshop facilities inclusive; £575. Further details tel. Upper Warlingham 2742.

FLY FROM STRATFORD-UPON-AVON at Long Martson Airsports Centre, Eagle and Mirage Distributors, for details of Microlights, Seminars and training courses phone: Ace Microlight Aircraft Co. Ltd. (0905) 423929 or (0789) 294454.

ALUMINIUM TUBE AND TUBE BENDING SERVICE to your design, Trailers and Engine Service. Phone Ace Aviation Co. on (0789) 294454 or (0905) 423929.

EAGLE, six months old, perfect condition, 10hrs flying time; £2,200 o.n.o. Tel. Stirling (0786) 70609 or 61190 anytime.

DEMON 195/TRIPACER, brand new condition, 3hrs flight time; £1,650. Tel. Edinburgh 031-331-1919.

DIRECT PROPELLERS ON REQUEST. Marsden Howitt, 11 Brook Terrace, Darlington, Co. Durham. Tel. (0325) 52112.

HIWAY 160 SKYTRIKE. Superb condition, climbs well and very economical; £750. Robert Bailey, 2 Denton Avenue, Leeds 8. Tel. (0532) 662518.

C.P. 16, just completed, not yet run in. Job overseas in new year forces sale. Tel. Alford, Lincs. (05212) 6427.

SKYTRIKE/STORM, attractive custom sail colours. Reinforced and fully de-bugged, 22hrs use; £1,200. Tel. (03745) 53227 evenings or Jim Mallison (0268) 557079 office.

ROTEC RALLY SPARES. Most spares in stock — realistic prices. ALSO ROTEC RALLY 2B ex-demonstration model 17hp, flies well, £2,050 plus VAT. Ready assembled. LARCO AEROSPORT, 6 Humber Street, Grimsby, South Humberside. 0472-41133.

PTERODACTYL ASCENDERS straight from the States. Cayuna reduction and canard. Kit only £2,973! Go for the best! Training available at Tilstock Airfield, Whitchurch, Shropshire. Contact Simon Dewhurst, Sicily Oak, Cholmondeley, Cheshire. 082 922 211.

HAVE you seen the **SCORPIION** — the amazing new British microlight? Northern enquiries welcome to Simon Dewhurst, KT Microlights, Sicily Oak, Cholmondeley, Cheshire. 082 922 211.

HORIZON SAILS, specialising in microlight and hang gliding sailmaking and repairs, trike seats, etc. Phone 079-156 590 day or 0273 774770 evening.

330 SUPERTRIKE for big fellas! Trikes (with or without gliders) using Panther 330 twins — very smooth and loads of climb rate. Steve Hunt, Huntair, 079 156 599.

BARGAINS! Skytrike 160 and Super Scorp; £950. Quicksilver hang glider, good for converting to power; £200. Two seat Sealander Trike, £1,850. Contact: Midland Microlights (0455) 632931/632526.

WANTED, reasonably priced second hand microlight, damaged one considered. Contact: Fred Bolton, 18 Deeside, Blackpool. Tel. (0253) 42517.

ENGINES. A new **all British** engine available soon. Especially commissioned for the Microlight movement to provide ample power with extreme reliability. Specifications: 2 cyl. 2 str. direct air cooled. Twin carb. 530 cc 40 BHP. Electric start, alternator, dual ignition, 55lb. Sole UK agent — SOLEAIR (0983) 526192.

PROPELLERS. Developed over 18 months, these beautiful Admiralty quality spruce and mahogany props. 50in. dia. suit engines 20hp - 60hp. Machine produced — any quantity. £72 inc. VAT. Discount on orders over 5. SOLEAIR AVIATION, Porchfield, I.o.W. (0983) 526192.

New! Exciting! Fast! British!

Scorpion

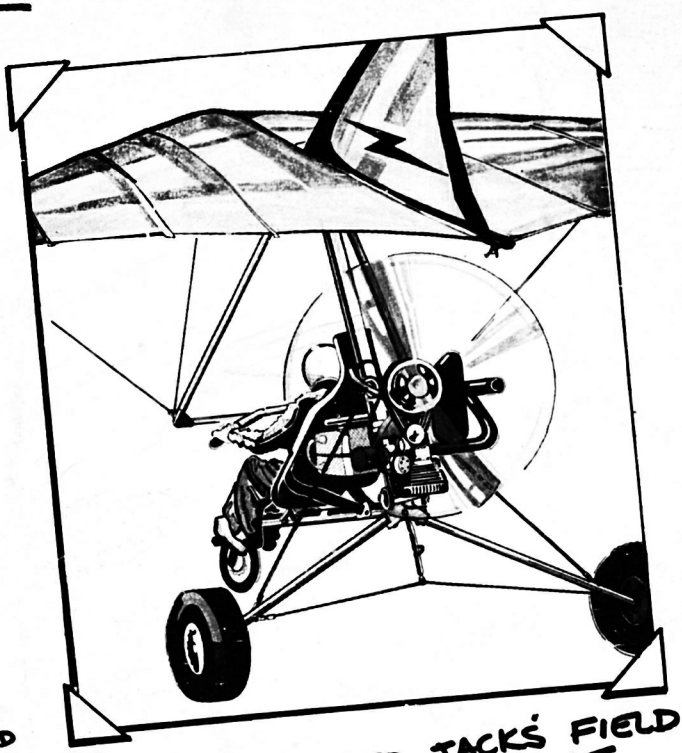
Southern Aero Sports proved at the first public appearance of the Scorpion at the Enstone Fly-in, that the sting is in the performance not in the price!!

Span 34ft Length 20ft
Weight 185lbs
2 engine options
Tricycle undercarriage
Climb 1000ft per min.
Speed 65-80 m.p.h.
Take of run 100ft
Double surface wing
Spoileron aileron control

The flood of orders and Dealership applications that followed this first showing, means that if you want to fly Scorpion in 1982 then the time to act is Now!

Southern Aero Sports
124 Punchcroft, New Ash Green
Kent DA3 8HS
Telephone: 0474 873836

ISN'T IT TIME YOU *REALLY* TOOK OFF?



FRIDAY 22ND

FINISHED 4.30 - DROVE TO JACKS FIELD
RIGGED THE 'LIGHTNING' IN 15 MINUTES FLAT.
ENGINE STARTED FIRST TURN, CLIMBED TO
CLOUDBASE AND CRUISED BELOW CLOUD AT
3,000 FEET. FANTASTIC VIEW - THIS IS LIVING!
LANDED AT CHICHESTER IN THE FIELD
BEHIND THE 'MILLERS' — MET VICKI IN THE PUB.
NICE PLACE TO SPEND THE WEEKEND....
AND ITS ONLY BEGINNING!

GET THE WHOLE STORY FROM:—

Southdown Sailwings, 82 Goldstone Villas,
Hove, Brighton. Tel: Brighton (0273) 732007