Aberdeen And District Soarers

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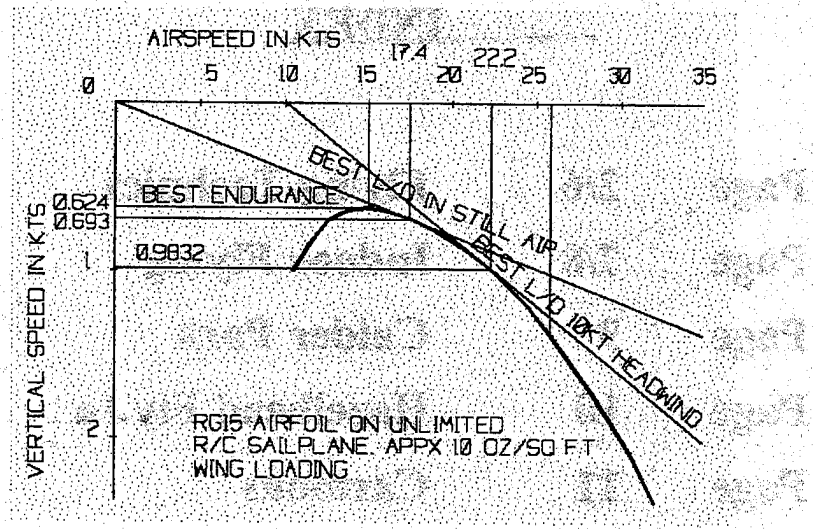
Probability And Airspeed

Why is it that soaring keeps us coming back year after year? How can this sport continue to hold the interest of the most intelligent and sophisticated of individuals? (A little sucking up to the reader never hurts.) I think it is because soaring is like gambling or digging for gold - you can never be precisely sure when you'll hit the big thermal jackpot. Because we never know just what we may find on any given flight, we keep coming back for more. Soaring contests also tend to favour a "jackpot" format - on any given day anyone can get lucky and win. The idea that today may be our day keeps us all coming back.

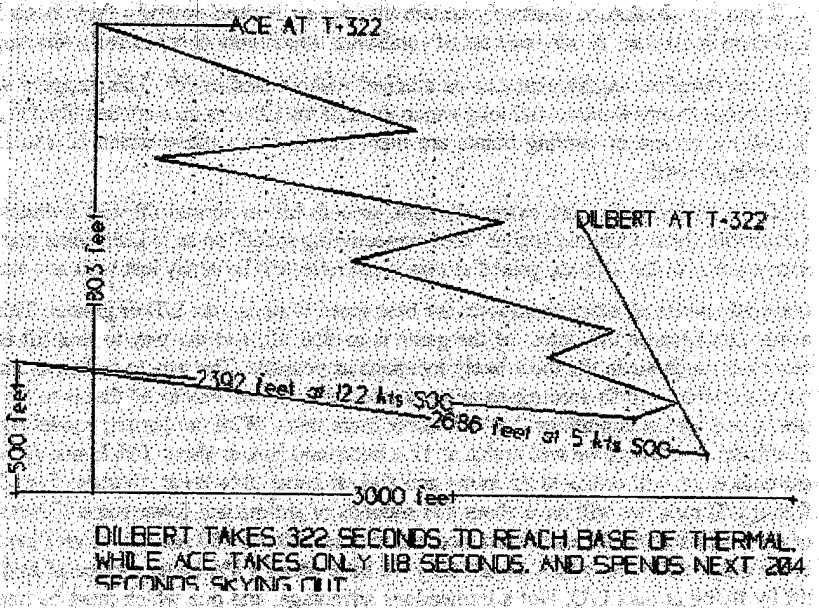
Soaring as a sport will always be a game of numbers, and aside from basic stick and rudder skills, your success is based in great part on how you play your percentages. One of the best ways to stack the odds in favour of a successful flight (aside from sandbagging) is to always fly the correct airspeed. Just flying at maximum endurance airspeed is statistically inappropriate most of the time. For example: If, prior to launch, you observe a huge hat-sucking thermal about a half mile upwind which is marked by ten other sailplanes and uncountable hawks and buzzards, you would not fly at maximum endurance to reach the thermal. You should fly at a speed that gets you to the thermal fast with minimum altitude loss. In still air, that speed would be the speed at



which your plane attains the maximum lift-to-drag ratio or minimum glide angle. As the breeze picks up (if you are flying up wind to a destination) you will have to fly faster into the wind to realize minimum glide angle. Do not assume that a thermal upwind will

come to you. Although it is drifting with the wind, it is also going up. By the time it gets to you the rising air may be hundreds of feet above your plane.

To graphically illustrate, this figure is a plot of airspeed versus vertical speed for a generic R/C sailplane using an RG15 aerofoil. Note that maximum endurance, -0.624 vertical knots is attained at an airspeed of 15 knots Also note that the best glide speed in still air is 17.4 knots at a vertical speed of - 0.693 knots. Maximum endurance airspeed



will never change (for a sailplane which does not dump ballast); however the airspeed which gives best glide angle over the ground will change as the wind increases.

Let's use the information in the figure to see what happens when we fly different speeds to that thermal upwind. We will assume a 10 knots wind, and a thermal that is going up at 5 knots. Not an extra-ordinary set of conditions. Further let's assume we have launched to 500 feet and the thermal is 1000 yards upwind when we decide to go for it. Dilbert Dipstick decides to float upwind at his best endurance speed of 15 knots, while Ace Wachowski goes at his best glide speed for a 10 knots headwind, 22.2 knots. The figure shows that Dilbert's glide ratio over the ground is about 8, and he will take about 322 seconds to cover the 2063.7 feet to the base of the thermal (if the thermal is still there!). Ace, on the other hand will cover the 1926.8 feet to thermal base in 118 seconds, leaving him about 204 seconds to gain altitude while Dilbert is still enroute. If this scenario plays out, by the time Dilbert gets to the thermal, Ace is at about 1803 feet (plus whatever altitude he gained zooming off speed when he got to the thermal) and Dilbert is at max pucker. Dilbert's plane is obviously a pig. Maybe he needs to do some glide tests to find a better CG location??? This scenario could be even worse. What if there is sink on the way to the thermal? Chances are if you are not flying in lift you are

in sink Dilbert may never even reach the thermal, while if Ace encounters sink, the effect will be minimal, and he will still have enough altitude to turn around and come home or try another search direction.

Ok, so the usual case is not one where there is a hugh thermal upwind just waiting to be flown into. Usually we launch and search around for a thermal. What speed should we fly? Max endurance is most frequently not the correct speed. Max endurance should be flown only under certain sets of circumstances such as:

1. If you are absolutely, positively certain that the air is dead neutral - there is no lift, and there is no sink. A very rare set of conditions which may occur in early morning.

2. If the duration requirement can be attained without finding lift. This happens with short tasks, strong winches and long winch lines. If the CD sets up a contest like this, he is either a moron or landing points are high and he has a plane which he can land exceedingly well.

3. If you are trying to work extremely light, smooth lift. In normal lift with turbulence, you should fly at a slightly higher "best manoeuvring speed" so as to keep some margin above stall. All the altitude gained at max endurance will be easily lost with one stall.

Generally under all other conditions, the best speed to fly is max L/D or greater. This is a true fact because the object of the game is to find lift, and the way to find lift is to search as much air in the most likely locations as possible. The way to search as much air as possible is to fly through as much as possible, and the way to do that is to fly the best speed for the conditions. Let's do some more math. With our generic model flying in still air at L/Dmax we will cruise at 17.4 knots and sink at about .696 knots. At max endurance we will cruise at 15 knots and sink at about .624 knots. Starting from 500 feet at L/D max, we will have about 431 seconds of airtime and cover some 12500 feet of air in our search. At max endurance, we will have about 480 seconds of air time but cover only 12000 feet of air. Statistically we have about a 4% better chance of finding lift by flying at max L/D. Not a tremendous advantage, and one which must be traded off against 49 seconds less air time if no lift is found, but if you are in a contest where you must max to win, there is no question about which is the best gamble. A 4% advantage is a tremendous advantage in most competitive sports.

The above is the simplest case. In real life we usually encounter sink while searching for lift. Let's assume a day where 1/2 of the air is neutral, 1/4 is going up at 3 knots, and 1/4 is coming down at 3 knots. Again Dilbert and Ace are going to go head to head. Dilbert will fly max endurance, while Ace will try to fly best speed for the conditions. Both pilots will fly a 6000 foot search pattern. Since we are playing God, we will make each pilot fly the neutral and sink air first before finding lift. Here is what happens: For the first 3000 feet in neutral air Dilbert loses 125 feet, while Ace, playing the odds at max L/D loses 120 feet. In the sink portion, Dilbert loses another 363 feet, and with only 12 feet of altitude, his plane disappears from sight. Dilbert lands out in a tree, and spends the remainder of the contest with a hatchet and rope trying to recover his £500 investment. Ace, on the other hand accelerates to best speed for the sink (about 30.6kts), cruises through losing a mere 250 feet of altitude and hits lift with 130 feet of altitude remaining. Ace circles confidently in lift and goes on to max the flight. Again, Dilbert's airplane has let him down. Probably the wrong aerofoil. Maybe a few hours

sitting in a tree in the hot sun will make it better.

The conclusion we must draw from all this analysis is that flying the right speed for the conditions makes the difference between winning and losing performances. Knowing what speed to fly, and flying it is one reason why a great pilot with a good plane will always beat a good pilot with a great plane.

Here are some hints that may help you in your quest for greatness:

1. Fly max endurance only when you have nowhere to go.

2. As the wind picks up, add about 1/2 the relative wind speed to your L/D max speed for best glide angle in any given direction relative to the wind. Do this only if you have a good reason to get somewhere upwind.

3. When you are flying through sink, add speed proportionately to the strength of the sink. Basically, get out of sink fast. Flying away from sink (or not flying in it at all) is even better than flying fast through it.

Since we have no instruments in R/C sailplanes which we can read, and since it is frequently quite difficult to estimate airspeed, we must rely on experience to tell us what speed is correct for conditions, and we should have good trim presets which allow the plane to attain these speeds with little pilot interference. There are some clues which you can use to estimate speed:

Attitude - in neutral air and steady flight, airspeed will be proportional to the nose attitude. The lower the nose, the faster you are going. Attitude can be misleading in lift and sink conditions or when you are wildly making stick inputs.

Responsiveness of controls - the faster you fly, the more responsive the controls become.

There are other indications which are of less utility. Wind noise - if you hear wind noise from your plane, you are either standing too close or going very, very fast.

Flutter and shedding parts - if control surfaces begin to vibrate and then to fall off, chances are you are/were going very fast.

Some Thoughts on Balancing your Plane

Now that you are convinced to fly max L/D or faster, you are probably thinking, "*&*!*, now I've got to go out and change the CG location on my plane so that I'm trimmed for L/D max." Wrong! It is an interesting fact, that when a plane is balanced properly for max endurance (with a clean wing), it is also balanced properly to attain L/D max (with the same aerofoil configuration). All you need to do to switch from one mode to the other is push/pull the nose over and trim in/out a few clicks on the elevator.

Unfortunately, if you have full span trailing edge camber, or just flaps, the world becomes more complicated. Max endurance is almost always attained with some degree of camber, and L/D max will probably require some reflex, or at least, flaps full up. So, now you are in an apples and oranges situation with two or more totally different aerofoil combinations to consider. Good reason to not worry excessively about the balance point of your model relative to L/Dmax or max endurance. Fact is that within the flyable balance range from dementedly unstable to unyieldingly stable, over-all

efficiency varies an amount which, given the way most of us fly, is inconsequential. It is far more critical to balance for the stability you need to fly the plane at altitude and distance, when you can't quite tell what it's doing, and for stability which will yield a good accurate spot landing. For example, our generic sailplane when balanced for max endurance will float out a flight less than 2% better than the same plane balanced so stably that your grandmother could fly it. So Dilbert floats out 12 more seconds on a ten minute flight. Big deal! He will probably get a 20 point landing, and eat up an additional 30 seconds air time in trying to control the plane coming way back from where he drifted downwind. One more point. On at least one occasion (probably more because I usually make the same mistake at least three times), I have balanced my plane with a rearward CG which seemed just stable enough on a nice still air day, only to find that when the wind and turbulence picked up that the plane was almost unflyable. Balance with a good margin of stability so that when conditions get bad you are ready for them. Landings will be more accurate, and air times will go up because less control input will be required and the model will fly more efficiently.

Conclusion: Fly faster than max endurance most of the time. Since you can't read airspeed while standing on the ground a half mile from your aeroplane you must practice a lot to be able to recognize and attain the appropriate speed for the conditions. Balance to attain the necessary stability to land accurately and to control the plane at a distance when conditions are bad. When it comes to maxing those flight times, the only factor more important than flying the right speed is being in the right place at the right time. Being in the right place at the right time frequently requires either sandbagging or psychic ability. Flying the right speed makes it more likely that all of us normal and fair minded types will be able to accomplish this feat

INDOOR TAKES OFF IN ABERDEEN

Report on two Indoor Flying meetings held in the Aberdeen Exhibition & Conference Centre 26th. February & 26th. March 1997

Interest in indoor flying in Aberdeen was first sparked off four years ago with the hiring of a small school hall by Aberdeen & District Soarers for the purpose of holding monthly meetings for various activities, which would include indoor flying, during the winter months. I set about building an Easy 'B' from Lew Gitlow's book on indoor planes and after first flights, it soon became clear that it would be possible to use the hall for indoor flying. Easy 'B's and Penny Planes were built by a small band of enthusiasts, and the necessary skills were developed to get these lightweight machines to fly successfully within the confines of the hall, getting them to circle tightly while climbing lazily to the ceiling. The hall also became the venue for the club's annual indoor glider competition culminating in the creation of lightweight structures which took about 15 seconds to fly the length of the hall from a hand launch.

This experience proved to be a good grounding for the two indoor flying events organised by ADS and held in the Aberdeen Exhibition & Conference Centre in February and March of this year. With 80,000 square feet of floor space and a 33 feet vertical clearance, hopes were high for a boost to this fascinating aspect of our hobby. Frantic activity just prior to the first of the two meetings found me involved in the mass production of Penny-Plane propellers (I found that a large dog-food can was just the right size for this!).

On my arrival there on the evening of 26th February, the Penny-Planes were already in action and the eminent suitability of this venue became immediately obvious. As the evening progressed many were reaching the dizzy heights of the roof beams, much to the delight of the many onlookers. In addition to the Penny-Planes, we had flights by other model types including chuck gliders, rubber duration, peanut scale, diesel (DC Bambi 020) and electric (KP01) power. My own attempt at RC indoor gliding (CETO micro-radio) had a measure of success. Highlights of the evening included the mass fly-off of Penny-Planes and Jim Ruxton's vertical take-off Penny-Plane getting stuck in the roof trusses!

Expectations that the second meeting on the 26th March would be just as enjoyable were reinforced by rumours that SAMS had been completely cleaned out of Penny-Planes within two days of the first meeting! The 26th March event was indeed just as enjoyable. Increased number of participants, models and spectators including wives and youngsters ensured another successful evening. I was particularly pleased to meet modellers from other clubs in the area and from as far afield as Banchory, Huntly, Stonehaven, Arbroath and Dundee. Other interesting models that evening included a rubber powered autogyro, two helicopters (Little Twister and the Penny-Helicopter), and a Microfly (micro-light design). My own KP01 powered 5-wing Whoopee had too much left trim for it to fly successfully - but next time? Other possibilities for future events could include CO2 flying, Round-The-Pole, or an ornithopter, or if you haven't much time for building, try a Loony Flyer!

With two successful meetings behind us, what are the prospects for further meets? well further meets there will be, but with the evenings stretching and thoughts turning once more to outdoor activities, there are no plans for meetings in the immediate future but it is anticipated that arrangements will be made with the AECC for a series of similar events beginning next autumn. Clubs will be kept informed.

Indoor flying is great fun, and anyone thinking about building an indoor flyer couldn't go far wrong with an Easy 'B' or a Penny-Plane. Although they are easy to build from plans, excellent kits are available from SAMS. They cost very little and can be put together in a few evenings. You can obtain a copy of the SAMS catalogue by sending £1.00 to SAMS at the following address:

SAMS

The Chapel

Sandon

Buntingford

Herts. SG9 OQJ

(tel. 01763 288384)

Have a browse through this catalogue and you're sure to be tempted into buying something, how about a Slow Poke, or a Flapping Flyer, or a peanut, or a Parlour Copter, or a .....

See you at the next meet

Mike Pirie

Tuesday Nights *flying* has commenced at Calder *Park*

As can be seen by the members who have turned up on Tuesdays we are getting more geared toward safety with winches being set, pilots boxes marked out and landing spots also marked.

A frequency board is also being used on most Tuesdays (when I remember to put it in the boot of my car.)The turn out has been varied with as many as 15 people turning out to fly and down to two, myself and Dave Curry on the Tuesday past (13/5/97) I think this was down to the fact that the weather did look rather grotty but by 7 o-clock flying conditions were nearly perfect.

Our first compettition night was on the last Tuesday of April the conditions were not perfect but a few brave souls decided to try competition flights the scores we have noted are as follows:

NORRIE KERR LEADING WITH 1500 POINTS

Ewan Munro with a very respectable 890 points this being only I think his second flight

Both Neil Masson and George Thomson on 850 points and myself propping up the table with 570 points (this flying a very heavy veron cobra yes it was Bob McCluskey).

But no real excuse as Neil was flying the same model himself not having finished his CALYPSO yet!!!!.

The next comp. night is on the 27th of May so please come along as we don't want to see Norrie winning a hundred quid do we.

Please accept my apologies if I missed anyone or your points are wrong as I m doing this from memory.

Also a quick mention for the slope nights we have on the first Tuesday of the month anyone interested meet at the car park at Brimmond hill. some one will be there.

The annual Hazelhead Flyin and competition on the 7th and 8th of June

The annual Hazelhead flyin and competition is to be held on the 7th and 8th of June.

The saturday allows anyone to fly any model power, electric, diesel gliders, freeflight (mike) all welcome as long as you have insurance.

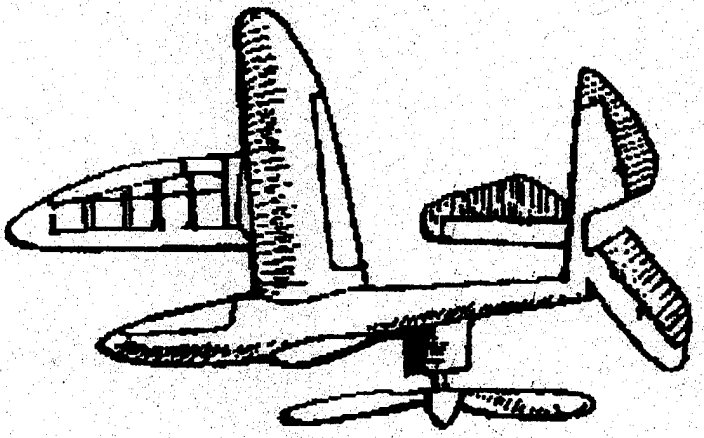
As in years gone by the sunday is competition day with the 100s and open comp.being held with an electric slot if there are enough participants.

As usual we will have coffee tea and a BBQ for all who come along.

So make a note in your diaries as we hope it will be a good weekend flying.

Tom Bartlett

If they really are diving for worms
tell me how they know where they are!



DESIGN FOR ELECTROSLOT 400
BY PABLO PICASSO