



free flight • vol libre

1/96
Feb/Mar



Liaison



1996 has already started and it will be a fun year with many interesting challenges in front of us, but first let us look at 1995 for a last time.

We turned fifty, and in a later edition we will see what you have done to celebrate that event. We had a very successful annual general meeting and nationals, both hosted by Gatineau Gliding Club. Cold Lake has been very busy with what appears to be a very well thought out competition. If the weather cooperates, it will be a super event.

Our membership reached 1291, a modest 3% increase over 1994, but an increase just the same. The membership meter on page 22 will show you some outstanding achievements by many clubs. Unfortunately, the end of the season was disastrous for accidents — two Blaniks and a single Grob got totalled. Our safety record *has* to improve!

Our goals for 1996 are: an improved safety record, ensure that potential changes within Transport Canada are in our best interests, more than 1325 members (our 1990–94 average), ensure our participation in the 1997 Worlds in France, have more direct board member involvement in committees, and help restructure the Aero Club of Canada to ensure its survival but at a price we can afford.

I am sure that you are busy nursing your birds, because by the time you read this, the 1996 season will be just about to start.

J'ai eu plusieurs commentaires relativement au manque de matériel en français dans notre magazine. En fait très souvent nous manquons de matériel en général, et notre éditeur doit puiser dans des articles parus dans d'autres revues du même genre, généralement les publications d'Australie, Angleterre et autres. Tony publie tout ce qu'il reçoit en français alors, allez y gaiement!

J'ai aussi eu des commentaires quant à la pertinence de traduire SOAR quand on a accès au manuel de la Fédération Française de Vol à Voile. Premièrement, cette demande de ma part n'est pas un vote de blâme quant à la qualité de ce dernier document.

Cependant SOAR reflète les procédures et réglementations utilisées au Canada et qui peuvent être différentes de ce qui se fait en Europe. Toutefois SOAR a la qualité être plus direct. Notre objectif est aussi de l'offrir au même prix que la version anglaise, soit environ \$20. Le manuel de la FFVV coûte plus de \$50. C'est toutefois un excellent ouvrage de référence, moins austère que certains autres bouquins sur ce sujet.

Pierre Pepin president

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The journal of the Soaring Association of Canada
Le journal de l'Association Canadienne de Vol à Voile

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Cover

Dave Webb on final at the World contest in 1991 in his DG-300.

A correction on the cover of the last issue, it was Paul Scott in Edmonton's ASW-15, not Chester Zwarych in his DG-202.

More than two cents worth!

Svein Hubinette responds in spades to Pierre Pepin's request for feedback.

In the last issue of *free flight*, Pierre asks whether anyone has any opinions on SAC matters. Of course — we all do, the problem is finding a forum where people can freely, easily and preferably instantaneously exchange ideas and opinions and feel that their input is listened to. Certainly *free flight* should be an important part, but it also has to be a two way dialogue and I have seen very little on what tasks our committees and board members are engaged in and their accomplishments and progress. To name a few:

- 1 The resolution at 1993 AGM to actively increase SAC membership and clubs.
- 2 At the 1994 AGM we were told SAC had a committee to deal with issues relating to Transport Canada. I'm sure the committee is working hard on our behalf, but nothing has appeared in the five issues of *free flight* published since then. Instead, our only source of information has been from the press, the Canadian Owners and Pilots Association and the Recreational Aircraft Association, and they are not dealing with our issues.
- 3 Internet — this is possibly the most significant communication tool ever. Some clubs have set up their own "home pages" and have done a good job of it, but a central SAC site is sorely missing. Canada is one of the most "wired" countries so we really should be ahead of the game. A popular home site could expect thousands of "visits" per year. If anybody is willing to set up a site I'm willing to give my two cents as to content and layout. (For a good introduction to other countries' soaring Net sites, look at my list [on page 7]. I propose that SAC immediately set up a permanent home site to provide a central source on the Canadian soaring scene including forums, news and advertising. (See a response to this on page 23. ed) With the amount of "visitors" we can expect, I feel it will not be difficult to get sponsors so we might even turn a profit! The SAC national office and *free flight* editor must be on-line. This will make it much easier to communicate — articles, photos and graphics can be sent instantly through e-mail and reduce the work load of our editor and allow him to concentrate on more productive tasks. It should also do much to promote Canadian content in *free flight* (another problem Pierre mentioned).
- 4 I feel we and most other aviation groups in Canada do a poor job of cooperating and the Aero Club of Canada situation proves it. We all tend to put on our blinkers to try and ignore what goes on around us. Think what we could accomplish with more cooperation/integration as is successfully done in other countries.
- 5 There is the common feeling that SAC doesn't do anything for its members and this was reinforced in many MSC members' opinion when we single-handedly had to take on the task of dealing with airspace and glider licensing issues with Transport Canada.

On a brighter note, I'm very happy to hear that Jim McCollum is taking up an executive position in our head office and I hope his talents will strengthen SAC.

That we may have a national team again is also very positive and I wish all those involved the best of luck. Although the Canadian Advanced Soaring group is positive for the movement, I feel it must strive for wider membership which the current \$25 subscription does not do. Why not lower the fee and make it optional in addition to the SAC fee, so one T4 slip could be issued. The FAI sporting licence should also be integrated with this. With a wider membership base you should also be able to reduce the entry fees for competition pilots. The aims of the group are good and to make membership more attractive I suggest they add two more items to their objectives (do it and I will join!):

- A Canada Cup: Many countries have a series of mini-competitions held throughout the season at different locations. They usually take place over a weekend allowing more pilots to compete. I suggest four to five be held annually and evenly geographically located. Each contest winner would be declared and the overall scores be computed on a best of (say) three competitions. The overall results would count towards national seeding.
- To make the membership more attractive, badge flying should be actively promoted.

On the issue of membership involvement, I feel it would help if elections were more open (and dare I say democratic!). I propose that the president be elected by mail-in ballot with the precondition that candidates would have to submit a resumé including why → p7



The SOARING ASSOCIATION of CANADA

is a non-profit organization of enthusiasts who seek to foster and promote all phases of gliding and soaring on a national and international basis. The association is a member of the Aero Club of Canada (ACC), the Canadian national aero club representing Canada in the Fédération Aéronautique Internationale (FAI), the world sport aviation governing body composed of national aero clubs. The ACC delegates to SAC the supervision of FAI-related soaring activities such as competition sanctions, issuing FAI badges, record attempts, and the selection of a Canadian team for the biennial World soaring championships.

free flight is the official journal of SAC.

Material published in *free flight* is contributed by individuals or clubs for the enjoyment of Canadian soaring enthusiasts. The accuracy of the material is the responsibility of the contributor. No payment is offered for submitted material. All individuals and clubs are invited to contribute articles, reports, club activities, and photos of soaring interest. A 3.5" disk copy of text in any common word processing format is welcome (Macintosh preferred, DOS is ok in ASCII text). All material is subject to editing to the space requirements and the quality standards of the magazine.

Prints in B&W or colour are required. No slides or negatives please.

free flight also serves as a forum for opinion on soaring matters and will publish letters to the editor as space permits. Publication of ideas and opinion in *free flight* does not imply endorsement by SAC. Correspondents who wish formal action on their concerns should contact their SAC Zone Director whose name and address is listed in the magazine.

The contents of *free flight* may be reprinted; however, SAC requests that both the magazine and the author be given acknowledgement.

For change of address and subscriptions to non-SAC members (\$20 per year, US\$22 in USA, and US\$26 overseas - extended subscriptions available at cost savings), please contact the National Office, address below.

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L'ASSOCIATION CANADIENNE DE VOL A VOILE

est une organisation à but non lucratif formée de personnes enthousiastes cherchant à développer et à promouvoir le vol à voile sous toutes ses formes sur une base nationale et internationale. L'association est membre de l'Aéro Club du Canada (ACC) représentant le Canada au sein de la Fédération Aéronautique Internationale (FAI), administration formée des aéro clubs nationaux responsables des sports aériens à l'échelle mondiale. Selon les normes de la FAI, l'ACC a délégué à l'Association Canadienne de Vol à Voile la supervision des activités de vol à voile telles que tentatives de records, sanctions des compétitions, délivrance des brevets de la FAI etc. ainsi que la sélection d'une équipe nationale pour les championnats mondiaux biennaux de vol à voile.

vol libre est le journal officiel de l'ACVV.

Les articles publiés dans *vol libre* sont des contributions dues à la gracieuseté d'individus ou de groupes enthousiastes du vol à voile. Le contenu des articles soumis est la responsabilité exclusive de leurs auteurs. Aucune compensation financière n'est offerte pour la fourniture d'un article. Chacun est invité à participer à la réalisation de la revue, soit par reportages, échanges d'opinions, activités dans le club, etc. Le texte peut être soumis sur disquette de format 3.5" sous n'importe quel format de traitement de texte bien que l'éditeur préfère le format Macintosh (DOS est acceptable). Les articles seront publiés selon l'espace disponible. Les textes et les photos seront soumis à la rédaction et, dépendant de leur intérêt, seront insérés dans la revue.

Les épreuves de photo en noir et blanc ou couleur sont requises; pas de diapositives ni de négatifs s'il vous plaît.

L'exactitude des articles publiés est la responsabilité des auteurs et ne saurait en aucun cas engager celle de la revue *vol libre*, ni celle de l'ACVV ni refléter leurs idées. Toute personne désirant faire des représentations sur un sujet précis auprès de l'ACVV devra s'adresser au directeur régional de l'ACVV dont le nom apparaît dans la revue.

Les articles de *vol libre* peuvent être reproduits librement, mais la mention du nom de la revue et de l'auteur serait grandement appréciée.

Pour changements d'adresse et abonnements aux non membres de l'ACVV (\$20 par an, EU\$22 dans les Etats Unis, et EU\$26 outre-mer) veuillez contacter le bureau national à l'adresse qui apparaît au bas de la page à gauche.

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Letters & Opinions

FF ARTICLES FROM QUEBECKERS

First I'd like to wish you a happy New Year, good health, and for all members of SAC a season of fun-filled and safe soaring.

This afternoon I was talking with Pierre Pepin and I asked him what the reason was for not reading about the flying experiences of Quebec pilots. I believed that only articles written in English were published. Pierre assured me that [was not the case] ... but then why? Perhaps French members thought like I do, so maybe they could be reminded in *free flight* that they're also part of this world. I hope to read about pilots from this side of the planet in the future.

Also, could you kindly ask writers to fully describe the meaning of abbreviations such as AGM, WGC, CAS, GPS, FAI and others which appear in technical material. In our club (Association de Vol à Voile Champlain) I guess 15-20% of members, including yours truly, are new and have little aeronautical exposure. *free flight* would be appreciated more if the content were fully understood.

Rudi Hupperetz

This editor is as desperate as all others to get material from pilots, and Canadian stories for free flight are always welcome. I do print French language articles and club news but receive very few of them.

Mon expertise en français est extrêmement limitée. Je vous demande d'être très diligent et de vous assurer que vos textes sont grammaticalement corrects. Un bon moyen est de vous faire relire par un tiers. Les gens qui écrivent, en général, ne voient pas leurs fautes. Si vous croyez que l'article pourrait être intéressant pour les membres du Canada anglais, j'apprécierais si vous pouviez m'envoyer un court résumé en anglais.

It's my job to make sure uncommon acronyms and abbreviations are spelled out prior to use. Since knowing what they say doesn't always mean they are understood, I will be more diligent in explaining them. Of course, every group has its own jargon, and there is a lot in aviation, so free flight assumes that SAC members have absorbed some basic "common knowledge" through training and from other experienced pilots. Ask around if some term puzzles you. Tony

IS BEING DRAB OUR PROBLEM?

I write in response to some of the comments in issue 6/95 of *free flight*. Pierre noted recruiting is of concern. This is not a new issue, I have been impressed by the success that the Canadian Sport Parachuting Association has had in increasing their

membership over the past two years. There are many parallels in the history of SAC and the CSPA. Like SAC, CSPA was once part of Sports Canada. They were more successful with paid Technical and Executive Directors, subsidized offices, and trips to compete elsewhere and so on. This relationship came to an end as it did for SAC. And membership declined. But then it began to grow, slowly, until now, they have passed the membership level of SAC and are perilously close to 2000 members. What is obvious about their success to an outsider ... me:

Participation in everything. Hundreds will turn out for their AGM. They party a lot and they "boogie" (jump) a lot. They are enthusiastic. Five jumps a day every weekend are common. At \$20 a leap, it makes our tow costs ridiculous. Everyone, it seems, owns their own equipment (save for beginners) and, at about \$4000 plus taxes, it is a starting barrier. Yet there seems to be a thriving market — parachutes wear out.

Communication They have a thick, thriving communications channel, a magazine called *CANPARA*. Lots of colour in every issue, full of gossip, some really wild articles. And pictures, lots of pictures. Stories of trips and activities everywhere with lots of videos.

Joie de vivre They dress wildly, with colour. Lots. Canopies are brilliant. See the hang gliding crowd too. Yes, they are young; isn't that what we need? Grunge is not their wardrobe or their lifestyle. This year, as a lead into the 1997 World Air Games, Turkey is proposing to host the World Cup for Aerial Freestyle and Skysurfing Championships. And parachuting is expected to be in the next summer World Games in Helsinki.

Competition The Aero Club issues more FAI sporting licences to CSPA than any other organization. All of their competitions require a sporting licence to participate.

These are the issues, the items that strike me every time I am involved with the parachuting community. Yes, they are concerned about safety. Yes, they are worried about standards of operation of their jump zones. And the standard of training of parachutists, especially now that they have converted completely to the ram tube type of parachute that almost have the glide ratio of a "primary". And that's, of course, the next step... parapente — a convergence of canopy with hang gliding that now is converging with soaring. And yes, they are worried about costs. They have a full time office with 1.5 people; needing two. It is alive.

My point? We need to look outside of our world. Do we dress drably because we are drab? Are we so concerned → **next page**

Letters and Opinions continued

about costs that we are cheap? Are we afraid to spend money to brighten up and modernize our facilities (including aircraft) because there is risk? The heightened interest we are seeing in cross-country flying and competition is a result of the determination of a few around 15 years ago not to let competition die. We need more of that outward looking determination and courage, in all aspects of our sport. How about it?

Bob Carlson

Al MacDonald, an experienced jumper with his feet in flying too, was shown Bob's letter and asked to give his perspective on the differences and similarities of each sport.

I have spent over twenty years around parachutists as a jumper (1500), a jump pilot (1000 hours), and jump equipment manufacturer (15 years). I have also had several glider rides (even one with your editor), watched two SAC Nationals, given parachute seminars to glider pilots, and dealt with a number of SAC members and clubs who have purchased equipment from me.

I think Bob has spent time around jumpers as his observations are quite accurate. Bob's letter got me thinking of a few differences I've observed between our groups.

Thrills Skydivers like adrenalin, and skydiving supplies that in huge doses. As a pilot (powered only) I have always said, "Flying is fun, but skydiving is exciting. When flying becomes exciting, I don't want any part of it!" I don't see most soaring pilots looking for that kind of excitement. I suppose those wanting adrenalin could always do aerobatics or tight formation work (wing overlap preferable for the best buzz).

Participation Freefall formation flying is exhilarating and a great thing to share with your friends; it helps to promote strong bonds. It's also great material for comparing the "there I was ..." stories around the campfire party that evening. Once airborne, soaring seems to be more of a solo event.

Cost It appears there are similar costs for a student of either sport to acquire their first licence. Although top of the line parachute equipment may cost \$6000, you can start off with safe equipment for \$1000 — hardly comparable to the cost of owning your own sailplane. The "C of A" inspection for parachute equipment might run \$50 — again, hardly comparable. Most people would find it hard to drop \$2-300 per weekend for their sport — the adrenalin and lifestyle of skydiving make it more of a priority for many jumpers to set aside that money.

The long haul Skydivers mostly start young, often during high school. The carefree attitude of youth shows here. Perhaps 95% of students have no intention of trying more than one or two jumps. For those who are bitten, the standard scenario is a 2-3 year stint of eat/sleep/breathe skydiving, amass a

lot of jumps and experience, then either burn out or do the married with children thing. When I started in 1973 the average age was 18, now it is about 30. I guess a few of us are hanging in — with aviation costs soaring (sorry), skydivers are now more trades people and professionals. I've always seen soaring pilots as mostly middle aged and financially well established.

Clubs Although the Canadian Sport Parachuting Association was originally a group of clubs, it is now mainly a group of commercial centres. A large centre can train 1500 first jumpers in a year, so if that centre affiliates with CSPA we get huge boosts in membership. Clubs cannot seriously compete with profit-driven commercial enterprises.

The magazine Many jumpers view their *CANPARA* magazine as the main benefit of belonging to CSPA. It is great that the membership is large enough and significant equipment advertising can support some colour and thickness to this magazine.

A photographer's goal is to capture not only an *event* but also a *feeling* on film; skydiving offers opportunities of intense feeling. Although I don't see that same intensity in soaring, all pilots see things that provoke emotion — all that is needed is the desire to capture that on film. How about a photo contest?

Time Skydivers need less technical knowledge compared to piloting aircraft. They want to pay their money, get into an airplane, and step out at altitude — period. Soaring is a very time-intensive sport and pilots must put in a large amount of ground-work for each hour flown.

The bottom line The points outlined above make our two sports attractive to different types of people. I see soaring as less intense but perhaps more sophisticated. Personally, I have purposely stayed away from soaring as it is yet another "3D" sport I could get hooked on immediately.

Al MacDonald
CSPA Life Member

Now a few words about the status of the Aero Club of Canada from Bob Carlson

When ACC started, it inherited an annual \$25,000 grant from Transport Canada which had gone to the organization it replaced, and the Swiss Franc, the currency of the FAI, cost only 82 cents to buy.

As of March 1995 there is no grant, and it takes about \$1.18 to \$1.40 to buy a Swiss Franc. The FAI fee for Canada levelled out at CHF30,700 four years ago. This converts to around \$36,200 at the current 1.18 rate. The most the ACC has received from *all* the member societies, annually, has been \$25,000. The net costs of the ACC have been about \$19,000. The result has been a reduction of assets. We are, at this time, in a critical state.

To add complication, the Model Aeronautics Association of Canada has resigned. This adds to the individual financial burden, at least in theory. I do believe that in a while, Phoenix-like, a redirected Model organization will arise.

We have tried twice to have our FAI fee reduced. Both times our proposal has been rejected. Unfortunately, since only the modellers and power pilots have supplied requested activity information, we have no data to support our hardship claim. Canada is in the "Group of Seven" and is one of the ten largest economies in the world.

The FAI looks at us and has said bluntly, "your members cannot afford the cost of four cups of coffee each year to belong to the FAI?"

Unless there is a National Airsport Control (NAC) or National Aero Club, you cannot belong to the FAI and participate in its competition, achievement and proficiency programs and awards or Olympic or World Games. Every country has one, and the ACC is the NAC for Canada.

The FAI is not interested in a change. Nevertheless, because of the critique we have made of their process, a serious review has begun of the way in which the fee structure of the FAI is defined. There is no guarantee that we will see relief — especially without statistics.

What we are trying to do is to reinvent the fee structure of the ACC. There is a belief that the individuals who need/benefit from the opportunities provided by the FAI should, in proportion, contribute relative to the level of the benefit received.

In short, the ACC is hurting. There is a good group of people from all of the associations working to resolve the problems.

Finally, if you question the value of the FAI and the ACC, consider all of those in soaring, hang gliding and ultralights who almost lost the category IV medical this year. The "why" is complicated. The rescue came because of the resources of an FAI medical commission doctor in Wales, the Canadian member of that commission, Dr. Peter Perry, and the leadership of the ACC in the discussions, negotiations and meetings with Health & Welfare and Transport.

LOOKING FOR LK-10A HISTORY

Herrie ten Cate is attempting to write a history of his LK-10A, C-FZAJ, and he is looking for any old photos and documentation of this ship and its sister, C-FZAK, which were based in Kingston, ON from the late 40s to the early 90s.

Pilots, especially those who flew at Rideau Gliding Club, who have any material of use to Herrie may contact him at (416) 205-3339 (fax), (416) 205-2646 (phone), or e-mail htencate@toronto.cbc.ca

FREE FLIGHT SEXIST?

I always look forward to receiving my copy of *free flight* in the mail. It has given me much reading pleasure in the past. Just yesterday, I received my copy of the October/November issue and much to my disappointment, I came across your cartoon which shows a woman in a glider suggesting that the only reason why she might take up the sport is because of being in the presence of the opposite sex.

Now some might say that I'm a prude [or] that I need to "get a life", but as a solo pilot and a female, I took strong offense to this cartoon.

As a long time member of an Air Cadet squadron, I have always had a strong passion for flying. I was able to realize my dream in the summer of 1994 when I joined the Erin Soaring Club. I started soaring in May and I soloed in September that same year. Your cartoon implies that women take

up this wonderful sport simply to meet men. This is very unfair! I feel that you have insulted women as well as the sport of soaring. You should be ashamed of yourself to even consider printing this offensive comic. I hope in the future you will give more thought to what you choose to print. An apology couldn't hurt either.

Valerie Jamieson

Congratulations on having made a good start in the sport, Valerie, but have another look at the cartoon. Do you really believe the young lady thinks that the total grub stepping into the back seat is cute?? Now that would be unfair to women.

Perhaps the more probable interpretation is that "Tenrag" is taking a dig at the general sartorial state of the men in gliding clubs. But then that still makes the cartoon sexist, doesn't it? Almost by definition humour, to some degree, offends its subject. Tony

SAC HISTORIAN FROM OTTAWA AREA WANTED

The SAC board had candidates for a number of committee chairmanships, but has received no suggestions for Historian. Since this committee does not deal with pressing issues, there is a danger that it could remain vacant for an extended period. This would be a shame since it is useful to document our activities and we run the risk of losing the opportunity to do so. The job, of course, is whatever the person wants to make of it, but one of the main things is an interest in the history of the sport and a willingness to do a bit of writing and organizing of documents. If you can be this person, please contact the SAC office. Since most of soaring's historical material is in the National Archives, the Historian really needs to be in the Ottawa area.

Jim McCollum, Executive Director

More than two cents worth!

from page 4

they seek the position and what their aims and objectives are. This way we can have a more open debate and elect those we feel will serve us and soaring best. I would leave the election process for zone directors up to each zone — there is enough other SAC business to take care of at the AGM! This will increase the size of the board by one, but I don't think the current rule of electing one of the directors to president is fair to

him/her or to his local 'constituents' and one cannot expect him/her to do both jobs equally well. I'm sure the current incumbent would agree! Lastly, on the paid SAC position, I don't remember any national office positions ever being advertised in *free flight*. I think this should be mandatory prior to going outside, with SAC members given preference.

Svein Hubinette

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more about soaring on the Net:

Royal Canadian Air Cadets	http://www.isinet.com/smacdougarcac/rcac.html
Australian Soaring home page	http://aus-soaring.on.net/soaring
Danish Soaring Assn web page	http://www.datashopper.dk/~arbo/DSvU/dksoar.html
Norwegian Aero Club	http://www.stud.unit.no/studorg/nthsfk/nak/nak.html
Soaring Society of South Africa	http://www.pix.za/soaring/ssahome.html
Swedish Soaring Federation	http://www.segelflyget.se/
Swiss Soaring Association	http://ezinfo.ethz.ch/eth/afg/sfvs/sfvs_e.html
Soaring Society of America	http://acro.harward.edu/SSA/ssa_homepg.html

For those not familiar with the Net, these sites will lead to others such as the news forum *rec.aviation.soaring*. A list of over 1600 glider pilots e-mail addresses is found (you can add yourself) at: <http://www.research.digital.com/CRL/personal/tuttle/aviation/email.html> Other sites are available for all aviation topics including homebuilts, weather maps etc, not to mention general interest topics — let your imagination run wild. All this for a small monthly fee (\$15 in my case) and a computer with a 14.4 or 28.8 kB modem. You can even chat or talk long distance for free!

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PRAIRIE Zone

vacant

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Gaggle flying

Terry Cubley

from *Australian Gliding*

GAGGLE FLYING is looked on with some disdain by a large number of people. Many deny that they use gaggles much and many complain when they are forced to use them. Irrespective of this opinion, many competitions involve some amount of gaggle flying and often a poor result on these days can lose you the competition. Often you will not grab a huge number of points over your close rivals, but you can certainly lose a heap if you do it wrong. There are a number of techniques and tactics which can be learned and developed which can increase your performance in these situations.

Why gaggle flying? On days when it is blue, when thermals are more difficult to centre and when convection heights are lower, it is often faster to fly with a gaggle. The purist will avoid this and the really good ones will probably do quite well on their own. You have to consider the risk however of missing out when on your own and losing a lot of time. Good gaggle fliers need to have the ability to fly on their own, to enable them to leave the gaggle at some stage of the flight without dropping out of the bottom and having to catch up again. The signs of a real gaggle day are:

- when you head off by yourself, the gaggle flies over the top a few minutes later;
- you gradually pick up the strugglers as you progress on track.

These days can result in quite a large gaggle, especially as you pass turnpoints. The days are won at the start and finish and only the ones who fall out really lose any significant number of points.

Prestart The main time when gaggles occur is before the start. Of course, you don't lose any points, but these gaggles are important, particularly just prior to the start. Thermalling pre-start can be a little riskier as people approach from a large number of directions and quite often do not leave when they reach the top, prepared to wait it out even if the lift stops. This leads to people getting a lot closer, more crowding, flatter angles of bank, people coming up from below, people turning inside, etc.

The obvious thing to do is to leave and find your own thermal, but if you are getting close to the start time you risk missing a thermal and getting low, just when everyone else decides to leave. To avoid this it is often better to leave the top of the thermal, fly away and then come back in again 500 feet lower in the clear airspace. This also puts you in a good position to watch the rest of the gaggle start and then continue

climbing to start a couple of minutes behind them.

On-track thermalling The gaggle will not work if flown at too flat an angle of bank. If you are the only one who flies flat, then you will fall out quite quickly. If this happens to you all the time then you need to develop your thermalling technique to a higher standard.

Rate of turn, speed control, and wing loading all affect how you fit into the circle. You need to watch other gliders and control these variables to reduce any conflict. This also lets you see where the best part of the thermal is, and move the circle to suit. Provided everyone else is watching you, the whole gaggle will move into the better part of the thermal. If someone is not watching then you'll have some avoiding to do.

You need to consider the other pilots, but if you're too polite and make way for everyone else you will soon fall out the bottom again. You need to develop an assertive position in the gaggle. If you want to out-climb the gaggle then you may need to be even more aggressive, but this is fraught with danger and assumes that everyone else will give way. This approach usually involves a number of people having a quiet word with you. It is exciting when two aggressive people are in the same thermal!

On track, the gaggle may not be climbing all that well sometimes and you will be tempted to head off and find something better. This will result in you either moving to the top of the gaggle, falling out completely, or disappearing while the gaggle gets home twenty minutes ahead of you. You need to consider the risks at this stage of the flight. If you are close to final glide you may decide to stay with the gaggle and get into a good position to win the day.

On a number of occasions I've left a 4 knot gaggle to find the next climb at 6 knots, only to have the gaggle fly over the top of me. Unless you are convinced that the gaggle is a bad one, it is often good tactics to put up with a poorer climb rate for a short period of time.

How to catch a gaggle Starting a few minutes behind the gaggle is often a good tactic, but this leads to the well-recorded start gate tactics with no one being prepared to leave. If no one leaves and you all land out on the way home there is no penalty for this. Unfortunately there is always somebody who leaves on their own and is home and tied down by the time you are landing out. (The use of a multiple start gate in national championships has reduced this problem a little.)

If you lose five minutes in the first 50 km through starting first and being caught up, it is not the end of the world. You still have a lot of opportunity to make up the difference — but it is better if you have caught up five minutes on the others. If you start five minutes after somebody and they are cruising at 80 knots, they will be 12.1 km ahead of you, so you have a lot of catching to do. Ten minutes is 25 km which means you won't see them at all.

If there is a continual stream of gliders on course, then you can pick them off one at a time and gradually catch up to the ones ahead. If they have gone in a group then you have some hard flying to do to catch them, as they are already working as a gaggle. Some aggressive flying is required, being very particular about the thermals you are prepared to take. If you use the same 5 knot thermal as the gaggle, you will be 2500 feet below them when you enter and you have to hope that the thermal is still working. You will probably spot them climbing when they are still 6–7 km away, provided the visibility is good.

Catching a gaggle implies that you have picked up a good thermal which they have missed, or you are able to use the same thermals but have not had to spend time centering them. If the latter is true then it will take a long time to pick up the difference. You will be helped by the people who are falling out of the bottom of the gaggle, providing the vital contacts as to the location of the thermal.

If you push too hard to reach their thermal by going low, you risk missing the bottom and then floundering around abusing yourself while they fly into the sunset. So, don't be too impatient. By using their thermals which are marked so you center faster, by not having to compete with the gaggle for the centre of the lift, by leaving the instant the thermals weaken (whereas the gaggle usually wastes a little bit of time at the top), and by being constantly on the lookout for that extra good thermal which they have missed, you will gradually catch up and become one with the hordes.

Getting away from the gaggle This is a little more difficult and you need to be sure that you really do want to get away. If it is early in the flight then it may be worth staying put until you have worked out the lift patterns for the day. The main reasons for getting away are:

- final glide is approaching and you are confident of the last climb and want to get a jump on the crowd;
- you are convinced that the gaggle is too slow or too crowded;
- you hope to catch a gaggle which is ahead;
- you are convinced that you are faster on your own.

To get away usually requires that you be at the top of the gaggle. To do it by leading out requires that you are able to fly ⇒ p13

Making your own canopy

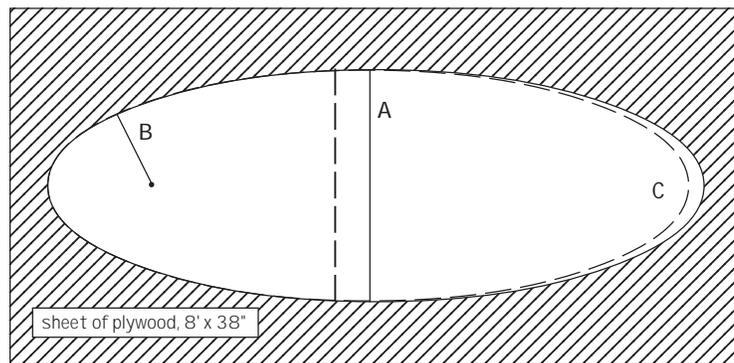
Paul Moffat

Winnipeg Gliding Club

THEY SAID it couldn't be done, but I went ahead anyway. Two versions were tried, before a winning combination worked. The first trial was with a chamber that heated the plastic from one side and drew the plastic sheet into a vacuum chamber/form. This failed since the heat was too uneven, so hot spots developed that allowed the plastic to blow out at the hotter location. I tried several times, using plastic cutoff parts from the plastic supplier at a discount. After six tries that ended when the cabinet threatened to implode with the draw being only a third of what was wanted, I decided to go a different route.

A series of articles in *SOARING* and *free flight* had suggested the use of the oven approach, so I decided to give it a try. It made sense to heat the entire sheet, then use compressed air rather than a vacuum to form the bubble. I built an oven that was 4x4x10 feet in size, made of 1x4 lumber and Masonite sheets. This would allow a canopy up to 38 inches by 8 feet to be blown. The interior was lined with three inches of fibreglass batting, held in place with chicken wire.

A central "fire tube" was placed down the center, lengthwise for the heat entry points, and heated with a Tiger Torch. The tube is a length of 6" heating duct with slots cut into it about 18" apart to allow heat to be released evenly within the oven. The sheet that held the canopy forms was placed about 13 inches from the base; the heat was un-



The form with the cutout about the shape of the canopy edge. A is the actual canopy width, B is the radius (canopy height desired), and end C is extended somewhat so that the front of your trimmed canopy is not too vertical (porpoised, see photo above). Two small canopies can be made using both ends.

derneath the plywood sheet, and the air circulated around the box. A fan kept the air moving inside. Also, at the end near the torch was a dial temperature gauge to monitor the temperature near the plywood sheet level (for forming, a temperature of 315–325°F is required).

The form was a full 4'x8' plywood sheet, ripped to 38" wide, with the excess material forming the several pieces of the edge clamp. This clamp is cut to the outline of the desired canopy. About 100 drywall screws were used to clamp the plastic sheet to the plywood. The air inlet was from the bottom of the sheet, near the center.

I also had a window at the midpoint of the oven so I could watch the forming process. The window I used was from an old quartz/halogen floodlight that could take the heat.

The other thing to keep in mind when making a canopy, is that the curve *does not* follow the frame opening in the glider! What must be remembered is that the curve is a free blown bubble and the HEIGHT of the plastic equals the RADIUS on the form. If the canopy is to be 18" high at the top of the curve, then the form must be 36" wide. The plastic is drawn in when it is fitted to the canopy frame and will flatten slightly.

The forming is symmetric, so two canopies may be formed simultaneously in one pass with a careful layout. Keep in mind that the



The test canopy is a success! Paul Moffat on left, Jim Cook on right

process doesn't always obey the rules. The canopy will blow higher in the areas that are hotter, so *even* heat is required.

Rules to Follow

- Make form larger than you need. You will find a useable shape somewhere in the bubble.
- Heat evenly. A hot or cold

spot will distort the shapes with uneven curvature.

- Final thickness is about 1/2 of original. 3/16" sheet will thin to 1/8" (in theory) — in practise the sheet will be thinnest at greatest distance and thicker towards the edges. A 3/16" sheet is generally all that is needed for most canopies and 1/4" for the largest (ie. 2–33 sized).
- Use a hanging gauge inside the oven at the desired height. When the plastic just touches it, you are done. Locate this in an area you intend to cut off, or just barely touch when blowing is in a required zone.
- A small air compressor is all that is needed, and a needle valve with a low pressure gauge to monitor the pressure in the canopy bubble.

Procedures that WORK

- Clamp the plastic securely to the base ply, and test for air leaks. This stage is very important as it determines the amount of air needed and the flow rate. You want to have the sheet hold its own without loss of pressure. Too fast an airflow to compensate for leaks will cause a cold spot on the canopy.
- Heat oven to 315–325°F and hold for 30 minutes for 3/16" sheets, 45 minutes for 1/4" sheets. Use just enough air pressure to lift the sheet off the base ply. This keeps the plywood grain from imprinting the sheet. Don't use too much pressure or the sheet will rise prematurely, with a possible hot spot blowout. 3/4 psi is all that is needed.
- Hold the heat with the fans OFF to allow for hot spot dissipation, 5 to 10 minutes; use just enough heat to maintain the temperature.
- Heat OFF and blow carefully; you will need only 12–20 psi of air pressure or less. Proceed at a medium rate until the height is reached. Then open the oven and allow to cool. Use the air pressure to hold the shape until firm (you can test the firmness at a lower edge with your fingers). When firm, the air pressure may be turned off.
- Remove all the plywood form clamps quickly to avoid stress cracks being generated at the clamp holes — an 8 foot ⇒ 24

QUICK! Tie me kangaroo down

Dave Hennigar, Winnipeg

WHAT THE DEVIL IS GOING ON? It's noisy, it's black, the building is shaking, what's going on and where am I? Okay — finally found the pull string and the light is on; yes I'm in my "hut" in Benalla, Australia, but why all the shaking and noise? Storms like this aren't supposed to happen in this part of OZ.

A few details are necessary to set the scene of my confusion and consternation. The Gliding Club of Victoria (200 kilometres northeast of Melbourne), is a friendly place to hide from Manitoba weather and get in good gliding in pleasant surroundings. The club is a full time operation with weekday courses and cross-country flying with staff looking after things. Friday night the club members arrive to take over the weekend operation. During the good flying season there is plenty of company around the club house, both "locals" and pilots from all over the world.

The previous week we had been flying a lot so the invasion of club members Friday night was welcome — Saturday and Sunday would be rest days. Early Saturday was spent catching up on the gossip, doing laundry and cleaning up the hut. The conditions were not great (you should have been here yesterday!) so I was roped in on a couple of nearby retrieves. After some more gossip and a pleasant meal it was off to bed for another good night's rest.

Back to the Saturday night fright. Two small rooms in a 50+ year old RAAF hut beside a tree do not provide many safe places to take cover. The bed was too low to get under, no basement and no bathtub, so I was left standing in the doorway under a two-by-four of the half-wall. The wind was blowing harder than I'd ever heard before and then increased dramatically, accompanied by thunder and flashes of lightening. About this time the top-hinged ventilators above the windows started banging and you could feel very strong pressure surges on the eardrums, then the lights went out and there was a loud crash.

Suddenly the room was filled with wind, rain, hail and shredded leaves. A smart retreat to the kitchen was carried out with some improvement in living conditions. The wind then dropped off as fast as it had come blasting in. After grovelling around for the flashlight and checking for damage, my heartbeat settled down to near normal. Things seemed to be in fairly good shape

except for the bedroom which was wet and covered in bits of leaves. There was still some wind and rain coming in the window so I pulled the drapes aside and reached to close the window, reached further and there it was — gone — hinges torn out. Very shortly the wind was almost calm; the window could wait. Checking around (as well as you can with a penlight) and, thankfully, finding that there were no injuries and no serious damage in the camp area, bed seemed to be the best place on a dark and wet night.

Sunday morning was bright and sunny. Riding over to the clubhouse entailed several detours around very large gum trees, now horizontal. Fortunately, the power was back on so a good breakfast was in order before starting the clean-up.

The club aircraft were all undamaged inside the good sturdy hangars. One empty glider trailer, not securely tied down, was demolished. A light aircraft parked nearby (not tied down) apparently weathercocked into wind and was blown 100 metres to the grass at the edge of the ramp and was undamaged! The piecart (a mobile flight office) had been recently rebuilt but now had the corners rounded off and had to be written off. All was not lost, the radio was salvaged along with the OZ sense of humour — the piecart was awarded a solo certificate and received summonses for flying in the hours of darkness and for unauthorized aerobatics.

The glider trailer park and the private hangars did not get off unscathed. One glider had minor damage to a wingtip when the doors were blown in and several hangar roof trusses were buckled — upward. The cabinetmaker's shop (ANTIQUÉ FURNITURE MADE TO ORDER — 30 DAYS) had the roof blown off and a lot of the debris landed on the glider trailers parked nearby.

Lots of damage in Benalla town. Ironically, the Emergency Measures Organization headquarters building was badly damaged. The hospital had part of the roof blown off and many homes were damaged. For the next week you could hear chain saws clearing downed trees.

We could have been flying on Sunday once the field had been cleared of the piecart, boundary markers replaced, and the pieces of glider trailers picked up — some almost a mile from the carcass. Several trailer loads

of machinery from the open air cabinet shop was manhandled into vacant space in the club work hangar. The trailer park had some damage but mainly needed removal of trees and branches as well as covering dents and broken windows. Speaking of windows, I found mine some distance along the hut — minus the glass of course. With the glass reinstalled and secured in the frame, it was now necessary to remove the frame to open the window. After getting the situation under control at the field, some of the club members migrated to town and gave assistance to those needing help. The following weekend things were back to normal with serious verbal and written political statements about the up-coming AGM and elections.

Okay, what's the moral of the story? Secure everything when you are finished with it, especially anywhere near aircraft. The Benalla tornado/downburst was unforecast. The previous day had been pleasant but not a good soaring day with stable air. There were no reports of severe weather anywhere. The forecast mentioned that a slow moving "cold change" (they don't have cold fronts) may come through during the night with possible rain showers and a slight risk of thunderstorms over the mountains. I'd sure hate to be there when they put out a severe thunderstorm watch!

We recently had a loaded glider trailer blown over and into another trailer, damaging the aircraft inside the second trailer. Some time ago we had our trailer blown sideways to nuzzle against a Bergfalke trailer (fortunately just as rugged as the aircraft) — just a little scratched paint.

After several false starts I arrived at a fairly simple and strong trailer hitch anchor. Take a 5 inch diameter spiral-coiled aircraft tie-down, bend the upper "eye" horizontal and weld on an appropriate size "ball", now weld on a 14 inch (more or less) bar at 90 degrees to the tie-down as a handle to screw it into the ground (hollow tubing or rebar are not suitable). After allowing the masterpiece to cool, try it out. The tie-down will go into most soils except hardpan or large rocks. If the ground is very hard, add some water to it. Rotate the handle until aligned with trailer tongue. If your safety chains are conveniently located, a padlock cleverly inserted in the chains will make the trailer difficult to steal. The light weight and large area of a glider trailer require a substantial tie-down — doggie tie-downs are for dogs. ❖

Flying the Puchatec (aka Krosno)

Ian Oldaker

WHAT EXCELLENT VISIBILITY, especially from the back seat! This does not mean it is any less excellent from the front of course. I had the opportunity to fly the Montreal Soaring Council's latest acquisition, both solo and with several other pilots, and my thanks go to them, especially Joe Bowe their CFI, for the chance to fly it. The club bought it as a potential Blanik replacement, and after much delay in paperwork were able to launch it for the first time in the fall of '95.

The appearance of this trainer is one of a businesslike and no-nonsense efficiency. Not as sleek as others, but a definite crowd pleaser, and its large clear canopy on an all metal fuselage sets it as a modern, well built machine. It comes from the Polish stables at PZL Krosno that have produced so many good gliders in the past and continue to do so today. Therefore one has an immediate expectation that the glider will perform up to a good standard, and indeed it does.

It has a large single piece canopy with the excellent properties mentioned above. It is well made with few distortions. Clear vision panels afford good ventilation, and a front vent allows the canopy and the pilots to be kept clear and cool respectively. I noticed there is a tendency for people to lean on such a large expanse of plastic, so owners will have to 'teach' onlookers not to touch it with sweaty hands! Also one has to be careful to lift such a canopy by lifting on the frame, not by lifting it on the edges of the openings on the plastic itself!

The fuselage and wings are of metal construction. Aft of the main spars the wings are cloth covered as are the ailerons and tail surfaces. This particular Puchatec had some trailing 'rash' on the wing leading edges, possibly caused by being stored for a year in South Carolina under damp conditions (the paint appeared to have bubbled where it had rested in the wing cradles), but generally the paint finish looked very good. In fact the finish is the usual Polish excellent polyurethane finish, possibly the best there is for fibreglass. If the excellent weathering performance of the Puchacz that I partially own is anything to go by, the Puchatec should also stand up to our sunny weather very well. One point owners will need to watch is that the cloth on this machine was not treated with what we would



Mike Maskell

consider adequate ultraviolet 'stop' under the finishing layer of paint. By looking up through the aileron push rod access holes into the wings, I could see daylight through the cloth. I would guess the ailerons and other cloth areas would be similarly devoid of the aluminium paint layer. I have taken this up with the Canadian distributor.

The wings have a constant chord and are thick for their chord length (about 18%), suggesting good slow flight characteristics for soaring but less efficient for higher speed flight. This is borne out when flying. Frise type ailerons are of interest. I'm unsure of their effectiveness, but in five flights I became quite used to the aileron/rudder coordination. The all-metal fuselage has a low side to the cockpit, even lower than the Puchacz, allowing very elegant entry.

This machine was not fitted with a nose wheel and had a largish skid instead. I suspect it cost a couple of points on the L/D as there was a noticeable wind noise generated there. I understand all current models have a faired nose wheel. The main wheel is fixed but adequately sprung, promising more comfortable rides for instructors on bumpy runways when compared to unsprung gliders with upright sitting positions. One item I found surprising was a lack of factory supplied cushions! However this would allow a club to fit energy absorbing foam cushions to start with, a definite plus to my mind.

Cockpit space seems adequate (I'm 6 feet or 183 cm tall) and I had no problems reaching all controls easily. The rudder pedals are adjustable in flight. The spring trim is a large early Jantar type detent on the left that had a tendency to skip out if heavily loaded. Instructors will have to watch this, and beware of wear on the detent's edges with time. Trim tabs on the elevators, as in the Puchacz, are preferable. The dive brakes are powerful and feature an over-centre lock when the handle is pushed fully forward. Ground handling was no problem as the

empty glider is well balanced close to the main wheel. One set of instruments are adequately visible from the rear seat except in the case of mismatched student and instructor sizes, which lowers the overall cost.

The initial ground run is bumpy as the Puchatec runs on the nose skid or wheel, but as speed builds up the nose can be raised and the takeoff is then normal. One does not need to "lift" it off the ground, though there may be the tendency to do so if lifting the skid off too vigorously!

The ailerons are very effective, even at slow speeds, and the rudder is excellent for directional control on the ground. I gained

an initial good feel for the glider. The trim is powerful and needs to be adjusted as the tow progresses if it has not been set accurately prior to takeoff. This takes a bit of practise as the trim detents are coarse and care is needed to lock the trim in.

Flying free of the tug was a pleasure with that fabulous visibility! The roll rate is excellent at about 5 seconds from 45° to 45°, but a full amount of rudder is needed to help the Frise ailerons avoid too much adverse yaw! The trim is positive, hence the elevator can feel a bit heavy if the trim is not set accurately for the desired speed. After a quick local check flight, I managed to soar the Puchatec quite easily on my second flight in weakish conditions, as one would expect of this machine.

The ship is easily controlled and centred using either medium or steep bank angles. When busy with changing angles of bank, one becomes aware of the need to retrim often, but once centred, the glider is a pleasure to fly. It can soar quite slowly and happily just above stall speed. I did not detect any tendency to drop a wing suddenly, and an immediate lowering of the nose stopped any hint of 'mushing' when close to the stall. The machine shows good stall characteristics when the speed is reduced slowly to show an inadvertent stall, and it will spin readily from a slow over-ruddered gentle turn. The recovery from the incipient spin stage is readily made by lowering the nose. In fact the wings 'bite' again immediately they are unstalled. It will recover from a fully developed spin with the conventional recovery sequence. If heavily loaded it will be difficult or impossible to get it to spin, it rather drops into a good spiral dive!

On approach the glide path can be easily steepened too much with the powerful brakes. These are pretty effective even when slightly open. Hence I think that teaching fine glidepath control with these brakes will take a little more time than if the brakes were more progressive from first → p22

Cu-nim & Lightning

Tom Bradbury

from *SAILPLANE & GLIDING*

MOST HEAVY THUNDERSTORMS occur during the late summer months when both land and sea have warmed up and the air has become moist. However, the winter of 1994–95 produced a surprising number of thunderstorms in Europe. Some even appeared close to the Arctic Circle near Iceland and Norway. These winter storms are usually short-lived and seldom dump vast quantities of water. This is because winter clouds do not extend so high and contain less moisture than the hot summer storms.

Locating thunderstorms

It has been estimated that up to one thousand thunderstorms can be in progress at any one time over the entire globe. Most of these are in tropical or sub-tropical regions where the air is very warm, moist and unstable. There are too few observing stations for all the storms to be seen but they can be located by picking up the radio noise produced.

In the 1920s Robert Watson Watt (better known for his work on radar) built the earliest set for thunderstorm location. It consisted of a pair of huge frame aeri- als set at right angles feeding two matched receivers tuned to the extremely low frequency of 10 kHz. The two signals were fed to the east-west and north-south deflector coils of a very early "cathode ray tube". When a flash was received it drew a line on the tube representing the bearing of the storm. Intersecting bearings from other stations allowed the operators to get a fix by triangulation. This old system was remarkably successful and a modified version was used until a few years ago when it was replaced by a computerized system. This uses the difference in arrival times at different stations to calculate a fix.

Some thunderstorm sizes

Cu-nim come in a wide range of sizes. The smallest cloud from which lightning has been seen was only about 10,000 feet high but practically all cu-nim go far above that height and the largest have been measured to reach nearly 66,000 feet. The diameters of cu-nim range from as little as three kilometres to more than 50 km. Cold fronts can produce a chain of thunderstorms well over 100 km long and some extend for 500 km.

Duration Some small thunderstorms do little more than produce a single bang and the cloud expires within half an hour. These

brief storms are often the winter ones with little energy to spare. Bigger thunderstorms are likely to last a couple of hours but storms associated with active cold fronts may keep going for 48 hours and travel with the front as much as 2000 kilometres or more.

Updrafts The width of the updraft within a cu-nim can range from a mere 300 metres to some 2000 metres. The mass of air sucked into a cu-nim can be about 500 tonnes/second. In extreme cases the lift inside may exceed 100 knots with sink of 60 knots nearby. Most cumuli stop rising and spread out when they meet an inversion. The very strong upcurrents in a cu-nim can push the summit a long way through an inversion, even penetrating the inversion at the tropopause. Powerful cu-nim can push several 1000 feet up into the stratosphere to form a dome where the temperature may be 10°C colder than the environment. These domes are transient features, though they may rebuild several times. In most cu-nim the tops spread out to form a wide flat topped anvil which is extended by the wind. Strong upper winds may pull an anvil out for 50 km or more and jet streams can pull some tropical anvils 1000 km out from the originating cu-nim.

Electrical fields Even when there are no clouds, the upper atmosphere is usually plus 300 kilovolts (kV) relative to earth. At low levels the gradient may be 130 volts/metre but the strength decreases with altitude. Before lightning occurs the field strength at cloudbase (around 3000 feet) may be more than 100 kV/m. In one set of trials some 90 rocket probes were sent into cu-nim; two of the 90 measured more than 400 kV/m. These exceptionally strong fields were confined to small volumes of the cloud.

Lightning development

In the last 40 years, there have been transits through cu-nim by instrumented aircraft, doppler radar has probed the vertical motions in big storm clouds, and balloons and rockets have been sent in to collect more data. Despite all this effort, there is still no complete description of how lightning is produced, but there is good agreement on the most favourable conditions.

Lightning is nearly always associated with large cu-nim which extend far above the level at which the temperature is -15°C. There are a few exceptions. Very rarely a flash may be produced by a cloud whose

top barely exceeds three kilometres (about 10,000 feet), but normally both water droplets and ice crystals are needed before large electrical charges can form in a cloud.

Charge separation

Ice crystals form when the cloud moisture is carried up well beyond the freezing level. These ice crystals first appear in a region where there are still a lot of unfrozen droplets. The crystals grow when they collide with water droplets because the water freezes on contact to form a layer of rime. These frozen cloud particles are often termed "graupel" (the German term for soft hail). Graupel forms where there is a strong updraft. When the graupel is very cold, collisions with smaller particles give it a small negative charge. The smaller ice particles (which fall very much slower) are carried up with a positive charge. The faster falling graupel carry their negative charge down to the lower part of the cloud. The situation is complicated by the fact that the process is temperature sensitive. The graupel starts becoming positively charged when it gets warmer than -15°C.

Fall speeds of particles

The little ice crystals drift down at 0.6 to 3.0 knots, accelerating as they pick up more rime. Graupel with a size of 1–3 mm has a fall speed of 2–6 knots while fully developed hailstones fall ten times as fast. Some very large hailstones may even exceed 100 knots. This difference in fall speed acts to separate the negatively charged graupel from the positively charged ice crystals. Penetrations of numerous cu-nim usually show that the main negative charge occurs at a level where the temperature is about -15°C. This negative charge is probably less than a kilometre deep but extends horizontally for several kilometres. A positive charge develops near the top of growing turrets. When the upcurrent fails, the turret usually slumps back and as it does so the charge disappears.

Figure 1 shows a growing cu-nim. The youngest cells are rising on the left while the older mature cells are downwind on the right. The new turrets on the left consist only of water droplets. Ice appears in the cloud when the powerful updraft reaches well above the freezing level. An overshooting dome often appears where the cloud penetrates the upper inversion (often the tropopause). Beyond this the cloud flattens out to form the anvil.

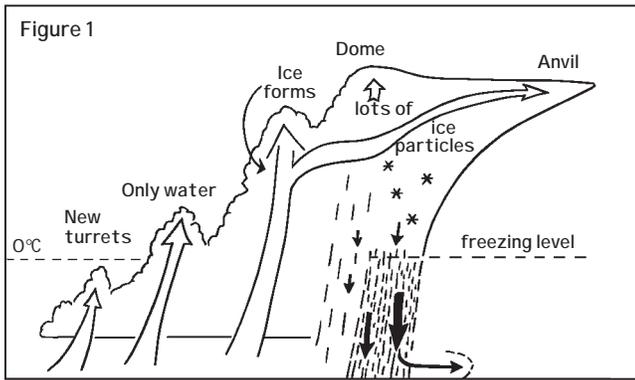
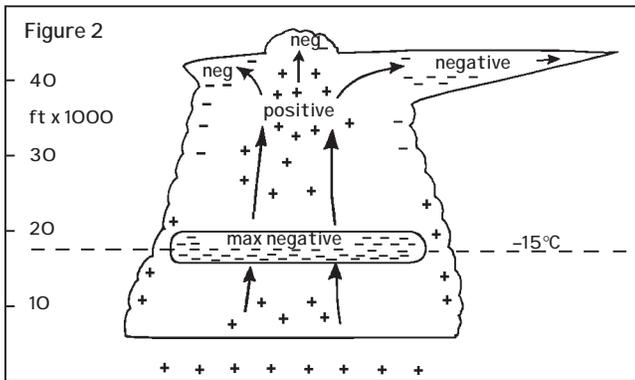


Figure 2 shows where the main electrical charges may be found in an active cu-nim. It marks the negative layer sandwiched between two positive charges above and below. Another negative charge may develop in the cu-nim anvil and sometimes the extreme top of the overshooting dome.

Association of electrical fields with precipitation

The increase of an electrical field is usually associated with precipitation of some sort, but this does not work both ways. Precipitation, even when it is intense, can occur



without a corresponding electrical field. Precipitation can be traced easily by the strong radar echo produced. The first echoes appear near the top of active cu-nim turrets and airborne instruments detect the first cloud electrification at this time. After the first flash of lightning, the radar

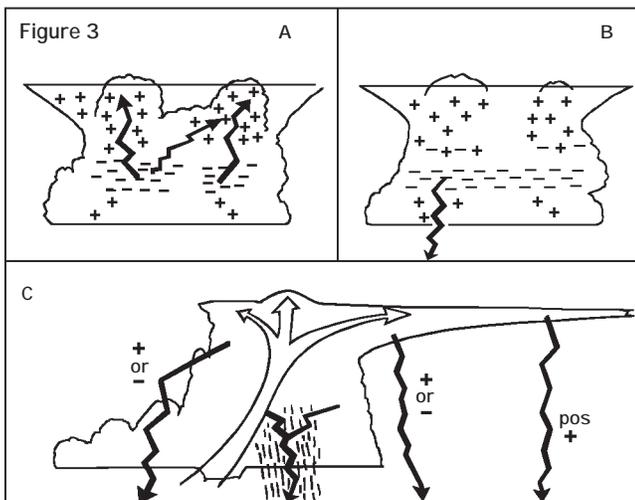
ascend it picks up yet another layer of ice and in exceptional cases the hailstone may grow to a weight of 3 to 4 kilograms. This is heavy enough to do serious damage when it finally lands.

The lightning flash

The first lightning flashes are usually internal or from cloud to cloud and the cu-nim is generally growing vigorously. Cloud to ground flashes tend to appear 5-10 minutes later. A flash transfers a charge from one place to another and in the process a narrow channel of air is heated up to around 30,000°C before it has time to expand. In this heated channel the air pressure is raised for a moment to about 100 times normal. It then expands, producing a shock wave followed by a slower moving sound wave which is the thunder.

Figure 3 below shows (A) internal flashes; (B) a cloud to ground strike and (C) a series of strikes from different parts of the cu-nim. Strikes in the rain shaft are normally negative; others may be either. The surprising item is a strike well away from the main cloud mass coming from the anvil on the right. This is usually positive.

The very long flash coming down from the anvil is a warning that lightning may strike some distance from the main cu-nim. This is one reason why winch launching can get dangerous if there is a thunderstorm nearby even if it appears to be several kilometres away.



Upward flashes have been seen coming from the top of a cu-nim, apparently carrying charge into the stratosphere. This is not commonly seen, perhaps because there are relatively few aircraft flying above the 50,000 foot level needed to get a good view over the storm tops. ❖

a little more aggressively, fly a little faster, push on low to the one good thermal and hope that others will wimp out and you will find a better climb. If it doesn't work then you will be starting from the bottom again. Another approach is to push ahead and top up in a number of thermals, leaving just before the next pilots arrive. If they stop and look for your thermal, then they may miss the core and so slowly slip backwards, or if they keep going then they will be a little lower and you may slowly escape.

You can also do it from behind, wait in the thermal a little longer until the main group leaves, then pick up some of the climbs that they bypass, and hope that this topping up will give you the edge.

You also have the option of flying off on a different track and work on picking your own thermals. This takes a positive attitude as there is a strong temptation to nip back to the thermal where you suddenly see them climbing just off to the side. These approaches can be more easily achieved if a small group works together. Provided they all work hard they can get a sufficient break.

Cruising techniques

One of the biggest problems with flying in gaggles is that it is very easy to stop thinking, and just follow blindly on. This often results in your falling slowly behind and then falling out the bottom. You are then in a serious position because you now have to start thinking for yourself, and you haven't developed a feel for the day. I find this the worst when cruising behind a few leaders. It is very easy to follow the person without feeling the air yourself. You then pull up where you think they did instead of where you feel the lift. This means that your speeds are all wrong, and you don't get the energy out of the thermals. I make a conscious effort to watch the other people and fly as though on my own, but keep one eye on what they are up to so as to spot any lift or sink streets that they find.

Developing your own feel for the air and the patterns of lift and sink is vital if you are to be in control of the flight. If you want to get out to front at some stage then this is even more important.

If you end up in front of the gaggle at an awkward time, such as just before final glide or when the weather has turned a little tricky, then you need some techniques to avoid a disaster. By flying at a slower speed than the normal cruising speed you will be quickly joined by those who were following you. You can now fly side by side or even drop behind if you wish. (This is amusing if everyone is trying the same technique.) By turning in the next weak lift you can see what everyone else is up to and a number of those close behind will pass by. If you are confident, then the option is always to just head off and hope you get a good climb, and sometimes this is the only logical action. ❖

Water Vapour

the invisible factor

Tom Bradbury
from *SAILPLANE & GLIDING*

CLOUDS ARE THE VISIBLE RESULT OF the condensation of water vapour. In most years the British Isles has so much cloud cover that few people concern themselves with the invisible portion of the atmosphere. In exceptional summers such as 1976, 1983 and 1995 one starts to wonder where all the water has gone.

Water vapour, humidity, and dew point

These three factors are closely connected. The amount of water vapour in the atmosphere is usually quoted in grams of water vapour per kilogram of dry air. One can find the value marked along the foot of a tephigram, and the figures run from 4g/kg at a pressure of 1050mb and a temperature of about 1.2°C to 24 g/kg at the same pressure and a temperature of about 28.5°C. Figure 1 is a graph showing how the vapour content increases with temperature. The curve rises rapidly as high temperatures are approached.

Humidity is defined as the condition of the atmosphere in respect of its water vapour content. There are several variations but the one most people think of is "relative humidity". This is expressed as a percentage of the actual vapour content of the air over its maximum vapour content. Thus 50% means the air is half saturated while 100% means the air is completely saturated. The dew point is the temperature at which the air is completely saturated. If the temperature falls below the dew point, the air would be supersaturated. Normally excess water vapour is condensed out to form dew on any surface, hence the term.

Finding the dew point

The airfield weather reports quote air temperature and dew point. The dew point is usually calculated from the difference in temperature between dry bulb and wet bulb thermometers using a special slide rule.

Hygrometers

One can measure humidity directly without the usual wet and dry bulb thermometers. The simplest devices consist of a bundle of hairs in tension which actuate a needle or pen arm. Changes of humidity alter the length of the hair and vary the readings. Old radiosondes used a tiny strip of Gold Beater's Skin which is made from the outside membrane of the large intestine of an ox. The skin is hygroscopic — it expands or contracts with changes of humidity. Modern instruments use the electric resistance of films of hygroscopic material.

Use of a tephigram

One can find the dew point from temperature and humidity readings. For example, if the pressure was 1000mb and the temperature 24.7°C, the tephigram shows the vapour content to be 20g/kg at 100% humidity. If the measured humidity was 60%, then the vapour content would be reduced to 12g/kg. The dashed line from this value gives a dew point of 16.6°C at 1000mb.

Lapse rates

The lapse rate is the change of temperature with height. The initial state of the atmosphere is usually measured by sending up radiosondes. These establish the "environmental lapse rate" which changes if the air goes up or down. Ascent takes it to a level of lower pressure so the air expands. Expansion takes energy which involves a loss of heat so rising air cools. It always cools at the same rate as long as it remains unsaturated. This is called the Dry Adiabatic Lapse Rate (DALR). Adiabatic means that heat from outside does not enter or leave the system. The DALR is 9.8°C/km or 3°C (5.4°F)/1000 ft. It is true both for ascent and descent of dry air.

Saturated air

The cooling caused by lifting of air eventually reduces the temperature to the dew point. Further cooling usually produces condensation of the excess water vapour into fog or cloud droplets. In free air, condensation nuclei are needed before the process can begin. It is theoretically possible for absolutely pure air to be supersaturated by some 300% but in practise there are always enough nuclei to allow cloud droplets to form with much less than 1% supersaturation.

Evaporation of water requires extra heat to turn drops into water vapour. This latent heat is released again when vapour condenses and so the surrounding air is warmed. The warming lowers the lapse rate of the rising air. The new rate is called the Saturated

Adiabatic Lapse Rate (SALR). The SALR is neither constant nor reversible. A tephigram shows a series of curves representing the SALR. The difference between the dry and saturated lapse rates is greatest at high temperatures and becomes almost zero below -40°C. When saturated air is lifted its temperature follows one of the SALR curves. During its ascent some of the moisture may fall out as rain. If so, the air will not follow the same SALR on descent. Saturated adiabats are not reversible. They are only correct for rising air.

Dew point and cloudbase

When air is lifted the temperature at first decreases at the DALR of 3°C/1000ft. The vapour content stays the same and the dew point follows the dashed vapour content line as shown on the tephigram. At the point where the DALR and dew point lines cross, the air temperature and dew point are the same, so the humidity must be 100%. Figure 2, which is a skeleton tephigram, shows a dry adiabatic from the spot marked dry bulb and a dew point line from the spot marked dew point. These lines cross at CL, the condensation level. Any further lifting results in cooling at the saturated adiabatic rate. By following the SALR down to the surface one can find the wet bulb temperature there.

Finding cloudbase

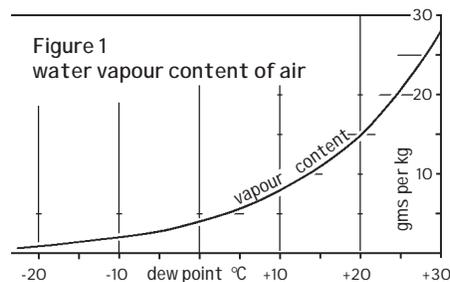
The cloudbase is almost the same as the condensation level and there is a simple rule for getting cloudbase from the difference between dry bulb and dew point. Multiply the difference by 400 to find the cloudbase in feet.

In Figure 2 on the next page, the difference between dry bulb and dew point is 13°C which gives a cloudbase of about 5200 feet. One day last summer the Volmet broadcasts gave "temperature 31, dew point 8". The 23° difference suggested a condensation level of 9200 feet and a pilot observed cu based at 9000 feet.

In 1976 a pilot saw a cu form just above him with a base of 11,000 feet. This is the highest report I have seen over England but bases can be much higher over continents such as Africa, Australia, and the USA.

How dew point changes affect cumuli

Figure 3 shows the effect of increasing the dew point. The thick line shows the environmental temperature measured before dawn. DP1 is a low dew point and T is the



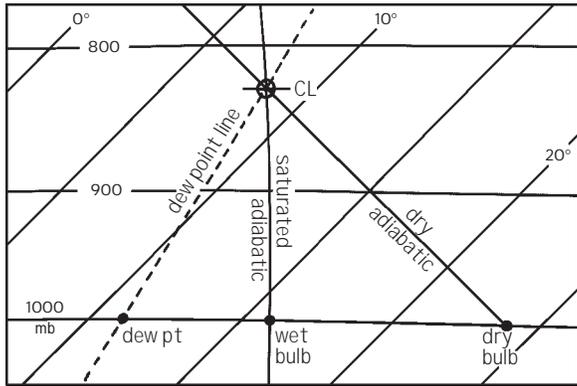


Figure 2 Skeleton tephigram showing how dry bulb and dew point data can define the condensation level.

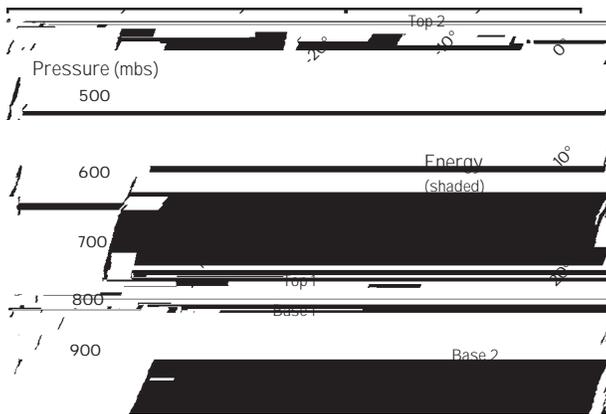


Figure 3 Skeleton tephigram to illustrate how dew point changes can alter cumulus size.

temperature when cu first form. The DALR from T and the dashed dew point line from $DP1$ meet at a level marked as *Base 1*. This is just below a stable layer which limits tops to *Top 1*.

If moister air intrudes so that the dew point rises to $DP2$, cloudbase lowers to *Base 2*. The SALR up from *Base 2* is warmer than the environment up to the much higher *Top 2*. The shaded region between the SALR and the environment curve represents the energy released when towering cumulus form. This example shows how a 5° rise of the dew point may make all the difference between a day of fair weather cu and a showery day.

Effect on spread out

The increase of moisture also affects spread out of cumulus under an inversion. On good soaring days the air below the inversion is relatively dry, so when cu form the clouds evaporate before they join up. If moist air spreads in, clouds are slow to evaporate and the cumulus tends to join up to form a continuous sheet of stratocu which cuts off the sun and ruins the soaring. Regions near the sea are affected the most. Ireland often has extensive stratocu while sheltered eastern areas of Scotland, England and Wales keep well-broken cloud.

Effect of water vapour on air density

The atmosphere consists mostly of nitrogen

and oxygen which are heavier than water vapour. The addition of water vapour reduces the total density. The buoyancy of a thermal depends on the difference in temperature between the thermal and its environment. The effect of water vapour is allowed for using a fictitious value known as the "virtual temperature".

Virtual temperature

The virtual temperature of moist air is the temperature at which dry air would have the same density. For example if the air at 1000mb was completely saturated at a temperature of 20°C , then it would have the same density as dry air at 22.6°C . The difference of 2.6° between the actual and virtual temperatures shows the extra buoyancy of moist air rising through a very dry environment. If the air in the thermal was only half saturated (relative humidity 50%) then the difference would be halved too, making the virtual temperature only 21.3°C .

Moisture increases the thermal buoyancy

Many thermals carry moisture up from the surface so the air inside may contain more water vapour than the environment. As a result a thermal may

still be buoyant even though it no longer has an excess of temperature. However, the effect is likely to be small in cold weather.

Evening lift over woods

Towards the end of a warm sunny day, weak lift may be found over woods when nearly all other thermals have died out. This is often attributed to the release of heat stored in the woods, but it may be due in part to the extra moisture. As long as the roots have a good supply of moisture the process of transpiration can add tons of water vapour to the atmosphere.

The energy in a depression

Most depressions (lows) are associated with large areas of slowly ascending air. At low levels the air converges towards the fronts or troughs while at high levels the air is extracted by strong upper winds. This causes a large mass of air to ascend, producing extensive areas of cloud. When warm moist

air is drawn into the region of ascent, a large amount of heat energy is released by condensation. This extra energy is used in deepening the depression and increasing the winds.

The earliest computer models of the atmosphere were not given any water vapour data. As a result the depressions they predicted were too shallow and the winds too light. As soon as water vapour data was included, the numerical models began to predict much more vigorous depressions.

Some of the fiercest depressions are the hurricanes and typhoons which form over tropical seas whose temperature is about 28°C . Evaporation from these very warm waters makes the vapour content particularly high, so when condensation occurs a vast amount of energy is available. Active hurricanes spend most of their life over the sea and when they move overland they start to weaken as there is no longer enough moisture to supply the energy.

Dry spells and hot weather

Although most moisture comes from evaporation over the oceans, a significant amount comes from green vegetation. A wood can extract hundreds of tons of water from the ground each day. If water starts to run short, the stomata in the leaves close to cut down the water loss. As dry spells continue the grass dies and the normally green English countryside begins to look as brown as southern Europe.

Dry ground becomes much hotter since little of the sun's energy is wasted heating up soggy fields. With little water to be evaporated, the dew points fall lower than usual during the afternoons, the cloudbase lifts higher and the cloud amounts dwindle. Thus an unstable northwesterly airstream which produces 7/8 spread out overland in April or May can only manage 2/8 shallow cu after a spell of summer drought. Conditions of drought are good for long cross-countries such as the 1000 kilometre flight this July in England. ❖

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On the risk of being alive

"We are so constituted that if we insist upon being as sure as is conceivable in every step of our course, we must be content to creep along the ground, and can never soar." Cardinal Newman

The Coyote Pilot's Howl

Iain Colquhoun

*When the cruel winds blow 'round the campfire's glow, under stars of icy hale,
From frozen lips moist with rot-gut sips comes a queer and eerie tale,
Of a time gone by when the storm was high and the Crowsnest shrieked and snowed;
In the darkened sun, straight down 'twenty-one,' the Coyote Pilots towed.*

*On a pale straw morn from the west was born a warm and murmured sigh.
One again believed that a goddess breathed and her breath filled the early sky.
From her ocean home her heart strove to roam where the sun leaves its dark midnight grave,
And her craft was the air and the wind was her hair and her wings were the great mountain wave.*

*As the pale straw light quelled the restless night and dark shadows fled to their lair,
As the white birds slept, from their midst there crept one whose dreams sensed the whispering air.
On the field alone, seeming turned to stone, staring far to the vanishing gloom,
The Coyote could tell by those hues of Hell, that today he would tow to his doom.*

*In the crimson sun golden rays were spun, and they flowed o'er the Porkies' shield;
Down the river's bowl, past the swimming hole, to the frozen hoary field.
As the camp awoke and the cookshack smoke hurried east in the quickening swell,
Every pilot who, stalked the great wave knew, of this day there would be tales to tell.*

*Though the lift was strong still the tows were long, through minefields of rotor and sink.
Of the gale's savage whip as it battered his ship, the Coyote tried hard not to flink.
Through the gale's savage lash and the thundering crash of the dark air's murderous rage,
'Neath the dark slabs of heaven, the Coyote was driven, for the Devil had settled his wage.*

*In the darkening sun, the ships one by one scurried home from the stern mountain's glare.
By the deafening groan a child would have known a rock-shattering storm rode the air.
Though his body was wracked, he had beaten Hell's pact, and he sneered as he turned from his foe,
But one sailplane remained and, his energy drained, the Coyote made one final tow.*

*Long ages ticked by as they rose in the sky – two souls bound by fate and by steel.
Before two thousand feet, the sailplane was beat, and returned his bruised body to heal.
As the storm dimmed the view and the gale's fury grew, the Coyote's clan waited in vain.
Hell's blade to the haft, it rent pilot and craft; they would never be heard of again.*



*When the cruel winds blow 'round the campfire's glow, under stars of icy hale,
Watchers still can hear as they cower in fear, a distant, hellish wail.
It echos long like the banshee's song, 'round the mountains' flinty scowl.
O'er the frozen ground, comes the hollow sound of the Coyote pilot's howl.*

Here is a little background for those who have not had the privilege of flying at Cowley. This homage to towpilots is best read around a campfire with all the verve one treats a recitation of Robert Service's *The Cremation of Sam McGee*. The winds blasting over the Livingstone Range or out of the Crowsnest Pass over Cowley are awe-inspiring at times, and have blown towplanes upside down. The Porcupine Hills backstop the airfield just to the east. One can provoke the coyotes to sing back if you howl at them in the evening. The Coyote is the Chief Towpilot at Cowley — it has been Iain. The Cu Nim Gliding Club's towpilot of the year trophy features the silhouette of a coyote head cut from the spruce of a broken Scout spar.

Tom Knauff
from *NZ Gliding Kiwi*

It has been about 90 years since the first power plane fatal accident, about a hundred since Lilienthal's demise. Each month, some major aviation magazine prints an article about stalling, which has been called *the* major problem in aviation. Fifty years ago, stalling was the primary cause of over 75% of all fatal aviation accidents. It is still true today. Why? Pilots are trained, and trained, and trained for stalls — check rides, flight reviews, flight tests all emphasize stalls. Training manuals devote a major portion of their pages to stalls, so pilots know everything about stalls. Or do they?

Pilots are typically taught how to perform stalls and stall recovery. But is this what they need to know in order to fly safely? Is it important to know how to perform a stall? Maybe not.

If we could somehow reconstruct the debris that results from a fatal stall accident and take the pilot back up to altitude, it would be discovered the pilot knew how to perform stalls. But there is the unavoidable proof the pilot did not know something about stalls, or else how do you explain the debris? What does the typical pilot *not* know that results in the horrific statistics? In future articles, we will investigate this in detail. For now, let's begin with a question few glider pilots have been taught:

When are you most likely to die as the result of a stall?

Every glider pilot should be acutely aware of when they are at the most risk. Why is it most glider pilots have never thought of this question? Is the answer so obvious that instructors assume it is not necessary to inform every student of this life saving information? When are you at most risk? Accident statistics point to three occasions:

1 *PT³* Many years ago, I termed the myriad things that can go wrong during the first few seconds of flight, *PT³*, or "Premature Terminations of The Tow". Statistics still reveal that nearly 20% of all fatal glider accidents are the result of something happening at the beginning of a launch...

the rope breaks and the pilot dies. The canopy opens and the pilot dies, the tug engine fails and the pilot dies, a bee is in the cockpit and the pilot dies, the air vent is closed and the pilot reaches up to open it and pulls the release by mistake ...

The list of things that can go wrong is far more extensive than most pilots realize. This type of accident is totally unnecessary and can be cured almost overnight.

2 *Low altitude thermalling*

Pilots attempt to perform the superhuman by trying to stay aloft in impossible circumstances. The result is often deadly. ➔ p24

My four minute Silver distance attempt

Very good judgement is displayed by a pilot under stress. The temptation to act impulsively was suppressed, and the "SOAR" technique is well demonstrated.

William Bentley
from *Sailplane Builder*

I am forwarding the account of this flight in the hope that it will encourage builders and owners to look over their craft one more time for loose or movable items that might shift and cause a problem. I also felt others might be interested in my thought processes during the various stages of this short flight. I wanted to write them down while they were fresh (read that "etched") in my mind.

A fellow pilot at the gliderport where I instruct part time offered me the use of his recently acquired Duster plus barograph to, at long last, start collecting badges. For people like myself who didn't know a Duster on sight, it looks like a Woodstock with long plywood covered wings. Having flown the Duster once previously, on a promising day I preflighted it then squeezed into the cockpit along with water, chart, camera, pee container, barograph etc., but without room left for any cushions.

Takeoff across the drought-hardened field was accompanied by the usual bouncing and chattering inside this little wooden box. Once airborne I found that the control stick would not move left of centre.

Thanks to the adverse yaw characteristics of sailplanes, we back seat types tell new students to always push rudder whenever you use ailerons. In this case, without even thinking, when the aileron wouldn't move, the rudder picked up the dropping wing and kept the Duster level above the grass. A loud voice in my head stated, "I did do the control check, I did do the control check." When trying to break loose the binding aileron with rapid side movements of the stick, a sound reminiscent of the "Anvil Chorus" from Verdi's *Il Trovatore* came from behind the seat.

My first impulse was to release from tow here and drop in from six feet above the runway before something else broke. Bad idea! At 50 mph I didn't want to drop in from any height with these old bones. If I am flying now, I reasoned, why make things worse on the chance that something else might fail. At 200 feet on tow the thought struck me that now I can release and turn back to the runway. Bad idea! I don't want any part of 180 degree turns at 200 feet with only rudder. The old adage about "the sky above and the runway behind" came to mind, so I stayed on tow.

At 800 feet the towplane started a turn to look for lift and I felt it was now time to release. Flying free away from the gliderport the temptation was to bank to the right for the turn back. Bad idea! Rolling into the turn would be easy with normal aileron in that direction, but coming out of a 25° bank with only rudder would not be fun. My frequent warnings from the back seat to ab initio students about never making uncoordinated or shallow turns close to the ground came to mind. Now I was going to be doing both. But it takes three ingredients to spin in on approach: an uncoordinated turn, shallow bank angle and low airspeed. So I increased airspeed to 65 mph, which was 10 mph above 150% of stall speed, then pushed lots of left rudder. The turn wasn't pretty, but dihedral effect did slew the Duster around to the runway heading.

I was now high on glide path with a tailwind. The thought of a 360 degree turn to the right flashed through my mind, but the roll out with only rudder close to the ground was out of the question. Shallow S-turns were made; ailerons plus rudder to the right and only rudder to the left. One thing about rudder only turns is that they eat up a lot of altitude, so glide path control to a normal landing was no problem.

After roll out and stopping, I had to accept all the congratulations for making the field's shortest Silver Distance attempt!

The owner of the Duster (not the original builder) pulled the plywood seat back out looking for the problem. He found the shoulder harness D-ring mounted free on a steel rod spanning about 18 inches between two frame members above the aileron bell cranks. This D-ring and the shoulder harness sewn to it had slid back until it blocked the movement of the aileron bell crank. The shoulder harness straps had been pinched between the seatback and the frame member allowing the straps to be pulled tight by the pilot yet leaving slack between the seat-back and the traveling D-ring.

One wonders how many hours this Duster had flown with that D-ring hanging close to those bell cranks. A lesson to be learned from this experience is that even though a designer of an aircraft specifies the location and fit of a major component, additions by the builder of things like shoulder belts should be checked closely for future interference possibilities. ❖

hangar flying

MISC INTELLIGENCE

- 29 July 1995 was a great day on the plain in Spain, when 15 pilots completed 1000 kilometre flights!
- The FAI in Paris is now on the Internet and the following e-mail addresses can be used: *sec@fai.org* (general correspondence and requests to FAI office), *maxb@fai.org* (to Max Bishop, FAI Secretary General), *record@fai.org* (notification of world record claims and all correspondence pertaining to world records).
- Group Genesis has reported that it has entered into a joint manufacturing alliance with *Sportine Aviacija* in Lithuania, which produces the LAK 12 sailplane. They will be building the Genesis 1 kits in the Experimental/Racing category and getting them JAR 22 type-certified.
- Hans Werner Grosse, holder of a rack of world records, has convinced the German Aero Club of his position to only allow national record flights which have been flown in daytime. John Roake of New Zealand suggests that this campaign arose when someone, perhaps with tongue firmly in cheek, told Grosse of a concept to fly a two day distance flight of as much as 4000 kilometres in New Zealand by parking during overnight darkness (11pm to 3am) in a consistent wave produced by the Remarkables Range near Queenstown.
- Owners of Cobra trailers should inspect the lower attach bolts for the gas struts which support the clamshell. It appears that the bolts (8mm with 19mm heads) used in early trailers are too small for the loads imposed on them and can fail. Later models have 10mm bolts with 24mm heads.
- The USA Sports class competitions will introduce "windcapping" in 1996. This additional handicap will be used in the scoring to help adjust for the effects of wind-speed, which has an increasingly adverse effect as sailplane performance decreases.
- The future of the PW-5 World class sailplane looks rosy if a market survey conducted by the University of Tennessee proves correct. The 2-3000 units predicted by the IGC over the 15 year design life may only satisfy the minimum likely demand over the next five years, says the study director. The study was based on a 31% response to 203 clubs and commercial operators in the USA, Internet info from current owners on actual operational impact, and international pilot numbers to get total use.

In Canada, *HMZ Aero Engineering* are in the process of building molds for the PW-5 World class glider and plan to be in pro-

duction sometime in 1996. They plan to build 50 per year and have an "Alert List" if you are interested in keeping up with their progress. Their address is 78 Fletcherdon Court, North York, ON, M3N 1S3 (Internet *mb@tor250.org*). To join the World Class Soaring Association, send US\$15 to 545 McCarty Drive, Furlong, PA 18295.

DID YOU KNOW?

I have an idea for a regular feature for *free flight* — why not include little known gliding facts and invite other readers to contribute their own bits of trivia (*do it, people!*). To start it off, here are two samples which may not be known except by avid readers of old and new soaring journals:

Did you know? The pitot tube was named after French scientist and engineer Henri Pitot (1695-1777). He developed his tube to measure the pressure of flowing liquids.

Did you know? The earliest recorded glider flight in Canada was in 1907. Fifteen year old Larry Lesh used a glider designed by Octave Canute and a horse drawn tow. Subsequent tows were made with a boat from the Montreal docks to Pointe aux Trembles.

Bob Nancarrow

PROPOSAL FOR MORE WORLD RECORD CATEGORIES

It seems that a main aim of having records is to encourage pilots to fly and keep improving performances. So it follows that the more record categories there are, the more pilots will fly and the better performances will be across a wide spectrum of soaring. So why are world records for each of the four (Open, 15m, Standard and World class) FAI classes not recognized? Surely the establishment of these new record categories would be a good move.

The reason for pursuing such recognition is that to fly most world records now, a pilot effectively needs a modern Open class sailplane. This appears an unnecessary and undesirable limitation when ease of access is being accentuated in most spheres of society. It also denies international recognition to the great majority of pilots who fly in the 15m, Standard, or World class gliders. The existing world record system evolved prior to the introduction of the (then) three FAI classes of sailplanes. Perhaps it is now appropriate for the world record book to reflect current realities.

So how would this change begin? Existing worldwide national gliding records could be examined with the best in each class

and category becoming the nonhomologated world record; eg. Terry Cubley's Australian Standard class 300 km triangle speed record of 143.32 km/h could become a "world record". Only future national records from IGC member countries would be eligible as is the case now with homologated world records. Regarding the longer term decision to prepare a proposal to IGC for recognizing World, 15m, Standard and Open class glider world records, it appears that only slight changes to Sporting Code Section 3, rule 3.2.2 would be needed to add the new designations. Rule 6.3.2 already defines all four FAI classes.

Because only existing national records, and future national records which have to be homologated in any case, would be registered as unofficial world records by national aeroclubs, the only impediment to later IGC recognition of these flights seems a procedural one.

I believe these proposals have wide support. I suggest the Sporting committee take action now to implement these motions. It would be a significant and welcome boost to the current resurgence of the sport of soaring.

Chris Stevens, from *Australian Gliding*

MOFFAT AGAINST TEAM FLYING

The following is a letter by George Moffat printed in the American "Sailplane Racing News". It supports the comments of Justin Wills on worrisome World contest trends printed in free flight 5/95.

In my role as competition sub-chairman, I have been giving considerable thought to how we can affect a turn-around in the fortunes of the US Team. Put very simply, with no regard to the possibilities or politics of getting such measures accepted, we must:

- 1 Select the Team a year earlier to allow participation in the pre-Worlds (and insist on and pay for the Team's involvement.)
- 2 Hold selecting Nationals at sites as similar to the next Worlds as possible. It's useless to use sites like Hobbs, Minden, or Uvalde to select pilots for a contest to be held in Europe — as most are. This of course means heavy travel for the majority of our competition pilots who live in the west and southwest. Eastern practise obviously wins. Did you know that five US pilots have won the Worlds, ten have come in second or third, and every single pilot from east of the Mississippi?
- 3 Mandatory Team practise sessions under the direction of a coach with enough clout to send home the uncooperative or outclassed. Obviously you'd choose 10-12 for practise competition and make a final cut to top six, as in all other sports.
- 4 Delegation in the Worlds of one Open Class ship as a two-place electronic intelli-

gence and communications center for the rest of the team.

5 In each class an appointed Squadron Leader — and of course the others who get to say “Yes, sir!” a lot.

Well, I could go on, but you get the picture. Do you like the picture? I sure don't. I don't think many of us got into soaring because we wanted to be cogs in a machine or techno-jockies who happen to be riding in a sailplane.

All right, so what do we do about this? We can out-French the French, which will be expensive both in money and the toll of competitive soaring as we know it, or we can try to dismantle the growing monster, at present mostly confined to France and Germany. To do this our IGC representative in Paris needs to back Justin's proposals or something very like them, to the fullest possible degree. I think that action must be taken now, before next season, while the lessons of New Zealand are still fresh in everyone's mind and before the French can say it's too late for any changes for 1997. I would be happy to work with whoever is our rep to Paris on this.

\$500 PRIZE FOR 1000 KM

Rocky Mountain Soaring Centre in Golden, BC is offering an attractive incentive to try something big in the Columbia valley. Uwe Kleinhempel has informed *free flight* that he will award \$500 to the first pilot achieving a 1000 kilometre flight out of Golden in the 1996 season.

A SIMPLE SCORING SYSTEM

A computer independent, cost lowering, sportsmanlike, and simple scoring system is proposed for the benefit of IGC as an alternative for free choice and application.

Fundamental idea:

- Distance is calculated at one point per kilometre achieved on course.
- Speed is calculated at 1 point per km/h.
Variant 1: To avoid identical speed points, calculate to two decimals.
Variant 2: Use any speed (V) factor between 1 and X.

Examples:

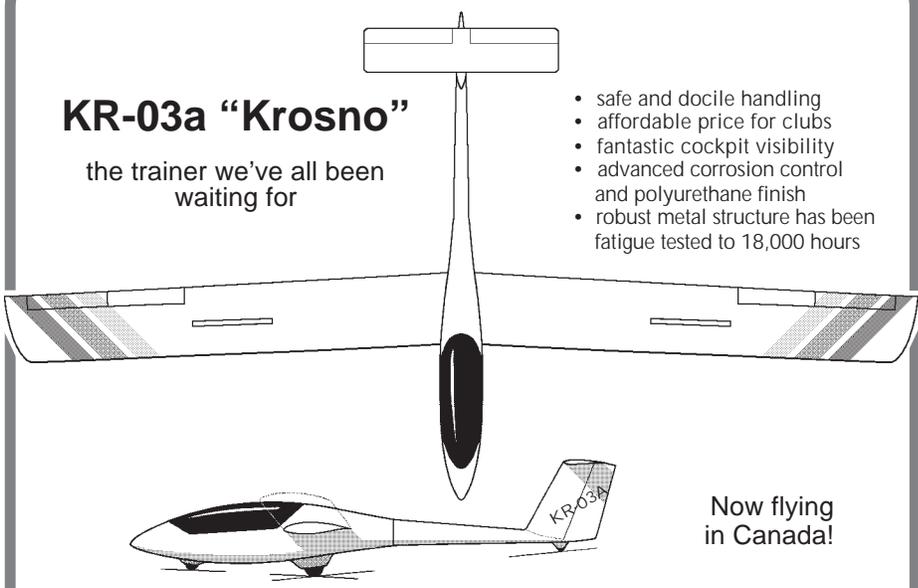
- Task distance: 180.45 km
Speed: 57.76 km/h
Scoring with V-factor of 1:
 $180 + 57.76 = 237.76$ points
Scoring with V-factor of 2:
 $180 + 115.52 = 295.52$ points
- Task distance: 480.60 km
Speed: 130.85 km/h
Scoring with V-factor of 1:
 $480 + 130.85 = 610.85$ points
Scoring with V-factor of 2:
 $480 + 261.70 = 741.70$ points

The V-factor can be selected according to general conditions (climate, level of pilots'

KR-03a “Krosno”

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experience, or other features) or may be graduated depending on the distance of the task set (for example: 1 up to 250 km, 2 up to 500 km, 3 for more than 500 km, or otherwise).

Features of such a scoring system:

- Simple, computer-independent calculation.
- Lower cost, personal and time saving.
- Measured time gives the points directly.
- Better point relation between completed tasks and landouts.
- Handicap factor can be used with im-

mediate results, or may be left out for continental or world championships.

- No day factor necessary.
- Very slow competitors still get points.
- The pilot who alone lands out is not penalized in a Draconian way.
- Most important perhaps: the points of the daily winner are not dependent on the worse performance of the other pilots (the mathematized jealousy of the unsuccessful) while the single outlanding pilot doesn't credit anyone with additional points. Such an unfair scoring relationship is not used in other sports.

This scoring system has been tested since 1984 with the simple basic idea of one point for one kilometre, and one point for one km/h without any day and any handicap factor, and without any decimal places. The results were astonishingly equal to the results of national and international final ranking lists.

Hans Nietlispach
Swiss IGC delegate



Canadian Soaring Championships Red Deer AB

This is the very attractive logo for the 1996 Nationals. T-shirts are now available. An e-mail info site is up and running, as well as the phone hotline; call dmercer@jetnet.ab.ca

club news

† SILENT WINGS – Norman Eley

The soaring fraternity lost one of its pioneers with the peaceful passing of Norman Eley on November 24, at the age of 84. Norman was actively involved in many phases of flying from the early thirties until just a few years ago. He knew many of the barnstormers and had an urgent desire to fly on his own. To attain this goal, he and brother Art built a Zögling primary glider and, after he learned to fly it himself, he trained three of his brothers. He was not only the first to fly the Zögling in 1938, but was also the last to fly it in April 1991 after it had been restored.

Norman spent the war years piloting Ansons and training bomb-aimers and navigators for the British Commonwealth Air Training Plan. After the war he encouraged his brothers to take up soaring, and power as a necessary evil!

He was an early member of the Regina gliding club and managed to get six other brothers, sons and nephews to join. He had a real desire to have people experience the joy of soaring flight, and talked it up at every opportunity.

Because of his enthusiasm, he was instrumental in forming the Saskatoon Soaring Club. Until the club had its own equipment, he organized mid-week excursions to Regina, brought his own tow-pilot and did the instructing himself. With the formation of the club, he not only trained pilots from Saskatoon, but also added several more family members including his daughter Mary and his future son-in-law. For a short time, ab initio training was done with an open cockpit, single seat Schweizer 1-19, using car-tow. Weather rules applied in winter, no training if the temperature was below 15°F or if there was more than a foot of snow on the ground!



Norman in '91 at age 80, at the controls of the Eley's restored Zögling. His wife Francis is next to him. Note the small boy in the "Vee" of the fuselage frame behind Norman. Some flights used to be made this way with a small passenger.

Norman obtained his Silver badge in 1961, and participated in one of the Nationals at Regina. He took part in several excursions to Pincher Creek, flying and enjoying the hospitality of Alvie Cook's home along with the group.

Norman was always ready to try new things. At the age of 70, he joined the skydiving club that just happened to be based at the Colonsay farm. After making four jumps, he persuaded a brother and a niece that it wasn't too bad and they tried it too. Norman's real love was always soaring and its promotion. He enjoyed it until just a few years ago. Strong lift and smooth landings, Norman. We miss you.

Harold Eley

CU NIM GLIDING CLUB

The final two months of the season were kind of the Dickens — they were "the best of times, the worst of times". In the good times column, all three members of "Team Keen" (Al Hoar, Gord Taciuk & Keath Jorgensen) completed their licence check flights on Labour Day, and the following weekend Matt Roden went solo. Then came *Black Weekend*. On Saturday, we blew out the canopy on our new Jantar, *Funny Girl*, when it popped open on landing. On Sunday we wrote off one of our Blaniks. The spoilers inadvertently opened on take-off, and when the tow-pilot gave the rudder wag, the glider pilot released and ended up in a stall/spin from low height. The good news is that the pilot suffered only minor cuts and bruises.

October gave us the salve of lift and became our second best month of soaring. Both Thanksgiving and the following weekend brought excellent wave, and nearly every day had soarable thermals.

The Fledgling Award, for Cu Nim's student(s) of the year, went to "Team Keen". Between them, they logged over 300 flights to each progress through solo, licence and transition into the club Jantar, all in the course of one season. It was a remarkable achievement!

The day after Thanksgiving, I led Keath off on his first cross-country, where we played in six knot thermals and ran along at 80 knots under miles and miles of cloud street with never a turn.

FAI Badges

Please note my mailing address change opposite. Congratulations to Todd Benko of Cold Lake for his flight of 9 October at Cowley in which he achieved two SSA 1-26 Association records for Canada: absolute altitude of 28,700 feet and a height gain of 20,100 feet.

For all badge hopefuls in '96, reread and remember the Sporting Code changes mentioned in the last issue. To club Senior OOs, OOs and pilots, the SAC office now has a revised SAC flight declaration form which includes space to record barograph data. There are also revised record flight claim forms held by the office and the record claims chairman. You can also take advantage of other helpful OO material such as the OO questionnaire and the OO flight checklist. There's a lot of stuff around to assist the badge pilot, you just have to get it and USE it!
Tony

I don't think Keath came down until the snow fell a week later!

(Keath was flying in actual thermals and he couldn't stop babbling about it on the radio! Now Keath had flown bags of Blanik flights over a couple of seasons, but was infamous for having thermals avoid him at all cost. He gets full marks for superhuman persistence, and he got the laughter and applause on landing for finally discovering what the sport is all about. Tony)

We did get in one more day in October and, at the end, I think we were back to the best of times.

On 17 November, Cu Nim hosted a large turnout to its annual Christmas party, which was once again held in the summit Tea-house at Canada Olympic Park — where the sparkling view, good food and warm friends made for a delightful evening. Happy New Year everyone.

Terry Southwood

LAST FLYING DAY AT MSC

Congratulations to all the "Hardy Boys" who braved cccold temperatures to quench their unsated desire for soaring — even if it was only gliding. A gang of about a dozen flew on 18, 19 and 25 November. Over thirty flights helped offset an otherwise lacklustre season. The 25th had about two inches of snow on the field. The Closedown committee braved -10° and about a foot of snow on 2 December to wrap up the season.

The club single Astir was written off at Lake Placid when it was force-landed into tall trees on a mountainside following steady heavy sink and turbulence. The pilot was unhurt and hiked out several miles through bush to a road.

from MSC *Downwind*

FAI badges

Walter Weir

3 Sumac Court Burketon, RR2, Blackstock, ON L0B 1B0
(905) 263-4374 e-mail walter.weir@canrem.com

The following Badge legs were recorded in the Canadian Soaring Register during the period 3 November to 31 December 1995.

DIAMOND BADGE

85 David Frank Rideau Valley

SILVER BADGE

865 Paul Chefurka Rideau Valley
866 Stephen Liard SOSA
867 Daniel Cook Gatineau
868 Serge Soucy Quebec
869 Chris Luxemburger COSA

DIAMOND DISTANCE (500 km)

Chester Zwarych Edmonton 509.4 km DG-202 Chipman, AB
Uwe Kleinhempel Rocky Mtn Sc 569.5 km Pilatus B4 Golden, BC

DIAMOND ALTITUDE (5000 m gain)

Tim Wood - 5460 m Blanik L-23 Westcliffe, CO
Todd Benko Cold Lake 6130 m 1-26 Cowley, AB
David Frank Rideau Valley 5940 m ASW-20 Lake Placid, NY

GOLD ALTITUDE (3000 m gain)

Tim Wood - 5460 m Blanik L-23 Westcliffe, CO
Todd Benko Cold Lake 6130 m 1-26 Cowley, AB
Jean-Guy Hélie Quebec 3240 m Jantar Std 2 Baie St Paul, PQ
Alfred Hunkeler SOSA 3500 m SZD-41A Julian, PA

SILVER DISTANCE (50 km)

Paul Chefurka Rideau Valley 58.9 km 1-34 Kars, ON
Stephen Liard SOSA 61.7 km 1-26 Rockton, ON
Daniel Cook Gatineau 60.1 km Jantar Pendleton, ON
Serge Soucy Quebec 71.8 km ASW-19 St Raymond, PQ
Bruce Walzer Winnipeg 74.7 km L-Spatz III Starbuck, MB
Darryl Klassen Cold Lake 62.3 km 1-26 Cold Lake, AB
Chris Luxemburger COSA 67.4 km Skylark 4 Omemee, ON

SILVER ALTITUDE (1000 m gain)

Paul Chefurka Rideau Valley 1280 m 1-34 Kars, ON
Stephen Liard SOSA 1590 m 1-26 Rockton, ON
Daniel Cook Gatineau 1550 m Jantar Pendleton, ON
Serge Soucy Quebec 1720 m ASW-19 St Raymond, PQ
Todd Benko Cold Lake 6130 m 1-26 Cowley, AB
Darryl Klassen Cold Lake 1335 m 1-26 Cold Lake, AB
Doug Smith Vancouver 1680 m Grob G-102 Hope, BC

SILVER DURATION (5 hours)

Kurt Berger Rideau Valley 5:53 h Pilatus B4 Kars, ON
Stephen Liard SOSA 5:08 h 1-26 Rockton, ON
Serge Soucy Quebec 5:24 h ASW-19 St Raymond, PQ
Susan Snell Winnipeg 5:30 h IS29D2 Lark Starbuck, MB
Pierre Tourangeau Champlain 5:31 h Jantar St Dominique, PQ
Denis Marceau Quebec 5:11 h Grob G-102 St Raymond, PQ
Philip Croft - 5:15 h ASK-23 Eagleville, TN

C BADGE (1 hour flight)

2498 Robert Kirkby Borden 1:31 h 2-33 Borden, ON
2499 Stephen Liard SOSA 2:14 h 1-26 Rockton, ON
2500 Serge Soucy Quebec 5:24 h ASW-19 St Raymond, PQ
2501 Todd Benko Cold Lake see Diamond altitude Cowley, AB
2502 Darryl Klassen Cold Lake see Silver distance Cold Lake, AB
2503 Attila Kardos Vancouver 3:10 h Blanik L-23 Hope, BC
2504 Alan Hoar Cu Nim 1:25 h Blanik L-13 Cowley, AB
2505 Martin Chamberland Quebec 1:47 h Grob G-102 St Raymond, PQ
2506 Denis Marceau Quebec 5:11 h Grob G-102 St Raymond, PQ
2507 Tomas Florian Cu Nim 1:10 h Blanik L-13 Cowley, AB
2508 Philip Croft - 5:15 h ASK-23 Eagleville, TN

FAI records

Dave Hennigar

404 Moray Street, Winnipeg, MB R3J 3A5 (204) 837-1585 H

The following record flight has been approved:

Free O & R Distance, Open, citizen, 519.4 km, 15 Oct 1995, Walter Weir, ASW-20B, C-GGWW. Flown from Julian, PA to Seneca Rock, VA and return. This is the first entry in the new free out and return distance category, and is also a pending world record claim.

SAC SUPPLIES FOR CERTIFICATES AND BADGES

1	FAI 'A' badge, silver plate pin	\$ 5.00
2	FAI 'B' badge, silver plate pin	\$ 5.00
3	SAC BRONZE badge pin (<i>available from your club</i>)	\$ 6.00
4	FAI 'C' badge, cloth, 3" dia.	\$ 4.50
5	FAI SILVER badge, cloth 3" dia.	\$ 4.50
6	FAI GOLD badge, cloth 3" dia.	\$ 4.50
7	FAI 'C' badge, silver plate pin	\$ 5.00
8	FAI SILVER badge, pin	\$39.00
9	FAI GOLD badge, gold plate pin	\$35.00
	<i>Items 4-12 ordered through FAI awards chairman</i>	
	<i>Items 10, 11 not stocked - external purchase approval given</i>	
10	FAI GOLD badge 10k or 14k pin	
11	FAI DIAMOND badge, 10k or 14k pin and diamonds	
12	FAI Gliding Certificate (personal record of badge achievements)	\$10.00
	Processing fee for each FAI application form submitted	\$10.00
13	FAI badge application form (<i>also stocked by club</i>)	n/c
14	Official Observer application form (<i>also stocked by club</i>)	n/c
15	SAC Flight Trophies application form (<i>also stocked by club</i>)	n/c
16	FAI Records application form	n/c
17	Flight Declaration form (<i>also stocked by club</i>) per sheet	\$ 0.15
18	SAC guide "Badge and Records Procedures", ed. 6	\$ 5.00
19	FAI Sporting Code, Section 3, Gliders, 1995	\$ 7.00
	<i>available from and payable to the Aero Club of Canada (address below)</i>	

Please enclose payment with order; price includes postage. GST not required. Ontario residents, add 8% sales tax. Items 1-6 and 13-18 available from SAC National Office. Check with your club first if you are looking for forms.

SAC National Office, 111 - 1090 Ambleside Drive, Ottawa, ON K2B 8G7 tel (613) 829-0536 • fax (613) 829-9497
Aero Club of/du Canada (temporary,) 1572 Kerns Road, Unit 7, Burlington, ON L7P 3A7 tel (905) 336-7393 • fax (905) 335-6462

ARTICLES ACVV POUR CERTIFICATS ET INSIGNES

Insigne FAI 'A', plaqué argent	
Insigne FAI 'B', plaqué argent	
Insigne ACVV BRONZE (<i>disponible au club</i>)	
Insigne FAI 'C', écusson de tissu, 3" dia.	
Insigne FAI ARGENT, écusson de tissu, 3" dia.	
Insigne FAI OR, écusson de tissu, 3" dia.	
Insigne FAI 'C', plaqué argent	
Insigne FAI ARGENT	
Insigne FAI OR, plaqué or	
<i>Les articles 4-12 sont disponibles au président des prix de la FAI</i>	
<i>Les articles 10, 11 ne sont pas en stock - permis d'achat externe</i>	
Insigne FAI OR, 10k ou 14k	
Insigne FAI DIAMAND, 10k ou 14k et diamands	
Certificat FAI de vol à voile (recueil des insignes)	
Frais de services pour chaque formulaire de demande soumis	
Formulaire de demande pour insignes (<i>aussi disponible au club</i>)	
Formulaire de demande pour observateur officiel (<i>aussi disponible au club</i>)	
Formulaire de demande pour trophées de vol de l'ACVV (<i>aussi disp. au club</i>)	
Formulaire de demande pour records FAI	
Formulaire de déclaration de vol par feuille (<i>aussi disponible au club</i>)	
ACVV guide des procédures pour FAI certificats et insignes (éd.6 anglais)	
FAI Code Sportif, Planeurs, 1995	
<i>disponible et payable à l'Aéro Club du Canada (l'adresse ci-dessous)</i>	

Votre paiement devrait accompagner la commande. La livraison est incluse dans le prix. TPS n'est pas requise. Les résidents de l'Ontario sont priés d'ajouter la taxe de 8%. Les articles 1-6 et 13-18 sont disponibles au bureau national de l'ACVV.

SAC affairs

SAC BOARD OF DIRECTORS SUMMARY OF FALL MEETING

The very productive meeting was held in Montreal 24-26 November.

Finances and Budget The overall 1995 finances were satisfactory and SAC will have a modest surplus. A preliminary 1996 budget workup indicates that an increase of \$2 (about \$1 after tax) for the basic membership fee and \$1 for most other membership categories will be necessary.

What is SAC? The old problem of member and club perception of SAC was aired again with the assistance of invited club presidents Jean Lapierre of Champlain and Jim Henry of MSC. Jim proposed that SAC emphasize the adventure and excitement of our sport to attract new members. He noted that MSC's publicity budget was larger than SAC's. He thought that SAC should adopt a much more confrontational style with Transport Canada as does the Canadian Owners and Pilots Association (COPA), and that we should not be doing TC's work.

Jean thought that SAC's profile among pilots was too low and their awareness stops at *free flight*. He felt that SAC should be imposing more structure — everyone should be encouraged to use SAC manuals, etc. and SAC should be operating more independently from government as does the British Gliding Association. He also thought that SAC should be more involved in marketing with the clubs.

Aero Club of Canada The ACC is virtually bankrupt. There was an extended discussion of what this implies for Canada's participation in the FAI and for SAC (FAI badges, participation in international competitions, SAC expenses, etc). The financial challenge is that the FAI fees (set in Swiss francs) have risen as has the Swiss franc against the dollar, and the ACC's operating expenses also have to be covered now that they no longer receive funds from the federal government.

Representatives of the member aerospace associations (soaring, ballooning, etc.) will be meeting to try to resolve matters. Chris Eaves has been designated as SAC's representative and will attend on our behalf.

Sporting and World contest issues

The terms of reference for the Sporting committee have been redrafted and submitted to the board. Wilfred Krueger collected more funds than he needed to participate in New Zealand. These funds have been placed in the Wolf Mix Fund to assist future Canadian teams. The SAC Steering committee recommended that only sanctioned pilots

be a part of national teams, and there was discussion on the team selection process.

Donations to SAC The World Contest Fund received a donation of \$3500 from the Jack Freedman Foundation, which is administered by Robert Wappel, as well as \$1000 from Mintz & Partners. Mr Wappel also donated \$1500 to the Pioneer Trust Fund. A significant number of donations have been received for the Pioneer Fund.

The role of Directors Pierre indicated that individual directors need to take on more active responsibility in SAC business as too many issues have to be handled by the president now which spreads his efforts too much.

Hal Werneburg indicated he can focus on sporting matters and be the SAC representative to the IGC. Harald Tilgner will take on issues surrounding commercial glider operations and how SAC can best accommodate them and will work on the criteria for a new class of membership. John Broomhall will get involved with publicity issues. Karl Robinson will liaise with the Flight Training & Safety committee.

Insurance status Richard Longhurst indicated that 1995 insurance losses were high and similar to 1994. There were fewer but larger claims. As there is only one company interested in SAC business, we are not in a good negotiating position on rates and a premium increase will be difficult to avoid.

Appointments

The steering committee recommended and the Board accepted the appointment of Robert Wappel as legal counsel for SAC. Jim McCollum has been appointed as SAC Executive Director with the responsibility of overseeing office operations.

Jim wanted free flight to point out that he being named Executive Director does not mean that the office is able to take on a lot of additional responsibilities for members. Jim is now doing during working hours much the same things that he was in the evenings before he retired from the civil service, plus the day to day secretarial stuff of the past. SAC is looking for part-time staff through word of mouth rather than going through a time-consuming formal job application process.

Committee chairmanship changes

John Broomhall will take over the Radio and Communication committee from Paul Moffat. Dave McAsey of Cu Nim will take over Trophies. A potential candidate for Airspace is being approached. Ted Froelich of GGC will take over the SAC video library from Gordon Waugh.

SAC "MEMBERSHIP METER" 1995 YEAR END

Club	Membership (31 Dec)		
	90-94 avg	1995 total	% avg
ASTRA	2	20	1000
Air Sailing	32	21	66
Albarni	11	15	136
Aero ... Outardes	37	39	105
Base Borden	15	15	100
Beaver Valley	11	11	100
Bluenose	42	34	81
Bonnechere	9	7	78
Bulkley Valley	14	8	57
Central Alberta (new)	-	10	-
Champlain (+ App)	55	63	115
CVV Quebec	38	36	95
Cold Lake	28	24	86
COSA (+ Kawartha)	46	29	63
Cu Nim	63	56	89
Edmonton	68	67	99
Erin	30	42	140
Gatineau	87	92	106
Grande Prairie	7	10	143
Gravelbourg	6	7	117
Guelph	31	27	87
London	45	37	82
Mont Valin	5	3	60
Montreal (+ Ariadne)	103	103	100
Prince Albert	8	13	162
Regina	33	29	88
Rideau	19	7	37
Rideau Valley	41	30	73
Saskatoon	12	18	150
SOSA	120	140	117
Swan Valley	6	6	100
Toronto	19	19	100
Vancouver	105	85	81
Westman	4	1	25
Windsor	12	9	75
Winnipeg	70	70	100
York	91	79	87
Non-club	9	9	100
totals	1331	1291	97

The 1995 membership has improved over the 1994 value by a total of 34.

Flying the Puchatec

from page 11

open (slightly effective) to fully open. They are not as smooth as one would wish for a basic trainer. We will also need to teach full-brake landings to avoid students finding out when solo how not to do it!

The higher speeds are where the Puchatec shows a considerable disadvantage over its more expensive cousin, the Puchacz. You pay your money and gets the performance to match! Hence the Puchatec is not your Blanik replacement, rather one should consider the Puchacz for this role.

Overall, we have here in the Puchatec a good to excellent basic trainer. It is easily handled on the ground, is a pleasure to fly, soars easily, spins and recovers readily (which is needed in a basic trainer these days), and it can be integrated well into any club's normal training program. ❖

Announcement/Annoncer – Pierre Pepin

Your board of directors is pleased to announce the nomination of James F. McCollum as Executive Director of the Soaring Association of Canada.

This position has been vacant for many years and the board has felt that we needed a more rigorous management of our national affairs, especially in light of the upcoming changes within Transport Canada.

In that position, Jim will be responsible for the management of our National office and coordinate and facilitate the actions of all of us who do volunteer work for SAC.

A graduate of Rice University (PhD. Economics) James McCollum was, until his recent retirement, a senior executive of the federal Finance Department where his duties ranged from representing Canada on international commissions to formulating legislation.

Jim has been SAC treasurer for many years, and we have been fortunate to have the benefit of his enormous dedication through various office automation projects. Jim is an active pilot, flying his 1-35 out of the Gatineau Gliding Club.

Jim received the Tissandier award from the FAI in 1995 for his outstanding contributions behind the scenes to the Soaring Association throughout the years.

Your board of directors is pleased to announce the formation of a permanent **National Soaring team**.

- The team members are the top five pilots of the Standard and the 15 metre classes, as determined by the seeding list compiled by the Sporting committee.
- The team roster will be refreshed after each national competition.
- Canadian representatives to the World competition will be selected from the current National team.

The objectives are as follows:

- 1 to recognize the top performers in the sport,
- 2 to give us an additional platform to promote the sport as well from within as to the general public,
- 3 to improve the calibre of the sport in Canada and the competitiveness of Canadian soaring pilots to world events,
- 4 facilitate the participation of a Canadian team to world events.

Votre conseil d'administration est heureux d'annoncer la nomination de James F. McCollum comme Directeur Exécutif de l'Association Canadienne de Vol à Voile. Monsieur McCollum est bilingue. Ce poste était vacant depuis plusieurs années et nous ressentions le besoin de nous doter d'une gestion plus rigoureuse, spécialement à la lumière des changements qui interviendront chez Transport Canada.

A ce poste, Jim sera responsable de la gestion du bureau national et de coordonner et faciliter le travail des volontaires qui se dévouent pour notre organisation.

Détenteur d'un doctorat en économie de l'Université Rice, James McCollum était avant de prendre sa retraite, un haut fonctionnaire du ministère fédéral des finances. Son travail consistait autant à représenter le Canada au niveau des commissions internationales que de formuler des documents législatifs.

Jim est le trésorier de l'ACVV depuis de nombreuses années et nous avons été chanceux de pouvoir profiter de son expertise pour des projets d'automatisation de nos activités administratives. Jim est un membre actif de Gatineau Gliding où est basé son 1-35.

En 1995, Jim recevait le diplôme Tissandier de la Fédération Aéronautique Internationale pour son travail discret mais incessant auprès de l'Association Canadienne de Vol à Voile.

Votre conseil d'administration est heureux d'annoncer la formation de l'**Équipe Nationale de Vol à Voile**. Cette équipe sera permanente.

- L'équipe sera formée des cinq meilleurs pilotes des classes Standard et 15 mètre, selon la liste compilée par le Comité Sportif (alias Sporting committee).
- La liste sera remise à jour après chaque compétition nationale.
- Les représentants canadiens aux compétitions mondiales seront recrutés à partir des membres de l'équipe nationale.

Nos objectifs, en créant cette équipe, sont:

- 1 identifier les meilleurs performeurs en vol à voile,
- 2 nous donner une opportunité additionnelle de promouvoir notre sport autant à l'intérieur de notre organisation qu'à l'extérieur,
- 3 améliorer les standards du sport au Canada et la compétitivité des pilotes canadiens au niveau international,
- 4 faciliter la participation d'une équipe canadienne aux compétitions mondiales.

The 1995 National Soaring Team is / L'Équipe Nationale 1995 est

Standard

Jörg Stieber, Ed Hollestelle, Ian Grant, Kerry Kirby, and Richard Longhurst.

15 metre

Ulli Werneburg, Nick Bonnière, Dave Springford, André Pepin, et Heri Pölzl.

INTERNET: IS SAC DITHERING?

A number of members have asked, "Why isn't SAC on the Internet?" It is, and has been for some time. The SAC e-mail address, bx271@freenet.carleton.ca has been published in *free flight* since the spring of '95 (see shaded box on page 4). Additionally, SAC has had a temporary Web site for several months which provides links to clubs with home pages. The address is: <http://www.pubnix.net/~rmacpher/sac.html>

These have always been viewed as temporary measures. They were designed to meet some immediate needs and to allow the National office to consult on an effective longer term strategy which will best address the needs of the whole Canadian gliding community. An announcement and a background article on this will appear in the next issue.

PAUL MOFFAT FLEES THE COUNTRY

Paul Moffat has resigned from the board of directors after many years as Prairie zone director. He was also the chairman of the Radio and Communications committee. Paul has relocated to Alabama and has started on a new job there. Paul is known around Winnipeg for his glider building and repair projects. He had to dispose of the shares he owned in many gliders but has taken his Ka6 with him and will likely join a northern Florida club. Our best wishes to him in his new job.

Pierre Pepin

IMPORTANT PAWNEE AD

The following AD is in effect for all Pawnee PA-25, 25/235, 25/260 aircraft: 95-12-01 Piper Aircraft Corp. This AD requires regular inspection or replacement of the fuselage tube cluster to which the wing forward spar is attached. Cracks and corrosion have been found in this area.



Coming Events

8-10 Mar, 1996 **SAC AGM**, Regina, SK see pg 24

Mar-Apr **Lake Placid spring camp**, organized by Montreal Soaring Council. For info contact Svein Hubinette (514) 765-9951, e-mail: svein@aei.ca

23 Jun - 4 Jul **1996 Canadian Nationals**, Red Deer, AB. Contest organizer: Randy Blackwell (403) 594-2171.

27 Jul - 5 Aug **Cowley Summer Camp**, Canada's largest soaring event. Contact: Tony Burton (403) 625-4563.

ONTARIO SOARING LADDER

End of season flight claims have added new names to the list. In all, 13 pilots claimed 50 flights, 9883 km, and 3046 m height gain – well over double last year's activity.

The final score shows Dave Frank of Rideau Valley Soaring in first with four declared flights of 3–400 kilometres each which earned him 1690 handicapped points. Sue Eaves of London, who led for much of the year, dropped to second place. Sue's flights included a 508 Diamond distance that set a feminine free distance record. Although she claimed more kilometres than Dave, it's the four highest scoring flights that count. Best novice was Matt Keast of London for his Silver height gain. The competition was fierce. Congratulations to all!

It's good to see activity increasing in the Ladder. Thank you for your feedback and support. Jörg Stieber commented that Germany organizes a popular "decentralized nationals" on lines similar to our Ladder. A further benefit he mentioned is that it docu-

ments activity level in the sport if needed when airspace comes up for discussion.

Dave Frank recently pointed out that the Ladder's rules are similar to SAC's Canadair trophy, the only difference appears to be that the Canadair is scored on the five best flights rather than our four. If our rules were the same, the Ladder winner could use the same flights and evidence for the Canadair. Makes sense to me. I intend to look at the Canadair trophy rules with a view to revising next year's Ladder.

I am happy to continue as Ladder Administrator, although I will say that sorting through 50 flight claims trying to keep the scores straight is more work than I thought it would be, despite my latest "U-score" claim form. If any programming whiz out there would like to put together simple scoring software I'd be happy to talk to you. Indeed if any of you have comments or suggestions please write or phone. Plan to participate in 1996!

Ian Grant, 41 Gillespie Crescent, Ottawa, ON K1V 0C1 (613) 737-9407 (home).

Name	Club	Glider	Call Sign	No. Flts	Total Kms	Alt Gain	Pts	Place
Dave Frank	RVSS	ASW-20	SR	4	1453.8		1690	1
Sue Eaves	LSS	LS-4	SU	9	1683.8		1283	2
George Wilson	LSS	Libelle 201	JK	6	1141.6		1109	3
Doug Bremner	SOSA	SZD-55	XT	5	999	1796	1029	4
Fred Hunkeler	SOSA	Std Jantar	1M	6	977.4		1012	5
Chris Eaves	LSS	ASW-20	XU	6	1194.4		1000	6
Jörg Stieber	SOSA	LS-4	JS	2	587		715	7
Ian Grant	GGC	LS-4	ZT	3	607.7		683	8
Gilles Séguin	MSC	DG-200	GS	5	722		639	9
Norman Fortin	GGC	LS-4	ZT	1	315		312	10
Matthew Keast	LSS	Std Austria	ZDO	1		1250	211	11
Peter Vados	SOSA	G103	GLA	1	106		125	12
James Adamczyk	SOSA	Std Jantar	1M	1	96.7		100	13

Note: points are awarded for the four highest scoring flights.

SAC AGM Regina 8-10 Mar 1996

Travelodge Hotel 4177 Albert Street
room rate: \$59.95, call (306) 586-3443

For flight reservations, call AIR CANADA (1-800-361-7585)
at least 7 days prior (some lower fares available with 14 days notice)
or contact any *Carlson Wagonlit Travel Agency*
– use convention #CV960403 –

AGM registration: convention \$25, banquet \$25 (\$30 after 31 Jan), lunch \$15
SAC AGM coordinator: Jim Thompson (306) 761-0292

Friday 1700-2000 registration, 1900-2200 president's reception
Saturday 0900-1600 seminars with lunch, 1800 cocktails, 1900 banquet & awards
Sunday 0800-1200 annual general meeting

... most at risk?

from page 17

There is specific pilot knowledge that will solve this.

3 *Landing pattern stalls* Most pilots identify the turn onto base or final as being the principle culprit to their safety. This is only partially correct, and in aviation, 90% is not a passing grade — the knowledge you don't have can kill you.

Knowing the three occasions you are at most risk for a stall accident can help you be especially alert, help you avoid the problem or help you be prepared with a plan of action. Future articles will discuss each of these occasions in detail and will investigate some rather surprising facts and misconceptions about stalls and stall training.

Making your own canopy from page 9

sheet will shrink up to 3/4" on cooling! You can take up to 1/2 hour to do this, but don't let the canopy sit overnight, or it may be in three pieces in the morning.

- Cool the inside air; this air will be HOT! Remove the plastic from the forming sheet and allow to cool.

Post-processing The canopy will spring inward as the flange is removed. Handle carefully, too much stress in a bend will crack it. Move your canopy frame around to find the best fit of shape and mark the canopy for cutting. Use care not to scratch the plastic — cover the frame with masking tape and hold against inside surface. The best way to separate the desired section is to use a hot knife to slice the parts away. I used a kitchen knife with a thin blade heated to less than red hot (red hot would ignite the plastic!). This produces a clean, crack-free edge with a small burr. Be generous with the first cuts — it's easy to make the canopy smaller, impossible to make larger.

Once the plastic is attached to a frame, the excess may be trimmed with a bandsaw. A thin blade with 8–12 teeth per inch works best. Use the hot knife to make vent openings, etc. With care, the cutout will be the window to place back. You can make a slider, just like Megaplex, from scrap plastic that is cut and attached to the canopy. One small word of caution — the freshly formed plastic is rather brittle and can crack easily; whenever you must make a cut, or drill a hole, use a hot knife or soldering iron tip. The plastic will also craze when glued at this time; use caution, 6–12 months later the plastic will behave more benignly.

Note: Check with your plastic supplier — some acrylic *isn't* suitable for heat forming. You can make your own canopy for home-built aircraft, but certified aeroplanes may be a different matter. Check with your local AME and TC officials; their responses vary considerably across Canada on the permissibility of making your own canopy. ❖



SAC SOARING STUFF / ARTICLES DE L'AIR

Feb 1996

Price	Size	Qty.	Amount	T
Prix	Taille	Qté	Total	A
				X

prices include postage and GST • la livraison et TPS sont inclus dans les prix

1	SAC T-shirt • navy with gold and white crest specify size – M, L, XL	15.00	✓	ACVV T-shirt • bleu marin avec un écusson or et blanc, précisez la taille – M, G, XG
2	“SAC University” T-shirt • various colours specify size – M, L, XL	15.00	✓	T-shirt “l’université de l’ACVV” • couleurs diverses précisez la taille – M, G, XG
3	SAC golf shirt • navy specify size – M, L, XL	25.00	✓	ACVV chemise de golf • bleu marine précisez la taille – M, G, XG
4	SAC sweat shirt • navy specify size – M, L, XL	25.00	✓	ACVV sweat shirt • bleu marin précisez la taille – M, G, XG
✿ 5	SAC 50th ANNIVERSARY sweat shirt specify size – L, XL	25.00	✓	ACVV sweat shirt 50ième anniversaire précisez la taille – G, XG
6	SAC hooded sweat shirt • navy specify size – M, L, XL	35.00	✓	ACVV sweat shirt à capuchon • bleu marin précisez la taille – M, G, XG
7	SAC Beanie • white with blue gliders	12.00	✓	ACVV chapeau • blanc avec des planeurs bleus
✿ 8	SAC cap • black, SAC in large white letters	10.00	✓	ACVV casquette • noir aux caractères blancs
9	SAC tie • blue with red gliders	20.00	✓	ACVV cravate • bleue avec des planeurs rouges
✿ 10	SAC decal (glider & maple leaf)	2.00	✓	Auto collant “AVCC” (planeur et feuille d’érable)
✿ 11	Decal “I’D RATHER BEE SOARING”	0.50	✓	Auto collant “I’D RATHER BEE SOARING”
12	Sunshade (sun protector for your car windshield; glider design)	6.00	✓	Sunshade (para-soleil en carton pour votre voiture; dessin d’un planeur)
✿ 13	Bumper sticker “I’D RATHER BE SOARING”	2.00	✓	Auto collant “I’D RATHER BE SOARING”
14	Licence plate holder “I’D RATHER BE SOARING”	10.00	✓	Étui de plaque de matriculation “I’D RATHER BE SOARING”
15	Tost ring (4 for \$100)	28.00	✓	Anneau de remorquage Tost (4 pour \$100)
Books from international authors				
20	SOARING CROSS-COUNTRY – ed. 2 Helmut Reichmann	58.00		Livres des auteurs internationaux
✿ 21	FLYING SAILPLANES • Helmut Reichmann	40.00		SOARING CROSS-COUNTRY – ed. 2 Helmut Reichmann
✿ 22	SILENCE ON THE WIND • Helmut Reichmann	45.00		FLYING SAILPLANES • Helmut Reichmann
23	SOARING WITH THE SCHWEIZERS Bill Schweizer	30.00		SILENCE ON THE WIND • Helmut Reichmann
24	GLIDING SAFETY • Derek Piggott (autographed)	35.00		SOARING WITH THE SCHWEIZERS Bill Schweizer
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30	SOARING ACCIDENTS THAT ALMOST HAPPENED • Steve Dupont	12.00		THE BOOK OF THE BEST • Ursula Wiese
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				FROM THE GROUND UP • Isabel Pepler

✿ any change to last flyer

continued on other side — voir au verso

Price	Size	Qty.	Amount	T A X
Prix	Taille	Qté	Total	

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SAC crests, pins, cards					Ecussons et epingles de l'ACVV
40	Crest "SAC•ACVV", embroidered		3.50	✓	Ecusson "SAC•ACVV", brodé
41	"SAC" lapel pin		5.00	✓	Epingle "SAC"
42	Lapel pin • Glider		10.00	✓	Epingle • Planeur
43	Postcards (set of 5 sailplane photographs)		1.25	✓	Cinq cartes postales (photos des planeurs)
Manuals and flying aids					Manuels et accessoires de vol
50	Glider pilot logbook (box of 22 for \$199)		10.00	✓	Carnet de vol pour pilote de planeur (boîte de 22 pour \$199)
51	Student progress book (10 for \$30)		4.00	✓	Carnet de vol d'entraînement de l'élève pilote (français) (10 pour \$30)
52	French instruction manual		6.00		Manuel d'instructions de vol à voile rev. jan 80 (français)
53	<i>SOAR AND LEARN TO FLY GLIDERS</i> ed. 1993 (English only)		19.95		revision française en préparation
54	Air instruction notes (for instructors) (10 for \$40)		5.00		Instructions en vol – notes (pour instructeurs) (français) (10 pour \$40)
55	SAC guide " <i>Badge and Records Procedures</i> " • edition 6 (10 for \$40)		5.00	✓	ACVV guide des procédures pour FAI certifi- cats et insignes (édition 6 • anglais) (10 pour \$40)
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6	FAI Gold badge, cloth, 3" dia.		4.50	✓	Insigne FAI or, écusson de tissu
7	Flight Declaration form (available from your club)		0.15	✓	Formulaire de déclaration de vol (disponible au club)

Total _____

8% Tax _____

Total _____

Please enclose payment with order. Prices include postage and GST. *Ontario residents*, add 8% sales tax for items having a ✓ in the "Tax" column. Do not forget to indicate the size you want for shirts. *We cannot accept credit cards.*

Votre paiement devrait accompagner la commande. La livraison et TPS sont incluses dans les prix. Ne pas oublier de mentionner la taille des chemises. Nous ne pouvons pas accepter les cartes de crédit.

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Trading Post

Personal ads are a free service to SAC members (please give me the name of your club) \$10 per insertion for nonmembers. Send ad to editor, NOT the national office.

Box 1916, Claresholm, AB T0L 0T0
tel/fax (403) 625-4563

Ad will run 3 times unless you renew. Please tell me if your item has been sold sooner. Maximum length is 6 lines, ads subject to some editing as necessary.

single seat

Skylark 2, excellent condition, recovered in 1987, electric vario, chute, encl trailer, current c of a. \$5500 obo. Fred Lukianow (519) 681-0533.

Skylark 3, excellent cond, new paint, encl trailer (needs some work). \$6000 obo. (519) 271-3230.

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HP-14, 450h TT, good condition, single piece canopy, filled wings, TE vario, chute, new Imron paint. US\$9000. Keith Pritchard, (519) 570-9437 (H), (519) 571-1434 (B), e-mail kpritchard@sstech.on.ca.

1-35, 650 h, yellow, aileron/flap interconnect, radio, O2, new canopy and cover, Varicalc 3 audio flight computer, metal trailer, complete history and documentations. \$20,000 Don Wood (604) 658-8288, fax 658-5538.

Ka-6CR, C-GJUA, fully instrumented, radio, wood trailer. Estate sale, price negotiable. Adam Martin (519) 354-6041.

USED SAILPLANES WANTED FROM CLUBS & PILOTS

If you are considering selling, call *free flight* now, don't wait for the magazine to appear! The sailplane market is tight, and the editor gets regular calls to see if anything is available.

Diamond Days in the United States of America and Canada

by Michael Steckner, fwd by RH Johnson

An analysis of 2880 500+km flights and 2440 5000+m height gain flights (see *ff* 5/95, p18), 348 pages, 145 graphs, and a full printout of flight data. US\$40 incl postage. Foreign and Canadian orders \$US45, international money order only.

Michael Steckner, 418 Eagle Trace
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Phoebus B, C-FOKA, 1014 h, vg cond, never damaged, Cambridge vario, O2, tail dolly, gear warning, excellent encl trailer, delivery available. \$17,500 (604) 344-6620, 1-800-268-SOAR.

Pilatus B4, C-GRMS, 1116 h, Rico vario, radio, O2, gear warning,vg cond, ready to fly. Encl trailer and delivery available. \$22,800 (604) 344-6620, 1-800-268-SOAR.

Std Cirrus, #148, tinted canopy, water, baro, Radair 10 radio, chute, alum trailer, never broken, super finish, always hangared. Call Ozzie, (613) 678-5197.

SZD-55-1, C-FTVS, brand new, fully instrumented with latest or with basic instruments. Licensed and ready to fly. New *Trailcraft* clamshell trailer. Ed Hollestelle (519) 455-3316 W, (519) 461-1464 H.

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beautiful soaring photos

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magazines

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NEW ZEALAND GLIDING KIWI — the bi-monthly journal of the New Zealand Gliding Association. Editor, John Roake. \$US25/year. NZ Gliding Kiwi, Private Bag, Tauranga, NZ.

SAILPLANE & GLIDING — the only authoritative British magazine devoted entirely to gliding. 52 pp, bi-monthly. Canadian agent Terry Beasley, Box 169, L'Original, ON K0B 1K0 or to BGA, Kimberley House, Vaughan Way, Leicester, LE1 4SG, England. £15.50 per annum (\$US30) or \$US40 air.

AUSTRALIAN GLIDING — the journal of the Gliding Federation of Australia. Published monthly. \$A40.50 surface mail, \$A55 airmail per annum. Payable on an Australian bank, international money order, Visa, Mastercard. (No US\$ personal checks.) Box 1650, GPO, Adelaide, South Australia 5001.

Solaire Canada

Ed Hollestelle (519) 455-3316 p & fx

LX-20 the new FAI standard for stand-alone GPS data recorders \$1995

ATR720A 760 chan VHF with mounting tray and wiring harness \$1695

SHM1010 Boom mike and wiring (as installed by most glider manufacturers) \$150

LX-4000E S-RAM final glide computer or connects to any GPS (with NMEA output) or connects to LX-20 data recorder \$2795

LX-5000 the ultimate GPS/final glide computer system with large backlit graphic display and FAI data recorder \$5995

LX-400 3 demo units, 2-1/4" panel mount GPS with Canadian database \$1295

two place

Lark IS28B2, C-GVLI, 1400 h. Basic instruments, Cambridge vario & back seat repeater, Alpha 100 radio, Varicalc flight computer, g-meters, professionally built open trailer. Available immediately. \$US19,500 obo. Contact Winnipeg Gliding Club. e-mail: wgc-info@lark.magic.mb.ca or leave message at (204) 837-8128 (24 hrs).

miscellaneous

Wanted - Winch with large block gasoline V8 engine in good working condition. Prefer tandem axle unit with good tracking. Send photos/info to Box 7943, Saskatoon SK, S7K 4R6, or call (306) 947-2830 eves.

Barograph JMF MkII 30,000 ft barograph, large 14 hour drum, calibration incl. \$350. Pneumatic switches for netto on/off etc. \$15. John Firth, 542 Coronation Ave, Ottawa, ON K1G 0M4 (613) 731-6997.

'M' Nav final glide computer, with 3-1/4" vario. As new condition. Adjustable for any polar. \$1499. **Radio**, KX99 handheld, like new with many accessories/extras. A Jackson, days (403) 720-0262, eves (403) 246-7919.

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Used final glide computer/audio vario, several available at good prices. Peschges VP3E and Zander SR-820, \$1495 each. Ed Hollestelle (519) 455-3316 W, (519) 461-1464 H.

Bubble canopy, smoke gray tint, free blown to these dimensions: 85" long, 24" @ widest, 14" greatest depth. Blunt ends, distortions free, 1/4" starting thickness. Not trimmed from form (flange in place). \$300 Jim Cook (204) 489-6929.

suppliers

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