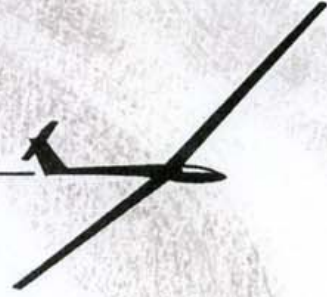


Dec 70 - Jan 71



# Free Flight

official publication of  
THE SOARING ASSOCIATION OF CANADA

SOARING ASSOCIATION OF CANADA  
Box 1173, Station "B", Ottawa 4, Ont.

List of Supplies

<u>ITEM NO.</u>	<u>D E S C R I P T I O N</u>	<u>UNIT COST</u>
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NOTES:

- 1) Item 2 available ONLY from:  
V. Shobridge, 1849 Burrill Street, North Vancouver, B.C.
- 2) Item 5 available ALSO from V. Shobridge.
- 3) Items 6, 7 and 8 make up the S.A.C. Instructor's Manual. The  
will be available in March 1971 - Prices will be approx. the  
same as previous Manual components.
- 4) Make all cheques payable to:  
Soaring Association of Canada.

SOARING ASSOCIATION OF CANADA

List of Member Clubs

1. QUEBEC & MARITIME ZONE

Appalachian Soaring Club, Box 271, Sherbrooke, P.Q.  
Buckingham Gliding Club, 1464 MacLaren Street, Buckingham, P.Q.  
Champlain Soaring Association, c/o J.D. McCormick 875-54th Ave., Lacine, P.Q.  
Lahr Gliding Club, c/o Capt D. Bentley, 1 Wing CAP, CFPO 5000, Belleville, Ont.  
Montreal Soaring Council, Box 1082, St. Laurent, Montreal 379, P.Q.  
Quebec Soaring Club, Box 276, Quebec 10, P.Q.

2. ONTARIO ZONE

Air Cadet League (Ontario), 1107 Avenue Road, Toronto 12, Ont.  
for mail:- Attention: R.E. Nevin, Chairman, Glider Committee  
Air Sailing Club, Box 618, Station "K", Toronto, Ont.  
Air Trails Soaring Club, c/o R. Scholey, 1651 Norman Road, Windsor, Ont.  
Algoma Soaring Club, Box 921, Sault Ste. Marie, Ont.  
Belleville Flying Club (1960), Box 322, Belleville, Ont.  
for mail:- Attention: J.E. Marker.  
Bonnehore Soaring Association, Box 35, Deep River, Ont.  
Central Ontario Soaring Association, Box 762, Peterborough, Ont.  
Chatham Pioneer Flying Club, c/o H. Brubman, 561 Lacroix St., Chatham, Ont.  
Erin Soaring Society, R.R.#2, Erin, Ont.  
Gatineau Gliding Club, Box 883, Station "B", Ottawa, Ont.  
London Soaring Society, Box 773, Station "B", London, Ont.  
Pioneer Soaring, R.R.#2, Tottenham, Ont.  
Rideau Gliding Club, c/o H. Janzen, 172 College Street, Kingston, Ont.  
SOSA Gliding Club, Rockton, Ont.  
Toronto Soaring Club, Box 192, Station "C", Toronto 3, Ont.  
Windsor Gliding Club, c/o J. Dunn, 1105 Coventry Court, Windsor 16, Ont.  
York Soaring Association, c/o F. Balchunas, 41 Dundonald St., #704, Toronto, Ont.

3. PRAIRIE ZONE

Lakehead Gliding Club, Box 161, Station "P", Thunder Bay, Ont.  
Melville District Gliding & Soaring Club, c/o Credit Union Ltd, Melville, Sask.  
Pine Tree Soaring Club, 821 - 22nd Street East, Prince Albert, Sask.  
Red River Soaring Association, Box 1074, Winnipeg, Man.  
Regina Gliding & Soaring Club, c/o W. Reed, 3075 Angus Street, Regina, Sask.  
Winnipeg Gliding Club, Box 1265, Winnipeg, Man.

4. PACIFIC ZONE

Cu-Nim Gliding Club, Box 5922, Station "A", Calgary, Alta.  
Edmonton Soaring Club, Box 293, Edmonton, Alta.  
Kamloops Soaring Club, Box 699, Kamloops, B.C.  
Red Deer Soaring Association, Box 963, Red Deer, Alta.  
Skyway Air Services, Box 520, Langley, B.C.  
Vancouver Soaring Association, c/o D. Ducham, 1064 Ruthina Ave, N. Vancouver, B.C.  
Van Isle Gliding Association, c/o D. Pearson, Stirling Arm Drive, R.R. # 3,  
Port Alberni, B.C.



# Free Flight

Issue 1/71

Dec. 1970 - Jan. 1971

\* \* \* Season's Greetings \* \* \* Meilleurs Souhails \* \* \*

## S.A.C. NEWS

The Annual General Meeting will be held in Ottawa, Ont., on March 20th, 1971. The next issue of 'Free Flight' (due out approx. March 1st, 1971), will have an Agenda for the Meeting, together with some advance 'Notices of Motions' to be tabled.

In this regard, if any member has a 'Notice of Motion' that he wishes to be included with the March 1st issue, would he please send details to the Editor. This will give the total membership a chance to assess the merits of the planned motions that will be presented at the Meeting.

### MAIL VOTING:

The mail voting is in progress. Will all Clubs please meet the deadlines of the Procedure letters sent out by Mrs. Hamilton of Box 1173. This will ensure a representative vote from each of the four Zones.

### 1971 INSTRUCTORS' SCHOOLS:

The timing for these Schools has now been established - West School, at Easter time: April 10-16/71 inclusive, at Penhold, Alberta; and the East School: May 23-29/71 inclusive, at Pendleton, Ontario.

This year it will be necessary to request a \$20.00 deposit for each candidate attending either School, at least 30 days prior to the start of the School. Each deposit will be applied against the expenses of the depositor, and will not be cashed until the end of the School. However, if the individual does not show up, the deposit will be forfeited, and will be used for the expenses of those attending.

It is strongly recommended that each Club pay the \$20.00 for the candidate(s) representing it, and take the responsibility of ensuring that a candidate shows up for each deposit. This contribution by Clubs would encourage candidates to attend - and the individual does, after all, contribute one week's vacation period and pay the other expenses for the privilege of working hard as a Club Instructor.



It is not yet known whether there will be Federal Funds for traveling and living as in 1969. If these are not available, it is planned to have the S.A.C. subsidize one-half the cost of the flying exercises, as in 1970.

Will those interested, please contact either Don Skinner, c/o Cu-Nim Gliding Club, or Walter Piercy, c/o Rideau Gliding Club. (All Club addresses, including the three new clubs mentioned below, are given in the SAC Member Club List elsewhere in this issue).

#### NEW CLUBS:

As of the end of 1970, we officially welcomed three new member clubs: Algoma Soaring Club, Bonnechere Soaring Association, and the London Soaring Society.

#### F.A.I. APPLICATION FORM FOR BADGES (S.A.C. Form No. 10, Issue 6, May 1968).

It is necessary to revise the above form to show an increase in the fees for gliding certificates, which are listed at the bottom of Page 1. For the present, the fees listed should be regarded as obsolete. The new fee schedule will be published in 'Free Flight' prior to new forms being made available.

#### FIVE BEST FLIGHTS AND "200" TROPHIES:

Flights to qualify for the above trophies should be submitted to Paul Thomsen, 2675 Vaudreuil, No. 11, Sherbrooke, P.Q. It is hoped to publish a list of 1970 performance flights in the next issue of 'Free Flight'. The trophies will be awarded at the A.G.M. on March 20th.

#### C.O.P.A.

For the information of all members, Mrs. L. Miller has left the COPA office and her place has been taken by Mrs. N. Hamilton. The change was effective November 1st, and Mrs. Hamilton is already involved in answering enquiries directed to S.A.C. at Box 1173 in Ottawa.

#### SOARING SOCIETY OF AMERICA - 1971 CALENDARS:

This year S.A.C. members can obtain calendars for \$1.15 each, a reduction of 50¢ from 1970 due to SSA only using two-colour photos instead of the full-colour ones as in the past. An easy way to obtain your calendar is to have your Club Secretary send in your name, and cheque, to Mrs. T. Tucker (SAC Membership Secretary, 786 Chapman Blvd., Ottawa 8, Ont.) who will arrange for you to receive the calendar direct.

Walter J. Piercy,  
President

#### ALBERTA SOARING COUNCIL A.G.M.

Mr. Frank Holman, President of A.S.C., advises that the Annual General Meeting will be held on Saturday, February 6th, 1971, at the Grenada Hotel in Red Deer.

## F.A.I. COMMITTEE ANNOUNCEMENTS.

1971 Nationals (Pendleton Airport; tentative date July 6 to 15 incl.).

The F.A.I. Committee and the Contest Organisers (G.G.C.) wish to promote a Sports Class again in 1971, despite the lack of interest at Carman. The success of the large sailplanes at Marfa has further underlined the fact that money buys a fairly big performance advantage, and if you think an ASW-12 is expensive, wait till you see what a Nimbus will cost. The only hope for the average man is the establishment and acceptance of either handicaps, and/or, class concepts.

### Entry Qualifications

A Silver Badge will be the minimum entry requirement for 1971, for both Classes.

### Possible Changes in the Scoring Rules for the Championship Class:

Since the present rules are closely based on World Contest rules, which are predicated on a contest of 40 very competent pilots, some changes in the application of these rules is indicated:

- (1) A valid contest day requires 25% to exceed 50 km.
- (2) The distribution of speed and distance points in a race is sharply affected by the percentage of finishers.

Therefore it is proposed that as a basis for determining the percentages indicated above, only the following pilots will be counted in the denominator:

- (a) Those who have finished in the top 50% of a Canadian or U.S. National contest.
- (b) Those who have completed a Gold Distance flight.

Non qualifiers may still enter the Championship Class and will be counted in the numerator of the percentage calculation.

### Sports Class

It will be normal practice to set the same task for both Classes. However, when it is seen to be desirable to set different tasks, a pilot may opt to fly the Championship task, and still be scored in the Sports Class as follows:

His score will be calculated according to the Championship Class rules, his aircraft handicap will then be applied and the resulting score may be counted in the Sports Class. Normally this will be a considerable disadvantage compared with flying the Sports task. However, this will enable him to continue in contention for the championship without foregoing his chances in the Sports Class.

It should be emphasised that this is a proposal only; comments should be sent to Chairman, F.A.I. Committee, 542 Coronation Avenue, Ottawa.

John Firth,  
Chairman, F.A.I. Committee

'Free Flight' regrets to report that Douglas Audette, the son of Julien and Myrtle Audette of Regina, died suddenly on November 16th. He was 20 years old.

Douglas crewed for his father for many years and was well known to the gliding community. Sincere condolences are extended to the Audette family from their many friends in the Soaring Assoc. of Canada.

#### HIGH ALTITUDE INDOCTRINATION COURSE

Major J. Soutendam of the Institute of Environmental Medicine in Toronto advises that courses can be arranged for Glider Pilots during 1971. Bob Gairns has undertaken to contact the Institute towards the end of January 1971 to arrange dates. Therefore, Eastern Zone pilots interested in attending the course should contact Bob at 130 St. Francis St., Chateaugay, P.Q. Or call: 514-691-4754.

Similarly, courses can be arranged at the Canadian Armed Forces Aero-medical Training Units at CFB Winnipeg and Cold Lake. Interested pilots should contact Paul Krauss or George Dunbar respectively. (Their addresses are: P. Krauss, 426 St. Anne's Road, Winnipeg 8, Man. Tel: 204-253-5095; G. Dunbar, 1419 Chardie Pl. S.W., Calgary 9, Alta. Tel: 403-255-7586.

Please DO NOT contact the Institute direct as we have been requested to co-ordinate courses through the S.A.C.

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#### INTERNATIONAL F.A.I. BADGES

By Vic Shobridge

The following were approved in Canada during the months of October and November, 1970:

#### DIAMOND ALTITUDE

496	James Pick	Pirat	White Mt.	SOSA
497	Richard Robinson	Pirat	" "	SOSA
498	Lorant Jenvay	Ka6CR	" "	COSA
499	Peter van Gruen	Cirrus	Wenatchee	

#### GOLD BADGE LEG

498	C.G. Thomas	1-23	Alt.	Hinton	ESC
500	Dale Goulin	BG-12	"	N. Conway	ESS

#### SILVER BADGE LEGS

495	Barbara Puky	1-23	Alt./Dist.	Chemong	COSA
499	Gordon Speer	Ka-6	Duration	"	COSA
501	William Windover	1-26	Dist.	Colorado Springs	
502	Bernard Brayshaw	1-26	Alt.	Hope	VSA

#### CANADIAN RECORDS

Single-seat 100 Km. triangle - 113.43 kph by Richard M. Cook (Std. Cirrus).  
 Fem. Multiplace Absolute Alt. by Antonia Cservenka - 13,800 ft. (2-32).  
 Fem. " Gain of Height by Antonia Cservenka - 9,800 ft. (2-32).

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## O.S.T.I.V. NEWS

By T.R. Beasley

Following the established custom, O.S.T.I.V. (Organisation Scientifique et Technique du Vol à Voile) meetings were held during the period of the World Gliding Championships at Marfa. The writer was fortunate enough to be able to attend some meetings, and S.A.C. members will be interested to know that our own Dave Marsden (Edmonton Soaring Club) presented a paper: "Sailplane Performance in Circling Flight"; David J. Marsden, Associate Professor, Department of Mechanical Engineering, University of Alberta, Edmonton, Alta.

Another good friend of Canadian Soaring presented a paper: "Forecasting during Gliding Contests (International Co-operation); Dr. Sepp J. Froeschl, Ministry of Transport, Montreal, Canada.

It is very satisfying to see that Canada is participating in this way towards the future of our sport.

The Minutes of the official business transacted have just been received and the following brief notes may be of interest:

- 1.0 Swiss Aero Revue will remain the official organ of OSTIV, although some papers may be printed in 'Soaring' due to a cutback in the number of pages made available in Swiss Aero Revue.
- 2.0 OSTIV Publication X containing the 1968 Congress (Leszno) papers should shortly be available; price \$3.25. It will be announced in 'Free Flight' when available.
- 3.0 The proposed publication "Introduction to Sailplane Technology" has been regrettably abandoned. As an alternative, a similar concept is proceeding on an individual chapter basis. As previously mentioned in 'Free Flight', the first section has been published: "Sailplane Weight Estimation" by W. Stender. The second chapter will be "Stability and Control" by Prof. Morelli, and the third "Profiles and Performance" by Prof. Wortmann.
- 4.0 The acceptance of the OSTIV "Airworthiness Requirements for Sailplanes" can be judged from the fact that the 1966 edition is completely sold out; it was therefore reprinted in 1969, although a completely new edition is planned for 1971. This will include some important changes, e.g. tail loads, gust loads, etc. Requirements for motor gliders may also be introduced.
- 5.0 The OSTIV Airworthiness requirements appear to be well on the way to international recognition. This should prove to be a very valuable step towards simplifying certification procedures - particularly in countries not enjoying such a favourable relationship with their Airworthiness Authority as exists between M.O.T. and S.A.C.
- 6.0 Volumes I and II of the "World's Sailplanes" are sold out. Unfortunately there are no immediate plans for Volume III.



- 7.0 Proposals are in hand to arrange an international training course for Meteorological Forecasters for soaring contests. Evidently Montreal was named as a possible locale. If this comes to pass, we hope S.A.C. and the Montreal clubs will be able to offer support.
- 8.0 It was agreed that the Standard Class was now so well established that the OSTIV competition would be abandoned in favour of giving a prize for any significant structural improvement in sailplane design.
- 9.0 OSTIV exists to encourage technical development in soaring design and meteorology. S.A.C. is a full member of the organization. Individuals may also join as "individual members" at U.S. \$5.00 a year. This includes subscription to 'Swiss Aero Revue', which alone is worth the price. However, a word of warning, the publication carries articles in English, German, French, and sometimes Italian. The OSTIV papers are published in the original language and where not English, usually include an English summary. You can support the valuable work of OSTIV by joining as an individual member, or alternatively, why not get four friends to join you and reduce the cost to only \$1.00 each? This is a fine way to be "in the know" regarding technical progress. You will also find that 'Swiss Aero Revue' often has non OSTIV articles of considerable interest to the soaring enthusiast. Please let us see all our clubs sending in some applications for individual membership in this fine organization. Send your application to OSTIV Secretariat, c/o NLM Atoomgebouw, SCHIPOL OOST, The Netherlands, and please mention that you are joining as a result of a recommendation from the Soaring Association of Canada.

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#### TECHNICAL COMMITTEE NOTES

Skylark 4 Owners may be interested to know that the British Gliding Association has approved an increase in all up weight to 880 lb. if operated in the NORMAL Category (i.e. no Aerobatics or Cloud Flying). This will not apply to Canadian registered aircraft unless a Canadian owner requests the S.A.C. to negotiate a change with the Ministry of Transport.

Standard Cirrus. The Ministry of Transport has re-issued Aircraft Type Approval 6-88 as Issue 2 on 29th September to include the Standard Cirrus.

Special Group Insurance (for gliders). S.A.C. has previously made unsuccessful attempts to obtain special group rates for S.A.C. Clubs. Our movement is larger now and it is considered appropriate to have another try. A letter was sent to the President of all member clubs on 15th October asking for data on all gliders, including private owners. To date, four returns have been received. Please chase up your Club President. S.A.C. cannot help you if you don't reply to such queries.

T.R. Beasley,  
Chairman, Technical Committee



W A V E     F L Y I N G
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By Henri Chabot

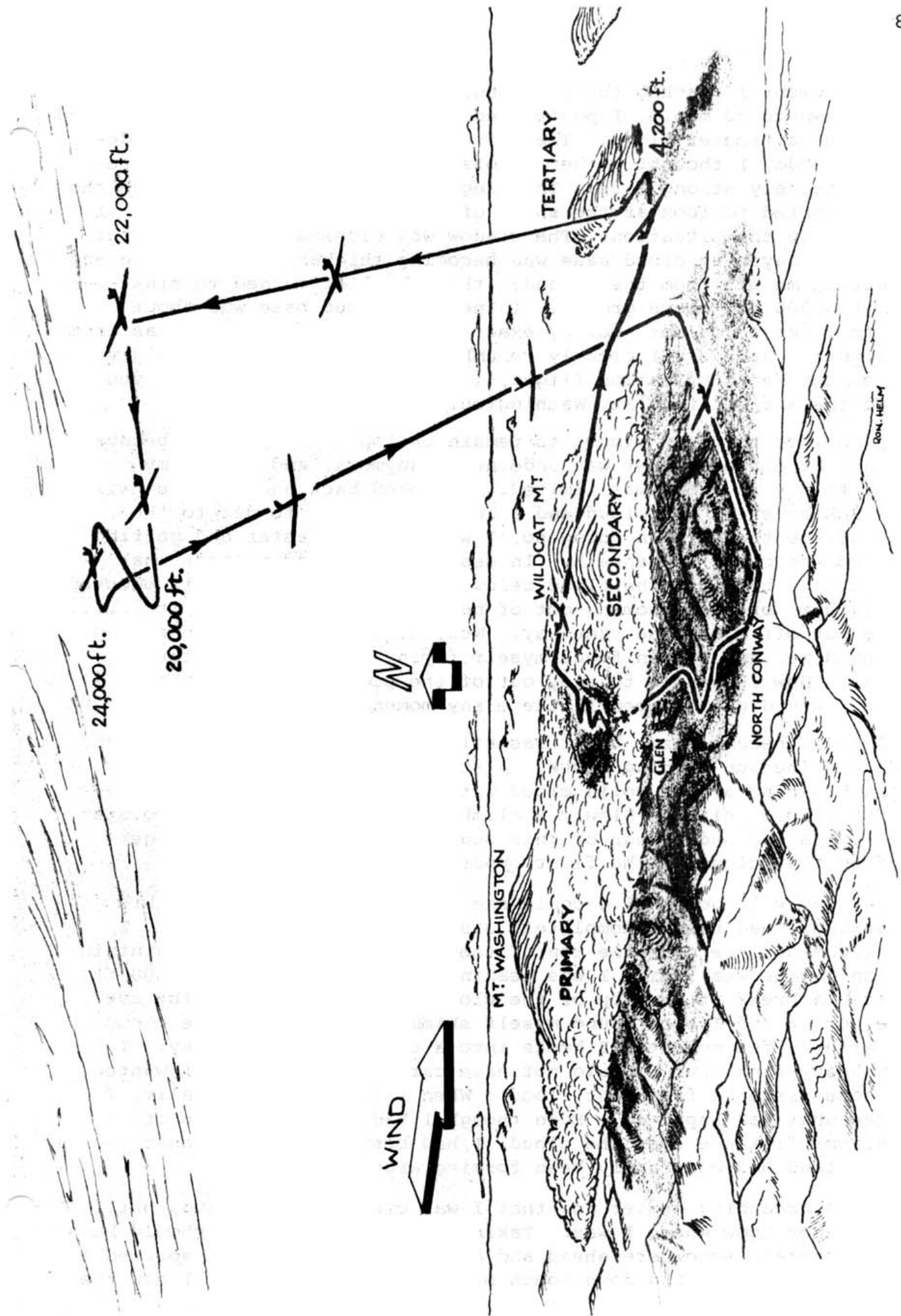
24,000 feet. .... From that high vantage point, the World beneath was looking magnificent. To the south, the outline of the coast was visible and beyond it, the sky was meeting the ocean in an indefinable haze. To the north and the west, the landscape was smoothly disappearing on the horizon. Directly below, hiding Mount Washington and the neighboring mountains, were four well defined clouds: ..... the Mount Washington Wave Phenomena!

In reality, my first encounter with wave flying occurred seven years ago. Since that time, with mixed feelings, I have been seeking my Diamond height. I say "mixed feelings" because to this day, I am simultaneously fascinated and fearful of this phenomena. This last expedition to Mt. Washington illustrates this remarkably well. Each year, more or less, my partner in the SHK, Kurt Kovacs, and myself make a habit of going to the Mt. Washington wave camp.

So, on Saturday 17th October, with the sailplane behind the car, I left Montreal at 6 a.m. It was a long drive accompanied by rain and snow at times and I arrived at North Conway around noon. The sky was partly overcast, but completely unproductive. The rest of the day was spent watching some of the sailplanes, which had arrived earlier, polish the ridge adjacent to the field. There was a light breeze from the west, but apparently it was not strong enough to produce wave. By the end of the day, I had that old familiar feeling that it would be one of those trips again. My hopes were upped somewhat though, when Allan MacNicol, the organizer of the camp, came up with the forecast for Sunday. It looked promising and since one needs an excuse, that's the one I used to stay for Sunday!

Sunday morning turned out to be everything it was promised to be. Cold, windy and clear air. Only the top of Mt. Washington was covered by a cap cloud. By 8 a.m. we were feverishly rigging the SHK. At 10:05 a.m., oxygen turned on and barograph ticking, I was taking-off.

At about 100 ft. off the ground, the now familiar turbulence started. Mild at first, then steadily increasing with altitude and distance from the field. Ahead, the window of the secondary was getting closer. As we were getting higher and closer to the cloud, the window seemed to decrease in size. At the time, I thought it was because of the shallower angle at which I was looking at the cloud, so I didn't think anything of it. At 4,000 ft. the tow was very rough and I found it was extremely hard to maintain position behind the towplane. At what I thought was 4,500 ft. (the towpilot says it was 3,500 ft.), I got so badly out of position that I was forced to release. I was not particularly worried because of the proximity of the window and, at 80 mph, I started to penetrate upwind, skimming the base of the cloud.



The moment I reached the clearing, I hit 400 ft/min. lift. Slowing down to 50 m.p.h. I positioned myself in front of the cloud and watched the altimeter climb. The lift was turbulent, and slowly decreasing! Odd, I thought, other pilots on preceding flights had reported extremely strong lift! Thinking I was out of position with the lift, I started to look at the shape of the window for some clue. I soon sized up the situation. The window was closing rapidly. First, a very thin layer at cloud base was becoming thicker by the minute and was cutting me off from the ground; then the lift turned to sink ---- I was at 6,500 ft. above ground. I knew the cloud base was about 4,500 ft., but I did not know my exact location and how far I was from the airport. However, I clearly remembered the advice that was given to us on the familiarization flight, i.e. "6,500 ft. should get you back to the airport from Mt. Washington."

I decided to do my utmost to remain on top of the cloud, because I was not at all sure what was underneath anymore, and I knew my ability to fly in cloud was limited. I looked back and saw the tail of the SHK brushing the cloud and I increased speed to get to the centre of the trough. In doing so, I was sinking faster and getting closer to the cloud underneath. In despair, I turned towards what looked like a break in the cloud below, but soon found the air blocked by a big hump of cloud coming out of nowhere. I flew around it ..... but was cut off again the same way. Now, more clouds were appearing all around me, and I soon found myself flying in some very elusive canyons. How I managed to stay out of the clouds, I don't know! I thought I would get trapped in there any moment!

Soon it became hazy, but I was still able to see features of the clouds and the sun shining above. I stumbled into relatively clear air and brushing a more solid cloud with a wing, the sink stopped --- then 200 ft/min. climb. Slowly I climbed, frantically trying to stay in lift. Having had enough of this scaring game, I decided to get away from that cloud at the first opportunity!

But where to go? All I could see were clouds! With all this maneuvering I had become completely disorientated. At 6,000 ft. I still could not see over the top of the clouds. In order to maintain position in the weak lift, I was heading roughly north. At 6,500 ft. I spotted a break at the top of the cloud, approximately to the east. I made for it and I soon found myself skimming the top of the cloud. Then, after a few moments, I broke into a completely clear sky. I was in heavy sink, but I could not have cared less, because I wanted to be some distance from that cloud. When I looked back finally, I realised what had happened. Even though I had the impression of moving some distance over the cloud, I had been almost stationary, and the cloud had constantly been forming around me.

I was breathing easier now that I was clear of the cloud, but I still did not know where I was. Taking a westerly heading should have put the mountain somewhere ahead and once under the cloud I spotted a ridge of hills. Looking down south of them, to my delight, I saw the

airport ..... what a relief! With a height of 4,500 ft. and wanting to salvage something out of this flight, I started to look around for traces of a possible tertiary wave. I spotted a few wisps of cloud and, investigating just upwind of them, I ran into beautifully smooth lift at 4,200 ft. The lift went from 400 ft/min., to 600 ft/min., then 800 ft/min. I took a reference point on the ground and adjusted my airspeed to maintain that position. I climbed rapidly and was soon putting on the oxygen mask. .. 15,000 ft., .. 18,000 ft., .. 20,000 ft.,.. then, finally, 22,000 ft. I fell out of the lift at that point and I radioed back to the field to tell Kurt my altitude and also tell him I would try to get a little higher, just to make sure I had enough altitude for my Diamond.

Increasing speed from 50 mph to 80 mph I slowly penetrated upwind to the secondary wave. At 20,000 ft. I got back into 400 ft/min. lift and this time I climbed to 24,000 ft. before I lost it again. Anyway, I had more height than I required for a Diamond and while the lift was still strong, I decided that Kurt should have a go at it. Out went the dive brakes and increasing the speed to 80-90 mph, I came down at a very steep angle. Twenty minutes later I was landing. As soon as I stopped rolling, I jumped out and reached for the barograph. The trace was there - nice and clear. At last, I had made my Diamond height and also had the proof required to claim it.

Looking back on the flight now, I think I have learned a few more things about wave flying. First, one must never take weather conditions for granted, - they can change very rapidly. Second, I would certainly have been happier if I had been more proficient in Blind Flying. This would be a very desirable accomplishment for further wave flying. Because of the environment, it would be foolhardy for anyone to deliberately fly on instruments, but .... at least if one is forced into a situation where one has to come down through the cloud cover, the danger is partly decreased by not losing control.

In my opinion, when wave flying, one should be prepared for anything: the worst and the best. You will probably get both on the same flight. I did!

P.S. I want to thank Ron Helm for his magnificent illustration. It proves that a picture is worth more than a thousand words!

\* \* \*

Editor's notes: Ron Helm is a former employee of Slingsby Sailplanes and is now with Canadair Limited, Montreal.

Kurt Kovacs did contact the wave and succeeded in obtaining a leg of his Diamond badge with a height gain of 19,500'.

On the same day, Bob Gairns also reached 22,000 ft. in his Libelle H301, but unfortunately his barograph failed to record correctly above 16,000 ft. and ..... - but that is another story.



## ATTITUDE AND PRACTICE

By Franck Pellerin

### Flight Planning for the Solo Pilot:

How many times have you gone up for a local flight and regretfully observed after landing, that you should have either stayed in bed or, at least, on the ground!? If you feel you achieved nothing and you are getting frustrated, start to think about your flying.

You probably go up and fly around, doing things which you already know how to do. Mostly because you have no flight PLAN.

A local flight, soaring or not, should be planned well prior to the actual flight, and preferably in the comfort of your armchair, at home, when you cannot be dangerously distracted.

First make a list of the manoeuvres you know you do not do well enough. In fact, you could review all manoeuvres, or as many as you can think of, and divide them into several categories: --- those you have mastered; those which present no difficulties and which you will master with time; those which you cannot yet do well and which you will master with practice; and finally, those you want to practice with an instructor for safety reasons and to save time and money.

You should add a fifth category which will include certain exercises geared at getting you to know a particular sailplane better. You may feel quite at home in the 1-26, but not quite "with it" in the Bergefalke. You need familiarization and you won't get it by flying casually or aimlessly. You must explore all the properties & qualities of the ship.

As an example of the flying manoeuvres which you want to practice, you may have:

- speed control in medium turns
- steep turns
- medium stalls
- turn reversals
- transition from slow to fast level flight through 180° steep turn.
- transition from fast to slow level flight through 180° steep turn.
- etc., etc. ....

As an example of the flying exercises which will help you to get familiarized with a particular sailplane, you may have:

- slow flight
- all stalls
- red line flight down to D/W leg.
- flying for distance
- flying for time
- etc., etc. ....

In addition to these familiarization exercises, you'll do well to make another list pertaining to soaring exercises, such as making your way up wind as far as possible, thermal centering, thermal hunting by ground inspection, etc. .... etc. This will ensure the success of your first cross-country.

Next you list the weather conditions which will govern the programme of your flight. These conditions will be those as you see them from the ground or heard of them from fellow pilots. Your flight programme will be geared to these conditions, but it must include an alternate programme should the conditions you actually encounter prove to be different. You'll have a "lift" or "no lift" condition each with a "no lift" or "lift" provision. The winds will be calm/strong/gusty/cross...thermals will top well above spin practice height or not, etc., etc.

By now, you can see that there is an enormous number of factors to take into consideration in order to plan a meaningful flight. The computer people might even feel like using their machines but there is really no need for that. Here is where it becomes simple. Choose only one exercise per flight, two at the maximum. Have a few in reserve just in case the conditions happen to be different from what you thought and also for the "lift/no lift" provision. Don't cram your flight; my first programmed flights were so loaded that I did not have the time to do anything well and as I came in for landings, I used to feel like a fellow who is tripping down the stairs with his arms full of parcels.

So the next time somebody asks,

"Who is next?", you can reply something like, "I don't know who is next, but I am ready", instead of " ... O.K. .. I'll go..". As you climb into the cockpit, you will feel the great satisfaction of knowing why you're there, where you are going and what you are going to do. And you will not have to tell anybody. ... It will be plain to see.

Beside this satisfaction of knowing that nobody will rush you because they know you have a plan, you will discover that you will progress much faster and that you will become more proficient. Beautiful flights, long soaring flights and cross-country will be that much closer.

----

(Reprinted from the Red River Soaring Association NEWSLETTER).

\* \* \*

# SCHWEIZER AIRCRAFT CORPORATION ANNOUNCES

Taken from RRSA Newsletter

Effective October 1st, Schweizer will handle all Canadian sales directly through the factory organization and will establish Canadian prices, which will represent considerable savings to Canadian purchasers. (Obviously this is an important announcement, since most S.A.C. Member Clubs depend on Schweizer products for their basic club fleets).

Schweizer has attempted to build up a dealer organization in Canada over the last ten years, but has come to the conclusion that, unlike the U.S.A. (where commercial soaring operations have proven successful), a strong Club organization seems to eliminate the need for commercial operators, at least for some years to come.

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## A d v e r t i s e m e n t

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## LOCAL STABILITY ANALYSIS

By J.R. Janzen, Meteorological Officer  
Canforbase Namao

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### (1) ABSTRACT

A simplified method of local stability analysis is presented, which is especially suited to soaring activity, and which uses a minimum of equipment. A method for observing pertinent data, plotting it on a specialized tephigram form, and analyzing the resultant sounding for stability is explained in a manner suitable for the non-professional meteorologist.

### (2) INTRODUCTION

Stability analysis is extremely important for soaring operations, but unfortunately the data required for a reliable analysis of local conditions are not easily available from the Canadian Weather Service. The regular soundings and readings done on a routine basis extend to beyond 50,000 feet, and are too coarse in the lower levels to be of much use for soaring operations, which generally stay below 10,000 feet. In this paper, a method for executing a detailed analysis of local stability conditions through a shallow layer of the atmosphere (below 12,000 feet) is presented. A minimum of materials is needed and in most soaring operations the required instruments are available. The sounding equipment consists of a person (henceforth called the Observer) sitting in the passenger seat of the towplane, data card in hand, thermometer, and pen, during the warm-up flight. The thermometer required is a mercury-in-glass type calibrated in degrees Celsius (Centigrade). A reliable humidity measuring device is needed, as well - a household hair type hygrometer of reputable make will suffice.

### (3) THEORY OF OPERATION

The analysis method is based upon the Parcel Theory of convection, and assumes that rising air parcels originate at the earth's surface, and are not entrained during ascent.

### (4) PRESENTATION

#### (A) Description of Materials

The tephigram form included in this paper is a modified and expanded version of the Canadian Tephigram. It is shown in blank form in Appendix II, and in labelled form in Appendix V, and in completed form in Appendix IV.

The ISOBARS (horizontal lines tagged 'Height Lines' on Appendix V) are labelled in feet, rather than in millibars. The labelling is based on the ICAO Standard Atmosphere, and is compatible with aircraft altimeters.

The ISOTHERMS (temperature lines sloped to the right on Appendix V) are labelled in degrees Celsius.

The SATURATION MIXING RATIO LINES (tagged 'Mixing Ratio Isopleths' and sloping to the right on Appendix V) are labelled conventionally in grams (of water vapour) per kilogram (of dry air).

The DRY ADIABATIC LINES (sloping to the left on Appendix V) give the rate of change of temperature with height of an ascending parcel of dry air. They are labelled for every 5 degrees Kelvin of potential temperature.

The DATA CARD (a blank one shown in Appendix I and a data-filled one in Appendix III) is designed to contain all the information required for the analysis.

#### (B) Observation of the Data

The first step in constructing the local sounding is a call to the local Weather Office, to obtain the maximum expected temperature for the day, as well as information on impending storms or bad weather. The maximum expected temperature is entered on the DATA CARD.

The Observer then measures the Surface Temperature to the nearest  $\frac{1}{2}$  degree, using a shaded thermometer, which is kept away from artificial heat sources. A good place for this is over a short cropped grass surface, well away from buildings, etc. By using the hygrometer in a similar fashion (i.e. shaded, away from artificial moisture sources) the Observer measures the Surface Relative Humidity. Both of these measurements should be done at a height of about 5 feet from the ground. These two readings are used in Item (D). The Surface Relative Humidity is entered on the DATA CARD.

(B) Observation of the Data (cont.)

Now, the Pressure Altitude of the gliding site is recorded in the DATA CARD. This is given in feet a.s.l., and is obtained by setting an aircraft altimeter to 29.92 inches, and then reading the height on the instrument in the conventional manner.

The Observer now enters the towplane, and with the altimeter set to 29.92 inches, the towplane is flown to the nearest multiple of 500 feet that is safe and convenient. In each case, the altitude is to be maintained while the thermometer is exposed to the OUTSIDE air away from exhaust streams and other artificial heat sources. After a stabilization period of about 30 seconds, the Observer will record the temperature on the DATA CARD to the nearest  $\frac{1}{2}$  degree.

This process is repeated at 500 foot intervals to an altitude that is convenient, and this should be as high as time and costs permit.

(C) Construction of the Sounding Curve

Once back on the ground, with the temperatures aloft entered on the DATA CARD at 500 foot intervals, the Observer can begin constructing the SOUNDING CURVE. This is done by recording on the tephigram form the temperatures at the respective altitudes, using a small x or other convenient mark. These marks are then joined with a reasonably smooth curve. The curve is called the SOUNDING CURVE, and is shown on Appendix IV.

(D) Drawing of the Mixing Ratio Line

The first thing to do is to calculate the surface actual mixing ratio. This is a straight-forward calculation using the recorded Surface Relative Humidity. From the tephigram form estimate the 'saturation mixing ratio' by interpolating the value of the Mixing Ratio Isopleth which would run through the recorded Surface Temperature. This is then multiplied by the Surface Relative Humidity, in %, and divided by 100. The value so computed is recorded with a convenient mark in the appropriate place on the tephigram form (i.e. the same 'altitude' as the Surface Temperature, in the proper position indicated by the values of the Mixing Ratio Isopleths). Through this point, draw a line parallel to the Mixing Ratio Isopleths, and extend it to the top of the tephigram form. This line is called the MIXING RATIO LINE, and is shown in Appendix IV.

(E) Hourly Temperature Forecast Calculations

This is accomplished by simple linear interpolation between the recorded Surface Temperature and the forecast Maximum Temperature. The Maximum Temperature is assumed to occur at 1400 local STANDARD time. These hourly temperature values are marked on the tephigram, at the surface pressure altitude using a small dot or other convenient notation.

Through each of the hourly forecast temperatures, draw lines parallel to the Dry Adiabatic Lines to intercept the Sounding Curve or the Mixing Ratio Line, whichever is the lower of the two. The lines so drawn are called ADIABATIC LINES for convenience, and are shown on Appendix IV.

(F) Stability Analysis and Prediction

The analysis is now complete, and predictions of thermal activity can now be made. If an Adiabatic Line meets the Sounding Curve, the convection can be expected to occur up to the height indicated by the intersection, and one would then predict thermal activity up to this level.

If the Adiabatic Line intercepts the Mixing Ratio Line first, then cumulus cloud can be expected to form with bases at the level indicated by the intersection point. Convection will, of course, occur above this point, but this will be activity within the cloud.

By an inspection of each of the Adiabatic Lines, one can estimate the TIME at which convection will occur and/or the TIME at which cloud will form, in addition to the HEIGHT to which convection occurs. Keep in mind that the HEIGHTS will be above Mean Sea Level, and in order to obtain the HEIGHT above ground, it is necessary to subtract the Pressure Altitude of the airport.

(G) Example

Appendices III and IV of this paper give an example of a completed Data Card and Tephigram analysis done in the above manner. All the lines on the tephigram are labelled, and the example may be used as a guide for future analyses.

(H) Critique

The method presented above is a reasonably simple one and should, if done carefully, give good results. Its use, however, should be tempered with good judgement. It is designed for use in an undisturbed weather situation, and for a day which shows promise of good thermal activity. It can be used on any day which is "flyable", but best results will be achieved on a "good soaring day".

Many variables are omitted for simplicity, but these omissions will not, in general, hamper the effectiveness of the method. When used carefully, good predictions can be made.

**NOTE:** Some changes may be made to the basic technique, at the Observer's discretion:

- 1) The vertical extent may be altered if so desired - and this is recommended should the Observer notice that a deep inversion is present.
- 2) Observations may be made at 1000 foot intervals rather than at 500 foot intervals. This will, of course, cause some loss of detail in the temperature profile.
- 3) Experience and good judgement will eventually bring about changes in the method in order to make it apply best at each particular soaring site.



## DATA CARD

Time Observation Commenced 0930		Surface Humidity 80 %		Forecast Max. Temp 24 °C	
Surface Mixing Ratio 8 g/kg		Pressure Altitude 850 Feet A.S.L.			
PRESSURE ALTITUDE	TEMPERATURE	PRESSURE ALTITUDE	TEMPERATURE	PRESSURE ALTITUDE	TEMPERATURE
0 Feet	—	4000 Feet	14.5	8000 Feet	5.0
500 Feet	—	4500 Feet	14.0	8500 Feet	4.0
1000 Feet	SFC 13°C	5000 Feet	12.5	9000 Feet	3.5
1500 Feet	16.0	5500 Feet	11.0	9500 Feet	3.0
2000 Feet	18.0	6000 Feet	10.0	10000 Feet	3.0
2500 Feet	17.0	6500 Feet	9.0	10500 Feet	3.5
3000 Feet	16.0	7000 Feet	8.0	11000 Feet	3.5
3500 Feet	15.0	7500 Feet	6.5	11500 Feet	3.0

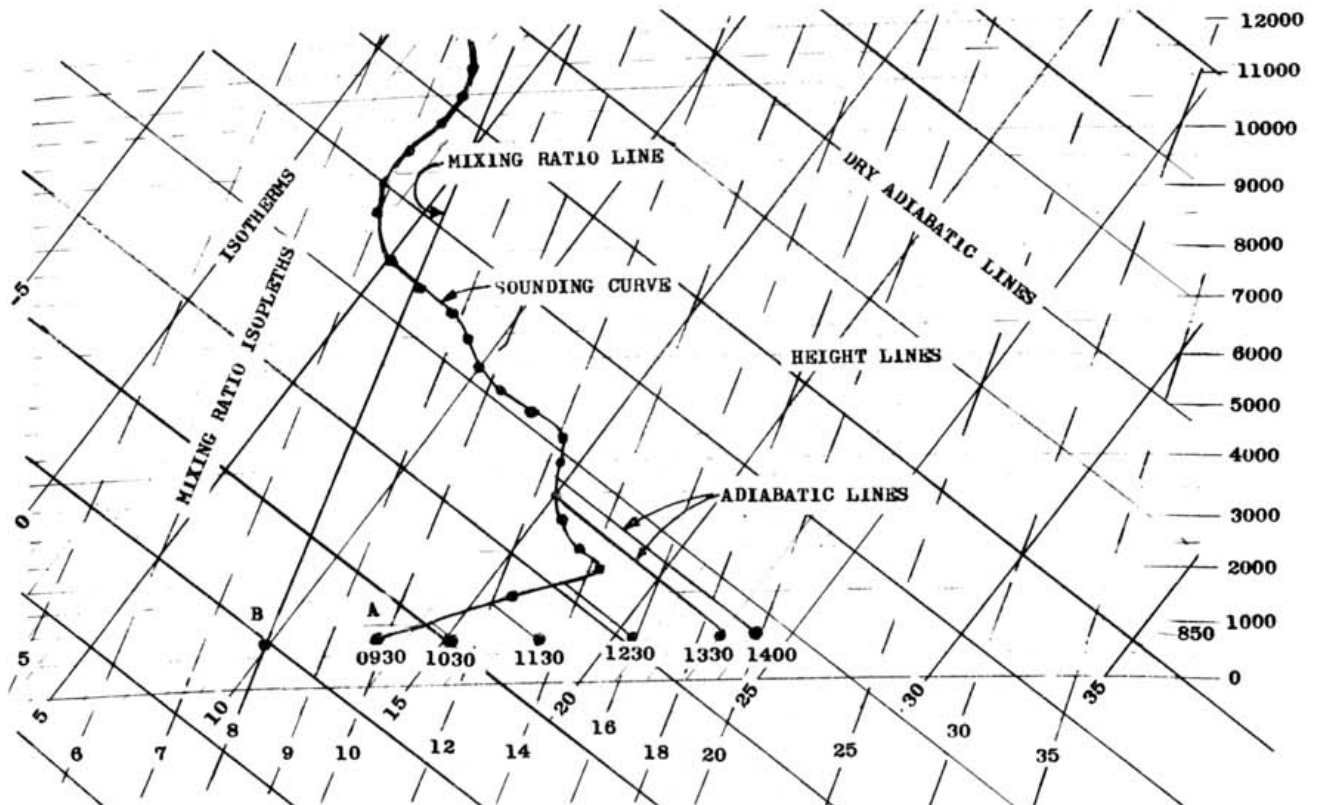
**NOTE:** All readings are to be made with Altimeter set at 29.92 inches.

A = Sat. Mixing Ratio = 10g/Kg(13°C)  
 B = Actual Mixing Ratio  
 = A x Surface R.H.(%) =  $\frac{10 \times 80}{100}$   
 = 8 g/Kg

## SPECIAL TEPHIGRAM

Forecast: Thermals forming  
 to 2700 ft. above  
 ground by 1:30 PM

Appendices II, IV & V



## THE "CANADIAN GLIDER BOOSTERS"

## (Part II)

(This is a continuation of the story written by the late Norm Bruce in January, 1948, covering the gliding exhibition tour which started from Calgary, Alberta, on the 25th May, 1935, and covered 2,500 miles).

. . .

Fretwell came back with news that a suitable field was not available and that a tow-car could never get sufficient speed to tow the glider into the air. I made a quick survey of the district and found a small field a short distance from the main street. It was a suitable field to land in, but not large enough for auto towing. Returning quickly with a plan, I explained it in confidence to my friends. The townspeople, little realizing what was intended, cheered in amazement as I was zooming off the main street, past shop windows, above the roof tops and up over the town. Circling overhead, with keen eyes on the little field I had chosen for landing and my diminishing height, I was able to keep in full view of the crowd and at the last moment, prepared to land. My field looked dangerously small, but with good luck to help me, I skimmed in, hedge-hopped a cow, scattered chickens and came to rest with only a few feet to spare from the fence at the end of the pasture.

The glider was carried back to the town, borne on the shoulders of willing helpers and Fretwell was soon repeating the flight. We never tire of telling of this unique flight, and the people were shown that gliders could be controlled in flight regardless of wind.

It was our practice to establish a camping site and after dinner, and particularly during the evening, we encouraged the people to visit us, so that we could talk on gliding and help and advise the amateur builder as often was the case.

Under the warm evening skies after sundown, our camp was often a cheerful and pleasant spot. Pelletier with his deep rich French Canadian voice, accompanied by banjo or guitar, was a soothing tonic to our tightened up nerves.

Our day started with washing in the camp, breakfast at the restaurant, filling up with gas and mailing of notices in advance of our exhibitions. One occasion we drove 97 miles to the next exhibition. At times like this, we drove all night and next day to be on schedule. Tired, hungry and travel stained, little time was left for getting the glider rigged and prepared for flying. Nerves tightened, and as the strain increased, we found our only relaxation was when flying or lying down at night.

One day we gave two exhibitions, one at noon and the other in the evening at the next village only a few miles away. The school children were all given a holiday to come and see the gliding and it proved a real educational value to students and teacher.

We packed up quickly, raced to the second village and without stopping to eat, were flying on schedule the second time that day, before a very appreciative audience. Too tired to pack up, we staked our glider out in the field, left an enthusiastic admirer to guard it, staggered into the restaurant, ate pancakes, drank horrible coffee and had mince-pie that may, at some earlier date, have been fresh and tasty! Too tired to complain, we returned to our camp and, in utter exhaustion, slept until sunup.

During the early stages of our tour, we met with our first accident, while on the road. On May 27th, just prior to leaving for Taber, the stabilizer of the glider struck a telegraph pole as we were turning the huge trailer around in the street. The fuselage snapped off just in front of the tail surfaces, but with great speed, we had it repaired that night. This necessitated breaking our schedule, or leaving out one of the towns. We decided to leave out our next call and proceed, passing through the town, but without stopping.

June 5th saw us at Maple Creek. We planned a big exhibition and made arrangements for an interesting display, but the crowds were poor owing to threatening rain and a very chilly wind. To make matters worse, we were forced to use a particularly rough field with low bushes. Only two flights were made and further attempts abandoned; the glider nearly being wrecked on the last flight when landing in the thick scrub.

Collections were poor and we had little surplus capital. Rainy weather set in and for the first time we had the choice of buying enough gasoline to get us to our next stop, or buying food for ourselves, of which we were in great need. Tucking in our belts, we drove on only to be faced by a deluge of rain at Swift Current. Hungry and ill at ease, we sat beside our glider praying for the rain to cease. Great oceans of mud turned into running torrents and soon our landing ground was flooded. However, towards late afternoon the rain stopped and the sun came out in all its glory. We stopped a few cars on the highway to get a crowd together and in a short time a nice gathering lined the highway. It was impossible for a car to tow the glider through all that sea of mud, so our only alternative was to tow from the highway. Telephone lines were on the offside and our take-offs had to be made across wind. The car actually dragged the glider into the air as huge clods of mud dropped off the skid. Without a moments hesitation, Pelletier started collecting and managed to take in the sum of \$2.90. We gave them a good display, four flights in all, and our landings were near to seaplane landings after the rain. We were too hungry and tired to pack our machine, so we staked it down in the mud and drove off to the first restaurant where we did justice to a hearty meal.

To be continued.

THE AIR CADET LEAGUE OF CANADA  
Ontario Provincial Committee

To Canada's 30,000 Air Cadets probably the most exciting development in the Air Cadet Program during recent years is the introduction of gliding.

The enthusiastic response of Cadets to the gliding activity at Mountain View has lead to adoption of gliding as a major activity by the Air Cadet League, with vital support and assistance from the Canadian Armed Forces and the Soaring Association of Canada.

The rate at which gliding has grown speaks clearly by the figures in this report. In 1968 when the gliding program first started at Mountain View, there were 747 flights with one glider. Today we have 3 gliders at Mountain View, & of course, there is an extremely active program at Chatham. Sarnia owns one glider, and North Bay is considering the purchase of one.

Familiarization flying from the Fall 1969 to November 9th saw 565 flights for a total of 14 days of operations. Ten Squadrons were brought into the Mountain View area and were provided with a well organized day of flying. Spring 1970 familiarization commenced on April 11th, and three Squadrons participated.

The Glider Pilot Training Course held May 2 - 10, 1970, had 6 students and all qualified for their Glider Pilot's Licence; there were a total of 411 flights.

The Dominion Glider Pilot Course held May 29 to June 7 had 10 students, two from the Atlantic Provinces, two from Quebec, two Ontario and two Western Provinces. Total number of trips 596, and all students qualified.

The Public Relations and Presentation Day held June 27 was an outstanding success. CF-ACH was

presented to the Ontario Provincial Committee by Mr. Ken Cook, Chairman of the RCAF Association (Toronto Wings). (The Association raised the money for CF-ACH from the Battle of Britain picture). Approx. 50 members of the Assoc. attended and all took flights in the gliders and enjoyed this flying experience. Excellent radio coverage was given by CFRB.

The success of the Summer Camp at Trenton is best summed up by Lt.Col. Jack Donnelly, as follows:

"The Gliding programme was perhaps the most interesting aspect of Summer Camp. Its rapid growth of operation and the enjoyment it provided for cadets, and as well, the tremendous potential it holds for creating interest in the air element, cannot be overlooked. The Gliding Staff, under the direction of Maj. R.A. Ough put in long hrs. to accomplish a record of performance & achievement second to none. All with the safety of the Cadets and Glider Staff as the prime requisite. With three gliders now serviceable, & with a much needed second winch, this operation can produce not only familiarization flying for cadets, but also cadet glider pilots. With this in mind, serious consideration should be given to the training of qualified glider instructor pilots in the Autumn 1970 and Spring 1971. We now have the nucleus of qualified glider personnel in all phases of the glider operation. The cooperation of Air Traffic Control and the Mountain View Detachment is greatly appreciated."

During the Camp there was a total of 3,251 trips, compared to 1,642 in 1969. 274½ hours were flown in 1970 compared to 135 hrs. 10 minutes in 1969.



Over the past training year there were 5,422 flights and 476 hours logged - an outstanding achievement for our third year of operation.

One of the main objectives of the O.P.C. was to be able to move the glider and crew to the North Country to provide familiarization flights for some of the Squadrons. We are pleased to say that this has become a reality & it is planned to fly 547, 536 and 200 Squadrons there from South River A/P, on October 3rd and 4th.

Plans for the 1970/71 training year include: Greater mobility of the gliders to Northern Squadrons; A PR program in the Spring; Three pilot courses (a) Spring Instructors' Course, (b) Spring Pilot training course - Ontario only, (c) National Course; Cadet Scholarships on a Provincial basis to be held during the 1971 Summer Camp period. Familiarization flying is to continue through this Fall and

start as early as possible in Spring 1971. We hope that two more winches and one Schweizer type trailer can be manufactured and ready for use by March 15th, 1971.

I would like to express thanks on behalf of the Ontario Provincial Committee, to all the members of the Glider Committee, the Glider Instructors, Pilots and maintenance crews who worked so enthusiastically over this past year. Without the continued co-operation from the Canadian Armed Forces' staff at Trenton, this program would not have achieved the success it has to date. Assuming that this rate of progress can be maintained, the day may not be too far off when every Air Cadet in Canada will enjoy the experience of silent, motorless flight, and where many will be wearing the wings of a qualified glider pilot.

Ronald E. Nevin  
Chairman (Glider Committee)

#### AIR CADET ACTIVITIES ELSEWHERE IN CANADA

An Air Cadet Squadron in Galt, Ont., who are starting gliding, have recently purchased Schweizer 2-22 (CF-ZBL) from Montreal Soaring Council.

The Air Cadet League of B.C. are progressing well and expect to purchase two 2-33's and a 1-26 with League bonds. The M.O.T. has granted permission for them to fly from Abbotsford A/P, and all gliders will be equipped with VHF 2-way radios. A week of instruction is planned during the Easter week to standardize instruction and train new instructors if necessary. (Taken from 'Vancouver Soaring Scene' news in SGC 'TOWLINE').

#### A D V E R T I S E M E N T

The ultra-reliable Bertea ML200 Transceiver is now approved and available in Canada. This space-age beauty is fully transistorized, modularized, and epoxied to resist temperature variations, vibration, and humidity. Only 3.5 lbs., adaptable to any 3 1/8 inch cut-out, and less than 10 inches long. Adds a new dimension to soaring fun. Team up for enjoyable cross country flying and organized retrieves!

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# CLUB NEWS

## CHAMPLAIN SOARING ASSOCIATION:

(Taken from 'Cross Wind')

With the gliding season coming to a close, the Club's Christmas party is being planned for December 12th and also an evening of films, to include:

- i) 'Principles of Flight'.
- ii) 'Glider in the Sky' - the story of a cross-country flight in a glider.
- iii) 'Flight' - a short film on gliding in the Laurentians and the Rocky Mountains.
- iv) 'Sky' - one day in the life of the sky over the Rockies. Time lapse photography shows how clouds and systems develop.
- v) 'Air Maps and how to use them' this is an R.C.A.F. film.
- vi) 'Getting Around' - Gliding in Saskatchewan.

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## RED RIVER SOARING ASSOCIATION:

(Taken from 'RRSA Newsletter')

Whilst out West visiting in Saskatchewan, I visited some chaps who have been gliding enthusiasts for some 35 years: the Eley brothers of Colonsay, Sask. Norman Eley was telling me how the brothers built a 'Zogling' primary in 1935 and virtually taught themselves how to fly, although the construction plans they purchased described how to fly it. A power pilot in Regina felt that they should have some better idea of how to fly however, and gave Norm half an hour's training in a power ship. After that it was a matter of towing the Zogling behind a car until they progressed from 'slides' to 'hops' to 'flights'. The Zogling is still in the loft of the barn where the boys' farm.

The brothers live on adjacent farms, and flying is very much in the family's blood. I visited Art who was busy repairing a Cessna in his T-hangar. Norm is going to re-fabric a Schweizer 1-19. Wilbur

("Shorty") is constructing a Pie-tenpol power aircraft, which they have been assured will be adequate for towing up their 1-26. The 1-26 has a T-hangar of its own, but when I visited, "Shorty" was fly-in it (the 1-26!) at Pincher Creek, Alberta. In another T-hangar, I was introduced to a Ka6-CR that they are storing for a friend in Germany. The Ka6, incidentally, is for sale for about \$2,500, c/w: oxygen equipment, 90-channel radio, dust covers and trailer. It probably needs new fabric, I was told and since it had a U.S. C. of A., the total price would probably be closer to \$3,500.

Bob Hayes

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## WINDSOR GLIDING CLUB:

(Letter from Henry Preiss)

Things are looking up and we are growing. There are now six privately owned ships and one Club ship, among these are 3 spanking, brand new 2-seaters. These sail-planes are so new that they missed the last page of the "Directory". Consequently we take pride in introducing the Canadian designed & built R.H.J.-8. Construction is all metal. The wings are attached at about two thirds fuselage height; they slowly rise and taper towards the tips and measure 58" total distance. The fuselage features side-by-side seating; it is low in profile with a reclining pilot position. At the end of its 24' looms an impressive T-tail, which is also very effective. The single wheel is of the balloon type and is retractable. The empty weight is 570 lbs.; min. pilot weight is 200 lbs., max. 400 lbs. Visibility is excellent. Since we have not done any performance testing, I will not mention any figures - you would not believe them anyway! However, all three of us, including myself, the designer, are very pleased with our new ships.