Proceedings of the Annual Symposium On Competition Soaring 1969 – 1970

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Proceedings of the First Annual Symposium On Competition Soaring

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Edited By: Ed Byars & Bill Holbrook

PREFACE

We believe that the epitome of all soaring is competition soaring. All other forms are or should be simply training, pointed toward improving competition abilities. One exception, which is viewed only as an interesting sidelight, is soaring for world records. State and National record seeking is, in our view, competition practice.

In the past the foreign (especially European) soaring pilots have far outnumbered American soaring pilots. In recent years the number of American competitive soaring pilots truly qualified to be instructors are only a handful and do not have time to give much individual instruction. A few of us are lucky and get to fly alongside these giants occasionally while they practice and compete but this is no answer to the problem. While most of these top people are quite capable of writing, they usually cannot afford the time to concentrate on instructive writing. As a consequence, most of the English language literature on competition soaring is not applicable to the U.S., is not advanced enough, and is written by the British for the British - which is fine for them but inadequate for us.

Soaring Symposia was created to help alleviate this problem of advanced soaring instruction in America. We seek to afford an opportunity for the world's best in soaring to help those who aspire to be the world's best. We feel that a compact two-day symposium is one of the best vehicles for this purpose.

Judging from the quality of the papers contained herein and from the think this first Symposium is a good reaction to this Symposium, we like to first step toward accomplishing our objective.

We would like to take this opportunity to thank the members of the faculty for their efforts. Their knowledge has made this Symposium possible. The mark of a true champion is not only his advanced knowledge and ability to apply it, but also his willingness to share it.

Suggestions and comments from our readers and participants are welcome.

Ed Byars & Bill Holbrook

The Do’s And Don’ts Of Contest Flying

By Richard Schreder

The subject of my talk this morning is the Do’s and Don’ts of contest flying. I’m going to work from notes that I’ve made over the years since I’ve been in soaring. I’ve had lots of happy experiences, a few unhappy ones, and I’ve tried to write down all of the reasons for having the unhappy ones. This is what I’m going to dwell on principally this morning. They are not organized in any special way. I’m just going to run through them and read off the note that I made at the time, and I made these notes right after I was down on the ground sitting and watching everybody going over with beautiful cumulus in the sky. So some of these may sound sad or they may not make good sense, but they made awfully good sense to me at the time.

First of all I would like to say that to go into a contest you must have a good sailplane, a good car, a good crew, and a good trailer. Of course you’re already committed when you decide to go. You have your sailplane, but a little thought ahead of time will save you a lot of trouble. A good sailplane in a contest will save you a lot of headache. You want something that you’re familiar in and here again I say don’t do like I do but do as I say, because I’ve gone to several contests, as most of you know, with sailplanes that have only been flown once or maybe not even flown at all in one case and this certainly doesn’t help you to do well in the contest. The same way with the car. You should have a car that has good tires on it that aren’t going to wear out before you get there, and the car isn’t going to break down. Same way with the trailer. Most of us leave our trailers until the very end and it’s a last minute rush job to get the trailer finished and you’re picking the pieces up and putting it together all the way to the competition, during the contest and on the way home. A crew-this is really a big thing. I’ve had lots of crew problems and strangely enough you just can’t tell about a crew man until you’ve lived with him awhile. It’s much like getting married. You really prove the marriage out after you live with the other party, so I just can’t overemphasize the importance of picking out a crew. I would say never go to a national contest with a crew that hasn’t at least worked with you on a regional or local competition of some sort. Because you run into all kinds of problems. Suppose you’re getting ready to take off and you’re rushing to get down to the line, you only have ten minutes before you’re supposed to be in the air, and you look around for your crew and you find they’ve gone to breakfast because they just can’t miss breakfast. This is the kind of crew man you sometimes encounter. And it can go on and on so check these things out very carefully. One more item about crews. The best crew man you can possibly get is your wife. Now for those of you single fellows who are not married-this is the most important thing in picking your mate for life.

All right, I’m just going to start right here and go down the list.

1. Always take a full tow to 2000 feet. The rules have been changed now so that you can release any time you want. We did have rules that said you had to wait until you were in the release area. That’s been changed now, but many of us old timers have come to grief by going up when we were allowed to release early and while flying along at 500 feet we go through a boomer and pull the string and you go around three, four times and you can’t find it and the next thing you know you’re on the ground. If you’re lucky its back at the airport, and if you’re unlucky you don’t even make the airport. Well, you don’t win any points for the day if you must go back to the end of the list, especially if you have to dismantle your sailplane to get there.

2. Stay with the first lift you find at 2000 feet or below. In other words, if you find a one meter thermal when you are below 2000 feet, you had better stay with it and get some altitude. Don’t go looking for a two meter or a three meter thermal, because at that time you are likely to get very anxious and want to push on and not waste time, especially if it’s a speed task. When you’re down to 2000 feet and you find something that will even keep you up, you better stay with it and get some altitude because if you go on you might not find anything. And once on the ground, you’re finished. My procedure in working thermals is: I fly through a thermal -when I’m barreling along and I wait until I reach the maximum lift and notice that it’s starting to drop off-this is on the total energy variometer-and then I start making a turn. This works pretty well. Most of the time you will be fairly well centered in it or not too far off. The next item is that I always turn in the direction that the thermal has tried to pick up my wing. Some of these things probably sound very simple and I may look stupid standing up here telling you this. You probably know all these things, but maybe some of you don’t. Use your own judgment on what you want to do about it. As I go into each thermal, I try to consciously pick up the reaction of the sailplane. I hold the stick very loosely and if the right wing is trying to come up, this is a pretty good indication that the best part of the thermal is on your right. As soon as the thermal begins to drop off, I rack it up to the right.

   There’s a lot of controversy, of course, about all the thermals circling to the left in the northern hemisphere and to the right in the southern hemisphere. Most of us fly better with one arm than with the other and we get into a habit of always turning in one direction. I think this is a mistake. I think you ought to practice flying in both directions, circling in both directions, get so you can circle just as well to the left as you can to the right. Then if you know that the thermal is on your right you can circle just as well that way as you can the other. It's common to get into competition where the first man in the thermal is supposed to set the direction of the turn. Then you can't do anything about it. If you can go into a thermal with forty gliders in it and they're all turning to the right, you better turn to the right too. Of course, there is always somebody that, halfway up, is going around to the left. This makes it rather interesting, especially when you're 15 or 20 feet apart in altitude and passing each other every time you go around. Getting back to this turn right in the southern hemisphere and left in the northern or vice versa, right in the northern hemisphere and left in the southern hemisphere because of the way the thermals are supposed to naturally travel, I had an operation in Puerto Rico and had a Puerto Rican running the place. I showed him what a thermal looked like one day when all these sugar cane leaves were going around and going up into the air and I said, "Well, I'm going to be gone for two months and while I'm gone, every time you see one of these, I want you to write down which direction it's going." So I came back two months later and he had the list and we added it up and I think there were 71 that went to the right and 72 that went to the left.

6. If a dust devil is associated with the thermal and you are getting a good indication on the ground of the direction that the thermal is turning, then by all means fly against the thermal, because undoubtedly your circling speed will be lower if you're going against the rotation than if you're going with it.

7. Thermal five miles per hour above stall unless thermal is unusually large, when minimum sink should be used. In other words, if the thermal is small and it's not too rough, I feel that I can do my best flying just above the stall. Of course, here again it depends on the ship that you have and its characteristics, but I feel you're better off sacrificing a little of your best sink performance to stay right in that core if the thermal is small. If it's large then you can afford to fly a little faster. Where you have a better minimum sink your sailplane performance is better and you don't have to rack it up. You're not putting as much of a G load on your wing, which is going to decrease your climb and you should wind up with a better net climb with a little higher speed.

8. Do not leave the field without gaining altitude in the vicinity. This is especially true at the start of a contest day. I wouldn't leave the airport without a lot of altitude. While you are over the airport (your starting point), especially on a speed task day, you are better off to try to work your thermal and get altitude there. If you have a problem and just don't seem to be able to get up and you waste a lot of time, you can always go down and take another tow and get another start. However, if you go pushing off into the boondocks with no altitude and you get out there scraping around, working zero sink for an hour or two, you don't have much choice because you're too far away from home to come back and start again.

9. When you're low and having problems staying up, you want to do everything you possibly can to help yourself. If you're down low and there are no apparent thermals and you are desperate, the first thing you want to look for is a dark area on the ground. This will help you more than anything. Look for ground fires. If somebody is burning off a crop on the field, you can almost always find a thermal there if there are any. Tops of hills tend to kick off the thermals. Ridges which face into the wind are good. This is all elementary stuff but you want to have this in your mind. Incidentally, I read these notes over every time before I go out in a contest and I try to review them every day, because it's surprising and very discouraging when you forget one of these simple things that you've written down and you're on the ground watching everybody go by and you realize you have violated one of your own points that you have just completely forgotten about or neglected on this particular day. Another thing that I watch for and it's saved me many times is if I am down low and having trouble finding a thermal and I am flying over fields that have a high flexible crop, like soy beans or wheat, even corn-corn isn't quite as good-but if you watch closely you can see thermals working in this kind of a crop. You'll see the crop swaying in a circular pattern as the thermal passes along. I've gotten back up from altitudes as low as 200 feet by using this method. When you are a little higher, say, 1000 feet or more above the ground and you have clouds, it's better to stick with the clouds. If you have cumulus clouds spotted around and you are still above 1000 feet on the average, to me at least, it seems that I can do better by trying to get under the best looking clouds. Once you are down low, however, the lift that is forming the cloud may have been cut off at the ground and you might get right under it and find absolutely nothing. It is much better to aim for the dark areas and ridges and hills and obvious wind patterns on the ground. Quite often you will be flying on a good day-going along and get into heavy sink and speed up (you fly faster in the sink, of course)-but you just don't seem to get out of it, and it's a mystery because you appear to be under the cloud or cloud street and the thing to do under that situation is turn, either right or left, because you are apparently flying down a trough of descending air, that is, a wave between the cloud streets. The reason I wrote this down is I went down and landed one day when there were cumulus clouds all over the sky. I just flew for several miles before I hit the ground without finding a single bit of lift and after I got down and watched everybody go by and got to analyzing it, I figured that what happened was I just continued to fly exactly downwind, parallel to the cloud

streets and all the lift. If I had merely turned one way or the other, I could have gotten out of it and gotten into the lift.

10. When following another Sailplane at the same altitude, keep your position if you are behind him and he is ahead of you. I always try to put my right wing tip in the spot where I think his left wing tip vortex will be. And I don't know, maybe all of you know this, maybe you don't, but the biggest loss in a sailplane is in the wing tip vortices. All of you have seen ducks and geese flying in formation. They don't do that because they have been to some military academy. They have found that by doing this they let the leader do most of the work and the rest are going along for a free ride. The leader is spinning two vortices off his wing tips and all those birds that are following him are reversing the turn on these vortices, at lease on one of their wing tips, and they are converting that energy back into flying their machines. They can cut their drag 10 to 15 percent by doing this. If you try this scheme and you can actually get your wing tip in the vortex of the ship ahead, you will find that even though you are both flying the same type of machine, you will gain on him and you will finally be able to pull right up alongside of him. Then you are the same, and you must work just as hard as he.

11. Fly under cloud streets whenever possible. This is very obvious but you can certainly increase your cross country speed by being able to fly along at a very low sink or zero sink than you can by flying rapidly in smooth air, stopping occasionally in thermals to climb.

12. Slow down when flying straight and when in lift. Speed up when in down or sink. This is of course a standard rule in soaring but it is something you want to keep in mind, because the longer you are in lift, the more it is going to help you, and of course the longer you are in down more it is going to hurt you. You want to get out of the down as soon as you can, and here again if this down persists, don't continue straight on course. Turn and get out of it. now just as a rule of thumb, a lot of people have fancier rate of climb indicators than I do. Some of them have computers that average their climb and everything. I've never gotten around to this and I use a rule of thumb for most flying, maybe it's wrong, maybe it's right., I don't know, but when I have nothing else to go on, I cruise at about the same speed corresponding to the rate of sink value as I normally get positive in a climb. if I am climbing one meter that day, then I cruise at about one meter down. If I am climbing at two or three, I can afford to fly faster so I fly at two or three meters per second down. Of course I use a speed calculator for the ship that I am flying and I refer to that, but I find this is a pretty good rule of thumb.

13. Here is one that has trapped me several times. It trapped me in Poland. One day in Poland I was at the head of the pack making tremendous time and I came-(we had had cumulus clouds all the way)-and I came to an area where there were no more cumulus clouds but it did look like there was lift out there. You could see puffs in the haze, but I barreled right on out in this area with lots of altitude. I flew at the same speed, and the next thing I knew I was down below 500 feet. I struggled there for about 45 minutes at 500 feet and watched several other ships that were following me come along and go down and land in the field right under me. I wasted enough time there so I lost too many points that day. It hurt me very badly in the contest. I finally got back up, but then instead of being at the front of the pack, I was at the rear. As it turned out, nobody completed the task and it meant that I went a much shorter distance than the others. Therefore, the thing to do when you are flying and have had good conditions and you see a definite change in the weather patterns, such as running into an area where there are no more clouds, it means one of two things. Either the thermals have stopped because the ground is wet or you are running into a different air mass. In any event, there is something different and you had better be cautious. Once you get out in it, you may find that the thermals are just as strong as they were and you don't have any trouble. Then you can speed up again, but the safe thing to do is to slow down. In all of your contest flying, you must be somewhat conservative. Because if you go down on one day, and most everybody else completes the task, you are out of the contest. It used to be in the old days that there were not too many good pilots, six or seven, and you could have one bad day and recover, but not any more. The ships are getting better, the pilots are getting better, and you just cannot afford to make mistakes, and especially obvious mistakes.

14. Avoid areas shaded by high cirrus or cu-nims. This again is a very simple thing. Everybody should know it. You need sunlight in order to have thermals and if you fly into areas that are shaded by high cloud cover, you are just bound to have poor scaring conditions, and there is nothing that will kill off lift quicker than a towering cu-nim that goes to 35,000 or 40,000 feet and casts a huge shadow over the entire area. So avoid shaded areas whenever you possibly can and if you do have sunlit areas, zigzag around on your course to try to hit the sunlit areas and even then it is better to stay on the side where you know the ground has been heated longer. In other words, if you have a good wind and the clouds are drifting along, it is better to stay on the downwind side of the lighted area of the ground because it has been in the sunlight a little longer than the other.

15. Favor slopes facing bright sunlight and the prevailing wind, If you have a slope on a hill that is in the sunlight and it also has the prevailing wind blowing up the surface, you have your best chance of finding a thermal there, because you have two things working for you.

16. A big mistake that a lot of pilots make is staying in thermals too long. If you have good thermals that go up to a good altitude you see so many pilots circling right up at the very top where the rate of climb has dropped off from four or five meters down to two or three. They are just wasting their time there and you don't want to get trapped into circling under these people and finding that there is very little lift left. Normally, this area is from 500 to 1000 feet from the absolute top of the thermal, but of course this will vary especially if you are under clouds). Quite often under clouds the thermal will get stronger, right up under the base of the cloud. But I'm talking mainly about dry thermals.

17. Here is an excellent one. On down-wind leg, get maximum altitude before making a turnpoint. On upwind leg, go into a turnpoint low and drift back on course while climbing.

18. On an open day get the earliest possible start. Now there is a big difference of opinion on this but it is my belief that on an open day, if you can get away and stay up that you are much better off than the man who is at the end of the list because if you do nothing more than circle and drift with the wind, you are going to be 15, 20, 30 miles or more away from the field when that last man takes off. So no matter how you cut it, you are 30 miles ahead of him. Now of course if you go out and go down, you have lost the game for the day too, so you must be sure that you can stay up before you leave the field. We have to assume that, but I do believe that on distance days, the earlier you can get away the better off you are. Of course on a speed task it is best to try to bracket what you think will be the strongest conditions of the day, but here again I would say favor the early time rather than the later time because many many times I have gone down and a lot of other people have gone down because we waited too long. We wanted to get the very best conditions so that we would be first instead of second or third, and then we found out that we waited too long and we could not complete the task and then were last or near last. So its better to start early than to start late. It gives you a little more insurance.

19. A good rule of thumb is that you can't fly through most fronts, or you shouldn't expect to make it. This is true even if it's a very minor appearing front and now I'm thinking of the one out in Marfa in 1967. All of us (except the very smartest like A.J. Smith) got trapped in this front. We took off from Marfa, and had a struggle getting to Van Horn. As we approached Van Horn the clouds developed much better, the lift be- came strong and we were able to get up to cloudbase and go booming along and hitting these 5, 6, 7 meter thermals. But right at Van Horn we could see a line of dust blowing on the ground, and beyond that the sky was clear. I got trapped in it and a lot of other people got trapped. I think there were only about three that got through, three or four, and I had 12,000 feet about five miles from Van Horn, which really isn't the time you start worrying about having to land. We had no front forecast whatsoever and most of us probably failed to assess this as a front. We thought it was a local phenomenon or a shower or something that was trying to build up and I myself pressed into this thing at high speed. I could have climbed another 1000 feet or so and flown at a slower speed where I wouldn't have lost altitude as rapidly, but I thought it was going to be a lead pipe cinch to go across this five miles from 12,000 feet to the turnpoint and turn around and come back where there was tremendous lift in the area where the clouds were. I thought I'd get back into that and just go barreling right straight down to the next turn at Pecos and make 100 mile an hour average at least. Well, I buzzed across into this area, made the turn at Van Horn, with probably 8, 9, or 10,000 feet, somewhere in there, I don't remember exactly but plenty of altitude left, and better than 5000 feet above the ground. I dashed back and got under the clouds and there was no lift. And I continued. I vent three or four miles back on course toward Marfa, and still found no lift and I had passed under all this beautiful area that had had lift, and I was absolutely baffled. I couldn't understand it. And the next thing I know I was down on the hills trying to ridge soar and finally had to land on a ranch where there was no one at hone, no telephone and the only way they ever got me out of there was I got in touch with an airplane that was flying over to relay a message back. What happened here? This actually turned out to be a cold front, this cold air mass was sweeping down from the first turnpoint towards Marfa where we had started. There was a wedge of cold air coming across and that was what was picking up the dust on the ground.

    What happened was all of us hot rocks up here were flying at very high speeds, we flew into the turn and we penetrated this wedge of cold air. We made a turn, we came back, we flew right under the wedge, right to the ground without recognizing it. Had we recognized it earlier, and been thinking a little more and been prepared for some kind of trouble we wouldn't have flown so fast. We would have flown at a better glide ratio where we could have made the turn and come back and penetrated that wedge of cold air and gotten back where all the lift and all the action was, like A.J. Smith did. While I'm talking about A.J. Smith I'd like to just mention I heard him on the air one day when he was over in Poland hollering for his crew and he was down below 500 feet and he said, “This is it, it’s all over, get here and pick me up,” and the next thing we know he was back up again and won the contest.

I’ve already mentioned if the weather is doubtful or likely to blow up, start just as early as you can, especially if they are forecasting heavy thunderstorm activity, because there is nothing that will bring you down like heavy thunderstorms. If you get thunderstorms all over the area and they throw the entire area into a shadow, you will be very lucky to even complete the task. So on days like that get away just as early as you can. What started me on this long discourse. There is never lift on the sides of a front, That you can be sure of. So if you have to penetrate a front get absolutely as high as you can before you start into it. Now, if you can get high enough-of course if you could go into clouds, you would have no problem because you could get high enough so that you could go far enough through the front to get into the cu conditions on the back side if it were a cold front. But of course we are not allowed, and I don’t foresee any time in the future when we will be allowed to fly instruments in national competition and so you just can’t do this.

20. Don’t pay too much attention to thermals chosen by other gliders unless you are desperate. I’ve gotten trapped so many times by dashing over under a thermal or circling glider, expecting to go back up and I get there and find there is absolutely nothing. And. by that time I am down a lot closer to the ground than I want to be. I have actually gone down and landed because I have done this, So one thing that will help you is to carry a sheet with the numbers of the competitors on it. You will find that there are certain numbers that circle in thermals and there are certain other numbers that circle in zero sink. Here again I’d like to mention A.J. Smith again. Number two is a good number. Dick Johnson is pretty good too. Oh, there are a lot of other good pilots too but there are certain ones that do this sort of thing and you will learn who they are, I’m sure.

21. Always pick a suitable area for possible landing. I am different than most people-I’m not like Paul Bikle. Paul Bikle will head out into any area at any altitude, and he doesn’t mind me saying this because he tells everybody that he does this, and he saves himself lots of times, but occasionally he goes down too. But I personally never go into an area unless I am sure I can land. I went down in East Germany once, I forgot about it then, but..... As a general rule, if I am flying in rough country and I can see nothing but woods and trees up ahead and not any good indication of lift, in other words if there aren’t cu’s, all the way and it looks like there is a big hole, I won’t head over that area. I’ll try to skirt around it, because if you can’t fly the next day you are out of the contest. And if your glider is hanging in a tree, you are out of the contest. So you can’t be reckless. You have to fly safely, and remember that there is another day. Of course if it’s the last clay of the contest, well, then you can smash up the glider.

22. Use the yaw string for accurate flying. A lot of people laugh at me, they think I’m back from the age of the Wright brothers, and they look at ray ship and see a little piece of yarn on the canopy, but frankly this is one of the best instruments I have. You’ll find that with a turn and bank with a ball in it, that the ball will sit there right in the middle and that yaw string will be pointing off this way or that way or it will be swinging back and forth and the ball will just sit there. I think most of you can realize that the glider flies a little better if it is going straight into the wind than if it is skidding. So I’d suggest a yaw string.

23. Fly at minimum weight in poor conditions. If I had disposable ballast in my glider, I would not start out, for instance, with the water tanks full on a very weak day, or if carrying sand bags and uranium blocks like some other pilots do (I’m not mentioning any names here) you wouldn’t want to start out with these on a very poor day. The reason I wrote this down was that at Marfa, I put 165 pounds of sand bags in the HP-14 and started out on what looked like a good day and next thing I knew I was down to 300 feet with 165 pounds of sand in the back of the sailplane. Luckily I got back up and I still can’t figure out how I did it.

24. The higher the thermal tops, the stronger and fewer the thermals. This is a general rule, it’s not always true. On days when you have very high thermals, you can be quite sure that they are going to be a little farther apart, because these high thermals take a lot of energy and there just isn’t enough energy left for a lot of small ones in between. And conversely, when the thermal tops are low, you are going to find a lot more, or on the average you will. I remember one day in particular when A.J. Smith and I were flying in a local contest from Adrian, we wound up in Dayton. I don’t think we got more than 1800 feet above the ground all the way down there, and every glide you made you thought you were going to land but you picked up another thermal and we just kept going. We would go up to 1800 feet and come down to a thousand and back up to 1800 all the way. About 190 miles, I guess.

25. Avoid large wet or green areas. This is especially true out in the southwest. If there is an irrigated area, that spells bad news because almost invariably you will find very poor sink. Avoid heavily wooded areas whenever possible, except in Poland. In Poland the best thermals are over the woods. I still don’t know why. There were pine trees and

lots of needles on the ground. Maybe that had something to do with it. Also, late in the evening, thermals become better over the woods. In dry country watch for dust devils. They are the best markers that you can find. Under poor conditions, watch for hawks. If you are getting down low and desperate, take a sweep around the sky and if you see a hawk circling, that is often a good life saver.

26. Land in bare fields wherever possible. I always take a plowed field in preference to any other kind of field. Better yet, take a disked field. It is better than plowed. I would rather land in a plowed field than in a nice grassy field., because I've landed several times in grass and stepped out on boulders that were right up to the rim of the cockpit.

27. Stay as high as possible late in the day. I don't have to expound on that. Also if you land in high grass or high crops, you should expect a violent ground loop. That is another reason to stay out of grass.

28. Carry extra speed in the landing pattern and on final approach to guard against wind gradient and negative gusts so that you don't undershoot.

29. Avoid hard landings at all costs. If you damage your ship in a contest, you are out, and if you are out one day, you're really out.

30. Avoid rain areas. This is the wet ground thing again.

31. When flying in shear line areas, plan your flight to take maximum advantage of the shear line and its movement. If you expect to have a shear line on course, try to plan your flight to fly parallel to the shear line as much as you can.

32. Stay out of thunderstorms. Some of these little innocent looking showers can turn into the most violent thunderstorms you have ever seen or heard of. This has happened to me.

33. Plan each flight carefully. Consider weather, course, and distance. I strongly advise that all of you make a checklist that you carry and each morning before you get into the ship, run through this checklist and check everything off. You have all heard the story, I'm sure, of the pilot over in the Chicago area who took off and his wife called him on the radio and said, "Hans, haben see de shucil een de pocket," or whatever it was, and he said "Ya, ich habe im pocket,' I and "I will fly over the field, tie the keys to the handkerchief and drop it. I have dropped the keys, did you see them?" "No, ve didn't see them."

34. Be very careful what you say over the air. Dean Svec had a very interesting experience. His wife Barbara called him one day during a practice day and she said, "Honey, how soon will you be down. I'm very hot and I'd like to go to the motel." About twelve transmissions came in and said, "We'll be right down." Thank you.

Question and Answer Session

Question: (Wylie Mullen) "How do you go about finding the lift under a cloud?"

Answer: "Of course I always try to go toward the part of the cloud that looks the heaviest, the fluffiest, and the darkest on the bottom, On certain days you will find the best lift on the downwind side of the cloud and on other days you will find it on the upwind side. After you have flown under several clouds you get a pretty good idea what this pattern is. In general, head for the darkest and blackest area and the sharpest area on top which indicates that there is more activity in the cloud and it is building more rapidly there."

Question; (Steve DuPont) "I hear a lot about shear lines. Can you tell me where you can find them and what they look like?"

Answer: "Shear lines are always caused by two different air masses. One air mass is always a little warmer than the other, and it tends to climb over the colder air mass and kicks Off thermals. I don't think we get so many shear lines here in this part of the country and in the central U.S. but they are very prominent out in the El Mirage area. Every after noon there the cold and dirty air comes through from Los Angeles through the passes and into the desert and right on the leading edge of that is a wedge of cold air. Here again it is the same as the conditions I described at Van Horn. This cold air mass runs along the ground and kicks up these thermals and you get a lot of dust devils. They are really the best indications. If you see a line of dust devils, you know you have a shear line, and also you will quite often get a different condition of air clarity. The shear line will be dustier on one side than the other, and this gives you a pretty good idea if there are no clouds or no dust devils 'where it is. When there is a sea breeze front, you get the same conditions. For example, in England where every afternoon the wind comes in off the ocean and the cold air sweeps lap the warm air and causes a shear line. These things are always moving. They are not stationary so you want to try to stay with them.

Question: "You mean go downwind of them more or less?"

Answer: "No, I would say stay ahead of it, just like any front."

Question: (Cal Walker) "Do You have any special rule about whether you ever backtrack on course when you fly into an area and things aren't too good?"

Answer: "Well, I think all of us have gone back to thermals we've left before, but You can only do so much of that. You have to press ahead and you usually don't have enough altitude when you get in trouble to go too far back, but, yes, if you know where there is a thermal within gliding distance and you are desperate, you better get back to it."

Question: (A.J. Smith) "Dick, I particularly like that one point that you didn't expound on and that is, if you can, go high into a turnpoint you are going downwind, and go in low is you are going upwind."

Answer: That is right. If you're going into a turnpoint against the wind, then it would pay you to go in and not waste time getting high to go into the turn, but as soon as you are sure you can get to the turnpoint without being too low and taking a chance on going down then you head into the turn, go around the turn low and then get your thermal and you can take a lot of time working back up because you will then be drifting on course. But if you get a lot of altitude and go into the turn, you have wasted a lot of time because you have drifted back downcourse while climbing. If you're going with the wind, get all the altitude you can before you go into the turn because you are drifting towards the turn and getting closer to it. Then when you make the turn you can go a long way before you have to circle and drift back with the wind again."

Low Loss Flying

By George Moffat

What I would like to talk about today essentially is how to win by not losing. You know there are people who can do very intelligent things like Dick and A.J. and others. There is another way to do the whole thing. There is the art of not making mistakes.

My contention is that in any sort of competition, really in very many fields, there are three possible ways to win. You can have equipment that completely outclasses anybody else-for instance Dick Johnson in the Fifties with the RJ-5-just a whole new departure, no other ship was in the same league. Or you can do something really better than anybody else, for instance you can be absolute world champion thermal pilot. Or, a third thing, you can avoid making mistakes. Well, number one is out, There really are no ships currently available that will significantly outperform any other ships. So you have a Phoebus C, I have a Cirrus, or you have a Diamant 18. They are all pretty much in the same bag. Poland, among other places, made this very clear indeed. So you can't do it by equipment, at least not at the moment. How about by doing something dramatically better, thermalling or high speed cruise or something of that sort? That's out, too. There isn't anybody who is demonstrably, materially, better than any of the best other people today; and if you don't think so, take a look at the point scores again. In Poland, for example, with the best in the world flying, there was an easily catchable difference of points among the first five pilots in both the standard and open classes. One more day could have easily made an upset. The points were very close, Consequently, since you can't have better equipment and you can't be dramatically better at, say, thermalling or something like that, there remains the last thing, you can avoid making a whole lot of little mistakes. You can add up the seconds that you save. And that's what I would like to talk about today.

I would like to talk about this from two points of view, first the ship itself and what you can do to make the ship save you some time, and secondly, I'd like to talk about a typical contest flight, an imaginary two hundred mile contest triangle on which we investigate what Pilot A and Pilot B might do that would make one win over the other, and by how much.

First, seconds. It seems to me that very few sailplane pilots properly appreciate how long a second is and how fast seconds add up. I guess perhaps it's because I used to race boats a lot that I got very aware of this. We speak a lot in racing boats of seconds per mile. You don't hear that much in sailplane flying, but it counts just the same. Just because you don't have somebody near you so you can see that he is beating you by a second a mile doesn't mean he's not doing it. Just to dramatize what I'm talking about, last year in Poland I lost third place by 20 seconds and second place by 55 seconds. Now let's say that a circle takes most of us about 20 seconds to fly-that is one circle during eight days of contest flying, mind you. I was one circle out of third place and three circles out of second place. Well, if you would like other illustrations, consider this. The U.S. Nationals have been won-and lost-four times in the last eight years by margins of under 20 points. In American contest flying, points tend to average about six to eight a minute, Not much of a margin.

All right, well, let's talk about the ship a minute, and see what you can save on the ship. Now in Germany last spring I was fortunate and had a sabbatical so I could spend a lot of time working on the Elfe, I spent I would say about five to six hours a day on the Elfe for a bit better than a month, doing this and that, a lot of little things, nothing very vital: aileron seals, improved canopy fit, improved dive brake fit, covering up the tow release, improving the wing fillets, a few little odds and ends of that sort. There was a list of about three pieces of paper filled up with things to do, I think there were about thirty or forty items all told. My guess is from making comparison flights before and after with one of the Swiss Elfes (Bloch's), was that perhaps, we gained two to three percent from doing this. We modified A.J.'s ship to match mine so the two ships were, at least supposedly, very much alike. Two to three percent. Well, that worked out at about 30 minutes saved in an eight day contest. I worked out the number of hours we flew and found out what two or three percent would get you. It got you about 20 to 30 minutes, which happens to be just about exactly the margin that the Swiss ship lost by, and yet Bloch, a very nice chap, rather a casual type, told me just about this time last year when I was starting to work on the Elfe, "Oh, these little things can't make any real difference." Well, I think they did make a real difference. They gave A.J. and me a margin to play with over the Swiss Elfe.

Now aside from changing around physical properties of the ship, what else can save a few seconds? Well, for one thing, how about the ship you fly? Does everything really work all the time, are you really confident about it? Because a lot of the ships I fly, borrowed ones, have variometers like that of a BS-1 I flew last summer that had something like a seven second lag. They have total energy systems that don't work at all or very badly. All sorts of little things that don't happen the way they ought to happen. Well, how about these things? Do they add up at all? I can only tell you from my own experience what happened in Texas in 1967. There I had a brand new Diamant 16.5, the ship Walt Talalas has now, absolutely fresh out of the crate. I had about three hours flying on it (in rather bad weather), I think, before I took it to Texas. We soon discovered in practice in Texas that the total energy system worked dreadfully and yet this was the system I had just taken lock, stock and barrel out of my Austria in which it had worked perfectly for two years. All sorts of experts were brought in, this one and that one, and nobody could figure out what was wrong. Finally, with the help of Paul Bikle and Dick Schreder and others we found out what the problem was on the fourth contest day. At the same time the ballast tanks finally arrived from Switzerland, so I had total energy that worked and ballast tanks for the first time on the fifth day. Well, you might be interested in how the scores went. On days one through four I placed, 28, 21, 1, and 13, (the 1 was mostly from following Dick around, using his instruments). On days five through eight, with the working instruments, the places were, 6, 1, 1, 4. Now you can say, “Oh, well, he learned how to fly the ship,!” yes, no doubt. a little bit, but I don’t think an average that went from about sixteen to about three was entirely due to the ship. It was partly due to knowing where the thermals were by having decent instruments.

Now, I just wanted to mention a few things about ships and about equipment that I thought might be worth considering. What I’d really like to talk about most is how you can save a few seconds flying, and exactly how many seconds you save, and what this adds up to in terms of minutes at the end, and what it adds up to in miles an hour, and what it adds up to in points.

I’m going to ask you to suppose that we’re flying together around a 200 mile triangle and further, let’s suppose it’s a pretty reasonable sort of eastern day, that we have about 300 foot per minute lift, that the leader whom we’ll call Pilot B averages 45 miles an hour, that each pilot uses thermals about ten miles apart-a total of 20 thermals for each pilot. Let’s assume further that each pilot has exactly the same ability, that neither can out-thermal the other and neither can out-cruise the other. Once they’re set on cruise, they go exactly the same. One doesn’t have better judgment than the other, one doesn’t have better skill; they are both flying the same make of ship. Everything is as much alike as possible. I have ten items in which I claim that Pilot B can just beat Pilot A silly.

First, the start. Some people, it seems to me, don’t realize that starting accurately is a very very difficult thing to do and requires a great deal of practice. Imagine our Pilot B, our Pilot Better, if you want to call him that, crosses the starting line at 2950 feet and 140 miles an hour. We’ll say 3000 feet is the starting altitude. He gains about 150 feet by pulling up as soon as he’s safely across the line, pulling up gradually to convert his speed into climb until he’s down to his anticipated cruising speed. Pilot A, on the other hand, hasn’t done very much practicing on his starts and underestimates the amount of altitude he needs, so he starts a bit low at 2700 feet and he’s only doing 80 miles an hour as he crosses the line. He looks up and sees the other chaps ahead but doesn’t think very much of it; however, if he gets out his calculator, he’ll find out he needs 80 seconds to climb that lost altitude. There is no way to get it back. One second after the start, Pilot B is 80 seconds better.

Well, both our pilots head toward likely looking clouds because after all one has to climb some time or another. As you know it’s rather common to hit a certain amount of sink alongside a likely looking cloud. Pilot A, our not-so-hot one, adequate perhaps, Pilot A goes in toward a cloud and like me sometimes or perhaps you sometimes, thinks he sees a really good looking one and begins to horse back on the stick slightly before he gets there, anticipating the bounce, so by the time he hits the sink he’s only going, say, 65 miles an hour. The sink goes on for 12 seconds. He will lose about 120 feet. Conversely Pilot B, holding his air speed at 90 miles an hour or whatever he’s cruising at, goes through the sink at that 90 miles an hour, and is in it for only 9 seconds, and of course loses only 90 feet. Not very much difference. However, Pilot B can use his speed to pull up in the thermal, pull up before he turns, and gains, from flying 90 miles an hour, approximately 150 feet before he turns. Pilot A has wasted most of this speed by pulling back gradually and losing in the sink, and the difference works out at exactly 37 seconds. Multiply it by 20 thermals while you’re at it.

Take an alternate example. Both pilots enter the thermal properly at high speed but Pilot A does what I’ve seen an awful lot of people do, he immediately rolls into a bank, a good tight turn in order not to lose the thermal, thereby of course wasting all his potential energy. Pilot B pulls up as usual before turning. Pilot B will get a total gain of approximately 150 feet which takes 30 seconds to climb, at our 300 feet per minute.

Take another example. Pilot A comes into a thermal, he sees 200 feet per minute on his total energy variometer, but thinking better things must be nearby, makes a couple of circles to search. He finds nothing better than 200 feet per minute and goes on. Pilot B pulls up, notes that he only gets 200 feet a minute on the variometer when he knows that the lift is averaging 300 feet a minute for the day, noses back down as soon as he’s out of the best of the lift and pushes on. This gains him 15 seconds. Now you think it might be a little bit more than that but you have to allow for the fact that the first pilot, Pilot A aid gain something or other in his 200 feet per minute.

Take the point that Dick Schreder brought up. Pilot A sees a gaggle, Gaggles have a remarkable fascination for many people. He sees a gaggle, say, 20 degrees off course, goes over to join. The lift turns out to be 200 feet a minute. I don't know why but whenever you see a large gaggle, the lift is often not so hot. But Pilot A is an optimistic type and he thinks it's got to be better, otherwise there wouldn't be all those ships there, so he makes about three turns, hoping for better things before he goes on. Pilot B sees the gaggle, notices that it doesn't seem to be doing anything very special and ignores the whole thing. The gain is 20 seconds all told from doing this. Now, you can imagine for yourself, how often on the average 200 mile flight you or I get lured by gaggles. I think one thing to remember about what Dick said on gaggles is that it's an awfully good idea to have at least a mental list of the top contest numbers. I find it very handy to note the top paint jobs as well. Paul Bikle, for example, is a lovely type. I don't know a nicer man. He always paints the nose of the ship a nice shiny red. You can spot it from four miles away, a real good trick for the opposition. Me, I like to have the most anonymous glider I can possibly get. If they'd allow you to throw a veil over the numbers from start to finish, I'd do it. I think if you're too far away to read numbers, there are other ways to tell whether gaggles are worthwhile or not. Obviously if you're low and desperate, gaggles are always worthwhile. However, if you're not low and desperate but see what you suppose to be some pretty good ships wrapped up in good tight angles of bank, you can be fairly sure that the gaggle is worth going to. If you see a bunch of K-6's milling around in 20 degree banks, run, do not walk, in the other direction. It's almost surefire that a decent thermal has tightly banked ships. The only exception is very very late in the day or very very early in the day when the thermals are gentle sorts of things.

We have talked about the various ways of entering thermals. How about leaving thermals? My contention is that leaving thermals badly can be just as costly as entering them badly. Imagine that our friend Pilot A has climbed to within about 1000 feet of cloud base and sees the lift drop off from 300 feet a minute, which has been the average, to 200 feet a minute. He continues to circle, seeing ships above, four more times because he's sure it's going to get better, besides all those other chaps are up there and he doesn't want them getting ahead. Pilot B takes one look at the variometer and when it drops, tightens up, and gets out of the thermal right away. You'll find that even allowing for the extra altitude that A gained, B has gained 23 seconds by not climbing in the weaker lift. As Dick Schreder said a few minutes ago I think this is one of the commonest mistakes that all of us make at one time or another, keeping on circling, fat and happy, when the lift has dropped off. If you find, as we so often found in Poland, that the lift drops off materially at, say, 5000 feet, although you can climb to 6000, you have no business flying around at 5100 feet. All you are doing is wasting good time.

How about techniques of leaving thermals? Our adequate friend Pilot A leaves his thermal at thermalling speed, say, 50 miles an hour. Most thermals have a good bit of sink alongside and he is only going 60 or so when he hits it. Pilot B uses a technique which I first heard from Adam Witek of Poland. On his last circle he tightens up hard at the far side, comes right across the middle of the thermal with the nose well down, gaining speed as fast as ever he can so by the time he hits the far side he's doing 80, 90 miles an hour. He goes through the sink pretty briskly, and gains five seconds, 20 times, for each thermal. It's a very good trick, this tightening up and going right through the center to gain your speed. If you keep on going the periphery and start gaining speed gradually you'll certainly do your gaining of speed in sink, which is not a very profitable way to do things. I'm not guessing at these figures. I worked them all out with my handy calculator for all of these items, and I found that it cost five seconds under the conditions named to leave the thermal in a not-so-clever fashion.

Let's imagine that cruising between thermals, Pilot B flies exactly what his speed ring says, if it's 300 feet a minute, he flies the proper speed for 300 feet a minute. Pilot A does what I think most of us have done at one time or another, he says, "Well, gee, it doesn't look so good ahead, I'll just pull back ten miles an hour to be on the safe side." Well, that will be on the safe side all right, and some time or other it might be useful, but if you calculate what the one mile an hour average speed lost costs you for four and one-half hours, you'll find it adds up to six and one-half minutes.

Now, in this comparison we've been making an assumption which is very rarely true, we've been making an assumption that our two pilots are exactly equal in inter-thermal flying ability. Everybody really knows that the whole secret in soaring is inter-thermal flying. There is no top pilot in America or in the world that we've seen that can consistently out thermal anybody else. You hear a lot about magic pilots and thermals, Dick Johnson and all that sort of thing, but you will not find that he can out climb any other really good pilot by any very considerable margin. The only place that you can make a lot is between thermals. For the sake of this study, we're just ignoring the fact that one pilot is going to be better than the other between thermals, but if I could just stop and talk about this one moment, I would say that almost all the top pilots I know work the hardest when they're flying from thermal to thermal. The things to work at are indications of cloud streeting as Dick said, indications that you're in a trough of sink, indications of what the thermals are likely to be like ahead. If you're down in Texas, and there likely to be dust devils, a very clever trick is to time the duration of a few of those dust devils because there is absolutely no point in heading for a dust devil that is ten miles away when you know the dust devil is going to last six minutes. You just aren't going to get there in time, and you are going to get there fairly low, stretching for it, and there won't be any dust devil when you get there. Now we have all pulled this trick once or twice, and it is a very grim feeling indeed.

I think there's almost invariably something, some piece of knowledge you can get by paying attention that can make you go faster. Knowledge that has to do with terrain, knowledge that has to do with how the ship is performing, even looking at how the flies are gathering on the leading edge will tell you something about what you ought to be doing next. Terrain, often very important, particularly down in Marfa. I don't think there was anybody in '67 who didn't get caught in the McCamey trap at one time or another. You know, you'd be barreling along up to Fort Stockton, you'd have five meters and you'd think you're really going and all of a sudden you'd be barreling along-and barreling along-and barreling along-and you'd passed up a whole lot of thermals you wish you hadn't. You hadn't noticed that the terrain had changed; fundamentally, it had all gone sand and sand doesn't make very good thermals. People with their eyes open saw that sort of thing. Dick mentioned irrigation areas-sudden death all over the midwest-especially around Texas where there are getting to be so many of them these days. Where you see irrigation you may assume there are no thermals-and for a long way to leeward of the irrigation area as well.

You may have noticed if you listen to your radio very much that you don't hear much of Dick Schreder or A.J. Smith or Ben Greene. Now, some might think that this is because they are nice chaps and have very good manners and things like that; but I think it's because talking on the radio takes concentration, and concentration is what make you go faster-not talking on the radio.

To get back to our mythical flight, pay attention to turnpoints. I've gone around turnpoints with a lot of people and very frequently you notice seconds over the chap who just went over the turn and banked really sharply and got on about his business on the next leg.

Well, how about final glide? My contention is that Pilot B probably uses 25/1 as a great many of us do on his computer and he finishes off at the customary five feet off the deck, just as it says in the books. But Pilot A hasn't practiced with his computer very much, he doesn't trust it very much-some people don't when they don't practice with their computers-and he decides, "Gee, it looks like a long way," and he goes up to 20/1 just to make sure. Let's suppose you start your final glide from 25 miles out. Pilot A will need 1300 extra feet which will take him 260 seconds extra to climb. He will gain back 180 seconds by being able to come in faster, but he still loses 80 seconds overall. If our Pilot A, our not-so-hot pilot, is one of those chaps that finishes at 300 feet-and we see a lot of this at the Nationals even, and especially at regionals -will have lost another minute, because a minute takes 300 feet to climb at the finish line just the same way it did at the start.

Suppose we add all these items up and see what happens. Start - B loses 80 seconds; entering thermals - 37 seconds each, times 20, 340 seconds; using weak thermals - say he did it five times, losing 15 seconds a piece, that will come out 60 seconds; lured by a gaggle, say he did it three times, that will lose 60 seconds; extra circles at the top of a thermal, unnecessary ones, will lose him 460 seconds; leaving a thermal too slowly will cost him 100 seconds in all, five seconds and 20 thermals; cruising too slowly will cost him 390 seconds; overflying the turns by too much of a margin will cost him 100 seconds; and a bad finish technique will cost him 80 seconds. What does this add up to? It adds up to 2070 seconds which is 34-1/2 minutes. Remember these are pilots of identical abilities flying the same ship. Now if B finishes in four hours and 27 minutes, which he would at an average of 45 miles an hour, A will finish in 5 hours 1-1/2 minutes for an average of 39.8. If points cost five per minute which is a low figure under the U.S. rules, A will have lost 173 points. Multiply by 8 days for the whole contest. If points count 12 points a minute, as they did in the World Championship (I took the trouble to average them up to see what they count) A will lose 416 points for the day. Keep in mind that in this hypothetical flight, we've assumed that the pilots were identical, the ships were identical, that the only gains were in these low loss possibility factors that I've been talking about. Now, it would be nice to have a super ship with 100 foot span and really clean up big. It would be nice to be able to do something so much better than everybody else that you could clean up big that way.

Low loss type flying isn't dramatic, it isn't showy, and it does demand a good deal of discipline. But it works.

The Electric Variometer System

By A. Gene Moore

This discussion assumes that the soaring pilot is already convinced of the value of total energy compensation in his variometer system, and that he understands the basic operating principle of the diaphragm type compensator.

In order for a sailplane to fly through the air, energy must be exchanged or distance. The available energy is in two forms, potential (mass x height) and kinetic (1/2 mass x velocity**2). At his discretion, the pilot can readily exchange one form of energy for the other. By zooming, a pilot decreases his velocity and increases his height. He is trading kinetic for potential energy. Although he is momentarily higher, he has not increased his total energy, and he will hit the ground at almost the same time that he would from his lower but faster position.

During the zoom maneuver with an uncompensated variometer, the pilot suffers from an information "black out." It is impossible for him to tell whether he is in lift or sink while the air speed is changing. He is often fooled by what is called a "stick thermal," and he continues to circle in sink until the air speed becomes steady and the variometer settles down and shows that he is actually going down. A total energy compensated variometer system is required to cure this problem. One compensating scheme makes use of an operational element (diaphragm and spring) connected between the pitot and the variometer. This system is responsive to both rate of change of air speed and rate of climb (rate of kinetic and potential energy changes). These two measurements are summed by the operational element in such a way that the output indication on the variometer shows the instantaneous rate of total energy change. This makes it possible for the pilot to optimize his position in lift even while changing air speed.

Following the system concept, a new diaphragm type total energy compensator together with a dynamic bench calibrator will be described. If the static error of a particular sailplane is known, it is now possible to bench tune and test a total energy compensated variometer system with predictable flight results. The circuits and equipment to be described have resulted from a mathematical model of the sailplane - total energy system, which was worked out by Wil Schuemann. Wil hopes to give a paper on this work at the OSTIV meeting in 1970.

Historically, variometers have been sold as component parts; the same as total energy compensators, restrictions, and even sailplanes. As glider pilots we assemble these components into a system. When the system doesn't "play" and performance is less than expected, we do the natural thing and blame it on the manufacturer whose component (the indicator) costs the most money.

The popularity of the electric variometer is due first of all to its rapid response, and second to the fact that it will drive an audio attachment. It is the speed or fast response of the electric variometer that causes most of the system problems. These problems are caused by the size and location of the restrictions used to slow up the system. We must stop thinking of our variometer as a single instrument. Instead, we should think of the whole system, which includes the sailplane, the restrictions, the total energy diaphragm, and the variometer indicator. Again, this is a system.

[Figure 1]

The variometers used in modern sailplanes are extremely sensitive nstruments. For example, if you hold a brass tube 1/8" I.D. by 1" in length between your fingers, as shown in Figure 1, vertically in the gravitational field, the heat from the fingers will cause an air flow due to thermal convection through the tube that is roughly equivalent to the flow from a one pint flask when climbing 100 feet per minute. As you can imagine, the blast of air coming out of the brass tube won't blow the hat off your head. However, we expect our instruments to be able to measure signals of this level and even much less, and they do just that.

[Figure 2]

Figures 2 through 5 will provide some background on the types of variometers available today. Figure 2 shows the "Leaky Capsule" type variometer. This is the basic principle used in the standard aircraft rate of climb instrument and the Ball Electric Variometer. It operates by measuring the pressure drop across a fixed restriction (R) placed between the reference pressure capacity (C) and the static ports on the sailplane, The pressure drop across (R), which is proportional to rate of climb or descent, is measured by the sensing capsule.

[Figure 3]

Figure 3 shows a vane type variometer. The PZL uses this principle.

The principle is that the pressure drop across the restriction formed between the vane and the case is a measure of rate of climb. For any rate of climb, within the range of the instrument, there will be an equilibrium position of the vane where the torque in the hair springs balances the force on the vane. If you raise the system, air will pass from the capacity through the restriction, deflecting the vane, and give an “UP” indication.

[Figure 4]

Figure 4 shows a pellet type variometer similar to the Cosim. It has two small pellets in cross connected tapered tubes. In industry, this type is called a variable area flow meter. It operates on the principle of a fixed pressure drop across a restriction that varies in area. From the plumbing shown, you can see that the air flowing out of the reference chamber (C), if you raise the system, will raise the green ball, and the air will be exhausted through the static port of the sailplane. Now, if you lower the system the green ball will drop and back seat on the tapered tube forcing the air to go through the other branch lifting the red ball and allowing the air to flow into C.

[Figure 5]

Figure 5 shows a thermistor type variometer, and this is the one with which I am the most familiar. It operates by sensing the flow of air in and out of a fixed reference chamber (C) connected to the static source of the sailplane. The black dots are two very tiny thermistors. They are much smaller than the head of a pin, and in the Moore variometer they are located adjacent to each other, as shown, in the line connecting the reference chamber to the static source. The thermistors are configured in an electrical bridge circuit, and a voltage is applied to the bridge. The small current, about 15 ma, passing through the thermistors causes them to self heat approximately 100 degrees Centigrade above the ambient temperature of the system. There is now two hot beads, with the characteristic that their resistance changes quite drastically with temperature, operating in relatively cool air. When the flow of air is from the reference chamber to the static source, the right hand bead will be cooled and increase its resistance. There will also be a hot air bubble that will move downstream and actually warm the left hand thermistor. This is the case at very low flow. The change in temperature causes a change in resistance of the thermistors. The resistance change of the thermistors in the bridge circuit causes an output voltage at Eout. The output voltage is read in terms of climb or descent.

[Figure 6]

Figure 6 shows a complete variometer circuit. The two thermistors shown in Figure 5 are T1 and T2, and the rest of the schematic is a differential amplifier used to drive the meter and to tailor the characteristics of the circuit.

[Figure 7]

Figure 7 is the complete pneumatic circuit of a total energy variometer system. The important considerations in tuning this system are:

1. The sailplane should have an error free static source. If this is not the case, the static error must be determined in order to adjust the diaphragm compensator.

2. The altitude at which you wish the best compensation must be selected. The diaphragm type compensator (C1) can only be adjusted for one altitude. If it is on the nose at 3,000 feet, it will overcompensate below and undercompensate above this level.

3. The diaphragm compensator (C1) must be adjusted to exactly match the volume change required by C2 at the altitude where you want exact compensation. in practice a system tuned for 3,000 feet would work satisfactorily from ground level to 6,000 feet, but not at 10,000 feet (like over Marfa).

4. It will be necessary to add some restrictions to the system. R1 is normally added to cut down the effect of gusts hitting the pitot. But R1 works with C1 to form a time constant R1C1, and this makes it necessary to add R2 to the circuit so that R1C1 = R2C2. In fact, adding R2 to any electric variometer system that already has R1 will greatly improve the system. R3 should be left out if possible by making both R1 and R2 longer to slow down the system. Some starting values for R1 and R2 are I” x 0.020” capillary. If the system is still too fast, make them 2” x 0.020”. This would be better than adding R3. In any event don’t make R3 longer than one inch.

5. Put 3 Chore-Girl pot cleaners in C2 to act as heat sink material. The reason will be explained later.

[Figure 8]

Figure 8 shows the dynamic bench calibrator connected to a variometer system under test. With this calibrator it is very easy to tune or match the time constants R1Cl and R2C2 mentioned earlier.

The calibrator has a variable transformer for controlling the output air pressure (pitot) from the pump. The pitot pressure is divided by two precision restrictions R4 and R5. A virtual static point is formed at the junction between R4 and R5, and a standard rate of climb indicator is connected to the static point. An air speed indicator is connected between the pitot line and the static point. The variometer system as shown in Figure 7 is connected to the bench calibrator.

In operation, we can vary the airspeed on the calibrator and watch the rate of climb indicator showing what a sailplane would actually be doing if undergoing similar air speed changes. At the same time, the variometer indicator shows how well we are doing in tuning the pneumatic portion of the variometer system. We start by fixing R2C2 and adjusting R1C1 until the variometer reads a continuous zero for zooms and dives between 35 and 140 knots .

The only question left unanswered when the variometer system leaves the calibrator is the static error of the sailplane. Once this is pinned down for a particular model, a compensating correction can be made to R5. R5 also serves as the altitude adjustment. By increasing the pneumatic resistance of R5, we can raise the altitude at which compensation is optimum.

When tuning a variometer system with response in the one half to two second range, it is helpful to put heat sink material in the thermos.

[Figure 9]

Figure 9 shows the results of putting three Chore Girl pot cleaners in a one pint thermos used as the reference chamber for a variometer. The test shown is this. If you are climbing at 1,500 ft/min and level off, it will take the normal system nearly ten seconds before the indicator is below 100 ft/min. The air has expanded and cooled, but the glass wall of the thermos hasn't cooled as rapidly as the air, and as the air inside the flask warms back up to the glass temperature it continues to expand and flows through the variometer giving a false "up" reading.

With the heat sink material the expansion process is changed from near adiabatic to near isothermal. The variometer will now recover in two seconds instead of ten, an improvement of five to one.

[Figure 10]

Figure 10 shows the performance measurement of three total energy type diaphragms. This is the change in volume that is necessary with pressure or air speed to compensate a one pint reference bottle. The diagonal line represents the volumetric change with pressure needed from a diaphragm to exactly match a one pint bottle at sea level. The Burton was over-compensating in the low speed ranges, crossed at 50 or 60 miles per hour, and above 90 miles per hour was very inadequate. The next One is a PZL. You can see from the slope of the line that this particular compensator will not compensate a one pint bottle, but it does have a linear response. To get adequate compensation out of the PZL, you would need to go to a smaller bottle. The squares are the output plots from a Moore-Schuemann compensator. This test shows that it is possible to get a linear response from a diaphragm type calibrator over a wide speed range.

[Figure 11]

Figure 11 is the Moore-Schuemann total energy compensator. It has all of the features necessary for good total energy compensation. The thermos is filled with heat sink material. R2 is potted in place. C1 is adjusted for the selected altitude and the static error of the particular sailplane. R1 is cut to length so that R1C1 = R2C2 as determined on the beach calibrator. When the Moore-Schuemann compensator is connected between the pitot and the vario it is ready to fly.

The outcome of all this effort is summed up on 16 mm data film (running time six minutes). This film shows the actual testing of several variometer systems on the dynamic bench calibrator. The highlights are the tremendous improvement obtained by adding R2 to the garden variety total energy system and the near perfect performance of the Moore-Schuemann system when zooming from 120 to 35 knots air speed.

Mr. A. Gene Moore is Project Engineer for Electronic Products with Hercules Incorporated at Cumberland, Maryland. He is currently working full time on a recently patented fluidic angular rate sensor that he invented while working with electric variometers in his basement.

PANEL DISCUSSION: Factors Influencing Crucial Decisions

By A.J. Smith and Dick Schreder

A. J. Smith -

In competition soaring, it is important to have a plan for each flight. Granted, for a majority of the days during a contest, the weather information will be bad, tasks poorly selected, the tows poor, the start line radio out of operation, etc. Still, one should have a general plan for each flight.

A flight plan should be done with the understanding that most preflight information may be false, and that there will be many contingencies. Plan for the worst conditions. List the alternates. This will provide an advantage when you're faced with decisions out on course. Anticipate the worst and have alternates in mind. If things are going as assumed, you will be prepared and confident. Thus, a plan is riot a bible; it's a guide. It should include alternates. And, as Dick Schreder has pointed out, it should include safety factors. For example, earlier than necessary starts on tasks provide a safety factor. With slightly early starts, if delays occur along course, there is a margin of soaring time left to work in. There's some time left during the soarable part of the day to work out problems.

Again, for emphasis, in beginning this discussion of factors influencing crucial decisions, determine that you will make flight plan. Then, if the planning is good, one should be faced with fewer crucial decisions. In the decision-making process in soaring, you should search for decisions to make. We've tried to determine how many decisions one makes during a soaring flight. I've concluded that really basic decisions probably are made, or reviewed, at the rate of two or three or several a minute. I constantly use this conclusion, to test my level of activity during a flight.

As Moffat pointed out, perhaps we should be doing most decision-making during cruise between thermals. George was telling us that it's more important to do plan work during cruising flight than it is to work hard at the stick and rudder bit of thermaling. I agree with him. I would say, further, that you should be using the same decision-making process, the same planning, and review while thermaling that you might when you're cruising. That is, decide where you should go next, where the next lift is, where the next workable thermal is, what the course is, what problems are anticipated (are there shadows of cirrus here, or more sunlight there, cloudless blue holes or better cloud structures. or whatever). Simply, then, work hard in both cruising and thermaling conditions. But always work at the same thing. Planning. Not planning how to move the stick and rudder in a thermal but, rather, how long to stay in it and what to do next. Look for decisions to make.

We each must rattle our own drum and go according to our own rhythm. Perhaps others won't find the things we do to be successful for them in soaring. However, one thing that's apparently important for success is worry. It doesn't always make a happy life, but worrying helps in sorting out decisions that might be crucial. With worry, one looks harder for decisions to make.

You actually can time yourself and say, if you haven't been making or reviewing decisions, really basic decisions, at the rate of several per minute, that you've been asleep.

I often find myself asleep during flights and almost literally, too. Eight or nine hour contest flights are strenuous. I like to take a nap after lunch. This is difficult to do in soaring, but my body doesn't understand this and takes a nap anyway. It often takes me ten or fifteen minutes to realize that I haven't been making decisions. I know then I've been bumbling along. So I drink tea, Metrecal, orange juice, or whatever, to get blood circulating again, and start looking for decisions to make.

Now, Dick Schreder should expand a bit in terms of unusual weather factors he's experienced. His example of the front at Van Horn, Texas, was beautiful, and there are many more. The question and the answer session will bring out the kind of decisions possible in these crucial situations.

It's important that we give examples of factors which influence the decision we must make. Other pilots must build on our comments here with their own experience. Perhaps an important thing we can do for them, just now, is to help them to realize that decisions must be made, that there are a lot of them to be made, and, to be more successful in soaring, they might try increasing their rate of decision making.

Dick Schreder -

I like to think of a pilot of a sailplane in a competition as being nothing more than an auto pilot hooked into a computer and the computer is re-evaluating every minute all of the facts he's facing in the flight and has to come up with the correct answer to try to get the ship across the finish line before anyone else and to prevent at all costs going down in the process. So it's a pretty complicated problem. I think this is why the sport appeals to us so much because it's an elusive sort of thing that we're always trying to grasp, and we're trying to solve the problems and conquer the elements. We never quite do it to our satisfaction and it spurs us on to keep trying harder, like having the proverbial bear by the tail and not daring let go.

But I think since this is a panel discussion that we could probably accomplish more and help you fellows more by having you put questions to us on what goes through our minds when we're faced with certain situations and how we decide whether to hold back or to press on. These are very crucial decisions because we can press on into the ground, or you can hold back and be the last one to finish. Sometimes if you hold back, you're the only one to finish, and this was a good decision. I think the best way to do this is to just open it up to a panel discussion, and A. J. and I will try to do our best to let you know what goes through our minds when we have to do these things.

Question: (Quentin Berg) There were conditions in Poland and in the nationals at Elmira where people waited out the area and then went through it. Could you give more ramifications of that?

Answer: (Dick Schreder) I'd like to tell you what I did in that situation and how it didn't work out. I pressed on, the clouds were very low, conditions were anything but favorable, and I pressed on to the top of a hill about twenty miles southwest of Elmira and sat there for about 2-1/2 hours - Then feeling I had done kaflooey in the competition and since I hadn't been flying my own ship, my excuse anyhow, I decided that all was lost and that I should make a brilliant coup that day and finish with the best possible time. So I flew all the way back to Elmira against the wind and made the turn and hoped that I could make a fast dash to the goal, but the thing that happened was that it was just a little too late and I didn't make it and went clown again; but these are very difficult decisions to make, and the winners laugh and tell funny jokes and the losers cry and give excuses. So I -really don't have a good answer for that. You just have to evaluate the situation and try to, in Your own mind, see what you can do best, and you must at all times keep in mind that going down is a disaster, but you must also push in order to get there, and there's a very fine balance between the two.

Answer: (A. J. Smith) This is an important problem. If you're coming into an area of bad soaring weather and, if you're reasonably certain as you look ahead that you're likely to go down if you continue, atop! Examine all other alternates first. There are few situations when you should commit to go on into the bad area. You should know, when you do commit, that you surely will go down. There are but few situations (when the bad area is moving toward you and there is no way around it) when you must fly into the area as soon as possible to get maximum distance. These are exceptions.

The front at Van Horn was an important exception. That front and the bad weather with it quickly covered a part of the triangle. The Van Horn turn point was already behind the front as we were approaching. It was apparent that we had to do something immediately because of the fantastic speed of the frontal movement. It was sweeping up dirt ahead of it, a wall of dirt carried up to or 9000 feet. It was necessary to fly much faster than best speed to fly theory would indicate, simply to get there as soon as possible so that the distance through the front, into the turn and back out through the front, would be minimum. Normally, you wouldn't fly that fast because you would increase the risk of going down. But, in this case, getting there sooner minimized the exposure in the bad area behind the front and minimized the total risk.

A second exception was the warm front situation we flew into in England in 1965. We knew the front was coming against the direction of flight. We knew everybody was going to hit it and land essentially at the front. The only justification for pressing a bit harder that day, getting to the front earlier and immediately going through it into the bad area, was to get a few miles before the front moved in. The pilot who sat back and used time to analyze the situation was going to have the front push him back along course before he started his final glide.

Those examples, indicate when you might go on into a bad area. In other general cases you shouldn't go into bad weather areas. Just don't go in. Look for other answers. Fly out around the area. Hold back. Drift with the good weather. Do anything to avoid that final commitment.

Question: The question came up because in the Philadelphia regionals an area to the west was under clear sky, to the east was under clouds, and you had a cat's cradle with a choice. The people who went into the clear area actually did better and got as good or better thermals as they had under the clouds and yet the reverse was true in that situation in Elmira. How would you know?

Answer: (A. J. Smith) When you're faced with a cloudless blue area, if you don't have air mass data, you don't really know what it's like. You can test the blue by going into it. Go in at maximum glide ratio. Go on in a short way. See if you run into lift. Quite often it's just a drier air mass - just as active but drier. Go on in cautiously. Keep calculating so that you get back out again if there isn't any lift. That's one of the alternates, always. A way out. Don't drive fast into blue areas. Investigate.

Answer: (Dick Schreder) I think a good example of a master of this technique is Dick Johnson, and I remember the year he won the nationals in Elmira, and he knew when not to press. He went out and circled over a smoke stack for an hour or better until conditions improved and then he went on. This helped him very much in the contest.

Question: (Neil Ridenhour) This is all very close to the question that I was working on. Quite often we're faced with the blue area ahead, and do you have any rule of thumb for any clues or anything as far as whether you may expect this lift because I think at least 25% of the time or even more, that blue area does have good lift and so forth and you end up holding back and then you find out you should have pushed on, but do you have any clues that you've used to help identify whether this blue area may be for some reason just cloudless, but still have good lift?

Answer: (Dick Schreder) I hate blue areas. Yea, I have a general - my general plan of action with a blue area is just to become cautious most of the time. Once in a while you forget and don't pay or give it the attention it deserves. But an example of a blue area is the kind you get near your vicinity of Chicago. I've flown up that way several times from Bryan and you have a wind from the northwest or the north coming off Lake Michigan and you try to fly westward (or eastward, for that matter) - You most always find that on a day when there are good cu's back inland, that along the end of the lake where the wind is blowing off the lake over the land mass, you will have a big blue hole, and invariably this is caused because the air mass has been cooled by the lake and there are thermals in there, they're not as good, but they don't go as high because the air has been cooled down and the technique, of course, is to stay as far away from the lake as you can. Stay away from whatever is causing it (if you can identify it) and then fly cautiously and stay as high as you can to try to get across this area with the least chance of going down possible.

But there is always a reason for a blue area, and sometimes you just can't tell what's causing it, like A. J. said, it could be a drier air mass, and you'll sometimes get in there and find the thermals are just as good - A good clue to watch for is when you do get in there, be especially alert to notice if the thermals are going as high and almost always you'll find they're not going as high as they were. Now if they are, then you know it's a drier air mass, and you probably can boom right on through.

Answer: (A. J. Smith) I could expand on this. Cloudless blue holes are unpredictable; avoid them if you can. You are certain to build up a philosophy about this problem through the decision making practice. If you realize that often you have suddenly arrived at the edges of a blue hole, you've probably made your mistakes fifteen or twenty minutes before these shocking arrivals and didn't realize it. It really shouldn't happen to you that way. You should see situations developing way ahead. It's good if, as you're getting near the tops of thermals, or as you begin cruising, that you condition yourself to make a general assessment of the weather. Then you will begin to see bad situations from some distance off. You might be surprised at the number of times you find that blue holes can be avoided with minor deviations from course. If, however, you find yourself right at the edge of a hole you'll probably fly a greater distance to get around it or take an unnecessary risk to get across it. In those sudden confrontations, you've got a hard problem to solve because you've either got to slow down and gamble on getting across the hole or take the long way round. Either is bad.

If you can anticipate bad areas, say 15 or 20 miles ahead, which shouldn't be difficult to do, most times you will find you can make broader decisions that save you a lot of time. I wouldn't always plan to go way round a hole. I might fly across the edge at best speed to fly and plan to arrive at the next obvious lift with some reasonable altitude left. If the conditions got worse in the hole, I could detour very slightly and be back in the good area. Then I'd head right for the next turn. This is simple geometry; this is the shorter way to go.

I would caution again by saying that if you often find yourself suddenly at the edges of a blue hole, if this seems to be a habit with you, something's wrong. That makes you feel good, doesn't it, Neil?

Question: (Ed Replogle) Can you tell - let's say you are in one of these dead holes and you have no choice or at least you've decided to go in and try - can you tell from the feel of the air in there whether it's dead without going on and on, can you get any cues from the air whether it's dead or not?

Answer: (Dick Schreder) Yes. It's lively, it's turbulent, and after you've flown a long time you can actually sniff an air mass.

Question: (Bob Buck) Could you possibly be a little more specific on what you consider a flight plan is like.

Answer: (A. J. Smith) I start out with a vertical altitude scale, and a horizontal time scale graph sketched as we go through the briefing. I make them a little larger (higher and longer) than necessary. As the briefing goes along, I begin indicating, on the graph, start of take-offs, start of tows, and end of tows. You can crank in start line opens, start line closes, turn point opens, etc. You can build up on this time scale all the critical times during the day. They are laid out for you at the briefing.

The next easiest thing to do is the terrain, and in places like Marfa, this is important. You can build up the terrain in this graph, first as a rough estimate in relation to time, later, as you calculate for the particular task, as a surprisingly accurate estimate. You'll predict your time over high ground, mountains, irrigated lowland, etc. You can also graph, from the weather briefings, the beginning of the thermals and about how their altitude increases, if it builds up slowly or rapidly and what will happen at the end of the day. On this line showing thermal altitude/time, you can begin to sketch what's going to happen in cloud structures during the day.

You might also indicate turn points laid in on the terrain/time line. This is a good check. Terrain against turn points, both against time. Remember that this plan is not a bible. It can shift back and forth as you get off schedule. Finally, indicate the flight time. For example, indicate two and a half hours on the horizontal time scale. Add a half hour on the front for safety factor. This determines the start time and the estimated finish. I estimate how well have I got to do to win the day. I estimate where I should be at a particular time and so on. This kind of information begins to raise questions. You begin to worry about your problems. You begin to anticipate the times when you have to make decisions and when you have to change pace, when you should press harder, or what.

My flight plan is basically a graphic one because I'm graphically oriented, but it could be done in prose or poetry, mathematically, any way you want to do it.

Question: (John Hearn) We've had a glimpse of some of the contents of your cockpit; we've heard of Metrecal and orange juice and Spanish goat skins. What I would like to ask is, what physiological preparations are desirable before and during the flight? I think this is of some importance. What do you do as far as food, drink when you're going to be flying in a contest?

Answer: (Dick Schreder) This is very important. I'm probably a little different from the people that smoke and drink and carrouse around. I usually settle for dried fruit and fruit juice, and things like that. I don't know what these other fellows drink, but I stay strictly with the fruit juice and water and carry lots of it - especially out in Texas and California and the desert areas. You really need it. I always run out of water - that's the first thing I run out of, even altitude sometimes, but you need lots of water and you need some food and, of course, it goes without saying that you should have emergency gear with you. You don't know where you're going to wind up that night, so by all means you should have a flashlight. I walked a couple of miles after dark in the desert without a flashlight once and it was frightening - I would have gotten in a little quicker if I'd had a flashlight, but I think it's important for the pilot to be comfortable. If he isn't comfortable, if he has problems, physical problems in the cockpit, he can't concentrate on flying the sailplane and doing his best. I think he's lost the day if he's uncomfortable and has problems. Along with this, you need good ventilation in a sailplane. Almost always, you'll get fogging when you get up under the bottom of the cloud bases in Texas. You need something to keep your canopy clear; you need good cushions to keep comfortable so you don't get bed sores. I know all of us have flown over nine hours, two, three or four days in these contests, and you're going to do it in Marfa, so you want to really make sure your cockpit's comfortable and that you're not sitting on things you shouldn't be sitting on, and I think we should all give more attention to having some kind of a relief tube. It gets pretty hard to hold it for nine hours, and you just do everything you possibly can to make yourself comfortable. I can't overstress the importance of having a check list to check these things off before you get in the sailplane and take off, because you'll always forget something, like your charts. This happened to me one day, and when I got down I bawled Angie out for forgetting the charts - She reached in under the seat, and I'd been sitting on them all day. So you really want to be organized when you start out.

Question: (Mike Levette) Do you use oxygen to speed up your mental processes if you're operating, say, eight, ten thousand feet, or do you just use it if you go above twelve thousand?

Answer: (Dick Schreder) Well, I suppose everyone has a different idea of this, and it also depends upon how plentiful your supply is. I personally use it as soon as I get to 12,000. Now other people, people who smoke of course, have to start sooner. But I do think that you should plan on using it at least by twelve, maybe some other people at ten, but there again it depends on how long the flight's going to be. If it's a race where you're only going to be in the air for a couple of hours, you could use it all the time, especially if you had a headache; it would help clear you up. I don't know, A. J., what do you do about oxygen?

Answer: (A. J. Smith) I make it a point to taste the pleasures of life almost every night. And Dick's right. I went through the physiological test center at Chanute Field. They took us up to 23,000 feet in the altitude chamber. We took off our masks, and I passed out almost immediately. Others were sitting there four minutes later writing away. This gave me a clue about my own capacity. I would say that I've had one chance to put this information to work. I did use oxygen at Marfa, no matter the altitude (we were there mostly at eight to twelve thousand feet) and I used it regularly, not constantly, every 15 or 20 minutes. I felt that it helped tremendously. I measured that by my fatigue at the end of the day. The first few days I didn't use the oxygen and I was fatigued, even on short flights. I realized that we could carry much more weight. I put the oxygen system in and used it, and I was in better condition at the end of a flight. My mental processes were much more efficient through the flight. I think that this is an important point because you are asking your brain to work on these flights and if it isn't working at maximum efficiency, then you aren't going to do your best.

Question: (Steve Dupont) This may be a silly question, but at Marfa I got lost and badly lost several times. Do you have any suggestions about that?

Answer: (Dick Schreder) I had that in MY list as one of the points but in speeding things up I missed it. I think it's very important to keep track of where you are at all times. And what I do - of course, on a speed dash you have lines drawn on your chart - but what I try to do on an open day or any kind of a distance day is to carry a couple of pens with me, these felt pens, and I keep marking my course. Every time I get a definite landmark, I draw that line over that mark so that this way you keep pretty good track of where you are and you don't get mixed up.

Now a lot of well-known pilots have gotten into terrible trouble by getting lost. Dick Johnson had this happen to him over in England during the Internationals. He got lost and absolutely could not find the second turnpoint on a speed dash, and, of course, this is the end if it happens in any contest. So all I can say is, have your charts with you and mark your course as you go along; and keep checking the ground because everybody tends to watch their instruments and concentrate on staying up, but you must also keep track of where you are. Out in Texas this is doubly important because you have very few railroads, very few towns, and a lot of that country looks the same. I see another fellow shaking his head who got lost out in there.

Answer: (A. J. Smith) Steve, this is a general answer and not directed particularly to you, but you know there's a basic thing that we do wrong. I wonder if you people have thought this out; I'm certain you have.

I put marks on the map to indicate my positions. Next to the marks, I put the time. If I get confused, I can go back to this log and see how I've been moving. I can project and estimate my position. But, to get a position, first look for something on the ground, something really prominent. It may be far off. Then locate it on the map. Pilots, in general aviation, who've been lost, were looking first at the chart, and they'd say over and over again, "I couldn't find that town, you know, 1 just couldn't find the town." They've had it reversed, you know. Find the landmark first and then locate it on the map.

(Steve Dupont) In Marfa, a lot of times you were so high that if a road was ten miles over there you couldn't see it.

(A..J. Smith) It's much tougher there. The thing that helped down in Marfa was to sort out Lookout Mountain and the passes. These were landmarks ten or fifteen miles away. Some of the courses were over the mountain or through a particular pass. This was about the only way you could remain oriented around the big desert areas that you're talking about.

(Steve) You go for the big terrain features, don't you, rather than the details?

(Dick Schreder) Yes, mountain peaks are especially good, and the thing that is most prominent is the best landmark, and that's the thing to keep track of.

Question: (Roy McMasters) I'm sure that you do much compass navigation, particularly when you consider the flat gliding angle that some of these sailplanes have and you start your final glide and you simply just cannot see your goal and a few degrees error with the altitude margin you're leaving yourself -You could be wiped out just by missing the airport. How do you go about this and how do you handle the problem?

Answer: (Dick Schreder) I'm sure A. J. does the same thing I do. First of all, you make sure you have a good compass in the ship and that it is well compensated so that you know exactly what your deviation is; and I'm sure all of us are forced to fly compass headings even when we have landmarks. If you're off to one side, you still need a compass heading to be sure of where you are.

Answer: (A. J. Smith) One of the beautiful things about panel discussions is that you find the divergency of operations. I don't carry a compass. The only really satisfactory compass I've found is one that Dick got surplus a long time ago. I installed this for a while. I had it on the cockpit. I really liked the way it worked but I didn't ever use it. It even got to be annoying because it fell off when you trailered the ship. Perhaps the safest thing, though, is to start working with a compass. I have an advantage, and this works for me even in Texas, Steve. I can see major landmarks on the ground, a section of road or whatever, and, again, because I'm graphically oriented, I can put my ship within a degree or two in relation to that landmark. More times than you realize, if you use the concept of major landmarks, you know where the turnpoint is. You know, and you can practically stop detailed navigation. You don't worry any more about details once you've picked a major landmark in relation to a turnpoint or a finish line.

A final glide from 40 or so miles out is possible, relating to just one landmark. The finish may actually be out of sight behind a ridge or whatever. But, you get to it through a particular valley, or between two mountains. Even in desert country, goals are easily related to major landmarks. Don't waste time with detail navigation. Just fix your goal from forty miles out.

(Roy McMasters) I wondered. I've been flying with a completely magnetic 1-23 in which the compass is absolutely useless and I just wondered, I mean in terms of the high L/D that some of these ships have, particularly on their final glide where you can't really see a prominent landmark or you really can't see your goal. How do you handle that? If you've missed that one, you've really missed it because you won't have another chance.

Answer: (Dick Schreder) Well, you have different situations around this part of the country than you do out in Marfa. Out in Marfa, the visibility's 50 or 100 miles normally. Around here you can get very low visibilities and, of course, then the problem gets more difficult.

(?) There's another way. You can thermal a couple of times, and the way you want to go is always upwind.

(?) In the case of Marfa, you'd do well to take a couple of days beforehand either hire an airplane or fly around the territory.

(Dick Schreder) Oh, I think you'd do better to take a couple of days and fly around in your glider.

(George Moffat) I used to be of A.J.'s persuasion and very rarely used compasses, but I certainly got my come uppance last year flying in some of the German contests, because there, well a little like Elmira, but say Elmira squared, everything looked exactly like everything, and there's much too much of it. Furthermore, the charts are not nearly as good as ours. I found that a trick the German pilots use helped immeasurably (A) Get a good compass and install it. Get it swung, but (B) Before you start, fly all the courses that you're going to use. Note down what you actually have to fly to make them good on the chart. Now, of course, the wind may change before the first turnpoint, but it's not likely to change that much without your knowing about it. This way you get a sort of gunsight navigation which I found was extraordinarily important after you went around a turn. Then you knew exactly what to set off for even if there didn't happen to be any handy landmarks. You just set off on compass, and you couldn't be too far off. Then you begin to check your landmarks off to see whether you're drifting one way or the other. But this is a technique that a lot of the German pilots are using, and it seems to me a very, very good one.

(Dick Schreder) That's a very good point. I'd forgotten that I do that myself. What I do is when I start down a leg after making a turn, I try to pick out some kind of a prominent landmark that's on the course, and I head towards it. I keep glancing at the compass as I'm heading towards it and then I know that if I stay within a few degrees of that, that I'll at least be able to see the turn when I get near it. I had this work out very well in the Internationals over in England - I believe it was a national competition we were in over there - we actually went up and did some cloud flying. After you've been in a cloud for 20 minutes or a half hour, you don't really know where you are, and you have to hold a compass heading when you come out because you come out of the cloud and there are clouds all over - From 15,000 feet, it's very difficult to recognize anything on the ground, especially in England because there are RAF Air Force fields all over the place, and they all look alike -so what I did on that day, I held this compass heading and got down very low and finally got a thermal and was working my way up and I looked and I was right at the turnpoint. It was just a short ways ahead, and I know I would have never found it if I hadn't had a compass heading to fly.

Question: (Cal Walker) If you were doing a shortish speed task and your assessment of the lift was very strong, would your flight plan include a tendency to go as the crow flies, or would you leave the option open and still look for lift where you found it?

Answer: (Dick Schreder) If it was a strong day, you wouldn't be wandering off course very far.

Question: (?) I have a difficulty in clear air and small thermals when I'm pressing hard, wrapping up and getting centered. What is your technique?

Answer: (Dick Schreder) Well, I suppose most of us have a little different technique here. I think I've already told you mine. I wait until I begin to get a drop off in the thermal or also watch the total energy variometer; and if it's not indicating as strong as an average thermal and I have enough altitude, I immediately decide that I'm not even going to circle, and if it reaches, Say, two meters and I've been getting four, I just decide right there, as it begins to drop off, that I'm not even going to bother with it, arid I start pressing on. But if it's a good thermal, then I do the same thing that George does. I zoom up and as you're zooming up, if you have a lot of speed, you go almost straight up, and then you start your turn when you're down at low speed so that you can make a small radius turn and stay in the thermal. But I imagine everybody does it a little differently, and we haven't heard your method, A. J.

(A.J. Smith) I think my technique is different. I'm probably reacting a bit more on the feel of the thermal. I use the same indications Dick does when coming into the thermal. I make certain I've got a good total energy system, and a good indication on it. If the source of lift is indicated by a cloud, the problem is easy. The problem is tough with the blue thermal that you're talking about.

As I begin to get the turbulence at the edge of a thermal, if I'm cruising at high speed, I begin to slow a bit, but I don't get below eight or ten knots above the best glide angle (ten or fifteen knots above the best glide angle on a good day), and I keep going through the turbulence, the wash board effect, you quite often have on the edge of the thermal. I begin to be very careful and look for the wing that comes up as you bounce about and, from then on, I'm operating on the seat of the pants feel of that surge that's really the core of the thermal. I want to react instantly when I feel that surge. I react essentially the same each time. I use as little aileron as possible and as much elevator as possible to zoom up in the core. As the ship starts to slow, I tuck in a little aileron and let it fall into the turn. It does this quite naturally without violent control movements. I'm operating on, and reacting to, the feel of the thermal. I would say that from my experience in flying with Dick that I think I gain a bit on a successful entry, but at times I lose a bit because I've made a poor decision. I think I've felt the surge and I really pull up in it, make a turn, and it's no blasted good. Dick overcomes this by going kind of through the thing. He makes complete assessment of the thermal before he makes a decision. I think, in the end, we come out about the same. It's just that for me those wingovers right into the core make you feel big ... good!

Question: (T. I. Weston) I'm interested in hearing you fellows discuss crew communications back and forth. I understand you don't say much. and I'd just like to know what you do say and if it means something.

Answer: (A. J. Smith) It's strange, your asking me for a definition of crew communications because I have a reputation for not communicating with a crew in certain areas. However, I assume you mean on the radio.

(T.I. Weston) What I had in mind is how does your crew know where they're going and when and how do you keep in touch with them, and how do they find you, and things of this nature. It's not on the program anywhere else, and I thought it would be a good time to bring it up.

(A.J. Smith) Dale May, one time, got up a 30 page memo on this. He was to give a prize each day to the pilot who used the worst radio procedure. He won each day.

I've thought about radio procedure. I think I have developed a technique. I tell the crew that they don't need to use the call sign. If they can't recognize my voice after the first practice day, they're in bad shape or haven't been listening. I call my crew and simply say, "Two ground, go Van Horn." They simply reply, "Going to Van Horn." I can recognize their voices. The reply confirms that they've received me and they understand the message. That's all that's necessary.

A typical crew report is, "Two ground at Van Horn." If I happen to have the radio on, I'll give them the courtesy of a "Roger." Nothing else. About the only other transmission code I use is, "Hold at Fort Stockton." The crew has instructions then to drive the wheels off the car to get to Fort

Stockton. To use the car up. The car is to be just as exhausted at the end of the competition as is the pilot. That's hard to make a crew understand. It's really difficult to make them use the blasted automobile.

Again, a crew report, at a holding point, when they finally get there is, "holding at Fort Stockton," or "Two, holding at Fort Stockton." And, again, if I happen to be listening to the radio, I'll give them the courtesy of a "Roger."

If you think about it a while, this is all that's necessary. The business involving "Rabbit two to two ground," and the reply, "Rabbit two, this is two ground, I read you, go ahead" is stupid. Repeated many times in a day, it is, simply, inefficient. I'm selfish about this for the reason that it wastes my time.

(Dick Schreder) I think A.J.'s points there are very good, and I think most of us tend to do the same thing, because with 80 people on the air and most of them on the same frequency, if you all get into extraneous transmissions, there's no room to report and keep in touch with your crew. I think it's most important before you start out to brief your crew on how you would like them to go if all goes well and goes according to plan because then if they lose communication with you they have some idea of what to do. Now in almost every contest, there is somebody that goes straight east and their crew goes straight west, and they don't see each other for the next two days. You should do everything you can to avoid this situation, but more times than not you're going to find that you get out of communication with your crew and then they just have to rely on what you've said at the beginning of the briefing.

The Philosophy Of Winning

By A. J. Smith

The lesson this morning is on a philosophy. Ed suggested this sort of beginning line. I guess it's as good a way as any to get started, but I'd be, generally, awfully suspicious about people who like to philosophize when we've got a task to do.

We're going to talk about winning. But, we have to sense the nature of the competition first, what's it like. It can take a lot of forms. Actually, our competition has been going on here during the last day or two. In essence, we've all decided, if you agree, that sailplanes are the same except for one or two of them that are bigger, and which probably come apart in just as many pieces as they go together in. We know that pilots are essentially all the same, at least in terms of ability to move the stick and rudder, to find a thermal and other ordinary things. Beyond that, if you've been taking notes, you've accumulated all of our secrets, so there really isn't much left. But Schreder's still been competing. He started the first day by making flattering remarks about George's ability and my ability. What he's really thinking is that now we'll be overconfident. He makes references to smoking. He thinks I'll give it up. Then I'll be a nervous wreck, and he'll be breathing clean air. And he says to make a list of the contest numbers of the ones who thermal well, or select good thermals. He suggests that No. 2 is a good number to list and follow. I'd like to turn that around and use my friend Avis' words, "Why follow No. 2 when you can follow No. l." You can see what he's hoping - He's hoping he's sold a hundred guys on descending on No. 2.

Comment from audience (Dick Schreder): "Remember, No. 2 tries harder. That's right."

This kind of competition is all great fun. I'm certain that you are aware that there's been other competition here in the last day or so, in a similar humorous vein. But there's got to be more to competition than this in order to guarantee a win.

Most of us would agree, if there is any one characteristic that we would recognize in a good competition pilot, it's determination. I've heard this word used by almost all of the people who were involved here. I've probably heard it used more often by pilots who are not at this meeting. How this determination shows up in a pilot's character is a changeable thing. Sometimes it is difficult to recognize. After you know competitors as individuals, you realize that in one fashion or other, they have a great deal of determination. Sometimes, because of their nature, it's a hidden thing. And sometimes, with others, because of their character you automatically stand to one side because they're volatile. However it is expressed, determination is a necessity, I am certain.

Dick and George have a high degree of determination but their outward signs and character are certainly quite different. Still, this determination is the common beginning point. As soon as you realize this is a necessity, then you've got to think about getting yourself tuned up for competition. Again, you may feel that you operate at a fairly high level of efficiency constantly and you don't need to do any extra work on your psyche for a contest day to do well. This I doubt, in relation to myself. Remember again that what I'm telling you now is not a bible. Set your own pace. I'm simply trying to tell you what works for me and what probably will work for you in some form or other.

If you want to compete successfully, you've got to talk in terms of being in first place. Second place only gets you the opportunity to try harder, which is no great pleasure in this world. It's best to be in first place and have a sufficient advantage so that you can relax. First of all then, you've got to have a determination to be in first place, not second place. Excuses are no good. A Ka 6 isn't a good excuse. It really isn't. If you use it for an excuse, you're defeated before you come to a contest.

I'm certain that Wally Scott, for example, while he moans a lot, is not defeated before he comes to a contest with a Ka 6; and he moans in hopes you'll discount him as a competitor and be overconfident. That gives him a perfect opportunity to climb up through you. First, you've got to have determination. Second, you've got to be prepared. I think we've covered generally the areas of preparation during the last day, but we must reinforce that this is an essential. There's no way to win without preparation. You can examine any form of competition in this world, in business or sport, and success is not a happenstance thing. It is a result of preparation.

Keep a file on your activities, keep a record of your contests, keep a record of your mistakes. Dick converts his into a list of do's and don'ts. It is surprisingly like my list of do's and don'ts. Study. Use the records. As you go back to a competition site, review the records. You must have learned something about the terrain and the weather in the area if you've flown there before. It you didn't, you've made a mistake.

In a race a few years back I, noted that a friend passed about 8 cars in the first turn. It took me a year to analyze why he could do it; the next year I was prepared, and right behind him as we passed 8 cars. The following year it was the same. And the following year the same again. It was simply that there were about 20 other people in that competition who didn't remember and didn't keep records. That was worth a couple of seconds at a crucial point, which grew into a couple of minutes, which won the race each time.

You do have to prepare in the tiniest detail. Prepare, first, the sailplane, because you do save seconds this way. These result indeed from the tiniest details. For the most part, among 30 or 40 modifications that George Moffat put together for us this summer, no one of them, and perhaps no 20 of them together, could make a measurable improvement in the performance of our ships. I'm certain I could pick 20, carefully select them for their minimal effect, and come up with half of that list that did essentially no good. They made the sailplane quieter, perhaps, and did things psychologically, but that's hard to guess about. The other 20 probably did make a measurable difference. Somewhere then, in all of that effort, was some measurable improvement in the sailplane. Perhaps it would be in the order of 10 percent. Measured in terms of the first day we flew those sailplanes, just as they came out of the factory, perhaps it was 15 percent. Profitable work.

This means you should work all winter on your ship in a sense. Have a plan to do this and have a list of and a priority of items to improve your sailplane. The list should be so long that you never get it completed, but you should work hard at it. You build a discipline, you build a respect, perhaps a better word, you build a respect, at the time you do this work, for the amount of effort necessary for success. You build a respect for the seconds that are important. When the contest finally comes, you're better prepared, not only in terms of equipment, but mentally. You know the sailplane better, you know all of its problems. You're much better prepared.

Of course, you've got to prepare the systems too. You've got to have all the instruments working. This was covered beautifully here. Thank Gene Moore for his contribution in this area. A good variometer and a good total energy compensated variometer is essential. But you've got to prepare mentally as well. The tow car has to be good. The trailer has to be good. You should buy your next automobile only on the basis of its ability as a tow car. There is no other justification. This means you have a fight with Detroit first of all. Own your own car, so that when you say, "drive the wheels off the car," the crewman cannot misinterpret that. Prepare yourself physically, not only in terms of physical conditioning but in terms of weight. There is certainly an optimum pilot weight for Elmira, one for Marfa, and so on. John Slack is in trouble in all areas. They haven't made strong enough soaring weather yet for John.

And finally to elaborate a bit more on our previous discussion, you've got to have a plan and the plan should be one that enables you to win. The plan should be done in detail too.

As has been pointed out, this is a strange kind of competition we're in because we don't often have measuring sticks. If you have an automobile alongside of you as you go through a corner, you've got a good measuring stick. It's tough to find a parallel in soaring. Some of us who progressed faster have been fortunate to be able to fly with others, who are good soaring pilots, so that we've had a measuring stick with us. We've developed our techniques not only in contests but in comparison flying during the week. The real breakthrough, perhaps, for both Dick Schreder and myself came the one spring when we said, "Let's go flying every day the weather is good or even halfway good." We went out on Mondays, Tuesdays, Wednesdays, and whatever.

We flew pretty much by ourselves in the Adrian area. We experienced the first sea breeze front I saw in that area and we were a bit puzzled by that. What we developed, most importantly I think, was a rhythm in using thermals. We got to work very efficiently because we were, in a sense, competing with each other constantly, trying to outclimb the other, trying to leave the thermal before the other, trying to find the next thermal before the other. That sort of thing. That spring was a revolutionary one for us. We went to Elmira that year, and we did quite will. You've got to have a plan to win, and you've got to practice.

Remember the sort of graphic plan that I use? Chuck Lindsay reminded me in his slides this morning, that it is a development of a briefing form we had used in England. Use that graphic plan or something similar. Go beyond that. Study the maps of the area, the actual terrain of the area, and try to arrive at a scheme that uses that terrain or the weather or whatever minor factor there might be. Put the factors together in as many ways as possible. Perhaps no one has thought out the best combination and indeed the way to win. Study the maps carefully before you fly, not only in hope that you won't have to use them to navigate, but also in hope that they will give you some clue to the best course. This is not simply for distance tasks or long triangles but for very short triangles. There is some advantage somewhere to someone. It's your problem to seek it out.

Have plans to win the little bits of each day. You can, for example, try to win the start. Again, if you have measuring sticks, this helps. If you can get across the start line faster and closer than the others, then you're really winning the start. You're breaking the whole task down into the first of its components. How do you win the start? Let's consider an example.

My start of the last day in Poland this year was difficult. I got off late in the tows, the good weather was coming through in a series of waves perpendicular to the course and the people who got off a few minutes ahead of me got into a wave of good weather. I got off into a trough, a wave of poor weather. I saw Pilots, as I was releasing from tow, making very high speed starts off under their wave of good weather. You could recognize the good starts because they were done in dives, long, long, dives. As I got into the starting altitudes, approximately 3,000 feet, it was in very, very weak weather. There was no chance for me to make that good kind of start. At least, not at that time. Because of my position in the standings, if I didn't make that kind of start, I probably had no chance of winning the competition. So I stayed around the field for nearly an hour until the next good wave came through. This necessitated, just to stay up, flying approximately 25 miles away from the field back under some good weather, then slowly working upwind to get back under the next good wave, then drifting down to the state line with it. This whole process took about an hour and involved probably 60 miles of flying. I arrived over the field, nearly the last man to start - everybody else had disappeared, but I was still quite confident that I was at least taking care of one factor that was necessary for me if I were to win the competition, and I did get a good start. As I passed over the start line, I was on the back side of a good wave so that I could make a high speed run and a few miles out come under the good wave and then have the advantage of riding with it for a while. As I made my start, I saw one sailplane come back to make a start. I have a feeling that it may have been Stouffs. I felt, then, that I had him beaten because he was fully two minutes too late to make a good start. He had little chance to catch the wave I was going to catch and he apparently didn't. I would like to talk to him some day to confirm that. Timing was essential. I had a plan to win the start. It was successful.

You've got to win the thermals too. When you're with other people, they are a good measuring stick. In the absence of other people, and this is probably the better way to work thermals, by yourself, your measuring stick is your previous performance in thermals that day. You've at least got to measure up to that kind of climb that you've been experiencing earlier in the day, or you've got to achieve some new level of performance in the thermal. You've got to work each thermal and work it better and, if you're working with someone, work it better than he does. Again, you're breaking down the task into smaller components.

You've got to win the cruises. You've got to know, as you cruise normally on a soaring day, even in poor weather, a sense that you're taking advantage of some factor in weather or terrain or whatever, which is minimizing your sink or increasing your speed. If you're not doing as well as the other plane you have visual contact with, find out why in a hurry. Don't hesitate to do it like he does. Even if he has told you to do it some other way.

Finally, as the next to the last point, have an overall plan to win the day. This is the next larger assembly. Try to think of a way that will enable you to win the day. I don't think you win, to repeat, I don't think you really win, by doing a sort of good regularized, procedural thing each day. Some factor that you see that others don't see, can give you an advantage. This is no different than everyday life or business.

Finally, consider a plan to win the contest. Naturally, if you've been successful as you've gone through the business of winning the components, the last consideration is academic. Get out your good suit and plan to have your crew follow the briefing of the previous day and have your sailplane assembled at the winning stand. And this is not a minor problem. They will have forgotten.

There is a way to plan for winning the competition. You should begin in each contest with a plan, again not as a bible but as a guideline. Before the competition begins, assess the terrain. Study the kind of weather you can expect, how best to use your particular sailplane and your particular abilities to maximize your performance in that particular contest. Use that study as a guideline. Modify it. It's much easier to modify guidelines as the weather develops, as the contest situation develops, as your position in the standing develops; it's much easier to modify guidelines than it is to think up some brilliant new scheme each day. That last approach is really taxing and you tend to give up. But, if you have a kind of guideline, you can modify it each day. Review your situation in the contest. If you're fortunate to be in first place at the end of the first day, with a good margin, this should tell you something about how you should fly the next day. Depending on that margin, perhaps it should tell you how you should fly for the next seven or eight days. I found myself in that position in 1967, and it made the contest easy for me. My crew doesn't know it, but they should have appreciated this because they had only a mildly abrasive two weeks compared with a normal operation. I was able to determine, at the end of the first day, that I could be conservative for the entire contest. This is not a put-down on anybody else. It was just a fortunate position to be in. My flying didn't suffer all that much. I think my performance probably was perhaps 10 percent less than what I might have done if I'd pressed and, at times perhaps, 20 percent less than what might have happened if I had gambled. But I was able to coast at that conservative level and take fewer chances and know that I had a good chance, from the first day on, to win the competition.

I have found it just as often to be the other way. I've been far down in the standings on the last day of the competition and have known that the only thing to do is to gamble everything every day - to fly faster than the best speed to fly ring says in hopes that I'd be lucky to continually get thermals that are better than the last one, or that I'd find some extraordinary circumstance that would enable me to catch the six people who were ahead of me. I have indeed been fortunate to be successful in that situation too and to win the competition on the final day, as have others here. In either situation, you've got to have a plan to win the contest, first in the form of general guidelines for the entire competition, modified as you go along and then, second, in the form of a detailed plan for each day.

Who can define psyching? To psyche or not to psyche? Is there any value in really tuning yourself up for competition or for a flight? As you can infer from my comments, for me, I am convinced there is. You can begin it, or rather you can continue it, through the year. You do it by working on your sailplane, thinking about the machine, thinking about the systems, the instrumentation, thinking about the flying you're going to do, keeping records, studying, and whatever. This keeps your mental facilities tuned to the problem of competition. Does it really help? I'm certain it helps all of us. How much we want to tune ourselves up is probably quite a personal thing. I don't always try consciously to tune myself up. I've discovered through the years that I do get twitchy as the takeoff time comes. Sometimes twitchier than others. I have found myself in some circumstances where I realized this and began consciously to build on it. To begin consciously to develop the pitch faster for myself. There are a number of ways to do this. You can take long, quiet walks, or you can get back in the corner of the hangar. You can sit in an air-conditioned car and give yourself pep talks, or whatever. Sometimes your competition helps in this problem. They come up to you and say things like, "Boy, the SISU will never climb on a day like this." It's usually not that obvious and probably not calculated at all. They say innocent things. Perhaps they don't mean them that way, but they say just enough to tick you off and, on occasions, almost consciously, I've seized on this opportunity and read them off for about five minutes and then, almost at the conclusion, jumped into the cockpit and gone like stink for an hour. Mad! It really works for me. As I say, it's not completely a conscious thing, certainly. It begins as a subconscious thing. I'm quite aware of it now. I don't fight it. I relax with it. It annoys the other people. It really does. It gets the people around you so choked up that the officials, if they could appoint a firing squad at any one point, would get them together. But, we're not competing with them.

To sum up. Be determined. Be prepared. In equipment, body, and mind. Plan. Plan to win the bits. The components. Focus your energy. Concentrate on the contest. Don't waste your energy on diverting influences. Win.

Answers To Questions From Participants

By Schreder, Moffat, Smith, Moore, Lindsay

Question: How many hours in sailplanes will any of you fly this year in preparation for the Marfa Nationals?

Answer: (Dick S.) Fifty

Answer: (George M.) Oh, fifty or sixty.

Answer: (A. J. S.) The same.

Question: Today there are many reasonably good pilots with good equipment who are poor contest pilots. In 1969 would it be more efficient to spend more time building a plan for each contest flight and attempt to learn the principles taught at this seminar by trial and error, or wouldn't it simply be better to follow some of the pros, like A. J., Dick and George, around in regional meets doing the right things and then later figure out why?

Answer: (Dick) No.

Answer: (George) You win by trying harder mostly. Any way that will do that I think helps. Following is a good trick, a lot easier said than done.

Answer: (A. J.) One thing to remember. We've talked a lot about preparation. But, most important, for most of you, the first day of the season that we have good soaring should be the day you should be in the air. You should fly every available minute you can, every time the weather is soarable.

Answer: (George) One more thing on that, it should be cross country. Flying around the airport is an absolute waste of time.

Answer: (Dick) Amen.

Question: How many variometers in your ship? How often do you calculate your cross country speed on a task?

Answer: (Dick) Two variometers and I try to calculate after every flight.

Answer: (George) Three variometers, the same calculations.

Answer: (A. J.) Two variometers. I read the contest results.

Question: It says, How often do you calculate your speed on a task? - That probably means, Do you calculate it during the task? Do you keep up with how fast you're going?

Answer, (Dick) No.

Answer: (George) No.

Answer: (A. J.) That's a waste of time.

Question: When you're an hour out, don't you at least look at your map to see how many miles you've gone to get an idea of how fast you're going?

Answer: (Dick) Sometimes.

Answer: (George) Only if it's pretty marginal weather.

Answer: (A. J.) Almost never.

Question: Please discuss the merits of the well equipped sailplane; that is, full panel, ballasts and so forth versus the super-light sailplane as applied to competitive soaring. Your choice, why, and so forth.

Answer: (Dick) I wouldn't bet on the super-light sailplane. I'd rather have a well equipped heavier sailplane.

Answer: (George) I'd agree. Super-lights are only good for one condition. You probably won't get it all that often.

Answer: (A. J.) Agreed. I want the best piece of equipment and I want the heaviest sailplane that'll stay up on a given day.

Question: Under what conditions would you expect lift under an overcast? What prompted this was the last contest day at Elmira.

Answer: (Dick) Well, a good lapse rate and signs of the sun getting through occasionally.

Answer: (George) Well, really there are so many variables I don't think you could answer significantly.

Question: Gene Moore, explain "Chore Girl" function.

Answer: (Gene) That was just an example I showed here of how the heat sink material in the reference flask could actually speed up the output from the flask if you do the zoom maneuver that I described, that is climbing 1500 feet per minute and leveling off abruptly. That is described in some of the literature as a winch thermal. It's the artificial thermal that you see after a winch tow. I did want to show that when you are worrying about a very fast system, it is important to look at things that might be of small importance perhaps as this actually is in normal flying.

Question: Dick Schreder, quote, "Stay with the first lift below 2000 feet."
Question - stay how long? Any comments, or is this just a matter of experienced guesswork?"

Answer: (Dick) It depends on the conditions, but at least get back up above 2000 feet.

Question: What comments do you have concerning east nationals versus west nationals, pro east or pro west, and reasons?

Answer: (Dick) I don’t know. I seem to win the western ones and can’t do very well at home.

Answer: (George) What we are flying for is competition. As long as everybody is flying at the same place, it doesn’t make much difference.

Answer: (A. J.) I can only add that apparently the experience we get here in the east is good experience. Eastern pilots seem to do well in national competitions, even when they’re held in the west. I think, perhaps, the reason might be that we’re accustomed to working with weaker soaring conditions. I think the experience we get here is extremely valuable but, like George, I don’t care where the contest is. The rules are the same for everybody. The terrain is the same for everybody.

Question: Chuck, would you draw a diagram of a rotor cloud or dust cloud in front of a sea breeze front.

Answer: (Chuck Lindsay) I think he must be referring to these. This is the coast line and this is the ocean. You’ve got the cool air moving in, of course, and even before that you have thermals rising up here. As the cool air comes in, of course it tends to push back this other air, and this warmer air rises up ever it, so that you get a circulation then going up, and this air then returns out to the sea. And of course you get your clouds developing right in this area right in here. Also, they will tend to lean out here because this air is still rising out here. Wallington has actually soared up and not just under this, but out a ways, with this ledge lift out here, with a tail wind, come down and then go back in toward the station where we were at Lasham with a tail wind. But this is where your line of clouds is, right where this cold air meets the warm air.

Answer: (Dick) I’d like to add something to that, and that is if you’re flying parallel to one of these fronts, stay out on this side. Don’t get caught back here; you’ll go down.

Answer: (A. J.) Quite often you’ll find some wisps of clouds hanging down at the front where condensation is beginning to take place. As Dick says, it’s good right there on the land side. It might be interesting to you people who are worried about how these fronts lock. When you finally come to a sea breeze front, you will recognize it. The definition between clear air and hazy air is relatively easy to see. If it’s that hard to identify, very few other people are going to identify it. Stay with the shear lines in the west.

Question: A. J. Smith, primarily what is the value of the 450 wing sanding you reportedly are so enthusiastic about?

Answer: (A. J.) It’s a peculiar thing with the Sisu. The Sisu airfoil, in my opinion, is sensitive to atmospheric turbulence. It doesn’t climb well in a turbulent thermal and it doesn’t glide well in turbulent air. Over a period of years of having prepared the sailplane in the winter, contouring the wing and that sort of thing, I have experienced that it seems to fly better in the first of the season just after I’ve rough sanded it with 320 paper. I’ve sanded it diagonally. First, because that’s the way to get the contours right in the easiest and most efficient manner. During contests, I clean the bugs from the leading edge of the wing each day. The polishing compound, or cleaning or rubbing compound, puts a glossy finish on the wing. After three or four days, perhaps halfway through the contest, I seem to be aware that the ship is beginning to lose its ability to climb in turbulent air. I’ve roughed the wing up a few times, and each time it seemed to be improved. And I say “seemed to” with a purpose because this is difficult to evaluate. That next day might have been a slightly smoother day. All this may apply only to the Sisu.

Question: How did you rough it up?

Answer: (A. J.) With a long, contoured, smooth sanding block and 320 paper moved at 45 degrees. If this does work, apparently the theory behind it is that a slightly turbulent air flow is more difficult to separate than a laminar air flow.

Answer: (George) Last year when my Cirrus was first delivered, I found it had a stalling speed of about 82 kilometers. I was away for about a month, during which time the designer, Klaus Holinghaus, was flying the ship and doing some tests. After I got back, I noticed that the best speed to fly seemed to be about 78 kilometers so I asked Klaus about it. He said he had been working on the wings and sanded them a bit, and it had definitely lowered the stall speed. Everything else was the same, the instruments, static ports, the whole installation.

Answer: (Dick) I too have had a similar experience. In the nationals last year my ship hadn't returned so I had to borrow Joe Perrucci's and couldn't keep it in the air for several days, and started looking around and found quite a few things wrong. We got working on it, and the biggest improvement we got was with sanding the wings; and I understand that since then, Joe's done some more and gotten some instruments.

Question: Has this sanding been concentrated on the leading edge of the wing?

Answer: (Dick) No, you start right at the leading edge and go all the way back if you have time.

Answer: (George) The most important part is right there at the leading edge and just back to the thickest section. On the Cirrus there is no point in bothering with anything past the 50 percent point. Laminar flow breaks down about there as it does on most wings for practical purposes.

Answer: (A. J.) First, you have to get the wing wave-free. It has to be optically a perfect surface. Then you can worry about whether this little turbulator is important.

Question: (Steve Dupont) Dick, can I say something? The HP-14 you built is now three years old and it has been chalking severely. It chalks so bad that when you put the wing on you get covered with it. No amount of washing will take it off. Do you have any comment on that?

Answer: (Dick) Wipe if off before every flight.

Question: What is the minimum crew number?

Answer: (Dick) Well, that depends on your ship. If you have a ship that two people can disassemble, I think you could get by with one good crew man, like a good wife, but in general I think you need at least two crew members beside the pilot and three is better.

Answer: (George) I disagree. I think that the minimum that can handle things is best. I've used two on mostly 600-pound ships for 7 or 8 years now. I did try three and they just got in each other's way. Two besides myself.

Answer: (A. J.) I would agree with that. I want two good ones, and I would say further that an infinite number of poor ones doesn't get anything done.

(Ed Byars) Ben Green won in Elmira last year with one crew man, with a good man and a little Libelle, of course.

Question: What is the minimum practical experience level to get in the '69 nationals?

Answer: (Dick) I think they've made it a Diamond Goal, haven't they?

Question: The question is, What is the minimum level? I'm not worrying about the rules.

Answer: (Dick) Well, like A. J. said, everybody should go expecting to win, but I seriously doubt if anyone could go and win if they didn't have several years of soaring under their belt. I don't think anybody that has an airplane pilot's license can buy any kind of a sailplane and go to the nationals without any practice and hope to win.

Answer: (George) I agree completely with what Dick said; however, the only way to learn to fly in contests is to fly in contests. They don't want to be pip-squeak contests, they want to be darn good contests because one of the first things that everybody says when he flies in a contest is, "Gee, I never learned so much in two days in all my life." I've heard this so often, and the reason, in my opinion, is that you get to see what people like A. J. or Dick can do in weather in which you don't think anybody would even bother to open the hangar doors.

Answer: (A. J.) I would agree. It's a good bit of advice. Your experience or lack of experience is not going to bother other competitors in the nationals, but if you're not safe, if you can't circle safely in thermals with a good number of other ships, be careful. Don't go. If you do go, get out of the way. Go as soon as you're safe and can handle the equipment and realize what kind of terrain you're going to be flying in. This should be a part of personal judgment.

Answer: (Dick) I agree 100 percent with all that A. J. and George said, but you'll find that you will learn more in your first national competition than you've learned in all of your soaring to date.

Question: Is there any attempt being made to have the U.S. team fly U.S. sailplanes in 1970?

Answer: (Dick) I'm doing everything I can!

Answer: (George) I'm not very patriotic when it comes to sailplanes. I want the one that'll win the contest.

Answer: (A. J.) I wish Dick a lot of luck.

Question: What pre-contest flight sailplane preparations are used? What materials are best to prepare wings?

Answer: (Dick) I think we've handled that pretty well. The Russians have been showing up in the last two world competitions with bare metal, and I think this is a mistake. I don't think you can get bare metal anywhere near what you can with a fiberglass or painted finish.

Answer: (A. J.) I think one area that we haven't covered here might be worth a few minutes conversation. Number one, seal up all leaks. Seal every tiny leak because that leak is an air flow, usually perpendicular to the surface that's leaking, and it's like an antenna sticking out of your wing. Seal all the leaks first. Number two, saw off all the protuberances. Don't fair them in, saw them off. And then number three, get every surface smooth and wave-free.

Question: (Steve Dupont) How about leaks on the windshield and around the canopy where you can feel them blowing on you?

Answer: (A. J.) Put the leak exactly where you want it. You should only have an air intake in the optimum position. That means taking the air in where you want it to come in and exhausting it in an opposite location. Don't take chances, assuming it's a good condition because it seems to be leaking in here. It may be going out like stink down here.

Answer: (Dick) I would agree with that too, but I'd like to go back once more to Joe Perrucci's ship. When I first saw it, it looked very beautiful and I didn't realize that there wasn't something wrong with me. It took two or three days to find out it was the ship, because I absolutely couldn't stay up under good-looking cu's. I'd go down to the ground, and about the third day I realized I was getting a 300-foot per minute sink in smooth air, and we found all sorts of things wrong looking the ship over carefully. There were gaps between the ailerons and flaps, gaps between the flaps and the fuselage, discontinuities in fuselage contour up at the nose, leaks in the canopy, unsmooth wing surfaces, gaps between the ailerons and the wing and the tail and the stabilizers, and you just have to start a program to correct all these things on your ship.

Answer; (George) Even the best ships, I mean Libelles and Cirruses and so on, need never less than 50 hours work before they're ready for a contest, and often very much more.

Question: How about an open window in the canopy?

Answer: (Dick) The less of that you have, the better.

Question: What decrease in performance do you experience from raindrops on your wing surface?

Answer: (Dick) It feels like you've thrown a sea anchor cut.

Answer: (George) It varies very greatly with airfoils. John Ryan won't like me for saying this, but I flew with a Phoebus A last year which was absolutely even with the Elfe when we were both dry, but I wouldn't say his performance was even half that of mine when he was wet. Now this isn't saying nasty things about the Phoebus A because you're really not going to be flying in rain all that much, but there are some airfoils that are quite a lot more sensitive than others, as A..J. remarked on the Sisu a moment ago.

Answer: (A. J.) I think as soon as the first raindrop hits the ship, you should make a basic decision. If you possibly can, go somewhere else. Out of the rain. Answer: (Dick) Most of you can check this yourselves if you get the opportunity to fly through a cloud that'll leave water droplets on the wings, and you can check that the rate of descent is much higher when you come out the other side, and you can actually feel the ship accelerate when it evaporates off.

Question: George Moffat, why do you not like the cat's cradle as a task and regardless of your personal opinion, do you recognize it as a good task for national competition?

Answer: (George) No, it's a very bad task in my opinion for national competition. The purpose of a competition is to measure ability of the pilot. You cannot measure ability of pilots if they're not doing fundamentally the same thing. Imagine that you start an auto race from here this afternoon at two o'clock. Turn points are Cumberland, Martinsburg, and Baltimore. The driver getting the most mileage wins. That is a cat's cradle! If you really want to make it a cat's cradle, imagine that there have been quite a few floods nearby and some of the bridges are out, some aren't; you have no way of knowing which ones are which. You do have some fairly inaccurate information thanks to some maps compiled that morning from spot observations taken 200 miles apart. The cat's cradle is a very thinly disguised free distance. The basic problem with free distance is the same lack of direct competition.

Take Texas in '67. Dick Johnson went due east, got absolutely no place. Dick Schreder went north, contacted a front and won. He probably wouldn't have chosen the route he took if he had flown a lot in Texas like, say, Ben Green. Bikle went someplace that nobody in his right mind would have gone that day, but he was so far down in the standings that he had to do something far out. He went very, very well and got second for the day, taking a long chance; but these people hadn't been competing against each other. You don't know if Bikle was a better pilot than Johnson. Johnson went 226 miles, Bikle went 450. Do you really think that Bikle is twice as good as Johnson? You don't know from that task. This is my fundamental objection to both free distance and cat's cradle.

Answer: (Dick) The British and the people who draw up our rules are in favor of the cat's cradle. When I left the meeting in Paris day before yesterday, the Poles and the Germans were fighting the cat's cradle like mad at Marfa. How it turned out I don't know, but our people were holding out for the cat's cradle.

Answer: (A. J.) The cat's cradle is a return to the marathon and walkathon. of the 1930's. The only time I like to have a gambling situation, as George puts it, is when I'm far behind. Then the gambling, the element of luck with a distance task becomes very great and I think my chances improve. If we have, instead, a straight-out legitimate race around the same course, then we are really testing pilot against pilot, and I don't expect to beat anybody by very much or have anyone beat me by much.

Question: Is the objection the same to an out and return distance along a fixed course where everyone is flying the same task, even though you're flying distance?

Answer: (Dick) I would say to a certain extent that my greatest objection is that I've flown, I believe, three cat's cradles, and I was in the air over nine hours on each of them. I think this is too long in a national contest. Answer: (George) There's one other problem that comes up on these open end tasks of any sort, and that's quite simply that frequently, especially in Texas, you can fly after dark. That does put you in a rather awkward situation. There's a strong tendency to stay in the air too long, especially if you're at high altitude; you don't realize how dark it is on the ground. I know at least three pilots in this group that have landed after dark, myself included, and that is a kind of scary feeling.

Question: Do you make any changes in thermal technique when you're below 1,000 feet?

Answer: (Dick) You just do it more so.

Answer: (George) When low, below four or five hundred, I often thermal a bit more on instruments because there is a tendency to skid on turns a good deal if you look out the window.

Answer: (A. J.) That's good. I think my thermaling techniques change when I'm low. I play it a bit safer, faster, shallower, etc. Any sailplane at a low altitude is more apt to get into a wind shear condition and this aggravates things.

Answer: (George) I think there's another point about it. In several regional contests I have seen people who have had bad accidents by circling right on down into the ground. To me this is absolutely unforgivable. I hardly know anybody who could pick up a thermal below 150 feet. It's just not sane to keep on going below that altitude, and furthermore, I think you want to consult your altimeter regularly, once a circle. Memorize whatever you've got, say 210 feet, then if you go down to 200 feet, make sure you take another look out the window to see how your clearances are doing. Then go back and concentrate on variometers and yaw strings, but look at the altimeter again every round to see whether you're making or losing.

Answer: (Dick) I do something different when I'm down that low, and the first thing I do is get within gliding distance of a good field to land in, and then, and only then, do I continue circling; and I never start another turn when I'm not positive I can still make it into the field.

Answer: (A. J.) We can't be too careful about this. The things we've been talking to you about in the last few days can lead you into some bad situations. Exercise your judgment. Most of us talk from a great deal of experience. I've got photographs of two separate sailplanes that were badly wrecked because I didn't follow this kind of discipline. Pick a good landing spot at 1000 feet and just don't leave it until you start getting back up again.

Answer: (Dick) I'd like to add to that too. I've been flying quite a while, and I haven't had a serious sailplane injury or damage, just because I follow this technique religiously, and I've had three real bad auto accidents during the contests.

Question: When the wind is too weak for ridge lift, would you expect the thermals to form on the upwind or downwind slopes of the ridge?

Answer: (Dick) I'd rather stay on the upwind side.

Answer: (George) Upwind, definitely. The only time the downwind side is likely to be of much use is if the wind's quite strong when you may get wind shadow thermals.

Answer: (A. J.) Regarding the last question, my answer is yes!

Answer: (Dick) I would make an exception. If the wind is very light and the wind is striking the downwind side at perpendicular angles, then it might change the situation just a little.

Answer: (George) Just one thing on that. If you're low on the ridges, watch your step. That's how Phillip Wills came very, very close to killing himself last year - broken back and all that sort of thing. He was wandering around the end of a little ridge. The wind was not quite in the direction he thought it was. He got a little shear, and first thing you know, instead of flying fifty knots, he was flying at 37, according to the air speed, and the Dart didn't fly too well at 37 at 200 feet.

Answer: (Dick) I'd like to add to Phillip Wills' accident. I think another thing that got him into trouble was that he completely forgot that if the wind is strong over the top of a hill, that it very often blows in the opposite direction on the lee side, and I think he landed downwind too.

Answer: (George) He landed at a bad angle, if you call that a landing. 70 degrees, measured.

Question: In Marfa 1969 outlandings, comment on this please.

Answer: (Dick) They can be tough. There are lots of places you have trouble finding anything but yucca trees and sagebrush. I think all of us who have flown out there have landed in some rather bad fields, and even on the highways occasionally; and now with the reflectors on both sides of the highways, be very wary of those - and I would say be more careful than ever at Marfa that you have a suitable place in mind when you start getting low.

Answer: (George) I think I've flown there longer than either Dick or A. J. On the reflector problem - reflectors will always be found on curves (even slight curves). If you see it's straight, there's a reasonable chance that the reflectors will not be there or won't be too frequent. However, you will not be able to see them from much distance, so keep an alternate. And I don't really agree with Dick. I think very much of Marfa is very easy to land in, particularly the area covered by the cat's cradle. Even if you get stuck in the mountains up by Livermore, you'll find quite nice grass meadows that you can land on, even make air tows cut of. Phillip Wills did in 1964. Last point. Be extremely careful of ranch strips. All the local ships are Cessnas because Cessnas are about the only thing that operates very successfully out of those altitudes - base altitude is 5000 feet. Ranchers make those strips about 35 feet wide. They don't cut the brush below about four feet on the sides. I would not ever land on a ranch strip unless I know the strip. I'm really quite surprised that we haven't had some accidents from that. The only reason, I believe, is because all the local people know this.

Answer: (Ed Byars) The reflectors are also over the dry washes, even on the straight stretches. You can see the culverts pretty well, even if you can't see the reflectors.

Answer: (Dick) I'd like to add to that. The people from Texas say that the highway department has had a very ambitious program to put reflectors along straight stretches. I would say everybody that goes out there ought to look the situation over carefully while you're driving into Marfa.

Answer: (George) I agree completely with what Dick says. However, do not die of a heart attack if you come in by way of Pecos. There are two ways to get to Marfa; either go by Fort Stockton or go by way of Pecos. The easiest way, the usual way, is by Pecos. If you go that way, you drive through about 35 miles of the wildest looking mountains you ever saw. Don't turn around and come back. It looks a whole lot better from 2000 feet higher. I say that as someone who darn near did turn around and come back in 1962 when I went down there to auto tow the HP-8 around and try for a few records. The country just plain seems impossible, but it really isn't that bad from the air at all. Further, even in the open desert, there are a great many places to land. Brush is clearly defined, and you'll see quite a number of openings. Here's just one other thing. You'll find quite a few very much abandoned World War II airstrips. Be very cautious about them indeed. They're frequently gullied three feet deep.

Answer: (A. J.) I don't think that that area between Pecos and Marfa looks that much better from the air. Exercise a little caution when you go to your first competition, particularly in areas like Marfa. I would have to add to what Dick and George have said. If you haven't planned a landing on an airfield or a ranch strip that you personally know, or on a public airport or some facility like that, then everything else that you might do is strictly a gamble. Landing on the highway is a gamble. Landing out on the desert is a gamble. I made two landings in the desert, and I was pleased to find that they were safe. But I was not confident that I was safe until I was practically on the ground. Those landings were unpredictable. That's bad.

Answer: (Dick) One thing you have to watch in the desert is that the sagebrush looks very innocent from the air; but when you get on the ground, you'll find that they have very well developed roots, and the sand has been blown up into the roots and packed, and it would be just about like hitting a tree stump.

Answer: (Ed Byars) I have one of these broken reflector signs at home if you want to see one. They break off clean at the ground; they are steel hat sections.

Question: When flying a speed triangle and you have a choice of direction, how do you plan which leg to go on when?

Answer: (Dick) Well, I don't think you ever have a choice on a speed triangle which way you go. They always direct you because this would be disastrous if people were making the turns from both directions.

Question: Well, how about cat's cradle then?

Answer: (Dick) Well, if there's anything in the terrain that would let you get high altitude while you're going into the turn, I'd say this would probably be one of the decisions that would help you.

Answer: (George) If there were no other important factors dictating otherwise, I would always make the first leg downwind, simply because you have to do a lot of climbing that you can't control on the first leg and might as well be drifting in the right direction. Then you can arrange to be high at the turn and drive off on the second leg. The last leg would then normally be into the wind. That's your best leg to be into the wind because you can start at 10,000 feet - whatever you can climb to - and finish off the task, so you'll waste the least possible time thermaling.

Proceedings of the 1970 Symposium On Competitive Soaring

Presented at: Chatham Center, Pittsburgh, Pennsylvania, February 21-22, 1970

Edited by: Ed Byars & Bill Holbrook

PREFACE

The 1970 Symposium on Competitive Soaring was held in Pittsburgh on February 21-22, 1970. We were pleased to have Commodore Goodhart join our faculty this year to add European viewpoint and flavor.

Emphasis was placed on new trends in equipment, especially sailplanes, as well as a continuation of emphasis on competition techniques and instrumentation.

The response to the Proceedings of 1969 was very gratifying and makes us feel that perhaps our efforts are a worthwhile contribution to the sport. Requests for the Proceedings have come from all parts of the world - at least two dozen countries at last count - with several requests for translation rights. It is interesting to hear from a small African country and from a South American country in the same mail. Iron Curtain countries have been conspicuous by their silence. We hear rumors that copies are being smuggled in. The ratio of readers in Europe to those in the United States is interesting and shows that even though the Symposium was “American” in nature, the world soaring CG is still closer to the east side of the Atlantic.

We would again like to thank our readers, faculty and participants who made the Symposium and these resulting Proceedings possible.

Comments on this and future symposia are welcome.

Ed Byars & Bill Holbrook

Marfa 1969 AND 1970

By George Moffat

In Marfa the name of the game is ships so ships are what I am going to talk about this morning. Of course by now anyone who knows enough to come in out of the sink knows that ships is the name of the game everywhere. The days when a top pilot could win in an also-ran ship are long gone. Anyone who thinks that a Dick Johnson could hop into a 1-23 and do well in a modern contest has not been paying much attention to the ships that have been winning for the last three years or so. Occasional good performances by older ships, especially in contests flown in weak and variable conditions, should not blind any but the most dreamy eyed romantics to the fact that the vast majority of recent contests have been won by a very few types.

Why this growing dominance of ship over pilot? Paradoxically, it has been the very growth of pilot skill which has made ships so important. A look at the scores in last year’s Nationals shows an average separation of only 50 points for the first 30 contestants, with many a final placing being decided by less than 10 points. On the final task, 48 pilots beat the world’s record for a 300 km triangle of a dozen years ago. With this sort of competition, extra points are getting very hard to find. Contests are increasingly won, not by brilliance, but by making the fewest mistakes. One of the biggest mistakes - made by my two fellow speakers last summer - is bringing the wrong sailplane.

In Marfa last summer there were two and a half sailplanes with any real chance of winning. The two placed first and second. The half, the Kestrel, gave up most of its chance by not having water ballast until half way through the contest. Now I realize that the many members of the Libelle Lobby are massing for the attack even as I speak but, unfortunately, they cannot change the fact that a great big ship is better than a great little ship. The fact that Rudy Alleman and Bud Mears were really hanging in there with a fourth and fifth should not obscure the equally important fact that they trailed by around 400 points. Keep in mind also that both these pilots had 900+ point scores on the free distance day, gaining 300 and more points on Scott, Moffat, Greene, and Johnson, who with their vast experience in West Texas flying and their touching faith in the weatherman’s charts, all went East - the wrong way. As is so frequently the case, it pays to drop the free distance day from consideration if you want to compare ship performance uninfluenced by luck.

Do these comments mean that the open class is finished as many have suggested? I think not. Of the 82 ships entered, 10 were Cirruses and an ASW-12. One of the Kestrel pilots - Ben Greene - had a perfectly good ASW-12 sitting at home. In short, one just cannot say that only a rich or favored few had any real chance to win the contest. The price of these two sailplanes is not significantly above that of other 17-18 meter ships.

One of the recurrent cries that one hears in sailplane flying, or at least one that I have heard - and sometimes joined in making in the last 10 years - is that ship X has completely outdated every ship now flying, and the open class is now dead save for the very rich. The RJ-5 was probably the first ship X, the HP-8 was another, the Sisu a third. The ASW-12 is only the last of a long line. What is interesting to see is that no one of these ships ever dominated the open class for any great period. The HP-8 was beaten by Dick Johnson’s lowly Weihe in 1959. Eleven Sisus managed to win three contests between 1960 and 1969, the top placers being beaten by K-6’s, Austrias, HP’s, and Skylarks in the other contests.

How do the super ships fare in actual contests? How do they get beaten? Very frequently they get beaten because they can only do one thing really well or because, as in the ASW-12, they cannot do one thing - land well. Take a look at the situation last summer in Marfa.

To a Cirrus driver like me, it seemed obvious that there were two ships to beat - the BJ-4 and the ASW-12. The BJ-4 looked especially dangerous. I had read the long articles on it published in Soaring and Sailplane and Gliding and knew of its many records established in South Africa with its Marfa-like weather. Based on polars, the BJ looked to have a 10 mph average speed advantage over the Cirrus in any weather from 700 fpm up. Unlike the ASW-12, it was a very well thought-out ship with excellent dive brakes, able to land anywhere. What were the weaknesses that made the ship finish 13th despite the first class flying of Bomber Jackson? The first clue came during the practice week when the South Africans were heard to wonder when the good weather could be expected to arrive. Now, in point of fact, the weather during the practice week was by far the best I have ever seen in Marfa, with cloud base at 17,000 feet and more as opposed to the usual 12-13,000 feet, and thermals to match. A little flying with the BJ revealed that the climb was not bad, though no match for the Cirrus, but that the ship seemed to lose a lot both entering and leaving thermals. A look in the cockpit showed why. To change from cruise to climb configuration requires flicking two ratchets and operating three handles, one through several cycles. Changing back to cruise requires the reverse of all this. In the sharp, narrow and frequently ephemeral Marfa thermals, this just proved too much to do. Moreover, if the thermal evaporated after one turn, as was so frequently the case, the BJ lost heavily by being in the wrong configuration. On the contrary, the Cirrus pilot just pushed over and concentrated on cruising - and the next thermal. Another point soon noticed about the BJ was the weird howling it made crossing the finish. Noise means drag. A close look showed all sorts of flap tracks, balances, Fowler ailerons and rudder, etc., hanging out in the breeze. The BJ, weighing in at well over nine pounds wing loading in cruise configuration, normally flew at 120-130 mph, but it dropped pretty fast, too. We Cirrus types, toddling along at 105 mph, usually were ahead when we came together at the next thermal. On the final day - the strongest of the meet - I passed the BJ about 250 miles out and beat him to the finish by better than 20 minutes. The paper super ship had proven to be mostly paper.

The ASW-12 was another brand of bird entirely. I had already both flown ,it and flown against it and had every respect for its ability. In straight performance I would give it a 2 to 3 percent edge over even the long wing Cirrus. Its flight characteristics are good, but it is certainly more work to fly and not nearly so comfortable as the Cirrus; factors, considering the many long flying days anticipated at Marfa. By the way, those interested in this ship should see Wally Scott’s flight report in the September 1969 Soaring, one of the finest pilot reports I have read. Actually, despite all these good things that I know about the ASW-12, I was happy with the Cirrus. With my 190 pounds of ballast I thought I could pretty well keep up in the strong weather, and with my lighter wing loading and lower circling speed I expected to do better at the beginning and end of the distance days. All this proved true. I beat Wally by an average of just under 60 miles on the three distance days. Of course the big problem with the ASW-12 was the lack of dive brakes. tail parachutes don’t inspire maximum confidence, exactly, and even after you have practiced extensively with them, as I have, you need a bigger field and are more critical as to wind direction. In my Cirrus I was able to pass up an airport at 300 feet on the free distance day and pick up three miles because I was confident of being able to get down anywhere, Incidentally, my tail chute failed to deploy on that short field landing. ASW-12 fans will be glad to know that they are now being equipped with dive brakes.

The two ships that looked like such world beaters both turned out to be cut down to beatable size by some elements that didn’t show up on paper.

All of these comments do not change my initial point that performance is everything. I only want to stress that it must be a real performance, not a calculated L/D type performance, Real performance includes such factors as ease of flying, rate of climb, losses in rough air, dive brakes, control forces, etc., as well as the pretty curves the designer draws on the L/D chart.

What of the also-rans, ships like the Kestrel, the FK-3, and the Diamant? The Kestrel looked very potent on the drawing board and would have been unbeatable if the finished product had weighed in at the projected 463 pounds. Unfortunately the ship actually weighs 578, stripped, according to Ben Greene’s weight and balance. This, combined with late delivery and no water ballast tanks until the fifth day, pretty well washed up the Kestrel’s chances. The Kestrels at Marfa were easy to outclimb if neither of us had water, which may have had something to do with the fact that only once did a Kestrel ever do much on a distance day. The poor climb was probably aggravated by the fact that Ben’s ship, at least, had severe static source problems and thus virtually no total energy. Several of these problems were a result of last minute arrival of the ships and may well be overcome. Certainly the high speed performance of these ships is very good.

The FK-3, which I flew after the contest, is very good and may well prove hard to beat, but in Marfa it had only 100 pounds of water and was far too light for the strong conditions. Plans have been made to go to 250 pounds of water. The ship climbs very well light and is a pleasure to fly, quite reminiscent of the Weihe. The Diamant is a very potent ship - but small at 16.5 meters and heavy as a result of modifications and thus not at its best in weak going.

So much for the past. What of the future? What do we have to look out for in the Internationals?

My guess is that the open Class should be won by Klaus Holighaus’ Nimbus, a Ship Of 72 foot span, 850 pounds weight, and an aspect ratio of 31. The measured best L/D comes in at a hair under 50. The average speed in lift strengths between 500-1000 fpm is about 8 to 10 mph better than the Cirrus. It has HP style flaps and a tail chute, so landing should be no problem. In the two contests it has entered to date it was an easy first and a second -the second in the chancy, rain plagued German Nationals last year. At the moment, I don’t know who will be flying the ship, I am supposed to but since the SSA does not plan to give any aid to team pilots this year on the understandable grounds that they must spend every cent on running the contest itself, and since the military doesn’t seem interested in flying the Nimbus over and back, and since the price of having it flown commercially will be $2500 to $3000, which combined with insurance and normal contest expenses will bring the total to about $5000, I rather doubt that I will be able to fly it unless we can get help from some airline or other source. Any suggestions will be most acceptable.

The Nimbus will not be the only 72 foot ship in Marfa. The long wing Kestrel to be flown by Neubert of Germany has had the normal 17 meter Kestrel wing extended by 5.4 meters by adding a center section - 73 feet in all. Hans Werner Grosse will be flying an extended wing ASW-12 of 65 foot span but as Klaus Holighaus put it in a recent letter, "The ship has no dive brakes, no ballast, and already a very nervous pilot."

As far as I have been able to find out, there are no other superships which are likely to appear at Marfa. The Swiss 72 foot ship now being built by Albert Neukom will almost certainly not be ready in time, despite a move to a simpler flap system.

What of the future? In a few minutes you will be hearing about the Sigma, certainly the most ambitious project ever in sailplane design and one which will take a lot of beating if it does not fall into the same flight problems that seem to afflict the BJ-4. And, speaking of the BJ, Pat Beatty departed from Texas muttering about a BJ-5 that would clear up all the problems of the 4. Just in case anyone is inclined to rest on his 72 foot laurels, I learned last week that the Akaflieg Braunschweig, the aeronautical graduate school that first produced the BS-1, among other ships, and many of Germany's top designers, is currently working on a 30 meter ship for the future. That's 99.3 feet for those of you whose slide rules aren't used to astronomy. Does all of this mean that the open class will die as the competitive group we know today? I think so, but not for several years, at least in this country. Certainly the big exotics will be very expensive. The Nimbus is on the block for $27,000, the Sigma will undoubtedly cost a good deal more, and no one could guess the likely price of a 100 footer. The very price of these ships, to say nothing of their size and weight, makes it improbable that they will ever -be produced in any quantity. It seems likely that the countries that own them will use them pretty much for World Championship flying. In the meantime the open class, perhaps especially in the US, where none of the top pilots have expressed any interest in owning the Nimbus, Will probably go on much as we know it today, although I would anticipate a gradual falling off of interest in favor of the smaller, lighter, and more competitive standard class, as has already happened in Europe. Perhaps in 10 years the competitive soaring scene will much resemble the power plane Unlimited racing scene of today where a Darryl Greenmayer completely dominates the competition. Can we envision A.J. Smith, Al Parker, and five or six other devotees of the ultimate - damn the expense - fighting it out in their 200 footers while the real competition takes place in the standard class? Probably.

In Europe the top pilots on many of the teams choose to fly in the standard class since there is better competition. This state has been slow to come to the U.S., but I think by 1972 the center of interest will have shifted so that the "real" champion is the chap that wins in the standard class. This might seem like an odd statement after the dismal showing of the standard ships at Marfa last summer. Of the ten entries, the best finished 30th and the average must have been over 50th. However, only one of these ships was flown by a pilot who had done well in recent years, and this pilot, Henri Stouffs of Belgium, was obviously finding conditions a bit different from his homeland. Perhaps the best indication on what could be done by a pilot who pushed a bit was Tommy Beltz' outstanding showing in the Austria SH, a ship that is standard according to the 1970 rules. I feel little doubt that the top five pilots in the contest would have lost only a few places had they been flying in the best of the new standard ships.

What are the best of the new standard ships? I feel fairly confident that the Internationals will be won this year by a Cirrus Standard, an LS-1 or an ASW-15. The Libelle Standard has a chance but it seems to give away too much performance on the high speed end. Ships like the Cirrus Standard and ASW-15 can stick amazingly close to the big open ships and in some cases pass them. I flew away and left a very startled Diamant 16.5 pilot last summer at 125 mph indicated on the Cirrus Standard. In climb the small ship's maneuverability frequently makes up for the larger one's lower sink.

While meaningful tests have yet to be made, I would guess that the Cirrus Standard and ASW-15 are very similar in performance. I somewhat prefer the former for its really remarkable handling characteristics, especially in yaw stability, but there is no question that both are outstanding ships. By comparison, the Libelle suffers from the too small fin and rudder of the Open Libelle. The unknown is the LS-1. Reports from Germany have been very good but so far have given no evidence of a clear-cut superiority over the other ships. At any rate, LS-1's are going to be hard to get for a while as the fuselage factory just burned down with all the molds. Incidentally, the LS-1, ASW-15, and Cirrus Standard were each produced by one of that remarkable trio of German designers who planned and built the famous D-36 while still students. The three are the best of friends, confer often, and it is no accident that their work is very similar.

There have been no reports of any standard class superships headed for Marfa this summer. This does not mean that none will be produced. The first such ship was built at Akaflieg Stuttgart in 1968. This ship, the Cuervo, has an aspect ratio of 26 and an empty weight of only 315 pounds as compared to 400 to 450 for all the other standard ships. The ship has never been flown in a big contest by a first class pilot and remains an unknown as to performance. The light weight

has been achieved by going to very light structure - the fuselage feels scarcely substantial enough to hold the pilot. A ship of this sort could never sell in competition with the general purpose standard ships now being produced, but these specialized racing jobs will doubtless come to dominate the standard class during the
1970's.

So far, we have talked entirely of ships and trends. The pilot factor at Marfa cannot be completely ignored. Marfa flying is a rather specialized sort of affair and requires a good deal of adjustment for even the best pilots used to the East and Europe. It was very notable that such famous national and international champions as Wroblewski of Poland, Wodl of Austria, and Stouffs of Belgium were well out of their usual top placing. Makula of Poland told me that he didn't expect any foreign pilot to do well in 1970 if he had not come to Marfa in 1969. Europeans (and many Easterners) hear of the powerful thermals and high cloud bases and often forget that the thermals can be very wide spaced and that 10,000 foot altitudes are no very impressive over 6000 foot terrain, especially when there is no place much to land for the next 20 miles. With thermals spaced as much as 20 miles apart, there is a tendency to take every one to the top, which of course is disastrous in terms of speed,

Finally, one last word on ships. Today, with most of the new ships arriving beautifully polished and apparently aerodynamically immaculate, I notice few pilots are taking the trouble to clean up the minor details that no factory can afford to attend to. Just to give an idea of what can be done, on my Cirrus I made fairings for the aileron control rods (four) which protrude 3/4 inch, sealed the gear doors so there would be a minimum of air leakage when they are closed, worked out some canopy seats to reduce leakage, made a black instrument panel cover to cut glare, made a fairing to cover the hollow bolt ends of the tail wheel, and replaced the large tail wheel with a flush skid for contest flying. A more major project consisted of increasing the span by 32 inches, thus bringing the aspect ratio from 25 to 27. The effects? The only measurable one was in reducing the best speed to thermal by 2 mph with a corresponding increase in rate of climb, but there is little doubt that all these things added together must have given at least a 1/4 percent difference, and 1/4 percent works out at about 17 points over the length of the whole contest. Eleven ships out of the first 25 at Marfa would have gained a place with 17 more points. There is no such thing as a sailplane that cannot be improved, there are only pilots who lack energy and imagination.

Crystal ball gazing is even more chancy than soaring, and it will be just my luck to have the open class won by a K-6 next summer.

Question And Answer Period

Question: How often do you not use the water ballast or use part water or dump your water during a contest?

Moffat:, At Marfa I used water every day last year. I dumped three times. The first time I got in trouble on the second day about five miles away from the field and couldn't stay up any other way. I hurt for the water very, very badly all around the course. The second time was on the free distance task at about 5:00 o'clock when I saw my last thermal of over half a meter, and I flew until 8:00 o'clock. That's something you couldn't have done with the AS-12, in my opinion. The third time was on the final throw of cat's cradle day. I dumped as I turned downwind because it was just a question of staying airborne while you flew on down the last 70 miles or so.

Question: (Tom Smith) I noticed in all of your comments, you had none to make on the Phoebus B or C. Do you have an opinion?

Moffat: Yes. The Phoebus B is a very puzzling ship, as was the A. When they're good, they're very, very good. When they're bad, they're terrible.

And nobody I've yet discovered seems to be able to tell why one is one way and the other's another. When they're good, they're just as good as any; and when they're bad, they just don't climb at all. I tried one out quite a few years ago. It couldn't outclimb a rather heavy Sisu even in weak weather. That wasn't just me. We traded pilots around a little bit, However, others climb like a dream - just as long as the wings are dry. Run into a little rain and the bottom drops out. The Phoebus C seems to be pretty good on climb but it's too specialized a ship. It has no water ballast and, consequently, you're killed by the ships that have water ballast when it gets to the strong weather.

Competition Flying In Sigma

By E.C.N. Goodhart

The point of this talk is that I believe that competition flying in Sigma will be very different from what we are used to, so I am going to start by showing you what is different about Sigma.

Well, for a start, we can see from Figure 1 and Figure 2, that it certainly looks different. The aspect ratio flap-in is about 36 and flap out it comes down to just under 27. It weighs about 1500 pounds and has a wing loading of 11-1/2 lbs/sq ft flap-in and 8-1/2 lbs/sq ft flap-out, but despite these very high loadings the stall speed is 42 mph due to the very high camber of the wing with the flap out.

Figure 3 shows the flap-in and flap-out wing sections. Both sections are laminar flow Wortmann airfoils. The flap-in section has a good performance over the whole cruising speed range and the flap-out section is designed to give good L/D’s in the very high lift range, i.e., solely for circling flight.

That introduces the flap which is the main feature of Sigma. Now, let us look at the other control surfaces shown in Fig. 3. The tail end is conventional with all moving horizontal stabilizer with full span anti-balance tab. But on the wing we have what at first sight seems a grossly excessive number of assorted control surfaces. The ailerons cover over three-quarters of the span but are of very narrow chord; they are attached to the trailing edge of the flap. A similar surface over the rest of the span is used together with the ailerons for camber changing purposes in cruising flight.

The ailerons are not sufficient for max rate of roll at low speed so an additional surface in front of the aileron is used as a spoiler to provide additional rolling moment.

Further surfaces on the inboard wing are used as air brakes in addition to the tail parachute.

When the air brake surfaces are extended, the camber changing flap is deflected to reduce the pitching moments.

One other important point is that the flaps are hydraulically operated thus, provided there is power in the accumulator, they move instantaneously from one position to the other. Keeping the accumulator charged requires a lot of effort and this will be done by pumping with both feet on the rudder pedals. We have arranged this by allowing you to disconnect the rudder adjustment lock and having a wire joining the pedal slide to the hydraulic pump. Maybe as many as 20 pumps per flap in-out operation but there should be about five cycles in the accumulator before you start.

You may wonder why Sigma’s fuselage joins the fin in the middle instead of at the bottom as in conventional gliders. The requirement is that the fuselage shall lie along the streamlines in cruising flight and this defines the relationship between the fuselage and the wing chord line. With the flap down, the landing attitude is almost exactly the same as cruising flight so we had to put something under the fuselage to mount the tail wheel on. Part of the fin seemed the obvious answer. Incidentally, in the same context, the rather long, stalky undercarriage is fitted in order to keep the wings Well clear of ground obstructions even when they are in their static deflection position, i.e., drooping.

Now we will look at Signals performance. Figure 5 shows Sigma in comparison with Cirrus. Down at the slow speed end Sigma is very slightly worse: in narrow thermals the rate of climb is likely to be about 35 fpm less an this loss is almost entirely due to the fact that the weight we have selected for Sigma produces a stall speed about 2 mph higher than Cirrus. But at cruising speeds, Sigma has a glide ratio up to 70 percent better. This results first of all in an achieved cross-country speed which is 16 percent better than Cirrus on a day, when Cirrus climbs at, 2.0 knots (200 fpm) and increases to 25 percent better on a day when Cirrus climbs at 5 knots (500 fpm).

Since Sigma’s climb is slightly worse than Cirrus, it is clear that all the extra performance comes from high speed cruise at shallow glide angles. Figure 6 shows the cruise speed against achieved rate of climb for both gliders in the normal working range, Sigma cruises 20 knots (23 mph), or more faster than Cirrus and what is equally important, at the best cruising speed Sigma is cruising about six glide ratios better.

To put numbers to this, let us look at Sigma and Cirrus starting side by side at the bottom of a thermal in which Cirrus climbs at 400 fpm. We will assume a climb of 2000 feet is available. Figure 7 shows the distance against time of the two gliders.

Sigma takes half a minute more to climb but as the cruising speed is 97 knots (111 mph) compared to Cirrus' 74 knots (85 mph), Sigma passes Cirrus after 2-1/2 miles and covers 2-3/4 miles more than Cirrus before getting back to start level and needing another thermal.

You will see from the bottom part of the diagram the actual height of Sigma and Cirrus along the track. An important point is that Sigma has to dive off 400 feet to gain cruising speed while Cirrus only dives off 200 feet.

This is an inevitable fact of life and nothing whatever to do with the gliders; it derives simply from the conversion of potential energy into kinetic energy and the higher the cruising speed the greater the height dived off to get up to the required speed. Fortunately it is all recovered (and I mean all) at end of the glide when you pull up to thermaling speed on joining the next thermal, However, it does have a significant effect in that the ground will be that much closer throughout the cruise. Where the working layer is near the ground, this may be discouraging. The other important point brought out by this diagram is that Sigma covers 30 percent more distance in each glide than Cirrus does with the consequent opportunity to choose the next thermal from a greater selection. If, as seems probable, thermal strengths have a standard type of distribution, this increased selection capability should give a significant improvement in the strength of the thermals used on any particular day.

A big advantage stemming from the higher cruising speed is the shorter time to reach the next cloud. This means that one is less likely to suffer the all too familiar problem of the cloud that goes soft just as you get there.

But there are disadvantages in high cruising speeds. For a start the total energy variometer has really got to be good - unlike nearly all the installations I have flown with. Even with a successful total energy, there is the problem of slowing down where you think there is going to be lift and then speeding up if it isn't there. Contrary to popular ideas, this does not create any great loss - only a little due to the short time you are not flying at best cruising speed.

In Sigma the flap has one purpose only, it reduces the speed for minimum sink. Nothing else. Minimum sink is the same flap-in or flap-out except that flap-in it occurs at 56 knots (64 mph) and flap-out at 39.5 knots (45 mph). Flap is there only for circling, so if you are slowing down to feel for a thermal in straight flight this will be done at about 55 to 60 knots (65 to 70 mph). This will certainly involve a new technique and may be more difficult but I think we will get used to reacting more quickly; it will certainly lay stress on a really good total energy variometer. If we find it difficult to pick up thermals at these higher speeds there is no reason why the flap should not be put out but this will be a more complicated maneuver and I visualize difficulty in getting a variometer to cope during the flap-out or flap in maneuver. This will undoubtedly be troublesome. However, you must bear in mind that we expect Sigma flap-out to be very similar to any existing high performance glider in the 40 to 60 knot (45 to 70 mph) speed range. So, unlike BJ-4, there is no severe penalty if flap is put out and the thermal turns out be nonexistent.

The actual thermal climb in Sigma should be no different from an ordinary glider although aileron control is unlikely to be as pleasant, since I doubt very much whether we will be able to produce a really smooth relationship between stick movement, stick force, rate of roll, and adverse or proverse yaw. Using, as we are, a combination of ailerons and spoilers the compromise between these four parameters is unlikely to be better than acceptable.

Fore and aft control should be good since we are fitting an all moving tail with anti-balance tab. The tailplane area is also fairly large to take care of the trim changes due to the flap. The rudder should be normal and, in view of the aileron spoiler arrangement for roll control, there should be ample rudder effectiveness for all maneuvers.

How, let's go on a 100 km triangle in Sigma. We take off with hydraulic accumulator fully charged and flap out. If it is an ordinary tug we will be climbing flap-out; at least 70 knots (80 mph) would be needed flap-in. We cannot get the wheels up as the tow hook is on the main undercarriage. At 2000 feet we cut loose and select wheels up (they are hydraulic) leave the flaps down and amble round to join the nearest gaggle. At the earliest opportunity we unlock the rudder pedals and pump up the hydraulic accumulator, say, 15 Pumps to put back what the wheels used.

Let us assume it's a good day with 600 fpm thermals between 3000 feet and 6000 feet. We will want to cross the line at Vne which is 140 knots (160 mph) and we will know that this is achieved by diving from a point one mile short of the start line starting at 70 knots (80 mph) and a height of 4150 feet.

We are now cruising around in the region of the start line at 5000 feet or so and waiting for a few other pilots to get strung out along the line and, even more important, waiting for a clear indication of a good thermal within a couple of miles of the start line. We check the hydraulic accumulator fully charged, everything stowed in its proper place, all instruments running, camera ready, sunglasses clean, hat, sunshade ventilation adjusted, gyro set to compass, right piece of map on knee pad, straps tight.

Nobody else diving for the line. A touch of air brake gets you to 150 feet at 70 knots (80 mph); dive to 140 knots (160 mph); and over the line at 3250 feet. Confirmation of start comes over the radio and you ease up to 110 knots (125 mph). A minute after start and you are two miles out and pulling up under the first cloud, At 60 knots (70 mph) you will be at about 3500 feet and listening to every twitter from the audio. Suddenly there is a heave and you know you have a core. Roll-in, slot the flap lever down, bang go the flaps and a sharp backward heave on the elevator brings you into a tight circle. A couple of circles gets you centered and good steady climb develops. Apart from concentrating on the climb, you are now very busy sorting out the next thermal. Which cloud? Or - join a gaggle five miles ahead which appears to be doing well?

Four minutes of climb brings you to 6000 feet and the rate of climb begins to fall off. Straighten up towards the gaggle, bang in the flaps and dive 600 feet to get 110 knots (125 mph) and away on the cruise. The first job is to recharge the hydraulics; release the rudder pedals and pump maybe 30 pumps, relock and sort out the navigation. The gaggle is approximately on track to the first turn point. You get to within half a mile of them at 3500 feet and pull up to join them. You gain 500 feet in the climb and pop the flaps at the top. Sigma. has substantially equal climb performance and you are soon away from the top of the thermal with a few other gliders streaming for the turn point in front of you. In flaps, dive, pump up the accumulator and almost at once you go flashing past those who had left the thermal ahead of you. Turn point coming, check the second leg for a good cloud, round the turn point at 5000 feet, photograph, straighten up for the next cloud, you will have taken about 18 minutes so far.

On the second leg there is no gaggle but a good looking cloud is available and you feel your way under it slowing down to 60 knots (70 mph). It is a large cloud and there is a wide area of weak lift. You cruise around and fly through one or two poor cores but the real meat is not there. You still have 4000 feet and a new cloud is showing a couple of miles ahead so you press on and sure enough you find a real boomer. Once again that rather tricky roll-in, flap-out, turn maneuver and you are locked into your last climb, for at 110 knots (125 mph) your final glide with 50 km to go requires just 5400 feet. But as you pass 5000 feet the climb builds up to 800 fpm and your final glide break-off computer tells you that with this rate of climb you should break off at 6300 feet and glide at 120 knots (140 mph). But it dies back again to 600 fpm so you break off at 5400 feet and head for the second turn point.

Now comes that hair raising game of checking height against distance. At times it looks good, at times not so good and it’s nerve wracking when you speed up in sink and height seems to evaporate in a flash. The turn point comes and you make the turn at 3600 feet which checks out exactly. Already it is looking good because with 110 knots on the clock you have a good five km of level flight available if you reach ground level short of the finish line. This is why you did not allow any margin in your break-off from the last thermal. Ten km from home you have 1000 feet and know it’s made. If the flight works out as I have described, you should cross the finish line just 42 minutes after starting, for an average speed of 143 kph, and if you do I am quite sure of one thing - you are going to be one helluva tired man! There has been more to cope with and less time to do it in and there is the actual physical effort of keeping the hydraulic pumped up as well. You did remember, didn’t you, because you haven’t landed yet and there is going to be a nasty incident if you cannot get the flaps and undercarriage down.

The undercarriage drops down under gravity but you’ll need the flap or else a very large airfield. So, a quiet circuit to lose speed, gear down, flap down, turn in on final with 200 feet or so, pop the chute and use the air brake for fine adjustment. And that’s it.

I’m not at all sure it’s going to be fun but if Sigma does work, we ought to be able to rewrite the record book and it will certainly be exciting.

Question And Answer Period

Question: (Schreder) I imagine there are a lot of visitors here who are panting for one of these Sigmas and they’d like to know the purchase price and the earliest delivery date.

Goodhart: The answer to that is we are building at the present time a prototype. We are hoping to learn a great deal from building this prototype. After we build it we’ll look at it and see what can be done. It looks like $100,000 to build this program.

Question: (Moffat) I’m curious Nick, what are you going to do when you get this thing built and it works out just exactly the way you said but some chap who never flew anything but a K-6 wins the Nationals under your handicap system and then becomes the Sigma pilot?

Goodhart: We shan't lend it to him. No, I think it's going to take quite a bit of learning to learn to fly this bird. You're going to have to have a lot of high performance time to fly this.

Question: (Seibels) Nick, if this isn't classified, I don't think I heard you say anything about what sort of materials you're building this ship out of.

Goodhart: The ship is entirely built out of aluminum alloys except that the pod on the fuselage - the part around the pilot is the fiberglass pod. The tail cone is aluminum. Just as a matter of interest, the wing skin thickness at the root is 5/16 inch.

Question: (Roy McMasters) I'm curious about the maximum speed at which you can bang a flap down. It seems to me that if it gets triggered accidentally at 170 mph, that it would disintegrate itself in the process of the flap coming down because of the tremendous forces involved in the center pressure change.

Goodhart: We are making the flap lever a very long and conscious movement. You've got to first move it along a slot and slide it down. Hopefully, nobody would be silly enough to do that at any speed above flap limiting speed which is 75 knots.

Question: (T. I. Weston) I'd like to hear you comment on crew and caravans involved in moving this thing around and taking it apart and putting it together.

Goodhart: Well the overall weight is just under 800 pounds. It's a three-piece wing and it takes four people with lifting bars. We've designed special lifting bars for them to carry it. We don't necessarily visualize putting it together manually, or taking it apart, except for off airport landings. We rather visualize, in fact, building a small crane on the trailer in order to hang up the center section and drive the fuselage under it. This should be no problem. I accept the point entirely. This is not a Sunday afternoon glider at all.

Question: (Seibels) All that fin area down under the fuselage. Isn't that going to be pretty vulnerable to getting banged up on off-field landings?

Goodhart: I think you're right. In the case where the back end drops in a rabbit hole, we may well be in trouble there. If the end comes off we will glue it on again.

Question: (Byars) With the advent of a stiffer laminate such as carbon or boron fibers, is there any thought being given to changing the materials of the wings?

Goodhart: No, we haven't thought about what we'd do yet with the Sigma II. There's no advantage, that we know of, in going to higher aspect ratio if it only permits you to go to a higher span. I am very doubtful of the roll control problems. We stopped at 21 meters because we thought that was about the limit for roll control problems. I'd be interested to see these 30 meter ships George is talking about.

Question: (T. I. Weston) Please comment on the computer program you talked about which took two years. How was it used?

Goodhart; We did a parametric study and developed a program which, given the wind tunnel data on the wing section, does a full analysis of the performance. This applies to a whole series of thermals. We have a fair thermal -model -it may not be right - but not many people know what a thermal looks like. The program gives cross country speeds for particular types of thermals. We then simply let the computer look for a maximum over a whole range of aspect ratios, spans, and weights. This computer procedure led us to our present Sigma design.

Standard Class - Present And Future

Goodhart - Moffat - Schreder - Smith

GOODHART: The trouble with standard class is that it is not standard. First, it was restrictions on copy for minimum dimensions, then it was retractable wheels, and now even flaps are going to be allowed. I just heard a couple of weeks ago that the CIVV has agreed that from 1974 onward standard class will be allowed to have flaps. And if the aim of the standard class is to bring gliding within reach of the ordinary man, then it has to stay stationary. Yet, I agree that all the revisions that have been made have been justified. The only trouble is that we just have not got onto a plateau of performance which will allow a fixed set of rules to remain relevant and with it. All we can do for the time being is stay tuned. We hope the next program will be a long one in which we can buy a glider which will not be outclassed in months.

Of the many performance limits of the great range of possible standard class gliders, all having the same Wortmann wing sections, my first conclusion was there was no case for an aspect ratio above 24. We've already reached this. In fact, there's scarcely a gnat's whisker of performance difference over the range of aspect ratios from 20 to 24 provided they're all flown at the right weight. In the range of 200 to 400 feet net rate of climb (what I would call European rates of climb), the best weights are much lower than those currently being reached. My calculations show 20 aspect ratio optimizing at about 525 pounds - that's all up weight. On a 24 aspect ratio -optimizing at 475 pounds. These are wing loadings of 4.35 pounds per square foot, and 4.7 pounds per square foot. Incidentally, the wing section I was using is the FX 61-163, which seems to be one of the most popular. I'm suggesting that, aerodynamically, perhaps we have reached some sort of a plateau because there isn't much more to come. The Wortmann and Eppler airfoils have so much laminar flow that I don't believe anyone is going to produce a significantly better airfoil. The other contribution to the drag such as fuselage, interference, leaks, gaps, aerials, and that sort of thing have all been reduced to very low levels indeed, now; so the line of development as I see it (and it only applies to Europe so maybe I shouldn't be saying this to you) is in weight. We've got to look to structural experts to get all the strength we want at much lower structure weight. Possibly carbon fiber has an application here.

So I see standard class caught in the same trap as the open class. It will be possible to up performance significantly but only at very considerable cost. There is only one alternative and that, I think, is the alternative that you're able to adopt and that is always to fly in thermals of 400 to 600 feet a minute or more and that's a great solution because the optimum weights are then up in the weights which people are currently building standard class gliders - at around 60D to 650 pounds. What I'd like to say about the standard class is that I'd like to see gliding grow to the point where we'd get away from this coverall of standard 15 meters and get down to real class racing as with the dinghy sailors. This is something which we've got to get to quite soon; and when we do this we really find out who our best pilots are and I look forward very much indeed to this day when we can have a better contest.

MOFFAT: Well, I guess I should say first off that I disagree with Nick on quite a number of points. I don't believe that the standard class is and I don't believe that it should become anything like a one-design class. I think that the changes and improvements that have been made recently and are projected for 1974 are very much to the good. Further, I think they may not make the standard class prohibitively expensive although I do think they'll make it rather more expensive than we're used to today.

I think, second, that the racing oriented standard class ship will have to come unless interest in gliding virtually dies, because if the competitive scene continues, as entries for the Nationals and would-be entries for the Nationals show it to be continuing in our country, I don't see any reason to suppose that the level of competition will not be driven up very high indeed. This means that certain people will be perfectly willing to sacrifice club-type comforts and structural strength perhaps, as well, in order to get a racing ship, just as has happened in boat design. I think the corollary of this is that we must develop the chap who wants to fly in competition and does not want to spend the amounts of money that development classes always entail. We must develop a meaningful one-design class and I do not mean a 1-26 (which is about the most ridiculous joke of a one-design class that I can imagine, since the weights of early 1-26's are 100 pounds less than the weights of late 1-26's).

I would like very much to see a good 13-meter ship for one-design class rather like the standard class of the moment, only scaled down. There's every reason to believe from the German Hildoga, which was a 13-meter ship that had a best L/D of about 36 on an empty weight of 226 pounds - there's every reason to believe that such an interesting 13-meter one-design could be developed.

Finally, I don't agree with Nick on his analogy to dinghy racing. If they had an open Libelle class contest, for example, I think that some people would have Libelles that were very, very much better than other people and I don't think, unless you know the right people to borrow from, that you'd be likely to borrow one with much of a chance of winning. In short, there are Libelles - and there are Libelles. Just as there are 1-26's - and there are 1-26's. Unless you have rules to state very explicitly, as we have in dinghy sailing, exactly what you can do, and what you cannot, you run into trouble. And, believe me, I've raced dinghies for 10 or 15 years and the boats that I raced very frequently (often borrowed) were infinitely better than the boats just plain ordinary people that didn't have any reputation could buy. I think the same thing will happen in sailplane flying. Believe me, the kind of dinghy that Peter Scott or Stuart Morris raced in England., doesn't bear much resemblance to what you buy in a boat shop.

SCHREDER: Well, I think the standard class is on its way to becoming the most important class in the United States. I think that if we have open class Internationals where ships like the Sigma and the Nimbus show up and consistently win because of their big size and complexity, this will discourage most of the normal soaring fraternity from trying to compete in this type of class and the open class will eventually degenerate into an America's Cup type of race. I think most of you people out here are going to be interested, eventually, in standard class ships. The greatest reason, of course, would be that you don't want to wrestle with these huge ships and you probably won't have a pocketbook big enough to buy a Sigma, for instance. I also agree with Nick in his statement that the standard class ships are just about to reach the limit of their development unless, of course, someone comes up with some entirely new idea that we're not aware of at the present time. I do think we're near the maximum performance that can be expected from a 15-meter ship. I think there's a lot of development to be done to simplify the construction and get the price down because as all of you know, the prices are steadily climbing, and I'll try to touch on that later when we talk about design. I personally think and hope that the ultimate standard class limitation will be only a 15-meter span. I think when we try to legislate all of these restrictions we run into all kinds of problems because for every law that you make, someone can find a way of getting around it, and it's usually in a very expensive manner. The reason I believe we should have a 15-meter span limitation is that we're going to restrict people that can develop better ships and I don't see any reason why we should restrict the development of better sailplanes that will have better performance without necessarily increasing the costs.

SMITH: The history of the standard class has been kind of irregular (I guess this is a good adjective) - mostly because of the administration and the bureaucracy. I think that this is what Fick was hinting at. However, I think it's serving its purpose in that it's pointing out that we can't continue to have soaring competition in this fashion. I think what e standard class will do is indicate that we do need to expand class competition, and that we will need more classes. Because of the pressures we're feeling about the standard class here in the United States, I believe that we will have many, many more competitors and I think that this will naturally force more classes. I agree basically with everything that's been said but I think that the overriding factor in all of this is just the plain purchase price of the sailplane. I don't think that the kind of rules we have or the kind of changes we make in the rules or the kind of classes we can have will ever be able to override the simple fact that people want to buy less expensive sailplanes and, to date, this standard class should have been the answer to that, except perhaps, for ships like the 1-26, but even there the cost difference is very slight. I think all of this argument is really kind of academic - what we're talking about is the whole economics of the situation. You get more people involved constantly in soaring and all of our efforts are directed in this fashion; sometimes not by design. I think this simple activity of getting together here is going to encourage more soaring and get more people involved. They're going to want to compete; and if they're serious competitors, they're going to get into the best competitive position they can get into; they're going to argue for class type competition and they're going to be successful in it because there's going to be so many of them. We're going to have some continuation of the concept of the standard class, I think, without all of the variations that the standard class has gone through in the past few years.

Question And Answer Period

Question: (Hearn) We've heard a great deal about the economical advantage of having a standard class. I'd like to discuss the unfortunate position of the Libelle owner who has bought a 301. low we have a standard class Libelle which had no retracting undercarriage; but now he can have it retracting, so he has to spend some money to have this modification made. Worse yet, in the near future it looks like he'd have to get rid of the whole standard Libelle anyway, because now he's going to be allowed flaps. The 301 pilot who at the present time will not be able to compete in the standard class, will later be able to compete, and therefore, all Standard Libelle buyers will have to get rid of their Standard Libelle. This constant switching and changing is very bad economically for, indeed, some of you on the board are selling your 17-meter ships. Should we not have, as I think one new Zealand or Australian chap wrote recently in Soaring, more than one class? The idea of just a 15-meter class seems to me, wrong. There is also a very large group of gliders at present, the 301, 17- and 18-meter gliders, that should also be able to compete in a class. Is there, perhaps, room for another class as well as the standard?

Answer: (Schreder) I'd like to answer that. I'll answer your last question first and that is that the Board of Directors of the SSA, of which at least two of us are members, have gone on record by stating that they will support and promote any class that becomes popular. In other words, if there is a group in the United States that would like to promote a class of 13-1/2-meter ships, or a class that would, say, be limited to 15-meters to 17-meters -if there are enough people interested in having a competition of such a class, the SSA will give it official sanction and do everything to promote it the same as any other class such as the open or standard class.

Now, to get back to the other question about the owners of Libelles having to change the flaps - I'm probably the most rabid flap man in the United States - I really don't see any reason why this would be necessary. Even though I am a promoter of flaps, I don't really believe that there are any performance advantages in a simple flap. If there are, they are very, very minor. I am in favor of flaps mainly because of the additional safety features such as being able to land at lower speeds, in smaller fields, and simplifying the wing construction, etc., but I see no reason for anyone who already has a ship with adequate dive brakes to make this change or to spend any money at All. I don't think it would help him a bit.

Comment. (Moffat) One or two points that John (Hearn) raised - one that of the current changes of rules in the standard class will tend to make ships date rather quickly. I think if you're going to compete very much, you have to recognize that the object tends to date rather quickly; I don't care whether it be in boats, cars, airplanes, gliders, or what have you. It's rather unusual to have an object, any object, in a competitive class, still winable after three or four years. I think that's one thing to consider. Another point that John raised was in saying a word about the state of chaps who own Libelle 301's, the open class Libelle at the moment, for example, and other open class ships. I think it would be too bad if people came away from this meeting and other types of meetings around the country with the idea that the only type of competition in the United States will -be in standard ships from now on. If your interest is primarily, for instance, in regional contests, and you would plan to enter the Nationals when they are close enough to not entail a tremendous output of money, the open class is still very interesting indeed. I think this is particularly true in the East. I don't see any reason for owners of open ships to panic. Further - one last point - the 301 Libelle would not be eligible as a standard class ship under any likely interpretation of the flap rule. The flap rule is still to be written, but I know the people who are doing the writing and I think that I could guess that the 301 Libelle would not qualify as standard by 1974.

Question: How about the spoilers? You can't have both.

Comment: (Byars) Would you like to comment on that specific point, Nick?

Answer: (Goodhart) I can't comment on the rule because, as George (Moffat) said, it hasn't been written yet, and then again, I know the people who are writing it and I know that their aim will be to keep it down to the simplest possible flap and try to exclude anything which looks like being expensive. I'd like to just say that in U.K., of course, we have got another class. In fact, the second class in our national championships is not the standard class; it's what we call the sport class, which is designed to catch all the older opens as well as the standard class. We simply use as a measure of whether a glider is qualified for the sport class or not the handicapped figure for that glider. We have a system for measuring handicaps for all the gliders. For example, a 19-meter ship was in our sport class competition last year and it didn't win.

(Byars) Anybody else?

(A.J. Smith)- I think a way that we could make a contribution here is by giving an idea of what we think is going to happen. I think that we're going to get more activity in the standard class and standard class nationals; and probably some of the pilots that do well in the standard class will -be included in the seeding for the international team and all this sort of thing. But, it is pretty obvious that it isn't going to happen very fast. If you want it to happen faster, you have to make even more noise than you have been making so far. I sense that there is a lot of sentiment for the standard class. I think the best advice we could give you is to be prepared to trade ships as often as you can for the next two years while you're still young, healthy, and competitive, because that's the way it's going to be.

Even after we get a class kind of competition, it's going to take a long time for people in the soaring movement to understand really how to control a class type competition so after you once buy what you hope will be a rigidly controlled class competition sailplane, John, they may still be figuring out the rules - how to measure it and how to weigh it. It's going to take at least a decade for somebody to figure out that all pilots should weigh what the handbook says pilots weigh, which is 170 pounds. It's surprising how many people don't realize that this is a factor in competition. Simple things like this are going to take years and years to sort out, so the best thing we can say to you, I think, is to keep fighting' but advertise your sailplane and lay aside capital for reinvesting. Question: I think it's important in this discussion to qualify this flap requirement. I realize it's not written yet but you fellows seem to have some idea of what it's going to be. The question in my mind - is it going to allow some limited amount of camber changing?

Answer: (Moffat) I think I might be somewhat qualified here, as is probably Nick too, since I talked to Loren Welch, who probably will have the writing of the rule to do. I know that Loren's feeling is that camber changing could be performance enhancing and is to be avoided at all costs because of the word "costs." I'm sure that Loren will put in a requirement for full flap extension at Vne at probably not over five seconds, which is a very, very difficult design requirement. I feel (Nick may not like this very much), but I feel fairly confident that since Loren is not at all in favor of flaps as an idea, that he'll make it very hard for people like Dick Schreder.

(Schreder): Just a year ago I went, at my own expense, over to a meeting of the CIVV, simply because they were going to have a discussion on the flap and, unfortunately, I left about five minutes before they voted on the thing because I had to get back to one of these symposiums over here. The Europeans are very much adverse to flaps. Not knowing anything about them, they don't like them, and they're against them. There were All kinds of ideas proposed at this meeting to install drag strips and require portions of the flap to come up and act as spoilers and actually complicate the flaps so that no advantage could be gained from them. My point is that if we do have a flap that's used for a dive brake, why in the world should we build lower performance into the ship and destroy any of the possible advantages that could be gained just from the simple flap. I don't believe in having expensive tracks and extending flaps and all this sort of thing. I think that, as long as we can build a flap that will be a superior dive brake at no additional cost, we should allow any advantages that can accrue from the use of this flap.

(Goodhart): I don't like to say it, but having flown with a Schreder-type flap, and having found it absolutely first class, I strongly support Dick's point of view, and I shall do my best back in U.K., if I have any power, to make sure we get his sort of flap allowed.

(Moffat): You might be interested to know the reason that I got the offer to fly the Nimbus was that the German team turned it down. Klaus Holighaus told me last summer in Marfa that he, for political reasons, had to offer it to the German team first. The reason that they turned it down was that none of them had any experience with a flap-type sailplane. They were scared to death to fly it in a strange place like Marfa. They would prefer to fly something like the ASW-12 with the tail chute alone. Many of you have flown flapped ships and you know how marvelous they are, but it's that kind of prejudice that's made life so difficult for people like Dick to get a sensible flap rule.

(Steve du Pont) I don't know what the rule Is. I understand it isn't written yet, but in previous conversations, it was my understanding that it was flaps or spoilers on standard class now. I don't believe that the Libelle flap could be put down 900, and if it did, it would fail to function as well as it does for camber changing because I think the binge is not at the lover surface. I'm not sure of it; I never studied it; but this is the key to it as I see it; that you have spoilers or flaps. I think that may answer the question of whether the Libelle 301 is going to become standard class or not.

Question (Byars) I'd like to add here a bit of comment as to keeping the cost of the standard class down. It seems to me like there's only two real controls we can put on the standard Class. One is span and the other is empty weight. When we get to the competition, about the only way we can equalize the competition is that, since the span is already standardized, we'll have to equalize the all up weight, the flying weight. I'd like a little bit of comment on that.

Answer: (Schreder) Well, I don't know whether I'm an expert on that but I agree with you although I don't even think we can control the weight because, with pilots varying from 120 to 250 pounds, it gets pretty hard to control the weight, and it would mean an awful lot of ballast to stick someplace in a sailplane that doesn't have any storage area. Or, since the standard class is prohibited from having dropable ballast, you can't have water tanks under the present rules. It will get pretty difficult to add this kind of weight to a sailplane so I think, in my own mind, that the only workable limitation is span.

(Goodhart). If I got the question right, the real point is how are we going to get the cost down. You started, I think, from that point and it appears to me there's one very simple answer in getting the cost down and that is we've got somehow to get long production runs. Once we get somebody producing 500 or 600 of one type of glider, the costs will come rocketing down. That's why I'm very interested in backing class. I should add the;, 0 my original statement on class racing and I don't mean to the exclusion of the continued development of standard class but perhaps it will arise as a thriving competition class in addition to the standard class.

Question: Dick, your discussion about flaps has all been on the basis of increasing drag. As one raises flaps, one can increase the high speed end of the performance. Do you object to that in your design?

Answer: (Schreder) Not at all. I think the rule should be written so that you would be permitted to do this because it certainly wouldn't cost you five cents in expense to raise a flap above neutral and I see no objection at all and I think this is one of the added advantages of a flap over a dive brake.

Question: (Seibels) It seems to me that so much of the bureaucratic emphasis of this standard class thing has been rather arbitrary. We keep trying to limit performance-enhancing things that don't really cost that much money or even safety things, for instance, no tail chutes on a standard class plane. Well, I think that's a bunch of nonsense. If a tail chute which can be put into a plane for $100 can keep you from tearing up your sailplane, I think that's an economical factor that should be considered and it serves you no other purpose.

Answer: (Schreder) I would agree with that, and I think it would even be permitted under the present rules, except that you would have to have a dive brake that would limit the speed to Vne. But I would go along with the people who write the rules 100 percent in disapproving a parachute as the only means of a dive brake.

(Seibels): I didn't mean that. It's a great additional safety factor.

(Schreder): Right. Well, I think that you could, under the present rules, include a parachute. That's my personal opinion.

Question: (Byars) Why are not any of the five manufacturers of that class now willing to go to the tail parachute?

Answer: (Goodhart) Well, I should have mentioned, of course, you must have some speed limiting brakes and since you've got speed limiting brakes, none of the manufacturers deemed it worthwhile to put the parachute on, but I am reasonably sure they can do so if they want to. At also extra cost perhaps.

Question: (Art Hirst) Application was given to me for the standard class contest at Elmira but the contest director said that drag chutes are prohibited. If I show up with a drag chute I have put on that ship, am I illegal as a standard class?

Answer: (Schreder) I don't think that that really is quite accurate and I'm sure if you could prove that you did have dive brakes that would limit the speed to Vne , I think You would when they wrote the rule was that a parachute as a full means of dive brake is prohibited.

(Hirst): Take a standard class Cirrus, put a drag chute on it, and arrive at the Nationals this summer. You're legal. That's what you're saying?

(Schreder): No. I'm not saying that. I'm saying that I think that if you would write the contest board and point out that you were coming with a ship that had an adequate dive brake and you merely wanted to add a tail parachute, I'm sure that they would interpret this as complying with the rules.

(McMaster): Dick is referring to the SSA contest board and not anyone in Elmira. In other words, the rules are imposed on us and we are taking them as they were given to us, so I guess Mr. Ivans is the man you want to talk to. Is that right?

(Schreder): That's right. And I think it's just that they weren't thinking of somebody coming with a dive brake and a parachute; they were thinking only of the parachute. But really I don't see any reason for the SSA writing any rule whatsoever like that because they have decided that they will abide by the present or the current standard class rules as written by CIVV.

Question: I have another question. I wonder if, in the history of soaring, in this decade at least, we have ever had to use dive brakes at VNE for any reason whatsoever.

Answer: (Schreder) Well, I don't think I can answer that because I don't know of any case but I think the requirement, in this country at least, is a very, very harsh design requirement because it's practically impossible to get FAA approval to fly in clouds in this country and that's really the only justification that I can see for that requirement. This requirement of lowering your flaps, for instance (if they do allow flaps), at Vne, is a very severe requirement if you can't justify it. It would be like requiring the builders of airplanes to be able to put their flaps down at Vne and this would probably increase the weight of the airplane 50 percent, to say nothing about what it would do to the occupants.

(A.J. Smith) The tone of the exchange is interesting and it's the same tone you hear in all conversations about the standard class and I -think you have to understand the background of the standard class a little bit. First of all, I'm convinced in talking with some of the originators that they don't like it themselves any more and this opinion that they express in private conversations with you is sometimes different from the opinion they express in public for publication, and further, everybody who has bought a standard class machine assumes that this original group of people backing the standard class were of one mind and they were firm in their convictions and they didn't change their minds and all this sort of thing, and I 'think that's where you are making a mistake. They have changed a lot and you are coming in now after the fact and you have sailplanes and you didn't really know that things weren't firmed up and now I think you direct a lot of energy and moaning and groaning about the situation - if I can be -blunt about it. What you should really be doing is to sort out your ideas about what the standard class should be or what any class should be and begin to get then on paper and get some agreement between all of you literally hundreds of people now who are interested in competition of some sort in something like the standard class. Once you have that firmed up in your mind, then you can come to people in the directorship of the Soaring Society with a recommendation and I think you'll find ready acceptance. You really don't get much sympathy now because you present so many different ideas and so many different reactions to the situation that if a guy were to try to pacify all of you, he would be doing some terrible gymnastics, you know, in terms of his attitudes. I think one way of summing up a conversation about the standard class is that if you are as much in favor of it as you seem to be, you should put together what you think the standard class should be and try to get that carried on up through the channels to the people who made the rules.

(Schreder): I think Jim has a very good point there and the directors of SSA, of course, who set up the rules for operations in the United States, are as varied in their opinions as you are and we've gone from one extreme to another as to standard class. We've chosen to ignore it and at the current time we're going to accept the CIVV definition of the standard class so I think if the majority of the standard class owners or people who are interested in the standard class could get a petition up and. all agree on what your idea is as to certain limitations that should be on standard class, I'm sure the SSA would go along with it and they would adopt that set of rules for our own standard class Nationals.

(Moffat): I'll say I'm very much in favor of what Dick has in mind but I also feel that we've made about as many changes in standard class as will be profitable for a little while. Now I admit quickly to being rather prejudiced in this in that I have a standard Cirrus arriving a week from Sunday. I think that there has to be a reasonable lead time on changes because, frankly, I think flaps are marvelous. There's no bigger fan than I 'of flaps for dive brakes but I think that it's going to require quite a bit of thinking to get a rule which does not outdate most of the present ships and think it's the very last thing we need, now that we have a rather good crop of standard ships coming along with very similar performances. I think it's very important that we don't outdate the whole flock of them, so Dick, I'd be able to vote really both ways on your proposal. Yes, I'd like to see what we've got stay for a while - at least until we build up what I would call a tradition of the standard class in this country -and, yes, I would like to see flaps as well but I'd like to have a little lead time on it.

(Seibels); A.J. Mentioned about the amount of energy that we put into moaning and groaning. I think perhaps one reason for that is that most of us don't have these hot-off-the-griddle German ships forced upon us by the manufacturers for us to fly in contests. We put in an order for a ship and if we're lucky three years later it may get here. In the meantime, we are watching all these developments. The standard class is loosened up and the open class goes to 21 meters and, in my case, I was obsolete two months before my plane ever got here. This troubles a lot of us because it does represent a pretty big investment. That's why we moan and groan so much.

(Moffat): My own standard class Cirrus was ordered in the spring of 1968 before any firm drawing was made. My open Cirrus was ordered, as I recall, in 1965, before there was any real idea of what it would look like. I think it is a misconception that people up here get ships forced upon them. It's anything but the case. I had a Kestrel on order for last year, for example, which would not be delivered in time for the contest. I think all of us have been going through considerable shenanigans - I know A.J. has this winter - over getting a ship to fly in the Internationals. I think the time will come when the better pilots get ships forced upon them as the better racing sailors get boats forced upon them today.

(A.J. Smith): I'm getting an LS-1 next week but it was hard to do because in the United States they stupidly delay the seeding of the international team until around Christmas time or somewhere around there and then you suddenly find out you're in a class that you are not equipped to fly in and have to try to find a sailplane. The only reason I got the LS-1 in this short time was that several people traded delivery positions on the list and I think, also, that some other friends have paid essentially weekly visits to the factory to remind them that they have a promise made to them on this particular ship. So it hasn't been quite all that easy, but I kind of stick with the moan and groan business. I don't blame you for being moaners and groaners. I simply try to point out that at the moment, that is a waste of time. I think that what you want to do, now that you realize how wishy-washy this situation has been, is quickly firm up a stop order that it’s going to take and throw it down. I think this is a much more effective use of your energy. I think you have been submarined really. Everything you say is true. I’m certain you bought the ships feeling that these class rules were firm and the people behind the concept were firm in their opinions and now you’ve discovered as I’ve been trying to tell people for four or five years now that that’s just not the case. I think on a short term basis, like for the next few weeks or month, if you really feel this serious about the situation, get your efforts together to put down some kind of a stop action or at least lay down a recommendation. On a long term operation, I would say continue as I recommended earlier - start saving up your money for the next ship. That’s sort of the way it. is, you know.

The Variometer System: Part II

By Gene Moore

This presentation ties into and is built on last year's presentation which was published in the first proceedings. It is suggested that a careful study of that first more basic paper precede a study of this paper. In this paper the key word is systems. A system is a group of interacting components. That is what I will emphasize here; the interacting or the contribution of each component to the system. We have basically three major components in our system. The instrument, the diaphragm type compensator, and the sailplane.

[Figure 1]

Figure 1 is a plot of sensitivity change with altitude. The conditions are standard atmospheric and the instrument is at the same temperature as the atmosphere outside the sailplane, and this is pretty close to the case in the sailplane. These data were obtained using an altitude chamber in my basement lab.

The important thing here is that the leaky capsule type retains essentially a constant sensivity with altitude change, and for these conditions the slope of the plot is only 3 percent change for about 30,000 feet of altitude. The next important thing borne out by this figure is that the thermal type variometers are essentially mass rate of flow instruments and their sensitivity drops about 10 percent for each 3000 feet of altitude increase.

Of the three system components mentioned above, the instrument itself gives the least trouble. If it is at fault, it is easiest to identify and the easiest to fix. The second component, the diaphragm type compensator, is connected in the system from the pitot line and its function is to provide a signal that exactly cancels the unwanted variometer signal that would be seen on the variometer when a change in altitude occurs due to a speed change, We will discuss the response of the diaphragm and also the time constants which will include the restrictions and the capacities in the system.

[Figure 2]

Figure 2 is a plot of response needed if the variometer system had a reference capacity of 525 cc and were being tuned for 4000 feet msl. The initial slope is 1.49 cc per inch of H20 pitot pressure change. Notice that the solid line departs from the initial slope especially in the high speed ranges. It is the nature of this type of plot that this important little difference doesn't stand out. This information is replotted. in Figure 3 as slope (diaphragm response) vs. pitot pressure.

[Figure 3]

Figure 3 is the most significant information in this presentation and should be studied very carefully. It contains a lot of information. The required total energy response, and I have selected 4000 feet msl, is equal to C2 effective divided by the pressure Altitude. C2 effective includes the volume in the thermos flask plus the volume in the flask side of the variometer line plus the volume under the diaphragm, C 3 Figure. 5.

These small extra capacities were really not too important when we were flying over very limited speed ranges. However, as the speed range increases -we are actually considering speeds up to 200 mph as far as this design work goes - it becomes important. In Figure 3 the straight, solid top line actually represents the solid line on the previous figure - the required diaphragm response. This is what happens. Our initial slope, as we saw in Figure 2, is 1.49 cc per inch of H20 pressure change on the diaphragm. This is the left, or starting point, in Figure 3. As we dive and pick up speed, we move to the right in Figure 3 and the diaphragm is displaced toward the bottle. We find that as we move to the right side of our plots we have displaced our diaphragm because of the 20 inches of pitot pressure. We have actually moved the diaphragm and decreased C2 effective by 28 cc. At the same time, we are not where we started. We have dropped; because at altitude you can trade each inch of pitot pressure for one inch of pressure altitude; and we have actually descended 20 inches of pressure altitude, so the pressure altitude of 352 inches of H20 is not increased to 372. So, if we work it out again, the response required on the right (or high speed) end is now about 1.35 cc per inch of pitot pressure. That says that we really don't want a perfectly linear device, we want a device that is almost linear but falls off on the high end.

The test that we perform with the dynamic bench calibrator involves the total energy system that is set up according to these rules. We start at high air speeds and climb at a given rate, either 1000 fpm or 2000 fpm. This is what the sailplane would actually be doing. While we are doing this maneuver we will read the variometer in the total energy compensated system. Any non-zero reading is an error in the system. If we are climbing at 2000 fpm and we show 200 feet on the compensated variometer, this is a 10 percent error. We find that we are able to adjust the compensator so the error will be less than 10 percent above 100 mph and less than 5 percent between 100 mph and stall. Figure 3 shows the measured response of a typical unit adjusted for 4000 feet msl.

[Figure 4]

To check out the diaphragm response, I want to offer another system that is less complicated than the bench calibrator. The set-up in Figure 4 will do the job. What we are checking here is the response, that is, the change in volume divided by the change in pressure such as we started with in Figure 2. Figure 4 shows two simple U-tube manometers. Syringe 1 and syringe 2 are simple throw away 10 cc capacity types. They are good for over 100 mph. We set up the system just as in Figure 2. A trick in running this system is that there is some interaction between syringe and syringe 2. To start with, you would have syringe 1 extended (pulled out) and syringe 2 run in to zero (pushed in). Then start applying the pressure with No. 1. While you are applying the pressure with No. 1 with your left hand, just back syringe No. 2 out with your right hand and maintain the null. You can perform this test quite easily and you and limited only by how much you want to refine the test. You could use electric manometers in place of the U-tubes and measure pressures to 100ths inches of water. You can also refine the volume measurement, but generally speaking, these throw-away syringes will resolve 2/10th of a cc, and I think that is close enough for this type of test. This concludes the discussion of the diaphragm.

[Figure 5]

The third part of the system is the sailplane itself. This is what we face. We take our system out and put it in the real world. In Figure 5, the variometer system is on the right and the sailplane is shown on the left. RP and RS are the pneumatic resistance of the pitot and the static lines. C 4 is the biggest culprit. It represents the collected volume of all the other instruments in the sailplane that require a static connection. The manner in which C 4 trouble manifests itself in the sailplane is as follows. You get the vario system on the right in Figure 5 all tuned up and working correctly on the bench at the altitudes that you have selected and then take it out and put it in the sailplane and go to altitude (your compensated altitude). Then perform a very rapid pitch maneuver. This is a pretty abrupt maneuver which has about a 5-second cycle, about 2-1/2 seconds down and 2-1/2 seconds up. You rotate just about as fast as the ship can rotate in pitch. With this situation, and with tail static ports and some extra capacity on the panel (C 4), your first indication (with back stick) is a big down. And it’s a big down! And the correction for this erroneous reading is to add restriction at R 1 to slow the pitot until the signal from the pitot and the static lines are in phase. You can do more to correct your total energy system by changing R 1 than any other one thing you can do. We’ll make a little proviso. The diaphragm response has to be pretty good. Figure 6 describes the bench calibrator. It has an air speed indicator, rate of climb, and the variometer. If you were making one of these units, your variometer would be the one shown here as the indicator 1. One of the questions frequently asked in letters I get relates to R4 and R 5’ I think the thing I failed to do last year was to get it across that these really had to be instrument quality fluidic elements. They must support 40 inches of pressure from pitot (Figure 6) to atmosphere; the reason being that we are operating to 20 inches at the virtual static point which is only half of the total pressure that R4 and R5 have to support. These restrictions must operate under linear conditions. The idea is to make R4 and R5 operate at high flow rates so that we can ignore the small flow required by the static side of the variometer.

[Figure 6]

Another point is that you should have a filter on the intake to the pump. In my case, the pump is the power unit from a tank type vacuum sweeper. The filter that comes with the sweeper is sufficient to take all air pollution out so that you won’t be blowing small airborne particles into the restrictions and through your instrument system.

[Figure 7]

Figure 7 shows construction detail for R4 and R5’ These are constructed by taking 8 pieces of 1/32 inch I.D. brass tubing and placing them inside a thin walled brass tube that is 1/4 inch O.D. The space between them is filled with epoxy so that the only air path is through the bore of the small brass tubes. A convenient way to do that is to buy these small tubes in 12-inch lengths. You can get them at the local hobby shop. Seal the ends of the small tubes by soldering the ends shut; fit them inside the big tube; suck the epoxy up through the space between tubes with a syringe; then let the epoxy cure. Saw the ends off and cut them to length and you have the two restrictions. Don’t try a short cut and cut your little tubes and mix them so that they don’t run continuously through R 4 and R 5’ This whole exercise is really a beautiful way to measure the I.D. of small bore tubes in that the pneumatic resistance of these small capillaries is dependent upon the bore of the tubes to the 4th power of the inside dimension. If you will do as I say and use continuous lengths and then cut them in two, you can come out with units that are fairly well matched. If you want to tune a variometer at something other than ground level, you must adjust the ratio of R4 to R5'. For example, at 3000 feet above the level of the bench calibrator, R4 should be 5 inches and R5 should be 5.6 inches. This is just the pressure ratio of the two altitudes.

[Figure 8]

Figure 8 details the compensator that we showed last year and it included all the restrictions and the precautions and the provisions that we thought necessary to make a satisfactory total energy unit to fly over a wide speed range. There are some things that we found out. The first thing was that the adjustable spring was very complicated and it required such a large volume of cutout area above the R 2 restriction that we had, effectively, a second capacity (C3 Figure 5) that was not working through a restrictor. This caused enough trouble that we redesigned the unit and made it much simpler to build -and probably much easier to copy - if you are interested in building one.

[Figure 9]

Figure 9 is the unit that we make now. The figure is somewhat misleading because it is not to scale. Try to keep the volume under the diaphragm as small as possible.

We recommend for a starter that you use 2 inches of 0.025 inch capillary for R1 and R2' This will give you about a 2-second time constant. Then you fill the reference capacity with three Chore Girl pot cleaners. These are little metal scouring pads that have no soap or tramp metal, and they are very clean. You just place three of them in a pint bottle and it makes a nice loose pack and does a very neat job of making the process very close to isothermal. The change in scale factor is insignificant.

I have some numbers here that you might like to note. The spring is one inch long, 0.475 inch O.D., is made of 0.050 inch steel wire, and has 6 free turns. The course adjustment is made by adjusting the number of free turns. If you determine that you have too much compensation, just increase the height of the epoxy button and short out, so to speak, a half of turn or a turn until you get up into the range that can be tuned easily just by changing the tension on the latex diaphragm. I would say that, typically, you have about 2/3rds of your spring constant in the spring and about 1/3 in the latex. The only way you can change your response is to change the spring constant. You don't get anything by changing the tension. You must change the constant and the constant here is the parallel combination of the spring rate of the wire spring and the spring rate of the latex diaphragm. We can get enough adjustment in the latex diaphragm that we can adjust the compensator response quite readily. This concludes my comments on the diaphragm compensated total energy system. Are there any questions?

Question And Answer Period

Question: Please comment on adjustable compensators. There is a new one out. I think that PZL also claims to be adjustable. What does this mean and is it really true?

Moore: What this new device does is to provide a couple of fingers that extend through an O-ring seal and actually turn the little washer inside the PZL from the pilot's side of the panel. This will change your spring tension but it will not change the spring constant. You must change the spring constant to effect the response. It won't do the job that I'm talking about. All it could do would be to allow the pilot to move the spring back to where it should have been in the first place. In other words, he can find the factory range where it is against the diaphragm with no preset in the spring. You can probably turn it enough to get in a lot of trouble if you screw the tension up too much. Then you will run out of compensator entirely when you slow to thermaling speed and then your instrument will be entirely uncompensated right at the range in which you want to fly. If the spring bottoms out at 60 mph and you want to fly at 50, you won't have any total energy at all.

Question: Gene, if that were a variable wound coil spring it would work wouldn't it? Different spacing?

Moore: No. However, if you put a little shaft inside the coil spring with a bridge that would wind down through the coils so you could change the length of that spring, it would work, The basic problem is that the PZL simply doesn't have enough capacity to get much of an altitude adjustment anyway. The way you must fix this is to change the volume. If you have a PZL system that is working now at your lower altitudes and you're going to go to Marfa, the safest thing you can do is take some volume out of your bottle. Put a little section of closed cell polystyrene or something in there. About 40 cc would give you 3000 feet altitude increase. It will change the calibration of your instrument, it should be noted, but that's a minor penalty to pay for a good working total energy system.

Question: Over how much speed range will the normal PZL compensator operate?

Moore: Well, of course, that depends upon the altitude. We had some plots in the Symposium Proceedings last year and I believe they showed some typical responses. Generally from about stall to over 100 mph. Where you really eat up the response is when you get to the high speed range. A little bit of air speed change here is a lot of pressure.

Question: (Squillario) I have the eternal question, Gene and Wil Schuemann. When are you going to make some of these instruments?

Moore: I think we answered that last year. We're tinkerers, we're not manufacturers.

Question: Surely you don't think that the 10 percent drop in sensitivity with altitude is critical?

Moore: Well, yes, it is. I think that you should have your system set up for what you think is going to be your mean altitude throughout a contest period. Over the past year, in working with these things, I en. more convinced that we have more of a problem in the time constant than we have in some of the responses not being right. We can set the response on the bench calibrator but we can't set the time constant. The sailplane is involved in that problem too strongly and you should have a flight test. That is really why Wil and I wouldn't be interested in doing any consulting on variometers unless the guys could come to Cumberland and have a flight test and get it checked out. It won't work out without a flight test. You'd be unhappy about it.

The only instrument that you can buy right now that has all the elements to do this job is the Ball, and it does it very nicely.

Question: Why did you decide not to make the leaky capsule type like the Ball, where you don't have to worry about altitude?

Moore; I was looking for something that I could do in the basement. It is more difficult for me to work with his technology with a soldering gun and a pair of pliers. The thermistor is a much simpler unit to build starting from scratch.

Question: Is it faster than the Ball, for example,

Moore: Yes. You can make a thermistor unit as fast as you want, but we don't need all that speed.

Question: What, if any, is the objection to the BSW?

Moore: Well, the BSW leaves the pilot with the problem - what is he going to do for total energy. You see, that is the important thing. They need to furnish a working total energy device with their variometer. It's otherwise a beautiful system. A very nice instrument. It is well made and has a beautiful tone, if you're a musician. It's quite pleasing. There are a lot of them sold but it still leaves the pilot stuck with solving the total energy problem.

Question: In other words, the ideal total energy compensator -with the BSW system would be as good as any system?

Moore: Yes. However, it would fall off in sensitivity with altitude. If that doesn't bother you (it wouldn't bother me) then it's O.K. It will decrease in sensitivity as you increase altitude.

Question: Gene, what do you recommend as a compensator to be used with the BSW?

Moore: I would recommend one that was made using the ideas discussed earlier. Whether you or someone else makes it. Incidentally, you can make one with a couple of Skippy peanut butter jar lids and a spring and a diaphragm. It doesn't have to be cast like Figure 8. If you want to do the job, there is enough information here to do it.

Question: If the Ball variometer has all these advantages, why isn't it more popular?

Moore: I think that pilots really haven't found out how good it is. That's my personal opinion. It's got an altitude adjustment that will go from sea level to about 5000 feet msl. Incidentally, I found that it requires about five turns per 1000 feet. You might want to make a note of that if you have a Ball.

Question: Have you found that the Ball variable total energy compensator works well?

Moore: Oh, yes it works. If it isn't working, you may need to take out or add a little restriction to R1. Ball has an R 1 in the pitot approach so you may have to adjust this restriction to compensate for C4 in Figure 5. Question: For a quick fix in your pitot, could you just change the length of line? Maybe by putting some extra line in and then tuning it? Moore: That would be a lot of line because one inch of 0.025 inch restrictor is equivalent to about 20 or 30 feet of line. A needle valve would be the best.

Question: Is there a needle valve type restrictor available?

Moore: I think many instrument companies have a suitable type of needle valve. Anyone selling scientific equipment would have it in the gas chromatography field or industrial instrumentation. For example, Imperial Eastman Company has a one degree taper needle metering valve in their Poly-Flo fittings that is fairly inexpensive. About $6 to $7.

Question: But this would slow your air speed, wouldn't it?

Moore: Don't put it where it bothers anything but the variometer. In other words, put it after you tee off the pitot. No. Don't get into your other instrument system.

A Synopsis On Design - Present And Future

By Dick Schreder

A Synopsis on Design - Past, Present, and Future - I am adding past in there because I think we have come a long way in the design of sailplanes. In the past, of course, we started out with wood, plywood, and fabric. This era ended about 10 years ago when most of the people got into competition with plywood ships and found that they had trouble maintaining the surfaces and keeping them smooth. Many people such as A.J. Smith struggled for many years with ships like the LO-150. They spent all winter trying to smooth the wings and. when the weather changed in the spring they suddenly found that all the gunk they had put on the wings in the hollows had caused humps when the hollows had flattened out. This encouraged everyone to look for better materials and better methods of construction. In this country, the Schweizers went to metal and most of my work was in metal. In Europe, they went to fiberglass. There is always a question - which is better? - fiberglass or metal. I think that they both have their place and should be used where they work the best, One of the reasons the Europeans went to fiberglass, principally in Germany, was because they developed the fiberglass technology ahead of everyone else. They also had a very great reluctance to go to metal because they simply didn't have the technicians or the people who were familiar with metal. They have, therefore, led the world with fiberglass ships. To come to the present time, we now have less wood, more metal, and lots of fiberglass. I think that the trend in the future will be away from fiberglass. It will still be used, but I think we will go more to metal. My reason for saying this is that the prices of sailplanes are getting very high. Most of you who have sailplanes on order certainly know this., The prices are continually going up. The West German mark was re-valued, to our disadvantage in terms of dollars, and the prices have gone up additionally on these ships. The reason prices are high and the reason I say we are going to metal is that I believe we can build ships of metal in fever man-hours. I have toured all the plants in Germany and watched them build ships from fiberglass and, contrary to most opinions, the man-hours required to build the fiberglass ship are generally higher than those required to build a metal ship. Bolkow (which, in my opinion, has the best control and the best methods of all the plants I was) claimed that in building the Phoebus, they required 900 man-hours for each ship. At our rates of pay, 900 man-hours results in prohibitive cost figures. I think it is out of the question to build fiberglass ships in the United States. I am not sure that all of you are familiar with the general methods of fiberglass construction. Most of the wings have sandwich type surfaces. There is an upper panel, lower panel, front web, and a rear shear web. Quite often they have another shear web at the point of max thickness. The wing is built in two halves, the shear webs are glued, and then the two halves are assembled. The halves are built in female molds and they start out by laying the top skin into the mold, and they lay up two or three layers of fiberglass, building in more layers at the root, and then they begin fitting in small sticks of balsa wood. They run spanwise in the wing. After the balsa is in place, another inner layer of one or two sheets of glass is added. This method of construction is very, very time consuming and costly. At the Bolkow factory balsa is purchased in very large chunks and each piece is physically measured and weighed. They then calculate the density and mark it on each block of balsa. They stock these blocks in large bins and saw them up into small sticks about 3/8 inch square. The balsa is laid in accordance with the plan form of the wing. They use their heavier densities in the root and gradually change to lighter densities as they work towards the tip. You can imagine how costly it is to keep control and records on all of this balsa and to fit these pieces. When they come to the joints, they don't just butt the balsa sticks together, they scarf the ends so that they will have full strength when they move together. I think you can see that this is a very expensive way to build wings. Some of the companies over there, Schempp-Hirth for instance, I believe have gotten away from balsa and are using foam. Apparently the foam is working out all right and it is certainly a cheaper and quicker way of performing the same function. I think that Schleicher and Bolkow built a few fuselages the same way with balsa. Some of the other companies are using pure fiberglass structures, with a thicker skin. It's a little bit heavier but is cheaper and easier to work with.

There aren't very many people building sailplanes out of metal at the present time, using conventional construction. Schweizer's designs have more or less conventional construction throughout. The wings are built up with spars to carry the loads, ribs to give the shape, and aluminum covering. This conventional metal construction requires fewer man-hours than fiberglass but this type of construction still isn't good enough. I think in the future, in order to get the price of sailplanes down, we must go to even simpler methods than we have used up to this point. On the HP-15, I attempted to build a wing of much simpler construction. The wing on the HP-15 is built as follows: There is a top skin and a bottom skin. These skins are heavy at the root (1/16 inch thick). There are bent sheet metal front and rear spars. The leading edge nose cap of plastic or aluminum closes the box.

The entire wing between the front and rear spars and the top and bottom skins is then filled with aluminum honeycomb with the cells running vertically. This type of construction simplifies the wing considerably because all but three of the normal wing ribs have been eliminated. The honeycomb next is cut and glued into the wing. This wing panel is as easy to build as the average spar in a conventional wing. The construction time is cut to about 25 percent of that required by conventions methods. Of course, the ailerons and flaps are sheet metal and hung onto the back with piano hinges. I think in the future, in order to lower the price of sailplanes, we must go to this type of construction on wings. I am talking mainly about standard class sailplanes because this class will become more popular as time goes on. There still will be some exotic ships like the Sigma, as described by Nick Goodhart, and others like the Nimbus. Such super racers will be hand built and high cost must be expected by the buyers. As Nick said, they have $100,000 invested already in the Sigma. We can't afford to spend this kind of money on standard class sailplanes or the type of sailplanes you people want to buy. Even the present prices of $8000 or $9000, I feel, are too high for most of us. We must, therefore, go to these simpler types of construction.

Fiberglass is hard to beat for fuselage nose sections. Aluminum is better for the tail boom and tail surfaces. With this type of construction, we can use a very simple fiberglass structure and add some metal to take the wing loads, the wheel loads, and tie into the tail boom. In the Toledo area there is a very good boat manufacturer who makes sailboats out of fiberglass. This company has quoted a price of about $300 to $400 for a complete pod. If you could get a pod for even $500 and just add a simple tail boom, you would have a very simple fuselage at a reasonable price. In fact, it would be the type of fuselage that, if damaged, you could afford to throw the pod away, get a new one, and hook it back up to your tail boom. It would also lend itself very well to low cost repairs.

I think this is the type of ship we are going to see in the future. This type of construction fits very well into the home builder's basement type of project. We are going to continue to see a lot of ships built by home builders, especially if we can get the man-hours down. An HP-14 can be assembled by an experienced builder in around 1000 man-hours. Even that is too much because the average fellow just can't afford to work for a couple of years to build a ship. He wants to get something finished sooner than that. I feel that with a little thought and preparation, this type of kit could be put out so that it could be assembled in about 500 man-hours, and the cost could be held below $3000. This price would fit a lot more pocketbooks. If we want scaring to grow and want to see ships built in this country, I think we are going to have to resort to this type of construction. One of the problems we are having now is getting people to use the simple flap. They have been approved by the CIVV for world competition in 1974, and by vote of the SSA Board of Directors for immediate use in the U.S. I have a list of the advantages of the simple flap and I would like to run through it. I know some of you people have flown HP-11's, HP-13's, or -14's, and you realize what some of these advantages are. Most sailplanes, of course, that meet the standard class specification now have dive brakes, and they have some pretty serious drawbacks. First, when you pull out the dive brakes on the average ship that has the DFS type, the stalling speed increases. In other words, if you are coining in to land with open dive brakes, you are landing about 10 miles an hour faster. With a simple flap, you land about 10 miles an hour slower. This means that when landing in a very bad field, you will do less damage if you run into rocks or stumps, or a very rough terrain type of field. Also, you will land shorter. By actual test in the HP-14 with no wind, we found that we could land in 88 feet from the time we touched ground until we stopped. The flaps are more effective at low speeds. Most of the DFS type dive brakes are very powerful at high speeds but as you slow up they get less effective. The DFS type of brake is very difficult to build because you have to have a slot in your wing anywhere from 5 to 8 feet long. From a structural standpoint, it is very difficult to build. As the wing flexes you get differential bending at that point. It also weakens your torque tube, your torque box, and it gives you problems when the wing flexes because the wing structure bends while the dive brake itself stays straight. Some of the European ships have solved this problem by having a small strip that is spring loaded so that it will lie on the surface as the wing bends.. Also, with all of this complicated structure right in the most critical part of the wing, cost of construction is seriously increased. The simple flap, on the other hand, is nothing but an aluminum triangular shaped box usually with no spar in it. They can be driven from one end so that no parts are required out in the wing to operate the flap. Another problem with the DFS type dive brake is with extra drag when retracted. All of you who have owned ships with a DFS type brake have tried to fill them. When you are flying in a contest and get into the air, the wing bends, thus forcing the clay to pop out. You no longer have laminar flow over that section. The simple flap is lighter in weight because the mechanism and brake boxes are eliminated.

One of the reasons the standard class requires the speed limiting dive brake is that if a student pilot gets caught in a cloud he is supposed to be able to slow up the ship and get out of the cloud. I have found, in flying in Europe, especially in England, that every time you get up in clouds you usually get icing and usually come out of the bottom of the cloud with a load of ice all over the airplane and hope that it will melt off before you get to the ground. With the DFS type dive brake sticking out, that is the first thing that the ice builds up on and I am not too sure you will always - be able to get them back in the wing. When we flew in the Internationals over in England, we iced up in every cloud above 8000 or 9000 feet.

Another advantage of the trailing edge simple flap is, when making an approach to land, you can come in at a steeper angle than you can with any of the ships I have ever flown with the DFS type dive brakes. Also, when you put the flap down, it puts the nose of the ship down so you have very good visibility over the nose to see the field in which you are landing.

A further feature that you get with the trailing edge flap when you put the flap down is that the decalage angle between the wing and the horizontal tail is increased. This tends to increase the longitudinal stability. In most of the HP's, when you are making an approach with the flaps down, you can let go of the stick and be very stable. When the stick is pushed forward and then released the nose will pop right back up to the trim speed.

An additional flap advantage is realized on takeoff. You can get off the ground much quicker because down flaps have the effect of increasing the angle of attack of the wing and gives a higher lift coefficient.

Therefore, if you are taking off in a crosswind or under adverse conditions, you can get into the air much quicker than you can without a flap. I have mentioned that this type of flap does not require any special bracing in the wing as would be required with the DFS type.

When you are flying at relatively high speeds in gusty air with the trailing edge flap, you actually strengthen the wing when you put the flap down because it moves the center of pressure inboard towards the fuselage. If you are flying at high speed you can lock out at your wings and they will actually bend down because at the higher speeds the angle of attack of your wing outboard of the flaps is negative and you are getting negative lift on that portion of the wing. The reverse is usually true on the DFS type dive brakes because you kill off your lift in the area that has the brakes, and then the wing from the brake to the tip has to carry the weight of the ship. They had some severe problems with this phenomenon on the Dart. In some of the early tests, the wings bent up very sharply. Subsequent calculations revealed that the spars were below the necessary strength in this condition. The spars had to be reinforced before flight tests could be continued. There is also a possibility with a trailing edge flap of getting some improvement in performance at low speed and at high speeds by varying flap position settings. There is a definite increase in performance when you are running at high speed and can put your flaps up slightly because it lines up the fuselage better with the airflow and instead of flying along with a nose down, the nose comes up and the ship trims in a more level attitude. At low speed there are flap advantages because you can fly a little slower, which allows a smaller turn radius and allows the sailplane to circle a little closer to the core of the thermal. On approach, you have much better visibility as you are coming into the field.

I think that in the future, the material used in sailplane construction is going to be determined ‘by economics. If we can save money by using fiberglass over metal, then certainly fiberglass should be used. If metal will work out better than fiberglass, then it should be used. Of course, you have some other aspects to consider and that is pilot protection. I personally believe that metal in the fuselage area is a little bit better because when it buckles it still retains some strength. When fiberglass lets go you don't have much left.

This is about the extent of my discussion on types of materials and the trends in design. I think Nick gave a very good presentation of the trends in open class ships. About the only way this class can go from now on is to higher aspect ratios and greater spans. The increase in span and the resulting increase in chord will give a better Reynolds number. Almost anybody can sit down with a pencil and paper and find that if you can increase the span and increase the Reynolds number, improvement of the glide ratio is automatic. Of course, as has been said earlier, glide ratio isn't everything, and as the ships get bigger, the problems get bigger. There are very real problems of being able to trailer the ship, tear it down, and assemble it. Longer wings introduce other problems. Increased droop in the wings at rest is one. Since it is quite impractical to keep making the ship higher (although in the case of the Sigma they have done it by extending the landing gear farther), long flexible wings will about touch the ground at rest. If you land in a field with high grass or a high crop, one of those wings is going to catch and you are going to do a vicious ground loop. With such a large ship, the chances of damage are much greater than with a smaller standard class ship. I think-that most of us are afraid of these bigger ships and feel that the open class is going to turn into a giant class. Maybe these practical disadvantages will limit the size of the ships, but certainly there is no limit to the cost and the complexity. This is one reason why I have become more interested in the standard class. Only time will tell where we are going, but as of now, it looks to me like the standard class is going to become much more important and much more attractive to the average pilot. This is the reason why I built the HP-15 and I intend in the future to do most of my work and experimentation in the standard class. I do wish that we could get more pressure to get across our feelings on this flap situation because I feel that it is a definite improvement. I think it would make all of our ships safer and less prone to damage. The people in Europe, of course, have had very little experience with flaps and they are most reluctant to make the change. I think if anybody has any questions they would like to ask, this might be the time.

Question And Answer Period

Question: (du Pont) Discuss the dive brake design of the standard class HP-12.

Schreder: I flew the HP-12 in England in the Internationals in 1963. We took the outboard half of the flap and hinged it at the top so that when the bottom of the inboard section came down the outboard section went up. It fulfilled the requirement of the rules in that it didn't really change the camber of the wing but I didn't feel that it was a very good solution to the problem because here we were trying to comply with the letter of the rules which say that you should have no camber changing device. We were actually making the construction more complicated and more costly. We. of course, lost most of the advantages that flaps normally have and they were not as effective. For the same speed or the same flap setting, the speeds were higher.

Question: I understand you have a very unusual root attachment on the wing on the HP-15, and I wonder if you could briefly describe that to us and tell us how it worked out.

Schreder: On the original design of the HP-15 wing, there was quite a problem in how to join the two wing panels together, since all of the loads were being carried by the skins. You have the two wing panels coming into the fuselage like this, and the first attempt to make the wings was to build stub spars in the roots similar to the European fiberglass designs. So, in one wing, we found in order to carry all of the bending loads here at the root, that these spars had to be made of solid 7075-T6 aluminum. They were screwed to the skin. There are two of these on one side and one on the other side. The single spar was 1-1/2 inches thick and about 4-1/4 inches deep. The two straddling spars in the other wing were each 3/4 inch thick and of identical shape. These two spars weighed 44 pounds. This was a tremendous amount of weight, and every time I lifted them I said to myself, “There must be a better way.” In working on the problem I came up with this kind of solution. We brought the wings in to about 1-1/2 inches apart, then took straps of 7075-T6, 1/2 inch thick and 3/4 inch wide, and riveted them to the skins. These straps are riveted to the skins with 3/16 inch rivets and there are 10-32 bolts through the ribs. In other words, there are 11 straps on one side, and another 10 over on the other side, top and bottom, and as you put the wings together, they interlock like a piano hinge. The pin holes are 1/4 inch. The two pins are curved to fit both the top and bottom contours of the wing -with handles on them. To put the two wings together, the fingers mesh. You put the pin in and shove. The pins are curved and you wouldn't think they'd ever go through but they do and it's a very efficient and lightweight connection for the wing. The total weight of all of these 42 straps and the two pins, is 11 pounds. The net saving on this type of construction is 33 pounds or about 10 percent on the wing weight.

Question: I was curious as to the bonding method of the honeycomb and the skin. What do you use to bond your honeycomb to your skin?

Schreder: When I first proposed this type of construction to the Honey-comb Corporation of America, they said that it was impossible to do without an autoclave and without very sophisticated equipment; but we went ahead and finally got our honeycomb from Hexcel.

I got the blocks of honeycomb from Hexcel Corporation. When you see the block, it looks just like a solid block of aluminum. They are two inches thick - 2000 sheets of aluminum foil 0.001 inch thick, laminated together to make a 2-inch block. We cut the blocks by band sawing the contour into the block. When you pull the block apart, it will open up like a Japanese Christmas bell and form hexagonal cells. But when you pull them apart to form the cells, the block shrinks about 20 percent. So, in developing the contour, you have to allow for this shrinkage so that when you pull it apart you will wind up with a width that will just fit. The overall depth is about 1/16th greater than the cavity in the wing so that there will be a bit to trim. The block is stretched out to a 12-foot length. The spars and the bottom skin are coated with epoxy cement. You must etch the skins very carefully first to assure a good bond. The stretched honeycomb is laid into the cavity (with the top skin off). The wing rests on a supporting structure mounted on a table to maintain the lower skin contour. You push the aluminum honeycomb down into the cavity and put weights on it to hold it in place so that it is touching all the way along the bottom. Then let it set until the glue cures. You then take a light above the core, look down into the core through the cells, and if there's even one single cell that hasn't bonded to the lower skin, it Is very apparent because you get a different reflective pattern. If there are several cells, there will be a bright area where the glue hasn't touched the cells. In other words, if you didn't have good contact in one spot (if the honeycomb was up a little) then you wouldn't get any contact with the bottom skin. All you do then is take a hypodermic syringe with epoxy resin mixed in it and inject it down in one of the cells in the center of that area. We only had a few small areas, maybe as big as a half dollar, where we didn't get contact. The glue would run down the cell and spread out where there was no contact. When the cement rises to touch the honeycomb it forms fillets around the base of the honeycomb cells

After the voids were filled and the cement cured, the bottom half of the wing was finished. Templates are then laid from the front spar to the rear spar to check the proper contour of the wing. Special templates are then fitted every 18 inches. Since we made the honeycomb blocks a little bit higher than it had to be, the templates would be about 1/16th of an inch above the spar. A block of wood with sandpaper glued to the surface is used to sand the honeycomb. This honeycomb material is only 0.0007 inch thick and it sands very rapidly - much faster than balsa wood. You must sand carefully and keep fitting the template. You sand the high spots until the template touches both the front and rear spars and contacts the honeycomb all the way between. This is done at each 18-inch station and then a longer sandpaper covered board is used to bring the honeycomb down to contour between stations. Just run it back and forth in between until you can lay the straightedge spanwise and you have no high spots. Then you're all ready to put your top skin on.

The top skin is predrilled before epoxy is applied. A drill guide with 1-inch spacing is used to run a series of holes from the root out to the tip through the skin into the spar. All holes Are countersunk so that the rivets are all ready to put in. The skin is now ready to go on. You lift the wing up, turn it over and shake cut all of the shavings you got when you sanded the honeycomb. You put epoxy cement on the inside of this top skin and put the wing back on the form blocks that are mounted on the table. This takes all the twist out of the wing and holds the wing straight and level so that when you put the top skin on, your wing will have no twist and will be perfectly straight. Bricks are placed on the wing to hold the skin against the honeycomb.

The skin is then clecoed to the front and rear spars. Rivets are installed and covered with strips of tape so that riveting can be expedited from one end to the other. A more sophisticated arrangement would be to enclose the wing in a plastic bag after it was riveted and evacuate the air. I didn't bother to go that far.

The next question you're going to ask is what happens if the skin does not touch perfectly at some place. After the glue has had a chance to cure, you take the weights off and take a piece of metal and go along the top and click the skin. If there is any place where the glue did not make contact with the skin you will get a very flat hollow sound. On one wing we had absolutely no hollow spots. On the other wing we had two spots right about in the area where the two 12-foot skins came together and had a doubler plate on the inside. At the edges of the doubler plate there was an area several inches wide on each side of the doubler plate right at the top of the airfoil section. By tapping the wing I could easily outline the area that had not made contact. You take a grease pencil and mark off the shape of the void on a piece of plastic. Then you turn the wing over and lay the piece of plastic on the bottom and transfer those voids to the bottom skin. Drill a 0.040 inch diameter hole in the center of each one of these voids - just big enough for the hypodermic needle. You inject the epoxy through these holes. It goes down in the cell, runs underneath until it contacts all of the free cells. We drilled two holes. One that we injected in and another over in the corner of the void. When all the cells were wetted, the excess came up in the other hole and popped out the top, We then knew we had the voids filled. We let it cure and went back with a piece of metal and tapped on the top where we had the void and it sounded exactly like the rest of the wing. We then had a sound wing.

It seems like a lot of work but each wing took about one hour to put all of the honeycomb in place and to get it weighted down. It took three hours on each wing panel to sand the top down to contour, and it took about two hours to rivet the top skin and place the weights. I would say that each one of these wing panels could be assembled by two men in a day. In other words, you could assemble one wing and if you had the other one ready to go, you could get one riveted together and then go over to the next one and rivet it together. In two days you could put the two wings together. That is, you could put all of the honeycomb in the wing. This is a tremendous saving in time because only two ribs at the root and one at the tip were used in the whole wing. The leading edge was formed out of a thermoplastic high-impact material. The flaps and ailerons are simply bent up out of sheet metal.

Question: How large were the spaces in the honeycomb?

Schreder: The honeycomb that I used had 3/16th inch cells, and the foil itself was 0.001 inch thick.

Question: How about the weight?

Schreder: It weighed 2.0 pounds per cubic foot. That is about equal in weight to the lightest foam you can get. And incidentally, at the beginning of this project, we had intended to use urethane foam. We bought the very best we could get and made a test panel. This test section had the same dimensions as the root and was about four feet long. We had each end mounted to a 6-inch I-beam. One I-beam was tied down to the floor and the other was above the floor with a platform on the end so we could add weights. We tested this section and got up to four G's. We had the equivalent of shear and bending forces that we would get at four GIs when it began to show signs of failure. While we stood there and watched (it was upside down and what would normally be the top skin was on the bottom) it began to wrinkle inward. As that wrinkle progressed, it went faster and faster and all of a sudden it went in and the wing failed. We, therefore, figured the 2-pound urethane foam was too light so we got 4-pound foam. We duplicated the test and the 4-pound foam was getting to be an appreciable amount of weight. It was amounting to about 30 pounds of weight per wing and we didn't figure we could afford that much weight, especially when it wouldn't do the job.

We then immediately went over to aluminum honeycomb and the aluminum Honeycomb is roughly ten times as strong as the foam in compression for the sane weight per square foot. We ran the aluminum honeycomb lip to nine G's and broke our fixture, so we gave up at that point figuring that was good enough. Actually, the strength of this honeycomb is 50,000 pounds per square foot. You could lay one of these wing panels on the ground and drive the biggest truck, loaded with anything, up that wing panel and you would not crush the wing.

Question: Do you roll the skins?

Schreder: No. We preform the skins right in the shop at Bryan. We found that the nearest place to get skins like that rolled would be the West coast. We had gone through that once before. It was very expensive and we didn't get too good a job. We developed a method for bending them right in our shop and we had the exact contour prerolled into the skin. In other words, we tapered the roll from one end to the other.

Question: What contour was it?

Schreder: The contour we used was a constant radius, however, we could put any contour in that we wanted.

Question: Dick, how many joints do you have on the length of each wing panel?

Schreder: There are two joints. We had two 12-foot panels and then we added about five inches out at the tip just to make a standard class 15-meter span.

Question: Dick, you've had this out now for about a year or so. Have you found the epoxy still holding on all of your cells? Are there any voids?

Schreder: There are no voids. Of course, I am not absolutely sure that you have to be free of voids, unless you had a large void. The minute the skin starts to go down it touches the core and I don't think it would fail. I have clicked the wings several times since they were built and can find no voids.

Question: Would you care to elaborate on the HP-10, the basic philosophy, and how you ended up doing this?

Schreder: The HP-10 had a different type or construction. On the HP-10 we had wing panels that had double surfaces much like the Libelle wings only they were aluminum instead of fiberglass. We used a "Z" section at each spar and then another skin on the inside, and had a slice of constant thickness honeycomb -I believe it was 3/8ths of an inch thick. The trouble with this system is that in order to form these honeycomb panels, you must have very elaborate female forms. Building the forms was a much bigger job than building the wing. The forms had to have the contour. There was a built-up box of aluminum and it had to be made of 3/16th inch thick aluminum. Each rivet coming through the surface had to have an O-ring around it before you drove it from the bottom side so the air couldn't leak through. We had Goodyear Aircraft in Akron, Ohio, make these panels for us. They wanted $5000 for one form 12 feet long and the width of the wing. On the HP-10 we used a rectangular wing so that we would only have to have one form for the top surface and one for the bottom. If you made a tapered wing, that means you would have to have eight forms. This HP-l0 type of construction is, about, pound for pound, the same for the size wings we are talking about as filling the wing completely with honeycomb. With this system you have to have forms for the panels and this would be almost impossible for a home builder. You'd have to make the forms.

Question: Could you build a little larger chord than this and get away with it?

Schreder: Yes. There is no restriction on the size except that as you increase the volume of the wing, you increase the weight of the honeycomb, and if you get a very thick wing and a very wide chord, I am sure that the honeycomb would weigh more than the conventional ribs and spar. But for the wing that was built on the HP-15, this was by far the lightest type of construction that could have been used. The wing was only 4.312 inches thick at the root. The top panel carries the compression in normal flight and the bottom panel carries the tension. Since the wing is only four inches deep, in flight you get quite a noticeable amount of deflection. You soon get used to this deflection.

Question: How much did the wing weigh?

Schreder: These wing panels weighed, after they were painted, exactly 100 pounds each. This was a pretty low weight considering we had a 33 to 1 aspect ratio and a 12-G safety factor.

Question: (Byars) Would you review the design philosophy on the -15 and discuss how you coped with what you feel might have been the trouble that you had in Marfa?

Schreder: Well, the design philosophy on the HP-15 was to go to a much higher aspect ratio than anyone had used before. We had a standard 15meter span. The wing chord at the root was 24 inches and at the tip it was 12 inches. The thickness of the wing was 15 percent and the airfoil section was NACA 662/618. We found that with this particular airfoil we could lay constant radius curves over 60 percent of the chord. In other words, the part that we would have to make and fill with honeycomb had a constant radius - very little deviation from the basic airfoil. So this is one reason why this airfoil was chosen.

The problem I ran into at Marfa! We made one test flight before leaving for Marfa. On that test flight it was an unsoarable day and all we could do was make straight runs. The ship had a great glide ratio. This was borne out at Marfa. I don't think I ever flew with anybody at Marfa that I couldn't pull away from except the BJ-4. We made runs side by side at speeds up to about 150 mph, and our performance was almost identical until we got up to the very high speeds and then the BJ-4 would slowly pull away from me. I could pull away from most of the other ships. I didn't get a chance to fly with the ASW-12, so I can't speak for that.

My problem was when I got into a thermal. I couldn't climb and this was very embarrassing. You have no idea what kind of a feeling this gives you if you find a nice thermal and start working it and a bunch of characters like A.J. Smith and George Moffat come tearing over there way down below and shortly thereafter they climb above you!

Comment: (Steve du Pont) You'll get used to that!

Schreder: Thank you, Steve. I feel better already. Anyhow, meanwhile in the thermal... First of all, I could fly alongside other ships and could slow right down until I reached the HP-15's stall speed. The problem was when I got into a thermal and would start cranking around at lower speeds, I could feel this separation. I could feel the aileron shaking and I could feel the flaps shuddering - which indicated that the air was leaving the upper wing surface. It wasn't following over the top surfaces of the flaps and the ailerons. I felt that the angle of airfoil in the rear was just too great and I was getting about the same type of problem that Dick Johnson had with his mahogany bomber, where he had used an Eppler airfoil. It had a very similar shape. The maximum thickness was pretty far aft and the airfoil closed so rapidly back there that the air just wouldn't follow the upper surface at higher angles, intact.

After I got back home, I increased the root chord of my flap from five inches to eight inches. Now, this apparently has solved my problem. I've only flown the ship twice since doing this. We haven't had any soaring weather all winter, so I can't tell what's going to happen when we are out soaring. The two times I flew it, we had a K-7 up for comparison. We had very weak thermals where we could just about hold our altitude for 10 or 15 minutes at a time, and I was able to stay right with the K-7. So, I'm hoping that I've solved the problem; but I'll find out soon whether it is corrected or not,

Question: What is the wing loading now?

Schreder: The wing loading now is down to about 7-1/2 pounds. It was over eight pounds in Marfa.

Question: Aspect ratio?

Schreder: Down to 30 to 1.

Question: What's your indicated stall speed now, Dick?

Schreder- Indicated stall speed now is about 43 mph. It was 47 in Marfa with flaps in neutral.

Comment: (Moffat) It might interest people to know that at Marfa, I was doing a test with Dick the first day he flew, and I discovered that he wasn't climbing very well. I followed him around at the same speed to see what speed he was thermaling and it turned out to be 78 mph.

Schreder: You have no idea how I suffered.

Question: The arguments that have frequently been heard of dive brakes over flaps is that in the landing approach, when you get slowed down with the flap configuration, what do you do when you get in sink and need to dump the flaps *in order to make the field? The argument is that, well, if you've got dive brakes, you turn them off and that improves the flying characteristics so that you can get the extra penetration to make it in to the field.*

Schreder: This is really the only valid question against flaps but it really doesn't have any bearing and I'll tell you why. In the first place, when you make an approach with any sailplane, it is my theory that you should have 15 or 20 mph above your stalling speed, according to how gusty it is. You use either your flaps or your dive brakes, not to control your air speed, but to control your glide path as you approach. In other words, you always use the same pattern around the field and then when it looks like you are too high you begin cranking in your dive brakes or your flaps; and you maintain that same speed all the way down to your flare out. Now, this, I'm sure, is the best method to make an approach. In the case of using dive brakes, as soon as you see you are a little low you immediately retract but you still maintain that same speed unless you have to slow down to reach the field. But, if you are coming in on a normal approach angle and you can see you are getting a little below it you retract your dive brakes, You do the same thing with flaps. If you are coming around on final and it looks like you are a little too low, you immediately retract your flaps and, of course, your glide flattens right out. You continue until you get back on your glide path where you crank them down again. Now. the one thing you don't ever do is leave your flaps down and just keep pulling the stick back trying to zoom in to the field, any more than you would leave your dive brakes out and keep pulling your nose up trying to hold altitude to get to the field. So, I really don't think it is a valid question. Now, it's true, if you left them out and kept slowing down until you got to your stall speed with the flaps down and saw you weren't going to reach the field, there is nothing you could do.

Question; The question is, what if you slowed down too much for a flaps up configuration and, in reality, you're saying that this should never happen.

Schreder: That's right. They don't know how to use the flaps. And, the only people who ask this question are the people who have never used them. Comment: I've been flying HP's a lot since '66 and the situation he describes will never happen to a fellow who has made two or three or four landings with them. One of the advantages that Dick mentioned was a steeper approach. That immediately takes the situation and wipes it out. On final approach I'm anywhere from 200 to 400 feet higher than I would come in with a conventional glider and I could either overshoot the field flaps up or put both flaps on and undershoot the field. With these type of flaps you've got such a wide angle that you will never find yourself doing it short.

Comment: The advantage, then, is the slower speed on actual touchdown?

Schreder: That's right. If you did get yourself into a position where you couldn't make the field, you would be much better off with flaps than you would with dive brakes because if you are going to run into a fence or you are going to go into the boondocks across the road from the airport, you are much better off with flaps because when you see you are going to go in there, you just crank them down all the way, and, if you have a 10 mph wind you touch down at about 25 or 30 mph, whereas if you had dive brakes, you'd be going maybe 10 mph faster, and if you put the dive brakes out, you'd be going even faster. So, this is the extra safety feature of the flaps.

Question: Could you elaborate a little bit on the difference between tile tails of different sailplanes?

Schreder: Yes. I favor V-tails for several reasons. First of all, and most important, I feel that the V-tail is less likely to be damaged in landing. About the same can be said for a T-tail, although I think you could go into a higher crop with a V-tail than you could with a T-tail. The next point is that the V-tail is stronger than a T-tail. A T-tail has the mass up so high that if you do a ground loop and hit something with the tail, your horizontal stabilizer is probably going to keep going; and also, the T-tail (I've built both) is much more complicated to build and it just isn't possible, without adding a lot of weight, to get the same strength into it. And then, with the T-tail, it is harder to counterbalance the rudder. So, I prefer the V-tail because it's lighter, it's stronger, and it's simpler to make. In the air, I don't feel that there is a whole lot of difference between the V-tail and a T-tail, or a conventional tail. Sometimes the English don't quite agree with us on that. I will say this, I don't think the V-tail is quite as effective on the ground, but I don't believe you can depend on your vertical rudder to steer on the ground anyway because if you land in a crosswind you are not going to have any rudder control after you have slowed down below a certain point. We try to solve the problem on the HP's by having a steerable tail wheel; and I think that anyone who has flown an HP with a good steerable tail wheel can bear me out when I say that you can land even in a moderate crosswind and taxi right up and stop on your tiedown area.

Question: Is the V-tail cheaper to build than the conventional?

Schreder: Yes. You really only have two pieces to build In a V-tail, where you have essentially three with a conventional or a T. And, of course, in the V-tail, the two pieces are identical but are right and left.

Question: Dick, you mentioned that economics and safety were going to be primary criteria for design of sailplanes of the future. It would seem to me that this would be very true if the performance could be comparable to the fiberglass. Is there anything inherently better suited for performance than fiberglass or metal?

Schreder: I don't think so. I think that from a weight standpoint, the fiberglass and metal ships are about the same. I think it's a little easier to get heavy with fiberglass because it's easier to add more material. More resin might be needed in some places; and one of the problems of fiberglass is the difficulty of getting local stiffness. You can have a fiberglass panel that is more than adequate in strength, but, if somebody leans on it, they are apt to crack it,

Question: Do you wind up having to fill and sand on the wing like you do it on the others?

Schreder: No. On this wing we had absolutely perfect contours on the top and bottom and the only place where we really had to do any filling was where we had this plastic leading edge coming in. Even though it was the same thickness as our skin, you do get a little irregularity and you must spray it and sand it to get it smooth.

Question: Are you going to make an HP-16 anytime soon

Schreder: Oh, I wouldn't make any rash statements today one way or the other. I probably will, just judging from past experience.

Question: Are you aware of the efforts that have been made to use vacuum forming plastics in sailplanes, and, if so, would you comment on that?

Schreder: To use vacuum forming plastics? I'm not really aware of any efforts that have been made. Vacuum forming is a beautiful way of getting contours but I'm in the plastics business and I have yet to see a thermal plastic material that has any appreciable strength where you could use it for a structural member. It's very good for fairings. We used it for fairings on the HP-14 and the HP-11, but I haven't heard of any structural applications. I hope, someday, that there will be that type of material which can be used. I really don't see any reason why you couldn't imbed fiberglass in a thermoplastic material. The trouble is that it would be very hard to form it to make a compound curve where you couldn't stretch the fibers.

Question: You mentioned, in discussing this fiberglass pod, that it did not give you as much pilot protection as metal. Have you given any thoughts possibly to laying a metal mesh inside this fiberglass pod for strengthening and protection?

Schreder: No. I really hadn't considered that. The way we intend to get around that problem is to possibly use aluminum rails for reinforcing around the cockpit.

Question: Will you comment about the FK-3, the new German all-metal aircraft? I think you said you saw it and flew it-

Schreder: No, I didn't fly it, I saw it down at Marfa and it's a beautiful looking ship. It had a different type of construction. I'm not exactly sure what it locked like inside but I was told that it had a conventional spar and very thin skin but that they used urethane ribs. I don't know exactly how thick they were but they were spaced about every three inches. It was a very smooth wing and, of course, they got away from using any rivets where the ribs were attached.

Question: It was glued on?

Schreder: It was glued on. If it's been adequately tested, it looks like a good system. I'm a little bit afraid of urethane foam since we ran a test on it.

How To Practice To Improve Contest Performance

Goodhart - Moffat - Schreder - Smith

GOODHART: When Ed Byars gave me my orders for the panel discussion, he said to prepare opening remarks that would take not more than five minutes. I can beat that easily on this subject. The answer is "Yes" - yes today, yes yesterday, and yes tomorrow, and yes - every day that you possibly can. But perhaps I can expand on that for a few moments. What's the aim of practice? As far as I am concerned, the first and primary aim is to fly the ship completely subconsciously. No thoughts like I must roll into a turn and watch the yaw string to avoid slip or skid and pull back to keep the speed at 49 mph, or whatever. Instead, there must be simply the thought that the core of the thermal is over to the left, and there you are in it. I am convinced that you must get to that stage because the human brain is a limited computer, to say the least, and there are always far more problems to work on in competition flying than you can possibly adequately process. To have to spend quite a number of the available channels if, indeed, there are any appreciable number of them, on thinking how to fly the ship, is not going to leave you enough for other important matters in competition flying.

Assuming that you have your flying of the ship absolutely subconsciously organized, the next question is whether you have developed the ability to pick up all the available data and process it to the best advantage. Let's face it, you are really only a computer sitting there and your job is to sense all the inputs that are available. Some of them tend to be rather more interesting but really not so valuable. You sometimes get fascinating remarks on the radio which leads you to a feeling of perhaps elation when you hear somebody else has gone down or has gone back for a re-light, but that isn't going to find you the next thermal to the best advantage. You must try to reject the less valuable inputs but nevertheless pick up the more valuable inputs. Such things as the next cloud - has it got a, faint fuzziness around the edge of it? Is it, in fact, one of those types that is going to decay before you get there?

What you are really trying to do is simply to accumulate experience against which you can judge the incoming information. Some of the information comes in from the seat of your pants. Some comes in from your instruments. You must know your variometer system really well to the point where you really understand what it means. I have never had the privilege of flying with a variometer system of the Gene Moore standard but if you can interpret what it means when it is the ordinary sort that most people have to fly with, you are ahead. You can do a little better, I reckon, if you have had a lot of practice and watched it for a number of hours flying.

Then perhaps there is one final aspect of practice, and that is local knowledge. I rate this a long third because from what one has seen, the locals never seem to do outstandingly well in competitions. One very often finds that the chaps who come in from outside and don't know the area do just as well if not better than the locals. In fact, I'm not sure that the world championship has ever been won by the local on his home ground.

One finds that in a competition these days the top pilots all achieve very closely the same speed and you might conclude that that was the ultimate speed that was practical on that day, but I am strongly suspicious of this. I still suspect that if one did a perfect flight by always flying to that place where the best thermal actually was, went straight into it, climbed in it to the best advantage and went on to the next one, etc., one would achieve speeds of the order of 20 percent higher than we are achieving at present. Much of that accounts for perfection, and obviously you cannot do it, but the more you get to know about the air and its ways, the more likely you are to get somewhere near that sort of performance.

So as far as I am concerned, the answer to how to practice is to be clear on why you are practicing and set yourself clear goals. The first, and most important in my opinion, is subconscious flying. The second is to accumulate an enormous store of experience which provides you with something to measure the incoming information against. It is no good looking at a cloud. unless you have looked at thousands before and have an accumulated feel for their life cycle and where the lift lies under them. It is no good looking at a variometer unless you have an accumulated feel for what it is likely to do next, taking into account all the other information that may be available.

You're never going to get all the decisions right, but with more practice, you will get more right. After all, sell you have to do is get more right than anyone else. Then there's local knowledge, which I don't rate as being so important. Practice does one other thing for you as well, and that is it irons out the bugs in your ship, or it starts ironing them out. I have never ever got to the point where I have ironed them all out. How many times have you heard even the top flyers admit that something vent wrong during a competition flight? An instrument maybe, or perhaps even the seating wasn't as comfortable as it ought to be, and these things are absolutely essential. So to some of you, practice is absolutely essential There is one major problem. You never have time to do it.

MOFFAT: While Nick was telling you all these things I kept thinking yes, yes, yes. He had the right word to start with. I subscribe very strongly to everything that he said. While he was talking, I was busily jotting down a few things that I pay particular attention to. If I were going to start practice, as I probably am as soon as the mud gets off the field, which will be about the first of April, I think I would be thinking about the following things, which are, I am surprised to see, ten in number.

First, there is something you can do right now and something which everybody here is doing right now, as a matter of fact, and has been doing for a long time. That is to think about the ship; what you can do about it; what you can do to make it better; and particularly to assign priorities for what things come first and what things come second. It seems to me I see an awful lot of people who are always fiddling about with their ships but they never stop to think, as far as I can see, whether what they are doing is likely to improve the performance or only the appearance, or whether what they are doing is going to make a fairly obvious increase in performance or a very slight and probably nonexistent increase. Do the important ones first. I mentioned this morning some of the things I did on my Cirrus last year for the Nationals. They were, about in order: 1) lengthening the wings; 2) making the aileron horn covers; 3) making the tail skid in place of the tail wheel; 4) sealing the landing gear; 5) sealing the canopy. Then there were several other minor things that followed -sort of catch as catch can. I quite agree with Nick. You never finish. You never even begin to catch up with what is in your mind, as a matter of fact.

The second point is - when you practice, fly cross country whenever humanly possible. I find it very handy to keep track of the number of miles I fly in my log book. Everybody puts down hours. I put down hours and miles as well. I would expect to have at least 700 or, if the weather is any good at all, 1000 miles before I go down to Marfa, for example. That would be in April and May. That's not too much by any means.

Third point. When you are doing these practice runs, don't concentrate entirely on speed. Allow yourself some time for experimentation. If you see an interesting looking condition; a cloud that looks a little unfamiliar in shape; something that might be a wave or maybe not a wave; or just an interesting looking hole go ahead - take time out to investigate. See what happens when you go over there. The information can be extremely useful later on. I think a lot of pilots get mesmerized by the idea of whizzing around the course at a certain speed so they do only the most likely things to get them speed. Thus, they give up chances to investigate conditions, particularly, for instance, when you get one of those days which is about 7/10 overcast. It is very interesting to see where the lift really is; whether you do better going out in the sun or whether you do better sticking on the edges; or whether sometimes you do better going in unlikely spots. I think it pays to practice and find out.

Fourth point. Try to do a fair amount of flying in weak weather. I don't know about your home places, but around where I fly, most people won't fly if it's under 1000 fpm, as far as I can see, and they never go cross country if it's under 1000 fpm. In fact, most of them never go cross country if it's 2000 fpm. Anybody can fly 1000 fpm or 500 fpm, or 250 fpm. The time that it gets interesting is when it gets down to a ceiling of about 2000 feet and maybe 50 feet a minute. That's the one that gets the points. Anybody can fly when it's easy. So if you always have strong weather you are more fortunate than most people, and you will have to do your practice fairly early in the morning or fairly late in the afternoon. I tend to try to take off early because later the lift lines for the tug get long. If you take off at 10:30, there is not a soul - very nice.

I think when you are practicing thermaling, a good thing to do on days that are too weak to go anyplace reliably is to practice thermaling with other ships as much as you can. One of the things that I think causes new pilots the most trouble in contests is getting used to gaggles. You must be able to perform as well when there is another ship 50 feet away as you perform when there is not another ship 50 feet away. This takes a little getting used to.

Fifth point. If you can carry ballast, fly with the ballast most of the time. A ship behaves quite differently with ballast and in most cases it to a lot more work to fly. I was wondering seriously at Marfa whether my aim was going to hold out for the contest. In a long wine Cirrus with full ballast tanks, the wing bend so much that, the control guides don't work very well. The ailerons are, therefore, very stiff, and you might as well build up the muscles before the contest.

Sixth point. Try to get other people to come along in little triangles that you fly; but if you got them to come, along with you don't play good buddies with everybody (for example, you know "I'm over the lake here. Come along - it's great;"). Compete! I have seen a lot of people go off and fly with each other and learn absolutely nothing because they spend all their time waiting around for the other chap. If he can't fly any better than that, let him fly by himself.

Number seven. Use a calculator a fair amount so you get to believe in it because if you don't use it you don't believe in it, especially if you have a very high performance ship. Those 40 to I final glides just have to be practiced. You don't have to actually make it a final glide into the field. Just make sure that if you think you are going to be getting 35 to 1 at such and such an airspeed, you really are getting 35 to 1. It is more probable that you are getting 30 to 1.

Point eight. Use all this practice time to check instruments, especially total energy - which is far more important than all the rest put together. It doesn't really make much difference to me whether I have PZL, Moore, BSW, Ball, or what have you, as long as the total energy works. I would gladly trade a Memphis or use a Memphis that had good total energy, as opposed to the Most super, super electric that didn't have good total energy, Total energy is really so important it is hard to exaggerate. Get to know whatever instruments you are flying with because even pretty lousy instruments are not bad if you know what they are likely to do. If, for example, the PZL read very well under one meter, you learn to compensate for it.

Number nine. I think the thing to practice most is how to get in and out of thermals efficiently - especially how to get in. It requires good timing so I think it is worth practicing.

The last point. It's not a bad idea at all after each flight to think over the many stupidities that you created in it. It sometimes seems a continual stream of stupidities. That is, of course, exactly what Nick was ended up saying. Think over all the dumb things you did, I like to think back on all the dumb things I did in contest flights particularly, and try to make sure that I won't do them over again.

SCHREDER: Well, I think those are all good points, George. I have something else to add. I think the thing that helped me more than anything else when I first started in soaring was that I made a habit of flying on cross-countries with other pilots. A.J. Smith and I started flying sailplanes about the same time and we flew a good many hours together. We would go out cross country; head for different places; pick out triangles or goals; and it really helps if you are flying with someone that is right up there - top notch. If you have someone in your club that is an outstanding pilot, try to fly with him all you can. You will soon find out how you stack up compared to him, and you will know right away when you have made a mistake. If he gets ahead of you at the same altitude, you know that he did something better than you did and you should find out why. I think you can learn more in a shorter time by flying with someone else, especially if it is someone who has more experience than you. One very good point that George made was: keep track of all the mistakes that you make. Write them down and keep them for review because you are going to make enough mistakes without making the same ones over again. If you read this list over occasionally, you won't find yourself in a position where you're on the ground looking at everybody else flying over and realize that you did that same thing last year.

SMITH: I have been busily crossing out key points in my notes. I think we might have in mind that, realistically, most of you are probably practicing for some great success in future contests - not this year, and maybe not the next two years, but at some future time. I think there are not many people now who are going to be able to achieve consistently high levels of performance in competition in their first few years of flying, so I would think that this makes one point obvious. The best practice you can get is in competition. I would suggest that you fly in every regional meet possible. I think if you are seriously interested in competition, you might do as they appear to be doing quite a bit in Southern California. Organize smaller competitions and develop competition techniques, In this way you get what I consider more realistic practice

I agree with everything Nick says about getting to the point where moving the stick and rudder is not a conscious thing anymore. However, you must go beyond that point. You must be able to almost subconsciously make good starts, good runs, good turnpoints, and this sort of thing. This brings up the point that practice should include making the kind of starts that we discussed at our first symposium, and I would practice making several starts on each flight or on each weekend. You will discover that the technique that you need to use to make a good start is going to be dependent on the lift you have on a particular day, particularly the distribution of lift in the area of the start line, the turbulence you might encounter, and various other factors.

I would set established turnpoints and make practice turns., using the camera technique that seems to be standardized now, and I would do it with film at least often enough to know that your technique is working. This is important because I am certain that you can save many, many seconds, and perhaps minutes, in executing a good run into a turnpoint. a nice precise tight turn at the proper point, and a nice runout.

I would agree with George about practicing final glides. I think the use of a calculator is the first decision to make. If it is going to be a part of your operation then certainly you must learn to use it. You should use it so efficiently that it does not detract from your flying. Observe what happens on final glides and adjust your calculator (if you are going to use it as a tool) until you can absolutely depend on it. I don't see any reason for not making the finish of each flight a final glide. Certainly the best way to do this is to operate at sort of maximum range from the field on that day according to the altitude you are achieving in the thermals. Do it like you would do it in a contest flight.

I suppose, to summarize my comments, I would say that I agree with everything that has been said here.

The Philosophy Of Winning - Part II

By A. J. Smith

We're here because we seriously want to compete in soaring. We assume you've made that decision and you're a bit along the way to making that decision pay off. It's clear to us that many of you have elected to fly in the standard class. I wonder about the others. How many are considering the purchase of a sailplane and are still considering the open class? A few - good! Great!

The problems are clear if you're going into open class. They're clear and, perhaps, not as serious as we just now make them out to be. We can put a fairly accurate number on the additional dollars required. It's somewhere between $1000 and $5000 extra to get into a competitive open class sailplane. You'll be able to compete with that piece of equipment for a number of years in spite of there being things like the Sigma around. Around! It's over on the other side. And they don't have enough money to ship it here for many contests. You really won't have to worry about it. We'll have difficulty with the Sigma and the like for a few years in international competition, but we'll discover ways to remain competitive with what resources we have.

In addition to more dollars, the open class requires more work, because, generally, you're talking about more area. With a very high aspect ratio, it isn't a lot more area. Until they open out these great whopping Sigma type flaps. You have to clean those and find a way to get inside the wing and clean it too, to get the accumulation of bees, dust and whatever, out of all those details. It's a lot more work, simply because the equipment is heavier, the systems more complicated, and all that sort of thing. You simply cannot fly any sailplane or operate any piece of equipment successfully in competition without constantly working on it, maintaining it, and improving it. This is particularly true if you're doing a new sailplane, as I'm certain the English are aware. But it's also true if you're buying an open class sailplane that's already in production such as the ASW-12, Cirrus, or whatever. You've a lot of work to do to get it competition ready. And, for the open class sailplane, it's a considerable amount more work than you might expect to put into a standard class machine. Considerable, but not so much that it should influence your decision between open and standard.

If you've selected a standard class machine and it's any-thing later than a K-6 series, you probably have a good competitive sailplane. Just now, thoughtful people, in evaluating sailplanes, say there is little difference between late model standard class sailplanes. That includes Standard Libelle, Elfe, Standard Cirrus, Phoebus, LS-1, ASW-15, and others in that family. They say further that you're likely to find a greater difference between two sailplanes of different types. I'm inclined to agree, from observation. We have seen considerable difference in Standard Libelles already. Some obviously are as good as any other standard class machine. Probably as a result of some amount of effort on the part of the pilot to properly prepare his machine.

That says to you, that you shouldn't go off in a swivet because Moffat says that your Standard Libelle is not going to win. You should, instead, go home and make your Standard Libelle the best one around. By the time you get it to that state, you'll probably have a better sailplane than 50 percent of the Standard Cirruses, or 50 percent of the LS-1's, or 50 percent of whatever. The capability of making the sailplane competitive in the standard class, now, with these machines, is in your hands. You can begin to exercise that capability by studying your own particular sailplane.

No two sailplanes really are alike. Not even two sailplanes of a single type - Standard Libelles, again, to take an example. You should begin by checking your sailplane against its specifications. While Nick Goodhart says that all of them are basically, according to factory specifications, within the weights and aspect ratios that seem to him to lead to best performance, we really must admit that most of them are too heavy. Certainly much too heavy for anything less than Nick's standard thermal, which we should consider to be a rare good thermal even for most parts of the United States. Certainly for New England and our part of the country.

So, a weight reduction program is important. And it's not nearly so difficult as one might imagine. One Libelle pilot has taken a lot of weight, something in the order of 30 pounds, out of his machine. This is perfectly possible. The total weight reduction of a Sisu was something in the order of 45 pounds. This weight reduction will make a tremendous difference in the handling and performance of a sailplane. Come back from Marfa, for examples, and take out 20 pounds of oxygen equipment, a few pounds of emergency equipment, all of the bits and pieces you've had in the cockpit, including cans of Metrecal, all that sort of thing, and you can feel the sailplane climb much -better. This is when we're beginning to realize the best performance of a sailplane for the weaker soaring weather.

In addition, we have not seen a sailplane in which all the details are solved at a level that's sufficiently good for competition. It isn't so because the designer doesn't know how to solve them or the manufacturer's derelict or whatever. It's simply a matter of cost. You will quickly discover, when you improve all the details, that you will have spent, minimum, in the order of 200 hours on a new sailplane to make it really competitive. If you have a major smoothing work to do on a wing you can add another 100 hours for the first time through on that. This could add $2000 to the manufacturers costs, if he were to do the work during his production, The effect on his market would be bad.

Don't take anything for granted. Get airfoil coordinates from your sailplane dealer or apply pressure directly on the manufacturer for a set of templates. Check the contour of the wing. The most expensive sailplane being delivered to the United States now, in more than one example, has had a wing that was far from the true airfoil. You've got to start with the true airfoil, Airfoils are, outside of laboratory conditions, unpredictable. One can go through the development of a series of airfoils, a particular family of airfoils, and begin to see a certain favorable progression in the results of investigation of those airfoils. One would be tempted to bet on the outcome of the test of the next member of the family. One might suddenly be surprised to find the airfoil just doesn't perform. It's that bad. Don't make assumptions. Use templates, check the airfoil, and make it right. If anybody tells you anything else will work, don't listen. You've got to get the airfoil right. And then wave-free.

Detail work needs to be extended from aerodynamics into the comfort, handling, and instrumentation of the sailplane.

Some of you have particular comfort problems. It's fine to have the handbooks say that pilots are 170 pounds, but they should say something about pilot shapes. That's the designer's problem. European ships have tended to be tight in cockpit space. Now, to a degree, they may have overreacted and made the cockpits larger than need be. But, perhaps, this an asset. It gives one room to work in. However, even with a spacious cockpit you can do a tremendous amount to improve your comfort; and if you're seriously thinking about your own efficiency under difficult operating conditions, you know that when you're comfortable and your temperature right, you're like any other machine, you're working better. So comfort and ventilation are important factors to consider in the preparation of the sailplane. And, again, it's not difficult to visualize spending several days on these factors alone.

If you combine thoughts about the first evaluation of the sailplane, particularly its weight, with this development of comfort, you find specific problems. It's easy to buy a piece of foam rubber, for example, put it in the cockpit, and sink into it in blissful comfort. However, you may discover that piece of foam rubber weighs anything up to five or six pounds. if so, you've made a serious error. You should be able to solve your problem and get safe comfortable cushioning for something under a pound and a half But even a pound and a half is a lot. Cut lightening holes in it.

Improve the handling of your sailplane. Experience with different sailplanes of a single type indicates that, while control pressures generally are the same and the relationships between the pressures and responses generally are the same, no two, in reality, exactly are the same. Examine your ship for excessive control system friction. Examine it for excessive friction under all conditions of flight and loading. Examine it for flexing and looseness in the control systems. If you don't have a predictable and a constant reaction in the control system, you will be distracted. You'll not develop a subconscious flight operation that's desirable. You'll be working with unnecessary -variables. Eliminate play, eliminate friction. Again, if you have a problem in your particular sailplane in this direction, the solution can require considerable time. And, again, the most expensive sailplane being imported in the country now still has excessive control system friction; and the problem is apparently without a solution. The manufacturer says that there's nothing to worry about; in about two years it all loosens up!

The most important thing we have learned this weekend was how to develop a good sailplane total energy compensated variometer system. We should not only read Moore's paper again but also go through the exercise, preparing a system in the way he recommends. And this exercise, in effect, is typically the answer to our problems in competitive soaring. If we anticipate problems with sailplane variometer systems or with photographic procedure, and whatever, the best thing we can do is to go through the exercise of preparation and operation. We'll find that it's not nearly so difficult as we anticipate.

Compensated variometer systems really should do exactly what you've always read variometer systems do. It's difficult to explain just how important this is or how much easier it makes competition soaring. Your interpretation of the information you are getting from a good system and your utilization of that information will then begin to be the kind of subconscious procedure that we mention now in terms of the stick and rudder part of flying.

Let's hold just a moment on instruments and their interpretation and talk about the stick and rudder part of flying. This may help to explain the importance of a good variometer system.

You may realize, as you go into competition at this particular time -perhaps this will not be true in a few years - that you're competing with people who have a tremendous number of flight hours. If not first in power planes, then certainly concentrated in flying sailplanes in recent years. And probably they have been for a long time at a level where they readily fly any aircraft simply by attitude. They no longer think much about exactly how the controls are working. It's subconscious in their systems. They immediately can fly a reasonably good handling aircraft of any type at any time. And fly it efficiently no matter how many engines, how much weight, and this sort of thing. What the stick pressures are, or the responses and whatever, is of little consequence. They may complain a little, but they manage to get the aircraft up and down, and do it efficiently. Get them into a good sailplane and the conscious stick and rudder bit simply disappears as a factor in their performance. You, too, must quickly get to that subconscious high level of performance. Practice.

The same thing is true and necessary in relation to the instruments and the information you get from them. You have to be able to accept that information readily and react almost subconsciously. If you have to interpret what a poor variometer system is doing, as we all have been doing for years, you will not be competitive. Perhaps we've learned mentally to compensate for the inaccuracies of a poor system, and we've constantly gone through some kind of arithmetic to determine just exactly what kind of thermal we've got. That kind of compensation is not a substitute for the real total energy compensated system. You're not only doing unnecessary work, you're being distracted from other tasks that are more important.

Gene Moore says it all in his paper. We've everything we need in it to get a good working variometer system. Put the instrument systems, the total energy compensated variometer system in particular, high on your preparation list. Give it top priority, even before the aerodynamic preparation of the sailplane, and certainly before comfort and handling.

Further, the preparation of calculators, charts, best-speed-to-fly rings, and all of this sort of thing is important. It's productive. Perhaps 100 percent reliance on all of these calculators, charts, and whatever is questionable; however, judicious use of them will increase our efficiency. Preparation, as much as use, of a best-speed-to-fly ring and final glide charts shows you what you should 'be thinking about and what you should be looking for in competition flight. And just knowing that - going through the exercise of construction of these accessories - having it reinforced in your mind that this is how the whole sailplane and soaring flight works, that it is a calculated and predictable performance, encourages you to take the next step. You can take the easy way out; you can buy John Williams' final glide calculator, for example, which does everything we have talked about here. From it you can know when to cut off your last climb, how to calculate your final glide, get your required altitude at any distance from the field, and so on, and so on. However, rather than to simply buy such a calculator and use it, I would prefer to recommend that you actually construct one. Better yet, buy one - John's is a good one, but go through the exercise of constructing one yourself. That makes you understand the process better.

Work with navigational charts, the sectionals, or whatever, that will be used when flying in competition. Know everything that's included on a sectional. Learn to make notes on a sectional that will reinforce the information that's there or to add information that's important. Get all this information in mind so the chart becomes not a crutch for constant use during a flight but rather a tool used before flight to visualize landmarks, changes in terrain, changes in vegetation, changes in best lift areas, and so on. Learn to anticipate everything that you might see on a flight and particularly on distance flights. Learn to anticipate these things from pre-flight study of the sectional chart.

In addition, do a lot of practicing on the contest site. If you're going to Regionals, at least two days of practice prior to the start is good. For the Nationals, take the maximum practice session, probably in the order of a week. Fly the entire area. It's easy in Marfa where you have fixed turnpoints. It's still relatively easy in areas like Adrian or others in the middle west. The contest organization should be happy to tell you the general area you'll fly in and the turnpoints they've selected. Practice flying the area and not simply in irregular patterns but more directly on the courses you'll fly in competition. Knowing the terrain directly on course and the thermal sources that you might find, particularly if you're in an area where you'll do a lot of low altitude soaring is extremely important. Being able simply to find the turnpoint, again without referring constantly to the chart, is a great time saver.

The practice at a contest site, should be done in at least two specific phases, and perhaps even three. In the first phase, utilize the entire one week long Nationals practice session, learn the character of the total contest area.

The second phase, which might be carried on as part of the first, should concentrate in great detail on the immediate contest site: its thermal sources; directions for starts; the look of far-off landmarks and courses to them; how you need to make starts for that particular site; what final glides will be like - they'll be coming in low, remember, from the opposite direction and the site might not look familiar; landmarks coming into the contest site from out on course;

obstacles on final glide paths; and, very important - thermal sources related to final glide paths. As the opening day of the contest approaches you should perhaps concentrate more on conditions in the immediate area of the contest site.

In the third phase, practice the evaluation you should do before your particular start of each task. The rules for launches are changing a bit. The tendency is that most pilots will have in the order of an hour in the air before they make the start. If we tend more toward speed tasks, you can begin to control this period of time. We should expect to see it extended by all serious competition pilots until they are, perhaps, in the air at least an hour and a half or two hours before the start. Use that time to "warm up," get comfortable in the cockpit, get over the frustrations of a too late launch by an inept crew and a poor tow pilot, and get smoothly into the business of flying the sailplane without thinking about it. Avoid flying with other sailplanes, except when they can help you to evaluate the atmosphere, and get on with the - business of reviewing or evaluating the day. This should be a systematic examination of the thermals ,and as thorough as time will allow. You should examine-the entire height of the thermals and know the strength of the thermal at any altitude for its entire height. Note as quickly as you can how that strength is changing and how the effective, most efficient or the best range of the thermal is changing. And it is changing. Constantly.

Pinpoint any layers of shear. You should have noted this in the weather briefings earlier, but try to pinpoint them in the air. Evaluate the seriousness of any shear layers. Decide if these shear layers are to be avoided.

Get all of this in mind. Establish working altitudes as nearly as you can in this hour before the flight. Check out thermal sources. Check out the clouds. If you have them, determine how they are working for that particular day. Know any change in wind velocity and direction at cloud base so that you have an idea of how the lift is going to be working in relation to the cloud 'bases. Determine, in fact, if pre-flight information agrees with what you really experience. Certainly, if you have time, make some practice starts. At least one. Most of our sites, when we really begin to know them, seem to have fairly fixed areas of lift and sink. If, as we had in Marfa this year, you have a long line of lift existing almost every day going into the start line, this is important information. In a Sigma you'd need only 3300 feet to start your run in. Go across the line at 3250 - feet, not knots.

Finally, remember to develop the-necessary determination if you want to compete successfully, if you want to win. Then you'll have the drive necessary to do at least as much as we've outlined. If you're going to beat all of the others here, perhaps you have to do a lot more.

Question And Answer Period

Question: (Steve duPont) Would you talk more about lines of lift?

Smith: Probably the patterns of lift almost anywhere are much more orderly than we visualize. This statement may generally apply both for flat terrain of the middle vest and the more rugged area near Marfa in the foothills and mountains. I think it's generally much better organized than Huth believe, if you read one chap's interpretation of his - philosophy. He writes that lift is as random as the trees in a forest and he flies accordingly. Perhaps he'd modify his flight for the United States in areas like Marfa, Reno, and whatever, where we have terrain that seriously affects convective lift. And even over flat terrain perhaps there's a pattern and an organization of areas of lift that's more pronounced than many of us imagine. While it's fairly easy to predict, from the textbook, the conditions which will produce cloud streets or regular patterns of lift, there are an infinite number of subtle variations and combinations of winds, convection and terrain, that promote regular patterns of lift.

Question: (duPont) Do you find them oriented?

Smith: We find them oriented in many ways, Steve. Perhaps the more successful pilots in competition are less inclined to say that things are exactly this way or that, you know. They tend to quality statements about the character of thermals and the use of weather. Probably what they're implying is that you've got to learn the factors you're working with and quickly sort out these factors of lift and weather for a particular day or for a particular moment. You may then suddenly discover a pattern. Perhaps you haven't seen that pattern before. Lift in lines is a pattern that occurs often. In our area it's lined up with the wind more often than not. In Marfa, for the first few days of our contest this year, it seemed to line up crosswind more often than not. On each flight, particularly before each start, go through an investigation. Anticipate the patterns you might be able to work with that day. Discover indeed if the lift is lined up. When you leave a thermal, try going right downwind or upwind. Observe the results. If the thermals are not lined up and indeed there are random cus, you may find that you get dumped and that probably the way to leave the thermals that day is to wind up a bit and go out the side - much more successfully. Observe. Adjust. There are few fixed rules.

Question: There have been several references to working altitude bands. I'm curious to ask you and any of the others how strongly you discipline yourself to stay within these altitude bands that you have assessed to offer the strongest lift?

Smith: Very strongly, but with mixed success, really. You're trying very hard to stay in a range and being particularly conscious of heights in the thermal that are particularly difficult to get through. This almost always implies, or at least I infer from this, that it's a shear layer that you want to avoid. As I come down to one of those layers I may slow up and go to max L/D and try to pick up a good thermal. If I get down through such a layer and I know I've got another 3000 feet in which I might find good thermals, I might go back up to good cruising speed again until I get one. But I'm unhappy because I know when I get a thermal and cone up that I'm going to have to spend a lot of time to get back through that layer again. That requires another discipline. You must realize, if you want to get back up in the better lift, that you must patiently work with the ragged conditions in the layer. Nick, can you comment relative to European conditions?

Goodhart: I don't think we generally get multiple layers. The shear layer that we're always worried about is the one that's right near the ground, and you don't go through that unless you're going down, and I find that my flying when I leave the top of a thermal is to start off cruising optimistically on the assumption that the next one is going to be reasonably good of the standards that you've assessed for the day and to start off at a fairly fast cruise. But, as I cruise down, the probability of not finding the next thermal is beginning to increase and, therefore, you've got to start making your glide cover more and more ground and by the time I'm down to heights of the order of 2000 feet, I'm pretty near back to max glide because you're up against the probability by then that if you don't find one fairly soon you're going to go down, and so you've got to search the maximum possible amount of air. So all this speed ring calculation stuff, as far as I'm concerned, is tempered with the fact that you've got to search more and more air the nearer you get to the ground to increase the probability of not going down.

Future Competition Trends

Goodhart - Moffat - Schreder - Smith

SMITH: For the short term, let's say, five to ten years, we know what competition soaring is going to be like. It's going to be done with the new ships, the Sigma, Nimbus, super ASW-12, super Cirrus, super Kestrel and the like, in open class competition. Those sailplanes will be in a state of development for several years. After they've gone through continuous improvement for the next three or four years, they will remain competitive for another three or four years. We're talking about designs that have a competitive life of perhaps ten years, so we've already seen or heard what the immediate future is like. Because we can realize a considerable increase in performance right now, it is more difficult to predict what's going to happen after those ten years are past.

What we're talking about in this current development, particularly in open class competition, is the extension of the speed range of the sailplane. We have had a tendency to think that performance is limited by the maximum capabilities of an airfoil at relatively low speeds. The ratios which will become more important are those which occur at higher speeds. The Sigma project is beginning seriously to penetrate this area of extended upper end speed range. The Nimbus obviously is making improvements in terms of achieved ground speed too. But it may be doing it at cruising speeds that are not much different than we're experiencing now. However, its efficiency at those speeds is much higher than we're accustomed to. Thus it's getting higher average speeds. Sigma, in contrast, is considering cruising speeds perhaps 25 percent greater than we've been accustomed to. The solutions vary a bit. Nimbus tends to refinement of the existing. Sigma pushes a bit more into seldom used concepts

In standard class, before this session, I had few thoughts about what the future might bring. It seems clear now, after bearing Hick's comments, that perhaps the biggest area for improvement is in the structures. New structures designed to considerably decrease sailplane weight. The implication for the short term is more money. The first impact of this structural development will not be great in terms of performance but considerable in cost.

I'm not convinced that we've done all we can with airfoils in standard class. I'm not even certain that Wortmann's latest information actually is being used on standard class sailplanes at the moment.

So that may be, for competition soaring, one view of the future: wider speed range, considerably extended on the high speed end for the open class; lighter structure and some lesser aerodynamic improvement for standard class machines.

SCHREDER: I would disagree with A.J. (Smith) on the higher costs of standard class. With a little attention to detail, the HP-16 could be cheaper than the current standard class sailplanes. On the subject of competition trends in the future, I think it is simply a case of having to work harder and prepare better for competition simply because there are more good pilots. We are getting to the point where it is necessary to limit the number of contestants in the Nationals. This means that instead of people just coming for the ride or just to fly around, most of those who enter will be serious competitors. If you want to win, you will have to be a little better than the next fellow, and that means you must work harder than you have before. I can only see that it's going to get tougher instead of easier. I think that is exactly why most of you are here - to improve your techniques and your knowledge so that you can be better. You have taken a step in the right direction already.

GOODHART: I think I will take the opportunity, since it is the last panel discussion, to be a little provocative on this subject. Maybe we need to start with a bit of basic philosophy, and the starting point I am going to take is air space. I get the impression that there is a tendency for gliding in this country to be squeezed out of the air to an appreciable extent and that really you ought to be thinking on how to avoid this problem.

Gliding is undoubtedly a minority sport. Indeed, I would go so far as to say it was a minor minority sport, and for that reason you have no pull - no pull whatever. Perhaps that is too strong, but it is pretty close to that. I suspect and, unless you develop some sort of popularity, I believe that you may be in for a fairly hard time. There comes the question of whether you must now temper your competition to give some sort of spectator appeal.

Right now, you run competitions for competition pilots, pure and simple. Indeed, other glider pilots don't even bother to come to the competitions. There is nothing duller, unless you are a competition pilot, or possibly a crew, than going to a competition. All the chaps get into their gliders and they don't even cross the line together. They cross the line and disappear. It is dull beyond all degree. With any luck, late in the evening a few of them turn up again and that is the end of it. It isn't a spectator sport; and I wonder, therefore, whether one could not dream up a new stage of competitions; still keep the competition pilots amused; but also providing some sort of spectator appeal.

I would like to go through a few, perhaps, dream possibilities which might lead to this state of affairs. First of all. the start is at present the dullest thing you ever saw, and I am actually convinced that, if you are going to get any spectator appeal into the starts, you must get what I call the Yarbury start. I don't visualize forty on the first day, but I do visualize ten aircraft crossing the line, or trying to cross the line at a specified time. I think it is perfectly feasible. I don't believe you would come to any harm at all. I am a bit scared of forty all at once, but I believe you can certainly run at least ten in complete safety. We might find that you can run more than that across the start line.

Now this will be impressive. Chaps will enjoy watching this., I'm pretty sure that a reasonably competent bunch of pilots will be able to keep out of each other's way while crossing the start line. Well, that gets you off to a first piece of spectator appeal.

Now the next thing is that this business where they all just disappear is all very fine, but I reckon they have got to keep on coming back. You have got to run a competition with a small closed circuit, even only 50 kilometers run, so that after you have done a simultaneous start, then the first chap who reappears is the chap in the lead. Somebody on the broadcast system can whoop up with a bit of enthusiasm with so-and-so appearing; coming around the corner; somebody cheering; somebody else coming in below him-, and, you know, you can soon jazz it up into quite a show; getting everybody interested.

But, of course, everybody doesn't want to around 50 kilometer triangles. Round and round, say, five times around a 50 kilometer or something like that. This gets a bit tedious for the pilots, so one then comes to the idea that what people are accustomed to doing in spectator sports if identifying themselves with teams, not with individuals. It a very difficult to identify yourself with an individual because he's an individual, but you can identify if you've got the Philadelphia Planeguiders or the whatever it might be, the Elmira Eggheads or whatever.

So you come to the idea that perhaps chaps ought to fly in teams of, say, three pilots, with three tasks on one day. You put your new ace recruit into the 50 kilometer round and round race and your old hand goes off an the distance task, crawling off into the middle distance, and somebody else does the 300 K triangle on the same day. So you can get the spectators amused with three starts. All through the day chaps keep on flashing around this small triangle. Meanwhile reports come in from distant turn points and, finally, of course, the little short triangle, five times round or whatever it is, finishes and there is great excitement as these chaps come flashing across the finish line and somebody has to stop for a thermal two miles out, you know, and there he is struggling. Another chap flashes by, and it's all splendid stuff, and they cross the line at 150 miles an hour because they got their final glides wrong, as you see happening everywhere. Meanwhile, of course, reports are still coming in from the distance, and finally, late in the evening everybody is tensely waiting. It is an exciting moment when you are waiting for the people on the distant starts to call in. It isn't just whether they have done any good, but whether their team is still ahead. Maybe they were perhaps in the lead on the first two races which have already been reported. You are still waiting for this final report of their man who hasn't landed yet and it's 7:30, 7:45, you know, or even 8:00, and by golly in comes a report and you find that the other chap's gone much farther and upset the team ratings. I could see you could keep a whole day going of really good spectator sport.

Now, to do this, of course, you must live in a country where when the spectators arrive they don't stand, as I say we do in England, In a damp, wet tent, getting cold. If you have reasonable weather and you could be reasonably sure of giving the spectators a day's sport, I reckon you could build up to the point where this could become quite a reasonable spectator sport.

Now this, of course, to the purists, is an appalling thought. They are in it for what they can get out of competition flying. That is their aim in life. But perhaps there are advantages in that where you get spectators you get money. One might actually get to the point where he might find that it's possible to get a certain amount of his expenses paid, if not completely, as is true in so many other sports.

I put this out as a purely provocative line of thought of a possible future competition trend. All these experts are telling you about what is actually going to happen.

MOFFAT: I like Nick's ideas very much, and one part of it is surprisingly similar to what I had jotted down on my trusty envelope here. In no particular order, I think I see about four or five things happening in the next five to ten years that A.J. was talking about.

First, I think we will see a whole new magnitude of pilot ability. I don't think we have even begun as yet, I can look at contests I have flown in the last three or four years and I can't think of one in which I haven't had at least one spectacularly stupid day, and usually three or four. I can look at A.J. and Dick, and I think everybody here, and see that they have had their little problems too. I think we're going to get an awful lot better. I think we had better get an awful lot better or we aren't going to be sitting up here on a symposium panel. I also think we are going to see young pilots coming to the fore. The only reason we haven't seen it as yet is very simple. Cash. In countries where cash isn't a factor, mainly Poland, the best pilots are usually fairly young. For example, Wroblewski. He didn't win the Internationals in open class in a Foka for nothing. He was about 23 at the time.

The next thing I think I see in the future is a change in tasks, perhaps not quite as extreme as Nick suggests, but I think the distance day will go. It practically has already gone in Europe, all except the U.K. I think speed days have so many advantages over distance days that they will naturally triumph in quite a short time. One of the problems is that as contests get larger, distance days get less and less practical, and the basic reason for this is takeoff times. Nobody has yet solved the problem that I know of a reasonable takeoff time system for distance dashes. Nick said if you have contest management select the takeoff times whoever happens to be low on the list has had it if it takes an hour to get every ship in the air. There is no way in five to ten hours of flying time to make up an hour lag in starting - absolutely none. On our own pilot selected times it depends very heavily on the luck of the draw as to whether you have a reasonable early choice or not on the distance dash. This was not obvious last year at Marfa simply because the weather prediction and when you could start was so far off that all of us who knew it was far off could start whenever we wanted and we started early. Had it been as it usually is, I know at least one of us, probably two of us here, would have gotten completely had, by being at the end of a list an hour and fifteen minutes behind the chap who was at the head of the list. Of course, another advantage I see in all speed days is that you can get by with a smaller crew since traveling about doesn't seem to be so important. It also costs less, and it becomes less of a driving contest and much more of a flying contest.

I, for one, would hope that if we get all speed. days, that, particularly in regional contests - but perhaps in all contests - we outlaw re-lights. If you outlaw re-lights, you get away from all that high speed driving, and you get away from large crews. There is no need to have more than your wife for a crew if you have a standard class ship, if there isn't that desperate problem of getting the ship de-rigged back at the base and re-rigged again in nothing flat. So I hope re-lights will tend to go. It will foster a slightly different type of flying, a rather more cautious type of flying, but it will, I think, be equally fair to all.

At least in America, and probably all over, the thing that is probably going to be most important in the next little while is development of some sort of one-design class. I hope it will be a small one; I hope something around the size of a 1-26 but the general configuration and very much of the performance of the present-day standard ships. The German Hildago was a 13-meter ship (42 foot span) with 226 pound empty weight and a glide ratio reputedly up around 36. It did very well in the German Nationals in the open class a couple of years ago. It was to me an indication of what can be done.

Lastly, I think we ought to see - we have to see - very, very much more competition available than we have now. I am thinking of things not so much like more Regionals because Regionals are really, in a way, bad. Unless you have unlimited vacation time to get to more than one Regional and the Nationals in a year, it pretty much over-extends most of our vacation time. I know some people that like to do one or two other things besides soar with their vacations. A lot of people's wives, for example. What I am talking about is the kind of thing that is so common in yacht racing at the moment. The weekend series. I think this would fit beautifully with what Nick was just talking about, and what Dick - in his usual pioneering sort of way - was already doing early in the 1960's. That is, having short races with the turn points maybe only 20 miles away, in which you went round and round if you felt like distance or you made three circuits if you felt like speed. I flew one of these contests at PGC, and it was really one of the most enjoyable contest dates I can remember. We had a distance day. It was 20 miles out, 20 miles back, as many times around as you could manage. You always had somebody in sight, you always had somebody about whom you could say, "Well, he's only three miles ahead. I'm going to get him," and see whether you did get him or not. There was something to compete about, not that endless boredom of cat's cradle days where if you do see anybody, you haven't the faintest idea if he's going in the same direction as you happen to be.

I hope to see us having Saturday and Sunday series that would extend over, say, a spring series, summer series, fall series, as we do in small boat racing, where you could put together not just one day but a series of days. These races don't have to be long; they could be 50 kilometers, 100 kilometers. I would like to see them short enough so that you could rent a 1-26 and compete. You could have a 1-26 class if you happen to have a lot of 1-26's around, as we do at our airport. I think this sort of thing has to be explored.

I think something that Jim Herman was talking about recently is very important, too. We have got to have some means to train the people that are going to run these contests because we really don't have any mechanism at all at the moment for training people who are eager to run contests but who really don't have a clue as to how to go about it. I think we need some sort of book on that. Maybe That's the thing to have a symposium on sometime.

Those are the things I'd like to see in the future: particularly a one design class; hopefully ships that wouldn't cost much over $4000 or $5000; light ships; and easy ships to handle. I hope we see younger pilots. I hope we see all speed days. I hope we see a whole lot more competition, and competition that you don't have to take a week's vacation to go to.

Question And Answer Period

Comment: Regarding the it no re-light" rule, not having retrieve accidents or re-light accidents is reason enough for such a rule. I understand that they're doing this extensively in Europe now. In fact, I think it's the standard rule in most of the countries. I don't like any rule that takes away pilot options during the contest, but I think that, as George (Moffat) says, this is going to be fair to everybody because you'll all be operating under the same rules. About all it will do will be to make the brash pilot perhaps hesitate a little bit about dashing out with the knowledge that we can always reassemble and take a re-light.

Comment: (Goodhart) I should say I agree 100 percent that it would be a valuable rule. We don't have it in U.K. and I don't see us getting it, actually, for a while yet; but it is, as just confirmed, common in Europe now and I think universal.

Question; Since we're discussing this, I wonder if someone would point up the reasoning behind wanting this rule. I don't quite understand the reasoning behind it.

Answer: (Seibels) It would eliminate the temptation for crews to go charging about the countryside at 150 knots on the surface trying to locate their pilot after an off-field landing; disassemble the ship; get it back to the field; throw it back together; get off before the start line closes. I think there is a lot of inherent danger involved in this system. I have seen it during meets. I have had my hair stand on end at some of the near misses some of these people have had cruising around the back roads in South Carolina at something well over 30 miles an hour above the speed limit - which is all considered good sporting until you kill an innocent farmer coming out of his driveway. We had a fatal accident in South Carolina back in the 1940's that stopped soaring down there for about 20 years and I don't want to see that happen again.

From a competitive standpoint, I think it could conceivably lead a brash pilot into having advantage over the rest of the field. Let's assume we have a weak day and some guy goes charging out on the course before the rest of the pack thinks it's possible, and it isn't possible, and he lands 10 to 12 miles out. The day slowly improves. The rest of the field goes out under these slowly improving conditions and struggles around the course. By the time he's back to the airport, reassembled, and gets a re-light, the weather has peaked and he has the advantage - through no merit of his own - of flying around the course under the strongest part of the day as a result of his mistake.

Comment: (Moffat) I feel pretty strongly that the present re-light rule is dangerous and unnecessary. I, too, have seen people take off in sailplanes that were very casually assembled. I've taken off in sailplanes that were very casually assembled. I had my tug, one day at El Mirage, nose over on takeoff because the pilot was frantically trying to get the thing into position so he could get me off one minute before the close of the takeoff line. I was delighted to see him nose over; it was the happiest day of my life; because that gave me five more minutes to tape. The HP-8 didn't fly very well untaped. It put the stall speed up about 10 mph, and the thermaling speed went from 67 to 77 or something like that. I think it's inherently dangerous to rush putting ships together. It seems to me that there is so little advantage that accrues from re-lighting or having re-lights. Further, I think one thing that's well worth remembering is that re-lights favor large crews, and large crews cost a lot of money. I don't think we should encourage a competition where money automatically wins. I can see virtually no advantage to allowing re-lights, and I can see a great many disadvantages that I think Gren (Seibels) has very aptly summed up.

Comment: (Schreder) I think all of us up here will go along with this eliminating the re-light. I, for one, would like it because my crew could stay back at the field on all of the triangle days and the out and return days. I have tended to do this anyhow - trying to be a little careful not going down - and I think all of those who do take chances would be a little more careful if we had this no re-light rule. I think all four of us up here are 100 percent for it.

Comment: Mr. Goodhart touched on something very nicely and strongly - the idea of having competition that would be -basically within the sight of the spectators for maybe 60 or 70 percent of the flight. My idea was along the line of having the 1-26's flying in Regionals but not on the same task as the standard class and open class. Mr Goodhart's idea of having some of the machines within sight of the spectators fits the 1-26's very nicely under most conditions, and I would sure like to see the gentlemen on the panel try to encourage this idea.

Comment: (Schreder) Back about, I don't remember the exact year, but it must have been somewhere around 1963, we had a competition at Bryan which we timed to be just before the Nationals were going to be held in Elmira. We counted on catching a lot of people en route. We had about a 3-day warm-up contest and we conducted it in just the manner that we're talking about here. We had racehorse starts; we put everybody into the air; after the last man had a chance to get up we put out a symbol and this signified the opening of the course. We had points that were only at turnpoints that were about 10 miles away, maybe a little less, 8 miles: We had the gliders going south to one point, turning, coming back, and going north to another point - they were going back and forth over the airport. I've forgotten how many circuits some of us made but we had 35 people show up for this competition. This is just in a little town of Bryan (7,500 population) and I think everyone had a very good time. They had a good warm-up for the Nationals; it was highly successful; we had no collisions; and I don't think there were any problems at all as I recall, on crossing the starting line. I think it works out very well.

Question: Did you have any spectators?

Answer: (Schreder) We had a lot of spectators, and the people around that part of the country are still talking about it - how they saw all those sailplanes going back and forth.

Written Questions And Answers

Goodhart - Moffat - Schreder - Smith

Question: Two of the 15-meter German fiberglass ships differ in aspect ratio by more than four points. Should this difference alone influence my decision on which product to purchase?

Moffat: No.

Goodhart: I'm not sure which way he thinks it might influence it.

Smith: A lot depends on what the aspect ratios are, but I think most of us have been using too high an aspect ratio. It seems that if they are in the range of 20 to 24 they are both pretty good.

Question: Discuss the aspects of getting a sailplane from Europe to the U.S. Air vs. sea, paperwork, hints, etc.

Answer: (Byars) The most delightful way is to have it flown over. Seaboard World will do a real nice job, but It's $1200 freight for a Kestrel. There was no crating charge though, It was very nice, Since you save the crating charge the cost was reduced to $200 or $300 above the sea cost.

Moffat: I have had gliders brought over by practically all ways, one time or another. I am inclined to recommend very highly at the moment getting your glider brought over in a container. People involved don't care very much about crates, but containers cost a lot of money and they aren't going to run a forklift through a container. I just talked to Bill Foley before coming down here. He said he just got four Cirruses in a container. He was absolutely pleased with the handling and all that. He said he could have gotten six or seven in one container.

Question: When you speak of container, this is surface transportation, right.

Moffat: Yes, by sea. The smaller gliders can sit in a 30-footer. I believe it's a standard 30-foot cargo container. They come in 20's, 30's, and 40's. My standard Cirrus and Mac Roman's standard Cirrus are coming next Sunday together in a container. Even with the low utilization of two ships, it turns out to be materially cheaper than having them crated. Also, you don't get the forklift holes.

Question: Where do you pick it up? What East coast port?

Moffat: Elizabethport, which is much better than downtown New York for pickup. I don't have the figures yet on what you save. My guess is probably in the neighborhood of $100. It would depend a little on where you pick it up as well as when it arrives. There are some union problems on that, too.

Question: How do you go about deciding how to set your speed ring?

Goodhart: I think it’s a question of setting it rather than setting the marks on it. Setting it is simply a question of estimating how strong your next thermal is going to be. If you know the answer to that, you’re made. Question: How do you select minimum cruising altitude; that is, at what altitude do you accept any lift?

Moffat: That depends very much on the day, the geographical locality, etc. In Europe, I have flown for an hour and never got up to 1000 feet and have been relatively happy. The thermals are fairly close together there, so you might say 700 feet was the place we started to get real worried about the whole thing. But in Marfa, or more particularly Reno, we have the really extreme case. If you are below 5000 feet you are in deep trouble - really deep trouble. I mean above the ground. You really want to start thinking about where you’re going to put it. You don’t have to think very hard because there’s hardly ever any place to put it,

Question: When flying a speed triangle and you have a choice of direction (I don’t know when that would be), how do you plan which way to go around?

Answer: In contests, you never have a choice. They tell you which way to go.

Question: Suppose you were laying out a record.

Goodhart: For laying out a record, there is a very considerable advantage in making the last leg into wind -because you don’t climb the last leg. It’s all downhill. So the first leg wants to be substantially downwind.

Question: This is for Gene Moore. List your first three choices of systems for maximum performance per dollar. Say, in a standard class, in the stall to 90 mph speed range.

Moore: I think if you want to consider performance per dollar, you would have to consider making the device yourself. I have given a little talk on the $10 variometer and the total energy device which will do most of the things that the one described here will do. It is made out of two Skippy peanut butter jar lids and a spring and a diaphragm. It would give you the most performance per dollar. The next, I think you must consider whether or not you want to really solve the problems that we talked about. In fact, you’ve got to really have some sort of a system philosophy here. There are three methods of dealing with the problem. The first one, and most widely used, is just to ignore the problem. The next method is to compromise with it and, finally, the third is to solve it. We haven’t even talked about solving it. We’ve only talked about compromising with it. If we study Fig. 4 in my paper we see that the only solution that we really have for the total energy problem is for starting at 4000 feet and increasing your speed to 200 mph while going down to 3600 feet. As long as you were flying on that path, you would have perfect total energy compensation with that system. So then anything else we do is really compromising and learning to live with our instruments. My second choice would be a Ball because it does have the elements in the device to make an altitude adjustment. My next choice would be a PZL compensator or some type like that. I’m familiar with that particular device, and I’d say a PZL diaphragm compensator will probably make a wonderful instrument in something like a K-6. It’s been my experience that the PZL is slightly short on compensation, The K-6 has a little suction on the static, and they just work out very nicely together. so I’d say build one, the Ball and a PZL.

Question: Since variometers have received so much attention, what specific instruments do you use in your own sailplane? What compensator? What audio, if any, electric or pneumatic, or what, and what range?

Moffat: I use a Moore electric with a Moore audio and a PZL compensator, a PZL 5-meter with compensator, and a PZL 3D-meter for optimistic times uncompensated. That’s three instruments.

Goodhart. I use a PZL with a homemade compensator, a Burton electric with a Burton audio. The reason for having two really is, one is compensated and the other isn’t. The electric one, of course, gives me the audio. Schreder: I use a Ball, which has audio and compensation, and a Friebe which has no compensation. I also carry a Pioneer at the bottom of the seat for an emergency.

Smith: My main variometer indicator is a PZL with a PZL compensator and bottle. I’ve got also a BSW electric with audio with a PZL compensator and bottle. I use the BSW only rarely except for the audio signal. I would just as soon put the indicator out of sight and just rely on the audio. I also carry an early Memphis rate of climb with the restrictors removed as a standby system because it requires no bottles or connections. The Memphis goes to +/-2000 feet, which gives me something to take care of extreme conditions. Question: How difficult would the design or installation of vertical see through panels in the fuselage be for help in taking turn-point photos? Smith: Difficult, I think, and I'd like to comment on how to avoid the view panel. You should concentrate on getting a good fix as you come into the turnpoint. You should select a road or some system of intersections or fences or hills, or whatever, that you can look at and know that the spot that you need to take the photograph from is just beyond the spot. You can watch the spot. You can keep lined up a cross fix on the photograph taking point. I find that as you barrel on, you can take a few seconds to make that fix in your mind. Then, you can come up into a slow, tight turn, and you'll be exactly in position. I am, therefore, not certain that the vision panel is a necessity.

Schreder: I would agree with A.J. (Smith) and think that would be a better solution than trying to put a window in the bottom or the side of the ship Moffat: The window is hard to do, or we'd have all done it long ago. I agree with A.J. It's not valuable enough to spend the time it would take. Question: (For Moore and Smith) It would seem natural to assume that factory test programs should have established correct static port locations on the new fiberglass ships. Nevertheless, Wil Schuemann has drastically changed them on his Libelle. Is this because of changes in his modified fuselage, or is it an indication that all of us should not accept the factory locations as correct on some of the never ships. Please discuss briefly the sailplane static systems. Are there any quick and dirty checks to determine a good vs. a bad system? Nose vs. tail and other static port locations?

Smith: I haven't trusted factory's static locations and in the past I've gone back to nose port locations. Gene makes me realize that the reason that this probably works is that I've been using PZL equipment and I get a little suction with that location, which makes the PZL compensator more accurate. About the rest of it, I can't really comment that much. Moffat: I would never trust factory located ports. They are often laughably far off. The Diamant was a very good case. The Elfe had been flying for 2-1/2 years when A.J. and I flew it, and the location was absolutely absurd. It was about six inches under the wing. They could not understand why they weren't getting total energy.

Question: How did you determine that it was bad? Did you use trial and error, or did you actually make some measurements?

Moffat: Well, actually that one was so wildly out that by using the known instrument system that I had from another ship it was obvious the location was impossible and equally obvious that ports on the nose was probably a pretty good idea from past experience with the PZL.

Moore: Wil Schuemann and I found that the nose static on his Libelle had some error. We found this out in two ways. The first was airspeed indication error. That is probably the easiest check that you can run on a static system. Put a calibrated airspeed indicator in the ship and do a flight test and make up your mind whether or not this thing is telling you the truth. The second indication came when we tuned up his compensator on the bench. We found out that it didn't match the static situation for the ship, and he, therefore, undertook the operation of moving the static to the rear of the ship on the fuselage and that fixed the problem in that particular ship.

Question: It didn't have anything to do with the fuselage modification at all, did it?

Moore: No. None. That was a separate item, and I would be interested in hearing from Nick and Dick because they're actually in the business of designing sailplanes. Perhaps they can comment on just how much attention they give to this detail.

Goodhart: The first thing we always do is a positionary check, using a trailing static, which hangs out on a long piece of line 100 feet below the aircraft and you compare the static there with the static you are getting from the aircraft over a whole range of speeds, and this gives you a very good analysis of whether you've got a satisfactory static position or not. Question: (For Smith) Why do you have the weight reduction now when in the Proceedings and at the symposium last year, you and Dick said you would always want to fly the heaviest ship you could keep in the air?

Smith: I'm glad somebody finally caught that. I have been amazed to go back through the Proceedings and find out that we really shoot off our mouths pretty quickly and get too fast on the draw. A much smarter statement would be to say that there is an optimum weight for the sailplane for a particular day, and must guess about it. It can, however, be a pretty intelligent guess. I was trying to emphasize that I would like to carry weight up to that optimum and maybe just a hair beyond it. Maybe a lot of it beyond if it is disposable.

Schreder: I agree with A.J.

Question: (For Smith) After reducing weight to the bare minimum, would you then add ballast for a strong day?

Smith: It is rather interesting. Most of those man hours in my weight reduction program that I talked about were in the last four years. They would total up to about 800 man hours at, let's say, hobby costs of $10 or $20 an hour times 800 is like $8000 or $16,000. If you take out 48 pounds, that is a lot of money per pound. But really what you are trying to do is give yourself the option of having a light ship on the weak days and carrying a lot of ballast on strong days.

Question: Please comment on Paul Bikle's flight tests which show none of the modern ships tested do any better in L/D than the RJ-5's, 40 to 1Schreder: He will have an article in Soaring. I think this is one of the best projects I have ever seen because Paul, of course, is well qualified to do this sort of thing, and he's willing to spend the time.

Byars: Would one of you like to mention some figures?

Schreder: I can't give exact numbers because I'm quoting from memory from looking at them very hurried1y. As I recall, he got 36+ on the HP-14. The highest one he had was 38 on. a Kestrel. I think the Cirrus was down very close to the HP-14 and one of the very interesting points that he discovered is that the Kestrel, which has the highest L/D has the lowest aspect ratio (which is about 20 -to 1).

Question: (Byars) What, speeds were these?

Schreder: He tested them over the whole speed range but, of course, the max L/D was at the max L/D speed.

Smith: It takes a tremendous amount of effort to measure a sailplane, but you get very interesting information. We have all been aware that the general condition exists whereby performances are not quite as good as the published curve indicates. Ziacher has pointed this out on a number of ships over the past years. Raspet, in really getting down to measuring the Sisu, discovered that it only had a 37 to I glide ratio instead of the 41 to 1. Ships generally perform less than published but this is not great news; pretty interesting though. I'd like to see more information and more research on the development aspect of a sailplane rather than simple measurements but, of course, measurements are sort of a beginning point to any program.

Moffat: Two things must be remembered about measurements no matter how carefully made. First, I don't think max L/D is a very meaningful figure. It has -been used for many years, but how many hours have you ever flown at max L/D? Out of my 1200 or so, I doubt if it is 30. You hardly ever know it is the last thermal and consequently you usually can time flying over max L/D. The second point; tests must be made in ideal air conditions which are dead smooth. Gliders almost never get flown in ideal air conditions. The Sisu was a particularly spectacular example, and so, by the way, is the 2-32. In fact, it is true that all the ones of that family of wing sections look grand in smooth air and very poor in rough. I have seen this in many ships aside from the Sisu and the 2-32. I saw it in tests with the Phoebus, for example. Unless we find a -way to measure ships in standard turbulence, you shouldn't be too surprised to see the contest results of a Cirrus be a bit different from the contest results of an HP-14. Question: One of the standard class designers is changing to a top surface only dive brake design. The bottom half is eliminated to keep them out of the weeds. Will this really work in limiting terminal velocity?

Moffat: Yes, this is Klaus Holighaus in the standard Cirrus. He came upon this by accident last spring. I had a letter from him about it. He was having some vibration trouble with the dive brake housing and removed first the lower surface and then the upper surface to find out what was causing it. He was most surprised to discover when he got the upper surface dive brake on and the lower surface dive brake off, that he still had 80 percent of his effectiveness. In fact, he suggested to me that I take the lower dive brake off the Cirrus before the contest last year. I made some experiments with it, and it was perfectly satisfactory for glide control, but it is a non-returnable modification, and I was afraid that I would have trouble selling it if I did it, so I didn't.

Question: Dick, what, if anything, do you think of the modular wing construction being used by Jim Bede and its possible application to gliders?

Schreder: I don't think it would be very applicable to gliders because I am afraid you would have torsional problems and I'm sure it would not be the lightest design. It would add weight. I can't see any real application for sailplanes.

Question: Smith made the suggestion that one obtains templates of wing contours to check same on a new sailplane. Can significant changes be made without danger to the structure, excluding obvious defects which may be filled? It likely that basic contours will be off?

Smith: You can generally get from the manufacturer a print that gives the airfoil at various stations, and this can be reproduced on mylar, metal, or whatever. You can carve out the templates and put them down on the wing, and check the fit. Most of the discrepancies I have seen are right on the leading edge, perhaps within the first five percent. That is normally called the nose radius. These are non-structural changes.

Moffat: I think there is something that a lot of people are not at all aware of, and that is that fiberglass manufacturers like Schempp-Hirth and Glasflugel and others, are extremely pleased if they make the molds of the prototype stay within a millimeter on the wing section. A millimeter is quite large in some respects. It is virtually impossible to make molds from a prototype and get the same section. There are heat problems, weight problems, and many other problems. If you talk to designers privately, they will tell you that they just don't get what they thought they had. That may be a factor if you are checking with the templates.

Question: Do any of you anticipate future speed record triangle attempts? What special techniques are involved as opposed to competition?

Goodhart: The answer is yes. We will, as soon as we get Sigma going (if we get it going). We shall certainly try to set some records with it. As to techniques, I don't think there is anything special. Obviously, as we mentioned earlier, there is a major advantage in getting the triangle oriented right with regard to the wind so that your last leg is into the wind, particularly on the shorter triangles. It can make about 10 percent difference.

Moffat: I don't plan to do much more record flying unless it happens to be very convenient. The biggest necessity for record flying is a whole lot of time to spend in a likely spot. I was talking to Joe Lincoln last night. He plans to spend up to a month in the proper spot, hoping to hit the weather. They have been doing this (waiting) in Odessa for ten years now, and they had one really great day only it didn't look like a great day. Only Al Parker, whose wife wanted him back for church on Sunday, took off. That was when he made the world's distance record. I think the -basic difference in speed record flying is that it is feast or famine. You count very heavily on the next thermal being a boomer, and you are perfectly willing to go down to the ground to find it.

Question: Would you ask the panel to discuss techniques for really poor days, overcast days, etc.?

Goodhart: We have something I call pussyfooting, which is feeling your way dead slow, staying with what you've got, and always having some idea what you're going for. On a bad day you go straight to the ground if you haven't got a clear aim; or some reason; something you can see; something you know that will indicate a better chance of lift somewhere in the grey haze in front of you. I reduce nearly always to just loosely holding in zero and waiting for something to indicate the possibility of something better out front because there really isn't any use going on. I remember in the German Internationals I went down on the last day and lost the championship because we had to go through a warm front. Three or four chaps did go through this warm front but by golly it was difficult. I remember at least 25 of us, all circling in zero. In fact, some of them were circling in sink because they didn't climb that well. It was a great group and there wasn't anywhere to go and everybody was just holding on and wondering where to go. Being a sort of nervous character or something, I finally dream up some reason going on and went on and went to the ground. Not 20 minutes later, after I had landed, a patch of the faintest grey watery sun Just became visible and over the chaps went.

Moffat: I think one of the things to keep in mind for this kind of flying is you really want to think about how to get markers out there. I think your start on a day like that should be planned so that you will have other ships out ahead of you all the way around the course, if humanly possible. There just isn't a variometer like another sailplane.

Question: What are common symptoms for common field vario problems such as leaks in the pitot or the static. How do you recognize them? Any quick field solutions for gross over or under compensation?

Moore: One of the common troubles is a leak on the bottle side of the variometer and since this is located in the cockpit area, it would quite likely show up as an erroneous down reading. Another common trouble is no sensitivity or low sensitivity. If your bottle is leaking, you will lose sensitivity and it may or may not produce the down reading. The down reading that I described depends on whether or not the cockpit static and the static ports of the ship are at the same pressure. Probably the most satisfactory field fix on compensation would be to put a plug in the bottle, a small piece of closed cell foam or cork or something of that nature. Change the volume of the bottle.

Steve du Pont: I have two Friebe variometers, one over 30 years old and one brand new. They both had leaks around the glass. I had to make a spanner wrench and screw the glass up tight, and check the O-ring underneath. I put a new O-ring in one of them.

Question: Considering the possible clean-up, could differential spoilers for roll control without ailerons be justified?

Schreder: I would think it would be very bad because if you're flying, if you're thermaling (all the ships I've thermaled in) you find you use quite a bit of aileron, and I'm sure that the drag of a spoiler would be greater than the drag of ailerons. Maybe Nick has something different.

Goodhart: Oh yes, our feeling on the spoiler we're going to use, and it's strictly there to add the last bit of the rate of roll where you can accept that it produced quite a high drag. I would think that as a regular control service it would be quite unacceptable from the drag point of view. A.J. was asking whether we planned to have a detent at the end of the aileron movement at the beginning of the spoiler. No, we shall move progressively from one to the other, but I think you'll feel it in the hinge balance.

Moffat: You might be interested to know that Klaus Holighaus found when he first built the Nimbus that his roll rate was rather unacceptable. It was about six seconds as I recall. He added a spoiler of the kind Nick is talking about that engaged at I think it was the end of 15' aileron travel and reduced his roll rate by a fall second. Now he's down to 5 on 72 foot span.

Question: Are all the manufacturers thinking in terms of a system approach to sailplane trailer combinations? Home built trailers are a headache. Any comments on trailers or trailer-sailplane combinations?

Smith: I know of two manufacturers who are not solving the problem. No. I doesn't wish to get involved in trailer production and the shipping problems and this sort of thing so consequently practically no trailers at all. The other one says our transport wagons aren't the best, and they just don't work. They're not treated as a system for assembly particularly. Schreder: Anybody that has a real problem, we might be able to help them. We developed a trailer for the HP-15 which was all metal, very simple to build, stress-skin construction, and very light. It weighed 650 pounds, and this is a real joy to tow after going trailers made out of plywood that weighed more than twice that.

Question: What was the approximate cost, Dick?

Schreder: Approximate cost - around $700. This is a kit of all materials.

Goodhart: Yes, it seems to me that it's a little unkind to say that home built trailers aren't going to go it because I've seen some jolly good home built trailers. It's the home design that you've got to look at. The building is all right, but I've seen some terrible designs. People haven't got to first base on the principles of what constitutes a good trailer, so I reckon that if somebody would produce a decent design and everybody can build a decent trailer from a kit of parts, or even from a design.

Moffat; We have an enormous advantage in America for the home builder, which is cheap plywood. I've built four trailers now; I think billings on all materials, including paint and stuff like that have come between about $245 and about $290. That includes commercial 1500 pound axle and all that. The weights seem to go around 1000 pounds or a bit less. They trail pretty well up to 107 which is as fast as the car will go.

Question: I am sure that each of the panel members has at one time or another served as a contest director at a soaring meet. I'd like to hear some comments on task selection, pre-contest selection of turnpoints, daily task selection, tow, start gate, finish gate, opening and closing times, whether this particular day should be a speed task or a distance task, etc. Well, I'd say just a few brief comments.

Moffat: As I recall (Nick you'll notice) there is an excellent article in Sailplane and Gliding on this by Ann Welch. I'd see that by all means. She knows a whole lot more about it than any of us do, except maybe Nick. Goodhart: Well now, I don't know a thing about it. I've only been on the receiving end, and I'm one of the chaps who's quite prepared to accept any task I'm offered, within reason.

Schreder: I think I'd just have to say I agree with those two.

Smith: The book, "The New Soaring Pilot" has an appendix which has a chart to help you with task selection based oil given meteorological conditions and I recommend anybody who's going to be faced with this problem get a copy.

Answer: I would like to add one comment and that is, by all means get a competent soaring pilot who knows the area on the task selecting committee so that some intelligent decisions can be made.

Question: (For Smith) Dick explained his poor Marfa performance. Your performance and standing were good, but you didn't win. Was it the wrong ship or bad luck or what?

Smith: The Sisu is a great sailplane. It's really tremendous, but it's not the best competition sailplane. It's good for records and good when the conditions are really good, but it's not a good competition machine. My mistake was in believing that I was really going to get EL new ship in time for the competition, and it didn't really materialize. I think I had the wrong ship. I don't think I made any real serious errors during the competition. I had one particularly bad day on a speed task where I got very low in a mountainous area and it just took a long time to get out. I felt pretty good at the end of the contest. I felt that I'd gotten about as much out of the Sisu as I could on the average. I think 7th isn't too bad.

Question; Briefly describe the pressure brought upon a pilot and his crew in a national or international competition. Are there any quick comments you could make about such things?

Moffat: You'll never know until you've been there.

Goodhart: I'm told that I become very, very unpleasant under that pressure.

Schreder: Yes, you're Dr. Jekyl and Mr. Hyde during the contest.

Smith: Pressure is tremendous, and you've got choices to make when you begin to have problems either with yourself or with your crew.

Moffat: I think there's another side to this crew thing. Frankly, I think it's unwise of A.J. to use pickup crews. I think you should give a lot of time and thought to having a reliable crew, and I certainly feel that a lot of my success in five years has been due to having the same crew, Suzanne and Ralph, that I can count on absolutely. The other thing is, and one of the things that I think adds to the pressure, is that you had better use a little self control and not bite the crew's head off because if you bite the crew's head off they will slack off on you a bit. I think it's extremely important that the crew be just as competitive as the pilot. You don't want anybody on the team who doesn't care.

Smith: Very interesting. I think Wiley Mullan who is one of the most fantastic crewmen for me summed it all up. Wiley was an interesting guy. He was one of the ones that you didn't really know was around, but the job was always done and the ship was quite a bit better every day to fly so he was not only getting it assembled and getting it into position but he was doing little things to improve the ship every day without coaching and all this sort of thing, and I really didn't realize how good he was until two years later, but he summed it up one night. He said that the longest list of crew members in the world is the list of crew members who have crewed for Smith and the shortest list is the ones who have crewed for him twice. I've had a tremendous number of really good crewmen in Wiley Mullan and Ed Butts and some young chaps who have helped me during the summer -just fantastic people-and I'd be the first to admit that any problems I have with them on a personality basis are because I'm competitive, but in the pressure of the moment, I want to get the job done.

Schreder: I'd say that about the worst experience that a competition pilot can have is to be ready for takeoff and not be able to find his crew, during a national contest or in international competition - and it does happen.

Question: Please discuss radios and how to obtain reliability and get good service. What kind do you use?

Schreder: I had a BEI and sent it back to the factory. They sent me a card saying that the factory burned down, my radio was gone, and it wasn't insured.

Smith: I've had very good luck with Baysides. The only failure I've ever had is in misuse of the equipment by trying to crank down too hard on the antenna attachment. We rotated the whole assembly and shorted out all the connections at the bottom, and transmitting without the antenna connected is tough on transistors. Otherwise, the set has been very dependable.

Moffat: I had an early Bayside bought in '63 which was a magnificent radio. The only mistake I ever made was selling it with the ship. I had, I think, two or three later Baysides, none of which ever worked despite many trips back to the factory - before it burned down. I am currently using a Bertea, which I like very much, but I haven't used it for more than about a month so it's really too early to tell, but it really seems to be good.

Byars; A couple of months ago Graham Thomson told me he had sold about 40 or 50 Berteas and had had excellent results. Of course, he's a salesman. The Bertea has quite a bit higher current drain than the BEI, which may be a factor for some people.

Question: (For Moffat and Smith) How many days and how many dollars have you spent on the sport of gliding during the past ten years - a rough ballpark estimate.

Moffat: What a question! It's tricky because you have sailplane expenses and operating expenses. Sailplane expenses have not been bad because of the market for the last ten years. You could usually even make a few dollars. I don't think I've spent many more dollars since I bought Dick's HP-8 for, I think it was $5000. I always manage to trade up a little. So the sailplanes weren't too bad. About the minimum other expense you get away with in the Nationals would be around $2000. If you're going to compete I don't see how you could possibly spend much under $2000 a year. I'd hate to add it up. It would shock me too much.

Smith: Averaged out over ten years, I would estimate about 120 hours of flying each year, about 80 of that in the Nationals, so not very much flying. That takes a minimum of three weeks of the summer and if you go to the Internationals, that takes five weeks or thereabouts. You can't put a dollar sign on that time. I think I've spent on the average of 200 hours during the winter in preparation. In other words, the ratio for me of preparation of flying is two to one, and, again, I can't put dollar signs on that time. If I did, I would give it all up and do something else. I would say that my expenses are about like George's. I'd say $2000 a year minimum and going to the Internationals adds maybe another $500 or so to that. Fortunately, in the past, in the Internationals, we've been relatively well reimbursed by the SSA fund. However, again, the dollars out of your pocket are probably still in the order of $1000 or so. The big thing, I think, is this time in preparation.

Moffat: I neglected to say anything about time. As I recall, I've got about 1200 flying hours in gliders in the last ten years, and I think that my log shows about 28,000 cross country miles. I don't count anything under 50 miles, but I quite agree with A.J., if you count your own time it is absolutely prohibitive, especially on a teacher's salary. I don't know about architects

Question: Give pros and cons regarding a wetting agent or detergent on smooth, sanded and compounded wing surfaces. What do you use on fiberglass? Goodhart: I haven't got any really useful comment to make. I don't believe it makes very much difference whether you have matt surface or polished surface or whether you put wetting agents on or not. What does matter is the waviness, and if you can get rid of the waviness then I reckon you're doing the most important job.

Schreder: We use 400-grit sandpaper, dry.

Smith: Generally, just washing down with plain water, and when necessary, cleaning off the accumulation of grime and whatever, with either rubbing compound or 400 paper.

Proceedings of the 1971 Symposium On Competitive Soaring

Presented at: Mont Chateau Lodge, Morgantown, West Virginia, February 13-14, 1971

Edited by: Ed Byars Bill Holbrook

PREFACE

The rapid growth of the number of competitive soaring pilots in the United States creates an increasing demand for advanced soaring information. Soaring Symposia is trying to provide the latest and best data by conducting annual symposiums on competitive soaring and printing the transcript of the proceedings for the study of those who attend and the information of those unable to come to the meetings.

What began as an effort to improve the quality of American pilots has spread to the world fraternity as these proceedings are read internationally.

The entire faculty has expressed concern about the number of sailplanes damaged in contest landings. They continue to emphasize that you can't win with a broken bird. The knowledge gained by home study must be tempered with experience.

Know your own capabilities with your sailplane!

We particularly thank the faculty who make these symposia meaningful. The hard work Dr. Leland Ransom spends taping all of our symposia and Bree Morecraft's hours of meticulous typing are gratefully acknowledged.

The finest part of Soaring Symposia is the opportunity to know so many friends through their comments, both written and verbal, on our books. Please continue to let us know of your thoughts about our work.

Ed Byars & Bill Holbrook

Contest Strategy

by George Moffat

Two years ago at the first Symposium I talked about tactical flying-all the endless little ways you can save a second here, a second there-the whole theory of winning by not losing. Today I would like to consider the other side of the coin, the strategic choices that a pilot must make, and make correctly, if all the seconds saved by careful tactical flying are not to be thrown away by making wrong overall decisions-or perhaps by failing to realize that there are decisions to make.

We will consider this subject under four general categories based on the various kinds of tasks and problems. First, we will take that persistent relic, the free distance task. Following that we will cover its slightly disguised cousin, the cat's cradle. Next will come the speed task; and finally we will consider general strategic problems concerned with the type of ship and one's current placing in the contest. I hope to be able to illustrate all of these problems by reference to recent contest flights, and I will try to give you some idea of how successful I have been (or haven't been) an each type of task so you will know whether to listen or not.

First, let us take up the jolly old free distance dearly beloved of Minamoa owners. I have won two out of nine free distance tries, -by the way, in case you think the grapes are entirely sour. A.J. and Dick Schreder have equal records over the same years. No advocates of the task that I know of have won more than one. Since I have, many times, said all the nasty things I can think of about this expensive, pointless, outdated and luck-prone event, I will spare you my opinion of it now. Unfortunately, despite the low regard most of the better contest pilots have for the task, it is still very much with us (we had not one but two at the 1970 Standard Class Nationals, one of which turned into a no-contest day), so we might as well think of the smartest ways to fly the thing.

The reason that the free distance day is so luck-prone and thus detested by the better competitors is that one seldom has adequate or accurate weather information. For example, in 1964 there was supposed to be a 25knot southerly wind, so everyone headed dutifully north into nothing type weather. Actually the wind was quite light. A few of us decided to chance it and had the best flights, A. J. winning. In Adrian in 1965 it was supposed to be good to the west and raining in the south. One chap apparently got his directions mixed, went south and won easily. Those of us who went west found the rain. The weatherman apparently got his directions mixed, too. In 1969 there was an uncrossable front 200 miles north so the smart money went east for about 350 miles. As it happened the front had a big hole, and people who drifted off downwind to the north found it and poured through with distances up to 520 miles. And so it goes.

What does all this tell us from a strategic point of view? The first lesson is that you cannot possibly trust the weather information. The next is that you had better use a sort of fail-safe plan. By this I mean that, unless you are hopelessly behind, you had better try for a pretty good flight rather than a flat out winner. The logic here is that most of your serious competitors are in the same boat and will probably make about the game choices given the same information. The types that win big on free distance days by trying the radical are hardly ever the pilots that end up in the top places.

Obviously the most important information that you need concerns the weather. You should listen to the briefing with great care, noting especially such natural barriers as fronts and such speed producing factors as wind and thermal strength. If the free distance task comes after the third contest day, you should be beginning to have some idea of the idiosyncrasies of the weatherman. Does he, like Dave Oven, always seem very conservative on when thermals will begin? Does he never look out the hanger door to see what's actually happening? Does be consistently under or overestimate thermal strength? I like to go have a bit of a chat with the weatherman each day after the briefing, not BO much because I may get extra information, but just to get to know him and let him get to know me. This allows me to better judge the degree of certainty behind the predictions. I usually drop by once an hour before takeoff to see if there are any changes and particularly to see if the heating is going according to prediction.

Normally the weather briefing will show one or two definite directions to go. For instance in Reno in 1966 it was blowing 50-60 mph with weak thermals so no great concentration was needed. If there are conflicting choices, you should investigate the possibilities carefully. Too many pilots just turn downwind and hope for the best. You must plan to maximize flying hours and go where you can get the most distance. For example, in 1969 there was a front 200-250 miles downwind with little chance given to either cross it or run along it. West looked dead, east had a warm front. A narrow line to the northeast offered a crosswind turning to headwind after about 300 miles, with very weak thermals late in the day. The latter choice didn't sound very promising, but it was the correct one because it offered a chance to stay airborne for 8-1/2 hours. Even if you only averaged 40-45 mph you would have 340-380 miles, whereas the northern route offered 250 at most although with average speeds of 50-60 mph. I actually covered 376 to the northeast.

Terrain features should be considered in plotting course. If there is a choice, try to be over reasonably landable country at the end of the day. You can cover a lot of extra miles if you don't have to break off at 1500 feet to take the last available field. I lost 30 miles that way in 1966. 1 gained a few additional miles in 1969 by being able to pass up an airport when I was down to 300 feet to get to some obviously good fields beyond.

Should one make major changes of plan during the flight if conditions seem markedly different from the forecast? I hope A. J. is going to talk about this one, but in general I would say yes. I think I am too slow to make such changes. However, it is very important not to mill around aimlessly. Too many people circle interminably at the top of used up thermals because they can't decide what to do next.

A few years ago Paul Bikle thought up the prescribed area distance task, more irreverently known as cat's cradle or Bikle's basket. The idea was to test the pilot's evaluation of weather and course possibilities as in free distance without incurring the long, expensive retrieves. Unfortunately the task has usually turned into either a nine hour race (in good weather or predictable conditions) or a straight luck job in questionable weather. Last year Paul thought up a great improvement on his system, but unfortunately contest directors, at least in the Standard Nationals often did not call the task on the sorts of day that Paul specified, so we ended up with the worst of two worlds. We have been averaging about two cat's cradles per contest lately, so the task deserves a good deal of strategic consideration. Incidentally, I have flown nine cat's cradles in national or international competition and won four, for a win average of about 45 percent.

In working out where to go in a cat's cradle the most important thing is to plan backwards. The key to doing well lies in being in the right spot three hours before the anticipated end of the flying day. A normal prescribed area envelope will be about 250 miles long and perhaps 200 high so there is quite a lot of room to move around. The whole point lies in being as far upwind as you think you will be able to fly in the last three hours so that as the thermals weaken you can take maximum advantage of the wind. For example, if you think the day will end at seven you expect to average 35 mph for the last three hours, and the wind is 15 mph, you should try to make your last turn about 150 miles upwind at around 4:00 o'clock.

Last summer in the Internationals in the second cat's cradle we had a 15 mph wind from the east. Wally and I chose to buck this wind up to Odessa (145 miles) and then turn southeast to buck it again to Big Lake for another 80 miles. We rounded Big Lake according to plan at about 5:00 o'clock, having covered only 225 miles. Next, we flew west to Wink with a quartering tailwind and finally turned downwind to Sierra Blanca, the extreme western end of the course, arriving there at about sundown with just enough altitude to glide the last 20 miles back into the dying wind for a total of 480 miles. During the last weak hour we passed many pilots who had allowed themselves to get downwind too early and were stuck trying to get upwind in 60 fpm thermals. At 5:00 o'clock some of these pilots mist have had a 70-mile lead on Wally and me, but they don't count up the points until you land.

An even more interesting example of the same sort of strategic planning came on the first day of the Standard Nationals in Elmira last summer. As many of you will remember, the wind was about 15 mph out of the WNW with about 400-500 fpm thermals predicted. With this in mind I planned to go downwind to Wurtsboro (140 miles), back west to Bloomsburg (140 miles), using the heart of the day to buck the wind, and, arriving there a bit after five, coast downwind as far as possible. In actual fact I soon discovered the thermals were far weaker than forecast so after about 25 miles, I turned south to go to Mount Pocono, arriving there about 2:00 o'clock. Once there I turned west toward Bloomsburg, bucking the wind in 300 fpm lift, and arrived about 4:30 with the day obviously beginning to die. I turned east in thermals which varied from zero sink to 100 fpm and managed to drift 120 miles before landing at about 7:00 o'clock for a flight of 262 miles. I later discovered that most of my competitors had gone to Wurtsboro first but then had not been able to get far enough upwind to use the last two hours of the day effectively, many of them having run out of course to the east by 5:30. The next best flights were about 210 miles.

The kind of planning that I have been recommending takes some rather close calculation of likely speeds. A successful pilot should be able to figure his average speed in a given set of conditions to within 3-5 mph. Always work out speeds when practicing just to see how close you can get.

Of course the key to a successful area distance flight is weather information, and equally of course, the weather is usually absent entirely (as at Elmira last summer) or doubtful at best. Unfortunately cat's cradles tend to be called in rather chancy weather so results often have more to do with luck in not getting blocked by a big storm. over your turn than any great wisdom displayed by the pilot. As in free distance flying, the fail-safe method seems best. Try to avoid turnpoints that will leave you with no productive alternate if you find them blocked when you get within ten miles. The whole U.S. team got had this way on the first day of the Internationals last summer.

An interesting and typical weather decision turned up on the second area distance in the World's last summer. The prediction called for 600-800 fpm thermals in the western half of the area with scattered cu-nim, and 400-600 fpm in the eastern half with no chance of storms. The western sector would obviously produce the best flights if there was no blocking by storms, the eastern end would give less mileage but no blocking and the chance of a long downwind final glide. The whole U.S. team chose to buck the wind and weaker thermals to head east, partly influenced, in my case by being well up in the standings, very much influenced by our collective disaster with cu-nims on the first day. All turned out about as predicted except that there were no storms anywhere. Wally and I turned in about 482 miles, Neubert of Germany in the Kestrel 22 won with 500 miles, all done in the western sector. I still feel I made the right decision. In Neubert's shoes I would have done as he did since he had to have a very good day in order to climb back up in the standings. Wally should probably have taken a chance on the west in view of his relatively poor standing at the time, but he may have been partly influenced by the advantages of team flying. There is no question that our team flying worked superbly and helped both our scores a lot. A more effective teammate or a better pilot than Wally Scott would be hard to imagine.

The strategy of choosing takeoff times assumes great importance on distance days-always supposing you are not last on the choice list. Ideally I would take the earliest possible time plus ten minutes or ten minutes after the first man, whichever was later. The theory here is that you will have a few other ships launched ahead of you to mark whatever little early thermals there may be. Of course if you have reason to think that everyone is taking off far too late, it pays to keep your later time until the last minute and then move quickly up to the head of the line and get off. The reason for the last minute move is that sailplane pilots often show a depressing similarity to sheep in that they will do whatever they see some other pilot do, In the Internationals in 1960 Dick Schreder dashed to his ship, jumped in and took off in an obviously dead sky-and watched 60 of the world's best follow suite. He just did it for fun.

Assuming that you do get off among the first and it is very weak, don't be in too big a hurry to dash right out on course. Many such top pilots as Dick Johnson will mill around for half an hour or more waiting for conditions to improve and especially, waiting for some of the more impatient types to get out on course. Keep in mind that one can make fabulous time jumping from gaggle to well marked gaggle and soon be right up with the leaders. Of course if you realize that everyone is hanging back unnecessarily, you had better get going. Unfortunately, if you are at all well known, you will immediately attract a minnow pack of followers. The best bet is to ignore them, they usually soon get lost.

Speed tasks are, for me, much the most fun to fly, since the luck element is fairly low and one is somewhat less dependent on inaccurate or doubtful weather reports than in distance tasks. They are also cheap and relatively non-tiring, since retrieves are seldom involved. I am supposed to like them because they are a big specialty of mine, but actually I have won 23 out of 54 flown for an average of 48 percent as opposed to a 45 percent average on cat's cradle tasks. My experience has been that in an 8-day contest of all speed tasks all the elements of judgment and weak weather ability will be tested fully as well as if distance tasks were thrown in.

The basic strategy in speed tasks has to do with time and its proper use. As soon as the task and weather have been announced, the pilot should get busy with his computer and figure out likely speeds. He needs to know the best possible speed, the likely speed and a minimum likely speed. If the course is 200 miles and the maximum lift predicted is 400 fpm he might figure 54 mph as maximum, 46 mph as likely and 35 as least likely. The times thus are 3:40, 4:20 and 5:40. If the lift should be starting at noon and ending about 8:00 o'clock, the pilot would want to start between 13:45 and 14:00. The reasoning is that if the weather is much better than anticipated you will still be doing most of your flying in the heart of the day; if the weather is about as predicted, you will be utilizing the best 4-1/2 hour stretch; and if things really fall apart you will still make it home. With the latter in mind, a pilot should get airborne about an hour before the planned start so that he can feel out the day. This hour of leeway should be used to time climbs In order to determine lift strength and ceiling. If conditions seem markedly worse than anticipated, move up the start time accordingly. A false start or two during the pre-start period will often encourage competitors to start too early. There is a strong psychological pressure to get going which should be resisted. Those who don't resist it will serve as thermal finders for you all the way around the course.

If your chosen starting time is 3:00 o'clock and everyone else seems to be long gone by 2:30, consider the advisability of starting early. Those others may know something you don't. You will also lose their valuable thermal marking service-especially helpful on weak days-if you stick too closely to plan. Another general rule: if in doubt, start earlier. You may not win the day, but you may save the contest. Wally Scott got shot down in just this way in the last Internationals, and I missed sharing his fate by only a couple of minutes. I probably lost the 1968 Hahnweide contest in Germany by starting too late on a 300 km triangle-I had great time until I hit the ground 60 miles short of the finish-and certainly scuppered. myself on the first day of the 1967 Nationals by starting a bit too late in my greed for a few extra points.

The growing prevalence of designating starts causes a strategy problem. Especially on good days with fairly short tasks one is often launched two to three hours before the best starting time. The endless milling around while awaiting the magic hour is very boring and extremely sapping of the competitive drive so necessary for winning. I try to get off by myself so as to spend as little energy as possible while waiting out the clock. Almost everyone starts too early under these conditions, and you might want to adjust your strategy accordingly. When flying under our good old pilot selected takeoff system, it is a good idea to keep an eye on unpredicted weather which may influence takeoff time. Early observance of the growing cu-nim that turned into The Great Tornado of the 1967 Nationals allowed me to move my launch time up an hour and win the day. Such sneaky maneuvers are best done quietly. If you always have your ship out on the line early, less people will wonder about your sudden activity. Make sure the crew is loitering nearby.

The other strategic aspects of speed task flying, such as knowledge and use of terrain have been covered under the other type tasks. Heedless to say, you always round downwind turns at maximum altitude and upwind ones as low as you dare, but these are more nearly items of tactics than of strategy.

We have covered strategy for particular tasks; now what about overall strategy? There are two major considerations, ship and place in contest.

First, consider the ship. You will be unhappy to learn that not all of us always get to fly the best ship for a given contest. A. J. first made his reputation in an LO-150, hardly a world beater even ten years ago; Dick Schreder and I both had our first wins in the HP-8 which, at close to eight pounds wing loading, sometimes left a few things to be desired. The point is to utilize up to the maximum the things you can expect to do with your equipment.

If you fly a Ka-6 you cannot hope realistically to win speed days. Trying to beat the lead sleds at their own game will result in your taking too many chances and ending up on the deck. The trick is to pull a Dick Johnson. Dick has never won a speed day as long as I have been flying against him. On the other hand he never loses by all that much, and with our point system, which gives disproportionately small encouragement to speed, he does very well. With a light ship you must do as Dick does, become a weak weather specialist. A Ka-6 is right up there with the latest glass jobs when the thermals drop into the 100 fpm category, as John Seymour kept demonstrating last summer at Elmira. Consistency when others are being inconsistent wins a lot of contests. Ed Makula, flying a Foka. in Reno in 1966, gave a perfect illustration of this principle. Conversely, if you fly a heavy ship you must do well on speed tasks in good weather and just try to hang in there very cautiously in bad weather. I find it very hard to discipline myself to fly at max L/D when I am used to cruising 30 mph faster. There is an almost ungovernable tendency to drop the nose and lose the trailing gaggle, but it is very depressing to watch from the ground a few minutes later as they drift cautiously on overhead.

Your ship’s performance may very much influence your overall approach to the contest. In Marfa last summer I was confident that the Nimbus’ performance edge would bail me out even after the first disastrous day. Consequently I flew quite conservatively, especially towards the end. Neubert’s bad luck on the second day allowed me to do this; otherwise I would have had to push really hard. In Elmira I decided to fly extremely cautiously, never really trying to win a day (and seldom winning by much of a margin) because I felt sure that in the very weak weather my ship had no real advantage but that consistency would be every-thing.

Practice days can be quite important strategically. One should never lose a chance to defeat another ship in either climb or glide, and one should never continue a comparison flight if the other pilot can see he is beating you. A. J. and I took great and planned delight in Poland in flying rings around all the Fokas we could find just to demoralize the opposition. I did the same with the Nimbus last summer. Pilots who think they will be beaten are beaten.

Your place in a contest or your anticipated place is another major strategic consideration. Generally speaking, the farther up you are in the standings or the higher you expect to be, the more cautiously you fly. Winning individual days is not important. It is not losing days that counts. On the other hand, if you are tanked for some reason as Dick Schreder, I, and so many others were on the first day in Texas in 1967, you had better consider a go-for-broke approach. My thinking that year was influenced by the fact that I didn’t expect I could get on the U.S. team for the following year unless I was in the first five. As a result I took far more chances than I usually do and finally made it to fourth spot.

Strategy by itself will never win a contest. Tactical flying is still far more important. Still, proper use of strategic considerations can often save the pilot from hasty and rash decisions which will waste the valuable seconds saved by careful flying. Strategy consists of taking the long range view of a course of action to see where it will get you at the end of the meet. Too often a failure to consider overall objectives causes a pilot to take a chance which is not justified in terms of the long range result desired.

Questions And Answers

Question: (John Ryan) Are there cases where you should seriously consider going around twice on a speed task?

Answer: It should never be a consideration and in recent years has not been. In the early sixties it was common to call speed tasks of, say, 60 or 70 mile lengths. I can remember one case of going around three times. I think this was Elmira in 1963. In the last three or four years committees have generally not called tasks short enough for you to effectively get around twice. My thinking is that it is far better to choose the one best time if the task is, say, about three and one-half hours, rather than have an early and late trip both in not so hot weather.

There is another factor. Dick Johnson, I thought, was a superb team captain in Marfa last year, but the only mistake I thought he made was encouraging Wally Scott to go around a 250 mile task on, I believe, the fourth day. I think Dick was thinking very competitively but I don't think he was thinking effectively on long range and degree of weariness. Effective speed flying is very, very tiring and I think probably it cost Wally more on energy to make that second run than it was worth. Incidentally, he didn't up his speed. He didn't leave until about 4:00 o'clock which meant he couldn't possibly finish until around 7:30 and the day was beginning to die by then.

Question: (Doug Gaines) When do you make the decision that things are not as good or that things are better than you originally predicted? Answer: That's a very good question because that is a very hard decision to make. I'm sure that a lot of it is just based on plenty of experience.

Now, to give a finite example, on the first day at Elmira I decided that it wasn't going to be any good when I couldn't find any decent thermals to begin with. If in ten miles you find no decent thermals, it may be just bad luck; but if in 25 miles you find no decent thermals, then probably it is because there are no decent thermals. Another thing is you begin to look at the clouds. In this case this was a basic northwest weather day which in this area gives us sharp well defined clouds with obvious cores. But this day the clouds were rather straggly looking and were not developing as they should. They looked flat and they were flat. Experience shows that this would be likely to lead to an early demise of the day. I think generally what you work on is a general feeling based on experience.

Question: (Leo Buckley) You are critical of the distance task because of the possibility of isolated air mass thunderstorms blocking the turnpoint. Isn't this an equally valid criticism of a speed task, and if not, why not?

Answer: No it is not, because if a large air mass thunderstorm is blocking the turnpoint when you get there, you can assume that it has been blocking the turnpoint for a bit of time and is going to block it for a bit of time. What you do is wait on the outside for it to go away. If it doesn't go away then everyone is going to land pretty much in the same spot and the day might as well not have been a contest day because everyone will wind up with approximately the same score. Now if it does go away, then your patience in hanging around will be rewarded. However, if you do this on a distance task or cat's cradle, then you are absolutely had. You have to shovel off to the next turnpoint, perhaps 80 miles or more away, and in doing so give up a weak day three hours. There is no known way whatsoever that you can get this back and yet it was not poor judgment that got you there. In fact, it may have been very good judgment. It was just a. chance that you could not foresee nor could the weather man.

Comment. (A. J. Smith) It is a rare situation where everybody is in the same unfortunate incident in a cat's cradle.

Comment: (Moffat) Yes, I feel that this is a very, very important point.

Airmanship - Inflight Decisions

by A. J. Smith

Previously we've talked about general, almost textbook aspects of competition soaring. Now we'll consider one specific aspect to illustrate what it's like in reality.

The decisions a competition pilot makes inflight are important. Inflight decisions are important because most preflight strategy is based on weather observations, reports and analyses which seldom are complete or accurate enough for our purposes. Weather observations made later inflight provide more and better information. Really critical decisions are going to be made or confirmed on the basis of what we see and observe after we're airborne. If we examine just one aspect of the process of inflight decisions, we begin to see a philosophy for dealing with other problems.

Anticipation of need for inflight observation and examination well ahead of time, (now!) should help us develop systematic inflight observation and evaluation and facilitate quick and good decisions during competition flights when we don't have much time. We can and should gain experience and develop an approach to competition flying before we are actually involved in it.

I choose to examine the simple aspect of course deviations during a contest flight.

Competition flight paths seldom look like the classic soaring textbook climb and glide profiles. There's so little relationship between the paths or profiles we produce in the air and those we read about in the textbook, that we might consider reviewing our entire approach. The textbook deserves only credit for pointing out the general philosophy of soaring; very general, rare and classic but seldom the way it really is. Perhaps on some occasions when you're at the right exotic site-there aren't many-you might produce a flight that resembles the textbook soaring flight . This is indeed rare. You might even have the possibility of putting together several classic flights in one competition. If you are able to do that, you are quite likely to win the competition and have a tremendous sense of your good luck. It doesn't happen often.

We can consider the many factors in the problem of deviations from course and draw classic solutions for the problem. It's important that we understand all the factors but it seems more important to realize that the classic solutions provide only general guidelines.

Nick Goodhart, in Sailplane and Gliding about a year ago, discussed the problem of dealing with crosswind as we progress to a goal. His solution was beautifully accurate and practically done, but in the category of Sunday night fun around the bar. What are most such flights really like? Most commonly the flights wander off in random patterns well away from the course and well away from the idealized vertical profile of a soaring flight. We're concerned here that we wander randomly away from the perfect course line. We know the reasons. The weather forces or entices us away from the course line.

The problem is to accommodate to this enticement. To accommodate profitably we've got to be competent in evaluating weather influenced alternate courses available to us. Getting competent requires practice.

In simple terms, we might begin practicing systematic evaluation in three parts.

The first part could be observation; and this is a part for constant consideration during flight. The question? Are there any significant weather induced alternate courses to our goal? Constant consideration? We can ask that question every few minutes. We've got to learn to constantly observe weather inflight; we've got to observe its changing results and influences. It's important to know, too, that we should observe the weather at all altitudes and from all altitudes. This simply because the weather we're looking at-the air mass-its results and influences, are three-dimensional. The three-dimensional masses are composed of visual solids, clouds, dust, haze, and of voids. We can't accurately assess these three-dimensional masses-these solids and voids-unless we look at them from as many angles as possible and then estimate their sections. We can't have a good understanding of three-dimensional masses with just one view of them.

Our vantage points for viewing air masses are many because we're going up and down in thermals and moving horizontally.

We can practice weather observation during all our soaring flights. We can sharpen our ability to observe. Because some of us, in our daily work, are oriented to activities that don't involve visual observation, we need to improve our ability in this activity.

We can practice expanding our field of visual consciousness. For the most part, we look at things not more than a few hundred feet away. This is poor utilization of our consciousness. We should exercise our ability to observe at maximum distance. In soaring, if we don't expand our field of vision, we miss a lot.

How far can we see? This question is just as important at Marfa where sometimes we're observing weather at 200 miles or thereabouts; it is just as important there as it is where our field of vision is limited to a few miles by air masses, terrain and whatever. This simple question is the foundation for a practice exercise. Practice looking out as far as possible.

What do we see? How many different conditions do we see? Again, the farther we see, the more we see, and the more facets we observe and consider in the air mass, the better the decisions we make.

When we're at the top of a thermal we are provided with an excellent vantage point to assess the air mass and make long range plans. Each time, as we anticipate the top of the thermal and we consider the decision to leave, we should look around, really look around. At this moment our view of cloud shadows is superb. We Bee the patterns of the clouds better or, if there is no particular orderly pattern of the clouds, we see sequences of clouds, perhaps irrational patterns, that would be good to use to continue our flight. We see greater distances, at this moment; our visual penetration through haze is better. Perhaps more importantly, we can assess the top of the air mass. We can compare cloud masses over a wide range and clearly see what is happening at some distance and the varying depth of convection. In the structure of distant clouds we can see developments that tend to indicate an alternate to our perfect course to the goal.

The second part of our practice of a systematic evaluation of alternate courses might be comparison practice. The question, after observing weather variations; what relative values might we expect on the weather influenced alternate courses? What changes in the rate of climb? What changes in the frequency of the thermals? What patterns or distributions of lift might be available on the alternate courses? More frequent thermals give us the opportunity for selectivity in addition to the possibility that we might simply use more of them in straight flight. The advantage of some pattern of lift could easily obviate the need to use one thermal. We must be able to evaluate differences which might be experienced in alternate micro air masses. There is a way to practice this.

On every flight and particularly during the period prior to our start on a competition flight we should sample each of the different air masses which might be available to us. There are often several micro air masses available for sampling before starting. Instead of picking the best one, soaring easily and comfortably until the time is right for starting, we might sample the worst ones and determine the full range of conditions. Surprisingly, we find many times that an air mass which might be judged poor from visual inspection will provide better soaring than anticipated. We've gained valuable experience if we determine this. It is particularly pertinent if we determine this in the few minutes before a start of a competition flight; it is almost as valuable if we determine this during a flight around our home base. We gain valuable experience for future comparisons thus.

The game is to accumulate experience through sampling air masses.

This builds backward to part one; we've observed that there are differences in micro air masses, and now, because we've a lot of experience, we can accurately estimate the values in different air masses. We're gaining experience so that estimates made in future competition will be better estimates. With experience, we're not frightened of the classic blue holes and that sort of thing. We know that we have examined many of them and some provide quite good soaring.

The last part of the examination of alternate courses might be the final calculation. We've observed that there are alternates available to us. We've compared the different values we might expect in these alternate courses. The calculation involves only simple arithmetic. We realize we're going to fly some extra distance to deviate from the textbook courseline. We must accurately measure this added mileage. This probably is one of the few things in this whole process that we can do accurately. We need a map. Using cloud shadows, landmarks, and whatever, we should do an accurate plot of the alternate courses. Don't try to judge distances. Use a scale. Since it is wise to keep the number of tools in the cockpit at a minimum, it is fortunate that most calculators have scales along the side and we can quickly measure the extra distance to fly if we choose an alternate course.

Measure the cost. For a rule of thumb, an added mile will require an added minute. Our average speeds are on the order of 60 mph, so an added mile is an added minute. An added minute on the average task, it's reasonably fair to say, is probably one-half mile per hour and is approximately a one percent decrease in speed for the average task. It's really worth worrying about. In the final standings a one percent difference might cover several top places. That is the cost. What are the advantages of going the alternate course? We've observed the alternate course and we've got to calculate the return if we go that way. Again, to establish a simple rule of thumb, 100 fpm better climb in one thermal on the alternate course could, in the average thermal, save approximately two minutes. One such thermal-increase the rate of climb 100 fpm-saves two minutes and, might on the average speed task increase our achieved speed by one mph. The net return, if we added a mile to our course as we deviated for that slightly better thermal, is minus a minute and plus one-half mph. That's worth going after.

The lesson in this simple example is to look a bit to the sides for better thermals. I questioned this lesson systematically for a year because I felt I was tending to go too far from the perfect courselines. I found I was at worst coming up even and at best with slight changes in course I was overtaking other pilots.

After evaluating course deviations for a season and realizing they weren't costing much, I've concluded I needn't worry about minor angular wanderings. I simply invest in minor wanderings to better conditions and an confident of gaining considerable chances for savings in time. However, it still seems necessary to do accurate measuring and simple but accurate arithmetic to determine whether moderate or major angular wanderings are profitable.

Several times in recent Internationals, major deviations from course may not have been forced, may not have been absolutely necessary, but the enticements were fantastic in terms of both cost and advantage. The cost sometimes in terms of flying as much as 30 extra miles on one 70 mile leg. Coming ahead of a great clot of sailplanes that vent direct, after flying fifty percent farther proved the worth of systematic evaluation of alternate courses. Some precompetition study of our sailplane's Achieved cross country speed with thermal strengths would facilitate evaluation of these large deviations.

There is a good point to keep in mind in this discussion. We might be tempted, if we are inclined to conservatism, laziness, or whatever, to continue straight down the perfect course. If we were to go through an evaluation and determine that a deviation generated a net return of zero, we might be tempted to take the easy way and stay on course. However, we shouldn't neglect the fact that any deviation to better soaring conditions, most particularly in marginal weather, is going to decrease your chances of complete failure. The big game in competition soaring is in completing all the tasks. If we go through an evaluation and come up with a zero net return, we ought not to lay it aside. We should first ask, "is the weather sufficiently marginal to make me want to deviate simply to increase my chances of completing the task"?

Just as good as a better thermal would be a better pattern of lift along possible alternate courses. Thirty miles of cruise, with altitude loss for example, using various patterns, could obviate one climb in a thermal and allow perhaps five or six miles added mileage and still net a one mph increase in ground speed. That's a lot.

Examine available alternate weather influenced courses in the simplest terms-30 miles out and six miles across generates a moderate angle. This one to five ratio doesn't appear great as we look at it from its acute apex in the sky. It doesn't tend to make us anxious. What sometimes frightens though is the measurement of that last six mile correction going into the turn. However, if the evaluation looks favorable, we should start out on the alternate course and continue our evaluation. If it works well, proceed. If it doesn't, we've still an opportunity to revert to near courseline with little time invested.

Keep in mind as we go through these wanderings, contrary to what the textbook says about idealized sawtooth courses with crosswinds and this sort of thing, the object is to get to the turnpoint at the most advantageous Altitude in the fastest way from where we are at any particular moment.

In the simplest of terms, we've examined one facet and one kind of decision out of the many we must make inflight. We study this one example in order to develop a philosophy of dealing with other tactical soaring problems. Once we practice breaking the operation down into observation, comparison and calculation we can apply the same approach to other problems which confront us in competition.

We can practice solving problems by sketching typical course deviations. We can sketch the example of the slight deviation to a better thermal and get a feeling for distances involved, the scale and values of the problem. We can sketch the example of a pattern of lift which deviates from our perfect course and sense the mileage involved.

Since we have moved quickly into high performance sailplanes, a feeling for the scale of these problems in relation to the performance of our machines is important. Very few of us appreciate the scale of glides in high performance ships. With the machinery we've got, we should be looking out as far as possible, perhaps using our calculators a bit more and studying usable lift patterns 20, 30 or 40 miles away.

We might tend to complain at this point that we've taken all the fun out of soaring again; that we haven't allowed for the appreciation of the beauty of it or whatever; and we've made work of it. In reaction we could say that for the flower lovers there's a simple version of our evaluation.

They could go through the same sequence. They could look far out and appreciate the beauty of the structure of the clouds as they change and the difference in patterns and shadows. In the event of overwhelming beauty they could go and taste the joys of better soaring and experience the relevancy of doing that. The rest of us who practice and work diligently, plan and measure accurately, and calculate precisely will probably be waiting back at the finish line for them.

All the above refers generally to speed tasks. Some comment should be made to relate the above to distance tasks.

Gross deviations from the planned course and strategy on a distance day early in the flight don't cost much. We can compensate for these early deviations. As a distance flight progresses, major deviations can tend to become more costly and more difficult to compensate. The justification for early deviations may be one of simply having to stay up. Staying up with some gross deviation from course, perhaps even coming back a bit, might give the weather a chance to improve and provide overall opportunity. However, the justification may simply be in selection of the best of relatively good alternatives.

Paul Bikle made an outstanding competition distance flight to the west out of Marfa when almost all others went to the northeast. He made the decision to go west after he was airborne, and he did much better than the others. The others were probably equally good observers but Paul was a better evaluator that day. They experienced the same conditions at the same moments but he wasn't bound by previous strategy or by previous weather information. He elected to make a major deviation from the more obvious course and to go with the favorable conditions observed inflight. It was a wise decision made early enough in the flight. The flight illustrates the point.

We can build on our preflight strategy through the process of the inflight evaluations. We should build by making large scale plans just as we should in our preflight strategy. We should anticipate all the consequences of a deviation and project the results of that deviation as far as we can into the future. In that fashion, we will either complement our preflight strategy or have a realistic foundation to challenge that strategy.

Questions And Answers

Question: (Tom Page) You've really talked about a cost/benefit analysis almost, as analyzing conditions inflight and making decisions to change them. What about the cost of acquiring this information? You don't say anything about that. if you're going to have to be sitting there writing and calculating and figuring all the time, that is going to cut into your perception. What kind of criterion do you have for balancing the cost of acquiring, or in a sense, remembering information against the time spent in collecting it?

Answer: Well, I'm not doing any-thing more important up there. The cost is high. Constant attention is difficult. Memory training is important. But the calculations are easy. They detract little from observation activity.

A year ago I said that unless you are working every minute, even late in a seven or eight hour flight when you're tired, you're not getting the job done. I suppose in overall terms that the cost is extremely high. But, that's the game. I'm convinced you can do this observation, comparison and calculation, and keep doing it constantly during a long flight. Precontest practice will make it easier.

Our problem is that we drift away mentally from any one subject quickly. If we can pay better attention we tend to stop worrying about the cost, we use our time more effectively and perform better in competition. The answer is the cost in effort is high; it's hard work. That's why I presented the flower lovers' version. The cost to them would be much less. Probably the return in competition less also.

Comment: (Ed Byars) I believe you said you usually make two decisions of a major proportion every minute. Is that right?

Answer: Perhaps a major decision or a review of a major decision. Frequently reviewing a previously made decision is valuable business too. I make a lot of decisions that need to be reviewed!

Sailplane Preparation For Competition

by Paul F. Bikle

I would sure like to talk some about the things that George and A. J. were talking about but I've come to the conclusion, after some years of trying to compete with A. J. and George in competition, that I'd probably find it more appropriate to act in line with my demonstrated inadequacy and act as Crew Chief of this operation. I'm going to talk about preparing a sailplane for competition.

When Ed first asked me to talk about this subject I was a little bit dismayed because I didn't think I had any particularly earth shaking things to say about it, so I asked a lot of people what they considered to be most important in preparing a sailplane for competition. After I got to thinking things over I found there was a great deal to talk about, still none of it very earth shaking. Before I get around to that, I might address the thing that most of the people mentioned first when I asked them. That had to do with ways of improving performance and the most frequent thing mentioned was the matter of smoothing wings (sanding), and how much this might be expected to help them out.

I have observed that people spend a great deal of time sanding wings and many seem to find the best time to do this is during the contest practice days and even during the contest itself. I think we might consider whether this is the best way to spend time and effort, or maybe work on things that really don't take so much effort and might have a better chance of payoff. Most of us, in buying a sailplane or anything else have a limited amount of time so you should try to get the most chance of help from the time you spend. It might be of interest to take a look at just what people are achieving with their sanding efforts and surface smoothness.

We just finished a 57-flight evaluation of nine sailplanes over the holidays and have the plots of the surface waviness measurements that we made on the sailplanes.

Figures 1-2

Figure 1 is of Alex Aldott's LS-1C. As you can see, it is very highly polished and also has had a great deal of sanding done on it, This was the LS-1c that was flown by one of the French pilots at Marfa. As you may also see, the reflections in the wing would not indicate that the smoothness was of the degree that you would like to see.

Figure 2 is a picture showing Anne Enevoldson and Alan Bikle making surface waviness measurements on the wing tip of the same airplane.

Figures 3-7

In Figure 3 we have plotted the surface gage data obtained at six span stations along the upper surface. The scale along the bottom is in inches of wing chord with the vertical dash line drawn at 50 percent chord as a reference. On the vertical scale, each increment represents 0.001 inch curvature in a two inch arch for each increment of scale along the left side of the plot. The curved dash lines are mean surface lines while the heavy lines shows the actual surface and the difference between these two lines gives a fair picture of the amount of waviness in the surface. The left hand side is toward the leading edge. We can see that we have a fair number of waves and some of these are as great as 0.004 inch in two inches on the forward part of the wing.

In the plot of Figure 4, the same kind of data is shown for the Standard Cirrus that we flew. 'he wings on this ship had also been sanded. It is the ship that was flown in the U.S. Nationals last year and placed the highest of the Standard Class sailplanes. This one also has waves about 0.004 or 0.005 inch in two inches and these waves tend to occur just in front of the 50 percent chord line and are at a place where they could be expected to cause early transition.

Figure 5. The same type of curves for the Standard Libelle. The wings were just as they came from the factory-they were not sanded although they were clean and dry. On the whole, the waviness is about the same order as shown before, except for the one wave on the left inboard part of the wing which is a bit worse with a double amplitude to about 0.005 inch in two inches.

Figure 6 is of the wing of an ASW-15 as delivered from the factory and at first glance it looks like it has more waves; but the deviation is less-it is about 0.003 inch in two inches.

Figure 7 represents the measurements made of the 1-34; there are more waves and the amplitude is more than any of the other sailplanes-more than 0.015 inch in two inches.

Figures 8-12

Figure 8 is similar data obtained on the LP49. It is smoother than the 1-34 but still almost double the amplitude of the waves that were measured on the fiberglass sailplanes.

In Figure 9, the curves are for the wing of the Diamant 18 that Ross Briegleb flew to win the National Championship at El Mirage last year. He had done a great deal of sanding on the wing before the contest. It's the best of those we have seen so far in these figures but it still had a few waves-as much as 0.004 inch in two inches.

In Figure 10, this was one of the three ASW-12 wings that we have measured and, in this case the wing was just as it came from the factory except for cleaning it. It is not bad-there are some waves that are 0.004 or 0.005 inch in two inches-but it is in factory delivered condition. The waves that are of some amplitude seem to be quite far forward on the leading edge where it might be anticipated they wouldn't cause too much trouble-at least waves of this magnitude-although we don't really know.

Shown in Figure 11 is the second ASW-12 that we tested. This is the one that Rudy Mozer flew for a number of years and which he had completely redone. As you can see, it is by far the best of those that we have seen so far. Generally, you could say that all waves are less than 0.002 inch in two inches.

Figure 12 is the surface data shown in Soaring magazine awhile back for Ben Greene's ship as measured last summer right after the Nationals and shortly after the time he flew the ship to a new World's distance record. We have something less than 0.002 inch in two inches.

The most that we can hope to get from this kind of data is some idea of what the waviness in the wings may be. What does all of this mean? Obviously, the LP-49 and 1-34 are not competition sailplanes although the wings were filled, painted and sanded to some extent. The resulting waviness is too much for consideration in this discussion although the wing on the LP-49 has about the same degree of waviness as my T-6 and is actually pretty good for conventional American metal construction. It's not very good but it's about the best the most of us are able to do.

All four of the fiberglass sailplanes had waviness of 0.004 or 0.005 inch in two inches and it would appear, just from looking at the curves, that the differences between the two that were sanded and the two that were not sanded were minimal; there was probably some slight improvement. The LSIC was also polished and although we had no way of really determining what this did, we couldn't see that it helped nor did we see any detrimental effect. The Diamant 18 wing was somewhat smoother-about 0.004 as we saw it. I might mention that on the four Standard Class sailplanes we couldn't see any correlation between differences in performance and differences in wing smoothness. However, this is a rather gross evaluation and I don't think we could see those changes unless they were fairly large.

In the case of the Diamant, I thought it was interesting that this ship was quite a bit smoother than the Diamant 16-1/2 that we tested last year. When we corrected the performance of the two airplanes for the difference in the aspect ratio, the polars fell right on top of each other indicating that, within the accuracy of our measurements, the extra smoothness did not help the Diamant although that again is a rather gross type of thing since they were two different sailplanes.

In the case of the three ASW-12's, the data may be a bit more interesting. Here the "as delivered" wing was better than those of the Standard Class sailplanes. The second one was very smooth and about 0.002 inch in two inches, and the third one was about the same although I felt overall maybe a little bit better. Here there was also a difference in measured performance with the better performance consistent with the degree of smoothness that we observed in the wing.

One could conclude that wings with less than 0.002 inch waviness in two inches did have an appreciable effect an performance. On the other hand, I really think you should be careful about such conclusions because, as is often the case, the wings that had the most work done on them and were the smoothest were on the sailplanes where the people that owned them probably had the greatest motivation; had sealed all the air leaks and had done all of the other many little things that you can do to help yourself out on the sailplane. I think it may be just as likely that the added performance came from those other sources as it did from the smoothness but I really don't know.

The main point is that some people spend one tremendous amount of time on sanding wings. I would say, that except for very few cases, they haven't really achieved any great degree of increased smoothness. I'm not even sure that when you do you get smoother wings, that you achieve any great degree
of performance improvement.

Of course, all of this work is not going to do any harm and if you have the time to do it, fine, go ahead and do it, but it shouldn't be done at the expense of some other items which maybe were important and are a lot easier to do.

Before I talk about some of these other things, I would like to make it clear that success in competition is going to depend primarily upon the pilot and it's going to depend upon the kind of things A. J. and George have been talking about and all the preparation in the world won't make up for any deficiencies in the piloting department. On the other hand, even the test pilot may be all but eliminated from contention by problems, usually pretty mundane problems, which could have been prevented by more careful preparation of the sailplane. In a sense, this type of preparation is an extension of George's remarks of two years ago and of the type of things that both George and A. J. said this morning when they were talking about winning by not losing. All of these things are associated with being very careful and making a detailed inspection of the sailplane, cleaning everything up, correcting any deficiencies and providing tools and spare parts for quick repairs or replacements during the contest. There are so many items to be considered that there is not time to do much more than list them. On the other hand, these are pretty simple things and there is really no need to discuss them.

We shall start with inspection and cleaning. This may sound pretty mundane too, but actually open everything up where it is easy to get at. Take a look at things and at least you understand what is in there so if you have to do something during the contest you won't spend half of your time trying to figure out how to get in there and fix it. Look at all the fittings, brackets, rod ends and bolts and be sure that the safety devices are in place.

When I got my new SHK and I took the time to do this, a castellated nut on the little elevator control stud-the one that drives the ruddervators-didn't have a safety. If this had worked loose it could sure have spoiled the whole day. How many people ever check the rigging on their ship before a contest? I never realized the problem was so great until we started running these performance tests. We found flaps that were rigged as much as 50 off from the cockpit control readings used to match the flap setting to the airspeed for best performance. Aileron droop has been as much as 50 different from that specified and that's just like carrying 5 degrees of flap around in the wrong place over some 30 percent of your wing span. It can also affect thermaling and stalls in the thermal. Things like this can really hurt in some cases. The aileron travel has been as much as 10' less than called for and this is a loss in aileron power which can degrade thermaling and roll response in general. Improperly rigged elevators and rudder controls can influence spin recovery and again could spoil your whole day.

Speed brakes, which are not rigged and sealed properly can cause all kinds of problems. It would sure pay to check these while your ship is rigged and check it by loading your wings on the ground and make sure the speed brake controls go over center and will stay latched. A. J. told me yesterday he had the speed brakes come open twice on him while he was flying the LS-1 at Marfa this year. Regardless of the amount of checking we do on the ground the real way to check them is in the air. While you are checking the speed brakes, check the fit. Be sure that all the seals are tight and there are no air leaks around the brakes, and again under load as well as statically. This isn't always too easy to do. Looking at the 20 ships that we tested in the last year, at least one-half of them had pretty bad air leaks around the speed brakes before they were sealed.

The general problem of air leaks is probably the area where, for any given amount of effort expended, you could make the greatest gain in preparing for contests. Every air leak isn't necessarily going to really ruin your performance but we have had enough cases where it does so that it sure looks like the best thing is to be sure you have no air leaks. Wheel doors obviously should be sealed and, to make doubly sure, you should have a wheel well which is airtight around the gear. Air leaks in this area show at least as much drag as carrying a fixed gear did, not an extended retractable gear, but a good fixed gear.

Klaus mentioned yesterday about the necessity for sealing flaps and ailerons. This usually is riot too difficult and is probably high up on the list of pieces of work you can do with a good chance of a worthwhile payoff. Not only payoff in the sense of drag but also payoff in the sense of effectiveness which might even be more important than the drag.

Probably the worst leaks we have seen have been on the canopies. These are not too easy to check but they can be extremely costly. We've had one case with a ship with an L/D of around 40 where the aft canopy seal was lost. The performance dropped to an L/D of 33 and was brought back up to 39 fast by resealing the canopy. On the other hand, a number of people fly their ships around with canopies cracked. I am sure there are some cases, just depending upon how the flow comes out of the canopy, where it probably doesn't cause very much trouble but you don't have any good way to know this. Once again, I would suggest that a good place to spend some time is sealing these things up.

Air leaks around the wing roots can hurt your slow speed performance and increase your stall speed. Most ships have some provisions for sealing around the roots but if there is any question at all I certainly recommend taping in this area.

Just common sense things. Certainly check the tires for wear and cuts and replace them if they are not in first-class condition. Remove and inspect the wheels and grease the bearings; check the brakes and adjustments.

Carry a spare wheel assembly with tire and axle, spare wheel well doors, and a spare tail wheel and axle. On more occasions than I would like to think of I have seen pilots lose the best part of a day trying to repair or find spare parts for wheels or tires. If I remember correctly, George, you lost a good part of a day at El Mirage in the 1962 Nationals (two days). I think that this is probably more common than we realize (maybe only two or three times in a contest) but if it happens to you, all of the other things you do are liable to be of no avail.

A good brake. There is nothing I appreciate more than knowing my brakes are going to work when I am going into a small field and obviously it can be the difference between just a retrieve from a small field and working on a ship all night to repair a bashed-in nose or a wingtip.

When I talked to people, they hardly ever mentioned cockpit comfort. For most of us, this is an item of top importance and I do not think you want to wait until you get ready to take off before you worry about this. In the first place you have to try it in flight and I think you should be able to fly for six or seven hours without any feeling of discomfort. While you're doing this, make sure everything is secured in the cockpit and you are not losing things behind you and you are not having any-thing come loose and jamming things up at the wrong time.

I can remember watching one of our pilots sand on his wings. It might sound that I'm real hep on sanding wings but he did and practically up to an hour before takeoff. At the last minute, right on the takeoff line, he decided his cockpit was not very comfortable so he pulled out the seat back to give him a little more room to stretch out. He took off and as soon as he released he dove back to the field because he found he couldn't get his gear up because his chute jammed the landing gear. After a quick ground adjustment he was off again and got his gear up O.K.; he flew like gang busters until he crossed the finish line at 50 feet, did a low 180 for a landing; this time the chute was jamming the gear in the up position. He didn't lose very much except a night's sleep while he repaired the gear doors and the bottom of the sailplane.

While we're in the cockpit area, there is the simple matter of a clear canopy; get rid of scratches; make sure you can see through it well. A. J. talked about the importance of looking out and seeing what is going on and I couldn't agree more, but if you are going to do this to your maximum you have to have a clear canopy. It is not just a matter of being able to see through a bad canopy but you find that these things are distracting and it takes away your ability to see what is important.

I'd certainly recommend, and this isn't a lot of work, that you remove your instruments and have them calibrated and bench checked. At least make sure that they are working properly. You should have some spare instruments, a spare airspeed and a spare variometer, certainly, and these should be in good shape and checked each year also. As in the case of a spare wheel, there are always two or three cases during the contest where somebody is madly dashing around looking for an airspeed indicator because the needle fell off of his or because it's got a bad case leak or something. This happened to me at Adrian in 1965 and Ben Greene lent me an instrument. Sometime somebody is not going to be around to lend you one and then you are going to be in deep trouble.

I am always surprised at the number of sailplanes with leaks in the airspeed systems; about 30 percent of those we have tested have had bad leaks. You can't always say this is going to cause you trouble. In many cases it doesn't, but it can cause you a lot of trouble and it isn't that hard to correct and make your system leaktight. Last winter one of the test sailplanes we had leaked so fast when we put the leak checker on it we couldn't even raise the pressure in the line. A brief check showed that the trouble was primarily where the tygon tubing slipped onto the back of the airspeed indicator and, in this instance, it was just slipped onto the shipping plugs in the instrument. I talked to the pilot and he said he questioned that when to got the sailplane but the dealer told him that was a standard way of doing it so that's the way it was. It also happened that on that ship we also found leaks in the variometer and I don't think these are too uncommon; it's just that if you don't look for them you're never going to find them and they can cause you real problems.

It is probably a pretty good idea not to hook the altimeter up to any of your static lines; just vent it to the cockpit and at least it is not a possible source of leaks and you are not adding any lag where you don't want it. There has been a lot said about variometers recently. When you pull the instruments for a bench check, the variometer should be checked for both its calibration and the total energy compensation. Of course, anything you do on the bench here you have to do over again in the air anyway but it is well worth doing. Total energy compensation has been treated in detail by a lot of other people and I will not try to go into that here.

Total energy compensation and the altitude effects on the compensation have been covered very well and its importance depends pretty much on the individual and what reliance he tends to place on the speed ring. If he uses it for any-thing, then obviously the relationship between the speed and rate of sink should be meaningful. I have been sort of curious about this on many ships with relationships that were as much as 20 knots off. You could conclude that it might be better not to have one under those occasions. These errors may come from not taking into consideration a gross instrument error in either the rate of climb or the airspeed indicator. On ships where there are large errors in the airspeed static system, I have never seen anyone take these into account. There is one other thing that can be done very easily although I seldom see anyone do it and that is to take into account the effect of the fact that you are flying at some altitude above sea level. You get the speed and rate of sink relationships from looking at a sea level polar and here of course indicated airspeed and rate of sink can be used directly because indicated airspeed and true airspeed are the same. If you are flying at 10,000 feet average density altitude as you do in the vest quite frequently this could cause an error in the relationship of as much as 20 percent. If you are flying in the east where you might consider your density altitude as 5,000 feet, the error would be closer to 10 percent. You might think 5,000 feet is a little high for back here but normally you are flying on days that are warmer than standard and your density altitude tends to be 1,000 or 2,000 higher than what you are showing an your altimeter on the average. I'm not sure that this is real important because this whole idea of the speed ring is really dependent on what you think is going to happen in the next thermal. Whether you need to be any more accurate than a guess, which on many occasions may have a 40 percent uncertainty in it, I don't know. It does seem that if you do fly by airspeed a lot, you might as well have the best information you can.

Of course, if you carry oxygen, check the system; you shouldn't accept any leaks otherwise half the time you will find your bottles are down and you don't have what you thought you were going to have. I've seen many ships that do not have a fill valve where you can get to it real quick without taking any covers and things like that off.

I wanted to talk a little bit about radios and I might first say I certainly enjoyed Gren Seibel's book where he managed to wedge in about four, five or six choice remarks about electronic marvels and cans of worms. I couldn't help but think of this as I watched TV last week and listened to Al Shepherd and Ed Mitchell tinkering with Al's suit radio for an hour before they could go out for their first walk on the moon. These things are probably the greatest source of frustration I can think of. Obviously, you want to have your radios checked and have them checked by somebody who knows what they are doing and tuned up before a contest. It is probably a good idea to carry a spare but I think the really best words of advice would be to be fully prepared to carry on without radios. Once you start having your troubles, the frustration probably affects your flying a lot more than any real problem the lack of a radio causes. The only thing that is going to interfere with that type of advice is the general dependence on the radio for getting information at the starting line.

A whole talk could be given on ballast tanks. We have seen pilots flying around the contest sitting in a half a foot of water in the cockpit because the ballast tanks leaked into the cockpit. That might be just an inconvenience and maybe not too important. Of greater concern, there were at least three cases last year where there was structural damage with ballast tanks because of plugged or sealed vent lines. I do mean sealed; in one instance the pilot had taped off the vent line and as he went up in altitude the pressure change across every square inch of wing where these bags were laying in it caused the surfaces to be noticeably bulged out. There was damage in the epoxy joints; a very risky operation. Of course, there is no sense in tying off the vent lines but I have seen cases of plugged vent lines.

Preparation of the sailplane should include the turnpoint cameras. If you think about it the camera, under the present rule, is a pretty fundamental part of' the sailplane. Again, you do the obvious thing. You have them cleaned; check them over and be sure you have at least one spare with you (I always carry two); and make sure your mounts are rigid and properly aligned and checked out in flight. It pays to make some of those turns you make in taking practice turnpoint photos and practice turn photos are well worthwhile just from the pilot's proficiency standpoint. Go over the photos afterward and make sure that you can aim the cameras easily with the wing tip and that you know what you are going to take when you press the button. Also, check to see if the marks on the canopy show up like they should because the first contest day is pretty late to find out that you have troubles here and that you have to do something about it.

In spite of what I said about surface finish, you should check over the surface finish on your wings and while you are doing it look at the fuselage nose and the portions of the tail where there might be a chance for laminar flow. You want to repair any of the obvious cracks and other defects.

I have seen surfaces on two fiberglass sailplanes now where there was evidence of continuing curing after the wings left the molds and this has become evident after the sailplanes have been in this country for awhile. These almost look like the old plywood ships when we bought them up in the desert and they dried out; not nearly that bad but they had that appearance. These look worse than they really are; most of these defects have been only a matter of a few thousandths of an inch but since you can see it running along the spar all the way it looks terrible. Where you have a discontinuity it is obvious that you will want to do some filling and smoothing and it is not that hard because you can see where it is and you can work it out easily. Unless there are obvious deficiencies like this, just give the wings a light sanding to clean off all the small defects and wash them and wipe them dry before each contest day. If you plan to do more than that, it should be looked upon as a major modification type effort which does not come in the context of doing it in a month or so before the contest. If you try to do it at the last moment, you are going to end up doing that and probably not doing the other things. It is the kind of thing you do in mid-winter.

I mentioned spare parts and you also want to be ready to make repairs. You should lay out the tools that you need for this and pack them carefully along with the spares. Don't just throw them into a big box out in front of every-thing but when you do need them you want to get at them right away so store them pretty carefully. They ought to be in the car or trailer someplace where you can get at them. While you are at it you ought to go over your car and trailer in the same way and use the same care as the sailplane. I'd make up spare kits for these too and I would certainly suggest providing for carrying spare gasoline and water because the failure of the car or trailer can have a shattering effect if you land 15 miles out on a good contest day if you don't get back again. As mentioned earlier, the problem is not one of what are all of the things you would do if you did all of the conceivable things you could think of. It gets down to the matter of what can be done best in the time available-where should you spend your efforts-what is the most likely to pay off.

I have talked about sanding wings and suggested that there may be better ways to spend your time. Maybe you should forget about this because I think there are some people that get some sort of a philosophical or a mystic recharge out of going out and sanding and polishing wings at the last minute. If this helps the pilot's frame of mind, I would say go to it; make sure the lucky penny is stuck under the instrument panel; and make sure you have your lucky hat. If any of these improve the pilot's state of mind, they are more important than all of the other things put together.

Questions And Answers

Question: (Tom Smith) Regarding this statement you made on apparent continual curing, I have a Phoebus whose rear spar appears to be encountering this condition. When you get in the light just right you can see this condition. It appears to be a drawdown somewhere back around the 70 percent chord point. What comment would you have on the effect that this condition might be giving me?

Answer: (Bikle) My guess would be that it would not hurt too much, but this is only a guess. We have not made any measurements on this particular phenomena.

Question: (John Slack) This question refers to the speed ring. Do you, Paul, utilize this ring? Would you care to comment on this?

Answer: (Bikle) I use it enough so that I feel that I want to know what it's telling me, so I, therefore, take the trouble to get the right numbers on the ring. I am very much concerned about the problem of what's going to happen next and because of this we shouldn't place too much reliance on the ring. There is certainly never any point in going any slower than what the zero thermal speeds on the speed ring call for. In fact, it can really hurt you if you do. So, if things are weak I tend to use it more so that I can make sure I am not going too slow; and I tend to use it at high speeds to make sure that I am going fast enough.

Question: (Steve DuPont) This concerns sealing of the tail fuselage junction. I find that this has significance on the HP series in both handling and performance. Would you care to comment?

Answer: (Bikle) Yes, I think I forgot to mention that in my regular lecture when I was talking about sealing. I had it in my notes. I think there is just as much reason to pay attention to the gaps on the tail. A. J. tells me that he has even devised a way to seal the air leaks around the gap of the moving tail stab on the new fiberglass ships. This certainly sounds like a good idea.

Question: (Gren Seibels) Paul, in your various tests and on the data that you have been collecting on performance, have you had any opportunity to compare performance on a given ship with an eggshell or matte finish on the wing and then compared with a same type ship with a glossy type finish on the wings. In other words, is there any data to indicate that this different finish has any significance.

Answer: (Bikle) I did touch on that, Gren, but I haven't done that recently. But I did it a number of times many years ago on the ships I had. About all I can say is that any effects are small enough so that I cannot measure them. I really don't think you can do that type of measurement in flight unless the effects are very large. This is the kind of stuff that should be done in the wind tunnel. There is a fair amount of data in the wind tunnel on this subject. I think the people have their own little tricks but the best data that you can draw from the tunnel test is that the 400 sandpaper finish is certainly adequate. And you are not going to gain anything by going any smoother. Certainly you don't want the polish or wax, or anything like that because you tend to pick up bugs more. I guess that might be a more general statement of what the general opinion is. If you are asking specifically about facts measured in flight then I just don't think there are any.

Question: (Bill Felbaumer) You emphasize the importance of sealing up the canopy. Would you comment on what effect these little air vent windows have on the performance?

Answer: (Bikle) I don't know. I FIND THAT THE FURTHER AWAY I GET FROM BEING WORLD SOARING CHAMPION THE LESS POSITIVE I BECOME ABOUT THINGS I DON'T KNOW ABOUT.

Question: (Rob Buck) A lot of us Libelle owners have been curious about the canopy and the way it can be opened up in flight. I thought I would do some tufting around the canopy area. Have you tufted the Libelle? Is it critical as to size of yarn and placing relative to adjacent tufts?

Answer: (Bikle) No, I don't think so. All tufts are going to tell you is what the airflow is and whether you have separation in flow or nonseparation in flow, and it will show you what the direction is. It isn't going to tell you anything about laminar flow or nonlaminar flow. I think you have an excellent idea and I say, "Go to it and let's see what it does." I had in mind the canopy on the Libelle and also Ed made remarks on the canopy of the Kestrel when I said that canopy leaks per se are not necessarily bad. I think Ed has said that he can fly in thermals with the Kestrel canopy cracked open and doesn't seem to have any great effect.

Comment: (Ed Byars) It doesn't seem to have any effect that I can discern,
Paul, however, perhaps I don't discern too well.

Comment: Bikle) I have the same problem, Ed.

Question: (?) Paul, would you care to comment on how important trim drag is?

Answer; (Bikle) Again, I don't have the answer but I have been working on it. There was a paper given at the OSTIV last year in Marfa. The author asked me afterwards if we could do some flight testing to verify the paper. We checked the paper and it certainly seemed to be technically sound. We have been running test points as we get a chance but it's an extremely difficult thing to measure. It seems like it's a little more important than minor differences in surface finish, anyway. I haven't come across anything yet that would make me indicate that it would show anything different from the theory. For example, on my own ship I have been checking this by moving in flight the CG by 30 percent. This means that I have been taking 75 pounds of lead and shifting it from the nose to back behind the trailing edge of the wing. I use another sailplane as a reference plane while we are doing this. It is a very time consuming and expensive thing but I think by the summer we will have enough points so that we can publish generally for that type of ship. By theory it shows that you would have increases in rates of sink in the order of ten fpm, more or less, throughout the speed range. It was surprising to me that when I first thought about it showed more increase in rate of sink at the high speeds than at the low speeds although not more percent increase. Now remember, that's over 30 or 35 percent shift in CG. I hardly think anybody is flying that far off in CG. I think as a general practice it pays to run your CG back as far as you feel you can satisfactorily fly the sailplane. This is pretty much an individual pilot judgment. For those of you that have the certified sailplanes I would say that you should balance the airplane so that you would be at the aft limit because they are supposed to fly all right in that position. Then if you don't like it, you can always move it forward A five percent difference in CG is probably going to make a difference in sink of maybe one or two fpm in sink. Once again, let me say that I have difficulty in measuring these types of things, but you certainly cannot afford to give it away either.

Question: (Gleb Derujinsky) You nave mentioned sanding the wings but have you thought of any way to keep bugs off the wing such as teflon coatings or such things?

Answer: (Bikle) There is no question about it. This is one of the reasons I am not too carried away with sanding wings. No matter how good the finish is it's probably not going to last any longer than it takes to get bugs on it. I don't know of any practical way to keep the bugs off. I guess it's not impossible but it depends on whether you want to do it. When we were running tests on airplanes in studying laminar flow, we used to cover the wings with a cover during takeoff and when we got up to altitude and the test conditions we would pull a rip cord and the covers would fly off. If someone was that concerned about it I guess they could do it.

Question: (Doug Gaines) Paul, how about fairing in projections that you can't get rid of, for example, aileron horns, and that sort of thing?

Answer: (Bikle) I tend to say, sure, go ahead and do it. You are certainly not likely to lose anything. Again though, I would urge that it not be done at the expense of not doing other things like bringing a spare tire.

Designing For Competiton

by Klaus Holighaus

With the introduction of the glass-fiber construction, the development of sailplanes has seen enormous progress during the last five years. Since sailplanes of 22-meter span and a gliding ratio (L/D) of about 50 are flying already, the question arises as to what further advances are possible in the future.

The following statements shall be an attempt to show how far the aerodynamic parameters such as span, aspect ratio, airfoil polar, Re-numbers, and wing loading affect the design of new competition sailplanes and which directions the development possibly will take in the next years.

To judge the performance of a sailplane In competition it is necessary to determine its average cruising speed in special weather conditions in comparison with other gliders. Such comparisons make evident that the maximum L/D, no doubt, has an influence on the aerodynamic quality, but must not decide the performance of a sailplane in competition, since a cross country flight consists of climbing at low speeds and gliding at high speeds.

Knowing the polar of a sailplane, the best average cruising speed for the respective average climb can be determined easily.

The derivation can be found in many references on performance soaring flight.

$$V\_cruise = \frac{V\_glide}{1 + \frac{V\_glide}{e + \left(V\_climb + V\_sink\right)}}$$

e = glide ratio

Therefore further definitions are not necessary.

1. The Influence of Thermal Types on the Climbing Performance.

   Assuming uniformity of pilot’s qualification, the performance of a glider is not judged from its polar only. It is also of great importance to know the climbing qualities.

   A comparison of climbing performances in thermals depends highly upon the form of thermals. Referring to Carmichel we differentiate three forms of thermals which are found most frequently in competitions.

   [Figure 1]

   Figure 1

   You will normally find strong thermals associated with strong wind after a front has passed. They are very narrow. Wide thermals are found in continental weather conditions. An optimum design of a competition sailplane is possible only for one of these forms of thermals. An adaptation to other forms often can be obtained by carrying water ballast.

   The utilization of the best rate of climb depends to a great extent on the wing loading, the angle of bank, and the lowest circling speed. From these parameters the optimum climbing velocity can be found for a certain radius.

   [Figure 2]

   Figure 2

   The cruising between thermals, of course, must be done with McCready speeds.

2. The Influence of the Wing Airfoil.

The total drag (CD) of a sailplane is composed of

CD = CD(parasite) + CD(airfoil) + CD(induced)

It can be seen in Fig. 3 that the influence of the different drag coefficients varies with the speed.

[Figure 3]

Figure 3

Whereas the induced drag mainly influences the low speed flight and the parasite drag the high speed flight, the airfoil drag however is effective upon the high as well as on the low speed. It is therefore important to choose an airfoil with a wide laminar bucket considering normal weather conditions during competitions.

[Figure 4]

Figure 4

Camber flap airfoils of course comply best with the demand for a wide laminar bucket and low drag.

Other than ember flap airfoils, Professor Wortmann and Professor Eppler have also developed normal airfoils without flaps which, with regard to the laminar bucket and drag characteristic, are clearly superior to the former NACA airfoils.

3. The Influence of Wing Loading.

The wing loading has a great influence on the climbing as well as on the gliding performance of a sailplane, both of which determine the average cruising speed. In any case high wing loading means a loss in climbing performance, whereas the high speed qualities are always improved.

The assumptions under which a special wing loading can be regarded as optimum are shown in Fig. 5 and Fig. 6. These curves have been derived from a method developed by Quast and Thomas of the Akaflieg at Braunschweig.

[Figure 5]

Figure 5

As already mentioned before, a high wing loading is always disadvantageous in respect to the climbing performance, more in strong or weak thermals than in wide ones. In wide thermals where the radius of the circle is not so important, this influence is reduced.

[Figure 6]

Figure 6

Surprisingly, the wing loading has a rather low effect on the optimum cruising speed which is more influenced by weather conditions, but it turns out that it is possible to fly with a wing loading of 40 kp/cm 2 (8.2 lb./sq.ft.) or even more in wide thermals, as in Texas, For a short task especially, under the best conditions of the day, high wing loading is of great importance for optimum final glide.

When carrying water ballast it is always necessary to check whether the thermals are of a wide or of a narrow nature. In strong narrow thermals it is often useful to drain some of the water.

4. The Influence of Span and Aspect Ratio

The induced drag of a glider depends upon the aspect ratio of the wing. As we have seen from the foregoing figure, the induced drag is of great importance with regard to the low speed qualities and also with regard to the best gliding angle.

Whereas extremely high aspect ratios could not be realized in the past due to structural requirements, there are no problems of this kind in modern glass-fiber construction.

As we see from later figures, the choice of the optimum aspect ratio essentially depends upon the span of a glider. Taking for instance a Standard Class sailplane with a span of 15 meters, an increase in the aspect ratio is necessarily associated with decreasing the wing chord.

Decreasing the wing chord results directly in a lowering of the Re-number.

[Figure 7]

Figure 7

Decreasing Re-number however increases the airfoil drag coefficient rapidly as shown in Fig. 7. This is true especially for Re-number lower than one million.

[Figure 8]

Figure 8

Consequently, on Standard Class sailplanes, the airfoil drag coefficient at a certain aspect ratio increases to a greater extent as the induced drag coefficient is decreasing. The total drag increases again at a certain optimum aspect ratio, as Fig. 8 shows.

A further increase in the aspect ratio therefore would be associated with a loss in performance.

Open Class sailplanes, however, offer other interesting possibilities. Here a higher aspect ratio always has a positive effect, because it can be obtained by increasing the span, while the wing chord and therefore the Re-number are kept constant. This means also no variation in the airfoil drag coefficient.

Thus the designer has the alternative of increasing the span and therefore improving the performance, but the sailplane would become heavier and more expensive. Therefore, it is not advisable at present to exceed 22 meters (72 feet) of span, even when employing new material like Carbon or Boron fibers.

An exact determination of the optimum aspect ratio for a certain span however is not so easy because of the differences in the best values at high and at low speed.

[Figure 9]

Figure 9

As can be seen from Fig. 9, a high aspect ratio is needed in the low speed range, whereas a low aspect ratio is optimum at high speed. This leads to the desirability of changing the span in flight, as the birds do, in order to obtain the best possible flight performance. Here the future lies ahead and offers the designer a wide field of research.

Fowler flaps which lower the wing loading for circling in thermals result in an undesirable variation of the aspect ratio and therefore are effective only in extremely strong and narrow thermals. In normal thermals (even Texas thermals) where circling with a small radius is not required, the increase in airfoil and induced drag causes a remarkable loss in climbing performance (see BJ-4).

It appears advantageous to design modern sailplanes with an aspect ratio for the average speed. This means for a CL value of about 0.7, which approximates the best glide of a sailplane.

[Figure 10]

Figure 10

As presented in Fig. 10, it is not advisable to design Standard Class sailplanes with an aspect ratio of more than 22, a value which is already commonly used today.

For a span of 22 meters (72 feet) however, an optimum aspect ratio of 31 has been found. This result is exactly realized on the Nimbus.

5. Conclusions.

The foregoing statements show, that the optimum values are already attained for Standard Class as well as for some special Open Class sailplanes. It can be taken as certain, that the sensational improvements in performance of the last years, based on the introduction of new material, cannot be expected in the near future. It does not seem likely that increased performance will come about even when using brand new material like Carbon or Boron fibers unless new airfoils can be developed which associate low Re-numbers with considerably lower drag coefficients. Professor Wortmann says that there is very little chance.

In the Open Class, of course, the possibility exists to develop competition sailplanes with still greater span or variable span. Such gliders. however, are very expensive and become very much more difficult to fly.

A handicap factor has been introduced in Germany for the next Nationals by which sailplanes with a span greater than 20 meters will get a score deduction of 1 percent per meter of exceeding span. If this regulation should become official world-wide (Germany will apply for it on the next FAI meeting in March), it would become unattractive for the designer to engage in great span developments in the future.

The acceptance of the aforementioned span handicap factor would indicate to me that national and international competitions are calming down, and that the modern Open Class sailplanes probably would aim at a span of around 20 meters.

Questions And Answers

Question: (Bob Ball) You mentioned the BJ-4 which has Fowler flaps. Did you imply that the Fowler flaps degrade the climb performance of the BJ-4?

Answer: Fowler flaps have remarkably higher lift coefficient, of course, and also much higher profile drag, and in normal thermals the high drag coefficient is worse than the better lift coefficient. Therefore, I feel that it fails to gain performance with the use of Fowler flaps in low speed circling. And you also have much lover aspect ratio since you increase your wing chord and your wing area. The lover wing loading does increase the climb performance but I feel that in normal thermals you lose more than you win. In very narrow thermals or extremely strong thermals, as in South Africa, you may be ahead in this case; but in normal conditions-no.

Question: (Bill Foley) In the British Sigma project they have a mechanism to increase the wing area supposedly without this increase in drag. Would you care to comment on the Signs project?

Answer: It is very difficult to give a complete answer. I know this profile that they are using on the Sigma very well. It looks great if it works on a glider. They will, however, lose performance because they are increasing the wing chord. But they will not lose so much performance with higher drag coefficients. So there may be a chance that this way is better but as I have discussed often, I don’t believe in the project for I think the changing the wing when you are entering a thermal is so difficult that you cannot do it in an optimum way. It is already difficult with camber flaps.

Question: (Leo Buckley) Can you say, Klaus, why you feel the CL equal to 0.7 is the optimum number you should use?

Answer: You must compromise. The lift coefficient of about 0.7 or 0.8 is a coefficient where you are in the middle of the usual flying range and applies for very weak weather conditions and on your final glide.

Panel Discussion: Contest Rules

Bikle - Moffat - Smith

GEORGE MOFFAT:

I'm not sure I know exactly what Ed had in mind on this particular Panel, but I know what I had in mind, so I'm going to talk about things that I thought we might want to do about contest rules.

I would like to begin by outlining some ideas and by saying that I think people who make rules only hear moans about what is wrong with the rules. What I would like to point out is that I think the present rules are very good indeed, compared to those we had ten years ago or if you read really old magazines, 15 years ago. I think contests today are fairer and much better and I think a great deal of this is due to people like Paul Bikle and Bill Ivans who are willing to do an awful lot of work, the kind that is not much fun and the kind that you don't get much credit for, to try to improve the rules by which we fly. These people have brought us things like photo recognition of turnpoints, have eliminated such old-fashioned things as the pilot selected goal, and have done an awful lot of good for soaring in general.

There are, however, four things, I feel, we should consider for change, in no particular order. As many of you know, I would like to see us go to the European system of having all speed tasks, on the grounds that it would emphasize flying instead of driving. I would drive race cars if I liked to measure driving ability.

I think one unfortunate thing that has tended to happen in recent years is that distance tasks have been more and more relegated to very chancy kind of days and consequently the luck factor is rather high and furthermore, you don't have enough of them. This may seem contradictory. I think free distance was quite a fair task in the days when you had eight free distance tasks and that was the contest, because over the eight days, the pilot ability probably balanced out pretty well. If you have only one day of free distance as we do nowadays, you don't have a chance for a bad break to balance out over the long run.

The second point that I would like to make is that I feel that re-lights that is, landing away from the airport, and de-rigging and coming back and re-rigging and taking off, should go. I feel that this is very expensive. It means that you have to have bigger crews, you must have better and much more powerful cars, and must have a driver who is willing to drive 80 or 90 mph in order to keep up with you. And to me this should go. The Germans have already done this and I believe the British are considering this too.

The third point. I would like to see it considered weighing speed tasks a little bit differently than they do now, with more emphasis given for speed. For instance, it's a possibility it might be considered that no speed points be given for anyone whose speed is less than, say, 75 percent, or say 66 percent of the winner. He would get distance points only, but no speed points. This would encourage people to take a few more chances and fly faster. It would, of course, at the same time, give these people a bigger point spread as they do, for instance, in Poland.

The last point. I would like to say that I highly oppose what we keep hearing rumors about, which is a handicap system. I oppose for reasons which I have never heard expressed publicly before. It is two reasons really, one is well known. One would require the measurements of sailplanes for the handicapping, which we do not have, and have, according to Paul, no way of getting. That is, measurements of sailplanes' performance in thermal rough air, not smooth air. Nobody cares what a sailplane does in smooth air because you never fly in smooth air. What you want to know is what it does in average afternoon rough air. It is very, very different from what it does in smooth. My second objection is that I feel that if we had a handicapping system, it would give an absolutely unbeatable advantage to people like Paul, A. J., Dick Schreder, and some of the rest of us who have been flying a lot of ships for a lot of years, simply because we would have the experience with these ships to know which ship is not being handicapped fairly. For instance, in England right now, anybody in his right mind would be flying an Open Cirrus on the handicap system. They say the Open Cirrus is not even as good as the BS-1, which is an absolute joke, especially for English conditions. And anyone who had flown the two against one another would know this. But the British handicap system does not point this out.

Those are things concerning contest rules that I feel are fairly important at this particular moment.

A. J. SMITH:

I find myself in a somewhat similar position in not worrying too much about the present rules as long as everybody is operating under the same rules. I am, therefore, reasonably happy. At the risk of being fired or sent off on sabbatical by

Byars and Holbrook, I won't say much more about rules except to say that I am happy to see the recognition of and a tendency in organizing, particularly the launching aspects of soaring competition, so that everybody at least has the opportunity to start out on a task under his choice of conditions. This does away with the unhappy circumstance of being launched late. This is one which I have been and still am somewhat bitter about. However, the problem is recognized and people are doing something about it and I would encourage them to do more in that direction.

I have heard a lot of people talk about a kind of launch and start which would be a so-called racehorse start where everybody gets off on an actual start at one time. I realize that this problem is extremely difficult, particularly when you begin to talk about more than 50 sailplanes. I have a suspicion, however, that it is not an impossible thing to accomplish and I would like to see some continuing work on it. It has been tried a couple of times previously in Chicago and Bryan, where there are a reasonably low number of sailplanes, and I felt it was extremely successful, and I think it could be extended further.

One added element in this start that I had thought might make the system work might be a system that had maybe a first turnpoint or very close to the start line, a sort of a scatter pylon that is used in power plane racing which might involve photo identification and this sort of thing. I think it possible then to use a rather wide starting gate and have that starting gate monitored by, perhaps, power planes-a couple of them-and have this first short leg, and have this first scatter pylon or whatever you want to call it, also monitored by power planes. I think there is a possibility that this type thing might work. At the moment I am afraid that idea merely moves all the wreckage from the field and off to some nearby town. But perhaps it might be the beginnings of a way to go. I would really like to see this happen because I am enthralled with the idea of seeing everybody out there get started under exactly the same conditions and I am also enthralled with the idea of knowing where you are in relation to other people out on course, and I think this could get to be even more fun on the second lap around.

I, too, would like to see speed points increased, perhaps geometrically, with the speed differential. I have heard all the arguments against this and I am only moderately in favor of that and I haven't heard enough arguments yet to convince me that it's a bad idea.

I had not planned to say anything about handicaps but since George mentioned it I should comment. My comment is that I am still convinced that there are many circumstances under which the higher performance ship has real advantages that can't be compensated for with a handicap system. A tabulation I did a couple of years ago indicated that there were 27 conditions where the higher performance ship had a considerable advantage and I don't see any evidence yet that any of those 27 conditions have been compensated for in the current even percentage stand concept. So I am afraid I am still not in favor of handicapping.

PAUL BIKLE:

I am going to keep my remarks pretty short. Bill Holbrook told me last night that he and Ed had really only invited me down here to give everybody an opportunity to sort of tell me what they thought about how lousy the rules were. In all fairness, I feel that I should provide the maximum time for this purpose. But at the same time I probably ought to make what might be considered as sort of an announcement. As of last Monday I an no longer on the Rules Committee. I had put a space here in my notes for applause (laughter). I can, however, still answer questions about what the rules are and the thinking behind why they are that way, if anybody is interested. And I suggest that before a lot of these things are brought up that you keep in mind that no matter what you decide, there are going to be people for it and people against it. I might also point out that the Rules Committee, as such, does not decide many of these things that are the basis of complaints. For instance, the SSA sent out some 300 questionnaires to every pilot who was registered in any sanctioned contest last year and to any officials that they had record of. I couldn't help but notice that to a considerable extent, many of these people who are most loud in their objections in public meetings, didn't bother to answer the questionnaires. We did, however, get a fairly good response which was something around 60 percent, which for a questionnaire, isn't too bad. They used to restrict it to about 50 people and we used to get 80 to 85 percent return response. They were people who were more active in competition and had more at stake.

We sat down and went over these rules. We had the president of the Soaring Society, chairman of the Contest Board, myself, and the executive director, and we hassled over each of these points. For example, some of the things that George brought up such as should we do away with the re-lights, we considered the arguments for and against. In most of these cases it is not a question of what is right or wrong or, black or white. You balance out what you think are the advantages and the disadvantages and you elect to go on some course. After these decisions were made, in each case at this meeting, then it becomes the job of the Rules Committee to go back and write the words that will try to implement these decisions in a fashion which can be worked in a contest.

I think that since I am no longer on the Rules Committee, this gives me a freedom to speak more of what I feel myself, rather than speaking for the Rules Committee. Always before I have felt that I had to talk with two hats, one with what I thought myself and the other, why the rules were the way they were, which in many cases represented a compromise with which I personally-did not agree.

I think with that we should go ahead with the questions.

Question: (Gren Seibels) Paul, would you summarize briefly the thinking of the Rules Committee in deciding that the 301-B Libelle would not be allowed to enter Standard Class competition in 1971.

Answer: (Bikle) Gren, I think that was a good example of what I was trying to explain. The Rules Committee didn't make any such decision. In this policy meeting that we had, we did discuss Standard Class at great length and for a variety of reasons there were big pushes to go to 15-meter class and there were pushes to do various other things. It was basically decided that the primary reason for the FAI Standard Class being recognized as it was, and since it is so recognized, then we should follow along with their definitions since we are part of the FAI. The only decision which was made was that any ship, in order to be allowed in any FAI class competition, would have to comply with the CIVV regulations. And we recognized that those were in the process of being changed and this is beyond your control.

Question: (Leo Buckley) There is a rule 2.2.8 about unsportsmanlike conduct and I noticed in the Internationals we had team flying with use of radios. Am I to interpret that in our nationals and regionals that team flying and radio communications of this nature are considered unsportsmanlike conduct.

Answer: (Bikle) There are many things that are not covered specifically. I think that the only thing that tends to rule it out is the part in the rules that tells you what radio conversations must be limited to. In view of all the garbage that goes on over the air, I hardly think anyone team flying would be noticed. I don't think we have ever decided that we particularly wanted to rule our team flying out. We felt that individuals, being individuals that they are in this country, that it wasn't too likely to happen.

Question: (Steve DuPont) Here is a question that is oftentimes asked me. If I am in two regionals, am I taking away somebody else's chance to be in the Nationals, or is my win only counted once in the priority or seeding arrangement for the Nationals.

Answer: (Bikle) That's one of these things which I think hasn't been brought up. Actually that's not in the rules and would be a decision that would be made by the chairman of the Contest Board because it gets into the seeding procedure. Certainly, as far as the rules are concerned, if you placed in two regionals, you would get the medals and the prizes as winning two regionals. Now, how this would cut anybody else out in the seeding procedure, I'm not sure just how the chairman of the Contest Board would rule. I would suspect that he would rule that you were qualified by reason of your winning the first regional and as is the case of people who are qualified in the higher categories, you would then be dropped on the second regional and the next highest guy would be seeded.

Question: (Captain Ray Young) Did the Rules Committee in the discussion of the re-light problem differentiate between landing back at the airport against coming in from an off-field landing by trailer.

Answer: (Bikle) Negative. It was decided to leave it as it has been so that you can re-light from either one. The point about differentiating was, of course, brought up by many of the people who are in this room.

Question: (Tom Page) George indicated that there was one modification of the Bikle Basket that he does approve of. I don't think many people here know exactly what that modification is. I understand that it is in the rules this year. I would like to have both George and Paul comment on what it is because it is unfamiliar.

Answer: (Bikle) It was in the rules last year for the national contest, and on at least one occasion it was approved for a regional contest. Actually, there are several modifications, but the one that George is talking about is that you now have an opportunity to select one of three applications of the prescribed area task. The one that we feel is the best application, I suspect, would not be chosen by regionals because of the 'extra work involved. That is, however, the one that George is talking about. What it primarily recommends is that you establish a lot of turnpoints (like 18 or 20) around the arc of a circle, roughly 100 miles out from your contest site. The maximum in the task is 150, but I would think back here in the East that 100 would be more appropriate. When you do this, you've got an area to fly in that is sufficiently big that you have all kinds of choices to make as to where you want to go. You also have enough points around the arc of the circle so that if you head for one point and it happens to be socked in, then it's only a minor deviation to the next point closest to it, especially if you made the choice a little ways before you get to the first point.

The only restriction on where you go in this application of the task is that you can only claim two turnpoints during the day. But, when you think that this gives YOU a circle of some 300 miles across (or maybe 200 miles around here), this gives you the possibility of flying maybe 500 miles even back here. You can go to as many points as you want, and then if you decide it is to your benefit you can just discard the one you've been to and go to another one. But at the end of the day you can just claim two. Now, on a poor clay, you might have a situation where nobody even reaches the turnpoint, and, at least in the philosophy of the task, this would be maybe a rather ideal application for those who look at distance tasks as having some virtue. It would give you all the benefits, as those people see it, of a free distance day, and take none of the risk on far out retrieves.

Question: (Steve Silverman) In a recent issue of Soaring Magazine a new type of task was proposed which includes an out and return where the pilot picks the point. Has this type task been formally discussed by the Contest Committee?

Answer: (Bikle) Yes, quite a bit, and we have had a number of applications from regionals to try this task and I might just give some of the background. That is a task that was set up by Carl Herold and others out in northern California. They talked to me some about it and I suggested that they try it in one or two of their local contests and get the pilots' reactions, and if they wanted to use it in their regionals, to work out enough of the details so that it could be innovated into the rules. The general philosophy is described in the article in Soaring, but there are any number of detail questions that need to be decided.

The Contest Board has been corresponding with various regions about the possibility of including other tasks. What it involves is that the person who wants to run a new task must think it out and must show that he presently understands what the present tasks are, and secondly, that he understands what the impact of the new task would be. We can best ascertain whether he has an understanding by asking him to make his request for permission to use the new task in terms of specific changes in the existing rules. One other thing, for instance, that would have to be decided is that the existing rules call for minimum distances and require that at least 20 percent of the people fly at least 60 miles or you don't have a contest day. On this new type task, they are proposing that people fly out at least half the day and you don't get any points for that. Once you pick a turnpoint and start back then you start scoring. I would guess that there should be some change in the minimum distance that people should fly to make a contest day. There are many other aspects of this new task that must be studied.

Question: (Doug Gaines) Since this is a panel discussion, I would like to hear George and A. J.'s opinion of that task.

Answer: (Moffat) I think it is horrible. If we decided to do very much of this I think I would go back to sailing where at least I could get some competition. I felt pretty often that way about the distance tasks that we have now. My view, and in partial answer to a question mentioned previously, is that I like Paul's modification of the cat's cradle best of any distance task I happen to know about but I don't think very much of it either. The reason is very simple. If you want competition, you must have it so that people can compete against one another. It is extremely hard to compete when you are all going different directions. Furthermore, it's rather boring when you never see anybody all day long. I don't know about you but I kind of like catching up with people or being ahead of people. One of the things I have against all forms of cat's cradle is that they are boring to fly. I feel as A. J. does, that I like to know that when I see somebody I like to know that I an beating him or he is beating me. Specifically, I do think that this task has a very great many difficulties and to me it seems to be only a matter of going back to the old 1950 Of Pilot selected goal.

Answer: (Smith) I will preface my remarks by saying in somewhat different words the same thing that Paul said to me a couple of days ago. I'm not really in favor of distance tasks as such, but I have to admit that I enjoy them very much and I enjoy one aspect of them. That is, that it seems to me that it is true that there is a different kind of judgment to be exercised in a distance task. This aspect has always been very appealing to me. I never manage to do very well in this type at the outset but I have managed to improve and this has been very satisfying to me.

It still remains that under the present level of weather information and this sort of thing I am against taking these kind of gambles. If somebody can give me some assurance that the weather is going to be accurate for the assumptions that all of the pilots are going to make, then I think it's a fair kind of competition. But I feel that my assumptions are quite likely to be as valid as yours when I decide where I am going to go, but I might find myself in the unfortunate circumstance of not having the weather that somebody told me would be there and you might be lucky enough to have the weather that someone said would be at your turnpoint, and I don't think that's a fair kind of competition.

Comment: (Bikle) I would like to take this opportunity to answer some of those things that George has been saying about distance tasks and I want to answer it from my own personal feeling, just like I am sure he was talking about his own personal feelings. I think we are getting into a real fundamental difference of viewpoint between different people

and I don't think there is any question that George does equally well on both type tasks and I don't think we are, therefore, talking about people looking for
advantage. I think we are talking more about what people see soaring to be.

Although most of the top pilots do not agree, to me the essence of soaring has been one of competing against the elements that you are flying in and you are trying to do the best under the circumstances, and here is where we have the basic difference. To George it is competing against somebody else and in that sense, the closer you come down to running everybody down the same track at the same time, well the better it's going to be. It is sort of like in the Indianapolis speed race or a sailboat race. Now if you depart from the basic viewpoint that I had, the basic thing that you are competing against is the weather and this matter of not being able to get weather reports that are going to apply in detail all the way down the road is part of what makes soaring to me. I like to fly cross country even when I'm on my own and try to guess what the weather is going to be on the basis of what I see around me, which has its limitations, obviously. To me it's a much bigger thrill than beating somebody around a speed triangle or something like that. I just want to point out that there are many people around the country that feel this way about it too. They don't happen to be the people who speak out, mostly, and I haven't spoken out too much on it because I felt restrained by my being on the Rules Committee and I think maybe this is the first time I've really said what appeals to me personally. People say they come to a contest to fly and they use this as an excuse to have more speed tasks. I can think of contests, for instance, where you might have five free distance days and you would get in just as much flying as if you had five speed tasks. So I don't think that your purpose of coming to a contest to fly is seriously affected by these task selections.

I might add one more comment about my feeling on the prescribed area task. Although to a considerable extent, I am responsible for it, my responsibility has been in the sense that we were trying to gain for those people who see an advantage to free distance, whatever those advantages were, with as few restrictions as possible and still trying to limit retrieves since that seemed to be the major complaint against it at the time. I must say that I hate the task with a passion and I have done extremely poorly every time I have flown it. After you have come in 30th on one of the durn things it's kind of bad to get chewed out the next day for inventing it. Let me say that in every case I have not felt that it was the task's fault when I came out 30th. I just felt that I had made some very poor decisions and I haven't tended to blame the task for it.

If you really want to have a speed task, there is a very simple way to have it. It gets back to your racehorse start. We actually ran some out in southern California as part of our southern California competition to see how the rules could be worked out. You break the contest up into heats of ten, which is not too different from a lot of other sports. During the first few days you have 40 or 50 ships and you launch them all off in groups of ten and they race against the ten in the group. On the second day, rather like a golf match, you take the top two, three, or four out of each heat and they race against each other. The ones that fall out of the picture go into a consolation heat. If people want to have these kind of races, certainly they are practical and the rules could be worked up for them. It is a completely different philosophical basis than what we have been working on and I can see maybe where it would end up where we would have soaring races or sailplane races and we also have soaring contests in the old-fashioned context.

Proceedings of the 1972 Symposium on Competitive Soaring

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PREFACE

The growth of American competitive soaring since Soaring Symposia's first meeting in February 1969 is best illustrated by the 1973 regional contest in Chester S.C. The pilot entry list approached the official limit of 65 for the first time in American Soaring history. In 1972 The Soaring Society Of America compiled the first seeding list. This list is now needed to determine the priority of pilots who wish to enter the sanctioned contests. These proceedings are part of Soaring Symposia's effort to raise the quality of this growing number of competitive pilots.

They are intended to supplement and refine the competitive pilots skills. The strategies and techniques suggested by the experienced faculty are meant to be used with good judgement and a strict sense of safety.

The candid remarks of the faculty make these symposia valuable and commenting as competitive pilots as well as your editors we extend our thanks to them.

Dr. Leland Ransom's efforts in taping all of the symposia since 1969 are again grateful acknowledged, for without his perseverance and skill much of this valuable information would have been lost.

The persistent encouragement of all of our soaring friends has finally born fruit as this Proceedings might never have reached the printer had it not been for their efforts.

Please continue to let us know your thoughts about our work.

Ed Byars & Bill Holbrook

PRACTICING FOR COMPETITION

By George Moffat

Practice is obviously the key to improvement whether a pilot has two hours or two thousand, but over the years I have seen a great many pilots who confuse practicing with just plain flying. Practice for competition must always be channeled toward specific improvement and specific problems. Meaningful practice must cover not only the mechanical aspects of flying itself but everything that can lead towards winning. In this talk I would like to cover three general areas that seem vital to consider if a pilot wishes to compete seriously. These three areas are psychological conditioning, making use of the past, and actual flying itself.

I would like to start with the psychological aspect because I feel that for most people it is the biggest single stumbling block. Soaring is made up of decisions, and decisions are relatively easy when there is little pressure. Unfortunately pressure is the very essence of competition flying, and some people who do very well in day to day flying tend to come apart under the stress. I remember in the early Sixties down at the Marfa records camps doing a lot of flying with Ben Greene and thinking he was about as fine a pilot as I'd ever flown with, cool, smooth, always making the right decision. But until a couple of years ago he couldn't seem to put it together under contest pressure. The basic difference I see between Ben now and Ben then isn't the technical skills-they are much the same-but the ability to keep the pressure under control so it works for him rather than against him.

How do you practice to get this control? The only way is to enter all the contests you can get to-but especially big contests. Lots of people who do well in Regionals never seem able to put it all together in the big contests. I know pilots that I would consider hard to beat in a fifteen ship contest that I would never even consider as competition in the Nationals. Their mental attitude is all wrong. They begin to think about all the people who could beat them rather than all the people they are going to beat. In soaring as in most other things there are those who go out to get and those who go out to get got.

An important thing to realize is that pressure is good; that the butteries in the belly help performance as long as you keep them under control. During my pole vaulting days in high school I could seldom clear better than ten feet in practice, but under pressure of a meet I could do 1l' 6" or better. The competitive pressure made the difference.

It is important that the crew as well as the pilot be able to handle pressure. A good crew has to be hopped up about the team effort, has to really care. I would far rather have a thoroughly competitive crew than a don't-give-a-damn one who had a few more skills. But, like the pilot, the crew has to be able to handle the pressure. Crew members who start running around like chickens with their head's cut off are worse than useless and very distracting to the pilot. On my own crew I find Ralph's twenty years of professional stock car racing invaluable not only because of the skills it has given him but also because of the ability to understand and handle competitive pressure.

One of the hardest things to learn is proper pacing in competition. Beginners tend to use up all their psychic energy in the first four days of a meet and they have nothing left for the last half. This may be one reason for the fact that some of the newer pilots who do very well in Regionals can't seem to handle a Nationals. Last summer in Bryan a pilot who was well up in the first ten at the end of the fifth day told me that he was just going to try to hang on to his spot for the rest of the contest. He no longer had the aggressive attitude that it takes to win, yet he could easily have beaten at least one of the pilots ahead of him.

On the morning of a contest day I like to have all the mechanical and technical problems out of the way by an hour to an hour and a half before takeoff. This lets me concentrate on building up just about the right head of steam, thinking about the task itself. Something I have often noticed before take-off is a growing sense of loneliness, of growing farther and farther away from friends and crew as you get more and more immersed in this thing that you have to do alone. I always like crossing the finish and landing. It feels like coming back to humanity.

On speed days the period between take-off and crossing the start line offers problems. There is a tendency to do a lot of gaggle flying and waste a lot of energy trying to out climb people. Don't. If possible go off a couple of miles and find a thermal of your own to laze around in. If there are only one or two thermals, just fly around in big lazy circles, relaxing as much as possible. You don't start to make points until you cross the starting line. I find it rather hard to hold on to just the right amount of tension during these waits that can take two hours and more.

Tension will inevitably mount as you near the end of a contest, particularly if you are doing well. It is very important to keep control just as you would keep control of physical energy if you were running a race.. I remember in the Nationals in Marfa in '69 when Wally Scott, Rudy Alleman and I were very close to even in points going into the last day, looking over at Rudy when the 350 mile task was announced and watching his face fall. I knew right away that he was pretty well licked. Looking over at Wally, I could see his thin little smile. Nobody handles tension better than Wally.

A good pilot must be aware of the psychological state of competitors. Some people are all finished if they have one bad day, some never give up. On the final day of the World's in Texas Hans Werner Grosse, a couple of hundred points down in second place, came over and said "George, how are we going to beat that Frenchman (Mercier, standing third)? Immediately it was clear that Hans Werner was concerned about keeping second rather than winning first. There was no need to worry much about him.

There is no real way to practice having the right mental attitude except by entering all the meets you can get into and by being constantly aware of the importance of tension and its pacing. No amount of flying skill will enable you to win if you go to pieces under pressure.

The second major factor in realistic practice is the lessons that can be learned from the past. Every pilot who seriously wants to win must be aware of his own strong and weak points. He must be able to look back at flights and contests of the past and decide what he did well and what he did badly. Sometimes it helps to ask friends what they think are your strong and weak points, but politeness frequently prevents criticism that is sharp enough to be of any use.

In my own case I find that I fly best in relatively predictable weather where patterns of lift can be established and used. My weakest point seems to be in making use of banded or cycling weather such as we had in Nebraska in '64, Poland in '68 and Bryan in '71. A.J. is far and away the best pilot I know at flying in such conditions. He got a 3-1-1 in these three contests; I averaged about 18th. Obviously in both thinking and actual practice I need to work especially hard on this problem.

In trying to ascertain past performance don't be misled by good placings that you didn't deserve or disturbed unduly by just plain bad luck. On the second day at Bryan I finished 2nd behind AJ in my Standard Cirrus, which might seem like a pretty good flight. Actually I made several rather bad mistakes. On the first leg I allowed myself to be lulled into complacency by the relatively strong conditions because I recognized the distant spacing of the few strong thermals and waited to get to them before circling even though it meant getting lower than I like. At the second turn, with things looking pretty dead, I made a real beginner's mistake in joining a gaggle that obviously wasn't doing very much. The penalty was dragging a lot of them along for half the third leg. Finally I made a navigational error during my last climb, thermalled higher than necessary, and lost perhaps five minutes in finishing too high. Second, but not a good flight. Conversely, on the 5th day I finished 42nd, my worst ever, but feel the flight was really not a bad one. With wide spaced but fairly good dry thermals, I left the last turn at 6000 feet and about 80 mph to try to leave a large gaggle behind. In one of those nightmare cases that haunt your dreams, I found absolutely not a ripple and landed 35 miles farther on. I discovered later that the rest of the gaggle had set out at max L/D, spreading out to increase chances of thermal finding, and had finished slowly but safely. However, I was trying to win and felt the risk worth taking.

It is important to be very skeptical about laying problems to luck. If "bad luck" always seems to haunt you under certain circumstances, it's probably really bad judgment. And don't forget to balance off the bad luck with the good like the totally undeserved save I got on the last day at Bryan at three hundred feet.

Learn to look at performance realistically, not in terms of final placings. In Bryan the pilot who ended up 5th had daily placings of 27-35-2-13-12-23-20-19. The pilot who finished seventh had 6-4-20-22-2-2-4-29. They were flying ships of roughly equal performance. The seventh place man is obviously quite a lot the better pilot, having five days in the top ten as opposed to one for the fifth place man. A study of scores matched to days would show that the higher placing pilot did his best on the weakest and least predictable days, his opponent did his worst on these days on which luck is likely to be a major factor. The fifth place finisher did rather badly on the honest speed days, which shows the need of more practice in aggressive flying. The seventh place finisher did extremely well on the more predictable days, but his consistently low performance on the weak days would indicate need for greater caution and more practice under these conditions.

We have covered the psychological factors and the uses of past experience. How about actual practice flying?

Certainly the most important point to remember is that if you aren't flying cross country, you aren't practicing. There is almost no point at all to piling up hours within five miles of the airport. Actually I think that such flying is actively detrimental. Quite a few of the pilots and instructors at my own field have grown so used to the three "reliable" home thermals that they seem utterly lost if they have to find lift over strange territory. For many years I have entered in the remarks column of my logbook the number of XC miles covered, not bothering to log flights of under fifty miles.

Adding up these miles gives a much more realistic idea of practice than do hours. I usually try to get in 1000-1500 miles during the spring before the big contests.

Much the best type of practice is to get a group of friends together and organize a competition around a course. Frequently at Wurtsboro we choose a course after we have been airborne awhile and all start together from some common altitude. While fun, this is not as good practice as starting separately at the time each pilot thinks best. When starting together there is too much tendency for the less experienced pilots to just follow the leader, learning little about decision making. On these practice tasks it is important to really compete-none of this “Hey, Dick, there’s a great thermal here over the turn, I’ll wait for you at the top.” Practice should be as contest-like as possible. In practice as well as in contests, success seems to be inversely proportionate to the amount of time spent on the radio. Talkers aren’t winners.

In practice flying special attention must be given to weak points. If you decide that your thermaling needs work, give thermaling special practice. One good technique for this is to drop down to 800 feet and try to get back up. As soon as you hit 2000 feet open the dive brakes and try again. It’s less wasteful of tows if you practice this just before you plan to land at the end of the day. One of the reasons Wally Scott is so good is that he invariably auto tows with a ratty old tow line that breaks every other launch. Nobody has as much practice as Wally at getting away from 300 feet. Last year I noticed in my own flying that my final glides were getting sloppy, so I’ll be giving them some special attention this spring.

Too many pilots only practice on good days. Anyone can fly on good days with nice, regular, cloud marked thermals. It’s the bad days that separate the men from the boys. Even if the weather is too weak to make XC worth while, an hour or two of weak weather practice and thermaling can be had. Sometimes a 15 mile triangle can be laid out with the field in the center so that you can practice against time and other ships without the bother of a retrieve. If the practice is to be meaningful you should not stay in one thermal all afternoon but try to, find others even if you don’t manage to win the I-stayed-up-longer-than-you-did-trophy. Contests are frequently won and lost on weak days. It takes confidence and practice to do well in such weather, particularly to make the decisions as when to hold awaiting better conditions that so frequently decide the difference between winner and also-ran.

Weak days are especially good for practicing gaggle flying since most of the local pilots wig obligingly create gaggles for you to play with without even being asked. Here the big problem is how to climb through other ships. In contests one frequently gets stuck below a slow climber who can hold up progress for minutes at a time. Practice ways to get through such as really tight turns, luring him away from the core (if he will take his eyes out of the cockpit long enough to notice you), wide turns, etc. Notice particularly the effect it has on your ship if you follow in his downwash and how far back you have to be to escape the effect. Get used to flying in close quarters with other ships and especially to using them in place of the variometer as an indication to the size and shape of the thermal.

For most pilots the biggest single avenue for improvement lies in entering and leaving thermals. If you can save 15 seconds on getting centered in each thermal, you will gain five minutes on the average contest flight. It takes a lot of conscious practice to enter thermals properly, especially from high speed and in the bigger and less maneuverable ships that are being forced upon us in the Open Class. Too many pilots begin to turn immediately as they pull back on entering a thermal without realizing that the high speed will ensure that they end up well to one side of the core. The correct technique is to pull back, but keep the wings level until the speed drops to ten miles above circling speed. At this point one banks into thermaling angle and begins to circle. During the first circle or two it is especially important to note the strongest and weakest parts of the thermal and pursue some plan to get really centered immediately. Some pilots take a long time to edge into the core, apparently trying not to scare it. This is time wasted. A good way to practice entering thermals is to come into a thermal below an already circling ship. Come in fast, pull up, make your turn and then see if you really are lined up right below him. An too often you wig find yourself well beyond or to one side of your target. Since successful contest flying involves a fair amount of swiping other people’s hard won lift, this maneuver needs plenty of practice.

Leaving thermals is also important. Too many people seem hypnotized by lift. Be the first kid in your gaggle to leave! Practice getting out as soon as the lift declines to a pre selected figure, don’t dawdle about hoping things win get better. If the thermal is reasonably wide it can pay to tighten up the last turn and cut across the middle while gaining speed. At any rate practice getting the ship up to cruise quickly and decisively. Too many people can’t seem to bear to get the nose down for the first mile or so. If you are flying a course with competitors, practice getting into their blind spot before you peel out. It may take them a circle or two to realize they have been left. Keep in mind that if all this practicing does any good you should be winning enough things so people will think you know what you are doing. Don’t make it easy to follow you. Escaping gaggles is extremely important, especially in the Standard Class where ship performance is virtually identical.

During practice flights get used to spotting other gliders at maximum distance. Often the only indication of a distant gaggle is an occasional flash of the wings. Ability to see gaggles at a distance may have important bearing on your decisions about the weather up ahead. One of the reasons that a fairly late start on a speed day often works well is that one can step from gaggle to gaggle, saving valuable time on centering. Practice especially judging whether the ships in gaggles up ahead are climbing well or not. You may just want to bump the thermal and keep on running. Nothing is more demoralizing that working your heart out in a thermal and seeing some hot shot Eke AJ bomb right on by it.

Another interesting item to work on with a cooperative friend in a similar type ship is whether the so called “dolphin” techniques of pulling up sharply in minor thermals works for you and your ship. Have your friend hold his speed steady through the thermal while you dolphin. You may be surprised to discover that you are losing quite a bit. Dolphining doesn’t seem to work on ships that are prone to easy separation like the Pheobus. It also takes good timing which takes plenty of practice. I find it only gives a really clear cut advantage in big predictable thermals or with ships with lots of kinetic energy like the ASW-12.

An item that you can practice on weak days is turn point photography. Use the ends of the various runways as turn points and the other end as the target. Practice picking out lines of reference from a couple of miles away so that you can tell when you have actually arrived over the turn without any wild slips to check position. Arriving at the wrong spot and having to correct is very expensive in tune. Practice taking the photos themselves without any wild gyrations. Spinning out while trying to get lined up is a stupid way to lose a couple of thousand feet-as I found out in Texas in 1970. But even if you never manage to do anything dramatic like that, the couple of hundred feet you lose on each turn through poor line up and faulty technique are four hundred feet you will have to climb back somewhere along the course. Much of this practice can be done by just clicking the camera shutter, but it pays to run film through each camera every once in a while just to make sure you really are getting what you think you are and that the pictures are clear and readable.

Speaking of equipment, practice periods are a fine time make sure everything works in the way of equipment, instruments, computers, etc. To win, you must have confidence in all your instruments and gear. This goes triple for total energy systems. If you aren’t too experienced, get someone who is to fly your ship and give you an idea of whether the instruments are doing all they should do. A surprising number of pilots fly around with poor instrument systems just because they have no idea how good a system can be. Most of the better pilots will be glad to try your ship out if you offer to pay the tow. During practice use any computers you have aboard as much as possible. This is especially important if you are using something complex like the Skye computer-variometer or one of those ultra-elaborate circular computers that Graham Thompson sells. Gadgets of this type are an active detriment unless you are so used to them that you barely have to glance at them. Do enough final glides at various speeds so that you believe your ship will do what computer says-or know what allowances to make. Eight miles out on a low approach is no place to start wondering if the calculator really works.

Finally, during practice, experiment with different approaches to problems, the behavior of streets, likely and unlikely thermal sources. If there are waves about, don’t just sit there getting higher and colder, experiment with methods of getting from wave to wave, relationships of hill to wave to lennie, etc. Who knows, the next Nationals might be at Reno! Soaring is still a young sport, and not all the knowledge is in books by a long shot.

SAILPLANE MODIFICATIONS

By Wil Schuemann

In the last year and a half or so I did quite a modification program on an open Libelle. It impressed a number of people so we are going to talk about it today. A lot of pilots spend thousands of hours smoothing wings and sealing gaps, these are modifications that mainly help on the low speed end. The only thing that the typical pilot has done that has helped on the high speed end is add water, and that doesn't really help the efficiency of the glider.

I would like to show you that it is within your realm of capability to probe your own ship to find out where the problem areas are in the high speed region, and to show you that you can do quite a bit about it without ever touching your ship structurally or doing anything particularly drastic. In most cases you can do it with little work. At least a lot less work than say, smoothing a wing.

With the open Libelle on which I worked, I got a net thirty percent improvement in performance at one hundred knots. About fifteen percent of that improvement came quite easily. I would say several hundred hours got fifteen percent, a good thousand hours got the next ten percent and the final five was just a fluke.

I would like to spend a little time telling you about the instrumentation you need to probe your ship and what you should look for. And then at the end I will show you how it was applied to my Libelle.

In high speed drag there are two principal ways that you get losses. One is having an excessive amount of turbulent flow on the surfaces of your glider. In the high speed region, especially on the flapped sailplane, the flow on the forward half of the upper and lower surface of the wing should be laminar and on the fuselage up the region of the wing the flow should be laminar. The forward half of the tail surfaces should be laminar. If you have more area that that turbulent, you are unnecessarily losing performance.

The equipment you need to determine what part of your sailplane is laminar consists of 1/16th inch diameter plastic tubing that you get from your hobby shop and a stethoscope. The way you use it is to get into the cockpit with the stethoscope, take the tube and tape it to the side of the fuselage in the area of interest, and run it into the cockpit. Then go up and fly and listen. You will hear one of three things. If the flow is laminar, you will hear at most a gentle rustle or usually nothing. If the flow is transitioning to turbulent, you will hear a lot of little whistles either some odd tones or one predominant tone. This tells you that the boundary disturbances are beginning to get irregular or they are beginning to build up, and as they pass the end of the tube they make these little noises. When you get full transition to turbulent, you get a very loud roar. So there are three regions and the difference between the laminar quiet sound and the very loud, irregular roar that tens you the flow is turbulent is easy to determine. So every time you go up you can put one or more probes on your ship quite easily and plot on your own glider as a function of speed what areas are laminar and what areas are turbulent. If you find some areas that are unnecessarily turbulent, you can ask the question: why? Then when you do your work you know you are working on an identified problem area.

Now as to the second major area of losses in the high speed region; this is what you need to determine them. You start out in the cockpit with a syringe full of red dye. The dye is water plus food coloring plus a few drops of detergent.

Let me talk a little bit about the definition of separations. Separations occur principally in a region where the geometry of the sailplane changes too abruptly and the boundary layer leaves the surface. Downstream of that transition you always want the boundary layer to be attached to the sailplane. The typical places where you have this type of problem are at the wing roots and aft of the tail wheel. Another place that is bad on some ships is just aft of the horizontal tail and right at the rudder.

If, for instance. you wanted to probe the wing root flow you go to the area of the wing root say just above or below the wing and say half way back on the chord and drill a 1/16th inch diameter hole in the skin, through that hole you insert your 1/16th inch tube so it is flush with the outside surface of the skin. On the inside you put just a little glue to hold it in place. Then run the tube back to the syringe. Then fly at the speed and flap setting you want to investigate and just trickle a little bit of dye out into the boundary layer. It will run in a fine stream all the way back to the tail if everything is all right, if not, it will run back and start to spread around. It will eddy and show all kinds of problems. if you have that kind of a situation you are going to have to do some sealing or some filleting or something to resolve the problem.

If you take an hour or so to set up such a test, you can do one every time you fly. After a while you will know whether the flow is proper or not over your entire glider The third area turned out to be rather critical on the Libelle is not strictly a high speed problem but a general one. It relates to the fact that on most flapped gliders you don't know where to set the flaps or how to rig the ailerons. On the Libelle this is particularly true. The differential between the flaps and the ailerons should be set so as to have the optimum lift distribution all the time. To do this you need a homemade manometer (just a "U" tube with water in it) and some more tubing. (This is radio spaghetti, real inexpensive, a couple dollars per hundred feet.) The outer end of the tube is closed off by heat and a very small hole is punched in the side of it. Lay this on the wing at about 1/3 of the chord, seal it down with tape and it becomes a static port. Place 7 or 8 of these along the wing span. When you are in the air fly at one speed and check the pressure at each one of these static ports. It is not exactly this simple but essentially you should have the same pressure relative to static. You have to hook the other side of the manometer to static. You should see the same pressure at all of the various ports across the entire wing span. If you've got that you have the proper aileron, flap coupling. If you don't then it needs to be adjusted; and in the Libelle it needs to be adjusted quite a bit.

The next thing you need is this book: Fluid Dynamic Drag by Dr. Sieghard Hoerner, Tuetfingen, Greenbriar, Ricktown, New Jersey 08723. A year and a half ago I didn't know anything about aerodynamics. A fellow in the lab where I work had it on his book shelf and I picked it up and started reading. It is very practical. If you can do fifth grade math you've got all you need in the way of mathematics to understand it. It's a compilation of all the flight and wind tunnel tests that are applicable to aerodynamics from the early thirties to about 1955. The author died a short time ago so the book may not be obtainable now. It is well worth having.

Then I got a notebook and recorded a lot of data in it. Much of this did not seem to be worthwhile when I was gathering it. But after I gathered enough of it, it was amazing how I could go back and put together the story and determine performance that I never thought I could extract out of the individual data point when I took it. So it really makes a worthwhile record.

I hope I have at least shown you that there is nothing complicated about gathering this information. It takes a little bit of perseverance but the results are dramatic as can be shown by the figures.

Lower wing surface completely turbulent at speeds over 80 knots

Flap position and flap-aileron coupling incorrect at speeds over 65 knots

Wing area error by manufacturer

Forward fuselage turbulent at speeds over 80 knots

Strong vortex shed from wing root at speeds over 70 knots

Separation aft of tailwheel

Lack of ventilation inlet or exhaust

FIGURE 1

Figure 1 is the list of all the problems that were identified on the open Libelle with regard to excess drag. They are not necessarily in the order of importance and without comment as to how we determined them.

The first one that we found is that the lower wing surface is completely turbulent. All the way from the leading edge to the trailing edge at speeds of over eighty knots in still air and of over sixty to sixty-five knots in turbulent air. We found this with the little probe and the stethoscope that we talked about. Then we found that the flap position and the flap-aileron coupling were incorrect at speeds over sixty-five knots. We found this by putting the static probes on the wing and measuring the pressure distribution across the wingspan.

Next, we found that the wing area was incorrectly stated by the manufacturer. There is a 7% difference between the actual wing area and that published. The actual wing area is 7% more than the stated area. This doesn't seem important, but if you are computing the wing loading at 7% higher than its true value it makes the high speed drag look rather bad.

We found that the forward fuselage was turbulent at speeds over 80 knots. This was done with the stethoscope and the probe. That may have been a particular characteristic of my glider. We will get into that later.

We found that a strong vortex was shed from the wing root at speeds over 70 knots. You may have noticed on this model Libelle as the flap comes up a gap opens between the fuselage and the flap. You wouldn't believe how that messes up the flow on the side of the fuselage as determined by the little dye test we described.

Then we found separation aft of the tail wheel. This was not determined by any of the described methods rather was found as a result of building an exhaust ventilator in that area and not being able to get it quieted down later. We were able to get it quiet by redesigning the exhaust, so I assume there was a separation there. The ship had no adequate ventilation inlet or exhaust as it came from the factory. It normally used the cockpit for both, and this is a rather poor situation.

Figure 2 is the ship as it finally looked. Note that the nose has been changed, the canopy cut and shortened, and the piece added to the fuselage over the wing with a fillet, new wheel well doors, moving fillets in the flap area, a new leading edge on the wing, a fillet up by the tail,

Figure 3 shows the exhaust that was spoken of earlier, under the tail.

Figure 4 shows the way air is brought into the ship. The gear doors were replaced with larger doors shaped to form a very shallow scoop to pick up the boundary layer and direct it into the gear cavity and subsequently up into the cockpit. (You can also see a little bit of the wing fillet that was added on to the fuselage.)

Figure 5 shows the canopy, note how it was faired in at the front edge so that it is very smooth. It was sealed very tightly all the way around, tongue and groove joints were added along the side to keep it from shifting position. There was a clamp inside to keep it down tight.

Figure 6 shows the cockpit. Note the top of the gear well has been modified too by adding a duct work to act as a vent. The air comes through the vents and attaches to the side of the inside of the canopy and acts to defog or deice rather effectively. It also shows the water ballast installation. We put water in it way back before we had much experience with water. I put in very large valves and also the tanks are rather large but the installation was successful.

Normally the Libelle had the tow hook under the nose and another one in back just forward of the wheel. We took those off and put the hook on the landing gear itself Figure 7 so the hook retracts with the gear.

Figure 8 shows the area aft of the doors, the holes are the dump chutes for the water ballast. When the gear doors close the whole area gets sealed up.

The first problem that we stumbled onto was the leading edge. The air foil on the Libelle turned out to be virtually identical to the latest series of Wortmann Airfoils which are going to be on the Nimbus, for instance. The Libelle airfoil was designed by Heutter and not by Wortmann. The only difference between the two is at leading edge region. The leading edge of the Heutter foil is much blunter and it tips up a little. This, coupled with the flap positions on the ship as it was delivered, resulted in the whole lower surface being turbulent at higher speeds. So I fitted on to the front of the airfoil the Wortmann leading edge, which made it essentially like the recent Wortmann foils. That worked out very successfully. The leading edge modification accounted for over 10% of the total drag reduction at 100 knots.

Figure 9 shows the front edge of the wing fillet, there is a piece on the fuselage and a little bit on the wing not very much. Now we can tape all the way around the wing because the canopy has been shortened. It also shows how much of a radius there is between the wing and the fuselage. You can also pick up a little detail of the flap wing junction. Figures 10, 11, and 12 show the area where the flap joins the wing. It is a pretty difficult problem to allow a smooth contour without any breaks as the flap moves up and down. Note that the gap between the flap and the fuselage has been sealed down to just a few mils so there is no leakage in that area. That is a particularly difficult problem to solve on the Libelle.

Figure 10 shows the ship in the maximum l/d or cruise position.

Figure 11 shows the flap in the up position; notice the gap is still Sealed all the way around.

Figure 12 shows the flaps in the climb position.

Figure 13 shows the tail wheel area. Note the exhaust fairing added to the fuselage extending the tail wheel fairing. We made the original hole at the very beginning and as we made more and more improvements it became increasingly obvious that this little hole was making an awful lot of noise. Then it dawned on me to add a little fin down from the rudder which formed a splitter plate which restricts the formation of vortices aft of the hole and quiets the noise. This is a very efficient way of dumping the ventilation air.

Now let us talk about performance before and after. Let us compare it to an ASW-12 curve (I don't want to say that these numbers are accurate to one percent, but they are within five percent.) The interesting thing about the Libelle curve Figure 14 is that it is not a smooth curve like you always see drawn for sailplanes. It comes up to around 75 or 80 knots and breaks rather abruptly to a much higher drag level and then continued on out. The break in the curve is caused by all the area that becomes turbulent. The wing became turbulent, the nose became turbulent, and the wing root problem began to become evident. These accounted for the extra drag. This also accounts for some of the history of the ship in competition. The curve shows that the Libelle is a very competitive sailplane up to about 75 or 80 knots. The place where this ship is very popular is in the east, where we do not have the strong conditions which tempt the pilots to fly at the higher speed range. At the higher speed in the Libelle you pay a large penalty. By eliminating these problems we have brought the high speed end up to where it is somewhat comparable to A.J.'s -12 (A.J. Smith's ASW -12). We compared it to his ASW-12 in actual flight runs. It is comparable to the "12" at 80 knots and seems to be perhaps a little better at 100 knots. Interestingly enough none of the modifications had any effect at the low speed end of the curve.

I think that pretty much covers what I wanted to say. I hope I have shown you that you can do some of this stuff yourself. There is no problem certainly with regard to determining what your problems are.

QUESTIONS AND ANSWERS

Question: What part of the thirty percent improvement came the easy way?

Answer: Ten percent or so came from the leading edge, six percent came out of the wing area. The wing area thing really isn't a performance improvement; it was just a discovery we made along the way. The wing fillet really didn't involve a lot of work. The rudimentary fillet, which was probably just as good as the final one, combined with the fairing behind the tail wheel and the little bit of work that was done on the nose, probably contributed fifteen percent summed up together. I don't have a breakdown on how each of those improvements helped.

Question: Did you seal the ailerons and flaps on the ship?

Answer: Not until very near the end. I personally have a thing in not believing in an air tight seal. I tend to like to use long rather close gaps to form what is really an effective seal. If you look at the amount of flow you get through a crack of four or five thousandths of an inch, at the pressures we are considering, it is almost negligible. So I believe in wiping joints which aren't actually physically contacting.

Question: I take it those are actual comparative flight tests that you make with the ASW-12?

Answer: They are comparative tests and there is some absolute data in that curve. There are three real good runs at a hundred knots, the data point at a hundred knots is really absolute. There are about four runs at 80 knots under different conditions. The principal run at 80 knots is a 35 thousand foot run in rough air. The data point that is on the curve there is a rough air point. So those two speeds, at least, are absolute on the curve and the other points are relative to A.J.'s ship.

Question: Is tape worth using?

Answer: Yes.

Question: What happens when you fix the flap on an open Libelle and fly it as a standard class ship.

Answer: The answer is that it is disastrous. If you plan to fly in standard class don't modify your leading edge.

Question: Can you provide an exhaust vent so you can use the provision for cracking the canopy for ventilation on an open Libelle?

Answer: I don't think so because the pressure field over the wings will suck the air out that gap no matter what you do and that is not good.

Question: Does the reentry angle on the canopy cause extra drag?

Answer: We probed the flow in front of the canopy and it turbulent quite a distance in front of the canopy, probably entirely because of the reentry angle. There is a side comment by Professor Al Ormsby who tells me the side vortexes formed of the side of the canopy caused by the reentry angle benefits you somehow in the flow around the wing root. I can't understand why it ever would, but there may be something to this.

Question: How do you open the area between the cockpit and the aft fuselage to let the air to the tail?

Answer: I took the door off. The one that is normally closed when you are flying.

Question: In regard to the nose modification?

Answer: I may have got suckered into something here. We have had one Libelle that has been checked. The normal nose has about a four inch radius. And anything less than a four inch radius is marginal as far as triggering boundary layer turbulence. I had done a lot of repainting in that area, changed the gear doors, etc. Every time you hit a rock or something you would have to redo it. I think that I may have raised a bump when sanding for the refinishing. The bump then caused the turbulence and the modification corrected it.

Question: How far then does the laminar flow extend since the modification of the nose.

Answer: Not very far; about half way to the canopy on the top and a little farther on the bottom.

Question: How about nose ventilators, are they serious sources of drag?

Answer: If the opening -allows unrestricted air flow through the hole it is probably just as good as a smooth pointed nose.

Question: Please explain in more detail the development of the idea to use dye for turbulent stream flow investigation.

Answer: This idea was suggested to me by Professor Al Ormsby after he had attempted to use tufts. The tufts were very unsatisfactory. We were flying so close we were scared half to death and the observer still couldn't seen anything significant. Then the dye showed the problem very plainly. The dye runs back and enough of it dries to show up plainly. It also washes off easily afterwards. You must be careful not to put out too much or put it out at more than one airspeed.

Question: What materials did you use to make all of the modifications?

Answer: I used polyester exclusively. That is not what Fred Jiran recommends. As long as your mods are non-structural, all my mods were non-structural, polyester works fine on a Libelle, as long as you make sure you clean off the mold release.

Now I have a Diamant and the polyester is useless in trying to attach to the epoxy it is made with. We have tried some test patches.

Question: What wing loadings did you use?

Answer: At times I carried as much as 240 pounds of water. I feel that for typical eastern conditions 100 pounds is plenty. The minimum wing loading was about 5.7 to 5.9. The maximum with the proper wing area, figure was uparound 7.8 pounds.

Question: Didn't you try some tests either on purpose or inadvertently with one wing filled with water and the other empty? If so what was your observation?

Answer: Yes, this was in the early days of the water ballast idea. I was concerned about the flow from one wing to the other and the possibility of unsymmetrical loading. That was the original reason for using two valves. One day when I was high I dumped part of the water in one wing, and slowed up, went through a stall, etc. After checking that out, I dumped some more. The net result was that with one wing empty and 120 pounds in the other, I picked up just a very little aileron pressure. I tried it at all speeds and with the flaps up and down experienced no control problems at all. It took about a quarter of the aileron travel to balance that wing. I concluded that the water imbalance is not a serious thing as long as you know what happened.