GEWINNEN OHNE ZEIT ZU VERLIEREN...

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Um die Wichtigkeit der Schnelligkeit in jeder Phase des Fluges zu unterstreichen, begeben wir uns in eine hypothetische Situation, addieren die gewonnenen Sekunden und sehen uns an, was die Gesamtersparnisse im Vergleich zum Stundendurchschnitt und den Punkten während eines Wettkampfes ausmacht.

Angenommen, wir fliegen 300km mit einem durchschnittlichen Steigen von 1,5 m/s, was für unser Gedankenexperiment angemessen ist. Wir stellen uns weiters von, dass der Führende, den wir Pilot B. nennen, eine Durchschnittsgeschwindigkeit von 80 km/h macht und dass jeder Pilot alle 15km Thermik ausnutzt, was im Ganzen 20 Aufwinde macht. Nehmen wir an, dass die beiden Segelflieger sich in Führung begeben, keiner übertrifft den anderen, weder im Steigen noch im Gleiten. Sie fliegen auf gleiche Weise vor und fliegen gleiche Flugzeuge. Kurz gesagt – Chancengleichheit. Dennoch werden wir sehen, dass es sich über Teilstrecken so entwickeln wird, dass Pilot B den Sieg gegenüber Pilot A mit einem beträchtlichen Vorsprung davonträgt.

Der Abflug

Gewisse Leute sind sich nicht klar darüber, dass Abfliegen im richtigen Moment etwas sehr Schweres ist und viel Praxis erfordert. Nehmen wir an, dass unser Pilot B die Linie bei 950m und mit 200km/h überfliegt und die Abflughöhe 1000m vorgegeben ist. Er spart ca. 50m indem er mit Gefühl zieht, sobald er sicher ist, die Linie überschritten zu haben, um seine Geschwindigkeit maximal in Höhe umzusetzen.

Pilot A, der solche Abflüge nicht gut trainiert hat, unterschätzt die Höhe, die er braucht. Er passiert die Linie mit 130km/h und ein bißchen zu tief bei 900m. Er sieht seinen Kollegen vor sich und höher, aber macht sich darüber keine Sorgen. Wenn er jedoch von seiner Kalkulation abgehen würde, würde er erkennen, dass ihm 80 Sekunden für Steigen fehlen, um den Höhenunterschied zu kompensieren. Es gibt keinen Weg zurück und einen Sekunde nach dem Start hat Pilot B bereits einen Vorsprung von 80 Sekunden.

Haben die beiden Segelflieger Kurs auf die vielversprechenden Wolken genommen? Wie jeder weiß, muss man eine Abwindzone durchqueren bevor man unter den Cumulus gelangt. Pilot A fliegt auf eine Wolke zu, von der er sich viel erhofft, und beginnt sanft zu ziehen, bevor er dort ankommt, den Aufwind vorausahnend. Also, in dem Moment wo er das Fallen passiert hat, fliegt er mit nicht mehr als ca. 100km/h. Diese Durchquerung dauert 12 Sekunden, er wird an die Umgebung 40m verlieren.

Im Gegensatz dazu behält B seine Geschwindigkeit von 150km/h bei, es bleiben nur 9 Sekunden, was einen Verlust von 30m ausmacht. Die Differenz ist nicht enorm. Währenddessen nutzt B seine Geschwindigkeit um in der Thermik hochzuziehen und gewinnt ca. 50m, indem er Geschwindigkeit in Höhe umwandelt, bevor er einkurbelt. Der Pilot A hat den größten Teil seiner Energie verschwendet, indem er seine Geschwindigkeit verstärkt im Fallen reduziert hat und das alles zeigt sich in einer Differenz von 37 Sekunden. Wenn sich dieser Fehler mehr oder weniger oft in den 20 Aufwinden unseres Dreiecks von 300km wiederholt, wäre der Vorteil von B zu A 740 Sekunden oder 12 Minuten und 20 Sekunden.

Kurbeln

Nehmen wir ein anderes Beispiel. Die beiden Piloten beginnen das Einkreisen mit hoher Geschwindigkeit. Tatsächlich habe ich folgendes oft gesehen: Sofort einkreisen um nicht zu riskieren die Thermik zu verlieren, anstatt seine Geschwindigkeit zu nutzen um Höhe zu gewinnen. B zieht hoch, bevor er wendet: Er wird 50m Höhengewinn erreichen, was ca. 30 Sekunden Zeitgewinn im Durchschnitt bedeutet. Diese Hypothese bedeutet für unseren Flug mit 20 Aufwinden 10 Minuten.

In einem günstigen Fall erreicht A einen Bart und liest 1m/s Gesamtenergie auf seinem Variometer. Aber indem er annimmt, dass das Steigen besser wird, sucht er weitere 2 Kreise. Er findet nichts Besseres als seinen Meter und fliegt dann ab. B zieht wie gewohnt hoch, bemerkt, dass er nur 1m/s auf seinem Vario hat, erinnert sich, dass der Durchschnitt der Aufwinde des Tages bei 1,5m/s liegt, drückt nach, sobald er das Zentrum verlassen hat und beschleunigt zurück in den Gleitflug. Das spart ihm 15 Sekunden. Man könnt denken, dass der Vorteil größer wäre, aber man muss die Tatsache im Auge behalten, dass der Pilot A auch mit seinem Meter etwas eingespart hat.

A hat eine Gruppe von Segelflugzeugen wahrgenommen. Die Menge übt immer eine unwiderstehliche Faszination auf die Segelflieger aus. Man hat eine Gruppe gesehen, z.B. auf 20 Grad des eigenen Kurses und will sie natürlich einholen. Das Steigen bringt tatsächlich nicht mehr als 1m/s. Und ich weiß nicht warum, aber jedes Mal gibt es eine Reihe von Segelflugzeugen im gleichen Bart, der meist nur schwach ist. Aber A ist Optimist und hofft, dass sich die Situation verbessert, obwohl die meisten Segelflugzeuge bereits abfliegen. Also macht er 3 Kreise, bevor auch er abfliegt. Gegenüber dieser Situation bemerkt B, dass dieser Bart nicht ausreichend Steigen verspricht und ignoriert das Ganze. Der Gewinn sind 20 Sekunden. Überlegen sie, wieviele Male es möglich ist, bei einer Strecke von 300km unter den gleichen Umständen, in eine Falle zu geraten...

Ich denke daran, was Dick Schreder bezüglich dieses Gedränges in der Thermik gesagt hat: Es ist eine gute Idee, die Kennzeichen der besten Wettkämpfer in Erinnerung zu behalten. Es ist ebenfalls praktisch sich in einer Ecke seines Gehirns die herausragenden Merkmale der besten Piloten gegenwärtig zu halten.

Wenn man zu weit entfernt ist um das Wettbewerbskennzeichen zu identifizieren, gibt es andere Wege um zu wissen, ob die Thermikvorhersagen stimmen oder nicht. Natürlich, wenn Sie tief sind, sind diese Pulks interessant. Aber in den anderen Fällen beobachten sie das Niveau. Die "großen Orchideen", die sich im Pulk befinden, deuten normalerweise darauf hin, dass es die Mühe wert ist. Wenn es sich aber nur um eine Traube mit Astir oder ähnlicher Typen handelt, flüchten sie sofort. Dann ist fast sicher, dass mehrere Segelflieger passende Thermik zum Einkurbeln nutzen wollen. Die einzige Ausnahme kommt früher oder später am Tag vor, wenn die Bärte zu sanften Kreaturen werden, die leicht zu verscheuchen sind.

Wir haben die verschiedenen Möglichkeiten, in einen Bart einzufliegen, studiert und widmen uns jetzt den Wegen, aus ihnen herauszukommen. Mein Vorschlag ist es zu beweisen, dass eine Thermik ungeschickt zu verlassen genauso viel kosten kann wie schlecht hineinzufliegen.

Nehmen wir an, dass unser Freund Pilot A auf ca. 3000m gestiegen ist – bis zur Basis der Wolken – und dass sein Steigen bei 1,5m/s liegt, sein durchschnittliches Stiegen liegt bei 1m/s. Da er über sich mehrere Segelflugzeuge gesehen hat, macht er vier weitere Kreise. Pilot B wirft einen Blick auf sein Variometer und sobald das Steigen weniger stark ist, macht er seinen letzten Kreis und verläßt die Thermik. Sie werden bemerken, dass, obwohl man die gewonnene Höhe von A in Betracht zieht, B ihm noch 23 Sekunden abgenommen hat, indem er den Bart vor seinem Schwächerwerden verlassen hat. Es ist, wie Dick Schreder sagt, einer der häufigsten Fehler, einen Bart, der seine Energie verliert, immer weiter auszunutzen. Wenn Sie bemerken, dass die Thermik bei 1500m schwächer wird, sie aber glauben, bis 1800m steigen zu können, verschwenden sie nur Zeit und vergeuden kostbare Augenblicke.

Sprechen wir von Techniken den Aufwind zu verlassen. Unser Freund Pilot A bleibt bei der Geschwindigkeit seines Kreisfluges bei ca. 80km/h. Er wird nur 100km/h schnell sein um die Abwindzone zu durchfliegen. B seinerseits zieht für den Ausstieg auf der gegenüberliegenden Seite den letzten Kreis enger, durchfliegt den Kern des Aufwindes mit tiefer Nase um die Geschwindigkeit rasch aufnehmen zu können und die Abwindzone mit 140-150km/h zu durchfliegen. Er passiert das Abwindfeld viel schneller und gewinnt noch 20 Sekunden bei jedem der 20 Aufwinde. Die Zunahme der Geschwindigkeit in der Abwindzone ist nicht immer so profitabel. Im Durchschnitt kostet es fünf Sekunden, den Aufwind ungeschickt zu verlassen. (siehe Reichmann)

Im Übergang

Nehmen wir an, dass Pilot B genau nach den Anweisungen seines McCready-Rings fliegt. Wenn er 1,5m/s im Durchschnitt gestiegen ist, wird er seinen Gleitflug mit McCready 1,5 machen. Pilot A handelt wie wir alle es in dem einen oder anderen Moment gemacht haben, er sagt sich "das sieht nicht sehr gut aus da vorne, deshalb werde ich 15km/h zur Sicherheit reduzieren." Sicher, das ist die Sicherheitskarte zu spielen und es macht sich manchmal bezahlt. Aber wenn man berechnet, was der Verlust von 15km/h Geschwindigkeit durchschnittlich während vier Stunden ausmacht, stellt man fest, dass dabei sechs Minuten und 30 Sekunden herauskommen.

In diesem Vergleich sind wir von dem Prinzip ausgegangen, dass sich unsere beiden Piloten in den Aufwinden gleich verhalten. Alle großen Piloten werden Ihnen sagen, dass das Geheimnis in der Fähigkeit den Übergang (die Flugphase zwischen den Bärten) gut zu meistern besteht. Ich habe nie einen Piloten von hohem Niveau getroffen, weder in Amerika noch anderswo, der fähig war sauberer zu steigen als seine Mitstreiter. Der einzige Moment, wo es etwas zu gewinnen gibt, ist zwischen den Aufwinden. Alle Spitzenpiloten trainieren hart um diese Übergänge zu verbessern. Die Faktoren auf die man achten muß sind die Existenz und Ausrichtung von Wolkenbildungen, Abwindzonen und die Anzeichen betreffend der Stärke von Thermik abzuschätzen.

Wenn sie in Texas fliegen, werden sie sicher sehen, wie sich Dust Devils ausbilden. Eine sehr praktische Sache besteht darin, ihre Lebensdauer zu schätzen. Es bringt keinerlei Vorteil, einen von ihnen, der 15km voraus liegt, ins Auge zu fassen, wenn er nur 6 Minuten anhält. Bei der Ankunft wird er verschwunden sein. Wir sind den ganzen Tag in diese Falle getappt mit einem starken Gefühl von Bitterkeit...

Um schnell zu fliegen glaube ich benötigt man Wissen, dass durch Beobachtung entsteht. Kenntnis des Terrains und des Verhaltens der Maschine. Auch die Bestimmung des Rhythmus, mit dem die Mücken sich zum Angriff zusammenrotten, kann eine nicht zu vernachlässigende Lehre sein. Die Natur der Sonneneinstrahlung hat oft große Bedeutung, wie das in Marfa 1967 der Fall war, wo niemand dem Thermikloch Mc Camey entkommen ist. Man stürzte mit -5m in der Gegend von Fort Stockton. Da man dachte, dass dieser Umstände außergewöhnlich wären, flog man einfach weiter und ignorierte die Serie von Aufwinden, die man nur hätte nutzen müssen und vergaß die Natur der Sonneneinstrahlung zu überprüfen, die ständig wechselte. Also kamen die Konkurrenten oberhalb einer sandigen Gegend an, doch der Sand produzierte keine guten Aufwinde. Die feuchten Regionen als anderes Beispiel, geben schreckliches Saufen, vor allem in Texas, wo sie die Tendenz haben sich zu vermehren. Im Falle des Überflugs dieser Regionen ist es besser nicht auf Aufwinde zu zählen.

Aber kommen wir wieder zurück zu unserem Streckenflug. Zum Vergnügen habe ich folgendes berechnet: wenn Pilot A 350m hinter dem vorgegebenen Wendepunkt wendet – aus Gründen der Sicherheit – kostet ihm das 100 Sekunden bis zur nächsten Wende. Er kann es nicht verhindern, 1 Minute und 40 Sekunden sind verloren im Vergleich zu demjenigen, der genau nach dem Passieren vom Wendepunkt wendet und ohne Zögern auf den zweiten Schenkel geht.

Der Endanflug

Der Pilot B operiert mit Hilfe des Endanflugrechners und der Einschätzung von Windkomponente und Aufwindqualität mit einem Gleiten von 1:25 und überfliegt die Linie mit 2m Höhe, wie gewohnt. A beherrscht den Rechner leider nicht gut und vertraut ihm auch nicht sehr (man vertraut ihm nicht, solange man ihn nicht gut kennt) und sagt sich: "Es ist noch weit!" Er reduziert seinen Endanflugrechner auf 1:20 um sicher zugehen.

Nehmen wir an, dass der Endanflug 40km vor der Ziellinie anfängt. Pilot A müßte 400m höher fliegen, was ihm 260 Sekunden für Steigen kostet. Er kann 180 Sekunden gutmachen, indem er auf seiner Flugbahn schnell fliegt, verliert aber trotzdem noch 80 Sekunden. Wenn A zu denen gehört, die die Linie bei 100m über der Ziellinie passieren (was oft bei nationalen und noch öfter bei regionalen Wettbewerben vorkommt), wird er eine weitere Minute verlieren, weil er wie beim Start eine Minute braucht um auf 100m zu steigen bevor er zum Endanflug ansetzt.

Machen wir jetzt die Berechnung und analysieren wir die Ergebnisse:
- beim Start 80 Sekunden
- im Aufwind kreisen, 37 Sekunden für jeden Bart multipliziert mit 20 (Anzahl ausgenutzte Aufwinde), ergibt total 740 Sekunden.
- Nutzung von schwacher Thermik (ca. 4 Mal) zu 15 Sekunden das Stück, macht zusätzliche 60 Sekunden.
- 3 Mal in eine Falle tappen durch Gruppen von Segelflugzeugen macht weitere 60 Sekunden.
- zusätzliche, nicht gerechtfertigte Kreise an der Basis = 460 Sekunden.
- Verlassen der 20 Aufwinde mit zu geringer Geschwindigkeit = 100 Sekunden (je 5 Sekunden)
- zu langsame Übergänge = 390 Sekunden
- Exzessives Überfliegen der Wendepunkte = 100 Sekunden
- schlechter Endanflug = 80 Sekunden

Auf wieviel beläuft sich die Addition? Auf 2070 Sekunden, was 34,5 Minuten sind. Und behalten wir im Gedächtnis, dass es sich hierbei um Segelflieger mit der gleichen Flugfähigkeit und dem gleichen Material handelt....

Also, wenn B nach 4 Stunden und 27 Minuten landet (wenn er mit durchschnittlich 72km/h fliegt) beendet A den Flug nach 5 Stunden und 1 Minute und 30 Sekunden, was einem Durchschnitt von 60km/h ergibt. Wenn die Minute 5 Punkte kostet, hätte A 173 Punkte verloren. Wenn der Wettbewerb aus 8 Wertungstagen besteht, berechnen Sie den Anstand! Und wenn die Minute 12 Punkten entspricht, wie es bei dem Weltmeisterschaften ist, verliert A 416 Punkte an einem einzigen Wertungstag.

Erinnern wir uns noch einmal an die Hypothese die wir am Anfang aufgestellt haben -
die Piloten und die Segelflugzeuge sind identisch. **Der Unterschied besteht in einer guten Zeitverwaltung. Der optimierte Flug ist nicht so schwer. Er erfordert einfach eine hohe Dosis an Genauigkeit...**

Soaring Syposia Archive 1969

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.