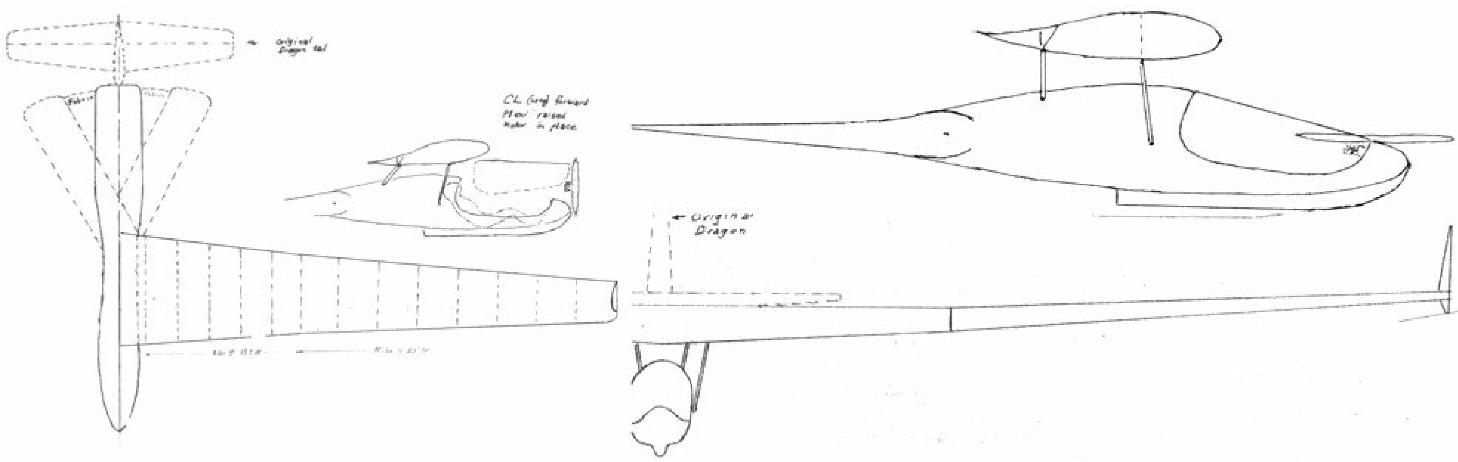
No. 192 JUNE 2002

T.W.I.T.T. NEWSLETTER



Last month, Syd Hall gave us some food for thought on how bird flight could be of assistance in helping us achieve better aircraft. This month we look at Syd's concept drawings and read a little about his thought process.

T.W.I.T.T.
The Wing Is The Thing
P.O. Box 20430
El Cajon, CA 92021

The number after your name indicates the ending year and month of your current subscription, i.e., **0206** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, July 20, 2002, beginning at 1:30 pm at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - Southeast side of Gillespie).

TWITT

THE WING IS THE THING

THE WING IS THE THING (T.W.I.T.T.)

T.W.I.T.T. is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is affiliated with The Hunsaker Foundation which is dedicated to furthering education and research in a variety of disciplines.

T.W.I.T.T. Officers:

The **T.W.I.T.T.** office is located at:
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Subscription Rates: $20 per year (US)
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Meetings are held on the third Saturday of every other month (beginning with January), at 1:30 PM, at Hanger A-4, Gillespie Field, El Cajon, California (first row of hangers on the south end of Joe Crosson Drive (#1720), east side of Gillespie or Skid Row for those flying in).

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PRESIDENT'S CORNER

First of all, I would like to personally thank Bruce Carmichael for stepping in and doing our May program. I am sure he will give the EAA group something to think about in terms of achieving better performance through better designs.

I didn't get much feedback on my question on membership retention, but several people had the same comment. They felt we were just going through the life cycle many organizations have over the years of their existence. However, this is the lowest I can remember us reaching through all the past cycles, so that is what sort of got my attention. We will just wait it out and see what happens over the next year or so.

For our members interested in the electronic side of the organization, I have to apologize for not doing much recently to update it with links to new sites or adding new material that has come in to us. I am now getting a handle on some personal business that has been consuming my time, so should be able to get back to the website in the near future.

Now that we are coming into the summer months, I have to assume some of you have finished winter building projects and are now ready to start flight-testing. We would sure like to hear from you with a short story on your aircraft, including any relevant pictures of it on the building board or in the air. The main point is to let others know what you have found out from your design that is both good and bad so we can pass it along. There is no sense in someone having to go through the same mistakes, while also being able to incorporate things that have worked well in a design.

We learned that the University of California San Diego design team won the 2002 AIAA competition in Kansas. They used two designs, one being a flying wing, and we hope to have them tell us about it at a future meeting.

Andy

JULY 20, 2002 PROGRAM

As of our publication date we didn't have a program lined up, but we are working diligently to find one on a flying wing subject. We have a few leads and hopefully one will work out for our announcement in the next newsletter. If you know of someone in the southern California area that would give a 45-minute to 1-hour presentation on a relevant subject, please let us know and we will try to make the necessary arrangements.

MAY 18, 2002 MEETING RECAP

Andy opened the meeting by welcoming what was a small group of our core people to the May meeting. We skipped the housekeeping items, since everyone already knew the drill and, Andy asked if anyone had something to offer before the program.

Bob Chase said he was very pleased with the ideas presented by Al Bowers at the April meeting. He had managed to give us the entire history of aviation aerodynamics and challenged us to take it to the next plateau. He also commented maybe one of the reasons for the decline in membership might be the lack of ideas in this area. In the past we had talked about electro-hyraulic systems for maintaining stability, but at a time when this wasn't really feasible to build on an amateur basis. One of the areas he thought needed to be brainstormed more is wingtip configurations to come up with new designs or re-evaluate previous ones that haven't made it big like the winglets. Another thing he would like to see discussed is reducing trim drag, which is the nemesis of all flying wing aircraft. He mentioned Marske's airfoils that have helped in this area, but there is still a lot to be done.

We had a brief discussion on the issue of the ebb and flow of our membership. Everyone seemed to be in agreement that this was just the nature of the beast and, that we would always have a solid group of people who are dyed in the wool flying wing enthusiasts. Pat Oliver suggested finding ways to promote the organization with young people who are interested in aviation, like the Civil Air Patrol. Or perhaps offer a student level membership aimed at college students enrolled in aviation related degree programs. These are things we will have to look into further and see if they have possibilities.

With all that out of the way, Andy introduced Bruce Carmichael who was going to give his presentation on Aerodynamic Excellence – The Sailplane. *(ed. – The following is the text material for this presentation prepared by Bruce.)*

AERODYNAMIC EXCELLENCE - THE SAILPLANE

By Bruce Carmichael

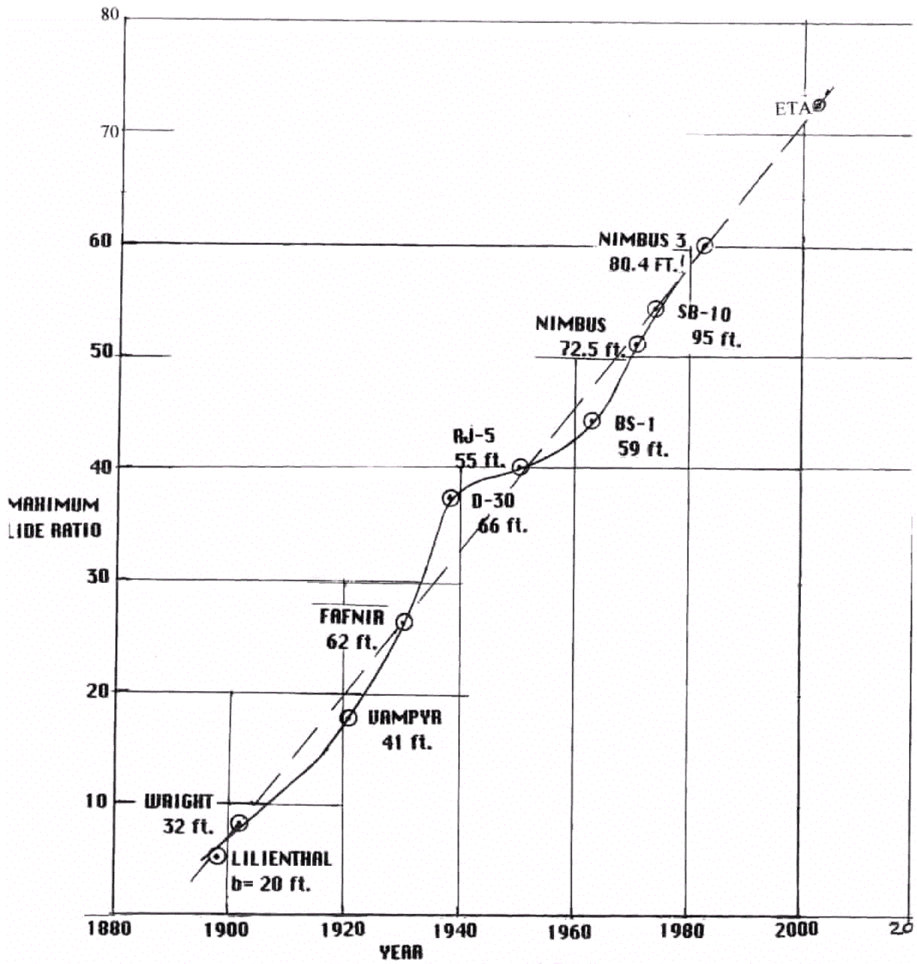
INTRODUCTION

Engineless sailplanes incorporate specific features to provide sustained flight using the limited energy available in the atmosphere. Powered by gravity and free of propulsion system design compromises, the sailplane is particularly suited for aerodynamic refinement. Application of sailplane derived aerodynamic and structural advances have lead to remarkable achievements in the fields of man and solar powered aircraft. Some of these advances now enhance the performance of personal and business aircraft following a decade after application to production sailplanes.

ABOVE: Bruce at the start of his presentation on Aerodynamic Excellence. A Diana sailplane is in the photo to the left. The wings behind Bruce are from an Ka-6 and were adapted to a Diamant fuselage to create one of the first partially composite sailplanes called the "White Knight".

CHARACTERISTICS OF THE SAILPLANE

The sailplane incorporates large wingspans (36 to 100 feet), large aspect ratios (18 to 50), a pod and boom fuselage of minimum wetted area and less than a 4-sq. ft. cross sectional area. They have large vertical tails, small horizontal tails located at the end of a long tail boom, retractable single landing wheel, absence of detectable skin joints, glass smooth surfaces of very low surface waviness (2/l000) and, tightly sealed control surface gaps. Their airfoil sections are capable of retaining low drag laminar flow over 50% to 70% of the wetted area and, full span trailing edge cruise flaps deflect both up and down to allow flight over a large speed range at the angle of attack for minimum drag. Boundary layer trip strips are often employed near the start of pressure recovery on wing and tail surfaces to prevent laminar separation bubbles. Water ballast tanks in the wings provide higher speeds between thermals while retaining reasonable glide angles on strong thermal days.



PROGRESS IN SAILPLANE MAXIMUM GLIDE RATIO

BRIEF SAILPLANE DEVELOPMENT HISTORY

Sailplanes evolved from a combination of aerodynamic theory and practical experiments. In the 1890s, Otto Lilienthal studied bird flight and measured the lift and drag of flat and curved plates on a whirling arm apparatus. He found curved or cambered plates to be superior and found lift to be linearly proportional to the angle of attack. He built hang gliders from willow wands and muslin and made the world's first heavier than air flights using weight shift for longitudinal control.

The Wright brothers made the next advance by developing a three-axis aerodynamic control system to replace weight shift. In the same year, Ludwig Prandtl evolved the theory of drag due to lift, finding it proportional to the square of the lift coefficient and inversely proportional to the wing aspect ratio. He also was able to compute the drag at zero lift by dividing the flow in a thin friction layer at the surface from the outer flow from which lift could be computed with classical theory.

These theoretical results guided the sailplane designers on the Wasserkuppe in Germany and Hawley Bowlus in San Diego in the 1920s. The D-tube forward wing construction by Madelung provided the bending and torsional strength required for the high span and aspect ratio desired for high performance. In the early 1940s, Dr. Pfenninger of Zurich developed low drag laminar wing sections, the cruise flap, and 100% laminar sections employing suction boundary layer control. Ever improved laminar airfoils were obtained from Stuttgart, Delft, Braunschweig, NASA and Penn State.

FABRICATION

Before the Second World War, sailplanes were mostly constructed of spruce and plywood. The plywood skins gave smooth surfaces but in time surface waviness occurred. By 1960, Eppler and Nagele had developed the Phoenix with balsa-core, fiberglass-sandwich construction. The balsa-core was replaced with foam plastic in most later productions to prevent water absorption. In some cases the very light paper honeycomb core was used but the surface often developed dimpling in time. Bjorn Stender was killed in a structural failure of an early high performance composite sailplane. It was realized that it was difficult to develop anywhere near the strength of the glass. Bjorn's father, an early leader in sailplane development, instituted test programs, which led to reliable composite design practices. The development of carbon material, particularly the extruded type provided greatly increased strength to weight ratios and, made it possible for higher span, higher aspect ratio and thinner wings to be built.

Development of stretched and free blown Plexiglas canopies facilitated clean forward fuselage design. The joint between canopy and fuselage remains a possible foreshortening of laminar extent and a possible increase in minimum fuselage drag. A single unit of forward fuselage/canopy which slides forward on rails for entry and egress has been proposed by this writer and has been tried out in both Germany and Australia but is not yet a feature of production sailplanes.

Production composite sailplanes are still mostly made by hand lay-up in female molds drawn from male plugs. A very advanced method is a computer directed five axis-milling machine cutting of female molds directly from very stable blocks of material. Some sanding is still required on the female molds. The sailplane skins laid up in these molds are very smooth and have a very low degree of surface waviness.

A simpler method for the homebuilder of a single sailplane is the Rand /Rutan method of hot wire cutting of foam plastic into a male form, insertion of a spar and covering with fiberglass. This is followed by doing a lot of filling and sanding to obtain a good surface.

At the end of the Second World War with plastics becoming available, it was thought that sailplanes could now be made at less expense. The amount of handwork required proved just the opposite and sailplanes remain a very expensive adult toy.

SAILPLANE PERFORMANCE

Standard class and 15 meter sailplanes are limited in wingspan to 49.2 feet while the unrestricted wingspan of open class sailplanes has now reached 100 feet. Gross weight of all sailplane classes is now limited to 1,656 pounds. Wing loading runs between 5-pounds/sq. ft. with no ballast to 10 p.s.f. with water ballast.

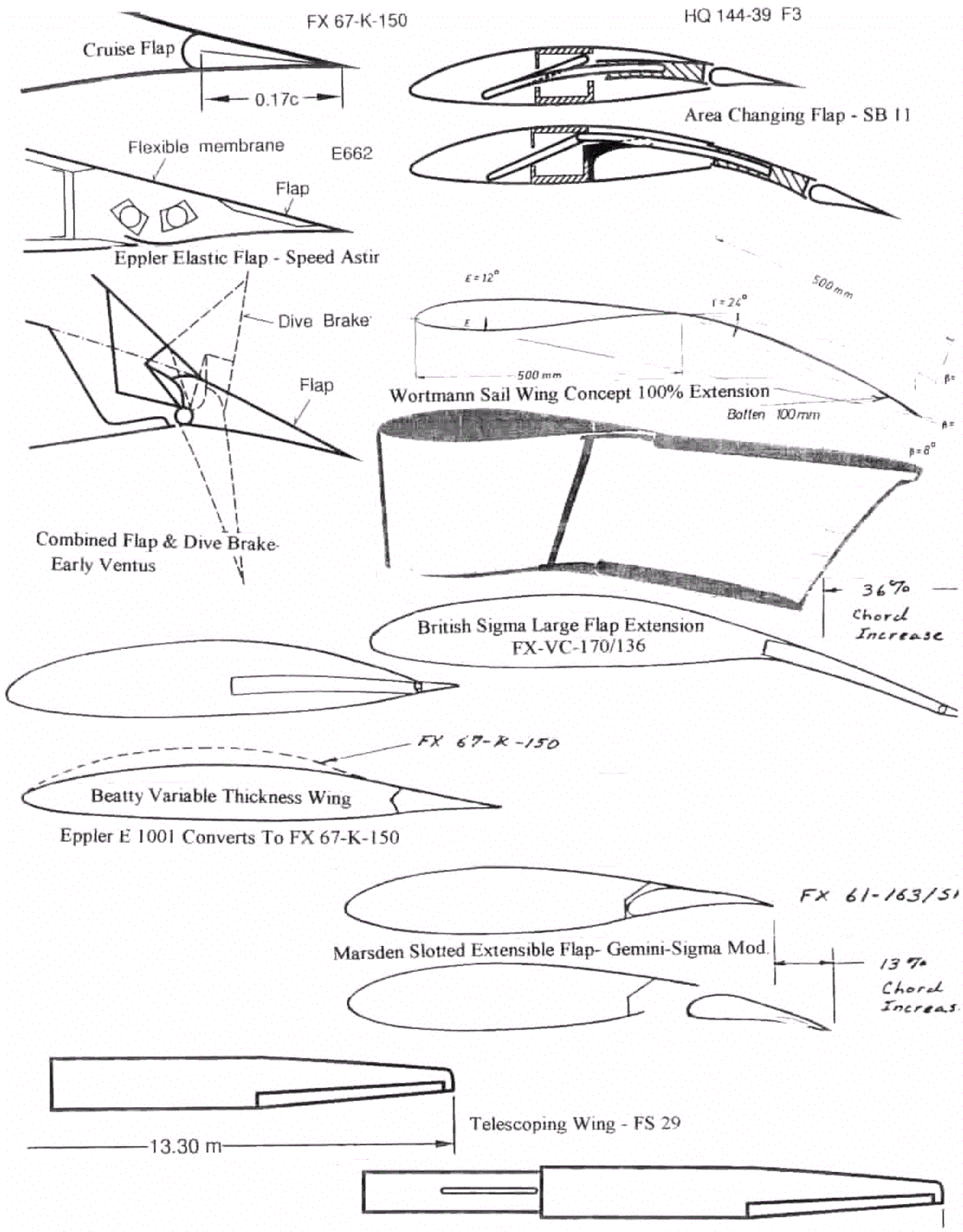
MINIMIUM SINKING SPEED

The minimum level of updraft strength for sustained flight is governed by the minimum sinking speed. Minimum sink is strongly influenced by the ratio of gross weight over wingspan squared. Standard class sailplanes have a minimum sinking speed of about 2 ft/second. The open class Nimbus 3 has a measured minimum sink of 1.17 ft./second at a 6 p.s.f. wing loading. At minimum pilot and equipment weight the minimum sink would approach 1 ft/sec. More on the significance of very low sink will be discussed under the Advanced Projects section below. The minimum sinking speed of several man powered aircraft operated as gliders averaged 0.6 ft./sec. and 0.25 horse power to maintain level flight.

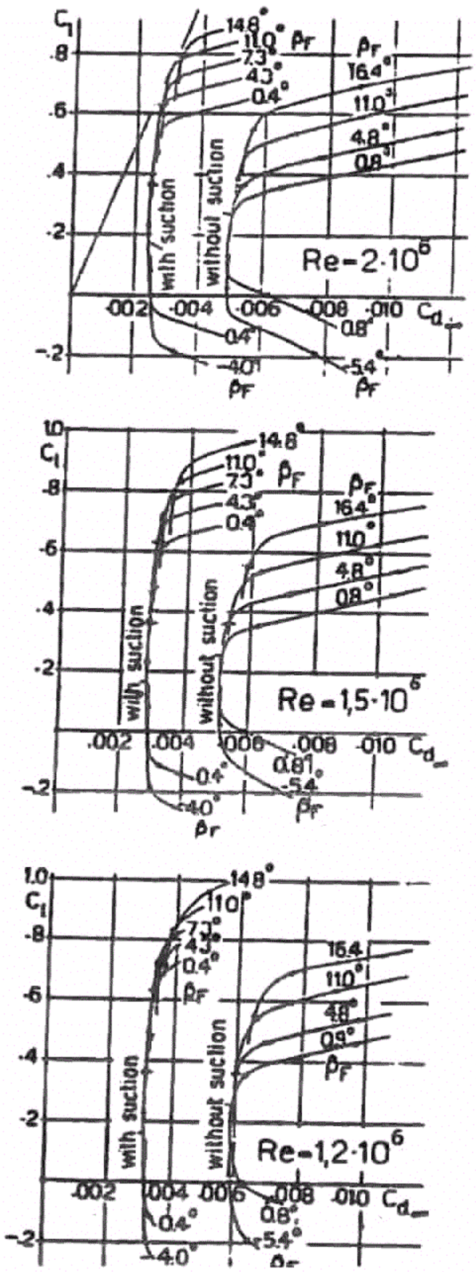
MAXIMUM GLIDE RATIO

Maximum glide ratio, or distance traveled per distance dropped, is proportional to the square root of the aspect ratio over the zero lift drag coefficient. Usable aspect ratio increases with increasing wingspan. In Figure 5 we see aspect ratio increasing from 22 at 50 ft., to 30 at 70 ft., to 37 at 80 ft. and, to 51 at 100 ft. The zero lift drag coefficient backed out of the L/D max. formula and aspect ratio is 0.0091 for 15 meter class and 0.0075 for the open class Nimbus 3. A plot of maximum glide ratio vs. year in Figure 6 shows almost a linear trend with time. The value for the giant ETA, Figure 7, has not yet been published, but the time extrapolation would place it at 73. The aspect ratio and span extrapolations of Figures 8 and 9 place it near 75.

PENETRATION



More important than maximum glide ratio in contest flying is the speed one can fly between thermals without coming down like a rock. A typical comparison point is the speed at which the sink reaches 6 ft./sec. For the 15 meter ASW-24, the speed is 101 m.p.h. with a glide ratio of 25 at a wing loading of 6.14 p.s.f. or, 122 m.p.h. with a 30 glide ratio when ballasted to 10.2 p.s.f. The open class Nimbus 3 flies at 107 m.p.h. with a glide ratio of 26 at a wing loading of 5.9 p.s.f. Ballasting, while powerful, has one drawback. If ballast is dropped when light conditions are encountered you can't get it back. Advanced concepts will deal with attempted solutions to this problem.



C_L = LIFT COEFF.
C_D = DRAG COEFF.
R_e = REYNOLDS NUMBER
β_F = CRUISE FLAP DEFLECTION

ADVANCED CONCEPTS

The features which have survived as most worthy for inclusion on the high performance sailplane of today include:

- Extensively laminar wing and tail airfoil sections.
- Full span + and - deflected cruise flaps for extending minimum profile drag over a wide speed range.
- Pod and boom fuselage for minimum wetted area.
- Aerodynamically efficient and practical T-tail configuration.
- Winglets or tip dihedral when span is limited.
- Composite construction for smooth surfaces of low surface waviness to promote laminar flow.
- Boundary layer trip strips where required to prevent laminar separation bubble drag increment.
- Use of carbon cloth and extruded rods to permit larger span and aspect ratio and thinner sections.
- Disposable water ballast for improved high-speed performance.

Now let us examine some recent advanced concepts for broadening soaring possibilities.

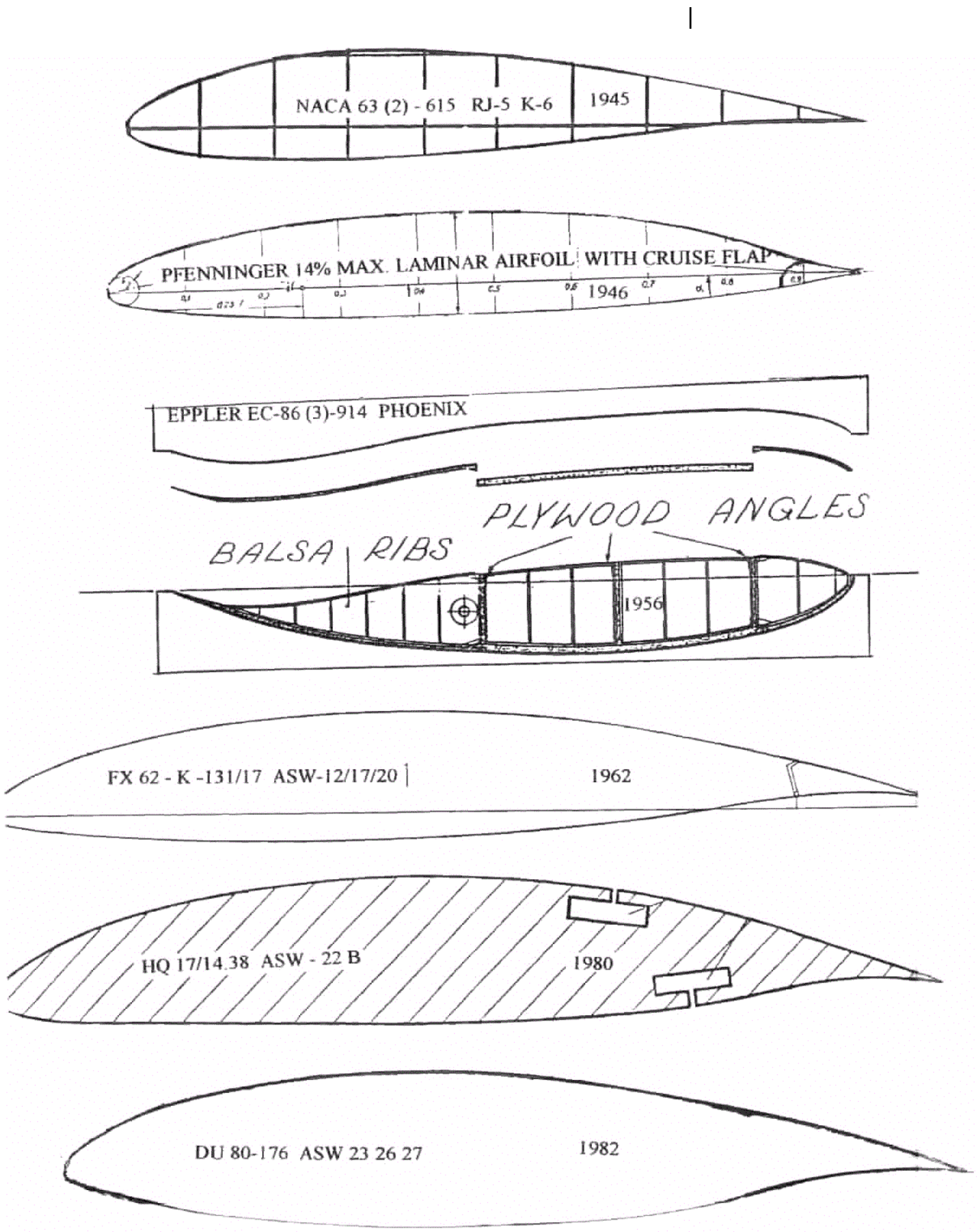
VARIABLE WING AREA

When water ballast is dumped upon encountering weak soaring conditions, one cannot restore ballast in the air when conditions improve. This limitation could be overcome if one could reduce wing area for the dash between thermals and increase it again to work thermals as the birds do. The excellent slotted flap work of Dave Marsden is a step in that direction and allows increased wing loading. The much larger flap area variation proposed by Wortmann and attempted by the British Sigma did not work out when applied to a high span wing. The German SB-11 has come closer to this goal. Variable wingspan is theoretically superior to variable chord, has been tried on the FS 29, but has not found its way to production sailplanes. Perhaps a new approach to variable area is required?

SMALLER LESS EXPENSIVE SAILPLANES

There is a dramatic difference in price between sailplanes and hang gliders. It would seem that an adaptation of the foot-launched weight shift controlled hang glider, to use of the highly developed rigid leading edge hang wing, to a pod with landing wheel and conventional controls would find wide sales. The hang glider people were not ready to give up the versatility of the pure hang glider when such concepts were introduced with the Swift some years ago. The recent development of advanced rigid wings such as the Ukrainian Specter may bring this type to the fore, particularly when the possibility for dynamic soaring is considered.

A very recent approach to a smaller, lighter, less expensive sailplane of conventional configuration is the 36-foot span, 155-pound empty weight, carbon Sparrowhawk.



SAILPLANES OF VERY L0W SINKING SPEED

In 1959, Dr. Paul MacCready stated that if a sailplane with sinking speed of 1-foot per second could he developed, one could soar almost anywhere and any time of day on the small-scale fluctuations in the lower atmosphere. Designing a practical 1-foot per second sink sailplane is a formidable task but perhaps now possible with advanced aerodynamics and structural materials. In the 1960's Franklin Farrar of Vanderbilt University designed and built a 61 foot span sailplane with an empty weight of 200 #, Figure 9. It had a sink close to l ft/sec. but was fragile and was damaged before much data could be gathered.

In the 1990's, Jim Maupin and Irv Culver designed and built the 44 foot span Carbon Dragon with an empty weight of 145 pounds and a 2 lbs./sq. ft. wing loading, Figure 10. It had a minimum sink of 1.67 ft./second. With large full span flaperons and a huge vertical tail it obtained the maneuverability required for micro lift and dynamic soaring as proven by Gary Osoba on the plains of Kansas.

At present the Light Hawk, designed and built by Dan Howell and associates, is the next step in the investigation of MacCready's prediction, Figure 11. The span is 49.2 feet, empty weight is a phenomenal 155 pounds due to very advanced material research. The wing loading is 2.8 lbs./sq. ft. and minimum sink is expected to be 1.3 ft/sec. or less. Full span flaperons with spanwise segmentation of complex deflection history are expected to result in a safe stall pattern while retaining minimum induced drag at high lift coefficients. Time will tell whether this is a better solution than Carbon Dragon.

DYNAMIC SOARING

Taras Kicenuik Jr., who developed rigid wing hang gliders as far back as 1972, has recently developed a theory of dynamic soaring which states, " Energy can be extracted from gusts by inclining the lift vector in the direction with the gust whether this is an updraft, a down draft or a side gust and the amount can be increased proportional to the g's pulled". Osoba has already demonstrated some of this. The technique applies to both low wing loading and high wing loading ships. Some time will be required to determine if the sailplane response times are a suitable match to the gust geometry and time constants and whether pilots can enjoy such irregular g pulling. Soaring birds have been sustaining flight without circling for eons. Although extreme care must be exercised, this writer feels these explorations to be the most exciting direction for soaring in the next few years.

TWO SUPER SAILPLANES

The Germans have developed a prototype sailplane under the rule, "What would result if cost were not a consideration?" The 101 foot span ETA with an aspect ratio of 51.3 and gross weight of 1,870 pounds has been described by Larrabee as, "a typical Teutonic exaggeration", Figure 14. Although the performance has not yet been published, extrapolation of a historical chart of L/D vs. year, Figure 12 yields a value of 73. Extrapolation on a chart of

L/D vs. aspect ratio, Figure 13, yields a value of 75 and extrapolation on a chart of L/D vs. span, Figure 13, yields a value of 75. Imagine their surprise when they built the prototype and received orders for 6 before they flew.

SOARING TO 100,000 FEET

The Perlan Project by Einer Enevoldson and Ed Teets is to develop a 95-foot span, 2,540 pound sailplane of 350 sq. ft. area and an aspect ratio 25.7 to climb on standing waves over the Sierra Nevada mountains in the U.S. or at Lauder, South Island, New Zealand to altitudes of 60,000 to 100,000 ft. breaking the present 49,000 ft. record. No subsonic aircraft of any type has flown at 100,000 feet where the density is down to 1.4% of sea level value and true speed is 8.1 times that at sea level giving a Mach number of 0.65. The wing Reynolds number will be down to 200,000 requiring wing sections typical of advanced R/C model aircraft.

LOW DRAG SUCTION BOUNDARY LAYER CONTROL

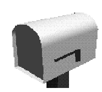
At a soaring convention a few years ago, Louek Bormanns told me that wing profile drag reduction by geometric means had reached its limit. He was on the trail of using suction to obtain 100% laminar flow. This was the subject upon which I aided Raspet and Pfenninger in the 1950s. Shortly before he died, F. X. Wortmann told me that he had been looking at the subject, Figure 15, using surface perforations and was pessimistic over using it on practical sailplanes. Geometry can already reduce the profile drag coefficient to 0.005. Laminar friction is 1/3d the value of turbulent friction at sailplanes Reynolds numbers and only 40% of the surface area is left to laminarize. Competition soaring will require the energy for the suction system to be taken from the atmosphere thus reducing climb rates in thermals to gain higher speeds between thermals. Suction cannot economically restore laminar flow to area turbularized by insect strikes.

The Plesser article in the April 2000 Technical Soaring shows that while with suction the remaining wake drag coefficient is only 0.0012, when the power required to provide the suction and return it to flight speed is added, the effective drag coefficient is 0 004. Plesser suggests a retractable windmill deployed aft from the tail cone to extract energy in the climb mode, storing it in a flywheel and using it to power the suction system in the high speed runs, Figure 16. Pfenninger's "All Laminar Strut Braced Sailplane" design study published in the October 1987 Technical Soaring, Figure 17, shows in great detail the optimization pains that must be taken in the windmill, suction compressor, wing surface and internal ducting. His 32.4 meter span, 54 aspect ratio design, 12 p.s.f, wing loading is projected at a 98.5 L/D at 87 m.p.h., a minimum sink of 1.08 ft/sec. at 60 mph. and at 203 m.p.h. the L/D was still 46. This constitutes a super complex and expensive end point design. A portion of these gains may someday be attempted.

AND IN ADDITION:

Who can predict what additional marvels of flight on a paucity of power will ensue from the fertile mind of Dr. Paul MacCready? Perhaps the dream suggested by that mysterious sage, Richard Miller, of distributed wing sensors wired to the pilots nerves will eventually provide us with an approach to the soaring bird's matchless adaptation to flight without power.

After thanking Bruce for this enlightening talk, we all took a short break for coffee and donuts. The group then sat down and watched the Discovery Channel's video on "Stealth Secrets", which had some excellent flying footage of the F-117, B-2 and new concepts that are either flying wings, blended wings or lifting bodies. We also experimented with the Air Surfer models the Morgan Detton had brought along. These are light foam wings that you can fly in front of a piece of cardboard that acts like a mini-slope. They are the commercial version of Tyler MacCready's Walk Along glider that was featured in a television program on Paul MacCready last year. Morgan got his at Walgreen's, but supposedly they are also at Toy's R Us for about $10 a pair.



LETTERS TO THE EDITOR

March 20, 2002

TWITT & Bruce:

(ed. - This is the follow-on to Syd Hall's piece last month.)

I address this both of you because in the past when I presented a question Bruce has answered. For that I thank him.

I have had a difficult time getting this all together and I hope you will accept and print the condensation of the book, followed by my contradiction of my own advice. I want no credit for the excepts from Lords Of The Air, and I assume total blame for the design and its argument.

I further recognize that the design is contrary to the concepts of TWITT, and that, properly, it should result in my expulsion. What I am advocating is heresy and the grand inquisitor of TWITT should seek my excommunication, but I am so old that it doesn't matter much. My ski buddy, who was on the Canadian Olympic team, quit three years ago at the age of 81, and he was one year younger than I, so my candle is almost burned out, though I still ski like a tired demon.

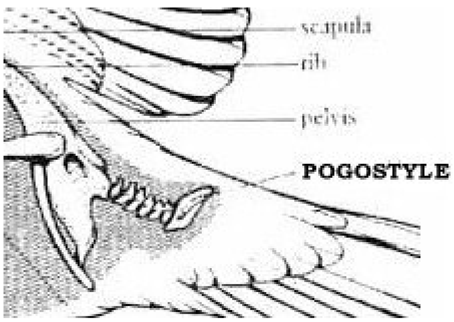
First, I think there is great worth in these excerpts from the Smithsonian's Lord Of The Air, because those of us who hope to copy a superior evolutionary form of life should recognize the perfection of their solutions and hold them in proper respect.

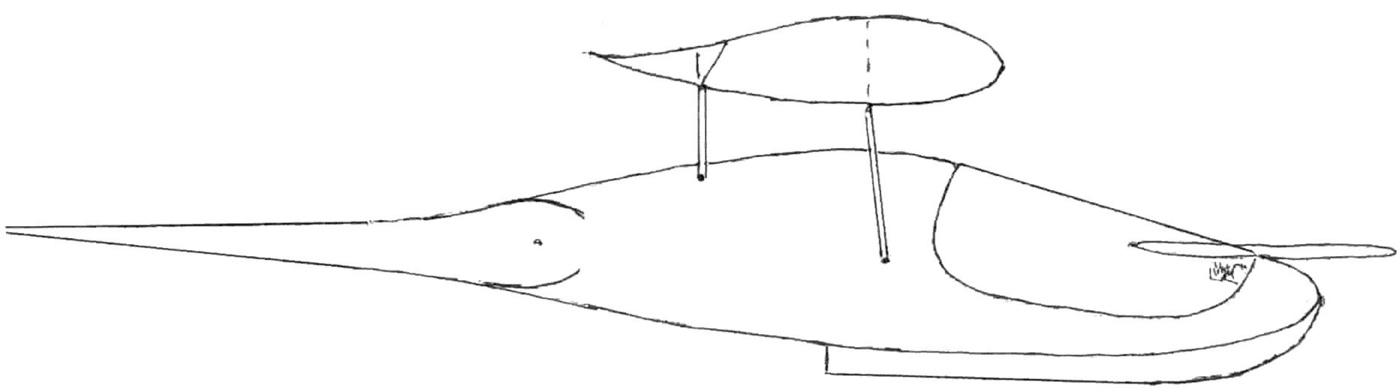
Syd Hall
Nevada City, CA

(ed. – I certainly wouldn't think of not publishing this material since it is another idea on how to approach "tailless" flight [meaning no conventional fuselage]. I like to think we are

open minded about all of this and are willing to let our membership decide for themselves whether or not a design has merit. This is a forum for such things and I hope our members will respond, both positively and negatively, to Syd's idea. Let's hear from you.)

(ed. – Syd sent along the following about last month's portion. "Thank you for printing the excerpts from Lords of the Air. The main reason I sent them was to illustrate the bird's most important bone – the PROGSTILE – because I feel that this important trim devise is basic and even essential to bird flight. In the reproduction of the photographic reduction it was difficult to identify this bone. Starting at the head, it is the last bone and it may be the most important.")





A NOT QUITE TAILLESS CONCEPT

TWITT praises and advocates the tailless concept, but overlooks the fact that sweptback solutions down load the tips, just as conventional shapes down load the tail, while canards up-load the canard and, the reflex of straight spar tailless solutions all, thereby produce drag, and the elimination of drag is the name of the game. I think that birds do not do this and the following design, which I hope to fly, may demonstrate this. Since it is predicated on the Irv Culver wing from Maupin's Dragon, it will be interesting to fly it against other Dragons and see if my thinking is valid.

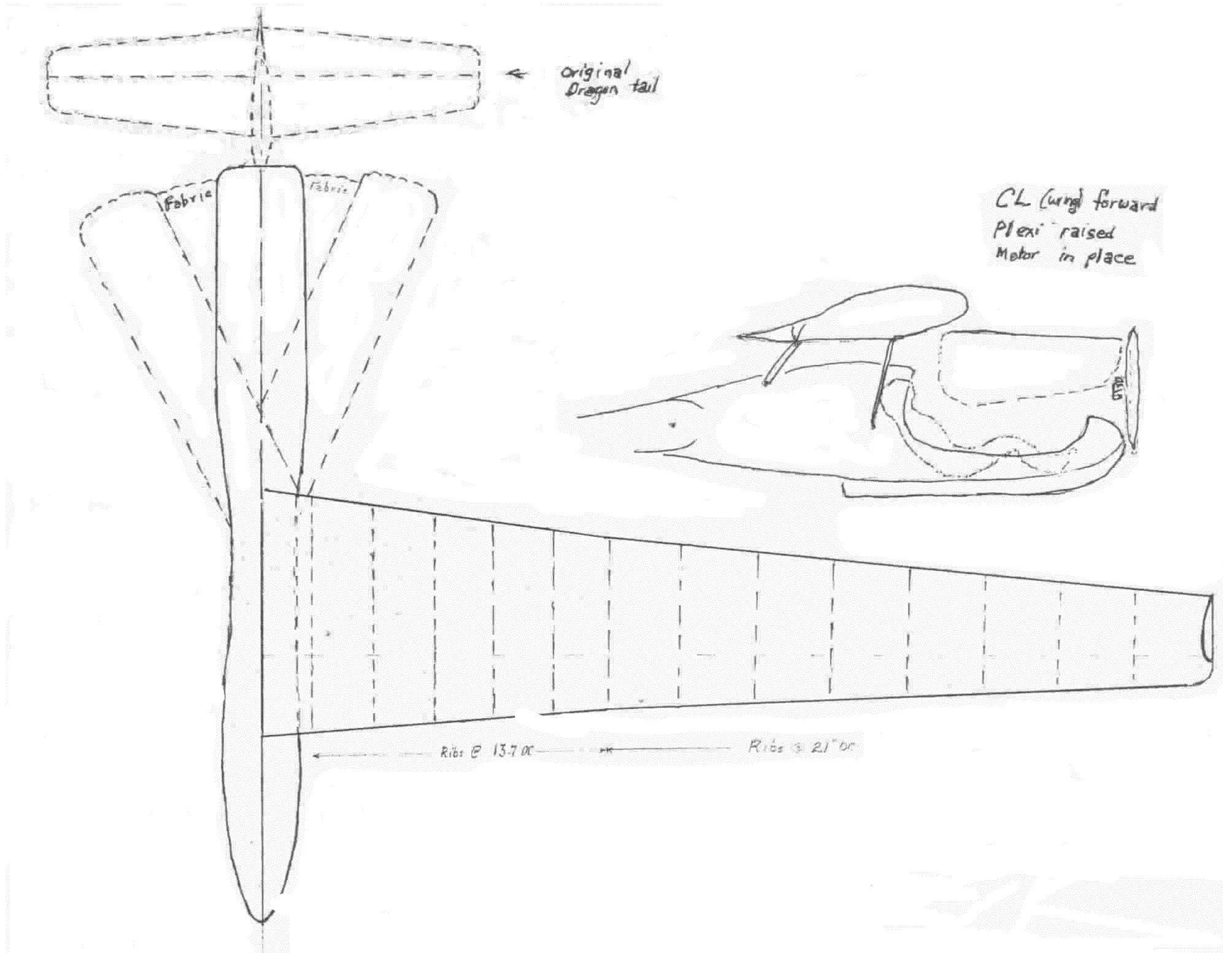
If we take a good look at all birds, since the first dinosaur got airborne, we see two things: 1. The wing has no sweep, either forwards or back, though at times it takes on sweep to accommodate weight shift and; 2. None of these are tailless. All, except for archaeopteryx who had a tail (boom) and went extinct, short-couple the streamlined, folded tail cone and only deploy it, as a Geisha does her fan, at the time of landing. But this tail cone is most important, if we judge by the size of the pogostyle and the muscles that it mounts on. We will see why, if we watch quail come in for a landing, which they do in beyond the stall, and further, they seem unable or unwilling to deviate from the straight path until earth contact, where after, they are apt to take a "taxi" off at an angle. (I think they recognize that this is dangerous territory.)

Instantly, there should be a chorus of warnings. "Do Not Enter – Danger", etc., but I propose to study this at altitude and in a slow speed aircraft – an ultralight. Reason being that if this can be controlled, the process can then be tried on land (water) and contact might be hoped to be considerably (10% ?) below the unstalled speed. I have often seen birds (seagulls) do it against the wind, vertically (on a pile at a yacht harbor, for example).

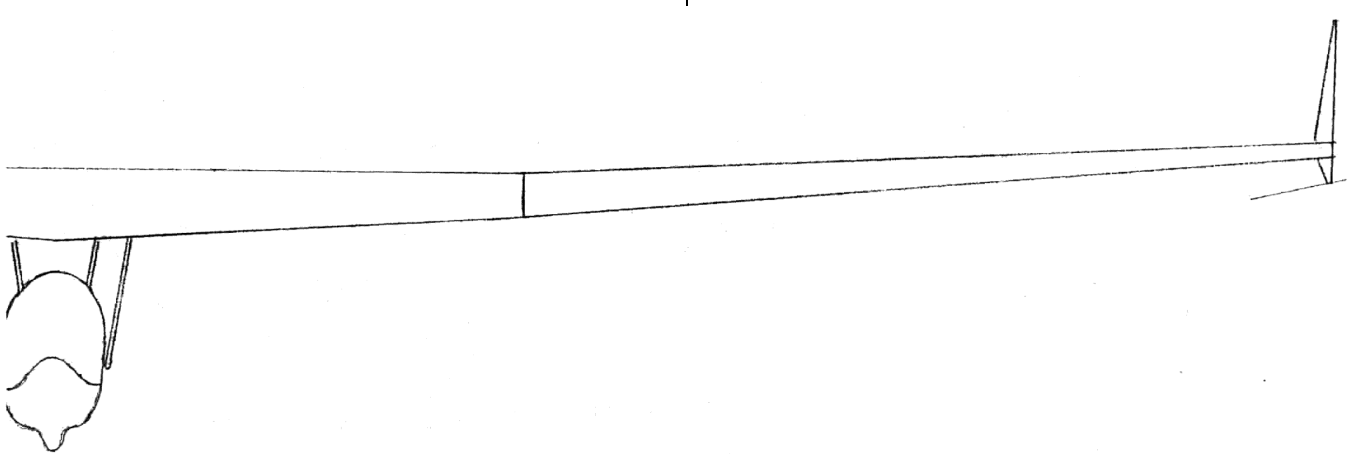
I recognize that this may require a large control effort and it may well be beyond the normal linkage, so I propose to separate out the CG shift by putting it on a wheel with "dogs", to hold it where set. And the folding of the Geisha fan, also on a different lever, also with detents. So the stick will only feed the folded tail cone (or deployed when learning) and the ailerons.

I feel it might be prudent to observe that birds do not do tail slides, Lomchavacks, etc., and only a few, like crows and geese do half-rolls, but they do not continue the roll past inverted but rather reverse rotation for normal flight, usually to burn off height before landing. Or is this to clear the brain like an old friend who used to snap roll before landing, "Just to make sure I'm totally awake". This bird that I describe is totally restricted. No stunts, period.

From the three-view, it should be obvious that I intend to shift weight by articulating the struts (which struts are of



different lengths, too, so nose will lower at weight aft, for landing, not too unlike the supersonic delta, though we are opposites. The rudders will go where they should on a long



span bird – to the tips. So I get rid of the tail, tail-boom and get a bird that folds to 16 feet as all Dragons should (Joint at rib 5). The final deviation from the original may or may not happen, but it is so neat that I have to offer it, and that is to hang a motor on the front end, which folds into the cockpit, under the plexiglass just in front of the instrument panel. One blade will stick out front like a bird's beak, and the other will be over my knees, when not working. This means that I will be close to it in order to assist in the "folding".

I think I want a motor because I will be busy working out all the bugs and I do not think I'll hunt thermals too well for a time. Maybe, later I can become "pure" with no motor, but come to think about it, birds use a motor. Possibly I should observe that I was close to assembly of a Dragon when my granddaughter brought me the best cold she could find in 4th grade, and I lost 15 lbs. I decided I'd never finish the Dragon and broke it up for kindling, but I still have the ribs. So I am quite far along to the realization of this project, and I just may live another year if I can get a flu shot in time.

May 21 – 31, 2002

TWITT:

My wife and I enjoyed the meeting last Saturday. There was a person there *(e. - Morgan Detton)* who had a package of two "wings" that Paul MacCready's son manufacturers. He indicated he had bought then at Walgreen's drug store. I have looked around and not been able to find any and I don't have the exact name of the package. Maybe you could print the necessary information in the newsletter, since there might be others who would like to experiment with them.

I looked for Model Airplane News' June 2002 issue for the information on Bob Hoey's R/C birds, but all that's on the newsstands are the July issues. Could you place his current projects and news of his progress in the newsletter or even put in some of the parts and drawings from the June issue for others to see.

I will try to get the R/C auto (2" x 1" x ¾") to you soon. They may be toys to some, but "tools" to us.

While I was in the Lake Elsinore area buying some auto parts, I saw this "airplane". It had about a 5-foot chord, about 40-foot wingspan, about 11" thickness and, a "V" tail on a pod and boom fuselage. But the most important thing was the use of nitrogen to fill the wings and "V" tail to make them lighter. The company name appears to be Vertigo, (909) 674-0604, and seems to run by four people. They are a group of engineers building very unusual aircraft. Maybe they have some knowledge that might help us.

Good luck,

Eugene Turner
San Jacinto, CA

(ed. – Thanks for the series of letters offering and asking for information. As for the Air Surfer that was designed by Tyler MacCready, you might find a package at a Toys 'R Us store or perhaps KayBee Toys in one of the shopping malls. Some model shops that cater to free flight might also have them. Use the Yellow Pages and make few calls around your local area and see what you come up with. I get you will find one.

As for the Bob Hoey material in Model Airplane News*, it is copyrighted so I can't really do much with it unless the magazine or Bob release it for others to publish. We are going to try and get Bob down for a meeting later this year, since he indicated he would have more test results by that time to share. You might want to call the magazine and see if you can buy an issue directly from them, since it is no longer on the newsstand shelves.*

On the Vertigo project, I haven't had a chance to call them yet to find out more about the use of nitrogen for "lightening" the load. I couldn't find anything on them on the Internet, but we will ask around and see what we come up with.

Bob said the radio control car came in today (6/3/02), but I haven't had a chance to see it yet. They think it will be of interest at the next meeting due to the reduced size of the electronics.)

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