Flapper Facts

Newsletter of the Ornithopter Modelers' Society

Issue #8 ~~Winter~~ 1994 FALL

New Address, Again

I have moved again. All OMS-related mail should now be sent to me at the address below. Any mail that was sent to one of the old addresses will, however, be forwarded.

Nathan Chronister
Box C-3815
Bucknell University
Lewisburg, PA 17837

Time to Renew Your Membership!

If you did not receive this issue of Flapper Facts, chances are you have allowed your membership to expire. And if you **are** reading this, there is a good chance your membership is about to expire. It will say so on your envelope if this is the case. Dues are still $9 per year in the USA, $14 elsewhere. If you send a check, it should be payable to "Nathan Chronister."

Enter the 1994 Ornithopter Modelers' Society Postal Contest!

Win prizes, become famous, and make history by flying one of the first ornithopters ever to fold its wings on the upstroke!

Most flapper fans already know about the postal contest, but you may be interested in this **update**.

Although no one has submitted proof of a successful folding-wing ornithopter, one member has sent still photos which appear to show such a model in flight. Regardless of whether or not he decides to enter the contest, the chances are very good for anyone else who wants to give it a try!

Then there is the design portion of the contest, for those of you who don't have time to build ornithopters but want to win prizes for your ideas. All you have to do is neatly draw a design for a folding-wing ornithopter with an adequate description of how it works. Your entry should be presented in an 8.5 x 11" format, ready to be printed in Flapper Facts. This is because all entries will be printed in the newsletter. The winners in the design category will be chosen by a vote in which all OMS members will be asked to participate. Because winners will be chosen in this way, you can increase your chances of winning by presenting your ideas clearly, but I guess a messy entry is better than none if you are pressed for time.

There are already some entries in this category, each of which is very different from the others in its approach to the problem. There is obviously a lot of room for experimentation with this type of ornithopter, and I hope that many of you will give it some thought and put pen to paper sometime between now and the March 31 deadline.

Due to the generous support of Lew Gitlow of Indoor Model Supply and Roy Clough, some very interesting prizes will be offered. For the winners of the documented flight category, there will be an autographed copy of Indoor Flying Models by Lew Gitlow. This is a wonderful and comprehensive book. Also, a two-year OMS membership, and a copy of the Flapper Facts backissues. Second place in this category will receive a copy of Indoor Flying Models and a one-year membership. In the design category, the prizes will be a copy of the backissues, a two-year membership, and a Flapping Flyer kit from Indoor Model Supply, which you can build according to the instructions, or somehow modify as a folding-wing ornithopter.

Variable Span Biplane Ornithopters, The Most Efficient Form of Flight?

In the last issue of this newsletter, I wrote about the debate over what types of models should be allowed in the AMA ornithopter event. Now, I'm going to raise some questions concerning a type of model which might outperform traditional indoor designs regardless of contest rules.

A lot of ornithopter researchers over the years have claimed that ornithopters are potentially more efficient than either helicopters or airplanes. Flapping wings may someday carry more weight while using less energy than is possible with fixed wings. Various mathematical models have supported this view, and some have contradicted it, but a simple analysis of the variable-span biplane shows how it might in fact be possible for an ornithopter to fly as well as an airplane.

The key to improved efficiency is folding the wings on the upstroke. This idea is usually associated with monoplane designs, perhaps because we look to the birds and bats as examples of variable-span flapping. However, some insects also vary their spans. Cicadas have a hinge line across the wing which allows it to partially fold. Some butterflies reduce their wing area by overlapping the two wing panels. Many other insects reduce the upstroke wingspan by folding the wings backwards at the shoulder. Grasshoppers do this, and they are biplanes, flapping the narrow front wings out of phase with the broad hindwings. If variable-span biplanes are relatively rare in nature, this is only to be expected. The insect wing is not conducive to span variation, so only a few insects make incomplete use of the technique. Vertebrates, with their more complex, foldable wings, were never candidates for the biplane configuration. Because of these evolutionary constraints, the most efficient configuration of all never evolved until, 200 million years after the first variable span ornithopter, the idea took flight right in front of you, here on the pages of Flapper Facts.

Not only is the variable-span concept applicable to biplanes, it works even better here than it does in monoplanes. This is because two of the wings are always in the downstroke, providing lift for the model while the other wings are folded. There is no need to compensate for the usual inefficiencies of the upstroke, or for the loss of altitude associated with a folded upstroke in monoplanes.

Consider what happens to a glider as it flies. It moves steadily downward with a particular sink rate, *r*. What we would like to do is impart some energy to this glider to cause it to fly level rather than sink at rate *r*. The amount of power which must be added can be easily calculated:

P (watts) = mass (kg) x r (meters/sec) x 9.8 meters/sec^2

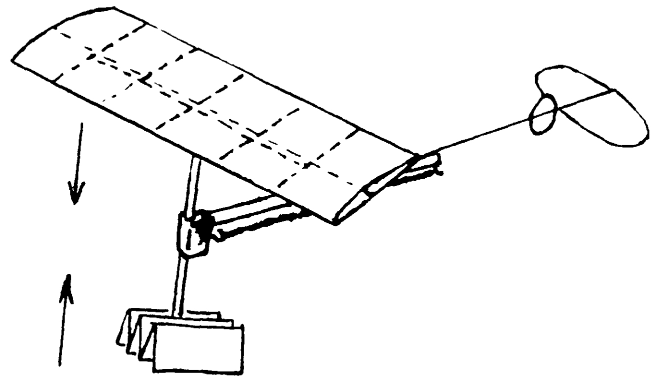
If a particular model has a mass of 1 kg and a sink rate of 1 meter per second, it will require only 9.8 watts of power to fly, as a theoretical minimum.

One way to impart energy is by pushing the glider, using a propeller. If we use this approach, we must expend an amount of energy much greater than that which is finally imparted to the glider, because propellers are only about 70% efficient.

If, however, we could exert a force directly on the fuselage, allowing it to be continuously raised in relation to the slowly sinking glider wing, the model would fly with the least possible expenditure of energy. The power required would be equal to the force needed to raise the fuselage, multiplied by the rate at which it needs to be raised, which is equivalent to the above formula.

The situation I am describing is clearly nothing like a conventional ornithopter. In order for a wing-flapper to achieve the above conditions, it would have to have **no upstroke**, so that the flight would consist of a continuous lowering of the wing relative to the fuselage. This can be accomplished in biplanes through the technique of total wing folding on the upstroke.

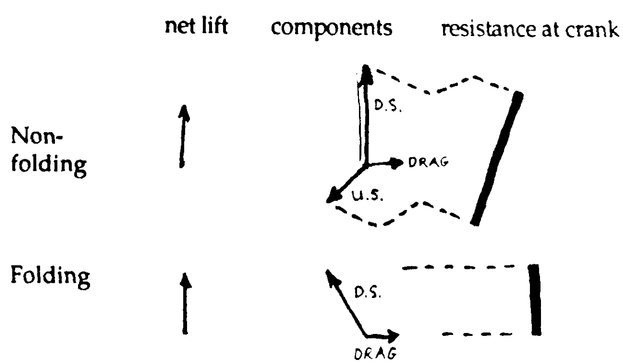
You will note that the above oversimplified analysis makes no mention of differences along the span of the wing, or of the fact that the flapping angle causes the wings to be inefficiently located high above their normal dihedral much of the time. For the sake of simplicity in construction, we could tolerate such inefficiencies, but if we want a really impressive endurance machine we might want to consider building a wing which plunges straight down rather than being hinged at the shoulders. The model which uses this technique might look something like the one shown below. I don't know how to build it. Maybe someone very clever can figure it out.



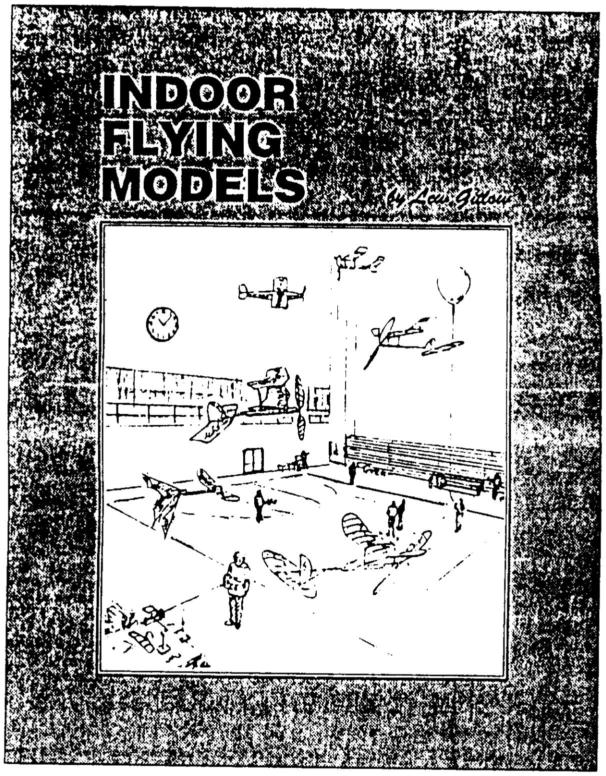
Even if we compromise, and use a shoulder-hinged flapping system, the advantages of variable-span biplanes over present ornithopter designs are clear. A typical biplane produces a down and forward force on the upstroke which counteracts the lift generated by the downstroking wings. Because the upstroke wings must be driven to produce this counterproductive force, somewhat greater torque is required to drive the wings than in the case of upstroke folding. For rubber models, upstroke folding therefore permits the use of a thinner motor with more winds. For electric or gas models, the folding wing design will have a higher wingbeat frequency and better climb.

The following diagram attempts to illustrate the difference in crank torque required for level flight between the two designs. Note that a difference in flight orientation, and thus crank axis, compensates for the lack of upstroke thrust in the folding configuration.

Difference in crank resistance in folding and nonfolding biplane ornithopters.



Studies of energy requirements in birds have shown that these "ornithopters" use less energy in flight than similar-sized model airplanes. Now, imagine what we can do, since we are not limited to the inefficient monoplane configuration as they are. Examples from nature prove that variable span flapping is mechanically feasible and aerodynamically efficient. All that remains is to figure out how to do it. (NC)



INDOOR FLYING MODELS

by Lew Gitlow

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Cover art by Mark Allison

Indoor Flying Models is approximately 160 pages, 8.5" x 11", with loads of plans. Many of the plans are full size and include I.M.S. Kits in addition to the original designs of famous contest winners like Banks, Coslick, Brown, Hunt, and dozens of others. The scope covers gliders to the F.1.D. international microfilm class models. With all the illustrations, technical data, building and experimenting with his own models, it comprises years of work.

You will find a development that starts with a theme of man's first dream of flying and how with imagination and the use of experimental models he actualized this dream. Then with a strong message for instructors he presents material that can be used to stimulate interest before the instructor adds his own experience. The basics of tools, materials, and "the right moves" lead you from the most simple to the most complex models and techniques, including "How to brew your own microfilm solution" and the secrets of the experts are revealed including "What your best flying buddy won't tell you."

By Lew Gitlow

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P. H. Spencer's Biplane Ornithopters

In the previous issue, I spent three and a half pages describing the monoplane ornithopters of P.H. Spencer, also known as Spence. This man, who showed his genius as a designer of full size aircraft as well as ornithopters, who was involved in aviation since it began, flew many of his gas-powered mechanical seagulls, but perhaps his greatest achievement was the earliest known radio-controlled ornithopter. That model was a biplane, built in the 1960's, but Spence's first biplane ornithopter was a much earlier project.

In 1934, before many of his gas-powered monoplane ornithopters had flown, Spence built a biplane ornithopter powered by a 1/8th horsepower (100 watt) Brown Jr. engine. The 40 to 1 reduction was provided by worm gears, a practice that Spence would later abandon in favor of spur gears. There was a minimal center section on each wing, so most of the area was flapping. It is reported to have flown well.

Spence didn't return to the biplane configuration until many years later, around 1960, when radio control became an option. Spence had built a variety of large and highly successful monoplane ornithopters, but it was anticipated that the vertical bounce of the fuselage in these monoplanes would be too much for the relay-operated radios that were available.

Taking a suggestion from Jack Stephenson, an R/C modeler who would participate in the ornithopter project, Spence decided to return to using biplanes. However, he went a step farther, devising a completely new biplane system which would allow all of the flappers to occupy the optimal range of movement without interfering with each other. To do this, Spence placed the lower flappers out at the end of fixed wing stubs. The upper flappers were rooted in a pylon which rose from the fuselage.

The first model built in this configuration flew poorly. It was a free flight model weighing 2 pounds, powered by a .1 horsepower engine. As an evolutionary step, however, this ornithopter was extremely successful, for it allowed Spence to build the larger, radio-controlled version.

The second model using the above configuration was named the Orniplane because of the fixed wing on which the lower flappers were mounted. This model had a wingspan of 8 feet and weighed 7.62 pounds including 1 pound of radio. The radio provided two control functions, but rather than simply use them for elevator and rudder, Spence made full use of his talents and devised a highly effective control system which operated by adjusting the amount of tension on the wing membranes. Adjusting the tension on the two sides differentially acted much like an aileron (for those of you who thought ornithopters couldn't have ailerons), effective regardless of whether or not the wings were flapping. A rudder and elevator were also present.

To avoid the use of heavy pushrods to operate the four spatially separated flapping thrusters, pull-pull wheels were used. This permitted the use of light-weight cables rather than pushrods, a pair of cables attaching to each wing root.

Takeoffs were made under the machine's own power. It was flown from pavement and took off in a short distance.

The Orniplane was studied by a number of investigators who were considering the possibility of a full size version. At Caltech in the early 1970's, James Fitz Patrick studied the Orniplane and concluded that a full-size version would be able to hover with only 28 horsepower. Engineers from Hughs, perhaps more objective than Fitz Patrick, also agreed that the man-carrying machine would be able to fly.

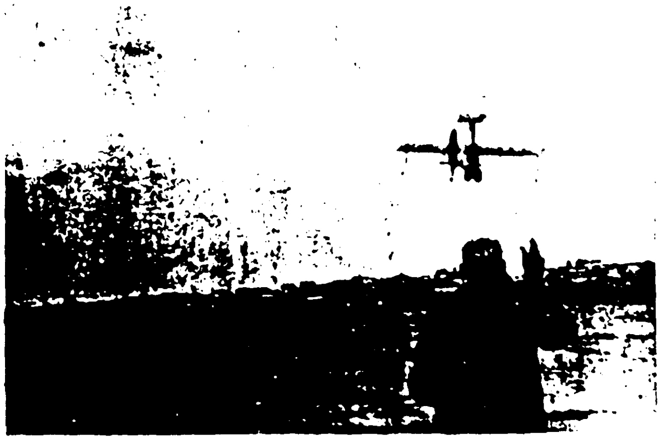
Spence never received enough funding to build the full size ornithopter, but he got closer than most to the construction of such a machine. Detailed plans for the SP-20, as it was to be called, were drawn up. These covered every detail of construction of the aircraft, which was to be based on the fuselage of a Piper PA-11 or T-3. The stub wings, tail, and landing gear of that airplane would be used, but the drive system would be quite unique. A two-stage V-belt reduction from a 60 horse water-cooled engine was planned. The pull-pull system of the R/C models was to be retained, but some refinements to the control system were proposed. These included a manual wing-leveling device in case of power failure, and a system of tightening both membranes simultaneously for a better glide ratio and vertical control.

For those of you who build engine-powered ornithopters, I will provide some data on the various ornithopters discussed in this article. The information, such as gear ratio, power loading, flapping rate, etc. may be useful, but please bear in mind that these characteristics may or may not apply to other designs. Most likely, a fully flapping design would require a slightly slower flapping rate than these tip-flappers. The information is excerpted from *The Spencer Orniplane*, a report which summarized the development of the Orniplane.

The New England Air Museum has been putting together a section dedicated to Spence which will display some of his ornithopters, and hopefully the original Orniplane model. There is also a possibility that one of the major model magazines will run a construction article on a 1/4 scale model of the SP-20. Fortunately, history has not forgotten one of the greatest pioneers of aviation and ornithopter flight. (NC)

AMA rules, further discussion

In the last issue, T. R. Quermann and I suggested a proposal to change the AMA ornithopter event rules to exclude models which are supported chiefly by fixed, rather than flapping, surfaces. Although the current rules limit the area which may be allotted to fixed surfaces, it is nevertheless possible, and indeed common practice, to violate the intent of these rules by placing the balance point of the model almost directly below the fixed surface, so the large flapping surfaces carry little of the model's weight. This issue contains several responses to the initial proposal, as well as subsequent discussion between Quermann and I in which we further refine our

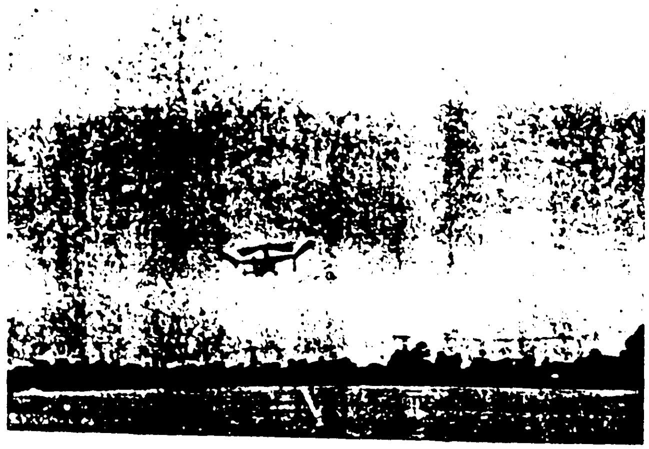


Model #1 in Flight (Fixed Trim)

Specifications

Engine: .10 H.P. 17,500 R.P.M. Gear Ration 50.4:1
Net Torque at Crank 13.7 in./lbs. .070 H.P.
Wing Beat Cycles 350 Per Min. (Static)
Wing Stroke 56 Deg. Pitch 30 Deg. (No Camber)

Gross Weight	2.12 lbs.
Wing Span (Total).........................	70.00 in.
Wing Area (Total)	789.00 sq. in.
Aspect Ratio Lower Wing	8.1:1
Aspect Ratio Upper Wing	6.5:1
Wing Area (Fixed Wing)...................	429.00 sq. in.
Wing Area (Beating Wing)	360.00 sq. in.
Wing Span (Fixed Wing)	36.50 in.
Wing Chord (Fixed Wing)	10.00 in.
Wing Span (Beating Wing)	16.75 in.
Wing Chord (Beating Wing Root)	8.25 in.
Wing Tip Set-Back	3.50 in.
Wing Gap	8.00 in.
Center Section Span (Balancer)	6.50 in.
Center Section Chord	10.00 in.
Length (O.A.)	40.00 in.
Height (O.A.)	17.00 in.
Tail Length (1/4 Chord to Elevator Hinge) (2.5:1)	25.75 in.
Angle of Incidence	3.00 deg.
Airfoil Section Clark "Y"	
Tail Surface Area, Vertical (7.7%)	61.00 sq. in.
Tail Surface Area, Horizontal (21.0%)	43.00 sq. in.
Center of Gravity (Vertical) on Chord Line	
Center of Gravity (Horizontal) 56% F.W. Chord	
Landing Gear Position 47 deg. from C.G.	
Wing Loading	.388 lbs./sq.ft.
Power Loading (Net Crank H.P.= .070)	28.0 lbs./H.P.

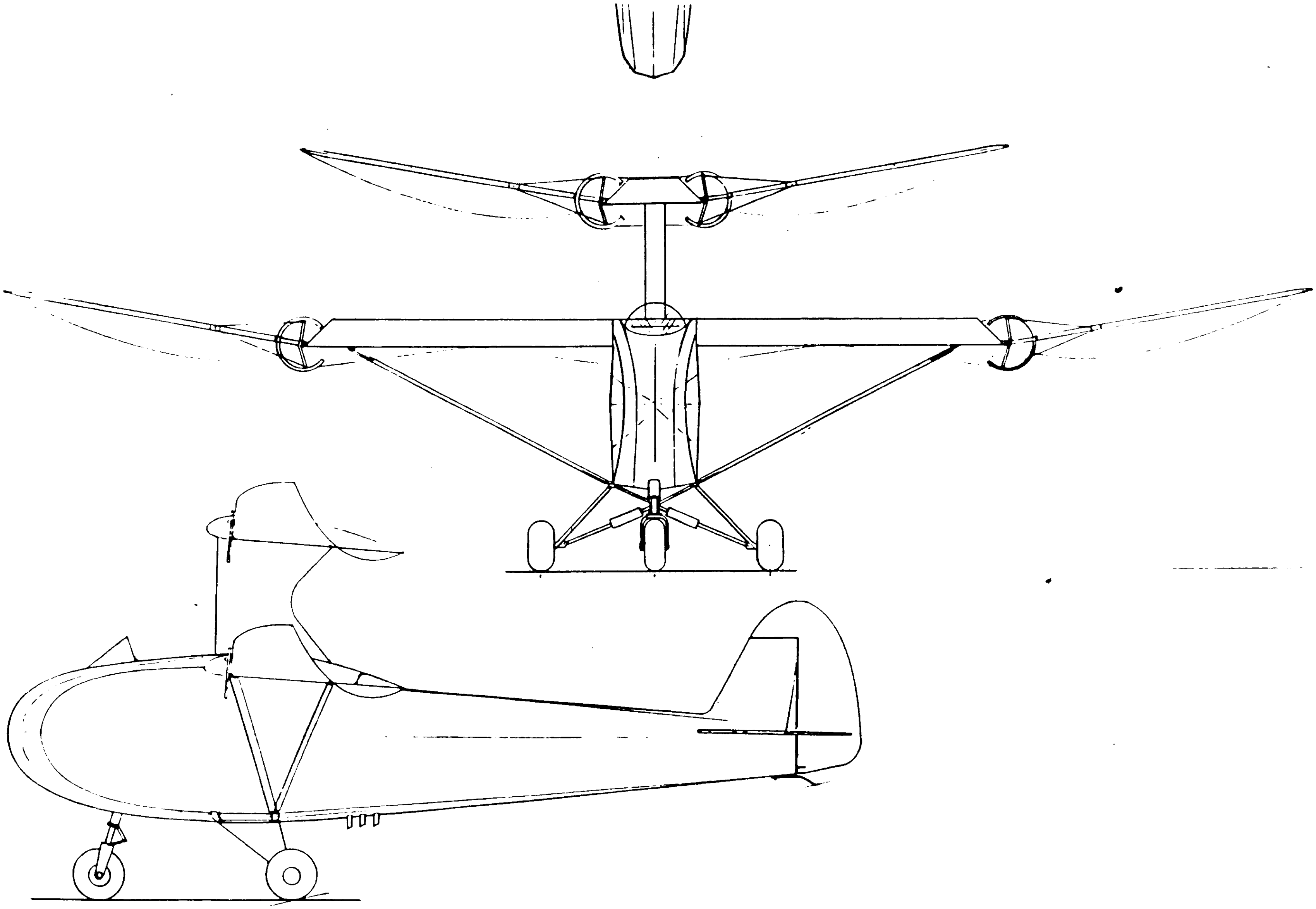


Model #2 In Flight (Radio Controlled)

Specifications

Engine: .71 H.P. 13,400 R.P.M. Gear Ratio 30.5:1
Net Torque at Crank 53.5 in./lbs. .38 H.P.
Wing beat Cycle 444 per min.
Wing Stroke 60 deg. Pitch 30 deg. (14% Camber)

Gross Weight (including radio) (1 lb.)	7.62 lbs.
Wing Span	91.50 in.
Wing area (total)	9.00 sq. ft.
Aspect Ratio Lower Wing	9.2:1
Aspect Ratio Upper Wing	6.8:1
Wing Area (Fixed Wing)	5.05 sq. ft.
Wing Area (Beating Wing)	4.00 sq. ft.
Wing Span (Fixed Wing)	48.00 in.
Wing Chord (Fixed Wing)	13.00 in.
Wing Span (Beating Wing)	21.75 in.
Wing Chord (Beating Wing Root)	10.75 in.
Wing Tip Set-Back	3.75 in.
Wing Gap	9.00 in.
Center Section Span	8.00 in.
Center Section Chord	13.00 in.
Length (O.A.)	51.12 in.
Height (O.A.)	24.50 in.
Tail Length (1/4 Chord to Elevator Hinge) (2.58:1)	33.75 in.
Angle of Incidence	4.00 deg.
Airfoil Section Clark "Y"	
Tail Surface Area, Vertical (6.2%)	81.40 sq. in.
Tail Surface Area, Horizontal (13.6%)	177.00 sq. in.
Center of Gravity (Vertical) 1.87 in. below Chord Line	
Center of Gravity (Horizontal) 41% F.W. Chord	
Landing Gear Position - Just aft of C.G.	
Wing Loading	.85 lbs./sq.ft.
Power Loading (Net Crank H.P. .38)	20.15 lbs./H.P.



SCALE 1/20	THREE VIEW	DRAWN BY
DATE. JULY 12-1961		[illegible]

SPENCER ORNIPLANE -

MODEL SO-2P

ORNIPLANE DESIGN CONCEPT

GENERAL SPECIFICATIONS MODEL SO-2-P

Single Place Open Cockpit

Engine Scott-McCullock, 3 cyl., 2 cycle, water cooled.

Weight including Starter, Generator and Cooling System 118.

H.P. - 5000 R.P.M.	60.
Power transmission system. 2-stage Vee belt.	
Ratio	11:1
Gross weight lbs.	960.
Empty weight lbs.	760.
Useful load lbs.	200
Wing span lower wing ft.	34.3
Wing span upper wing ft.	18.6
Chord lower and upper wing in.	63.
Aspect ratio lower wing	9.3:1
Aspect ratio upper wing	7.7:1
Wing area total sq. ft.	160.
Wing area fixed wings sq. ft.	95.2
Wing area propelling and lifting wings (15.7 sq.ft. each).	62.8
Length ft.	22.3
Height ft.	10.3
Wing loading lbs./sq. ft.	6.0
Power loading lbs./H.P.	16.0
Tail surface area vertical sq. ft. (5.84%)	9.37
Tail surface area horizontal sq. ft. (15.6%)	25.
Tail length 1/4 chord to elevator hinge in.	170.
Tail length to chord ratio	3.1:1

ideas. Although we missed the September 1 deadline for rules change proposals, we will continue working on this. Your input is welcome and vital for us to produce a rule proposal which meets everyone's needs.

There are two main issues concerning the ornithopter rules:

1. What type of models should the rules allow?

2. How can the rules be explicated in order to permit only that type of model?

In the article which was published in the previous issue, Quermann and I recommended a proposal which allows only true ornithopters, those which derive their chief support and sole propulsion from flapping wings. Such a rule is difficult to write because it's hard to tell how much support is being contributed by fixed surfaces. However, we have found various ways of doing this.

The existing rules had the same goal of excluding flapper-propelled airplanes, but some unforeseen model designs were able to circumvent those rules. The current rules impose a large number of design restrictions, none of which really restrict flapper-propelled models. Since these restrictions don't serve any purpose, they should be removed. This is especially true since one of the rules, requiring a distance to be placed between the wing and stabilizer, prevents the use of birdlike ornithopters.

Some fear that a new rule would only make things worse, so we have made every effort to keep our proposed rules simple and sensible.

Some, however, think there should be no restrictions at all on what type of models can be entered. Should anything that flaps, even if it flips its tail from side to side like a fish for propulsion, be allowed in the ornithopter event? Certainly a model such as that would be interesting, and there is some justification for allowing more freedom in design. Many of us fear, however, that this would simply cause airplanes with small flapping propellers to dominate the competition. It is believed that such models would have a substantial performance advantage, and since we don't want to see the event dominated by flapping-propellered airplanes that don't flap their wings, we would like to exclude these designs from the competition.

If you have an opinion on this issue, please let us know what you think ...

1. Should the contest allow all types of flapper propelled models, or should it allow only those which get most of their lift from the flapping surfaces? Or something in between?

2. What set of rules is the best for accomplishing this goal?

Certainly, the existing rules must be changed, since they impose a lot of restrictions without achieving the effect intended by the author. But what shall we change them to?

Freebird

Easy to build, easy to trim. This ornithopter is a great first flapper and possibly a good testbed for your folding-wing ideas. One OMS member commented that it flew very well considering the rugged construction. Just send an SASE to get a copy of the plans.

Backissues

Flapper Facts has been in print since 1983. I didn't join until 1988, and when I was given a copy of the backissues, I was delighted by the vast amount of information they contained. It is a dream come true for any ornithopter enthusiast.

- Plans for over thirty different ornithopters
- In-depth discussion of optimum design parameters
- Detailed analysis of flapping mechanisms by Frank Kieser
- Indoor canard construction by Frank Kieser
- Ornithopter cartoons!
- Articles on <u>all</u> ornithopter topics
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- 192 pages

To get your copy as soon as possible, please send $19 ($24 outside the USA) to Nathan Chronister, Box C-3815, Bucknell University, Lewisburg, PA 17837. Your contribution will allow OMS to sponsor contests and publicity which will help us serve you better.

And...

If you want even more information, get the Ornithopter Design Manual ($3) or Vast Ornithopter Information Directory (newly expanded, $1.50). The 42 page (5.5 x 8.5") Design Manual was written by Frank Kieser and describes how to design and build ornithopters. The info directory is a flapping flight bibliography.

Send your articles!

I am running out of material for the newsletter. I'm also running out of time for writing articles. I know that many of you don't have a lot of free time either, but if you do, please type up an article or draw up plans for your latest ornithopter (even if you haven't actually built it yet). Please use 8.5 x 11" paper and leave some margins so the copier won't crop off important information. By helping, you will make this a better newsletter and get your ideas recognized. Besides, it's fun.

ROBERT B. MEUSER
4200 Gregory St.
Oakland, CA 94619

7/27/94

Dear Nathan

Just a quick note re orni rules. Maybe more later, no time now.

I wrote the present AMA orni rules. The intent was to rule out "orni-prop-ters" such as Ken Johnson's. Clearly, it missed the mark. It is quite possible under the present rules to design a 'thopter with none of the lift supplied by the flapping surfaces. Just put "stabilizers" both ahead and behind the flappers. (Or your Figure D)

Immediately after the rules change, and maybe as a result of it in part, there was a flurry of activity in the orni. event. I found that, and the developments that followed, to be pretty exciting. It took me a while to realize that the intent had been totally violated.

Instead of revising the present rules, I suggest a "new" orni event for Pichancourt-type ornis — single wing, stabilizer in the rear.

I'll have to think about Quermani's proposals. One flaw in his first proposal is his reference to center of lift. That can't be determined by the judges. Even center of area is a problem. Judges don't have the time to figure it out. Perhaps the modeler would be required to furnish supporting calculations or at least a cardboard template with the ctr of area determined by the two-plumb-line method. Still a hassle.

Bob

KENNETH B. JOHNSON

16728 BERMUDA STREET, GRANADA HILLS, CA 91344 • 818/368-0448

July, 28, 1994

Dear Nathan-

Having just finished reading the summer 1994 issue of flapper facts, I find it necessary to set down at my Macintosh and fire off a letter.

I find all this talk about rules for ornithopters makes my blood boil. It seems to me that most everyone with any interest in these machines wants to write his or her own version of the rules. WHY?

It was the late 60's when Ken Johnson began building flappers. To date, 180+ models have come off my building board. So I consider myself an orthnthopter modeler. In fact, Warren Williams and myself have built and flown more flappers than most modelers have seen in their lifetime. I believe Warren has about 100 models at home now.

What is the difference how much fixed area vs. flapping area a given flapper has? Will it fly any better with more fixed area? I doubt it. I remember building a 25" fixed span flapper in the early 1970's just to see what kind of time it could do. There were 4 small flapping wings at the front of the craft. The best time the model would turn in was just over 4 minutes. Will a model with a short flapping stroke fly better? I don't think so. The winds will burn off faster so the flight will be shorter.

To my mind an ornithopter is a model that is powered by flapping wings. Period. If we are going to haggle about the area rules, why not say that the plane can have no supporting surface at all. No fixed wing and no stab at all. in effect, a flapping flying wing.

And, if we are going to try to imitate the birds, eliminate biplane flappers all togrether. Why not say that all model ornithopters must have birds feathers glued to the wings. That's how silly all this rules haggling has become to me.

Some time ago I stopped flying ornithopters for records and now I remember why. It was the stupid rules that we had gotten ourselves bound up in. This kind of thing will discourage any youngster from trying to build flappers. How many 12 year olds do you know, who know the meaning of protuberance?

The rule should read- An ornithopter is a model that is powered by flapping wings. Take off is not required. Any flight is offical.

Best Regards- Ken Johnson

P.S. I met Spence at the Macready flapper meeting in Pasadena several years ago. He is quite a guy. Is he still alive? Enclosed is the plan for my outdoor flapper, which did 9 minutes O.O.S. at Taft meet in May, 94.

Roy L. Clough, Jr.
RR 3, Box 150
Pittsfield, NH 03263
603 435-6369

Nathan Chronister
5311 Columbus Way S. #807
St. Petersburg, Fl 33712

Dear Nathan,

I'm no e pert on either ornithopters or rules, but it seems simplicity will encourage participation. My input is as follows:

1. An ornithopter is defined as a flying machine in which lift and propulsion are produced by the oscillatory "flapping" motion of its primary wing surfaces. Non-flapping portions of primary surfaces, or the fi ed surfaces to which they are attached shall be limited in area to the minimum required for mounting and power transfer. Lift may not be provided by one set of surfaces and propulsion by another. The intent of this definition is that "Ornithopter" means *both* lift and propulsion are provided by the same oscillating or flapping surface(s).

2. There shall be no limitation upon the number of such surfaces or upon their relative proximity to each other.

3. No rules shall apply to rate of oscillation,(beat frequency,) or arc described by wing motion travel.

4. All flights shall be hand-launched. To qualify for competition, models must fly for a minimum of 20 seconds when launched from a 60" height and must demonstrate the capability to double this altitude in free flight. The purpose of this rule is to discourage superlights that achieve some duration by virtue of low wing loading and the ability to wiggle their wings without producing appreciable lift.

5. Horizontal stabilizers may not exceed 25% of total wing area and vertical stabilizing surfaces may not exceed 12%. Combined surfaces, as vee tails shall not exceed 30% of total wing area. Vee surface area shall be actual, not as projected due to angle. Canard surfaces shall be limited to 15% of total projected wing area regardless of their shape. Stabilizing surfaces shall be uncambered flat surfaces whose function is clearly that of attitude/directional control and must be located at the extreme rear (or front) of the model where they cannot contribute appreciably to lift.

(Nothing in the above rules is intended to hinder categorization as to size, weight, area and type of power for the purpose of creating various classes of models for competition purposes.)

Roy

Walter C Erbach
2979 Dudley St
Lincoln NE 68503

Aug. 4, 1994

Dear Nate:

First of all, a "Thank You" for your efforts in preparing and sending out the OMS Flapper Facts. Having a couple of times edited and worked on small publications I know the effort needed and, as a result, appreciate greatly what you are doing.

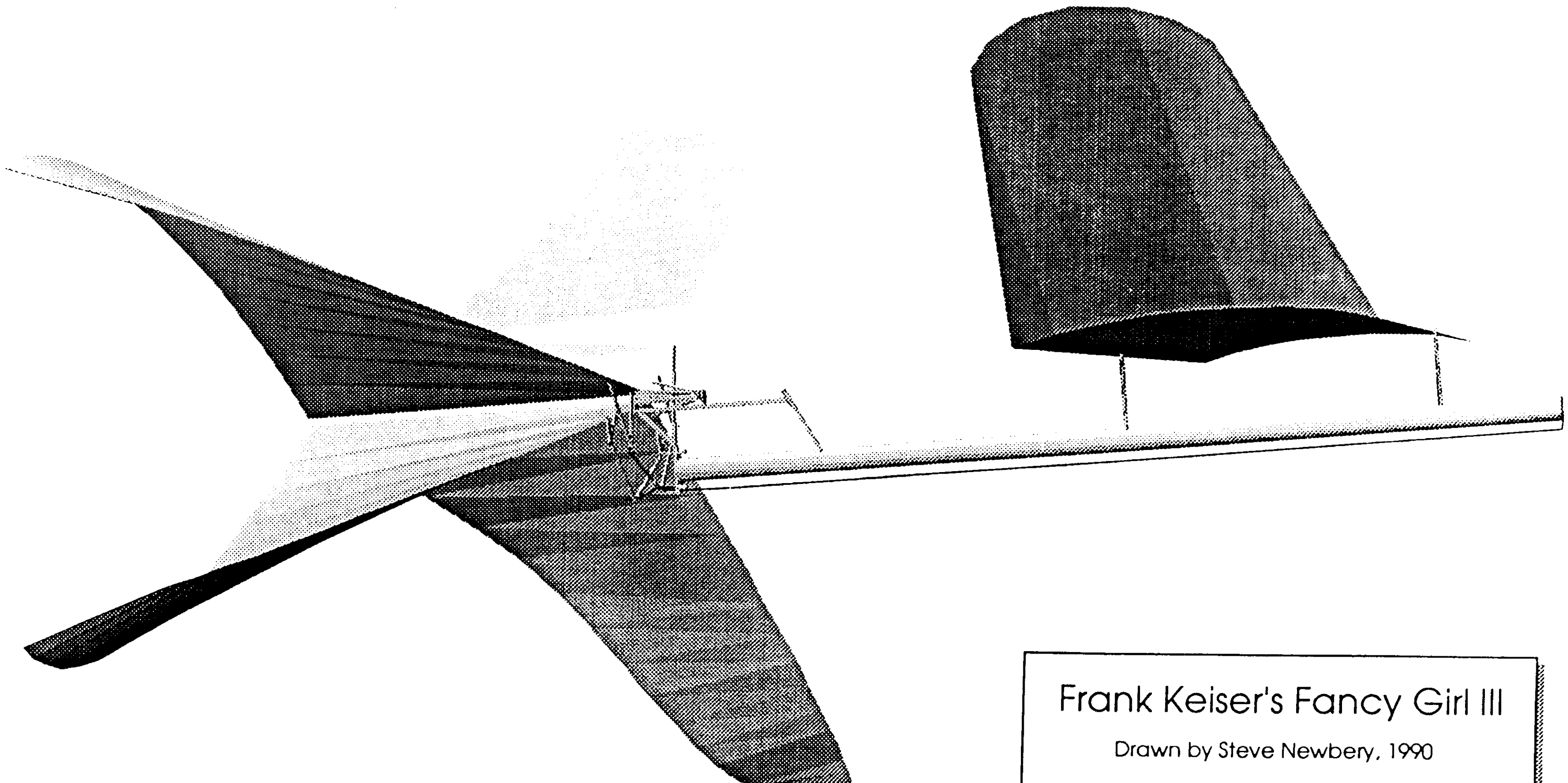
Second, the proposed ornithopter rules changes. It seems to me that we are not seeing the forest for the trees. Our first goal should be to reach an agreement in answer to the question,"What are we trying to accomplish with the rules"? Unlike any other type of AMA event the ornithopter owes its existence solely to creatures which fly (and in some cases far better than the best that man has been able to develop). We fluff this off with the casual AMA definition that an ornithopter derives its propulsion solely from flapping wings.

I start a new paragraph for emphasis on this although it is logically a part of the previous one: I checked my rules book file and the last pre-WWII AMA rules (1941) stated that an ornithoper derives LIFT AND PROPULSION solely from the flapping of its wings. In the first post-war rules flyer (1946) the word LIFT simply disappeared from the AMA definition. Although unprovable I think this was a typographical omission and have complained to the AMA but the original wording was never restored. Such restoration would remove having to fall back onto your "intent" of the rules.

Now back to the second previous paragraph in which we worry about THE GOAL OF THE EVENT. Do we want an ornithopter event in the spirit of the original rules in which we attempt to emulate flying creatures in some way or instead an anything-goes event? This decision then determines the rest of the rules. If we want to follow the birds and bees we must specify tractor and monoplane or tandem wing configuration (Should anyone argue that hovering humming birds and some flying insects can fly in reverse, albeit it for only short distances, then the arguer must be prepared to demonstrate that his/her model can also fly satisfactorily in either direction changing only incidence). My feeling has always been that a lay onlooker's impression should immediately be,"Hey, it flies like a bird", instead of "What in the world is that?". If the concensus lies in the other direction then my retort would be: Forget the flapping area percentage. Accept anything, including horizontal flapping a la fish (most of'em).

Further, we do not have to adhere to the 50% tail surface rule just because it is a requirement for other events. If it pleases people, cut the area to 40%, 25%, or whatever is deemed proper. Again, a tractor event would solve almost all problems immediately. Further, including lift as well as propulsion in the definition could prevent a Sid Davidson design. If it flies with the CG as he has specified, then the flapping wings fail the lift requirement, percentagewise. Lastly, your definition includes "center of lift" for measurement purposes. Where is the C.L. located for a flapping surface, especially with the odd outlines used?

Sincerely, Walter



Frank Keiser's Fancy Girl III

Drawn by Steve Newbery, 1990

Georges CHAULET
21 rue Louis Barthou
92160 ANTONY

Aug 4 94

Dear Nathan,

the best definition of an ornithopter for a contest is probably the simplest:

"A model ornithopter has flapping wings."

That's all and that's enough. To the devil the surfaces, the location of CG and all that hardware !

In 1949, an helicopter contest was held in Paris. 30 models were entered, mostly rubber-driven (I had 6). There was no rules. Anyone could bring what he had.

The next year, the organisers precised that "The models should be able to be developed as full-size helicopters." Result: there were but 3 models on the field.

So you see how to catch contestants and how to fear them.

I include a pict of the ornitho with rotating wings. A tremendous quantity of rubber is required for a very slow rotation. Gar ratio should be something like 20 instead of 4. Anyway, I can not go on experimenting with this kind of models, because I am too busy with autogyros. The one I am testing has crashed 17 times and broken 14 props. To morrow morning is the 18th try.

Sorry to let away flapping wings, there is too much to do with rotating ones !

Rotorfully,

Jojo

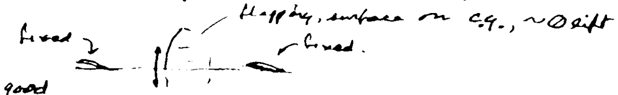
Ornithopter Rules Proposal, 10 August 1994
Nathan Chronister

An ornithopter model derives its chief support and sole propulsion from flapping wings. All wings shall be substantially identical in degree and rate of flapping motion. The model may have a maximum of one fixed horizontal surface (stabilizer), which shall contribute less than 1/3 of the model's lift. The stabilizer shall be placed at the extreme front or rear of the model, and the entire stabilizer shall be at least twice as far from the model's center of gravity as that part of the wing(s) which is farthest from the center of gravity, measured along the direction of fligt. Takeoff gear is not required. Twenty seconds will define and official flight.

Dear Nathan 8/13/94

Thanks for the reply. I appreciate that the no. of orni modelers is small (you cite that as a reason for only one orni event), but if there were more events there might be more participation (Some guys flying both events, other new orni guys for the simpler event. I don't know . . .

Re rules: you gotta be sure to limit the number of fixed horizontal surfaces to one

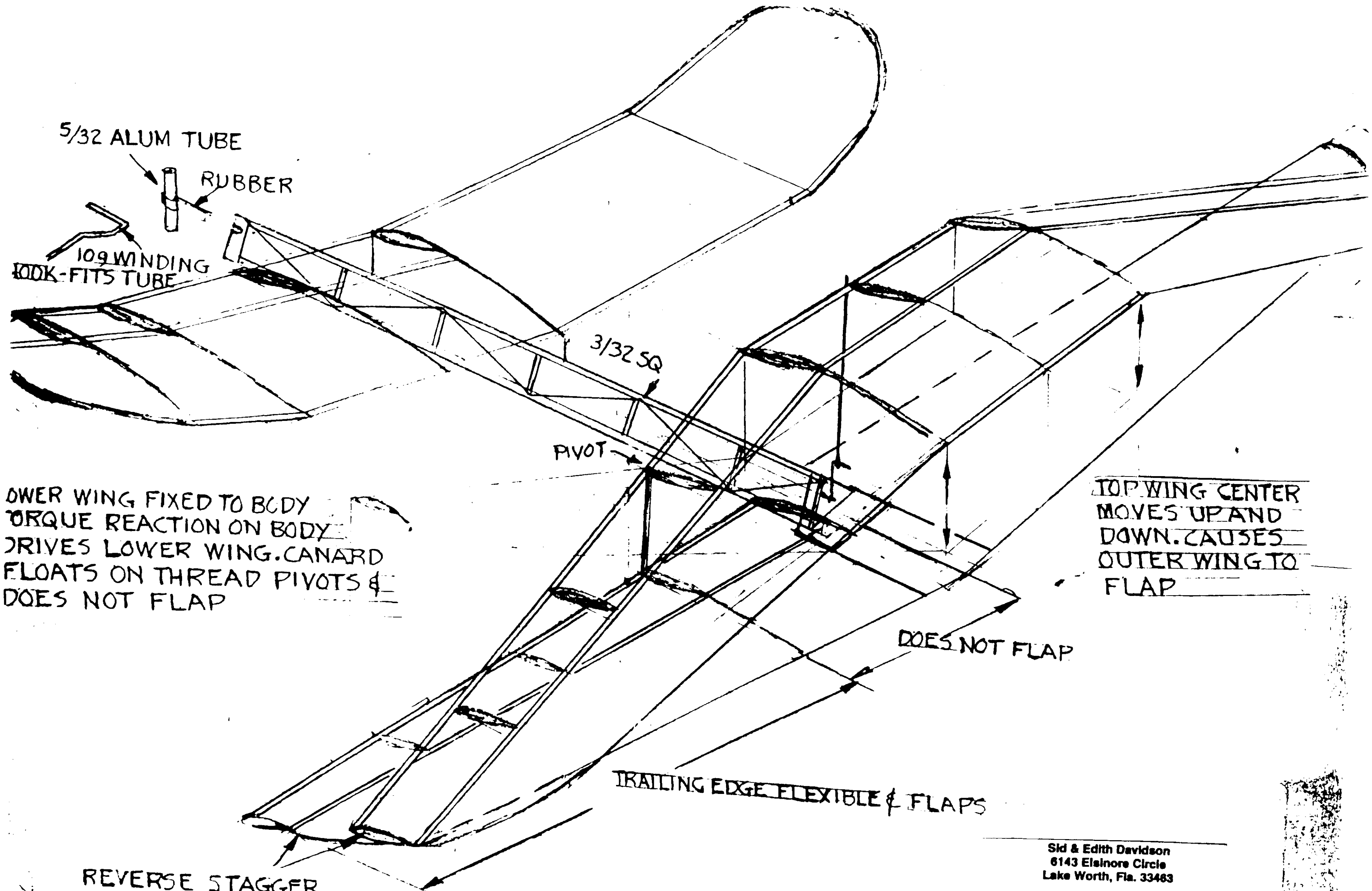


Writing good rules is a bitch!

Bob

How about using the 50%-of-root-chord point in place of Center of lift ?

Any rules change that makes current models obsolete is going to be a tough sell.



Sid & Edith Davidson
6143 Elsinore Circle
Lake Worth, Fla. 33463

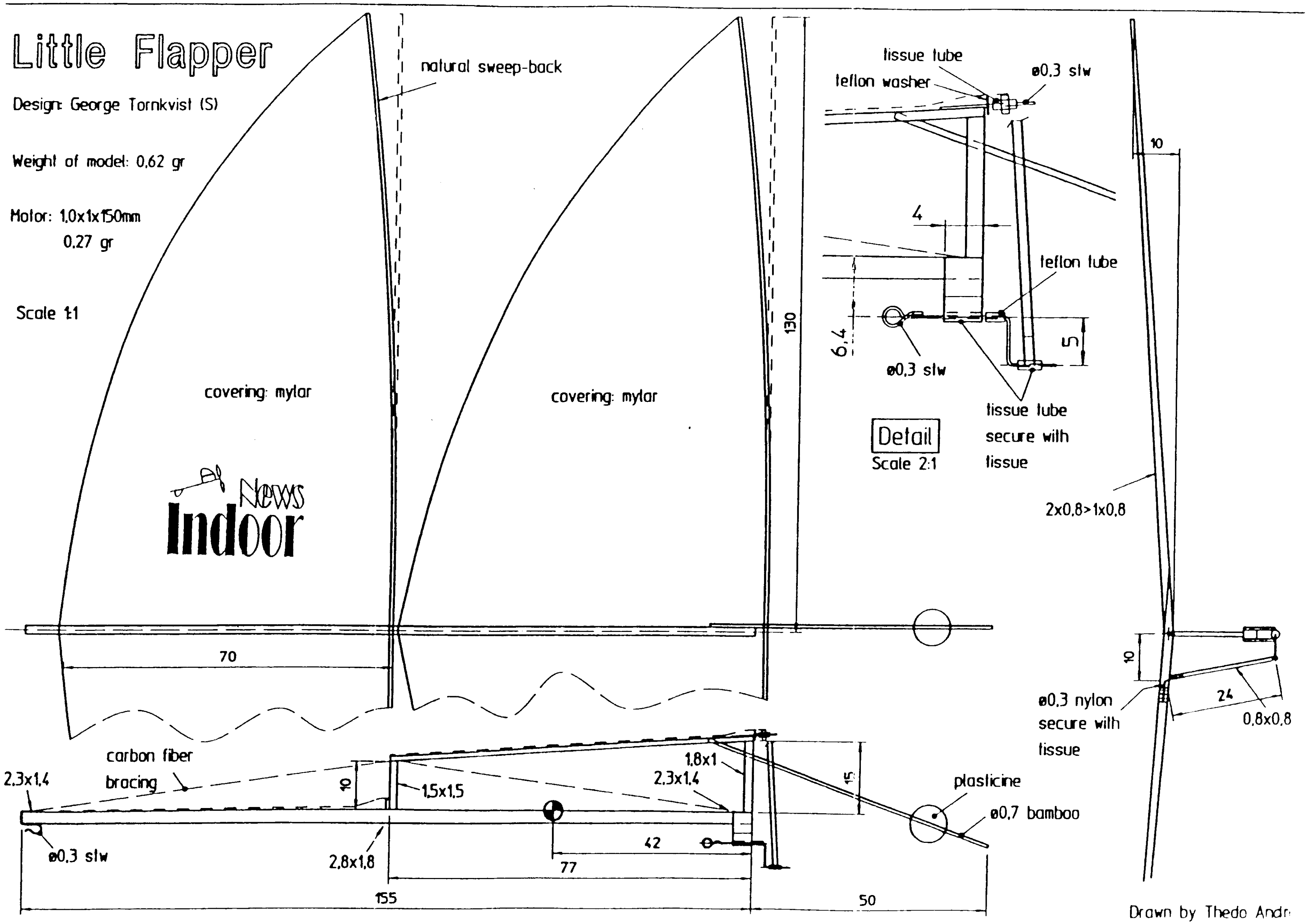
Little Flapper

Design: George Tornkvist (S)

Weight of model: 0,62 gr

Motor: 1,0x1x150mm
0,27 gr

Scale 1:1



Drawn by Thedo Andr

Freebird Biplane

For those of you who are new to ornithopter modeling, the following design is an attempt at bridging the gap between monoplanes and the generally more complex biplanes. It is based on the Freebird plans, which will be required in order to build this model. The flapping mechanism is basically the same as in Freebird, but each wing spar has been extended beyond its root to form another wing on the other side. It's like a scissor. One spar is in front of the other, forming the upper left and lower right wings. The other spar, in back, forms the lower left and upper right wings (see top view). Everything is the same as in the Freebird plans except as noted. Washers between the spars are recommended but not shown. Note that the wing hinge has been simplified since opposing membrane tension will insure perpendicularity. Tissue must be applied accurately and symmetrically, first to lower wings then to upper. If upper wings go below lower wings, shorten conrod. If crank locks in the down position, lengthen conrod or use a smaller crank diameter.