THE

# SCATER

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## How Newsletters for Free Flight got started - Editorial

Once upon a time there was free flight

Then along came little boys to build free flights

But there was no wood and glue so soon there was wood and glue

The wood came from far away so the boys parents built big boats and trains to bring the wood.

And the boys parents had to get jobs and work so that they would have food and shelter for their little boys.

Many homes and factories and stores were built and the little boys and their parents started living in big cities.

As the little boys found out more and more about free flight they started to teach each other and big schools and universities were started.

Some of the things they learned in the schools about free flight also helped them understand how other things like the boats, trains and cars worked and how the people in the cities and

the country lived.

When they went to fly their free flights it took longer and longer to get there so giant highway systems were built and motels and restaurants were invented.

And all the bad guys were not allowed to build free flights and so some of them built Motels in Wisconsin, and the rest started hiding all the flying fields behind houses and in the woods and swamps.

So the little boys invented the airplane for spotting lost free flights from the air. Then came the Honda and walkie talkies and giant industries were started in Japan, Montezuma and elsewhere for helping these little boys.

Then some of the little boy's fathers got together and wrote magazines about what was happening, and this made the little boys happy.

But then the fathers got so busy making money to pay for food, motels, cars, and radio controlled garbage trucks, that there wasn't any room left in the magazines to write about free flight.

And after awhile the little boys almost forgot about free flight.

Except one day some of the little boys said, "why don't we write a newsletter?" And sure enough that's how free flight newsletters got started.

Thrasher, the Optimum Model by Glenn Kinney

Glenn has developed what we think is a remarkable approach to the development of an optimum model. We have always admired Glenn's ability to get to the heart of the problem and produce practical solutions to quite complex aerodynamic phenomena. Let's let Glenn explain it.

> "After many conferences with serious modellers everywhere, including the German free-flight expert Max Flugzeit, the writer decided to attempt an optimal combination of practice and theory to produce an "ideal" model starting from scratch rather than from some arbitrary set of rules. Rubber power was chosen, of course, because the power-time distribution gives a cleaner power-to-glide transition

The rest of the model, however, had to be derived from a theory suited to the flight regime of models rather than full-size airplanes. This article reveals, for the first time anywhere, the approach that was deduced from the ideas that had been cooking in the minds of these modellers for several months.

The heart of the theory is a concept that reflects the major difference between full-size and model aircraft, and the theory's backbone is another idea peculiar to a model's stability requirements (after all, a model has no pilot). The first concept takes account of the fact that a model has a much lower density (mass per unit volume) and a higher form drag (drag per unit of cross-sectional area) due to the lower Reynolds number than has the full-scale airplane. After calculations too lengthy to be included in this article, it was determined that the product of the mass and the cross-sectional area (frontal) per unit drag of the model is a reasonable approximation of a model parameter equivalent to the power function (L 3/D 2) of real aircraft.

This new model function is written

$$C_{mad} = \frac{M \times D}{D}$$

and is called the "mass-area drag coefficient".* The use of this coefficient in the design of the model will be discussed later.

The second main idea of the approach was to recognize that while for full-scale aircraft the most efficient lift distribution is elliptical, for models the most efficient stability function (most stability for the least stability margin) is to be found with that wing design which produces an elliptical downwash at the stab with the axes of the ellipse varying correctly as a function of the instantaneous flight speed. By choosing the correct average axes of the ellipse, the model's pitching moment can be matched at the moment so that the corrective force of the stab is less at the higher speeds and greater at the lower speeds by just the proper amounts. The effect on stability is a quick recovery from sharp stalls occurring at low speeds, and a graceful, floating recovery from high speed stalls. These effects

* Thanks to Jim Daley

virtually eliminate looping under power, and greatly decrease loss of altitude due to stalls in the glide. The problem is to select the correct elliptical axes.

The values of the elliptical axes depend upon equations which relate the wing chord, pitching moment derivatives, speed under power, and speed in the glide for a given $C_{mad}$. The power curves demand a very high power output per unit of rubber mass at low flying speeds. The starting point of the design, therefore, is the rubber-prop combination (Wakefield fans, sound familiar?). Since the prop had to operate at the same Reynolds number as the wing, a dense motor and a large diameter prop with very low RPM were absolute necessities. The resulting high torque required a left-right pattern (with strong right auto-rudder on the power run), and we're off on the design!

Calculations indicated that a very close approximation to optimal airframe design was provided by the A/1 specifications for area (normally proportioned designs work well) as long as the fuselage cross-section is large enough. Since power output at low RN is inversely proportional to the 3/4 power of the rubber mass (not the rubber weight, since gravity counts here), the power equations call for 317 grammes of Pirelli, before lubrication, in a twelve inch motor, for gravity at 30 degrees North Latitude (a reasonable approximation).* A slightly larger wing was fitted to provide the necessary dihedral. The photo shows the completed model.

The wing airfoil is typical, but has multispar construction to provide multiple turbulation which guarantees elliptical downwash at the stab for all angles of attack. The stab can be a convenient flat-bottomed airfoil because elliptical downwash completely eliminates the need for powerful undercamber on the stab. No special attention need be given the wing tip design because the wing center section produces the proper downwash over the entire stab. Do not overdope the wing! The tissue flexibility is correct with three coats of thinned, plasticized nitrate.

The model shown is a hybrid that was developed as a pilot study. To date, only three flights have been attempted (we ran out of rubber). The first two flights were made with ten turns on the winder in the calm, early morning air, and were 4:17 and 4:21 respectively, indicating high consistency. On the third attempt, the anchor man lost his footing. The model was severely damaged, and the anchor

* See Webster's dictionary under "horse latitudes."

man recieved minor bruises and multiple lacerations (hence the name THRASHER). Further flight tests will be made, and the calculations checked, and the reader will be notified next April."

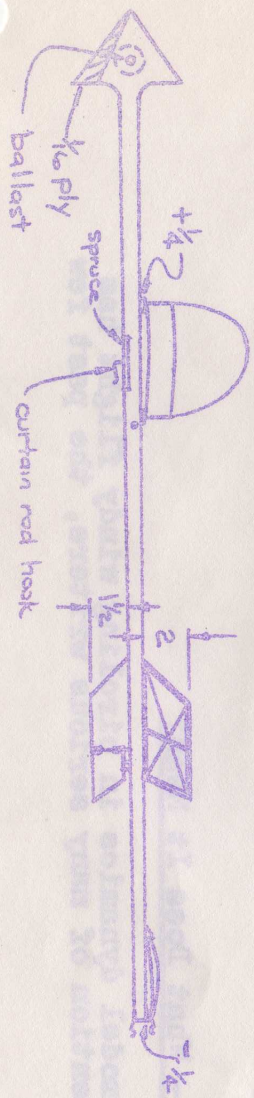
"Arrow" A-1 by Dan McDonald Greenville, Pennsylvania

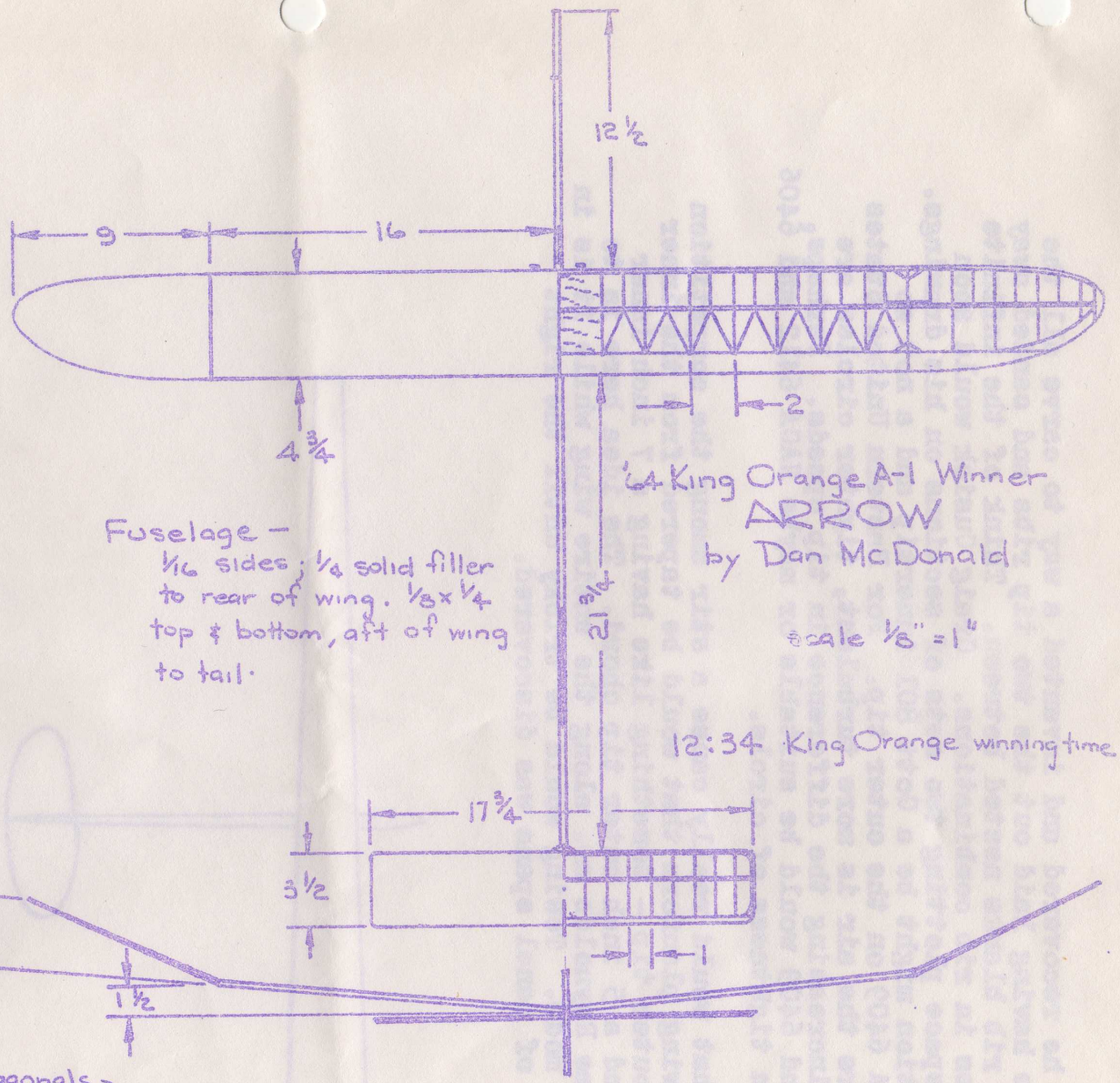
Way back in 1965 on a talent search through the East your editor uncovered this promising A-1. It is by Dan McDonald, a very unique kind of guy who flies a lot of Wakefield (U.S.A. Team '65) Nordic A-2, A-1 and pulls teeth in the wilds of Western Pennsylvania. He's also good with magic shows and can converse in 9 languages; American, English, Basque Sicilian, Suomi, Canuck, Hoosier, Borsht, and Federautiquernat.

If any of you are having trouble with your gum bands check with Dr. Dan.

Wing Design Ideas by Bill Bogart, Seat

One night recently, I was over at Dick Gildersleeve's house enjoying the business of omphaloskepsis with the PLAYBOY Calendar as the focal point when we got to discussing model airplanes as a diversion. In an attempt to advance the state-of-the-art, we delved into ways of increasing glide times on A-2 Nordics. We looked through old issues of SCATTER, AEROMODELLER, and PLAYBOY since Dick thought he remembered seeing an idea I had on regenerating the boundary layer with the use of a slot near the mid chord. We found it in AEROMODELLER by some Russian flyer. To which I thought, NUTS! the Russians really did think of it first. Then I got to thinking, I'll bet they never thought of making the wing sections thicker on the wing panel on the side of the glide turn. Since there is a group of people that concern themselves with the fact that the airspeed varies from the inner (toward the turn center of radius) tip to the outer tip, why not take advantage of this variation in speed by varying the airfoil section to suit. Hence, more camber on the inner side and less camber on the outside. Or maybe a combination of camber and thickness. This would set the meticulous builder back only a few




'64 King Orange A-1 Winner

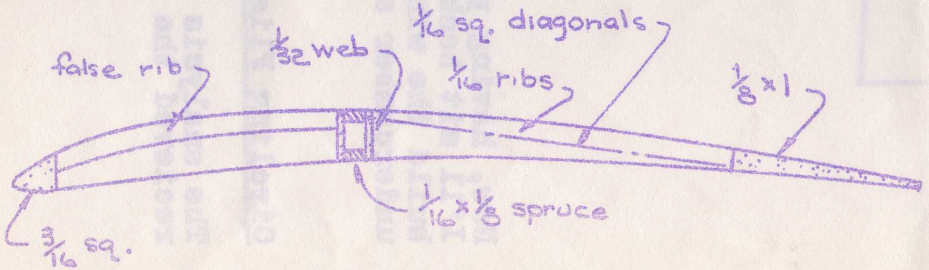
ARROW

by Dan McDonald

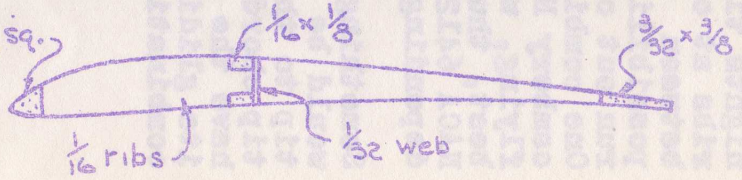
scale 1/8" = 1"

12:34 King Orange winning time

Fuselage –
1/16 sides; 1/4 solid filler to rear of wing. 1/8 x 1/4 top & bottom, aft of wing to tail.



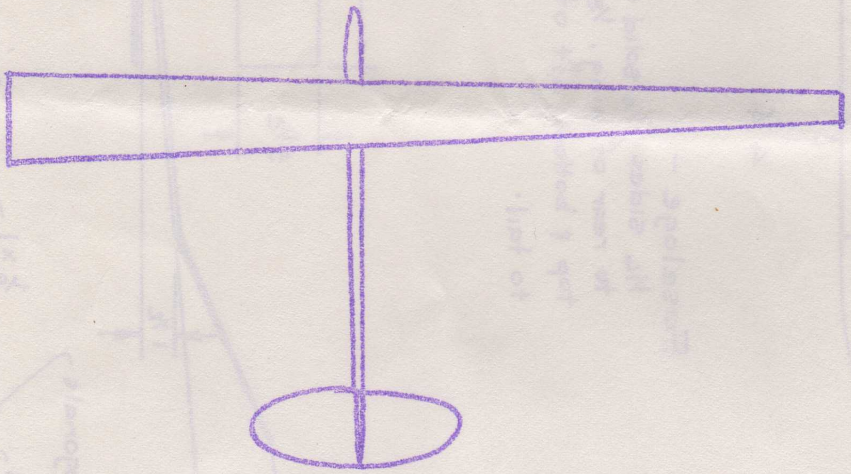

Wing Airfoil




Stab. Airfoil

nights till he recovered and invented a way to carve all the ribs at once having laid out the two tip ribs and sanded away between on rib blanks nested between. Think of the infinite possibilities in rib combinations. Craig Cusick would soon run out of space plotting two sets of sections on his drawings. One combination might be a Gott 801 innertip and a not so cambery NACA 6409 on the outer tip. For Eastern United States flying, where the air is more turbulent, tighter circles are best, thus increasing the difference in tip speeds. Perhaps, NACA 6412 and 6409 would be suitable or maybe NACA 6412 and 6406 depending on tightness of circle.

Something that would really cause a stir among the competition would be a wing planform that would be tapered from the inner tip to the outer tip - something like having a 7 inch inner tip chord and a 5 inch outer tip chord. The idea here is to have the same Reynolds no. along the entire wing while it is in its gliding mode. Towing would be tricky until the right combination of panel spans was discovered.



Now, having planted the seeds of thought for future A-2 designs, I'll sit back and see how fast Bob Wiehle discovers a way to build the wing jig for this type of wing planform with varying undercamber and chord.

Circling Flight - What Does It Mean?

The analysis of model dynamics in circling windy flight has recievsd the attention of many serious writers, the past few

years. Overlooked however is the study of bird soaring flight under similar conditions. It is felt by this writer that valuable knowledge can be obtained by going to the birds for answers.

Neglecting wind resistance for the moment:

Potential energy + kinetic = constant

$$gz + \tfrac{1}{2} V^2 = \text{constant}$$

z = height
V = speed

Flying in the wind shear near the surface, potential energy can be traded for kinetic energy by circling. The downwind glide should occupy a much longer time than the upwind glide in which height is gained.

The greatest of the albatrosses are only found in the southern oceans where they can soar round and round Antarctica several times a year in the prevailing westerlies.

This provides significant corrolation with models, since it is well known that most models are found downwind just as are the great soaring albatrosses.

News from Denmark - "The Hurricane Times."

Many thanks to the "Hurricane Times" for the following very interesting technical information:

"Vi vil hermed sige undskyld til KDA - & med glaede viderebringe endnu et budskab til begynderne -
"KDA er til for DIN skyld!"
Lad as slutte med digterens ord:
We all live in a yellow submarine,
Yellow submarine,
Yellow submarine.
We all live in a yellow submarine
Yellow submarine,
Yellow submarine."

Next Month

The May Issue!