Established 1936
SKY-SCRAPERS BKLYN NY
AMA Club Charter 470

FLYOFF 30

Round 30 / Summer 1995

The **SKYSCRAPERS** Quarterly

Edited by Bob Hatschek

What's up? XXX

We've been fragged!

The 1995 free-flight contest schedule is a mess! And that's in spite of a hell of a lot of well-meaning effort on the part of several dozen hard-working individuals. They know who they are. We all owe them a tremendous round of applause and appreciation. But we're not going to use the space needed to list all their names.

The principal problem is lack of centralized control over a number of factors and the late start on building the schedule. Free flight is certainly one of the more diverse phases of model aviation. It ranges from indoor featherweights to Class D power models (but no 50-pounders, thank Heaven); from P-30 simplicity to programmed F1Bs and F1Cs; from Peanut scale to Clipper Cargo; from Old-Timers to NosGas to bunting 1/2As. So be it. "Let a 100 flowers bloom."

But FAI and AMA and NFFS and SAM and the FAC all seem to operate in a vacuum that doesn't recognize the interlocking interests of the great majority of free-flighters. And chaos cascades throughout the scheduling "system."

For example: FAI schedules the FF World Champs for July 22-31 in Hungary. So a bunch of North American free-flighters plan trips to Europe. Some of them are running meets in our part of the world. Several weekends are chopped from the possibilities.

For example: The NFFS-sponsored USOC, to their credit, typically run by midwesterners, gets scheduled for the weekend the Eastern FF Championships has traditionally been held for the previous 13 years. Making this more binding is our need to coordinate use of Galeville with both West Point and the FBI, who apparently don't talk to each other either. Then the grandly proposed AMA Pacific Northwest Nats can't find a site and AMA takes the easy way (probably the only way) out and piggybacks on the USOC—calling it "the Nats." Fortunately, we were able to obtain Galeville two weeks earlier—a weekend with SAM meets in Gananoque (Ont) and Sturgis (Mich) and an FAC meet in Durham (Conn).

Once upon a time our team selection semifinals and finals were "traditionally" fixed on Labor Day weekend of alternate years. But that was abandoned when we kept having the finals in California and the Californians (the largest participating group) decided that Taft was still too hot in September. Strangely, the United States Free Flight Championships—unwisely allowed to have a AAAA rating, traditionally held on Memorial Day weekend and a far larger meet than the Team Finals—was then switched to Labor Day weekend. Remember? These shifts then backed up cross-country and had strong negative effects on East Coast scheduling.

We apologize for the conflicts you'll still find in the amended calendar on page 6. But that was the best we could do.

And we have to say that some conflicts were eliminated. Take the weekend of Aug. 5-6, for example. The original plans called for SAM 7 to run its Summer Rally for FF Old-Timers at Westover and SAM 75 to host a combined FF and RC Old-Timer meet at Galeville. Alerted to the conflict by *FLYOFF*, the two groups got together, moved the SAM 7 meet to Galeville and combined to make it an even bigger weekend for all Old-Timer fans. Now let the weather cooperate!

We are optimistic about the future, however. There's been word that the AMA Exec Council is considering a new meet category: 5A. This would give one meet top priority, as it once was with 4A.

And the new NFFS President, Bob Beecroft, has already indicated his awareness of the problem and his will to do something about it.

Skyscraper 1995 Annual Meet

Galeville, NY — Aug. 26-27, 1995

CD: Dave Acton (914/628-0526)
RD #3 Box 302, Lakeview Dr, Mahopac, NY 10541

Saturday, 10:00-6:00	Sunday, 8:00-4:00
Early 1/2A NosGas	AMA 1/2A
AMA ABCD combined	NosGas ABCD combined
Multihill	Dawn UnLimited (7:00-7:20)
PeeWee-30	P-30
Catapult Glider	HL Glider

America's Cup events:

F1A	Rounds 1-4	Rounds 5-7+ flyoff
F1B	90-min rounds	90-min rounds
F1C	starting at noon	starting at 8 a.m.

Fees: $10 registration fee for Open contestants, includes 1 event.
(Registration is free to Juniors and Seniors.)
Plus $3 per event for all age groups.
MAAC members may pay in Canadian dollars.

The following correspondence pertains to an earlier Round of *FLYOFF*. We apologize for the delay, but there just wasn't space to publish the letter sooner.

FLYOFF

To the editor.

The extreme complexity of the dynamics of a free flying model airplane and the need for ordinary modelers to design and trim them has led to a lot of bizarre theories. You may recall the proclamation by one Wakefielder that models with free-wheeling props drifted farther in the wind than those with folding props (or was it the other way around?). Bob Lipori's statement in his Icer P-30 article (*FLYOFF #1*) and your reiteration in your Goblin P-30 article (*FLYOFF #27*) that "the airstream from a free-wheeler continues to rotate after power is used up" is equally absurd!

There is a rotating airstream behind....[Continued on page 7]

Rubber Motor Turns

By John Barker

[*This outstanding article was originally published in the British newsletter,* Free Flight news, *edited by Ian Kaynes.—FLYOFF*]

We were discussing winding techniques at the club recently. There was not a great deal of variation, most people stretched the rubber about four times and started to come in around half turns. I do this myself but I said that I suppose we should really stretch to the maximum and come in all the time trading length for turns. This made me think a little more deeply about what happens when a motor is wound. I did not start off to look for a turns formula—I was really only trying to get a feeling for the mechanics of winding. However what I have come up with seems to give very sensible figures for the maximum number of turns that a motor will take.

The usual turns formula (in the form of $K/\sqrt{A}$) has been around for as long as I can remember and works fine once you establish the constants. I assume that it is based on the standard engineering torsion formula (Θ=L/Gr) with stress and modulus lumped into a single constant based on tests. However because I started thinking about this in connection with stretch winding I tried a different approach which, so far as I know, is original—but I expect it will prove not to be! My simple starting hypothesis was that the stretched rubber forms a long thin cylinder which wraps around itself in a regular manner as the motor is wound in. This seems too simple but the end results are so close to practical experience that perhaps it really is that simple!

It may be of interest because the method only depends on the maximum stretch that the rubber will take and stretching a test piece is easier and more reliable than winding it up.

Nomenclature(seedrawing):

- w = strip width
- t = strip thickness
- n = number of strands
- D = diameter of equivalent circle
- d_m = diameter of median circle
- L = length of motor
- x = extension (such that stretched length = xL)
- d = density of rubber
- m = mass of motor

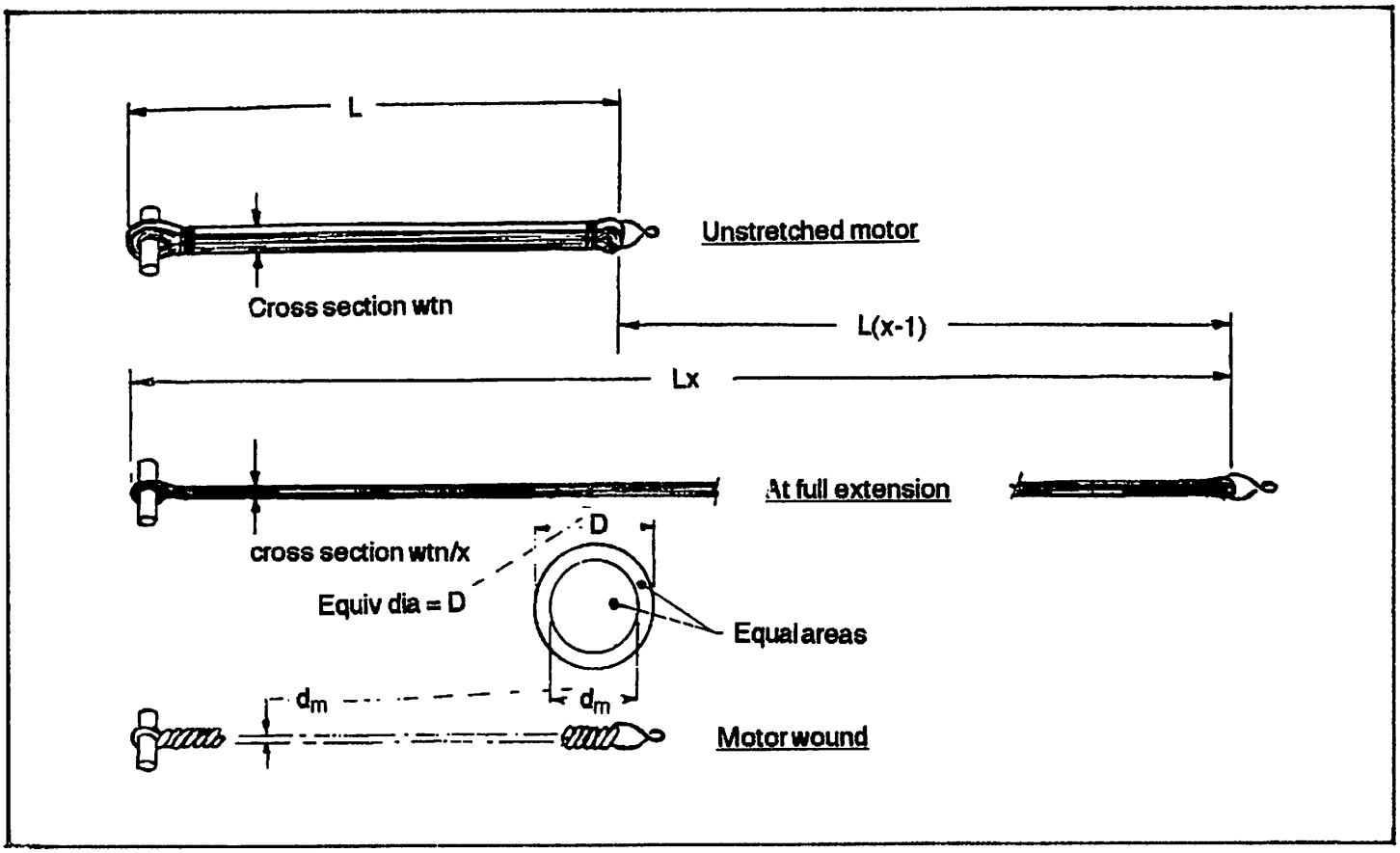
Then cross section of motor = wtn

$$\text{cross section when stretched} = \frac{wtn}{x}$$

The strands form an approximate circle when stretched and twisted and the diameter of the circle will be:

$$D = \sqrt{\frac{4}{\pi}}\sqrt{\frac{wtn}{x}} \quad \text{because} \quad \frac{\pi D^2}{4} = \frac{wtn}{x}$$

When the motor is wound it will twist around itself; sometimes the strands will lie on the surface of diameter D and sometimes they will pass through the center of the circle. A mean diameter d_m can be found which divides the circle D into two parts of equal area so half of the rubber will be contained within d_m and half will be between d_m and D. I therefore consider that on average the rubber wraps around the circumference of d_m.



So to find d_m and its circumference:

$$\frac{\pi}{4} d_m^2 = \frac{1}{2}\frac{\pi}{4} D^2$$

$$\therefore d_m = \frac{1}{\sqrt{2}} D = \frac{1}{\sqrt{2}} \sqrt{\frac{4}{\pi}} \sqrt{\frac{wtn}{x}}$$

$$\text{circumference of } d_m = \pi d_m = \frac{\pi}{\sqrt{2}} \sqrt{\frac{4}{\pi}} \sqrt{\frac{wtn}{x}}$$

$$\therefore \text{circumference} = \sqrt{2\pi} \sqrt{\frac{wtn}{x}}$$

The stretched length of the motor is xL and it finishes after winding at the original length of L so there is (x-1)L of rubber to wrap around the mean circumference so:

$$\text{Number of turns } T = \frac{\text{length to wrap}}{\text{circumference}}$$

$$T = \frac{L(x-1)}{\sqrt{2\pi} \sqrt{\frac{wtn}{x}}}$$

$$T = \frac{L}{\sqrt{n}} \frac{1}{\sqrt{wt}} \frac{(x-1)\sqrt{x}}{\sqrt{2\pi}}$$

I have put it into this form because the first term contains the items most likely to vary (motor length and number of strands) whereas the second term, strip size, and the third term, stretch characteristics, will probably be constant for a particular batch of rubber.

If the density of the rubber is known then the formula can be re-formed to work on motor length and weight instead of number and size of strands. Thus:

$$T = L^{1.5} \sqrt{\frac{d}{m}} \frac{(x-1)\sqrt{x}}{\sqrt{2\pi}}$$

I have checked the results against what published results I can find but all too often there is not enough information to be sure. However Fred Pearce, to whom we owe a great debt, often gives stretch data and my formulae give results very close to his figures for turns. I was surprised to find that it even seems to give sensible results down to two strand indoor motors.

Examples — My latest Tan 2 measures 0.13" (3.3mm) wide by 0.045" (1.14mm) thick with a density of 930 kg/m^3 (15.2 g/in^3). I will call the stretch 10 although it will go to about 10.2. Now take a Coupe motor made from this with a mass of 9.9g (allowing for knot and lubricant) and arranged in 12 strands 9.3 inches long. Use the first of the turns formulae. The stretch term comes to 11.35, the cross section term to 13.07 and the number of turns is 399. I think that this figure is about right.

Use the second formula to find the turns for an F1B motor with a mass of 39g and a length of 400mm. The stretch term is the same, the mass term comes to 154 m$^{-1.5}$ and the turns are then 442. (Watch the units, particularly if working in metric). A similar motor in Tan 1, which has a stretch of about 8.6, would only take about 346 turns according to the formula.

OTENWEE

By Bob Langelius, the Skyscrapers

The new unofficial "AMA .010" event is catching on and is a great opportunity to try scaling down many pet designs. Models are quick to build and economical. And they yield a maximum of flying pleasure for a minimum of building input. My hangup is a belief that all free-flight models should have two wheels and a cabin and I am always striving to develop such a design that will also be competitive.

This airplane is worth building because it has a remarkable glide and a climb that will surprise you!

My son Rob has helpfully put both my Nats-winning .020 PEEWEE and a derivative 36-inch .020 PAYWEE into his CAD system. The PAYWEE is just a higher aspect-ratio version of the PEEWEE. He was easily able to print out a full-size set of plans for a 100- sq.-in. version—the prototype for OTENWEE. Rib spacing is oddball and the trailing edge dimensions are non-stock, so some innovation will be required if you decide to build the OTENWEE. I can certainly recommend the plane—but understand that it is HOT! Small, fast planes are very sensitive, and this one is no different.

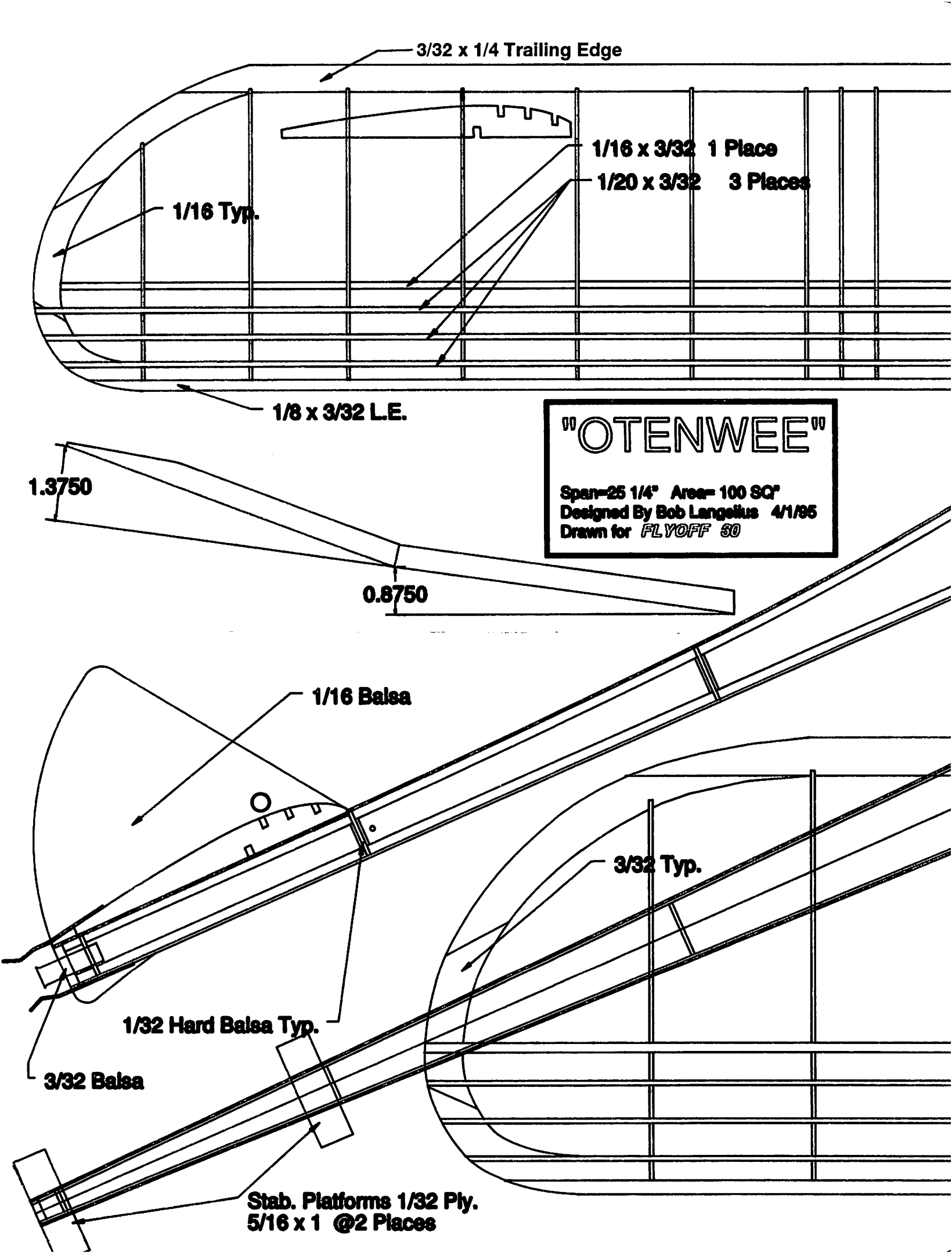
The size was arrived at after a review of the .010 contest results listed by Bob Stalick in *ModelBuilder*. And your editor rejoices in the model's ability to fit into a full-size *FLYOFF* plan without requiring any cutting and pasting. (Thanks again to R. L. Jr.) The plans will give an experienced modeler all the info he needs to construct his own OTENWEE. But note that this is not a beginner's project!

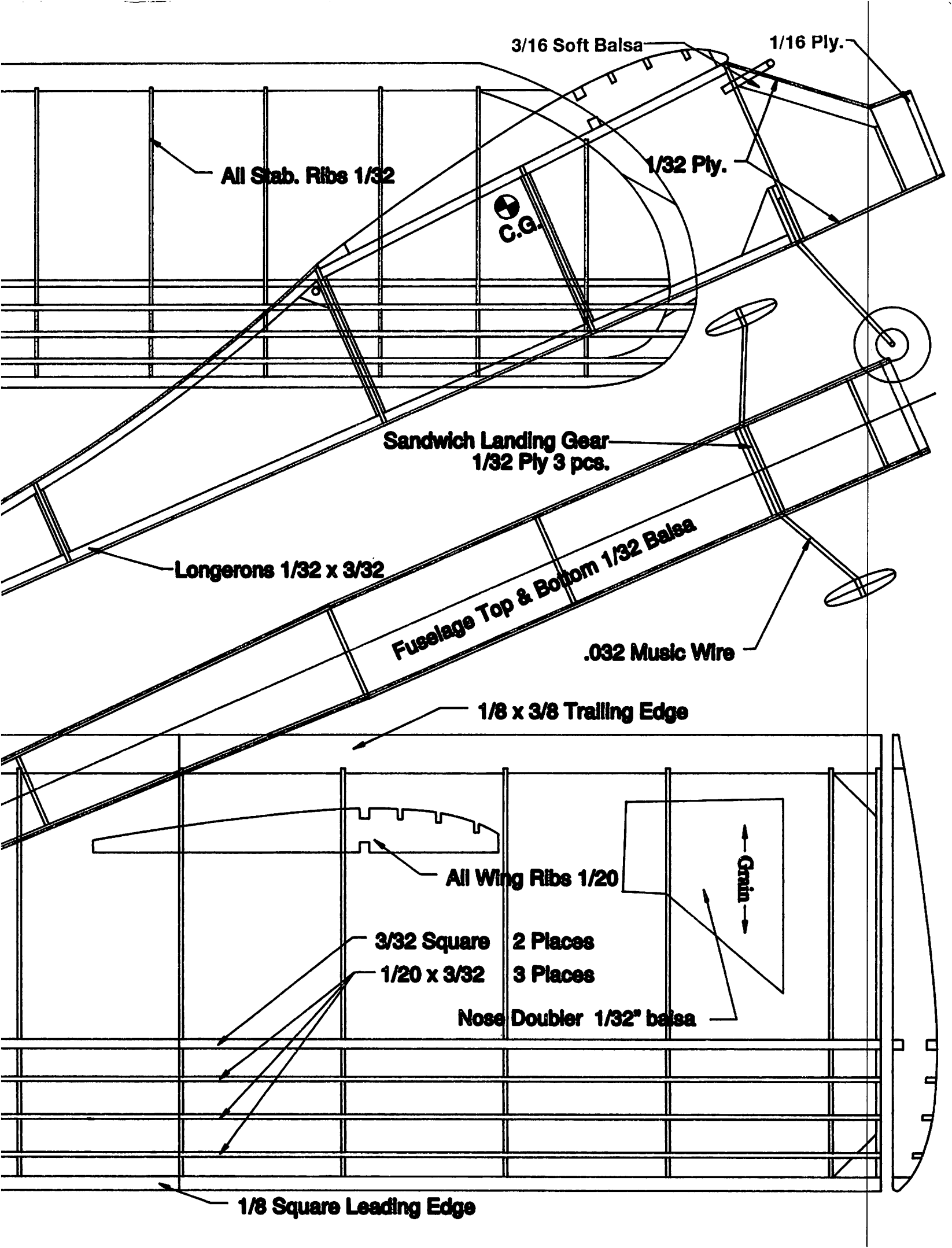
The Cox backplate mount can be ordered from the Cox Customer Service Dept. I received mine—plus some extra props and a backup needle valve—in about a week. You will need an old-fashioned glass eyedropper cut down, as the .010 can drink fuel. The wheels are a plywood and balsa sandwich with an aluminum tube bearing. These wheels are sanded to shape while spinning on a Dremel cutting-disk mandrel.

The prototype weighs 43 grams ready to fly and has a super climb, but it needed a lot of care to achieve it. There are no warps in the wing, but I feel that slight washin, say about 1/16 in., in the right center wing panel would help reduce the tendency to roll right under power. I used triangular wedges under the right center panel's trailing edge to keep the nose up under power. Go slowly, though, as too much may induce a spectacular series of loops. Please don't ask how I know!

Be sure that the model balances at the indicated CG position and that the incidence angles are as shown on the plans. Make sure that there is no slop in the wing and stabilizer keys. I used hard balsa keys with no play and no binding, and the model proved predictable and consistent throughout the entire adjusting process. Put the small Cox propeller on backwards and use rich needle settings for the initial power flights. The original flies right/right, but I'm considering a 125-sq.-in. version that I might try to fly left under power.

To keep the flying weight down I make my own d/t fuse from butcher's twine soaked in a saltpeter solution (1 tbsp in a pint of water) and use dental rubber bands (from Champion Models in California). The d/t has been absolutely reliable.


3/32 x 1/4 Trailing Edge
1/16 x 3/32 1 Place
1/20 x 3/32 3 Places
1/16 Typ.
1/8 x 3/32 L.E.
"OTENWEE"
Span=25 1/4" Area= 100 SQ"
Designed By Bob Langelius 4/1/95
Drawn for FLYOFF 30
1.3750
0.8750
1/16 Balsa
3/32 Typ.
1/32 Hard Balsa Typ.
3/32 Balsa
Stab. Platforms 1/32 Ply.
5/16 x 1 @2 Places


3/16 Soft Balsa
1/16 Ply.
All Stab. Ribs 1/32
1/32 Ply.
C.G.
Sandwich Landing Gear
1/32 Ply 3 pcs.
Longerons 1/32 x 3/32
Fuselage Top & Bottom 1/32 Balsa
.032 Music Wire
1/8 x 3/8 Trailing Edge
All Wing Ribs 1/20
Grain
3/32 Square 2 Places
1/20 x 3/32 3 Places
Nose Doubler 1/32" balsa
1/8 Square Leading Edge

FLYOFF 1995 FF Contest Calendar for the Northeast, AMENDED (As of May 31, 1995)

At presstime, **use of Galeville had not been approved for 9/16.** Approval is expected, but confirm before you drive to meet. List may not be complete. We regret any errors but many CDs did not report changes. Galeville will also be available for testing and sport flying on the following dates: Jun 24-25; Jul 2-4, 15-16; Aug 12-13, 19-20, 27; Sep 2-4, 24; Oct 1, 8, 14-15, 22, 28-29.

Dates	Site	Meet Name or Sponsor	Event guide	Info contact (Phone or send S.A.S.E.)
6/26-30	Muncie, IN	Combo AMA FF Nats & USOC	A,F,Fm,N,O,S,+	Steve Kaluf, AMA Competition Dept (317/287-1256), 5151E Memorial Dr, Muncie, IN 47302
7/1-2	Muncie, IN	Mid-West FAI FF Semi Finals	F	Steve Kaluf, AMA HQ (see above)
7/2	Westover AFB, MA	SAM 7 Summer Outing	O,N,A	Tom Lucas (203/875-5293), 18 Burke St, Rockville, CT 06066
7/8-10	CFB Borden, Ont	Canadian Nats	C,F,O,N	Jim Moseley (416/743-0145), Apt 406, 2000 Sheppard Ave W, Downsview, Ont. M3N 1A2, Canada
7/22-23	Wright-Pat AFB	CIA OT & NosGas Meet	A,N,O	Harry Murphy (317/642-7377), 3824 Oakwood Blvd. Anderson, IN 46011
7/22-31	Domsod, Hungary	FF World Champs	F	AMA Competition Dept (317/287-1256), 5151E Memorial Dr, Muncie, IN 47302
7/30	Galeville, NY	Mid Hudson Modelmasters	A,N,S,+	Vic Nippert (914/382-1967), 6 Douglas Dr, Lake Katrine, NY 12449
8/5-6	Wright-Pat AFB, OH	NOFFA FF Meet	A,N,O,+	Marge or Warren Weisenbach (216/671-8623), 4568 W 146 St, Cleveland, OH 44135
8/5-6	Galeville, NY	"Joe Beshar Commemorative" Old-Timer Meet, jointly cosponsored by SAM 7 (FF) and SAM 75 (RC)	O,+ (RC)	Larry Davidson (516/261-1265), 1 Salisbury Dr N. E Northport, NY 11731
8/5-6	Galeville, NY		O,N,+ (FF)	Al Vollmer (203/933-4400), 14 Check Point Ln, West Haven, CT 06516
8/9-11	Gananoque, Ont	SAM 86 Great Grape Gathering	O,N,S,+	Noel Kirby (613/592-5744), 5 Tiffany Crescent, Kanata, Ont, K2K 1W1 Canada
8/11-13	Fayette, NY	Empire State FF Champs	A,N,O,Fm,S,+	Bill Prensky (716/385-7939), 30 Larchwood Dr, Pittsford, NY 14534
8/19-20	Cuckoo, VA	Cuckoo Scramble	A,N,O,F,Fm,S,+	Bill Saunders (301/593-7196), 11613 Le Baron Terr. Silver Spring, MD 20902
8/19-20	Wright-Pat AFB	FFMAS FF Meet	A,N,O	Marty Richardson (513/236-4058), 7130 Claybeck Dr, Dayton, OH 45424
8/26-27	Galeville, NY	Skyscrapers Annual	A,Fm,N,O,+,2	Dave Acton (914/628-0526), RD#3, Box 302, Lakeview Dr, Mahopac, NY 10541
8/26-27	Gananoque, Ont.	Eastern Canada Open	C,N,F,Fm,O,S,+	Jerry McGlashan (514/695-7415), 170 Fairhaven Ave, Pointe Claire, Que, Canada H9S 4A7
9/2-3	Westover AFB, MA	SAM 7 EC OT Champs	O,+	Nick Notte (203/236-5144), 382 Bloomfield Ave. West Hartford, CT 06117
9/2-3	Muncie, IN	FAC Outdoor Champs	S	Lin Reichel (814/833-0314), 3301 Cindy Ln., Erie, or Steve Kaluf, AMA HQ
9/9-10	Durham, CT	Glastonbury FAC	S	Ed Novak (203/238-9066), Cutlery Ave, South Meriden, CT 06450
9/10	Galeville, NY	Bath BAM Bash	A,F	Clay Ott (215/837-7757), 6018 Nor-Bath Blvd, Bath, PA 18014
9/10-15	Colo Spgs, CO	SAM Champs	O	Art Hillis (303/693-4616), 18107 E Mansfield Ave, Aurora, CO 80013
9/16-17 (?)	Galeville, NY	FAI Team Semifinal	F	Aram Schlosberg (718/479-0478), 79-02 212 St, Bayside, NY 11364
9/23-24	Muncie, IN	CIA 16th Annual FF Champs	O,N,+	Harry Murphy (see 7/22-23 above)
9/23-24	Cuckoo, VA	CAAMA Fall Contest	A,O,N,+	Jim Coffin (701/256-3865), 4604 Hillbrook Dr, Annandale, VA 22003
10/1	Westover AFB, MA	SAM 7 Fall Rally	O,N,A	Jack Chilmark (203/874-8795), 10 Wepawaug Rd, Milford, CT
10/8	Petersburg, VA	Brainbusters Fall Meet	A,F,Fm,N,O,+	Abram Van Dover (804/877-2830), 112 Tillerson Dr, Newport News, VA 23602

Notes: FF events only. Most meets similar to '94. 1 = World Cup. 2 = Americas Cup. 3 = Selected contest for '97 Team. "Event Guide" indicates type of events or source of rules (Example: CdH, P-30, HH Cat would list as Fm,A). May not include all such events (check info sources for specifics). Codes are: A=AMA gas/non-gas; C=MAAC gas/non-gas; N=NosGas; O=Old-Timer gas/non-gas; S=Scale; F=FAI (F1A,B,C); Fm=FAI mini (F1G,H,J); In=Indoor; +=Special added events.

[Continued from page 1]....a free-wheeling propeller but it is (a) much smaller in magnitude and (b) in the opposite direction to that present during the powered phase.

In order to drive a free-wheeling prop CCW from the front against bearing friction, the air doing the work must be deflected CW. If the prop were fixed it's obvious which way the airstream would be deflected. Now if the friction were gradually reduced so that rotation could occur, it's obvious that the direction of deflection would not change; only its magnitude would reduce as the friction is reduced.

Ideally at zero friction, no rotation would appear in the following airstream. Of course, with imperfect propellers the 0 friction case would end up with both CCW and CW rotations in different regions adding up to 0 net rotation.

Reading the two articles, I'm not sure what the problem is. Lipori had trouble with a left-hand glide and presumably a right-hand climb while you report problems of unstated nature with a right-right pattern. Your observations concerning corrected No. 4 as a P-30U fail to mention that the new propeller was not only a folder but, also, a much larger diameter than the free-wheeler. I suspect that the major difference is the more intense airstream behind the free-wheeler during the powered phase. With a top rudder this produces a left turn effect which requires a lot of right thrust to force a right-turn climb. Crossed controls are usually less efficient than single or aiding controls. Thus your subrudder design should be more efficient than the top rudder in a right-turn climb pattern.

I might mention that there is a characteristic of free-wheeling propellers that does continue after power is used up and does affect both power and glide. This is the phenomenon, caused by cyclic variation in the blade angle of attack, that makes the spinning propeller act like a fixed pair of surfaces mutually perpendicular. Since this is caused by variation in angle of attack, it doesn't matter whether the nominal angle of attack is positive as in powered operation or near zero as in free-wheeling operation. For a tractor this produces a destabilizing effect which could account for Lipori's claimed "spin" problem. However, I suspect that his "spin" was in reality a spiral dive.

Galeville Maintenance Fund, 5/11/95

Previous Contributions	**Amount**	**Balance**
Skyscrapers	2664	
Friends of the Skyscrapers	4089	
		6753
Previous Expenditures	-5044	
		1709
New Contributions		
Skyscrapers		
		1709
Friends of the Skyscrapers		
Tom Fennell (4/95)	100	
Tobias Feuer (4/95)	20	
Joe Williams (4/95)	20	
		1849
New Expenditures		
None (as of 5/11/95)		
Current Balance (5/11/95)		$1849

Sincere thanks for all contributions. Funds are held in a separate account and are fully reported here. Please send donations (payable to "Skyscrapers") directly to *FLYOFF*. Thank you!

Another phenomenon associated with a free-wheeling propeller is the wake effect that causes the airstream velocity over surfaces behind the propeller to be lower than that over surfaces not so situated. The logic is simple. The airflow through the prop disk is causing drag, therefore the air must be undergoing forward acceleration.

Isn't it amazing how clear things can appear when viewed from an armchair far from the workbench and flying field? If only I knew then what I think I know now.....

Dick Quermann
Huntington Station, NY

You may be right, Dick. In which case both Lipori and I were extremely lucky in that we seem to have done the right thing for the wrong reason. And luck beats skill any day!

FLYOFF

FLYOFF Subscriptions & Renewals

Subscriptions: *FLYOFF* is published four times a year for active (dues paid) Skyscrapers. Others may subscribe to a minimum of five issues for $2 per issue in North America ($10 minimum) or $3 per issue overseas ($15 minimum). Payment must be in US funds, drawn on a US bank, made payable to "Skyscrapers."

Guarantee: All funds are held in escrow and only when an issue is mailed is $2 ($3 overseas) withdrawn. Thus, if an issue is not published for any reason, money is available for refunds.

Expiration: Your subscription expires with the Round Number in the code after your name on the address label. If it is "30", this is your last issue. If you are an active Skyscraper, please pay your dues. If you are a non-member, please send appropriate payment.

Back Issues: Some back issues (numbers below) are still available for $2 a copy ($3 overseas). Circle the desired numbers on coupon and mail with payment to *FLYOFF*.

Articles: We also seek your contributions (free-flight designs, letters, articles, drawings, ideas, etc). Unfortunately, we cannot pay in any currency other than the gratitude of all *FLYOFF* readers.

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Right in your own backyard... By Walt Rozelle, TTOMA Leafing through a recent *Model Aviation*, I came across a rather nondescript ad for Eastern Tool, a general supply house in lower Manhattan. Several items appealed to me, so I phoned an order, on plastic. Based on what I got and the prompt service, I can endorse the company's products. My order came via UPS in four business days, which means I got same-day service. Here's what I ordered:

- **Dial calipers** ($21). I was skeptical about the accuracy of this Chinese-made instrument (0–6-in., 0.100-in.-per- revolution dial, 0.001-in. graduation), but here's how it checked out measuring some drill bits: a .0625 bit read .063, a .125 measured .126, and a .25 showed .248. To me, that's close enough for gummint work.
- **T-bar sanders** ($2.30, 11-in.; $3.50, 22-in.). These items, 2.5-in. wide, were a pleasant surprise. Made of light but sturdy 1/16" extruded aluminum, their best feature is that they aren't in a "T" shape but a "π" shape. About 1" apart, the two legs provide a lot better grip than a standard T-bar. This one won't rock from side to side.
- **Adhesive abrasive paper** ($9 for 2.5-in. x 21-ft roll). I got a roll of medium grit and a roll of fine. I have only used the fine so far, but can report that it is extremely sharp and doesn't load up. Though it sounds expensive, I think the quality makes it a good buy. I quickly learned not to "sand," but to make slow, individual swipes.
- **Drill indexes.** I bought two. The 1–60 index ($16.50) is US-made and is in the standard metal box with bits arranged in tiered, swing-out rows. The 61-80 index ($12.00) doesn't show who made it. It's housed in a plastic box with a sliding top. The box is really tricky and its habit of hanging up when you try to open it is most aggravating. I once spilled the drills and had to use my new caliper to get them back in order, as the higher numbers get into "super hair" sizes. I haven't used the drills yet, but they seem to be good buys. I will shop for a standard index for the 61–80 bits.
- **T-pins** ($2.00 for 100). I quit using dressmaker pins when I bought some of Sal Fruciano's expensive, but stiletto-sharp Starline pins ($7 for 100). However, there are times when a longer, sturdier pin is essential—like when assembling wing panels. These 1.25" T-pins are serviceable and cheap.

(A word of warning about the Starline pins: They are extremely sharp and are prone to land on the workbench sitting on their plastic knobs. When you go to pick one up, look at it squarely or your finger is likely to get a hypo-like piercing.)

- **Epoxy brushes.** Standard, metal-handle, throwaways—but the cheapest I have ever found at $1 a dozen or $7 for a gross (144)!
- **Magnifier center punch** ($9.00). I didn't buy it, but I intend to. After I got the order, Louis Joyner dropped by. Perusing the catalog, he spotted a center punch like one he already has with a small magnifying glass attached to the shaft to aid in precisely locating the punch before you bonk it with a hammer. Louis heartily recommends it; I'll take his word.

At $3.00 (free with order), the Eastern catalog is loaded with other good buys. Next time I get to Manhattan, I'll drop in and check it out. Since it's right in the Skyscrapers' backyard, it might pay you to do the same. Eastern Tool & Supply Co., 149 Grand St., New York, NY 10013. Phone 212/226-3749. See the ad index in recent issues of *Model Aviation*.