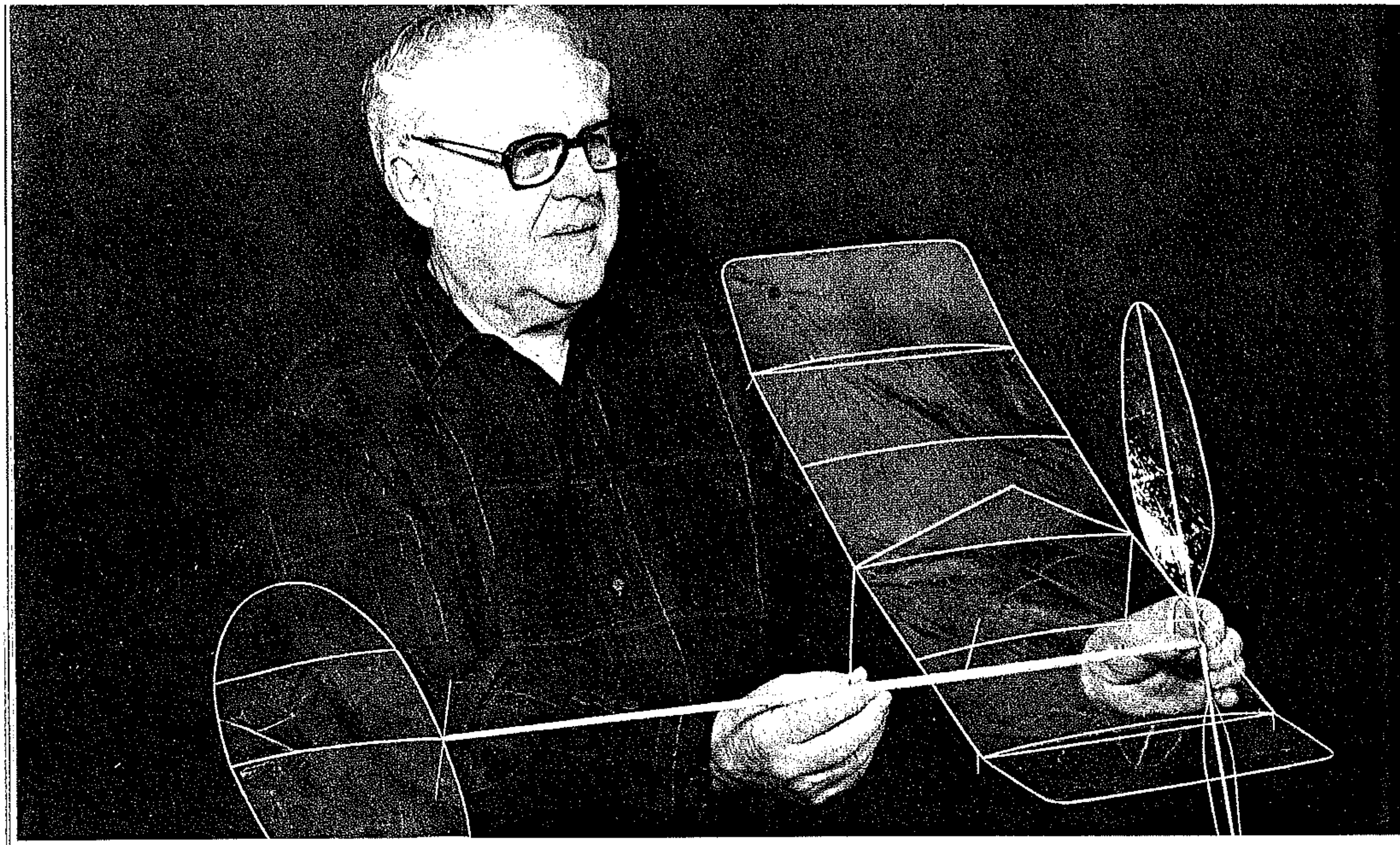
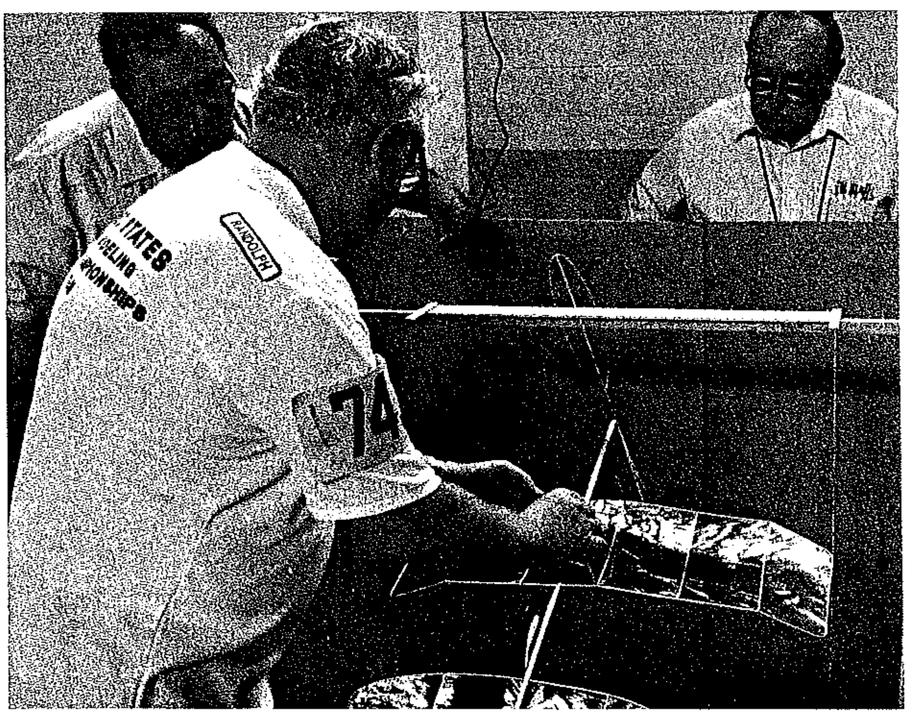


The author with the low-ceiling variant of his Top Cat 90. The gossamerlike covering is light silver and gold Rodemsky microfilm. 699

Top Cat 90L-1



Don Lindley (left) and Bud Tenny (right) man the processing booth to ensure that Top Cat 90 meets F1D weight and wingspan requirements at the '90 World Champs. Bob Clemens photo.

A LOW-CEILING version of Top Cat 90, my earlier Indoor model that itself has set new standards for consistency and performance, Top Cat 90L-1 became a triple record holder on a single flight. On May 3, 1991, it established the Category I World Record (still pending at this writing) and set new AMA F1D and Stick records with a duration of 32:09.

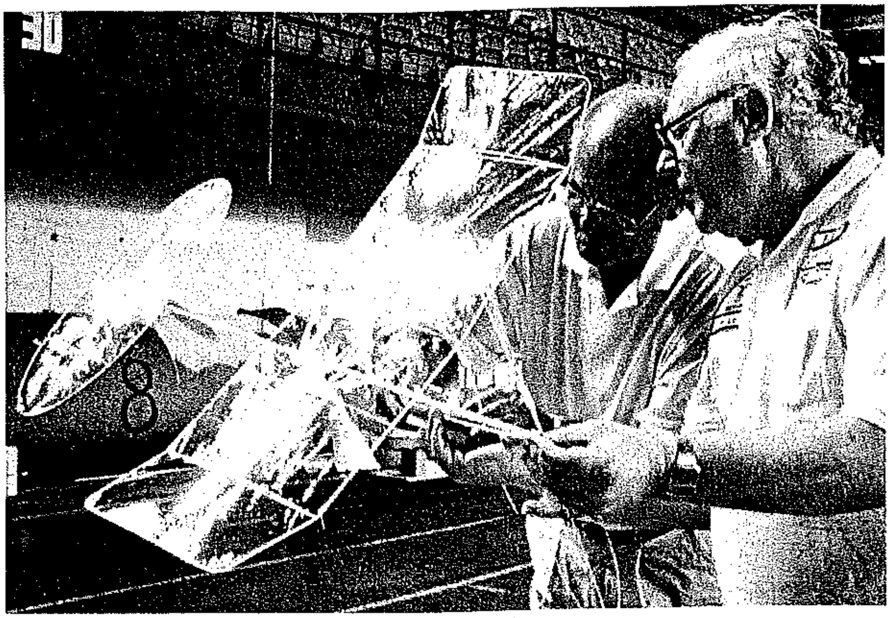
Top Cat 90 was designed for the 1990 Indoor World Championships and the special challenges presented by the Johnson City East Tennessee State University flying site. Having flown at the championships in 1988, I was painfully familiar with the snaggy beams and other hazards—ropes, bags, and vents—of the ETSU site. So I set out to design a model that could stay under the 106-foot beams and still fly longer than 40 minutes.

I incorporated features from both my Boron Bomber (flown at Nagoya in 1984) and my original Top Cat (flown at Cardington in 1986), and did quite a lot of quarter-motor testing under the 25-foot ceiling of my local Loma Linda Elementary School gymnasium before the design came together in its final form. It featured an adjustable VP (variable pitch) propeller, boron prop ribs, a short tail boom and small stabilizer, and asymmetrical wing rib camber. Flight tests with three prototypes indicated that the design goal would be met.

The very reliable VP propeller is torque actuated and has a tiny 00-90 screw for adjusting the maximum high pitch. It is able to change pitch over most of the rubber motor's decaying torque curve so that slightly greater than cruise thrust can be maintained.

At the 1990 World Champs, Top Cat 90 won only the Bronze Medal but stole the show. Because of its torque-actuated VP propeller, the model exceeded 40 minutes on all six official flights—a record that can never be broken. The very next day, the ship won the National Indoor Championship, and a month later it claimed the regional U.S. team selection contest at Moscow, Idaho.

The first time I tried a full motor in my testing gym, Top Cat 90 set new Category I AMA records for F1D and Stick. More recently, it was selected by the National Free Flight Society (NFFS) as Indoor Model of the Year for the 1991 *Symposium*.



Bud Romak, the 1976 F1D World Champion, helps count unused turns after a half-motor test flight at the 1990 world contest. In the author's view, partial test motors are a must. Top Cat 90 was named Indoor Model of the Year for 1991 by the NFFS. Leif Englund photo.

Like its predecessor, this triple record-holding, 1.06-gram F1D design just keeps on winning—with the Category I World Record still pending. One key to its exceptional endurance is the outstanding altitude control provided by the adjustable, torque-actuated variable-pitch propeller. ■Bob Randolph

Inspired by the ease with which I had acquired the two new Category I records, I decided to build this low-ceiling version. The changes were minor but important. A 22 x 36½ propeller replaced the original 22¼ x 40 one, the motor stick was shortened by 1½ in., and the tail boom was lengthened by the same amount. I also changed to a suspended stabilizer and nonsoldered VP propeller hub.

The details of that triple record-breaking May 1991 flight are noteworthy.

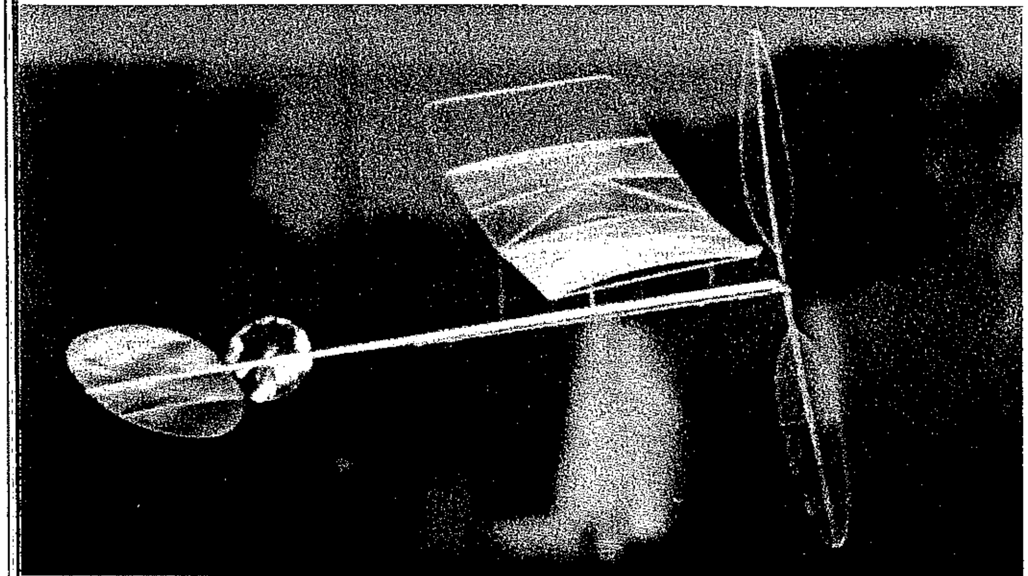
It was another beautiful spring day in Loma Linda, California. The skies were clear, temperatures moderate, humidity low. The air inside the gym was generally excellent, although there was a slow drift to the east at low levels and a drift to the west at the top of the building.

After putting 1,360 turns into a 12½-in. .070 tan rubber motor, I backed off 60 turns and released the model five feet above the floor. It slowly lost altitude for almost two minutes, leveling off at three feet. Finally, at three minutes, the prop smoothed out and the ship began slowly gaining altitude. Everyone breathed easier.

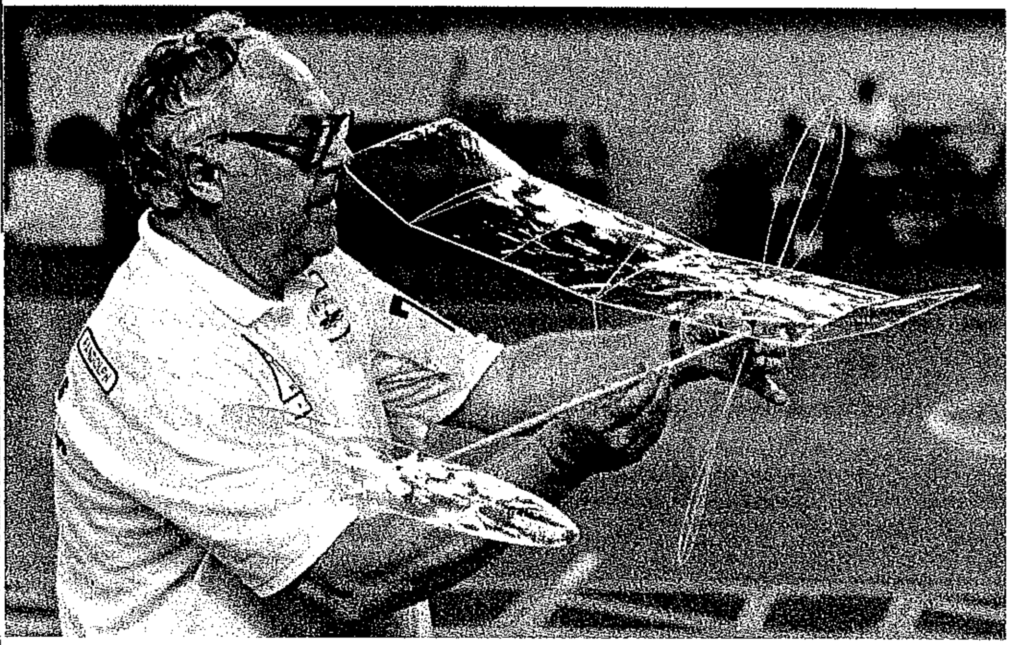
Top Cat reached the beams at 9:44 and continued to tap them gently about every other circle. The last touch was at 23:59, and the model settled to the floor at 32:09. Since 150 turns were unused, the average rpm for the flight was a remarkably low 35.7

Construction. Unless you're an experienced Indoor modeler, you'll have more flying fun if you increase most of the indicated wood sizes by 20 or 30 percent. Since the plan gives the dimensions of

Out of the box and ready for the fray. Team Manager Andy Tagliafico and timers Walt Van Gorder and Les Garber stand by. The box was decorated for the '84 WC. Bob Clemens photo.



Top Cat's climb angle is shallow even at high initial torque. The variable-pitch prop decreases in pitch as torque drops off. This allowed the ship to climb slowly for 16 to 18 minutes, then level off just under the 106-foot beams of the Johnson City ETSU site. Bob Clemens photo.



Top Cat about to be launched. The model won the Bronze Medal at the '90 WC. All six official flights exceeded 40 minutes, with a best time of 42:07. Bob Clemens photo.

Top Cat 90's remarkable performance at the Johnson City contest was just the first of a spate of successes that encouraged the author to design a low-ceiling version. Bob Clemens photo.

each part, figuring these adjustments should be easy. The only way to learn to build light and strong models is by building lots of them, making each one a little lighter.

I may be prejudiced, but I honestly believe that my props will improve the performance of any F1D ship. In fact, many of you may choose to make just the prop I've used on this design to try on your own model. For that reason, and because my variable-pitch props and their unique boron ribs require the most detailed explanation, I'll discuss them first.

Propeller. The adjustable VP hub combines Cezar Banks's idea of using MonoKote hinges and Larry Cailliau's concept of solderless construction with my own idea of using nylon adjusting screws.

Begin by cutting out three $^1/_{16}$-O.D. aluminum washers from the side of a soda or beer can. The hole must be drilled undersized and carefully reamed larger so that it exactly fits the .013 prop shaft wire.

Using a hammer, drift pin, and anvil, strike the shaft approximately where the thrust washer will go to deform it to .015. Slide one of the washers on the hook end of the shaft until it stops at the deformed area. Align the washer with the shaft, and glue lightly with Krazy Glue.

Make the driver arm from .012 wire with a .009 gap and with a butt joint at the center. Slide the driver arm on the front end of the shaft, align it next to the washer, and again glue lightly with Krazy Glue.

The next step is to build up a CyA cone over the driver arm and washer on the front side of the shaft. This is best done with the shaft held vertically in a vise, hook end up. Put a drop of CyA on waxed paper, then dab on small amounts with a pin. It will take four or five applications to build the cone. Wait for the CyA to set between applications.

I use guitar strings from a music store for the .009 music wire for the drive pins and spring, an idea borrowed from Rick Doig. Take along a micrometer to check the size.

Bend the spring with nine coil turns. The other two washers you've already made are glued to the hub to make wobble-free bearings. In cutting off the end of the prop shaft, be sure to remove any burr.

The tapered prop spars must mate perfectly with the wooden hub at the hinge overlap. Align the hub and spars on a flat surface, and lightly tack glue them together using Ambroid thinned with acetone. Since I use translucent orange MonoKote, I like to mark the prop size and identifier (22 x 35.5-1) on the spar so that the MonoKote hinge will cover and protect it.

Cut ½-in. strips of MonoKote, and iron them in place; take care not to crush the wood. I use my wife's lightest iron, set for high (cotton). Use a sharp razor to trim the MonoKote at the leading and trailing edges

Continued on page 158

F1D 32A WORLD RECORD

AMA CAT I F1D & STICK RECORDS

FLIGHT TIME: 32 MIN - 9 SEC

FLOWN BY: BOB RANDOLPH

SITE: LOMA LINDA ACADEMY GYM

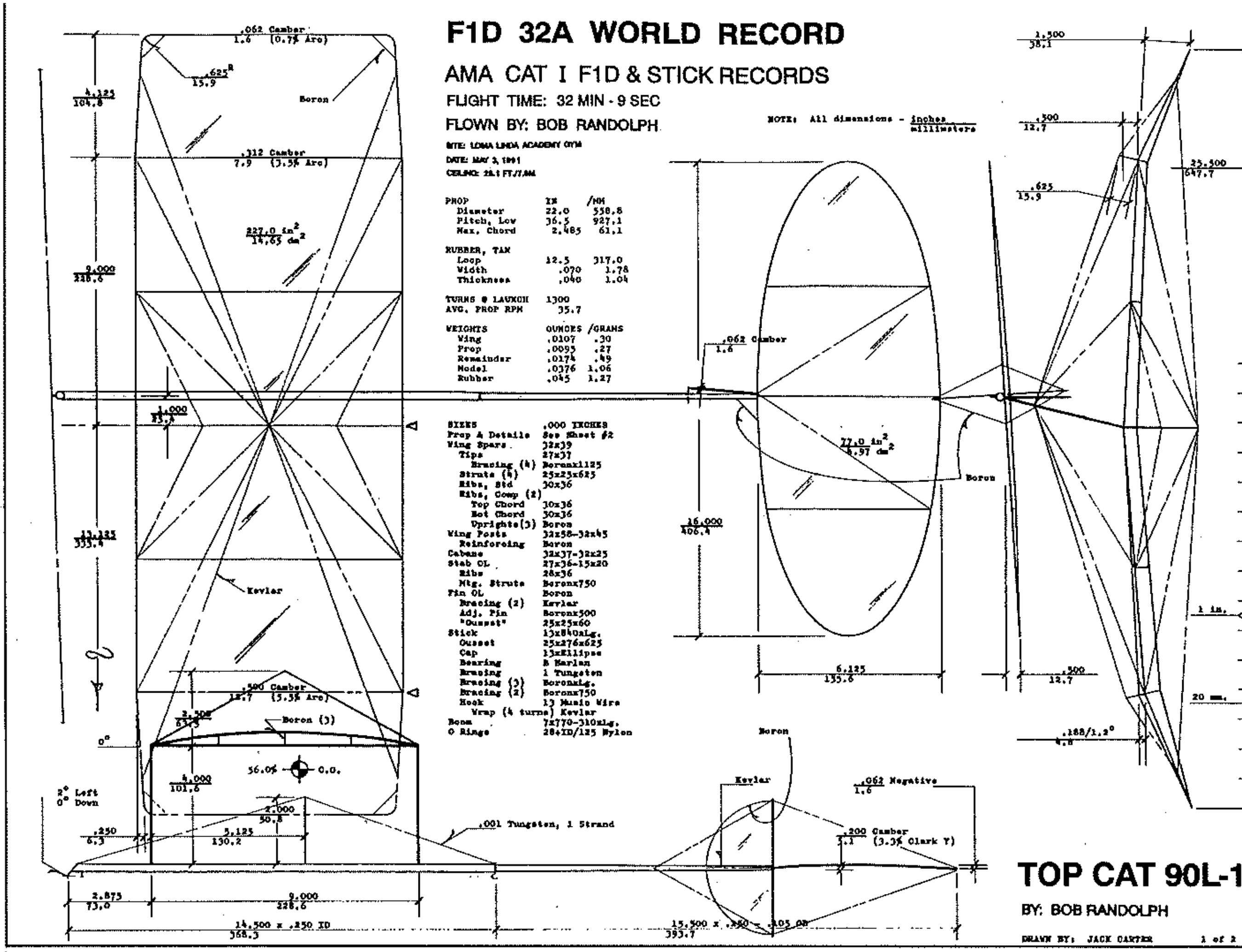
DATE: MAY 3, 1991

CEILING: 28.1 FT/7.8M

NOTE: All dimensions - inches / millimeters

PROP	IN	/MM
Diameter	22.0	558.8
Pitch, Low	36.5	927.1
Max. Chord	2.485	61.1
RUBBER, TAN		
Loop	12.5	317.0
Width	.070	1.78
Thickness	.040	1.04
TURNS @ LAUNCH	1300	
AVG. PROP RPM	35.7	
WEIGHTS	OUNCES	/GRAMS
Wing	.0107	.30
Prop	.0095	.27
Remainder	.0174	.49
Model	.0376	1.06
Rubber	.045	1.27

SIZES	.000 INCHES
Prop & Details	See Sheet #2
Wing Spars	32x39
Tips	27x37
Bracing (4)	Boronx1125
Struts (4)	25x25x625
Ribs, Std	30x36
Ribs, Comp (2)	
Top Chord	30x36
Bot Chord	30x36
Uprights (3)	Boron
Wing Posts	32x58-32x45
Reinforcing	Boron
Cabane	32x37-32x25
Stab OL	27x36-15x20
Ribs	28x36
Mtg. Struts	Boronx750
Fin OL	Boron
Bracing (2)	Kevlar
Adj. Fin	Boronx500
"Gusset"	25x25x60
Stick	13x840xLg.
Gusset	25x276x625
Cap	13xEllipse
Bearing	B Marlan
Bracing	1 Tungsten
Bracing (3)	BoronxLg.
Bracing (2)	Boronx750
Hook	13 Music Wire
Wrap (4 turns)	Kevlar
Boom	72770-310xLg.
O Rings	28+ID/125 Nylon



TOP CAT 90L-1

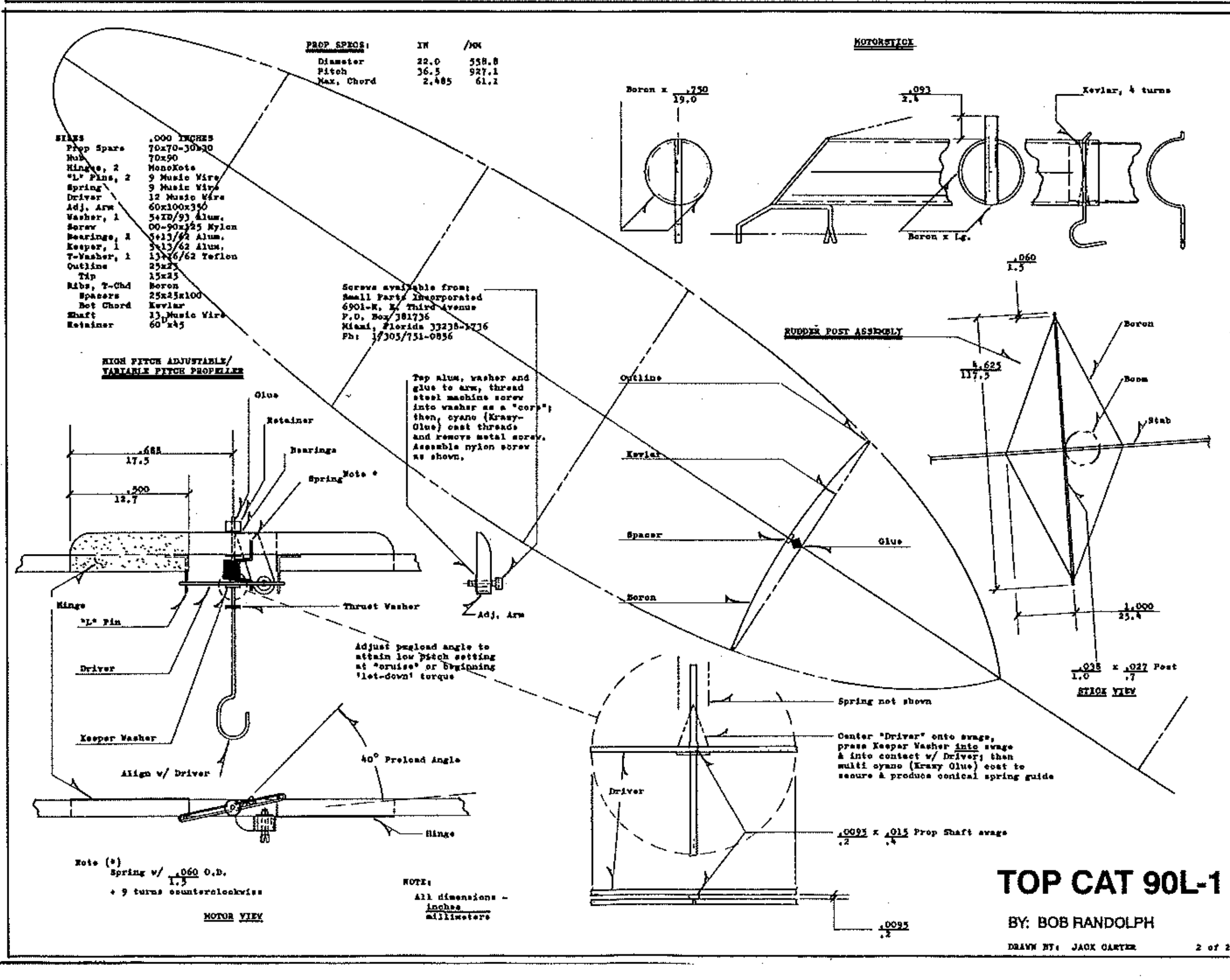
BY: BOB RANDOLPH

DRAWN BY: JACK CARTER 1 of 2

PROP SPECS:	IN	/MM
Diameter	22.0	558.8
Pitch	36.5	927.1
Max. Chord	2.485	61.1

SIZES	.000 INCHES
Prop Spars	70x70-30x30
Hub	70x90
Hinges, 2	MonoKote
"L" Pins, 2	9 Music Wire
Spring	9 Music Wire
Driver	12 Music Wire
Adj. Arm	60x100x350
Washer, 1	54ID/93 Alum.
Screw	00-90x125 Nylon
Bearings, 2	5+13/62 Alum.
Keeper, 1	5+13/62 Alum.
T-Washer, 1	13+16/62 Teflon
Outline	25x25
Tip	15x25
Ribs, T-Chd	Boron
Spacers	25x25x100
Bot Chord	Kevlar
Shaft	13 Music Wire
Retainer	60 D x45

Screws available from:
Small Parts Incorporated
6901-N, E. Third Avenue
P.O. Box 381736
Miami, Florida 33238-1736
Ph: 1/305/751-0856



Note (*)
Spring w/ .060 O.D.
1.5
+ 9 turns counterclockwise

MOTOR VIEW

NOTE:
All dimensions - inches / millimeters

TOP CAT 90L-1

BY: BOB RANDOLPH

DRAWN BY: JACK CARTER 2 of 2

Full-Size Plans Available . . . See Page 188

them to local merchants while they make their "toy runs."

Getting on the calendar early helps ensure that our event can be advertised along with all of the other Toys for Tots events announced on radio and TV. This should help us reach beyond our basic modeling audience and improve our public image.

The Flying Circuits club membership has averaged between 100 and 120 members in the three years we have held our Toys for Tots event. We have averaged about two toys donated per member. I challenge your club to do better.

But whether your club collects one toy or a thousand, remember that with every toy collected you are helping a needy child in your community, and the afterglow of that goes well beyond any scorecard.

Want to get started? Get in touch with your nearest Marine Reserves or recruiting station to find out how to get involved. If you do not have one near you, then consider contacting local churches or charity organizations with a similar mission and ask how you can help. The real key is to get involved with your community.

Don't limit yourselves to Christmas gifts, either. Chances are that you have local charities such as childrens' shelters in your area that could use some help any time of the year.

Enlist the support of your local hobby dealer and other area merchants for your events. Short of a free donation they can still help you with discounts on merchandise destined for charity or can help in other ways such as distributing flyers advertising your event and possibly in letting you use photocopiers or some other services to help prepare the flyers.

Their support does not even have to be toys or money. Many organizations could simply use good old-fashioned manpower involvement with a project. Get the reputation for helping out. Your club's good reputation *earned and demonstrated* by active involvement in community help projects certainly won't hurt next time you get pressure about your flying site.

Don't forget to get announcements to local newspaper, radio and TV community affairs bulletins.

Is it worthwhile? In many cases the toys collected and distributed by the Marines at Christmas are the only toys some children see. Our hobby of RC modeling is a *want* funded by our discretionary funds and not a *need.* Too many people in all of our communities still have needs that preclude giving gifts at Christmas—or any other time of the year. Simply by channeling some of your discretionary RC funds into a couple of toys you will be giving a needy child a treasured gift. □

FF Top Cat/Randolph

Continued from page 52

of the hinge. Dissolve the tacked-on glue with liberal amounts of acetone to allow the hinges freedom of movement; the MonoKote bond will not be affected.

Make the L-pins about an eighth-inch overlength. Glue them to the spars. Slip the shaft onto the hub; you'll need to exert preload torque so that the driver can be slipped onto the pins.

Make and fit the adjust-and-screw assembly so that it lines up with the driver arm and has clearance from both the spring end and the prop spar. The end of the nylon adjusting screw must be sanded or filed flat to prevent the driver arm from slipping off the screw end at high torque.

The prop blades are built flat in a cardboard female template. The boron ribs must be broken off so that they can be accurately positioned on the prop outline without extending beyond it. Glue on the ribs at the leading and trailing edges, taking care to keep them flat. Glue the balsa spacers under each boron rib on the spar centerline. When the glue has dried, mark the exact centerline with a felt-tipped pen.

Tack glue the prop spar on a prop block (40-in. pitch for the Top Cat 90, 36½-in. pitch for the 90L-1). Glue on the ribs from the tip end to the hub. Line up several ribs so that the marks on the spacers are over the center of the spar. Working with one rib section at a time, wet the outline as you glue the ribs to the spar. Wet the entire outline again so that it will hold the helical shape of the block.

When this assembly has dried, remove it from the block and fasten the other blade in the same manner. The prop frame is complete except for putting the camber in the ribs.

Place the prop on your building board with the rear of one of the blades facing upward and its tip end closest to you. Beginning at the tip, glue a length of Kevlar to the leading edge, positioning it directly over the first rib. Still working over the rib, tension the Kevlar to obtain the desired camber by squeezing it just past the trailing edge. Glue it to the trailing edge, make sure the tension is correct, and glue it again where it crosses the spar. Trim off excess Kevlar once the glue is dry. With a little practice the procedure becomes quite easy.

Take my word for it, boron prop ribs are unequaled for strength and lightness. I use Triple-R blue microfilm.

Rodemsky makes the solution, Bud Romak pours it, and I apply it. Though only two members of this ad hoc team have won the F1D World Championship title, I'm doing my best to correct that deficiency.

To achieve uniform pitch and smooth running, place the propeller on a prop block during covering. There's a trick to making the microfilm stick to the boron ribs. Moisten a brush with saliva and flick the end across the boron so that small droplets form at ¼-in. intervals along the rib length, then blow down gently as the material is applied.

Wing. Construction is conventional except for the tips, boron-stiffened wing posts, and my Kevlar bracing. I use old-fashioned built-up compression ribs because they can withstand the high-torque strain produced by the variable pitch. Since these ribs are not tapered, they are merely sliced off and sanded. Cut the wing spars at the dihedral points, and tack glue them flat.

Bend the wing tips around a 1-in.-dia. heated curling iron to make the small radius curves. Mark the center of each arc with a felt-tip pen, and moisten the wood in your lips before bending it. You'll have to repeat this several times, since the wood tends to spring back somewhat.

Cover the wing flat on the work surface, and add the trim. Carefully brush the dihedral joints with acetone, then bend and glue the wing to the correct dihedral angles. Add the two boron reinforcements to the wing posts. These are essential to stiffen the posts adequately. To achieve a good fit for the tissue wing sockets, I repeatedly snap my micrometer on the post ends until they've squeezed down to .058 inches.

While my bracing may seem excessive, it gives me the stiff wing I prefer, and the weight and drag of the Kevlar are negligible. The center rib will have too little camber after the wing has been braced. Correct this by gluing a tensioned Kevlar bowstring under the rib, using almost the same technique as for the prop rib camber.

Motor stick and tail boom. These are made from metal forms following standard soaking, rolling, and baking procedures. I glue the seams and the boron using a hypodermic needle. To avoid the curved tail booms that can result from glue shrinkage, I employ a Joe Foster technique:

Mount the large end of the boom form horizontally in a vise. Slip the baked boom onto the form, and clamp down the small end of the form about three-sixteenths of an inch to produce a bow. Glue the seam along the top of the form. The shrinkage will straighten the seam once the glue has dried.

Rudder. The trailing edge of the rudder-and-post is 4⅝ x 27 x 38/1,000. The leading edge is an 8½-in. length of boron. Pierce the post 1/16 in. from the end with the boron, and glue it in place. When the glue has dried, bend the boron around and pierce the other end, holding it in place while gluing.

Glue on the boron adjusting arm, and install a horizontal Kevlar brace before covering. I also make a razor slot in the post ends before covering, which makes it easier to adjust the stab later. Cover the rudder by placing it on a film frame and wetting the outline. Trim the microfilm with a hot wire, not with acetone.

Stabilizer. Cut the spars from tapered wood, and join the two halves by means of a scarf splice glued with CyA. Install the three ribs. Lay them on a flat surface for covering and trimming.

Tail assembly. Shim up the leading edge of the stab so that it's centered on the boom end, and glue it in place. Position and glue the rudder on the boom. The .0003 tungsten stab bracing is attached to the left side of the boom away from the rudder. Insert the boom in the motor stick. Use a jig to provide 1/16 in. negative incidence, and glue it in place.

Wing sockets and center-of-gravity. All that remains is to locate and drill the holes for the wing sockets.

Weigh the model. Make a dummy motor weight 1.25 times this amount and a dummy weight for the wing. Tack glue the dummy motor weight onto the stick midway between the prop shaft hook and the tail hook. Move the wing weight around until you can balance the model 56% from the wing front post, and mark the socket locations. This center-of-gravity location compensates for the small stab, short tail boom, and extremely high prop pitch at launch to provide the necessary stability.

The holes for the sockets go all the way through the stick. They must be carefully drilled to achieve the ½-in. stab tilt required.

VP propeller adjustment. Measure the torque required for cruise (level flight) by flight testing. Remove the prop, and adjust the preload tension so that the hinges just begin to open from low pitch when this torque is applied to the prop shaft.

Do more test flights to find the motor length and size that will use up almost all the turns when descending from top altitude. I call this the optimum motor. The old standard—one-third of a row of knots on landing—should not be used. Avoid overclimbing the site: Back off turns to reduce launch torque, and work up slowly to top altitude.

Make additional test flights using this optimum motor; back off less each time, and open the high-pitch screw. When you achieve a climb that begins with minimal altitude gain, use this torque value for all your flights. You'll find that when torque is kept constant, small adjustments with the high-pitch screw will result in outstanding altitude control.

Low-ceiling problems. Propeller adjustment for low-ceiling flight remains the same; flying, however, is more critical. The climb rate must be reduced by a factor of almost four to avoid the ceiling. This makes the initial climb rate close to zero.

I have found that the smallest difference in blade pitch at high launch torque will cause oscillation and loss of altitude. Also, launch speed and attitude are crucial. With very little forward thrust, you must provide some airspeed at launch so that the wing and stab can take hold. Finally, you must take care that your own body turbulence doesn't ruin the launch.

O-rings. In my opinion these are absolutely essential. They allow you to transfer a wound motor from torquemeter to model without loss of turns and torque. I use two O-rings on full motors, one on partial motors.

Partial motors. Different flying sites and/or weather conditions will alter the power requirements. Whether for a fun session, record trials, or a contest, the task

Continued on page 162

of finding the new optimum motor length and size is faster and safer when partial test motors are used.

The concept is simple. As an example, a quarter-size test motor requires a test stick that is exactly three-fourths of the distance between the hooks and that is weighted to exactly three times the lubed weight of the quarter-motor. Since only one-fourth of the full motor turns can be put in, the model should climb to one-fourth of its previous altitude and fly for one-fourth the time. The good news is that four times as many test flights can be made. The bad news is that any errors you induce through inaccurate procedure or faulty estimation of altitude will be compounded.

Most modelers overrate their ability to estimate an aircraft's altitude. I like to run a helium balloon up to the beams, then mark the line at exactly the 50 percent and 25 percent locations. This helps me make better height estimates.

Once I'm fairly certain of the optimum length and size for the test quarter-motor, I prefer to verify this with a half-motor if time permits. At the 1985 U.S. team selection finals in Akron, Ohio I was pressed for time and went directly from a 10:50 quarter-motor test flight to a full-motor official flight of 43:17. Still, this was only three seconds away from perfect correlation. Finding myself in the same situation flying Top Cat 90 at the 1990 Nationals, I went straight from a 10:23 quarter-motor test to the winning flight of 41:29, again deviating from perfect correlation by just three seconds.

I think you'll agree that partial-motor testing has great merit. Often full-motor flights will be slightly higher and longer because of warmer air near the site ceiling.

Easy to build, adjust, and fly, this National and World record-holding model has brought me great pride and pleasure. I hope it will do the same for you.

Recommended Indoor Suppliers

- Indoor Model Supply
  Box 5311
  Salem, OR 97304
- Micro-X Products
  5200 Seven Pines Drive
  Lorain, OH 44053
- F.A.I. Model Supply (FAI tan rubber)
  Box 3954
  Torrance, CA 90510
- Erv Rodemsky (microfilm)
  1600 Rockspring Place
  Walnut Creek, CA 94596
- Bob Oppegard (rubber cutters)
  140 East Golden Lake Lane
  Circle Pines, MN 55014 □

FF Duration/Haught

Continued from page 55

operation, and I highly recommend his products. Quality, service, and support are all excellent. A SASE to 1337 Pine Sap Court, Orlando, Florida 32825 will get you the latest information.

Despite the fact that it was conceived as a quickie model, and was whipped together in a few weeks prior to the Team Finals, Sheety Idea has exceeded expectations. It serves very nicely as a fly-anytime model and may be worth a serious look by those needing a trainer-type model or a quick-building replacement airplane.

High-dollar ½A. The emergency of the Shuriken and CS engines raises questions as far as what the future holds for ½A Gas as an AMA event. While I admit that a better product is a form of progress, the arrival of these engines on the scene threatens the nature of this event.

The fact that these engines drastically change the economics of the event could ruin the only AMA Gas event which would afford a beginner a fair chance to compete on even terms with a so-called expert.

Where, then, would a beginner Power fly? Pee Wee 30? Possibly, but in many areas this so-called beginner's event is as hotly contested as any on the field (and many competitors are the aforementioned experts). After PeeWee 30, there would still be no transition event for someone wishing to make progress in competition.