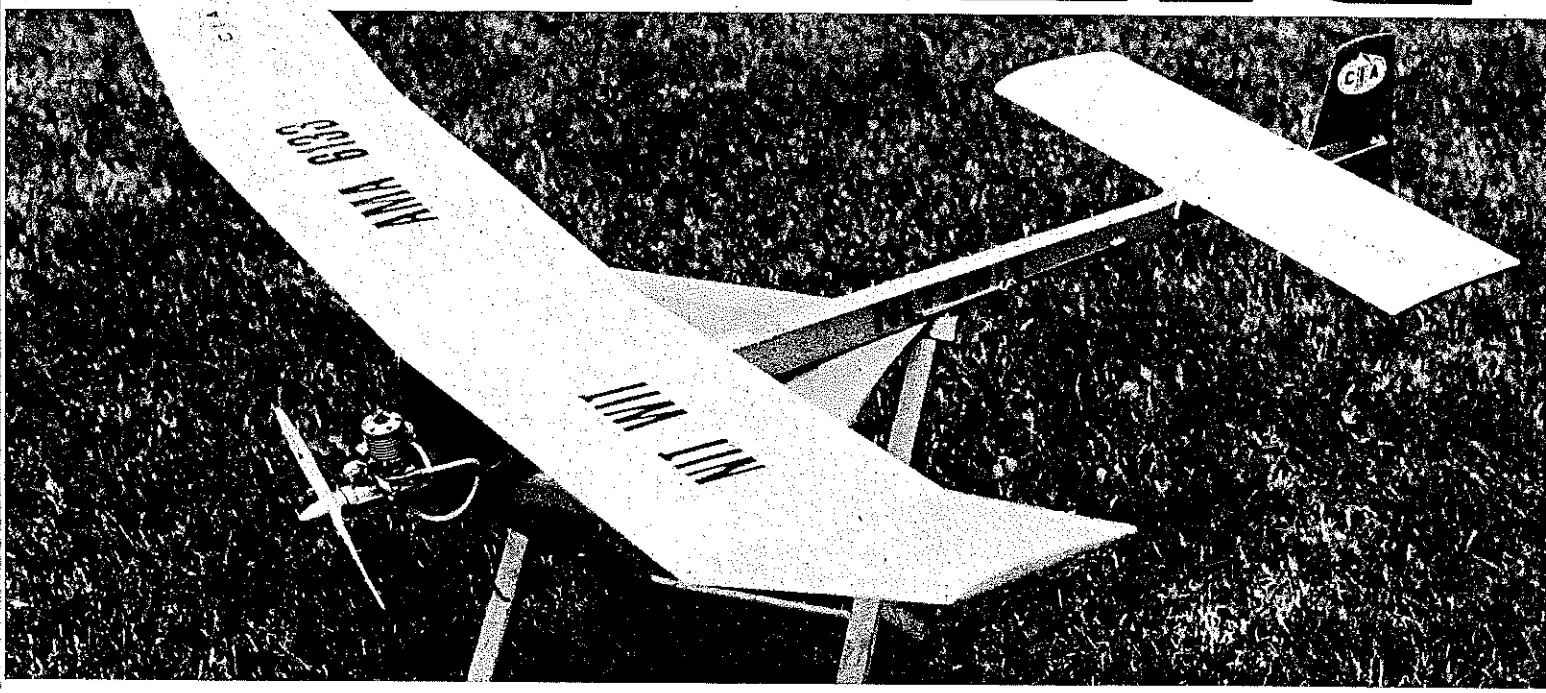
NIT WIT



Occupying the seat of honor is a late-model version with wing and stab covering of lightweight Coverite Micafilm. Black lettering on the wing is inexpensive stick-on vinyl found in the stationery department of large drugstores and the like. It's a state of the art model for Category III sites.

ACTIVE FF GAS enthusiasts who reside east of the Mississippi River are certainly aware of the seemingly endless struggle in recent years to obtain and retain suitable flying sites for competitions. Large sites have become all but extinct, and many of those currently available are much closer to the "small field" variety.

Some years ago, the AMA Contest Board recognized the need to tailor Free Flight competitions according to the size of the flying field. Categories I, II, and III resulted, each with special engine run and flight time limits. A separate National Record tally was kept for each of the three categories.

Whether intended or not, this action certainly instilled renewed vigor throughout the Free Flight community. The opportunity to win a contest and set a national record at the same time, even in a small-field situation, provided a basis for additional incentive and enthusiasm. The three-category system gave the small-site contestant a chance to make the record books again—a feat that had become increasingly more difficult at the smaller sites east of the Big Muddy. Small-field competitors were able to convert an assumed handicap into a definite challenge, and Category III contests eventually assumed a character all their own.

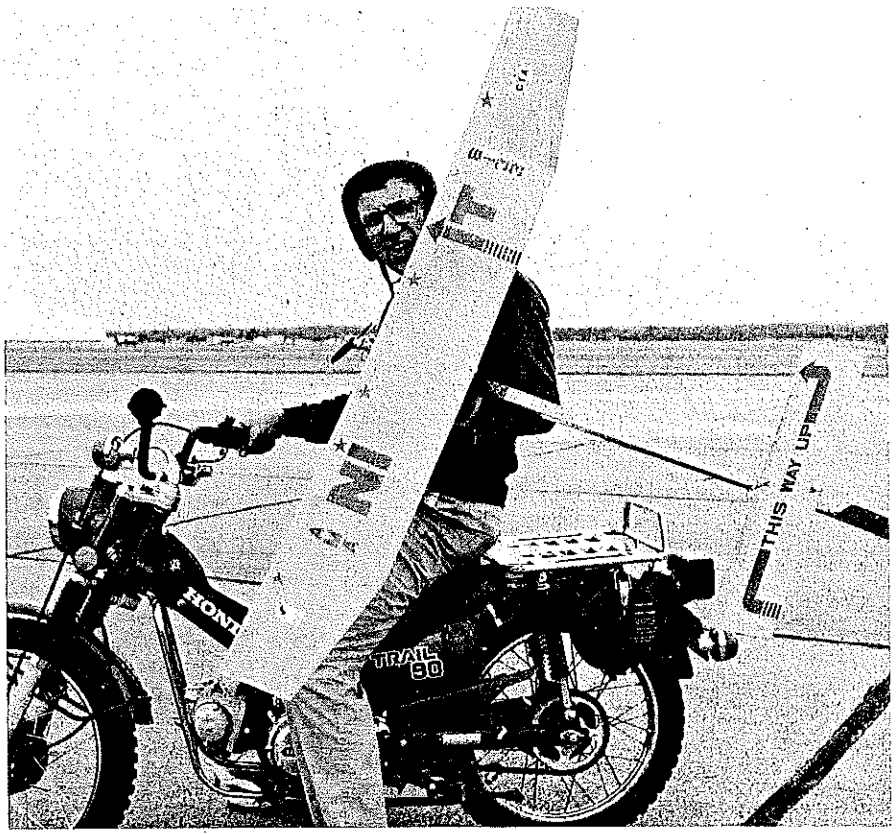
A case in point, with which I am familiar, is the succession of contests at Wright-Patterson AFB in Dayton, OH following the 1976 AMA Nats. (This affair opened previously-unavailable old Wright Field to area clubs for weekend competitions.) On given days of little wind drift, the site could sustain Category II activity. However, since the high fences that enclose the historic air base are virtually unscaleable, the four area FF clubs that sponsored meets there chose the 2-min. Category III limits. We had a long series of contest providing a steady diet of 5-sec. engine run and 2-min. max limits—on a superb flying site. With four different area clubs sponsoring contests on the same field on a near monthly basis, it was a rather simple task to track the progress of contestants in attacking the 5-sec., 2-min. challenge.

By the time a couple of flying seasons had passed, the W-P contestants were beginning to get a good grip on the 5 and 2 limits. It was not unusual to endure a marathon running into double digits of flyoff flights to determine a winner. In the course of this, model design and engine combinations were taking on an interesting trend. Simply by adding more power to existing models, such as with Schnuerle-ported engines, was not necessarily the ultimate answer. Total model weight was deemed an important factor in attempting to squeeze 2 min. of flight time out of a 5-sec. engine run, and the Schnuerles, although quite powerful, were also quite heavy.

By the spring of 1979, lightweight models built around lightweight engines were beginning to show considerable promise. Two of the initial success stories were Gib Robbins' superlight, rear-finned, 320 sq. in. Satellite powered by a Cox TD .09 and Gil Morris' early Toothpicks series using lightweight Fox engines. Gib's model was par-

The inception several years ago of FF Power model rules for smaller fields with 5-sec. engine run and 2-min. max required some new thinking to avoid being an also-ran. This model for Class A or B has shown its worth under these conditions. ■ Harry Murphy

In his inimitable tongue-in-cheek way, Harry Murphy says: "Note that the arrow is pointing directly at the real Nit Wit!" Not only is he a great model designer/flier, he puts together the witty CIA Informer newsletter. This pic, Joe Guylas, was shot at Wright Field.



ticularly significant, as it was the first consistent lightweight combination to begin edging the previously-dominant FAI Power entries out of the Class A trophy lines—culminated by winning Class A at the 1979 Lincoln Nats, a Category III contest.

In an effort to curb the marathon flyoff situation, the 1980 rules were changed to trim the Category III flyoff engine run to 4 sec. after the fifth max. This change all but eliminated the FAI Power model from contention, as it was found to be too heavy to glide 2 min. on a 4-sec. engine run. The 1980 Nats at W-P proved that the Wright Field regulars were up to the task by the fact that only one of the first-place trophies in the Power events was taken back across the Mississippi.

Ralph Prey for years has voiced the opinion that you do not have to use a super-hot engine to ensure a competitive engine/model combo. He has often stated that building the proper model around the engine, regardless of its comparative power, can produce very satisfactory results. This philosophy certainly is applicable to the successful present-day Category III models.

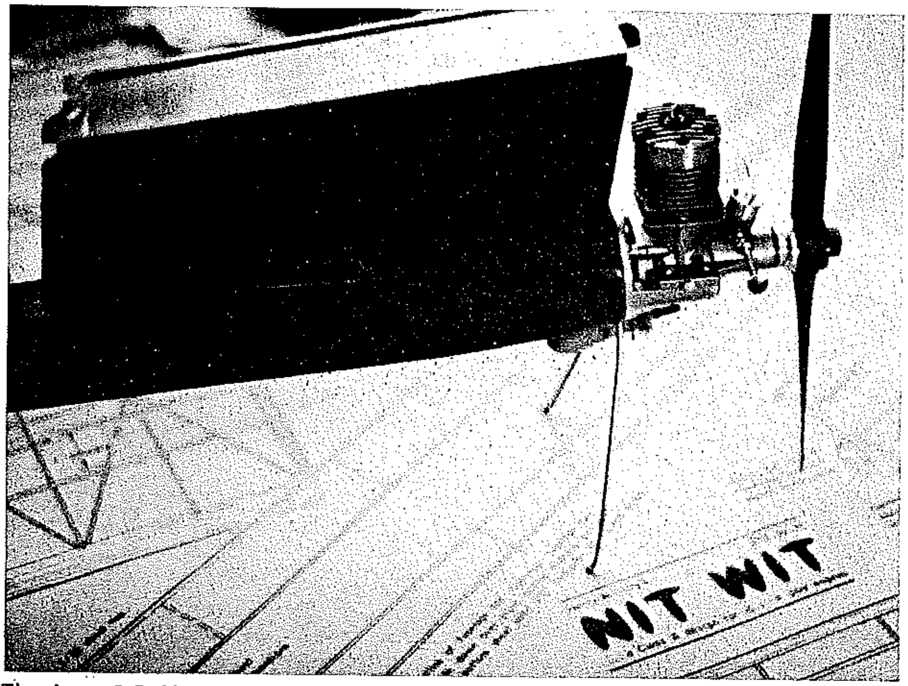
Surrendering to the old adage, "If you can't beat 'em—join 'em," the Nit Wit came about during the spring of 1980 and was completed just in time for the 1980 Dayton Nats. My intention was to create a smaller-than-normal model that would be speedy enough to reach the same altitude in 4 sec. that the previous year's bigger model had reached in 5 sec. A single second may not appear to be very significant, but it is 20% right off the top of the power pattern. A small model would also require a very lightweight engine if the total model weight was to be kept to a minimum. It would not be advantageous to simply build a smaller model if the total weight was not also reduced so that the altitude attained in the power burst could be sustained in the glide for the remaining 116 sec. This can be a very long time if the glide of the model leaves something to be desired.

After weighing each of my Class A engines, the lightest one by far was an old Cox TD .15 at 4¼ oz., so it was selected for the first Nit Wit. This combo and its optimistic pilot went to the 1980 Nats hoping to capture all the marbles in Class A. The first three official flights produced three maxes, and as I trotted downwind to retrieve the model from the third max, I was feeling pretty good about my new design. However, the model dethermalized onto the rear bumper of a parked van, knocking off the engine from the front of the fuselage. Since there was insufficient time to make appropriate repairs, I hurriedly put a Cox TD .051 in the same Lunar-Tic 240 that had won the ½A event for me on the previous day—and eventually chugged into fourth place. It was not a spectacular beginning, but I was convinced that this design would provide me with a lot of enjoyment in the future; it sure was a joy to fly.

Since the old Cox was a bit cranky on occasion, and some of the engine parts were difficult to obtain, I stepped up to a Supertigre G15 when I repaired the fuselage during the following winter. This power plant switch cost me over an ounce of weight penalty, but the power increase was considerable. First flights using a variety of 7-4 wood and fiberglass props indicated that the design could really handle excessive power, so subsequent flights were made with a ST G15/19 and even a special Doc Anderson ST G15/23 (which had a .23 piston and cylinder crammed into a G15 crankcase). Once trimmed for the desired power groove, the design appeared to be very forgiving with changes of the engine. This prototype Class A model was proving to be an excellent test bed for subsequent models of the same size and for possible scaled-up versions for the larger FF Power classes.

After repairing the original Nit Wit, I also crash-built a larger version (which I dubbed the Dim-Wit) prior to the 1982 Nats, which was fortunate to win Class D at Lincoln. This was also a Category III affair. This model was created with the same thoughts in mind: size and weight kept to a minimum. The Dim Wit was a 535 sq. in. model weighing only 26 oz. and sporting an O.S./Chamberlain .42. You can certainly raise a few eyebrows on the faces of your friendly competitors when you can state that your Class D entry weighs only 26 ounces. This particular lightweight engine was the brain-

Jim Walston's camera caught the Nit Wit a split second after launch. Jim ribs Harry about the basketball launch—says it looks as Harry is practicing a set shot. The ship moves.



There's an O.S. Max .25 plain-bearing engine on the front end in this photograph. Although it is about 65% larger in displacement than the usual Supertigre G15 power plant for this model, it is actually a couple of grams lighter. It goes to show that versatility is possible when considering lightweight engines for smaller-than-normal competition FF Power models.

child of a fellow CIA Club member, Meredith Chamberlain, who was first to take advantage of the discovery that the bore of the current O.S. Max .40 was a bit larger than the bore of the previous O.S. Max-H models. Should you mix up the parts you can produce a very reputable engine with an interesting displacement of .42 cu. in.

This article is supposed to be centered on a Class A design. The purpose of mentioning the parallel here is to point out that the superlight engine/model theory appears to work well for other clsses of Category III competition as well. Also, incorporation of the awesome power of the Schnuerle engine isn't absolutely necessary. Anyway, think small, guys—and think lightweight engines as well as airframes!

In that I have made a large issue of selecting a lightweight engine, maybe it would help to list some of the more readily available engines and their approximate weights as an aid in your eventual engine selection:

Class A	Ounces	Grams
O.S. Max .15	4.15	118
Cox TD .15	4.25	120
O.S. Max .20	5.5	156
Rossi .15	5.5	156
Fox .19	5.6	158
ST G15	5.6	158
ST G15/19	5.6	158
Class B		
O.S. Max .25	5.5	156
ST G20/23	5.8	165

Note that the plan suggests a commercial engine mount be incorporated. However, some of these engines can readily be mounted radially, which could eliminate the mount altogether and save another ounce or so of up-front weight—something you may wish to consider in arriving at your eventual choice.

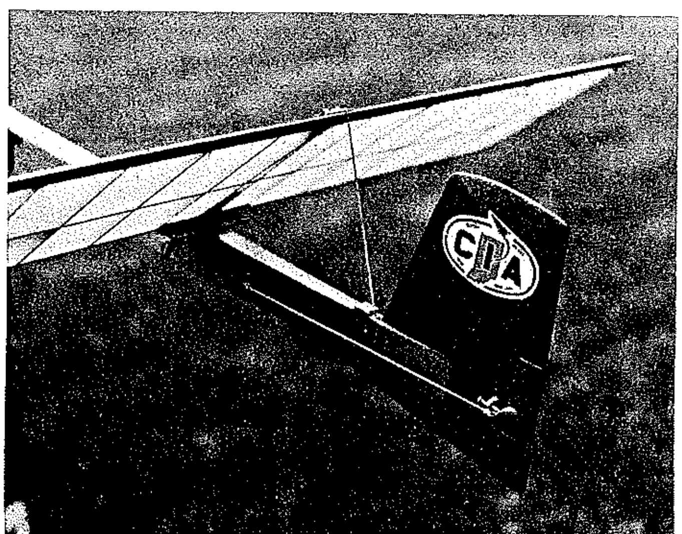
Construction. Ideally the completed model should balance at the desired CG location without the addition of any extra weight to either end of the fuselage. To achieve this, it is recommended that the wing and stabilizer be completely finished before work on the fuselage progresses very far. This will permit continual checking of the CG up to the final permanent attachment of the wing pylon atop the fuselage box. The wing pylon is the final item to be fabricated.

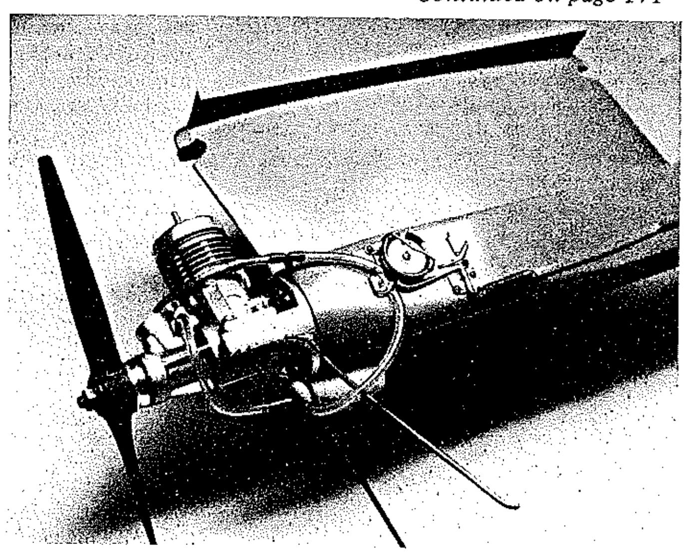
While the Nit Wit is not a particularly difficult model to construct, it is not a beginner's model, so I shall assume that those who may be interested in the details of its construction are also not beginners. Therefore, I shall attempt to refrain from taxing the integrity of experienced modelers with a superfluous explanation of where all the pins are to be placed. Also, at least one of the cyanoacrylate vendors suggests construction methods without pins at all. I am a "pin man" myself, but I certainly do not wish to be accused of being "old fashioned" by not recognizing progress when it is apparent.

Wing and stab. It is very difficult to start explaining the construction of a wing panel without beginning with those immortal words, "Pin the leading edge to the plans." Anyway, whatever your pet procedure—be it pins, 3M poster cement, or a concrete block—the L.E. and notched T.E. of the inner wing panels have to be properly located on the plans and "fastened securely in place."

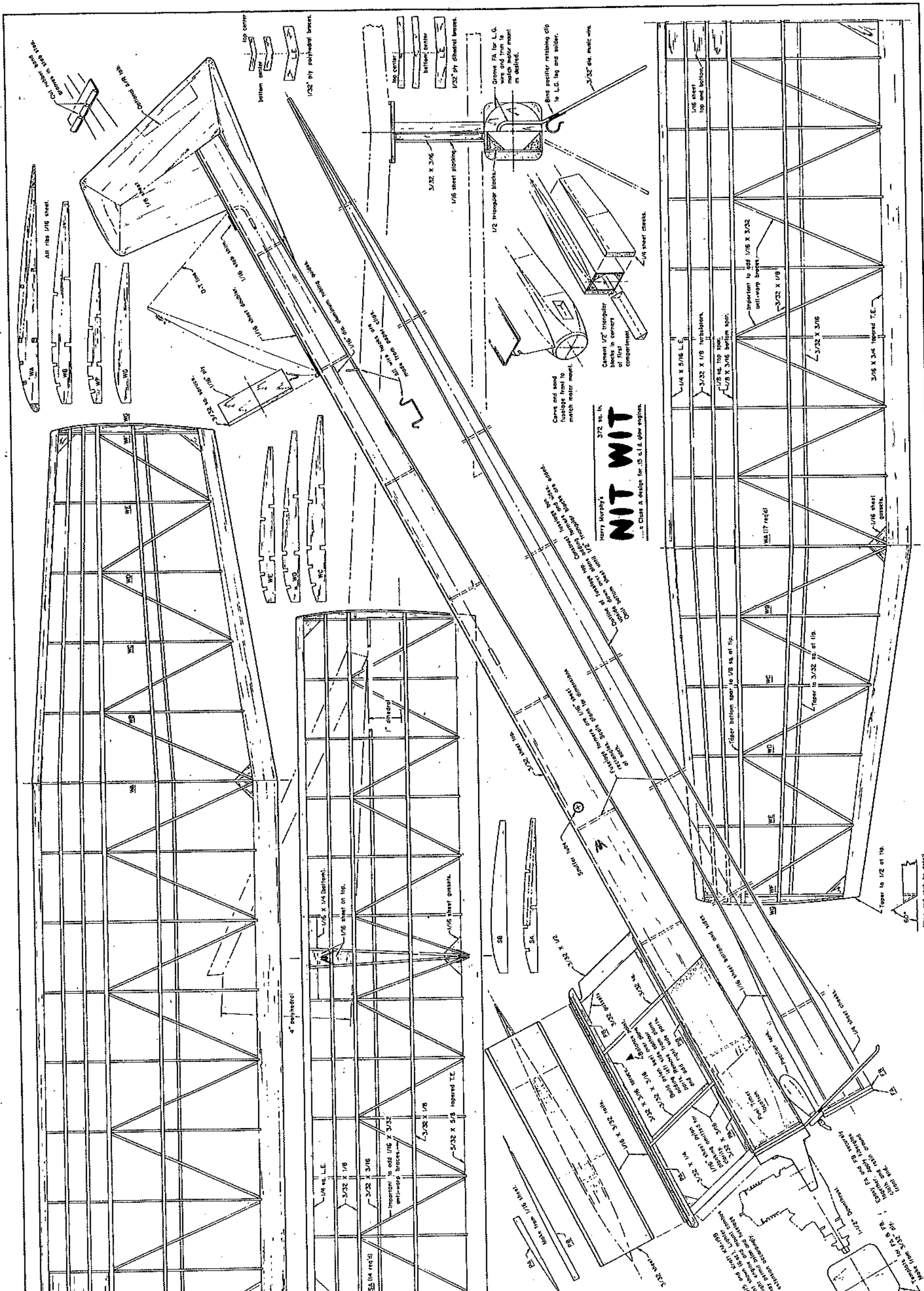
The T.E. of the wing tip panels are simply standard 3/16 × 3/4 tapered stock with the front edges cut away on a diagonal, resulting in a natural taper in thickness to the wing tip

Continued on page 171





Left: The no-nonsense rear end shows the auto-rudder and dethermalizer setup as well as the famous logo of the Central Indiana Aeromodelers. Actually, the author doesn't currently use the auto-rudder function. Right: The business end of the prototype model sports a Supertigre G15 on an aluminum Tatone mount. The timer is really a modified K-Mart camera timer behind a ½A Tatone flood-off faceplate. The additional trigger mechanism is for the auto-rudder, which was later deemed unnecessary. Note the T-fitting in the flood-off line to the top of the engine intake. This shoots enough fuel into the intake to stop the engine and dumps the rest of the fuel away from the model.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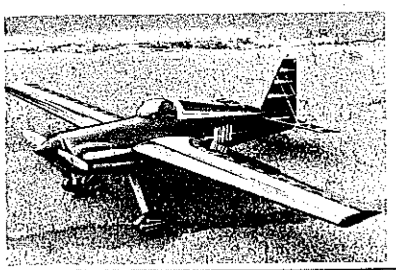

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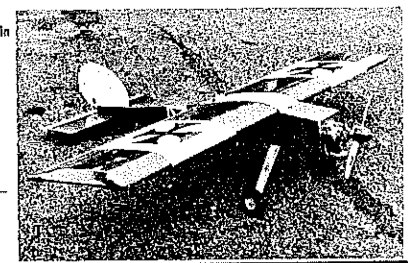

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the lettering must still be legible). A soft brush to remove eraser residue is nice to have, and you simply *have* to have a good pencil sharpener handy at all times. You should be using a fairly soft pencil (about a No. 2 lead) in order to get lines dark enough for reproduction by a blueprint machine. Those soft pencils should be resharpened after every few lines. Mechanical drafting pencils with extendable leads are reasonably inexpensive and much easier to sharpen than their wooden counterparts. One last important item is a good source of light, either natural or artificial.

Now you've got your paper taped to your drawing board, the light on, a ruler in one hand and a freshly sharpened pencil in the other. Now what? First, put down the pencil, then put down the ruler. Before we draw, we have to determine the two most important prerequisites for a well-drawn and nicely-executed design; *what* we're going to draw and *where* we're going to draw it.

I suggest that, before you attempt to put a design on paper in *graphic* form, you first have it on paper in a *mathematically-represented* form. I've included in this column a copy of my standard New Design Data Sheet. On this sheet, I have included all of the parameters I feel are important in either affecting the performance of the completed aircraft and/or are necessary for translating the numbers to the construction plan. There is significance to each of the parameters insofar as aircraft performance is concerned, but I want to deal strictly with those necessary for making the drawing, for now.

Start with the wing. At a minimum, you will have to have determined the desired span and area, length of the root and tip chords, flap size, and the specifications of the airfoil in terms of how thick it is and the location of the high point at both the tip and the root. An additional parameter which is not on the data sheet—but should be—is the leading edge radius (LER). Simply put, the LER is a circle drawn at the leading edge of the airfoil which determines the relative sharpness or bluntness of the airfoil. Lastly, you should determine the planform or shape of the wing, i.e. straight-taper, elliptical, constant-chord, swept forward or back, etc. (A helpful hint: straight-tapered wings with *straight* flap hinge lines are not only the easiest to build but fly the best! One man's opinion, but one who's been there!)

Now, repeat the above measurements for the stab and elevator. Span, area and proportion of total area to each are the primary concerns here. Tail thickness is still a subject on which the jury is out. My personal feelings have changed from preferring rather thick tails to a belief that they should be as thin as possible, given the need for structural rigidity.

Since the primary function of the fuselage is simply to hold the engine and keep the wing and tail in the proper relationship to each other, there are only a few numbers which are significant. How long is the nose going to be, where will you put the wing, and where will you put the tail? Again, while I feel there is a great deal of significance to what these numbers are, for this article's purposes I'll leave you to your own opinions and save mine for another time. Suffice to say, that you will have to decide on these parameters before you can commit them to paper.

Now that we have a good idea of what the airplane will look like aerodynamically we can go back to the drawing board and translate the numbers to a picture of an airplane. *(To be concluded next month.)*

Photos, comments, and news about Stunt should be addressed to Ted Fancher, 158 Flying Cloud Isle, Foster City, CA 94409.

Nit Wit/Murphy

Continued from page 76

itself. The bottom spars are secured in position next, with the ribs, in turn, to be cemented securely in place in the locations shown. Obviously, hold off putting in the ribs at the dihedral joints until the panels are joined. The $\frac{1}{8}$ sq. top spar at the airfoil high point should be cemented in place at this time to aid in retaining the proper alignment of the ribs as the panels are removed from the plan.

It is easier to add the $\frac{3}{32} \times \frac{1}{8}$ turbulators and rear top spar after all panels are attached together, but it is probably a good idea to add the $\frac{1}{16} \times \frac{3}{32}$ diagonal braces while

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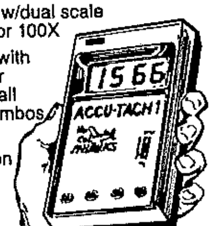

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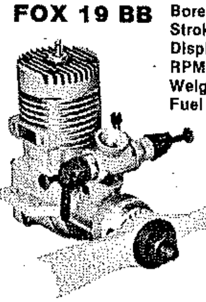

Schneurle porting, of course, rugged parts, lots of power, good idle. A unique design feature is that the upper cylinder casting can be turned with exhaust to either side, or back for rear exhaust installations. Structurally the Fox 19BB is without peer. The crankshaft is made from aircraft quality 8620 steel and is supported by two 11mm ball bearings. The con rod is bushed. The piston is fully machined from mehanite and runs in a leaded steel liner.

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each panel is secured flat to the workbench to aid in preventing any inherent warpage as the panels leave the plans. These diagonals should not be omitted; the airfoil is quite thin, and the internal bracing is necessary for anti-warp considerations.

The permanent assembly of the four individual wing panels to each other is the same as with any other wing. Make sure the mating ends are properly beveled and that each panel is properly aligned in plan view, along with the respective 4-in. polyhedral and 1-in. dihedral being incorporated. Add the 1/32 ply joint braces and proper gussets as indicated.

After constructing the wing, you will find the stab construction to be much the same. The plans are quite self-explanatory.

Both the wing and stab should be sanded and prepared for covering with your favorite covering material—preferably one with good tensile strength. The original model was covered with silkspan and appropriately doped with Randolph butyrate. This combination gave great strength to a thin airfoil. However, I found that the silkspan gradually absorbed fuel, causing the model's weight to slowly increase. On subsequent models, I have switched to Coverite's lightweight white Micafilm and can claim excellent results with this material—both for its fuel proof and skin stress properties.

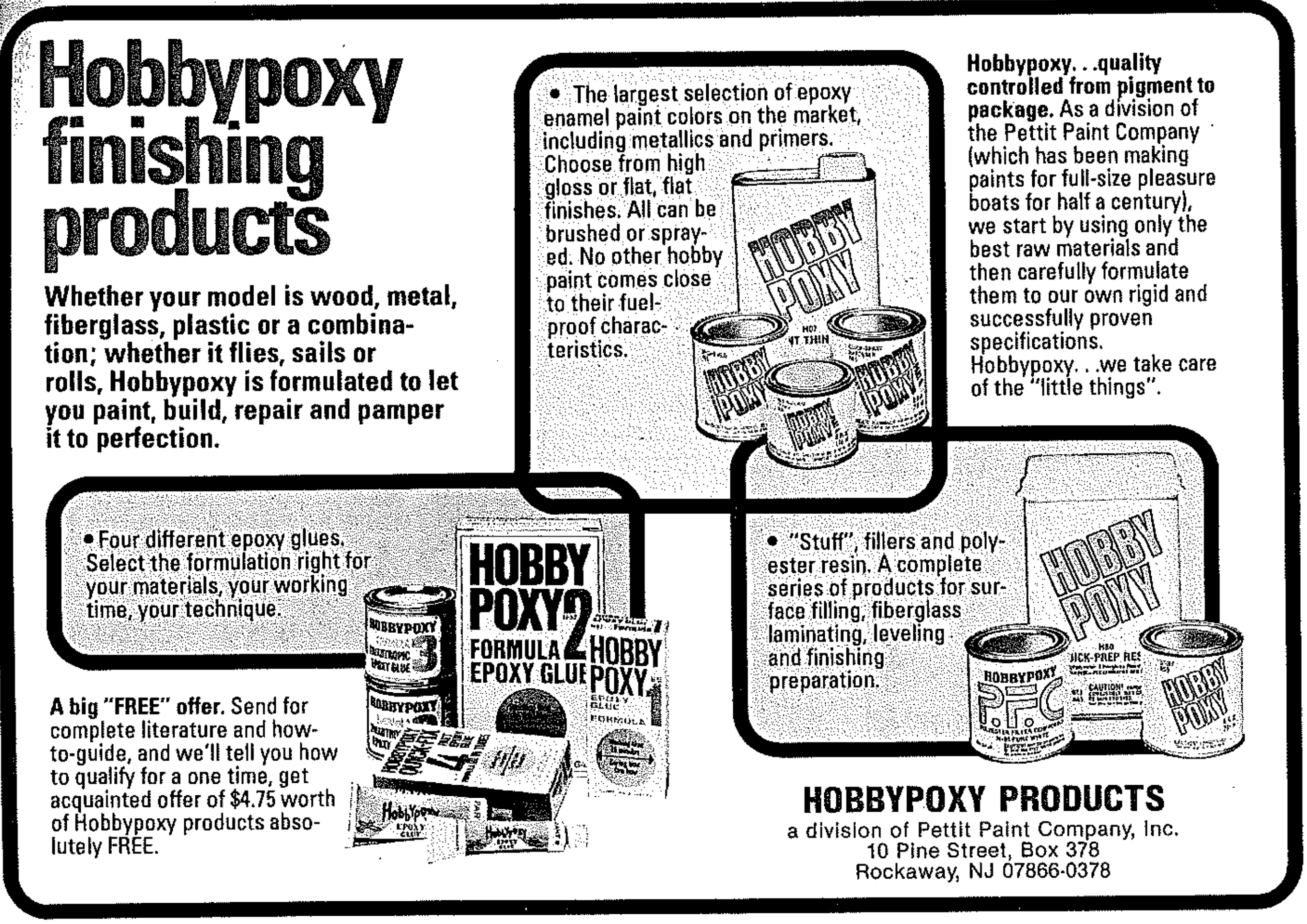
Fuselage. Parallel-sided, profile-type fuselages are certainly not very original (nor are the fat balsa box alternatives). The Nit Wit incorporates an interesting combination of a narrow, tapering balsa box with engine mount cheeks that make for a rather pleasing silhouette in both side and plan views. The selection of 3/32 balsa sheet for the fuselage top is most important. This should be firm C-grain stock, as it will become the backbone of the fuselage on which the pylon is to be attached.

The fuselage is built upside down over the plans with all of the rectangular-shaped 1/16 sheet formers cemented in place at the locations shown. The 1/16 sheet sides are assembled next. Be sure to add the ½-in. triangular balsa blocks to all four inside corners of the forward compartment before the 1/16 sheet bottom is attached. The ¼-in. sheet balsa cheeks can be added after the box is removed from the plans, but they should be pre-beveled before assembly for ease in carving. I have a small homemade 9-in. disc sander, powered by an old washing machine motor, that is ideal for these types of operations. It is also ideal for facing off the front of the fuselage prior to adding the 3/32 plywood firewall laminates. These can be epoxied in place after drilling the mounting holes and installation of the blind nuts to retain the engine mount. The mount is then attached, and the front end of the fuselage is carved and sanded to the desired shape. The groove for the bent 3/32 piano wire skid can be carved into the front of the firewall with an appropriate router held in a Dremel Moto-Tool.

The vertical fin is added next. It is cemented together over the plans from four separate pieces of ⅛ sheet balsa with the lower skid portion being of selected hard stock (basswood would also be okay for the skid portion). After the fin is attached to the fuselage, the 1/16 sheet doubler and 1/16 ply stab mount is added. The entire assembly is then ready for finish sanding.

At this point the engine, mount, skid, and fuel timer should be temporarily assembled, along with the completed stab, to approximately locate the all-important CG. This longitudinal point should be marked on the sides of the fuselage box, and then the fuselage laid on its side over the plans to check the fore and aft relationship to the balance point as marked on the pylon detail. Should the resultant balance point align itself such that the front edge of the yet-to-be-fabricated pylon would protrude forward of the firewall, the leading edge of the pylon can be angled rearward at its base or modified as per the plans.

The trapezoidal pylon keel is to be built over the plans with proper allowances for any necessary adjustment to the leading edge as just stated. The left side contour parts, PA and PB, and the slanting vertical 3/32 × 3/16 and 3/32 sq. strips can be cemented in place as the keel is secured over the plans. The right side parts may be added after the assembly is removed from the plans. After finish-sanding the pylon framework to a symmetrical shape, it is planked with 1/16 balsa sheet with the grain running parallel to the slanted uprights. Following proper trimming and



finish-sanding, the 3/32 sheet wing platform is securely cemented to the top of the pylon.

All that is left now is to determine the exact CG location with all parts and accessories assembled in their proper position; then the pylon is permanently cemented to the top of the fuselage box. I have often been asked if I have ever had a pylon separate from the fuselage using this method. All I can say is that I have used the built-up pylon feature and its simple direct cement attachment method for about 12 years, and I have yet to have a failure. Of course, the attachment should be made with either epoxy or a cyanoacrylate such as Super "T," as a cellulose cement might not be too reliable for this application.

I cover my fuselages with colored tissue or silkspan using nitrate dope. After a few coats of dope, I fog on a thin coat of clear K&B Super Poxy. I usually will add a heavier color coating of Super Poxy around the engine and pylon areas to ward off fuel problems as well as to add a bit of contrasting color to the model.

All of the other accessories are pretty much self-explanatory; most experienced modelers will incorporate their own pet attachments, anyway. An auto-rudder was incorporated on the prototype model, but this feature was omitted on the subsequent one, as it was deemed unnecessary. The model seems to have plenty of speed at the termination of the engine run to coast into a flat right-right glide pattern without the aid of an automatic "fin-kicker."

A completely finished Nit Wit should be thoroughly checked for warps and proper alignment. I am a firm believer in ample pre-flight preparations to prevent that first flight washout possibility. The stab should be perfectly flat and free of warps. Both wing tips should be washed-out about 1/16 in. and no more than 3/32 in. The left inner panel should be flat, and the right inner panel should incorporate about 1/16 to 3/32 in. of washin. All of these situations can easily be attained over a steamy teakettle; check the results repeatedly for a few days to guarantee permanent settings.

The rudder should be warped for no more than about 1/32 in. to the right to compensate for the right wing washin. The engine should be mounted with about 1/2 of a degree of left sidethrust.

Run the engine a number of times to ensure an initial timer setting of about 3 sec. This doesn't sound like much, but this model will get away quickly after the launch. The initial test hop is made with the prop on frontwards and the engine leaned out. I am a firm advocate of the vertical launch theory—which assumes that if the model is trimmed with no drastic warps of any kind and launched vertically, or almost so, the model will travel directly away from the ground; should it have a tendency to be a little out of trim, it will take more time than 3 sec. to turn around and come back at you! At least the hard ground moves much further away at a faster rate in a vertical launch than with the old ignition-era low angle-of-attack-type launches that we used for many years. Another argument: since the ultimate launch angle will be about 80° to the ground anyway, why waste all that time and submit to all those backward-mounted broken props from beginning with a near-horizontal low power trimming procedure and gradually moving up to an eventual contest launch mode when you can just point the model straight up with the engine screaming for a 3-sec. test hop and get all the scary agony over with in a hurry? It certainly sounds simple anyway, doesn't it?

Speaking of agony, at this point I shall volunteer to relieve you of any further claims or testimonials as to the contest potential of Nit Wit. The design has been a most enjoyable one for me. I hope you may find it just as enjoyable as well. See you downwind!

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the prop unloads when in flight; motor current decreases (perhaps 10-15%), and cooling air flows to the motor and battery (if you've applied what you've read in this series). Most importantly, the power information given is directly applicable in the various rules of thumb given previously.

Basically, there are two limitations which I recognize in determining where to quit pushing some motor. One is a current limi-