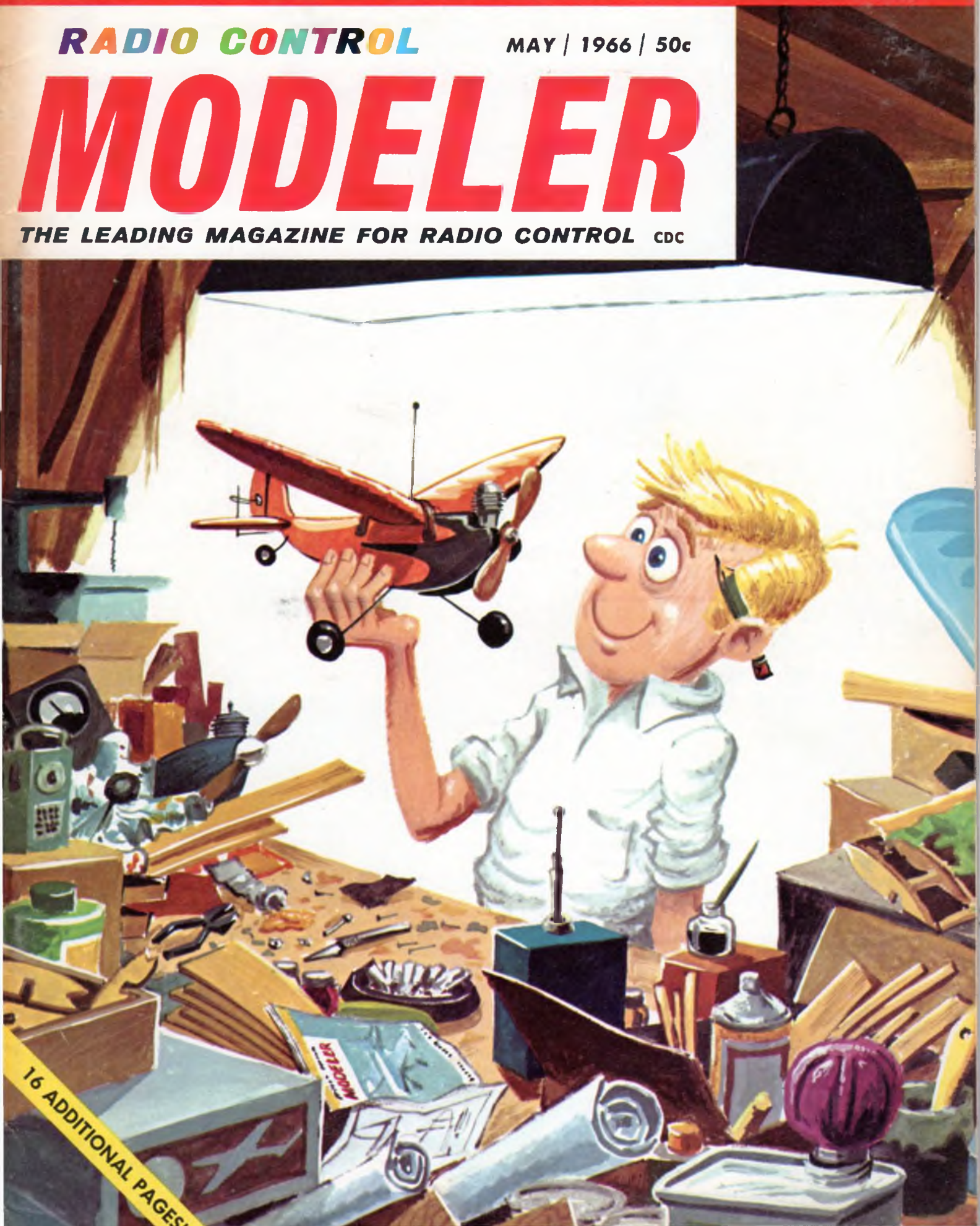
THE DIGIFLI: FIRST OF A NEW BREED

RADIO CONTROL MODELER

MAY | 1966 | 50c

THE LEADING MAGAZINE FOR RADIO CONTROL CDC



RADIO CONTROL MODELER

MAY 1966 VOL. 3, NO. 5

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DEPARTMENTS

The Cover

This month's cover is one of a series of four-color cartoon renderings of typical R/C situations by staff artist Bill Polvogt.

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1966 D.C.R.C. SYMPOSIUM

THIS year, the D.C.R.C. Symposium is slated for May 14-15, at the John Hopkins Applied Physics Laboratory, on Route 29, between Washington and Baltimore. This is the eighth year for this famous R/C seminar, and although many RCM readers have heard, or read, about the Symposium, many more are unfamiliar with this technical highlight of each year's activities.

The District of Columbia R/C Club, better known as the DCRC, is an outgrowth of a few interested modelers who used to meet with Dr. Walt Good to discuss various R/C problems that confronted hobbyists in the early days of radio control. This group met with Walt for about two years until the rapid growth of interest in R/C, and the limited size of Walt's basement, led to the formal organization of the club in August 1952.

In October of that year, and with a nucleus of 35 members, a Charter was obtained from the Academy of Model Aeronautics. Since that time the club has grown steadily so that now there are in excess of 150 members.

The ideas for FAI record attempts and other specialized events are not new to the members of the DCRC. In August, 1953, for example, the first of many FAI world record trials were held in an attempt to break the existing endurance record for an R/C model aircraft. As far as can be determined, no records were broken at this first attempt. In August 1954, however, FAI trials were again held and a new American flight record was set by DCRC member Jim Reed with a time of 1 hour, 1 minute and 59 seconds. Since that time the club has continued in its efforts to support the various FAI events, which has led to many more trials and the establishments of several new records for the U. S.

What was, perhaps, one of the most unique tests of endurance and pilot nerve occurred on February 23, 1954. This was an event held in conjunction with the Washington area's observance of Washington's birthday. Sponsored by Pan American Airways, and classed in the PAA load category, the pilot was to fly a silver dollar across the Potomac River. Considering the radio equipment of the day, this became a major project! The prize for the successful flight would mean a coveted PAA watch for the pilot. PAA officials also said that a special award would be given to any pilot who lost his plane in the river. When club officers found out that this "special award" was to the tune of $100 in cash, a plea went out to all members not to just go down and "dump one in!" The flight was finally made by Bill Nesbitt, who says that the PAA watch is still in fine working order.

The club symbol for the DCRC, in itself, depicts something of the history of radio control. As you can see from the emblem, the model is the old reliable "Rudder Bug" design by Walt Good, rounding the Washington Monument. The color of the Rudder Bug on the original design was orange, which eventually led to the establishment of orange as the official club color. This serves a double purpose. With an orange club shirt it is quite easy to see other members from afar as you tramp through the fields looking for lost aircraft. Many of the aircraft are also painted with the adopted color — the highest visibility color available, and one that shows up well in a green field or in the various trees that seem to attract R/C models.

In 1957, several club members proposed that there was a need for some type of technical conference that would allow an exchange of ideas on various subjects related to radio control. The first DCRC Symposium was held in the early spring of 1958. With the combined efforts of various club members, and the added support of the Academy of Model Aeronautics, this annual event has grown both in magnitude and national prestige.

Each year an attempt has been made to present articles of interest on all phases of the hobby. Many of these ideas and concepts have been substantially ahead of the present state of the art, so to speak. To our knowledge, this is the only annual meeting of its kind in the U. S., and as far as we know, the only one of its kind in the world. Printed copies of the Symposium proceedings have reached all corners of the earth where one will find species of homo sapiens commonly known as RC'ers.

Unlike other R/C get-togethers, the displays at the Symposium are limited in number, and are there by invitation only. Thus, the club tries to present the new and the unusual, which tends to compliment the overall theme of the Symposium, itself. It should be noted that, in the past, nearly all the major R/C system concepts that have enjoyed popularity have been presented in their earliest stages at the Symposium.

This year, as in the past, the speakers and audience will enjoy a truly scientific surrounding for the presenting of their papers. The staff of the John Hopkins Applied Physics Laboratory have indeed been ideal hosts, making available specialized equipment such as oscilloscopes, signal generators, power supplies, and closed circuit TV for presenting scope patterns on a large size

(*Continued on Page 74*)

CUNNINGHAM ON R/C

HOW TO BUILD A UNIVERSAL WING JIG FOR $2.50 . . .

WEBSTER'S Collegiate Dictionary defines a "jig" as . . . "to sing, play, dance, to jerk or jolt up and down, to move jerkily, or to work with the aid of a jig . . ."

This is as good a way as any to begin this month's journey into new ideas and practices, and after reading the following lines of chatter, you may well be dancing a jig. The principal quest this month is to make a jig that will allow you to build a true wing with a minimum of time and effort. Of course, the foam wing concept has made a big dent in the life of the modeling public in the past year and one half, but they are still not readily available at every hobby shop, and the dent that they make is not only in your thoughts, but sometimes in the hip pocket!

Balsa wings are not dead, in fact if you wish a different type wing, you must build it in the conventional manner. Very few kits feature foam wings, the predominance being balsa constructed, so what we need is a good jig that will allow almost any type wing to be built upon it. Or, in this case, in it.

There have been several jigs on the market for some time now, and not having been lucky enough to see any of them in action, our thoughts took a different direction in the development of the 'Thingamajig.' Actually, the ideas used are not new (is anything ever really **new**?), and were developed from several conversations with the FHD. (That's Friendly Hobby Dealer, in our parts, Ed Alexander). At any rate, jig ideas were dormant until one day it struck me that even though I had developed a pretty good building technique for wings, it still was a problem and took a lot of time. The fact that the wings did come out reasonably true meant that the idea was okay, but since I build about ten or twelve multi ships a year, and none is ever a repeat of the other, a new look had to be taken at the problem. Also, a couple of designs have been in the back of my head for some time . . . a ship with a wing similar to the "Streak" (Feb. 66 RCM), and a large stunt delta. The main item deterring the progress of these designs was a really simple way to build them.

This is a long way to tell you that for about two bucks, perhaps two and a half, you can build a jig that will solve the problem of building not only the normal type wings, but swept-back wings, (with dihedral if you wish), delta wings, triangular wings, symmetrical stab sections, and so on.

The pictures and drawings are reasonably clear as to what the finished jig looks like and how the components are made. The first wing built on the jig was a swept wing for my new stunt design, the Scimitar (named for the curved sword of the East). This wing was completed in less than five hours and led me to believe that the two bucks were pretty well spent on the jig.

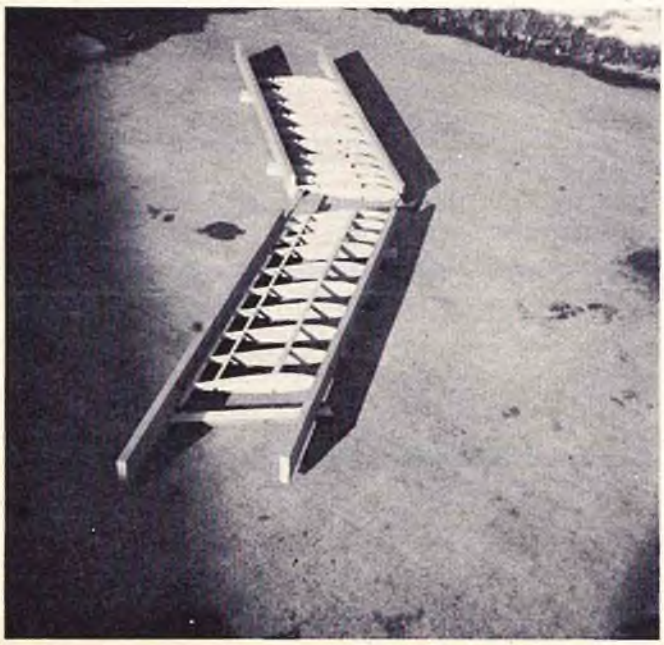
First, purchase from one of your better lumber yards, a sixteen foot piece of 1" x 3" white pine. This is pretty high-priced as lumber goes since this grade of wood is used only in finish work. Make sure that they pick out a good, straight piece.

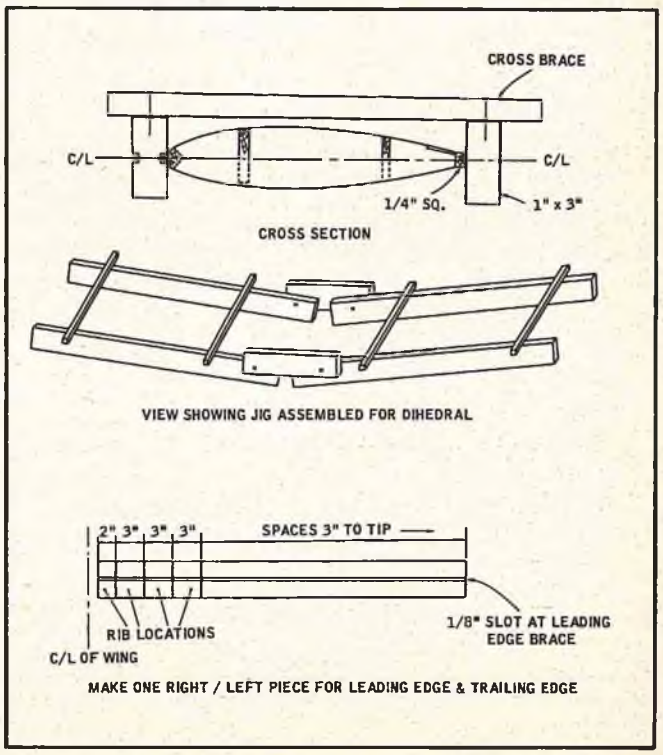
Next, decide just how big a jig you wish to make. In my case, I decided that a length for each wing panel of 39 inches would handle just about any wing that I wanted to build.

If you have a table saw, you are in business for the next step. If you do not, find a friend that does and get him to do the hard work. Locate the exact center of the three inch dimension. As you no doubt know, dressed lumber is ⅜" less than the nominal dimension, so be sure you have the center. When this has been done, set the rip guide on the table saw to give you a cut down this line. Set the blade so that the depth of the cut is not more than ⅛" deep. Cut both sides of two pieces 39" long. On the other two pieces, again

(*Continued on Page 60*)

Simple wing jig can be built for $2.50 and used for every type of wing. Johnnie Casburn's 'Sweeper' under construction on prototype.





EDITOR'S MEMO

by Don Dewey

This month, RCM adds another sixteen pages and welcomes a new member to the Art Department.

The first addition was accomplished in order to bring you even more material each month, as well as making room for the increasing number of new advertisers in the R/C field.

The addition to the Art Department, under the direction of Dick Kidd, is in the person of Bill Polvogt. Bill, who created this month's cover, is an active RC'er, and is nationally known for his cartoons which appear regularly in the Saturday Evening Post, Look, True, and many other magazines. In addition to being listed in Who's Who In American Art, Bill's work has been included in a number of collections, including The Best Cartoons of 1958. We're both honored and privileged to welcome Bill to the staff of RCM.

●

Speaking of the RCM staff . . . many modelers write to various columnists with questions, ideas, and photographs, which is appreciated by all of us at RCM. In order to save time, here are the addresses of the various staff members to whom you may write directly: Bernie Murphy, Kits and Pieces, P. O. Box 144, Linthicum, Maryland; Ken Willard, Sunday Flier, 665 Riviera Drive, Los Altos, California; Jerry Kleinburg, Top Out, 2512 W. Craig Place, San Antonio, Texas; Chuck Cunningham, Cunningham on R/C, 5333 Wooten Drive, Fort Worth, Texas; Mert Mischnick, Roostertail, c/o I.M.P.B.A., 2405 19th Avenue, Broadview, Illinois. All general articles and editorial material should be sent to RCM at P. O. Box 487, Sierra Madre, California. It's extremely difficult — in fact, impossible — to please all of the people all of the time, but we try. So, whatever you want to see in RCM, or discussed by the various columnists, let them know. We're here to give you what **you** want, and a proper balance between the various aspects of our sport and hobby can only be attained when you speak up as to your druthers. . . .

●

We read quite recently, in another model publication, that "Goodyear progress is quite disappointing." This was followed by a suggestion that these ships be flown with .19's instead of .40's. The N.M.P.R.A. Goodyear event is an experimental one — but an event that has captured all of the thrills and excitement of full-size Goodyear racing, for both the contestant and spectator alike. There are many, many problems to be ironed out before it, or variations of it, become an "everyman's event." It will take experimentation, participation, and the constructive work of nearly everyone interested in the event.

Regardless of how "disappointing" the progress seems to be to the author of that editorial, this "progress" has taken a lot of work on the part of quite a few people, from Coast to Coast. Perhaps it would be interesting to find out just how much of that "progress" resulted from work on the part of the writer of that editorial? Just how much effort has **he** expanded toward securing the future of this event? From the statement suggesting that a .19 be used in the same ship instead of a .40 cu. in. engine, it becomes apparent that he is not even familiar with the event or flying characteristics of these ships. For that writer's edification, an R/C model designed for competition under existing N.M.P.R.A. rules and regulations will **not** fly with a .19. If it **will** fly well with a .19, it will **not** be competitive in the event.

The Goodyear event is a **racing** event designed for **racing** aircraft. A lot of ground work **is** necessary in order to make it an event in which all racing enthusiasts can participate. It is **not** designed for 600 square inch, escapement powered rudder-only airplanes with .09 engines.

Perhaps this is where he became confused.

●

Before relegating this month's column to past history, an overdue note of thanks to Bernie Murphy for his excellent work in designing the Digitrio emblem.

Excelsior.

THE DIGIFLI

BY DICK SMITH AND ED THOMPSON

DESIGNED TO UTILIZE THE FULL PERFORMANCE POTENTIAL OF THE RCM DIGITRIO, THE DIGIFLI IS ONE OF THE FINEST R/C AIRCRAFT CREATED SPECIFICALLY FOR PROPORTIONAL SYSTEMS.

PREFACE BY ED THOMPSON

AS I mentioned in a previous issue, Dick Smith and I cooperated on an airplane designed for the Digitrio. This craft evolved in order to take advantage of the Digitrio's small physical size, low weight, and infinite control. For beginners, I recommend that they have a veteran flyer available for preliminary flight tests and for general assistance. The tyro should also use a "hot" .23 and balance the plane slightly nose heavy from the C.G. shown on the plans. With a hot .35 or .40 this plane is a "screamin' demon" and will require the full-time efforts of the pilot for best results!

Although the Digifli is very fast, the biggest item which will require your attention is its "quickness." If you do not know the difference between "fast" and "quick" you will find out when you put this bombshell in the air!

The contest ability of the Digifli will depend upon the individual pilot. A successful pattern airplane has, for the most part, fallen into the large, smooth, docile type. While this plane is docile in the attitudes you may place it, it will **not** do the flying for you. In other words, here is a plane that you will have to fly, and its performance will be measured by the pilot's proficiency. Although we have not flown this plane on reeds, I shudder to think what the outcome might be with a .40 up front! If you have even felt inadequate while flying one of the current crop of free-flight reed ships with a digital system, now is your chance to step into the picture and feel like a pilot!

There have been many books written on model aircraft design, theory, and practice, none of which were used on the Digifli! Regardless of what methods are used in the design of an R/C airplane, in the final analysis a good ship is one that pleases the owner, and this airplane really "turns me on!" The airfoil is a S-T Special, or as a lot of designers say when they cannot think of a better answer — "a highly modified Clark-Y."

Dick Smith did all of the actual construction work on the aircraft and is responsible for its excellent appearance. He is quite a designer and deserves the lion's share of the credit for the Digifli.

THE DIGIFLI . . . . . BY DICK SMITH

In 1964 I was introduced to Ed by a mutual friend and was advised that he was working up a proportional outfit. I fully expected to see (as I had previously run into these "do-it-yourself-guys") a "Mickey Mouse" system. I took little or no interest in the unit for that reason. I was a reed man, unsatisfied with the performance of the proportional units available, except for a few isolated outfits of various makes.

Our mutual friend died suddenly in an aircraft crash shortly after Christmas 1964, which tended to bring Ed and I a little closer together. As our friendship grew, Ed spoke several times of his unit, but being a little hard-headed, everything just bounced off. That is, until the evening he brought it over to my house to give me a bench demonstration.

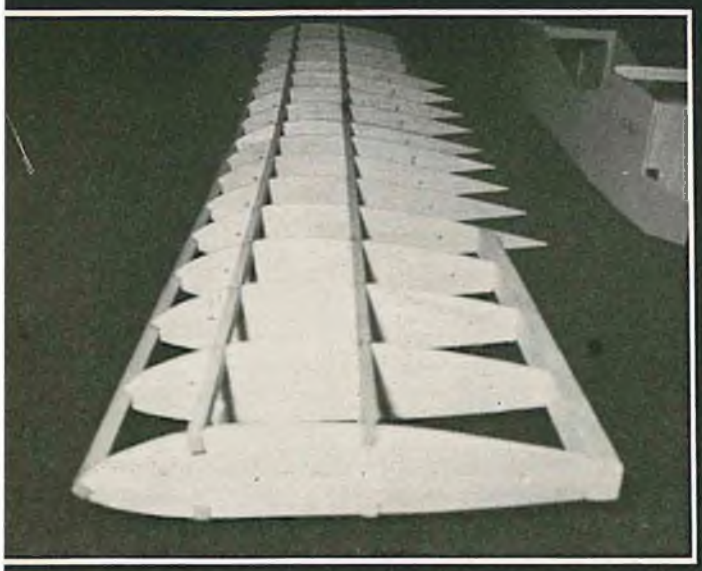
By now, Ed was fully aware of my attitude toward proportional units, thus came armed to the teeth with test conditions, propaganda, and the hope of brainwashing me. I would like to point out that, at that time, my proportional flying experience was very limited, and practically all of my opinions were based on the observations of other modelers flying this type of equipment.

Enter Ed . . . arms full of equipment — transmitter, receiver, servos, wiring harness, battery packs, etc., etc. From that point on, all I got to say was "Hi, Ed," because for the next four hours I listened and watched his demonstrations of servo power, torque and centering capability, and wild dissertations as to which component did what! After many cups of coffee, extremely painful eardrums and sleepy eyes, I agreed to put the gear into one of my ships and try it out. Initially, I made this concession in behalf of my own self-defense, but soon after, I learned rapidly that I was in for some real fun and many, many hours of enjoyable flying.

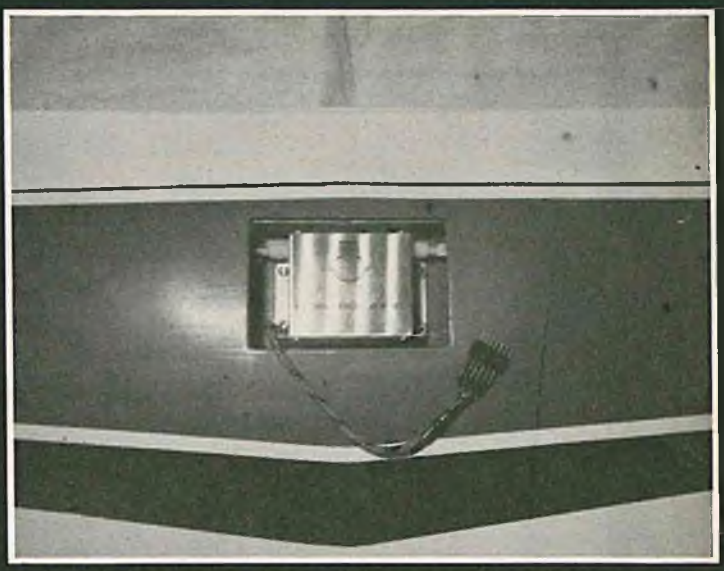
For the prototype, Ed had built up the old kit type Citizen-Ship servos, employing his own amplifier boards. Each servo had amplifier boards slightly different from the other and utilizing different components. This, of course, was done to check each one for maximum reliability.

The next day was a difficult one at work, and all my concentration was toward a nice supper and early bedtime that night. My wife prepared the nice supper, all right, but about the time I swallowed the last bite — re-enter Ed, arms even more loaded than the previous evening and a greeting consisting of "You ready?"

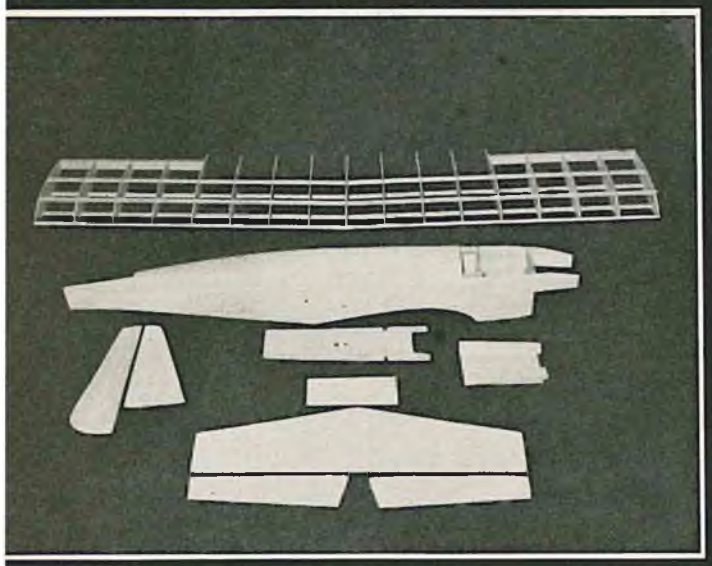
Ed took his armful, and I my weary body out to the shop. Jan put on the 48-cup coffee pot and we went to work. Along about 1:30 A.M., all the new



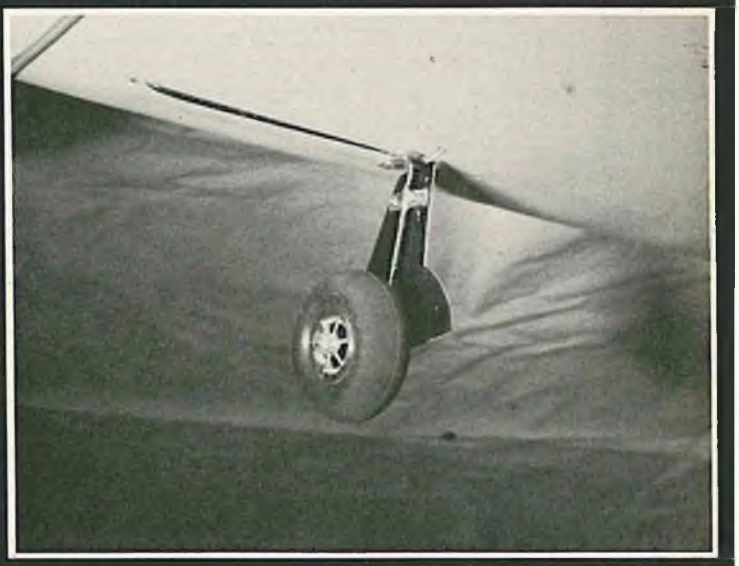
Digifli wing shows simple, strong, and lightweight structure.



Digitrio aileron servo mounted in wing.

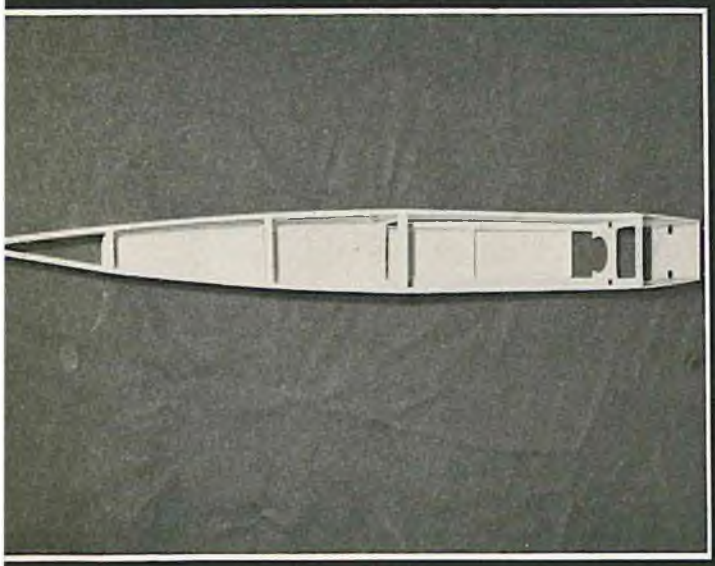


Basic airframe is keynoted by simplicity.

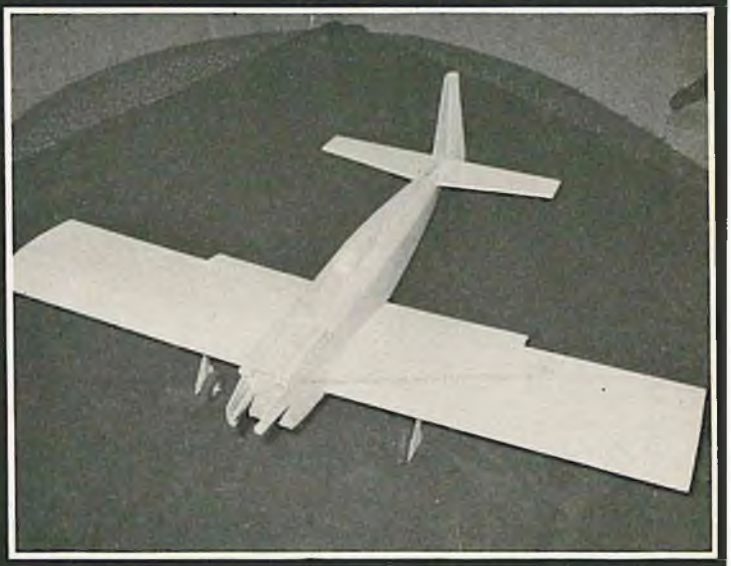


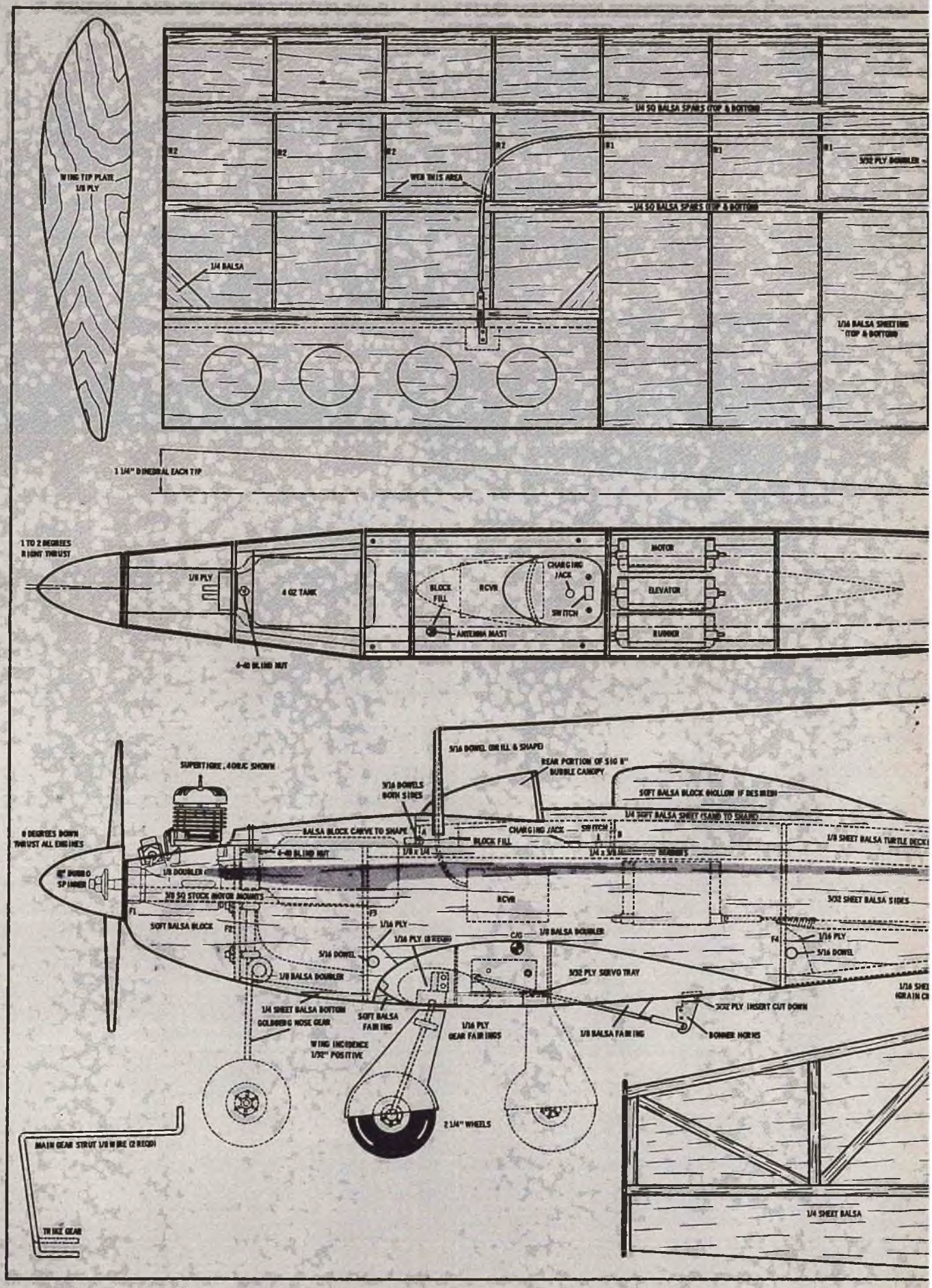
Standard low-wing gear configuration dressed up with wheel fairings.

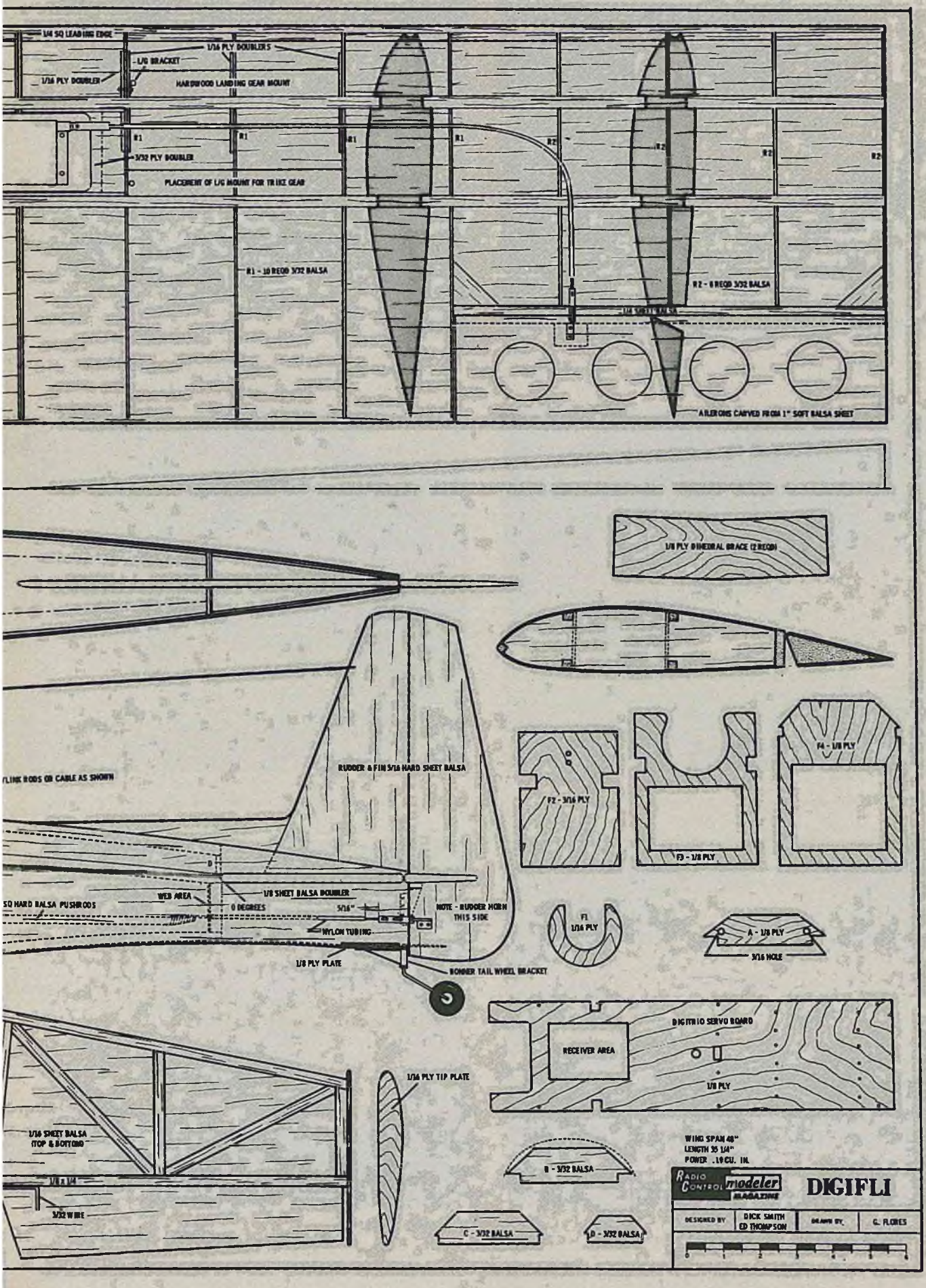
Basic fuselage structure — light but strong.

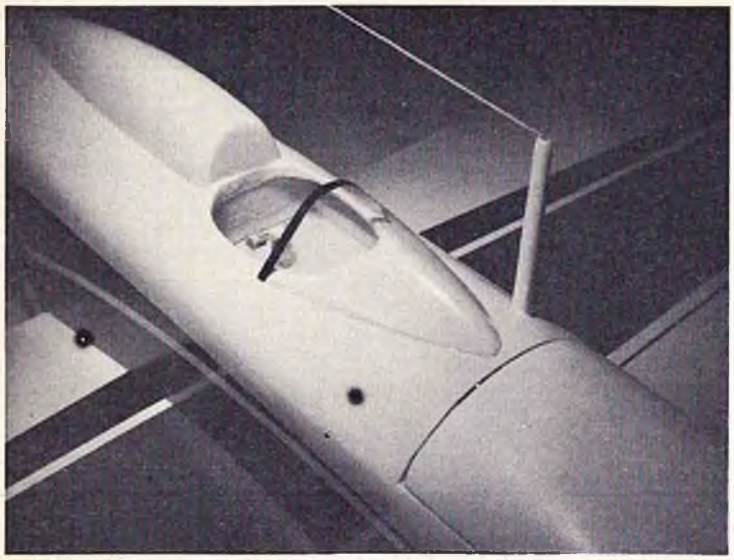


Completed airframe ready for finishing.

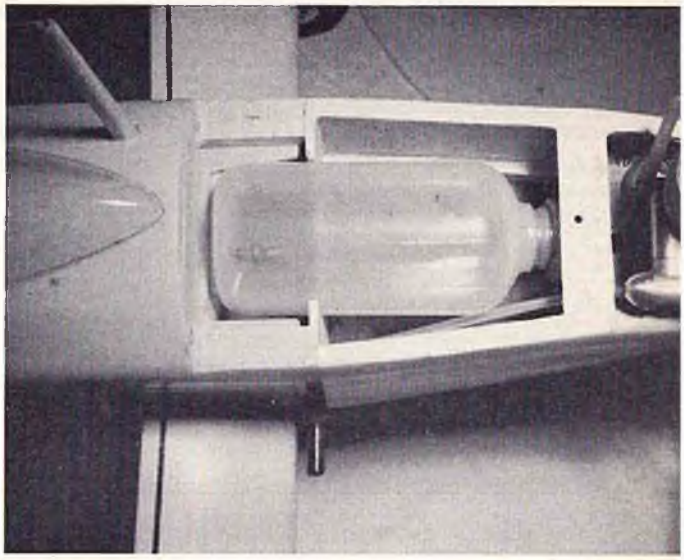



WING TIP PLATE 1/8 PLY
1/4 SQ BALSA SPARS (TOP & BOTTOM)
WEB THIS AREA
1/4 BALSA
1/16 BALSA SHEETING (TOP & BOTTOM)
1 1/4" DIHEDRAL EACH TIP
1 TO 2 DEGREES RIGHT THRUST
1/8 PLY
4 OZ TANK
BLOCK FILL
RCVR
CHARGING JACK
SWITCH
ANTENNA MAST
MOTOR
ELEVATOR
RUDDER
6-40 BLIND NUT
5/16 DOWEL DRILL & SHAPE
REAR PORTION OF SIG 8" BUBBLE CANOPY
SUPERTIGRE .40SIC SHOWN
3/16 DOWELS BOTH SIDES
SOFT BALSA BLOCK (HOLLOW IF DESIRED)
1/4 SOFT BALSA SHEET (SAND TO SHAPE)
0 DEGREES DOWN THRUST ALL ENGINES
BALSA BLOCK CARVE TO SHAPE
1/8 SHEET BALSA TURTLE DECK
8" DIAM'D SPINNER
1/8 DOUBLER
3/8 SQ STOCK (MOTOR MOUNTS)
5/32 SHEET BALSA SIDES
SOFT BALSA BLOCK
1/16 PLY
1/16 PLY (2 REQD)
C/G
1/8 BALSA DOUBLER
5/16 DOWEL
3/32 PLY SERVO TRAY
1/4 SHEET BALSA BOTTOM
GOLDBERG NOSE GEAR
SOFT BALSA FAIRING
1/16 PLY GEAR FAIRINGS
1/8 BALSA FAIRING
3/32 PLY INSERT CUT DOWN
BONNER HORNS
WING INCIDENCE 1/32" POSITIVE
2 1/4" WHEELS
MAIN GEAR STRUT 1/8 WIRE (2 REQD)
TRIKE GEAR
1/4 SHEET BALSA

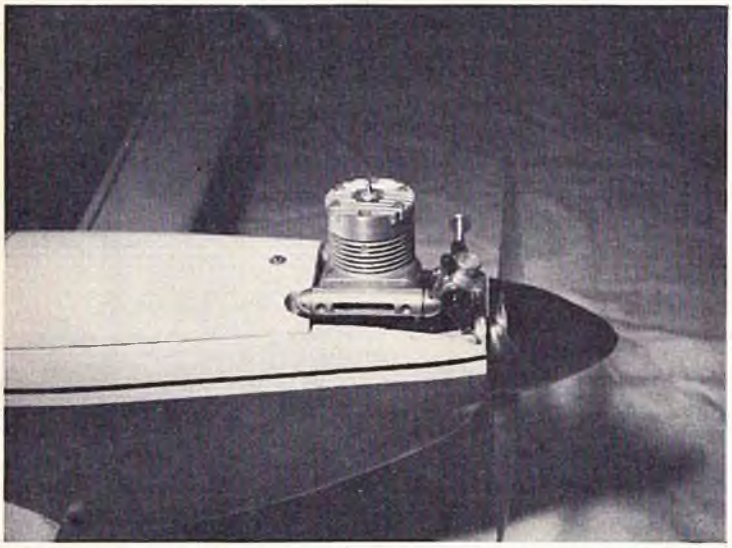

1/4 SQ LEADING EDGE
1/16 PLY DOUBLERS
L/G BRACKET
1/16 PLY DOUBLER
HARDWOOD LANDING GEAR MOUNT
R1
R2
3/32 PLY DOUBLER
PLACEMENT OF L/G MOUNT FOR TRIKE GEAR
R1 - 10 REQD 3/32 BALSA
R2 - 8 REQD 3/32 BALSA
AILERONS CARVED FROM 1" SOFT BALSA SHEET
1/8 PLY DIHEDRAL BRACE (2 REQD)
RUDDER & FIN 3/16 HARD SHEET BALSA
F2 - 3/16 PLY
F3 - 1/8 PLY
F4 - 1/8 PLY
WEB AREA
1/8 SHEET BALSA DOUBLER
0 DEGREES
5/16"
NOTE - RUDDER HORN THIS SIDE
NYLON TUBING
1/8 PLY PLATE
BONNER TAIL WHEEL BRACKET
F1 1/16 PLY
A - 1/8 PLY
3/16 HOLE
RECEIVER AREA
DIGITRIO SERVO BOARD
1/8 PLY
1/16 PLY TIP PLATE
1/16 SHEET BALSA (TOP & BOTTOM)
1/8 x 1/4
3/32 WIRE
B - 3/32 BALSA
C - 3/32 BALSA
D - 3/32 BALSA
WING SPAN 48"
LENGTH 35 1/4"
POWER .19 CU. IN.
Radio Control Modeler Magazine
DIGIFLI
DESIGNED BY
DICK SMITH
ED THOMPSON
DRAWN BY
G. FLORES



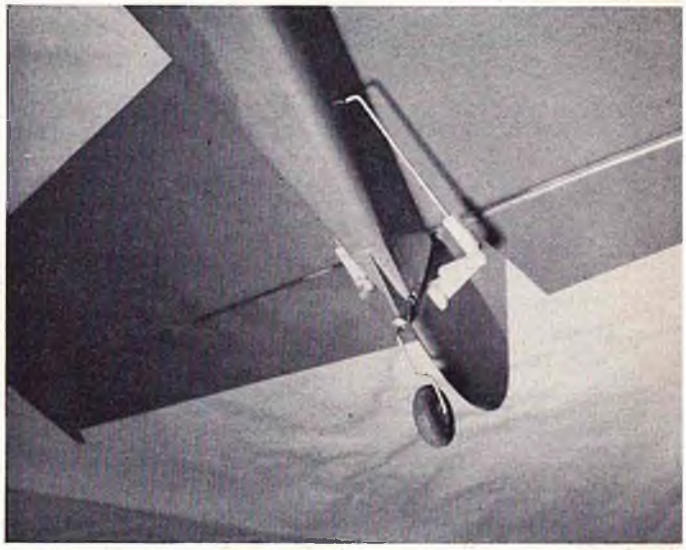
Cockpit and antenna post. Windshield is rear section of 8" Sig canopy.



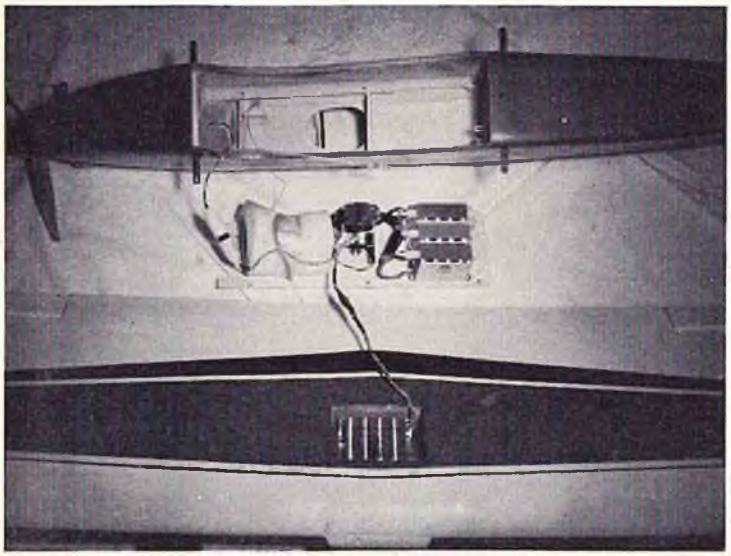
Details of tank installation and hatch hold-down.



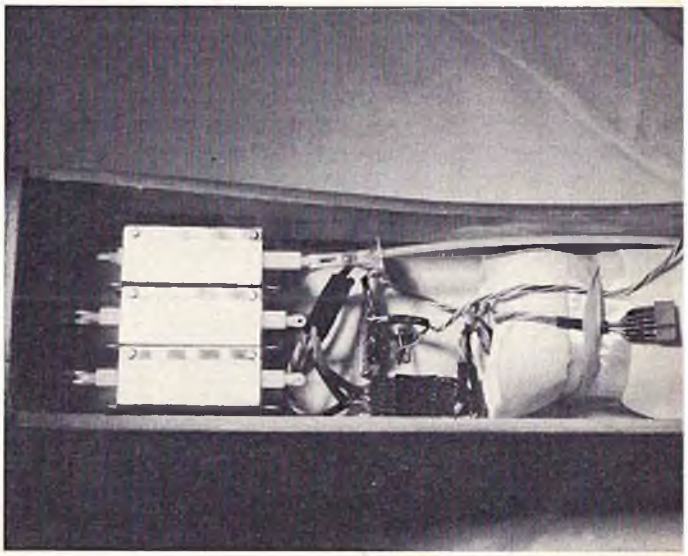
Note cut-out in hatch used for clearance on Max 40.



Control surface linkage and tail wheel details.



Complete installation utilizing radio tray detailed on plans.



RCM Digitrio completely installed.

gear was installed in a well-worn Falcon 56 and completely ground checked. The range check proved my previous suspicions that I had nice neighbors because this was preformed in the middle of the street, after midnight, with Ed walking further and further away with the bird, yelling out the control surface response to my stick movements! Not a peep from the neighbors. My physical status the next day? Forget it!

The next morning dawned bright and clear in Phoenix, Arizona, and the black and white Falcon nestled in the back of my old station wagon. As I drove toward Ed's house, I noted only a slight breeze stirring, and I remember thinking, "This is a good day for test hops." I brought my car to a halt, walked to the door, and knocked quietly so as not to wake the Thompson kids. The kids answered the door and then went to wake up Ed! It was catching up with him, too. Breakfast was served as the sun rose higher (as did the breeze)!

Eleven miles and twenty minutes later we arrived at the ARCS flying field at Beardsley, Arizona, and started the usual pre-flight checks. By now the desert wind was fairly strong, but steady, so it wouldn't be too bad. The engine was started, ship lined up, released, and away she went. I allowed her to run quite a distance before applying any back pressure on the stick. When I felt the time was right, I applied a slow, easy, steady pressure and the little bird became unstuck. Stick neutralized, she started a very gentle climb with the left wing dropping slightly, a little right trim and away we went!

From all outward appearances, everything was perfect. Then, several days and many flights later, a transformer failure caused the rudder servo to stick in full left, but we got away with only a broken shear plate, busted prop, and dirty engine.

Ed replaced the transformer and we were in the air again. About a week later, however, the same servo ran away again, which proved to be due to exactly the same problem. This time Ed replaced it with a different type altogether, and from that day on, any and all problems ceased to exist. Ed says he has since replaced the transformer with solid-state devices to eliminate the mass (whatever that means). Many modelers in this area (Arizona and California) flew this little propo, all with excellent results and no derogatory remarks.

By now, all interested parties are well aware that the original two-channel proportional has grown to a three channel unit and is tabbed the "Digitrio." Many days, weeks, and months have passed since the flights on the old prototype, but that's not all that has passed. All (and I do mean all) of my previous doubts about the shortcomings of Ed's system have been completely dislodged. After my return from an extended trip back East last summer, Ed brought over his repackaged Digitrio, which by now had flown several hundred flights.

My first trip into the wild blue was with a modified Falcon built by Rusty Fried. Later, Ed's unit was installed in the Don Dewey Special powered by a "sick" .35. This was something of an enlarged Royal Coachman – a typical Dewey design characterized by what appeared to be an "upside-down fuselage." Flown off a strip of pavement in the middle of the desert near the house, Ed and I took turns feeling the ship out. All went well for a long time until a Highway Patrolman pulled up to chat and observe. Ed was airborne at the time, putting the model through all sort of "didos," which included a low pass so that the patrolman could get a good look (nice and smooth). Pulling the nose up a little, Ed rolled it on its back. At this point, the "sick" engine regurgitated, which was immediately followed by a slick inverted landing. Actually, Ed said he became confused with the upside-down fuselage . . . he thought he was right side up all the time! Looking at the model, the patrolman frowned, then looked at us and smiled graciously. He entered his car and drove away with another look – one of complete dismay! Although Ed has bought several yards of desert and a Dewey Special, a check of the gear proved it was not only reliable and smooth, but also rugged! For the more sadistically inclined, the before and after photos of this particular flight were used as the lead photographs in the April issue of RCM for the "R/C Flying Safety" article by Cdr. Lou Guerrieri.

Back to the workshop to build another model. We were looking for something a little different this time but could find nothing that satisfied both our desires. We immediately got started on the only alternative left – we dug out the paper, pencils, T-square, and curves and commenced designing our own ship. It took two weeks from drafting board to test flights. The late hours we spent during those two weeks proved completely worthwhile. Our new bird flew beautifully right from the start. The Super Tigre 23, installed initially, proved to be a good combo for training purposes. It later was replaced with a 35 and then really put through its paces. With this new mill pulling the ship, and with one of Ed's newly completed radio systems built from World Engines kits, it surpassed all of our expectations.

We dubbed the bird the "Digifli." The following weekend found us in Tucson where the ARCS of Phoenix were invited to a Fly-In by the Tucson R/C Club. All of our members received absolute first-class treatment and many fine associations were made by the members of the two clubs. This, naturally, gave us a chance to show off our new bird. Equipment and model were enthusiastically greeted, especially after one of our members, Chuck Watkins, made a couple of demonstration flights – including several low inverted passes.

Chuck was especially impressed with the inverted flight characteristics. He bugged us to fly it again, to which I agreed, but only after I had a chance to fly the unlimited pylon race with the Digifli. Chuck didn't get the opportunity to fly it again because I evened the score with Ed while rounding the first pylon. It was all me. I told the transmitter "crash," the receiver picked up the signal, the servos moved and the model responded perfectly, right into the cement ramp! Even crashes are smoother with the Digitrio.

During the 90-mile drive back to Phoenix I occasionally heard Ed mumbling something about a successful day while I was fondling my sack full of toothpicks and dreaming of the next Digifli. Many such projects end up being completely abandoned after the first crash regardless of how smooth they are. But, I was convinced that this model had what it takes and although the lifespan of the first plane was comparatively short no design changes were necessary. So, the number 2 bird came off the assembly line exactly like the first with only gear-fairing doors added. We had already been the 23 and 35 route and Ed had just received a new Max OS 40 which we were itching to try out. The test flights on the new bird were performed at our usual flying site with an unusually large crowd present. The first attempts at take-off were pretty erratic as I was overanxious as to the torque factor with the 40 installed. This led me to overcontrol. Take-off was finally achieved by simply advancing the throttle and leaving everything else alone until the bird started a gentle climb. Although the engine was four-cycling, slight back-pressure on the stick caused the airplane to attain about a 35 degree climb accelerating all the time!

As I entered the first turn I realized that the tiger usually found in your tank I now had by the tail! This first flight terminated rapidly when the engine quit because we had not allowed ample bench time. We called it quits for the day and decided to run a few more tanks of fuel through the new Max (Ed still says, "it was mainly to allow my nerves to settle down"). Later flights pushed the bird and ourselves beyond all hopeful expectations. The Digifli comes in three "B" categories:

1. Bang – with a 23.

(Continued on Page 84)

VIBRATION LEVELS IN R/C MODELS

BY DR. WALT GOOD

Photos by John Hopkins University

SHOT DOWN BY INTERFERENCE? PERHAPS. BUT THE ODDS ARE BETTER THAN EVEN THAT IT WAS DUE TO VIBRATION. THESE ARE THE FACTS . . . AND THEY ARE ANYTHING BUT PLEASANT!

THERE is little doubt that the cry of "interference," from the panicked pilot of a meandering RC model means that the model is in trouble. Perhaps not from radio interference as the pilot believes but from one of many other causes. When the "interference" happens only with the engine running, it is likely that the culprit is VIBRATION.

We have all seen the evidence of vibration aboard the model. Erratic operation of the controls when vibration finds its way to a relay or a reed during a high speed power dive. A broken wire due to fatiguing vibration on a servo motor. Even a scorched wing where the vibration between the wing and the body has caused excessive frictional heat due to the rubbing action. And now with the larger engines the motor bolts fatigue and shear or shake the engine bearers away from their glued joints. Foaming fuel and bubbles in the fuel line come from vibration.

It seems like almost everything we've observed about vibration is bad so the best cure is to get rid of the vibration or at least reduce it.

This leads to a number of questions:

1. How great is the level of vibration in an RC model?
2. What is the source of vibration?
3. What course of action will reduce the vibration?

It is to the answer of these questions that this paper is directed.

A. *Measurement of Vibration*

Fortunately the technology of vibration measurement is a rather well-known subject. So it was not difficult to borrow a vibration pickup and its associated gear.[1]. The pickup used weighed ⅛ of an ounce and contained a tiny crystal which was responsive to vibration over a wide range of frequencies from 10 cps to 20,000 cps. The pickup actually responds to acceleration and puts out a voltage in proportion. It is normal to use gravity units or g's as the measure of acceleration. Thus a 10 g measurement means 10 times the acceleration of gravity.

The test set-up for measuring vibration is shown in Fig. 1. Here the model is tethered on the ground and the vibration pickup is fastened to the point of interest. The output of the pickup is sent through a cathode follower, to reduce the loading on the pickup, and then sent through a low-pass filter which permits only frequencies of 10 cps to 2000 cps to pass on to the oscilloscope. Since the highest engine frequency of interest was under 200 cps (12,000 rpm), it was felt that a frequency range of ten times beyond this would be more than adequate. Besides, early trial runs showed some high frequency hash which merely clouded the scope picture. This hash was removed by the filter which was then used for all the tests reported here.

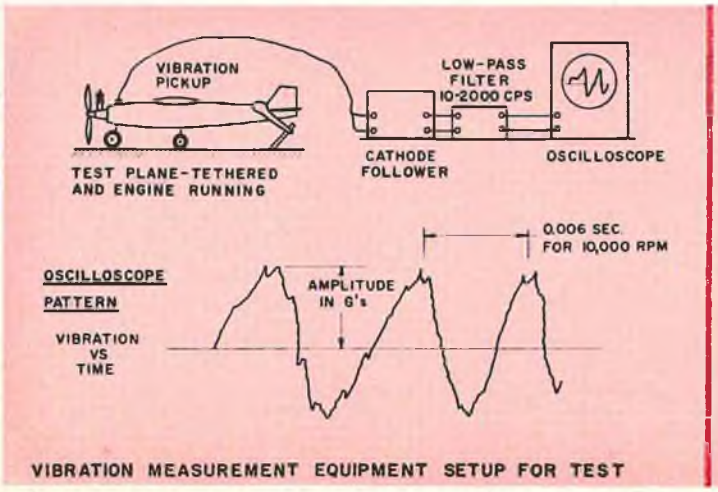
The oscilloscope pattern was read for the amplitude (or peak value) in g's. This is the reading from the center line to the highest bump on the pattern. Sometimes the pattern was almost a sine wave and other times it was very rich in harmonics with the fundamental hardly distinguishable. The reading was still taken to the highest bump.

B. *Vibration Survey on Several Planes*

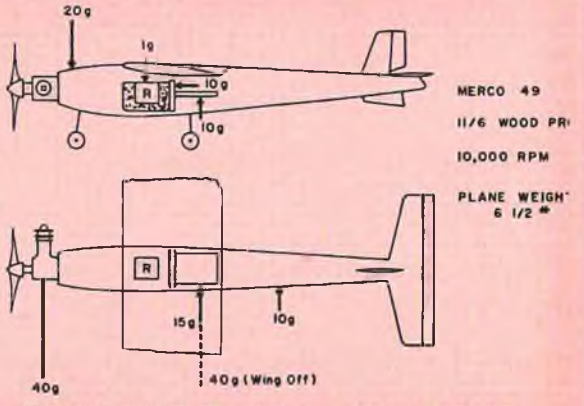
The first plane subjected to a survey was the author's "Acro-bug" which is a 6½ pound shoulder wing ship with a side mounted Merco 49 engine. In Fig. 2, the length of the arrows show the magnitude of the vibration when the engine was turning 10,000 rpm with a 11/6 wood propeller.

The level at the base of the engine, in line with the piston motion, is 40 g's. This is a very high level when it is known that even a missile designer becomes very unhappy when vibration levels exceed 10 g's! As the vibration pickup is moved aftward the level becomes smaller but still falls near 10 g's. Only the rubber foam mounted receiver (R) shows a low vibration level of 1 g.

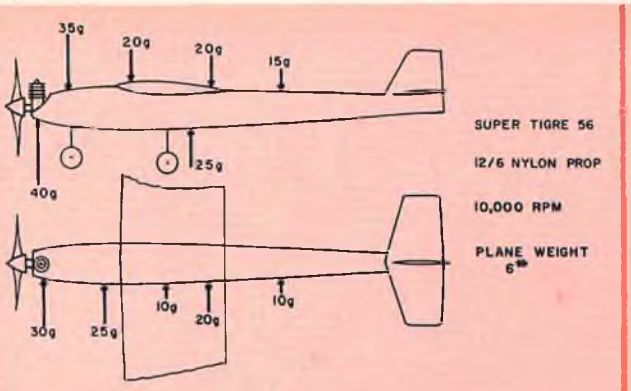
[1]The pickup and amplifier were made by Glennite, Gulton Industries, Metuchen, New Jersey.



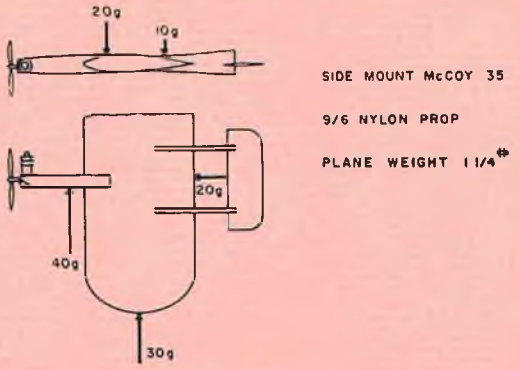
VIBRATION MEASUREMENT EQUIPMENT SETUP FOR TEST



VIBRATION SURVEY OF SHOULDER WING RC PLANE (W. GOOD'S ACRO-BUG)– SIDE MOUNT ENGINE



VIBRATION SURVEY OF SHOULDER WING RC PLANE (M L. HILLS MARYLANDER)—VERTICAL MOUNT ENGINE



VIBRATION SURVEY ON CL-Voo Doo COMBAT

Thus the foam mounting has reduced the vibration from the surroundings by a factor of 10. This 1 g level is quite satisfactory for proper receiver operation even with relays. The clatter of the relays will produce almost that much vibration!

The servo board, which was hard-mounted without grommets, shows 10 g's and the bulkhead forward of the servo board shows 10 g's in a fore and aft direction. This latter point illustrates how vibrations may wander around in a complex structure. And here we define a complex structure as anything which contains more than two simple elements! Hence all models qualify as complex. Or as one fellow put it, "a model plane is a collection of parts flying more or less in formation!" Another model with a servo board mounted on grommets showed a vibration reduction of about one-half that of the hard-mounted board; hence the grommets were worthwhile.

On this model another revelation was the change in vibration from 15 to 40 g's at the servo tray with the wing on and off. This explains why the servos appeared a little blurry and the screws came loose! Needless to say, all engine test runs are now done with the wing in place. This observation indicates that the wing is a good vibration absorber when its stiff direction (lengthwise) is mounted parallel to the piston motion. This is a good point for side mounted engines.

Maynard Hill's "Marylander" in Fig. 3, is also a shoulder wing but with a vertical mount Super Tigre 56 engine. The survey shows higher vibration levels in the vertical plane than in the horizontal. Note again that the levels attenuate as the pickup is moved aftward.

Since the Merco and the Super Tigre are considered to be "quiet" engines, it is assumed that other engines may give considerably higher vibration levels than noted here. Furthermore, unbalanced props will give higher levels, too.

The vibration measurements on a combat control line model are shown in Fig. 4. The total plane weight is only 1¼ pounds which is not much help in absorbing the vibration from the McCoy 35 engine. Here again we see evidence of the vibration wandering through the structure by noting the 20 g's measured fore-and-aft at the trailing edge of the wing.

The vibration survey of these three planes leads to several conclusions:

1. The source of the vibration is the engine.
2. The largest vibrations are at the engine and in the direction of the piston motion.
3. The level attenuates as the distance from the engine increases.
4. The direction of the vibration wanders through the structure.
5. Soft foam mounting is very effective in reducing the vibration level at the receiver.

C. *Vibration and Engine Speed*

How does the vibration vary with engine speed?

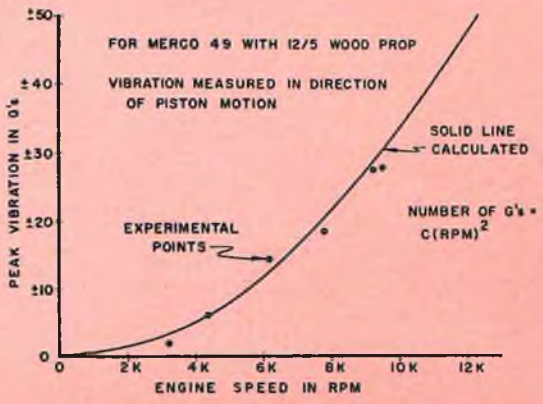
It is obvious that the high levels go with high engine speed but what is the exact relationship?

It turns out that the vibration varies as the square of the engine speed as shown in Fig. 5. Here the circles represent measured points while the solid line was calculated from the equation:

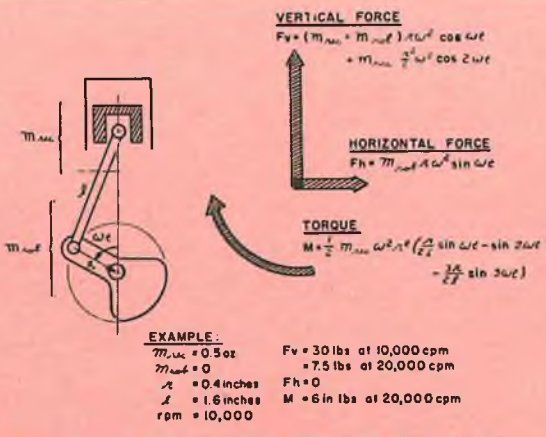
Number of g's = constant x (RPM)[2]

The correlation between theory and experiment is fairly good showing that an idling engine at 3000 rpm produces 3 g's while at full speed of 10,000 rpm produces 33 g's. This data was taken at the base of the engine in the direction of piston motion. It is important to note how rapidly the vibration level increases with speed. For example, 10,000 rpm gives 33 g's while 12,000 rpm gives 48 g's. This suggests that a vibration problem at the field might be quickly solved by using a larger propel-

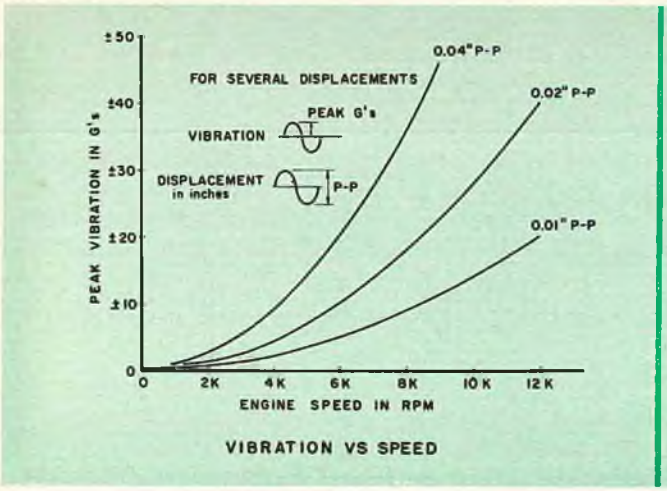
[2]Mechanical Vibrations—den Hartog — McGraw-Hill 1940, Chapter V.



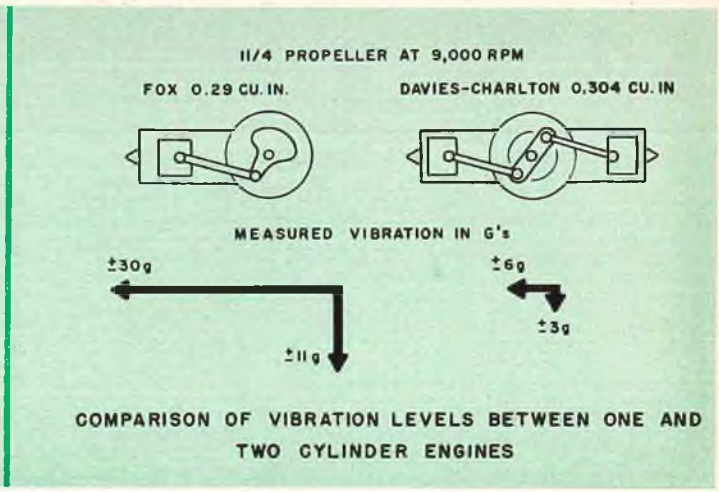
VIBRATION VS ENGINE SPEED



FORCES AND MOMENTS PRODUCED BY A SINGLE CYLINDER ENGINE



VIBRATION VS SPEED



COMPARISON OF VIBRATION LEVELS BETWEEN ONE AND TWO CYLINDER ENGINES

ler to lower the speed and hence lessen the vibration.

While taking the vibration vs. speed data on two different Merco 49's on two planes (Acro-bug and Multi-bug) a large difference in the results was noted. One ship gave 60 g's while the other was near 30 g's with the same rpm. The difference was traced to the fact that the high vibration ship was using a flight-chewed 12/5 nylon prop which, though balanced, was out-vibrating the 12/5 wood prop by a factor of two. Switching the props proved that the high vibration followed the prop and was not related to the particular Merco or plane. If the nylon prop results had been plotted, the curve of Fig. 5 would have all points raised by a factor of two!

On other tests with smaller engines and 11/4 nylon and wood props, the difference in vibration was hardly measurable. This shows a difference between the results of nylon and wood which is greatest for the large diameters.

Perhaps this experience shows why changing from a nylon to a wood prop at the field sometimes solves a vibration problem and sometimes makes no difference.

D. *A Little Theory*

In order to obtain a better understanding of the nature of the vibration we must take a closer look at the source, the engine.

The familiar sketch in Fig. 6 shows the parts of a single cylinder engine. The principle vibrator is the piston, wrist pin and the upper part of the connecting rod (labeled M_{rec}). Ignoring the remainder of the engine we can compute how many g's are executed by the piston by its vertical travel of 0.8 inches at 10,000 rpm. This turns out to be 1000 g's! Fortunately the rest of the engine weighs 12 oz. as compared with the ½ oz. of the piston, so the final g's are reduced by a factor of 24 to slightly over 40 g's. This means that an engine suspended on soft springs and running at 10,000 rpm would show a vibration level of 40 g's. Since this number is near to the values measured in the experiment, it appears that the mass of the nose of the plane doesn't contribute much help in absorbing the engine vibration. This result also indicates that the least vibration occurs when the piston is light and the engine is heavy.

A closer look at Fig. 6 and using the den Hartog reference[2] shows that we must also consider the rotating parts of the engine in order to obtain a more complete picture.

The figure defines M_{rot} as that unbalanced mass which appears at the crankpin. This is the lower part of the connecting rod and the effect of the counterbalance. Here (l) is the length of the rod, (r) is the radius of the crank, (w) is the rotation speed in radians per second, and (t) is time in seconds.

If one assumes the engine is bolted down to a large mass, then it is possible to compute the forces and moments carried through the bolts. The equations given in Fig. 6 are approximate ones showing the existence of a pulsating vertical force, a pulsating horizontal force and a pulsating torque. These are the *three* effects which shake your plane.

The vertical force (F_v) is the major one and is due to the motion of M_{rec} and M_{rot}. The fundamental frequency (cos w t) and the double frequency (cos 2 w t) both show themselves. The double frequency is due to the fact that the ratio of (l) to (r) is only 4 whereas if the ratio of (l) to (r) was very large then the double frequency would disappear. In fact, for a practical engine there should be even higher harmonics but they have been omitted from this approximate equation.

The horizontal force (F_h) depends completely upon the motion of M_{rot} and can be made zero by balancing the crankpin and lower connecting rod with the counterweight.

The surprising vibration effect is the existence of the pulsating torque (M). It is rich in harmonics and depends only on the M_{rec}. This torque comes about from translating a linear motion into a rotary one through a non-infinite connecting rod. Physically one can think of the piston giving the crankshaft a rotary push on the explosion portion of the cycle and then the crankshaft giving the piston a rotary push on the compression part of the cycle.

In order to get a feel for the size of these forces, an example is computed as shown in Fig. 6. The results give a 30 lb. vertical force pulsating at 10,000 cycles per minute and a 7.5 lb. vertical force pulsating at 20,000 cpm. The horizontal force is zero since the crankshaft was assumed balanced ($M_{rot} = 0$). The pulsating torque computes out at 6 inch lbs., at 20,000 cpm with smaller values at 10,000 and 30,000 cpm.

From these equations it is seen why a single cylinder engine cannot be balanced. Three cases are evident:

Case I

Assume $M_{rot} = 0$

Thus

$F_v \sim M_{rec}$ ....large

$F_h \sim M_{rot}$ ....zero

$M \sim M_{rec}$ ....large

Result: Large vertical force and torque with zero horizontal force.

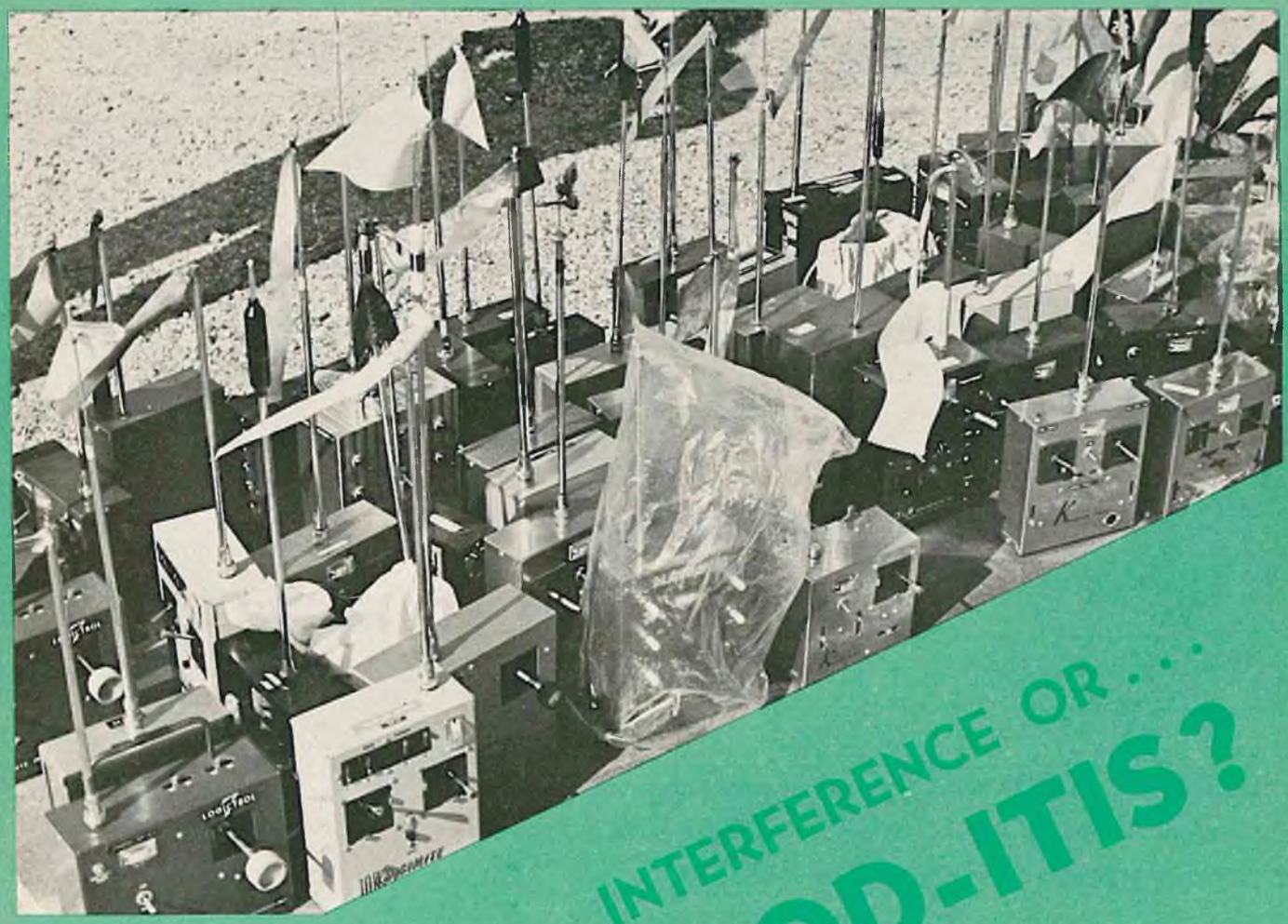
Case II

Assume $M_{rot} = M_{rec}$

Thus

$F_v \sim (M_{rec} - M_{rec})$ zero

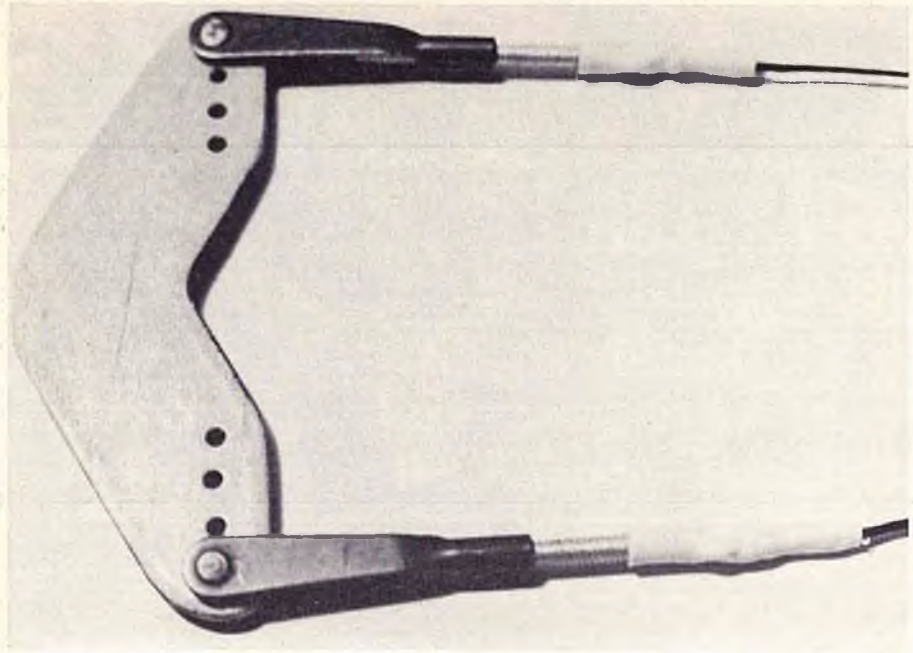
(*Continued on Page 69*)



INTERFERENCE OR . . .
PUSHROD-ITIS?

BY

RALPH SAWYER



Close-up of dual cable linkage for elevator.

PUSHRODS . . . The Antique Gremlins that have caused more than their Share of R/C Crashes. Here is the First Trouble-Free Control Linkage System . . .

HAS your R/C airplane ever had Pushroditis? Have you ever listened to control surfaces drumming as the plane passed overhead? Have you ever had a pushrod snap off a servo arm in a prang and then try to drive said arm through your receiver?

If you have experienced any of these symptoms or results in your plane then you have suffered from Pushroditis. Pushrods in R/C have caused more crashes and cost the average modeler more than most of us realize. This form of mechanical servo connection are partly metal in most installations and when metal parts are vibrated together they cause RF noise. In addition, their very presence looks like a reflected RF signal to the antenna. The receiver finds these conditions objectionable and may react as if it had a mind of its own. All the while the receiver, having its problems trying to operate intelligently in the midst of this high frequency, high amplitude airborne earthquake, the poor servos are developing mechanical ulcers due to this heavy suspended rod with a flapper attached to the other end, hammering away at their drive trains, contactors and board, and follow up pots (if proportional). This constant hammering is then transmitted on to the transistors, resistors, diodes, capacitors, chokes, and whatever other components the manufacturer deems necessary for their function. With this supposedly **normal** condition existing, and so intimately coupled to a sensitive receiver and as many as eight servos and associated wiring, it can only be a matter of time until the inevitable happens.

And this "inevitable" is called "glitch," "interference," "fail-safe," "pilot error," and a few other things we can't print, but it all adds up to a catastrophic crash directly due to pushrods and their effects on R/C – Pushroditis! It's a disease common to RC'ers, but fortunately, one that can be cured.

Another approach to this age old R/C installation problem is via cables. Something new! Just find some photos of the Wright Brothers first airplane and look real close for any pushrods! You may have to shove a lot of cables out of the way to find even one! The reason that cables are desirable in an R/C aircraft installation is as follows: (a) non-metallic, (b) small mass, (c) low weight, (d) ease and simplicity of installation, (e) has vibration damping characteristics for aircraft as well as servos, (f) contributes to control reliability, (g) eliminates control slop entirely, (h) drastically reduces R/C equipment damage in a crash, (i) contributes to smoother, more realistic flying, (j) completely eliminates "Pushroditis."

I have been flying two types of cables with my equipment – single channel, as well as reeds and proportional. They are 20-30 lb. monofilament (Penquin brand fish line) and radio dial cord (General Cement brand with glass center and woven rayon outer cover). The fishline costs about 1.5c per foot and the dial cord about 3c per foot. Each type has its advantages, depending upon where and how it is used. I used the fishline on **everything** except my own type of nose brake, which consists of a drum fastened to the wheel and with the dial cord attached to the strut and then wound four times around the 1" diameter drum, and then routed directly to the servo. This brake **really** works and the more oil and fuel that gets on it, the **better** it works! I prefer the fish line on all flight controls because you can cut the line after it is tied and seal the knot with a soldering iron all in one operation. In addition, it will stretch a little more than the dial cord for the same applied load. The dial cord knot should be sealed with glue after it is tied to prevent fraying of the end.

Speaking in general about cables, if you decide to use them, you will find more and more applications for them with each new plane you build, and each installation will teach you how to make the next one even better. For a start, proceed as follows:

Rudder

Rudder and nose wheel steering are one complete loop in order to simplify the system as much as possible. If nose wheel steering is not used, a turn around is employed at the servo. See Fig. 1.

Elevator

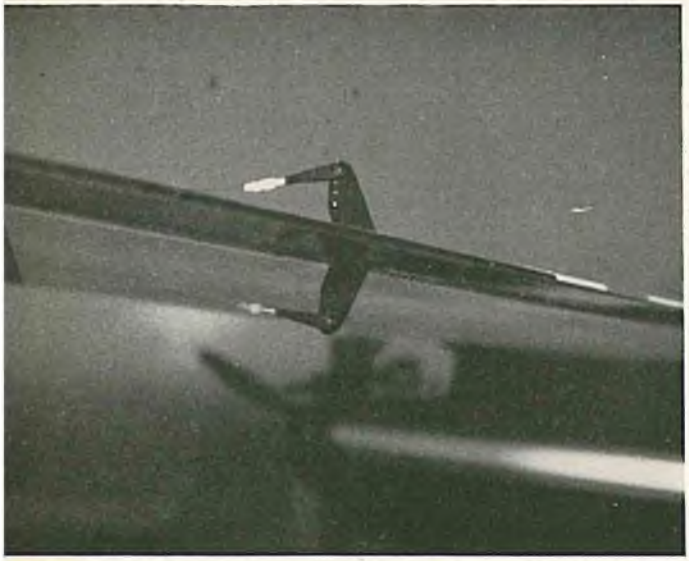
Elevator or cable system will require a servo turn around unless a servo with wheel output is used. See Fig. 2.

Throttle

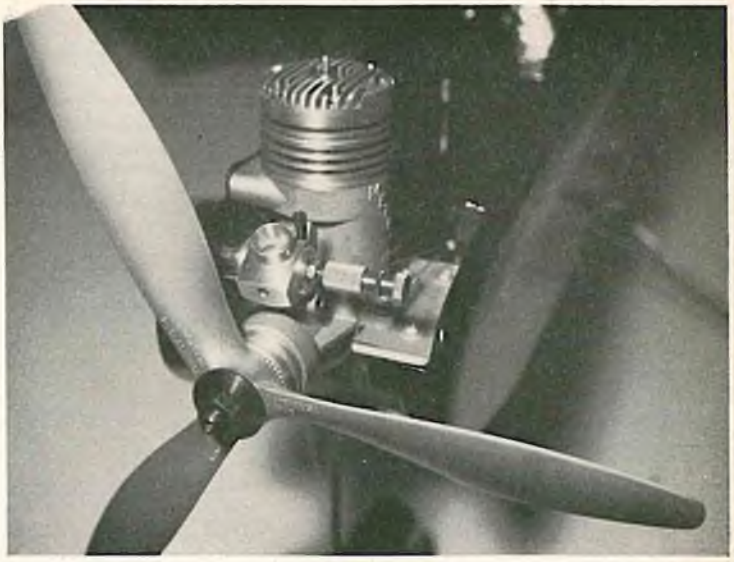
Cable control for the throttle is accomplished by running two cables through one conduit to a double-ended arm on the throttle if the engine is adaptable to it. If not, I use a .025 steel flex cable through the same conduit with a World Engines Nylink. Cut the adjustment rod off about ¼" above the threads and drill the rod to take the .025 steel flex cable. Use acid core solder and solder same together. For the dual cable system, a turn around is used in the same manner as the elevator. See Figure 3.

Brakes and Fuel Shut-Off

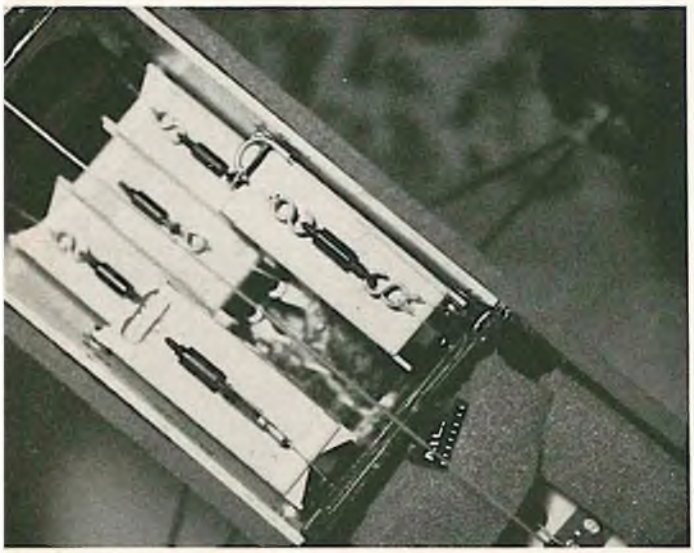
Brakes and fuel shut-off are accomplished by running a single cable directly, as in Figure 4 and Figure 5.



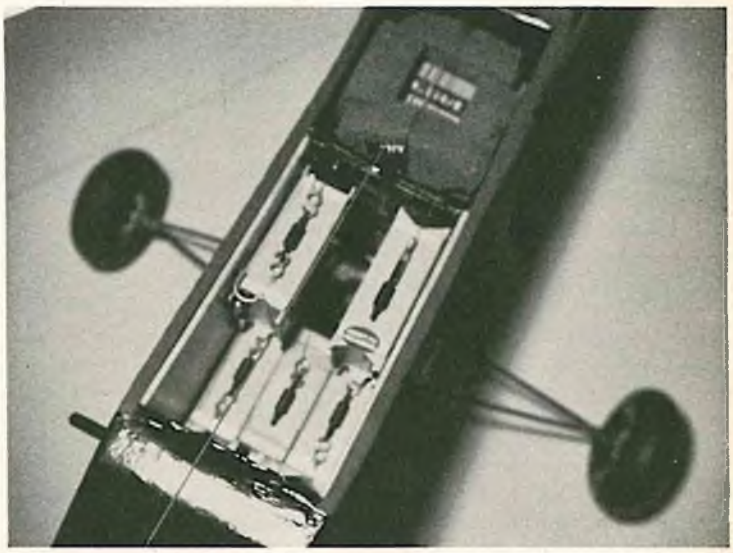
ron horn hook-up.



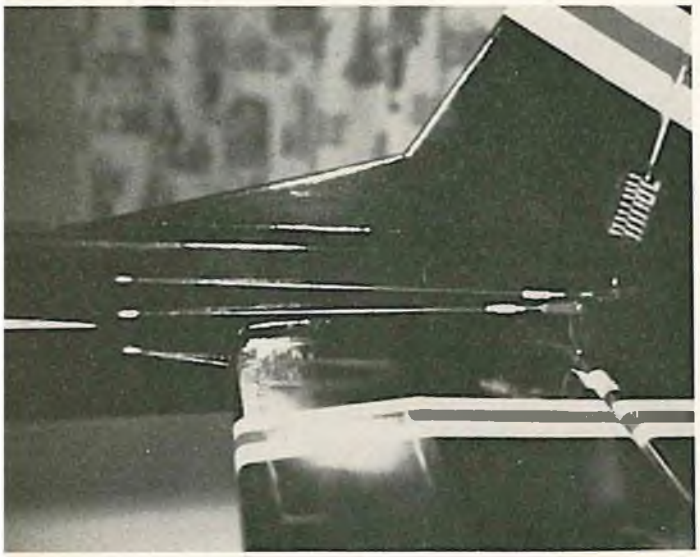
Mixture linkage.



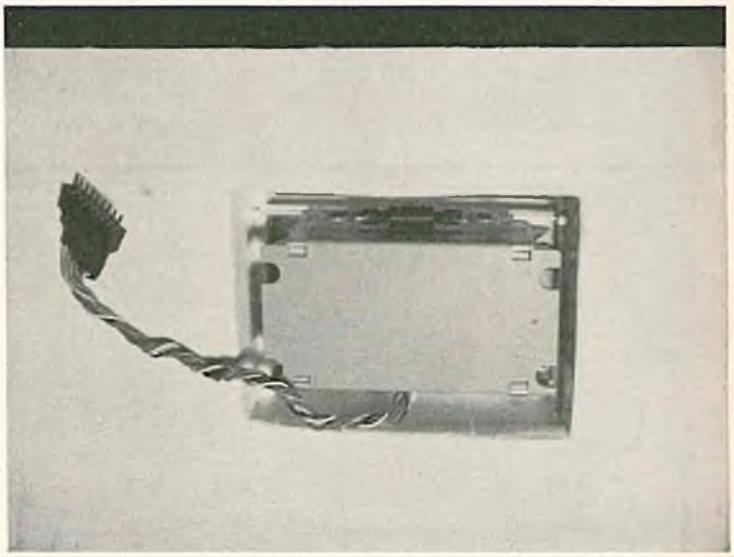
l hook-up and turn-around.



Overall servo perspective.



pennage control surface hook-up.



Aileron servo installation.

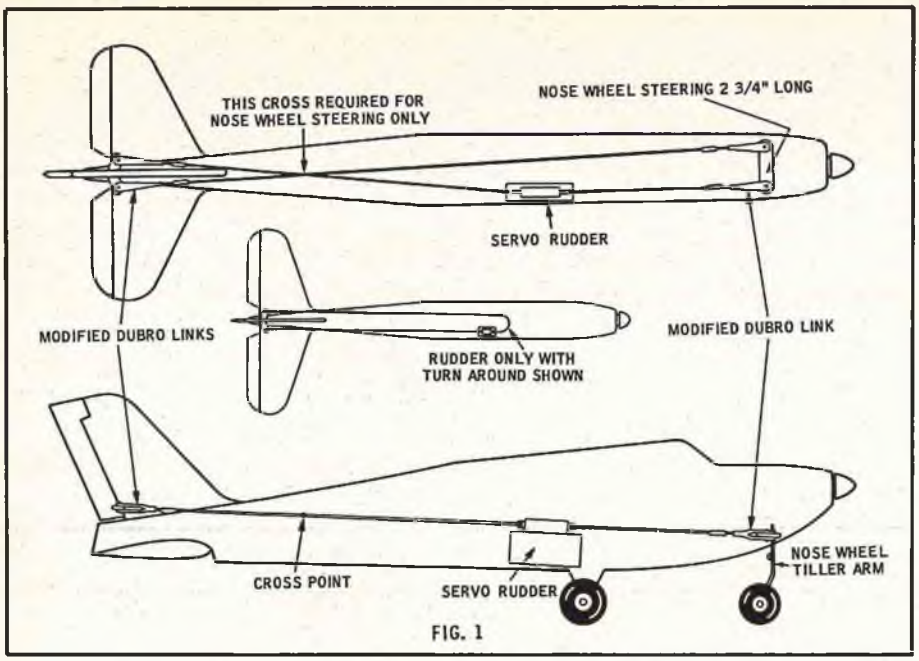


FIG. 1

Mixture Control

Mixture control is accomplished by running two cables through one conduit, almost identical to the throttle control, except that the cable is wrapped around the needle valve six times. The latter is grooved in the center of the six turns and a small coil spring is tied in the groove with the cables. Installation sequence is to tie the spring in the groove with the cable allowing equal distance on the ends of the cables. Take three turns around the needle valve in opposite directions with each cable. Route one through the conduit to the servo, the other through the same conduit except that this one is taken through the turn around to the servo. This makes a loop, and with a Merco throttle needle valve, this setup will give you ¾ of a turn for ⅜" servo travel. Adjustment is easily changed by grasping the spring and cable turn around with the thumb and forefinger of one hand and turning the needle valve with the other thumb and forefinger. On my Royal 'Regulus' I have combined mixture and fuel shutoff on one servo. I control mixture with 75% of servo travel and fuel shutoff closes at the extreme rich end of servo travel, or the remaining 25%. See Figure 6.

Ailerons

Aileron cable control is accomplished by using two horns, with each one mounted approximately in the center of each aileron. This feature eliminates aileron twist because of its length and also eliminates the fuselage side tear out feature during a cartwheel, quite common with pushrod installations. The aileron system is also a loop, but uses the two aileron horns for turn arounds. The lower right hand aileron cable leaves the servo, then goes to the right hand lower aileron horn. The next cable then leaves the upper right hand aileron horn and progresses to the upper left hand aileron horn. The next cable leaves the lower left hand aileron horn and goes to the other side of the servo. This completes the necessary loop. See Figure 7.

General Installation

As in any well-designed, smoothly operating machine, the R/C control system must be well thought out and planned before, during, and after aircraft construction, and not thrown in as a necessary evil or as an afterthought. Servos should be checked for compatibility to the job required of them and component placement must be decided from both a C.G. and displacement standpoint. With the servo positions established, it is then an easy matter to route the cable conduits through the structure and come out at the right places for proper alignment. In the fuselage installations, I plank the top and bottom **after** I have routed and secured all the conduits required for the system. The conduits are routed through the wing structure just prior to covering and brought through the covering when the latter is applied. On multi ships I run all cables through conduits, but on single channel systems I run the cable direct from the servo or escapement to the rudder horn with holes in the structure to allow proper clearance. The conduit can be run in straight lines, curves, spirals, and loops and still function properly, making pushrod limitations obsolete. The entire installation of cable systems will cause a new concept in thinking as to how to approach the project, which part to build first, and general sequence of installation in order to end up with a control system which looks and works like its full-size counterpart. The prime objective of the entire project is **reliability** and a smooth, realistic operation which is a joy to behold both by pilot and spectator alike.

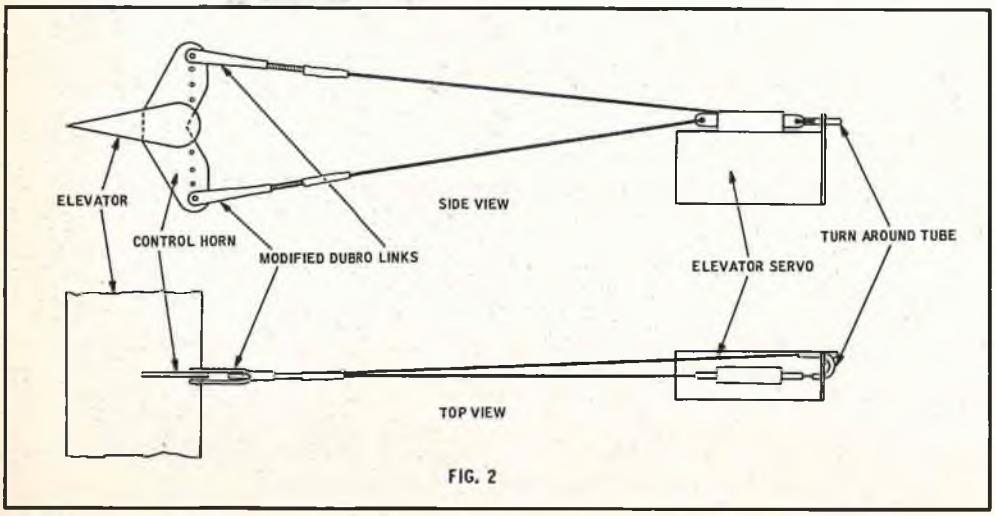


FIG. 2

Conduit

The conduit can be any type of nonmetallic tubing, such as teflon, nylon, or even plastic fuel line, but I prefer teflon due to its low cable drag factor. The teflon tubing I use has a 1/16" I.D. and a thin wall. You will find that it is impervious to cement and is not suitable as is. For this reason, I use a length of heat shrink tubing that will slide easily over the teflon. Then, using heat from the gas burner on the stove, the heat shrink tubing is shrunk over the teflon liner until they are almost one integral unit. Any model cement will grab the shrink tubing and weld itself to it, making for a good attach point anywhere in the structure. It also makes a neat exit wherever the conduit comes outside the skin.

Turn-Arounds

Cable turn arounds can take many forms. I have used pulleys of aluminum, nylon, and teflon-lined tubing. In addition, some servos have wheels for output with the cable attached to each side, thus providing a built-in turn around. My personal preference is a servo with a linear output like the Digimite with a teflon lined brass tube soldered to a bracket that slides under the servo mount grommets. This makes a simple, light, compact, low drag, and

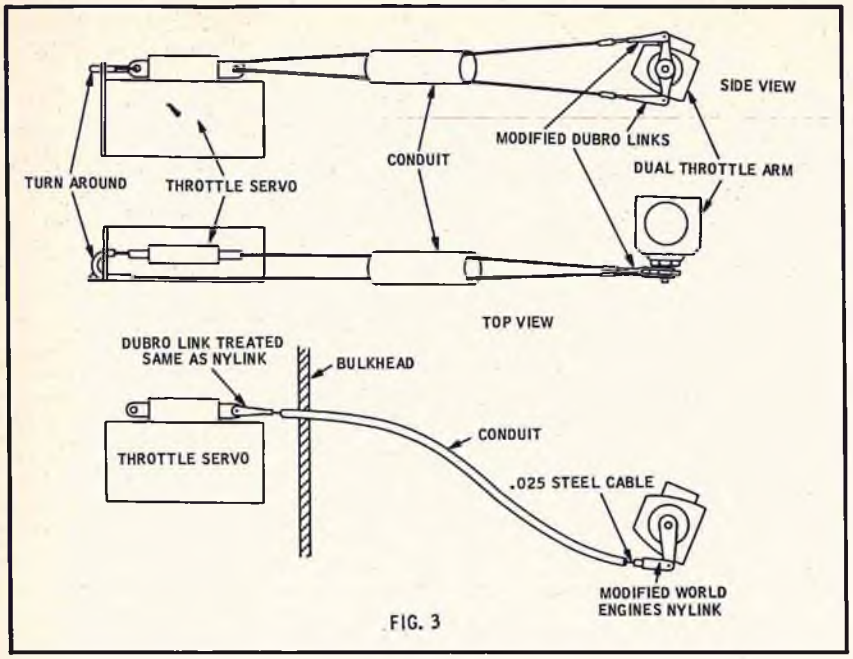
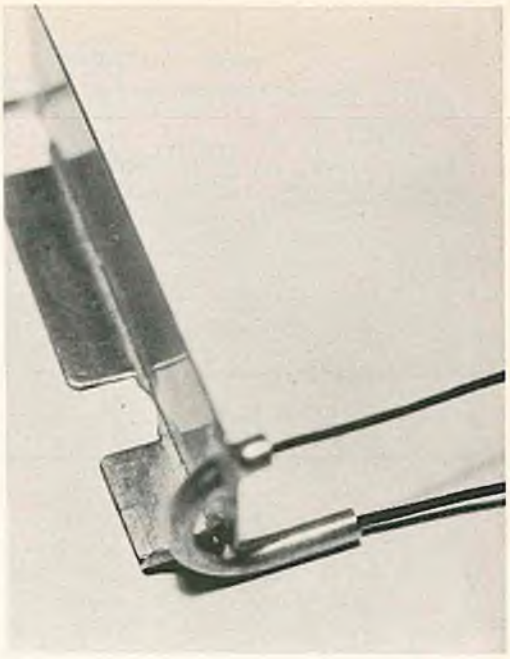


FIG. 3



reliable turn around. To line the 1/16" I.D. brass tubing, you chamfer the inside edges of a straight piece of tubing, and using the same teflon tubing mentioned earlier (under conduit), you stretch out a section of it to a point where it becomes small enough to go through the brass tubing. Then clamp the tubing in a vise and pull the teflon through the brass tube until you have enough to clear the stretched section of tubing. The unstretched tubing will shrink and size itself inside the brass tube as it enters through the chamfered edges. The teflon is then impossible to get out of the brass tubing once you cut off the ends flush with the brass. Turn arounds can be mounted to the servo or any place in the ship to line up with the servo output arm or conduit. The teflon lined tubing can easily be bent in a tight radius if you stack different size washers on a bolt with the smaller ones on the inside, depending upon the radius you want. Tighten them with a nut and clamp the nut in a vise. Using the lined tubing full length, as it was when you installed the teflon, grasp the tubing with both hands and wrap it around the washer assembly. When you have obtained the amount of turn around you want, cut off the turn around smooth and chamfer both ends prior to cable installation.

Servo Hooks

I have found it to be quite advantageous to use a hook to attach the cable to the servo output arm. This allows servo removal without cutting the cable. A piece of 1/16" brass welding rod works quite well for this application, using a pair of round nose pliers for forming the shape. One end of the hook is a loop, with the other end forming a hook. In appearance, it is almost a figure eight with one side left out of one of the loops, as in Figure 8.

Modified DuBro Kwik Link

Using a standard DuBro Kwik Link, cut the threaded rod off about 3/16" above the threads and flatten this 3/16" section in a vise. Round off all corners and drill a #56 hole through the center of this flattened section. Then, using a counter sink, chamfer the edges of the hole to prevent sharp edges from cutting the cable. You can use a 2-56 jam nut or slightly pinch the threaded barrel with the round nosed pliers to prevent the possibility of the threaded rod changing by itself. See Figure 9.

Cables

I have used monofilament fish line from 8 pound to 30 pound test and woven radio dial cord (small size) and have found it all suitable for the particular application. As stated before, I prefer the fish line for everything in the plane except for brakes, primarily from the knot tie-off and stretch standpoint. The fish line has a little more stretch for the same applied load than the dial cord, so you have to decide for yourself which size and type will work for you. I found the 8 lb. good for rudder only

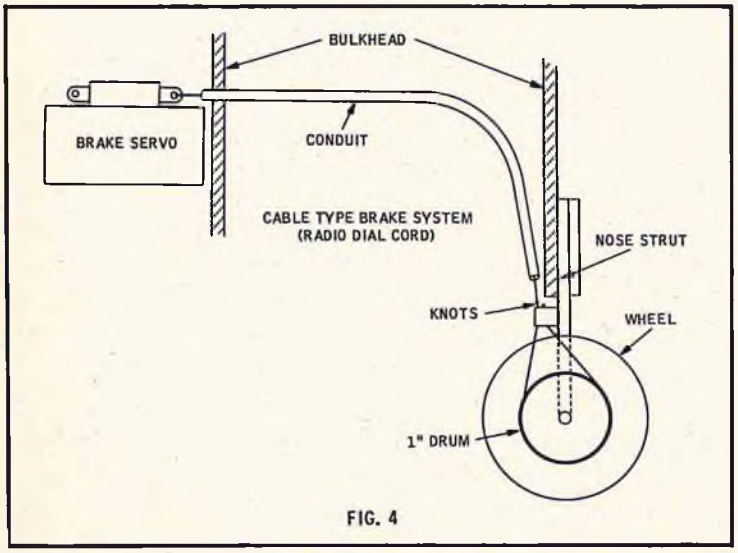
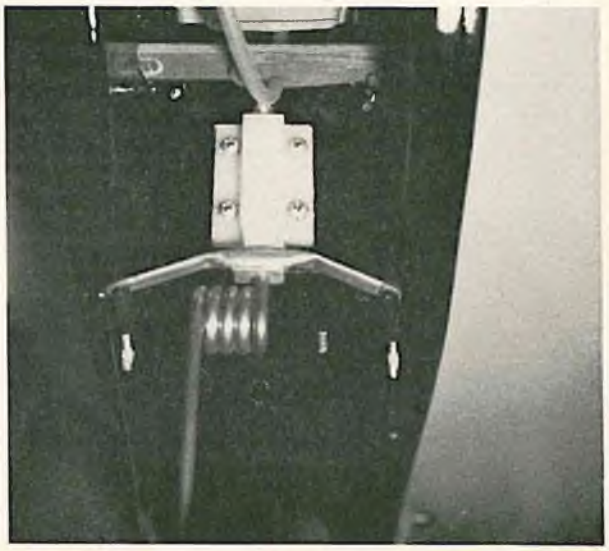


FIG. 4



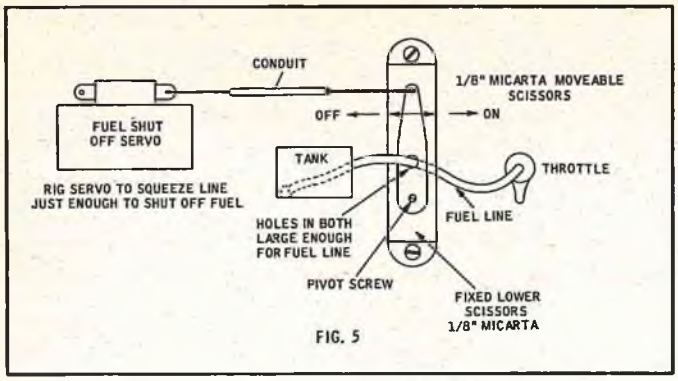


FIG. 5

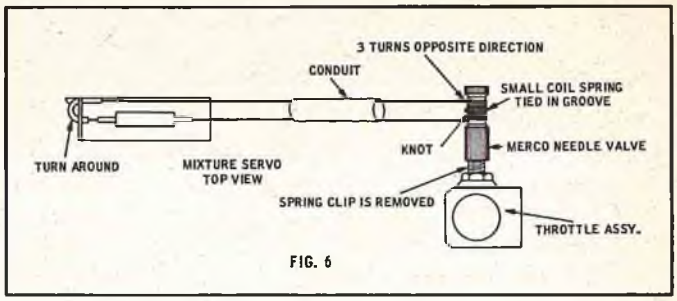


FIG. 6

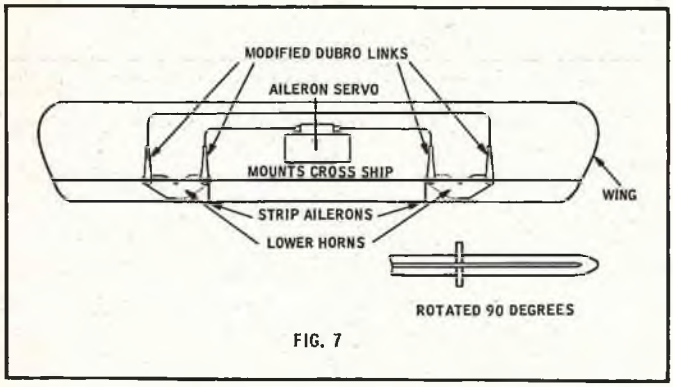


FIG. 7

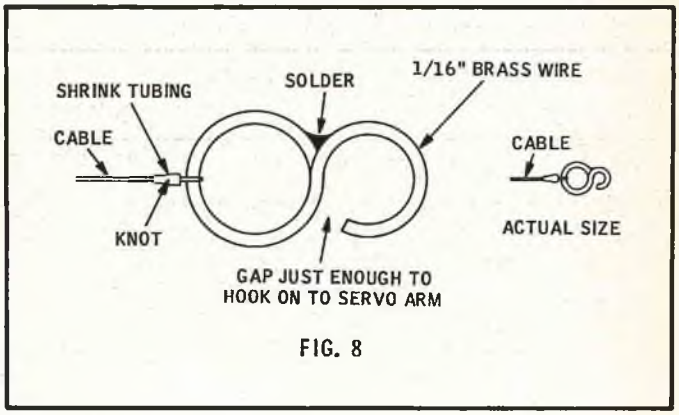


FIG. 8

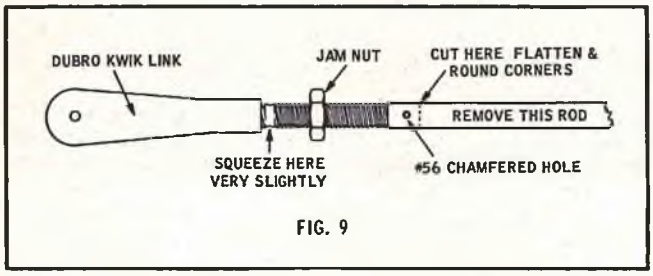


FIG. 9

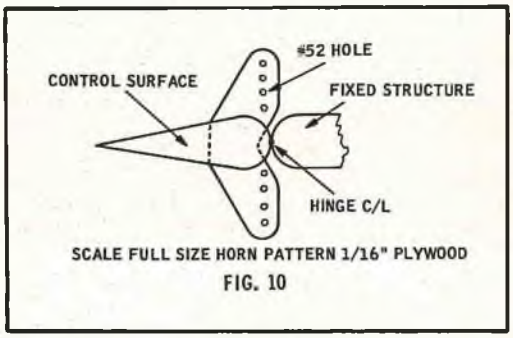


FIG. 10

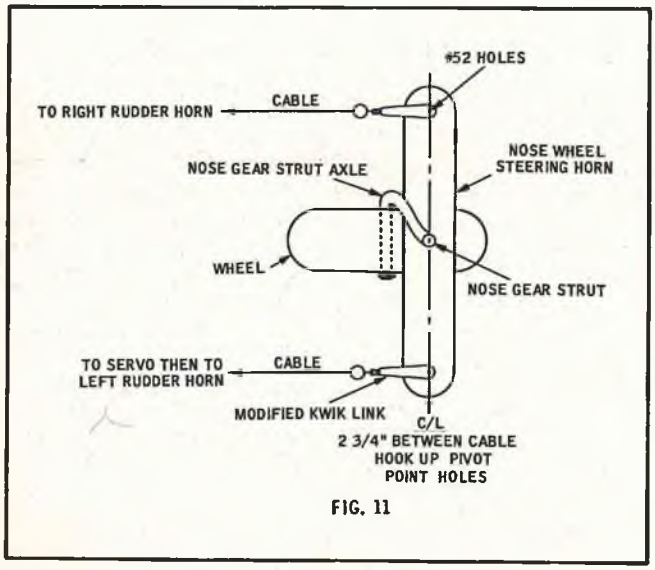


FIG. 11

Complete cable control system may seem complicated at first, but eliminates all of the problems associated with pushrods. A major step forward in R/C aircraft longevity!

and small planes, and the 20-30 lb. range better on the heavier planes with heavier surface air loads. **Do not** under any circumstances **rig the cables too tight** because it will load up your servo and chew up your nicads! Use just enough tension to remove all slack in the cable plus just a little more. If you feel that the surface will stretch it too much, use a heavier cable. You will, however, be surprised at just how little those air loads will stretch the cables, if any at all! I repeat — **use very little tension** and make a few test flights to see for yourself what is required for smooth operation.

Control Horns

Control horn design on a cable system is very important and a number of conditions have to be considered. First, and most important, its dimensions must be made to **keep the cables at the same tension regardless of control position.** This is accomplished by making the cable attach points to horn

(Continued on Page 86)

THE HOBO

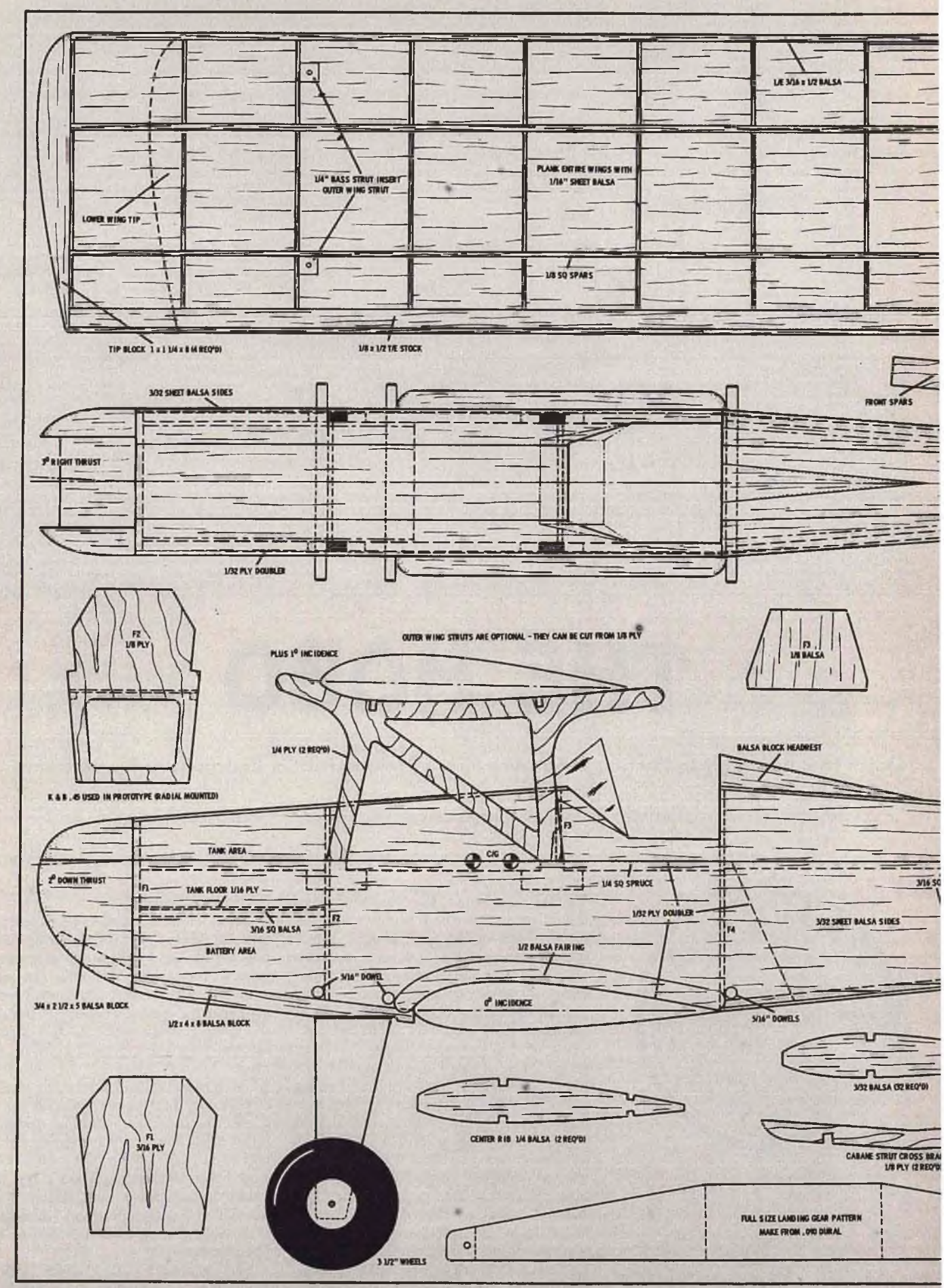
Quick to Build, Easy to Fly. . . . A Sunday Flier's Biplane for Six Channels or Proportional . . .

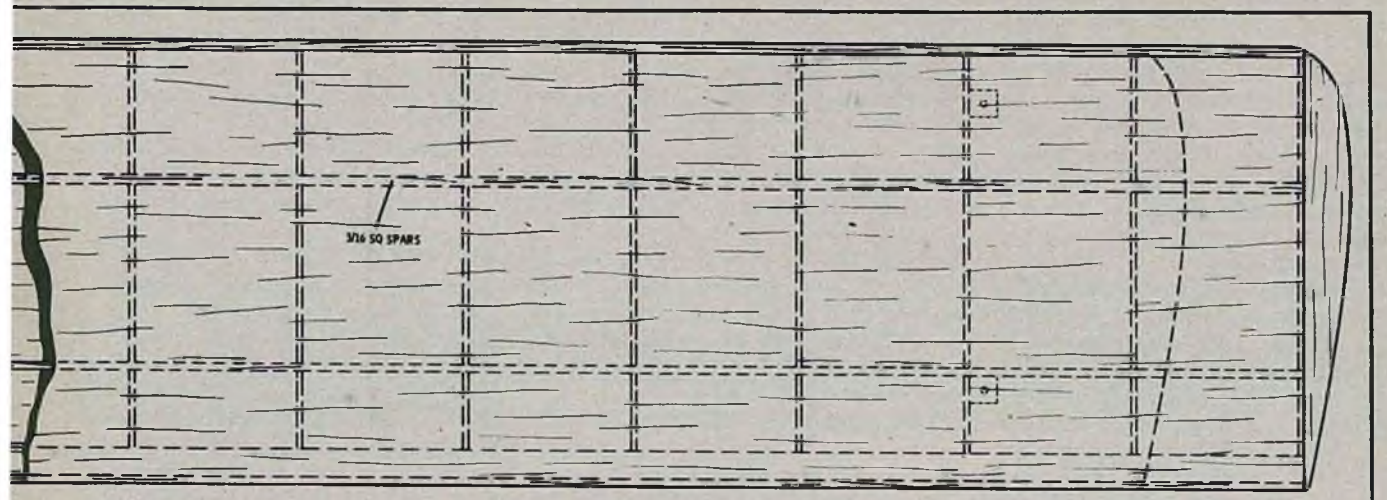
BY DR. D. J. GERNER

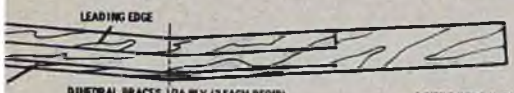
HOW many times have you wandered down a model flight line and turned back in the middle of it out of sheer boredom because all you saw were the same old "low-wingers," "mid-wingers" or cabin jobs? Oh sure, they had exotic paint jobs and all kinds of gimmicks and all kinds of names, but most of them were crosses between some kind of well-known model airplane or other. If you wandered down that flight line a little further you may have seen a group congregated around a particular airplane, and if you looked a little closer you may have found it was a "double winger." Comments ranging from "That's pretty nice" to "Gee, I gotta see that crate fly," were heard from the onlookers. The author may be a prejudiced biplane fan but he finds it difficult not to feel a particular type of thrill every time he sees a biplane in flight.

The idea of a six channel bipe came to mind while flying a Cal Smith "Wonder Wings" and noting its responsiveness on rudder-only control. The years went by with many airplanes coming and going (mostly going), but the thought of finding a true fun-type of biplane kept coming back to haunt this model builder. With the advent of the RCM design contest it was felt that an opportunity had presented itself to see if that dream biplane could be designed, built, and flown. After gathering together all the notes that had been stored for just such an occasion, and finally sitting down and getting busy, one fine Sunday morning the Hobo lifted into the skies and a dream had been realized.

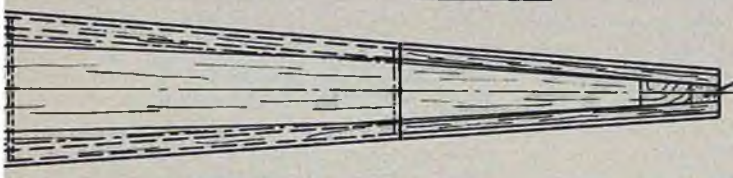
This plane is called 'Hobo,' for it looks like one around all the sophisti-

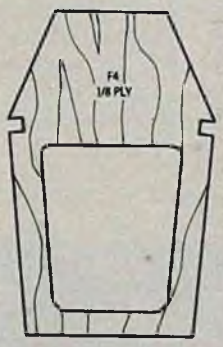

L/E 3/16 x 1/2 BALSA
1/4" BASS STRUT INSERT
OUTER WING STRUT
PLANK ENTIRE WINGS WITH
1/16" SHEET BALSA
LOWER WING TIP
1/8 SQ SPARS
TIP BLOCK 1 x 1 1/4 x 8 (4 REQ'D)
1/8 x 1/2 T/E STOCK
3/32 SHEET BALSA SIDES
FRONT SPARS
3° RIGHT THRUST
1/32 PLY DOUBLER
F2
1/8 PLY
K & B .45 USED IN PROTOTYPE (RADIAL MOUNTED)
OUTER WING STRUTS ARE OPTIONAL - THEY CAN BE CUT FROM 1/8 PLY
PLUS 1° INCIDENCE
F3
1/8 BALSA
1/4 PLY (2 REQ'D)
BALSA BLOCK HEADREST
F3
TANK AREA
C/G
2° DOWN THRUST
F1
TANK FLOOR 1/16 PLY
1/4 SQ SPRUCE
3/16 SQ BALSA
F2
1/32 PLY DOUBLER
F4
3/32 SHEET BALSA SIDES
BATTERY AREA
1/2 BALSA FAIRING
3/16" DOWEL
0° INCIDENCE
3/4 x 2 1/2 x 5 BALSA BLOCK
1/2 x 4 x 8 BALSA BLOCK
5/16" DOWELS
F1
3/16 PLY
3/32 BALSA (32 REQ'D)
CENTER RIB 1/4 BALSA (2 REQ'D)
CABANE STRUT CROSS BRA
1/8 PLY (2 REQ'D)
3 1/2" WHEELS
FULL SIZE LANDING GEAR PATTERN
MAKE FROM .090 DURAL

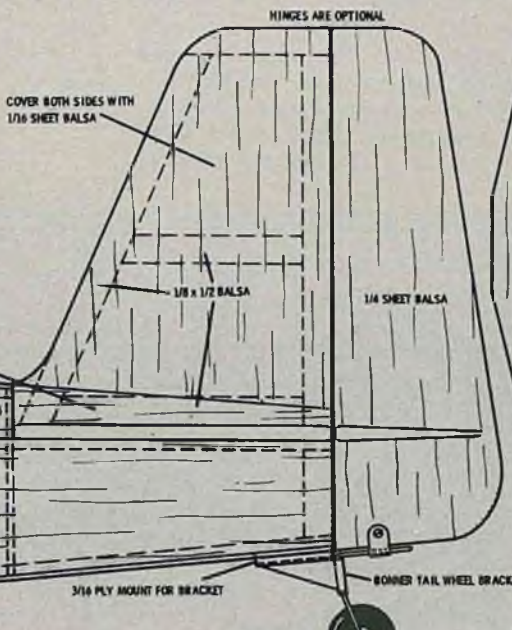


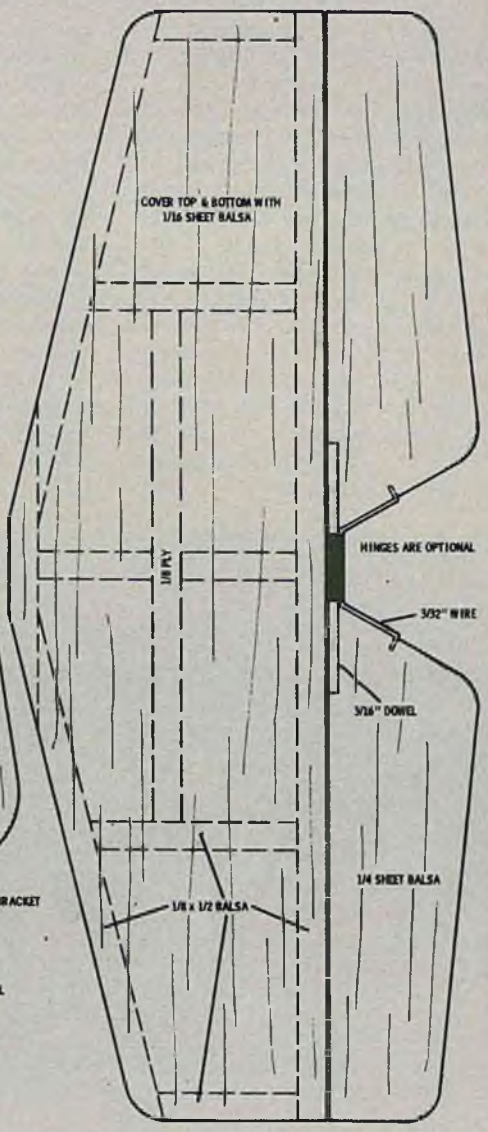


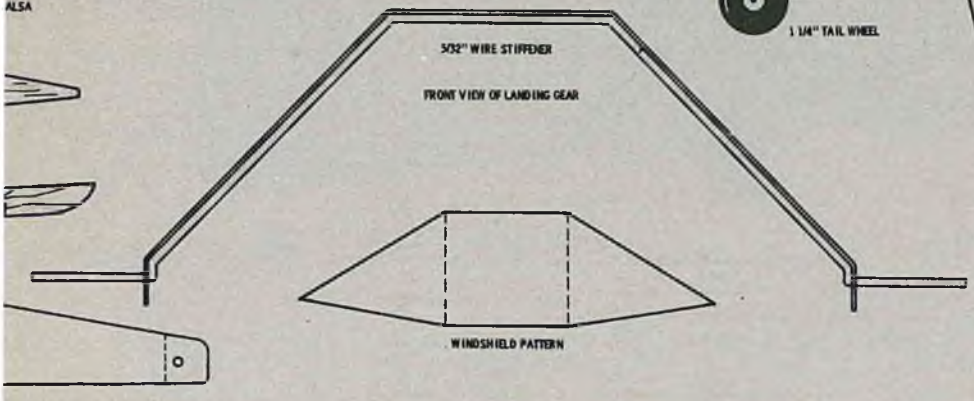
1 3/8" DIHEDRAL EACH TIP











SERVO & PUSHRODS INSTALLATION ARE LEFT TO BUILDERS CHOICE
SPAN 40" LENGHT 41" WEIGHT 6LB AREA 720 SQ IN.

RADIO CONTROL modeler MAGAZINE

HOBO

DESIGNED BY	DON J. GERNER	DRAWN BY	DICK KIDD

0 1 2 3 4 5 6

cated multi ships with their chrome spinners, varigated paint jobs, adjustable flaps and retractable gear. It has only simple functional lines with no more frills and gadgets than those necessary to promote an enjoyable Sunday afternoon's flying. This plane is not wild and flies at almost scale-like speeds. It is quite responsive and is a sight for sore eyes after seeing so many of the hot rod types.

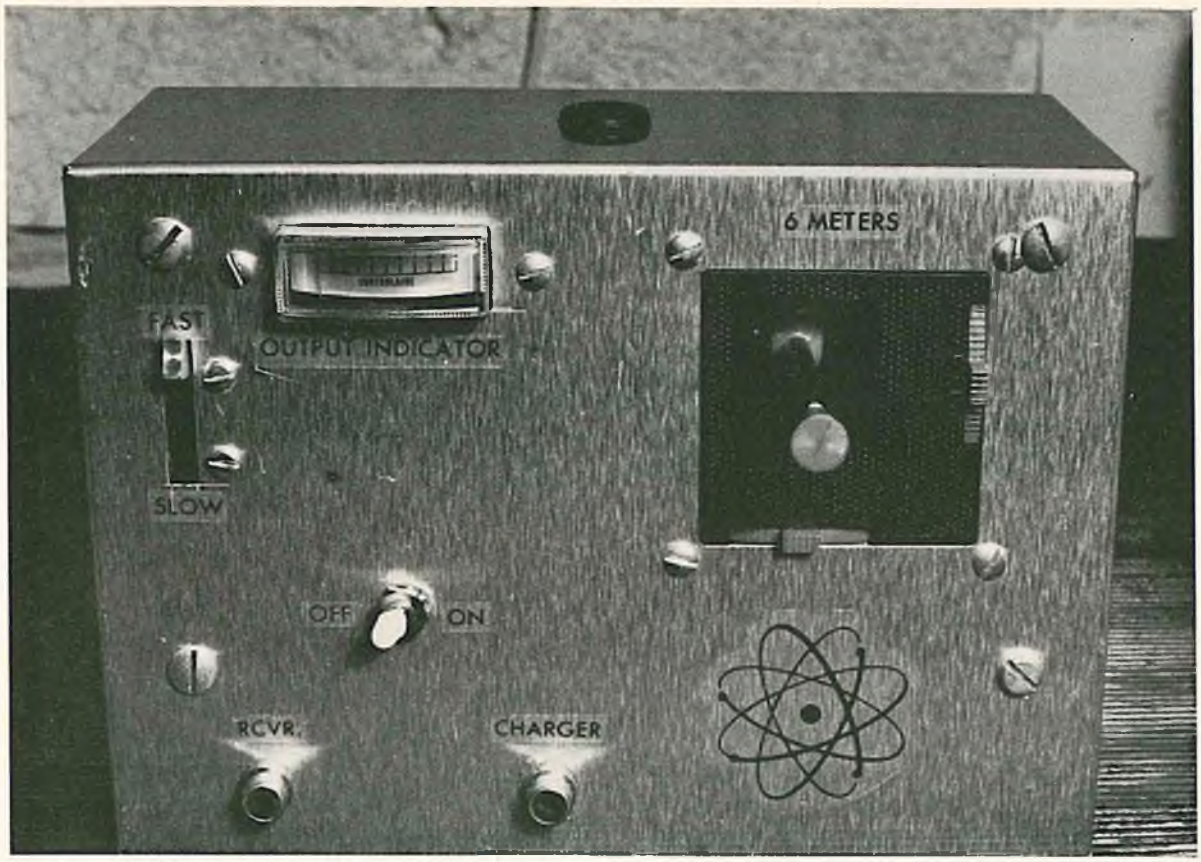
Now that you are convinced that a biplane can be fun you may think that darn bird cage and extra wing aren't worth all the effort. Well, the bird cage is taken care of nicely by being built out of plywood, and if you can't saw out one of these contraptions, take up bird watching as a hobby! The extra wing may take a little extra time but not much, as there is no covering to mess with, just sheeting of the wing and finishing.

FUSELAGE: Cut out the fuselage sides from 3/32" sheet and cement the 1/32" plywood doublers in place with contact cement. Cement the 1/4" sq. spruce into place along with the cabane struts, which may be cut from 3/16" or 1/4" plywood if you are squeamish. Cement the 3/16" sq. balsa in the aft portion of the fuselage sides. Next cut out and cement into place fuselage formers numbers 1, 2 and 4. After this has dried, using a **taut string** to determine the center line of the fuselage, cement in the tail post block; followed with the remaining fuselage formers. Omit the cabane cross braces (1/8" ply) until the last step as they might interfere with the sheeting of the fuselage top and bottom which is undertaken **after** provisions are made for mounting the self-locking nuts for the radial mount and an 8 oz. fuel tank. Place a plywood wafer between the radial mount and the firewall to ensure **at least** 2° right and 3° down thrust. The nose blocks and the battery compartment blocks are now cemented into place. If you feel that the built-up landing gear is too much trouble, use an aluminum one, but don't forget to put in an extra dowel to facilitate its attachment to the fuselage.

TAIL SURFACES: While you are waiting for some of the fuselage parts to dry, the elevator and the rudder assemblies can be built and made ready for attachment to the fuselage. Begin by gluing together the framework of the rudder and elevator. While this is drying, cut out the elevator and rudder flippers, sand to shape, and glue 1/16" ply reinforcements where the control horns will be attached. Assemble the elevator flipper assembly as indicated (ala DeBolt) and you will have a true and strong flipper assembly that will not spring under load. After the framework assembly has dried get out the contact cement and attach the sheeting (ala Cunningham) for the **quickest and truest** tail surfaces ever. Rudder fins built this way have **never** warped, which is not true of the 1/4 balsa sheet rudder fins even though the dope is plasticized with castor oil. The surfaces may be attached with nylon hinges, or may be sewn. The fairing blocks are now cemented to the rudder and elevator as are the lower wing cradle rests (1/2" medium hard sheet).

WINGS: We may now start building the wings, which really is not a bad job if you have a wing board. If you are not interested in **true** wings forget the wing board and have fun guessing just when the next snap roll is coming! If you are lazy, stack up the 3/32" sheet blanks, trace the rib outline on top of the stack and use a band saw to cut them out. If you can't get to a band saw, use a Dremel bench saw making certain that the blade is 90° to the holding table. Notch out the ribs for the spars and cut out the dihedral braces from 1/16" sheet plywood. The next step is to set up the correct dihedral value on the building board which can be checked with the main spar dihedral brace. The bottom main spar is pinned to the working surface and a 1/4" sq. balsa strip is positioned so all ribs are true in all positions. This position usually falls between the rear spar and the trailing edge. After the ribs are positioned, the dihedral braces are cemented in place followed by the trailing edge, top rear spar, top main spar and the leading edge. If you desire outboard N struts, 1/4" bass strut inserts are ce-

(Continued on Page 87)



TWO STICK ASSEMBLIES FOR THE RCM DIGITRIO

BY ED THOMPSON

AS you know by now I took a month's vacation from writing to do some flying and also to attend the Model Airplane Trade Show sponsored by the Garden Grove Radio Control Club. As a result, I was quite impressed by the advances being made in the digital proportional radio control systems. Reliability and simplicity seem to be the by-word with all the manufacturers. Those manufacturers who, at the time of this writing, did not have digital equipment on the market will probably have it by the time you read this. With the digital systems there is more room for originality in design than ever before possible in the radio control field. Integrated circuits are now present in several of the systems and appear to be one of the answers to future miniaturization. Increased reliability, on the other hand, will come from adept application of these circuits. I believe that digital systems, in general, have progressed to the point where they now equal or exceed the reliability of reed systems. The only way to go now is up. The advent of digital control has given the hobby a "shot-in-the-arm" and is bound to increase the number of radio control modelers who heretofore needed that little "touch of magic" to get them started. I feel that people like Don Mathes, Doug Spreng, Frank Hoover, Phil Kraft, Howard Bonner and others, whom I have not omitted deliberately, deserve a great deal of thanks for their pioneering efforts.

Another Stick Assembly for the Digitrio

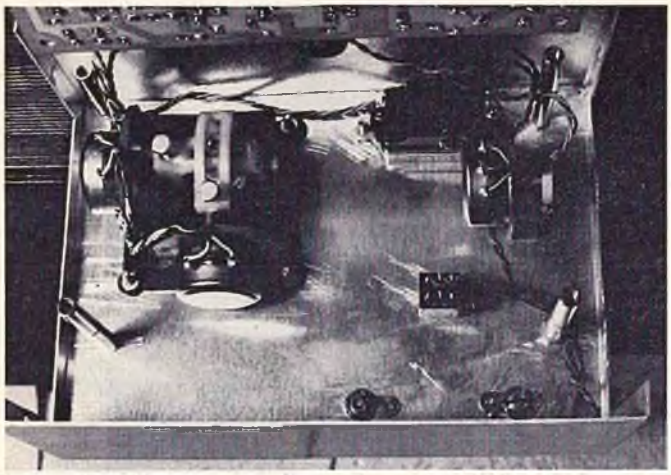
We received a very interesting letter from a Mr. Gerald Dale, President of the Montreal Model Aeronautics and Radio Specialists. He describes a stick assembly he home-crafted for the Digitrio and which I am including in this month's article. While it is a little more complicated than the Digitrio stick assembly it has several unique features and a more professional appearance.

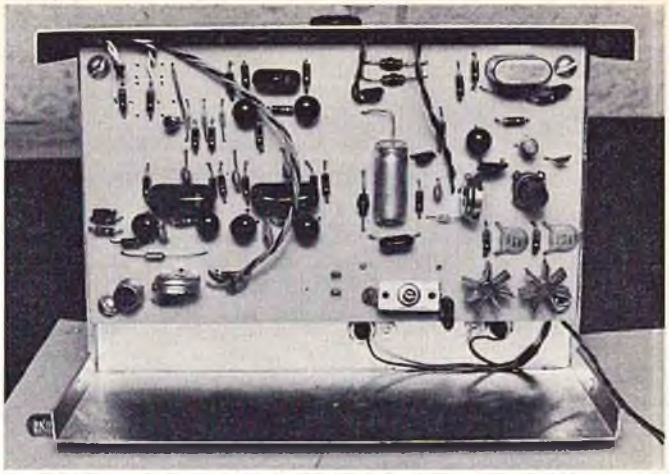
I had intended to present the 3+1 modification this month but the pictures were lost so I am presenting the installation of the Bonner stick assembly instead. I'll include the 3+1 modification next month.

Here is something I should have included in the March issue, along with the improved final amplifier modification.

For best performance your antenna should be checked for resonance as follows:

1. Insert a milliammeter, on the 0-100 MA scale, in series with the 47 uhy choke going to the final amplifier.
2. Extend the antenna fully and push the tip section down ¼" at a time while checking the milliammeter reading. Be sure to place both hands on the transmitter case each time you check the milliammeter.
3. Continue checking every ¼" until the milliammeter rises to a peak reading and falls off. The peak meter reading corresponds with resonance.
4. Go through this procedure a couple of times until you are sure where the antenna is resonant and solder the tip section in place (file the





plating off the antenna where you are going to solder to insure a good electrical bond). An alternate method would be to cut off the unused portion of the tip section and rethread it to accept the knob.

5. If no increase of final amplifier current is noted during this test, no change in length is necessary.

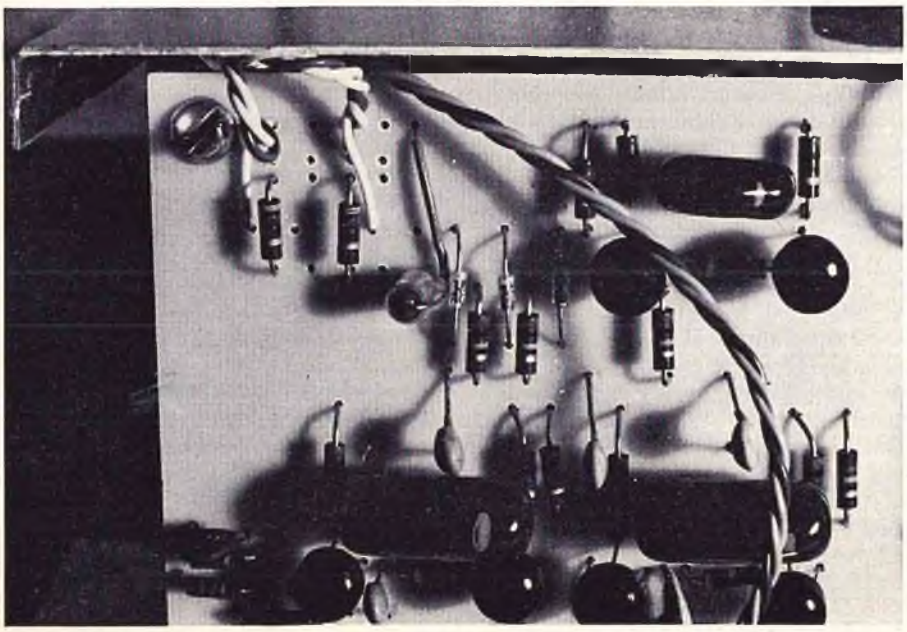
Your final amplifier current should be 45-60 MA and overall battery drain 120-140 MA.

You should get 1-2 feet of range with antenna removed and back of case screwed on. This will depend on how "RF" right the transmitter case is.

Using the Bonner Stick Assembly With the Digitrio

For those of you who would like to use a commercial stick assembly with the Digitrio here is how I constructed one of my transmitters using a Bonner stick assembly. This transmitter was built from a World Engines' kit which has a prepunched hole into which the Bonner stick will fit perfectly.

The pictures show the installation details and should make the job easy. You will notice that I have the elevator trim toward the outside of the case because I feel access to the trim levers is easier to obtain with my right thumb. You will also notice that the interior of the transmitter case has a much neater appearance due to the lack of trim pots. In the photo of the upper right-hand corner of the P.C. board, note that the two 22K ¼W resistors and the associated wiring going to the two trim pots have been deleted. These are no longer necessary due to the mechanical trim provisions built into the stick assembly. I received my Bonner stick in a sack, unassembled. I wish I could tell you how to put one together but do not feel that I am candid enough with words. Actually, it is not a difficult job and requires only a little patience. I would suggest that you check your stick carefully for binding after assembly to prevent interaction. Lightly grease both the ball joint and yokes to obtain smoothest operation. Electrically center the two 10K pots using the ohm-meter method described in the previous article. This can best be accomplished by loosening the pot shaft screw moving the stick, tightening the screw, moving the stick again thereby turning the shaft in the desired direction to obtain centering etc. Insure that the trim levers are centered while accomplishing the above. Final position of the pot shafts will be determined by the mechanical centering of the servos. After the stick installation is complete, repeat the above electrical centering procedures to obtain mechanical centering of the servos. You may find that the servo throw is not as much as you would like. This is because the Bonner stick assembly has less mechanical throw than the Digitrio stick assembly. It can be compensated for by replacing the two 1.2K ⅛W resistors in the servo with 1.5K ⅛W resistors. You will also notice that servo extremes are fixed regardless of trim lever settings. This is because the trim arrangement of the Bonner stick is mechanical rather than electrical. I find this of no particular disadvantage as long as your aircraft is properly trimmed. If you find mechanical trim necessary during a flight adjust your surfaces before further flights to allow equal control movement while you are in the air. You may also have noticed that I had to file the upper right-hand stick mounting screw head slightly since it touched the upper right-hand P.C. board mounting screwhead. This could have been prevented by shifting the P.C. board slightly. The installation of the Bonner stick is a real time saver, makes a neater transmitter and provides a more professional look. Considering the fact that you eliminate two 10K pots



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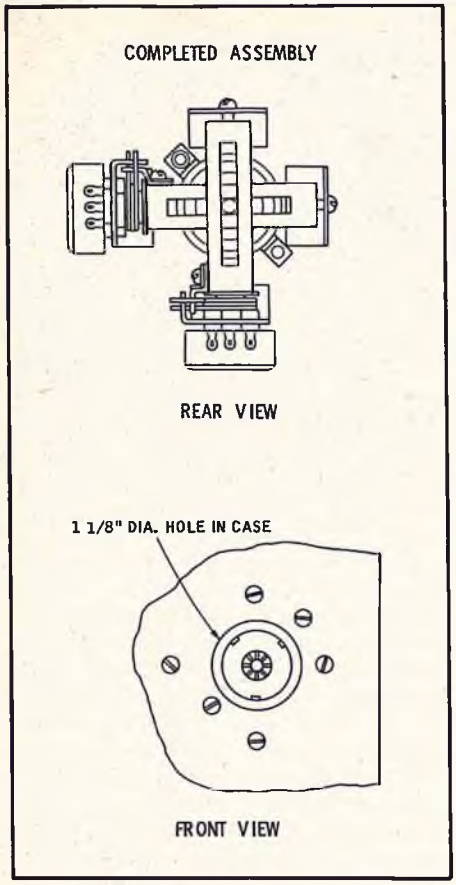
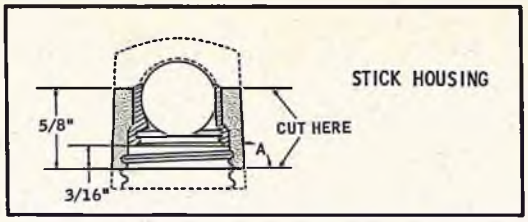
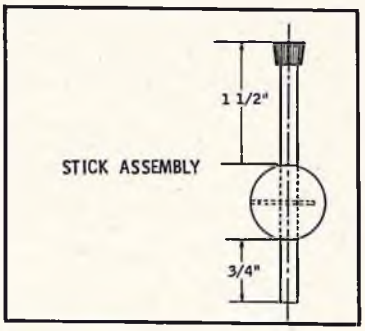
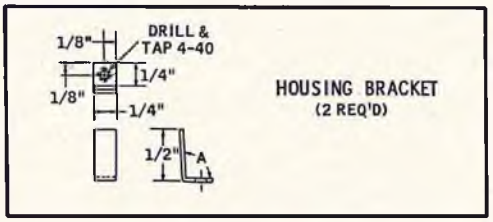




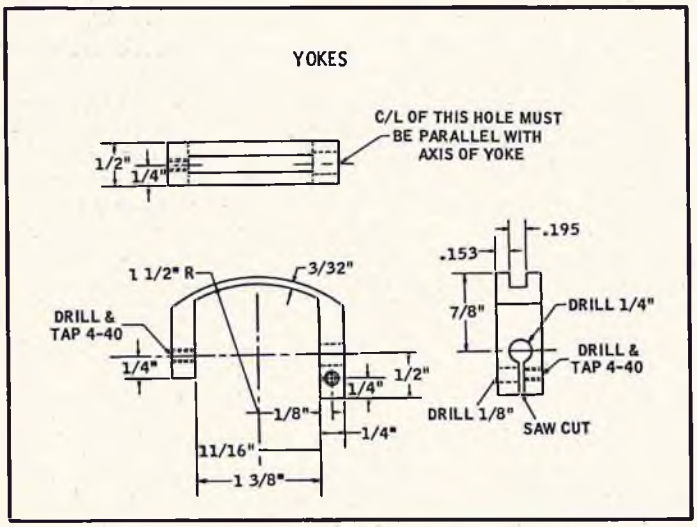
Stick Housing: Made from "Trig" or other suitable roll-on deodorant bottle cap. Cut as shown with hacksaw or razor saw.



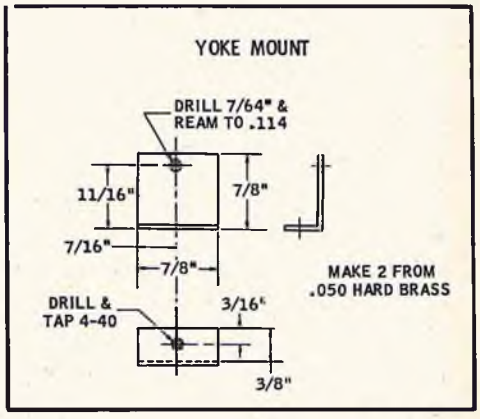
Stick Assembly: Drill 3/16" hole in center of ball. Insert 3/16" aluminum or plated brass shaft. Drill 1/16" hole at 90 degrees to shaft and pin with 1/16" music wire. Add knob of your choice.

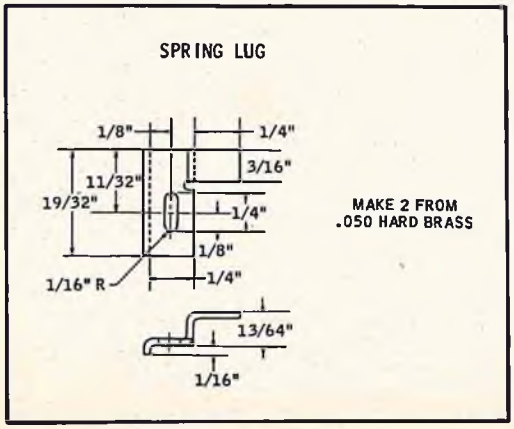


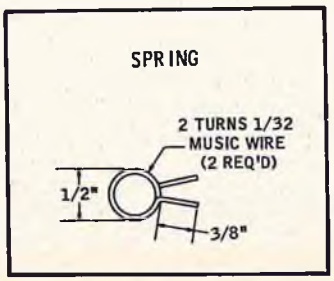
Housing Bracket (2 required). Make two from .050 hard brass. Epoxy to housing 180 degrees apart slightly underflush with housing base.

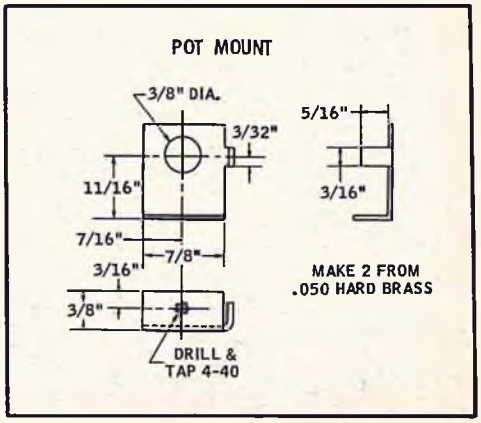


Upper yoke shown. Lower yoke identical except 7/8" dimension is 9/16". Make one each from either ½" Delrin sheet or 3" diameter Delrin rod. Cut with jigsaw or coping saw and sand smooth. Finish slot carefully to avoid excess play.









An Approach to . . .

R/C FLYING SAFETY

Part II By Cdr. Lou Guerrieri, U.S.N.

IN Part I a program of RC crash prevention was discussed. Education was proposed as the key to a successful safety program. A listing of accident causes under the broad heading of Personal Error indicated that the major contribution to a "save the plane" plan was to recognize and avoid operator-induced weak links in the RC flying chain. Part II continues the discussion of crash causes.

System Failure

As a bona fide crash cause, System Failure appears to be quite remote. Yet in spite of your best efforts the gods sometimes refuse to condone repeated intrusions into their domain and a full-blown crash results. The mechanical/electronic reliability of the aircraft/RC system breaks down. These failures constitute the great unknowns in RC primarily because of our inability to analyze the remains of the model and the lack of a program to report failures of this nature and pass the information to other RCers.

Some attempt is made to list System Failure crash causes in the box below.

SYSTEM FAILURE

1. Interference. Generally from another RC transmitter at the same location.
2. Batteries. Bad cell; internal short.
3. Receiver. Cracked crystal; loose/broken components; dirty reed bank contacts; adjacent reeds drive simultaneously.
4. Servo. Misaligned finger contacts; transistor or component failure; broken PC board; misaligned crown gear; burred/broken gear teeth.
5. Cabling/Wiring/Connectors/Switches. Cold solder joints; fatigue breaks; intermittent contact.
6. Push rods and control surfaces. Decoupling of control horn and rod linkage.
7. Transmitter. Misaligned lever switch contacts; dirty lever switch contacts; shorting of antenna mount; loose/broken components; tone drift.
8. Engine. Blown glow plug; blown gaskets; dirt in fuel line.
9. Electrical noise. Singing reed bank; jerky servo operation; unwanted signals.

One of the basics in combating System Failure is a complete and thorough pre-flight check of the model and all its equipment. Time spent here probably will decrease the number of "unknown" crash causes. It has been said before but bears repeating: if the equipment malfunctions on the ground it won't cure itself in the air. Once airborne, if any doubt exists that all is not as it should be (missed signals, spurious signals, etc.) select low engine, come back, and land. Give everything a very special inspection before attempting another flight.

Intimately related to the System Failure crash cause is the method of determining this cause, Crash Investigation.

Crash Investigation

In the Naval Aviation Safety Program we find that accident investigation and accurate reporting are fundamental to crash prevention.

The organization of every Naval Aircraft Squadron calls for the presence of an Aviation Safety Officer. These officers are pilots and most are graduates of the ten week Aviation Safety Officers' Course given at the University of Southern California. The Aviation Safety Officer is considered an expert in flying safety and accident investigation. In addition to flying, his primary job is to promote the squadron accident prevention program and participate in investigations as necessary. With a standard contingency plan each squadron is prepared to investigate and report accidents involving their own aircraft. The primary concern is not necessarily who caused the crash, but **what** caused it and **why**.

In most accidents it is impossible to single out one specific item as positively causing the mishap. The emphasis is on determining the most probable cause and the prompt reporting of this to the Naval Aviation Safety Center at the Naval Air Station, Norfolk, Virginia. Here the reports are analyzed, statistics accumulated, and briefings forwarded to all other naval activities operating the same type aircraft. Design or manufacturing deficiencies are reported to the prime contractor. Thus the education process continues. Study of a particular accident may prevent its occurrence in the future.

For our purposes, Crash Investigation should be considered if the slightest doubt exists that Personal Error was not the primary cause.

To investigate properly we should have the speed of a four-minute miler, a grasp of logic of a Sherlock Holmes, and a plan of action. Here are the basic requirements:

1. At the Scene of the Crash. It is very important to be the first one to arrive so that no item is disturbed before the wreckage pattern can be determined. At such times, however, small boys appear out of nowhere running full tilt for the spot. At the scene attempt to locate all major components and establish their relationship to the initial point of impact. It is necessary to know which part of the model struck first. We want to determine the direction, angle, and speed of the model upon impact. Keep in mind that we are searching for clues as to why the plane crashed. The attitude of the plane at moment of impact is such a clue. Get a good mental picture, or better yet, sketch out the point of impact, wreckage distribution, direction and attitude of the model at impact.

Now take a good hard look at the remains before moving them. Note condition of control surfaces and whether or not they are hooked up to their push-rods. They may have separated before or after impact. Later investigation may provide the answer. Pay particular attention to the position of switches, connectors, and servo arms. It is best to write down the information. Collection of the pieces can now take place. Gather these with as much care as possible, especially the electronic components. This will prevent even further damage, or worse yet, disguising the clues. Save all the items for a later detailed investigation.

2. Witnesses. Back at the flight line you will be deluged with the question, "What happened?" Explain briefly then talk with as many people as possible who saw the flight from the time the plane got into trouble until it crashed. They may be able to provide clues as to what equipment or component started the crash chain.

Did the plane start off by wobbling, tucking, zooming, etc.? What did it do then? If it turned or rolled – in what

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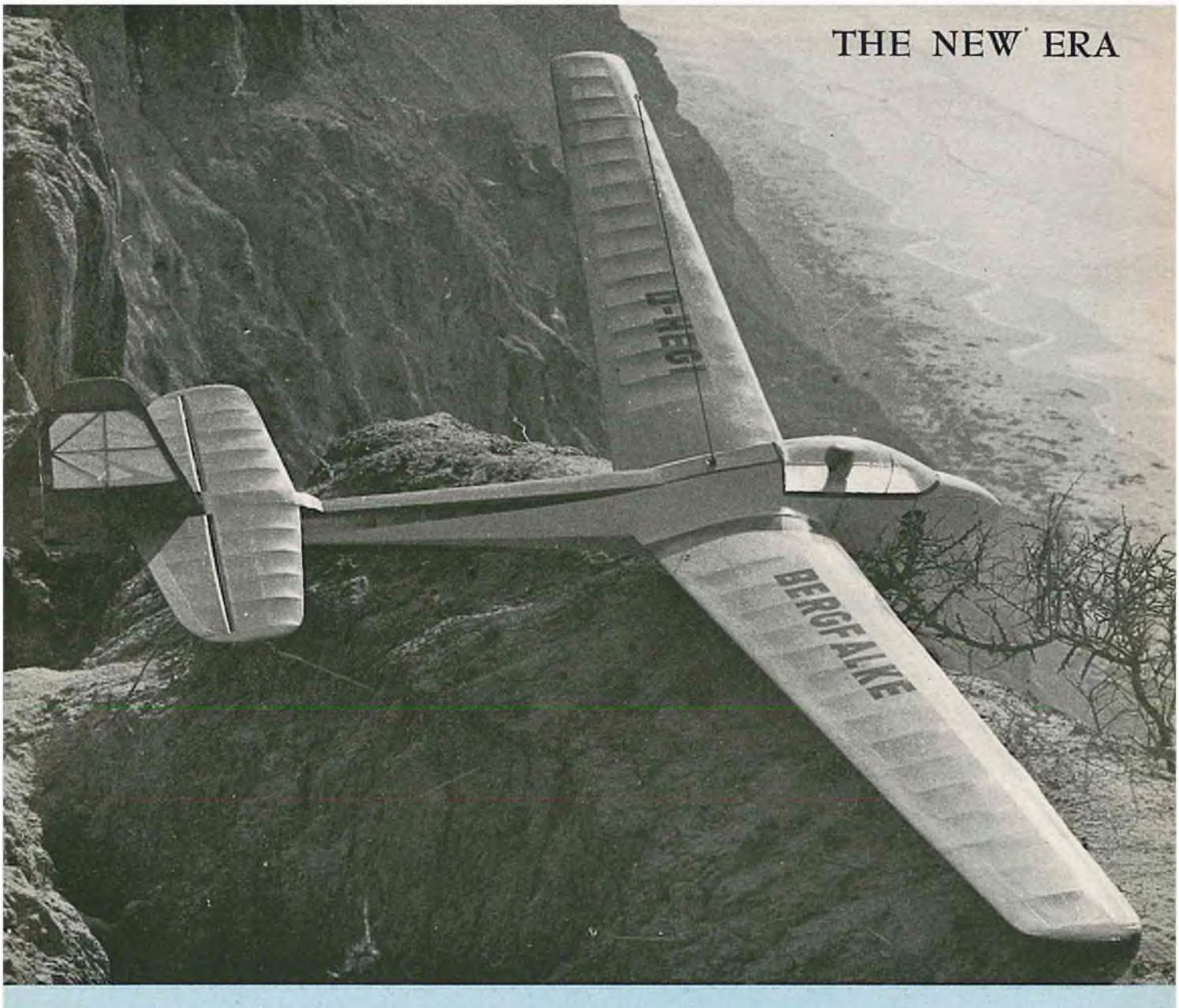
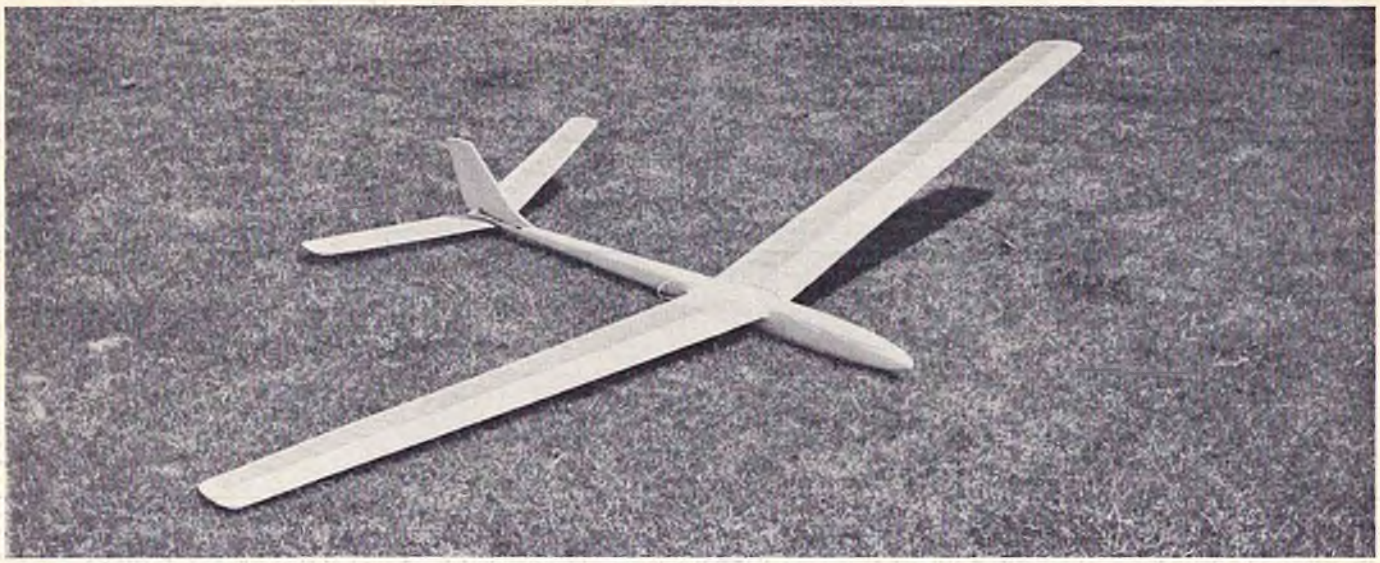


THE MAJESTY OF *SOARING*

By DALE WILLOUGHBY



Type: High performance Kurwi 33 with glass fuselage, swept surfaces and plug-in wings.

This Comprehensive Look into the Types and Techniques of Gliding will enable you to be Successful in this Phase of the New Era of R/C . . . the Majesty of soaring.

Throughout Europe in the recovery after the devastation wrought by World War II there were very few motors in the immediate post war era. Yet there were many modelers who felt the need to build and fly models. The natural inclination was to gliders, and with the advent of radio control equipment, design evolved into very efficient radio controlled gliders. In addition, there was a tendency to follow the lead of the full size glider buffs in using the beautiful terrain to do a lot of Sunday flying. The simplicity of equipment (and lack of noise) required for glider flying was further incentive to spend an afternoon just enjoying Mother Nature.

In most instances, Americans have not had the advantages of a locale where gliders could be flown hour after hour, except on the West Coast. This article then, is meant to encourage R/C modelers to a better understanding of the simple requirements for R/C glider flying.

There are at least five ways to get the glider airborne. The old style tow line (and with elevator control, this is quite simple, even for 4-5 lbs. gliders); Hi-Start, where the rubber bands stretched to do the work of running feet; slope soaring, where mechanical lift, generated by wind striking the face of a hill or slope, provides the lift; by towing behind powered models, and by flying Piggy Back to a safe altitude then releasing the model to hunt for thermals. Dr. Walt Good successfully pioneered Piggy Back on the East Coast. Each type of flying gliders has its merits, depending upon your particular

Type: Styrofoam and balsa wing, fuselage and stab, with balsa rudder. Light and strong.

Type: Flying wing glider (plank style) with elevons and rudder. R/C equipment in pod.

Type: Huge powered glider capable of payload, such as camera, parachute, etc.

Type: Dihedralled and swept flying wing with rig in center section. Needs more vertical area.

Slope soaring scale and silent combat — much fun and little damage.

Type: Duration and FAI type — Jetco Imperial R/C 100 with good streamlining and high lift.

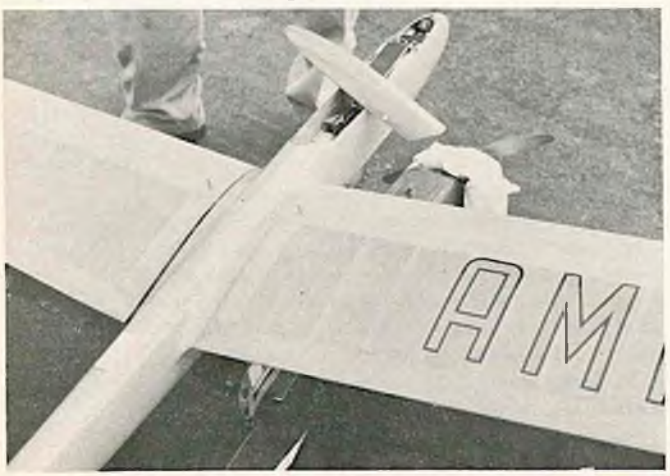
Type: Scale R/C gliders or full size gliders are quite challenging. R/C control adequate.

Type: Scale LO-100 with CAR easy to fly and easy to tow on Hi-Start. Rugged nose on this one.

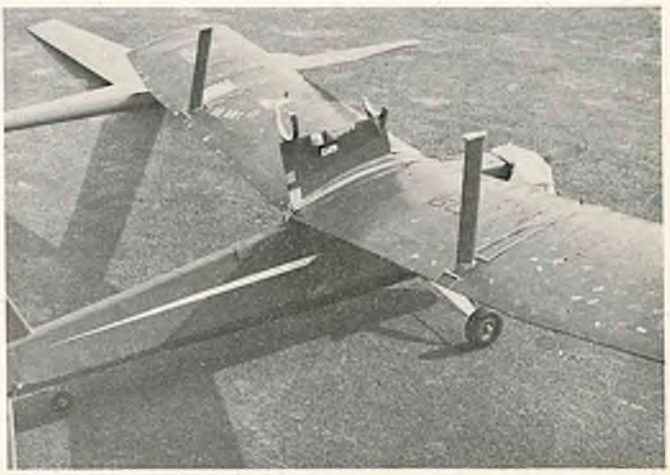
Type: Scale Zugvogel with 120" wing — 2" over scale wing, flies fast, will hardly turn downwind.

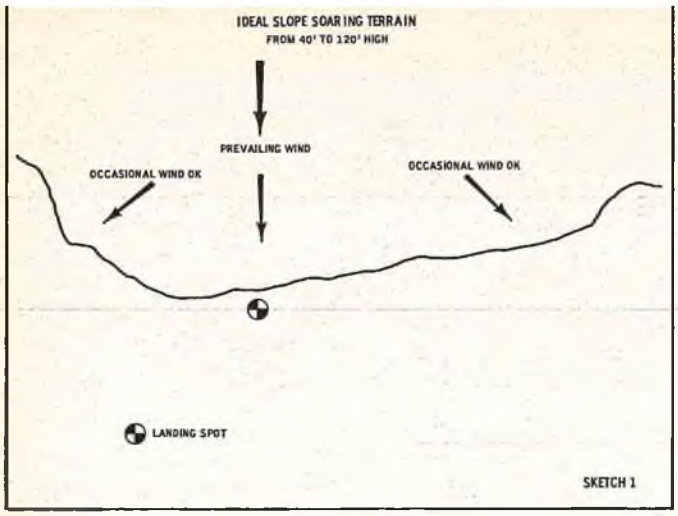
Type: Scale K-7 for rudder only, thermal capability with lightweight R/C rig.

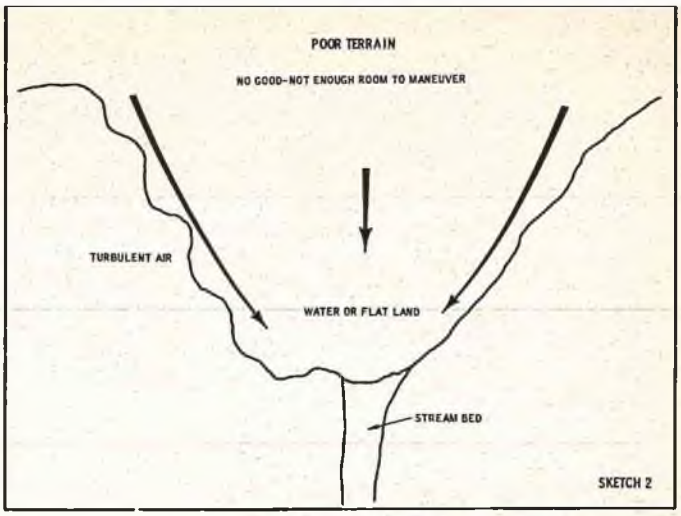
Type: Kurwi 33 atop Multi-Bug gets free ride to 500 feet, cast adrift to look for sustaining thermals.

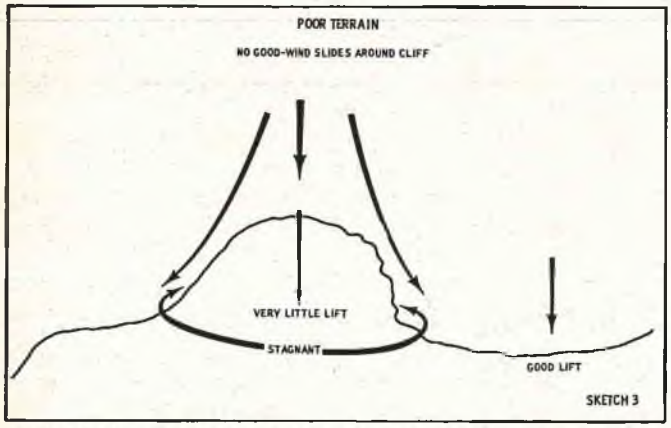


Cradle and anti-sway braces keep Kurwi 33 level until release.

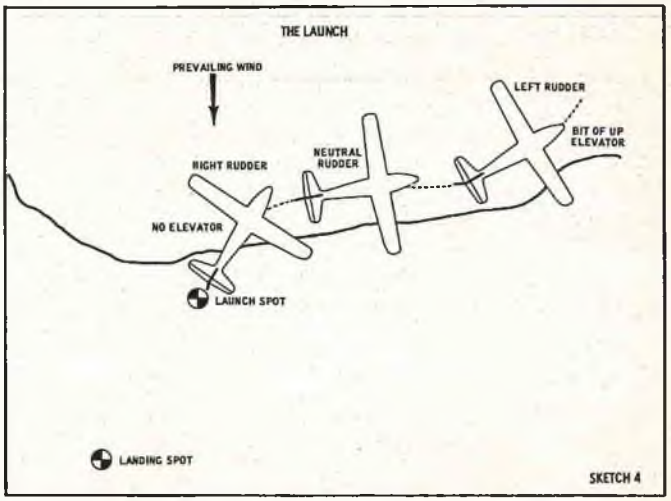


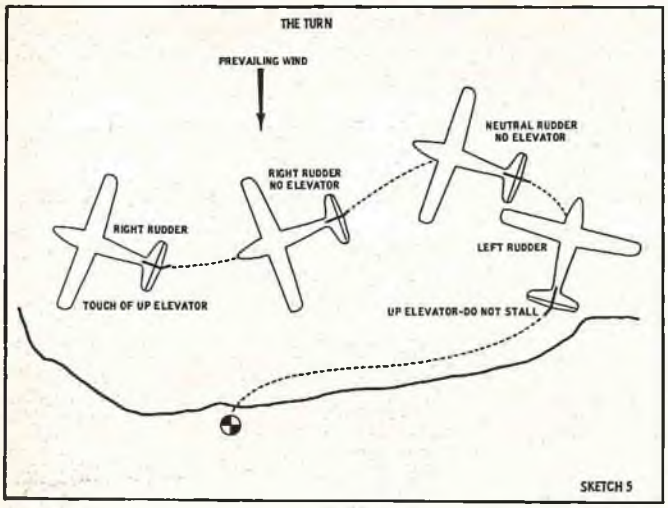


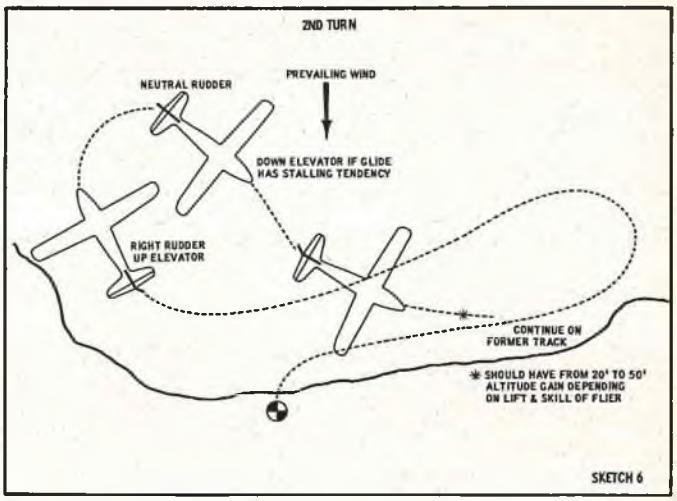


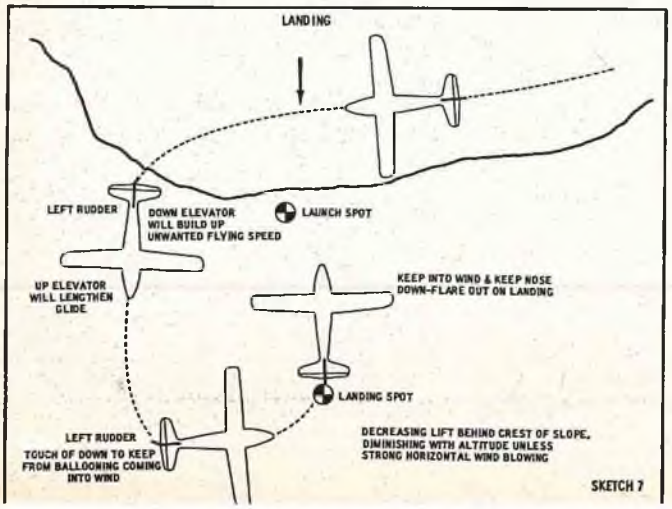


Under light wind conditions pick a spot below for landing. Maintain 60 to 65 degrees angle between point of cliff and glider for optimum use of lift, no matter how strong the wind.

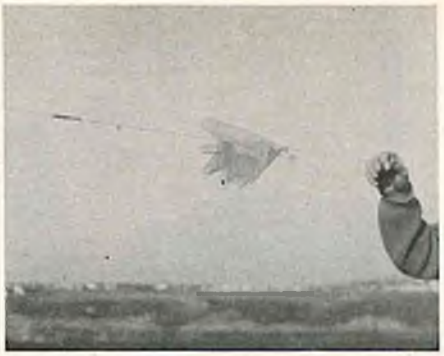








Wind Strength Guide: 0-8 Knots: no sustaining lift except thermal action; 8-12 knots: light weights, 6 to 10 ounce wing loading, and well trimmed gliders flown under capable hands; 12-20 knots: ideal lift, may blow back lightweights trimmed for low wind conditions. Re-trim or add weight to penetrate; 20-30 knots: strong, gusty winds make flying difficult but not impossible; 30-50 knots: build for a nicer day!



Technique: Hi-start with metal stake and ¼" flat rubber, unstretched. More line to be added. The hi-start parachute is rigged so that chute is kept closed until the glider is released. The parachute opens to keep line from snarling and to mark spot where ring landed.

terrain, but I will deal mainly with Hi-Start and Slope Soaring. Probably the 6th way of flying R/C gliders is to put a power pod above the C.G. or in the nose, and this method seems necessary for some modelers. Fortunately I am located near an excellent slope soaring site, and will be visiting the desert for Hi-Start flying when thermals are more abundant out there.

Some of the R/C gliders I have flown are quite varied. The conventional, the flying wing, the delta, semi-scale and scale have all had their times in the air. The most consistent flying glider has, of course, been the conventional layout, for with that type, I learned (and am still learning) how to fly the most appealing of all models.

As with powered models, construction is varied, and the use of balsa; hardwood and balsa; fiberglass; foam and combinations of any one of these is up to the individual builder. The properties of fiberglass lend themselves best to R/C gliders, either as a complete fuselage or over a balsa framework. And with slope soarers, weight is not always a factor. Thermal Soaring could be different, but the trimming of a glider has much to do with successful gliding.

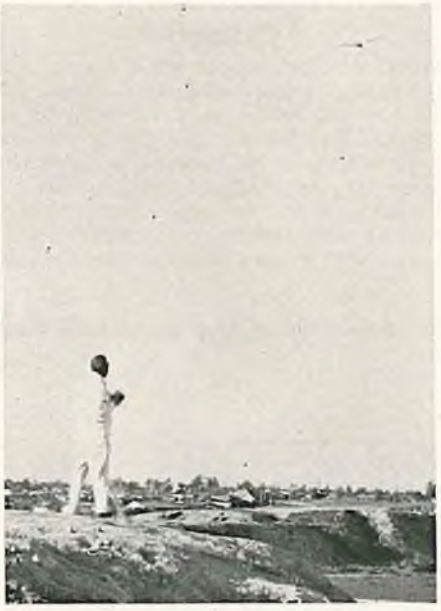
Many readers have towed A/1 and A/2 glider designs, and towing R/C gliders is as simple, especially with the correct tow-hook/C.G. relationship. My only problem is getting 10 mph feet when I only have 6 mph feet and they are slowing down every day! So I have turned to Hi-Start. While this is "old hat" to most modelers, recently I came across a Hi-Start set from Germany that shows great promise. With 100 meters (328 ft.) of ¼" flat rubber and 150 meters (492 ft.) of 50-lb. test monofilament line, together with a metal stake, parachute, swivel and ring, I am able to walk back as far as I dare, release and watch my glider go up to where the thermals are strong enough to sustain a 4-lb. machine. Tests are continuing with this Hi-Start and formulas will be furnished with the Hi-Start set so that anyone will be able to put a glider up even in Zero Wind and a 5-lb. glider with the tow hook correctly positioned. I expect this Hi-Start to open up glider flying to almost anyone in any area, and with such equipment, solo flights are very practicable.

For those who read about slope soaring fun and have wondered about the terrain necessity, I have prepared a number of sketches depicting the techniques of slope soaring. Close study and application of the principles set forth in these sketches will enable you to pick your own spot for leisurely R/C glider flying.

(*Continued in Page 54*)

Technique: Correct position for launching slope soaring gliders into wind. Only flying speed needed.

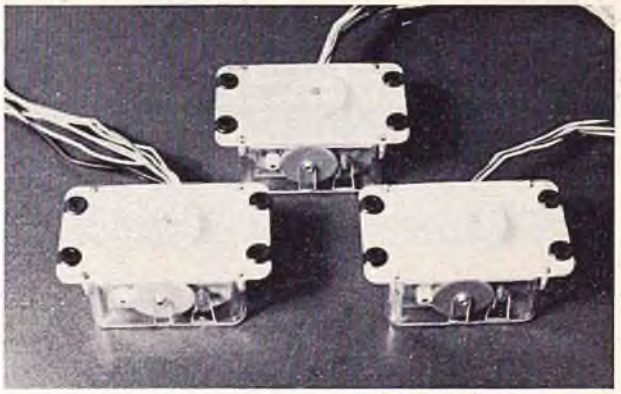
Technique: Correct angle for maximum use of available lift on slope — between 60 and 65 degrees.



Technique: Full size glider pilots show marked interest in R/C gliders—their advice can be helpful.

RUDDER, ELEVATOR, and MOTOR for Single Channel With The NEW ROYAL SERVOS

RCM PRODUCT REPORT



IN the November 1964 issue, RCM had the pleasure of reviewing the Royal Single Channel Servo system, distributed by Royal Products Corporation of Denver, Colorado. This was the first breakthrough into what had been primarily "escapement territory" – a single channel rudder and motor servo that worked to perfection both mechanically and electronically. Since their introduction in RCM, the Royal servos have virtually captured the majority of the single channel rudder-only market, proving beyond doubt in the field what we had found, and subsequently reported to you, in the product report on those units.

We are equally pleased to announce the newest addition to the Royal Products line – a **complete** and versatile single channel servo system consisting of a rudder (and/or aileron) servo, Model #13RA; elevator servo, Model #13E; and motor control servo, Model #13M. This combination, coupled with a superhet relay receiver, will enable the single channel flyer to obtain rudder or ailerons, or coupled rudder and ailerons, plus elevator and throttle control – all from a powerful and reliable single channel package!

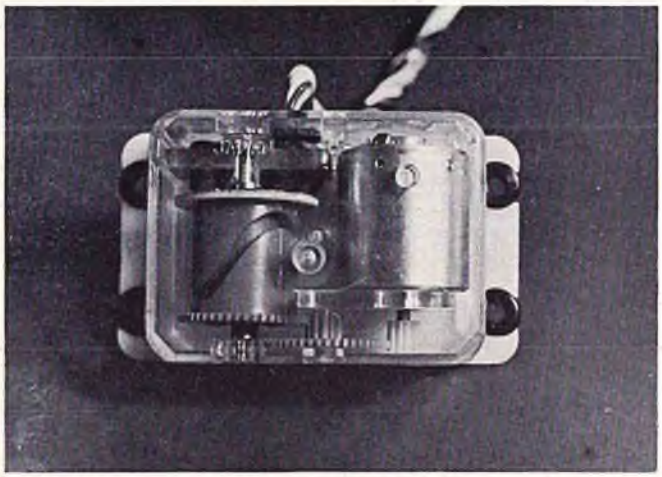
Each of the new Royal Single Channel Servos has been injection molded to assure the most precise unit of its kind ever manufactured. Weight of each individual servo is 2¼ ounces with overall mounting surface dimensions of 2½" long by 1 7/16" wide. Servo depth is 1" with an additional 5/16" for the output disc. Output is of the wheel type with four output holes on each disc. The servo motor is the extremely popular and efficient Mitsumi unit. Current drain is 60-70 Mah as the servo travels from control to control, with approximately 400 Mah fully stalled.

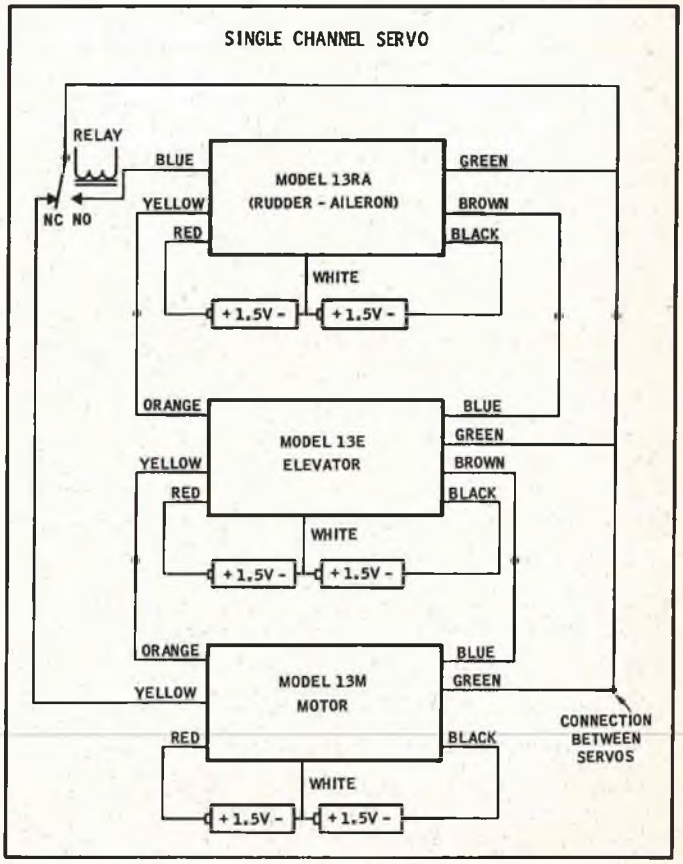
One of the most unique features of Royal's single channel servo system is in the matter of pulsing. The accepted procedure of one pulse=right, two pulses=left, three pulses=up elevator, four pulses=down elevator, and five pulses=motor control still applies. However, the innovation comes in the extremely easy manner in which the modeler may pulse these signals. Although difficult to explain in print, the rudder servo has three positions – right, left, and third. The fourth and fifth positions come from the elevator servo, rather than trying to cram five separate positions into the rudder servo alone. And from this factor is derived a great deal of the reliability that these units offer the RC'er. The motor control servo has three throttle positions – high, medium, and low.

The battery complement required for

(*Continued on Page 70*)

New Royal servos evidence highest quality engineering and workmanship. Provides servo powered rudder, elevator, and three position throttle for single channel fliers. 225 Mah nicad pack can be used for lightweight installations.





MONOKOTE

Top Flite's Revolutionary New Covering Material is Overnight Success!

RCM PRODUCT REPORT

NOTHING new under the sun? Don't you believe it!

A revolutionary innovation that eliminates the hours of time involved in the tedious tasks of silk or paper covering, doping, sanding, sealing and polishing, normally involved in covering and finishing R/C aircraft, has been announced by Top Flite Models, Inc., 2635 S. Wabash Avenue, Chicago, Illinois. Meticulous model builders who spend many, many hours over a period of days, and sometimes weeks of time covering and finishing model planes for local and national competition, have already expressed their excitement and delight over the introduction of this new patent-pending finishing material called Monokote.

As soon as word leaked out of the possibility of a new covering material, we at RCM tracked it down to Top Flite, and immediately asked for samples for test purposes. Monokote can best be described as "the covering material with the built-in finish." The material, which comes in sheets, has an adhesive back and a protective paper backing, and is applied to open framework or solid structures in three easy steps. First, you cut it to size, remove the backing sheet, then lay it in position on the model. Next you bond it to the structure with an ordinary household iron set at a moderate temperature (about the same as is used for pressing rayon or nylon material), and finally, you shrink the material skin tight by gliding the heated iron over the Monokote covered frame. Tightening of the material will not cause any warping whatsoever, since the material, by our own tests at RCM, appears to have a shrinkage pattern that is equally distributed over the entire plane of the material. Once the bond is heat-set, it holds more firmly than conventional doped silk material.

"Not only does Monokote save the modeler hours of work and days of waiting time by eliminating the normal doping, sanding, sealing and polishing operations," Sid Axelrod, Top Flite President explained, "but it is almost fool-proof. Even if haphazardly applied, dents and wrinkles quickly disappear by merely applying heat. For this reason, a novice is able to get a professional looking finish every time. Dents caused by mishaps can be eliminated in the same way. The material has a tensile strength of 25,000 pounds per square inch which makes it highly resistant to punctures and tears. Should they occur, however, they can be quickly and almost invisibly repaired by applying a patch."

Extensive tests conducted on Monokote prior to patent applications by Top Flite indicated that the material is completely fuel-proof, moisture-proof, stain-proof, and fade-proof. It will not dry out, crack, or become brittle under normal flying or storage conditions. Monokote, which has a far greater tensile and bursting strength than an equivalent silk and dope finish, weighs about half as much, and when applied, is ready-to-fly. The material is available in large 26" x 36" sheets which are extremely high-gloss and almost mirror-like. Colors available are white, black, yellow, orange, red, and aluminum. Undoubtedly, individual hobby shops will cut the material to smaller sizes for the benefit of those who need smaller sections for ¼ and ½A planes and for trimming. Price will be $3.50 per sheet.

One of our first questions concerning any "plastic-like" material is "how do you cover compound curves?" The answer with Monokote is in the application of heat to the surface. On a rounded wingtip, for example, the material is pulled as tight as possible, and heat applied. One wrinkle after another disappears as heat from the iron, or other source, is brought close to the material. This step is repeated until all wrinkles are removed. "It's the most exciting thing to come along in the model building field in my time," says Vic Husak, winner of the Best Finish Award at the Toledo R/C Conference. "I was able to completely finish a Taurus in nine hours, and an equivalent job would have taken me at least 50 to 60 hours of work over a period of weeks! It's definitely an improvement in the method of finishing models for the fellows who have neither the time nor the ability to come up with a championship finish."

Another outstanding aspect of Monokote is in its application for trim functions. An intricate trim design can be drawn on the protective backing sheet, the design cut out with ordinary scissors, the backing sheet removed, and the material applied on the model.

When positioning trim material, one

(*Continued on Page 74*)

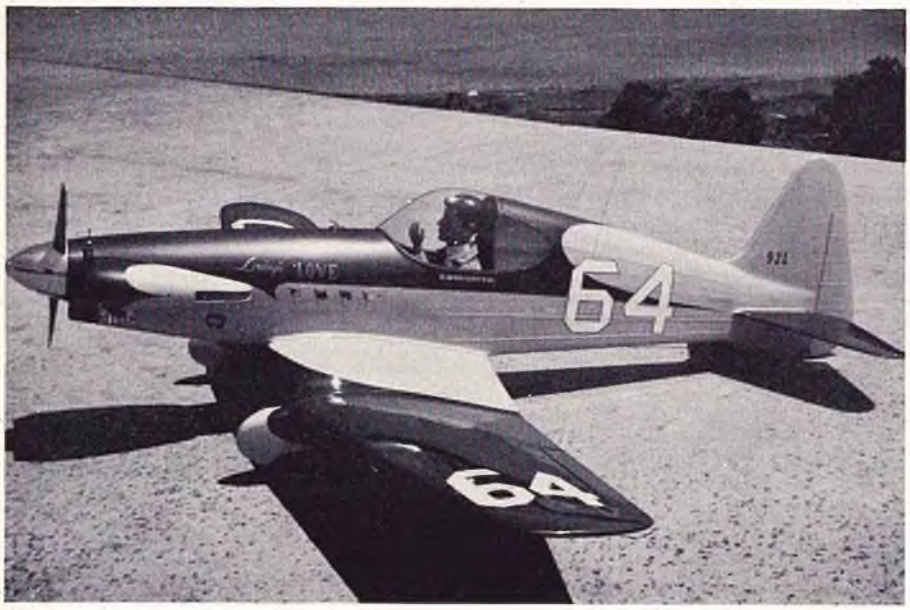
2. Seal edges with the heat of an iron.

1. Just lay it on.

3. Shrink it tight with heat.

NATIONAL MINIATURE PYLON RACING ASSOCIATION

613 Donner ● Las Vegas ● Nevada



Johnson Quarles magnificent metallic maroon and cream "Loving's Love." This is #2 prototype using K&B 64 series .40 mill.

THE National Miniature Pylon Racing Association would like to welcome its new Administrative Director, Gil Horstman, 613 Donner, Las Vegas, Nevada. Gil is an active modeler and an active booster and spokesman for the Goodyear Event. Gil and his wife volunteered their services in processing the NMPRA membership applications and correspondence which had bogged down due to a lack of time on behalf of RCM staff personnel. As soon as they are printed, 1966 membership cards will be mailed to all current members. An NMPRA membership application will be found in this issue and should be sent to Gil. New membership fee is $3.00 with no charge for renewal of 1965 membership. Material for this column should be addressed to R/C Modeler at P.O. Box 487, Sierra Madre, Calif.

●

The controversy over the form and shape that the Goodyear event should take still rages. This was prompted by an article by Hal deBolt in a recent issue of RCM. We will soon present a rebuttal written by Cliff Weirick, Joe Martin, and Jerry Nelson, collectively. The final analysis is up to you, so your opinion is needed. Let's take a look at a few of the letters received:

Dear Don,

Being a newcomer to the R/C phase of modeling (2 years) may not qualify me, in the eyes of some, to give an opinion on Mr. deBolts' article "Is The Goodyear Event Here to Stay"; however, Hal has made some statements that are rather presumptuous about what could happen to this event.

In the first place, is this an "Everyman's Event"? I say no it is not. As I see it the N.M.P.R.A. was conceived as an event to duplicate, as close as possible, the full size Goodyear midget races.

There is no room in the full size event for an "average Joe." Just because a person can fly does not qualify him to race.

As far as worrying about it becoming a specialized event, think that it should be anyway. After all what do we have now in all the rest of the categories; would an average flier have a chance to win any event in R/C as they now stand? No they would not, but they keep on trying.

It takes knowhow, practice and determination not to be just an "average Joe."

I cannot possibly see how this or any other event could discourage newcomers to R/C or any part of modeling. Anyone with a genuine interest in this sport of ours is not going to be discouraged or left out.

If there is a so called special event to be entered there is only one way to do it and be successful, and that is to learn as much about it as you possibly can and then apply this knowledge as best you can. Don't sit back and look and wish, or tell the officials to change the rules so that you may have a chance to win.

Being in competition with the best has the advantage of making one a better competitor. Remember the so called "experts" were not always experts.

The design of the Goodyear Racer was originally set up to be as close to the full scale planes as possible, which in my opinion is the best thing that has happened to R/C models since the first one was flown.

I think it is high time that the majority of R/C fliers and "designers" stopped wasting time, magazine space and good materials and started building something besides a box with a plank on it for a wing and a stupid looking little out of proportion bubble canopy on the top for a cockpit.

Nothing has gotten so monotonous as the large majority of the contest "designs" that have come along through the years.

Now we have a budding event that promises to eliminate some of the monotony and some character comes along and wants to change the rules to allow a simple airplane to compete. Whats so complicated? It only takes a little more time to do a job right and if you don't want to put forth that extra bit of effort then you deserve to be just an "average Joe" and there is no hope for you ever to succeed completely in any phase of this hobby.

Let's not even begin to contemplate changing the limits of the design of these airplanes, except to tighten up even more to keep out the "boxes."

Face up to the fact that racing planes of any types are a special breed and must be designed to do the job which they are supposed to do and do it better than the competition or lose the race.

There is one point, however, that I do agree with Mr. deBolt on and that is the speed and the danger associated with it. The efficiency of the engines now available is constantly rising and I believe that the limit on the engine size should be reduced to .35. There has already been one contest held where no engine idle was required. This is wrong and should not be allowed or sanctioned.

I hope I have made my point and would like to thank you for the opportunity to give my opinion.

Art Williams
202 E. Ackard Pl.
San Antonio, Texas
AMA 24672

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TOP OUT

BY JERRY KLEINBURG

Bob Follette's Sunday sporter. McCoy and reeds are features of the 4½ lb Heath Parasol fun ship. Pilot's arm is linked to a servo, waves to watchers as he chugs by. Bob is 1966 prexy of Oily Birds, east Texas RC action crowd.

BLUEPRINT FOR ACTION

THE Contest Board has their work cut out for them. It could also be safely said that they're on the spot. AMA's Executive Council, in changing Contest Board membership from an elective post to one that's appointed, inferred a criticism that progress hasn't come about as they believe it should. By the change unproductive members may be replaced by a district V.P. Whether the criticism is deserved or not, the present CB members are in a position of having to respond to the challenge and to assert the board's value within the AMA policy structure in a positive way. This can be a touchy chore since impetuous rule making could damn them also.

What brought this state of affairs about? The arithmetic of the situation is easy to understand – since the 16th of April 1964 when Ed Izzo stepped into the chairman's job only 18 proposals have been processed with 14 having been acted upon. The other four (Don Downing's #65-A1, New Jersey RC Club's #65-C1, and John Ross' #65-D1 & E1) after over a year are still in the limbo 'processing'. More arithmetic reveals the 11 AMA districts did not avail themselves on over 12½% of their opportunities to vote on proposals; that only 6 of the 11 districts have perfect voting records over the past two years; that only two of the 14 proposals received recorded votes from all 11 districts. . . .

So much for the arithmetic, but what of less tangible – yet important – factors that win or lose confidence? Communication, image, public relations – these can be vital factors unless they're recognized into a plan and successfully made good upon. Looking at the record with factors such as these in mind, it's found that the districts have a 40% negative voting record in the past two years with three districts voting 'against' more times than 'for'! Considering communications, and keeping in mind that insufficient or dragged out information tends to confuse or breed distrust in view of the use of delaying tactics in parliamentary maneuvers, the Contest Board in only filing 5 reports of their activity in two years appeared to forget the guys that elected them. To compound this, during the same time, little or no opportunity was taken to use the pages of the five model aircraft magazines to reflect CB thinking, ideas, or concern for the development of RC contesting and its relation to overall AMA goals.

With this as a general picture it's not surprising that the Executive Council moved in the direction it did. However in all fairness it must be realized the Contest Board alone doesn't deserve the figurative kick in the teeth. The Executive Council and the membership at large must take a part of the lashing for any track dragging that's occurred. A careful analysis of the timing of CB actions show they were increasing their tempo and that procedures were being streamlined to speed completed action on rules recommendations. Never-the-less CB failures were predictable where clear cut goals and objectives are not shaped accurately. Therefore, in putting the CB out on a limb the Executive Council has also exposed itself and since they'll be appointing future CB incumbents the EC must now give a lot clearer direction to assist the CB in its work. Otherwise dissatisfaction is bound to continue.

The Executive Council also recognized the need for deeper action from the 'troops,' so to speak. So they liberalized Leader Member growth and considering RC ranks where the percentage of LM's drags, it would appear to be a wise move. Perhaps it'll encourage a response from those who recognize the challenge of the Council's action and the opportunity to pump added life and vigor into AMA's framework. Taking a look at the voting percentages in elections of recent years, added oomph wouldn't be misplaced. The proof of this pudding, of course, will rely heavily upon prudent application by the Executive Council in its newly taken-on discretionary powers. After all, follow through is what counts.

. . .

As long as the primary goal of AMA remains to make aeromodeling useful the EC and CB must analyze the **gross** of past as well as intended actions and assure themselves they're on a course that coincides with AMA's goal. This requires drawing up a blueprint of action to clearly guide Contest Board operation. It's possible the newly proposed RC Advisory Committee could become a useful means of helping the Council develop such guidelines. However, if appointment to the Committee or, for

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SUNDAY FLIER

TGIF! The clarion call of office workers all over the United States. TGIF — thank goodness it's Friday. The weekend is ahead of you — and for us Sunday fliers a chance to finish up the new job, or repair the old one, and get in some flying. But there's that tedious covering job, or recovering, as the case may be.

Well, fellows, I've got an item for you. TGIF has a new meaning. You can now get a TGIF — Top Gloss Instant Finish — without sanding and doping and sanding and doping and sanding and doping until you're getting a little dopey yourself. Yes sir, just one covering does the job. It's a new material — well, not a new material, but a new way to use an existing material which has been worked out by the people at Top Flite. Let me tell you about it.

I first saw it being used at the MATS. Now there's another expression that has a new meaning. I used to be in MATS — the Military Air Transport Service, but now I go the commercial airlines to MATS — the Model Airplane Trade Show that the Garden Grove R/C Club put on this year for the first time, and which bids fair to become an annual event. More about that later.

Anyway, there at the Top Flite booth is Sid Axelrod, busily ironing a wing. Ironing a wing! Yes, that's what I said. He's got a wing in front of him with the glossiest finish you ever saw, but it's got some wrinkles in it, and believe it or not, he's ironing them out with a flat iron — just like your wife, or your mother uses on clothes.

Naturally, I'm fascinated, so I elbow my way through the crowd and watch. He takes the iron, runs it lightly over the wrinkles, and out they come. It's obvious he isn't ironing nylon or silk which has been doped or Hobby poxied. There are some samples of the material, so I pick it up. Hm-mm; pretty heavy. But then I see Sid cut a piece to shape and then peel off a sort of skin from the backing sheet, and this is what goes on the surface to be covered. So I peel off the sample, and now it's easy to see how it works. Actually, it's something like a piece of plastic tape, glossy on one side and sticky on the other, but the stickum really sticks to anything — especially the plastic itself, which is why it comes mounted on a backing sheet.

Well, after watching Sid work with the stuff for a while, I'm convinced it's worth trying. So I talked with him, found out what makes it tick, fanagled a couple of sheets, and took it home with me.

I've been experimenting with it since then, and I'm still learning how to use it, but I know enough about it now to tell you that it's a real step forward for sport fliers. Don't get me wrong; it's not going to replace all the standard covering materials. What it will do is augment them — just like Hobbypoxy

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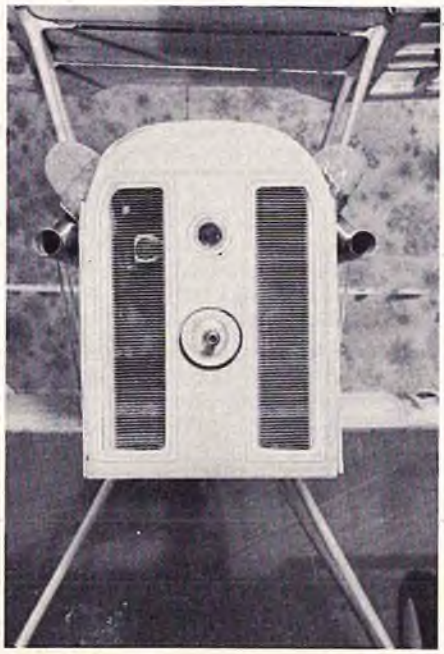
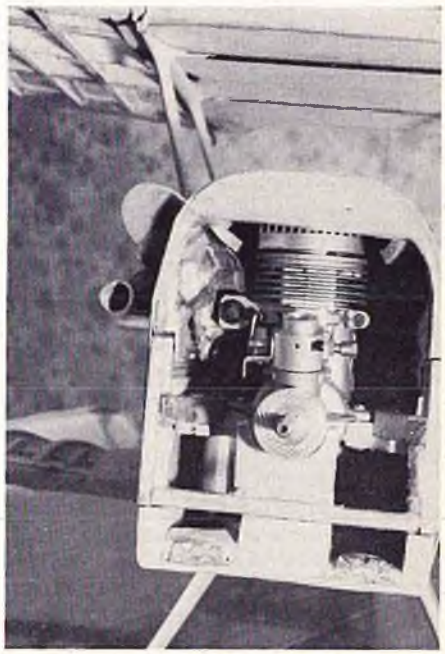
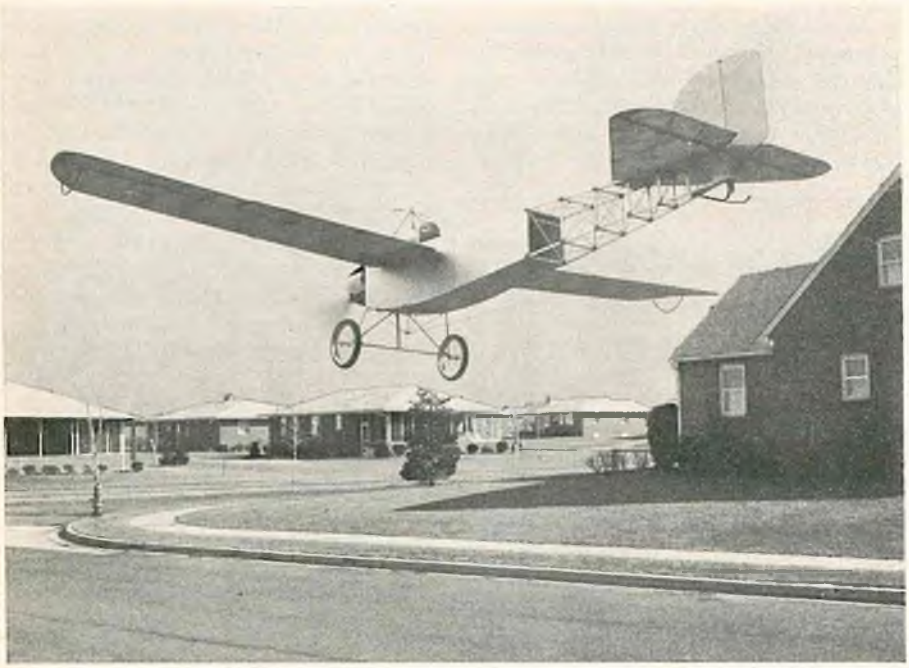


Lowell Dickson's 53" SE-5. Excellent detailing for a super scale R/C.



BERNIE MURPHY

KITS AND PIECES



In-flight photo shows Snoopy as he finds the Red Baron in a residential street.

OUR last column ended rather abruptly in the best tradition of the Batman TV series. The completed Antic photos did manage to squeeze in just in the nick of time.

Since then, we have flown the Antic. Wow! Any similarity between this ship and a trained buzzard must have been intentional. The ship is slow and docile. Aside from the fact that it requires a little more than average effort to construct, the Antic is an ideal trainer! The ship is so stable that even intentional "pilot error" is almost immediately righted. Take off and landings are practically "hands off." Our new PCS control system, which was installed at the last minute, functioned perfectly, and appears to be a top-notch outfit. We will be reviewing this system in a future RCM, just as soon as a reasonable amount of flight time has been logged. Initial bench tests have been very gratifying, and with a $300 price tag, it is bound to cause other proportional manufacturers to take a hard look at their own products.

If this month's column appears to be disorganized and lack continuity, there is good reason. RCM's lovable editor, generally referred to as Fearless Leader, continues to pile the construction projects on us at an impossible rate. Things have gotten to a point where there isn't even enough time left to remove the balsa chips which are accumulating on the floor at an ever increasing rate. In an effort to clean up a little, we have submitted this column to our Fearless Leader in a sack – written in long hand on balsa chips! If the copy doesn't read RIGHT, it's because he didn't find all of the pieces!

At the request of old FL (defined as "demand, combined with intimidation and coercion"), we tried a little Galloping Ghost flying during the past few weeks. A new actuator, the Rand LR-3, combined with radio gear designed for GG, has brought what was heretofore a "tinkerer's" type of flying within easy reach of the average weekend flyer. The Rand servo was used with both the Min-X Pulsemite 1200S transmitter and receiver combination and also with the new Controlaire GG transmitter and SH-100 superhet receiver. Both systems worked perfectly, giving positive proportional control of both rudder and elevator and positionable control of throttle. All linkages via pushrods! Both of the systems have been flown in an AAMCO H-Ray and also in a Kustom Kit (Special Editions Plans) "Mister E." Neither ship showed a tendency to "gallop." Handling of both planes proved to be surprisingly easy and lotsa' fun! Either of these systems are highly recommended for the RC'er on a budget, having a total system cost of $120 or less.

We mentioned the Kustom Kit "Mister E." This is a 50" low wing ship, closely approximating a Goodyear racer. It is a nice flyer, easy to build and handle. Flying the Mister E has prompted thought toward a smaller class Goodyear R/C for .10 to .15 cu. in. engines. These ships would be far more practical to the average flyer than the current high-power, high-torque, marginal bombs of the larger class. As a representative of the NMPRA, I feel that

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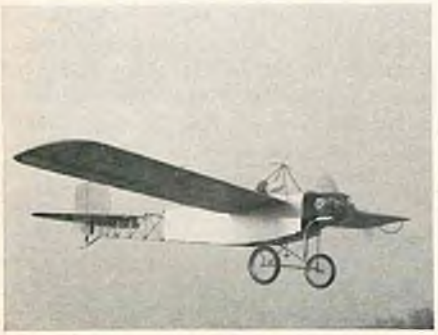
Snoopy, searching for the Red Baron.



Engine shot dead by the Baron, Snoopy glides home over the rooftops.

Framework of S.E.P.'s 'Mister E.'

THE MAJESTY OF SOARING

(*Continued from Page 45*)

SOME hints about towing gliders with powered models. First, unless your model is super stable, I have found that ailerons are a necessity. Secondly, a method of release upon command is very desirable; thirdly, the tow hook should be positioned near the nose, not left where you used it for Hi-Start or tow line, and last, your model must be trimmed for an even flat glide (no warps), and be towed by a powered multi ship capable of flying near the gliding speed. This last point is also important in using a power pod, either in the nose or above the wing. Your glider should not be forced to fly much faster than the normal down wind gliding speed.

As for Piggy Back, this is a two man operation, though Dr. Good informs me that his Kurwi 33 is capable of controlling the old Multi-Bug in flight, by just using the control surfaces on the Kurwi 33. There is still the problem of getting one model down while keeping the other in sight, plus handling two transmitters.

Readers concerned with equipment can rest assured that simple rudder only can be much fun (and still an exciting challenge) and is recommended for beginners. While the sketches on slope soaring depict flying multi (really Class II) equipment, just remember that a rudder only glider must be trimmed to fly faster than the speed of the wind over the edge of the cliff or it will be blown back. Also remember that when launching, as soon as possible in strong wind conditions, get your glider to fly along the path depicted in the sketches . . . not straight out. Many letters to me as Editor of the ZEPHYR, point out that flight duration is disappointingly short because their glider will not penetrate. Trimming is the answer, coupled with a correct flight path. Of course, as proportional equipment comes into greater use, this is the way to fly! My KP-4 Kraft set is enough for two gliders, 4 servos, and I fly with the single stick. While loops are fairly common, barrel rolls and Immelman turns are now being attempted and some times mastered. At a different locale in Southern California Dr. Rolf McPherson is experimenting with spins, and can get 3 turns before losing too much altitude for climbing back to where the lift still prevails.

Jerry Nelson and Dan Lutz maintain that a correctly proportioned rudder and elevator will permit an R/C glider to be flown well, without the use of ailerons. We consider them a luxury, not a necessity for slope soaring, as we do spoilers. The force arrangements on gliders we fly are such that anything more than a 270° turn will start a spiral dive. This is used to build up speed on rudder only gliders for loops or wing overs, in addition to losing altitude. Of course, I do not maintain there is any glider built that is equal to all kinds of gliding. Just as we have dragsters, sports cars and luxury sedans, so the modeller builds the kind of glider that will fulfill his specific needs for fun. But as the barker at the sideshow said, "Buddy, youse pays yer money and takes yer pick."

Admittedly, this is a brief summary of R/C glider flying, but certainly more can be learned by building one. As replies to individual letters take considerable time, I would encourage you to subscribe to the ZEPHYR for $2.50 per year, and by this means you will learn of reports from all over the world about trials and successes of R/C gliding, plus keeping abreast of latest progress and designs. Further, if you have found a good gliding spot locally, let others know about it through the pages of this magazine, or write ot me at 14695 Candeda Place, Tustin, California.

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did when it first came out. There's a place for all – silk, nylon, silkspan, Japanese tissue, and now this new material, called Monokote.

Monokote is a mylar type material with a pressure sensitive adhesive on one side that has the coloring right in it. When you peel it off the backing material, it's very flexible, and you have to handle it with some care to be sure it doesn't double over and stick to itself, but it isn't really hard to handle once you get used to it, and that only takes a few practice minutes.

In its normal state it's something like a fairly heavy paper – won't go around a double curve like fibreglass cloth will. So, it is most easily applied to flat surfaces or surfaces like a wing where most of the area has single curvature. However, when heated to around 300 degrees, two things happen. The adhesive really takes hold when pressed down, and the material will shrink. Now the interesting thing about the shrinkage is that the material loses its tensile strength at that temperature, so even though it shrinks, it won't warp a framework like an R/C wing. It will just pull up tight. Then when it cools, the strength returns and it is unbelievably tough. Also, when it's heated to that temperature, you can work it around gentle double curved surfaces and get them smoothly covered – although it does take some practice.

To cover a surface with Monokote, you cut a piece out, with the backing attached, which fits the outer framework dimensions of the surface. Then you peel the material away from the backing, lay it gently in place on the surface, and, as necessary, you can pull it away, realign it and put it back on until you get it on properly and as smoothly as possible. Even if it hangs a little loosely between the ribs of a wing, don't worry. Press it in place around the edges, first by hand, then, using an iron, with the temperature set for "rayon" or 300 degrees, whichever way your iron is calibrated, just iron the material all around the outer edge of the framework. You'll see the material attach itself firmly to the surface.

Once the outer edge of the material is ironed in place, you then lightly run the iron over the material and it shrinks tight. If you are ironing it onto balsa sheet, once you get it shrunk to fit, then you can press the iron a little heavier and the material virtually becomes a part of the surface. You can even see any flaws in the surface, particularly if they are bulges or protruding. Indentations don't show up unless you iron the material right down into them.

When covering a wing, cover the under side first, then, when you cover the top side, let the material overlap and wrap around the leading and trailing edges so it comes around underneath and overlaps the covering on the under side by about a quarter of an inch. This way you seal the wing completely and it is absolutely fuelproof.

Wingtips are pretty tricky if they are carved from blocks. You may even want to use dope rather than try to work the Monokote around the double curve, but, with a little practice, you can do a good job. The best way I've found is to lay the material in place so it touches the block along the high point of the wing tip curvature from leading edge to trailing edge. Normally this will be a line about half way between the tip rib and the wing tip proper. Then iron the material along that line, working away from it gradually towards the tip rib and the wing tip so it shrinks to fit the curved surface as you go.

Monokote has a shrink factor of 18%, so as you learn how to apply the iron, you can fit around some pretty good double curved surfaces.

Preparing a surface for this material consists only of making it relatively

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SUNDAY FLIER

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smooth. In fact, if it is too smooth the adhesive sticks so hard that the material can't move. Top Flite is working on an idea using a "wetting agent" so the material can be used over smooth surfaces like fibreglass, but I haven't tried it. For balsa, just sand it smooth with about a grade 0 paper, make sure there are no rough protrusions, and it's ready. No predoping is needed – in fact, it should not be done.

Since there's no odor, Monokote is a "wife pleaser." Except that, since it doesn't smell, you can do your covering job in the house, and the lady of the house may complain about the way you're cluttering up the place with the trimmings and stuff. So you do have to clean up after you're through.

Decorating a model is easy. You cut out contrasting material to the desired shape, pull it off the backing and lay it in place. Careful, though. Once it's pressed on, it's really hard to remove, so get it on right. And, for left and right patterns you can cut out one design, strip the material from the backing, then turn the backing over to get the reverse by tracing it on the backing of the other piece.

After you've finished – or at any time as you are working with Monokote, you can clean the edges where the adhesive seeps out and picks up dirt just by using some spot remover, or lighter fuel if you have some.

When you are finished, you have a high gloss surface, absolutely fuelproof. For the perfectionist it won't do because of the seams, but by careful planning the use of the material for the intended surfaces, you can make the seams come out at unobtrusive locations, or where they will be underneath the decorating trim strips. And you'll have a model that, from a few feet away, looks flawless.

The weight of Monokote compares favorably with nylon with about four coats of dope, and it's several times stronger.

Perhaps one of the problems is the cost. As close as I can figure it, the material cost is about half again as much as silk or nylon with four coats of dope. But most guys use more than four coats for a high gloss finish, and when you add the cost of brushes, things start to get more even. But the big thing is the saving in time. You cover and finish the model in one application. So when you figure everything in, and considering the beautiful finish you can get, it's worth a little more in initial cost.

So give it a try. It's new, and you fellows will undoubtedly figure out a lot of ways to work with it better than I have. Send me any thoughts you come up with so we can share them.

Like I said, I first saw Monokote at the MATS. There were several other new items there, naturally, but they will be covered pretty well by some of the other guys who attended. New proportional gear was all over the place: Lanier Industries had my old friend Len Purdy there showing their new "ready to fly" jobs, Tom Protheroe was there with his beautiful "Santa Barbara I" sailboat. (I've got to try that one day; I saw a regatta in Santa Barbara last summer, and those guys get just as excited as us airplane buffs. And take it from me, there's a lot of skill needed to race an R/C sailboat.)

Single channel enthusiasts weren't forgotten, either. Pacific Hobby Associates were showing their new "Selectron" system. It's clever. Gives rudder and motor control, without cycling through. You want right rudder, you get right rudder; you want left rudder, you get left rudder; you want motor control, you get it. And you don't have to go through right and left rudder before getting motor. Looks like a real good system for half A, and has enough power in the servo to fly a big .35 or .45 powered job.

There were a lot of other interesting things, but one of the attractions was the surroundings in which the MATS was held. The Garden Grove boys ar-

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SUNDAY FLIER

(Continued from Page 56)

ranged to have the displays scattered through the Museum of the Air which Frank Tallman and the late Paul Mantz built up over the years, and some of those old time airplanes really were in mint condition. Along with a lot of the other attendees, I spent as much time looking at the full size planes as I did inspecting the model exhibits. Which leads to an interesting question. Does holding a trade show in those surroundings tend to dilute the interest in the prime purpose? I suppose it does, and some of the people who came were there to see the museum more than the model equipment, but for the model fans it certainly added to the total overall attraction of the show. For a first attempt, the Garden Grove MATS was, in my opinion, quite successful. I think I'll go again next year.

In contrast to all of the new things that are coming out to make it easier for the modeler, there's always the other end of the spectrum – the perfectionist who doesn't care how long it takes or how tedious it is, he's going to make the perfect model. We've all done it at one time or another – made a model of the airplane we really love. I did it with a Spitfire once; made the fuselage framework, then inlaid it with balsa, sanded it, covered it with silk, sanded that until it felt like smooth metal, then found some dull matt finish paint to do the camouflage. Tedious, yes, but I've always thought that the Spitfire was one of the most beautiful airplanes ever designed – particularly when I was flying out of Gibraltar back in WW II as a weather observer in a Hudson bomber, with Spits for top cover whenever a scramble was on.

I also made a nice SE-5 once (no, dammit, I wasn't in WW I, wiseguy, but my dad was a flyer then) but compared to one that's in the works right now, it wasn't anything. Look at the photos of the one my friend Lowell Dixon is building. Scale all the way through, 53" span, it'll weigh about nine pounds, and with a Supertigre .60 for power it should be a real performer. But note the workmanship; the ingenious use of Kaiser screening for the louvres in the radiator. And the exhaust is ducted into the simulated cylinder head cap, then actually through the exhaust pipe running back beyond the cockpit! The duct from the engine exhaust was made from fibreglass, with an asbestos layer inside, then a liner of aluminum formed from discarded TV dinner trays. You have to see it to believe it.

Some time later this year I'll show you some shots of the finished job.

Lowell's got a real kick going in decorating it. It will be absolutely authentic, but undoubtedly will raise a whole rash of questions when some of you see it.

But Lowell's just one of the thousands of Sunday fliers you never hear about, who just go quietly on their way building and flying the models they love. He just happens to belong to the perfectionist clan.

The other photo shows me comparing the landing gear of my new "Top Dawg" with that of a Schoolmaster just completed by a complete newcomer to the hobby. The model is far from perfect, but it's a good job for a beginner. There's an interesting story behind the picture.

For some time I'd been looking for a good "new used" car. I wanted a 1965 Bonneville – you know, one with a few miles on it, and now that the '66s were out, maybe I could get a good deal. So I go down to Larry Hopkins, friend of mine who deals in them, to see if I can steal one. Larry's got a new used car manager, fellow I'd never heard of – up until then, name of Don Calundan. I can tell right away I'm up against a real salesman.

He shows me some of the stock, but I tell him exactly what I want. So he's got one, except it's the wrong color, but a real good buy. In fact he's driving it himself it's such a good car. Hm-m! So we look at it, and in the process he opens the trunk, and there, spread out on the floor, is a partially completed Schoolmaster!

Right away I'm intrigued. Here's a guy trying to sell me a car with one of my kits in it. It's got to be a plant – you know the old salesman gimmick; get next to the customer by showing an interest in his work, or hobby (just don't show an interest in his wife) and it'll soften him up for the kill.

Well, as it turned out, I couldn't have been more wrong. Obviously the model had been in work for some time, and Don really had never heard of me, except from the complaints of a couple of his salesmen that I just didn't understand how car prices had gone up. So, when I showed him my name on the box, he was as surprised as I had been when I first saw the kit in the car.

Seems that Don has a couple of boys and they're model fans. He'd been working with them with a "model on a string," as he puts it, and thought it might be real fun to try remote control.

Jim Sunday runs a model shop about a hundred yards down the road from Hopkins used car lot, and Jim sells Don a Schoolmaster kit as a good starter for a beginner.

Well, to wind up the story, Don sells me a car, Jim has sold him a kit of one of my designs, and I'm gonna wind up

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SUNDAY FLIER

(*Continued on Page 59*)

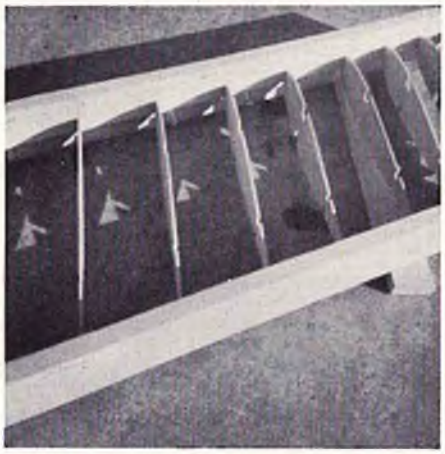
teaching him how to fly it. The Schoolmaster, not the Bonneville. And his kids will have a ball watching their dad shake like a leaf when I hand him the transmitter. Another Sunday flier — that is, if Larry will ever give him a Sunday off.

Now I gotta get busy. I promised you that I'd get the "Top Dawg" plans out in the June issue. Well, I've been flying it, but I haven't been working on the plans, so I better clean up the pencil scratches that I work from when making a prototype, and make them legible for you.

So write and tell me what's going on. I'm gonna be at the drawing board for a couple of weekends.

CUNNINGHAM ON R/C

(*Continued from Page 12*)



A few minutes labor creates a very practical wing jig.

39" long each, find the center and draw a line down this center. Draw this line on both sides of each piece.

These four pieces form the main portion of your jig. The slot is to be used if you build wings with a leading edge made from square stock used in a triangular position. If you use a flat leading edge, you can disregard the slot, but it will serve to line up the leading edge. The trailing edge pieces with the line drawn up the face can be used in several ways.

First, if you are planning to build a wing with strip ailerons and your basic structure trailing edge is a ¼" or 3/16" square piece, it can be pinned to the center line. If you want a sheet trailing edge, then a blocking piece of 3/16" or ¼" can be pinned to it to support the sheet. Whatever the method of construction, these leading edges and trailing edges can be pinned to these main members.

Henry Ford made a pile of money from the idea of standardization, and it's just possible that we could gain a bit of profit from this idea. If we try and standardize as many steps as possible, the end result should be arrived at much more quickly. Take the four main pieces and divide them up into three inch sections, then mark this division on each face with a dark pencil. Start only two inches from one end. This two inch gap is to enable us to get at this spot for our center section. If the jig is allowed to meet in the center you will find it hard to build in the dihedral, or sweep back. The three inch divisions are the rib locations.

If you really want to be fancy with your jig you can use the leftover parts

Sweeper wing with ribs and spars in place.

Sweeper wing showing radical sweepback.

Completed sweeper wing.

of lumber to make permanent dihedral braces. Drill corresponding holes in the main pieces and in two dihedral braces. Do not drill these holes on the center line – drill them about one inch above center. Use ¼" hex head bolts with washers and wing nuts. If you plan to sweep back the wings, the braces can be quickly discarded.

The next step in the use of the jig is to decide just what wing you are going to build. Suppose that you want a wing with a constant taper (and you have the rib patterns). Find a good level surface on which to set up your jig. Use the counter in the kitchen, if you can – chances are it is more level than any other surface in the house. In fact, if you have a formica counter top, you can draw the wing outline right on the formica with one of the new nylon marking pens. **Don't** use a brand called "Marks-a-Lot" – my mail runs pretty hot sometimes as it is! Use a pen that can be **wiped** off!

Pin the leading and trailing edges to the proper boards and then take a tip rib and a center section rib and get the proper space between the two main members of the jig. When this is lined up and square with what will be the center line (be careful to have everything square at all times), nail cross braces to the edges of the two main members. Make the other panel in the same fashion, remembering to make one right and one left hand panel.

With the cross braces firmly nailed in place, you can pick up each half of the jig and begin to place ribs in it. Each

(*Continued on Page 62*)

rib is pinned to both the leading edge and trailing edge. Pin only on the top side of each rib. If you use "egg-crate" construction, or multiple spar type construction, you can add these spars into the ribs. Glue all of the glue joints. This is made very easy by the fact that you can pick up the jig and work on all sides of it at once. With each panel completed, insofar as the main structure is concerned, you can now bring each half together. Either nail or bolt the dihedral braces in place on the jig, then glue the wing dihedral braces into the wing ribs. On swept wings, this is a difficult time for alignment, but with the jig set at just the right amount of sweepback, your wing has no possibility of coming out crooked. And, you can put in braces that beef up the center section and extend a good way into each wing panel.

With the main structure in place, the dihedral, and/or sweep setup, you can now turn over the wing and install the landing gear trunions. With these in place, go ahead and sheet the bottom of the wing. Don't do the top as yet. If you use contact cement for sheeting you will be able to complete this step as the main part is drying. Let all of the structure dry overnight. By now you should have spent no more than two or three hours.

The next morning you can remove the dried wing from the jig by unpinning the leading and trailing edges from the main members and lifting the wing from the rack. Install the top sheeting (sneak it in before you leave for work and it will be dry when evening rolls around). Another "plus" for contact cement is in installing the tip blocks. You don't have to wait for hours while white glue or model cement evaporates in order to carve and sand them to shape!

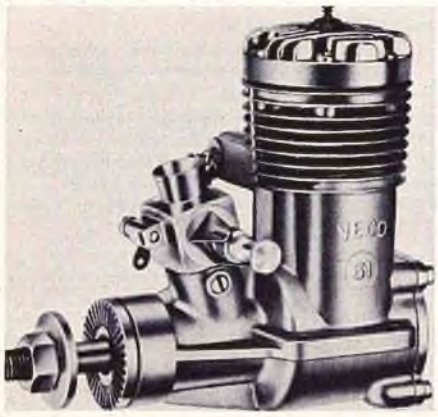
Your completed wing should be true and free from any warps. Use the jig in the same manner for symmetrical tail sections. As a matter of fact, you can get a few feet of 1" x 2" at the lumber yard to use as stab jigs — you can then build the stab while the wing is drying.

The biggest problem with jigs is in trying to develop one to use in building fuselages. I have tried numerous ideas without much success to date. If you have any thoughts along these lines, drop me a note — Chuck Cunningham, 5333 Wooten Drive, Fort Worth, Texas, and send some sketches. The more good ideas we have to pass around, the better we will all be able to enjoy the sport.

The use of jigs should be unlimited in our building, and no doubt given a bit of thought, you can come up with a better unit than the Thingamajig. Wings are really the most difficult part to build, and any way to ease this construction is worth attempting. Remember — set up the Thingamajig on a level, square surface and yours should give you many error-free wings.

TOP OUT

(*Continued from Page 51*)



Jack Henry's new VECO 61 due soon, joins 4 other sizes of the popular brand of engines. The double ball-bearing beauty is expected to give rudder ships added capability, muscle for propo gear.

that matter, to the CB or as a LM is bestowed lightly or primarily as an 'honorary' recognition, AMA can reconcile itself to another round of middlin' meandering in a morass of muddled mediocrity. And it might even be said that it couldn't happen to a nicer bunch of guys. . . .

THE READY PIT

*Rudderites are eying Jack Henry's latest engine offering with more than casual interest. The VECO 61 joins a long line of field proven engines and comes at a time when class I ships need more muscle for the propo rigs that are being stowed aboard. Cliff Weirick showed what the new mill can do – his Nats 1st and Internats 3rd proved the 61's consistency. The brute swings an 11-8 prop at 12000 RPM and promises to give rudder ships a 'standing start' looping capability, something long sought by rudderites. The engine's .940 bore and .880 stroke indicate Clarence Lee, who designed other VECO power plants, applied new factors in creating the new 14 ounce beauty.

*The San Antonio ARCS are continuing improvement of their flying site. With completion of a 300' macadam strip, work started on an operations and fliers control shed. Plans call for an 80' long roofed structure patterned after Baton Rouge's RC Club accommodation. The regular Sunday afternoon flying sessions are attracting many visitors and new members. TV publicity – fliers and their planes had a half hour show to help spark interest in the recent Nats program – is aiding the club's growth.

*Don Downing sends word of his new bird – a candy-apple epoxy finished beauty. Digimite equipped, Don's problem with the ship is to now sweat out good flying weather in the Dallas area as well as final exams at Arlington State University. Meanwhile another pattern ship is on the way from the Downing plant. This time it's a delta inspired by Howard Lincoln's "Streak." This one will have a foam wing and made up in Navy fighter markings for snappy looks, Don says.

*M. C. Reed also is waiting for thaw and wind to make outdoor action in Ohio feasible. Last season he and the Canton RC competition team put in 4000 miles going to 10 pattern meets, gathered in 7 firsts, 5 seconds, 7 thirds. This action was in addition to attending 12 fly-ins for the practice – and 8 wins, which is a good batting average in any league. The team is setting up separate practice accommodations where each member, on his own frequency, may practice to his heart's content. Reed says 1966 will be the propo year for class I and with the team's practice setup, a weatherman isn't needed to predict July in Chicago will be hot!

*Up in Michigan, Howard Ritter, with son Mike, are also looking forward to Chicago. Mike will be a top contender for the Jr-Sr crown with his own RC creations as he has been for several seasons now. With a record of three runner-up trophies in three Nats, along with a first at Dayton last year,

(*Continued on Page 66*)

TOP OUT

(*Continued from Page 64*)

ARCS visitors in San Antonio include Japanese Navy personnel. P/O's Morita, Kato, Sueda, Hatama and Lt. Matsumoto get Stormer and Separater lowdown from Harry Pullen.

Mike has an excellent chance to make good on his hopes and should be one to watch. Howard is pushing for a single Nats flight line for class I – says he'll be there on 27.145, too!

°Walt Staff, the Saltaires' leading rudder man, writes about the absence of a "good class I kit on the market." Walt continues, "I don't know why the manufacturers don't kit a Nats winner or some other good class I ship. Bet there would be a good market for it!" To which we add our assent. The market hasn't seen a contemporary class I kit and it appears from comments such as Walt's that the time is propitious – uh, yah. . . .

CONTEST MENU

● It may only be winter inaction speaking, however over and above the usual off-season impatience an increased call for 'standard' contests is being noted. Last season there was a decided tendency toward fly-for-fun's and such, but now there's a growing realization that pattern contests are meaningful in that they provide a universal yardstick by which all fliers may measure themselves as well as attaining other meaningful purposes. The fly-in's, etc., did reflect a desire for change and this has crystalized into the very sensible idea of elective maneuvers. A note from Fred Duval points up the need for a set of standard 'free style' maneuvers to be established as a judges' guide. Fred also says the Alexandria RC Club's annual sanctioned meet is set for April 23 & 24. Since Emily has promised to have the car washed and tuned up we'll be in attendance to try for a brass ring and to again enjoy Louisiana coffee – it's sure different! It'll also offer a chance to compare notes with Fred on free style developments as well as enjoy the scheduled Goodyear event that's to be run without "time polishing," as Fred puts it. A class I escapement event will also be featured at the meet.

● Hot on the heels of the Alexandria show will be an AMA sanctioned meet in Dallas, set for 7 & 8 May. Gordon Gabbert and the Dallas RC club, with Carl Summers as Contest Director (Carl is the new District VIII CB member) will host the affair which will be their first since the 1964 Nats. Dwayne Brown, club secretary, says they're hoping to have a 40' x 200' paved strip finished in time for the contest to be held at their new North Lake flying site. This is another contest we're looking forward to attending to season up the new bird.

● While on the subject of menus, how does the following sound?

Potentiometer Pizza with Resistor Relish
Roasted Reed Bank, or
Slide Switch Sandwich (try saying that fast)

In case you're wondering what's going on, this is a sample of the fare dished up by the Port Arthur Oily Birds. Here's more as presented in their artful hand embellished orange and gold menu:

Tossed Transistor Salad
Receiver Remoulade
Mashed Mighty Midgets with
Galloping Ghost Gravy

If that hasn't filled you, here's some dessert:

Crystal Custard (6 or 11 meter)
Jellied Nicads
Proportional Pudding

Major Hank Walker, Austin Texas R/C Club pres. congratulates ARCS pres. Harry Pullen (l) upon completion of club's now 36' x 300' strip. Added facilities are being planned to give the club an outstanding flying site.

While enjoying these gourmet delights entertainment was provided by:

Lonnie Betts singing, "Oh Where, Oh Where Has My Little Skylane Gone?"

followed by a reading of the monumental ballad "The Wreck of the Bipe" dramatically rendered by Add Evens.

The above "Moderately Modulated Mess of Electrolytic Epicurean Episodes Especially For the Fly-Away Fiends and the Poor People Who Pick Up the Pieces" came about at the club's 3rd annual banquet where Bob Moore assures real food somehow made the scene. But with this gang, you never can tell. They're even making beat up pencil-pushers honorary members. Thanks, guys. . . .

CONTEST TECHNIQUE

Loops — the next maneuver on the AMA pattern list — are primarily a problem of placement. That is, where to do them for best presentation to the judges while flying the maneuver where best control is possible for most accurate results. Looping ability of your plane plus wind are the two major ingredients that dictate the best course. First off, loops must be done in line with the wind and if your ship loops marginally it becomes important to keep accurate alignment with the wind, otherwise she may not loop for you. This is because in controlling to offset drifting out of the plane of the loop the law introduced will add drag and take a bite out of the ship's speed, and it'll generally be enough to foil your attempt. If the wind is high, even where looping ability is good, drift caused by the wind may result in a wobbly, tail

Wallace Armand, single channel fan, looks over his Falcon 56. Min-X, Royal servos, and ST 23 complete ship which will be seen at Alexandria, La. meet in April.

shaking maneuver that'll give poor scores. Although judges like to see loops from a wing tip view so that roundness and consistency of size, altitude, and position may be checked, be-

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$F_h \sim M_{rot}$ .....large

$M \sim M_{rec}$ .....large

Result: Large horizontal force and torque with zero vertical force.

Case III

Assume $M_{rot} = -\frac{1}{2} M_{rec}$

Thus

$F_v \sim (M_{rec} - \frac{1}{2} M_{rec})$ me.

$F_h \sim M_{rot}$ .....medium

$M \sim M_{rec}$ .....large

Result: Medium (about one-half) vertical and horizontal forces with large torque.

The end result is that there is no way to arrange the balance which will bring the total vibration of a single cylinder engine to a value less than half that of an unbalanced engine.

E. *Vibration Displacements*

When the needle valve is just a blur due to vibration, how many g's does it have? In Fig. 7 the vibration is plotted against engine speed for several values of peak-to-peak displacement. Hence, if your needle valve blurs to a displacement of 0.02 inches at 12,000 rpm, the number of g's is 40. These curves demonstrate for a fixed displacement that the number of g's is proportional to the square of the engine speed.

From a viewpoint of soft-mounting a tank, or receiver, or a servo board, or a battery, these charts show that the deflection of the cushioning material will be in the range of .010" to .020" peak-to-peak.

F. *The Two-Cylinder Engine*

Since the vibration level of a one-cylinder engine appears to be very high and essentially irreducible, it is natural to look toward a two-cylinder opposed engine. In theory, the primary vibrations cancel each other and leave only some of the secondary forces.

How well does a two-cylinder engine perform vibration-wise in practice? To answer this question, a single cylinder and a two-cylinder engine of the same capacity were mounted on the same model plane and the levels of the vertical and horizontal vibration were measured at the same speed. A Fox .29 (vintage 1936) and a Davies-Charlton .304 were compared using an 11/4 prop at 9,000 rpm. Even before the measurement was taken, it was immediately apparent that the two-cylinder engine was very smooth in its running.

The graph in Fig. 8 shows that the vibration levels were 30 g's and 6 g's in the direction of the piston and 11 g's and 3 g's at right angles for the single and twin cylinder engines, respectively. Even beyond this five-to-one improvement was the fact that the 30 g's were primarily fundamental frequencies whereas the 6 g's were mostly harmonics and hence much easier to filter out with a soft mounting. Thus the twin is quite superior and even better than the peak vibration numbers show.

It is abundantly clear that one very real solution to the vibration problem is to employ a twin-cylinder opposed engine. At the present time, twin engines are not generally available, so this paper hereby makes a plaintive appeal to the engine manufacturers to come forth and satisfy this need.

G. *Conclusions and Recommendations*

The vibration measurements reported in this paper reveal that very large vibration levels from the inherently unbalanced single cylinder engine are reaching all parts of the model plane structure and equipment. Vibrations as high as 60 g's were measured. These levels of vibration are considered harmful and hence efforts to reduce them are desirable.

It is important to use soft vibration isolation on all flight equipment such as the receiver, servo board, batteries and fuel tank. A more complete study of the isolation problem is needed and perhaps other experimenters will carry out studies in that direction.

The most direct step for reducing the vibration source by a large factor is the use of a two-cylinder opposed engine. On this point it is hoped that the engine industry will come forward with two-cylinder variable speed engines designed especially for radio controlled models.

ROYAL SERVOS

(*Continued from Page 48*)

the entire system is six nickel cadmium cells (225 to 500 Mah) or six pencells, plus whatever voltage is required for your individual receiver. A complete wiring diagram is included with this article. All up weight of the system with a Controlaire SH-100 superhet receiver, six 225 Mah nicads, three Royal servos, plugs and wiring harness, is 14 ounces.

Our own conclusions, following testing of this trio of servos, is that these units will allow the single channel flier to update his present rudder only flying to a Class II type system that will give him many years of dependable, trouble-free service. From construction through final performance, the Royal servos are outstanding and carry the RCM Tested and Approved recommendation.

Prices on the Royal servos are as follows: Royal #13RA (rudder-aileron): $13.95; Royal #13E (elevator): $14.45; Royal #13M (motor): $13.95.

TOP OUT

(*Continued from Page 67*)

cause of drift, control from the wing tip position is toughest to achieve as desired. Easiest, is a position directly upwind or downwind but these'll usually net fewer points from discerning judges. To compound the problem the sun's position, spectator and pit areas, field obstacles, etc., may offer added difficulty. Under average conditions a compromise between the straight upwind or downwind positions and the ideal judges view is necessary. This means about 30° to 45° off the wingtip point will offer you and the judges enough grasp of what's happening to allow control of the flying and judging of the maneuver.

Altitude is also a factor to settle on. Loops should bottom at 50 to 75 feet for best presentation; but don't hesitate to make it higher if you are rusty or the air is rough.

In this maneuver we'll select the upwind compromise position for our loops. (Downwind is OK in lighter breezes—don't take chances on blowing away otherwise.) With the maneuver centering at about 150′ altitude and out at a radius of 150′ also, the three consecutive loops called for will be viewed from a comfortable average 45° elevation. The preceding maneuver, the Immelman, left the ship at the right altitude and position heading downwind at maximum throttle. Using method no. 2 to pick up excess speed (RCM, Apr. 66) tip into a steep 180° turn (or a split S, as in method no. 3) to gain maximum knots. Strive to stop the turn and level the wings just before the plane reaches the lowest altitude. Also make sure you've gaged it right to line the ship up with the wind. As it comes to the bottom, call the maneuver to the judges and focus your attention on keeping wings level and the nose directly in line with that wind. Feed in changes gently and be prepared to apply right corrections for torque as the ship slows going up and opposite corrections as the ship hits maximum speed at the bottom.

If your ship is reasonably trimmed out the loops will continue in a natural way, so you may concentrate on keeping the ship on course and the loops superimposed on one another as much as possible. One thing, be sure to count the loops—besides the points it loses for you, it's downright embarrassing to do the wrong amount although it's easy to have happen when you're under pressure.

As the plane reaches the top for the third time, chop the throttle to full low and let the ship coast around to complete the maneuver. At the bottom crank in a 90° medium-steep banked turn to bring the ship toward a point directly upwind. This will get you headed right for the next maneuver which we'll dissect next time. . . .

FLYABILITY

VERSUS

PERFORMANCE

BY TOM STARK

This Analysis of the Performance Factor in R/C Aircraft Will Enable You to Select Your Own Flight Characteristics . . .

CHUCK Cunningham's article on 'Flyability' in the March issue of RCM was most interesting and certainly needed. However, the formula for Flyability (F), $F = \frac{DA}{W}$ where D=engine displacement, W=weight, and A=wing area, does not apply to all sizes of models. As an example, the Carl Goldberg Cessna Skylane: D=.049 cu. in., A=244 sq. in., and W=1.37 lbs., as indicated in the advertisements. Calculating F with these data (flyability), we get F=8.9, or according to the article, it won't fly at all. Most of us have seen Skylanes fly quite well, so what is wrong with the Flyability formula?

As Chuck points out, the performance of a model airplane is generally determined by power loading and wing loading. Power loading is approximated by $\frac{D}{W}$ and wing loading is $\frac{A}{W}$. If one were to take the product of wing loading and power loading as a rule of thumb measure of preformance, you would get a Performance $P = \frac{A}{W} X \frac{D}{W} = \frac{AD}{W^2}$. This looks a lot like the formula for F except that we divide by the weight squared.

Using this formula on the Skylane, we get P = 6.4. Using the same formula on a number of well known airplanes in comparison with the F formula we get:

	P	*F*
Cessna Skylane	6.4	8.9
Falcon 56 with .199 @ 3.5 lbs.	9.1	32.0
Falcon 56 with .099 @ 4.0 lbs.	3.5	14.0
Falcon 56 with .35 @ 4.0 lbs.	12.2	49.0
Sr. Falcon with .35 @ 6.25 lbs.	7.3	45.3
Sr. Falcon with .45 @ 6.25 lbs.	9.3	58.0

Using the Performance formula on other successful airplanes, the values generally fall between 6 and 12 with the data clustering between 7.5 and 9.5. The slow, trainer airplanes, such as the Skylane, have values around 6, as indicated above. The extremely hot airplanes like a 4 pound Falcon 56 with a .35 engine tend toward the high numbers. A Falcon 56 weighing 4 pounds with an .099 engine probably wouldn't fly at all and has a P of 3.5.

Using the formula for F, the .099 powered Falcon 56 should fly better than a Skylane. Also, a Sr. Falcon with a .35 engine would perform about the same as a .35 powered Falcon 56 according to the F formula. Clearly, neither condition is true, and this is predicted by the Performance formula, $P = \frac{AD}{W^2}$.

I feel that the P formula is a much better indicator of probable performance than the F formula. A model designer should be cautious not to design a model where P is lower than about 5.5 or higher than 13. The rules on wing loading and power loading given by Chuck Cunningham are excellent guides. On smaller models, such as ½A, the wing loading should be lower than on the large multi channel airplanes. Consequently, I would suggest extending the usable wing loading range down to 12 ounces per square foot.

SHOWCASE '66

(*Continued on Page 9*)

Mabuchi Motors, N.Y. Office: 314 Fifth Avenue, New York, N.Y. 10001, has released a sampler #8 which provides a sample plus specifications of Mabuchi low voltage 1.5 to 4.5 volt motors. Motors can be easily lifted out to test and fit in prototype models. Mabuchi is the world's largest producer of miniature D.C. motors. According to Irwin Polk, Foreign Sales Manager, "they are priced so that a lot of products, hitherto undreamed of, can be produced and marketed with the assurance of quality, low battery drain, and with performance to satisfy the consumer. Designers and engineers in the R/C field are invited to write to Irwin Polk at Mabuchi, for further information on Sampler #8.

Flite Line Products, 1324 62nd Street, Lubbock, Texas, has produced a set of custom foam R/C wing kits completely cut and covered with Flite-Span, a new product that can be finished with dope or epoxy and in general, be treated the same as balsa. Much less dope is required, and it makes a tough, easy to finish, light wing. Foam kits include die cut spars, shaped strip ailerons (when used), tips, and pre-cut dihedral. As an example, the Falcon 56 type can be completely finished in one hour using five minute epoxy glue. Aristo Cat type comes with ailerons and may be built without them if desired. Now available are kits for the Falcon 56, Jenny, Esquire, Aristo Cat, Sr. Falcon, and Stormer. Prices range from $12.95 to $18.95. Wing cores only, machine cut from 1# styrene foam, ready for covering and including die cut spars and pre-cut dihedral from $8.95 to $11.95. Dealer and jobber inquiries are invited. For further information, **Circle #11 on the Reader Service Card.**

The next item is one we, at RCM, sincerely appreciate — a long nylon shock absorbing steering arm for nose gears, retailing at 95c. This extra length eliminates the need for a reducing linkage to prevent nose gear over-steering. The last two items consist of formed low-wing wire landing gear for the Kwik Fli and priced at 90c; and a pair of universal nylon aileron horns for conventional ailerons, priced at 60c. Tested and recommended by RCM. **Circle #14 on the Reader Service Card.**

Top Flite Inc., has produced their revolutionary new covering material, Monokote, a one step covering with built in finish. For a complete review of this material, see this issue of RCM. For further information, **Circle #15 on the Reader Service Card.**

Royal Products Company has added another outstanding item to their line of servos — this time a rudder servo, elevator servo, and three position throttle servo for a complete Class II system for the single channel flier. A complete review of the servo system appears in this issue of RCM. For further information, **Circle #16 on the Reader Service Card.**

Meyers Models Company has expanded their line of ready-to-fly single channel airplanes with the May Fly #2. These planes designed for the .049 range of engines, are available in semi-finished form and in ready-to-fly (minus radio gear) form. The latter are completely painted and with engine supplied. The May Fly #2 was tested by RCM and found to be completely stable and easy to fly. For further information, **Circle #17 on the Reader Service Card.**

RCM DIGITRIO ERRATA

Now that the series on the Digitrio has been completed I have gone over all of the issues trying to spot errors in the writeup and artwork so that they could be passed on to you. Here are a couple more that I have found:

(1) *Receiver Schematic:* C16 has the polarity marked backwards. Q5 is a 2N3640.

(2) *Receiver Overlay:* C16 is shown as a 22 Mfd. It should be 2.2 Mfd. Tabs on transistors Q3 and Q4 are not shown — draw them in.

(3) Voltage at base of Q7 should be labeled .65.

(4) *Decoder Overlay:* The .22 Mfd. capacitor does not show polarity. The bottom is positive and the wire lead from the top is negative.

(5) *Servo Schematic:* The emitter of Q9 and Q10 should have a line connecting them. R7 should be 4.7K.

(6) Several of the scope pictures were mislabeled or shown backwards. Anyone sharp enough to find these errors will know what corrections to make.

This should answer the many letters that have come in inquiring about these errors. Thanks to all of you who wrote in.

MONOKOTE

(*Continued from Page 49*)

easy way we discovered was to remove the backing sheet, then coat the adhesive surface of the trim cut-out with soap or detergent and water, or a wetting agent such as Kodak's Photo-Flo solution (available at any photo dealer). Now the trim may be slid around like a wet decal until positioned correctly. Then, squeegee out the excess moisture with a cloth and allow to set overnight. The next morning, the trim application may be heated in place. Remember – when using trim you are simply applying heat to adhere the material in place, not shrink it, thus a lower degree of heat is required than when shrinking Monokote over an open structure.

What are our feelings on Monokote? Is it the ultimate answer in finishing and covering? We have tried Monokote and we like it. The old-time model builder will have to work with it to become used to anything other than the conventional materials we have used since model-building began. As for the ultimate – it is no more the final, one-and-only answer than a single individual model design would be universal to all modelers. What it **is** is the **first** new covering material introduced to model builders since the introduction of silk and nylon. And you'll hear a lot more about it. What it will do for **you** is provide you with an excellent finish in far less time and with far less effort, with the result that you will have more time to **fly**.

And, after all, that's what this hobby is all about. Tested and recommended by RCM.

D.C.R.C.

(*Continued from Page 6*)

screen. In conjunction with the Symposium, a dinner-banquet is scheduled for Saturday evening, after which a special program is presented in the Laboratory auditorium.

Sunday, the second day of the technical meet, activity is re-located to the flying field where the new ideas and concepts meet the challenge of the final flight test. An interesting sidenote concerning the flying is that this activity was formerly done right at the Applied Physics Laboratory – that is, until the insurance adjustors found out what it would cost to replace one of the lab's radar dishes that had been run through by an R/C model!

The District of Columbia R/C Club –RCM's Club Of The Month, we salute you.

They'll be looking forward to seeing **you** at this Eighth Annual Symposium!

The Roostertail

The Official Publication of the International Model Power Boat Association
General Office:
2405 19th Avenue Broadview, Ill.

THE date for the 17th Annual Invitational Regatta has been settled. The DeVry Dolphins will host the 1966 Regatta on August 21-22 at Potawatomie Park in Wheeling, Illinois. Wheeling is a few miles Northwest of Chicago, just off the Illinois tollway. All members of the IMPBA have received letters from DeVry announcing the contest and more information is coming. Be sure to return the reply cards you receive so that we may better plan the regatta around the events *you* want to see run. Your cooperation will be greatly appreciated.

●

The WEST COAST District Regatta for 1966 will be held by the San Francisco Model Yacht Club at Lake Merced on September 3-4. This gives you just enough time to get your equipment back in shape after the jaunt to Wheeling.

1966 Regatta Schedule

April 30-May 1
Blue Dolphins, Los Angeles, California. 1/16 and ¼ mile record trials.
May 22
DeVry Dolphins, Wheeling, Illinois. Multi Boat.
June 26
Aurora MPBC, Aurora, Illinois. Invitational Regatta.
July 23-24
Minute Breakers, Lombard, Illinois, Invitational Regatta: Multi Boat and Stock engine SK Multi Boat.
August 21-22
17th Annual Invitational Regatta, Wheeling, Illinois.
September 3-4
West Coast District Regatta, San Francisco, California.
September 18
DeVry Dolphin, Wheeling, Illinois. Multi Boat.

Record Trials

DeVry Dolphins

May 14, June 11, August 13, September 10.

Minute Breakers

May 29, July 17, August 7, August 28.

At the time of printing, no pond has been chosen for the annual Tether regatta. It seems that a highway commission is in the process of converting the pond of the New York MPBA into part of the Interstate Highway system. Until the bulldozers came along . . .

●

Model boatmen arise! You must be heard to be counted!

Common are the statements — "If only there were more boating articles, if only there were more products, if only there were more boatmen." *If*, it seems, is the biggest two letter word in the English language. When all the shouting is done, it all boils down to one thing — we must band together to achieve our common goal. The advancement of model boating as an exciting and desirable sport must be proven to those who appear on the fringe as they decide whether to join us or look elsewhere. This amounts to good public relations. Good "P.R." can come about in many ways, from answering the sometimes pesty questions asked by spectators to keeping our running area clean, to sending in a picture of our latest project to a magazine. Being a member of the IMPBA is also a good "P.R." because as the IMPBA grows, so can the share of space in model magazines grow. The IMPBA acts as a voice for model boatmen, airing and solving as many problems as possible to allow conditions to improve.

Model boating is very definitely growing in size. The number of people that participate in running model boats increases every day. This is a definite fact. But, because of our inadequate public relations an increasingly large percentage of new model boatmen pursue their hobby on their own, more or less as lone wolves. They do not join any local clubs, they do not enter contests, and they do not become members of the IMPBA. While it is not necessary for everyone to join a club or enter a contest, it is important for all boatmen to become IMPBA members. It is one way to obtain the additional space that we desire in the national modeling magazines along with the recognition of our problems by radio control manufacturers. In unity, there is power. For those who subscribe to R/C Modeler, through the IMPBA, membership for the year is only an additional 50c.

The IMPBA does, and will do, as the model boatmen dictate. It will be used by you, the model boatman, to promote

(*Continued on Page 78*)

ROOSTERTAIL

(*Continued from Page 77*)

model boating in the way and direction that you wish. You must help — it cannot be done alone. When you receive an IMPBA ballot, don't put it down and forget about it. This is your chance to have a voice in the IMPBA. Read it over carefully, talk to fellow club members, and VOTE! And, when new rule proposals are published in the Roostertail column, drop a post card to the IMPBA General Office and let somebody know that you read the thing and what your own individual ideas are — pro or con. Remember, it doesn't do any good to gripe about a rule change you don't like if you don't vote and share your ideas with other enthusiasts. Let the IMPBA know about your latest projects and accomplishments.

While we are on the subject of helping the IMPBA, one thing that could stand improvement is our way of timing the straight 1/16 mile course. Here's your chance to lend some suggestions and to air your views.

Up until now, many methods have been used for timing the straight 1/16 mile course. We have used everything from television cameras to signal flags. Unfortunately, the great majority of these methods are not practical under normal conditions, or else they are not as accurate as needed for our present high speed. The method that has given us the best results up until now is using two sighting devices which are placed at the opposite ends of a measured 1/16 mile. These scopes are set up so that when they pass a point 90 degrees to the base line between the two scopes, the scope will trip a micro-switch which will either signal the timers to start their watches, or when hooked directly to solenoids, will start a stopwatch. After the boat passes the approximate center of the course, the second operator starts tracking the boat. When it passes perpendicular to the base line, the second mircro-switch activates a light, or a second solenoid stops the timing watches.

This is a workable method of timing the straight 1/16th and the results have been fairly good, but it has many drawbacks. First, it means that timers must be at opposite ends of the course to stop and start the watch as it enters and leaves the course. Two, it takes a long length of cord to electrically tie the system together. Three, the device may give an inaccurate reading by a careless or uninterested operator. When using solenoids to stop the watches, the latter can be made inoperative due to the heavy pounding, and it can be very difficult to get people to volunteer their watches under these circumstances. This

problem might be solved by using a low voltage electric timer in place of a watch if one could be obtained from a surplus source.

There seems to be an increase of interest in running the straight ½6th, but clubs are having quite a difficult time in accurately setting up the method of timing. We welcome suggestions from IMPBA members. Your brainstorm might be just what we're looking for. All suggestions should be sent to the IMPBA General Office.

(membership application)

Application for Membership to the I.M.P.B.A. for 1966

I.M.P.B.A.
2405 S. 19th Avenue
Broadview, Illinois 60155

Annual dues 50 cents plus $5.50 for a year subscription to R/C Modeler Magazine. (See subscription rates for outside USA.) Family Plan: 50 cents per person plus $5.50 for a single one year subscription (one address only).

Name _____
Address _____
City _____ County _____
State _____ Country _____
IMPBA LIFE # _____ Interest: _____
R/C _____ Tether _____ Club _____
I have a current subscription to R/C Modeler: Yes ___ No ___ Fee Enclosed ___

Zip-along Cassidy

He Zip Codes ALL his mail

When new Postal Regulations go into effect, your mail will be delayed if it doesn't show your Zip Code. Start *now* to give *your* Zip Code as part of your address on ALL your mail.

HELP YOUR POSTOFFICE HELP *YOU*

Zip Codes are mandatory after January 1st. Check your magazine label now! If it does not include your Zip Code write immediately to R/C Modeler Magazine, Circulation Dept., P. O. Box 1128, Laguna Beach, California 92652 and notify us of your correct Zip Code.

N.M.P.R.A.

(Continued from Page 50)

P.S.

Just one more thought and I will put the old bones to bed; kick this around and maybe we can prompt Mr. deBolt to write another article.

Miniature Unlimited Pylon Racing

Limited in the design category only, to the scale types that have flown in the Thompson Trophy races and now flying in the Unlimited Class.

Minimum scale of 2" = 1'-0". Maximum scale 3" = 1'-0".

This would keep the size in fair proportion to the N.M.P.R.A. Goodyear Racers and it is entirely possible that the two events could be run together with the addition of another pylon.

As for speed, this type of model should fly about the same speed as the .60 powered class III multis now flying and performing the complete stunt pattern in front of spectators.

Since I am not and probably never will be classified as an expert maybe this will give me the foresight to set up an event of this type.

How about it? After all, Wilbur may not have been too sure about Orvil either.

Thanks for a fine magazine.
Art

Here's another from Don Lussier of Warwick, Rhode Island:

Dear Don:

After reading Hal deBolt's article in a recent RCM, I have given the Goodyear event some thought and will try to put these thoughts in writing. I am what you would call an average Sunday flyer who is interested in the Goodyear event. Presently, I am flying a Denight Special and am very happy with it. I really think it is too soon to "kick the tires" on the event for there hasn't been much time to give it a good evalution. Hal asks why only the experts are entering this event. It seems to me that the experts are the most easily adapted to any new event. They have the time, the experience, and resources to make the change, otherwise they wouldn't be experts. However, the average Joe is a kit builder rather than a "scratch builder," and with the advent of new kits of pre-fabs of Goodyear racers coming, I think his competition will greatly increase. He isn't as quick to jump on the bandwagon when he builds only two or three models a year.

This brings up another of Hal's comments. Rules. He maintained a contest where a different set of rules were used and a "newcomer" with a "slower than average airplane" placed second. It seems to me that if I had put time

and practice into this event, had a fast ship, then entered a contest and was beaten by a newcomer with a mediocre airplane because of a set of rules, this would get under my skin. After all, the good fliers weren't born that way. It took time, patience, and practice, and the best man and plane should win. My point is simply, "don't cut the rules to the point that you can't tell which is the best plane and pilot." As an illustration, the average Sunday golfer doesn't expect to compete with Jack Nichlaus but he has a ball playing with people of his own caliber still using the same rules as the champions. If the rules make us all equal then what is there to strive for? The thrill of competing for 6th or 7th place is just as real as 1st or 2nd!

There is something about seeing scale or scale-like ships racing together that can't be beat. Your competition is right in front of you instead of on a scoreboard at the CD's tent. The present rules suit me just fine. I am looking forward to next season with much enthusiasm and hope that there will be many Goodyear contests and events. I would personally do as much as I could toward this end. A little organization is needed here in the East, and I invite those interested and with ideas to write to me so that plans can be made for the coming season.

Don Lussier
15 Saxony Drive
Warwick, Rhode Island

And there you have a few ideas and suggestions. Hal deBolt will present a talk at the Toledo Conference on suggested changes and modifications to the current rules. You, however, are the NMPRA. The rules cannot be changed without your approval. It is your opinion that is needed – the Board of Directors can only propose changes that you have requested, and they can only be approved by a majority vote of the membership, so let's hear from **you**.

And if you're not building a Goodyear racer – better get started. We are currently working on quite a surprise and boost for the R/C Goodyear event – the NMPRA National Championships, to be held in conjunction with one of the largest full-size air races of the year. If this comes to pass, it will put the R/C Goodyear event in front of the general public in a most spectacular way. Complete with press and national television coverage. We'll let you know as planning progresses. The event, by the way, would be somewhere in the area of September of this year.

It doesn't take long to write a letter or take a picture of your current Goodyear design or kit or plan-built model. We'd like to see them and share them, along with your ideas for improving this event, with other RCM readers.

KITS & PIECES

(*Continued from Page 53*)

there is a need for such a class, where the majority of the flyers could compete, if only in interclub races. Let's have your thoughts.

We also managed to get into the middle of a glider kit this month — the Kurwi 33, available from Willoughby Enterprises at $40. The Kurwi 33 is a nine foot sailplane manufactured in Western Germany. This is our first attempt at an imported kit and we were somewhat surprised at the quality.

The Kurwi 33 features a completely finished and well-made fibreglass fuselage. All wing, stabilizer, and fin ribs are pre-cut and stacked. Leading and trailing edges are notched and tapered, and full length shimming strips are included to assure proper positioning of the leading and trailing edges during assembly. Assembly has been unusually simple and all parts fit well. Due to problems involved in shipping, wing leading edge planking is not included. Otherwise, the kit is quite complete. The wing framework is very light and some problems may be encountered when attempting to cover without introducing warps. We will try to advise next month, should any difficulty be encountered along these lines.

Gliders can be a wonderful "change of pace," and this one is a natural for the RCM Digitrio due to somewhat cramped quarters in the equipment area. The Kurwi 33 is also suitable for rudder only equipment.

Being too old (Ed's note: "old" is spelled LAZY) to run with a tow line, we are going to **attempt** a tow line pickup with the Antic! How's that for a way to prang 'em two at a time?

We received a note the other day from Leon Morrison in Green Bank, West Virginia. Leon bought an H-Ray some time ago, and has been having a ball flying it. After much praise about the ruggedness of the ship (seems he's been having some problems with his pilot flying and the ground), the note related the following experience — "while shooting bounce-and-go's (he's been watching me — Bernie) I heard a horrible racket coming from the bird. I circled overhead at about 50 feet, when suddenly the engine leaped out of the plane! The motor clattered to the pavement, and my flying buddy started yelling for me to watch the plane. I gave a blip of down elevator to pick up speed, picked out a spot, and made a beautiful three point landing. If you can't afford an engine, the Ray makes a beautiful glider!"

Now I've been flying a good many years, but I just couldn't buy Leon's story. You just don't move the CG that far aft and still have a flying machine! The story was passed on to Fearless Leader, knowing he would get a laugh from it. Only he didn't laugh. "You know, the same thing happened to Bill O'Brien," was his reply.

Being a skeptic, I had to see this one for myself. The engine was removed from our H-Ray, and off the hill it went! How about that — it's true! The H-Ray will still glide with no engine, just using a little down elevator! Okay . . . so I apologize! So what do you guys use to hold your engines in place? Bubble gum?

●

Angel Miniflite Co. has announced availability of one of the handiest items in the tool line that we have seen . . . a set of four "finger wrenches" for $2.50. If you have ever tried to slide a nut into position and then balance it on the end of an inaccessible screw, only to have it drop to some mysterious spot on the floor, you will find these a **must** in your tool rack. These wrenches will fit most R/C nuts . . . and if the wrench fits, Clyde, wear it!

●

One of the newest companies to make an appearance in the R/C field is offering a service-product which should prove to be a boon to RCM readers. Frank Gable of Plans Parts Service, 215 W. 4th Street, Oxnard, California, is producing parts kits for every construction article featured in R/C Modeler Magazine. These kits consist of all of the items you would normally have to cut out—one piece fuselage sides, formers, ribs, doublers, triplers, shaped and formed wing tips, nose blocks, etc. . . . and for approximately $1 more than the retail cost of the wood if you were to purchase the equivalent stock yourself! Not included are sheet and strip stock for stringers, wing planking, leading and trailing edges, etc., hardware or plans. The sheet and strip stock is readily available at any hobby shop, as is the hardware. The plans, of course, are available directly from Hobby House Plans Service on any parts kit produced by Plans Parts Service. Balsa wood and plywood used are top quality Sig and Pactra.

Currently available is Don Dewey's "Royal Coachman," priced at $4.49; the Tee Dee Bee at $2.95; and Don Mathes' six foot "Digester" at $7.98. Available soon will be the BD-1, Pipsqueak, Wolfmeister, and other plans featured monthly in RCM. An excellent buy, and certainly a time-saver. Plans parts kits will be available on each featured construction article as long as the demand warrants their production, and/or until kitted by a U. S. kit manufacturer, at which time production will cease on a given design.

●

'Till next month — see **you** at the field!

R/C FLYING SAFETY

(*Continued from Page 40*)

direction? This question may seem ridiculous but sometimes things happen so fast we cannot absolutely be sure of the direction of movement ourselves. Then what happened? Finally, "What do you think caused the crash?" Might as well get a variety of opinions at this point.

3. Detailed Investigation and Analysis. During this phase you must act the detective by evaluating the evidence and by attempting to separate damage sustained at impact from that which may have been present before the death dive. Concentrate on the electronic components. If an airframe failure was involved it would have been obvious from the falling piece of wing or horizontal stabilizer.

Here are clues to look for:

Wiring. Impact damage will be evident from the complete, clean cutting of all strands of a wire. The ends will be shiny. Pre-impact, progressive failure will be indicated by breaks in the strands. They will appear burned or reddish-brown at the ends. As each strand failed the others carried more and more of an electrical load. Over a period of time they continued to burn out one by one. Inspect each wire for progressive failure. An ohmmeter will be of value since the progressive failure may be in an area where the insulation is undamaged. The receiver antenna should be inspected also. Wiring should be completely suspect if the equipment failed suddenly after an extended period of satisfactory operation.

Servos. Examine all wiring as above. In a neutralizing servo is the servo arm at a full throw position? If so, this is a valuable clue. What caused this condition? Outboard sector gear wiper contacts slightly depressed, other contacts normal? Power interruption — check for broken strands in the servo motor leads. Broken gear teeth generally are caused by impact damage (the mass of the control surface and the pushrod continued in the direction of impact while the gears remained stationary). Check pattern of wiping grooves in the PC board. Is there over-travel or manifest lack of indication of wiping contact action? Any missing lid screws? The top may have worked loose.

Receiver. Impact will cause resistors, capacitors, and the tuning coil to lean into the direction of impact. Again check for broken wire strands. In a humid environment look for white powder (corrosion) around component leads. A "Flash Magnifier" (flashlight and seven power magnifying glass in one tool) will prove helpful.

Connectors. Are they making good contact? Bent pins indicate connector was mated and bending is impact damage. Suspect disconnected plugs and sockets with no bent pins. Straight-away separation at impact is rare. Possibly high "G" maneuver caused separation. Thus it is important to know at what point and during what maneuver trouble was first encountered.

Although this is not an extensive discussion of investigating techniques, you should get the idea of the steps you can take to find the "easter egg," the clue that says that this item most probably caused the crash.

Whether you do or do not find the cause, review the notes taken at the crash scene and the witness statements. Do the clues, the actions described by the witnesses, and the wreckage distribution all tie together logically? If not, you have not determined the most probable cause. Continue the detailed analysis of the remains. Here the relative calm of the workshop and another experienced RC'er will prove invaluable in brainstorming the crash. You yourself may be too close to the problem to find the discrepancy. It may be obvious to a more detached viewpoint. The Navy utilizes the skills of an aviation safety officer, two other aviators, and a flight surgeon for their investigations. This variety of viewpoints minimizes jumping to conclusions.

An example of the sort of crash analysis that should be undertaken is mentioned (in abbreviated form) in the Hints and Kinks Column of the June 1965 issue of Radio Control Modeler. Check the "Servo Contacts" paragraph on page 38.

When you have determined the most probable cause of the System Failure crash do not be content just to have that knowledge. You will be doing your fellow RC'ers a great service by passing the word. Your club newsletter or meeting may be the proper forum. Until some organization similar to the Naval Aviation Safety Center is established for RC this is the best we may hope for.

Part III will discuss a positive approach to improve your own RC flying safety record.

THE DIGIFLI

(*Continued from page 23*)

2. Boom — with a 35.
3. Bomb — with a 40.

The plans presented here are drawn with the proper forces for a 3+1 setup, however we started with a coupled arrangement which impressed us considerably. For those who would like to use the coupled aileron and rudder the only deviation from these plans is to decrease the chord of the ailerons to 2" but use the same throw as indicated. Engine side thrust will vary slightly, depending on the engine size. The 23 should be set at O; 29's to 35's 1 degree right; and the OS Max 40 required 2 degrees right thrust. The gear-fairing doors have the same effect as mounting white-wall tires on your car. The antenna post, although enhancing the appearance, has a decidely functional aspect by keeping the antenna wire away from all internal electrical circuits and should be used. The wing-tip plates, while enhancing the appearance of the airplane, also have a functional purpose as they are much easier to replace than to rebuild a conventional wing tip. Controlaire nylon tubing and flexible cable were used for the aileron linkage and work fine. It cuts the installation time to a matter of minutes and keeps play to a minimum. (Ed is going to use this same method for **all** linkages in his Digifli which is now under construction.) I have previously used nylon tubing and cable in limited applications and have been so favorably impressed that this method has been employed to greater and greater lengths with each succeeding airplane. The proper installation of the Nylink is quite simple requiring only tinning of the cable end, sliding the Nylink over the cable and placing a drop of solder in the slot provided. I have found by drilling a hole through the back wall of the Nylink connector and inserting the wire through this hole a more rigid connection can be made. One precaution to be observed when using this method is to keep the distance between the end of the nylon tubing and the Nylink proper to a minimum. This eliminates the possibility of the exposed cable flexing.

CONSTRUCTION

Overall construction of the Digifli is typical of a Class III type. Because of this I will expound in a few areas that I feel may require special attention.

Wing

For maximum rigidity and warp-free construction special attention must be devoted to the sheeting of the wing. First, apply the sheeting equally over the two ¼" spars on the top of the wing. After installing the aileron linkage apply the sheeting in the same area at the bottom of the wing. From there on the sheeting should be added toward the trailing edge alternately from top to bottom. The last sheeting process should be the top leading edge. If the nylon cable is installed use the fairing shown on the bottom of the wing. Be sure to glue the nylon tubing at each wing rib.

Fuselage

The only noteworthy item in the construction of the fuselage is to go light with the sanding block while shaping the top deck. The antenna post is made by first drilling completely through the dowel and then shaping to a streamlined section. Be sure and embed the antenna post well within the block shown on the plans inside the fuselage and set with epoxy. If you should elect to utilize nylon tubing and flexible cable throughout the entire ship be sure to install the tubing through the tail section prior to covering the bottom of the fuselage.

Horizontal Stabilizer

This unit should be kept as light as possible by using low-weight balsa.

RADIO INSTALLATION

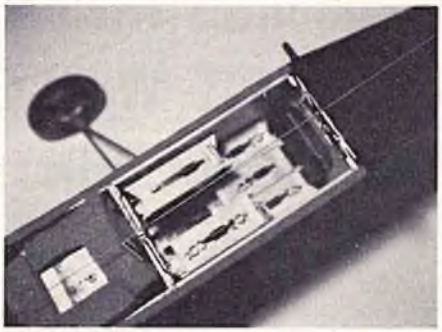
The full complement of radio equipment, including switch and charging jack, can be installed on the equipment-mounting tray as shown on the plans. The two notches in this tray allow a rubber band to hold the foam-wrapped receiver in place. The charging jack and switch are easily accessible through the cockpit opening. This installation allows easy removal and replacement of the entire radio system. Countersink ¼" holes under each of the two servo cover screws on the bottom of each servo to eliminate possible contact between the servo and the board. Be sure to use the bushings supplied with the servo kit rather than wood screws.

CONCLUSION

I sincerely hope that the Digifli will give you many hours of enjoyable flying and I would sincerely appreciate hearing your comments.

PUSHRODITIS

(*Continued from Page 32*)



in line and perpendicular to the control surface's hinge line, as in Figure 10. You will note that the #52 holes line up with the hinge center line as stated above. If the horn is mounted further aft on the control surface, the cables will be tight at neutral and slack at full throw.

The second condition is **control throw adjustments.** You will note the eight #52 holes in Figure 10. These allow changes in control throw in respect to servo travel, but identical opposite holes must be used to maintain cable tension.

The third condition is hole spacing for control surface travel. This you must decide for yourself, but through trial and error methods I arrived at the spacings shown on the full size sketch.

The fourth, and last consideration, is horn installation in the control surfaces. I slot the surface, leaving ⅛" material in front of the horn. When the 1/16" slot is just long enough to allow the horn to be forced in without splitting (about ½"), the horn is then slipped into place and cemented on all sides including front and back.

Nose Wheel Steering Horn

Just as with the control surface horn, the nose wheel steering horn must have the cable attach point in line with the gear pivot point in order to keep the cables at a constant tension. The horn can take many shapes depending upon the nose gear used, but in any case, the above mentioned condition must be satisfied. Hole spacing can vary, but I have found that a 2¾" hole spacing gives the best ground handling with no ground looping tendencies and sufficient sensitivity for a small tubing radius. Naturally, the distance between the nose gear and main gear has a very direct effect on this condition. Figure 11.

Cable Knots and Tie-Offs

I have had numerous questions and implied doubts on this subject and have found most of them without merit. The monofilament cable can be tied with almost any kind of knot with the end cut off about 3/16" from the knot with a soldering iron and the 3/16" material flowed back to the knot with the soldering iron and squeezed into the knot with the thumb and forefinger while it is still hot. This type of tie-off will not unravel, but for those who still have doubts, a ⅜" piece of shrink tubing, shrunk over the knot, will give additional insurance. I use about 3 or 4 half hitches on top of each other prior to the tie-off trick and have found no problems whatsoever. The radio dial cord knot can be glued after it is tied to prevent unraveling. Here, again, the shrink tubing can be applied in the same manner as mentioned above. The latter is shrunk over the knot with a part of the soldering iron which does not get as hot as the tip. I have also glued knots on the monofilament cable with good results.

Conclusion

The information and sketches presented in this article are the results of two years of extensive model construction, headaches, heartaches, flight tests, not to mention both time and money! Although I have flown cables in single channel, multi reeds, and am now flying them in two proportional controlled planes, I have found cables to be superior for almost any application. My 15-year-old son has flown them using a Bonner compound escapement and found control much smoother and more positive. This was done without conduits in order to reduce drag on the escapement to a minimum. On a servo powered system, conduits are standard equipment, especially if the cable cannot be routed in a straight line, or has to be replaced in an area that has been closed out. I have crashed one plane due to my own goof, and only one servo was damaged – this servo was the only one in the plane that had a conventional pushrod hooked up to it! This incident is not conclusive, of course, but does indicate the merit of cables hooked up to the other four servos in the plane.

One final thought! This entire presentation **sounds** far more complicated than it really is, as you will find out if you go the cable route. If you are being plagued with Pushroditis, try cables in your next R/C plane.

You'll never go back to any other method.

THE HOBO

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mented into place at this time. The top of the wing is sheeted with 1/16 x 4 x 36 with contact cement on the wing board to prevent any warpage. The wing is turned over and sheeted on the bottom on the wing board in the same manner as the top. The tip blocks are roughed out and attached to the wing with contact cement and finished down. The center section of both wings, top and bottom, are fiberglassed, and you'll be amazed at the light strong wings you have constructed even with this fiberglass protection. THE LOWER WING IS CONSTRUCTED THE SAME WAY EXCEPT IT IS SHORTENED BY ONE RIB STATION MEASURED FROM THE OUTSIDE TIP. Be sure

and pick out **light** balsa sheeting for the wings.

Finishing of the airplane was a hurry-up job. The entire framework was sanded and three coats of clear dope applied with a light sanding between coats. Sig filler coat was applied twice and thoroughly sanded followed by two more coats of clear dope with an equally thorough sanding application. Sig blue was brushed on the fuselage twice followed by a light spray coat. The wings were given three coats of Sig yellow followed by a light spray coat. The entire airplane was sprayed with one coat of clear dope. The entire framework may have been covered with silkspan, or some covering material, but this was a simple approach and it has proven more than rugged. Attach the windshield and install your favorite gear. Originally flown on reeds, the Hobo is now flying with an Orbit proportional. A K & B .45 was used for power and seemed adequate at this altitude. The Orbit relayless and Bonner Transmites functioned flawlessly on the reed version.

FLYING: Words can't describe the flying characteristics of the Hobo, for you will feel a thrill that you haven't experienced for a long time. If watching your "double winger" climb into the blue doesn't stir your soul, feel your pulse and see if you are still alive! To ensure best flying characteristics the Hobo should balance at the forward extreme of the CG limit. Make sure all surfaces are neutral except the top wing (1°+). Open the throttle, make any take off corrections that are necessary, then let the Hobo take off when ready and a prettier take off you will never see. The author has yet to apply corrective rudder on the take off run even with the aluminum gear in place. The plane may have a slight left turn which may be offset with thrust corrections and making certain that the wings balance beforehand. Explore the sky at your leisure with a stable and easy-to-fly biplane and when you get tired of chasing the wind and playing tag with the birds, throttle back and come in for an effortless landing that will make the "hot shots" envious. Taxi up to the ready line and cut the engine; then proceed with the unbuttoning of some of your shirt buttons because you are going to pop them if you don't! Good luck with your Hobo and drop me a card letting me know what you think of this little "double winger."

FINIS

ADDENDUM: "N" struts may be fashioned from 1/16" ply cut into 1/2" strips using 1/16" piano wire wrapped with thread at the tips for strength and ease of insertion. The mid-portion of the strut is attached with glue and wrapped with thread for rigidity.

EUROPEAN R/C GLIDER FANS

Dale Willoughby, Editor of the ZEPHYR, a newssheet devoted to reporting world wide radio control glider activities and designs, announces his 19 year old daughter, Nancy, will be touring England and the European continent from 25 July thru 5 September ending in Brussels. Any clubs or interested individuals desiring to view an 8mm color film, together with taped comments in English of slope and thermal soaring in America, should immediately write to Dale Willoughby, 14695 Candeda Place Tustin, California, 92680, USA, in order that an itinerary be planned for the trip. Travel on the Continent will be via Eurail and a limited number of showings of this documentary film will be made during the trip. A projector and tape play-back recorder must be available for the slope soaring film.

RCM DIGITRIO

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and the above mentioned advantages the extra cost is not so bad. Other commercial sticks can be used with the Digitrio and I would be interested in obtaining pictures of other types of sticks for publication in order to help others who prefer commercial stick assemblies.

The secret of the smooth operation and ease of manufacture of the stick assembly is the easily obtainable "roll-on" deodorant ball. Only certain types are satisfactory — I have used the ones from Trig and Secret with good success. The balls are solid except for a small air bubble in the center, and it is important to line up the drill with that air bubble when drilling the hole for the stick shaft. The sketches show manufacturing details, however, in case there are any questions, I will go through the method of manufacture and construction that I have employed as an aid to Mr. Average Homebuilder.

Stick Housing

Remove the cap from the deodorant bottle and light sand the outside to facilitate marking. Mark off the required ⅝" height as indicated. Remove the ball and cage from the bottle and put the cap back on. Clamp the bottle in a vise and make two cuts with a hacksaw. Sand the end surfaces smooth. Make two housing brackets from .050 or thicker brass sheet and form to match the angle of the bottle cap. Epoxy to the cap 180 degrees apart and just underflush with the lower cap surface.

Stick Assembly

Remove the ball from the cage and carefully drill a 3/16" hole through the center. I did this in a vise, but it might best be accomplished on a lathe if one is available. Cut the shaft to length and assemble. Cross-drill 1/16" and force in a piece of music wire, bent slightly to keep it from coming out at an inopportune moment. The knob is of the builders own choosing. I used plastic rod, drilled for a press fit, countersunk and crosscut on the end for thumb grip.

Yokes

The yokes look difficult but can be made in about an hour. Delrin machines much like medium hard wood and does not leave stringy edges like nylon. Most local plastics suppliers have free samples available for the price of a phone call. I used the 3" diameter rod because it was available and saved cutting the outside radius. When making these parts, check frequently to see that they are square. Cut slightly oversize and sand to shape with coarse followed by smooth sandpaper. Cut the shaft slot undersize and sand to the proper width, checking frequently with the shaft for a smooth but not sloppy fit.

Yoke Mount, Pot Mount, and Soring Lug are straightforward. The slot in the spring lug is to permit adjustment for accurate centering of the stick after assembly.

Cut the pot shafts to ¼" long and saw a slot in the end so that they can be centered easily when the clamping screw is loosened. Assemble the pot, pot mount, spring, spring lug, and yoke and adjust the formed portion of the spring to permit no play when the yoke is moved. Center the yoke parallel to the pot mount and tighten the clamp screw.

The sticks may be mounted 1⅜" from the edge of the case. Two sticks can be mounted easily on a case 7" wide, the pots toward the center of the case. Cut the 1⅜" diameter hole in the case in the desired location and transfer the holes from the other assemblies to the case. Assemble and readjust centering and spring tension if required.

The use of six screws to mount each stick assembly may not be acceptable to some from an appearance point of view. If this is so, the pot and yoke mounts could be made in one piece and the stick housing epoxied to it. The entire assembly could then be epoxied to the case. Since one screw has been used in the pot and yoke mounts, they must be secured with epoxy to maintain proper alignment in the previously mentioned assembly.

For those who like mechanical trim and do not want to make the yokes, one could purchase the Min-X assembly and use only the stick assembly described here. I have tried numerous versions of mechanical trim and have finally resorted to the extra pot because the trim sensitivity is adjustable and the mechanical assembly of the gear train is complicated and difficult without properly molded parts.