R/C MODELER

THE LEADING MAGAZINE FOR RADIO CONTROL • JULY 1967 • 60¢

JAN SAKERT'S
LIKI TIKI
TWIN FLYING BOAT

AMP GATE CHARGER
New Breakthrough Permits
3-Hour Battery Charging!

PREVIEW: 1967
WORLD CHAMPIONSHIPS

DON DEWEY'S CIRCUS - - - FAST BUILDING MULTI SPORT

A few words about me.

I am Electronic Engineer and this is my day job.

From tender age two things attracted my interest and I managed to have them in my life.

The first was electricity and the second the bluesky.

I´ve found the model airplanes hobby in October 1973.

I love the wooden structures from scratch airplanes and boats also.

I started collecting plans, articles, books and anything else that could help the hobby of many years ago and have created a very large personal collection of them.

Since 2004 I became involved with the digitization and restoration of them and started to share the plans from public domain with my fellow modelers.

Now after all this experience I have decided to digitize, to clean and to re publish in digital edition and free of all issues RC Modeler magazine from 1963 to 2005 and others books and magazines.

Certainly this will be a very long, difficult and tedious task but I believe with the help of all of you I will finish it in a short time.

I apologize in advance because my English is poor.
It is not my mother language because I am Greek.
I wish all of you who choose to collect and read this my work good enjoyment and enjoy your buildings.

My name is Elijah Efthimiopoulos. (H.E)
My nickname Hlsat.

My country is Greece, and the my city is Xanthi.

Λίγα λόγια για μένα.

Είμαι Μηχανικός Ηλεκτρονικός και αυτό είναι το αληθινό μου επάγγελμα εργασίας.
Από μικρός δυο πράγματα μου κέντρισαν το ενδιαφέρον και ασχολήθηκα με αυτά.
Πρώτον ο ηλεκτρισμός και δεύτερον το απέραντο γαλάζιο του ουρανού και ο αέρας αυτού.
Το χόμπι του αερομοντελισμού το πρωτογνώρισα τον Οκτώβριο του 1973.
Μου αρέσουν οι ξύλινες κατασκευές αεροπλάνων και σκαφών από το μηδέν.
Ξεκίνησα να συλλέγω σχέδια, άρθρα, βιβλία και ότι άλλο μπορούσε να με βοηθήσει στο χόμπι από τα πολύ παλιά χρόνια.
Έχω δημιουργήσει μια πολύ μεγάλη προσωπική συλλογή από αυτά.
Από το 2004 άρχισα να ασχολούμαι με την ψηφιοποίησης τους, τον καθαρισμό τους αλλά και να τα μοιράζομαι μαζί σας αφού τα δημοσιοποιώ στο διαδίκτυο (όσα από αυτά επιτρέπεται λόγο των πνευματικών δικαιωμάτων τους).
Σήμερα μετά από όλη αυτήν την εμπειρία που έχω αποκτήσει, αποφάσισα να ψηφιοποιήσω, να καθαρίσω και να ξαναδημοσιεύσω σε ψηφιακή έκδοση και ελεύθερα όλα τα τεύχη του περιοδικού RC Modeler από το 1963 μέχρι το 2005 και κάποια άλλα βιβλία και περιοδικά.
Σίγουρα είναι μια πολύ μεγάλη, δύσκολη και επίπονη εργασία αλλά πιστεύω με την βοήθεια όλων σας να την τελειώσω σε ένα καλό αλλά μεγάλο χρονικό διάστημα.
Ζητώ συγγνώμη εκ των προτέρων γιατί τα Αγγλικά μου είναι φτωχά.
Δεν είναι η μητρική μου γλώσσα γιατί είμαι Έλληνας.
Εύχομαι σε όλους εσάς που θα επιλέξετε να τα συλλέξετε και να τα διαβάσετε αυτήν την εργασία μου καλή απόλαυση και καλές κατασκευές.
Το όνομα μου είναι Ηλίας Ευθυμιόπουλος.(Η.Ε)
Το ψευδώνυμο μου Hlsat.
Η χώρα μου η Ελλάδα και η πολη μου η Ξάνθη.

RCM Magazine Editing and Resampling.

Work Done:

1)Advertisements removed.

2) Plans building plane removed and hyperlinked.

3)Articles building plane removed and hyperlinked.

4)Pages reordered.

5)Topics list added.

Now you can read these great issues and find the plans and building articles on multiple sites on the internet.

All Plans can be found here:

Hlsat Blog RCModeler Free Plans and Articles.

http://www.rcgroups.com/forums/showthread.php?t=2354459

AeroFred Gallery Free Plans.

http://aerofred.com/index.php

Hip Pocket Aeronautics Gallery Free Plans.

http://www.hippocketaeronautics.com/hpa_plans/index.php

James Hatton Blog Free Plans and Articles.

http://pulling-gz.blogspot.gr/?view=flipcard

Vintage & Old-Timer RCM Free Plans.

http://www.rcgroups.com/forums/showthread.php?t=2233857

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Thanks Elijah from Greece.

RADIO CONTROL
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Y 1967 VOLUME 4 NO. 7

features

COMING NEXT MONTH!

R/C BENSON GYRO COPTER

OWEN KAMPEN'S BONZO FOR GG GOODYEAR

PLUS MUCH MORE!

ON SALE JULY 10TH

departments

OVER

/hat better combination than two beautiful ıodels? The one in the foreground is a ıono-Koted Taurus. The checkered model is uth Urwiller, Santa Ana, Calif. Ektachrome y Doug Tucker.

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EDITOR'S MEMO

DON DEWEY

ONE of the fastest growing phases of our sport is that of gliding, or slope soaring. To the dyed-in-the-wool power hound, nothing sounds more boring than chucking some lightly loaded behemoth off a cliff to watch it settle slowly down to the valley below. This description, of course, is the farthest thing from the realities of slope soaring, but try and convince the average flier! I know, because Dale Willoughby of Flying Models worked on me for over a year before I finally, and quite reluctantly, gave it a try. Now I spend my "off magazine" hours hoarding glider designs and information, and working out new configurations to fit my own particular slope and its lift conditions.

What is soaring like? It is, I believe, an unending challenge between man, his machine, and the unseen, but ever-present elements of nature. There is a fascinating and beautiful majesty in silent flight. There is an old saying that "just about anything will fly in R/C." This may be true when you tie that screaming half-horse up front, but it's a different story when you have to depend upon sound aerodynamic principles, unseen lift, and the sometimes present, but ever elusive thermal.

If you find that you're in a rut, I would like to recommend that you try soaring. If you have a suitable slope, you're already ahead of the game. If not, try an electric winch or a Hi-Start towline. Gliders can be flown from virtually any site. And if you still think they are boring, try to attend a good glider meet or 'Soar-In.' Take a good look at the semi-symmetrical, low aspect ratio glider with rudder, ailerons, and elevator flying a tight pylon race against two or three other similar machines. Or, if you prefer, the high performance areobatic machine that is out there in that lift area performing the pattern maneuvers with silent grace and beauty.

You will find it is far more rewarding than you ever imagined possible—from the basic design considerations, to flying, to the accumulation of knowledge necessary to master the challenge that is ever present for the gliding enthusiast.

●

Before we leave the subject of gliding, the Harbor Slope Soaring Society would like to invite any of you who are interested in R/C gliders, and are planning on coming to the Los Alamitos Nat's, to bring your gliders along and try your hand at slope soaring. Their soaring site is about 15 miles south of Los Alamitos and readily accessible by freeway. The site is open all week and the wind during the summer months is generally good until the late evening hours. Maps will be available at the Nationals, and since most of the members of the Harbor Slope Soaring Society are on vacation during that week, someone will be at the bluff during most of the week.

If you don't have a glider, but are interested, feel free to come along and observe. For advance information, contact John Donelson, 16162 Little Drive, Huntington Beach, California 92647.

●

There is an old adage in writing circles about the 'biter-bit' story being always in demand. In other words, if a dog bites a man, that's not news. But if a man bites a dog, well . . .

One recent 'biter-bit' came to our attention from the Higginsville, Mo. newspaper, and concerned a man that sold a car dealer a new car! That, in fact, is what happened recently to Albert Ziems of Ziems-Grother Motor Company. Ford dealer Ziems purchased a Testors R/C Ford Mustang from Paul Runge, genial proprietor of Ace R/C. Which really doesn't prove anything except that Paul is a good salesman, and that R/C appeals to just about everyone, once they see and understand its function and potential for an interesting and rewarding hobby and sport.

●

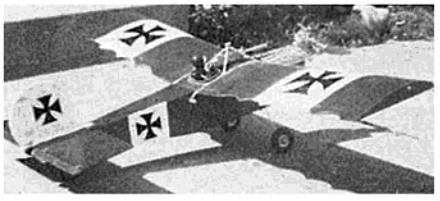
The annual Wright Brothers Memorial Radio Control Championship is, in this writer's opinion, one of the finest meets on the competition calendar. Sponsored by the WORKS of Dayton, Ohio, the Fifth Annual event is slated for June 24-25 at Wright-Patterson AFB, in Dayton. Events will include Class 3 Expert and Novice; Class 2, J-S-O; Class 1, Open; Class I, Jr.-Sr.; Scale, Open Pylon; Goodyear Pylon; Limbo; and Combat. Special attractions include a flyoff for the top flyers in Class 3 plus a Grand Champion chosen by results in all events. A special, improved pattern will be used on the four continuous flight lines. A large, rotating pool of experienced judges will assure each contestant of top notch judging. Don't miss this one! For complete information and entry data, write CD Don Laughhead, 4789 Lamme Rd., Dayton, Ohio 45439.

New to the 1967 contest calendar in the First Annual Western U. S. Championship for Open and Goodyear Pylon racing. Sanctioned by the AMA and NMPRA, and scheduled for August 5-6, this new meet is jointly sponsored by the UTES of Salt Lake City and the Belltower Hobby Shop. Entry fee will be $3 plus $1.50 for late fee. Trophies will be awarded for first through third place with medallions for all heat winners. Goodyear Tire and Rubber Company is putting up four Goodyear Double Eagle White Sidewall Tires, valued at $200 for the first place winner. Merchandise prizes are beyond description! Special hotel and motel rates have been established in Salt Lake City for competing pylon racers. For entry information, write Bob Sansom, Belltower Hobbycraft, 3555 W. 3100 South, Salt Lake City, Utah 84119.

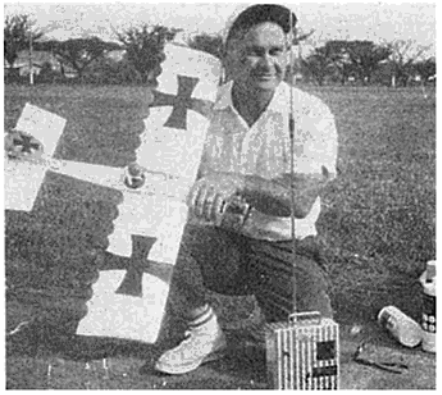
If you miss this one, don't say we didn't warn you!

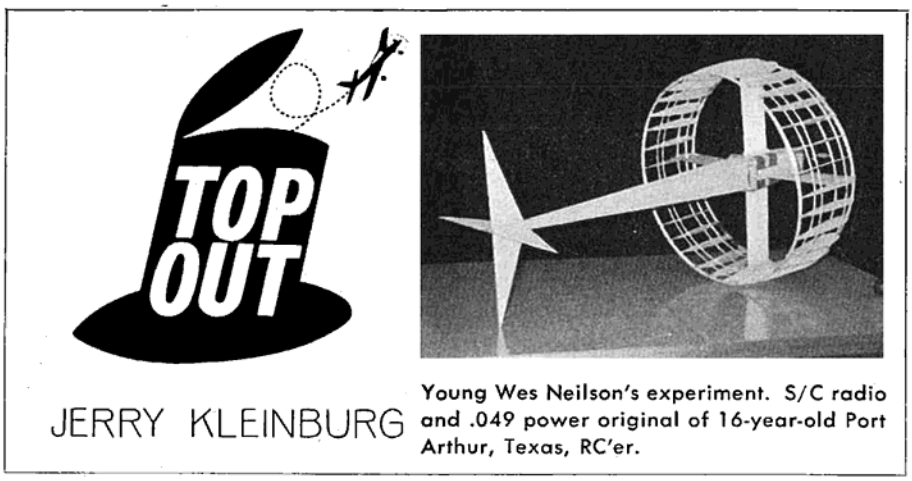
●

Even though it is impossible to print all of the pictures we receive each month, we do like to see photos of your latest project. And nothing boosts a designer's ego more than having him send a print of your version of his design. In the ego boosting category, here's a shot of a Wolfmeister, built by Bill McAbee of Del City, Oklahoma, for his daughter. (That's a good excuse, Bill!) Enya .09 and Galloping Ghost.



Still another Wolfmeister from the other side of the world — Capt. Stan Armstrong's version from Saigon, Vietnam. It seems that neither rain, nor sleet, nor Viet Cong stays the determined RC'er!





JERRY KLEINBURG

Young Wes Neilson's experiment. S/C radio and .049 power original of 16-year-old Port Arthur, Texas, RC'er.

GARDNER-THOMAS FAI DEMONSTRATIONS

FINAL preparations are underway — as you read this — for the 1966 National champs in Class I & II to jet to France and Ajaccio in Corsica for the 1967 Internats. Whole-hearted support stretching across the country — and to Hawaii — and coming from all segments of R/C, brought the demonstration idea to its current gratifying position. This support — made clear from the abundant mail and comment received — stems from desires to assure continued vigor and development of R/C and to promote fraternal aspects of this international pastime. Too often, in matters dealing across national borders, we may tend to allow competition factors to sway us or to be discouraged by official machinations, all of which combine to dampen enthusiasm of any given effort. In this particular case, stress has been on flying and good will as primary goals while keeping other aspects in perspective as considerations for attention at an appropriate time.

Flying demonstrations by Thomas and Gardner will simply be an unofficial display of flying techniques to share this R/C experience and to encourage enlargement and development of R/C forms not having current world status. The fact that Class I and II are shown does not in itself indicate these events are "bought" as official events since such status depends upon indications that they have sufficient activity levels and permanence to warrant official effort to organize them on an international basis. These, or any, demonstrations are only part of initial efforts to stimulate interest and to show in concrete form what's being talked about. Language differences being what they are, require such means to bring about maximum understanding. In addition, as we pointed out originally, "putting up" is the best form of showing faith in what's being done. To date, the broad support given the demonstrations shows flyers across the country possess a healthy hunk of such desire and favor this direct action.

(Continued on Page 7)

FLIGHT LINES

R/C news keeps coming on in large amounts and although we try to give notice to it all in these pages, only a part may be directly covered in any issue. To all correspondents we say, "Be of heart and patience, and we'll do our best to eventually share the news you send with all of RCM's readers."

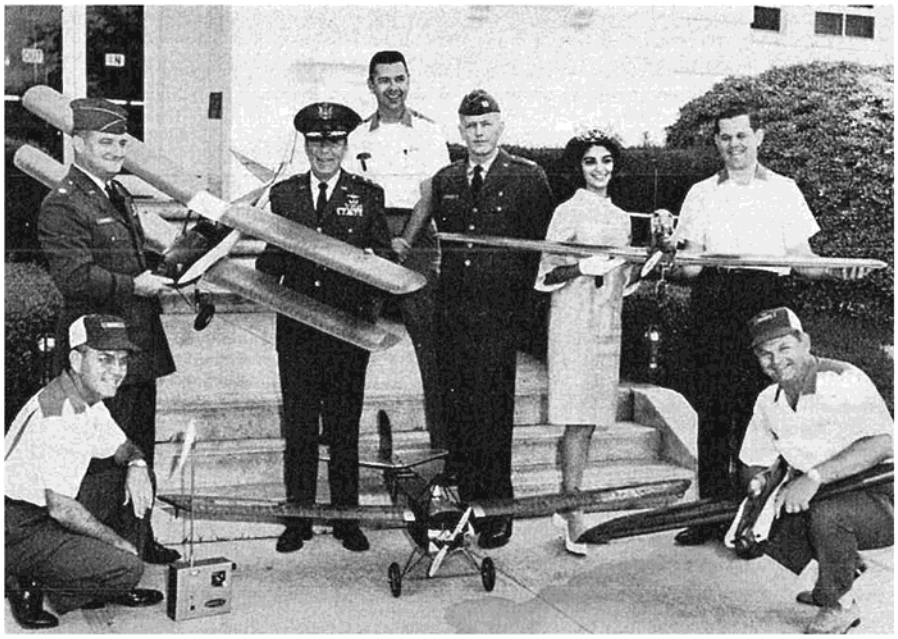
Although it's not possible to print everything deserving attention, the materials received are given attention by the entire RCM staff since it is valuable in keeping a complete understanding of R/C activity and thinking. Because we want to know "what it's all about" at all times, every letter and newsletter is gone over several times and thereby becomes part, at least indirectly, of the substance found in these pages. Together with the broadest and — we believe — best "out in the field" contact, RCM attempts to not merely report, but to remain an active participant in this great hobby/sport and to strenuously support attempts at its varied developments. So we repeat, be patient wit' us. . . . And now let's see who are the winners in this month's sweepstakes. . . .

AROUND THE CIRCUIT

● TEXAS. Wes Neilson, 16-year-old modeler from Port Arthur, tried his hand at an original plane utilizing a "barrel" wing. Initial efforts center around a single channel .049 powered prototype. Bob Moore helped with the wing covering which, come to think of it, must have been a heck of a job. Normal wings are tough enough, but a barrel. . . . As a side issue, wonder what the lift/force diagram is like on a wing of this nature? Further news is looked for from east Texas on Wes' creation.

The ALAMO RC'ers of San Antonio (ARCS), busy with preparations for their air show at the 50th Anniversary Open House at Kelly Air Force Base, welcomed a couple of visitors to their flying

Miss 50th Anniversary — Anita Marsh — joins M/Gen. Frank Rouse in previewing planes of the Alamo RC'ers. Gen. Rouse, an R/C fan, heads the San Antonio Air Material Area based at Kelly where the ARCS will stage an R/C airshow as part of the 50th year celebration of the famous air base. Major Rex O'Conner, Gen. Rouse, Blake Kothman, Capt. Glenn Coates, Miss 50th Anniversary, and Johnny Odem are standing while Jim Albers and Chuck Reisinger kneel. ARCS represent 5 Air Force commands located in San Antonio area. (USAF photo.)



Memphis trophy winners at successful Labor Day contest. Bigger affair planned for 1967 Labor Day repeat. (McClure pic.)

New Zealand R/C Nats Scale entries flew well despite rain. DH Chipmunk at lower left belongs to Mike Kendrick, took 1st place. Merco .49, Micro-Avionics.

TOP OUT

(Continued from Page 6)

strip. Lou Mango, also an ARCS member (only this "ARCS" stands for Alaska R/C Society), and Chuck Brannon of Sioux City, Iowa, enjoyed the mild mid-winter flying sessions. Chuck concentrates very nicely in R/C scale (check Flight Line, RCM, Dec. 1966), while Lou is a multi reed flyer. The ARCS — of San Antonio — have been invited to acquaint visitors to the giant AF base at Kelly with all aspects of R/C and have been hard at it putting polish to flight routines so as to present smooth performances for the 100,000 or so visitors officials expect for the 7 May affair. Washington officials are expected for the open house and Bob Hope is slated for MC chores. National TV may cover a part of the celebration. The ARCS show will include pattern, Goodyear, scale, and GG, with about 30 planes on static display. We expect to have full coverage on this important event next month.

June 17-18 and Sept. 23-24 are dates of sanctioned R/C meets in Houston this year. A full assortment of pattern along with pylon and scale will be available courtesy of the Houston R/C Club. May 13-14 saw speed record trials held by the club. Detailed results will be reported here since we plan coverage of this event.

● MISSOURI. The Spirits of St. Louis R/C Club (otherwise known as the R/C Club since the smaller title may be easily written on checks) reports via Travis McGinnis and their newsletter, club membership stands at about 40 members as result of concerted effort which saw flying field improvements, club emblems, and fuller meeting programs as chief ingredients underlying the effort. Members include Bill Weaver, AMA VP, Bob Williams and Bill Butters (not Bitters, as we had in our May stint). Trav is their energetic secretary who would like to trade newsletters with other clubs, and who tells of a maneuver he dubbed the "Buder Park Special." It involves trimming tree tops and 30-foot high spot landings complete with fuel dripping down the tree. He advises placing this maneuver late in the pattern since judges balk at climbing oily branches to measure how far you missed the spot! With such content the "Spirits" newsletter ought to become popular. Trav's address: 7491 Amhurst, University City, Mo. 63130.

Frog leg servos are featured — or is it served? — in the McDonnel R/C MAC March issue of their CARRIER WAVE newsletter. Borrowed from Frank Schwartz of the Mid-Tennessee R/C Society and based on Dick Mindel's experience in high school biology, use of bull frog legs to actuate servos is pictured and detailed. Phrases like, "Now with the sutures," and ". . . secure a large bottle of embalming fluid," reveal a brand new side to R/C. Daily shipments from the swamp are assured by the frog firm offering these inexpensive surface kickers. If you're really interested drop Al Signorino at 11959 Glenvalley in Bridgeton, Mo., a line — he and Bob Schwartz (no relation to Frank, we trust) had nerve enough to foist this item on members of the popular St. Louis club.

● HAWAII. The World's Other Great R/C Club, the Hawaii R/C Club, sends word all their flying will be concentrated at Barber's Point in order to maintain a high level of club activity. The Marine Corp flying strip at Kaneohe will be mothballed. . . . Pete Anthony, after learning the hard way, took the advice of Dick Riggs (remember his classic retracting gear racer?) and Ken Collins (known as Washing Machine Charlie) and reduced the decalage of his Great Lakes bipe. Pete also added 2 inches to the length of the nose to reduce tail heaviness that caused the snap roll . . . that caused the jolt . . . that caused. . . . Ed Foster, in the throes of smoothing out bugs in his original CHARIOT, scratched it a bit in a minor ding at the Point but expects to have it airborne again shortly. As an example of "prevention" being easier and wiser than repairing, Vic Schoenberg and Ken Collins are slated to present a talk and demonstration to the Honolulu Amateur Radio Club. By familiarizing Hawaiian hams (?!) with characteristics of our R/C gear it's anticipated better understanding will result. Perhaps their presentation could be used by other R/C clubs and groups, as well as in ham publications. . . .

● KANSAS. **Little Events That Don't Make Headlines:** CONTACTS, the KCRC poopsheet thoroughly put together by Charlie Reed, relates Bill Shepard's experience in obtaining an out-of-production item for an older piece of RC gear. Bill needed a pc board to put a 10 channel receiver back in shape. Initial effort to buy it from the original manufacturer resulted in a reply that it was no longer stocked. Bill, who's "a large part of the KC police department radio crew" persisted and explained his need suggesting he'd be glad to buy a negative to etch his own pc board. Within a short time an answer arrived requesting Bill take care of their enclosed best negative while a copy was made. Now Bill is helping others in similar condition with this item and probably wouldn't ticket Bob Dunham's automobile even if he parked it in the Mayor's parking spot! Bill's sorta proud to be in a hobby where big outfits like Orbit aren't too busy to help an individual stay in the air. . . .

Loren Tregellas and acrylic lacquered original. Popular pair due for workout at Wichita, Kansas Annual, 24-25 June. Merco 61 hauls slick beauty.

Olathe, Kansas will be location of 1968's Nationals we're informed by the AMA. The Naval Air Station at this city of 11,000 population will be substituted for the usual Dallas location on a one-time basis. The Navy will consider making it a permanent change after the 1968 trial. Olathe is located about 15-20 miles southwest of Kansas City on Interstate Highway 35. Olathe has previously been used for the Nats, as many recall. . . .

TOP OUT

(Continued from Page 7)

The Wichita R/C meet is set for June 24-25 this year. Loren Tregellas, the R/C mainstay in that area, ought to have his epic Delt-Aire warmed up for this affair. Perhaps something new also since he's not one to rest on past laurels.

● ILLINOIS. The Windy City Newsletter of the Chicagoland R/C Modelers, Inc. gives this interesting rundown on the Assoc. of Greater Chicago R/C Clubs: Nine clubs are currently included with about a total membership of 400. The Association was set up in 1966 through efforts of Don Wehrheim, Hugo Mosquera, and Dave Burt. Chief purpose was to coordinate negotiations with officials of the Forest Preserve District where a majority of the clubs have been flying at various locations. By-laws were approved and the Association came into being with Don Wehrheim its 1967 president. It's reported officials seem pleased with formation of this coordinating body.

And down in Washington . . . Illinois, that is, or more correctly, the Peoria-Washington area, we find the Peoria R/C Modelers, Inc., are headed up by Bill Hegler, while John Rediger keeps us up to date through his nooz-sheet. Veep Cal Speerly didn't let a wet field stop checks on his retro gear in preparation for exhibition at the Toledo Conference. A non-R/C exhibit called the Safari Club attracted Peoria visitors at Toledo where "interesting fuselages and engine nacelles with bare minimum in covering" were noted. Maneuver patterns were also found memorable. Jack Dobbins of Washington and Bob Fox of Peoria are the latest members added to the roll of this growing club.

● MICHIGAN. From BREEZE, news organ of the Benton Harbor-St. Joseph crowd, we pass on this "Handy Dandy Little Hint": "Past procedure when installing aileron bell cranks in wings has been to mount the crank on a 4-40 bolt and solder a nut above and below to hold it in place. This system eventually develops slop. Better way to mount the bellcrank is to run a 4-40 tap thru the center hole and then turn the bellcrank onto a 4-40 bolt. Threads in the bellcrank hold it quite secure. No retainer nuts are required and there is no play or bind." Some readers will point out this item is a repeat of a piece in Cunningham's column (RCM May '67) but this little gem bears repeating . . . as the man said as he ordered his second brew. . . .

● ARIZONA.

Space limits prevented reporting results of the 2nd Annual Cactus Festival which was mentioned here in earlier issues. The Tucson RCers affair attracted 27 entries and 35 planes, included the anticipated Haephong event — water balloon bombing — and the Blue Angels precision flying competition. Pattern was a team affair as advertised with Ted White, Ron Anderson, and Ernie Metzer placing first. Other results went as follows:

Blue Angels — Ted White & Dan Parsons

Open Pylon — Ted White (1) G. Goodman (2)

Goodyear — Ted White (1) Chuck Watkins (2)

Haephong Event — Chuck Watkins (1) Dan Parsons (2)

At this point the meet looks as if it must have been dubbed the Ted White Wingding but details show he earned the wins through close competition. For example, one second was the margin in Goodyear where Chuck Watkins and a Denight almost wouldn't be denied. After the final heat Chuck made a practice run, tried to cut the far pylon in two with his pretty Special, so check off one each Phoenix racer. We might add that Chuck went on to even the score at Buckeye where he placed ahead of Ted in a 27 man field at the 17th SW Regionals. The 3rd Annual Cactus Festival, incidently, is in the works for 4-5 November this year at what's become its usual Tucson corner. . . .

Alamo R/C Society is preparing R/C show slated for Kelly AFB 50th Anniversary. San Antonio visitors, Chuck Brannon and Lou Mango look over formation ships of Tom Valdez and Harry Pullen. Rex O'Conner, club prexy, in center.

● CALIFORNIA. Marlene Mollica of the Fresno Radio Modelers has been receiving bouquets — and deservedly so — for the WATTS NEW publication she edits for the California club. The smooth job done with coverage and innovations brought about a high popularity for the newsletter, which in turn attracts added contributions, and this of course helps to assure continued success of her efforts. In the March issue there were about 12 contributions, probably making Marlene the focus of a lot of envy from newssheet editors across the country. WATTS NEW material is varied with one article, as an example, by Brian Ehmke being especially timely since it gave details on a favorite item with modelers; Titebond glue. Taken from a recent technical bulletin of the Franklin Glue Company, Brian gleaned for WATTS NEW readers some interesting facts about this glue which RCers everywhere are finding near ideal for plane construction. Here's a sample of what Brian found: Density — 9.75 lbs. per gallon; Working temperature — 50° to 110°; Storage life — 12 months plus at 80°. Titebond is water based and setting depends upon water removal, so air circulation or porosity is needed. Spreading the glue thinly and using woods with low moisture content — like balsa — also aids in quick setting. Allowing surfaces with the glue applied to set a few moments before joining also helps although initial tack qualities are a feature of the glue. Titebond isn't affected by most lacquers, sealers or solvents, so finished problems are considerably reduced. The glue, once set, has high moisture resistance although it's not recommended for boat use. And it's sandable, a property which puts the cream-colored glue ahead of the white varieties. It doesn't load sandpaper or melt under sanding heat, Brian's article concludes.

Dick Carmen of the Pioneer R/C Club passes on, via the MODULATOR, some building tips we've found useful. Listen: "When wooden clothes pins (the spring variety) are reversed so the flat sides are together, they make good clamps. Or, how about masking tape to pull the sides to the bulkheads while drying? Rubber bands will cut the wood, so avoid them. Also, use masking tape and scotch tape over the masking tape except 1/16" on the paint for trimming colors. Then when you pull the whole mess off the paint doesn't come with it. Lumber yards sell what is called beaver board . . . muskrat board . . . fuzzy board (Jim Sunday, MODULATOR editor suggests asking for Celotex) . . . anyway, it's ½" thick and fairly flat and you can pin on it, spill beer on it, etc." Dick also points out that grommet hunters needing sizes smaller than ¼" for servo mounting will find VECO black fuel line cut into 3/16" lengths will do the job nicely and they're a little stiffer, too.

Cliff Weirick, Joe Foster, and Granger Williams were 1, 2, 3 at Turlock on a wet and windy March 11 & 12. Thirty-three flyers showed for the Goodyear races sponsored by the Pioneer R/Cers to watch Cliff put in a 2:19.0 top time (adjusted to 2:02.0 via handicap procedures). Lou DeLateur provided statistics in the MODULATOR which showed the Midget Mustang was the most popular ship followed by the Denight and Cosmic Wind — another version of the Mustang. Favorite engine was the K&B 40 found on 15 entries, with Super Tiger 40's being on 7 planes, and rear rotor K&B 40's seen on another 7 entries. Next scheduled Goodyear

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TOP OUT

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meet is the LARKS' affair set for Bakersfield on 22-23 April, followed by the LAMHA Cal-Western meet 20-21 May at Sepulveda Basin. Incidentally, the 7th Fresno Open is slated for 27-28 May at Madera, with the Pioneers hosting Goodyear-ites on 24-25 June at Sunnyvale.

Another west coast gal editor, this time Betty Stream of EYE VIEWS, the BIRDS news voice, provides added detail on results of the 17th SW Regionals we left out last month. 3rd, 4th, and 5th places in novice class III went to BIRDS Jim Witt, Joe Stream (after letting someone mid-air his ship when he was in 2nd place — tell him, Betty!), and Harry Gould respectively. Joe Bridi was 4th in class III ex. with his Sunfli III and had a 4th in Goodyear to go with a 1st in scale for a very respectable week end. Together with Bror Fabor's 2nd in class II, the BIRDS did real well indeed at Phoenix.

New club in the So. Cal. Council of R/C Clubs is the MARKS who are located over in San Bernardino. We expect to hear more from that area soon. Larry and Martha Beason are recent additions — who incidently, had a recent addition themselves. Makes 4 boys. . . .

● LOUISIANA. J. D. Alexander of the Shreveport SHARKS did some human factors research associated with R/C building and comes up with this in the latest SHARKS: "Construction inducement is inversely proportional to the square root of atmospheric pressure, minus the square of total refreshment factors contained in the family cryogenic system — or —

"1. Weather fine — no build.
2. Lousy weather and full refrigerator — no build.
3. Lousy weather and vacant pantry — break out the balsa!"

● UTAH. New president for 1967 of the USA (Utah State Aeromodelers) is Jay Jackson. Since the USA is a composite club having free flight and control line sections, the club has an R/C Veep who's Bud Pannier this year. Bud took Walt Staff's job, who now has time for things like being Modeler of the Month, etc. . . .

● OKLAHOMA. Stirrings to meet the problem of consistent judging have intensified of late and the latest effort to do something about the situation comes from TORKSville where Curt Brownlee sends word that arrangements are just about complete to hold a seminar type affair in Oklahoma City on May 13. Clubs from mid-America have been invited to send members to participate in the school where luminaries such as Ted White, Jerry Krause, and Gorden Gabbert will cover class III techniques, Bill Thomas and Bill Knost will hold forth on class II, and Tom Williams and Jerry Kleinburg (My gosh, as B. Northrop coyly puts it, that's me!) will be on hand for class I intricacies. Instruction will include both lecture and flying field demonstrations to assure maximum effectiveness. The TORKS, as usual, deserve large huzzahs for making this try in an area where many agree development is needed but where no one — except the TORKS — have had nerve and conviction enough to move off dead center and do something about it. We earnestly hope sufficient grist will generate at this mid-May effort so that a constructive beginning may be realized in Oklahoma City and that follow through will result in certified judges being available for all sanctioned meets in the not too distant future. It's a nice dream. . . . We'll have more on this pioneering move later.

Up in Tulsa, Bill Womach says the Glue Dobbers Annual is set for an August date and Willard Kerr ad-libs "13th and 14th!" OK, Will, and Bill, sign me up. Their spring rally will be May 20-21 with Ron Kip, their Prez., as CD. Bob Hanford will handle CD chores for the August bash. Willard Kerr, the newsletter editor, has a gem of a dissertation in the Glue Dobbers March issue and it's suggested (at the risk that he may cut off my supply) y'all drop him a line and receive a complete course on "How To Keep the Little Gal You Married Happy With Your Hobby." 4940 N. Johnstown St., Tulsa, Okla. 74126, is da blace. . . .

● COLORADO. A triple A R/C meet is set for June 10-11 in Denver to be hosted as usual by the MILE-HI R/C Club. Food at the flying field and a Saturday night banquet are other features. Newsletter chief, Larry Holt, at 11794 E. Virginia Dr. in Aurora has details.

INTERNATIONAL ROUND-UP

● MEXICO. Flash results of the 1967 R/C Nats have just been received and show Jerry Nelson took top honors at the 4-day Easter holiday affair. Finalists were; Salo Feiner, Feliciano Pratt, Chatto Sadurni, Dr. Alex Elizondo, and Luis Casteneda. Jerry flew a DB Stinger (It starts!) powered by an Enya 60 and equipped with Orbit propo. Most Mexican flyers favored the Merco 61 for their 7200' high flying field site. Weather was perfect for all the meet which is held each year during Easter week. Next major south-of-the-border contests is at Guadalajara on 15-17 September. Wonder if Bob Fransis and the other Pioneers plan to fly down for this one?

● NEW ZEALAND. Ross Johnson of the Palmerston North Aeroneers relays info and pics of the New Zealand Nats which despite very wet weather were well attended. Mike Kendrick and his DR Chipmunk took Scale honors using MicroAvionics and a Merco 49 in the rain. Pretty scale flying, were assured, was strong point of Mike's well done low-winger. Second overall, was Dave Whitehead with an original while Ed Hartley and a Perigee gained third. Ed used a Digitrio 4 while Dave's had MicroAvionics in it also.

● CANADA. Dr. Nino Campana, who edits THE GLITCH for the SoMoRaCC (Soo Modelers R/C Club) up in Sault Ste. Marie in Ontario, in a quiet droll way puts together a newsletter that's a favorite of ours because of its honest, human, and straight forward content. One of its items has been next to our typewriter for a spell now and it's too good not to share. Since no one else has used it . . . well, read on carefully, about this piece of SoMoRaCC legend. Only the names have been changed, to protect the innocent. . . .

"When Fred joined the Club in its formative years, he flew a Smog Hog and did more than passing well with it. He was so satisfied with his success he decided to design his own airplane after he washed out the Hog when he smote a rock head-on. He produced a bulky looking machine designed to cope with rocks jumping into its flight path. When test day came, he brought forth the .45 equipped plane he christened Uranus.

"Pore Fred! He had built it so heavy it just couldn't take-off. It was also too heavy to decently hand launch, so he shaved the grass off the flying field, and kept trying. That didn't help, so he put a .60 in it. The last time he was seen on the field, he had the plane taxiing slowly into the wind, engine revving full bore, and Fred screaming, "Up, Uranus! Up, Uranus!" Suddenly realizing what he was saying, he blushed crimson, sold his gear, and spent the money on a psychiatrist trying to learn if his language had any Freudian connotations."

Don & John Lee McClusky, San Antonio's father-son team, operate ancient Esquire, use GG and ST .09 diesel. Young John competent performer.

KEN WILLARD

R/C . . . AND HOW TO GET STARTED!

IF I were to receive a composite letter which combined the most common inquiries that I receive, it would read something like this:

"Dear Ken:

I am a newcomer to radio control modeling, and need some help. I live in Upper Squeedunk, about five miles from East Nowhere. Recently I became interested in radio control modeling when I picked up a copy of RCM after watching some fellows fly their models when I visited Chicago, which is two hundred miles from here.

There isn't any local hobby dealer that I can go to, so I have to order by mail. But the ads are so confusing that I don't know what to buy! Please tell me what is the best way to get into R/C."

Of course there are many variations to some of the later paragraphs. The modeler may be a former free flight or U-control enthusiast. Or he might be a farmer who owns his own full size plane. Sometimes it's a father who wants to get into the sport with his son.

But the gist of the letters is always the same; they're confused by the almost endless choice of equipment which is available today.

How do you give advice to these bewildered beginners?

It used to be pretty easy, really. About all there was to be recommended was a single channel setup with a receiver, escapement, batteries, and a transmitter. Of course you had to caution everyone when starting out that they should get help for the first few flights — and that hasn't changed one single bit — but you also had to caution them that the radio equipment might not work properly, so they should have great patience when the clobbers came along. And there was Walt Good's "Rudderbug" to install the stuff in, and it was so rugged that it could survive all but the most severe crashes with only minor damage.

Through the past six or seven years, though, the picture has changed completely. The technology of radio control is so advanced, compared to what it was, that there literally are several ways for newcomers to get into the sport. So what I'm going to try to do here is to talk about the different ways to start, bearing in mind that there are as many different kinds of "beginners" in R/C as there are variations in available equipment.

Remember too, that R/C is now becoming widely accepted as a sport — the sport of flying by radio control, and it is no longer necessary to be a hobby enthusiast in the field. In a way, you can compare R/C to fishing. The man who thinks of fishing as a hobby is the one who ties his own flies, or makes his own lures, and tinkers with his gear, then goes out and tests the results. But the man who likes fishing for the sport of it will buy his equipment and spend his time learning how to become skillful in its use.

The same situation prevails in R/C. Not quite to the same degree, but it won't be long. Right now you can buy several excellent ready-to-fly R/C models, except that the radio is not installed (which is still a problem to the newcomer), and even that shortcoming has been overcome in some instances.

Recently I was out at the Pioneers' flying site, Stewart Field, when a man approached me with his son, introduced himself, and asked me if I would help him fly their model, and maybe let the boy try it a couple of times. I agreed to, so they went back and got their model. It was a Testor's Skyhawk. I'd heard about it, and had seen a prototype before Testor took over the project, but had never seen one fly, or had the chance to fly one.

The man told me he'd bought it, read the instructions, which clearly say to get help for the first flights if you possibly can, and then had looked through the club listing which came with the package for the nearest R/C group. The Pioneers were listed, so he found the field, asked for help, and found, like the instruction book said, that R/C modelers like to see newcomers and are glad to help. Also, he didn't have an FCC permit, and the book had cautioned about the dire consequences of flying without a license.

I was fascinated.

So we fired up the engine, set the model on the runway and let it go. Of course the receiver and transmitter were on — and even though you may not like a flopping rudder, there's one good feature; you'll never launch or take off unless both receiver and transmitter are on, because you can't. The rudder is always hard over unless both transmitter and receiver are on, which the flopping rudder tells you.

The wind was right down the runway, and light, so the takeoff was simple. After the Skyhawk was airborne a few feet it started to lay over to the left — gently — and a little right rudder corrected that. The model climbed slowly — it's not overpowered — and as soon as it had reached about seventy feet of altitude I handed the transmitter to the boy, telling him to move the stick slightly to the left when the model got into a right turn, and vice versa, until he got the feel of it.

At first he overcontrolled — just like student pilots do with full size aircraft. But gradually he got the hang of it. When the engine quit he became a little nervous, so I landed the model for him, since the Pioneer's field is pretty small for beginners, and the Lower San Francisco bay is just a short distance north of the field.

We only had time for a couple of flights before the bay breeze came up too strong for a beginner, so they left. But it was apparent that they were completely hooked. And in a way, so was I. For several years I'd been trying to find an answer to the question "How does a beginner begin?" It looked like Testors might have that answer. At least to one type of beginner.

To test the validity of the idea that a simple, rudder-only, ready-to-fly airplane would be a good way to get beginners into the sport, I decided to run a test program, using some friends of mine who'd never been active in R/C, but typified the various types of beginners who write and ask what they should do.

I talked with Ahmi Arber of Testor's R/C Products Division and told him what I planned to do. He was kind enough to send me a Skyhawk — "and I'll send you some spare parts, just in case, considering what you're going to try."

This was the program. First, simulate the private pilot who lives in a remote area on a ranch, and who would have no one to help him, unless it was a friend who could read the instructions and hand launch the model if a smooth runway were not available (most ranch landing strips are grass, too high for the

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small wheels of the Skyhawk).

Second, get a father and son team together. The son to be 10-12.

Third, have a teenager, who'd flown U-control and saved money for getting into R/C, try his hand.

Fourth, introduce a professional man to the sport — a doctor, or lawyer, or dentist who'd like to relax with R/C. (Relax?)

That would just about spreadeagle the field of beginners, and also the facilities for beginning. In the case of the pilot, he'd have to fly the model from launch to landing, simulating the situation where no help is available. Same for the father-son team on their first flight, but with help on later flights — like they would get if they went to an R/C field.

With the teen-age U-control convert to RC, give him a little help, as required, but let him do as much of the flying on the first flight if possible.

With the professional man, give him a couple of lessons at a safe altitude, then let him go it alone.

Well, the Skyhawk arrived from Testor's about ten days later, and I had some "students" lined up and ready. But before I tell you the results, let me say a few words about the plane and its package. In my opinion, it is the most complete merchandising job the R/C modeling industry has ever done. The shipping box is cleverly braced so there is almost no chance of damage to the plane or the transmitter, and there is a card suggesting that you save the box in case you want (or have) to ship the model back for service.

The packet of instructions includes detailed outlines of how to assemble, check, and fly. In addition, there is a list of registered R/C clubs, so you'll know where the nearest one is if you want to get help (and you'd better!), an FCC license form, an Academy of Aeronautics application form, an engine instruction book by Cox, warranty, a packing checklist — and even a reassuring notice that little flecks of white in the red fuselage skin are harmless! The only thing they couldn't do was send an instructor along, so they do the next best thing, and tell you to be sure and get one if you possibly can.

As soon as I received the package, I started the test program. A business associate and private pilot was to be the first student. Ken McMullen, with whom I work at Lockheed, has about 700 hours flying time as a member of a very active flying club. He's meticulous and thorough, and went about the program that way. I gave him the instruction book, and a couple of days later got it back with a note "have read the attached. Am ready."

So the next day, during lunch, we drove over to the field, which is only about a mile from our offices. There was a breeze blowing crosswise to the runway, so we adopted the technique as described in the instruction book for hand launching. Since we were simulating the experience which would befall a private pilot in a remote area, he was to fly the airplane throughout the flight from launch to landing. I was not to touch the transmitter.

I launched the Skyhawk into the wind. It climbed out, and each time it started to lay over and turn, Ken corrected until a safe altitude of about fifty feet was achieved, then he turned the model, brought it back overhead, and flew it around, making turns to the right and the left. Every now and then the turn would get a little sharp and the nose would drop; remembering the instructions, Ken would turn it out of the recovery zoom—although not always with perfect timing, and another correction would be required.

There was a pretty good wind blowing about seventy feet up, and the model started downwind. And here an interesting thing happened. The book tells you that if you should get confused when the model is coming toward you, turn your back and look over your shoulder. Now very few of us who have been flying for some time do that, and I had discussed it with Ken. Although he had never flown a model before, I figured that with his big plane experience he wouldn't get disoriented by watching the model coming at him, so I told him just to head the model back towards himself and get it back up wind. So he made a turn and had the model coming back nicely when the engine quit. As the model went into the glide, it also started to turn to the right, and since it was coming toward us, that meant it went to our left. At that time, Ken corrected — but in the wrong direction, and gave it more right. That dumped it into the ground. Ken was chagrined, because he'd been doing very well up until that time. So was I, because it proved to me that although most of us fly by looking right at the model, Testor had made enough tests with beginners that they knew that turning your body to correspond to the heading of the model works best with newcomers to R/C!

We retrieved the model; it was only slightly dented in one wing and the cowl, and a couple of wheels had been knocked off. (The wheel retainers slide off the axles too easily in my opinion, and I would recommend that if you get one of the Skyhawks, be sure to check the fit of the retainers and if necessary glue them on more firmly.)

We only had time for the one flight, and that was all that was really necessary to prove the soundness of Testor's advice, which is "no matter what you've flown before — free flight, U-control, or full-size aircraft, when you fly your first R/C flight, the best way to proceed is to get an experienced flyer to get your model airborne, then you fly it around and get used to it before you try takeoffs or landings." But since your life isn't at stake, many newcomers will try to fly R/C models by themselves. Testor's Skyhawk is a good model for this purpose, because even though you dump it — unless you spiral it right down at full speed, it withstands the knocks and is ready for another flight.

The flight also proved that an introduction to the sport of R/C flying arouses the desire to do it again. Ken McMullen wants to fly the Skyhawk some more, even if he doesn't enter into the sport actively. The challenge to improve is there — and it could lead to active participation, were it not for the demands and limitations of time. We'll see.

The next part of the program was to get a father-son team to try it. Another associate in business, Howie Burnett, had been out to the field a couple of times with his young son Brad, and they were interested. So I had them simulate a situation where Dad has bought a model for his son in a location where no help is available, and they would try to fly the Skyhawk without help from me.

So we met at the field on a Saturday, after Brad had had a chance to read the instructions and familiarize himself with the plane. His first remark on arriving was "Hey, I didn't ask for an audience!" The usual group of Saturday flyers was what he referred to.

Well, we tried a takeoff, but the ground wasn't suitable, so again I hand launched the model for the newcomers, and again I was not to touch the transmitter.

The two of them flew the model to altitude — a little hairy at times, but successfully. Gradually the model started getting further away — not dangerously so from the standpoint of distance, but it was headed toward the bay, and so I finally had to take the transmitter and dump the plane before it went into the bay. We retrieved it again, and again a wheel had been knocked off and the cowl banged up, but no serious damage.

By this time I was completely satisfied on one point, and that is this: no matter who the beginner, or newcomer to R/C may be, he'd better seek out help for the first flights, for unless he's unusually lucky or exceptionally talented, his first attempts will end in failure. However, if help just isn't available, that failure need not be disastrous if he's starting with a Skyhawk, because it can survive a great deal of abuse and still go on flying.

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SUNDAY FLIER

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But back to the tests. On the next flight we went the route where I launched the model, flew it to altitude, then let Brad fly it around until it ran out of gas, then I landed it. Brad wanted to, but we waited until the next flight. On the next flight, Howie and his boy Brad were bringing the model in for a landing in great style, and Howie goofed by turning the wrong way. Naturally there was some good natured banter about that. On the last two flights I launched the airplane, then Brad flew it around, and when the engine quit he guided it back, with occasional help from me, and landed on the field.

The experiment was a success, although I'm not sure Howie agrees. He was doing it at my request, so I could determine the practicality of a ready-to-fly model — and now Brad is bugging him to buy one!

Due to our local weather conditions I was unable to complete the whole program which I have in mind. However, I will, and will report on the results from time to time. But from the experience so far, I am prepared to make this recommendation to all you newcomers who want to get started, and then go on from there. The Testor Skyhawk ready-to-fly model will get you into the sport of R/C flying easier and faster than any other means that I know of as of right now. Follow the instructions, get yourself an FCC license, join the AMA, and you're on your way.

But that's not the whole story. Some of you are former modelers, and would like to build your first model. Alternatively, some of you who learn with the Skyhawk will then want to progress and build your own.

There's a very natural sequence you can follow. Midwest Products has kitted Owen Kampen's "Whiz Kid" design — a model which uses the same foam wing and stabilizer as the Testor Skyhawk. The kit thus requires only building the fuselage and installing the radio. Radio Control Modeler Magazine has tested this model and it is on the recommended list.

Another good series is the "Mayfly" and "Shoofly." They can be bought in various stages of construction or kitting. And, incidentally, the design may not look sleek and streamlined, but it is one of the best functional designs on the market today.

Then we come to what radio setup to use — and this really can be confusing. For those of you who go the route I've suggested, though, you could use the radio setup that comes with the Skyhawk — unless you want to keep the model around for fun flying while you're progressing to more advanced projects. Otherwise, in the single channel field, it becomes to a certain extent a matter of how much you want to spend. Here, for example, is an excellent combination — Airtrol's RE-1, installed in a Top Flite Schoolmaster or Top Dawg with a Cox Golden Bee .049 for power. To be sure, there's no engine control — but if you install the REM-1, the added weight means that the Cox Medallion, which has engine control, can't be used in the .049 size and you have to go to the .09. And now you have a pretty advanced flying plane for a beginner.

World Engines SH-100 receiver is one of the best, as shown by its wide use in several radio systems. Connect one of them with Royal Products servos, or Hinode, in Top Flite's Top Dawg, with an .09 or a Max .10 in the nose, and you've got a fine flying, servo controlled, single channel rig.

How about galloping ghost? Well, I'll be completely honest — at the risk of a couple of brickbats. If you are a beginner, then begin very simply (or alternatively, very expensively, which I'll explain later), either with a pulsing rudder like the Skyhawk has, or with a simple servo setup. Why do I say that, and just after I recently wrote a "howgozit" explanation on GG? Well, I've flown quite a bit of GG — and it works very well — but unless you are flying the type which uses a decoder and separate actuators, the elevator action (even with a differential bellcrank) when motor control is used, just seems to startle an embryo flyer to the point of near loss of control — even though he's been warned. Tomoser's GG actuator, which has a sort of version of the old escapement "quick blip" type motor control, is an exception, but you'll have to be able to understand a wiring diagram which hooks up an escapement to the actuator.

And by the way, what about escapements? The main problem now seems to be availability. They're still an excellent means of control, but the reliability of servos and the corresponding lack of need to tinker and adjust the escapement mechanism — plus the fact that unless your batteries go dead, you won't run out of commands as can happen if the escapement rubber is unwound — it all adds up to the gradual phaseout of escapements except for special purposes.

Finally, I'd like to close this particular session with another route for beginners to follow — and this will probably startle many of you to hear me talking this way, but times have changed, and I like to think that I can keep up with them.

More and more newcomers to R/C seem to be able to afford whatever is available. The only thing they can't buy is experience, both in building and flying. But you can buy a big, ready-to-fly model, designed by an experienced modeler; and you can buy a proportional control system that needs only to be installed — it's prewired, has built-in chargers, works right out of the box, and is completely reliable so long as you operate it in accordance with the instructions. And the engines are equally reliable.

There are several such combinations available, and there probably will be more. At the time of this writing there is one combination that is outstanding for a newcomer who wants to go ultra first class. Lanier Industries' ready-to-fly series of 65" plastic and foam constructed models for the large .35 to .60 engines are excellently designed, good looking, and will fly an excellent pattern when powered with an MRC-Enya .45, and when guided by a PCS radio control system, or, if you want to spend a couple of hundred more or so, there's Logictrol, Kraft, Micro-Avionics, and others to choose from. I happen to like PCS because it's a little less expensive than the others and yet I've never seen any indication that it is any less reliable.

OK. So the well-heeled newcomer can get all of these things and have an airplane ready to fly in very short order. There's only one thing left. Flying.

Now maybe some newcomers can get away with learning on Testor's Skyhawk without any instruction other than the books. Even that is doubtful, but the thing is that the airplane will take a clobber or two, by which time the beginner may get the hang of it.

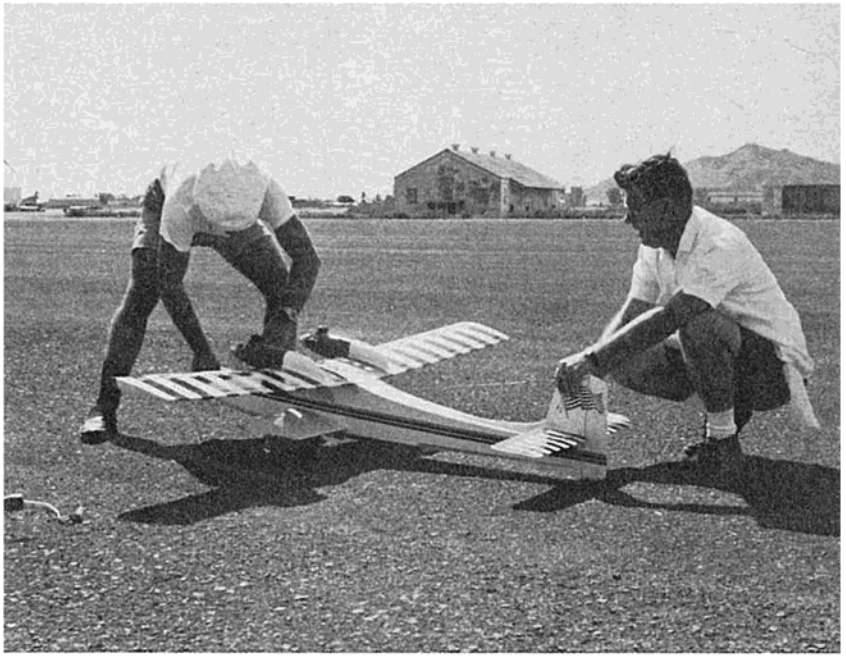
Not so with the big jobs. That old formula $E=mv^2$ will prevent it every time. You "gotta have heart" to spend all that dough to begin with, and you "gotta have help" if you don't want to spend it uselessly. Yet, if you go the route, and get the help of an experienced R/C flier, it is surprising how many beginners have been able to start right out with the most sophisticated rigs and wind up flying with the old hands and soon thereafter are able to help other newcomers. I've seen it happen, so if you can afford it, go to it, and welcome to the sport. Then if you want to build a "big rig" that's different, yet just as good when it comes to flying, get yourself one of Jim Jensen's "Das Ugly Stik" kits. Sure it's ugly — you wanted something different didn't you? But it's a great flyer, and the kit almost makes the airplane fall together.

So how does a beginner begin? I've tried to give you an answer, but as you can see, there are several, depending on the type of beginner and the condition of his wallet. There's one thing common to all, that I can't stress too highly. Flying R/C is easy when you know how, and it isn't hard to learn — but for the quickest — and cheapest — results, get help on those first few flights — even if you have to travel some distance to find help. And if your local club happens to be comprised entirely of "big rig" specialists who consider little sport jobs beneath their dignity — well, next time you're out this way, come see me.

Let's fly R/C together.


LIKI-TIKI

The design characteristics of the Liki-Tiki were intended to produce a full-blown R/C flying boat that did not suffer from compromise.



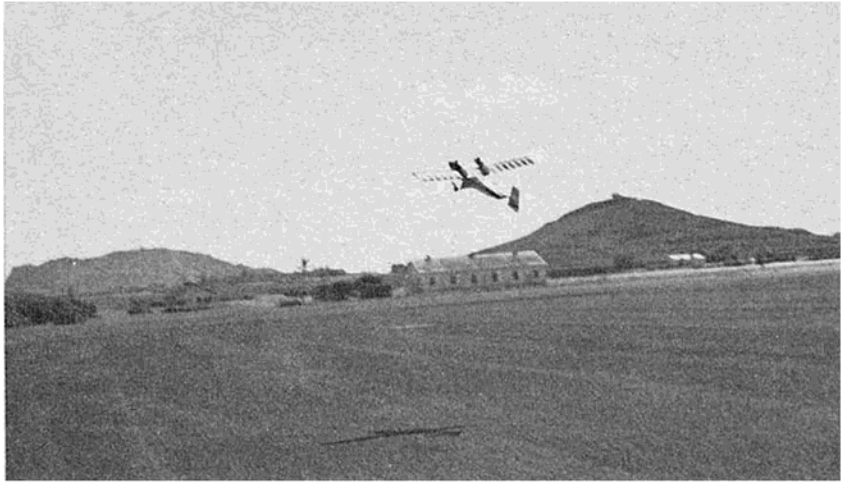
On land or water, a clean, well-powered flying boat that responds with the vigor expected of a Class III aircraft.

HAWAII'S 'LIKI-TIKI'

A truly magnificent amphibian for twin .35's . . .

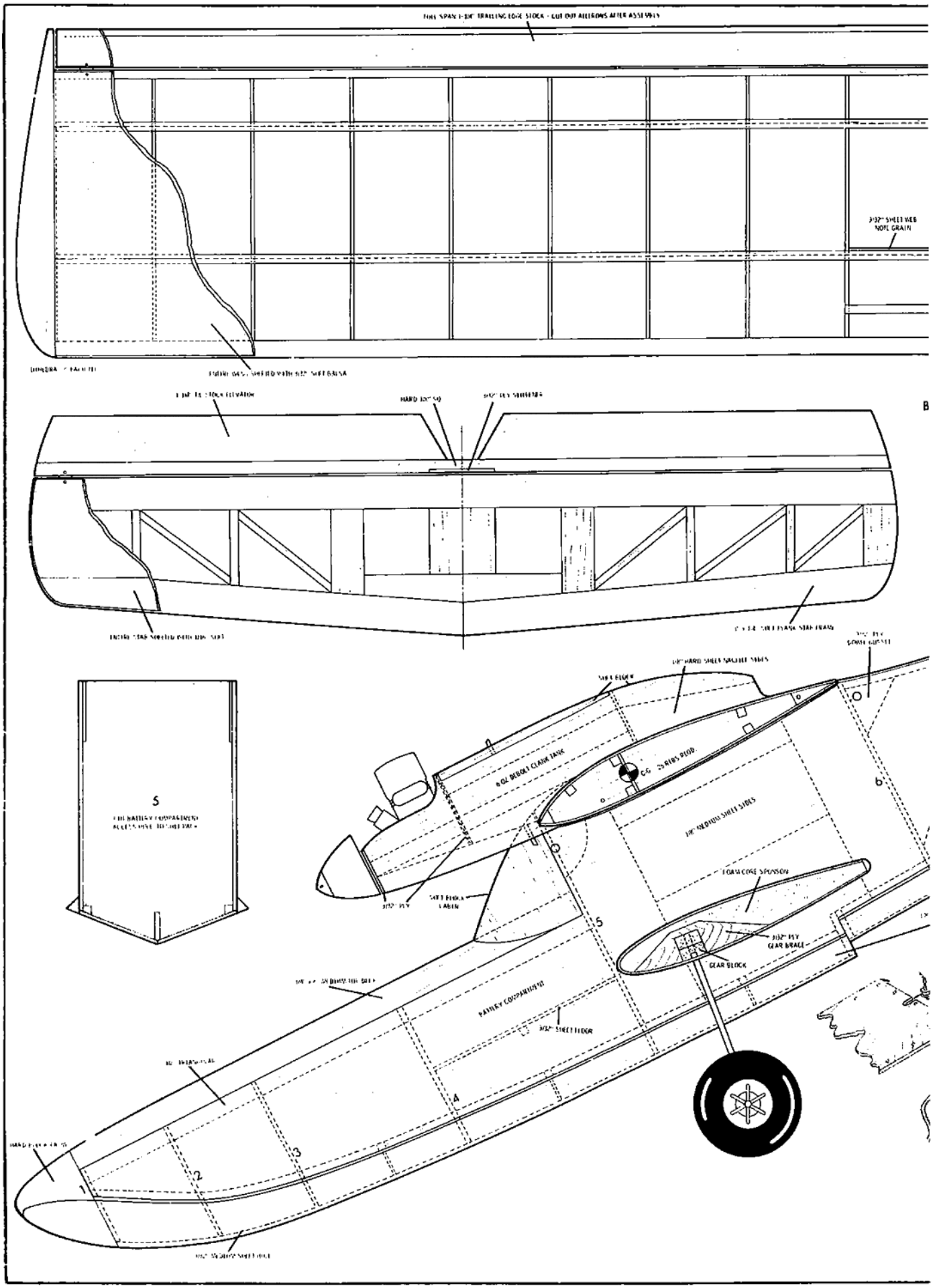
By Lt. Jan Sakert, USMC

In a rut? The Liki-Tiki is a "something different" project that will serve to revitalize your interests.



THE first remark that is usually provoked by the sight of a twin-engined flying boat is, "Whatever made you want to build a twin-engined flying boat?" In case you are wondering the same thing I'll submit a reason or two which I hope will defend my sanity.

This particular locale (Hawaii) is a peninsula that extends into Kaneohe Bay. The series of causeways that connect it to Oahu proper form several large seawater ponds. These ponds, because of their shallowness (3-6 feet) and large size (800 x 1500 feet) are ideally suited for model work if you overlook their high salt content. The availability of such an excellent area was one persuading factor that kept beckoning to me. Also, I had two relatively new KB .35 R/C mills and no immediate use for them. I had flown one of them in a couple of early NMPRA Goodyear racers but the current state of that art precludes their use as a competitive racing mill. Thirdly, the repetition of Class III flying was becoming fairly hum-drum and I was vulnerable to, and looking for, a change of pace. The growing epidemic of sport bipes may be an indication that


FULL SPAN 1-3/8" TRAILING EDGE STOCK - CUT OUT AILERONS AFTER ASSEMBLY
1/32" SHEET WEB
NOTE GRAIN
HARD 3/32" SQ
1/32" PLY SHEETING
B
6 OZ BEDELL CLARK TANK
C.G. 25 RIBS BLDD
1/8" BLDD SHEET SIDES
FOAM COSE SPONSON
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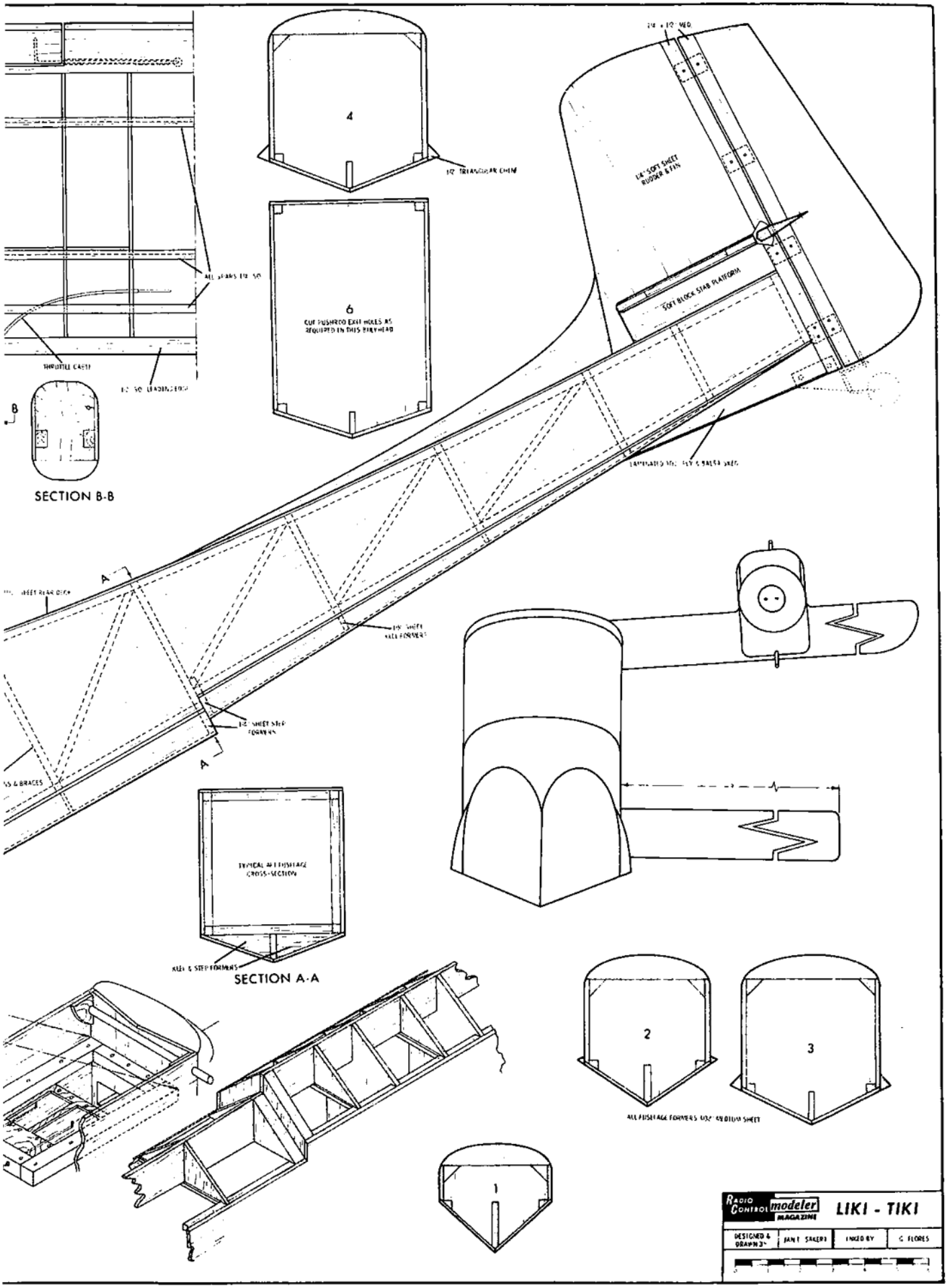
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SECTION B-B
SECTION A-A
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several modelers may also have been subject to this desire for a change of pace. As a "something different" subject, and for the reasons just explained, I cleared off the drawing board and started carpeting the floor with erasure crumbs.

It seemed that just as most Class III airplanes are more or less jokingly referred to as being a "modified Taurus," so could most current flying boats be related to the Sea-Cat.

Henry Struck probably gave little thought back in 1941 to the fact that the aircraft which he was designing would evolve as the matriarch of all subsequent flying boats. Undoubtedly, the Sea-Cat was, and still is, a fine airplane and served its design intent with no shortcomings. However, it was originally designed as a free-flight aircraft and this character seems to have been somewhat preserved in latter day multi-controlled flying boats. With due respect to Mr. Struck's pioneering efforts and successes, it seems that modern day science and technology have elevated the state of the model art to a point where free-flight characteristics are no longer desirable and much less required in a multi R/C aircraft.

The design characteristics of the LIKI-TIKI were intended to produce a full blown R/C flying boat that did not suffer from this FF/RC compromise. The current flying boat norm seemed to represent a lightly-loaded, under-powered airframe, with a high drag coefficient due to attachment of tip floats and engine pod. My desires were for a clean, well powered flying boat that would respond with the vigor of a Class III aircraft.

Tip float drag and inherent structural weaknesses could be precluded by using a sponson. The twin engines would obviate the pod and also serve to put the thrust couple closer to the drag couple. These two features dictated the general arrangement of the proposed aircraft, so more pencils were sharpened and more erasure crumbs were strewn while the design was developed.

A flying boat has a necessarily large frontal area (deep hull) so a relatively thin airfoil and 7:1 aspect ratio was selected to hold the drag down. This would serve another advantage since the prevailing tradewinds blow at an average 10-15 knots on this (the windward) side of Oahu and good penetration is very desirable. Ballooning during a water landing could have some very bad consequences and dampen one's spirit (pun).

A large aircraft is beyond my storage, transport, and work area (would you believe a clothes closet) capability so the wing was held down to 720 inches of area. This could be considered as somewhat small for an aircraft that could be expected to gross out at near nine pounds! However, it seemed that a good lifting airfoil, in combination with the considerable thrust and airspeed provided by twin 35's, would be adequate compensation. The idle-glide and approach would be well served by the built-in 15 knots of airspeed provided by the trades.

The wing-mounted nacelles caused some apprehension about spray effects and water ingestion since the prop arcs would be relatively close to the water surface. Some reduction of these phenomena could be arranged by locating the props as far forward as wing and nacelle strength would allow. This would put them forward of the bow-wave and any splash coming off the sponson.

The forward location of the props dictated the fuselage dimensions. A relatively long bow and two step hull would be required to dampen (another pun) pitch moment since very much of a pitch-down would put the prop tips to churning water.

Sponson arrangement and dimension

was quite perplexing. The available engineering manuals didn't even mention them. I was sure there must be a very good reason for their deletion and some doubt was cast on the wisdom of using them. However, their ease of construction, and the fact that they would serve admirably as a place to mount the gear blocks, made them preferable to tip floats. I did locate a Japanese language text on Dornier flying boats. My seven years of service in the Orient provided me with a fluency that would get me by in all but the highest class tea-houses but I somehow failed to acquire the vocabulary common to an engineering text. (???) It was all Greek to me! So, here I was, a U. S. Marine of Italian descent sitting in Hawaii poring over a Japanese text on German airplanes to facilitate the development of an all-American airplane with a Polynesian name! Anyhow, the book did contain many illustrations and I was further perplexed by the fact that there seemed to be as many sponson arrangements as there were flying boats. Each was different. Any sponson that attended this airplane was going to have to be of my own invention.

Volume displacement was computed using the estimated gross and a predicted water-line was drawn on the gull side view. The sponson was placed so that the trailing edge would be just awash when the craft was dead in the water. An angle was cranked in that would raise the leading edge above the water-line and, hopefully, also above the bow wave. This amounted to +5 and provoked some thought about its stall characteristics. Undoubtedly it would stall before the wing. The worst that could be foreseen was that a more vertical descent would be induced after the sponson stalled. This might contribute to a more or less "bell-smacker" landing and reduce the hazard of plowing the nose under as might happen on a relatively fast fly-on. Sponson span was another unknown. Precision "guess work" was employed.

All the sketching now provided a general arrangement of the aircraft and a few minutes were spent in smoothing out her curves for more eye appeal and also in working out construction details.

A description of the actual flight characteristics of this craft is in order before we get into the construction. I'm sure that just my design considerations didn't fire your interests or enthusiasm for this project. Let's allow the aircraft to speak for itself.

FLIGHT CHARACTERISTICS

On the day that initial flight off-the-water was planned the tradewinds were blowing at their normal velocity. The ponds are large enough that wind waves are readily formed and the leeward shore of the selected pond showed 3 to 5 inch wavelets running with the wind in random period. An occasional light gust would generate a series of 6 inch wave crests with about a 6 foot length that would run for several yards.

The aircraft was placed on the surface and it seemed to ride out these waves with acceptable pitch and roll stability. Engines were started and several taxi runs were made past the causeway to familiarize myself with water borne techniques and to please the numerous spectators and photographers that were summoned by the delightful harmonics of twin engines.

It didn't take long to discover that to turn and taxi downwind was quite a difficult task. The aircraft acts like a perfect windvane and 12 knots of wind was quite a bit of force to overcome. I learned that the aircraft could, in fact, be sailed with more precision rather than to be purposely steered. Directional corrections could best be accomplished by using short bursts of power and full

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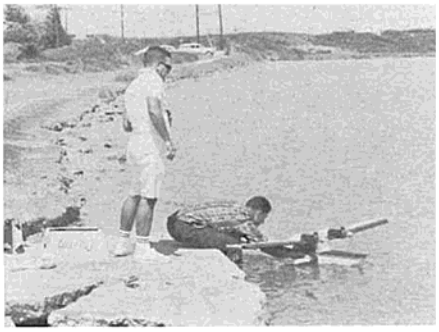

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aileron deflection to lower the wing in the desired direction of turn. The wind would then get under the opposite (raised) wing and induce sort of a "tack" in the desired direction. Downwind turns could be made by using full aileron deflection and holding high power until the selected wing was forced down onto the water. Power was then held on while the craft pivoted around the dragging tip and was reduced when it pointed into the desired direction. This maneuver causes considerable spray and splash and is not recommended except when absolutely necessary to retrieve the aircraft. The fact that I fly from a pond that is accessible around its entire circumference practically negates the necessity of taxiing and steering. The constancy of the trades means that if the craft is landed directly upwind it can be left alone and will sail (be blown) tail first right back to the launching point. With less ideal flying sites and an off shore wind I would suggest keeping a boat nearby.

Anyway, being impatient to get the craft airborne, spectators and photographers were cleared from the causeway and into a safer (just in case) area. I lined her up, poured on the coal, and was shortly very disappointed. It wouldn't come off. The craft would literally leap from one wave crest to the next. Each crest would smack the sponson causing a deluge of spray and a loss of all the forward speed that it had acquired. So, the first attempt resulted in a series of leaps or surges across the pond. A quartering take-off run was also tried with even less success. The weather cocked yaw threw up water like Old Faithful. Sometime during these abortive take-off runs some amount of spray was driven past what I thought was an adequate sealed wing-fuselage saddle. It got to one servo and the receiver and I don't think it's necessary to relate the consequences of salt water bathing of electronic components. That, of course, ended any further take-off attempts that day. The radio gear was packed off to Orbit while the compartment that had contained it was fitted with the hatch that is illustrated on the plan. While the quad single-stick was being repaired I installed my new 7-14 but had some reservations about hazarding it on the briny deep. Therefore, the wheels were screw into the beast and further trials were committed to terra-firma until the quad could be returned.

Engines were started and all systems were go so a speck of down trim was nudged into the box and my helper was signaled to "let 'er roll." Roll it did not! It **shot** into the air at an angle that seemed surely would provoke a horrible stall and fatal snap roll before I could get the nose over. The airplane soon showed me that there was no cause for alarm. Those twin 35's . . . "clean and jerked" . . . that craft off the ground and weren't about to allow it to slow down to stall speed no matter what rate of climb was established. This high angle and high speed climbout was allowed to continue while I held in a little right stick to compensate for visible torque effects. At a reasonable altitude some more down trim was rolled in to achieve level flight but it still wanted to climb. It was becoming obvious that in my zeal to produce a "vigorous" flying boat I had been somewhat excessive in my selection of power. With that combination of airspeed and airfoil the craft could probably gross something over a ton before lift and gravity reached equilibrium. RPM was reduced until level flight was achieved and it acted more like an airplane rather than a runaway Atlas booster. With the reduction of power any evidence of torque disappeared and the trim was brought back to center. Turns and loops were executed with no indication of any bad characteristics. Full throttle, however, would result in an immediate paint-scorching climb. Having such a ball, the clock was forgotten and the starboard engine ran dry. This, then, would be a real test of this aircraft even though it wasn't planned that way. Much to my relief, single-engine flight was only little different than when both were turning. Neutral trim and about 50% throttle resulted only in a very wide turn into the bad engine. At full throttle it required a moderate amount of rudder-induced yaw to keep it from spiraling around the dead mill. Power was brought back to idle and a left circling approach was made. Rudder and aileron effectiveness decreased in direct proportion to the decrease in airspeed and liberal doses of control were required to turn final and keep the approach straight with one engine out. Pitch stability in the approach was excellent and the touch-down was uneventful. Apparently the stall of the sponson has no noticeable effects on the round-out.

The climb tendency under full power cried out for investigation. The glide/idle power characteristics of the bird indicated that it must be aerodynamically sound. Any aft location of C.G., faulty arrangement of decalage or improper distribution of horizontal surface area would surely have manifested themselves in the glide pattern also. Since they didn't, all indications were that the power arrangement was the culprit. The thrust line serves as datum for the 1½° positive wing and 0° horizontal stabilizer. The high thrust couple opposing the low drag couple should contribute to a pitch down tendency. Since the tendency was a pitch-up, I could only conclude that the craft was being flown well beyond the airspeed required for lift/gravity equilibrium. Several solutions were applicable. Lift could be decreased by decreasing the decalage, changing the airfoil, redistribution of horizontal areas, or reducing the airspeed. All but the last would involve more or less major airframe modifications and also disturb the glide/idle-power pattern. Reduced airspeed then was indicated as the most feasible solution. This could be accomplished by lower pitched props (had been using 3-blade 9 x 6), lower RPM, less power by virtue of less displacement, or a combination of all three. Subsequent flights were made with 10 x 4 props and two flat washers worth of downthrust which was all that was possible without taking a saw to the forward ends of the nacelles. The climb tendency was considerably reduced but, nevertheless, still apparent. Level trim was accomplished by reducing RPM after take-off and climbout. If you're the type that likes to let it all hang out then by all means stick with the 35's and 9 x 6 props. Cruise her at reduced throttle and save that power reserve for when you need it and to silence the kibitzers with vertical take-offs and near supersonic climbouts. Most of your Class III flying partners will submit that all flying-boats must fly with the docile character of a China Clipper and your good standing within their ranks will suffer when you unveil this bird. However, odds are much better than even that more than a few will beg you for stick time once they witness the anxious response of this hot-blooded water-nympho. (Ed's Note: Nymph, Jan . . . Not Nympho!)

If you're looking for the aforementioned docile qualities then screw in a couple of 19's. You'd have an entirely adequate airplane but I'm afraid it would be "just another flying boat."

SOLVING THE WATER-BORNE PROBLEMS

Since the flight tests revealed that the basic aircraft was indeed a vigorous performing flying boat, she was deserving of a solution to her water-borne frivolity. The aircraft demonstrated its tremendous ability for getting off the ground in a fractional instant and I was of the opinion that it would do the same thing

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off calm waters.

Calm waters anywhere on or near windward Oahu might happen a half dozen days a year so the necessity of solution is apparent.

Dick Riggs, under whom I served my R/C apprenticeship, and Don Lindley, school chum, mentor of my youth and roommate when we both were in the employ of NACA, were each sent a detailed description of the costly folly in my vain attempts to get this craft to lift off the water. The experience of these two gentlemen need no qualification.

Replies were received in short order and both submitted that I had insufficient planing surface forward of the CG and/or the sponson was too far aft. Lindley suggested a sponson modification and Riggs proposed an addition to forward hull area by attachment of chine rails. Riggs' suggestion, being the least formidable, was undertaken. Half-inch triangular stock was epoxied along the chine from the fore step forward and faired into the prow. Theory here was that more hull area forward would cause the bow to ride up over the wavelets instead of slicing through them. This would rock the craft up out of the water and cause it to assume an angle of attack that would reduce sponson and wave collision.

The day of the second water trials saw less wind than on the first and the water was significantly smoother. The surface could best be described as rippled rather than being covered with the random 3 to 5 inch wavelets as previously discussed.

Some amount of taxiing was done to see what improvement the reduced wind would allow. At best, it was still difficult, and it can evidently be concluded that in anything less than a dead calm, flying boat steering is largely wishful thinking. At higher taxi speeds steering quality did improve somewhat while running into the wind. Downwind runs required aileron, rudder, and prop blast as before. One new aspect that was revealed by these taxi runs was that the chine rails did reduce the spray to some degree.

The nose was put into the wind and I poured on the coal. The craft jumped forward, went chattering across the surface for about 75 feet, heaved herself off and left the pond far behind and well below. No transition from plough, to plan, to lift-off rotation was noticeable, nor was any induced. The craft just accelerated until it achieved flying speed, and at that point, it quit acting like a boat and began acting like an airplane.

Whether the calmer waters or the added chine rails were responsible for this success I can't really say. Certainly the chine rails cannot detract from hull performance so they are included as a feature of this aircraft. The proof of the chine rail solution will be had when the aircraft is again subjected to rough water similar to her first trials.

Water landings are not unlike what you've been used to and no new techniques are required. Personal preference is to drag it in on final and hold it off until a frightening angle is achieved just before touchdown. With a little practice you'll learn how long you can safely hold it off which will facilitate a nearly tail-first touch-down. Full stall landings seem preferable to "wheel" landings. The latter could probably result in a "skip-off" with subsequent porpoise and hazard of an uncalled-for dousing.

This flying boat episode has been quite pleasurable and many times worth the effort. An occasional "something different" project serves to revitalize one's interest, and I highly recommend anything that will accomplish that end, whether it be bipes, boats, canards or ornithopters. You must be in agreement or else you would not have plowed your way through this voluminous text. So, let's not keep talking about it. Let's get on with it.

CONSTRUCTION

Building time was limited, so the structure inclines toward simplicity and rapidity. Honolulu's one model shop stocks a minimum of R/C essentials so no exotic accessories or techniques were included in the craft's composition.

Crank in your own short-cuts and building techniques if they suit you but a word of caution is appropriate at this point:

Don't compromise the water-tight integrity of the radio compartment! I did and it cost me a receiver and one servo. The illustration seal was installed "after the fact." If you have a better system, then by all means use it, but don't try to get by with anything less. An occasional shower of spray is unavoidable and the convergent prop blast will drive some of it under the wing saddle. The hazard of a drop or two flowing down the wiring and into a servo or receiver case is very real.

The original aircraft was slightly tail heavy and three ounces of lead shot was poured into the compartment behind the prow block to achieve proper balance. This could best have been prevented by fiberglassing the bow and forward hull. I highly recommend it even though I didn't do it. These areas will suffer numerous nicks and gouges from dragging her up onto the beach and any collision with floating debris at take-off velocity will tear through the hull like a fusillade of grape-shot! Fiberglass is worth the effort.

Don't exceed the amount of dihedral that is called for. Any more dihedral will aggravate the natural turn into the dead engine if one happens to cut. Dihedral will convert to yaw into a turn and this we certainly don't need in a twin configuration.

The sponson position serves an 8½ pound gross and a smooth water surface. If you intend to fly off rough water the sponson must be moved forward if lift-off is to be accomplished. My suggestion is to leave the sponson alone and leave the breakers and surf to the surfboarding crowd.

Enough said! Clean off the workbench (meaning dump the ashtray) and let's make the chips fly.

FUSELAGE: Cut the fuselage sides making sure that the splice coincides with one of the rear diagonals. Lay flat, insides up, and mark all former stations. Cement on all longerons, uprights, diagonals and doublers. When dry, set up inverted on flat surface and cement in formers 5 and 6. Take care to maintain squareness. When dry, bevel tail-post, pull together and cement. Centerline alignment must be absolutely accurate. The long fuselage will amplify any error and the result will be an unequal curvature of the fuselage sides. Cut crosspieces as illustrated on section A-A and cement in. This will establish the taper and curvature of the rear fuselage. Cut remaining crosspieces to fit between sides at upright stations. Cement in. Let dry well. Cement in forward formers, again paying special attention to centerline alignment and equal fuselage side curvature. Cut crosspieces to fit between forward fuselage sides halfway between formers 3, 4, and 5 and also halfway between former 5 and the forward step. These crosspieces reinforce the hull and are cemented only to the bottom. Cut to fit, and cement in crosspieces at each step station. Cut out the three keel pieces and cement them into formers and onto the crosspieces. Make keel and step formers by cementing sheet stock on each side of keel at crosspiece and step stations. When dry, trim to proper angle which will be dictated by straight line drawn from keel piece to fuselage side. Let structure dry thoroughly. With a sanding block make several careful lengthwise swipes along the hull. Make sure that the sanding block makes contact with the keel and fuselage side at the same time. This will true the keel formers, vee the keel pieces, and bevel the edge of the fuselage side all at the same time. Sheet the hull taking care not to pull the fuselage out of alignment. Best bet will be to shut the aft hull first and work forward. The forward hull sheeting will require some bending, and wetting the sheet will make this task easier. Let the structure dry thoroughly. Any handling at this stage could spring a seam and ruin an essential glue joint. When dry, turn over and run a bead of cement or fiberglass resin on the inside of the hull along all seams and joints. Cement in the battery compartment floor, for forward top deck, the cabin block and the prow block. Sheet the

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rear deck. Carve the prow, top deck and cabin to shape. Sand entire fuselage structure making sure that the stab mount area remains flat and true. Carve a streamline shape into the stab platform block and cement onto the fuselage. Cement on the ½-inch triangular chine rails and fair into the prow. Set entire structure aside and let cure.

SPONSON: The original aircraft had a foam core sponson. Find a friend with a wire or see if any of the foam core advertisers in this magazine will cut a section to your specification at reasonable cost. If this is too involved for you then build up the structure like a wing. Use any 12-18% symmetrical section. An 8½-inch chord and 24-inch span will keep you in the ball park. Epoxy gear blocks and plywood anti-twist ribs into the core. Sheet the sponson, rolling a single wetted sheet around the leading edge. Contact cement makes sheeting a foam core quite an easy task. Sand, seal, and cover with silkspan or silk. Slide through fuselage cut-outs, align and cement into place from the inside. On the outside, form a fillet with one of the many putty type epoxies that can be found in hobby shops and hardware stores.

TAIL SURFACES: Build stabilizer frame and sheet entire structure. A smoother sheeting job can be obtained by sanding the sheet smooth before application to the frame. Cement elevators to hard balsa spar and inset the plywood joiner. Tack glue to stabilizer and very lightly sand to smooth taper. Cut apart, bevel elevator leading edge and hinge to the stabilizer. For hinges I use .007 Mylar drafting film which costs about a buck for a square yard and is available at any big stationery or engineering supply store. Cement completed assembly onto the platform mount. Cut the rudder, fin and strake from the softest sheet you can find. Cement the ¼" x ½" stiffeners to the trailing edge of the fin and to the leading edge of the rudder. Notch the fin stiffener to accommodate and clear the elevator spar. Cement fin atop the stabilizer and cement the strake to fuselage and fin. Sandwich 3/32" plywood between 3/32" balsa and cut out to skeg outline. Cement to rear hull and fin stiffener. Fillet with epoxy putty. Bevel rudder leading edge and hinge to the fin.

NACELLES: Cut sides and trim together to ensure likeness. Mark off reference line for engine bearers again making sure that all four sides are identical. Cement on the bearers. When dry, join sides by cementing in the plywood spinner ring, firewall and the rear balsa former. Check and maintain squareness and alignment. When thoroughly dry set in the engine, attach Veco extension shaft and spinner back plate. Position engine and mark mounting bolt holes. Remove engine, drill holes and epoxy in blend nuts. Drill holes in firewall for throttle cable and fuel line. Drill hole diagonally up through appropriate bearer to allow passage of throttle cable. Bevel top inside edge of bearers behind firewall to seat the tank.

DO NOT install tank yet. Cement in the bottom block and carve to shape. Pull the AFT ends together and cement well. Hold together with clamps or clothespin while drying. Cut rear block to top outline shape and cement between sides. Put nacelles aside and begin the wing.

WING: Cut 26 wing ribs. 16 ribs will be notched for four spars and 10 will be notched for 4 spars. Wing halves will be built right side up. Pin down the 3" wide bottom trailing edge sheet. Cement ¼" square spar along the forward edge of the sheet allowing the spar to overlap the edge by ⅛". Cement the ribs down over the spar and onto the sheet. The first five ribs from the center towards the tip must be the five-notch variety. The remainder will be four notch. Fit 1¼ inch trailing edge stock against the ends of the ribs and cement in place onto the trailing edge sheet. Cement the ¼" square rear top spar into the ribs. Cement rear top sheeting on making sure that the sheet is adhered to trailing edge stock. Pin well and let dry. Cement forward full span top spar into the ribs. Butt glue ½" square leading edge onto front of ribs. Cement 4 inch wide top center sheeting on. Let this structure cure while you repeat the process for the other wing half. Take up first wing half and turn over. Cement in forward bottom spar. Cut to fit cement in 3/32" shear web between top and bottom forward spar. Cement on the 4 inch wide bottom center sheet. Razor plane leading edge to triangular shape that conforms to airfoil. Cement on the bottom leading edge sheet. Turn right side up. Lay in R/C Craft nylon tubing for throttle cable. The placement of this tubing within the wing will be dictated by your brand of radio gear. The Orbit servo mounts nicely lengthwise just ahead of the forward bottom spar. Each brand of servo will require a different mount and arrangement so use what you've found best for your purpose. The tubing must exit the top surface of the wing where it will be just under the engine bearer on the side from which the throttle must be worked. Keep the radius of bend as large as possible to reduce binding of the cable. Epoxy tubing where it passes through the ribs. Cement in the short ¼" square auxiliary spar. Cement on the top leading edge sheeting allowing the tubing to protrude by cutting a small slot for it. Cement on tip blocks. Complete remainder of other wing half, paying close attention to correct throttle tubing position. Carve tips to shape. Razor plane and sand leading edges to shape. Sand entire surface of both wing halves. Mark and saw out ailerons. Dress both wing roots to proper dihedral angle. Block up tips and join halves taking care to maintain proper alignment. Rout channels to receive aileron horns. Several manufacturers make this type of horn so you may install a suitable pair or make your own. I made my own from 3/32" wire and tubing. Set in horns and fill channels with epoxy putty. Fiberglass top and bottom of wing center section. Hinge and attach ailerons to wing. Use epoxy where the horn goes into the aileron. Mark nacelle location on top of each wing panel. Thread throttle cable through holes drilled in engine bearer and firewall. Slide nacelle onto wing. Check alignment and fit. Epoxy onto wing from the inside of nacelle. Form fillet on outside with epoxy putty. Cement in tank using G.E. Silicone rubber adhesive. Relieve bottom of nacelle top block to clear tank and cement between sides. Carve nacelle to desired shape and sand.

ASSEMBLY: Install servo plate and hatch frame in radio compartment. Keep switch inside compartment. Digital drain is very low and the switch can be turned on, the hatch battered down, wing strapped on and a day's flying put in without fear. However, don't forget to open her up and turn the switch off when you're finished. Make and install pushrods. I prefer fiberglass arrow shafts but can't get them over here. ⅜ inch dowels will do, even though they are somewhat heavy and they load the tail of a long moment aircraft. Make throttle and aileron servo mount in wing. Build sheet balsa wall around them and cover with foam to keep any water off them. Be meticulous and adjust wing and saddle for closer fit than you ever thought possible. Fair cabin into top of wing using any suitable putty filler. I prefer the epoxy varieties. Drill holes for wing dowels.

FINISH: Fiberglass forward hull and prow. Paint engine compartments with remaining resin. When set, sand entire airframe. Use large sanding block on all surfaces to prevent ripples and finger gouges. You may prefer to cover entire aircraft with silk or silkspan at this point. I'm of the opinion that the time and effort is barely worth the advantage. Use your own finish method but for the sake of making this text longer, here's mine. Slobber on a thick coat of lacquer sanding sealer which can be purchased at any paint store for around $3.00 a gallon. This has a nitro-cellulose base but don't worry about it. When dry, sand off and brush on another coat. Sand down and brush on a 50-50 coat,

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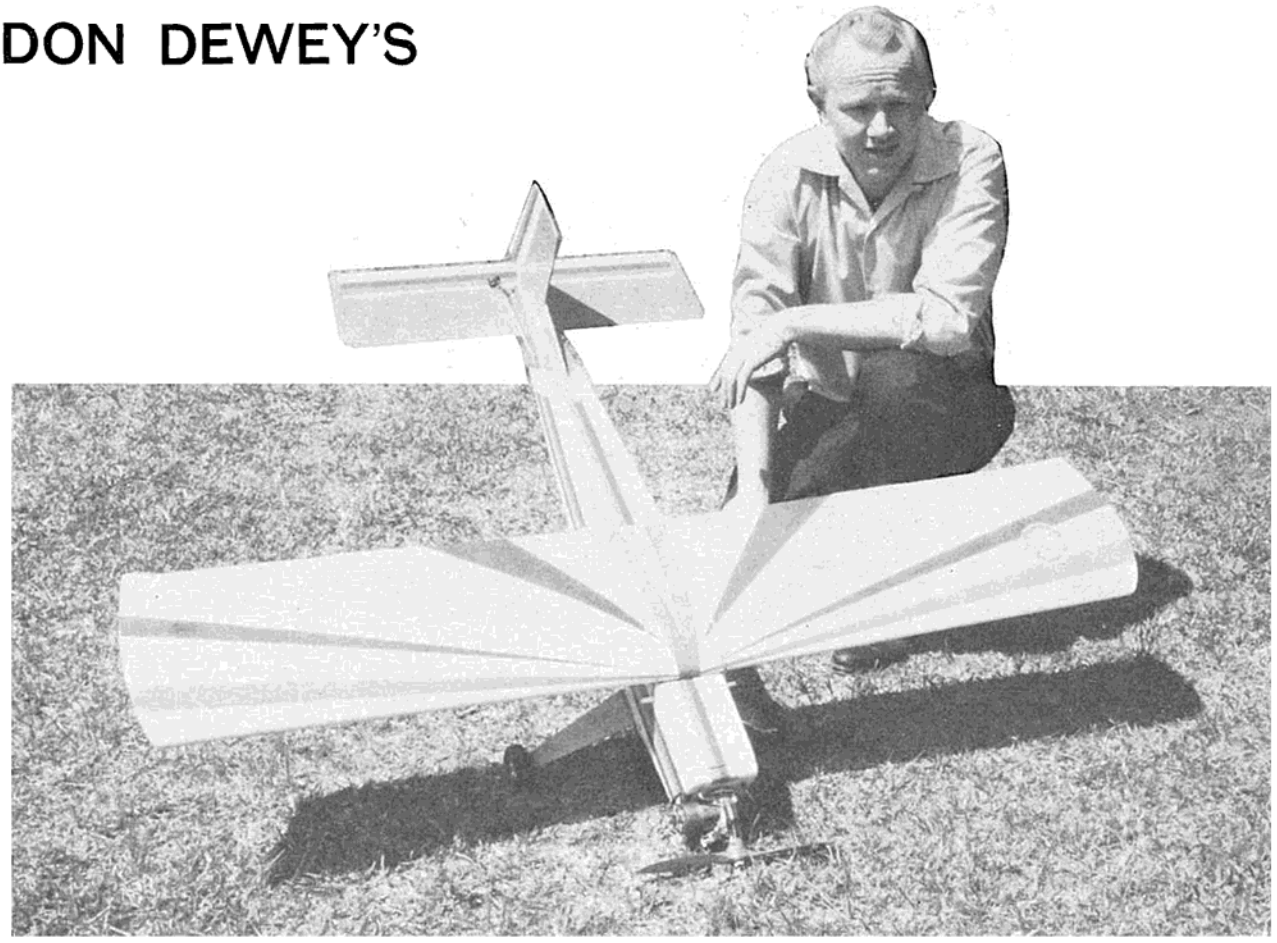
DON DEWEY'S



CIRCUS

. . . Or, how nearly everybody designed a quick, easy-building multi for propo rigs and .35 to .60 mills! A lot of flying for a minimum of effort!

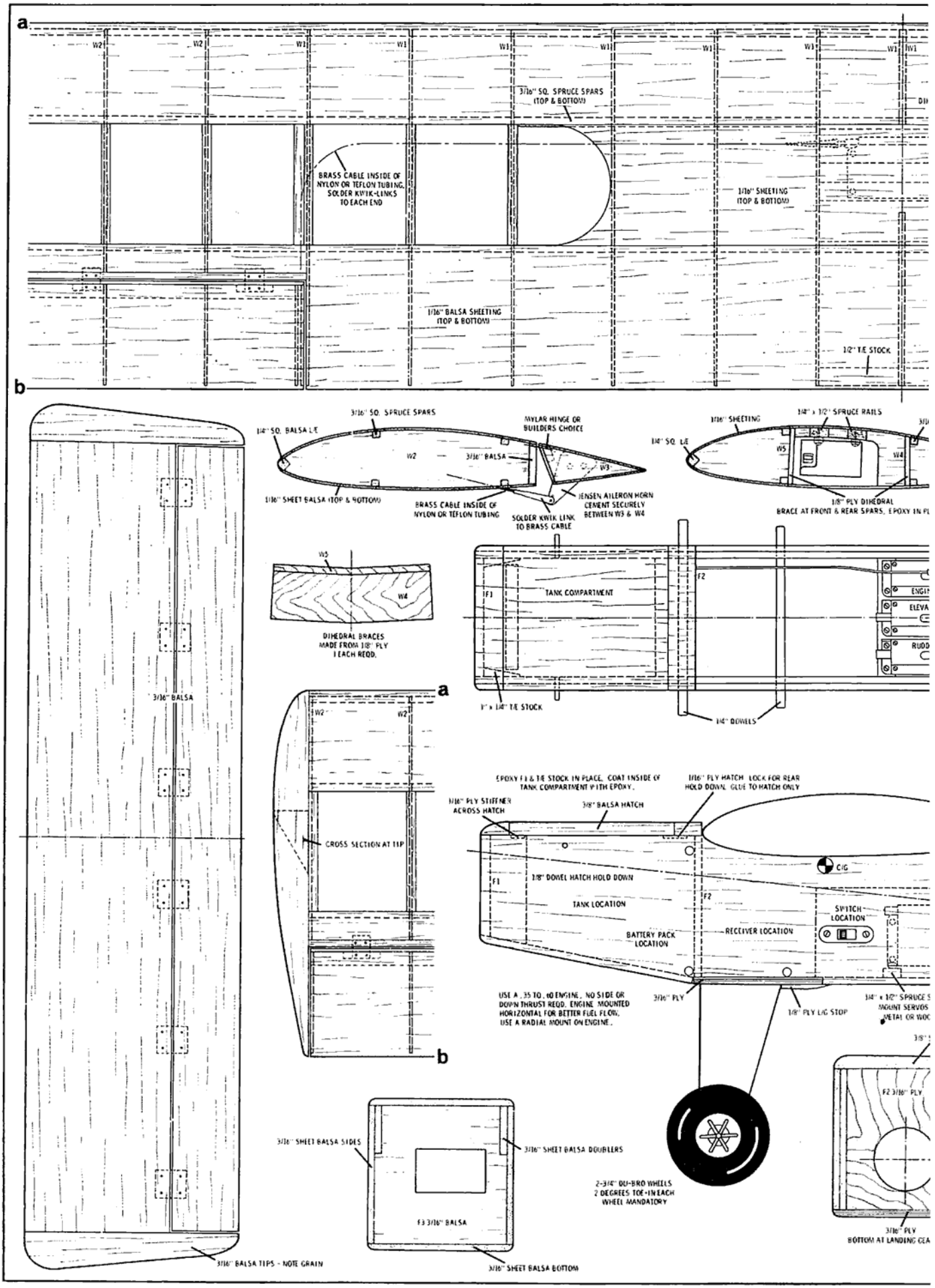
CONSIDERING today's trend toward sleek, streamlined, jet-like designs, as well as the technically excellent series of articles on the aerodynamics of Class III aircraft currently appearing in RCM, the Circus seems strangely out of place.

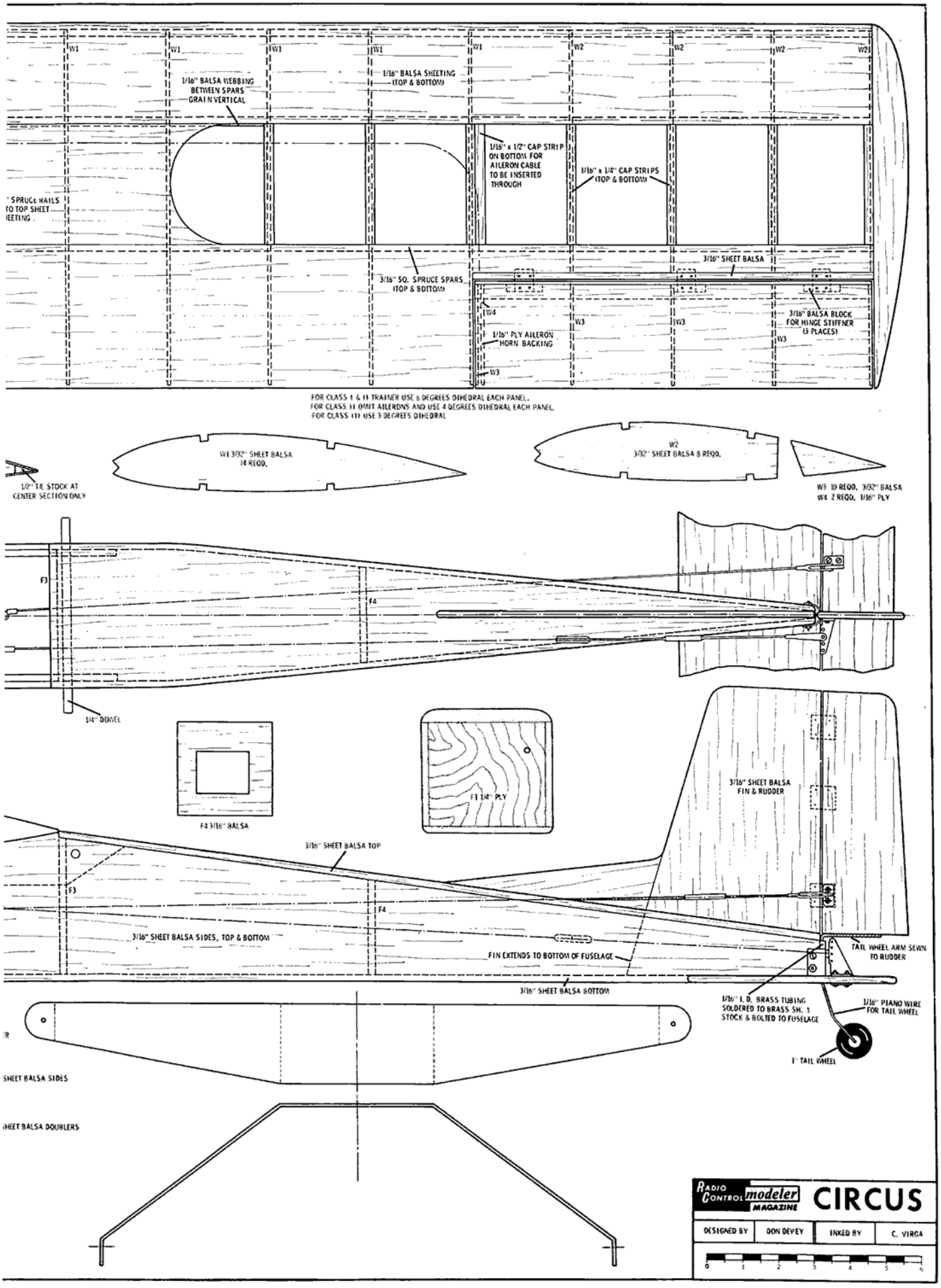
At this point in most construction articles, the author tells you the why's and wherefore's of his particular design. In a great majority of the twenty or thirty designs submitted to RCM each month, the individual writers have some sound reasoning behind their particular configuration. Being exposed to all of this engineering and aerodynamic data each month, you would naturally assume that the editor of this rag would be a veritable font of information. Just so you won't be disappointed, here is the scientific substantiation behind this radical new design.

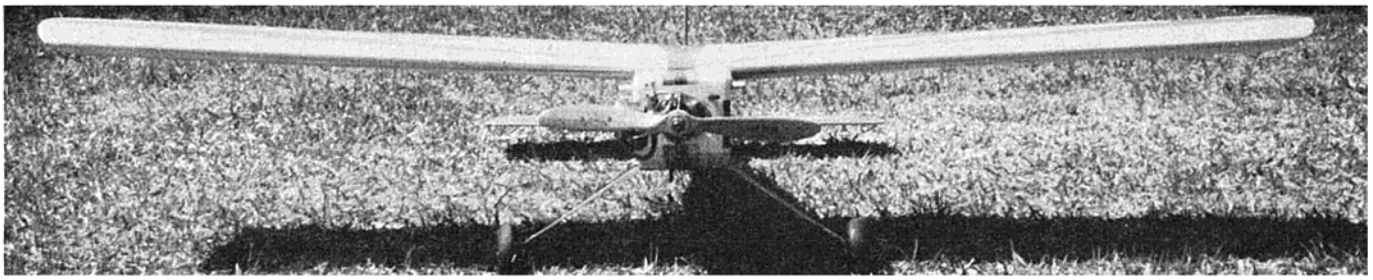
A few months ago, Whitey Pritchard submitted a design called the Praying Mantis. As you may recall, this was an all sheet-canard, resembling the XB-70. After accepting the article and plans, I turned them over to Dick Kidd, our Technical Art Editor, then rushed out and bought all of the 3/16" sheet in town. When Dick finished the plans and brought over a blueline so that I could finally build Whitey's creation, I found the whole thing was built out of 1/4" sheet! At this memorable point in history, Chuck Cunningham called from Texas and remarked that he would give $2 to anyone that could design an uglier airplane than my Royal Coachman. With such an incentive, and a rather larger pile of choice 3/16" sheet on hand, the Circus began to evolve.

The first step, of course, was to design the all-important wing. After all, airfoils have been the subject of a great deal of discussion, and it certainly wouldn't do to have anything less than the sum total of all that was known about airfoils. With this prerequisite in mind, I called Jack Doty at Foamcrafts and asked him what type of foam cores he had laying around in a shoulder wing configuration. After giving him the design criteria of a span between 50" and 72" with a-little-but-not-too-much dihedral, between 10-20% thick, and with either a symmetrical or semi-symmetrical section, Jack cried for a short while, then shipped down what looked suspiciously like a deBolt Jenny core with half the dihedral taken out. The shipping box, however, was marked Dewey Special, so my ego was satisfied.

The next step was to trace the airfoil


a
W2
W1
3/16" SQ. SPRUCE SPARS (TOP & BOTTOM)
BRASS CABLE INSIDE OF NYLON OR TEFLON TUBING, SOLDER KWIK-LINKS TO EACH END
3/16" SHEETING (TOP & BOTTOM)
1/16" BALSA SHEETING (TOP & BOTTOM)
1/2" T/E STOCK
b
3/16" BALSA
1/4" SQ. BALSA L/E
3/16" SQ. SPRUCE SPARS
MYLAR HINGE OR BUILDERS CHOICE
W2
3/16" BALSA
W3
1/16" SHEET BALSA (TOP & BOTTOM)
BRASS CABLE INSIDE OF NYLON OR TEFLON TUBING
JENSEN AILERON HORN CEMENT SECURELY BETWEEN W3 & W4
SOLDER KWIK LINK TO BRASS CABLE
3/16" SHEETING
1/4" x 1/2" SPRUCE RAILS
1/4" SQ. L/E
W5
W4
1/8" PLY DIHEDRAL BRACE AT FRONT & REAR SPARS, EPOXY IN PL
DIHEDRAL BRACES MADE FROM 1/8" PLY 1 EACH REQD.
F1
TANK COMPARTMENT
F2
1/4" DOWELS
a
b
CROSS SECTION AT TIP
EPOXY F1 & T/E STOCK IN PLACE, COAT INSIDE OF TANK COMPARTMENT WITH EPOXY.
1/16" PLY HATCH LOCK FOR REAR HOLD DOWN, GLUE TO HATCH ONLY
1/16" PLY STIFFENER ACROSS HATCH
3/8" BALSA HATCH
1/8" DOWEL HATCH HOLD DOWN
TANK LOCATION
BATTERY PACK LOCATION
RECEIVER LOCATION
SWITCH LOCATION
C/G
3/16" PLY
1/8" PLY L/G STOP
USE A .35 TO .60 ENGINE. NO SIDE OR DOWN THRUST REQD. ENGINE MOUNTED HORIZONTAL FOR BETTER FUEL FLOW. USE A RADIAL MOUNT ON ENGINE.
3/16" SHEET BALSA SIDES
3/16" SHEET BALSA DOUBLERS
F3 3/16" BALSA
3/16" SHEET BALSA BOTTOM
2-3/4" DU-BRO WHEELS
2 DEGREES TOE-IN EACH WHEEL MANDATORY
F2 3/16" PLY
3/16" PLY
3/16" BALSA TIPS - NOTE GRAIN


W1
W2
1/16" BALSA WEBBING BETWEEN SPARS GRAIN VERTICAL
1/16" BALSA SHEETING (TOP & BOTTOM)
1/16" x 1/2" CAP STRIP ON BOTTOM FOR AILERON CABLE TO BE INSERTED THROUGH
1/16" x 1/4" CAP STRIPS (TOP & BOTTOM)
3/16" SHEET BALSA
3/16" SQ. SPRUCE SPARS (TOP & BOTTOM)
W4
W3
1/16" PLY AILERON HORN BACKING
3/16" BALSA BLOCK FOR HINGE STIFFNER (3 PLACES)
FOR CLASS I & II TRAINER USE 0 DEGREES DIHEDRAL EACH PANEL.
FOR CLASS II OMIT AILERONS AND USE 4 DEGREES DIHEDRAL EACH PANEL.
FOR CLASS III USE 3 DEGREES DIHEDRAL
W1 3/32" SHEET BALSA (4 REQD.
W2 3/32" SHEET BALSA 8 REQD.
W3 10 REQD. 3/32" BALSA
W4 2 REQD. 1/16" PLY
1/2" TE STOCK AT CENTER SECTION ONLY
F3
F4
1/4" DOWEL
F4 3/16" BALSA
F1 1/4" PLY
3/16" SHEET BALSA FIN & RUDDER
3/16" SHEET BALSA TOP
3/16" SHEET BALSA SIDES, TOP & BOTTOM
FIN EXTENDS TO BOTTOM OF FUSELAGE
3/16" SHEET BALSA BOTTOM
TAIL WHEEL ARM SEWN TO RUDDER
1/16" I. D. BRASS TUBING SOLDERED TO BRASS SH. STOCK & BOLTED TO FUSELAGE
3/16" PIANO WIRE FOR TAIL WHEEL
" TAIL WHEEL
SHEET BALSA SIDES
SHEET BALSA DOUBLERS
RADIO CONTROL modeler MAGAZINE
CIRCUS
DESIGNED BY
DON DEVEY
INKED BY
C. VIRGA



section on a piece of paper and design a fuselage around it. Since anything I try to draw freehand has lumps in it, and considering the known fact that the shortest distance between any two points is a straight line, the fuselage evolved as a box. And — you guessed it — the whole damn thing was built out of 3/16" sheet—Fuselage, stab, elevator, fin, and rudder. Bulkheads, too, with the exception of the firewall which is 1/4" plywood. The fuel and battery compartment hatch is 3/8" sheet so that the wing would have something to rest against. Landing gear was conventional because everyone else uses trike gear.

Scientific, ain't it? After finishing the fuselage (about one evening's work), the Circus was painted white and trimmed with red, yellow, orange, and black dope. The painting scheme utilizes straight lines so as not to ruin the aesthetic qualities of the design. (?)

At this point, the fuselage was completed, including painting, and the wing cores were covered. And I was sick of the whole project. One day, Bill O'Brien, RCM's Special Projects Editor, came by and, spying the atrociously painted box, asked "What's that?"

"That," I replied modestly, "is the ultimate result of man's knowledge about flight."

After muttering something about "not speaking very highly for man's knowledge," O'Brien agreed to remove the thing from my garage until I felt more kindly disposed toward it. A short while later, Howard Fesler, a member of the San Gabriel Valley Radio Control League, spotted the unfinished masterpiece in Bill's garage and persuaded O'Brien to part with it. A few days later, Howard had installed the ailerons, finished the wing in a matching paint scheme, installed his PCS proportional gear, and brought it by for our inspection. We took a few Polaroid shots and sent it back to Howard.

The next day, the Circus was flown. And fly it did! With the Veco .45 in the nose it performed perfectly from the first flight — fast and maneuverable at full power, and quite docile when throttled back. To date, it has several dozen flights to its credit, and it has turned out to be quite a remarkable airplane.

There was still the problem of the foam wing, however. That is, some of you would want to build your own. Dick Kidd then went to work and drew the built-up version shown on the plans. Thus, the Circus was scientifically designed as follows: Fuselage by Dewey; original wing by Jack Doty (and perhaps some help from Pappy deBolt); built-up wing by Dick Kidd; flight tests and minor changes by Howard Fesler; and name by Bill O'Brien.

I won't go into details of construction — if you can't build this one from the plans you don't belong in R/C — go take part in a Love-In, or some other less stimulating hobby. A few general notes are in order, however. First, decide whether you're going to build the Circus for Class II or III. If you decide on Class II, omit the ailerons and use 4 degrees dihedral in each wing panel. If you want it as a sport trainer without ailerons, use 6 degrees dihedral in each panel. For Class III, build it as shown on the plans. Engine thrust is 0-0. Unless you like to ground loop all over the field to prove you can do it, use 2 degrees of toe-in on each wheel. If you don't like bending your own landing gear, the one used on the prototype is from Das Ugly Stik by Jensen Enterprises.

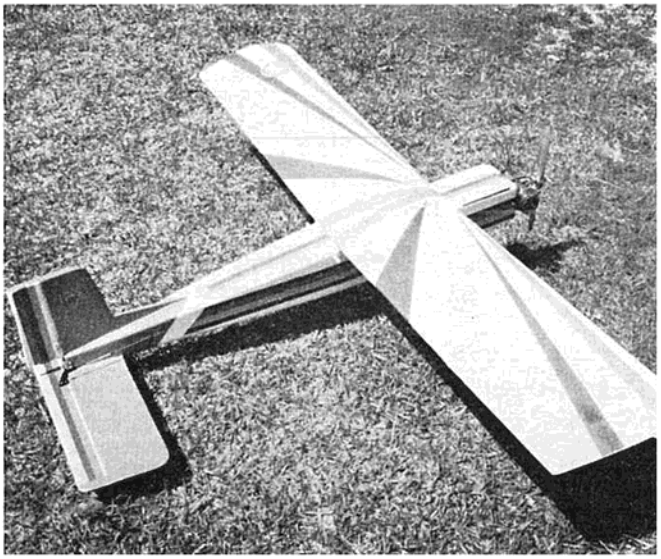
As for power, anything from a .35 to a .60 can be used. A .45 is more than adequate for anything but high altitude and/or power hounds. A .35 is fine if you're using the Circus for sport or training.

So there you have it. An airplane for Class II or III sport that doubles as a trainer — and one that can be ready to fly almost as fast as the plastic jobs. I really hated to do this to other great designers like Kraft, Spreng, deBolt, Kazmirski and the like, but the world needed the Circus.

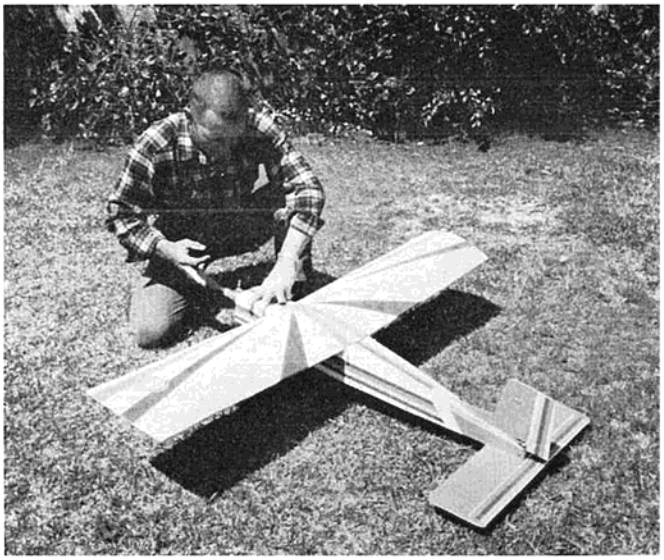
And I needed the two bucks from Cunningham.

FULL SIZE PLANS AVAILABLE SEE PAGE

The Circus, in all its glory . . . ? One thing, though — you can see it in the air!



Bill O'Brien about to lose a finger on the Veco .45. PCS proportional gear.



FOAM WINGS:

STEP-BY-STEP

PART II

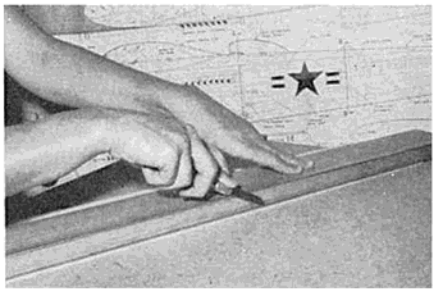
Now it's time to actually get down to the fun of sheeting the foam wing cores. We'll assume the core of your choice, along with the recommended contact adhesive, has arrived and you're ready to get to work.

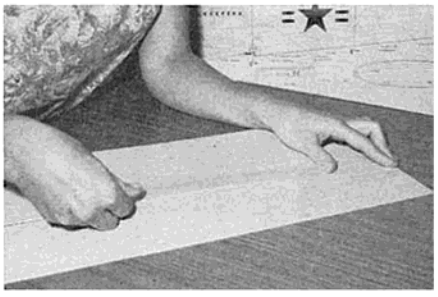
First, remove the cores from the shipping container and check to see that the landing gear slots align properly (if a low wing design), and that the cores are straight and not damaged. Read the manufacturer's instruction sheet thoroughly as well as the instructions on the can of contact cement. Do **not** proceed until they are thoroughly understood!

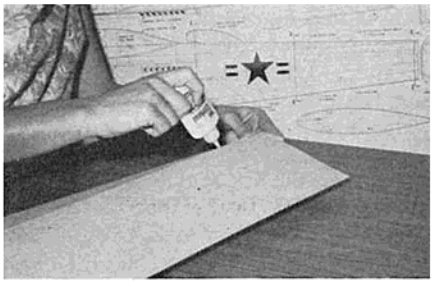
At this point, be sure you have a perfectly flat surface on which to work. Although foam cores are built on precision jigs and are guaranteed to be straight, you **can** build a warp into the wing during the sheeting process if you do not use a perfectly flat building surface. And, above all, follow these instructions to the letter!

Fabricating The Balsa Wing Skins

We will make up the skins first so that we can prepare the wing cores while the sheets are drying. Make up the wing skins from 1/16" x 4" x 36" or 1/16" x 6" x 36" Contest Grade balsa sheet. When joining individual sheets of balsa, trim the edges with a straight edge to get a good fit. (Photo #1). Now run masking, or Scotch tape along the full length of the seams on one side of the sheets. (Photo #2). Now, fold back the sheets along the seams and apply glue. Use Franklin Tite-Bond glue to make these seam joints as it is unaffected by dope solvents and sands readily. It is probably available at your hobby dealer. If not, it can be ordered by mail from North El Monte Hobby. Do not use white glue. (Photo #3).







Press the sheet flat and remove excess glue from seams while still wet. A razor blade or squeegee can be used. (Photo #4). Put sheets aside to dry by stacking them with interleaving layers of wax paper between the skins to prevent them from sticking together. Use weights on the stack of skins to keep them flat. The use of Tite-Bond will result in a wing with invisible seams.

Intermediate Steps

While we're waiting for the skins to dry, let's get our tools ready, make up the aileron pushrods, fabricate a utility foam cutter for our servo cutouts.

First, make sure you have your contact cement, thinner, and brushes on hand. Round up some 400 sandpaper and a sanding block. Gently sand both wing cores, smoothing out any rough surface, but being very careful not to destroy the shape of the airfoil. **Do not over-sand!** Now set the foam core panels aside.

To make a utility foam cutter, use a 6" length of #14 copper wire. Fairly stiff wire is best. Get a Weller solder gun (at least 150 watts) and remove the regular tip. Now shape the copper wire to the shape of the cut you intend to make in the foam, and you have an excellent foam cutter for small jobs without a major investment in fancy equipment.

Now let's make up our aileron pushrods. Fiberglass tubes are recommended and can be obtained from your local hobby dealer, from Foamcrafts, or from North El Monte Hobby. Bevel the inside end of the pushrod at a 30 degree angle so the very outside edge of the rod acts as a cutting surface. Push this rod down on a 2" piece of soft balsa block with the grain. The rod will cut into the balsa and jam the pushrod full of wood. Use an ice pick or awl to make a starter hole in the center of the wood. Apply epoxy cement to a Kwik-Link shaft (DuBro Products), and insert it into the hole. Apply more epoxy around the end of the shaft. These pushrods make a neat installation and will not flex or break in flight.

Wing Tips And Leading Edges

Now we get down to the heart of the project. Before we apply our Core-Grip cement to the panels, take a look at your skins, which should be thoroughly dry by now. If you didn't use lightweight Contest Grade balsa (Sig stamps it on the wood), you deserve to do it over — unless, of course, you want to prove you can build the heaviest wings in town!

Sand all of your wing skins on a flat surface, using #360 or #400 sandpaper and a sanding block. Clean off all sanding dust from the balsa skins and the foam cores. Now, open your can of Core-Grip and coat both the wing core tips and the balsa tips with the contact cement and **let dry completely** before joining. Core-Grip is a contact cement and is normally dry, ready to use, in 10 to 20 minutes at 70 degrees F. or higher. If in doubt, let it dry a little longer as the sheeting can be applied up to 48 hours after the Core-Grip has been applied. You can either use the cut-down brush, mentioned earlier, or a simple household sponge such as is obtainable in supermarkets or five and ten cent stores. If you use the latter, simply dip in about 1/2" of the edge of the sponge and use with a quick brushing type stroke. We have found the sponge method results in a more even, easier applied coat of cement.

Once your contact cement has dried, and if 45-degree wing tips are used, sheet the tips with 1/8" or 1/4" balsa sheet. If you are using balsa block tips, they will be epoxy cemented in place after the entire wing has been sheeted.

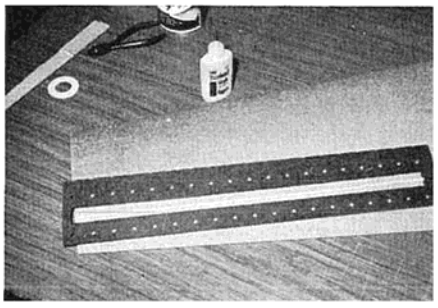
Now we will install the pre-formed balsa leading edges. Test fit these for position, then remove and apply contact

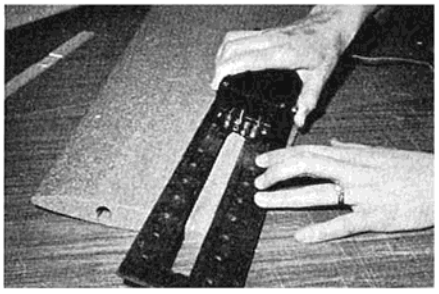
cement to both the core and the leading edge. Allow cement to dry. Now, for easy alignment of the balsa sheeting, you can put a piece of wax paper between the core and the sheeting, leaving about ⅛" that is not covered by the paper. The covering will adhere to the core in this area. **Now pull the wax** paper out one end of the wing tip while smoothing down the very tip of the leading edge. As you pull the wax paper out lengthwise, the covering will adhere to the core as the wax paper exposes them to each other. **Caution: If the sides contact first, you will have an air pocket in the leading edge of the wing! Smooth tip down first and then contact sides.** See photo 4.)

Ailerons

At this point, and prior to skinning the surfaces of the core, we will install our conventional inset ailerons. (If strip ailerons are to be used, go on to the skinning of the cores.)

First, lay out the size of the aileron on top of the foam core with a fine tip felt pen. Now inlay a piece of balsa strip ⅜" x ¾" in the top surface of the foam core at the hinge point of the aileron. To do this, we make a jig from a piece of plywood, 16" long by 4" wide. Cut a slot in the plywood ¾" wide by 14" long, using a Dremel jig saw. If longer ailerons are used, a longer jig can be fabricated. (Photo #6.) Sand the slot smooth

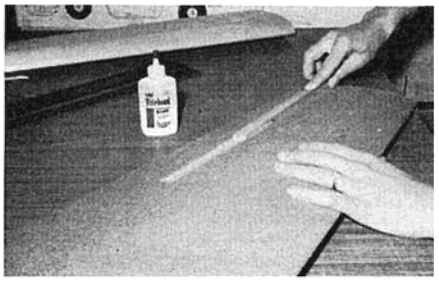




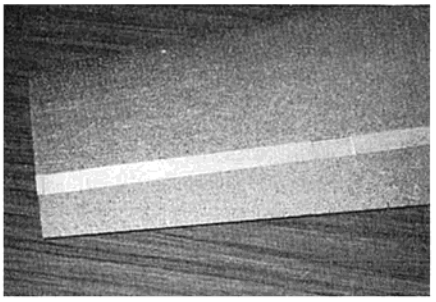
on the sides as the wire cutter must move smoothly along the sides of the jig.

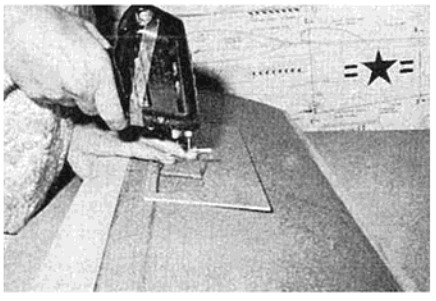
Now place the plywood jig on top of the core so that the hinge line you drew on the core is in the center of the slot. (Photo #6.) Using the utility foam cutter you made up, use a ⅛" x ¾" wire tip. Practice on a scrap in order to obtain the proper depth and width. Now insert your cutter in the jig and strip out a piece of foam ⅛" deep by ¾" wide. We recommend that the slot be 2" longer than the aileron. If a 12" aileron is used, make the slot 14" in length. (Photo #7.)

Using the landing gear spar piece furnished with the kit, contact cement piece of emery cloth to the spar piece. Use this to sand the slot you just cut, and to the exact depth, so that the ⅛" balsa strip will be flush with the surface of the core. It is mandatory that this be as exact as possible. A low strip will cause a dip or low spot in the sheeting of the wing after the skin has been applied. A strip that is too high will cause a bulge in the skin. (Photo #8.)



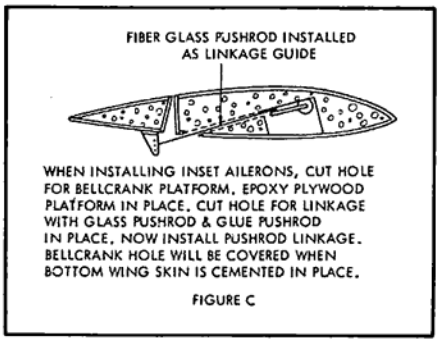
Now cut a piece of ⅛" x ¾" balsa stock to the length of the slot. At this point you must determine what type of hinge is to be used. We recommend Bonner hinges. Slots are dadoed in the balsa strip to accept Bonner hinges before it is glued into place on the wing



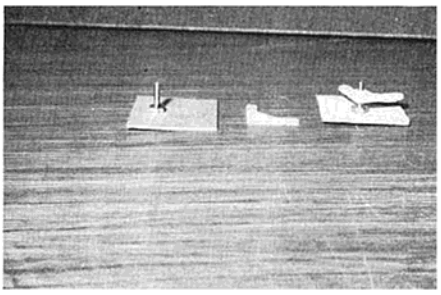


core. (Photo #9.) Now glue the ⅛" x ¾" strip into the slot on the wing core with Tite-Bond glue and allow to dry. Sand smooth to core surface.

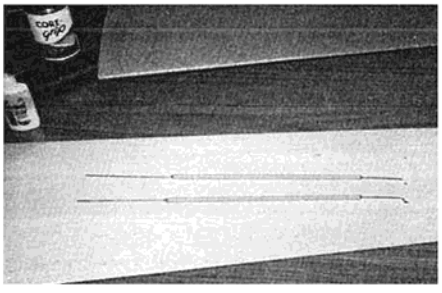
Now we must make a jig for forming the bellcrank cut out. (Photo #10.) This jig is made from 3/32" plywood. Cut out the 2" x 2" hole in the plywood. Use the soldering iron with the wire tip to make the cutout in the foam core. The desired angle of the bottom of the cutout can be formed by the wire cutter. This allows the bellcrank assembly rest at the desired angle so that a straight piece of wire can be used from the bellcrank to the aileron control horn. (Fig. C.)



The bellcrank assembly is made up in the following manner. We recommend using Williams Bros. nylon bellcranks. These cranks can be threaded using a 6/32 tap. A piece of 1/16" or 3/32" plywood is used as a bellcrank platform. Make a 6/32 hole in the plywood platform and install a 6/32" bolt and nut. Run down nut on lock washer against the plywood. Use Tite-Bond glue or solder nut to bolt so it will not vibrate loose. The bellcrank can now be threaded on to the 6/32" bolt and adjusted to proper level to receive the pushrod from the servo. (Photo



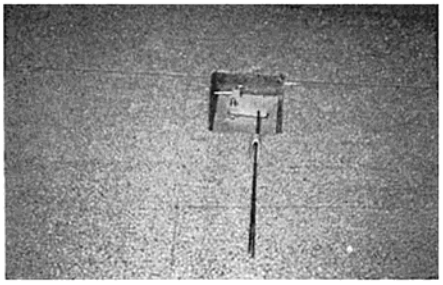
#11.) The aileron servo pushrods should be made up if you did not fabricate them under Intermediate Steps. (Photo #12.)



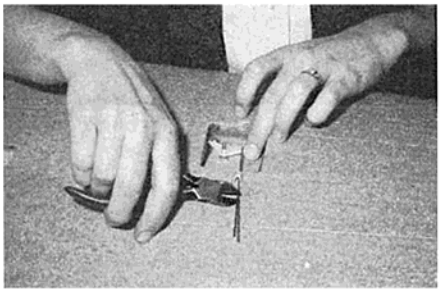
Insert the pushrod in the wing and pull end out of bellcrank hole. Insert in

proper hole in bellcrank. The latter may be rotated on the platform so the wire dog leg of pushrod can be inserted. (Photo #13.)

Glue the bellcrank platform in place using Tite-Bond glue. A slot is now cut to receive a short piece of fiberglass pushrod in the rear of the bellcrank cut-out. Insert a short length of 1/16" wire through the guide and insert dog leg of wire into bellcrank. Tite-Bond glue wire guide in place and adjust platform so all linkage works smoothly and is aligned properly. Let glue on bellcrank platform and wire guide dry thoroughly. (Photo #14.)



Rotate the bellcrank to the down aileron position to withdraw into the wing as much of the bellcrank aileron horn pushrod as is possible. Cut this wire flush with the surface of the wing core. This is done so that the sheeting can be applied smoothly. (Photo #15). Push-

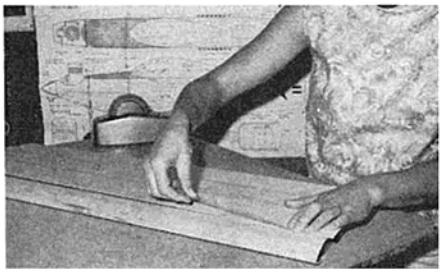


rod can be located by using a straight pin to mark the location just before the bottom sheet is glued to the core. Push straight pin through sheeting while observing the location of the wire guide under sheet. Mark the location on the top of the sheeting with a small felt tip pen or pencil.

Skinning the Cores

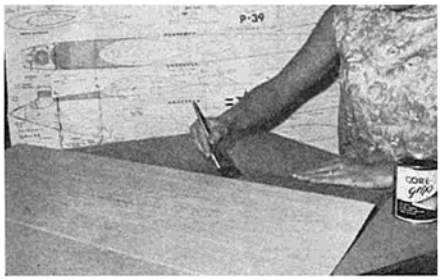
The top of the wing panels are sheeted first. Trim the leading edge flush with the end of foam cores. The next step is to sheet the wing panels with the prepared balsa skins. Pre-fit the wing skin to the leading edge on each panel. Trim with straight edge of sharp razor blade. (Photo #16.) Tape the wing skin to the

leading edge using Scotch brand tape. Make sure the sheet fits against the leading edge so no visible large cracks exist. (Photo #17.) Pick up the sheet

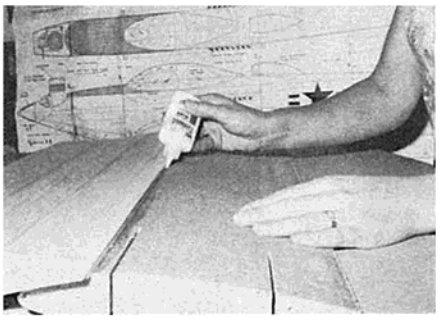


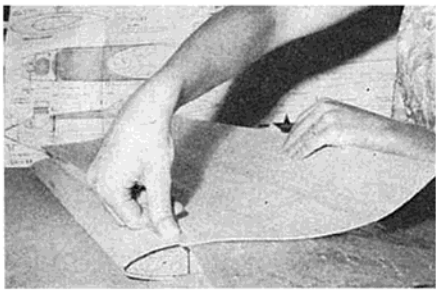
and turn it back over LE like you were opening the pages in a book. (Photo

#18.) Apply contact cement to both sheet and core. Let Dry! (Photo #19.)



After the cement is completely dry, use the wax paper between the sheet and core and turn the sheet back over. **Be sure to use a bead of Tite-Bond cement on the seam of leading edge and sheeting.** (Photo #20.) Smooth down the seam with your finger, leaving tape in place temporarily. Make sure the edges of the seam are flush and even. (Photo #21.) Now work the wax paper out a





little at a time, smoothing down the sheeting as you go. Trim off the overhang at both ends of wing panel. After the skin is applied, burnish it well with the palm or heel of your hand for maximum adhesion.

Inset Ailerons — Final Assembly

Lay out the size of aileron on the top of the wing panel with the palm or heel of your hand for maximum adhesion.

If strip ailerons are to be used and the wing core has a thick trailing edge, the square trailing edge stock may be butt-glued with Tite-Bond after both top and bottom wing skins have been cemented

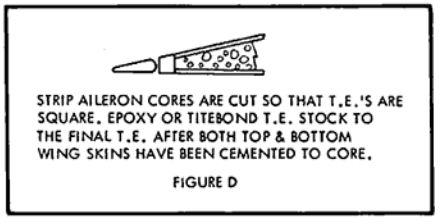


FIGURE D

to core. (Figure D.) If inset ailerons are used, the trailing edge stock is glued to the panel as shown in Figure E. Use

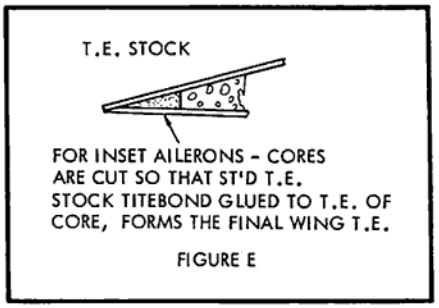


FIGURE E

Tite-Bond glue to glue trailing edge in place. After the glue is dry, trim excess sheet on trailing edge. Feather the trailing edge stock to the contour of the foam core. (Photo #22.)

Now sheet the bottom of the wing panel using the same method as used in

(Continued on Page 28)

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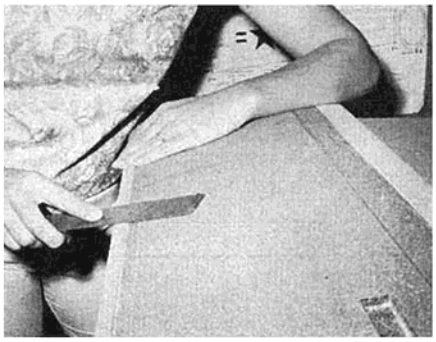
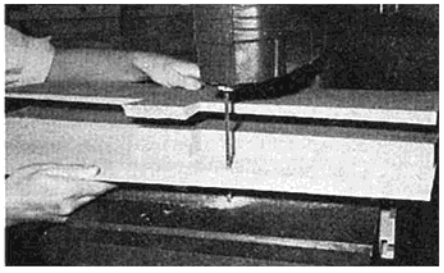


sheeting the top of the panels. If solid wingtip blocks are being used, sand sheets flush with core and butt-join the tip blocks with Tite-Bond or epoxy glue, holding in place with strips of tape until dry. Contour the blocks to shape of wing tip. (Figure F.) If you are using conventional inset ailerons, tack glue only the solid wingtips in place. After shaping, remove and glue back permanently only after the ailerons have been cut out.

Inset Ailerons — Final Assembly

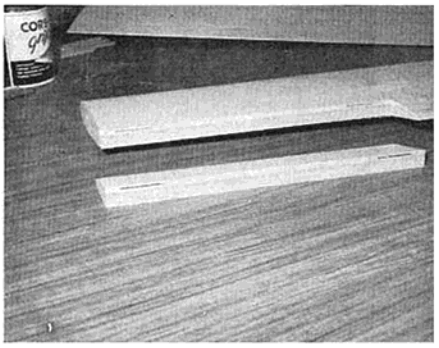
Lay out the size of aileron on the top of the wing panel with felt tip pen. Fine, narrow tips make the best lines. Your line should be in the center of the inlayed ⅛" x ¾" strip you inlayed under the skin so that your saw cut will split this piece down the center. Saw the aileron out on a band saw or jig saw if available. A jig to hold the core flat can be made from the foam block in which the cores were packed for shipping. (Photo



#23.) One aileron is cut with the core laying top up and one core laying bottom up. Just make sure the core is flat so the saw will cut straight, vertically. If a band saw or jig saw is not available, make the cut with a razor saw.

One sixteenth of an inch is trimmed down from the exposed foam surfaces in order to allow the surface to be capped with scrap 1/16" sheeting. Use Tite-Bond glue to apply cap sheet. The aileron may be beveled to the desired angle by shaving with a razor blade or on a jig saw.

You will note that after the aileron has been sawed out that slots are exposed both in the aileron and the core to accept the Bonner hinges. After the 1/16" cap strips have been glued on, trim out these slots with a sharp blade. Photo #24 shows the completed aileron.



Final Assembly

Butt-join the wing panels at center section with **epoxy only.** Do not use Tite-Bond here as this glue will only dry at the outer edges where exposed to the air. Epoxy does not need air in order to set and dry. **Do not use polyester resin as it will attack the foam.** If you are assembling a shoulder wing where there is no landing gear spar used, the dihedral pieces must be pushed in and cemented in their respective slots before the wing is joined. (Figure G.)

After the wing center has been glued together and is dry, trim out sheet over landing gear spar slot and cement the landing gear spar piece in place. You may want to drill landing gear holes in the slot before gluing in place. Lay out the size of servo cut-out desired, with straight edge and pencil. Use the straight edge and a sharp knife or razor saw to cut along lines just scribed. (Figures F and H.) Remove balsa skin from cutout. Cut out the servo hole in foam core.

The next step is absolutely mandatory for maximum strength and stress of your wing. Do not make any substitutions and follow these instructions exactly.

Apply two to four inches of fiberglass

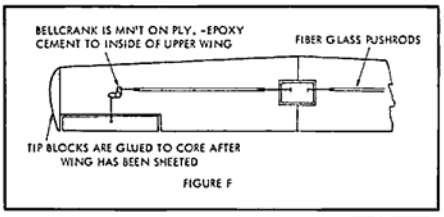
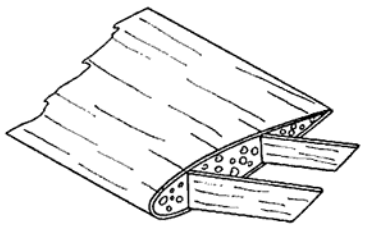


FIGURE F



EPOXY PLY DIHEDRAL BRACES IN PLACE AFTER WING HAS BEEN SHEETED & TRIMMED. NOW EPOXY WING HALVES TOGETHER & COVER JOINT WITH GLASS CLOTH & RESIN.

FIGURE G

cloth and epoxy over the center section of the wing. **Again, do not use polyester resin.** Hobby-Poxy epoxy or Sig-Epoxy will not attack the core and are recommended. It is recommended that you use 4"-wide fiberglass tape sold by many hobby shops or boat supply houses. This tape will not fray at the edges and makes a neat job.

This finishes the basic construction of your wing and after sanding the wing with fine sandpaper you are ready for finishing.

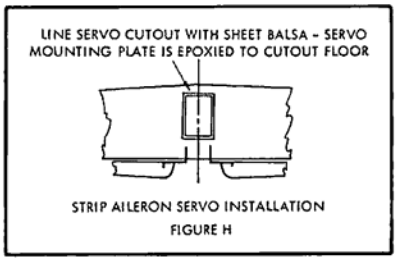


FIGURE H

Finishing the Foam Wing

Sand the entire wing with 220 followed by 320 wet or dry paper, used dry. Now you must determine just what kind of a finish you want. The fastest finish that can be applied to a balsa covered foam wing is Top Flite's MonoKote. It is not a purist's finish, but looks quite good when you have learned how to handle it. It is also relatively lightweight, as previously mentioned. The normal heat used for shrinking the MonoKote will not affect the balsa-covered foam if the iron is kept in motion.

DOPE

Dope solvents will attack the foam if they can get through to it, so don't thin your first couple of coats very much. Be sure to let each coat dry for a period of at least six hours at 70 degrees or above, otherwise the top coats dry first, trapping the solvents in the first few coats and driving them through the balsa pores with a possible long term attack on the foam. Core-Grip cement provides a good barrier against this happening, but don't slap on a half dozen or so coats of highly thinned dope in the same evening! There is no need to cover a balsa-covered foam wing with silk as it only adds unnecessary weight and expense. If you want to cover it with something (not necessary), you can use lightweight silkspan. Normal filling and finishing techniques can be used and this, of course, depends on what you're looking for, finish-wise.

Synthetic Finishes

Prepare your balsa-covered wing core with Hobbypoxy Clear. Mix the Hobbypoxy according to the directions and heat to the point where it is hot to the touch. Brush on a coat and let dry for 24 hours, then sand with 320 wet-or-dry, used wet with a touch of household detergent in the water. Brush on a second coat and again let dry 24 hours. Use the same sanding technique. Normally, this is sufficient, but if you wish, you can add a third coat. Now spray on two coats of DuPont Hi-Speed lacquer primer-surfacer (obtainable in most automotive

(Continued on Page 29)

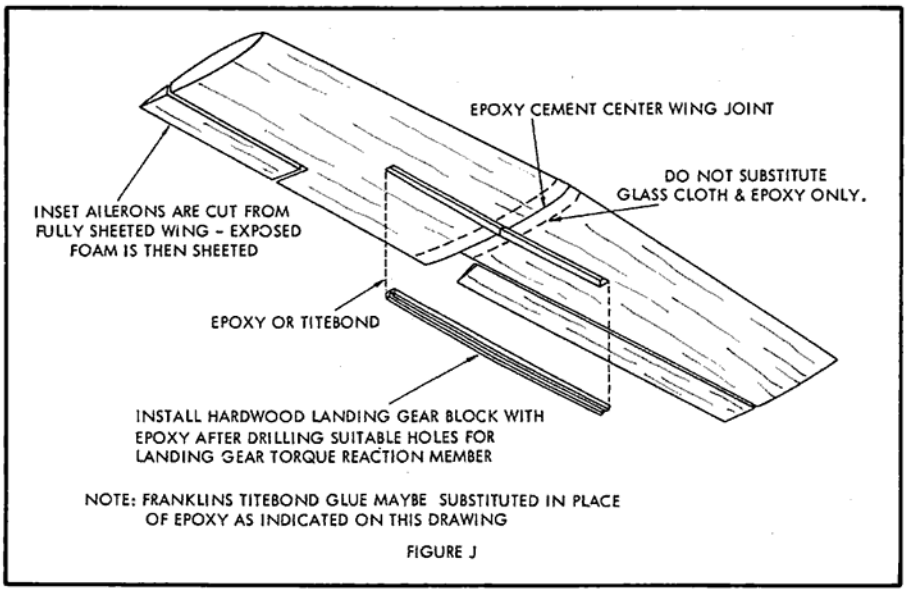


FIGURE J

FOAM WINGS

(Continued from Page 28)

supply houses), let dry preferably three days, and then sand most of it off with 360 paper until it is very thin.

Now you can spray with DuPont Dulux synthetic automotive enamel, following the directions on the can. This will give you a lightweight fuelproof mirror finish with no rubbing required. If you prefer, you can spray with Nason acrylic lacquer or dope instead of the DuPont Dulux.

Acrylic-Dope Method

A relatively new idea in finishes was recently demonstrated by Johnson Quarles in Los Angeles. Johnson uses two coats of dope-talc lacquer primer, wet sanding as mentioned above, until very thin. Johnson then mixes a 50-50 mixture of butyrate color and Nason acrylic lacquer together, which is then thinned to spraying consistency with acrylic thinner or butyrate dope thinner. This is sprayed on, and when dry, wet sanded with 600 wet-or-dry and then rubbed out. The ensuing finish is of the highest gloss, but with none of the brittleness normally associated with acrylic finishes. It is flexible, fuelproof, and beautiful. Try it on a test panel until you are completely familiar with the process. Remember — you can put acrylic over butyrate dope, but you cannot successfully put butyrate dope over acrylic lacquer.

Conclusion

This has been a long series of articles. We hope that the information has been of assistance to you. We feel that you will find that when the correct and proven products and techniques are used, a balsa-covered foam wing results in a quicker built, lighter, stronger, longer lasting, warp resistant, better looking and better flying structure than can be obtained in any other way. Don't be surprised if the ease of building a foam wing isn't completely realized on your first attempt as you'll be learning a new technique. But, after you've built a couple using the techniques we've outlined, I won't believe you'll ever want to build another built-up unless it's for a scale model or a glider wing.

Good luck good flying.

LIKI-TIKI

(Continued from Page 20)

sand smooth with 400 paper. The beauty of this type of sealer is that it can be sanded within thirty minutes of application; it is non-tautening. Anyone who has cried while butyrate has lifted off the fillets and bridged across joints will appreciate this. Now, find a spray rig. If you can't borrow one then go buy one. Anyone who brushes a finish on anything larger than a ½A ukie job must love to suffer. Several adequate spray rigs are on the market for less than $50.00. The J. C. Penney people make a fine one that goes for thirty bucks. Spray on one **dry** mist coat of light gray Martin-Senour 6252 auto lacquer primer. This will flash off before the nitro-cellulose that's under it even knows it's there. Let set about ten minutes and spray on a medium wet coat. When dry, hog it off with 320 paper, leaving primer in only the knicks and grain. Spray on one more dry mist coat. When dry, buff with 000 steel wool. Devise the color scheme of your choice. Use Martin-Senour Acrylic Lacquer for the color coats. Thin out with **acrylic** reducer and spray on. If you're good with the gun one coat will do it. If you want a showroom lustre wait a few days and rub it out with a fine grit compound. That's my way. I've tried them all and this is the quickest, cheapest, and prettiest. With the exception of Hobbypoxy, it's also the lightest.

The rest is up to you. Find a pond, convince the game warden that you're not going to kamikaze the fish, and go have yourself a ball like I'm doing.

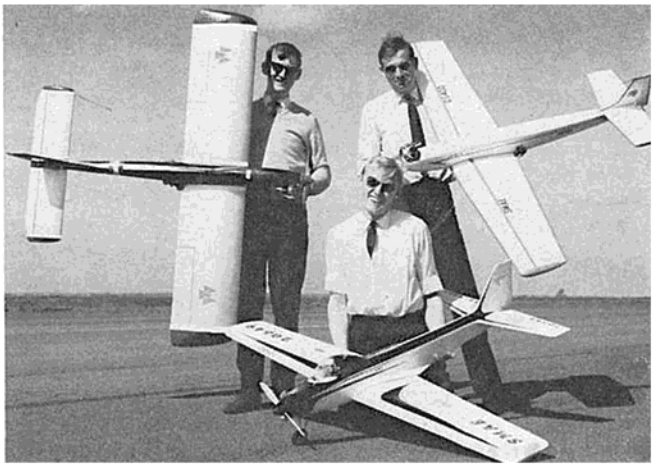
PREVIEW: 1967 WORLD R/C CHAMPIONSHIPS

Left: Fritz Bosch and Walter Schmitz (Germany) arrive at Ajaccio Airbase in Corsica. Private plane owned by manufacturer of German Simprop gear. Above: Fritz and Walter train at Corsica.

20 Nations To Vie For International R C Honors At Ajaccio, Corsica, June 21-25.

U. S. Internats team meets with Fritz Bosch at Toledo. L to R: Phil Kraft, Bosch, Doug Spreng, Cliff Weirick.

Great Britain's team — Standing, L to R: Pete Waters, Chris Olsen. Kneeling, Dennis Hammant. Waters flies U. S. Thunderstormer design.



1967 INTERNAT'S PREVIEW (cont.)

Extreme left: Third member of Germany's team, Curt Bauerkeim is a competent flier. German propo gear in a good looking design with a nice finish.

Photos By
WINDY
KREULEN

Left: Dr. Haageman is one of Belgium's team members. Competing with an original design aircraft, he will be using the French made radio, Tele-Pilot.

Jean Gobeaux, Sabene Airlines pilot, is #2 man on Belgium's team. Tele-Pilot radio.

Alfred Laline, Belgium, former Sabena flight engineer, rounds out team.

Jan Van Vliet, #1 on Holland's two-man team, is usually in top six in European competitions.

Jean Marrot of France's team, manufactures Tele-Pilot propo system. Original design, Lucifer.

Above: Jean Fontaine is likely to be on French team. Right: Earl Harting, Valley Flyers R/C Club prexy, delivering U. S. Team shirts to Jerry Nelson and Cliff Weirick. San Fernando, Calif., club donated shirts.

A study in Class III Aerodynamics by

BEN HERMAN
JACK CAPEHART

part III

PRECISION PATTERN AIRCRAFT DESIGN

Dihedral and Sweep

IN the last article we were in the midst of a discussion on stability and damping effects. We ran out of steam about half way through our discussion of roll, or lateral stability. We had discussed the effect of vertical fin placement on roll stability, and we are now ready for a discussion of dihedral.

Dihedral is like women! We can't live with it and we can't live without it (at least without a little of it) and furthermore it's rarely understood by us menfolk. Basically, dihedral serves two functions. From the point of view of stability, one is good and one is bad. From the point of the Class I and II boys, the bad one can sometimes be good.

The first function of dihedral and the good one, is that of providing a righting, or stabilizing effect for peturbations about the roll axis. The second effect is that of converting a yaw displacement into a roll displacement. If the initial yaw displacement happens to be unwanted, this effect is bad, but for the Class I and II flyers it enables them to perform rolls and so is indispensable.

Let's take a look at the following diagrams and see how all this comes about.

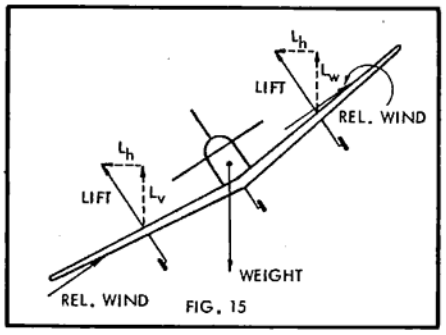


FIG. 15

In Fig. 15 we have indicated an aircraft which, due to a momentary gust, has suffered a displacement about the roll axis causing the left wing to drop. Let's consider the forces that are now produced by the wing. The lift on each wing panel which is always perpendicular to the wing panel has been broken up into its vertical and horizontal components, l_v and l_h, respectively. Note that the lifting force on a wing panel effectively acts at the center of pressure which is normally at about ½ the distance from root to tip. We remember that, when flying straight and level, the two horizontal components are equal and opposite in direction, as indicated in Fig. 12A of the last section, and thus canceled, leaving only a vertical component to balance the aircraft's weight. However, we see in Figure 15 that both horizontal components are acting to the left, and thus will not cancel. This unbalanced horizontal force will cause the plane to accelerate towards the left. Now let's look at the vertical components, the l_v's. Since part of the lifting force of the wings is acting in the horizontal direction as noted above, the vertical component must accordingly, be reduced. But, since the weight of the plane is still the same, the reduced vertical lift cannot balance it, and the plane loses altitude. Thus, in addition to its forward motion, the plane accelerates towards the left, and downward, giving rise to a relative wind, as seen from the rear, as indicated in Fig. 15. Figure 16 shows the relative wind from the top.

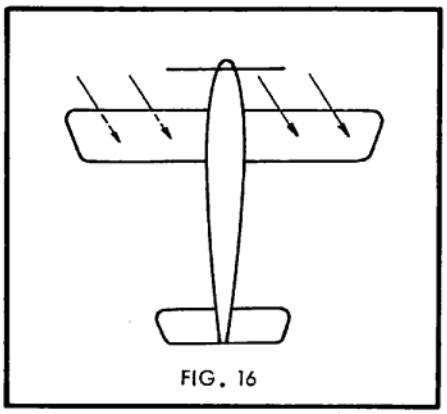


FIG. 16

We note from the figures that, due to the dihedral, the relative wind strikes the bottom of the lowered (left) wing panel and the top of the raised (right) wing panel. These forces normally have moment arms, d, (see Fig. 15), about the CG which produce a rotation to correct the roll disturbance. We say normally because, with a low wing configuration, under conditions of little dihedral and a high CG, it is possible for the relative wind force to act right through the CG, producing no correcting torque, or under extreme conditions, may even act below the CG to further aggravate the roll disturbance. This latter, destabilizing effect of dihedral is more likely with a short-wing. It may further be noted that the top or shoulder-wind configuration would never be susceptible to this latter destabilizing effect. Also, since the torque is proportional to the moment arm, d, more dihedral and/or a longer wing would provide a greater stabilizing effect because of the longer resulting moment arm, d. We'll return again to the dihedral effect on low wingers after we discuss the second dihedral effect, which is the conversion of a yaw

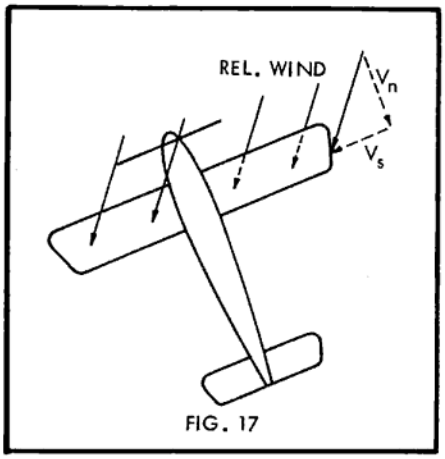


FIG. 17

displacement into a roll displacement. To see how this works, we'll refer to figure 17.

We assume that the aircraft has yawed to the left, resulting in a sideslip condition.

Due to the dihedral, the relative wind strikes the bottom side of the right wing and the top side of the left wing, causing the plane to roll to the left. The magnitude of the rolling torque will depend upon the magnitude and direction of the relative wind, and the moment arm, d, of this force about the CG.

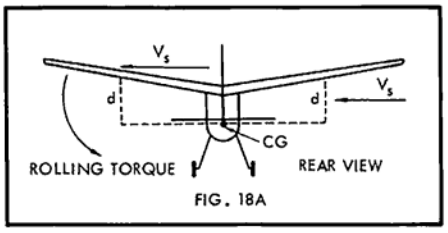


FIG. 18A

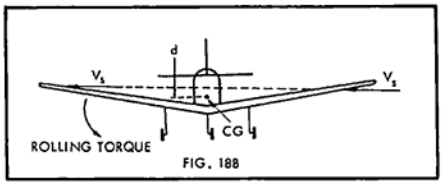


FIG. 18B

Let's look at this in a little more detail. In Fig. 18a we have shown a shoulder-wing configuration and have indicated the sideward component of the relative wind, V_S as indicated in Fig. 17. This sideward component strikes the wing panels producing an effective force at the center of the wing panel area with a moment arm, d, about the CG. This produces the torque which rolls the plane to the left. Thus, we have effectively converted an initial yaw displacement with its resulting sideslip, into a roll in the same direction. If the yaw was produced deliberately by rudder deflection, the resulting roll is usually desirable, particularly for the Class I and II boys. For Class III, it probably is not desirable, particularly in the wingover maneuver. It may be noted here that a high fin also produces a dihedral effect in that it converts left yaw to left roll, while the low fin has the opposite effect, i.e., it converts left yaw to right roll.

For the low wing configuration (Fig. 18b) things may become slightly more complicated. As we have indicated in the figure, the left yaw, and resulting sideslip again produce a rolling torque to the left, as with the shoulder wing configuration (Fig. 18a). But wait a minute! Note the moment arm, d, of the torque for the low winger. Under normal conditions, d will be much less for the low winger, because the effective point of application of the relative wind force is lower and therefore, closer to the CG. This smaller moment arm results in a smaller rolling torque. Thus, this is the reason that most low-wingers do not roll with a rudder deflection, unless the dihedral is unpleasingly large. With equal dihedral, the shoulder wing (or top wing) configuration will produce more rolling torque with a given rudder deflection. This is undoubtedly why Class I and Class II ships are predominantly of shoulder or high wing configuration.

With some low wings with just slight or moderate dihedral and a high CG, it would be possible for the effective relative wind to act below the CG, giving an opposite rolling torque. Thus, an initial yaw to the left results in a roll to the right. This analyses may also be applied to the case discussed previously concerning the stabilizing effect of dihedral for an initial roll displacement. With low wingers with little dihedral and a high CG, the previous stabilizing effect of dihedral becomes a destabilizing effect, further aggravating the roll displacement. It may be that some of our current low-wing designs have already reached this point and might even be better off with no dihedral at all, but we're not too sure of this after watching Doug Spreng's Thunderstormer with about 0° dihedral last summer at the Phoenix FAI trials. Now Doug, it does drop the nose if you bank it too steeply, doesn't it? Actually, we believe Doug has been quite clever here. He eliminated dihedral (actually we'd swear the thing has anhedral in it, but perhaps he used Phil Kraft's wing board) but made up for it with a very large, high fin which as you will recall gives dihedral effect. The Soviet Yak 18 PM, which is the current world acrobatic champ, also eliminated dihedral to improve maneuvers. Of course, the other effect of a very large vertical fin when in a steep bank, is to cause the tail to raise, thereby causing the nose to drop.

How about a little history lesson here? It's quite apparent to anyone who's been in this fool hobby for long that the trend on low-wingers has been to gradually reduce dihedral over the past few years. If you don't believe us, compare the Astro-Hog and the Orion, with the Kwik-Fli or the Thunderstormer. The Hog has a full 8° of dihedral (at least our current one that we use in the big meets does) while the Kwik-Fli has about 1° and the Thunderstormer has 0°. Dihedral is a case where we can't have the cake and eat it too. The more dihedral we have, the more susceptible our aircraft are to those disturbing gusts we are trying to correct for. Further, the more stability we gain while flying upright, the more instability we have in inverted flight. We believe that over the years the boys have come to realize this and have gradually reduced the dihedral, until today some of our low-wing designs have reached the point where the slight dihedral is more of a hindrance than a help due to the reasons discussed earlier. Perhaps we should consider a return to slightly more dihedral or, and we regretfully say this, give more consideration to sweepback. This we will do now.

Besides its purely esthetic value, there are some aerodynamic advantages to sweepback. Since we're on the general topic of stability now, we will only consider this aspect of sweep here. In many respects, the effects of sweep are similar to those of dihedral; that is, it can provide a corrective force for a roll displacement, and it can convert a yaw displacement into a roll. With regards to this latter effect, we feel there may be some room for experimentation here by the Class I and II boys. Let's look at these effects now in more detail. First we'll consider how sweepback acts as a stabilizing factor for a displacement along the roll axis. In Fig. 19 we show a typical swept-wing airplane (a Mark-8 that we saw Jerry Nelson flying at the recent Southwest Regionals in Buckeye) flying straight and level (a seemingly difficult maneuver for Jerry with this particular airplane) with arrows indicating the relative wind pattern.

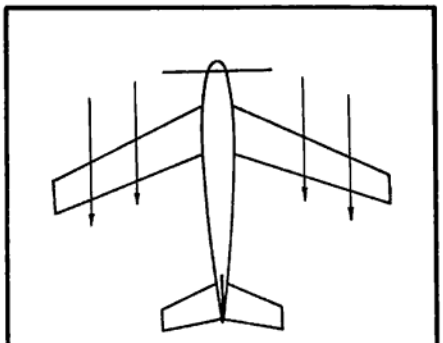


FIG. 19

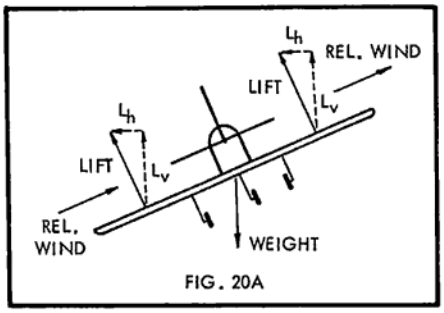


FIG. 20A

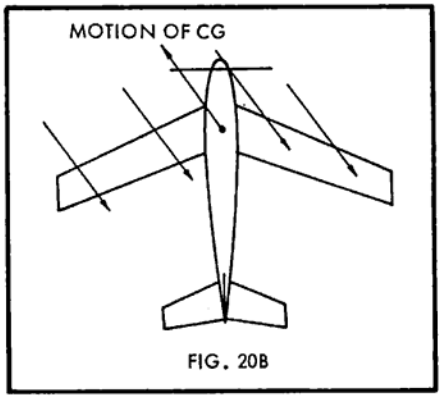


FIG. 20B

Assume again that we have a roll displacement causing the left wing to drop.

Fig. 20a shows the situation from the rear, while 20b shows it from the top.

As indicated in Fig. 20a, there is again an unbalanced horizonal component to the left force, l_h, causing the plane to slip to the left. At the same time the vertical component of the lift, l_v, has thus been reduced so that it can no longer balance the weight and the plane will also lose altitude. This results in a component of the relative wind moving across the plane from left to right as

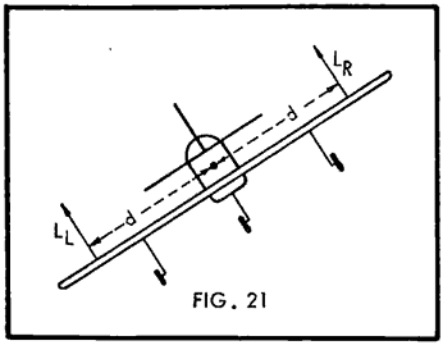


FIG. 21

indicated in Fig. 20a, and in 20b as seen from the top. Inspection of Fig. 20b shows that the air flow is more nearly perpendicular to the leading edge of the left wing panel than to the leading edge of the right wing panel. Note that this difference in the angle between the air flow and the leading edge of each wing panel is due solely to the sweepback; with no sweep the angle would be the same on each wing. However, with the swept wing, due to the more nearly perpendicular air flow over the left wing panel, this panel develops more lift than the right panel, thus causing it to correct itself.

This situation is indicated in Fig. 21. Here, the large lifting force on the left wing, l_L, is indicated by a long arrow, while the relatively small lifting force on the right wing panel, l_R, is indicated by a short arrow. These 2 lifting forces have moment arms, d, about the CG. Thus, the lifting force on the left wing causes a rolling torque to the right given by $l_L \times d$, while the lifting force on the right wing panel causes a rolling

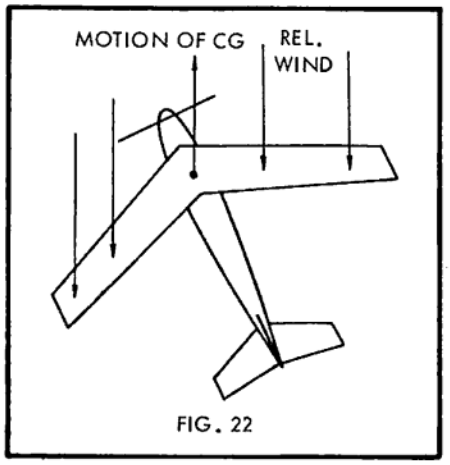


FIG. 22

torque to the left, $l_R \times d$. Since l_L is larger than l_R, while d is the same for both wings, there is an unbalanced torque to the right, causing the corrective roll. We note that the stabilizing effect due to sweepback is independent of wing placement; that is, it is the same for low and high wing aircraft, in contrast to the dihedral stabilizing torques, which were dependent upon the location of the wing.

The other similarity of sweepback to dihedral is its ability to convert a yaw displacement into a roll displacement. This may be seen quite easily from the following diagram.

In Fig. 22 we have indicated the aircraft having undergone a yaw displacement to the left, resulting in the relative wind pattern shown. Note that the relative wind pattern here is just the opposite for the case of a left roll displacement (Fig. 20b). Thus, in this case the flow is more nearly perpendicular to the **right** wing panel, thus causing this panel to generate greater lift, resulting in a left roll. Thus, just as with dihedral, a left yaw will be converted to a left roll. A plane with considerable sweep, and/or dihedral, would thus have considerable rolling tendency for displacements in

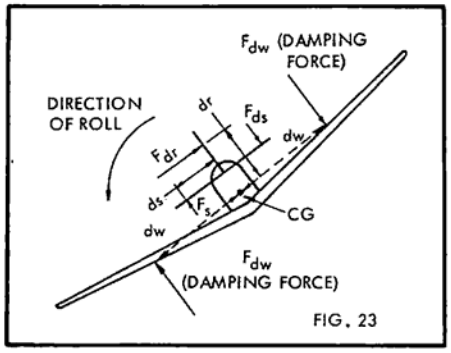


FIG. 23

the yaw axis. These aircraft thus require considerable yaw stability to maintain any semblance of straight flight. With insufficient yaw stability the condition known as "Dutch Roll" may develop, more about which will be said later.

Let's turn now to a brief discussion of damping about the roll axis. As is rather obvious, the main damping about the roll axis is due to the opposing force caused by the airflow striking the wing, as seen in plan form, whenever the airplane is rotating about the roll axis. This damping is actually due to torque about the roll axis, opposite in direction to the roll itself.

In Fig. 23 we have indicated a plane rolling to the left. Although several damping forces are indicated, let us consider for the moment only those due to the wing, F_{dw}. We first note that, although the damping forces oppose the rotation, they arise as a **result** of the rotation and are obviously not present in the absence of a rolling motion. At any rate, the two damping forces on the wings, F_{dw}, act at the center of **area** (not at the center of lift) of the wing so as to produce a torque, $F_{dw} \times d_w$, on each wing panel, in a direction opposite to the roll. It is obvious that the longer the wing for a given chord, the greater the moment arm, D_w, the greater the damping torque. Further, the greater the wing area, the greater will be the damping force, F_{dw}, also increasing the damping torque. Roll damping is, of course, useful in that it provides a resistance to unwanted roll displacements and further is indispensable in performing a 4-point roll and certain other rolling maneuvers such as the Cuban 8 and the rolling 8. Thus, some roll damping is necessary. However, what happens when we have too much roll damping? In order to get the necessary roll rate we are now forced to use large amounts of aileron deflection. This sounds fine and simple, but that old devil drag now rears its head. The excessive aileron deflection will break the airplane loose for one roll, but try three. The excessive drag slows its forward motion down, which in turn lessens the control force, and the rolls simply disintegrate. There are several currently popular designs which suffer from this defect in varying degrees, but the worst offender we ever tried was the big, old, Kwik-Fli (sorry again, Phil). Phil ingeniously corrected this defect by going to the smaller Kwik-Fli II, with a smaller wing area. Perhaps the tapered wing is the best solution to this problem. Most of them seem to have ample damping to stop at the points of a 4-point roll, and yet not suffer from requiring excessive amounts of aileron deflection for the required roll rate. The lesser damping of the tapered wing, of course, arises from the fact that the center of area of such a wing is closer to the root, thus reducing the moment arm, d_w, of the damping force. It thus appears to us that the tapered wing is better than the rectangular wing, at least in so far as rolling maneuvers are concerned. That is, if smaller deflections are required for a given roll rate, less drag is created and there is less slowing down in consecutive rolls. We may also point out here that the swept wing also has this advantage. Because of the sweepback, the center of area of the wing is closer to the fuselage, again reducing the moment arm, d_w, of the damping force.

Finally, in connection with wing damping on roll, is the matter of weight distribution. Most designs call for hollowing out wing tips or even building them up out of sheet balsa (if you can afford such a commodity these days) in order to keep the weight down. There is a good reason for this, even though we never have had time to do it since we started writing this article (where's our damn shirts, Dewey?). Heavy wing tips cause a large moment of inertia about the roll axis. Referring to our formula from the first of this series of articles (formula 2) we have

(Continued on Page **35***)*

(Continued from Page 34)

$$T = MI \times AA$$

With the same torque, the greater the moment of inertia, MI, the less the angular acceleration AA. Translated, this means heavier wing tips will respond noticeably slower to aileron deflection. However, once the plane is rolling, and we get off the aileron control, the counteracting torque due to wing damping will also have a large moment of inertia to fight, resulting in a slower angular deacceleration. Thus, the plane acts as though it were underdamped in the roll axis, and will tend to overshoot the points in a 4-point roll, for example. Because of the sluggishness of the plane to any rolling torques, this may create the illusion of stability. Jack Butler, a few years ago, even went so far as to place his batteries in the wing tips, claiming this gave greater roll stability. What he really did was create sluggishness to roll response. Maybe this isn't all bad however, since the "illusion" is what the judges see also.

Finally, in Fig. 23, several other arrows are shown indicating the roll damping forces due to the stabilizer and the vertical fin. These are relatively minor and rather self-explanatory. We may point out, however, that a large, high fin may give an appreciable roll damping effect, although we really can't say how important this effect is.

Well fellas, if you've stayed with us this far, congratulations. We now want to close this discussion on roll stability by what we suspect (would you believe, hope?) will start an uproar from at least some people and maybe even Doug Spreng. We have shown how both sweepback and dihedral provide us with a degree of roll stability, and also acts to convert a yaw displacement into a roll. The question now arises, what are we trying to say here? We're not sure we know. Excuse us while we have our fourth martini. Seriously, let's look at the advantages and disadvantages of both. Consider dihedral first. As we have shown, the stabilizing effect of dihedral depends upon the position of wing with respect to the CG; that is, with a given amount of dihedral, the high-winger is more stable than the low winger. Secondly, dihedral is a destabilizing influence when inverted. This effect is more serious than may be readily apparent. It leads to changes of rotational speed (as Don Lowe has already pointed out in his RCM article on the Phoenix) during the course of a roll, giving the rolls a "busy" appearance. Secondly, it makes loops harder to track because during the inverted portions it acts to destabilize the aircraft. Finally dihedral makes the aircraft more sensitive to the upsetting forces (side gusts and turbulence) that we put it there to correct for (one more martini). Although this seems paradoxical it nevertheless is true. This bad effect is most noticeable while flying at low speeds. If you don't believe us, come out and watch us land our "contest" Astro-Hog cross-wind on a windy day. Yes, we really do have wheels on the wing-tips, top side yet.

If you haven't discovered what we're leading up to yet, you will now. It looks like sweep is in, theoretically at least. None of the above disadvantages of dihedral apply to sweep. Its stabilizing effect does not depend upon wing placement, it acts the same inverted as upright, and is not sensitive to side gusts. It has the further (slight) advantage of providing directional stability through yaw damping, as discussed earlier. Finally, here's the real kicker. As we have mentioned, the stabilizing effect of dihedral and sweep both increase with speed. At high speeds 10 degrees of sweep is equivalent to roughly 1 degree of dihedral. However, even though sweep is about one-tenth as effective as dihedral, at high speeds this is ample because of the large magnitude of the stabilizing force. At low speeds, however, even though both stabilizing forces decrease, that due to sweep decreases less than that due to dihedral, and at stalling speeds sweep is about one-third as effective as dihedral. Thus, by putting in say, 30° of sweep instead of 3° of dihedral, we have equal stability at high speeds, but 3 times as much stability at low speeds, plus the bonus of less susceptibility to side gusts. So it looks like, on paper at least, sweep has definite advantages.

One disadvantage of sweep is its snap rolling tendency at low speeds. This is basically caused by tip stalling and subsequent extreme forward displacement of the center of lift. A more thorough discussion of this will be presented in the next section dealing with longitudinal stability. We may state here, however, that any means of preventing tip stalls will probably cure any snap rolling tendencies.

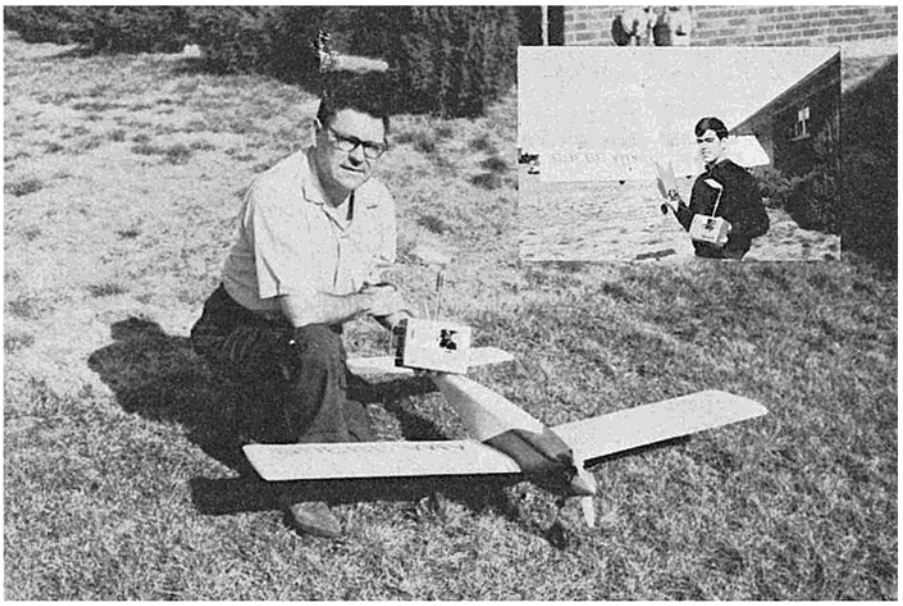
A further disadvantage of sweepback arises from the rearward position of the CG, making balancing difficult. We are pretty much restricted to the length of the nose moment arm of our planes because of the space requirements of the engine and tank. The rearward CG necessitates then, a long tail moment for proper balancing, resulting in an unusually long fuselage. However, some of the more ingenious members of the TRCC have solved this problem quite simply by building plywood fins and stabilizers. Now that it is evident that we work in a very stimulating environment, we'll close here with this thought, "The one time you can always be assured of receiving your money's worth is when accepting free advice."

(To be continued)

RCM ELECTRONICS

OPEN CIRCUIT

By Ed Thompson, Technical Editor



Pictured above is Stan Andrews who was the winner of the "Name Ed's Column Contest." Our Editor forgot him last month! The smaller photo is Stan's son, Ken, who is getting started on his own Digitrio.

GOOD weather and writing do not compliment each other. In fact, the only thing I can think of that compliments good weather is doing things outdoors. If work is the curse of the drinking class, then good weather must be the curse of writers. Have you noticed that most "raggedy" issues of magazines occur during the summer months? This is when the editors pull out the articles they previously shoved aside, during the winter, when they had more to pick from. This is when the mediocre magazine goes to pot and a good magazine gets mediocre. This is also when the editorials get long and boring because the editors themselves have to be more creative. It might be interesting to compare a few magazines this summer and see which ones are exceptions to the above. (Ed's note: You and your big mouth, Thompson!)

Ed Means of 1402 Murry Blvd., Colorado Springs, Colo., a good friend of mine, called me this month. He said that he would like to repair Digitrios and wanted to know if I knew of anyone needing repairs. He knows the Digitrio and has built and repaired many of those flying in his area. He also feels he can offer prompt service. I mention Ed as an answer to the many letters that I have received requesting repair service.

Last month I announced the winner of the "Name the Column" contest — Stanley O. Andrews—who won $20.00. Here are the 2nd and 3rd place winners:

2nd — Edward R. Mate, Chicago, Ill. — 2 yr. sub. to RCM.

3rd — Art Bass, Dresher, Pa. — 1 yr. sub to RCM.

Again thanks to all of you who entered the "Column" and "Dead-beat" contest.

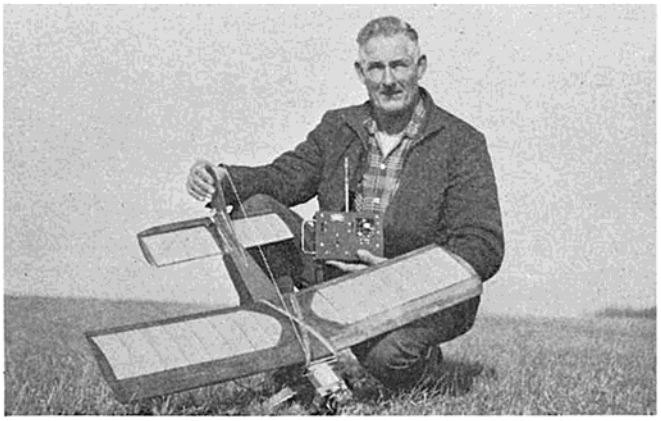
●

I have received a few new products from World Engines that deserve comment. One of the items is a stick assembly. It is a "closed face" type, of excellent quality, that will sell in the medium price range. It has electrical trim (stick doesn't move when trimmed) and a smooth "feel." Don Baisden of W. E. tells me that they have a three control version of this same stick due to arrive by the time this is in print. I received, also, their plastic servo case kit which will replace the metal type. It is a direct replacement for the metal case and requires about ½ hour to "swap" the "guts" from one to other. As an accessory to the servo case W. E. offers a bellcrank adapter for use with strip ailerons.

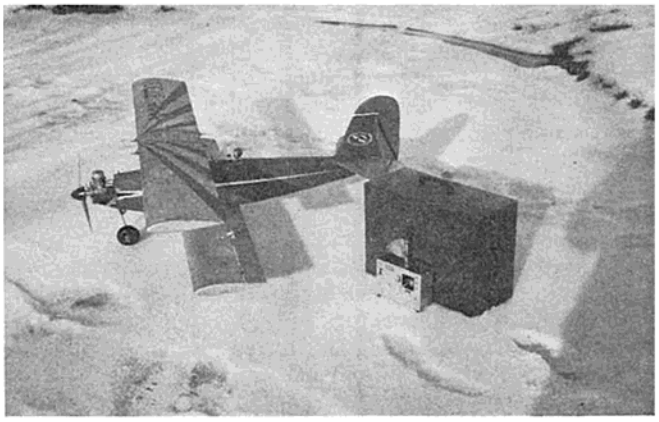
The last item received was a molded battery box held together with metal "snap" clips. It has no provisions for the usual spring-loaded connectors — instead you solder all connections to the batteries. This makes it only slightly larger than the space needed for the 5 pencell-type batteries it holds and gives the assurance of soldered connections.

I was also in Denver recently and

Bert Flaten, Sioux Falls, S. D., with a Fox .15 powered Lil Esquire. Scratch-built Digitrio.

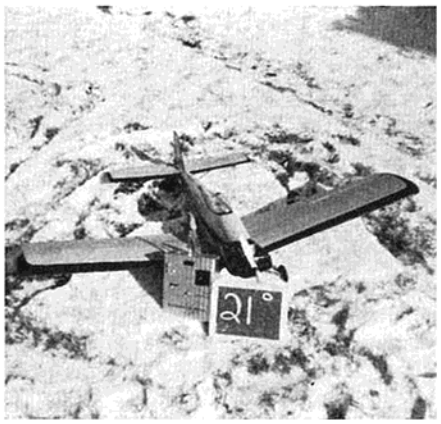


Lee Guhr, Clarendon Hills, Ill., with 1000 sq. in. original Bipe. 5½ lbs., S.T. 60. Almost 100 flights.

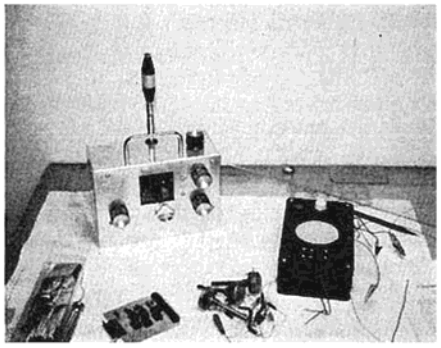


visited Royal Products new building, which is complete with the Royal Lions on the front. Ron Murray gave me a guided tour with a peek at some of their new products. I was impressed by the digital servos that they are offering and feel they are among the finest available. Ron gave me one of his catalogs — (which doesn't reflect all of their products because they introduce them so fast) — that you must see to appreciate. The catalog is almost too nice to use. It uses very expensive paper and lots of color along with professional layouts and photography.

●



Marv Kowalewskis deBolt Pursuit, O.S. .40, Digitrio-4.



Ed Mate's "Mickey Mouse Trio."

When you read this I will have sorted through and answered all the letters that I felt required an answer. Some that I discarded asked questions I felt would be cleared up by the time I got around to them and some have been lost. If you mailed a letter before the 1st of April and haven't received an answer and still desire one, please write again. If you sent an unconstructive or overly critical letter don't bother, you won't get an answer to your second letter either.

Edward R. Mate of 7716 S. Coles, Chicago 49, Illinois, (2nd place winner in the column contest) has a list of tested transistor substitutes for the Digitrio. He scratch built his digitrio and can probably help some of you "scroungers."

INDEX TO THE DIGITRIO ARTICLES

1965	*ARTICLES*
August	Introduction and Basic Circuits
September	Transmitter (Electronics)
November	Transmitter (Final Assembly)
December	Receiver
1966	*ARTICLES*
January	Decoder (3 Channel)
February	Servo
March	Final System Alignment plus Troubleshooting
May	Using the Bonner Stick
June	3 + Operation plus "Tips" by Frank Baker
July	Conversion to 6 Meters plus Dual Charger by Bob McKnight and 4-Channel Modification by Buddy Tomlinson
August	-4 Transmitter (Mechanical)
September	-4 Transmitter (Electronics)
October	Flying Evaluation by Warren Thomas plus Servo Tester by Dave Holmes
November	-4 Decoder plus Servo Modification by Ray Pizar
December	Troubleshooting the -4 Modifications

ERRATA

1966

December

1. Concerns transmitter waveforms.
2. Concerns transmitter construction schematic.
3. Concerns transmitter construction overlay (not valid).

1967

January

1.)
)
2.) Repeats of December 1966.
)
3.)
4. Concerns transmitter overlay components and pots.

OTHER ERRATA WORTH NOTING

Receiver

1. C16 should be installed as shown on the construction overlay.
2. Voltage at base of Q7 should be approximately .6V.

Servo

Connection between Q9 and Q10 emitter missing on schematic.

MODIFICATIONS TO BASIC CIRCUITS

Issue	*Modifications*	*When Recommended*
Feb 66	Adding copper shield to transmitter.	No requirement — superceded by mod. to power amplifier (see Mar 66).
Mar 66	1. Adding .01 cap and silicon diode to 200 us one shot in transmitter.	In all cases.
	2. Major change to power amplifier in transmitter. Also see May 66 for ant. resonating instructions.	In all cases.
	3. Replace R14 and R15 (4.7K's) in motor control servo with 10K's.	If servo chatters with 3-channel decoder.
	4. Replace R5 (27K) in motor-control servo with 33K.	If full travel of servo arm cannot be obtained with 3-channel decoder.
June 66	Replace R12 in decoder (10K) with 22K.	In all cases with 3-channel decoder.

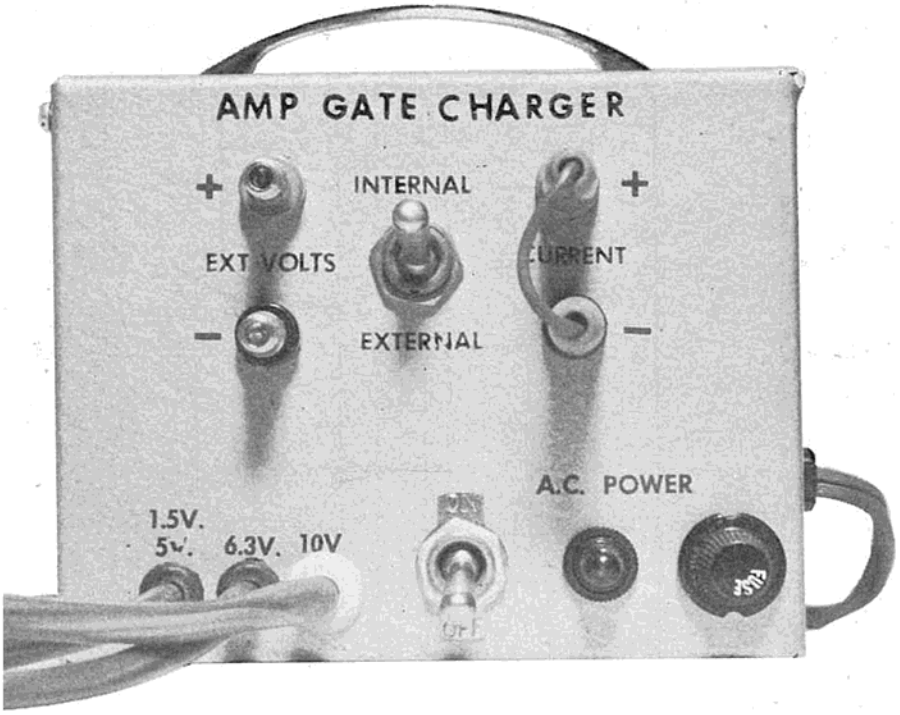
OTHER MODIFICATIONS RECOMMENDED

Replace C2 (27Pf) in receiver with 33Pf.	If slug is all the way in windings of L1 when peaked or when building a new receiver.
Replace R16 and R17 (22K) in servos with 47K's.	If faster servo response is desired with -4 mod.

Other comments and recommendations too numerous to list have appeared in my monthly columns since the inception of the Digitrio and will continue to appear when justified.

NOTE

Most back copies and reprints of construction articles for the Digitrio and -4 modifications are available from RCM — ATTN: CIRCULATION DEPT.



AMP GATE CHARGER

BY L. JACK WEIRSHAUSER

A major breakthrough in R/C, this new unit will allow you to fully charge your nickel cadmium pack in 2½-3 hours while charging each cell to the same level!

HOW would you like to charge your nicad batteries at 100-, 200-, 300-ma. or higher and **know** that you will not damage them; and also know that your batteries will be at a maximum charge?

The semi-conductor division of the P. R. Mallory Co. has developed a device called the **Amp Gate Diode** that is a natural for use in charging nicad batteries, in fact I wouldn't be surprised if they were developed with that in mind.

As you can see in figure 1, they have a very well-defined break-down point (the point at which they conduct) and since this point happens to be 1.55 volts, it coincides with the full charge voltage of a nicad battery.

Figure 2 shows the A.G.D. connected across the battery so that it is forward-biased (the positive voltage from the charger connected to the anode or plate of the diode). Referring to the time vs. charge graph this is basically what happens when charging current is applied.

The time vs. charge current graph shows the relationship between the current going through the battery and the current going through the diode at any given time during the charge cycle. A single 500 M.A.H. battery was used for this test that had been discharged through a 3.3 ohm resistor until the battery voltage read zero. It was then connected to the charger and a clip-on milliampmeter probe was clipped onto the positive lead of the charger. I must mention here that a conventional MA meter connected in series with the cell or diode **will not** work.

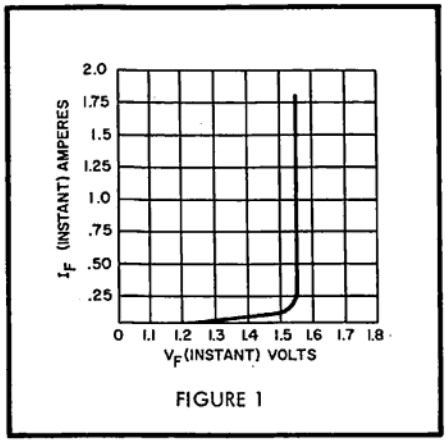


FIGURE 1

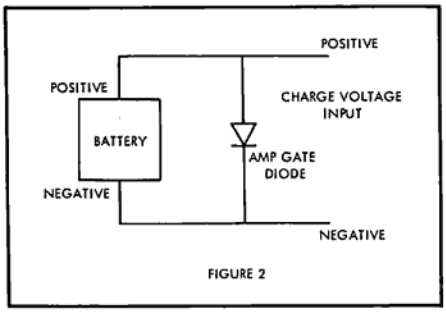


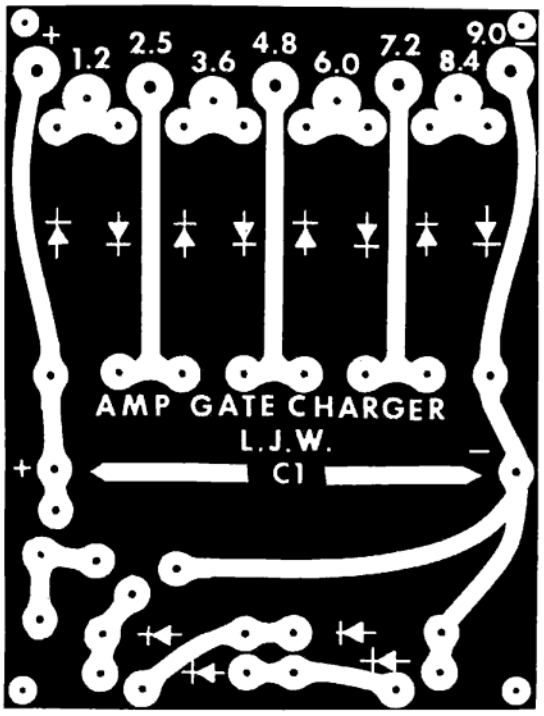
FIGURE 2

The DC resistance of a discharged battery is somewhere between .1 to .4 ohms with the resistance of the AGD being only slightly higher. If you put a meter in series with either the diode or the battery you will prevent the current changeover from taking place since the meter resistance is considerably greater than either the diode or battery (about 18 ohms on the 500 ma. scale using a Simpson 260 V.O.M.).

A clip-on MA meter inserts no resistance in either leg so the graph is a true picture of what really happens. The curve at the start (top) of the two plots occurs because the battery was completely dead and drew more current during the first 20 to 30 minutes of the charge, before settling down and becoming linear (about where the AGD and Battery Currents intersect.) You can see from the end (bottom) of the curves that the battery charge current is no longer changing and is now drawing only 15 to 18 ma. This is only slightly more than a trickle charge and can be left connected to the battery for a long period of time with no battery damage.

Because of the extremely low internal resistance of these batteries, the current, when measured at the front panel of the charger (now you can use a conventional DC ma. meter), will change when charging different size packs. The current when measured with no batteries connected will be about 275 ma. There will be very little change when one battery is connected; 5 cells (6-volt pack) will draw about 300 ma., and an 8-cell pack (9-10 volts) will draw about 315-320 ma.

As the packs become charged the current will drop off until the current again reads 275 ma. This is a way of checking to see if the pack is accepting a charge; just simply watch the current while you plug and unplug the pack, when the pack is fully charged (2 to 3 hours) you should see little or no change in the current. I might mention here that a dead cell or pack is normally considered to be one where the terminal voltage is 1.0 to 1.1 volts per cell when measured under a normal load, or where the cell or pack has been used as long as experience has shown it would be foolish to try just one more flight. You might also remember that proportional equipment draws considerably more current than reed equip-



FULL SIZE PRINTED CIRCUIT BOARD

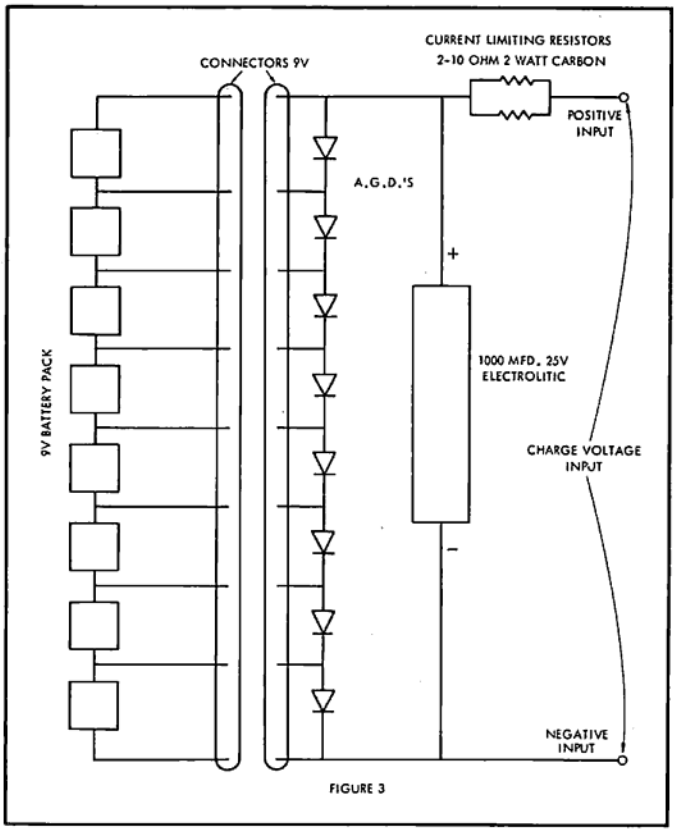


FIGURE 3

ment, so if you haven't had the experience to tell when the cell or pack is getting low, play it safe and use a meter and measure the voltage.

The single cell used to take measurements for the graph was later discharged using a 3.3 ohm resistor.

$$1=\frac{E}{R}=\frac{1.25}{3.3}=380 \text{ ma.}$$

It took 1 hour and 10 minutes for the cell to reach its end-point of 1 volt, which is what the battery discharge curves say it should be.

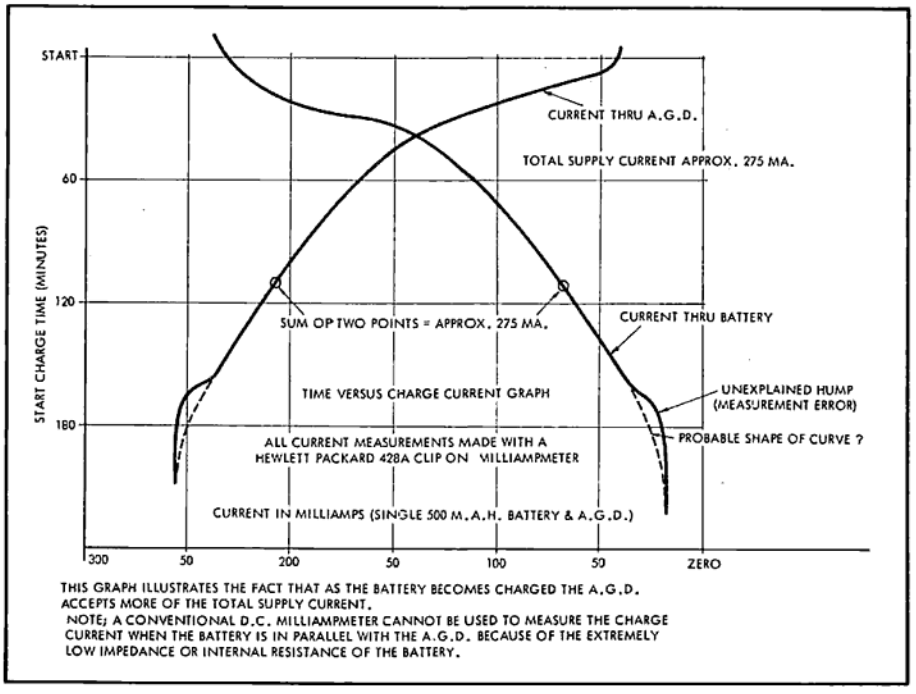
The nicad discharger used for these tests has a 3.3 ohm, 1 watt load resistor for each cell in the pack which can be switched in or out. There is a double-pole rotary switch which permits me to measure the voltage of any cell in the pack under load and when the voltage of this cell drops to its end voltage of 1.0 volts the 3.3 ohm load can be switched out and thereby prevent that cell from discharging any further. This unit will also prevent a potential disaster by enabling you to spot a weak cell, one which drops off much faster than the others when discharging. The unit as shown is probably a little expensive to build for the average "Sunday Flyer" but with a little thought I'm sure a more simple and inexpensive unit could be built. I just happen to be short on brains but long on parts so I built it this way.

It now becomes obvious that if you have a series string of batteries all in a different state of charge, and charge them with an A.G.D. in parallel with each battery (see figure 3), you will **always** end up with each battery having the same level of charge, with no one battery getting more than its share and becoming overcharged.

I don't intend to dwell on the chemistry or construction of nicad batteries; it has been done before by experts, but I will say this, **nicad batteries like to be treated rough, with respect, but rough nonetheless.**

The reliability of a nicad battery increases ten-fold if they are occasionally fully charged and discharged. Clarence Lee covered this very well indeed in the July 1966 issue of Model Airplane News. (Sorry about that Don — A .61 will do nicely, Clarence!) Also nicad batteries certainly do have a memory of sorts, and one that is very predictable, especially if you do everything the same way every time. Before I started using the charge-discharge technique, I would get 4½ ten-minute flights on my Orbit 8-channel super regen before I would suddenly lose right aileron. I then had about two minutes to get on the ground before I lost everything. I also would get 5 twelve minute flights from my Min-X 12-channel super het before I would lose simul.

Just to make sure this was something that I could predict and therefore control, I started using two sets of batteries for each receiver; one set was



THIS GRAPH ILLUSTRATES THE FACT THAT AS THE BATTERY BECOMES CHARGED THE A.G.D. ACCEPTS MORE OF THE TOTAL SUPPLY CURRENT.
NOTE; A CONVENTIONAL D.C. MILLIAMPMETER CANNOT BE USED TO MEASURE THE CHARGE CURRENT WHEN THE BATTERY IS IN PARALLEL WITH THE A.G.D. BECAUSE OF THE EXTREMELY LOW IMPEDANCE OR INTERNAL RESISTANCE OF THE BATTERY.

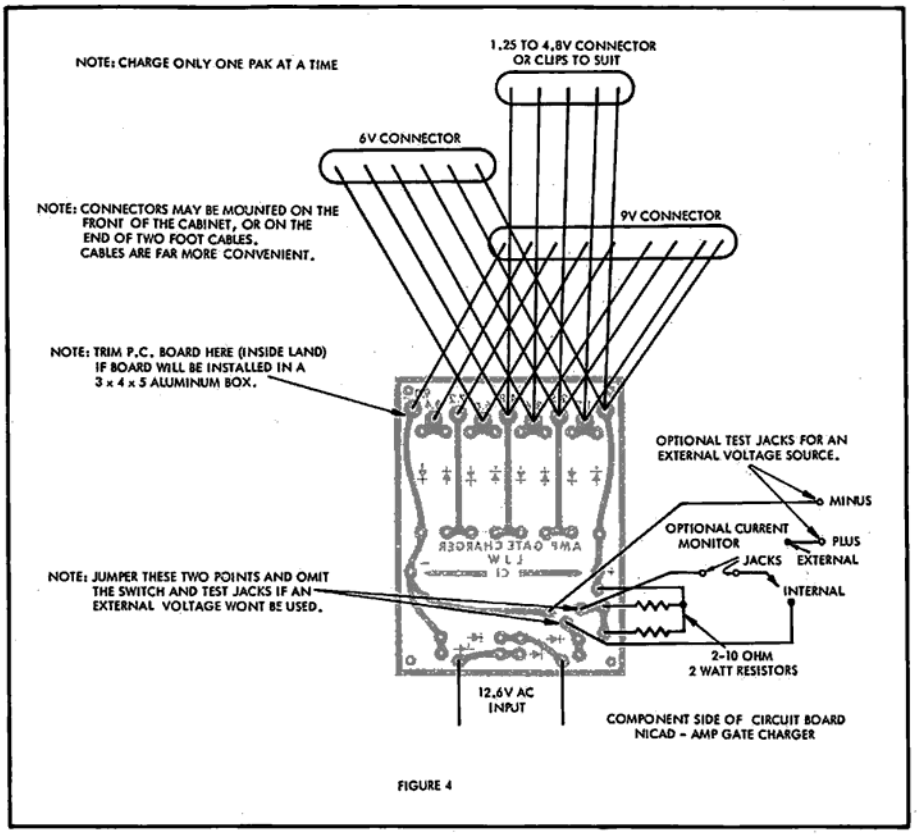


FIGURE 4

charged the "old" way and the other set was charged using the discharge and charge method and A.G.D.'s. After flying until my batteries gave out (those charged the old way), I would switch the packs and continue to fly. I found in the process, that it required five 25% discharge cycles on a pack to develop this so-called memory, and when I checked further I found that this equated to approximately four 10-minute flights for the Orbit (less than the Min-X because the batteries were also powering the filaments and DC converter in the pack). I couldn't finish the test on the Min-X because the batteries went down in the middle of a fifth flight during a spin (a simul. maneuver) and the controls failed to neutralize, Ugh.

I also found that this memory will develop much faster if you let the batteries sit in a partially discharged state; Sunday afternoon until Saturday night for instance.

In any event, I can now fly until I crash, run out of fuel, or just get tired, and I no longer worry about battery failures. A **great feeling!**

When I said earlier that nicads like to be treated rough, I meant that you should occasionally fully charge and discharge them, **and I mean do it,** observing their upper and lower end points, of course.

I have on occasion put a direct short on the Sonotone S 101 Pencells which are rated for 500 M.A. at a 1 hour rate (500 M.A.H.), and pulled 8 amps from them for a very short time. I then proceeded to charge this battery at 4 amps, also for a very short time. The reason for all this foolishness (yes, I did blow up several of them before I learned the time limitations) was because I could not get one of these batteries to accept a charge, and I was trying to form it just like you do with some types of large capacitors (come to think of it a battery **is** a capacitor). I had purchased 10 of these batteries to use with my newly completed Digitrio (that'll cost you, Ed), so I figured if one of them was a little unreliable, why take chances, and I gave all of them the same treatment. To date I have not even had the batteries drop off to the point where the Digitrio's built-in fail-safe takes over (sudden and positive low engine). **I love it!**

I most certainly don't recommend that you commit this sort of mayhem on your batteries, but I do say that the majority of battery failures can be traced directly to the fact that the batteries were babied and never received a full charge.

Good examples of this are the battery chargers that come with most R/C equipment. I have measured the output of some of these chargers to be as low as 20 ma. and when you remember that most batteries should be charged at approximately 45 ma. for 10 to 14 hours, you can see that an overnight charge would only bring a heavily discharged pack up to about 60 to 70% of a full charge.

For those of you who have a good battery charger, "good" meaning well filtered and rectified, and capable of delivering 300 ma. to 1 amp. at 12 volts, you need only add the A.G.D. network. (See Figure 3). However, for those of you who must use the charger that comes with your gear, I recommend that you build the charger that is shown in Figure 6. It is very easy to construct and can be put in anything you may have handy. A friend of mine has one built in a cake pan and hangs it on the wall over his bench — crazy! The only real expense is the A.G.D.'s and maybe by the time you read this they may be approximately a dollar each.

In order to use the amp gate charger you must tap each cell in the pack and bring out a wire for each one. This usually isn't too much trouble since most packs have only a plastic insulator over them that can be removed. This can be replaced with tape or large shrink tubing. It makes it very convenient to put a plug with the required amount of pins on the receiver and switch cable, and then put a mating plug on the front of the charger or extension cable. Now you

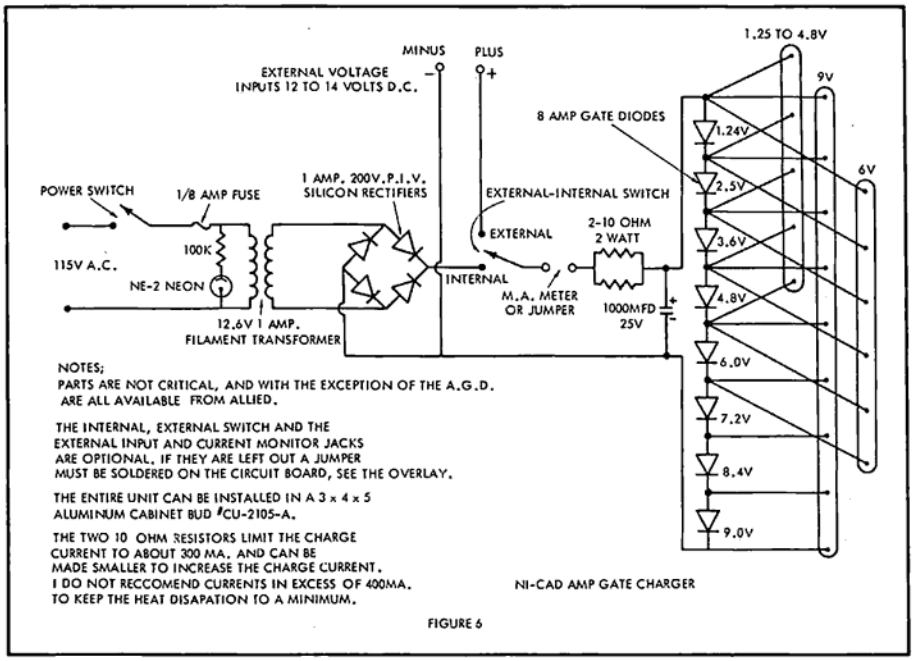
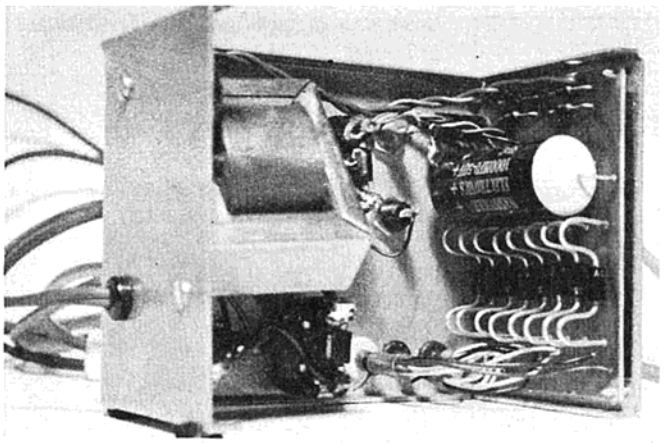
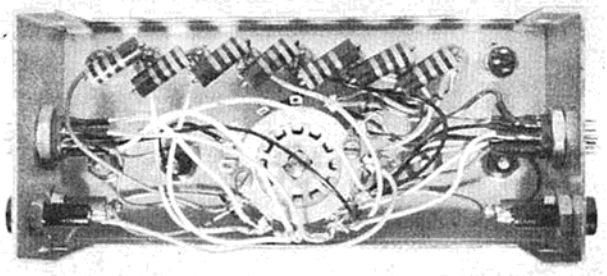


FIGURE 6





Left: Inside the Amp Gate Charger. Note method of installing diodes. Above: Discharger mentioned in text.

can plug in your pack, charge them at 10 times the normal rate and take a week's vacation without fear of overcharging. **No fooling.**

BUILDING INSTRUCTIONS

Make like you are playing jacks, and throw all of the parts out on the bench and find the circuit board. Now do all of the usual things that you have been told to do before, like clean it and inspect for defects, and drill the holes. Also, you might make sure it will fit wherever you plan on putting it.

Now find the four rectifiers. They're the ones that are different from the A.G.D.'s; if you don't have the A.G.D.'s yet, then you can't make a mistake. Mount the rectifiers so that the little pictures on the circuit board match the little pictures on the side of the rectifier diodes. Okay?

Now pick up the filter capacitor (it's about an inch in diameter and about 2 inches long, and looks like a big firecracker with a fuse on both ends). Look for the little plus sign on one end and stick the wire that sticks out of this end in the hole in the board that has a little plus sign next to it. Now stick the wire from the other end of the capacitor into the hole that has a minus sign next to it. Haven't you found it yet? Well look on the floor; who taught you how to play jacks anyway?

Now install the two 10-ohm resistors. Mount them on end on the board and bend the lead of the resistor closest to the capacitor over and push it through the board. Bend the lead of the other resistor over and solder it to the lead of the first resistor, thereby putting the resistors in parallel.

Now temporarily connect up the transformer to the board. Don't get the windings backward or you will put about 1000 volts into the rectifiers when you first and probably the only time turn it on, zzzzzzzzzap. (The two black leads go to 110 VAC.)

Now somehow or other, without "zapping" yourself, connect up the 115 volts to where it's supposed to go on the transformer. You should have pretty well decided by now what this thing will look like when it's done, so your switch, pilot light, and fuse holder, if you have decided to use them, should all be wired up (don't mount the A.G.D.'s yet, please). Connect a D.C. meter of some sort across the firecracker and be prepared to measure about 10 volts D.C. I told you to watch the transformer windings you idiot, get off the floor and open the window so the smoke will clear!

For those of you who measured the correct voltage we can proceed.

(Continued on Page 46)

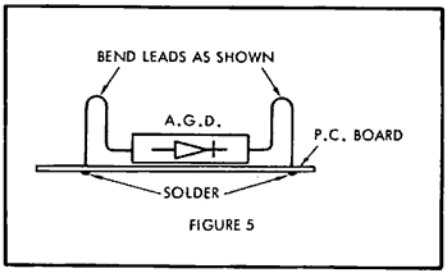


FIGURE 5

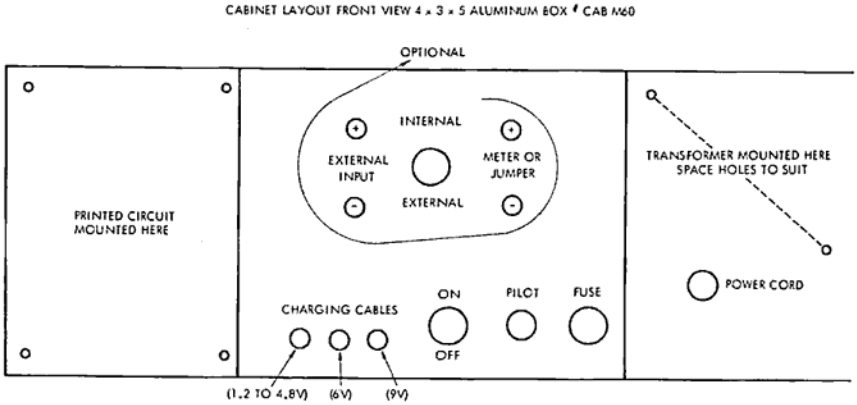
A.G.D. CHARGER PARTS LIST

All numbers taken from Allied Catalog #670-1967

Capacitor — 1000 Mfd. 25 Volts, C.D.E. #1000-25	Allied # 43D9261
Transformer — 12.6 Volts 1 Amp. Knight 12.6 volts 1.5 Amp #54D4136 (There are smaller transformers than this one available if you look)	
Rectifier Diodes — Sarkes Tarzian Rectifier #F4 1 Amp. 400 Volts P.I.V. 1N2483 (4 Required)	
Resistors — Ohmite 10 Ohm 2 Watt (2 Required)	Allied # 45D6080L
Tip Jacks — HH Smith # 1505 Red (2 Required) (These are optional)	Allied # 24A9150
Tip Jacks — HH Smith # 1505 Black (2 Required) (These are optional)	Allied # 24A9151
Pilot — Dialco Series 502 Red, with NE 2 Neon	Allied # 60A7967
Switch — S.P.S.T. Cutler Hammer # 7580K6	Allied # 56A4641
Switch — S.P.D.T. Cutler Hammer # 7582K6 (optional)	Allied # 56A4645
Fuse Holder Little Fuse #342001	Allied # 57A3001
Aluminum Box 3" x 4" x 5" Bud # CU 2105-A	Allied # 42D7621

The Amp Gate Diodes can be ordered directly from the Semi-Conductor Division of P. R. Mallory Co., Duquoin, Illinois.

All other parts are not critical as long as you use the values specified.



NOTE; NO HOLE SIZES ARE GIVEN SO THE BUILDER CAN DRILL HOLES TO SUIT THE COMPONENTS MOST AVAILABLE TO HIM.

FIGURE 7

Howard Bowers, President of the Denver Mile-Hi Model Boat Club and his 55" P.T. Boat. This is a 28-volt electric with twin motors, props, and rudders. R/C controlled with special plug-in control box.

POWER & SAIL

THE official details on the IMPBA Annal Regatta have just been received from Frank Snowden, 1878 Alameda, Redwood City, California. Dates are August 12-13, from 9:00 A.M. to 5:00 P.M. at Spreckels Lake and Lake Merced, San Francisco, California. Events will include 1/16 mile straight, 1/4 mile oval (multi boat races). Trophies will be awarded to first place in each engine size for hydro and mono in both 1/16 mile and 1/4 mile. Trophies for multiple boat racing will be awarded to third place in three engine classes: 0-.20, .21-.50, .51-unlimited. Both monoplane and hydroplane hulls will be combined and all multi boat races will be run in clockwise direction with a flying start. Right turns shall be used.

The 1/4 mile will be run at Spreckels Lake all day Saturday and a half day on Sunday. Events will then be moved to Lake Merced for Sunday afternoon multi boat racing from approximately 1:00 P.M. until closing. The 1/16 mile will be run all day Saturday and one half day Sunday at Merced.

No pre-registration is required for the IMPBA Internat's. All entrants, however, must have IMPBA membership cards in order to enter. Valid F.C.C. licenses are supposed to be in the contestant's possession at all times. Additional details on motels, annual dinner, etc., will be presented in next month's Power & Sail.

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On the contest scene, please note that the San Diego boat meet has been changed from its previously mentioned date in June to the Labor Day weekend. Mark this on your contest calendar.

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There has been quite a number of letters received at RCM concerning the use of the 72-76 Mc band by model boaters. In this connection, we are reprinting a copy of a letter received by RCM from the Academy of Model Aeronautics on this subject. The letter was written to the AMA by the AMA Frequency Committee attorney in answer to this question:

John Worth, Executive Director
The Academy of Model Aeronautics, Inc.
1239 Vermont Avenue, N.W.
Washington, D.C. 20005

Re: Use of 72-76 Mc band by model boat builders

Dear Mr. Worth:

You have asked whether the 72-76 mc band frequencies allocated for the use of Class C Citizens Radio Service stations may be used for the control of model boats as well as for the radio control of model aircraft. The answer is an unequivocal "No."

The Federal Communications Commission amended Section 95.3 (b) of its Citizens Rules as a result of the Docket 16122 proceeding initiated by the AMA to read as follows:

"Class C station. *A station in the Citizens Radio Service licensed to be operated on an authorized frequency in the 26.96-27.23 Mc/s band, or on the frequency 27.255 Mc/s, for the control of remote objects or devices by radio, or for the remote actuation of devices which are used solely as a means of attracting attention, or on an authorized frequency in the* 72-76 Mc/s band for the control of model aircraft only." *(Emphasis added.)*

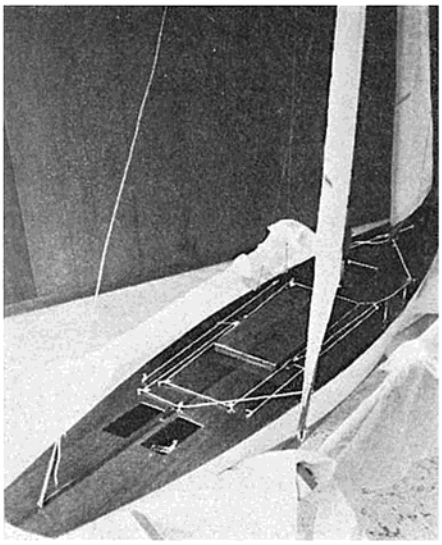
Thus, it is clear that the Commission differentiated between the radio control of model aircraft and all other radio controlled activities insofar as the 72-76 mc band frequencies are concerned, which are restricted solely to use for radio controlled model aircraft. The model boat builder, of course, still has available the frequencies in the 26.96-27.23 mc band or the frequency 27.255 mc for his radio control activities.

Very truly yours,
Jeremiah Courtney

●

Len Bjorenson's H.M.S. Kent, 55" R/C electric powered craft. Len scaled up plans from the English Model Boats Mag. Photo by Worthen.

Jim Oliver of the Denver Mile-Hi Model Boat Club and his Chris Craft Corvette. This is powered by a 3/4 H.P. O & R engine and is a fine performer. R/C controlled with Orbit. Photo by Worthen.



Our tests on the J. T. Goode Co. AQUATRONICS Power and Sailboat systems have covered the last six weeks. Power boat tests are being conducted by Steve Muck who holds several IMPBA records. He suggested a slight mechanical change involving a centering knob for steering and a steering trim knob. These have been added and all shipments of power boats versions have had this modification. Steve told us that as yet he has not had time to complete his report for this issue, but is particularly impressed with the servo power. The servos were tested for power. The proportional servos use the DuBro V Link for the output discs. Holes in these discs are arranged for either ½" or ⅝" total throw. At ½" throw the thrust is 8 lbs., and at ⅝" throw is 6 lbs. These are the most powerful servos we have tested. They can easily handle the largest boats for steering, both power and sail. The winch servo was tested with 3 turns of braided 1/16" nylon line and lifted a 10 lb. weight at the rate of 3 inches per second, taking over 12 lbs. to stall it.

The AQUATRONICS transmitter is of conventional hand held size. The panel contains a steering knob which covers 270°. Two push-buttons on the left side are used for in and out sheet control. Eight "C" size flashlight cells were installed (connected in series for 12 volts). Turning on our monitor to see what it sounded like, we heard a tone of about 250 cycles which apparently changed frequency by turning the steering knob. This can be changed explained as follows: There are 1000 milliseconds in a second. A full cycle of 250 c.p.s. takes 4 milliseconds (2ms for the + half and 2ms for the − half). The + and − halves are **independently** controlled. In the receiver the − half is inverted to a + half. These two pulses are then referred to reference generators and 2 digital channels result. Obviously, this makes a digital system that can't get out of sync. Another way of looking at it is that this isn't a "tone" at all — it is actually 2 digital length commands.

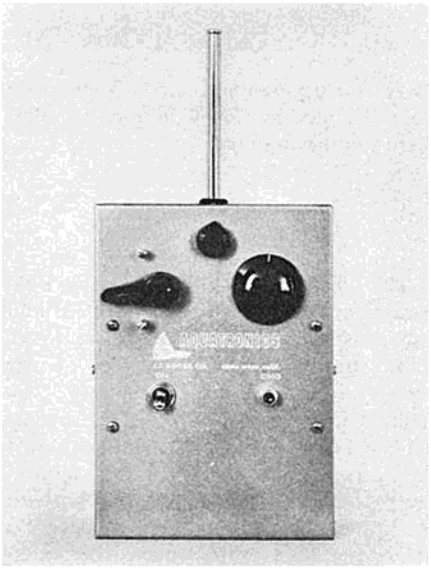
Both the receiver and transmitter have sockets for plug-in crystals. The advantage of this is self evident! The sockets hold the crystals very firmly and should withstand any shock or vibration. The receiver and servos, together, contain 36 transistors. We used 6 "D" flashlight cells for the receiver (9 volts). With no taps on the battery pack — this results in an even discharge, which is necessary because a winch servo furnishes real power in one direction and almost none in the other! Almost the entire 9 volts is applied to the servo motor, accomplished by 4 transistors in the motor drive circuit which can be compared to a double pole double throw switch with a center off position. Other interesting circuitry in the system involve a "power driven flip flop" working directly from a power detector (there is no audio amplifier). The usual one shots, and flip flop, drive power digital discriminators. Both sides of each servo amplifier are completely symmetrical and use complementary symmetry.

There are no tuning adjustments, the sailboat version using an insulated backstay for an antenna, while the powerboat antenna consists of a loading coil to be inserted between the receiver and an 18" vertical antenna. Range was out of sight.

The battery charging arrangement appears to be a sensible, simple economical approach to this problem. It requires the purchase of a readily available 1 amp charger obtainable at any auto supply house, for about $5.00. This is connected to the charging panel furnished with the equipment. Two cables go to the receiver and transmitter respectively. We used dry flashlight cells for our tests but recommend nickel cadmium units for extended use. With charging, however, the normal life of flashlight cells can be extended. Current drain of the transmitter is 70 ma at 12 volts and receive 40 ma idle with ½ amp or more on heavy winch or servo command — light command is about 160 ma. The length of the tiller arm on the rudder should be such that the rudder is deflected about 25 or 30° but this will vary with different sail and power boats. With the proper adjustment of the winch line — no limit switches are needed or desirable — see rigging picture and installation instructions.

We installed the system in the Regatta One Design #13 owned by RCM. A picture is shown of the deck arrangement. The below decks installation is, of course, simplicity itself. The winch drum on deck looks and acts like the winch on a full size ship. With the arrangement shown no sheet fouling was encountered. The digital proportional system of steering is a delight after using self centering servos, as on a reed system. The steering knob is not self centering, but the center is clearly marked. The two push buttons on the panel trim the sails in or out.

We have sailed in everything from a flat calm to rail down breezes. We think this is a simple, extremely well thought out system at a realistic price. The instructions are very complete and are easily understood. This equipment fills a real need and should find wide acceptance.



Jerry Dunlap, reporting for the Seattle Model Yacht Club, reports that the group is still in the planning stages for a "Junior Gold Cup," to be held this summer. Commodore Bill Baker has contacted the Greater Seattle organization and reported that they seemed interested in such an event. If possible, this event would be scheduled for Saturday, August 5th, preceding the Gold Cup by one day.

An interesting sidelight from Seattle concerns the club's successful attempts to involve their wives in R/C activities. The feminine modelers entered a Modified Speed Obstacle event held on March 19. On the 30th of the same month they had a 15-minute rat race with one required pit stop. On May 7th, three-lap pair racing was scheduled.

Besides being a complete success, it's a little easier to explain that $5-$6 per gallon fuel bill when the womenfolk become involved!

On Sunday, March 19, the SMYC ran the Speed Obstacle Course as presented in the March issue of RCM. The contest would have to be considered a success. The event was held at the Federal Way pond. It was estimated there were about 150-200 spectators, with almost ideal weather.

Nine contestants and 12 boats were entered. The course was approximately 75 yards by 50 yards with the middle buoys about 15 feet apart. Three engine classes were used: 0-.20; .21-.46; and .47 and over. A special ladies' event, running a modified course, was also held.

Jerry Dunlap pointing out next buoy to his wife, Maren. SMYC Women's events have proved popular.

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The Wolverine Miniature Race Boat Association, located in Detroit, Michigan, was organized rather late in 1966. Late, that is, for this section of the country where the snow flies early, consequently there were no racing events held in 1966. During the winter months they have been meeting once a month, the second Thursday of each month to be exact. Having no central meeting place, the Wolverines rotate the meetings in the homes of each member. The club running site is a gravel pit approximately 1200 x 400 feet, all fenced in with no interference or noise problems. We have a surveyed course laid out with buoys and a level site from which to operate, with activities every Sunday. This winter the club secured a 100/sec. clock and have ordered a power supply and sighting devices, hopefully to break some records come spring.

All of the boats are hydros at this moment, but have some prospective ski boaters interested in joining. All club members hold IMPBA cards and the group has applied for a club sanction. Officers for 1967 are: President, John Bridge, 24310 Prairie Lane, Warren, Michigan 48089; Vice President, Jack Bucknell, 25755 Forestview, Southfield, Michigan 48075; Secretary-Treasurer, Jack D. Paul.

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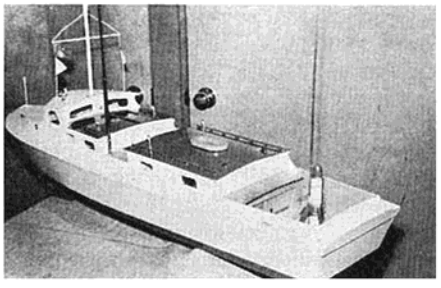
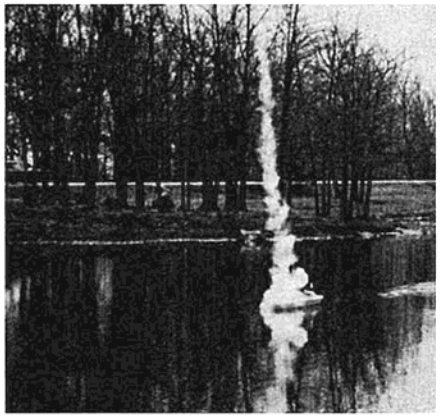
Pictured below is a 46" R/C model of the R.A.F. Crash Tender by AEROKIT just completed by Bill Zaiser, Bay Road, Stoughton, Mass. It is powered with two 12V Pittman motors with 2:1 reduction gearing. Motor power is from a 12V Honda motorcycle rechargeable wet cell battery. Bill made a slide type switch which gives him two forward speeds, one reverse, and off. This is operated by a trim servo. A second neutralizing servo operates rudder left and right (with quick links for easy adjustment) and a third servo operates two switches: one for a siren (bicycle type) and the other for shooting a rocket from the rear cockpit. The rockets are made from kits by Estes Industries, model rocketry being the hobby of his 13-year-old son Dana. Rocket ignition is attained with a nichrome wire powered by a 6V. lantern battery. The boat has a flashing masthead light, an operating spotlight, and the antenna is a telescoping type from a walkie-talkie. A Kraft 6 channel transmitter and receiver is used. This boat is very maneuverable, and operates realistically at a scale speed.





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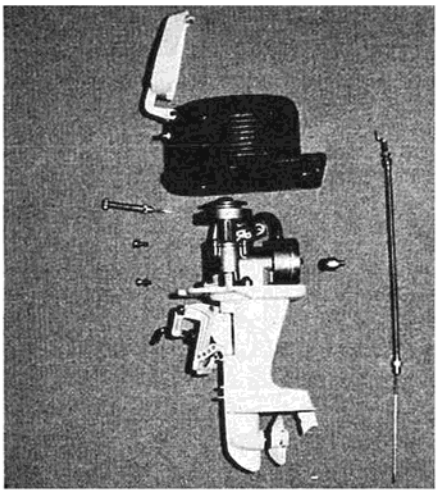
G.E.M. Models, P. O. Box 342, Broadview, Illinois 60153, is proud to announce the availability of the Fuji outboard for the discerning model builder. This completely scale-like outboard has a .15 cu. in. water-cooled engine concealed under the cover. Speed control is regulated through a scale-like throttle cable while the exhaust gases and exhaust water are discharged down the drive housing as per the prototype engines. The Fuji outboard is mounted via a scale type swivel bracket which is secured to the model transom by two screws. The engine may also be further adjusted as to rake for properly trimming out the hull. While the engine is typical to model engines in the fact that it is a rotary valve glow plug unit, it incorporates an integral water jacket and two stages of gears. The first gear stage raises the speed of the vertical drive shaft by a ratio of 16 to 13. The propeller speed is then reduced by a 2 to 1 bevel gear in the lower unit. The propeller is secured to the drive shaft by a shear pin arrangement similar to the full size outboards and the water pickup is mounted behind the propeller for cooling even if the engine is not in motion. The only necessary operation for installing the Fuji outboard on a model boat is an externally mounted fuel tank which greatly simplifies the model builder's previous chore of mounting a conventional inboard engine, stuffing box, rudder assembly and associated gear. The Fuji outboard is reasonably priced at $29.95.



ONE DESIGN . . . AND MODEL BOATING

WHEN the 45" Dumas Star Sailboat was introduced a little over a year ago, several members of the Greenwood Lake, New Jersey, Star Fleet (the full-size ones) immediately purchased the kits. By last fall two boats were finished and sailing. Shortly, other members of the fleet began building the models and now, when the ice breaks up this spring, there should be five of the Dumas Model Star boats competing against each other in the same waters where these sailors race their full-size Star boats.

Since this group of enthusiasts are aware of the very strict class rules of the full-size boats, it immediately became obvious to them that strict rules would have to be adhered to with the models in order to keep the competitive sailing on an even basis.

As a result, many of the boats were built in the shop of one of the members, and a system of weighing was adopted, assuring that the boats were truly "one design."

The great possibilities of model sailboat racing as a popular sport and hobby throughout the world have always been limited by the "design your own, build your own" precedent which was started in England. With the coming of the Santa Barbara one-design and the Dumas Star Model, just to mention two of the most popular, we are now stepping off into the world of competitive racing that limits winning only to helmsmanship, tactics, trim and experience; which have been the basics that have made full size yacht racing one of America's

fastest growing sports. The Model Star Yacht Racing Association presents a great step forward in model yacht racing. Those of us who own and race Dumas Stars can look forward to the opportunity of competing against sailors from all over the country without worrying about someone having an advantage because of weight, construction, or another type of hull, which may make our favorite boat noncompetitive.

It is a pleasant lot indeed to be able to spend the long hours necessary to build a beautiful model and be able to sail it for years, competitively, rather than having to continually make changes or build a completely new boat frequently.

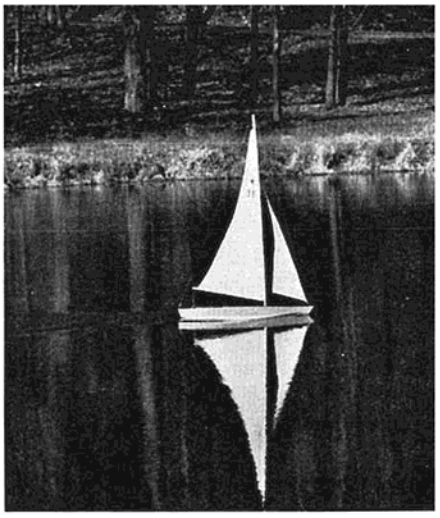
Subsequent to this construction program, one of the group, Bob Pettit (yes sir, THE Bob Pettit of Hobbypoxy), was elected president of the Model Star Class Yacht Racing Association, which was formed on the west coast by Frank D. Kelley of Spokane, Washington, and Don Dewey. The purpose of this new organization is to establish a hull and sail numbering program, set up fleets of Model Stars throughout the country and organize them into an international racing organization closely following the full-size International Star Class Yacht Racing Association (I.S.C.Y.R.A.).

Another member of the New Jersey group, who is helping with the program, is Pete Cutler. Pete, who sails a model Star as well as a full-size Star, is advertising manager of the ISCYRA. He will work with the Model Star group and help to set up fleets and district, national and international events; possibly even in conjunction with the same events conducted by the ISCYRA for full-size boats.

Pete Cutler, along with two other members of the New Jersey group, John Harris and Rick Glasier, spent several years actively competing slot cars. Their interest, besides Model Star racing, most naturally included model power boat racing, since all of them had also raced full-size power boats at one time or another.

Applying what these fellows had learned with some of the pitfalls of competitive slot car racing, they agreed that a "one design" group of R/C power boats would be a great asset to the sport.

Too many years had gone by where they had to build one or two scratch-built slot cars a week in order to remain competitive. The time involved for this effort proved not quite worth what the racing produced. To avoid this interest-reducing pitfall, the three agreed that they would select a readily available kit boat and reliable power plant and build a group of identical boats, with all parties making agreed changes, if desired. The desired result would be close competitive racing with the only difference in performance being generally one of tuning and driving ability.



Bob Pettit's Star just before the ice came in. (Incidentally, all of the Star Models are painted identically to their owner's full-size boats.)

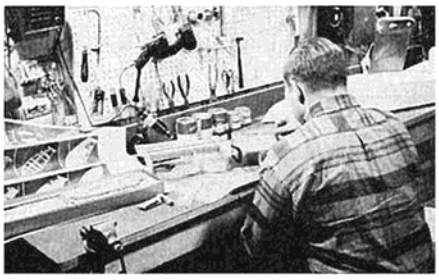
When John, Pete and Rick selected the Dumas SKdaddle Too Boat and the Enya .19 marine engine, Bob Pettit became interested too, and built one for himself. All the boats were built with 1/16" plywood bottoms, which is now being supplied with the Dumas kit instead of the 1/8" plywood which was standard at that time. Various types of radio gear are used in each boat; however, the hull and engines are identical, assuring close, exciting races and continuing interest.

With the wide variety of hop-up material, together with the ability of some people to build super-hot engines, it seems to us that some sort of stock boat racing, which is tightly controlled, is in order to create a continuing interest in the sport of R/C power model boat racing. Many of us simply do not have the time to spend on souping up engines, designing faster hulls and building every night into the wee hours. There is no reason why the vast majority of R/C power boat enthusiasts cannot have a class or a group of classes of their own, where they can build one or two boats and enjoy the fun of racing them for two or three years.

This plan has a greater effect on the driving ability of the participants than any other arrangement. Therefore, those members of the club who wish to go into scratch building of boats and engines, and go into competition in championship meets, can do so . . . and will go to these meets representing their boat club with a great degree of driving proficiency as well as the speed potential of their design.

This New Jersey club, for instance, now is building several other boats, for specific purposes, and as a result is attracting more members who can easily compete in many classes of races, yet who are not limited in any degree to any particular class of boat. For instance, they are now starting to consider building Tas and Enya 60 powered ski boats and hydros. On the other hand, are also building several Pittman slot car motor powered boats for straight line free racing. By the way, one enthusiastic member is installing single channel radio gear just to see if these boats could be raced on a closed course. Ultimately, they could be raced at indoor swimming pools, during the winter months. The activity in the east, in model boat racing as with most other hobbies, generally is a little behind the happenings in the west. However, in this case we feel that the west might consider the advantages designed to build longevity into the sport.

Rick Glasier of Morris Plains, N. J., busily glues on the bottom of his new ski boat in Pete Cutler's basement workshop in Convent Station, N. J. Cutler's Star in the background.



In full-size power and sail boat racing there are always stock one design classes as well as "development classes." The development classes are time consuming and expensive and generally require a certain amount of commercial support in order to be continued. The development classes usually offer the most spectator interest. However, the one design and stock classes are the stabilizing factors which hold racing together and produce the next crop of "hot drivers." Many of us would like to be capable of designing, building and racing boats like those of Steve Muck and Jim Whitlatch. However, very few of us are capable of starting out at that level. We do not have the experience, the ability or the time to devote. However, we are sure that a few of us who cut our teeth racing a relatively simple and readily available Enya powered SKdaddle Too will learn enough and get interested enough to someday try and climb the heights toward building hulls and engines, necessary in trying to become a record holder.

Setting up a "stabilizing" one-design power boat class is easy: for club racing, which after all is the basis for the entire R/C boating fraternity, select one or two members whose job it will be to pick

(Continued on Page 46)

AMP GATE CHARGER

(Continued from Page 41)

Now you may install the A.G.D.'s (don't clip the leads). The leads look a little strange, don't they? Kinda big and have a funny color. Well they're made that way on purpose; in fact the leads help determine part of the diode's unique characteristics, so don't clip them off but neatly put a loop in them and push just enough of the lead through the hole in the board to insure a good solder connection. See Figure 5.

I'll assume that you have already decided how you will connect the charger to the batteries so do that, I'll wait —

Now connect your milliammeter between the positive output of the charger and the positive input to the A.G.D.'s (where the jumper is shown). See Figure 4. Set the scale at some high value; half an amp should do it. Turn everything on and adjust the meter up scale or down scale, whichever is necessary, and make a reading. About 300 ma. is good. Now disconnect the batteries, but leave the meter connected; now turn the thing back on. No, there's nothing wrong; just because you measure almost the same current with the batteries disconnected is no reason to get upset. It just shows that the diodes have almost the same characteristics as the batteries and therefore will draw almost the same current.

EXTRA NOTES

The photographs of my unit show the deluxe version built into a 3 x 4 x 5 aluminum box. If you don't plan on using an external charging source, such as a car battery, etc., you can omit the external-internal switch and the 4 jacks on the front of the box. The unit as shown will charge at about 125 m.a. when a 12-volt car battery is used as an external source. This value can be raised by lowering the values of the two 10-ohm resistors slightly, however I don't recommend making them too small.

Without these resistors in the circuit, the internal charger will deliver about 650-700 m.a. and while this is within the limits of the A.G.D.'s they do run pretty hot at this current. As the unit stands it will charge at about 300 m.a., and will charge a completely dead 500 M.A.H. pack in about 2.5-3 hours.

I do not like to emphasize the speed at which this unit will charge a nicad pack however, because the most significant thing about this unit is the fact it **charges each cell in the pack separately and makes sure that each cell is charged to the same level.** Also, this unit makes overcharging and reverse charging a thing of the past.

Well, that's about it. Package the whole thing up neatly, use it, and check your cells under load occasionally. Build the Amp Gate Charger — you'll get a charge out of it!

TECH EDITOR'S NOTES

There is some question as to the effects of internal "gassing" as nicads are charged at an accelerated rate. The most common types in use, by RC'ers, are the sealed button and pencell types of 500-1.2 A.H. capacity. Also the plastic surplus type of various M.A.H. ratings that are used for glo-plugs and have an opening in the top for adding electrolite which is sealed off with a screw while in use. The sealed versions are normally protected internally to some degree to prevent damage due to excessive gassing while the surplus types usually are not.

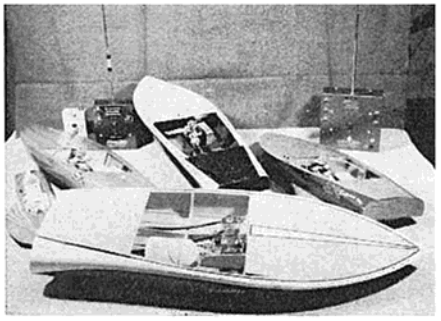
It is recommended that the maximum charge should not exceed .6 of the M.A.H rating with the above in mind. This means if you are using 500 M.A.H. cells, the charging rate for discharged cells should be set at 300 M.A. by adjustment of the series resistance between the charging source and the A.G.D.'s. This will give you a charging time of approximately 3 hours. If you are charging any nicad with a vent, such as the surplus types, be sure to remove the screw to allow gas to escape. Also be careful about smoking around vented nicads as the gas released is inflammable.

RCM is always looking for, and printing, articles which will advance our hobby in the hope that it will improve your enjoyment. To this end repeated tests by the author and RCM have shown no damage to cells when charged or discharged by the method presented. However, due to the varying quality and construction of nicads RCM assumes no responsibility for loss or damage caused by the use of this charger.

ONE DESIGN . . . AND MODEL BOATING

(Continued from Page 45)

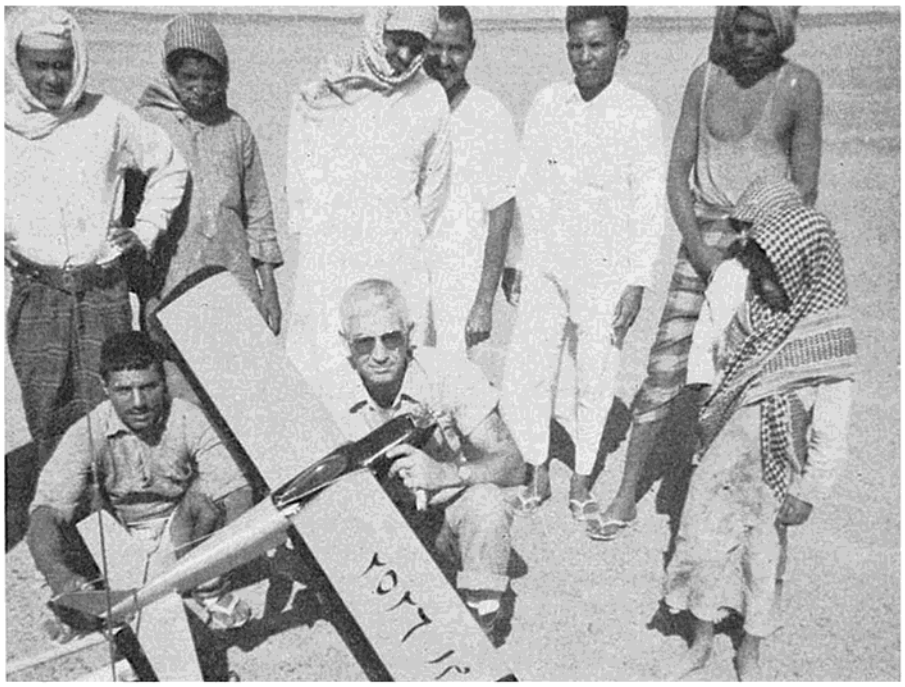
A close up of the presently completed R/C power boats that the New Jersey group has built.



out the most reliable group of products available for components, and a widely available stock boat kit that can be built quickly and easily; then set a date for all the boats to be completed, where they can be weighed and checked against each other for similarity and, of course, the engines examined for signs of cleaning up ports and other modifications. Once the boats and engines have been inspected and found to be stock, a metal or plastic tag can be affixed to the interior of the boat or a mark stamped or burned into the hull to indicate that the boat has been checked. Then it is just a matter of having fun racing and trying to squeeze out the ultimate performance to get the most speed around the course, through tuning, weight balance, and helmsmanship.

It is a thought . . . it worked in one part of the east . . . and we think it is worth the consideration of all groups of R/C boating enthusiasts.

CUNNINGHAM ON R/C



Jim Kasson flies his Digitrio equipped Tauri from the Sahara Desert! Note his flying companions in Saudi-Arabia!

THE peaceful blue sky was suddenly shattered by the whine of an aircraft engine. Nervous eyes shifted skyward to see this terror. The pitch of the engine rose higher and higher. A mad scramble enveloped on the ground. Shelter, any kind of shelter. And then . . . Wham! The hit!

Could this be your flying field on an average Sunday afternoon? Sure it could, or any other field for that matter. We all know that many many things can and do happen to bring the birds out of the sky. Even some of the strangest things. . . . Like last Sunday, there I was, making a down wind shallow dive when all of a sudden my entire rudder and vertical stab parted company from the rest of the aircraft. You know, the darn things fly pretty good without a rudder. Of course the thirty mph wind didn't help things too much but a one piece landing saved the ship for another day. The point is, though, that many unexpected things can come along to disrupt a good flight, and when that unexpected does happen, what are the safeguards at your field?

I've read in a number of the newsletters lately that safety is becoming more than just a word. It has to become a really living thing if we are to continue to enjoy this sport. At best, in most areas we are barely tolerated by the general public. Of course the afternoon spectators like to watch us, but those who happen to live or work in sounding range of most fields would like to see us fold our tents and slip silently away. Think what an uproar a major accident would cause. I'm sure that most of you do not know that about a year and a half ago a small boy was killed by an out-of-control multi ship. It didn't get widespread news coverage, but it could have caused a big reaction to this sport. Of course you read all of the time about major accidents in many sports, but usually where there is a commercial aspect to the sport the accidents are shrugged off by the general public. Not so with us. With this in mind it is time that we all take a good look at our own flying fields and habits and try to see just how safe we can make them. It is not a bad idea to appoint someone to be a safety officer. In our club we call them Field Marshalls and have equipped them with gold badges. They are charged with the responsibility of seeing that the fliers obey the safety rules and that the spectators stay in a reasonable area.

The physical layout of your flying field, and the number of spectators present has a lot to do with your emphasis on safety. If you fly in a remote area with little chance for an onlooker then you needn't bother with too much safety other than for yourself and your fellow pilot, but if you are in a populated area then it is smart thinking to get together and to formulate a good set of liveable rules.

Naturally your field is laid out with the prevailing wind in mind, since it is impossible to contend with a four quarter wind, but generally speaking, the wind in each area is probably constant from one or two directions most of the time. If you have a prevailing South wind then it is a good idea to lay out your field and the parking area so that the pit and parking facilities are on the West side of the field. This does double duty by allowing the sun to be at your back most of the time in afternoon flying. All pit areas and parking should be as far as practical away from the runway, and a clear space should be left between the pit area and the landing strip. In no case should the landing or take off pattern be over either the pit or parking areas, as this simply invites disaster. Also, any flying should be done over an open area *away* from the spectators and flyers and in a place that would leave plenty of room in case of an aborted flight. Any flying over the spectator areas should be forbidden — especially stunting over this area!

Transmitters and frequency control is a problem at most fields. Impounding the transmitters is not a bad idea, but unless someone is in charge of doing this, it is difficult to enforce since a new arrival, or a visiting flyer, may not be aware of the rules.

Probably the best method of frequency control is to divide the pit area into several sections, each section marked out with the color of the frequency, or the number. By requiring all flyers on the same frequency to pit in the same location they can each work out their own flight lines.

Safety is really a matter of good common sense. If you have ever dealt with insurance companies setting up workmen's compensation insurance in a manufacturing plant, then you know that these companies employ safety engineers who investigate your plant and make suggestions for safety improvements to prevent accidents and to hold down your insurance rates. In most cases those people connected with the subject company could make their own safety recommendation and do as good a service as do the safety engineers, but

they generally don't bother to do this. It's a case of "can't see the forest for the trees" . . . and we are in the same boat. We know what to do to keep it safe, but we simply don't take the time to do it.

Perhaps it would be a good idea if the AMA were to generate some rules to govern safety along with the rules governing competition. In this way it would then be possible to standardize flying field procedure and protocol so that almost all fields could be operated in a similar fashion. Pity the poor AMA, here is another guy telling them what they ought to do!

In order to promote safety and a standardization of the rules, we offer the following as a guide to those formulating safety ideas. (1) Make a safe physical layout of the field. (2) Formulate in writing and widely circulate any ground rules (or air rules) for your particular field. (3) Outlaw any flying over spectators or pit areas. (4) Set up a procedure for takeoff and landing control, much as a control tower. (5) Appoint someone to be in charge of safety. (6) Don't legislate all of the fun out of flying, just the hazards. (7) Set up firm frequency control methods.

In all parts of this country the flying and contest season is now in full swing. Many of you have spent the entire winter building in order to get ready for this time. It's a shame if some unforeseen event removes you from the air for even two or three weekends. The best way to prevent this is to have several ships in reserve. I know some fliers that keep a whole stable of ships ready to go, just in case something does happen to one or the other or their fleet. For some time now I've worked on various ideas to develope quick and easy methods of building big multi ships and also ways of holding down the cost of them. The two ideas really do go hand in hand.

I've found that in the past year or two I have become less and less fond of building and more fond of flying. Proportional radio has a lot to do with this feeling, but also, after a time, most of us simply get tired of building. If any of my fellow club members or flying buddies ever saw me show up at the field with a beautifully finished and trimmed ship, with seven million hand rubbed coats of dope they would all die right on the spot.

I personally hate the finishing part of building. Some guys eat up this aspect, but not me. When the structure is done I'm all for getting out to the field to see what happens. If you love to paint, rub, pin stripe, trim, and so forth I take my hat off to you. If you like to have a reasonably decent ship to fly then come on over to my corner and I'll tell you of a few new ideas that have come my way to get you into the air faster and cheaper.

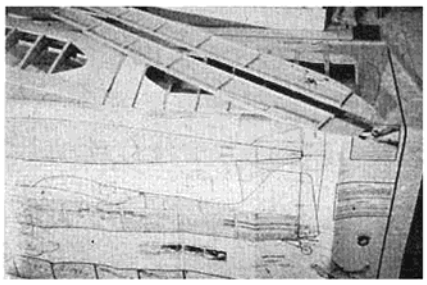
Two years ago I wrote an article on "Saving Time and Money on Your Next R/C." In that article were several thoughts on building and finishing that seemed to be a big help to me. Now, though, I think that an even quicker and cheaper method can be used to build than those pushed a short two years ago. I, along with most every one, dislike to build and cover and paint wings. Foam wings have greatly simplified the building part, especially if you cut out your own foam wings. All that is required in cutting foam wings is a steady hand, a foam cutting bow and transformer, and a well trained wife (who has an understanding husband who does not blame all of the goofs on her). It is a two man (?) operation, so if you try the foam route, enlist your wife as one end of the wire holder. It is much easier than getting a building buddy over to help.

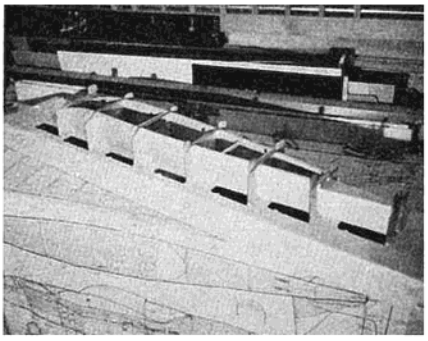
But back to the subject. With a foam wing all cut out and ready to go the next problem is what to cover it with. I've tried a number of different things, from balsa to mahogany veneer, to paper sheet plastic, and finally to cardboard. The last is *it*. No joke! I was first introduced to cardboard covered wings by Gerry Krause of EK Products, the builders of Logictrol proportional gear. I don't know where Gerry came up with cardboard as a covering material so no doubt proper credit cannot be given to the inventive genius that thought up the idea, but it works. It is far superior to balsa, superior in every way. I have tried poster board that is about 1/32" thick with a slick paper side on one surface. This does make a rather heavy wing, about 6 to 8 ounces heavier than a balsa covering, but several hundred times stronger. To finish this wing, all you need to do is spray on a couple of coats of quick dry enamel and it's done. I have some lighter cardboard to try next. The latter appears to be about the thickness of real heavy paper, but has a smooth, hard surface. The coat is really great! A sheet of the poster board I first used was thirty five cents for a 28" x 36" piece. Two sheets is enough for one wing plus a stab plus some to give to the kids to chop up in any way that they want. Think of it, a complete wing skin for about fifty cents! Now if you really like to put on a good finish you can dope over the cardboard to get a beautiful shine, or you can top it off with Mono Kote. The under surface is hard, smooth, and has no ridges or seems to mar the finish. One word of advice though, cardboard does have grain. I didn't think that it had, but it does, and Bob Campbell, one of the weekend residents of our flying field showed me how to find the grain. (After I had already covered my wing against the grain.) Try folding a piece of the cardboard, if it folds cleanly with no wavering of the fold line you are folding with the grain, if not, against the grain.

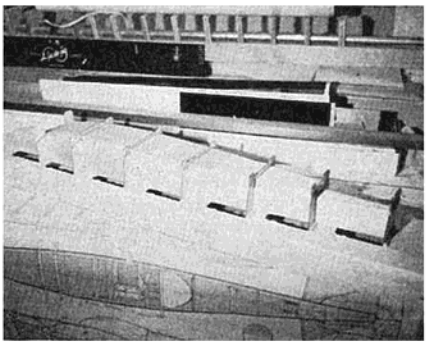
Let the grain be parallel to the span of the wing, then when you wrap it around the leading edge it will lay flat along this surface and will not try and bow back. The finished wing will be strong as the dickens, true without warps, and quick and easy to build. Use only a main center section brace of 1/8 to 1/4 plywood, extending about six inches into each wing panel. Install the landing gear trunions and torque blocks next to this main spar and epoxy together. Sweep the landing gear wire to the rear to get the proper wheel location. Wrap the center section with a 6" wide piece of fiber glass and apply the resin to it. There it is . . . a beautiful wing with not much work and, except for the foam, very little money. If you do cut the wings out yourself you can save a lot of expense on this item as well.

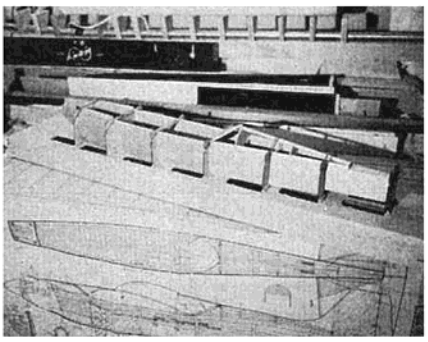
A fuselage can be either a terrific chore or can be completed in a very short time . . . it all depends on what you want. But again, if you want something quick and easy you can whip up a simple balsa box, reinforce it with plywood and set up an easy jig to build it in. Use contact adhesives for gluing in all doublers and this will save many hours of drying time and warps. If you have seen one of the new Ply Fly fuselages you will realize that here is another construction method that has been developed to make flying easier, and it is a very good one. Vacuum formed plastic fuselages as are used on the Lanier kits are making their way into the hobby shops and, though not inexpensive, they provide a way of securing a quick, good looking fuselage.

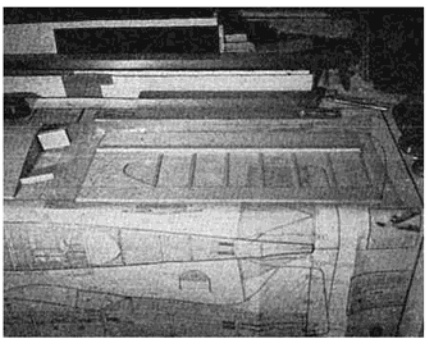
With great apologies to Phil Kraft, I have a ship that incorporates all of the above ideas, a foam and cardboard wing, a simple box fuselage with balsa vertical and horizontal stabilizers that I call the "Cheap Fly." And it is . . . the total cost of this ship, including two cans of spray enamel from the corner hardware store and excluding all of the necessary hardware such as kwick links, landing gears etc., is about four and a half bucks! And it's a full house propo ship with a .61 in the nose. I'll have to admit that the foam for the wings was secured more cheaply than usual, but if you exercise the old American trait of scrounging around, you can come up with expanded bead polystyrene foam used in flotation and insulation for about eleven or twelve cents a board foot. It may take some doing, but the savings is worth the effort. Don't tell 'em what you're going to use it for . . . no one ever understands what the heck a grown man is doing playing with toys, just say you're going to float your fishing boat, or to insulate your dog house, or some other worthy and accepted enterprise.

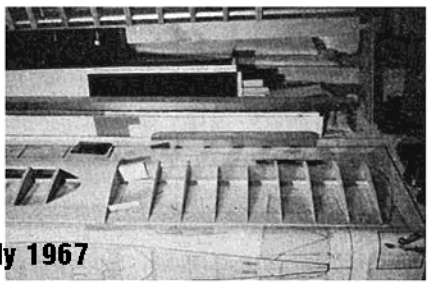












KITS & PIECES

BERNIE MURPHY

Top Dawg(s) by Top Flite, Min-X, and Schulz!

WE just received Top Flite's Top Dawg, and all other projects ceased. Ken Willard's original version of this ship had impressed us to the point of scratch building one. Now we have the Top Dawg in kit form.

Upon opening the kit, we were pleased with the neat appearance of the kit. Of immediate interest was the high quality of the balsa, and the unusually clean die cutting. Excellent vacuum formed wing tips and canopy are included (these later proved to fit perfectly). Landing gear is sturdy preformed tempered aluminum. A "goody" bag of accessories provides almost all of the hardware (screws, nuts, eyelets, nylon horns and tail wheel bracket etc., etc. — even rubber bands for assembly in the box jig!).

The first assembly step consisted of removing all of the parts from the box bottom, and converting it into a unique construction jig. Die cut supports are folded out of the carton and reinforced with 3/16 square balsa provided. The entire idea seemed a little weird, but the successful use of this innovation has sold us. The jig is TERRIFIC! Top Flite calls it T.A.C. (true alignment construction).

The photos pretty well show the construction procedure. The fuselage sides are first framed with 3/16 square stringers and uprights, and nose and landing gear supports added (be sure you make one right and one left). Location of vertical bracing and bulkheads is determined by placing one side over the plan and transferring positions (wing dowel holes should be used for positioning). Use the marked side to locate positions on opposite side assuring that the sides will match. The top stringer position is not completely clear on the plans. This stringer should be perfectly straight, and flush with the top of the fuselage sides, fore and aft, covering the notch in the sides. The front of this stringer ends flush with the front of the firewall, 1/8 inch forward of the vertical brace.

After the framing has completely dried, the sides are placed into the jig and the bulkheads and cross braces added. Rubber bands (supplied) are stretched across the top of the supports, and the entire framework is securely held — and in true alignment (T.A.C.)! Bottom sheeting is also added while in the jig. While the fuselage is drying is a good time to begin the wing construction.

After the fuselage has dried thoroughly, it is removed from the jig, turned over and replaced in the jig. (Center jig support, which held the sides apart during initial set up is now folded down.) Top framework is now added. (Note: 1/4 squares in hatch area are flush with outside of side sheeting.) Although the plans call for the turtledeck sheeting to be added at this point, we preferred to wait until the wing had been completed and fitted. This allowed us to sand all of the framework prior to covering — assuring a good fit between fuselage and wing fairings.

Wing construction of the Top Dawg is simple and true (as true as your building board). Bottom leading and trailing edge planking is pinned down, followed by die cut center section planking and cap strips. The bottom spar (notched for ribs) is then glued to the bottom sheeting. Wing ribs are glued into place and the top spar and shaped leading edge added. Spar joiners are also installed. After a few minutes, to allow the glue to "set," the top sheeting and cap strips can be added, using rubber bands pinned to the board to hold

the entire framework tight and flat.

After the first panel has dried thoroughly, it can be removed from the board and the second panel built in the same manner. The first panel built is butted against the bottom sheeting of the second panel and propped to the correct dihedral angle. The second panel is thereby built onto the first one, and when dry a *completed* wing is removed from the building board. Tape supplied is used to reinforce the center joint.

The completed wing was fitted to the fuselage, and top framework completed. Planking of the turtledeck, cowl and wing fairings requires a little patience and some trimming (sheeting is purposely oversize to allow fitting). Grain in the sheeting has been carefully planned and the wood selected to allow easy bending. A little extra care here will be rewarding in the finished job!

Fuselage doublers F-34 required a little trimming to produce the correct down thrust angle. It is a good idea to mark the motor mount position onto the fuse sides, per the plans. Adjust F-34 for a tight fit at the firewall, with the top edge forming the seat for the motor mount. Nose ring F-30 is glued onto the front of the fuselage sides and F-34 in a centered position. After this assembly has dried, the entire fuselage can be finish sanded.

Stabilizer is built up — two sheets with framework ribbing. Stab sheets are printed with the rib pattern. The only caution here is to keep the assembly heavily weighted on a flat surface until dry. Fin, rudder, and elevator are die cut sheet stock. After finish sanding, the fin and stab can be glued to the fuselage.

Plans show GG installation using the Rand LR-3, and mounting rails and formers are provided. Should you desire to use other gear, modifications will be simple.

An unmarked balsa bulkhead is supplied to form a battery compartment. This piece and the motor mounts, both of which are packed in the hardware package are unmarked. Another unmarked strip is provided for fill blocks beside the fin. All other parts are *clearly* marked in numerical order, closely following their order of assembly.

Wheel pants are built "sandwich style" and then sanded to a streamline contour. Hardware for installation is provided, the 6-32 screws in our kit proved to be too short, this condition has been corrected. You will need a pair of 2¼ in. wheels. A wood tail wheel (a la rubber ships) is supplied-OK it's better than nothing!

Our Top Dawg has been outfitted with a new Min-X system, the GG-1R. This is a pulsing rudder — elevator unit with trimmable throttle (Galloping Ghost). This is, in our opinion, one of the finest pulse proportional Gallopping Ghost systems available. An electronic switcher built into the receiver has eliminated the relay and its associated problems, as well as allowing the entire airborne system to operate from one small 3.75 volt rechargeable power pack. The receiver measures only ¾ x 1 7/16 x 1 15/16. Total airborne weight of this system is a mere 7 ounces.

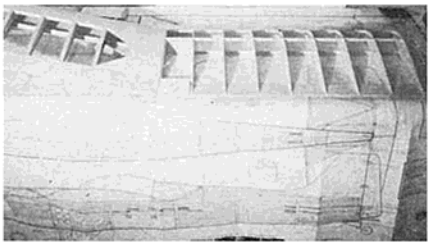
In the interests of time and weight, it was decided to cover and trim the Top Dawg with Mono Kote — Top Flite all the way! Since the curves are simple, this is an easy ship to cover with Mono Kote — although we did "chicken out" on the wheel pants. These were done via the Hobbypoxy "Easy Does It" route — epoxy sealer and White HP finish. The end result was a great looking little ship in a minimum of time. Do not attempt to cover the formed butyrate tips with Mono Kote, as the heat will deform them! The inside of the tips should be painted using Testor's TCL lacquer or plastic paints. The tips are added after the ship is completely finished, and can be held on very neatly with a thin stripe of Mono Kote. A thin coat of polyurethane varnish or clear epoxy paint along Mono Kote seams in heavy fuel areas will assure a complete seal.

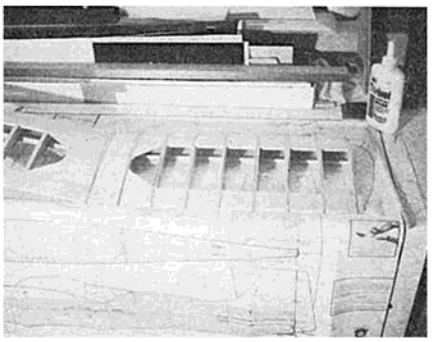
The motor plate of our ship was fitted with an OS Max 10 RC, and the hatch block cut out to receive a 2 oz. bottle tank. The aluminum sheet provided was fitted around the engine, completing the cowling and our Top Dawg. Total weight — less fuel — a shade under 30 ounces!

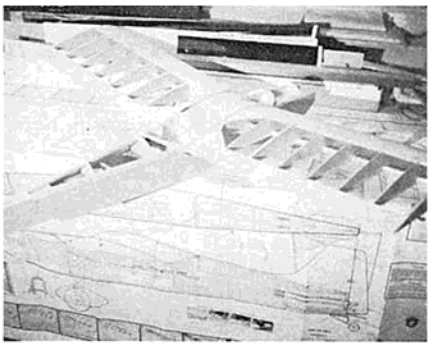
Flight tests were performed under less than ideal conditions, primarily a gusty, shifting wind. We had anticipated a left turning tendency, due to a lack of right engine thrust, but none developed. Off the board (Ed. note: Don't you mean off the box?) the ship flew with a gentle climb and *very* shallow left turn. One turn on the elevator link and the trim was perfect. The Max 10 at full bore makes the ship quite fast, but proved more than a match for the windy conditions — downwind — woosh! With the peak off of the engine the ship became quite docile, and should be a good flyer for the novice with a good .049 engine provided the weight is kept below 30 ounces.

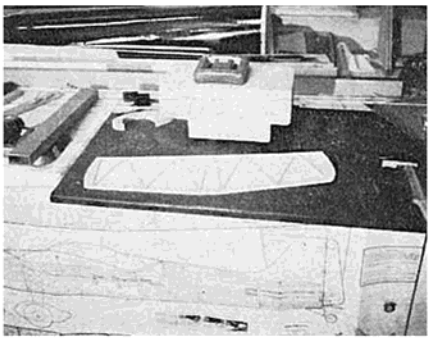
For you hot shots, there is room to fit in three channels of multi reed or propo gear along with a .15 engine. We are starting T.D. number 2 with ailerons — ready for one of Bonner's miniature 4RS full house systems!

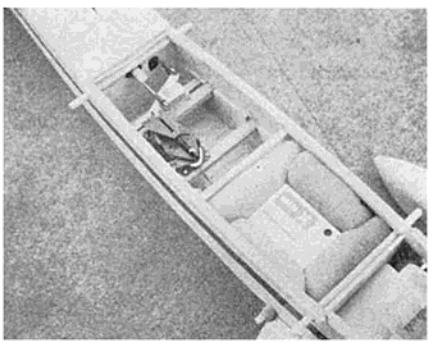
The Top Dawg is just that! A quick building ship for Galloping Ghost or rudder only, in a convenient size, (40 inch span), a ship that will really perform. We highly recommend the Top Dawg, it's from Top Flite, and it's TOPS. This one *is available* at your dealers — and at a most reasonable price — $12.95.









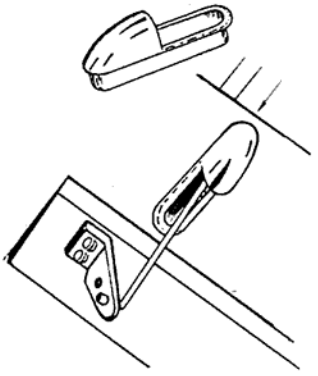


SHOWCASE '67

Additional information on Showcase '67 items can be obtained from RCM's Reader Service Dept. See page 77.

Orbit Electronics announces the opening of an authorized factory sales and service center in Montgomery, Alabama. This new facility provides Orbit system owners in the eastern states faster service at more economical rates, because of the shorter shipping distances. Warranties, inquiries, and items for service should be directed to: **Orbit Factory Sales and Service Center, P. O. Box 2681, Montgomery, Alabama 36105.** Pacific Coast and western states customers will continue to be served by Orbit Electronics, Inc., 11601 Anabel Avenue, Garden Grove, California 92640. For information on the complete line of Orbit products, **Circle #1 on the Reader Service Card.**

A new accessory will soon be available from **Crescent Industries, Inc., New Freedom, Pennsylvania.** Added to their popular Delrin pushrod exit guide is their aileron pushrod exit featuring a wing shield for low drag efficiency. Molded of nylon, its slot is 3/16" wide by 1" long. Price per pair will be 75c. For further information, **Circle #2 on the Reader Service Card.**

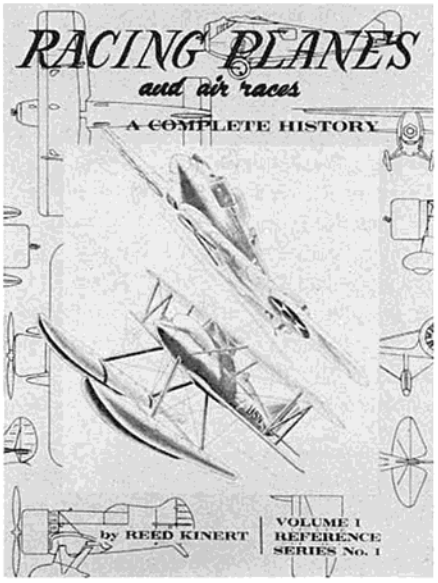


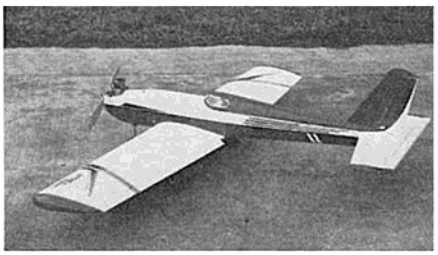
Rocket City R/C Specialties, 1901 Polk Drive N.E., Huntsville, Alabama, has released their new Thottle-Eze. This device will make the throttle hookup on your plane a fast and easy experience. Featuring an override mechanism, the Throttle-Eze eliminates the problem of a different amount of travel between the servo and the throttle linkage. Designed primarily for linear output servos such as the Kraft or PCS, it can be adapted to virtually any servomechanism. Price is 98c. Tested, approved, and recommended by RCM. For further information, **Circle #3 on the Reader Service Card.**

Jerry Johnson, the "Motor Man," P. O. Box 863, Woodland Hills, California 91364, has announced the import of the complete line of Taipan twin ball race engines. The first in the series, the Taipan .19 B.B., was tested by RCM and found to be one of the finest quality engines we have seen — both from a production and a performance standpoint. Power curves, starting, idle, and reliability are excellent. Soon to arrive are the Taipan .09, .29, .35, .45 and .61. All Australian made Taipan's are twin ball race with ultra precision craftsmanship for those RC'ers demanding the highest calibre mill. Mufflers are available for all engines. Price for the .19 BB R/C is $24.95. The muffler, which by the way demonstrated effective silencing with virtually no power loss, lists for $3.75. Dealer inquiries are invited. For further information, **Circle #4 on the Reader Service Card.**

X-Acto, Inc., 48-41 Van Dam Street, Long Island City, N.Y. 11101, has produced a Soldering Iron that turns into a Hot Knife. All that is required is to simply change the tip. This is a perfect tool for modeling for removing epoxy or flashing, cutting plastic, or reworking connectors. Complete with instructions, the X-Acto #378 Soldering Iron and Hot Knife Kit is $4.00. For complete information, **Circle #5 on the Reader Service Card.**

Aero Publishers, Inc., 329 Aviation Rd., Fallbrook, Calif. 92028, has published Volume 1 of 'Racing Planes and Air Races — A Complete History.' This $3 book, profusely illustrated with a rare collection of photographs, is a must for RC'ers interested in aviation's racing hall of fame. Volume 1 covers air races from 1909 to 1923; Volume 2, 1924-1931; and Volume 3, 1932 to the present. For further information, **Circle #6 on the Reader Service Card.**

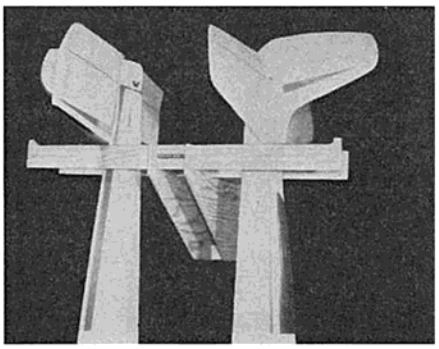




The newest in an excellent line of ready-to-fly aircraft from **Lanier Industries, Inc., Briarwood Rd., Oakwood, Georgia 30566,** is the Pursuit. Styled to suit racing fans, the Pursuit is similar to the well tested and proven Lanier Bronco and Thunderball. The best thing about the announcement of the Pursuit is that it is in stock, ready for shipment. Span is 65", area 630 sq. in. Power requirement is from .45 to .60. 17% symmetrical airfoil. For further information, **Circle #7 on the Reader Service Card.**

Something new from **Finishing Touch Decals, 9941 Debbie Drive, El Paso, Texas 79925,** is their offer to produce club decals on a custom order basis. Finishing Touch will produce these decals, not to exceed 3" square, in lots of 500, using up to five colors (red, white, blue, black, and yellow) including finished artwork (from a color sketch) for a flat fee of $75. Maximum time required is 120 days. For further information, **Circle #8 on the Reader Service Card.**

More-Craft Products Co., 567 Darwin Blvd., Rahway, N. J. 07065, manufacturers of the popular Planemate Field Box, Tote-All tool box, and Wingaway storage rack, has released their Fuseway, a wall-mounted unit for easily storing four fuselages. Made of mahogany plywood, the price is only $4.95. For further information, **Circle #9 on the Reader Service Card.**



Tatone Products, 1275 Geneva Ave., San Francisco, Calif., now has available the smallest, neatest booster battery that you have ever seen. A specially designed metal clip slides over a 1.2 nickel cadmium battery and is adjustable for any size engine, ½A to .74. It's so easy to use that you will wonder why someone didn't think of it sooner. No messy wires or alligator clips to bother with. The Tatone Pocket Booster is $2.25 and the matching charger $1.75 each. For further information, **Circle #10 on the Reader Service Card.**

Fliteglas Laminates, P. O. Box 915, Felton, California, announces their Pagan Mk I, employing the ultimate in fiberglass fuselage design for the RC'er who demands the finest. Custom foam wings and hardware are included with this striking low wing Class III machine. 66" span, 750 sq. in., for .45 to .61 power. When ordering, specify vertical beam or sidewinder mounts (radial). Complete kit with fiberglass fuselage, foam wings, hardware, etc., is $47.50. Fuselage only is $27.50. For further information, **Circle #11 on the Reader Service Card.**

Greece City Xanthi by Night

Old City Xanthi Street

Old City Xanthi House

Xanthi Central Square

Xanthi Lake Vistonida

Xanthi River Nestos

Xanthi Old House M.Xatzidakis

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