AMERICAN AIRCRAFT modeler

FEBRUARY 1968 60c 7/-

Glenn Lee on 2-Cycle Engines

Bud Atkinson's Beech Mentor RC

Meet Aeromite and Acromite

PAGE 31

Focke-Wulf

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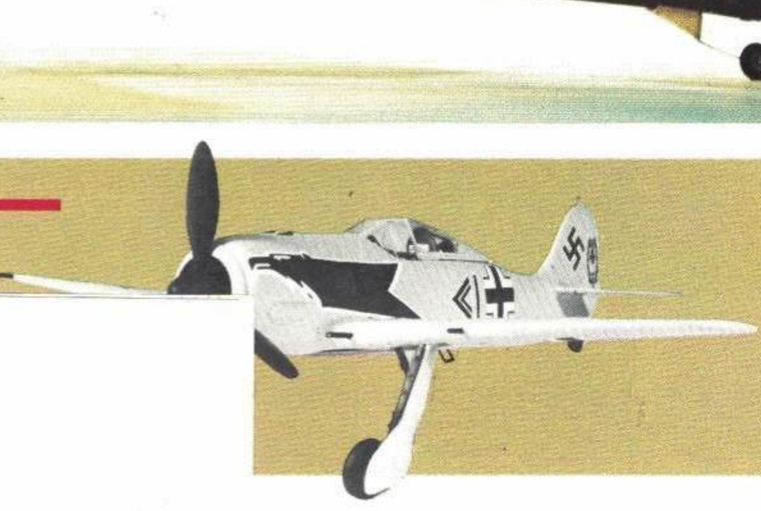

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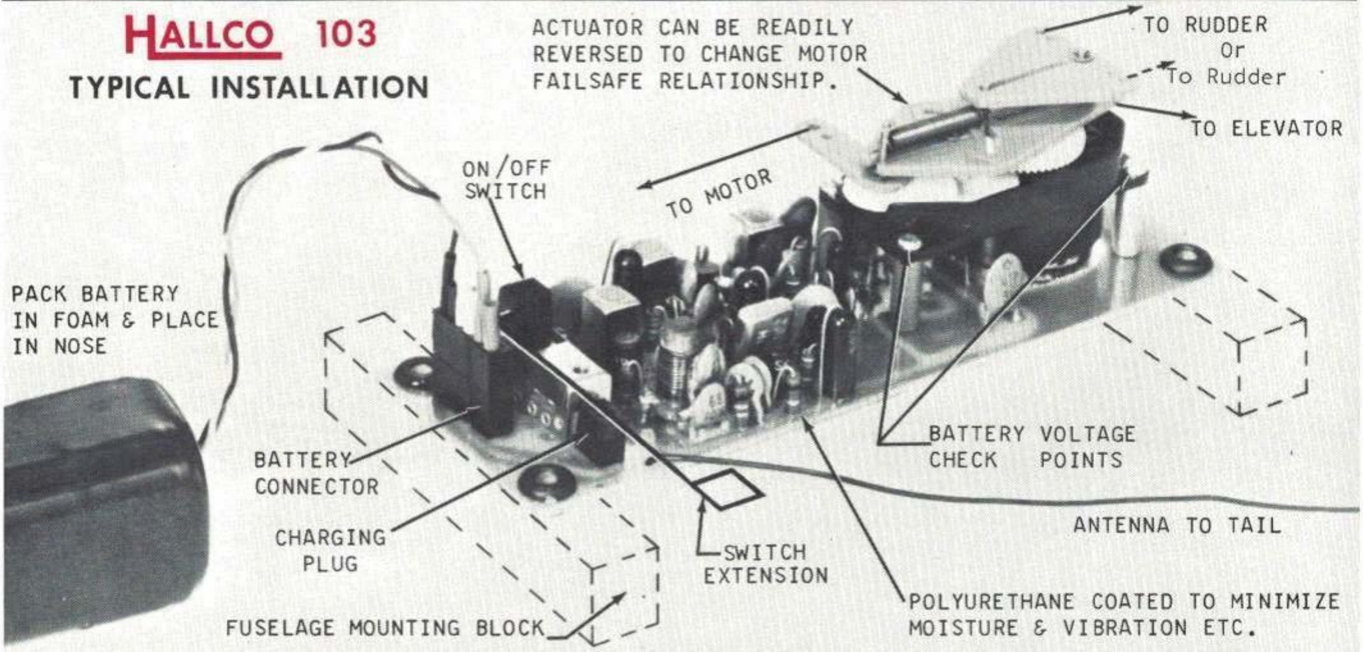

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AMERICAN AIRCRAFT modeler

VOLUME 66, NUMBER 2 FEBRUARY 1968

COVER PHOTO: There's a story behind Frank Pierce's interesting studio shot of the two cute RC jobs. It seems that Frank was experimenting with unique effects, just fooling around, so to speak. He should fool more often!

WILLIAM J. WINTER — EDITOR AND PUBLISHER

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Sally Barry, Production Editor

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STRAIGHT AND LEVEL

Would you believe: For every two boys between 12 and 15 years of age who build airplanes, one prefers rock collecting?

A survey is a valuable tool. It provides facts. Without facts one cannot conduct an effective business or, in any endeavour, obtain optimum results. It is nearly 30 years since a decent survey was conducted in this field. We mill around like a gaggle of opinionated idiots. Everybody is an expert. In the confusion of tongues, little is accomplished. Yet to meet our problems we need more than ever to know facts.

Before the writer is a 48-page, impressively documented survey tabulation: The Seventh Triennial Youth Market Survey, by *The Young Catholic Messenger*. *The Young Catholic Messenger* has an audience of 615,000 young people (survey between ages 12-15), and is described as a teaching aid. It is to be noted that the survey, like so many conducted by magazines, is aimed at the procurement of advertising — you need facts to impress prospective customers. The *Messenger* perhaps is not the largest thing of its kind — but it well serves our discussion. Its present list of advertisers includes Cox, Revell, AMT, Aurora.

Without reading significance into the survey results, a rundown of facts, as they occur, may be interesting. Of the boys some 52.1% receive a weekly allowance amounting to $1.09; 59% of the girls receive an average of $1.10. Some 65.8% of the boys earn additional spending money, averaging $4.81 weekly; for the girls, it is 52.3% and $2.39 weekly. Almost 95% of both boys and girls save money; how much is not stated.

A total of 3200 questionaires was sent to students in 1600 schools selected on a geographical pattern. 747 boys answered questions on hobbies. As of last June, 4% of these built model airplanes, 15.7% cars, 16.7% simply "models." 18.9% collect coins, 15.1% stamps, and, would you believe (?), 2% collect rocks. So for every two boys who build model airplanes, one collects rocks. Since the survey the slot-car market dropped off.

You may be interested in reading preference. The first 10 magazines are: *Boy's Life*, *American Girl*, *Life*, *Look*, *Catholic Miss*, *16 Magazine*, *Seventeen*, *Teen*, *Reader's Digest*, and *National Geographic*. Among magazines specifically mentioned in accountable quantity is MAD. Buried in miscellanous must be the model airplane magazines; but before industry reads anything into this, we point out that the only brand names apparently known to these youths are the better known plastic scale kit manufacturers. And monster kits are quite popular.

To the question "what type of kits have you had," 676 boys and 351 girls responded. 87.4% of these boys have had car kits, 73.7% airplane kits and (21% were engine-powered planes) 12.3% power-operated cars. Monster kits check in at 41.4%. Again, no comment! Boats rate 55.9%, trains 32.8%.

Of approximately 860 boys answering the question, 83 entered contests; also 9 girls from about 900. Of 76 boys from that 860, three (4%) entered model airplane contests. We might suppose that at least one was an AMA member! If so, he is not interested in radio control, because RC is not mentioned anywhere in the survey. Youth of 12 to 15 years of age apparently doesn't know that it exists.

Odd thoughts run through a publisher's mind. Guillow, for just one, does a big business in wonderful stick-and-paper beginner and sport models, many rubber powered. Other firms have sizeable production in this area. But we must assume that the model aviation we have evolved (did we outgrow the field?) and seek to promote, has little relationship to today's fantastically growing youth (12-15) market.

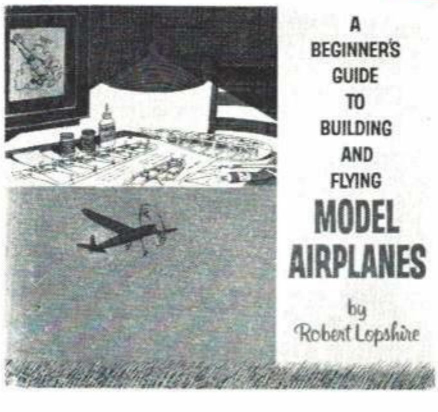
There is an interesting pattern in the publications field. In the beginning, when something is new, all things are on a relatively simple level, as they were just after the Lindbergh era. Age levels went up constantly since then, as did technical aspects. Progress was exhilarating. But what vacuum did we all leave behind us? Have we insured a life-cycle?

AMERICAN AIRCRAFT MODELER's experience has been bitterly frustrating in the beginner field. Because of our awareness of youth, many boys (and parents) have subscribed. The few simple projects we have managed to present have had eloquent response. The bottleneck is the appalling fact that almost no one has the imagination, the approach and the ability to create passable designs. Designers don't think "right" any more. Whether free flight or control-line, a designer must get inside a young fellow's mind to appreciate his problems. For example, a kid that goes to a hobby shop for lines may end up with a mysterious, expensive reel on which two wires are wrapped — like a miniature telephone cable spool.

What in tarnation is a blind nut? We lack concept, intuition, thoroughness, ability to explain detail. What flying sites are we designing for — a cul-de-sac in a housing development? A farm? A parking lot? A backyard? Schoolyard? Starting an engine is a problem. Who knows what stretch winding is, how you do it, and the thrills that result? Do you know — you, sir, right there — what high-start is?

When did you last see an article on simple, how-to-cover? Or how to work with balsa? Or even how to fly an airplane? There are questions by the thousands but few answers. Why does the hapless dealer, at best a harried spokesman, have to teach his customers for us when the time and effort required could cost him his business? If rock collecting is competitive, the challenge is obvious.

STANLEY M. ULANOFF



A Beginner's Guide to Building and Flying Model Airplanes, by Robert Lopshire, 128 pages. $4.95. Harper & Row, 49 E. 33 Street, New York, N. Y. 10016.

FOR anyone, young or old, who is ready to take up the model airplane hobby, this Guide is a "must." Clearly illustrated with diagrams, it answers many questions a newcomer might possibly ask. Starting from scratch, it goes through all the steps for building and flying models. It describes the different types of models, labels all the parts and pieces, points out the necessary tools (recommending use of the simple and inexpensive ones) and explains how to use them and take care of them. With all the do's and don'ts clearly illustrated, the beginner will find everything simply presented.

Why and how models fly is explained in simple language and diagrams.

Robert Lopshire, a combat photographer in World War II, is a veteran modeler, a member of the Academy of Model Aeronautics, and has done covers and articles for model airplane magazines.

The 1967 Aerospace Year Book, forty-fifth edition, edited by the Aerospace Industries Association of America, Inc., 580 pages. $11.00. Spartan Books, Inc., 432 Park Avenue South, New York, N. Y.

THIS is a comprehensive reference of the events and the accomplishments of the aerospace industry during 1966. In overall accomplishment 1966 might be considered the most impressive in our national space effort; with the successful Gemini program and the Surveyor and Lunar Orbiter unmanned space probe programs.

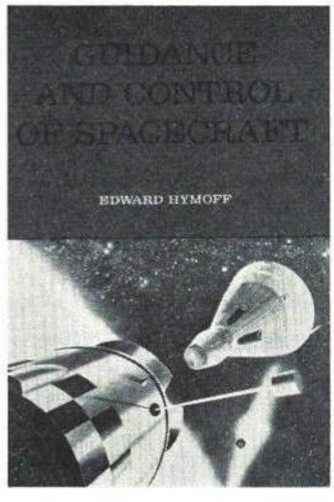
A pictorial display of these events as well as the other highlights of the year, including major developments involving aerospace people and equipment — the aircraft, missiles, launch vehicles, spacecraft, engines and systems — are set forth in the first section of the book.

The second section details the growth of the aerospace industry, company by company, during the year. Records were made in sales, backlog, deliveries and capital expenditures. The number of scientists and engineers working in the industry rose to a new high of an estimated 230,000.

In the third section, Government Research & Development, we find all the projects and systems undertaken by the government. These include the programs of the Department of Defense, AEC, FAA and NASA.

The fourth section is devoted to civil aviation, detailing and illustrating the accomplishments of the commercial airlines and general aviation community.

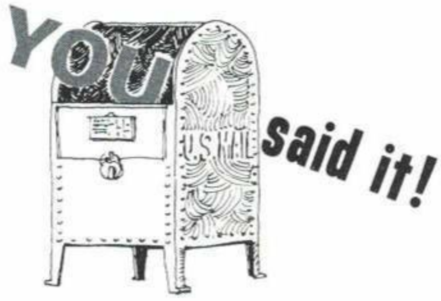
The Reference section contains specifications, performance and other data on over 600 products of the aerospace industry. In addition to the primary products — aircraft, engines, missiles, targets and drones, sounding rockets, spacecraft and launch vehicles — the Aerospace Year Book includes for the first time a section devoted to systems. The term system here denotes ground-based and aerospace equipment other than primary products, together with certain non-aerospace items produced by aerospace manufacturers. Over 100 of these systems are listed and described. These include fuel cells, radars and computers. On all the primary products, such as aircraft, a complete description is given: photos (two aircraft to a page), remarks, specifications, performances, prime and associate contractors. Profusely illustrated and fully indexed, the work is a handy and invaluable reference.



Manned Space Flight, by Max Faget; **Unmanned Space Flight,** by John E. Naugle; **Thrust Into Space,** by Maxwell W. Hunter II; **Guidance and Control of Spacecraft,** by Edward Hymoff. $2.95 each. Holt, Rinehart and Winston, Inc., 383 Madison Avenue, New York, N. Y. 10017.

THESE four books in the new "Space Science" series of the Holt Library bring together experts in the field who review the exciting scientific discoveries, major technological achievements and the applications of the new knowledge pouring out of American space programs. The volumes are thoroughly illustrated wth photographs,

Continued on page 70



Customer Always Right

You print your magazine on the financial support of the people who place ads. A guy reads an ad, gets hopped-up, then sends an order, and waits, waits, waits, and waits. Finally, a credit slip arrives stating that the equipment will be delivered in 90 days. They keep your money — to operate on apparently.

Are these suppliers deadbeats? Why do they advertise when they cannot fill the orders? Why can't they fill the orders? I must drive 50 miles to a hobby shop and I ask for a .15 engine, a Ni-Cad cell, or a kit. They don't have it because their orders have not been filled by their suppliers.

I've been building models since I was a kid but for 20 years these were rubber-band and free-flight models. Now that I've started into radio control (three years ago) I have nothing but headaches trying to get the things I want. Delays, delays, delays. By the time you get something it's obsolete. What a business!

Tony Michael, Bryant, Wis.

Although few of us have the problems Tony cites, not all of us have large, well-stocked hobby shops nearby, and getting what you want when you want it is not always as easy as it sounds. Industry does a good job in A.M.'s opinion. Now that the slot-car stampede is slowed down, manufacturers have renewed enthusiasm for planes. If service is good, it should become better! Ed.

Why Not?

Your magazine is proving to be as interesting on subscription as when it was picked up occasionally in a hobby shop or from the stands.

Sherwood Palmer, New York, N. Y.

Family Affair

I would like to take the opportunity to say "Thank you" for your excellent magazine. My sons and I really enjoy it. We have built more models from your magazine than any on the market. It's the magazine for everyone, not the few. Keep up the good work.

James A. Geary, A.P.O., New York

Remembers Beachey

I read your fine article on the life of Lincoln Beachey. I remember when he was active in exhibition flying. Also remember Hugh Robinson who flew a Curtiss biplane to escort President Taft's special trains to the Missouri State Fair grounds in 1911. Now at the tender age of 71, I have revived my interest in old airplanes, after 56 years as a motorcycle enthusiast and repairman, a Hawaiian guitarist and finally a steam engineer on a park train, built by the House of David at Benton Harbor, Mich.

I was attracted by the two articles by Hud Weeks regarding the old Curtiss biplane. I remembered them from my boyhood days. I was about 14 when Curtiss won the trophy at Reims and have always had a soft spot for the old biplane. I would not give 10c for any or all of the other types from Kitty Hawk to the latest 1967 models.

W. T. Smith, Sedalia, Mo.

Promote Safety Slogans

We would like to see more "Fly Safely" slogans in your magazine, since more and more people are reading American Aircraft Modeler. You just might help save a life.

An area modeler (non-club member) recentely lost his life when he flew his control-line model into some power lines. More emphasis needs to be placed on safe flying.

Our future is being jeopardized by unthinking modelers who continue to fly their models in unsafe areas.

Charles Borneman Jr., Kokomo Aero Team, Kokomo, Ind.

No sooner said than done! Appropriate fillers began to appear in the January issue. Such notices are carried on some kit plans, too. We urge all flyers always to fly safely — as they would drive a car, or a bike. Ed.

Fair Play

Obviously you are a hobbyist, strongly devoted to your particular field of model aviation — just as I am in my field of firearms.

I was more than a little disturbed at the quote, ". . . and gun nuts off, but it was a losing battle — the gun nuts had taken up shooting at the Marine Security Patrol. . . . The Marines are confiscating rifles and shotguns by the carload," in your September editorial. This is in reference to an area adjacent to Miramar Naval Air Station in Calif.

No doubt the quote was used in good faith, but may I suggest that whoever furnished it originally didn't know what the (blank) he was talking about. If the area is outside the Naval Air Station, then the Marines would have no authority whatever to confiscate any personal property — guns or other. Only under duly declared Martial Law would they have any such authority. This fact, in itself, casts considerable doubt on the credibility of the original statement. . . .

Acts of vandalism are occasionally committed with the aid of firearms — just as they are with automobiles, knives, rocks, clubs, gasoline and the unaided human hand. And, I seem to recall an occasional news release mentioning property damage caused by model aircraft. But, this is hardly adequate reason to repeat in print unfounded accusations against an entire group of legitimate sportsmen.

Both our groups have their problems . . . plenty of people who don't like what we do. They don't like the noise you make with your models and they think everyone who likes to own a gun is a potential killer. The magazines devoted to my primary interest don't pass on unfounded accusations against modelers, and we, "gun nuts," would certainly appreciate it if modeling magazines would grant us the same grace.

George C. Nonte Jr., Maj. ORDC, Ret.; Peoria, Ill.

Model airplane hobbyists may enjoy being called "bugs" or "nuts." Others seemingly are understandably sensitive about undignified adjectives. As to the mysterious goings-on outside the Miramar NAS, we suspect things have already sought their own level. Ed.

Thank you, Sir!

There has been a great improvement in the magazine. The inclusion of material on vintage aviation as well as the superb drawings by Paul Matt make me very happy that I have renewed by subscription.

N. K. McLeod, Prince Edward Island, Canada

Others Have Problems, Too

Articles speak of the junior problem, the senior problem, the builder of the model rule, the tendency of modeling to go to the expert and the professional, and the many other problems. Our town has about 30,000 population and, since the war, we have gone through four hobby shops and as many clubs. Today, the nearest hobby shop is 30 miles away; there is no club, and activity is at a minimum. How do you get things going or keep them going under this kind of handicap?

The junior and senior problem exists in other things as well as modeling. Scouting has this problem. Why are we to be different? We had payload sponsored by Pan Am and it folded. The Dodge and Plymouth dealers sponsored contests and they folded. Most outfits feel that sponsoring models is throwing money down the drain because of lack of results in advertising from sponsoring something such as this.

We are prone to catalog things as adult, juvenile. Even though the average person does not know what goes into developing a model, they do not class it as an adult sport or hobby.

Clifford Osborne, Chillicothe, Ohio

Small World

I have tried to locate details of the very small Curtiss-type pusher biplane that Lincoln Beachey flew at the 1915 Exposition in San Francisco, but no real result so far. I lived in San Francisco then, saw him fly, pick up a handkerchief on the ground with a wing tip. Also saw this plane at close-hand, after he flew in the Machinery Building there (plane was slightly damaged).

You did it again. You mention Willis Nye who has turned in both the Beachey Little Looper and Monoplane . . . must have been there many times when Nye was. It seems a matter of fate that I should pick up a copy of your magazine, which would lead me straight off onto plane details I have wanted for many years.

I am now in Japan, at Yokata Air Base, as a civilian engineer with the USAF.

Preston Hopkins, APO S.F., Calif.

Hobby Aids School Work

I want to thank you for "A.M. Reviews." I had to do a book report for school and it was just what I needed. My dad says it's great that my hobby also helps my school work.

Steve Hickok, Old Bennington, Vt.

Thanks For The "Easy B"

Sometimes I suppose you wonder if anyone out here in readerland is reading the magazine. I am one of those cover-to-cover types. I read all of it even the RC stuff which is not my own cup of tea.

I would like to thank you for running the "Easy B" indoor job. Indoor is a new world, and lots of fun. I have flown indoor hand-launch glider for years and enjoyed every session, but the fragile mike and paper I felt were beyond my grasp.

I read Bud Tenny's article and inspired, sent off to Micro-X in Cleveland, Ohio. They took awhile, but the materials are first rate.

John A. Thornhill, Mt. Rainier, Md.

model world
...on the international scene

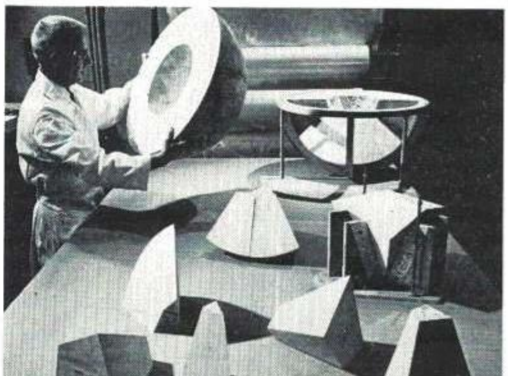
Bruno Nicora

Alpine air force base site of Swiss RC national meet

Seventeen winners of regional elimination contests assembled at Tichino last August to compete for the radio control championship of Switzerland. When it was over the winner proved to be B. Giezendanner, as might have been predicted. Two months earlier, at the RC world championships in Corsica, Giezendanner had scored the meet's best single flight and had led the Swiss team to fifth place. At Tichino the other team members also were near the top: Schenk was third and Gloor was sixth.

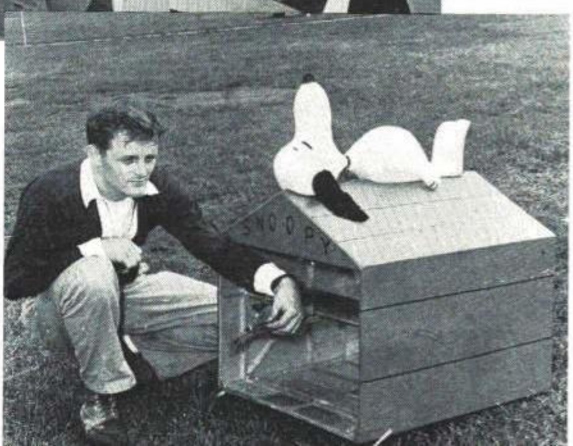
Perfect weather featured the national meet, together with fine organization and an enthusiastic crowd. This was the first time for such a contest in the upper Tichino highlands, surrounded by mountains. Cooperation of the local army command made the air base site available.

Giezendanner flew his Marabou design which used retractable landing gear. His degree of dedication was indicated when he admitted averaging five training flights per day! Second place was won by an 18-year-old, Rolf Zumkehr, of Zurich. Practically all of the radio equipment was of the proportional type, including Kraft, Simprop, Orbit and Switzerland's own Digifly. Only one set of the reed type was flown.



Model shop for lunar lumber

The first lumberyard on the moon may well be stocked with balsa wood. Balsa's unique qualities of lightness, strength, vibration and sound absorption, insulation, shock resistance, and others, which have endeared it to model builders the world over, have also been responsible for its use in the Ranger series of United States space probes. NASA's Jet Propulsion Laboratories, builders of the Rangers, found that balsa has about three times the shock absorbing capacity of the next best material. And, contrary to the characteristics of some other materials, balsa's impact absorption properties are retained in a vacuum. In the Ranger application, balsa segments are bonded together in a geometric arrangement of certain end-grain patterns, then covered with a glass fiber reinforced skin. This information supplied by Balsa Ecuador Lumber Corp.



Comical flying machine

The Twin Boro Flying Club of New Jersey found that Snoopy and his flying dog house were big attractions in the promotion of their first big contest. Local newspapers featured pictures and stories about Snoopy and the club's activities. The contest was a great success and so was Snoopy. The dog house is flown on control lines and was built by Walter Basler. The club also credits the Publicity Guide for Clubs which is published by the Academy of Model Aeronautics as the inspiration for its successful efforts which are supported by the towns of Bergenfield and Dumont. And AMA's insurance is the basic factor which gained flying site.

Criterium of Aces

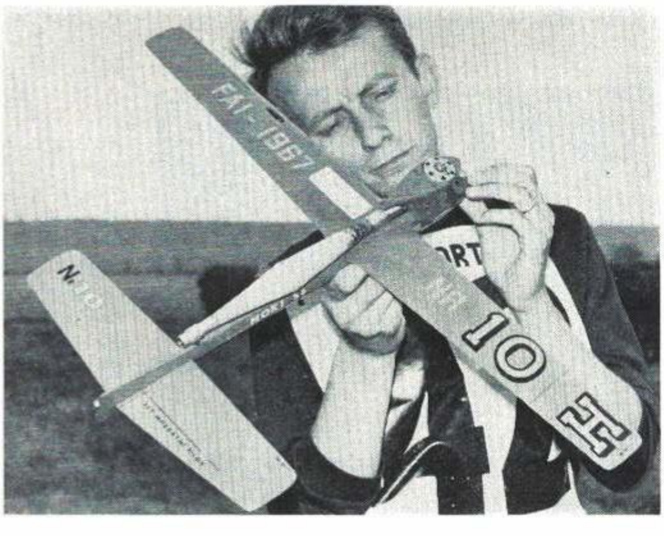
Held at Liege, Belgium, this famous International Control Line contest saw worldwide acceptance of the tuned exhaust pipe in speed, a U.S.A. win in team racing and the host country win in stunt.

In Team Race, Don Jehlik and Herb Stockton used the new Austrian-produced H.P. .15 engine to win. In the final race (200 laps), they won with a time of 9:36; to the Danes (Hasling brothers) 9:48 and Hungarians (Molnar/Kuti) 9:55. The top seven places went to as many different makes of engines.

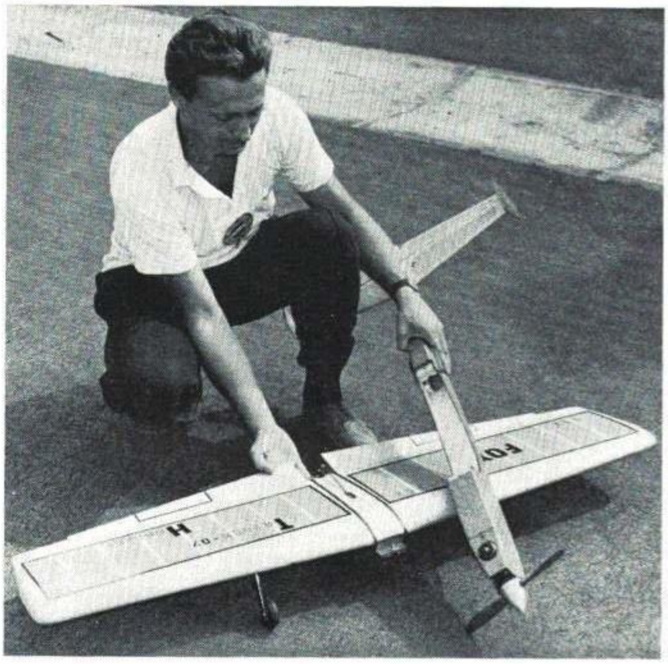
Stunt saw the current World Champion Josef Gabris (Czechoslovakia) beaten by Marc Vanderbeke of Belgium.

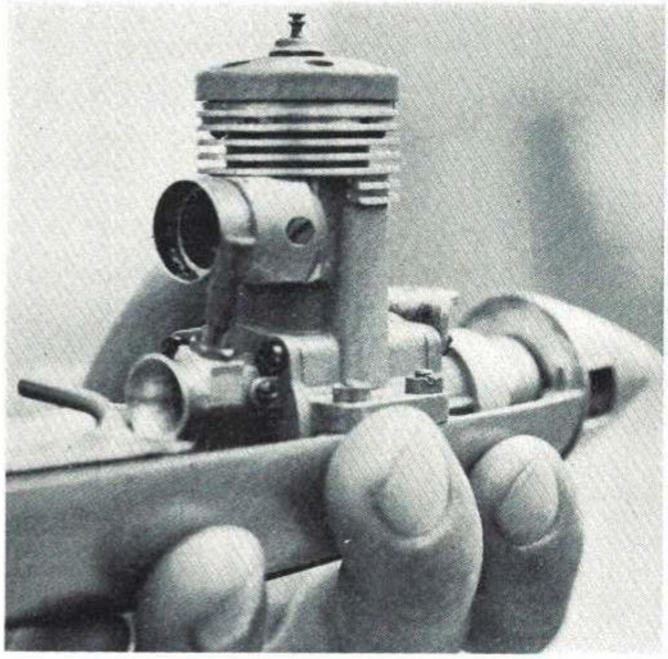
Speed was dominated by the European version of U. S. World Champion Wisniewski's resonant pipe. Hungarians won the first three places using tuned pipes with Moki rear exhaust S-6 racing .15's.

There were 11 entries in speed, 31 in team race, and 21 in stunt.



Everyone at the Criterium used tuned pipes in FAI Speed. Shown is Hungarian Mikos Sebestyne, with his Moke S-6 powered speedster. Cylinder head was machined from a magnesium-based alloy. Model is a credit to Bill Wisniewski of the United States, resembling closely his "Pink Lady" design series. Use of tuned pipes has added a new characteristic to the control-line speed scene: model accelerates slowly on takeoff dolly then suddenly, within about a lap, the pipe hits proper resonant frequency and the model is in the air and up to maximum speed — effect is electrifying.

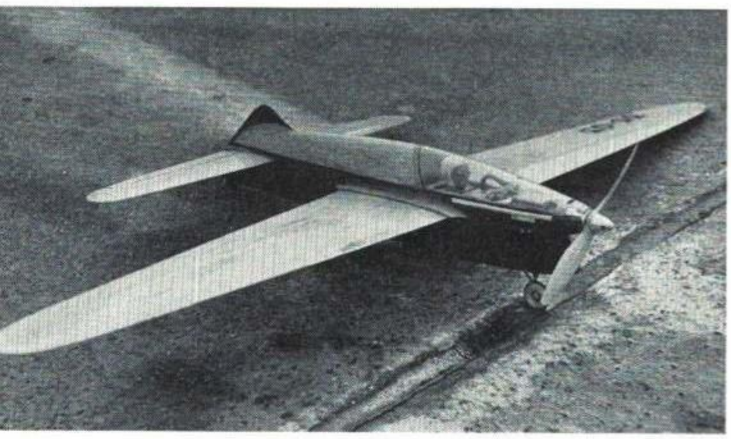




The best team race model in the world? The competition record seems to say so, although the event is as much a test of the pilot and pit-man as it is the model. At the 1967 Criterium, U. S. flyers and current FAI Team Race World Champs (Swinderby, England, 1966), Don Jehlik and Herb Stockton flew their "Jefe III" into first place. Model is powered by a H.P. .15 diesel with an added Cox .049 venturi to allow more laps by improvement of fuel economy — important because the fuel tank capacity is limited to only 7 cc. Out of the last three international contests entered, this team has taken a second and two firsts. Stockton is pilot. The team has since added a first place in the U. S. team selection finals and will be top contenders at the 1968 world championships in Finland this summer!

First two-piece stunter we've seen is G. Masznik's "Trygon-07." The Hungarian flyer locks the wing and fuselage together with screws; similar to radio control model practice. Plastic strips key the assembly to prevent movement. Elevator pushrod attaches to the flap horn upon assembly. The design solves a major problem for international competitors: transportation of models. Previous and still prevalent practice uses huge boxes to house completely assembled models, causing stowage difficulties even for the large cargo compartments of jet airliners. The Trygon is expected to influence future world championship stunt model designs. Tissue-covered model is powered by a Fox. 35; placed 9th.

The new Hungarian Moki S-6 speed engine features Schnuerle porting with an added boost port. Rear exhaust is fitted for a tuned pipe. Top three places at the Criterium were won with this engine; fastest time was 159.6 mph, backed up by another flight of 153.2 mph. Diecast crankcase indicates that this is probably a production version, not a "bar-stock" original. Now that Europeans have followed the lead of U. S. resonant-pipe design, and the Federation Aeronautique Internationale has refused to outlaw such engines from international competition, all speed engine manufacturers are seriously considering similar built-in provisions for tuned pipe attachments. Before long expected also are commercial tuned pipes matched to engines.

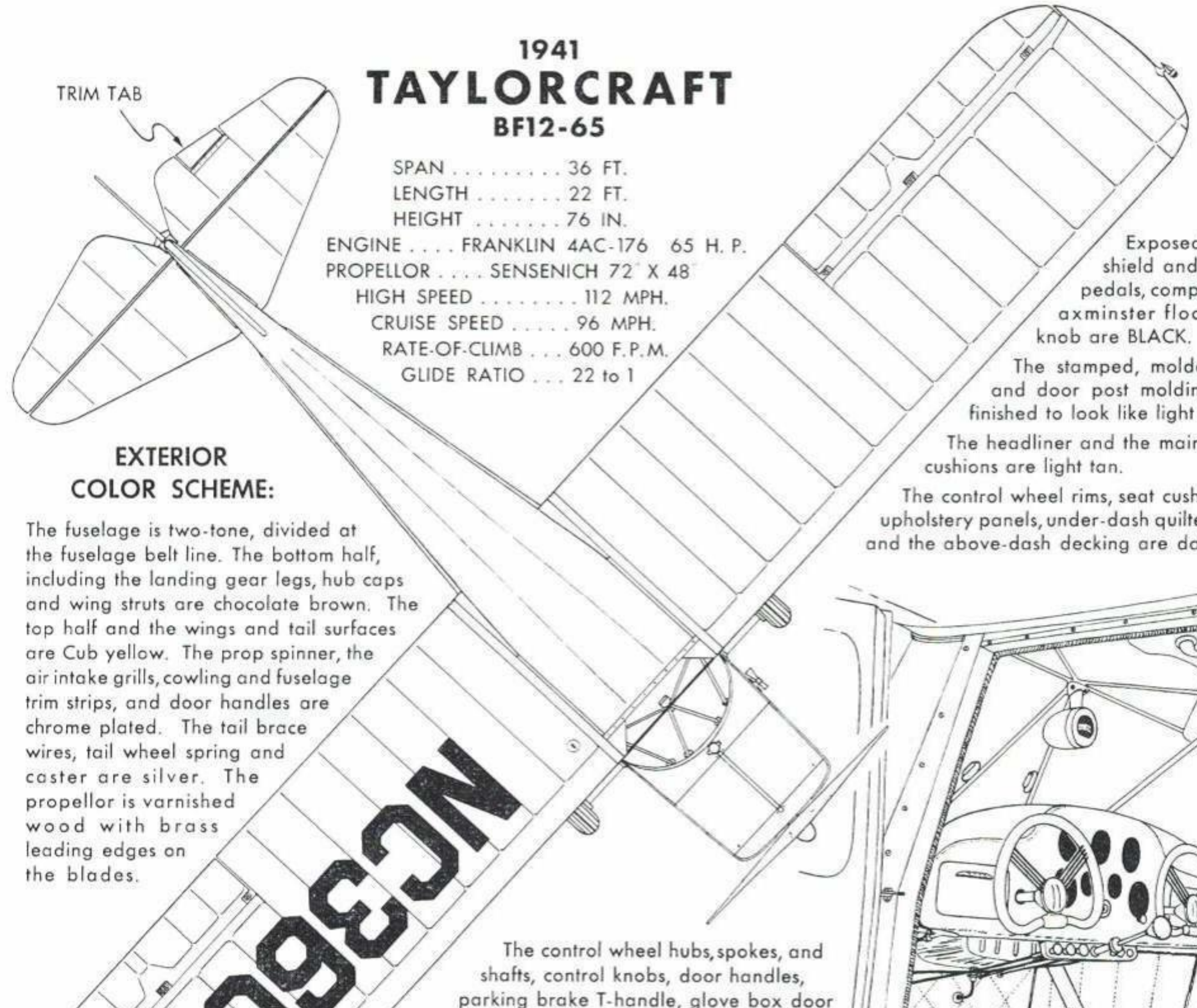


Team of Favre/Fabre from France, veterans of world championship competition, used a neat, clear-and-solid color finish on their team racer. Model was destroyed as the down elevator control-line caught on another flyer's head while overtaking — part of the normal risk which team racing pilots must contend with. Such risks occur frequently as flyers change positions in the circle during a race. A Webra Mach II .15 diesel was used with Jefe II-type through-fuselage ducting for engine exhaust, exiting at rear like a jet tailpipe. Note large, removable molded canopy: broken fuel line can be quickly spotted and dummy pilot's head (required for FAI rules) is visible without detracting from smooth low drag contour. Other design features include large very thin wings, metal wheel with narrow tire.

"Orion" team racer by Milan Drazeks (Czechoslovakia) has a clear, mirror-like finish. Inverted engine is a M.V.V.S. .15 T/R Super (rear exhaust) driving a 7⅛ x 7⅛ prop. A pressurized fuel system is strapped to the forearm. In use the rubber bulb is pumped, applying air pressure to the ribbed, expanding metal cylinder. Fuel is forced down tubing along arm and through a line filter to a small valve at the finger tip. Applying the valve to the model's tank vent opens the line and quicker than it takes to read these words the fueling is done. This expert and efficient approach saves precious seconds during critical pit stops — extremely important. At the 1966 world championships the winning margin was only one second after 200 laps and over nine minutes of flying!

1941 TAYLORCRAFT BF12-65

SPAN . . . . 36 FT.
LENGTH . . . . 22 FT.
HEIGHT . . . . 76 IN.
ENGINE . . . . FRANKLIN 4AC-176 65 H. P.
PROPELLOR . . . . SENSENICH 72" X 48"
HIGH SPEED . . . . 112 MPH.
CRUISE SPEED . . . . . 96 MPH.
RATE-OF-CLIMB . . . 600 F.P.M.
GLIDE RATIO . . . 22 to 1



EXTERIOR COLOR SCHEME:

The fuselage is two-tone, divided at the fuselage belt line. The bottom half, including the landing gear legs, hub caps and wing struts are chocolate brown. The top half and the wings and tail surfaces are Cub yellow. The prop spinner, the air intake grills, cowling and fuselage trim strips, and door handles are chrome plated. The tail brace wires, tail wheel spring and caster are silver. The propellor is varnished wood with brass leading edges on the blades.

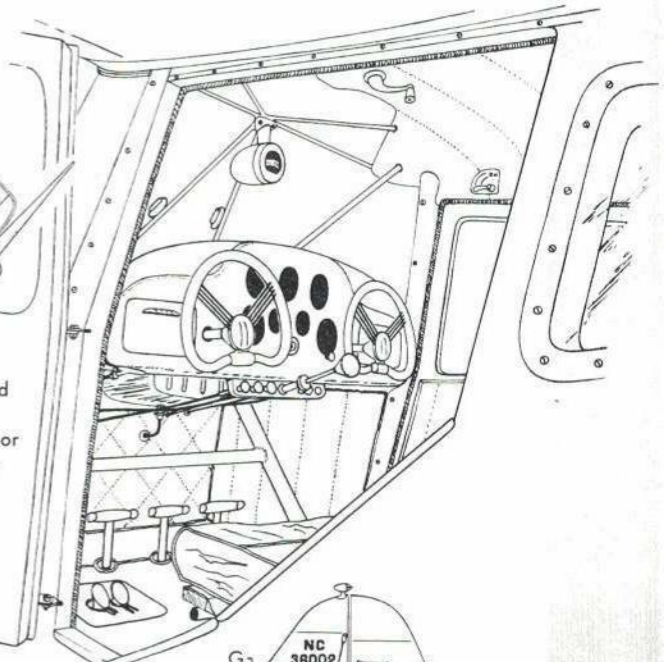
INTERIOR COLOR SCHEME:

Exposed tubes behind windshield and under dash, rudder pedals, compass, instrument faces, axminster floor rug, and throttle knob are BLACK.

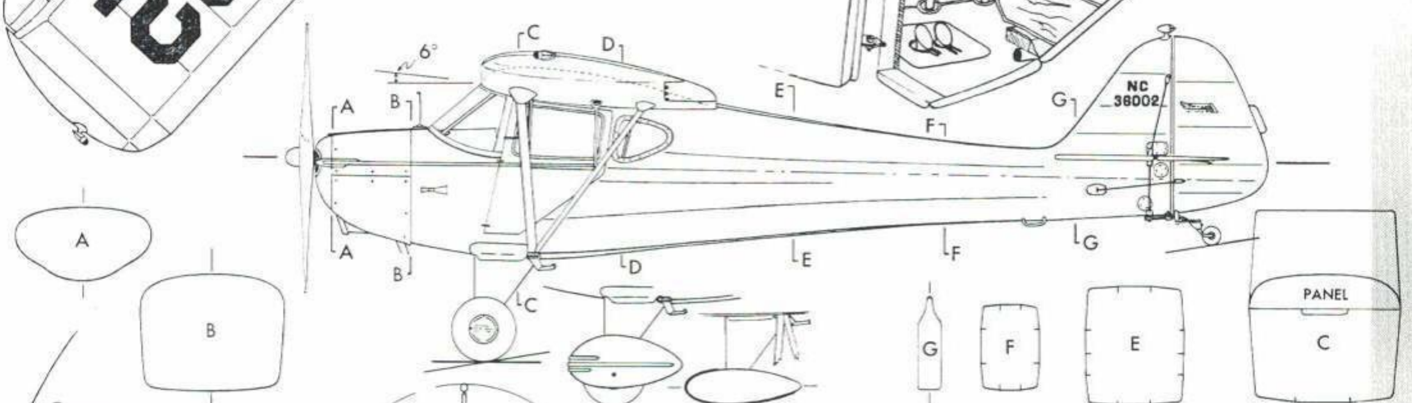
The stamped, molded instrument panel and door post moldings are wood grain finished to look like light oak.

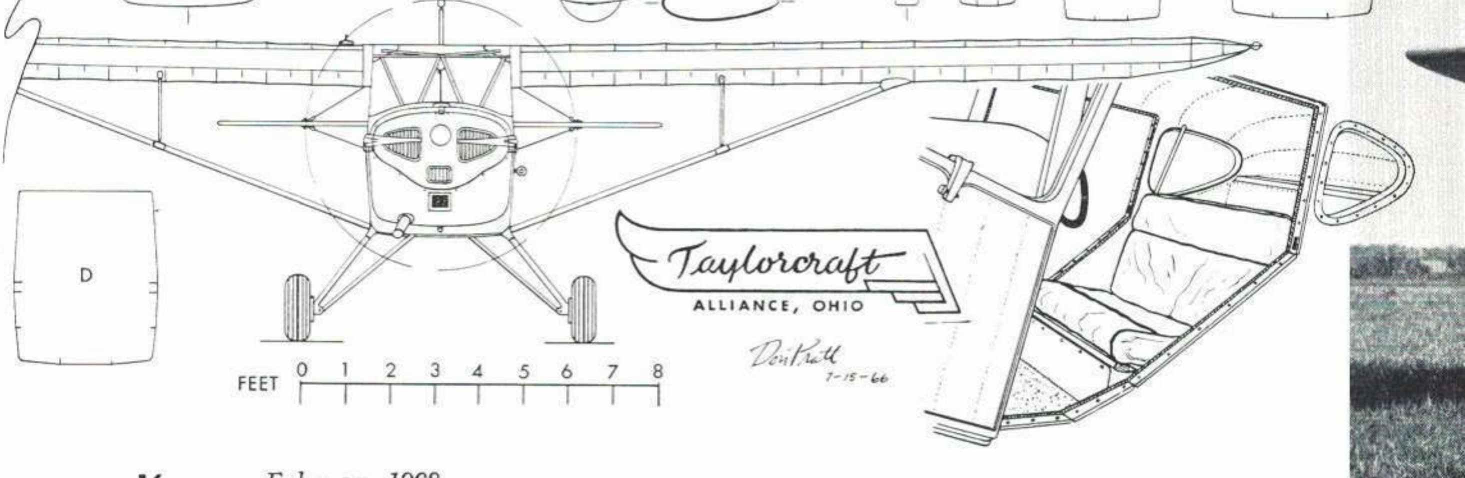
The headliner and the main sections of the seat cushions are light tan.

The control wheel rims, seat cushion trim, inside door upholstery panels, under-dash quilted upholstery panels, and the above-dash decking are dark chocolate brown.



The control wheel hubs, spokes, and shafts, control knobs, door handles, parking brake T-handle, glove box door handles, ignition switch, wing tank off-on lever, trim tab handle are all chrome plated.





Taylorcraft
ALLIANCE, OHIO

Don Kratt 7-15-66

The Taylorcraft

Though 13 years have passed since the last T-Craft was produced, it is still remembered as a classic. Call it what you will — Floater, Cloth-Moth, Barn Door or Porch Swing — it was a favorite.

Cowling detail for the scale modeler — spinner, cooling intakes and trim strips are chrome. Directly below center air intake grill is the oil cooler; below that is the exhaust stack.

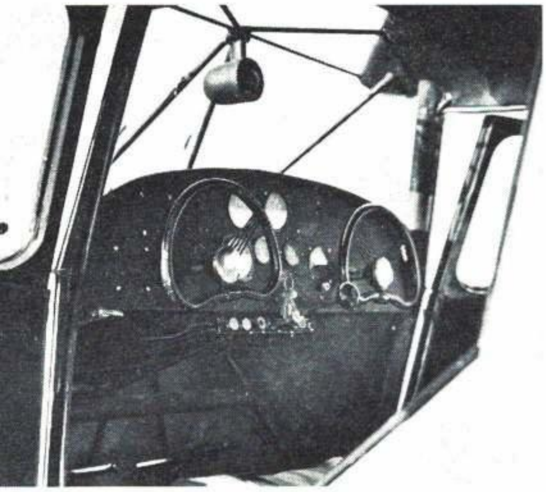
DON PRATT

IN January of 1937 Gilbert Taylor and Bill Piper Sr. parted company. This combination of airplane design genius in the former and hard-headed businessman in the latter had produced the immortal Cub and the highly successful Taylor Airplane Company that built it. Later, the two men decided to go their own ways. Piper controlled the greatest number of shares of stock so Gil Taylor went off to establish a factory that could produce airplanes according to his own design theories and ideas.

The split had come over a new design lightplane that Gil Taylor saw as the logical successor to the Cub. Though the Cub had been his brainchild, Taylor realized that the design was now nearly nine years old. Much had developed since 1929 and he wanted to build a plane that would take advantage of the new refinements in aerodynamics that had been discovered in the interim. Piper saw that the Cub was a proven successful seller and he wanted to ride with it as long as it remained so.

By mid-March of 1937 Taylor had gained financing and had a factory building in operation at Alliance, Ohio. The new company he formed became known as the Taylor-Young Airplane Co., and the new design airplane was called the Taylorcraft. In order to avoid confusion of the public by the similarity of the names of both companies, Bill Piper changed the name of the older organization to Piper Aircraft Corp. From that time on, the airplanes manufactured by that company would be known as the

Don Pratt's T-Craft looks factory-fresh 27 years later. Barn-door-size wing gave it a high glide ratio and the nickname of "Floater."



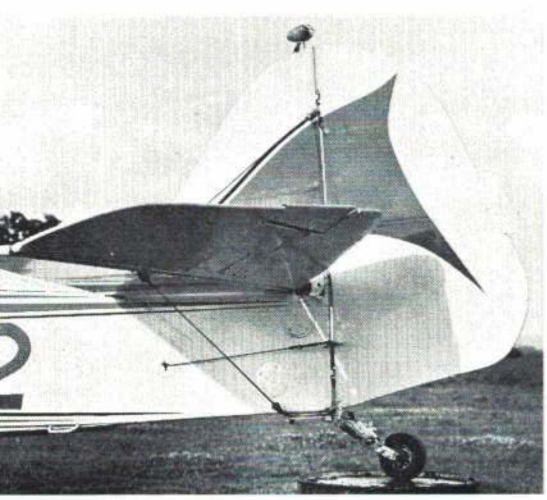
Early T-Crafts featured full-round steering wheels similar to automobiles instead of the more common stick controls. Cockpit detail shows the later, more compact half-round type of wheel.

Piper Cub.

The new Taylorcraft proved indeed to be a great improvement over the Cub. Such refinements as fairings on the wing struts and gear legs, NACA 23012 wing airfoil, and a better streamlined fuselage shape raised the cruising speed from the Cub's laborious 62 to a more impressive 82 mph. The Cub's dependable Continental 40-hp. engine was retained but the tandem seating of the older airplane was abandoned in favor of the cozier and more sociable side-by-side arrangement. The new design used the same open type engine cowling, with the cylinders hanging out in the cooling breeze as had been fitted to the Cub. The control sticks however were exchanged for neat little 12-in. diameter control wheels on shafts that protruded from the instrument panel. These were full-round and resembled the steering wheels used on automobiles of the period.

By 1941, when the subject of our three-view drawings was built, the T-Craft had undergone a number of effective refinements. These resulted in a considerable increase in speed; general performance, and comfort for the pilot and passenger. The T-Craft was to go through a series of further minor model changes and refinements in later years. In 1946 the vertical fin and rudder were enlarged to improve directional stability, and in 1952 an 85-hp Continental powered version was offered to the public. Most T-Craft fanciers among the antique airplane enthusiasts contend that the 1941 Deluxe model is the true classic of the breed. It is indeed now the rarest and most difficult to find of the hundreds of Taylorcraft products that may still be seen on the nations private flying airports. Like most of its contemporaries, the Taylorcraft Co. did not survive the post World War II airplane market depression. They ceased production altogether in 1954 and have not produced airplanes in volume since the 1948 model year.

The Taylorcraft can make an excellent subject for a scale flying model. The full-size craft has good proportions for direct reduction except for the vertical fin and rudder of the prewar models which would require some enlargement. The dihedral would have to be increased, of course. The glide ratio of the full sized T-Craft is something more akin to that of a secondary sailplane than a powered craft, and that characteristic carried down into the model could certainly increase duration in free-flight form. Best of all, there are still a lot of T-Crafts around, and a Sunday trip to an outlying airfield, armed with your box brownie, will usually bring you face to face with several of them so that you can collect photos of full scale details for your proof-of-scale portfolio.



The elevator trim tab is adjusted from the cabin; a fixed tab gives rudder trim. Castor-type tail wheel is linked to the rudder and is leaf-sprung. Note fuselage handhold at left and below "two" numeral.

. . . one-fourth size too!

MANY hobbyists have a special weakness for giant-sized flying models, and when it comes to large scale jobs, the Taylorcraft has a hypnotic attraction. The photo here was made at last winter's Toledo Weak Signals RC Conference, where Vic's one-fourth size T-Craft was a highlight of the show. In fact, it so enthralled your editor — who recollects fondly the real machine as well as earlier "large economy-size" kits of the past — that he decided to risk this plug (unsolicited) for Vic's Custom Models.

Unfortunately, the editor was soundly scooped by the Check List department editor who reported in the January issue on a sample kit, delivered by a Lockheed Hercules to the home office. Quoting his insubordinate prose, this 1946 version of the T-Craft spans nine feet with a chord of 1¼, and leaves the ground serenely — urged on by "at least a .60." We noted that, if ailerons are installed, each should have its own servo — which gives you the drift of things. You haven't lived until you've hefted those bulkheads — we've seen houses that seemed smaller. For the guy who loves to build (it is just bigger not more difficult), to finish, who wants realism and smooth flying, the design is a smorgasbord of all that's delightful.

We do have a bone to pick with those — and this was commonly claimed — who darn the big ship as a floater. Many old-timers that combined acres of area with clean lines — Piper Supercruiser, PA-11, etc., as well as the T-Craft — could be brought down on the near end of the runway (!) by either holding the nose up for increased sink, or just getting the wheels on the ground in a wheel landing. Even the model will probably float into the next county if you decide to land three-point with good flying speed. Nose up? Just hold the fuselage line parallel to the horizon. It worked on the real one, and maybe it will work on Vic's gem of gems. Just don't push it too much on a gusty day!

Bob Harness and Dennis Schauer with .35- and .45-size versions of this contest-going machine. A very durable common-sense design, it has all-weather performance. Both sizes popular on Coast. Has been flown through pattern by a blind pilot.

The Gladiator

A perfected design for the expert contest flyer. Plans show two sizes of this attractive and responsive model.

DENNIS SCHAUER

AFTER designing and building four or five considerably different designs, I finally decided to analyze what I really wanted in a competition stunt model. After looking over many good stunt designs published in the magazines and watching many more fly in the Nationals and other local contests, there was one airplane that caught my eye. This was the "Lark" by Charles Mackey.

The original Gladiator was similar in construction to Mackey's Lark. This is where the similarity ends. I decided that the airplane would have to be of a type that would be light enough to fly in all weather conditions, and have an eye-catching look. The first Gladiator was built early in the spring of 1960 and was flown in several Southern California contests. It either won or placed highly in all contests entered. The author qualified with it for the West Coast FAI Stunt Semi-finals in San Francisco, did poorly because of short engine runs.

The next contest was the 1960 Nationals in Dallas where the Gladiator placed sixth in total points and second in flight points. By this time, the model had seen considerable service and looked it. If it had had first place appearance points, it could have won. Since then, there have been seven more Gladiators built: two by my brother, Don; and one by Bob Harness Jr. — which was flown to third place at the 1966 Nationals in the Senior Stunt event.

I built the 45 version in the spring of 1963 for the Los Alamitos National, at which time, I had had some eye trouble. During that period I flew the model at several Southern California contests when I was totally blind. This proved to me that the model was very stable and turned well. It certainly was consistent.

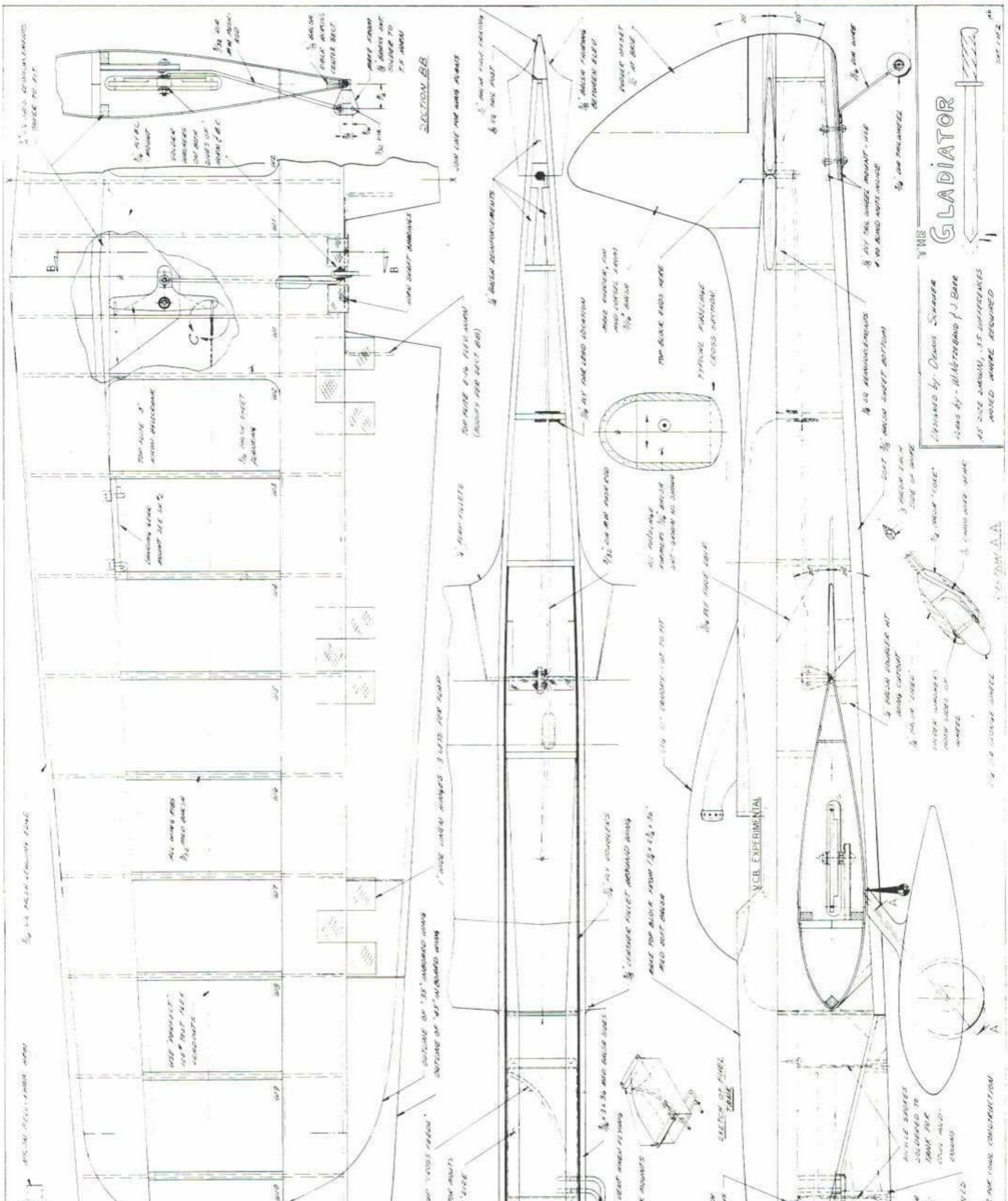
Various well-known stunt pilots have flown the original. All are of the opinion that this is a good airplane. It has good penetration which makes it an ideal windy weather airplane. The original has had approximately 50 gallons of fuel run through it and it is still in good structural condition.

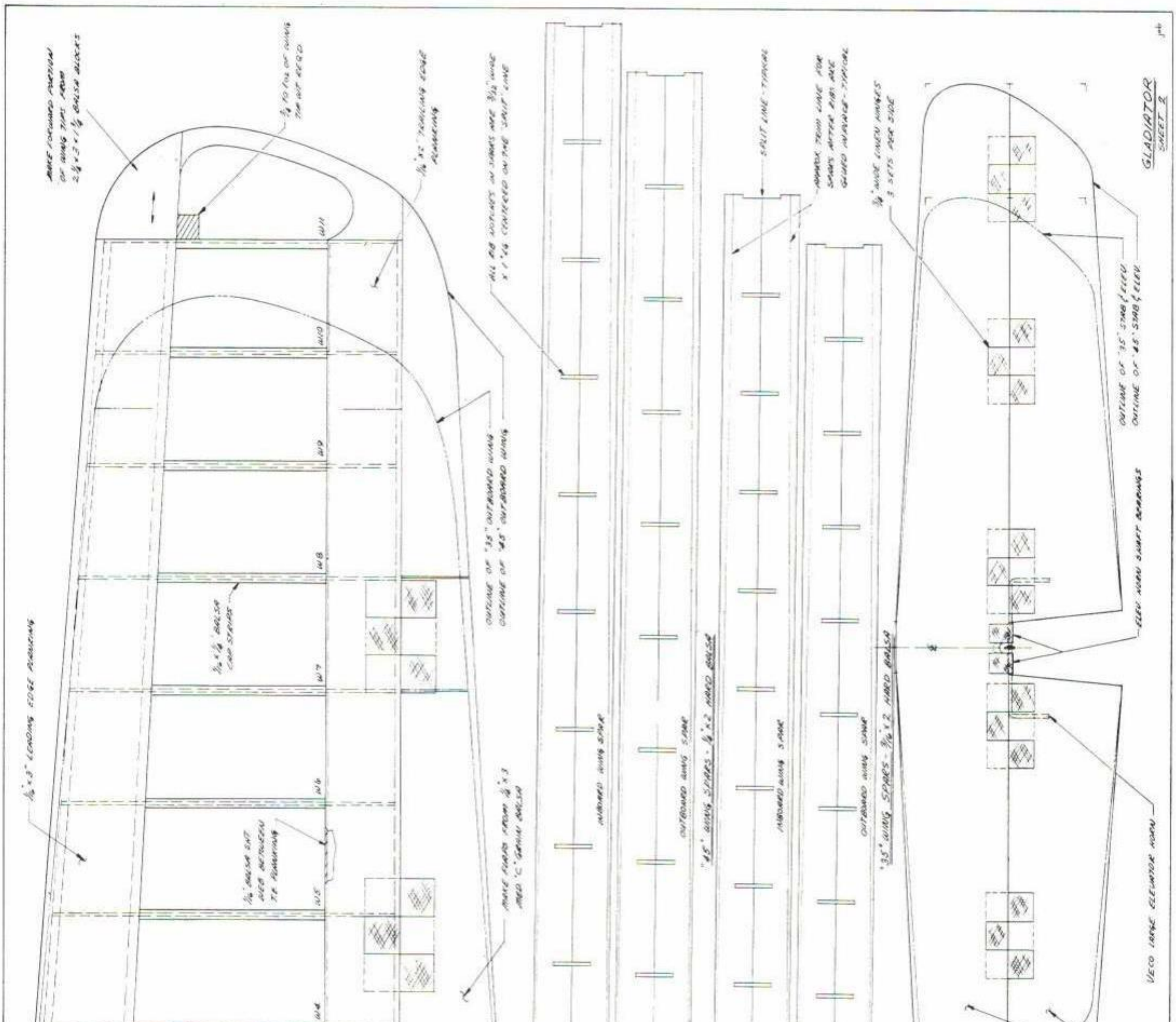
Due to its size and cost of construction, this is not a beginner's airplane. It is meant for the experienced modeler; therefore, I will not go too deeply into construction details. Most stunt modelers have their own methods of construction.

Wing construction is of the D-tube vertical spar type. There are two different wing spar templates shown on the plans, the shorter spars being for the 35 version. The spars are left full depth while the wing is being built, so that the wing may be built flat without any blocking of spars during construction. The spar splits along its centerline; wing is built in top and bottom halves. It is joined at the wing centerline with two 3/8 in. sq. spruce spars. The offset in the wing is accomplished by 1/8 in. wider rib spacing in the inboard wing. The ribs are cut by stacking 3/32 in. balsa blanks between root and tip rib templates, then carving the shape.

Fuselage is of simple slab-side and rounded block construction with plywood doublers at the nose. Be sure when drilling engine mount holes to get two to three degrees engine offset. This is important for maintaining line tension.

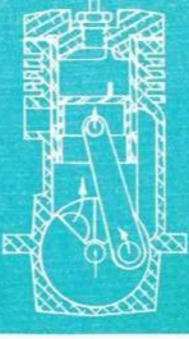
Continued on page 52


THE GLADIATOR
SECTION BB
V.C.B. EXPERIMENTAL



FULL SIZE PLANS AVAILABLE — SEE PAGE 60

INSIDE



GLENN LEE

. . . the two-cycle engine

There's more to a miniature powerplant than meets the eye.

MANY test articles have been written about engines, but few have explained many of the terms used. Almost all model engines used today are two-cycle; that is the engine fires every revolution. (See Fig. 1.) They are much simpler than four-cycle engines since they have no oil pumps, timing gears, camshafts, or head valves. They have their own problems, however, and this article will try to explain some of the design differences in engines available today and yesterday.

Two-cycle engines: First, consider the methods of getting a fresh charge of fuel and air into the cylinder and the exhaust gases out. The four strokes use an entire revolution of the crankshaft to pump the exhaust gases out and draw in a fresh charge. This pumping process results in a large frictional loss within the engine. In the two strokes, the charge is allowed in and the exhaust out during the lower part of each revolution. This results in a loss of power stroke and also mixes the fresh charge with part of the just-fired charge.

The two-stroke engine also labors from "crankcase scavenging." The crankcase is sealed, and the up and down travel of the piston acts like a pump to give positive and negative pressure in the crankcase. Valves are used to allow a fresh fuel-air charge to enter the case when the piston is going up. The valve is then closed and the downward travel of the piston compresses the charge. When the piston opens the bypass port, this compressed charge is directed up into the cylinder. As shown in Fig. 1., the exhaust port usually opens just before the bypass port and allows the burned gases to get out with a minimum of mixing with the fresh charge. This is "cylinder scavenging." Several different methods of scavenging will be discussed later.

Since the crankcase acts as the fuel pump, lubricating oil must be mixed with the fuel. The fuel is vaporized, and a layer of oil is left on all surfaces. Most of the oil goes through the crankcase and is burned in the cylinder or blown out the exhaust. This system is simpler than any pressure oil system, and you get an oil change every revolution. The cylinder walls are lubricated very well this way, resulting in low friction and long life.

The oil mist lubrication, however, does reduce the amount of fuel-air mixture we can get into the cylinder. Bearings do not always get an adequate supply of oil, and sleeve type bearings must be very loose.

Scavenging: Going back to cylinder scavenging, there are several different designs regularly used as diagramed in Fig. 2. All of them use an air blast coming through ports in the cylinder walls to force the exhaust gases out. Some names given to these methods of scavenging are: Uniflow, double-piston, cross, and loop. There are several variations of loop scavenging: Schnuerle, Curtis, reverse loop, and laminar flow.

The uniflow engine has the exhaust port or poppet valve in the top of the cylinder, and gases flow only one way. The fresh charge coming in just above the piston pushes the exhaust gases out the top. Some method must be used to open the valve at the proper time, such as a cam and rocker arm. Many years ago, Dooling experimented with an engine using a rotary valve in the head driven by a gear train, but was troubled by seizing problems due to high temperature exhaust gases.

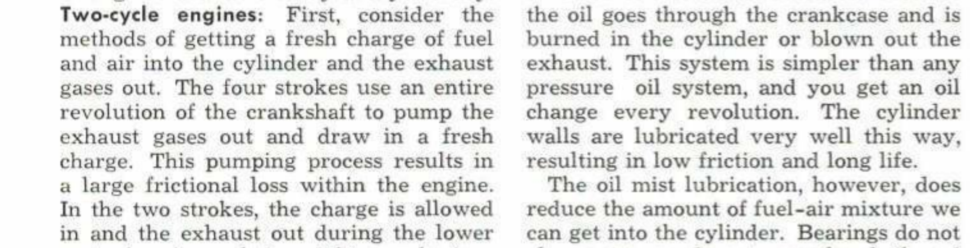
Cross scavenging is the type used in many engines sold today, such as McCoy, K&B, Fox, and O.S. Cross-flow engines have the bypass ports located on one side of the cylinder and the exhaust ports on the opposite side. The piston has a deflector baffle on the top to deflect the incoming charge up into the top of the cylinder.

The cross-flow engines have several minor disadvantages. The piston baffle is directly in the combustion chamber, and disturbs uniform combustion. It also overheats and distorts the piston. In fact, the baffle on speed engines usually gets melted away by ultra-high nitro content fuels. There is also a tendency toward a loss of the fresh charge out the exhaust port, with a resulting loss of power and economy.

A modification of the cross-flow design is the laminar-flow engine, notably the Super Tigre with its patented bypass port system. In this design, the top edges of the bypass ports are beveled with a double angle such that the air does not break away from the cylinder wall. The fresh charge flows around the bevel and is directed up into the cylinder. The piston top can now be flat, resulting in a uniform combustion chamber, and heat distortions on the piston are minimized.

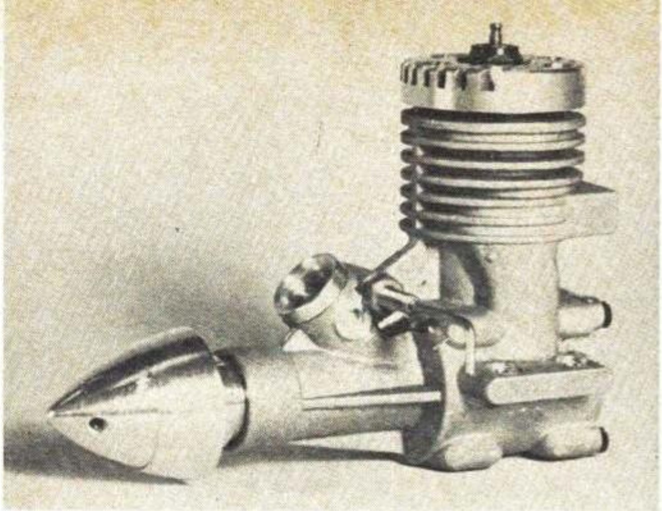
The loop scavenged engines have the bypass ports located to direct the fresh charge against the wall opposite the exhaust port. The charge then loops up into the cylinder, forcing the exhaust gases down the opposite side and out.

The original Schnuerle system used four ports. The bypass ports were on opposite sides of the cylinder and the exhaust ports were between them. The charge came through the bypass ports, met in the center, and then traveled to the top of the cylinder. The exhaust gases were forced down the sides. Several brands of engines have been built using

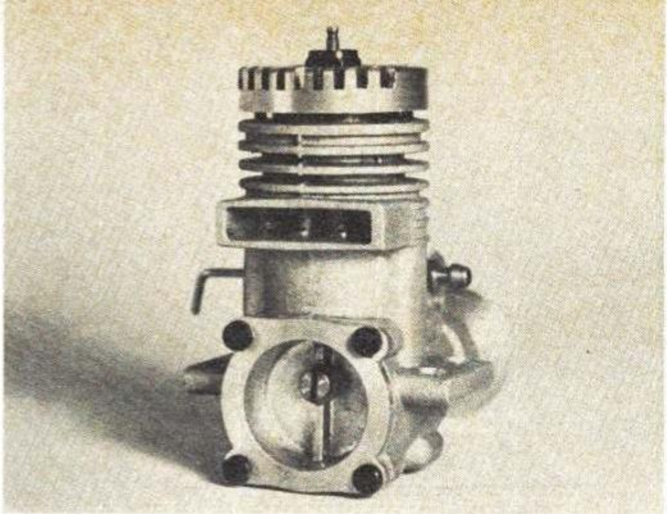


a. b. c. d.

Figure I: The two-cycle sequence. a. Air intake is closed, piston is compressing the crankcase charge. b. Bottom of stroke, ports open, cylinder scavenging takes place. c. Piston is drawing in a fresh charge as it compresses the cylinder charge. d. Combustion takes place, air intake is almost closed again.



The MVVS 2.5 c.c. glow engine features a rear exhaust, Schnuerle porting, ball bearings and a crankshaft rotary valve intake.



A rear view of the MVVS 2.5 c.c. glow engine. Prototypes of this engine have placed high in international speed contests.

this system — well-known engines, too.

Better results were obtained using a single exhaust port with the bypass ports located on each side of the exhaust and directed toward the opposite cylinder wall. The latest MVVS engine uses this system. Bill Wisniewski's engines with which he won the last two World Championships used Schnuerle porting with a small additional port opposite the exhaust port. This is called a boost port, uses a laminar flow bevel at the top edge, and directs a charge from under the piston up the cylinder wall. The newest Cox Mark II also uses a similar system.

One additional benefit from the Schnuerle porting is improved idling characteristics for RC or other throttle operation. In a cross scavenged engine, the wet fuel charge is directed at the glow plug. At rich settings and low rpm this wet charge puts out the glow plug and the engine stops. With loop scavenging the charge loops past the filament, and the engines can run at very rich, slow settings without stopping.

The Curtis scavenging uses multiple ports. The ones opposite the exhaust have laminar flow top edges while the others direct the flow away from the exhaust similar to the Schnuerle system.

The reverse-loop scavenging has two bypass ports that direct the fresh charge just above the exhaust port. The charge loops up that cylinder wall, down the side opposite the exhaust, and across the top of the piston. A slight variation to this is the swirl scavenging where one port is directed above the exhaust port and one is directed against the wall opposite the exhaust port. This results in a rotating charge giving high turbulence in the cylinder.

The double-piston engine shown in Fig. 3 has two cylinders with a common combustion chamber and two crankshafts geared together. The inlet ports are located in one end of the cylinder and exhaust ports in the other. By properly phasing the pistons, the exhaust ports can open before the inlet ports, and also close before the inlet ports. The exhaust gases can be cleared with a minimum loss of fresh charge. Complications are the gears and the double height of the engine. Vibration is minimized, however.

Porting: The biggest problem of scavenging two-cycle engines is to separate the exhaust residue and the incoming fresh charge. In most engines, the exhaust port opens slightly ahead of the bypass port. The rapid rush of the exhaust gases from the cylinder can cause the pressure in the cylinder to drop below atmospheric, and the resulting vacuum can draw part of

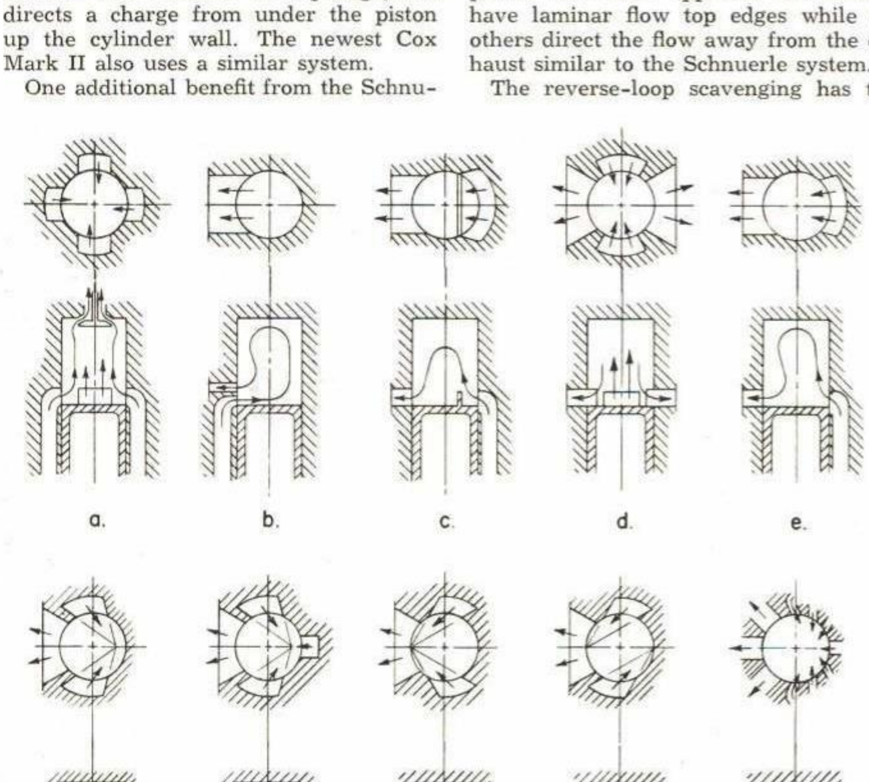


Figure 2: Types of scavenging. a. Uniflow, b. Loop, c. Cross, d. Original Schnuerle, e. Laminar, f. Schnuerle, g. Schnuerle with a boost port, h. Reverse loop, i. Swirl, j. Curtis.

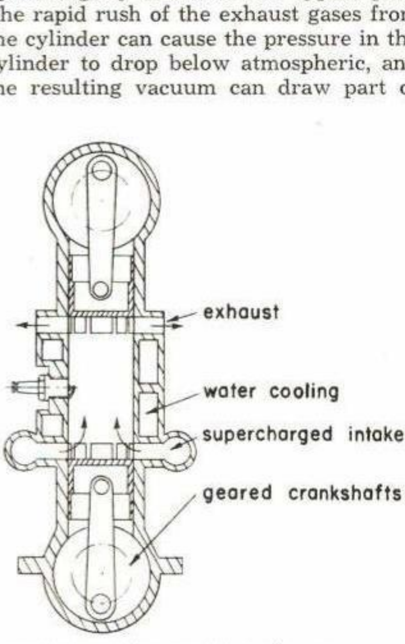
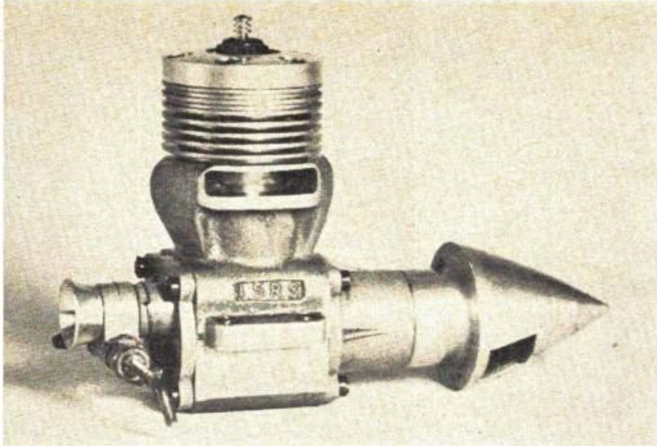
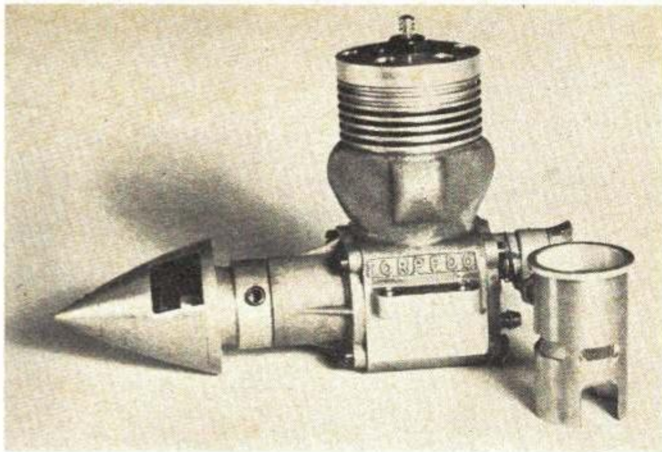


Figure 3: A "double-piston" engine.



The experimental K&B 15RC glow engine built by Bill Wisniewski and flown to first place in the 1964 World Championships. Bill is famed for his "tuned pipe" used on speed engines.



Left-side of K&B 15RS with cylinder sleeve shows "lumps" on case where three ports are located. Piston skirt notched to match lower part of sleeve.

the exhaust back into the cylinder.

If the exhaust port opens too soon, part of the incoming fresh charge can be lost out the exhaust. The pressure in the cylinder is very high during combustion, and very little time is required to let these gases out when the exhaust port opens. The crankcase pressure, however, is very low, on the order of six pounds per square inch. This low pressure cannot force the fresh charge into the cylinder very fast, so the bypass ports must be raised or widened to improve performance.

The exhaust port must open before the bypass port, so it must be raised along with the bypass port. The portion of the wall given to porting must be subtracted from the working stroke. So, the height of the ports must be matched to the rpm range at which the engine will be run and also to the burning rate of the fuel used. Racing engines using high nitro content fuels have very high, wide ports, while stunt or sport engines have much lower ports.

Port opening periods are usually noted as so many degrees of crankshaft rotation. This is "exhaust timing" and "bypassing timing." For speed engines the best exhaust timing has been found to be near 140 degrees, which means that the piston starts to uncover the exhaust opening when the crankshaft is 70 degrees from bottom dead center and closes when the crankshaft is 70 degrees past bottom dead center. Bypass timing varies from 120 to 130 degrees. The Super Tigre engines have symmetrical timing, the exhaust and bypass open simultaneously. The high pressure of the exhaust gases holds the fresh charge in the crankcase until the majority of the exhaust has gone out the exhaust port and pressure in the cylinder has been reduced below that of the crankcase. This gives the same effect as opening the exhaust port before the bypass yet allows a higher, larger bypass port to be used.

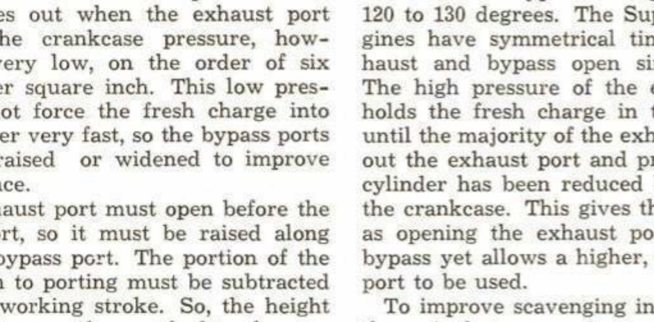
To improve scavenging in the cylinder, the main factors are time and the amount of fresh charge that you can get in. At 24,000 rpm, the bypass port is open for less than 1/1000 of a second. This is not enough time to allow a fresh charge to travel from the lower part of the crankcase all the way up into the cylinder. The top of the bypass chamber in the crankcase must be large enough to store a charge until the piston opens the port, letting the charge into the cylinder quite quickly.

Crankcase passages must be as large as possible to allow unrestricted flow of gases. On the other hand, this reduces crankcase pumping efficiency and can be detrimental to high speed performance. It has been found that the best solution to this problem is to "pack" the crankcase as much as possible, yet leave a large chamber right next to the bypass ports. Some engines, notably the Dooling, have transfer passages cut through the wall of the piston to allow the charge to travel into short, curved bypass passages. This also allows fresh charges to cool the inside of the piston a little better.

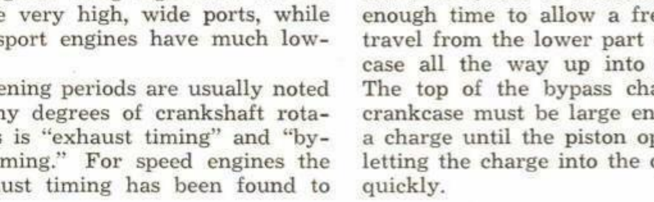
One of the greatest improvements in engine design in the last years has been the metallurgy of the sleeve-piston combination. The leaded steel sleeve and hardened cast iron piston is hard to beat, although chrome plating is still being experimentally used. A chrome plated sleeve is almost a necessity for top performance from a ringed, aluminum piston engine since friction is very high between aluminum and steel.

Pistons: Pistons, whether iron or aluminum, must be as stiff as possible to minimize warping and heat distortion. The best pistons have annular rings inside just above or below the wrist pin holes which aid in keeping them round. This greatly increases the cost of manufacture, but is usually necessary for high performance.

Even with a properly designed and manufactured engine, proper break-in of the sleeve and piston is required. Many



Baffled-piston combustion chambers: a. Flat, low compression. b. Hemispherical. c. Wedge.



Flat-top piston combustion chambers: d. Squish. e. Cone. f. Trumpet.

Figure 4

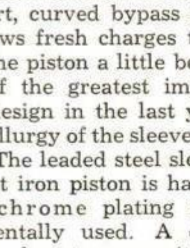
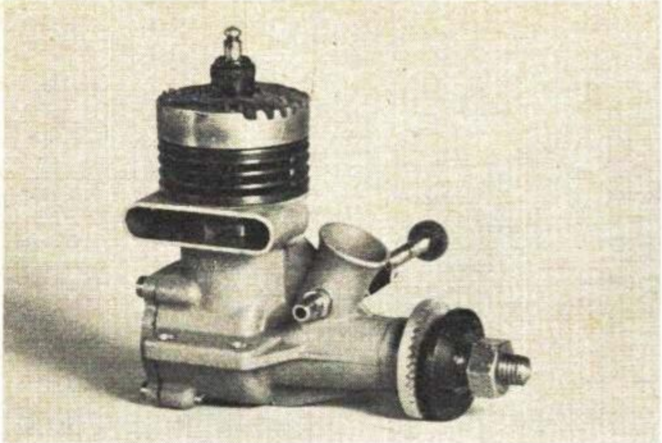
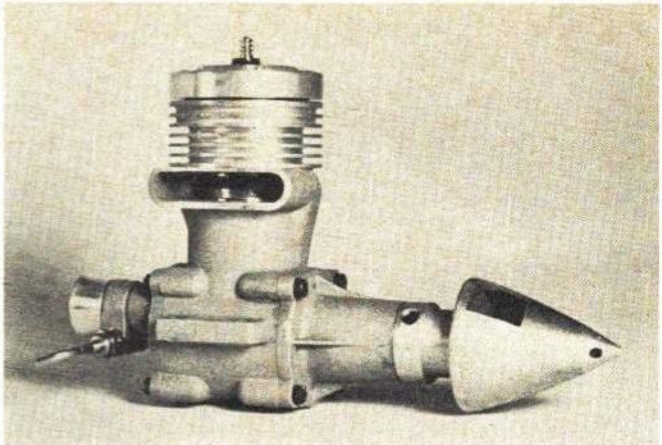


Figure 5: A "side-port" engine. The air intake usually enters at the rear of the case.



An O. S. 2.5 cc glow engine is an excellent low-priced powerplant. Features cross scavenging with front rotary valve and bronze sleeve bearing.



A 1966 series K&B .29 high-performance engine has cross scavenging, ball-bearing crankshaft, and a rear-disk rotary valve intake. Cross scavenging is used in many engines today.

attempts have been made to minimize or eliminate break-in running, but few methods are successful. For best performance, both the cylinder and the piston should be as round as possible and have the proper clearance to start with. Lapping the piston in its sleeve with some kind of abrasive compound usually results in a ruined engine since softer parts of the sleeve get cut deeper than harder areas. Also, the harder piston will force the abrasive into the soft metal of the sleeve; it does not get washed out, and will most likely cut too much clearance during the first runs.

Heating of the piston is not uniform during running, since intensely hot combustion gases heat the top causing it to expand more than the rest of the piston. The metal near the top of a lapped piston must be worn away to allow for this expansion before peak performance can be reached and maximum nitro fuel can be used. This metal worn away amounts to several thousandths of an inch off the diameter. Some of it can be ground away before running, but it is easy to grind too much unless you really know what you are doing. The piston also develops a bulge on the hotter exhaust side which must be worn away. Larger engines have used asymmetrical "cam-turned" pistons where this metal was ground away before assembly. It again is very difficult to grind the proper amount from a piston of the size we use.

The two stroke engines run very hot, and air cooling is usually uneven and inadequate. The main cooling is from the fresh air and fuel coming into the crankcase. Most high performance engines use a "hanger" type cylinder sleeve supported only by the lip at the top. The aluminum crankcase expands more than the sleeve, and even though it may expand unevenly, it does not squeeze the sleeve out of shape. Warped cases or warped sleeves are usually the greatest detriments to engine performance.

The importance of proper break-in cannot be overemphasized. Engines on the bench should be run at or slightly above the rpm that they will operate at in the air. A smaller diameter, lower pitch prop allows the engine to be run at operating rpm with a rich needle valve setting. The excess fuel mixture keeps the engine cool and lubricated to prevent tight parts from seizing.

One other aspect of proper break-in has to do with the instability of some piston materials. Hardened cast iron is unstable and will actually grow in dimension when it is heat cycled. This growth can be as much as .001" per inch of diameter. As an engine is run, the piston is heated and cooled during every stroke, resulting in a slow growth. This growth, however slight, must be worn away, and the engine is not broken in until the piston has stabilized. The time required for this varies according to the heat treatment and the alloy and can be several hours of high rpm running.

Head Design: Various head shapes are shown in Fig. 4. The classic domed piston and hemispherical or matched combustion chamber has almost totally been replaced by flat top pistons and "squish band" heads. The squish band is a circular band that fits very close to the piston at top dead center, and "squishes" the trapped charge into a central combustion chamber. The diameter of the chamber is usually about 65% of the bore diameter, and the depth is varied to give the correct compression ratio. A variation of the squish band head is the "trench" head,

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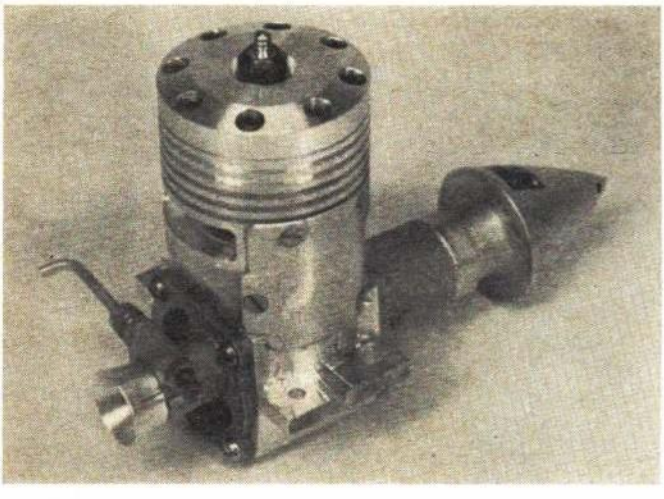
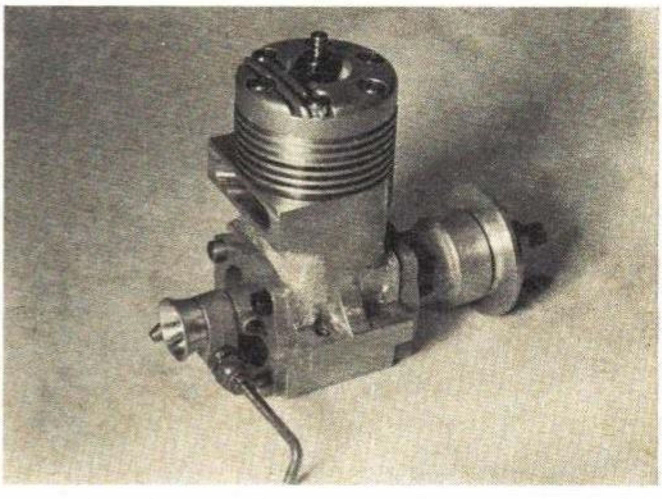
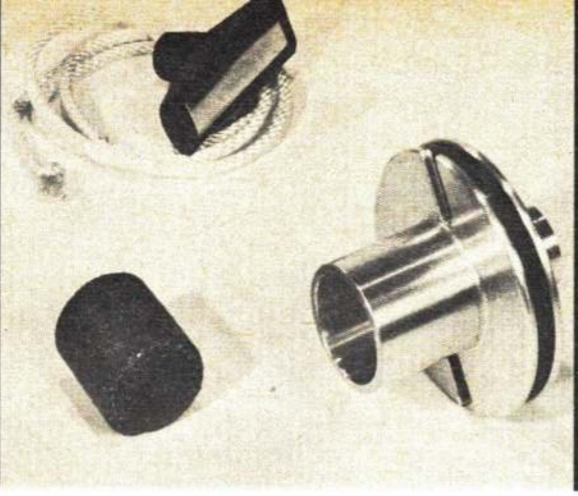


Rear-exhaust 2.5 cc engine built by the author using MOKI crankshaft, Super Tigre piston and head, and homemade crankcase and sleeve with Schnuerle porting.

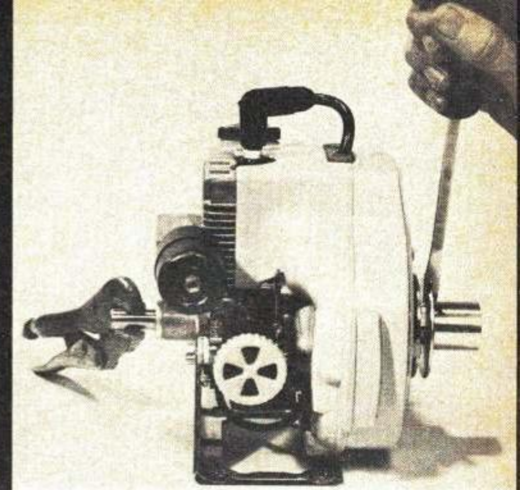


Bypass covers are epoxied and bolted on this .40 cu. in. engine built by the author. K&B .29 crankshaft and rotary valve used; crankcase machined from bar stock.

Remove the Recoil Starter unit from the Cox 140's flywheel. This end of the crankshaft must be used as it turns in the proper direction for starting conventional engines.



Three items are needed to convert the Cox 140 into a starter. Left to right — short length of 1" O.D. rubber hose to be pressed into adapter's open end; starter pull cord with handle (use the one from the Recoil Starter unit); and a machined starter adapter with notched pulley for the cord.



A pair of vise-grip pliers and a large screw driver are needed to fasten the starter adapter to the Cox 140 engine. Be sure to put it on TIGHT!

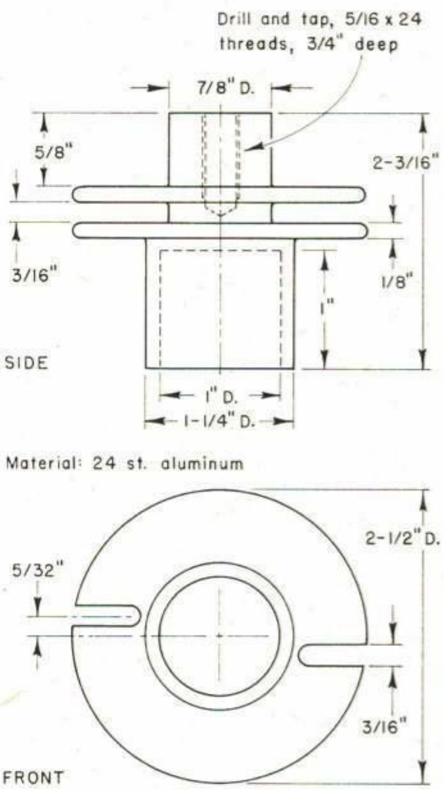
DALE KIRN

photography / PAUL GATES

ENGINE STARTERS — SOMETHING NEW

An adapter added to the Cox 140 transforms this utility engine into a compact and lightweight starter.

ABOUT a year ago, the L. M. Cox Mfg. Co. released a small one hp two-cycle utility engine. Its small size and light weight made it appealing for many applications. Already in the model plane field some radio control modelers are making modifications on it for use in large RC planes as it runs quite well on a glow plug.



STARTER ADAPTOR FOR COX 140 ENGINE

Another recent application is to use it as a starter unit for speed plane engines. This is really nothing new, as this author has seen several Briggs and Stratton engines set up for this purpose years ago. But they had a couple of undesirable points. First, the large size and weight of the engine itself. And second, the limited rpm range of the engine.

The starter unit you see in these pictures has been used to start all sizes of speed engines from .15's on up to .60's with no trouble at all. If you need more than 7,000 rpm to start your speed engine, you may have to "soup up" the Cox 140. However, we found that it would start a Rossi .60 at half throttle.

The most appealing thing about this Cox starter unit is its instant starting ability. No waiting for it to build up rpm, as is necessary with the inertia type starters. True, you have instant starting rpm with an electric starter, but with the Cox starter there is no battery to keep charged up. The Cox 140 runs on good ole gas and oil and has a magneto built right into the flywheel for the ignition system.

Once the speed engine is started, the Cox starter unit can be stopped by merely pushing down on the kill button on the top of the engine. So simple that even your girl friend or wife can do it.

Inertia starters are still popular today, but they are getting harder to find. Especialy the Army surplus 80:1 gear ratio units. Even if you are lucky enough to obtain one, there is still quite a bit of machining to do before you have a usable starter. And when the unit is ready, you still have to procure a willing strong arm to grind the starter up to the required rpm to start your engine. In some cases, this rpm must be maintained for a long period of time. It is not uncommon to observe two or three crankers give out at a contest — and ask for help. Muscles get tired. And so do tempers.

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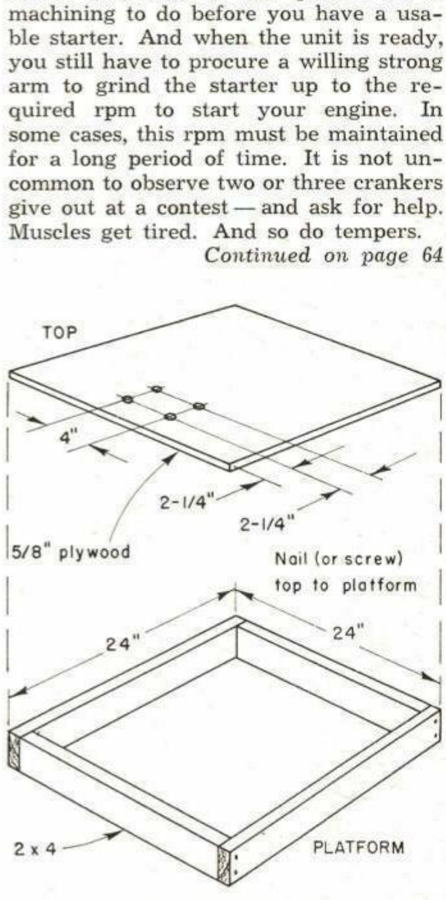

ENGINE MOUNTING STAND

Beechcraft Mentor

An accurate scale model of the T-34 advanced military trainer still seen today on active duty. It is easy to fly yet stuntable.

BUD ATKINSON

SCALE builders are always on the lookout for good scale subjects; ones that will adapt to model building and have good flying capabilities. Many times an airplane that is ideal for RC scale is overlooked. I think the T-34 has been, up to now, one of the overlooked. It's easy to build and has very good flying capabilities, much the same as our Class III stunt ship.

The Beechcraft model 45, named Mentor after the trusted servant of Greek mythology, first flew as a prototype in late 1948. Since that time the Mentor has served as a training airplane for thousands of United States Air Force and Navy pilots and continues in use at some military installations even today. Approximately 100 of the Wichita-built trainers are still in operation at the Pensacola Naval Air Station.

The Mentor was designed and privately financed by Beechcraft as a primary and basic trainer for the military services. It filled the design requirements so well, that over 1000 units were produced by Beechcraft for domestic and export sale. The aircraft was also produced under license from Beech by Japanese, Canadian and Argentine firms.

The Mentor, a single-engine, all-metal, two-place trainer, was built around the then-new Beechcraft Bonanza design to assure high performance while retaining economical operation and low fuel consumption.

The prototype aircraft was test flown December 2, 1948, by Vera Carstens, now retired, who was then Beechcraft's chief test pilot. The prototype Model 45 was powered by a Continental E-185 engine. It had a cruise speed of 160 mph at 10,000 feet and a top speed of 176 mph. Service ceiling was 18,000 feet and gross weight 2650 pounds.

The Mentor was stressed for ten positive and 4.5 negative "G's" and was fully aerobatic — a feature demonstrated in exhibitions at the Cleveland and Miami air races in 1949 and 1950 by the noted aerobatic pilot Beverly E. "Bevo" Howard. Betty Skelton also flew demonstration flights in the early Mentor. Additional demonstrations were flown in the United States and overseas by Beechcraft and guest military pilots through 1949 and 1950, winning every evaluation competition entered.

First production model of the Mentor was delivered to the U.S. Air Force, October 1953, at Edwards Air Force Base.

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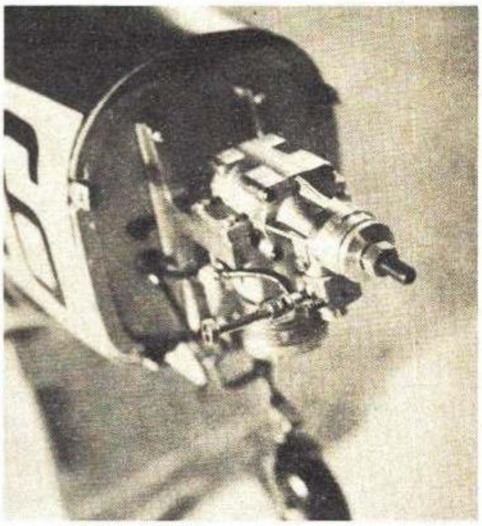
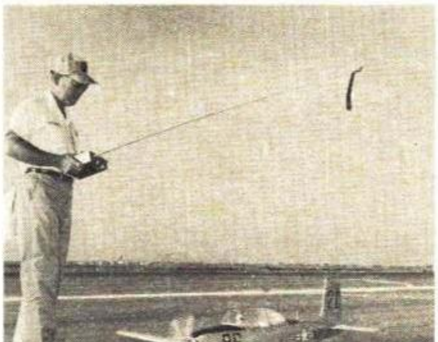
Beechcraft designed the Mentor as a high-speed prop-driven trainer. The plane is fully aerobatic, including outside maneuvers.

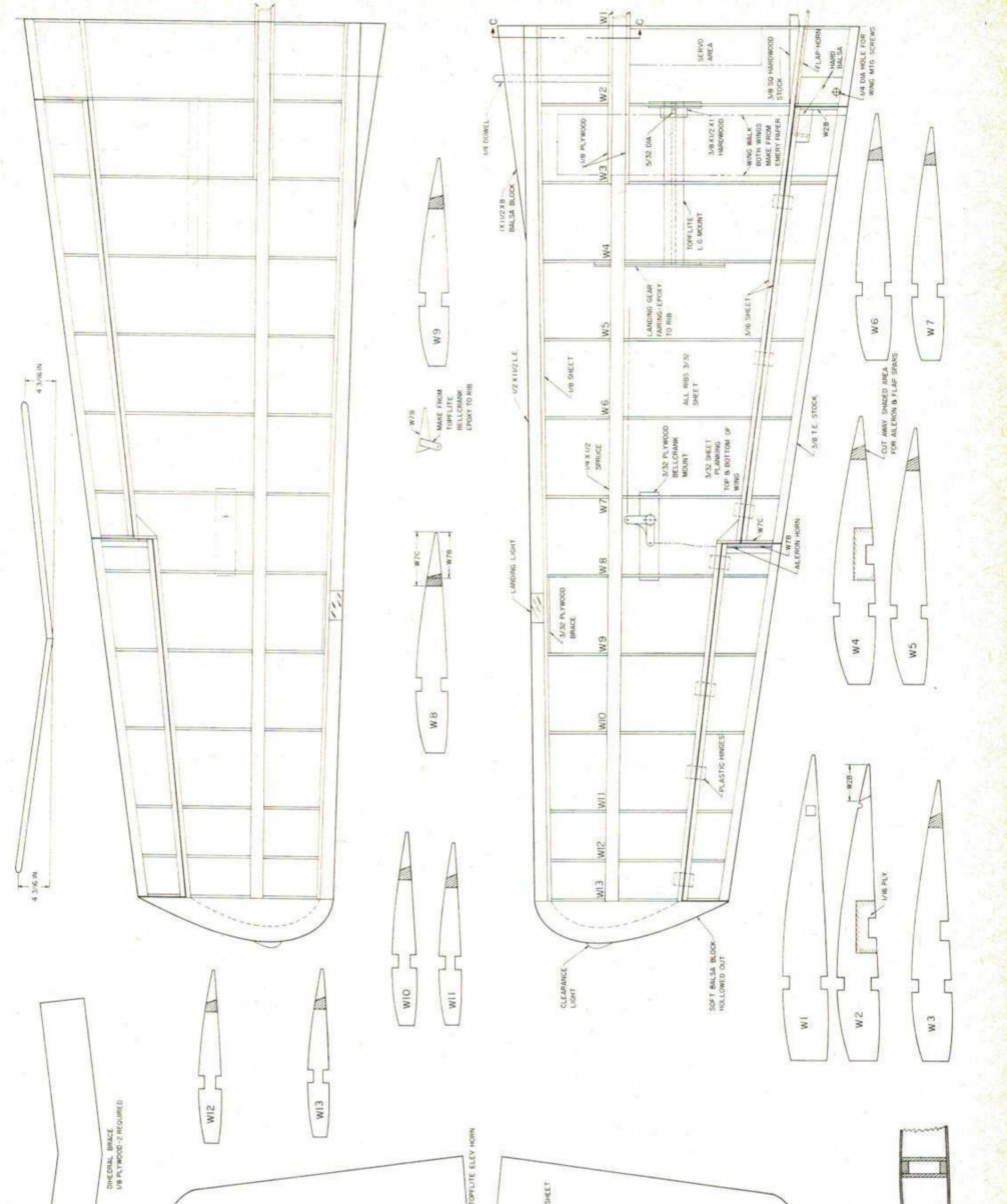


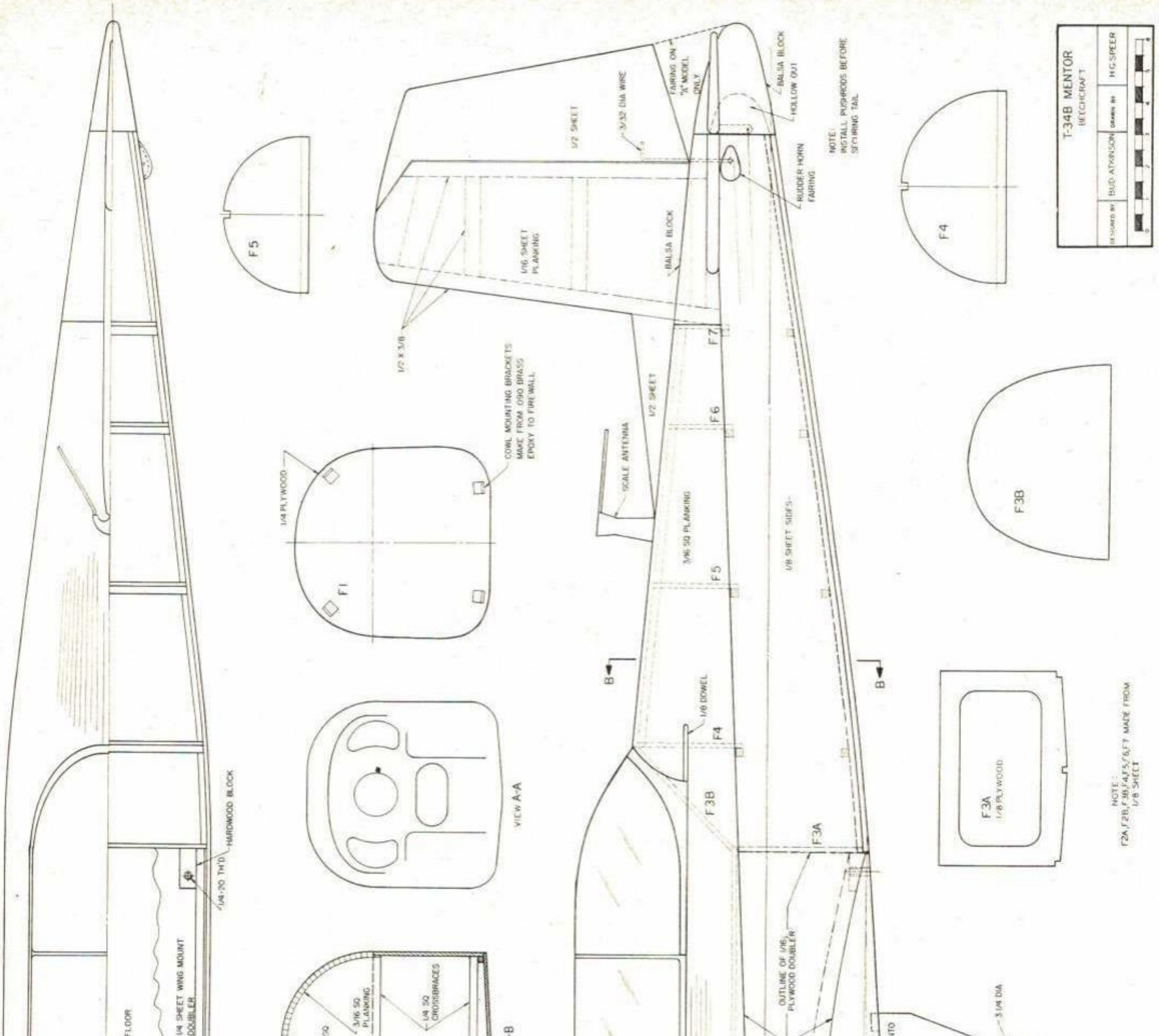
Under the fiberglass cowl (which is available from Ace R/C Inc.), an Enya .60 on Midwest mounts and a Lakin nose-gear assembly.



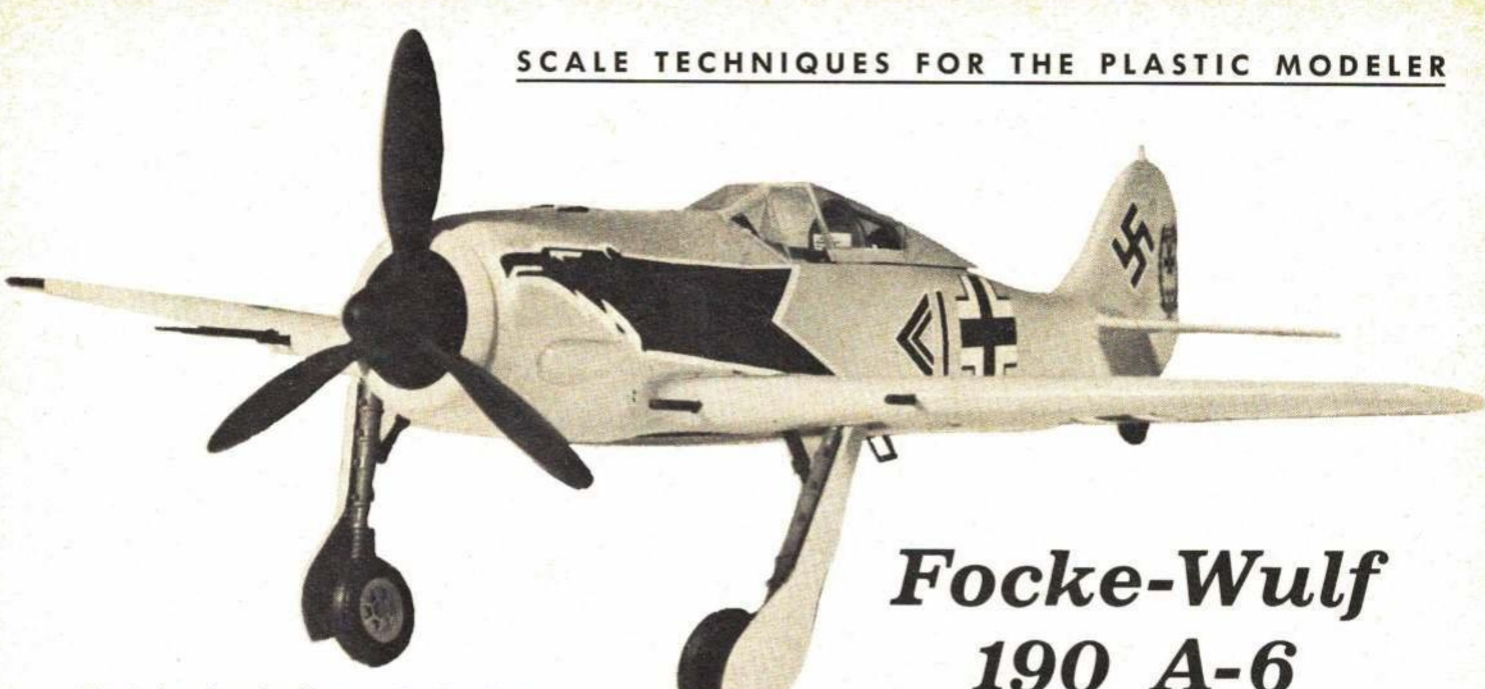
Following a realistic landing with the flaps down, Bud taxies the Mentor into the "hangar" at the 1967 Nationals at Los Al.

Because of its large flying and control surface areas, the model T-34 flies just as well, and is as aerobatic, as the real plane.


4 3/16 IN
4 3/16 IN
C
W1
C
1/8 DOWEL
1 X 1 1/2 X 8 BALSA BLOCK
1/8 PLYWOOD
5/32 DIA
3/8 X 1/2 X 1 HARDWOOD
WING WALK BOTH WINGS MAKE FROM EMERY PAPER
SERVO AREA
3/8 SQ HARDWOOD STOCK
FLAP HORN
HARD BALSA
1/4 DIA HOLE FOR WING MTG SCREWS
W2B
W2
W3
TOPFLITE L.G. MOUNT
W4
LANDING GEAR FAIRING - EPOXY TO RIB
3/16 SHEET
W5
1/2 X 1 1/2 L.E.
1/8 SHEET
ALL RIBS 3/32 SHEET
W6
3/8 T.E. STOCK
1/4 X 1/2 SPRUCE
3/32 PLYWOOD BELLCRANK MOUNT
3/32 SHEET PLANKING TOP & BOTTOM OF WING
W7
W7C
W7B
AILERON HORN
W8
LANDING LIGHT
3/32 PLYWOOD BRACE
W9
W10
PLASTIC HINGES
W11
W12
W13
CLEARANCE LIGHT
SOFT BALSA BLOCK HOLLOWED OUT
W7B
MAKE FROM TOPFLITE BELLCRANK EPOXY TO RIB
W9
W7C
W7B
W8
W10
W11
W12
W13
W6
W7
CUT AWAY SHADED AREA FOR AILERON & FLAP SPARS
W4
W5
W2B
1/16 PLY
W1
W2
W3
DIHEDRAL BRACE
1/8 PLYWOOD-2 REQUIRED
TOPFLITE ELEV HORN
3/8 SHEET
1/4 X 1/2 FRAME
1/16 SHEET PLANKING BOTH SIDES
1/4 SHEET TIPS
SEC C-C



FULL SIZE PLANS AVAILABLE — SEE PAGE 60



Front view shows landing gear detail and location of Eagle emblem and armament.

Focke-Wulf 190 A-6 Interceptor Fighter

JOHN N. TOWNSLEY

THIS month's aircraft is that of Major Hermann Graf (later Oberst Graf), tenth highest scoring ace in the German Luftwaffe with a score of 202 victories. His FW 190 A-6 aircraft was painted bright yellow — polished and gleaming as a jewel. The squadron he led was the Geschwader-Richthofen, the famous "Yellow-nose" Richthofen outfit. It was truly an elite corps, every pilot having been specially selected for superior qualities.

The Geschwader operated in France from Triqueville Airfield, the home base, and three satellite fields: Evreux/Fauville; Beaumont-Le Roger, and Saint-Andre. They were equipped with improved FW 190 A-6's that were lighter than the preceding Focke-Wulf series by 1,114 pounds.

Specifications. Wingspan: 34′ 5½″, length: 29′ 4⅛″; powerplant: B.M.W. 801 D-2 air-cooled 14-cylinder, 2-row radial engine of 1,700 hp; 2,100 hp at takeoff (with M.W. 50 methanol/water-injection system). Armament: Four MG 151's and two MG 17's mounted two in cowl and four in leading edge. Weight loaded: 8,600 lbs. Speed: 405 mph at 20,500 ft.; 355 at sea level. Rate of climb: 2,350 ft. per min.; service ceiling: 37,400 ft.

Color scheme and markings. Entire plane: gloss yellow. Either Aurora gloss yellow or Humbrol #8 gloss yellow enamel can be used. National markings, swastika, and the "200 Victory" decals are from the kit.

Preliminary procedures. Check for missing parts and familiarize yourself with the general pattern of assembly and location. If parts are broken, repair them at the outset if possible. Wash all parts in a warm detergent bath to remove mold release, rinsing well with clear lukewarm water and allowing to dry. Return all parts to kit box.

Painting small parts: Gray-green (mix ½ Pactra anti-glare green and ½ Pactra aircraft gray). Spray prop and fan flat black. Armor nose-ring: red inside, yellow (same as aircraft color) outside. Armor plate (Parts B-11 and B-13); gray-green; three tires: flat black; inside of wheel: dark gray (Pactra Hot-Rod gray); cockpit assembly (B-6, 7, 8) and cockpit interior: gray-green. Windscreen framework (B-37) and canopy frame

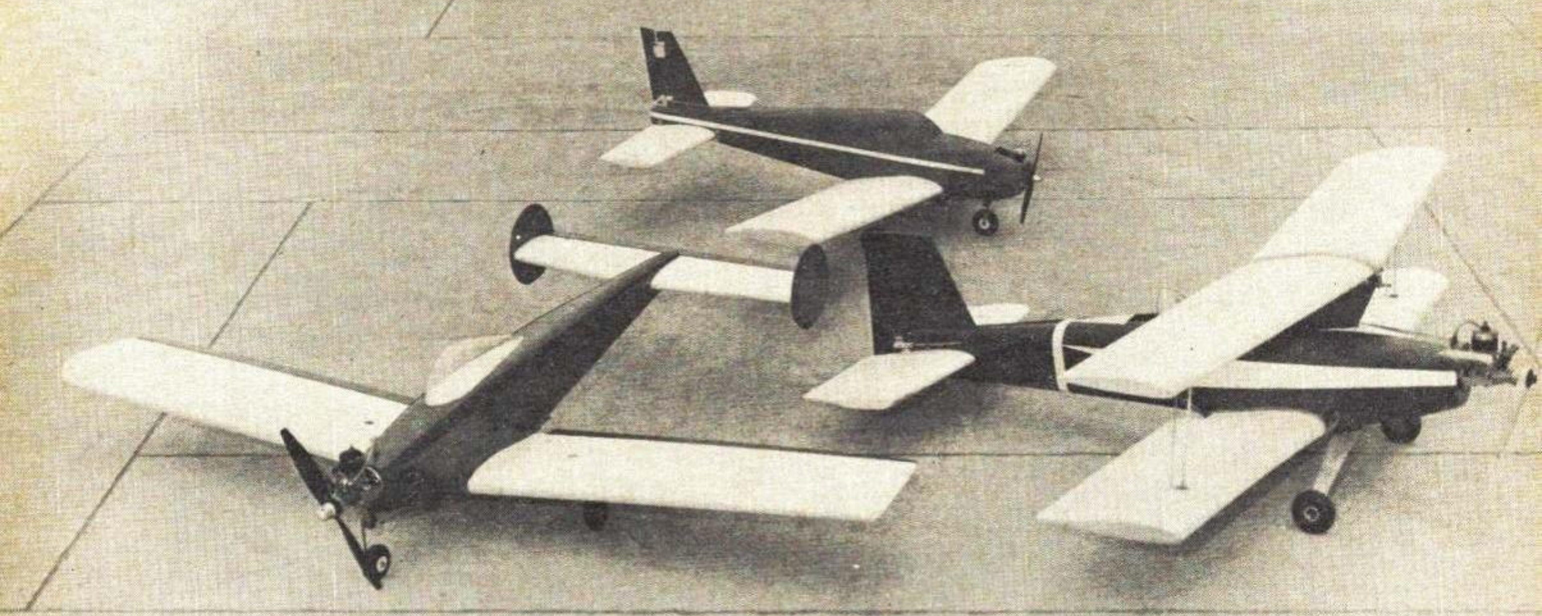
Continued on page 56

Major Hermann Graf was the German Luftwaffe's tenth ranked ace. His aircraft is this month's scale subject. Photo from the author's collection of famous fighter aces.

Placement of the "200 Victory" and national markings is seen here. Note partially open canopy. Features bright yellow glossy paint scheme which was kept immaculately polished.

Meet Aeromite and Acromite

Our full-house equipped models have the same wings as the single-channel Testor's Skyhawk in background. Schoolyard flying with all the fun of the big ones and great for Simpro III!



THE MINI MULTI'S

ED SWEENEY

Using Testor and Midwest foam wings, these high-performance midgets are quick to build, inexpensive, and thrilling to fly.

ON the following two pages are shown profiles of two inexpensive, small, fully aerobatic models which demonstrate that a revolution in radio control may be on hand. Why do we fly six-pound, six-foot, and .60-powered multi planes when the same performance and many advantages can be found in much smaller aircraft? It is practical to build and fly .15 powered, 44-in. winged, three to four pound models for active aerobatics with new miniaturized equipment. Perhaps we should think small, not big?

Our two models feature the Testor, or Midwest, 44-in. molded styrofoam wing and tail set available at most hobby shops for $5. No wing or stabilizer construction is required in either airplane. Just an easy fuselage. What could be simpler — or less expensive?

The models were flown originally with the Simpro III control system with two proportional functions and trimmable throttle. When the Bonner Digimite 4RS became available it was installed for full-house proportional. Whether full-house or 3+1, these simple models are amazing. Their performance includes all the FAI or AMA contest maneuvers and is comparable to that of such bigger models as Kwik-Fli, Taurus, Beachcomber, etc. Powered by a muffled .15 they regularly fly the contest pattern on only two ounces of fuel. More power would be excessive. The monoplane can perform four continuous vertical rolls entered from level flight, without any zoom to build up extra speed.

The monoplane was intended to be a "quick and dirty" type, not realizing how much performance was being created. It has ailerons, a nose wheel steered from the aileron servo, as well as elevator and motor control. The rudders are not operative, but could be controlled.

It showed its capability quickly. Rolls were easy and axial, inverted flight required only 20% down elevator and outside loops were smooth and symmetrical. Four-point rolls and slow rolls entered from a climb of only 15 degrees could be performed from one horizon to the other. Other maneuvers, which are combinations of rolls and pitch, were easy to do. Wingovers could be fudged by entering on a slight off-center climb with a power chop at the peak of the climb (not necessary if rudders are made steerable).

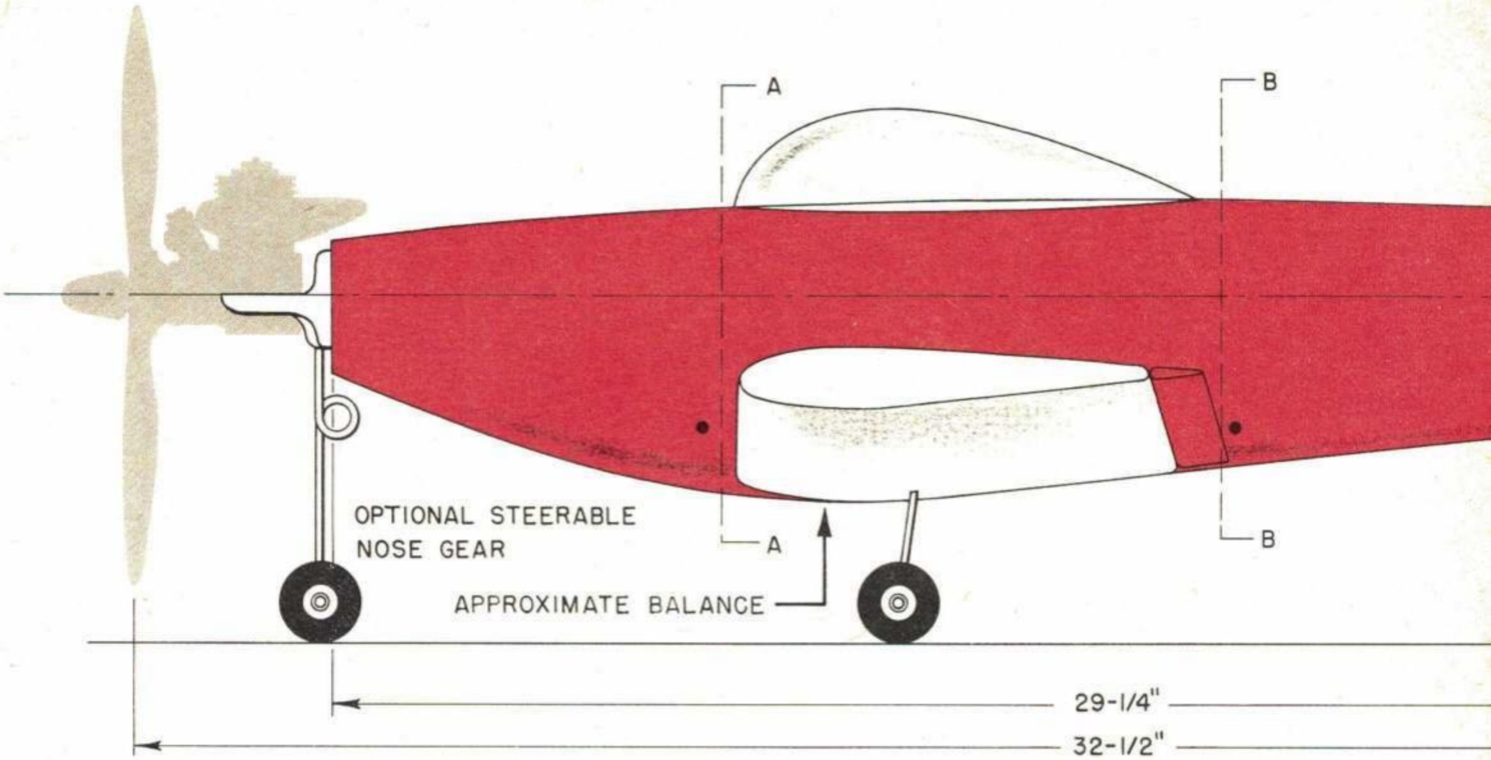
Flown mostly in the wind, it was surprising to see that a small, well-equipped model is not blown around as much as might be expected. Touch-downs in gusty wind are not a problem for a small model either. With the tricycle gear and steerable nose wheel, ground handling is a cinch. By the way, one can't miss stopping on the spot when proto-taxiing to the "hangar" in the AMA pattern. Brakes are not used since our .15 ran so slowly at idle.

After discovering the excellent flying characteristics of the monoplane, we became concerned about the possibility that a high "G" pull-out might fold the flexible wing. Much flying showed such danger does not exist. A .15 is more than ample power as long as the plane weighs less than three pounds. The wings perform beautifully at this wing-power loading. A bigger engine, or more weight and you might fold it up!

To alleviate this unfounded concern about the wings, we designed the biplane. It is heavier, and its two wings are clipped, but the combined flying surface area is very much greater, and thus it can withstand extreme flying pressures. The top wing is swept back by cutting it in half and angling the center section, and rejoined with epoxy. The bottom wing was clipped at the tips to about 39 inches and the top wing to 41 inches.

The biplane's flying characteristics are similar to those of the Aeromaster by AAMCO. It performs all maneuvers with grace and ease, especially landings and takeoffs. It is also very stable, but less responsive to the ailerons. The rudder is very effective for wingovers and spins. When doing rolls, it helps to use a little coordinated rudder and, as the plane comes to the inverted position, only a slight bit of down elevator keeps the nose up nicely. Because of the increased drag of two wings, it will perform one perfect vertical roll and level off smoothly. It is not fast. It lands very slowly and weathervanes into the wind strongly, but taxies cross-wind easily.

For increased aileron control, one can reduce the dihedral of the bottom wing,

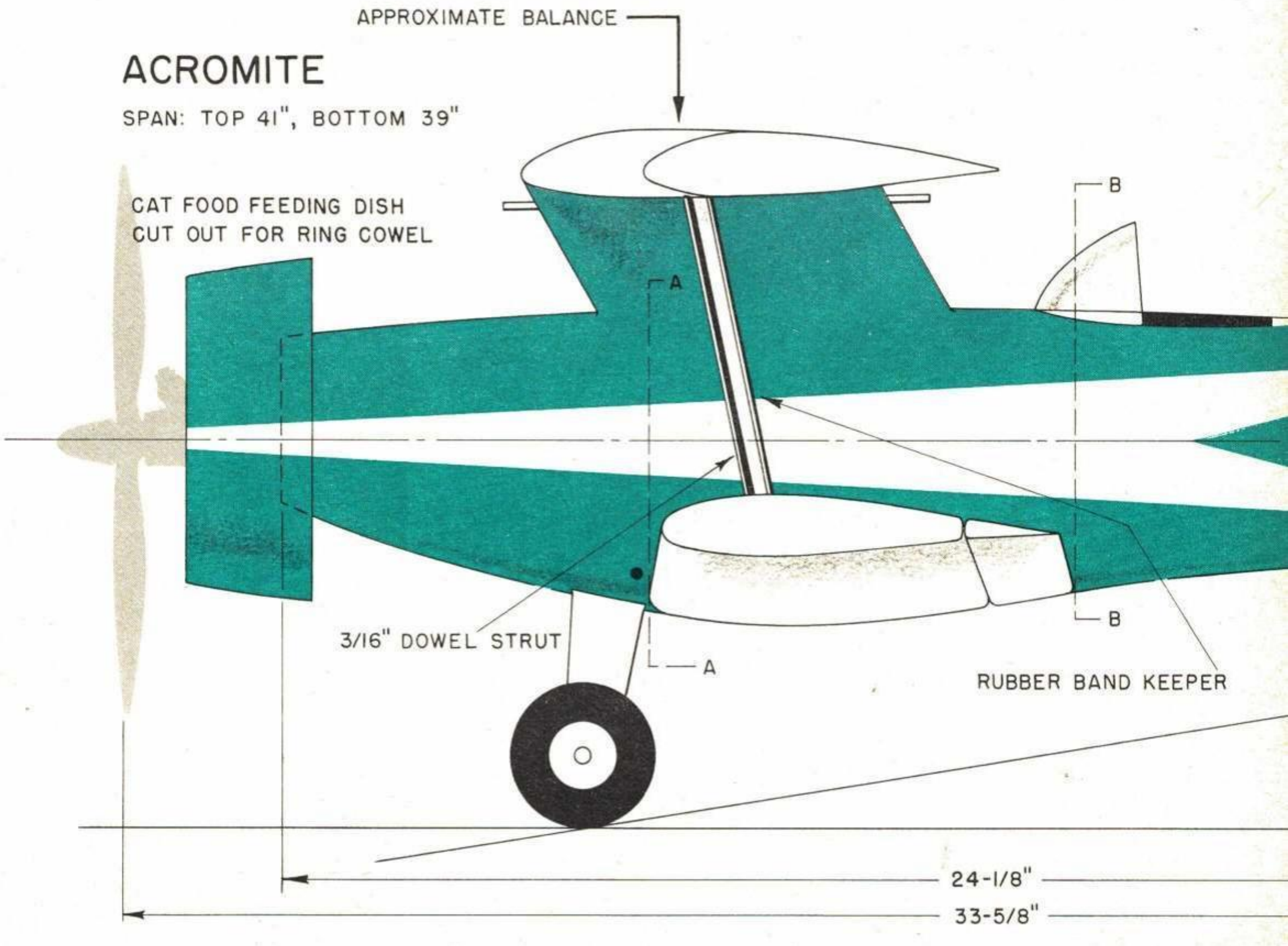


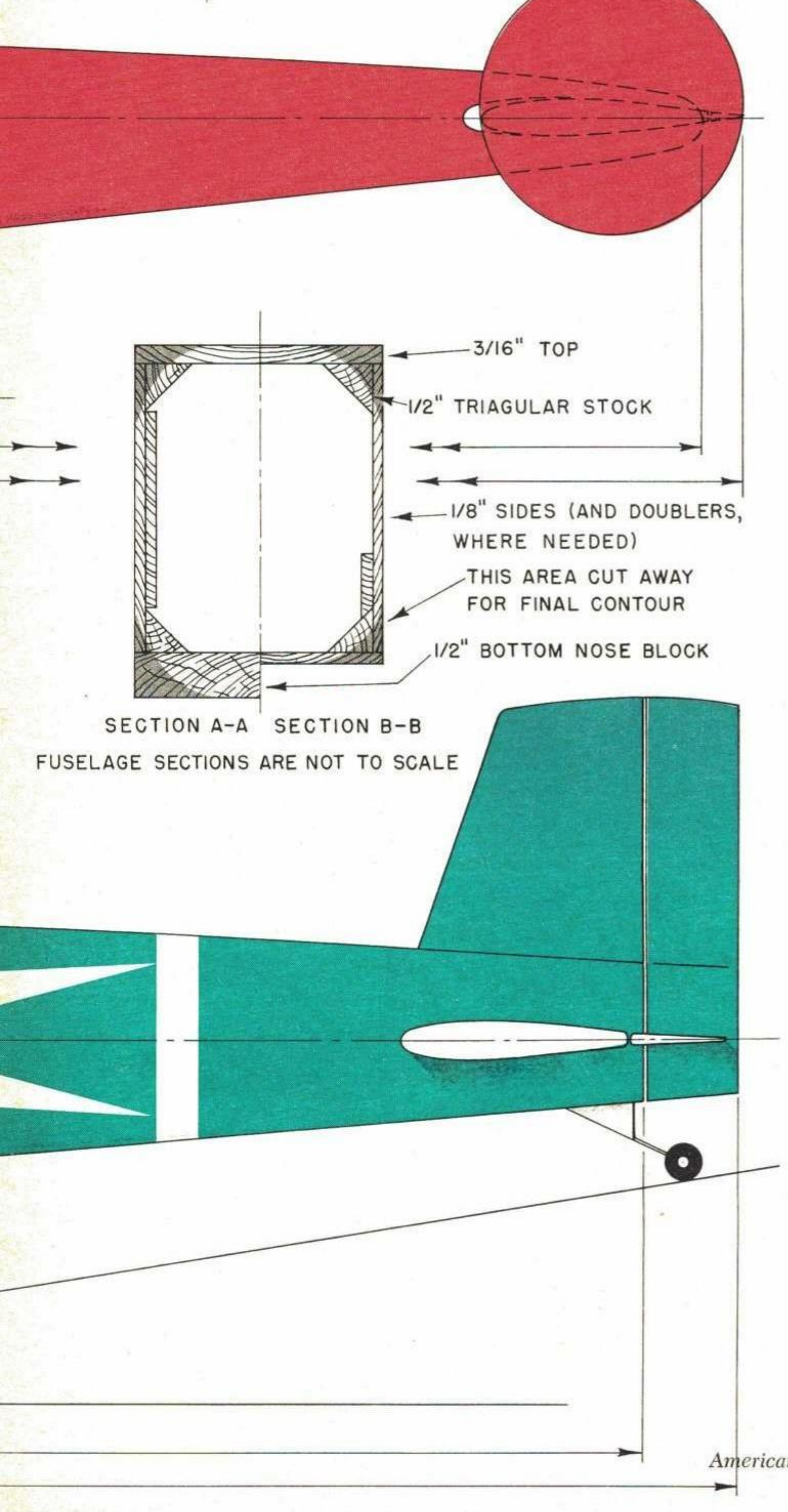
AEROMITE

SPAN: 44"

ACROMITE

SPAN: TOP 41", BOTTOM 39"





probably without upsetting the other flying characteristics. Or, set up four ailerons! The author likes a very stable model, and an effective rudder.

These smaller models are really good at flying out of small areas, like football fields and tennis courts (whose sides are not obstructed). There are a great many small parks which become natural flying sites for *quiet* models capable of using them. It has been thought that small models are hard to fly because they seem to respond to the controls too quickly or suddenly; this is not fact. They can, however, perform maneuvers within a smaller air space. One can do maneuvers the same size as with their larger counterparts; this is a matter of technique. At a contest, this ability may really pay off. The pattern can be presented much nearer, and in a much more confined space for the judge's convenience. Landings and takeoffs are short and easy, so why not land safely at the judge's feet! (Don't scare them though!)

There is not much to say about construction of the Mites; the only building is the fuselage and hinging of control surfaces. A few notes pertinent to each model may help.

A cross section used for both fuselages is shown. Sides, bottom sheeting, and doublers are 1/8" soft straight-grained balsa. Corners, glued first to the sides with the doublers, are 1/2" triangular stock. Top sheeting is soft 3/16" balsa. Firewalls are laminations of two pieces of 1/8" five-ply plywood. When glue-up is dry, the fuselage is a box which can be easily rounded off as indicated. Don't leave it square, because it will be heavy. The two bulkheads are cross-grained laminations of 1/8" balsa.

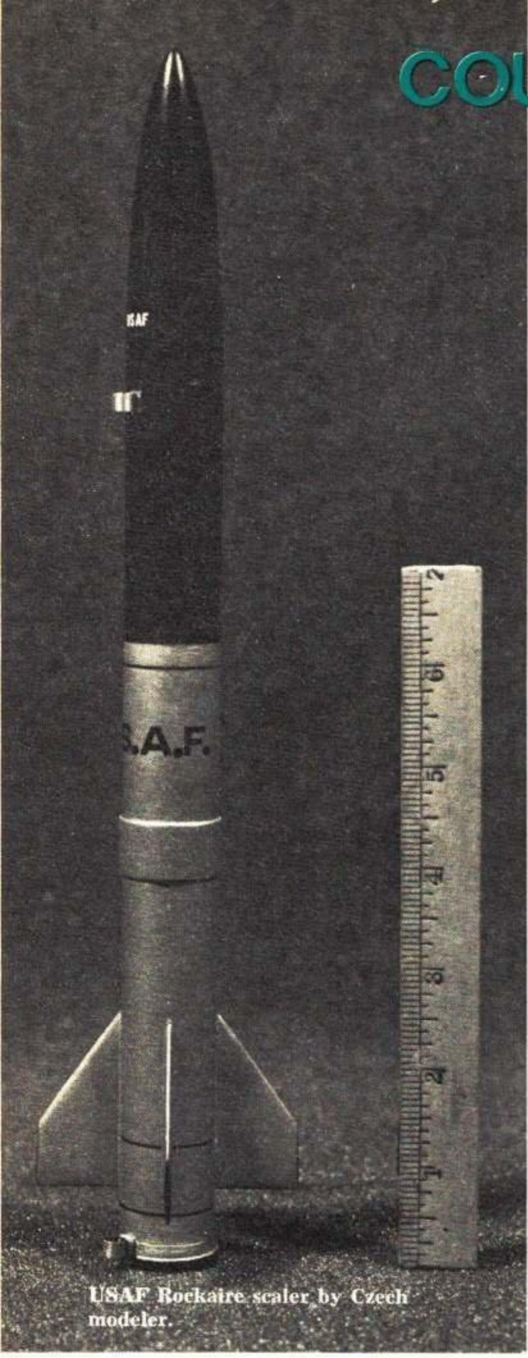
There are a few particular recommendations for the biplane. Its single-strut wing pylon is laminated with plywood and balsa so that it can be shaped as an airfoil, yet be rigid. The wing platform is 1/16" plywood epoxied to the strut following the shape of the wing's lower surface. When the pylon is completed, including the wing mount, shape and sand it to final contour before epoxying it into the fuselage. It is inlet into the top sheeting and keyed to the forward bulkhead. The wings' incidence, relative to each other, must be zero or with the top wing slightly negative. Adjust this while the epoxy is setting up when mounting the pylon to the fuselage. The stabilizer should be at zero incidence relative to the bottom wing.

Because of the flexibility of the styrofoam wings, the spreader struts between the wings are essential. Inset one-inch lengths of 1/2" dowel into the wings at the strut locations, and glue firmly in place with epoxy. The struts are lengths of 1/8" dowel that slip into holes in the larger dowel sections. A rubber band between the wings holds them together against the struts.

Control surface hinging applies to both models. We used the mechanical plastic hinges now becoming so popular. They are firmly glued first to the finished and painted balsa control surfaces. The trailing edge of the foam flying surfaces was cut off with a sharp razor to be about 1/4

Continued on page 53

COUNTDOWN



USAF Rockaire scaler by Czech modeler.

The In's and Out's

Following his December '67 article about choosing a prototype, the author now considers design require

G. HARRY STINE

NOW that you've selected a good full-scale rocket vehicle to build a scale model of, and have collected enough good information, where do you go from there? The next step is to design the model.

You must be intimately familiar with the model rocket parts and components that are available — body tubes, nose cones, engine mounts, etc. — as well as with the plethora of model rocket engine types you can get. With all of this in mind, you can then start sizing your scaler.

If you have chosen a prototype with lots of external detail and many complex shapes, it's better to build a large scale model. Little bitty details are often exceedingly difficult to make and attach to a model if the model is too small. On the other hand, if you have selected a rather simple prototype without many details — just a nose cone, cylindrical body, and a set of fins, for example — it will look better if it is smaller.

You may also have to size your model on the basis of what you intend to do with it. If it is a pure competition scaler, you don't have as many restrictions. If you want a scale altitude model, you will want low total drag, high impulse-to-weight ratio, and a large enough size so that it can be seen and tracked.

Use as many commercially available parts as you can. You will have plenty of custom-made parts to fabricate as it is. Use commercial body tubes. Many commercial nose cones and transition pieces can be easily modified for some scale model components.

The biggest single problem of nearly all scale models is their weight. The majority of scale model builders end up with a scaler that weighs too much. As a result, scalers are usually under-powered and just manage to stagger into the air when flown. Therefore, build as small as possible consistent with detailing.

And choose the engine you will use to power the bird before you start to design and build it! Match the engine to the model just as you would if you were building a sporting model. If your bird is under-powered, it will likely prang; if it is over-powered, you will probably kiss it bye-bye over yonder hill as the wind carries the parachute into the next county.

There are no hard-and-fast rules of thumb for properly sizing a scale model. Each case is different. And sometimes you may have to experiment a little by building two or more scalers of the same prototype in different sizes to find out which one will suit your needs and desires.

Learn to do a little simple drafting. Drawing equipment is available today at very reasonable prices. You'll need a drawing board, a T-square, a couple of triangles, a good pencil with a 2H lead in it, an eraser, an engineer's triangular scale, maybe a French curve or two, a drawing compass, and a protractor. Get

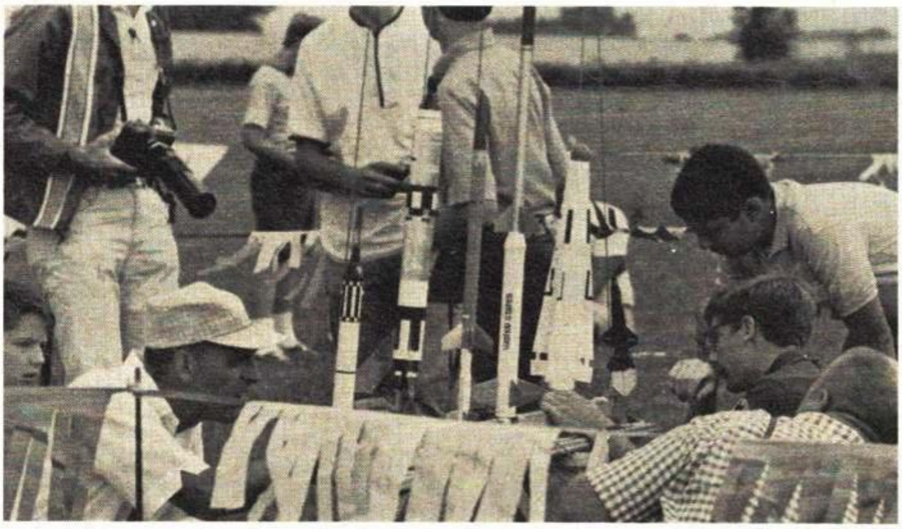
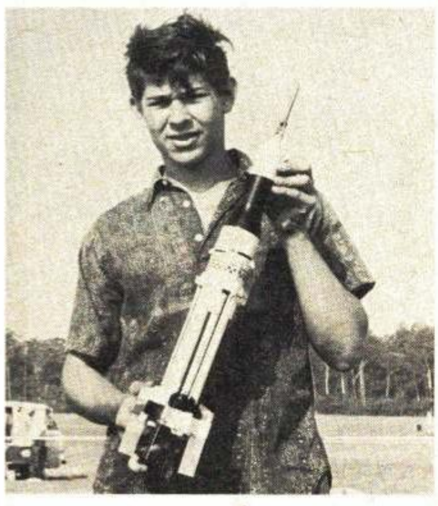


Photo by Pastrick.

Typical NARAM scale scene. Left to right on rack: Mercury-Redstone, Gemini-Titan, Aerobee-350, Nike-Tomahawk, GAR-11 Falcon, and X-15.



Howard Rotz of New York flew this beautiful NASA Saturn-1 at NARAM-6, Wallops Station. A complicated job.

# of Scale

ments of the model itself.

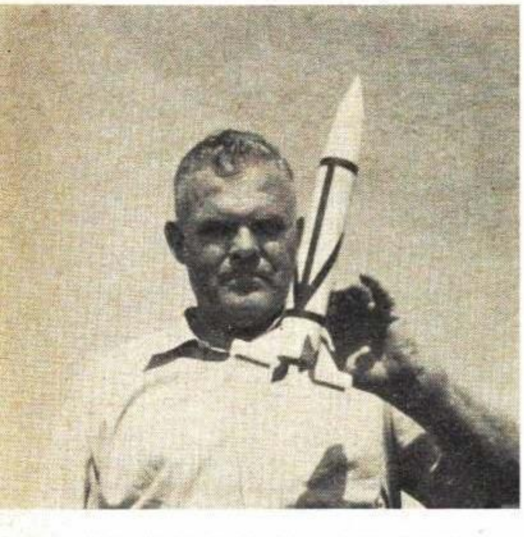
a little practice by designing and drawing a couple of sporting models on the board first.

Having decided upon the size of the scaler and prepared your drawing equipment, you then prepare a full-size drawing of the model. To do this, you must determine the scale of the model.

The most common method of determining the scale of the model is to determine the ratio between the diameter of the prototype and the diameter of the body tube of the model. For example, if the diameter of the prototype is 31.00 inches and you are using a body tube with an external diameter of 1.04 inches, you divide 1.04 into 31.00. This gives you a number — 29.8, for our example. The scale of your model is therefore 1 to 29.8, more commonly written as 1:29.8. Every dimension of the prototype must then be divided by 29.8, in our example, to come up with the dimensions of the model. With a piece of paper and a slide rule, you then divide every dimension of the prototype by the scale ratio. Naturally, a 30-degree angle on the prototype will also be a 30-degree angle on the model, so do not divide angles by the scale ratio.

Using the model dimensions you've calculated, you then make a full-sized drawing of your model. (If you're lazy and/or rich, you can take the prototype drawing to a copying company — for example, a blueprint shop — and have them make a photographic reduction of the prototype plans to exactly the size you

Continued on page 69



John Drake holds General Electric Hermes RV-A-10. Prototype was 1952 ancestor of the Minuteman. An uncomplicated model.

model rocketeer

NATIONAL ASSOCIATION OF ROCKETRY
1239 Vermont Avenue NW, Washington, DC 20005

VICE PRESIDENT HUMPHREY SEZ

Vice President Hubert Humphrey in a recent letter to the National Association of Rocketry commended the work of the Association in the field of model astronautics.

"It was rewarding to see the enthusiasm dispayed on the faces . . . (of the modelers). I sincerely appreciate the efforts of your association to help develop our most important natural resource — the youth of America."

Several NAR members in the Washington area built models and presented them to Mr. Humphrey in recognition of his support of the NAR program.

G.E. HONORS NAR CHAMPIONS

The General Electric Valley Forge Space Technology Center, located near Philadelphia, Penn., honored five NAR members on October 3, the eve of the tenth anniversary of the Space Age. Charles Duelfer, Stamford, Conn.; Mark Mercer, Bethesda, Md.; William Bloch, Pittsburgh, Pa.; Joseph Persio, Chehire, Conn.; and Greg Scinto, Stamford, Conn. were guests of the space center for the day.

News coverage of the event was extensive. A scale model Thor-Agena B that was launched at the ceremonies was presented to Mr. Hilliard W. Paige, G.E. Vice-President and Division General Manager. Mr. Paige commended the NAR modelers and urged them to continue their interest in astronautics. He said there will always be a need for qualified men and women in space technology.

Jim Kukowski, NAR Trustee, Rockville, Maryland accompanied the group.

NEW OFFICERS AND BOARD

A new slate of officers and Board of Trustees was elected at NARAM-9 by members of the NAR.

President — Dr. Ellsworth Beetch, 211 Clover Lane, Mankoto, Minn. 56001; Vice-President — Bryant Thompson, 511 South Century, Rantoul, Ill. 61866; Secretary — Robert Atwood, Box 98B, Route 3, Annapolis, Md. 21423; Treasurer — Dr. William B. Rich, 9904 Duncan St., Fairfax, Va. 22030.

Other members of the Board are; James Kukowski, 6 Grandin Circle, Rockville, Md. 20851; James Barrowman, 5614 Hamilton Manor Dr., Hyattsville, Md. 20782; Leslie Butterworth, Route 3, Eagle Lake, Minn. 56024; G. Harry Stine, 127 Bickford Lane, New Canaan, Conn. 06840; A.W. Guill, 32 Gerdes Road, New Canaan, Conn. 06840; John Belkewitch, 446 Brookside Drive, Roselle, N.J. 07203; Dr. Willy Ley, 3726-77th St., Jackson Heights, N.Y. 11372; Albert Kirchner Sr., 49 Cheshire Road, Bethpage, N.Y. 11714; John Worth, AMA, 1239 Vermont Ave. N.W., Washington, D.C. 20005.

SECTION ACTIVITIES

Fall model rocket meets were the vogue along the eastern seaboard. Even hurricane weather didn't stop a regional at Aberdeen Proving Ground, Md. Rockets flew in Connecticut, New York and other areas.

Unfortunately, we hear very little from sections in the west. Give us some good information in a short concise form and we will print it. The best way to get the word out is to publicize.

NARAM-9 PUBLICITY

Newspaper stories and features still filter in concerning NARAM-9. The Minneapolis *Sunday Tribune* and the St. Paul *Dispatch-Pioneer Press* ran Sunday supplement features on the meet.

The Bendix Corporation magazine ran an article in its 70,000 copy magazine and several more industry publications are expected to publish model rocket stories. The Goddard Space Flight Center news ran a full page story on the meet.

ROSTER OF NAR SECTIONS

As of September, 1967

AMA Rocket Club, Alberta Hands — Ruth Ketchmar, Box 407, Monticello, Ind. 47906.

Annapolis Assoc. of Rocketry, Robert Atwood, Route 3, Box 98B, Annapolis, Md. 21403

Apalachicola Valley Section, Ina Margaret Meter, P.O. Box 56, Apalachiola, Fla. 32320

Apollo Rocket Society, Neil Campbell, 2611 E. Grandview Rd., Phoenix, Ariz. 85032

Arevalos Rocket Associaton, L.D. Holliday, 19692 Lexington Lane, Huntington Beach, Calif. 92646

Ashland Rocket Society, Mike Zimmerman, 2111Crook St., Ashland, Ky.

Astro-Modelers, Larry Little, Box 172, Owen Hall, Purdue Univ., West Lafayette, Ind. 47906

Birch Lane Section, Thomas Hills, 2429 Temple Dr., Davis, Calif. 95616

Black Hawk Section NAR, Robert L. Custer, 2408-28 St., Rock Island, Ill. 61201

Boise Centaur Section, Steven Sherrill, 108 North 18th St., Boise, Idaho 83706

Cape Kennedy Section, Frank Cox, 106 Snead Rd., Apt. No. 1, Indian Harbour Beach, Fla. 32935

Catawaba Valley Rocketteers, Todd Lee Butler, 807 Sixth Ave. S.W., Hickory, N.C. 28601

Cheshire Assoc. of Rocketry, Joseph Persio, P.O. Box 123, Cheshire, Conn. 06410

"Cloudbusters," Bob Montgomery, AYA Center, APO New York 09123

DelVar (Delaware Valley Rockets), Robert R. Shue, 100 Overlook Ave., Willow Grove, Pa. 19090

Dreher Park Rocket Society, c/o Science Museum & Planetarium, W. Lakewood Rd., West Palm Beach, Fla. 33406

Eifel Thrusters, Robert Erickson, Bitburgh CMR No. 2223, APO New York 09132

Fairchester, Charles Duelfer, 75 Boxwood Dr., Stamford, Conn. 06906

Hempfield Area Model Rocketeers, Robert Brown, 15 Wayne Ave., Jeanette, Pa. 15644

La Salle Sec. NAR-Jets, Gary Spriggs, P.O. Box 1335, Cumberland, Md. 21502

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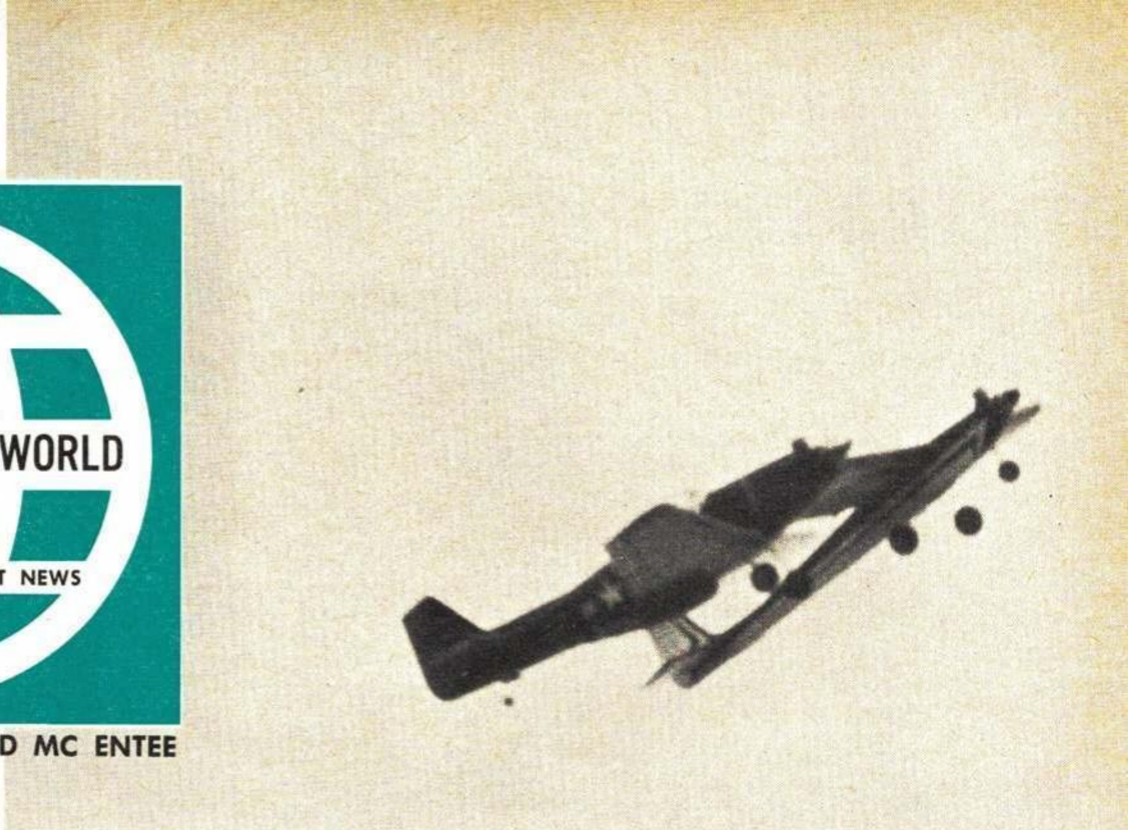
RADIO CONTROL WORLD

A ROUNDUP OF LATEST NEWS

CONDUCTED BY HOWARD MC ENTEE



Recommended Receiver. Having enjoyed flying with a receiver with circuit modified from one in May-June 1964 *Grid Leaks*, Australian modeler A. Sweatman (c/o Maryborough Tech. College, Mayborough, Victoria) suggests it to others. The original receiver was designed by John Phelps, and utilized a tuned filter for immunity to interference. Mr. Sweatman did not require this feature, but found the remainder of the circuit more stable than most super-regens.

The circuitry of the first two transistors following the antenna is practically identical to the Phelps original. The detector, incidentally, was designed especially for sharp tuning — that is, it is much sharper than many transistor regens (but nowhere near as sharp as a superhet). Mr. Sweatman's mods are in the last three transistor circuits; his receiver does not have the tuned audio filter, so will operate with most 27 Mhz transmitters that are modulated around 600-1000 cycles. Transformer TR can be most any small transistor interstage unit; this circuit utilized one rated at 5K ohms primary impedance, and 1K secondary (the Lafayette #99H6126 at 79c would do fine). The receiver idles (no tone) at 2-3 ma, and draws 30-40 ma with tone. This current may be reduced considerably by using a 300 ohm relay. 6V battery was utilized, since the 1.2K resistor was placed in the positive battery lead to increase stability (the original circuit did not have this resistor nor the 25 mf capacitor from battery plus to minus, and 4.8V was specified). Mr. Sweatman found the set would work fine on 4.8V as long as the nickel-cad battery was well charged, and he stresses that only such batteries be used. The tuning coil specified by Phelps had 15T of #30 enamel wire, tapped as indicated herewith, on a CTC type SPC11-4L coil form (Ace R/C stocks this form). The receiver has been found to work well in all temperatures, and is fine for pulse propo. It was built upon the printed circuit plate specified for the original Phelps receiver.

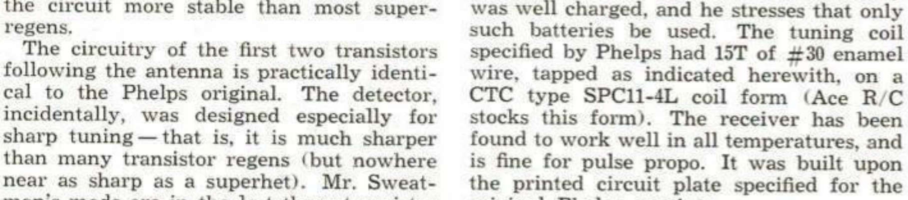
Cox Medallion Throttle. When Ronald Hilger (311 Clinton, Elmhurst, Ill. 60126) put a propo system in his .049-powered Junior Falcon, the power proved marginal. A Rand Galloping Ghost Pak replaced escapement. The Baby Bee was replaced by a Cox Medallion, and performance was excellent — until Ron added a Cox throttle. The engine lacked its former pep, which Ron attributed to too much restriction of the exhaust ports, even with the throttle wide open. His cure was to double the exhaust area by adding a second Cox exhaust throttle unit. The two units clamp together neatly around the cylinder; the threads intended for clamping screws in one, will have to be filed out for screw clearance. New parts are seen in our drawing.

The upper piece drives the two exhaust restrictors in and out together. The new restrictor itself is at center, and the plug at bottom closes the forward end of the added throttle unit. With the modified throttle, engine power went up to that attained before the throttle was added, starting seemed easier, and idling was just as good. These mods can help .09 and .15 Cox engines too.

Further increase in power is possible with Cox Q.Z. .049 cylinder and piston assembly, put on the Medallion engine. This cylinder is designed for operation with exhaust restriction; power increase by means of larger intake by-pass areas.

Unique Muffler. While visiting a Monmouth (N.J.) R/C Club meeting, we saw an unusual muffler built by Walter Watkins (RFD 1, Box 137, Eatontown, N.J.). Walt got the inspiration from seeing notice of a patent awarded to the McCullough Corp. for a muffler to improve quieting of small 2-cycle engines. Main idea was to close the muffler completely, except for one rather small outlet hole, over which was fitted a vibrating reed. Walt tried holding a flexible strip of metal over the outlet of standard model mufflers, found that when reed tension was right, there was indeed a great decrease in noise, yet the engine didn't seem to slow down noticeably.

Several reed mufflers have been attached to large engines (.60 capacity) and when properly "tuned," do a fine job. The drawing shows a representative unit. The finned stack is felt to be advisable, to get rid of heat both from the engine and the muffler tube. The reed may be made of berylium copper from .005 to .010" thick; shim brass

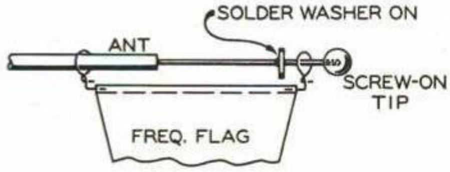


A super-regen receiver with very few parts for 27 Mhz. by A. Sweatman. It is inexpensive, pulses fast, and is temperature stable.

Bud Atkinson shows off Dornier DO-355 to Maxy Hester. It uses one engine in front and a free-wheeling prop at the rear. Seen at the Skylarks contest 1967. Photo by Claude McCullough.

Sleek Triplane by Glen Spickler took months of research and building. Scaled 2" to the foot, uses Kraft propo and new type servos.

At right: Keep the flag on top where it can be seen!



Great display of aerial agility and daring pilotese were seen in the mid-air meeting of Sterling Mustang and Goldberg Falcon.

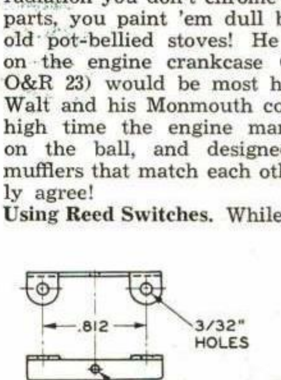
or clock spring material could also be tried. Too much spring tension increases back pressure; with not enough there isn't the desired quieting. The Monmouth group has used mufflers for over 3 years, feel one of the biggest problems with muffler-equipped engines is to dissipate the heat. They find that engines which have cylinder fins integral with the liner (as opposed to those which have a finned barrel fitted with a removable steel liner) tend to run cooler. Walt also points out that for maximum heat radiation you don't chrome plate hot metal parts, you paint 'em dull black — like the old pot-bellied stoves! He feels that fins on the engine crankcase (as on the old O&R 23) would be most helpful. In fact, Walt and his Monmouth cohorts opine it's high time the engine manufacturers got on the ball, and designed engines *and* mufflers that match each other. We heartily agree!

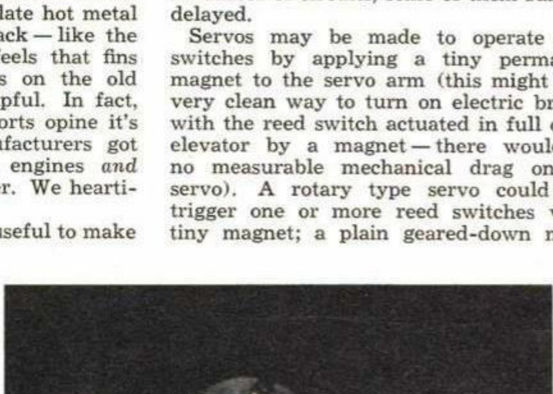
Using Reed Switches. While useful to make compact and efficient relays, reed switch capsules have other uses too. John Tufts (7429 Warner Ave., Richmond Heights, Mo. 63117) offers several suggestions. Our upper circuit shows several of the reed units being operated by one electro-magnet. Two of the circuits have time-delay relays in series, with the delays selected to give the desired operating sequence. Such a system might be applied to various operations on a model boat, with one channel operating a number of circuits, some of them suitably delayed.

Servos may be made to operate reed switches by applying a tiny permanent magnet to the servo arm (this might be a very clean way to turn on electric brakes, with the reed switch actuated in full down elevator by a magnet — there would be no measurable mechanical drag on the servo). A rotary type servo could also trigger one or more reed switches via a tiny magnet; a plain geared-down motor could do the same thing. Thermal time delay relays are small and light, and cost around $2.50 each, in the electronics mail order catalogs.

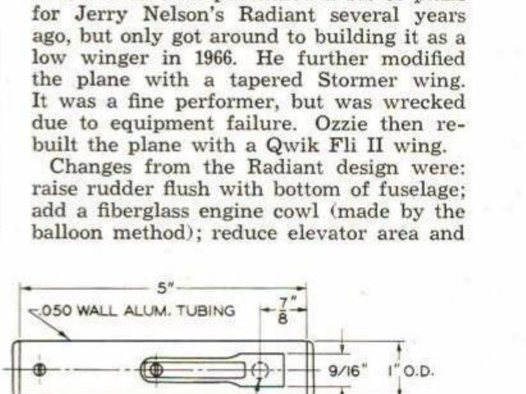
Neat Stunter. With all the sweptback fins and rudders these days, a plane with anything much different really stands out. We spotted such a craft in the *Mile Hi Newsletter* (Mile Hi R/C Club). Builder Oscar Leu (8178 Raleigh Pl. Westminster, Colo. 80030) sent accompanying pic and info. Seems Ozzie had purchased a set of plans for Jerry Nelson's Radiant several years ago, but only got around to building it as a low winger in 1966. He further modified the plane with a tapered Stormer wing. It was a fine performer, but was wrecked due to equipment failure. Ozzie then rebuilt the plane with a Qwik Fli II wing.

Changes from the Radiant design were: raise rudder flush with bottom of fuselage; add a fiberglass engine cowl (made by the balloon method); reduce elevator area and

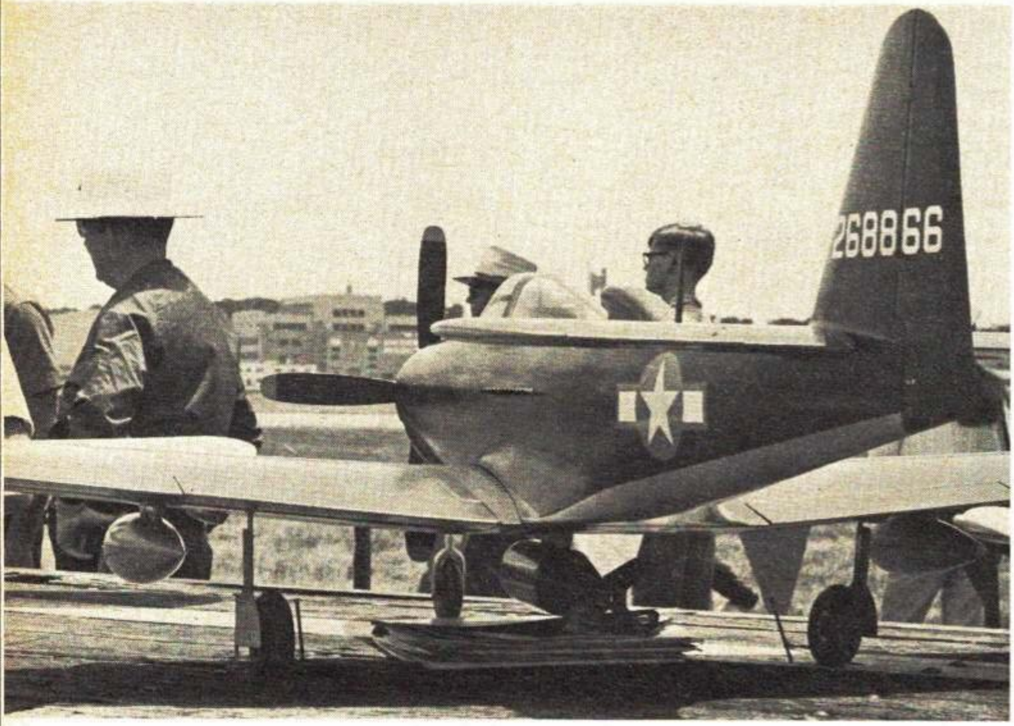




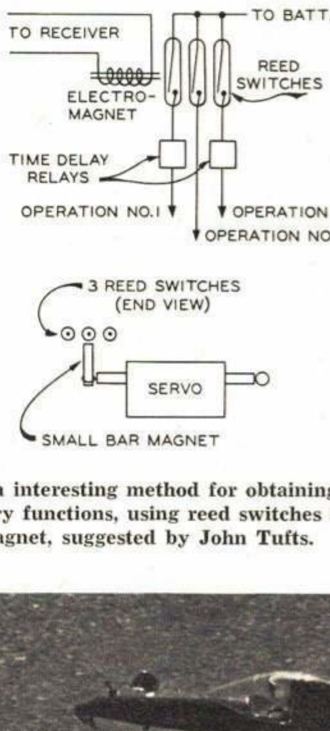
More power, more throttling with two exhaust restrictors, suggests Ronald Hilger. Works on all Cox engines with throttles.



Unique muffler using spring reed at outlet has less power loss, claims Walter Watkins.



Hale Wallace's scale-event winner at the 1967 Wright Memorial contest was this big S. T. .71-powered P-63.



An interesting method for obtaining auxiliary functions, using reed switches and bar magnet, suggested by John Tufts.

RADIO CONTROL WORLD

CONTINUED

increase stab to hold original horizontal tail outline; set Enya 60 at 45-degree angle and mount radially. Plane has Logictrol 5, Nyrod pushrods. It weighs 6½ lb. and engine, wing and stab are all at zero degrees. Engine has a 2 degree right thrust.

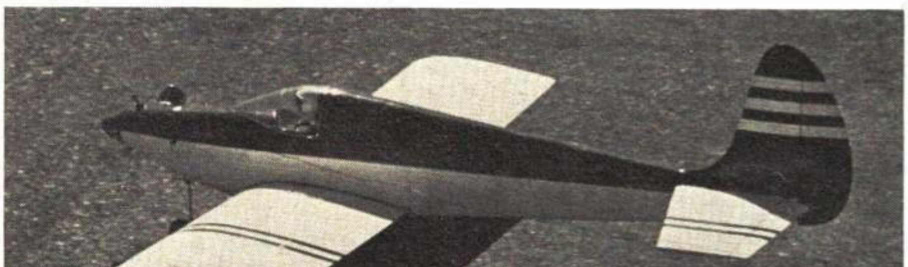
Ozzie feels it's a top grade stunter. He mentions a trick used by several Denver-area builders; after firewall is installed, about ¼" thickness of epoxy is poured behind it (firewall must be horizontal when this is done). When dry, the epoxy can be drilled and tapped to hold the engine mounts, the fiberglass cowl and even the nose gear. Latter is held right in the epoxy, without a separate mount.

West Coast Championships. A huge success, according to *Watts New* (Fresno, Calif., Radio Modelers). They give full credit to the Pioneers for much of the work; actually, it appears that many Fresno modelers helped run the affair, which was sponsored by the So. Calif. RCS. Meet was held Sept. 2-4 at Madera, Calif. Fine weather prevailed during the weekend, and the Pioneers had even set things up so the visitors could view the Wide World of Sports television showing that weekend of the Los Al Nationals.

R/C at the Races. The Cleveland National Air Races were again featured over Labor Day weekend, and exhibitions put on by members of the Northern Ohio Aeromodelers Assoc. were highly successful. Idea for N.O.A.A. participation was presented to Races officials, who were quite receptive. A carefully planned show was set up, to include all forms of RC flying. This boiled down to a Pylon race, an exhibition by a stunt team of three and four members, and a Free Style finale, with eight planes in the air at once. Needless to say, even though the flying (especially in that finale) got pretty hectic, safety was a major consideration, and the planes were kept well away from the crowds.

One of the team maneuvers was a "sun flower effect." Four planes circled together, then at a signal headed in four directions, coming together at the center of the field via a Split-S and dive, then pulling up in an Immelman. Quite spectacular, according to Frank Vidmar (26500 Zeman Ave., Euclid, O. 44132) who sent in the report. Several biplanes were in the 8-plane finale, some spinning down from high altitude. Frank says much credit must go to Noel Painchaud, Jack Cox and Don Butterfield of the Cleveland Air Races, and to Charles Tracy of the *Cleveland Press*, all of whom were most helpful. The N.O.A.A. is organized within the framework of the AMA, and includes two R/C clubs — the Cleveland Radio Controlaires, Inc., and the Mentor Area RCS, Inc. After their highly successful debut at the Cleveland Races in 1967, the group feels that model RC has a definite place at full-scale plane airshows.

50 Mhz Frequencies. 50 Mhz activity is increasing, as many modelers get ham licenses just to operate there. There is a wide variety of oddball frequencies in use, and things are rather chaotic in some areas, where there may be half a dozen 50 Mhz flyers waiting to go aloft. The AMA Frequency Committee has come up with a set of spot frequencies that allows simultaneous flying of five superhets, and two regens, all at the same time and with little likelihood of interference with each other — or from harmonics from 27 Mhz transmitters. The frequencies listed below are being adopted as official by the AMA, and 50 Mhz fliers are urged to change crystals to these spots as soon as possible. It must be noted that there's no guarantee these spots will not have interference in some areas, from other perfectly legal amateur radio communications. Most amateur activity is below 51 Mhz; but there are local "nets" in various areas, and you'll have to watch for them — just as you have in the past on this band. The AMA spots are as follows, with two ribbon system for each: 51.20 Mhz (one black, one light blue streamer); 52.04 (black and violet); 53.10 (black and brown); 53.20 (black and red); 53.30 (black and orange); 53.40 (black and yellow); 53.50 (black and green). Note that the band distinguishing color for 50 Mhz is black; it's white for 72 Mhz, and none is used on 27. 51.20 and 52.04 Mhz are designated solely for super-regens, the other five for 'hets. All frequencies have been picked so that there will be no interference on either the fundamental or the image of the superhet spots. Note that these spots are not mandatory, as are those on 27 and 72 Mhz (which were designed for RC purposes only by the FCC.)



Neat stunter by Oscar Leu is unusual these days; it does not have swept-back fins, wings, or rudders. Looks pretty, too.

Continued on page 66

NEW PRODUCTS CHECK LIST

Monogram/Thunderbolt. Famous P-47D Thunderbolt has been added to Monogram's ¼" scale series of WW II aircraft. Their highly detailed kit (PA187) retails at $1.50. Also released at this time was the 1/72 scale Messerschmitt Bf110, twin engine fighter. Full color decals and crew figures are included. Kit (PA162) price is $1. See Townsley's "Scale Techniques for the Plastic Modeler" in this issue. MONOGRAM MODELS, INC., 8601 Waukegan Rd., Morton Grove, Ill. 60053.

Heath Company/Digital 5 Proportional RC System. New Heathkit RC will let you go proportional with a five channel, digital rig after only 15 hours of assembly time. Saves money too — complete with transmitter, receiver, four servos and Nicad battery packs, the solid-state system costs only $219.95.

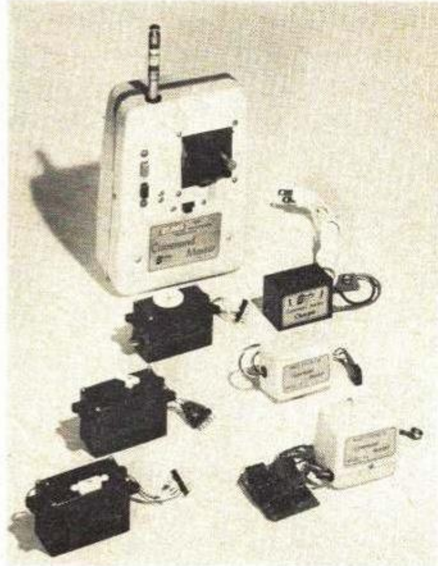
Transmitter features: pre-assembled RF section for peak operation, two control sticks, out-of-sight range, an antenna that telescopes into the case and a relative signal strength meter for monitoring Tx output. All channels are trimmable.

Receiver is highly sensitive, noise and temperature immune and cased in aluminum as is the transmitter. It uses only a four cell Nicad pack, weighing 5. oz.

Each servo has a wheel and two linear outputs. Sealed variable capacitors replace the resistive feedback elements used in other designs. Servos weigh only 2½ ounces.

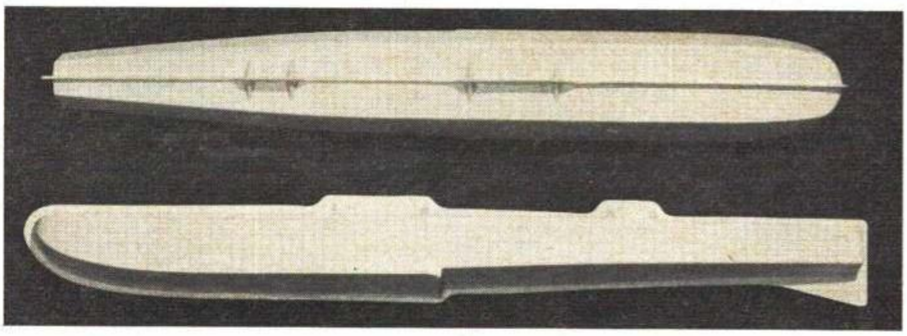
The system is available on the five frequencies in the 27 MHz band. Total weight of the airborne equipment is about 18 oz. All items are available separately too; ask for prices: HEATH COMPANY, Benton Harbor, Michigan 49022.

Hobby Lobby/Bonitron Super Sport. The Bonitron Super Sport is a pulse proportional system. Transmitter is a single stick unit with a lever switch motor control. Internal adjustments make the transmitter very versatile (see McEntee's "New In RC" this issue). Transmitter price is $74.95. The superhet receiver was designed to feed the Rand Dual Pak servos. It is priced at $39.95. A complete package of transmitter, receiver, Rand Dual Pak and all connectors is $189.90. Write: HOBBY LOBBY INTERNATIONAL, 2604 Franklin Rd., Nashville, Tenn. 37204.

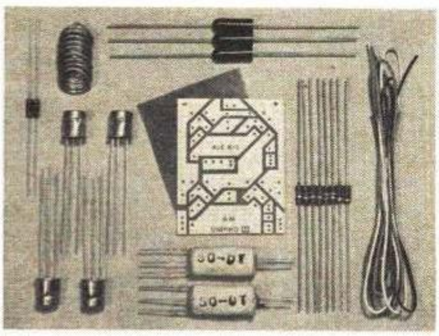


Sterling Models/Command Master 3 plus 1 System RTE. It's a feedback proportional type RC system — no pulsing or wig-wag. RTE means rudder, throttle and elevator functions — standard in the basic package, though a fourth servo may be added (that's the 3 plus 1). With the three servos you receive a transmitter and receiver, Nicad battery packs for both, a charger and a servo connector board. Total price $250. Sterling's five-year black box guarantee applies. Their first Command Master RT system may be updated to this one with no loss of original equipment cost. Ask: COMMAND MASTER DIV. OF STERLING MODELS, 501 E. Wister St., Philadelphia, Pa. 19144.

Dremel Mfg./Handbook of Hobbies, Crafts and Projects. Basic information chapters in this 160 page guide for the home craftsman or hobbyist deal with wood, metal and plastic techniques. Later sections show you how to build items of these materials. Hobby chapters give detailed information on model railroading, aircraft, boats, cars, etc. Over 200 photos and scale plans are included. Portable power tools are used throughout. It's now available at hardware stores and hobby shops at $1.45. DREMEL MFG. CO., Racine, Wis.

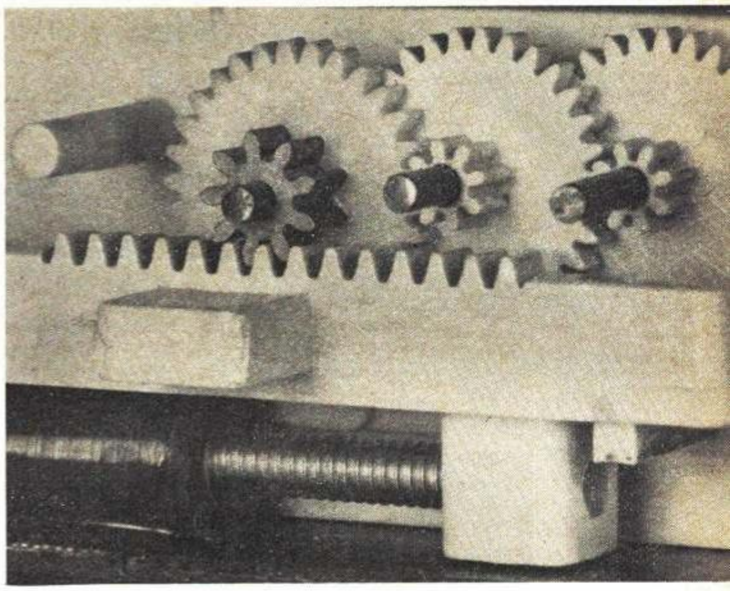


Beavercraft Products/Floats. Landlubber radio control flyers can go to sea with these tough, white plastic floats. Each pair, weighing 16 oz., will support 7½ lbs. — suitable for most multi ships. Overall length is 30". Beavercraft molds each float in two pieces; then these halves are joined along a center seam. The resulting ridge adds stiffness and reinforces the mounting areas. The hull design encourages a quick lift-off. Available at your hobby shop or by ordering direct from Beavercraft, $10.95 postpaid. A 36" size will be ready soon. More info: BEAVERCRAFT PRODUCTS, 2241 S. E. 154th St., Portland, Oregon 97233.



Ace Radio Control/Simpro III. Ace is now delivering the Simpro III parts kit — see photo. The Simpro III eliminates relays and works with commercially available pulse propo actuators. An article about this unit appeared in the November 1967 American Modeler. Ace supplies complete instructions and diagrams with each kit. Kit price is $27.50; if you want the Simpro III assembled and tested, the price is $34.95. ACE RADIO CONTROL, Box 301, Higginsville, Mo. 64037.

No accuracy or performance is lost with variable inductance. Output is linear and has ¾ in. total travel. Easily mounted.



Variable inductance is accomplished by moving a bar of iron (a length of 4-40 steel bolt) inside the bobbin of the tightly wound coil on the left. This bar screws into the output arm of the servo and its position is adjustable for servo centering.

The Variable Inductance Servo

Design and development of a new kind of feedback servo. An important article for the well-informed enthusiast and the scientifically inclined reader.

JOHN CLINE Engineer F&M Electronics

FEEDBACK control systems, either digital or analog, must utilize some form of feedback component to provide the appropriate reference signal denoting servo output position. Radio control systems have characteristically used the potentiometer as the feedback component, either in the form of a linear wirewound element or a circular fired ceramic element contacted by wipers. They are subject to performance deterioration caused by vibration, dirt and oxidation, which interrupts contact between the wiper and the element or to more drastic failures caused by breakage of the wirewound or ceramic element. The desirability of replacing the potentiometer with a feedback component which requires no physical contact has long been unquestioned; however, the implementation of other techniques has not been fruitful until recently.

Our initial attempts to eliminate the pot problems were directed toward improving it as the feedback element. During this investigation it was found that most of the wear in the pot was not caused by actual control movements but instead was located in a very narrow band around the center position of the servo as the result of control surface flutter being transmitted to the servo assembly through the pushrod. In general, in a system in which the servos have not been periodically rotated between control functions, the R, E, and A servos show markedly greater pot wear than does the throttle servo pot.

Samples of all available commercial potentiometers were procured and evaluated for application to feedback servos. We found that some were unsatisfactory for reasons of : 1) Size, 2) Susceptibility to wear, 3) Operating torque, 4) Ease of breakage, and 5) Exposure of wipers to foreign matter. Of the types evaluated, the fired ceramic type with a sealed housing was found best. However, it was felt that the feedback technique still required further improvement.

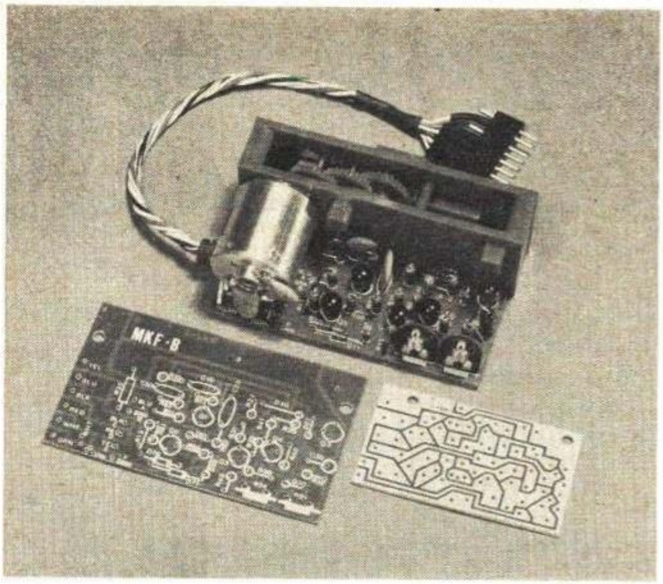
Design Goals. The requirement for any replacement for the conventional feedback potentiometer was established to be: a) No wiping contacts; b) As economical as the potentiometer; c) No more complex than the conventional servo; d) Easy alignment and adjustment; e) Easily manufactured, including ready availability of components; f) Weight and volume not to be compromised.

Alternative Approaches. Electronically, the conventional feedback potentiometer is used as a voltage divider. A fixed voltage is applied across the pot and the wiper serves to establish reference voltage as it moves along the element. Arrangement is such that the voltage appearing on the wiper is directly proportional to the position of the servo output arm. In the digital system this voltage is used to govern the duration of a reference pulse generated for comparison with the incoming control pulse and the reference pulse is made to be directly proportional to the actual position of the servo output.

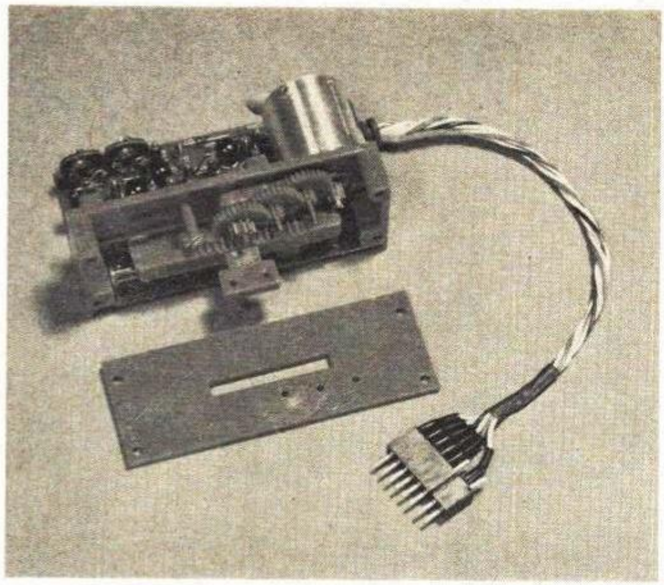
The first approach undertaken was a modification to existing circuitry using a variable capacitor in the monostable multi-vibrator used to generate the reference pulse. A single-shot, or monostable multi-vibrator, exhibits a pulse duration which is determined by a capacitor-resistor time constant. From a theoretical viewpoint, it is possible to change this time duration by changing the value of either the capacitor or resistor; however, this approach was discarded in favor of using a new design approach which utilizes an induction as the variable component in the reference generator.

The next approach involved using a variable inductor in a conventional single-shot. An inductor-resistor also represents a time-constant circuit. It is not practical to substitute a variable inductor directly in a conventional single-shot reference generator because approximately .2 henrys inductance is required. In our application this means that the inductor would weigh at least 4 or 5 ounces, which would, of course, be prohibitive.

We next examined the use of light intensity as the variable. This system could be implemented by using a standard light bulb for a light source and using a photodiode or photoresistor as a detector of this light. By placing a slid-



Servo under construction shows the kit's two etched and printed PC boards whose parts are widely separated for easy assembly.



The gear train gives lots of power and speed, three pounds thrust and .6 sec. end-to-end movement. A durable and rugged assembly.

ing screen between the source and the detector and making the screen such that its transparency is a function of the position of the screen, one could achieve an appropriate reference parameter in or at the detector which would be directly proportional to the position of the screen sliding between the light source and the light detector. The author had done some previous work with this type system and found it to be most successful.

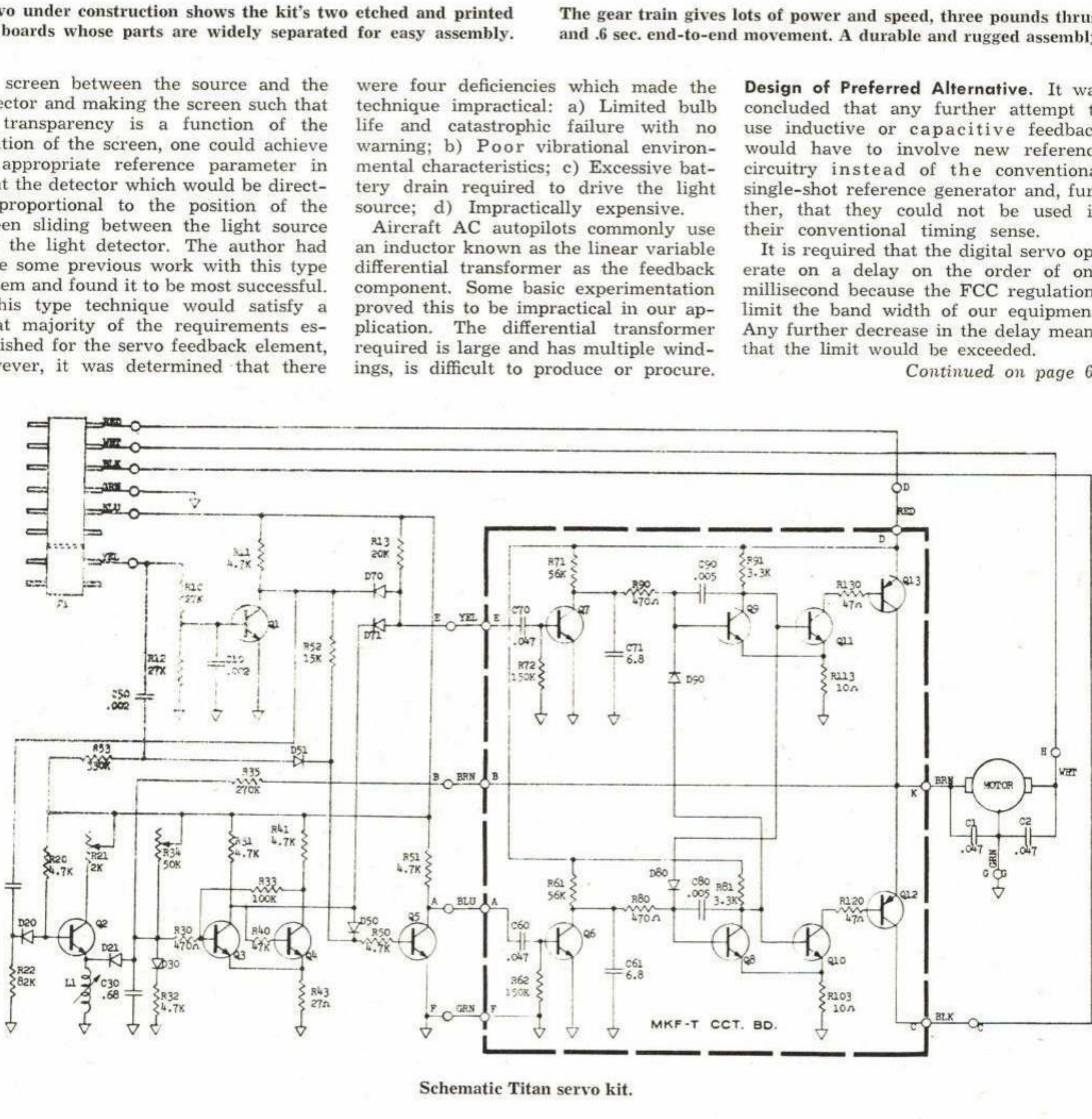
This type technique would satisfy a great majority of the requirements established for the servo feedback element, however, it was determined that there were four deficiencies which made the technique impractical: a) Limited bulb life and catastrophic failure with no warning; b) Poor vibrational environmental characteristics; c) Excessive battery drain required to drive the light source; d) Impractically expensive.

Aircraft AC autopilots commonly use an inductor known as the linear variable differential transformer as the feedback component. Some basic experimentation proved this to be impractical in our application. The differential transformer required is large and has multiple windings, is difficult to produce or procure.

Design of Preferred Alternative. It was concluded that any further attempt to use inductive or capacitive feedback would have to involve new reference circuitry instead of the conventional single-shot reference generator and, further, that they could not be used in their conventional timing sense.

It is required that the digital servo operate on a delay on the order of one millisecond because the FCC regulations limit the band width of our equipment. Any further decrease in the delay means that the limit would be exceeded.

Continued on page 60

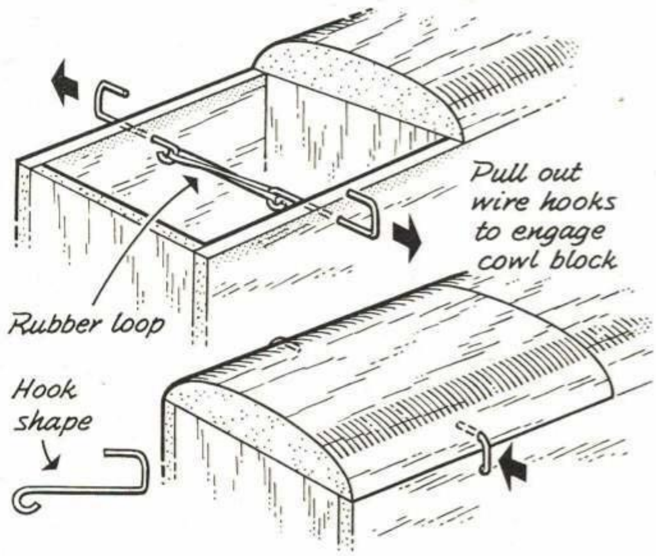


Schematic Titan servo kit.

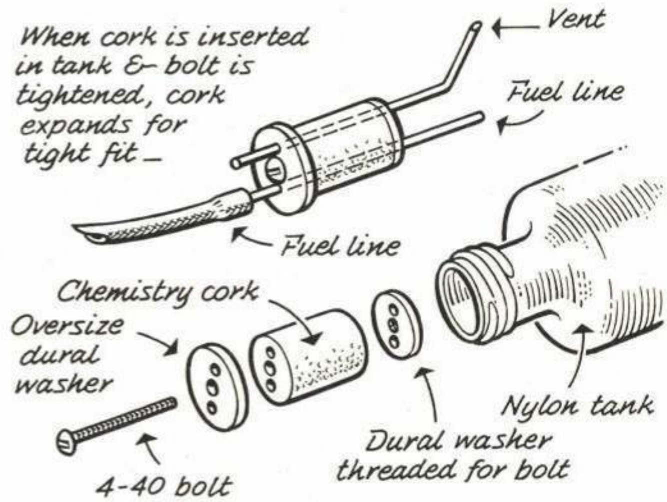
H. A. THOMAS

SKETCHBOOK

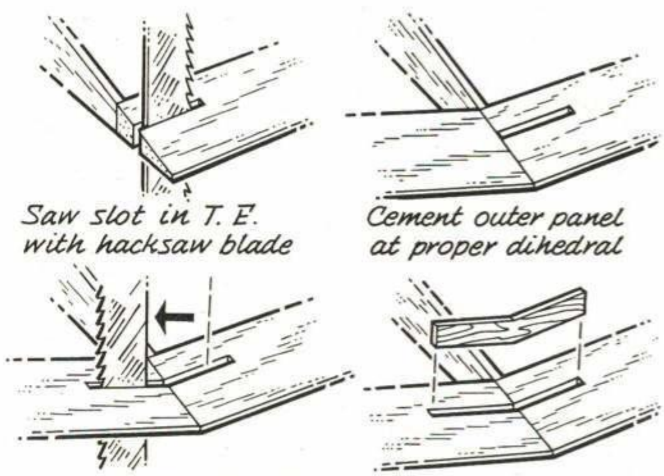
Have a new idea for construction, adjustment or operation of model aircraft or RC? AM pays $10 for each 'hint & kink' used. Send rough sketch and description to Sketchbook, c/o American Aircraft Modeler, Potomac Aviation Publications, Inc., 1012 14th St., NW, Washington, D.C. 20005.



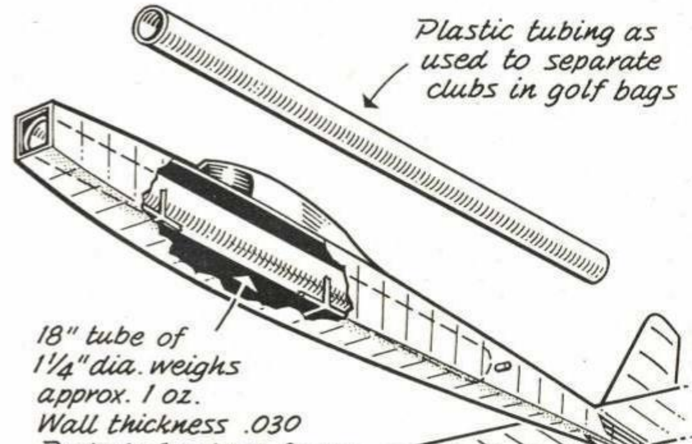
BILL CROMAN, Los Angeles, Calif., submits simple and fool-proof, cowl-latching device. Steel wire hooks are held in tension by rubber loop, are pulled out to engage and hold cowl securely.



LARGE capacity plastic fuel tank has specially built cork which encloses fuel line and vent. Central bolt and aluminum flanges tighten and expand cork for tight seal. From Marty Meyer, New Rochelle, N. Y.



WORKMANLIKE method of fitting plywood dihedral braces in trailing edges is used by Harry Murphy, Anderson, Ind. Hacksaw blade cuts slot for plywood part after panels are joined.



LIGHT plastic tube, used to separate clubs in golf bags, is ideal fuselage insert for rubber model fuselage, says Bob Pione, Cincinnati, Ohio. A 1¼" dia. tube, 18" long weighs only one oz.

FEBRUARY 1968

model aviation

Official magazine of the Academy of Model Aeronautics • 1239 Vermont Avenue N.W., Washington, DC 20005

1968 FAI Control Line Team Selection

1968 U. S. Control Line Team Manager, Pete Brandt (Calif.), ran '67 AMA selection program.

The following report of the Finals meet of the 1967 FAI CL program is by Pete Brandt, Team Selection Administrator. Time and place: Sept. 30-Oct. 1, 1967, Buder Park, St. Louis, Mo.

STUNT

1. **BOB GIESEKE**	Texas	7282
2. **JIM SILHAVY**	Ohio	6821
3. **STEVE WOOLEY**	Ohio	6562
4. **Bill Werwage**	Ohio	6442
5. **Jerry Worth**	Illinois	6390
6. **Jim Kostecky**	New York	6361
7. **Dave Gierke**	New York	6011
8. **Lewis McFarland**	Kentucky	5862
9. **Archie Adamisin**	Michigan	5748
10. **Charles Reeves**	Kentucky	5722
11. **Jean Pailet**	New York	4957
12. **Gregory Zajack**	New York	4931
13. **Larry Murphy**	Virginia	4922
14. **Mike Stott**	Minnesota	4453

Judges: Bob Gialdini, John Havel, Garry Cipra, Dick Mathis. Collected for team fund: $140. Scores are point totals, best two of three flights.

SPEED

1. **ROGER THEOBALD**	California	155.27
2. **ARNY NELSON**	California	150.18
3. **BILL WISNIEWSKI**	California	150.07
4. **Jim Nightingale**	California	145.83
5. **Laird Jackson**	Penn.	143.45
6. **Glenn Lee**	Wisconsin	143.37
7. **Don Yearout**	California	------

Note: Everyone used TWA engines and pipes, except Arny Nelson who used Super Tigre. Collected for team fund: $70. Scores (mph) are average of best two of four flights.

TEAM RACE

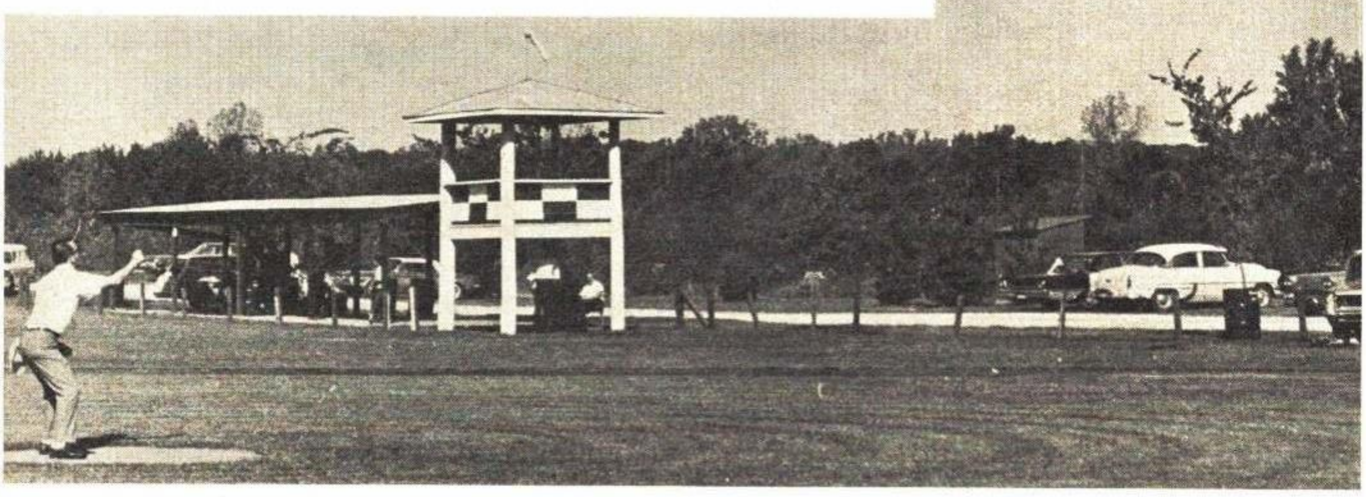
1. **STOCKTON/JEHLIK**	Virginia	4:46.2
2. **DUNKIN/WRIGHT**	Missouri	4:59.4
3. **MARVIN/ALBRITTON**	Maryland	5:02.2
4. **Barr/Theobald**	California	5:02.4
5. **Blackwell/Sims**	Alabama	5:14.9
6. **Wildman/Harness**	California	6:00.5
7. **Hall/Mobley**	Alabama	-----
8. **McDonald/Lauderdale**	Alabama	-----

Jury: Pete Brandt, Charlie Banks, Howard Mottin. Collected for team fund: $160. Scores are average times of best three of six heats (100 laps).

The St. Louis gang did a fine job in helping run this contest. The greater St. Louis model association and its member clubs—particularly the Yellow Jackets and the Parks department. **Individuals deserving special recognition are: Art Schaefer and Art Muser, Jerry Fels, Ralph Hoffman, Arlie Fridley, Kurt Hoyer, Frank Naes, and Charlie Smith**; also the stunt judges and the other two members of the TR jury who came from outside of St. Louis. **Bill Wright**, one of the TR team members from Kansas City area made patches to commemorate the event and these were passed out to contestants, officials, and helpers from the St. Louis area.

AMA HQ Note: As the first combined event central flyoff meet for control line team selection this was a highly successful culmination of the program initiated by the Academy of Model Aeronautics in 1966. The 1968 team is expected to represent the United States at the Control Line World Championships scheduled for Finland, probably in August. First three names in each category will make up the 1968 team.

Picture by finalist Jean Pailet (N. Y.) shows Larry Murphy (Virginia) during official flying in stunt-team selection competition at the excellent Buder Park field facilities in St. Louis.



Nats RC Judges

The use of civilian RC Pattern Judges at the 1967 Nationals was a success, due to two major factors: enough competent people volunteered to serve as judges and enough financial support was provided by the model industry to cover the costs involved. The Navy was able to provide transportation but not housing; the latter was taken up by the dozens of other Nats officials.

Basically, twenty-four judges served, plus one or two others who helped for short periods. The housing cost of these officials, slightly over $1100, was shared by sponsors. The project broke even, not counting AMA HQ time and effort.

The judges served valiantly despite punishing conditions — on duty in the sun continuously day after day, without breaks long enough for real relief. This was due to an oversight in the schedule which did not permit adequate time off between duty periods. Yet most said they would do it again, if this problem is corrected. It will be and judges are needed again for the '68 Nats — volunteers should contact AMA HQ, in writing.

THE JUDGES

***John Agee** New Orleans, La.	***Jack Josaitis** Dearborn, Mich.
***William Brown** Livonia, Mich.	**Garry Korpi** Pleasant Hill, Calif.
Raymond Cole Baltimore, Md.	***Bob Lien** New Orleans, La.
***Harold Cox** Fresno, Calif.	***William C. Northrop** Newark, Delaware
Norbert Dembinski Chicago, Ill.	**Bob Palmer** Arleta, Calif.
***Frank DeVore** New Rochelle, N.Y.	***Tom Rankin** Silver Spring, Md.
***Fred Duvall** Metairie, La.	***Arthur Schroeder Jr.** Glen Ridge, N.J.
***William J. Eich** Golden, Colo.	***R. C. Seigelkoff** San Lorenzo, Calif.
George Hickson Seattle, Wash.	**Ken Thorstad** Portland, Oregon
***Robert Hooper** Laurel, Md.	***Charles Waas** Ontario, Calif.
Wallace Hudson Marietta, Ga.	***Allen Wiltz** Metairie, La.
***Robert Jones** Towson, Md.	***W. R. Weaver** St. Louis, Mo.

*Finals Judges

THE JUDGE SPONSORS

American Modeler	**Model Airplane News**
Andrews Aircraft	**Orbit Electronics**
Bonner Specialties	**Prop. Control Systems**
Du-Bro Products	**RC Modeler**
EK Products	**Sig Manufacturing Co.**
Jensen Enterprises	**Sterling Models**
Kraft Systems, Inc.	**Top Flite Models**
Lanier Industries	
Micro-Avionics	
Min-X Radio	

Free Flight Symposium

At the 1968 Nationals, under the sponsorship of the National Free Flight Society and the Academy of Model Aeronautics, a symposium or conference is planned to be held. At the affair, prominent speakers are expected to give talks on major topics of current free flight interest. Such meetings were originated by the Academy during the early forties and have always been encouraged by AMA. In recent years a series of RC symposia have been held, with the most outstanding example being the annual DC/RC meetings — the '67 affair was their tenth. And for many years, until the mid-sixties, the S.E. Virginia RC Group held less formal annual technical meetings. Similar informal meetings have been part of the annual Buffalo and Toledo RC conferences.

Frank Ehling, AMA's Technical Director, triggered the current Free Flight Symposium which is now being billed as the first annual of the National Free Flight Society. Prompt and favorable response by current NFFS officers resulted in the appointment of Bill Hartill, of California, as Director. Bill has been hard at work ever since to produce a program of high technical and general interest. It is planned that a printed booklet of the talks will be part of the program. Those who attend in person — and pay the admission fee — will automatically receive the publication. Those who are unable to attend will be able to purchase copies. More information on the affair will be announced as details are developed.

Models in the Classroom

New book, produced at cost by AMA junior program committeeman Howard Bueschel, is helpful to those interested in promoting the use of model aviation as a classroom teaching aid. Includes suggestions for teachers, discusses the hobby and how it may be used to teach the science of flight. Illustrated, 61 pages. $1.50. Order: Model Airplanes in the Classroom, H. A. Bueschel, Trenton State College, Trenton, New Jersey 08625.

New 50 MHz RC Standards

In an effort to standardize frequency spacing in the 50-54 MHz band the Academy of Model Aeronautics' Frequency Committee has recommended five super-het frequencies and two super-regen frequencies to be used by equipment manufacturers in producing transmitters. This action is hoped to prevent interference which would arise from indiscriminate frequency selection by manufacturers resulting in inadequate separation of the super-het frequencies and inefficient use of the super-regen possibilities in this band. The action also is designed as a safety measure in preventing lack of control of aircraft at flying fields and contest sites which could endanger persons and property.

Following are the recommended frequencies and corresponding frequency identification flags:

SUPER-HET
53.10 Black/Brown
53.20 Black/Red
53.30 Black/Orange
53.40 Black/Yellow
53.50 Black/Green
SUPER-REGEN
51.20 Black/Blue (light)
52.04 Black/Violet

Chairman of the Frequency Committee is Edward J. Lorenz. Members are: Walter A. Good, Howard G. McEntee, John H. Phelps and Paul F. Runge.

New Indoor Rules?

Several years ago the AMA Executive Council directed the Free Flight Contest Board to examine Indoor events with the aim of bringing them in line with current competition practice. The following proposal resulted from the effort of many people and much study. It is presented here so that those AMA members concerned

Continued on page 50

White hats and uniformed man suggests Radio Control judging at '67 Nats was military, but civilians were used. Navy man recorded scores so that judges could concentrate on models in sky.

Sign by host Yellow Jackets club greeted CL team selection finalists at St. Louis last Sept. Similar hospitality is expected when Radio Control team finalists gather for '68 flyoff.

RC Team Selection

The spectacular success of the first central flyoff to pick the U.S. radio control team, held in Oklahoma in 1966, produced offers from several groups in various cities to host the 1968 meet at which the 1969 team will be selected. The most promising of these was in the St. Louis area, with the McDonnell RC Model Airplane Club as the host group. However, several months of negotiations finally broke down when it turned out the site — Scott Air Force Base — would not be available due to military problems and commitments. The McDonnell club then had to reluctantly withdraw as no other suitable site was available. Much credit is due the group for its efforts and the gratitude of Academy officers for a good try was expressed to the club.

Meanwhile, announcement of an alternate location is to be made shortly. It is expected to be in the midwest and sometime between the Nats and the fall. And the basic 1966 formula is expected to determine who is eligible to fly at the finals — the winners of key RC contests around the country. It is likely that major AMA sanctioned meets with a Class C Expert event, from Spring through late summer, will qualify winners.

It is important, therefore, that meets be sanctioned as soon as possible so that the schedule of eligible meets can be produced and published as soon as possible. It is intended that a meet schedule and details of the qualifying procedure be available no later than the end of March. Interested clubs are urged to register with AMA HQ, prior to Feb. 15, any intent to sanction a meet between May 1 and Aug. 31.

How To File an Insurance Claim

Don't go to a local agent! He may get in the act later, on instructions from Washington. The AMA insurance policy holder is the Insurance Co. of North America, with thousands of agents across the country and around the world. But AMA's insurance is very special and most agents are not familiar with it.

Attempts to go first to a local agent have led to disappointments, frustrations, embarrassments, confusion and lost time. The proper action is to report in writing the basics (what, when, where, and who) of an accident, to AMA HQ, using a special form if one is available (AMA clubs were sent these last year). If the form isn't handy, one will be sent from Washington upon receipt of the report.

Nothing will happen until the form is filled in and sent back to Washngton. Receipt of the form is what triggers official action on a claim. Decisions are made in individual cases whether to proceed via a local agent or out of Washington.

Point to remember: AMA insurance provides liability protection — it does not cover accidents a member causes to himself; only what he does to others.

The largest number of claims are in the "plane struck car" category — almost 50% of reported accidents from '65 thru '67. The need is obvious: park cars in a safe area, not too close to the launch point. Worst offenders: free flighters who launch from the car trunk, or wagon tailgate.

RC Scale At The Nats

Continuing last month's accounting of RC contestants at AMA's 1967 National Model Airplane Championships: who they were and what they flew. Information was compiled by Howard McEntee and contributed to the Academy of Model Aeronautics.

The abbreviation is mostly self explanatory. The sequence of each paragraph goes: contestant's name, age, occupation, home city; club, if one. Then comes plane description which includes name (modifications, if any), wingspan, wing area, weight; covering and finish material. Engine data shows maker and size, propeller (dia., then pitch), fuel used. Finally: controls available, radio make, operating frequency. Coverage includes the top ten only.

Here's how to decipher the shorthand used to describe controls: most entries show "REMA", which means rudder, elevator, motor (throttle) and ailerons. Indicated is the type of brakes, where specified. An "F" on the end of REMA shows the use of working flaps. Also indicated are such additional functions as mixture control and retractable LG.

Bud Atkinson, 42, Cabinet Maker, Blue Springs, Mo.; KCRC. Beechcraft T34 Mentor, 72" span, 710 sq. in., 9½ lb.; silk, Sig dope. Enya 60, 11-7½ prop. REMAF, elec. brakes, Logictrol 7, 26.995 mc.

Harold Auerhan, 48, Physician, Fortuna, Calif.; Eureka RCC. Great Lakes 2T-1-A, 57" span, 880 sq. in., 8 lb. 13 oz.; Sig butyrate dope. ST 46, 11-4 prop, K&B 100. REMA, Kraft KP-6B, 75.64 mc.

Frank Capan, 44, Auto Mech., Van Nuys, Cal., San Fernando Valley Flyers. No. Amer. OV10A, 70" span, 910 sq. in., 14½ lb.; silk, acrylic lacquer. Two Enya 60's, 11-8 prop, K&B 100. REMAF, elec. brakes; Logictrol 5 + 2, 29.450 mc.

Art Cummins, 41, Fireman, Palmdale, Cal.; Antelope Valley Tailwind Club. Great Lakes Trainer (Scale-Line kit), 56" span, 9 lb. 4 oz.; silk, Dulux enam. ST56, 12-5 prop, club mix fuel. REMA, Digitrio, 27.195 mc.

Bobby Green, 38, Airlines Mech., Aurora, Colo.; Mile Hi RCC. DH60M, mag plans, 6' span, 1500 sq. in., 8½ lb.; Silron, Aero Gloss. ST56 BB, 13-5½ prop, K&B 100. REMA, Orbit, 27.195 mc.

Maxey Hester, 42, Model Builder (Sig Mfg.), Montezuma, Iowa; Des Moines Modelaires. PT-19 from Sig kit (one piece wing), 72" span, 8½ lb.; silk, buty. dope. Enya, 11-8 prop, Sig N720C fuel. REMAF, Rocket City brakes, Logictrol, 27.045 mc.

Bob Noll, 30, Endicott, N.Y. Nieuport 27 from factory plans, 60" span, 8 lb.; silk, Aero Gloss. ST60, 14-4 prop, K&B 100. REMA, Orbit, 27.095 mc.

Lou Proctor, 57, Tooling Engineer, San Diego, Cal. Nieuport 11 from own plans, 61" span, 7 lb. 10 oz.; silk and bamboo paper. McCoy 60, 18" prop, Testor 39 fuel. REMA, Orbit reeds.

Jack Stafford, 34, Engineer, Culver City, Cal.; LARKS, Smog Cutters. Own Chipmunk kit prototype, 59" span. 565 sq. in. area, 6 lb. 15 oz.; Aero Gloss. Lee Veco 61, 11-7¾ prop, Cox blue label fuel. REMAF elec. brakes, PCS, 53.175 mc.

Woody Woodward, 37, Art Director, N. Hollywood, Cal.; Valley Flyers. Rearwin Speedster, 64" span, 620 sq. in. area, 7½ lb.; silk, Aero Gloss. ST 46, 11-6 prop, K&B 100. REMA, Logictrol 7, 27.045 mc.

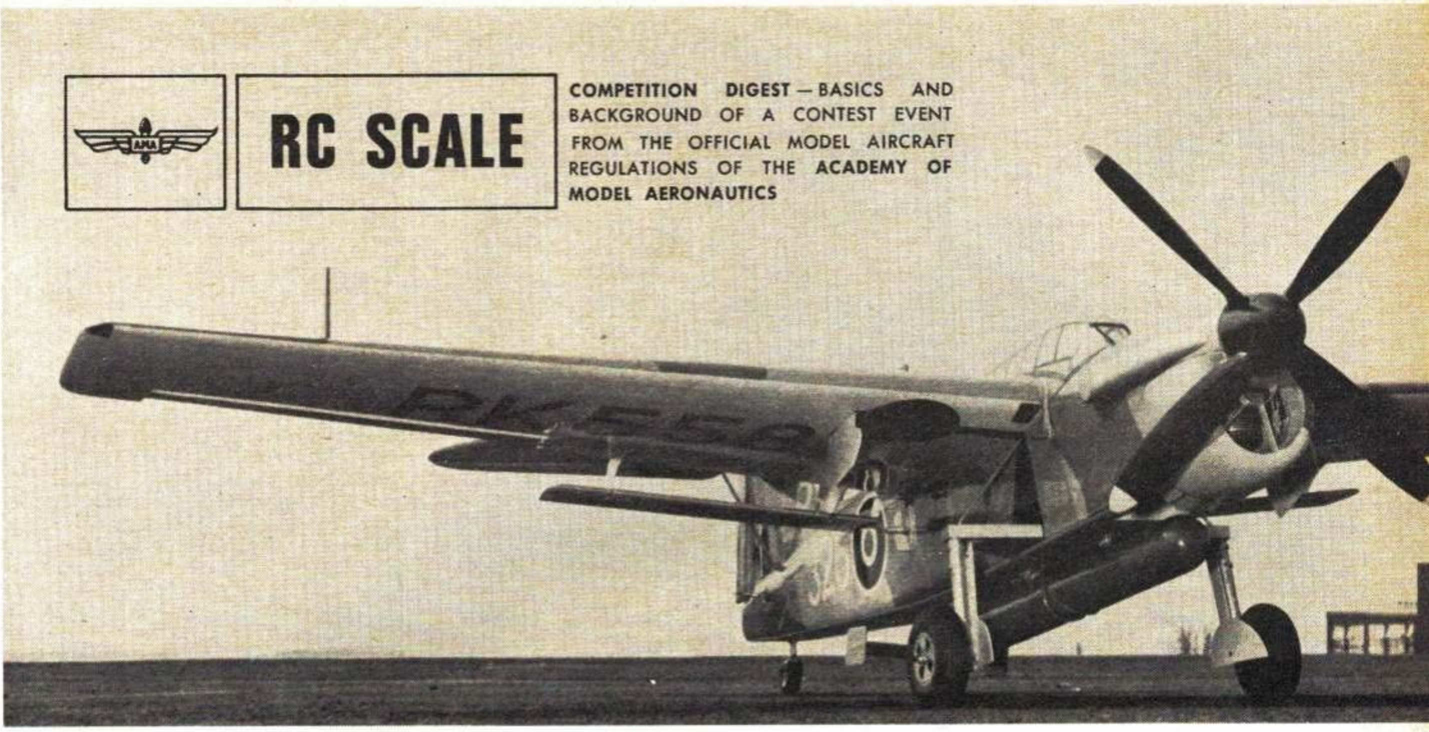
TOP TEN — RC SCALE

	W	+	F	+	B	+	O	×	F	=	TOTAL PTS.
1. Proctor	126		123		32		3.25		25.5		7248.38
2. Hester	71		68		5		21		40.5		6682.50
3. Auerhan	92		83		32		7.75		24.25		5207.69
4. Capan	39		38		9		25		45.75		5078.25
5. Atkinson	51		48		18		14.75		36.75		4841.81
6. Cummins	89		66		2		11		25.6		4556.80
7. Stafford	89		30		6		16.5		30		4245.00
8. Noll	55		50		26		14.5		26.25		3819.37
9. Woodward	57		55		14		5.16		28.66		3759.05
10. Green	59		47		0		8.83		26.16		3003.95

W: Workmanship, F: Fidelity, B: Bonus, O: Operations; F: Flight

RC SCALE

COMPETITION DIGEST — BASICS AND BACKGROUND OF A CONTEST EVENT FROM THE OFFICIAL MODEL AIRCRAFT REGULATIONS OF THE ACADEMY OF MODEL AERONAUTICS



The ultimate in flying models and factors important to competition success

RADIO-CONTROLLED flying scale models come the closest to duplicating full-scale aircraft in performance, besides being realistic in appearance and construction. The RC scale model, unlike control-line or free-flight types, may be steered on the ground and in the air as desired and is not restricted to flight patterns determined by tether or the wind.

For all scale models appearance is a big factor, but from a competition standpoint others are equally important. It is not enough for a model to look real — it must also measure up in terms of exactness to scale dimensions, reproduction of coloring and finish, duplication of markings, nature of construction and materials. It is for such specific items that competition points are scored.

It is also important to scoring for the model to duplicate a particular single aircraft. Several thousand P-51 aircraft have been produced, for example, but a scale model will be judged on how well it duplicates only one of the many similar full-scale planes of the series. To emphasize this factor the scale modeler is given additional points for providing "proof of scale" — data showing exactly what airplane is being modeled, including such items as license and serial numbers of the real plane, true coloring, details which might distinguish this plane from others in the series.

So the competition-minded scale modeler must not only place emphasis on duplicating a particular aircraft, he must also provide proof that the real aircraft existed and that his model is tailored to that evidence. And the manner of presentation is important since scale judges tend to downgrade their scoring if the material offered does not simply and precisely show the relationship between the model and the original aircraft. Volume of material for the presentation is less important than the effectiveness — a few good photos backed up by simple but authoritative drawings may be better than a complete set of original factory blueprints, simply because the latter may be too difficult to examine and interpret.

What is acceptable as an authoritative drawing is a key consideration. Manufacturer's drawings are not necessarily good proof of scale, particularly for many aircraft built during aviation's pioneer days. Airplanes of the twenties and thirties were often hand-fashioned without construction drawings and it was not uncommon for an official company plan to be made later and by draftsmen who were amateurish in ability. On the other hand, for most modern aircraft (since World War II) manufacturer's drawings are usually reliable, provided they apply to the particular model. Also, the Smithsonian Institution sells plans which are acknowledged to be extremely accurate, usually surpassing those of most manufacturers. And there are many excellent model magazine plans.

One point is noteworthy: Photographs and drawings should agree, if maximum scoring is to be expected — it is not helpful if a photo shows a rudder or cowling shape, for example, which differs from that on the plan. A common mistake of scale competition novices is to present a plan which does not agree with the model — since judges must go by the material submitted a downgrading may be expected.

Maximum effort in scale, besides making a realistic model and proving how well it reproduces the original, requires that the flying performance also be realistic. Simply proving that the model will fly, which some years ago was enough to win a scale contest, and often still is in free-flight or control-line categories, is no longer enough by national RC competition standards. The RC scale model is expected to fly as realistically as it looks.

A four-engined bomber may be expected to score less flight points if flown in the manner of a fighter, as may a World War I design if flown at a speed more appropriate to a World War II plane. Similarly, loops performed by a transport type aircraft are not helpful in gaining points for realistic flight. Although these factors apply to all types of flying scale models, there is greater emphasis in RC competition to demonstrate scale flight characteristics.

Radio-controlled scale models have one exclusive area of scoring — how realistically a model taxis prior to takeoff, with

BASICS

Competition requirements for contests sanctioned by the Academy of Model Aeronautics; further detailed in the Official Model Aircraft Regulations (AMA rule book).

Engine size — up to 1.25 cubic inches total piston displacement, any no. of engines.

Model size — two classes: I — no size limit or special requirements, except weight limit is 15 lbs., gross (ready for flight, except for fuel). II — Restricted to multi-engine models which weigh from 15 lbs. but not more than 20 lbs., gross; with maximum wing loading of 35 ounces per square foot — contestant must also certify that model has been successfully flown prior to contest.

Radio — no limitations.

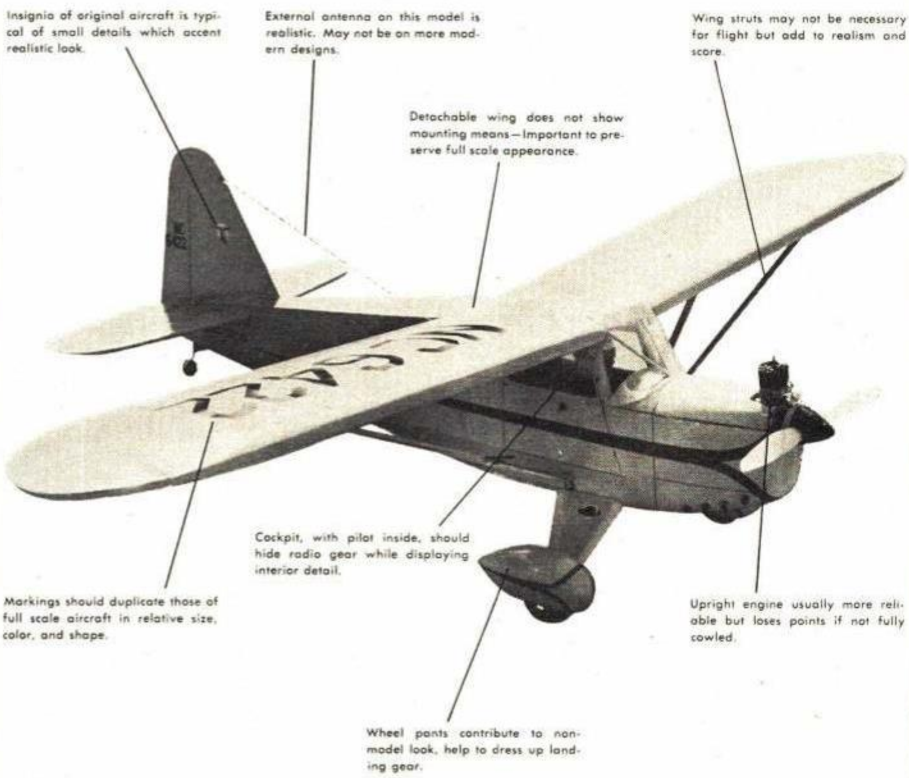
Qualification flight — may be required by Contest Director prior to scale judging.

Bonus points — for each engine in excess of one, in flight demonstration of: retractable landing gear, flaps, bomb drop, spraying or dusting, speed (pylon racer types only), parachute or cargo drop, others.

Scoring — sum of Workmanship, Fidelity, Presentation, Operations points multiplied by points scored on best single flight.

Beautiful RC craft by Claude McCullough illustrates exceptional realism and items which make for a good competition scale model: fully cowled engine, extra detail of bomb and flaps, colorful paint scheme and military markings, unusual landing gear.

Competition flight scoring begins with taxi out of starting box; RC pilot may follow model to direct steering into takeoff position.



Key elements of a flying scale model are shown by Woody Woodward's radio controlled Rearwin Speedster which placed high among National Model Airplane Championships entries. The cabin configuration will interest sport flyers.

consideration for whether it has two-wheeled or tricycle landing gear and whether brakes are involved. The model pilot is expected to steer his craft in accordance with the manner in which its full scale counterpart would be taxied. The same applies to takeoff and landing performance — a trike-geared airplane, for example, is expected to touch down differently.

Careful selection of aircraft choice is important to flying scale competition. Some feel that accuracy is more important than performance whereas others feel that exceptional flight characteristics can make up for many scale deficiencies. One factor can be traded for another but it is usually the model with the best combination of all factors which is the consistent winner.

Some advice from a national RC scale champ, Bud Atkinson, may be helpful: "Use plenty of power . . . many good subjects would have been successful if they hadn't been under-powered . . . more the case with bi-planes than not! Pick a subject that . . . has enough wing area. Most scale jobs have higher wing loading than . . . pattern or sport planes because of more finish and detailing . . . Try to have at least 15% horizontal stabilizer area . . . some scale models will fly with less . . . but are very touchy. Enlarge the stab (if necessary) . . . better to have a plane a little out of exact scale than to have exact scale and not fly!

"It's not practical in most cases to use the full scale airfoil . . . difficult to duplicate and may not perform on the model as it did on the full scale airplane. Two good airfoils . . . are the Clark Y and the 2412. Symmetrical airfoils . . . do not lift as much at slower speeds . . . make landing speed much faster and also stall at less angle of attack. Stall of most scale models is disastrous. Keep your scale model slightly nose heavy, more so than a pattern airplane. A tail-heavy scale job is usually very touchy and the higher wing loading can produce some violent stalls.

"Choose your power plant well as a good idling engine is a must . . . don't over-cowl . . . let your engine get plenty of air; overheating of engines in scale model is a common fault. Fiberglass cowls are very desirable. Try to put some kind of a pilot in . . . without a pilot it doesn't look like the real thing!"

This advice mainly reflects the importance of obtaining maximum flight points — very appropriate since scale points are multiplied by flight points for final score. But others say that by careful airplane selection there is less need to sacrifice scale points for better flight characteristics. But either way the skill of the pilot is important to get the most performance points. A good pilot can produce a good flight score with a model that may be barely flyable in the hands of a novice.

An important aid is the help of a more experienced flyer to make scale model test flights and to assist in trimming the model for best performance before the builder tries flying in competition himself — with a well tested and adjusted model the pilot can concentrate on achieving a maximum flight score rather than merely trying to keep from crashing.

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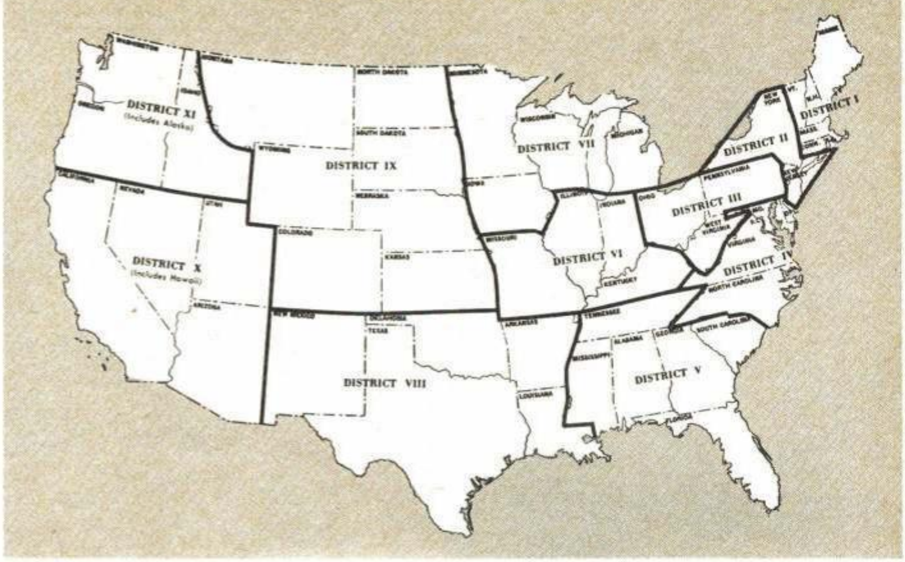

New Indoor Rules?

Continued from page 46

may pass on any comments to their local board representatives before final vote is taken in 1968, probably after March 31.

The basic proposal establishes one AMA class for Indoor Stick, one for Indoor Cabin, one for Paper Stick, eliminates Rise Off Water class and retains A ROG, Helicopter, Ornithopter and Autogyro. In addition, the FAI Indoor class is retained. The net result is to align the classes to conform with competition patterns which have existed for years, without causing any existing models to become obsolete (unusable). Thus the Council's request to reduce events has been accomplished without eliminating a basic model type (except R.O.W. Cabin). Proposal FF-67-A-2 would orient the rules toward FAI practice adopting FAI scoring and model steering.

PROPOSAL FF-67-A-1. Change Section 8 to read: 8.1 GENERAL. A powered model of the indoor type shall be so designed that it can only be properly flown indoors. No restriction shall be placed on these models except that they shall meet the specifications in this section. Indoor model classes which shall be recognized for National Records are defined as follows:

Rise Off Ground Stick Model — the projected area of the supporting surface(s) shall not exceed 30 square inches. **Paper Covered Hand Launched Stick Model** — The projected area of the supporting surface(s) shall not exceed 100 square inches. **Hand Launched Stick Model**—The projected area of the supporting surface(s) shall not exceed 300 square inches. **Rise Off Ground Cabin Model** — The projected area of the supporting surface(s) shall not exceed 150 square inches. **FAI Indoor Model** — Specifications are the same as for world championship FAI Indoor model regulations elsewhere in the Rule Book. **Autogyro, Ornithopter, Helicopter Classes**—No restrictions on model size or method of launch.

The following changes to current rules also apply. Where only number changes are indicated there is no other change.

8.2 — Delete; 8.3 AREA OF SUPPORTING SURFACE(S) — Change to 8.2; 8.4 STICK MODEL — Change to 8.3; 8.4.1 FAI INDOOR MODEL SPECIFICATIONS — Delete; 8.5 CABIN MODEL — Change to 8.4; 8.6 PAPER COVERED STICK MODEL — Change to 8.5; 8.7 FLYING WING MODEL — Delete; 8.8 HAND LAUNCHED—Change to 8.6; 8.9 RISE OFF GROUND — Change to 8.7.

8.10 WHEEL SIZES — Change to: 8.8 WHEEL SIZES. RISE OFF GROUND models shall have free rolling wheels no smaller than the following: Stick Model — 1/2 inch diameter; Cabin Model — 3/4 inch diameter. 8.11 RISE OFF WATER — Delete; 8.12 AUTOGYRO — Change to 8.9 (See '67 CB Interpretation); 8.13 ORNITHOPTER — Change to 8.10; 8.14 HELICOPTER—Change to 8.11; 8.15 NUMBER OF MODELS — Change to 8.12; 8-16 OFFICIAL FLIGHT — Change to 8.13; 8.17 UNOFFICIAL FLIGHT — Change to 8.14.

8.18 NUMBER OF FLIGHTS — Change to: 8.15 NUMBER OF FLIGHTS. Each contestant shall be allowed a total of six attempts to make three official flights. All official and unofficial flights described above are attempts. No penalty shall apply to a contestant who calls for a timer but is not able to launch the model because of a broken motor or handling mishap. 8.19 TIMING OF FLIGHTS — Change to 8.16; 8.20 SCORING OF FLIGHTS — Change to 8.17; 8.21 FLYING FOR RECORD — Change to 8.18.

PROPOSAL FF-67-A-2. Change noted paragraphs in Sec. 8:

8.16 OFFICIAL FLIGHT. An official flight occurs each time a model is launched in the presence of a contest official who has been called to time the model. In the event of a mis-launch or minor mishap, the elapsed time from launch until the model is caught or touches the floor or an obstacle shall be recorded as a flight. If the contestant elects to re-launch without rewinding, the stopwatch shall be cleared and a new official flight may be started.

8.17 UNOFFICIAL FLIGHT. No unofficial flights shall be allowed, since each flight attempt becomes official at the time of launch.

8.18 NUMBER OF FLIGHTS. Each contestant is allowed six official flights. No penalty shall apply to a contestant who calls for a timer but is not able to launch the model because of a broken motor or handling mishap.

8.20 SCORING OF FLIGHTS. Scoring time for indoor rubber models shall be the longest of six official flights. Flight duration shall be recorded to the nearest one-fifth second.

CONTEST CALENDAR

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Gladiator

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Stabilizer and rudder are of sheet balsa construction. The stabilizer is carved and sanded from 3/8 in. thick medium sheet. The rudder is built from 3/16 in. medium sheet and the offset is put in after the airplane is assembled by cutting with a razor saw along its bottom edge as shown on plans; allowing it to be warped to 1/2 in. offset. For this, apply glue or clear dope to the outside of the rudder, dampen the inside with warm water and set aside to dry.

Control system. It is of extreme importance to have a dependable system in a good flying model because of the practice needed to become a consistent winner. Pushrod bends from the bellcrank to the flap horn should be exactly 90 degrees to each other in order to stop pushrod wobble which wears both bellcrank and horn. Washers should be soldered to the pushrod on either side of the flap horn and bellcrank to insure alignment. The type of flap horn used in this model is somewhat different.

Both pushrods connect at the same height from the hinge line of the flaps. The elevator horn is also of the same dimension from the pushrod connection to the hinge line. This gives equal motion and leverage to both.

The leadout connection at the bellcrank should be done exactly as on plans, with a short piece of 1/16 O.D. brass tubing that has been annealed. The leadout is inserted through the bellcrank, bent U-shaped, then wrapped with copper wire and soldered in the normal manner. The same procedure is used at the wing tip connection. This insures long life without the leadout cutting through the bellcrank, or vice versa. The pushrod should have a smooth-fitted fairlead at the center bulkhead between wing and stabilizer.

Assembly order: Install the wing into fuselage before adding top and bottom blocks. The flaps should be hooked up and working. The stabilizer is then glued in place. The pushrod from the flap horn to the elevators is made in two pieces and joined by a length of 1/8 in. O.D. brass tubing in the center where the fairlead is in position on the center bulkhead. This allows adjustment for a neutral setting of both flaps and elevators. Top and bottom blocks are now added and carved to basic shape on their exterior surface. The top block is cut loose and hollowed as shown on plans.

The landing gear is bent from 1/8 in. music wire as shown on plans and installed to plywood gear mount plates with "J" bolts. The wheel pants are assembled, carved and sanded to shape as shown, then split apart, notched for wire, and epoxied in place on landing gear wire. Fairings are then added in two halves, also using epoxy as adhesive. They are sanded to shape after installation.

Wing fillets and stabilizer fillets are carved from 1/4 in. balsa for the wing and 3/8 in. balsa for stabilizer, which are added at this time. Dubro 3/8 in. leather fillet material is used at the wing fuselage joint; 1/4 in. material at stabilizer-fuselage joint.

The cowl is assembled from 1/4 in. balsa sides, 3/8 in. balsa bottom block, and balsa front block. These are carved to shape as shown.

Finish. This is the way I did it, but you probably will have your own methods. Lightweight fiberglass cloth was used on the fuselage and cowl from the center of the wing chord forward. The entire fuselage, stabilizer, rudder and flaps were finished with two coats of polyester resin and sanded smooth before covering. The wing was covered with silk and finished in normal manner. Canopy details and paint design are to your taste.

Fuel tank is the Nobler type. No baffles or uniflow system are used. The feed line to the engine is cross fed with the needle valve to the outside (of the circle) of the airplane. Fill and vent tubes face forward into the slipstream and run into the inside bottom front corner of the tank, then straight up to the top front corner. This tank has run extremely well for me over 14 years of flying.

The tank is held in with four small sheet-metal screws, two at either end. The cowl is held in place with bicycle spokes soldered to the front and back of the tank, projecting through the dowels shown in cowl detail on plans.

Set-up and flying. This model should be flown on .018 dia., 70-ft. stranded lines. The 35 version is flown on .015 dia., 70-ft. lines. Test as you would with any other stunt design. The center of gravity (balance point) should be as shown on the plans, or slightly forward of this point — never rearward. Check the airplane closely for warps and remove as many as possible by steaming or heating the covering and twisting in opposite direction while covering is warm. A straight wing is very important. If any slight warps should show up after first test flight, correct them by twisting flap horn opposite the warps.

Since the construction part of the article was written, the author and Bob Harness Jr. flew the airplanes shown in the pictures at the Orange County Thunderbugs Annual Contest in Expert Stunt. Bob Harness was first with approximately 520 points, the author third with 493 points.

I have found that practice should be done the day before a contest and only one or two needle-valve setting flights be made before your official contest flights. This insures you are fresh when you make your official flights, and not tired from endless practice the morning of the contest.

Mini Multi's

Continued from page 33

inch thick. Make slots for the hinges and glue them into the foam with epoxy. Be sure the hinges are not filled with epoxy! If you think the foam trailing edge is not strong enough, add a balsa trailing edge.

If you want to try these planes with heavier equipment, use only three servos and couple the ailerons and rudder mechanically. In both planes the aileron servo was mounted in the fuselage and a linkage from it worked a ½A-size control-line bellcrank located at the center of the wing. Conventional linkages from the bellcrank to the ailerons were used. The fuselage can be made wider to accommodate larger servos as necessary. As long as the weight of the monoplane is less than three pounds, and the weight of the biplane is less than four pounds ready-to-fly, there will be no loss of performance with the heavier equipment.

For the semi-scale enthusiast, one can surely design a fuselage to use the styrofoam wings and tail. The author is planning a P-51D Mustang using full-house control and a built-up fuselage. Bud Atkinson's T-34 Mentor, in this issue, is another possibilty. In any case, only the wing planform will be out of scale.

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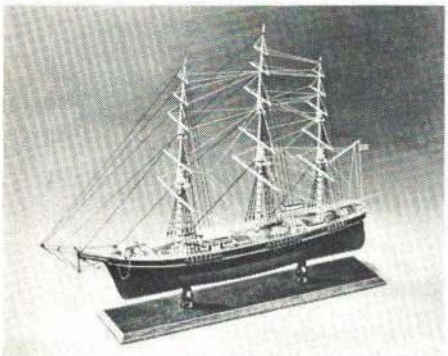

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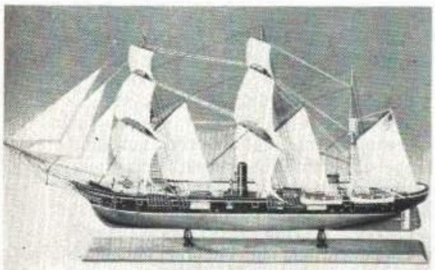

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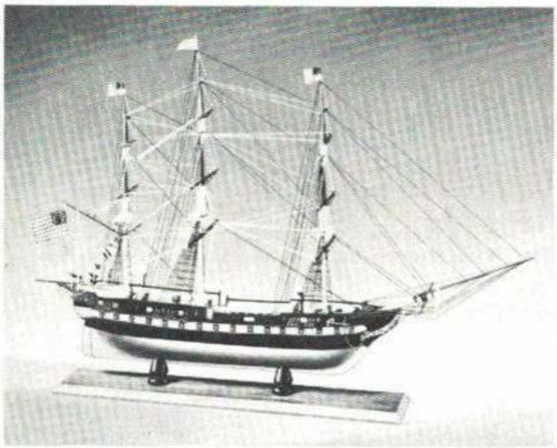

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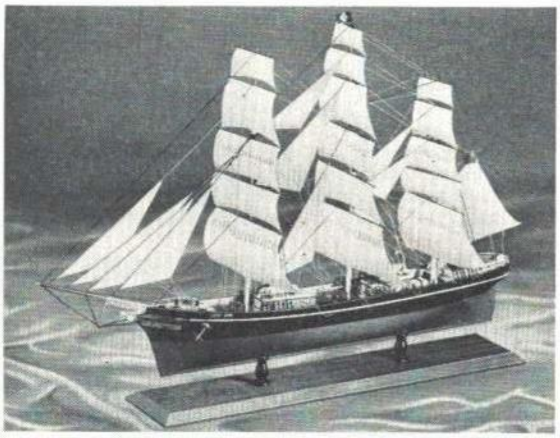

Kit 163 **CUTTY SARK, CLIPPER SHIP.** 23" exact scale replica of the world's fastest ship of 1868. This deluxe kit features genuine sails — printed on cloth. **$14.95**

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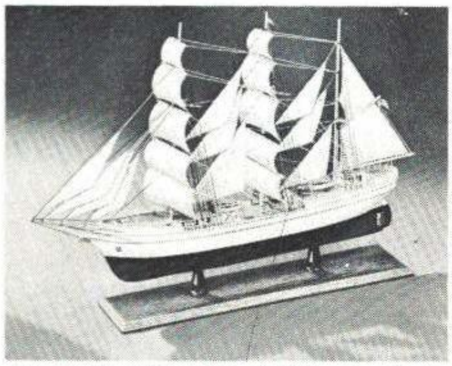

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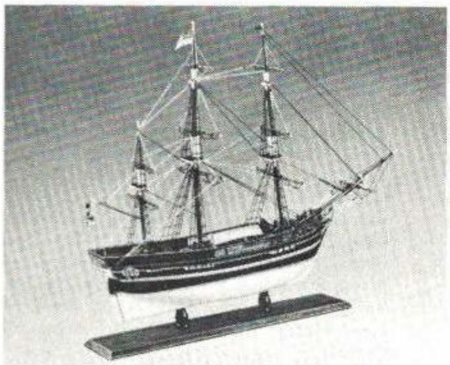

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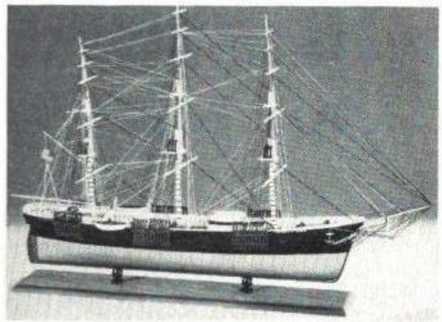

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WOOD SHIP MODELS

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Two-Cycle Engine

Continued from page 25

where the combustion chamber is a trench milled straight across, leaving wide squish flats on each side.

If the squish band is too close to the piston, a hydraulic lock can occur. That is, part of the fuel charge cannot get squished out of the way in time and is trapped. Extreme compression ratios result in the squish areas, and the result is erratic running and broken conrods. One way to relieve this problem is to give the squish band a slight angle relative to the piston; three degrees seems to work.

Squish band heads do have an effect on the allowable nitro content of racing fuels. Nitro contents as high as 70 and 80 % have been used without detonation.

Many other head shapes have been tried, such as the trumpet head in the "Rattler" engines, but compression ratio seems to make a bigger difference than head shape. Compression ratios as high as 18 to one have been used, but few glow plugs will stand up to such punishment. The compression ratio must be matched not only to your fuel, but to the weather as well. Test running and test flying is the only way to find the proper combinations.

Air intake: So far, we have talked about cylinder-piston combinations and head shapes, but we must also have an efficient means of getting fuel and air into the engine.

The simplest method of air induction is the "side port" system as shown in Fig. 5 where the intake port is uncovered by the piston skirt when the piston nears the top of its stroke. A pipe leads from the needle valve to the port, and when the port is opened by the piston skirt, the vacuum in the crankcase draws in the fresh charge. Many model engines have been built this way, but better results are obtained by rotary valves.

Some engines have been built using reed valves. These are simply a one-way valve formed by flat, thin, spring steel or beryllium copper reeds. When the piston goes up, negative pressure opens the reed allowing the fresh charge to come in, and when the piston starts down the reed closes. Disadvantages to this system are that the intake timing cannot be controlled, and the engine can also run in either direction.

The best, yet most complicated and most expensive system is the rotary valve. There are several types, but all of them use a rotary shaft or disk to open and close the air intake hole at the proper time. The simplest rotary valve is the hole through the crankshaft that valves the fuel and air into the crankcase through a port in the main bearing. One advantage to this system is the oil mist cooling of the crankshaft and bearings. The disadvantage is that the crankcase compression cannot be very high with the large hole in the crankshaft. Oversize bearings must also be used.

The rear rotary valve is a disk or drum that is rotated by the crankpin. A large segment of the disk is cut away to allow passage of fuel and air, and opens and closes the intake port as it is rotated. Different manufacturers use different intake timing, but usually the valve opens after the crankshaft has rotated 35 to 45 degrees past bottom dead center and closes near 45 degrees after top dead center.

Much has been written on hop-up procedures where techniques are stressed on polishing all air passages, but this can sometimes give a reduction of performance. Oil from the fuel will stick to a highly polished surface while it can be swept away from a rougher surface. If it sticks and piles up in the bypass, the result will be a smaller passage for air flow. Any gain from polishing is usually from the removal of metal, giving a larger passage.

I hope this article has explained a few of the principles of two-cycle engines without antagonizing anyone. I have purposely neglected such things as superchargers or tuned systems. Most engine designs are many years old, but there should be room for more development of the basic systems. Titanium pistons, for example, do not work, but bushed titanium conrods are already being used. Such metals as beryllium and single crystal iron must be tried for pistons or sleeves. Much experimental work is left.

Scale Techniques

Continued from page 30

(G-12): yellow; tail wheelframe (B-15): dull aluminum. Inside of flaps (G-22): gray-green if in lowered position — if in closed position, do not paint. Strut covers (G-25): gray-green inside, yellow outside. Strut supports (B-31) and struts (B-22, 23): dark gray; step (B-28): yellow.

Assembly: Paint all fuselage edges with liquid cement (at least three times or until edges are softened). Quickly align fuselage halves. After joining halves tension can be applied with masking tape crosswise on fuselage top and bottom. Rubber bands can be substituted. Repeat process on wings. After installing landing struts (B-22 and 23) and landing flaps (G-32 and 33) paint the edges of wing halves with liquid cement until softened. Be sure to install step (B-28) before wing halves are cemented together. After joining wing halves, tension can be applied with masking tape crosswise over the leading and trailing edges. A good idea is to put two pieces of tape on the wing tips.

While cement on wings and fuselage dries, make the right and left eagle decals as follows: Cut out eagle and use as template; mount on lightweight card, of at least postcard weight. Be sure to make a right and left decal, using black and white decal paper (I used "Sig" here). On the paper side of the white decal sheet, trace around the entire eagle. Cut with X-acto No. 11 blade and set aside. Now cut and remove the white outline from template, leaving the black eagle. Repeat same tracing process for black pattern as was used in making the white outline and cut with X-acto knife. Next, from the kit, cut the following: swastikas, the "200 Victory" markings, and the German lettering. The Geschwader-Kommodore markings are HisAirDec black and white decals, or make them by the same method as the eagle decal.

By this time, fuselage and wing cement should be dry. Assemble elevators to fuselage, cement and mount wing assembly to fuselage, using rubber bands to pull the fuselage assembly into position in wing assembly. After cement is dry, use spot putty or Duratite to fill all crevices. Use #600 wet or dry to sand all parts smooth.

Model now can be sprayed yellow. Apply a minimum of six coats of very thin enamel. After each coat, sand smooth any rough spots with #600 wet or dry. First coat should be the heaviest; after second coat, add thinner to enamel. You can attach the landing gear covers and wheels after enamel is dry; then clear plastic can be cemented to canopy. Immerse white eagle decal in lukewarm water, when separated slide into place per photo of model. While eagle outline is drying, cut and apply the rest of the decals. Next, paint white beak separation and eye with white enamel on black eagle decal paper. When dry — immerse black eagle decals in water and apply. Be sure the white outline shows, as in photo.

Revell, Frog, Airfix manufacture 1/72 Focke-Wulf kits; Airfix's is a Focke-Wulf 190 D. The model in the article is made from a Monogram FW-190 kit in ¼" scale, kit Number PA 107-100. In addition, these materials were used: Humbrol enamel (#8), Pactra enamels, Sig decal paper, Testor's liquid cement; Duco lacquer putty #228-53302 (Gray), Duratite surfacing putty, HisAirDec decals, and a Badger Air-Brush #200.

MAIL BAG

The Republic Thunderbolt has been added to the famous Monogram series of ¼" scale WWII Fighters. Their P-47D carries a 200 gal. drop tank, two 500 lb. bombs and eight 50 cal. machine guns. Engine and cockpit detail is faithfully reproduced. The tail-wheel swivels, wheels and propeller rotate and the canopy opens and closes. A matte-finished decal sheet carries both American and British markings. The Thunderbolt P-47D (PA 187) ¼" scale kit retails at $1.50.

Monogram's version of the famous Luftwaffe Messerschmitt "Zerstorer" or destroyer, is the Bf-110E-1 which carries two wing-mounted 110 lb. bombs and two 1,100 lb. bombs on external fuselage racks plus nose armament of four 7.9mm machine guns and two 20mm cannon. The model is complete with clear canopy, two-man crew figures, machine guns, bombs and full-color, matte-finished decal markings. Propellers and wheels rotate; landing gear can be built in either up or down position. Retailing at $1.00, the kit number is PA 162.

Received Frog's newest kit from A. J. Stafford, Product Manager of Rovex Scale Models Ltd. It is one of the year's best kits. Parts are clean, flash free and well fitting. The plane is the Air-Sea Rescue Avro Shackelton Mk, 3 long range, maritime reconnaissance bomber. Kit contains a matte-finished multiple transfer sheet with RAF and South Africa markings. In 1/72 scale, there are 147 parts, with opening bomb doors, movable control surfaces, propellers and flaps, long range wing-tip fuel tanks, pilot, co-pilot and stand; wingspan of completed model is 20". The coloring guide on the box bottom is all that would be wished for as a guide; cover is well illustrated. A grade A kit, which I highly recommend. Kit number is E-172.

AMA CLUBS HAVE INSURANCE TO PROTECT FLYING SITES!

Getting STARTED in RC

Courtesy and Common Sense: Seventh in a Series.

HOWARD McENTEE

THIS month we'll cover matters entirely different from the equipment, systems and such that we have detailed previously — but just as important to your RC flying and your fitting in well with the other RCers at your field. Beginning RCers have many problems on their minds when they go to the flying area, and many give little or no thought to the vital matter of field etiquette. (And from our observations, a lot of so-called "experts" give little thought to it either!) So read carefully, and put into practice the suggestions given below. If you do, your fellow flyers won't shudder when you show up. They'll welcome you.

To begin with, do all your testing, range checks and other such time-consuming chores at home. Most flying sites these days are loaded with modelers, few of whom care to sit idly by while you make interminable ground checks and tuneups. When you get to the field, your equipment should be tuned, tested, ready to go!

Have the proper frequency flags or ribbons on your transmitter antenna. What's proper? Flags are common on 27 mc (you can get good ones in most hobby shops) and the colors are: 26.995 mc, brown; 27.045, red; 27.095, orange; 27.145, yellow; 27.195, green; 27.255, blue. In some areas, regen flyers on 27 are asked to fly a black flag, but this isn't official or universal. For the 72 mc Citizens Band RC spots two ribbons are required; in all cases you attach a white ribbon to the antenna (this denotes 72 mc), and another with these colors; 72.08 mc, brown ribbon; 72.24, red; 72.40, orange; 72.96, yellow; 75.64, green.

The AMA has just set up standard RC spots for the amateur six meter band. Frequencies and ribbons are as follows: in all cases use a black ribbon to designate the band, and for 51.20 mc add a light blue ribbon; 52.04, violet; 53.10, brown; 53.20, red; 53.30, orange; 53.40, yellow; 53.50, green; on this band, the first two frequencies mentioned have been designated solely for regen receivers, all the remaining five for superhets.

On some fields there is a clothespin system to control frequencies; unless you have the proper clothespin on your antenna, you are not allowed to turn on your transmitter. Even with this or any other such system, check all transmitters of those who are flying before you take off; if you should launch your plane on the same frequency as that of one already in the air, you stand to wreck both planes — and you could (deservedly) get a transmitter wrapped around your neck too!

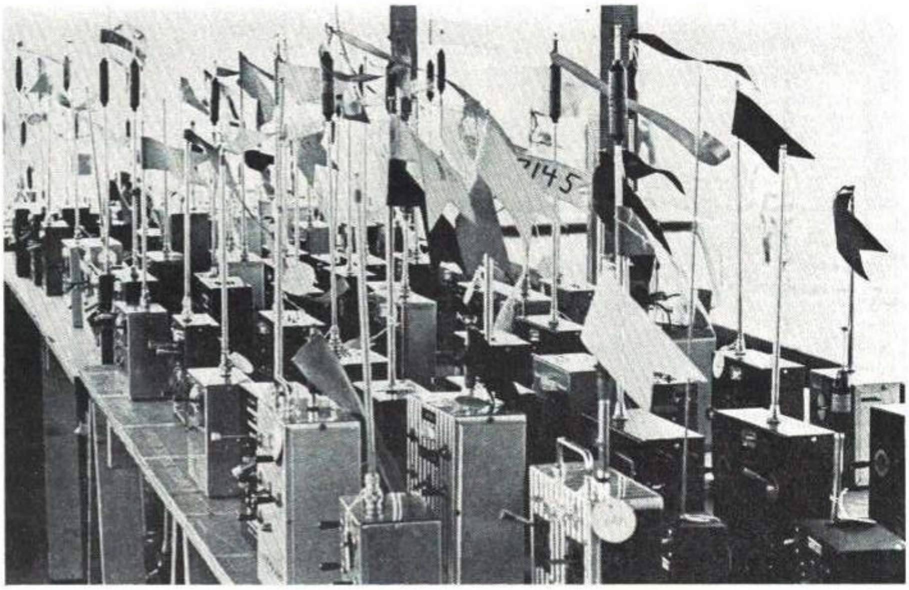
On crowded fields, super-regens are definitely not welcome, particularly on 27 mc; for when a regen flies, all other 27 mc planes must be grounded. So if your plane has a regen, don't fly the transmitter frequency color flag on your antenna, or others might put a plane in the air on other spots and "shoot you down." Check with all those ready to fly, before you go up.

Most clubs and other organized groups have a set of field rules, which will generally stress many of the points we cover here. Many have special rules, made necessary by local conditions, insurance and other factors. So learn the rules before you try to fly.

If you are a rank novice, get an experienced flyer to help you check out the plane, and let him fly it away from the ground before handing the controls to you. Your plane will last a lot longer this way! Let the expert land it too. Don't be afraid to ask for such help — the experts probably did too, when they were new at the game. We've seen a beginner hand launch his plane half a dozen times, only to see it pile in 50 feet or less away. He didn't realize that even though other transmitters in use at the time were on different frequencies, any one of them could clobber his plane, fitted with regen receiver!

Don't start your engine in the pit area; chances are it would throw a cloud of dirt and oil over all planes, people and equipment nearby. If you must do so, point the prop blast in a clear direction (and not one where the breeze will blow it all right back into the pits). If you must test-run an engine, do it at a good distance from the pits and from anyone flying; an engine roaring nearby on the ground is extremely annoying to most pilots who are flying.

Fly from the same side of the landing strip as the pit area (unless local rules specify otherwise). Some flyers, for various reasons (none of which are very important) prefer to fly from the side of the field opposite the pits. They are not only in the way of planes landing and taking off (and might very well get hit by one) but they tend to make their hot low passes and do their stunts directly over the pit area, the cars and the crowd. And worst of all, never fly from the landing strip itself — unless you are by yourself. Don't fly from the pit area, from between cars, etc., either. The experienced flyers look out on the flight line to see who's in the air; they can't be expected to check the entire area. They might fail to see you, especially if you are flying a small plane that doesn't make too much noise, and you aren't in the proper pilot area, alongside the strip.



Frequency flags are necessary at RC contests. Interference is regulated at large meets by impounding contestants' transmitters between flights. A typical impound area is shown. Equipment must be adjusted and in tune before the meet starts!

Once you have your plane aloft, it's well to have an experienced flyer stand nearby, to watch for other planes, warn you of drift downwind, nearby trees, buildings and such, and to be ready to take over the controls if you get into trouble. Again don't be afraid or ashamed to ask for such help. Why fight a plane through a wild death-dive just because you are too proud to ask for assistance?

If there are other planes in the air when you're flying — and at most RC fields today there will be — try to confine your plane to one definite area of the sky. Nothing is more disconcerting to those flying, as the pilot (beginner or expert) who is

Continued on page 60

all over the sky. Sudden changes in heading or altitude (due to stunts of various sorts) when just one such wandering plane is in the air, can be a sure cause of mid-air collisions — of which we hear more and more instances these days. You can do the entire AMA stunt pattern in one sky sector, if you put your mind to it. Or perhaps we should say, an experienced pilot can do so — it's highly doubtful that the beginner will be trying it. Three other planes could be doing the same — all quite safe from "mid-airs."

Don't do any stunting, hot high-speed passes and such over pits, cars, or spectators. It's too easy to goof and plant your plane among them. We've seen experienced flyers going inverted low over a crowd, pull up-elevator and climb out. We've seen low flying planes experience sudden equipment failure over a crowd. We've seen interference take control over a crowd. And we've seen people, planes and cars hit by the resultant instant crashes. Don't let it happen to your plane! It can — and often has — happened to the unthinking hotshots. Are you immune from such disasters?

Don't turn your transmitter on the same frequency as one controlling a plane in the air, even with the antenna collapsed, even if only for an instant. Some flyers tend to do this to move their engine throttle to a different position — and too often some unfortunate pilot wonders what made his plane take that fatal plunge.

This whole essay has been one "don't" after another. But the points we've brought up are just as important to your enjoying RC flying, as are having good equipment or a well-trimmed plane. They are just as important to your flying buddies. If every RCer observed them, radio control could be a much safer and more enjoyable hobby!

Inductance Servo

Continued from page 43

The use of a variable inductor in a new timing circuit was investigated next and proved to be an acceptable approach. It seemed reasonable that one could use the reverse induced EMF which appears across an inductor when the current in the inductor is changed. Going back to basic electronics, you will recall that if a steady state DC current is established in an inductor, and then is interrupted, or turned off, a voltage is induced across the terminals of the inductor. The magnitude of this voltage is a function of the magnitude of the current which was being passed through the inductor and the speed with which the current was turned off. It is also a function of the actual inductances of the coil itself. (The formula for this induced EMF is $E = L\,di/dt$.) Because the inductance is a function of the permeability of the magnetic flux path, it is quite simple to change the inductance of a given coil by moving an iron core in and out of the coil.

For example, this same mechanism is used in the RF coils which are used to tune the receiver in radio control systems. Visualize an inductor wound on a straight hollow form with an iron core moving in and out of the coil and you have an inductor whose value of L is dependent upon the position of the core in the coil. In the servo application, this core could be rigidly attached to the moving output arm of the servo while the coil would be fixed to the stationary portions of the servo. Hence, the position of the core would be determined by the position of the servo output, hence the value of inductance would be proportional to the position of the servo. By passing a fixed DC current through the inductor, and then turning it off abruptly, a voltage would be induced across the terminals of the inductor with the magnitude of the voltage proportional to the position of the servo. By properly designing the electronic circuitry, we produce a voltage proportional to servo position and achieve a feedback element which does not require wiping contacts. The problem remaining is to generate, from this induced voltage, the time delay approximately of 1 millisecond and, at the same time, maintain a direct relationship between the magnitude of the induced voltage and the duration of the time delay.

Mechanization of the preceding approach has been successfully achieved in the Titan Magnevac servo. In order to discuss this mechanization, refer to the schematic. The general functions of the different portions of the circuitry are as follows: Q1 is an input buffer and amplifier. Transistors Q2, Q3, Q4 with the variable inductor, L1, and associated resistors and capacitors, form the reference pulse generator. Diodes D70 and D71 form the comparator gate for one direction of servo travel, and D50 and D51 and resistor R52 form the comparator gate for the other direction of travel. Q5 amplifies and inverts the output from the latter half of the comparator.

Transistors Q7, Q9, Q11 and Q13 form a pulse-stretching network and the driver transistor which causes the motor to run in one direction and transistors Q6, Q8, Q10, and Q12 produce the opposite direction of travel.

Let us now investigate the operation of transistors Q2, Q3, and Q4. The inductor L1, is the feedback element and is located in the emitter leg of transistor Q2. Resistor R20 (4.7K on the base of Q2) biases Q2 ON so that, in the normal quiescent state, transistor Q2 is conducting and draws a steady state DC current of about 3 milliamperes through inductor L1. Q3 and Q4 are cross coupled in the basic Schmidt trigger configuration with transistor Q3 biased ON and Q4 biased OFF. The collector of transistor Q3 is the output of the reference generator and is coupled into both comparator gates. With Q3 biased normally ON, the output, or collector of Q3, is at or near ground potential.

The reference generator is triggered once each frame by the command pulse routed to each servo via the yellow lead of connector P1. This is a positive going signal whose duration (width) specifies commanded servo position and is the one millisecond duration mentioned earlier. This pulse turns on transistor Q1, thereby generating a negative going pulse with a duration of 1 millisecond on the collector of Q1. The rise and fall of this negative going pulse is differentiated by C20 and R22 to form first a short negative going spike, and then a short positive going spike 1 millisecond later. The negative going spike is coupled through diode D20 to the base of Q2 and turns Q2 OFF *i.e.*, causes it to stop conducting.

This means that the current has abruptly ceased to flow through inductor L1 and a reverse voltage is induced across L1. Thus, the top of L1 (the emitter of Q2) is caused to go negative for a short duration. The magnitude of this induced voltage is dependent upon the position of the core in the inductor L1. When the servo is at one end of its travel and the core is only slightly projecting into the coil of L1, this induced voltage is in the order of minus 20 or 30 millivolts. However, at the other end of its travel, when the core is projecting entirely through the coil of L1, the magnitude of this voltage is as much as minus 200 millivolts. This negative going voltage peak is coupled through diode D21 into capacitor C30, and, because of the low resistance of the inductor L1 and low forward resistance across diode D21, capacitor C30 is caused to discharge abruptly. When the voltage decays across L1 and the emitter returns to its DC level, diode D21 becomes reverse biased.

The positive going time constant (decay time) for capacitor C30 is determined primarily by the resistance value of trimming potentiometer R34. This causes capacitor C30 to recharge toward 6 volts with a time constant which is determined by C30 and (primarily) R34. The fact that the junction between C30 and R34 has abruptly become a negative voltage has caused Q3 to be turned off, thereby causing its collector to go positive. This action causes Q4 to be turned on.

The base of Q3 now recharges toward 6 volts until Q3 is again caused to conduct, and through the Schmidt trigger action, Q3 quickly turns back on thus turning Q4 off. One cycle of operation of the reference generator in now complete and the output, or collector of Q3 has changed state for a period of approximately 1 millisecond. As the core is moved further into inductor L1, the negative induced voltage becomes greater, thereby causing capacitor C30 to be further discharged. Since capacitor C30 recharges at a constant slope, it can be seen that for larger negative voltages, we generate a longer time delay during which transistor Q3 is off. This is the basic mode of operation of the Magnevac timing circuitry. A U.S. patent is pending on the circuitry around Q2, Q3, and Q4 and should be granted very shortly.

The remaining circuitry of the servo is more or less conventional. Position of the servo is a function of the input pulse width. The reference pulse is compared to the input pulse, and the appropriate pulse stretching and driver chain is turned on depending on whether the commanded pulse is wider or narrower than the reference pulse. This process is repeated once each pulse repetition period until the widths of the reference and commanded pulses coincide to produce a nulled condition.

A photograph shows the mechanical arrangement of the inductor and the core. Notice that the inductor itself is a coil-form which is attached rigidly to the printed circuit board of the servo. The core that moves in and out of the inductor is a soft steel continuous threaded 4-40 rod with a screw driver slot in one end for adjustment. The slug threads into the post which is an integral part of the output rack. When the rack or output arm of the servo moves, the slug moves with it, in and out of the inductor. The center position of the servo is readily adjusted by screwing the core into or out of the post. If this adjustment is performed with a nonferrous screw driver, the position of the servo can be adjusted for proper centering while the servo is operating. The resolution of this adjustment is exact.

Servo Development. Referring again to the schematic you notice that both R21 and R34 are potentiometers which provide for adjustment. R21 adjusts the DC current which flows through the inductor to change the absolute magnitude of the voltage induced across L1 when transistor Q2 is turned off. R34 controls the recharging time for capacitor C30. Thus, adjustment of R34 changes the slope with which C30 recharges toward 6 volts. Hence, it is possible to adjust both the end and the center positions of servo travel.

Extensive testing has established that the linearity of the inductive feedback principle is better than one-half percent as measured against the theoretical straight line. Linearity is lacking only at the extreme ends of the coil-form. This is due to the fringing effect of the magnetic field at the ends of the coil. However, since servo travel is restricted to ¾ in. and the coil is a full one in. long, the fringing, or end effect, is not observed in normal operation.

The final version of the Titan Servo was designed to provide a full ¾ in. permissible travel on the output arm and a transit time of about .6 seconds end-to-end. The thrust is 3½ pounds. The case is made of .032" half hard aluminum anodized blue and is mountable on three sides. The case has proved to be extremely durable and most resistant to crash damage. The size of the Titan Servo is 1 1/16" thick by 1¾" high by 3¼" long including mounting lugs.

The variable inductance servo is available in a wide range of models for use with most major brands of **digital** equipment today.

Model Rocketeer

Continued from page 35

Liverpool Organization of N.A.R., Robert M. Brunner, 7687 Admiral Dr., Liverpool, N.Y.
Mid Island, Steve Stutman, 3758 Jules Lane, Wantagh, N.Y.
Midland Amateur Rocket Society, Charles K. Mathis, 801 Devonian, Midland, Texas 79701
M.I.T. Section, Prof. Myron Arnold Hoffman, Box 427, 3 Ames St., Cambridge, Mass. 02139
Monroeville Rocket Research Society, Al Petrush, 652 Cooper Rd., Monroeville, Pa. 15146
Narfax, Bill Kendrick, 3310 Mill Springs Dr., Fairfax, Va. 22030
Pascack Valley, Karl Feldman, 4317 Cottage Ave., North Bergen, N.J. 07047
NARGAS, Scott Upton, 25 Topping Lane, St. Louis, Mo. 63131
NARHAMS, Carl Kratzer, 5002 Keokuk St., Bethesda, Md. 20034
NAR Orbiters, Bill Pum, 55 Avondale, Rochester, N.Y. 14622
North Shore Section, Robert Bauman, 19 Hartley Rd., Great Neck, N.Y. 11023
Pottstown YMCA Missle Minders, Carlton "Skip" Raymond, 338 King St., Pottstown, Pa. 19464
Quartz Hill Rocket Assoc., Guy A. Ottalini, M.D., 41260 No. 50th St., W., Lancaster, Calif. 93534
Randallstown Rocket Society, Richard Greenberg, 3403 Jo Ann Dr., Baltimore, Md. 21207
Space Center Rocket Society, Dr. M. L. Story, 8311 Winkler Drive, No. 186, Houston, Texas 77017.
Star Spangled Banner Section, Howard Galloway Jr., 428 Ben Oak Dr., W., Severna Park, Md. 21145.
Steel City Section, NAR, Robert Moeller, 1100 Fox Chapel Rd., Pittsburgh, Pa. 15238
Thruster Section, Tom Boyd, 512 Kreitzer Ave., Bloomington, Ill. 61701
Whitman Aerospace Research Society, Mark Mercer, 8036 Cindy Lane, Bethesda, Md. 20034
United Flying Organization, Jeff Pauley, 3211 Blueford Rd., Kensington, Md. 20795
White Sands Section, William M. Robson, 1409 Indiana, Alamogordo, N.M. 88310
Willow Grove Model Rocket Club, Upper Moreland Jr. H. S., c/o Phillip Mossburg, Willow Grove, Pa. 19090
YMCA Space Pioneers, G. Harry Stine, New Canaan Community YMCA, New Canaan, Conn. 06840
Zenith, Dr. Ellsworth B. Beetch, 211 Clover Lane, Mankato, Minn. 56001

Engine Starter

Continued from page 26

If you are in need of a starter unit for your speed engine, it may be well worth your time in obtaining one of these Cox 140 engines and converting it into a starter unit. Cox makes several different versions of this engine. Model No. 800-19 was chosen because it had the fuel tank and base mounting bracket already on the engine.

Only one machined part is required — the spinner adaptor and pull-cord unit. Even if you don't own a lathe, any good machinist can make this piece for you at a reasonable cost. All the necessary dimensions are given in the illustration.

It would be nice if you could put this adaptor unit on the power takeoff shaft, except for one very important factor. And that is, it would be turning in the wrong direction to start your speed engine.

It is advisable to run your Cox 140 engine several times to become familiar with its running characteristcs before removing the recoil starter mechanism. Unlike other Cox engines, this one does require a break-in running period. An operating manual comes with the engine and should be read thoroughly before starting your engine.

The type of mounting stand you make is up to you. The one shown in the photos (and the illustration) is quite easy to construct. Wheels or skids can be installed on it for ease in moving it around.

If you make the wooden mount as shown, be sure to give it a couple of coats of enamel or epoxy paint. Two-cycle engines are known to collect oil around the exhaust and other running parts and the stand will be much easier to wipe clean if it is painted.

Although the Cox 140 engine is equipped with a muffler, it is a bit on the loud side. This is quite noticeable when you are starting a .15 size engine. Perhaps you may want to adapt another type of two-cycle muffler to the Cox engine if this part bothers you.

When the starter unit is warmed up, it will start with one good pull of the starter cord, a most useful feature if you need a fast restart. It won't take long for your helper to appreciate this bonus feature, especially on a hot contest day — and you on your third attempt.

For some time there have been rumors going around that Cox was coming out with a larger engine. Well, the rumor was correct. But it wasn't a .29 or .35 as many had thought it would be. However you speed merchants can still find a use for it if your old starter unit is giving out on you! You will be surprised with the results.

Beechcraft Mentor

Continued from page 27

There it underwent evaluation in training conditions similar to those it would encounter in actual use. At one time during the evaluation, one Mentor was flown 23 hours and 20 minutes continuously with only seven brief ground stops for refueling and crew change.

A total of 1904 Mentors were manufactured by Beechcraft from December 1948 through 1958. These included 353 of the YT-34 and T-34 models produced from March 1950 to October 1, 1956 for the U. S. Air Force. The U. S. Navy version, the T-34B, was in production from October 1954 to mid 1957 with 423 units delivered. Beech also produced 318 units of the Model 45 for export.

Fuselage Construction: The T-34 fuselage is simple and straightforward, much like any stunt ship, and since it has slab sides and bottom, it makes for easy construction, not time consuming, as with many scale airplanes that have round fuselage that require a lot of planking. Only the top deck is planked on the T-34; if desired, the rear deck can be installed in a one or two piece sheet. Also, the T-34 had no wing fairing, like say, on a P-51 or Spitfire, which are rather hard to build and fit properly. I used a fiberglass cowl, as I do on all my scale airplanes, and is certainly worthwhile. However, the cowl is large and could be made of wood. A glass cowl may be obtained from Bee Line Products for $9.75.

Make sure the firewall is well epoxied onto the fuselage, as the big mills have a lot of power. Also, the nose gear can, as we all know, put a lot of strain on the firewall. I have to date, about 100 flights on my T-34 and the firewall shows no stress cracks. Check plans carefully to see how the firewall is installed.

I do not show any servo mounting, as there are about five different propo servos being used to date, so adapt servo mount to your particular servos. The T-34 has lots of room, so there is no problem.

The T-34, as with many scale airplanes, loses much in appearance if the proper canopy is not used. Most of the trainer-type airplanes had rather large greenhouse type canopies, and to the average modeler, this presents a problem. The canopy I used on my T-34 was made especially for the T-34 by Sig. Glen told me he still has the mold pattern for the T-34, and the canopy can be had upon request from Sig for $2.75; very reasonable for a canopy that's almost 18 inches long and 4 inches wide. The small bubble under the elevator is to house the rudder horn that protrudes outside of the fuselage slightly, so a small balsa fairing was used to cover the torque rod end and rudder horn. So, it's out of scale! There's not much explanation needed on the fuselage, as it is easy to construct.

Tail Construction: There are no problems here, as the fin and rudder are standard, as is the stabilizer and elevators. Care should be taken to select your wood; avoid hard, heavy balsa, as the tail is large, especially the elevators and rudder, which are made of solid sheet and should be of soft balsa. One of the pitfalls of scale seems to be to come out tail-heavy. All fairing tail blocks should be of soft balsa. Only the counter balance portion of the elevators and rudder should be of hard balsa, with grain running 90 degrees to elevator and rudder grain. Do not silk elevators or rudder; use tissue paper, so as not to warp.

Wing Construction: As you can see by the plans, the wing is constructed about the same as any stunt wood wing would be. Landing gear installation is standard. Epoxy gear block well as scale jobs are heavy and some rougher landings are usually experienced. The airfoil used on the T-34 is a basic 2412. I believe it to be one of the finest for scale. The flaps are scale, and are rigged the same as you would strip ailerons. I have found this to be much easier than the bellcrank operated hookup, as it's easier to make adjustment. A 1/16" wire yoke may be used for hooking-up to servo.

A word on the flaps; it's a real thrill to use flaps on a scale model, as it was on the prototype. There have been some misgivings on the use of flaps in the past, but if they are properly installed and wisely used they add much to your scale airplane. More on flaps later.

A note of interest on the main gear doors: do not attach doors to landing gear! I don't care how good a landing you make, the gear doors will flex with the gear and dig into the wing, damaging the wing skin. Glue or epoxy the doors to the wing itself with about 1/8 inch clearance from the gear leg. In this way the gear can flex and not disturb the doors. I have flown my T-34 out of grass fields and have made some rough landings with no damage to doors or wing. The wing could be made of foam with no trouble, if so desired.

T-34A — T-34B: My model is the T-34B, or Navy version, and as a trainer was all yellow-orange, with black lettering. Note the V cut out of the lower section of the rudder. T-34A, as used by the Air Force was basically the same, but was all natural aluminum, with black letters. The T-34A did not have the V cut out on the rudder. Don't ask me why. The Navy T-34 used only the OMNI antenna, as plans show. You may find T-34's on about any Navy or Air Force base today, and are a variety of colors from all white to wild red, white and blue ones.

Flying Notes: I have built many scale RC airplanes, and many barely made first flights that needed adjustments — shifting of weight, etc., but the T-34 made almost perfect first test flights. If I build a thousand scale models, I will still hate that first flight; all that work and money, and loving care that goes into a scale RC airplane, and there is always the possibility it will go home in a basket. I hope they all fly as well as the T-34 did in its maiden flight. The only adjustment to date was to the nose gear for a straighter taxi.

Make your first flights with flaps up, to get your T-34 trimmed and get the feel of the controls. I found it smooth, but yet responsive on full command; the ailerons are very responsive for a scale, and corrective rolls are easy to accomplish. I found, in fact, that the T-34 will do any maneuver required in the stunt pattern. After a couple of flights are made and she is trimmed to your satisfaction, try flaps on takeoff. I have about 35 degrees full flap on my T-34; you will notice the takeoff run somewhat shorter, and the climb out steeper with flaps. Let it gain 50 or 60 feet of altitude, then pull up the flaps; don't pull flaps too soon! As soon as the flaps come up, the nose will drop back to level flight. Too soon or too low flap retraction, and the T-34 will drop its nose to gain flying speed and can be rather hairy if too low or slow. For landing, I drop full flaps at about 40% power, or on my downwind leg of my traffic pattern; you will notice the nose come up; trim with control stick, not control trim, as you may have to make a go around or apply full power, and you don't want downtrim. Anyway, I don't! The nose will level as speed reduces. As you turn into the final, slowly reduce power to about 20% (I like to fly them in myself). You will notice that the T-34 will fly at this setting at almost a perfect three-point attitude. As you are almost to the landing spot, reduce the power to 10 or 15%, and as she touches the main gear chop all power, and the Mentor will stick like on fly-paper. Power may be added in the final if too short with no ill effects, — just don't let the nose get too high. Don't panic if you have to make a go around with the flaps down; no harm is done, as you can over-ride the flaps with a slight bit of down elevator till you feel you are at a safe altitude. I have tried dropping full flaps at high speed and no adverse condition occurred. The nose came up only to about 40 degrees in a big arc. It is not advisable to do this as you could damage the servo or the flaps themselves.

I believe you will find, for a scale airplane that's 95% scale, the T-34 Mentor flies and handles very well and is a joy to fly, even on those no-contests Sundays. So let's build more scale!

Radio Control World

Continued from page 38

MACRCMAC Blasts. Big midwest meet each year is that sponsored by the very active McDonnell R/C MAC, and their 10th annual on Aug. 26-27 was no exception. Weather was bright but windy. Two mid-air collisions livened things.

Interesting frequency breakdown of entrants showed that 25 were on 27 Mhz (9 were on 27.145, 6 each on 26.995, 2 each on 27.045 and 27.095); 5 were scattered on 50 Mhz band; 1 was on 72.08, 2 each on 72.96 and 75.64. Apparently all transmitters were proportional; 23 dual stick, 8 single stick. The sponsors put out a very neat 12-page booklet about their own club, and other clubs in the area, AMA maneuvers, and other RC matters.

AMA "Class" Committees. Set up to promote Class I and II flying, both in competition and "Sunday flying," two Committees composed of avid proponents of the old Class I and Class II (which essentially went out of the rules at the end of 1967) have been formed, will operate within AMA framework. The Class I Committee has appointed an avid flyer in this category in each of the AMA districts; you can get their names from AMA headquarters; this group has set up a complete set of rules for comp. flying, including many maneuvers from the 1967 rules book, plus some new ones that such planes can perform. They will also allow wheel brakes and ground steering via RC, but other rules are essentially as per last year.

The Class II Advancement Committee included eight avid Class II flyers when we first heard from them, probably have many more now. Again, get addresses from AMA. This group expects to follow the 1967 Class

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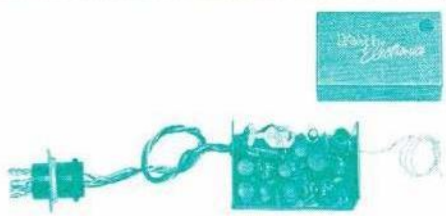

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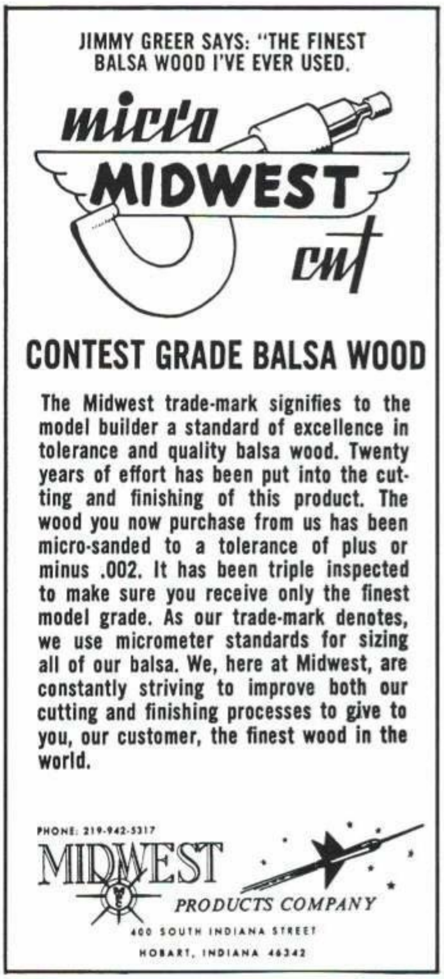

II rules. Since the 1968 Nats will be at Olathe, Kans. — center of a great deal of Class II comp. flying — the group will endeavor to include an event in this class. Committee Chairmen are: Class I, Jackie Gardner (Box 1252, Jackson, Miss.); Class II, J. R. Cox (101 West Alto, Hobbs, N. M. 88240).

Third Northwest Conference. Enthusiasm has been so high for their past two tries, that the Seattle RAMS will again host an RC Conference, Feb. 3-4, at Tyee Motor Inn (500 Tyee Dr., Olympia, Wash.) Ten prize categories have been set up for the planes on display. All planes entered will automatically be entered in the Best Finish and Best-of-Show categories. There will be continuous RC movies, a Saturday night banquet and dance following, raffle of a complete plane. A field will be available for Sunday flying. Those expecting to attend are asked to make their own reservations at the Inn; and bring bathing suits — a fine indoor pool is available. This info from George Hickson (11809 18th SW, Seattle, Wash. 98146).

Detroit Model Air Circus. As usual, the RCCD had some unusual events at their Fall meet, Sept. 9-10, but it wasn't a stunt meet for top Class 3 flyers, as in the past. There are so many expert competition flyers these days that the group felt they really couldn't pick 20 or so — too many good ones would be left out. When a new concept for selection can be devised, the RCCD will again hold its usual Fall Invitational. The Air Circus was open to all R/Cers, who paid no entry fees. Expenses were covered by request for a $1 donation from each car — there were around 3000 spectators — and by several raffles. A real effort was made to explain the equipment, planes and flying to the spectators. Flyers were paid cash prizes of from $5 (first place) down through 8th in each event, and for each heat of Pylon; payments were made right after each event, and few flyers went home with less than $3 (some had as much as $20). All contestants except RCCD members were given raffle tickets for a TV set, won by Butch Sherwood of Jackson, Mich., plus many other raffle awards.

Events were: *Carrier Landing,* where planes had three attempts to land in a group of marked boxes totaling 20′ wide and 45′ in landing direction (different points in each of five boxes) and total points for the three tries determined winner; *Take Off, Loop and Land,* a timed event, from plane release to landing; *Spin Event,* 1 minute to climb, max spin turns; *Unusual Aircraft* (bipes, deltas and other unusual planes flew); *Combat,* fliers worked as partners to attain maximum number of ribbon cuts; *.09-.15 Pylon,* 10 laps; *AMA Goodyear Pylon,* 10 laps; *Open Pylon,* 10 laps; *Formation Event,* two planes flew prescribed pattern including spins, loops, rolls, AMA landing pattern. Mel Santmyers, (29153 Malvina, Warren, Mich. 48093) who sent this info, says the club will lose their fine field next season.

Buffalo Bisons' RC Conference

The 1968 Bisons' conference will hold forth again at the Airways Hotel, located at the Buffalo Airport entrance.

Starts Friday, January 19 at 6 p.m., continuing through Sunday noon, January 21. Saturday is the big day with the traditional awards banquet in the evening followed by dancing to a live band. Prizes to three places in the following categories: Scale, Non-Scale, Most Unusual Airplane, Best WW I Airplane and Boats.

More door prizes will be given at the banquet than ever before in addition to tongue-in-cheek awards; full-house propo as grand door prize.

To save space for airplanes, there will be no club exhibits; a used equipment auction will be held Saturday afternoon. Manufacturers will exhibit. Forum of experts will field questions from the floor.

Direct inquiries to Mr. H. C. Keller, 39 Lorfield Dr., Snyder, N. Y. 14226, phone 716-839-1754.

14th Toledo RC Conference

The Lucas County Recreation Hall will again house the manufacturing exhibits, and there will be space for over 200 models. You will find the same RC Trading Post and movies that have been so popular. Prizes will be awarded for best planes in Classes 1, 2 and 3, Goodyear racer, for best RC car and boat and best finished model. Those expecting to attend should make their motel reservations *early!*

Headquarters motel is the Howard Johnson (2450 S. Reynolds Rd., Maumee, O.), just north of Ohio Turnpike Exit 4. Doors open to the public at 9 a.m. Saturday, February 24 and the 25th.

Info from The Weak Signals RC Club (Box 5772, Sta. Wernert, Toledo, Ohio).

NEW IN RC

Relayless superhet receiver designed especially for pulse propo by **Ace Radio Control (Higginsville, Mo.).** Reliably handles pulsing as fast as required. A 9-transitor unit on five 27 MHz spots, measures 1$\frac{5}{16}$ x 2¼ x ¾"and weighs just over ¾ oz. Designed for 2.4V nickel-cad supply; double-ended output will drive Adams or similar dual-coil actuator without switcher. Will also feed decoders such as Simpro III. Assembled, $26.50 (specify frequency). Ace also offers kit for Simpro III ($27.50, or $34.95 assembled and tested), and two different Parts Packages; Package #1 includes the decoder kit, Rand HR1 and HR2 servos, special mounting plate for your receiver, $59.50. Package #2 is same but omits the Rand HR2 (you use your own Rand LR3), $41.50.

Versatile **Pulse Propo Transmitter** and **Receiver** intended for Galloping Ghost, Kickin' Duck, Simpro or other single-channel systems requiring variation of pulse rate and length have been marketed by **Hobby Lobby International (2604 Franklin Rd., Nashville, Tenn.).** Both units are specially set up for use with the Rand Dual Pak; a combo of this Pak plus Rx and Tx lists at $189.90. Bonitron Super Sport transmitter measures 6½ x 6⅜ x 2⅛" less control stick, weighs 2 lbs. 5½ oz. with a large 9V dry battery. It has an all-metal control stick for rudder and elevator, and a lever switch for tone on—off (motor control). Trim pots provided for R and E; there is an RF output meter. Removable antenna measures 41" extended, 6¼" retracted. Most interesting is that transmitter has internal switches and pots so you can get high or low pulse rate, vary rate amplitude and width throw and center the actuators. These features make it versatile. Transmitter lists at $74.95. Bonitron superhet is uncased, measures 2¼ x 1⅞ x ¾" and weighs 1.3 oz. Designed specially to feed the Rand Dual Pak servos, which have built-in decoders, it can be adapted to other systems. Receiver retails for $39.95. If you purchase a complete set with Rand Pak, all connectors for gear in the plane will be factory installed. Receiver will operate with transmitters modulated 1000 to 2000 cycles and requires a 3.6V nickel-cad supply. In the combination Rx operates from the Rand Pak battery.

Retractable Antenna. Vertical antennas are favored by many propo flyers and by some manufacturers. They claim a vertical on the plane eliminates some of the glitches seen in propo craft; placed well forward on the fuselage, it gets the entire antenna away from servos, pushrods or metallic linkages that cause interference. A vertical is a nuisance when stashing your plane in a car, but **More-Craft Products Co. (S. Plainfield, N.J. 07080)** offers a cure — the Anten-Away. Don't remove it, just shove it down inside the model when you finish RC operations (can be used on RC boats or cars, too). More-Craft's $2 kit of parts includes all items needed except the antenna itself — a length of .045" dia. music wire. Nylon tubing guides the wire inside the model. Antenna is firmly clamped in the extended position for solid electrical contact.

Countdown

Continued from page 35

wish to do your building from.

From the drawing you've made, you can determine the size of the parts for your model. By tracing the fin outline onto card stock or thin cardboard, you can get your fin pattern. You can also make templates for the nose shape, transition shapes, boattail shapes, etc. You will know how long to cut your body tube, etc.

But don't start to build yet! If you want a successful scaler, stay with the paperwork as long as you can and resist the temptation to chop balsa. Calculate the center of pressure using the Barrowman Method; you can use the cardboard cutout method, but most scalers are a bit shy on fin area which results in a lot of nose weight being used if C.P. is determined by the cutout method. Make a trial run at calculating the center of gravity. This sometimes takes some estimating, but I've had calculated CG's come within a tenth of an inch of actual model CG's. Also calculate the probable flight performance using the Malewicki Report and assuming a conservative drag coefficient such as 0.75. (Sometimes you can get actual subsonic drag coefficients of the real vehicle, and this makes flight performance calculations quite accurate.)

You may discover at this point that your model will be too heavy, under-powered, or require too much nose weight. You may also discover that it can't be built at all (this has happened to me). In any case, the time spent on the drawing board and over the slide rule always pays off. This is particularly so if problems show up, because it doesn't take much time to do the designing and calculating, and it costs almost nothing to do it. Better to find out about it at this point than after you've spent weeks building the model, which costs something.

Recheck your numbers, too. And believe in them after you've done so. Once I spent weeks building a scale bird, calculated that the total flight time would be six seconds, flew the bird with a six second delay anyway hoping that maybe I could beat the odds of slightly rounded-off numbers and production tolerances — and had the bird pop its chute a fraction of a second after the nose cone kissed the turf.

Now you're ready to make balsa dust! Make lots of it. Build two or more of the same scale models side by side at the same time. Reason: use the first one to test-fly the design. Don't do a super-detailing job on the first one, but make it flyable. Construct both models together, but finish one first and use it to test things. You may find out that you'll have to modify things slightly, and you can use the first bird for modification testing. You may need less weight, more impulse, higher thrust, more nose weight, etc. You may even find out that you have to junk both models.

When you know that the beast is going to fly the way you want it to, you can then complete the second model and may even be able to bring the test model up to suitable scale standards by repainting, detailing, etc.

Most of the NAR National Champions have learned that you can greatly improve a scale model by building it again and again. You learn tricks in putting it together, finishing it, detailing it, etc. The more models of a given scale bird you build, the better they get. And the quicker they go together. This is what is known as progressing on the learning curve. Talley Guill has been building the MX-774 since 1963; he can turn one out very fast now, and it will do exactly what he wants it to do. His father, A.W. "Pinky" Guill, is on the same kick with the Astrobee-1500. It took years for Charley Duelfer to wring the bugs out of his USAF Falcon. And I must have built a dozen or so models of POGO-HI and Tomahawk. Once you get a good combination, stick with it and improve it. Research additional details. Lighten it here and strengthen it there. Put a better finish on the next one. Strive for reliability. (And not the kind of reliability where the bird prangs consistently.)

In the meantime, try a scaler that is a little more complex. And when you think you've reached the utmost pinnacle of scale modeling, tackle a working scale model launching complex! Fun and games, daddy! And there is no end to this, as anybody knows who has ever seen or been involved with HO model railroading, for example.

I wonder when somebody will show up with a complete scale working model of the Kennedy Space Center, complete with operating VAB, transporter-crawler, arming tower, and Saturn V? See what you're getting into with scale model astronautics?

A.M. Reviews

Continued from page 8

diagrams and charts making the technical material covered both readable and understandable.

In *Manned Space Flight*, (176 pages), Max Faget, Assistant Director for Engineering and Development at the Manned Spacecraft Center of NASA and the co-designer of Gemini, tells the dramatic story of man's venture into space, explaining fully the complex problems involved. Starting with Project Mercury, the first U. S. program involving manned spacecraft, the reader is taken through succeeding phases, the two-man Gemini flights and then to the moon with Project Apollo. Some of the technical problems facing the builders and manned spacecraft — in design, construction and successful operation, and the natural difficulties that must be overcome in making space flight safe and reliable—are skillfully discussed by Mr. Faget.

In *Unmanned Space Flight*, (175 pages), Dr. John E. Naugle, Director of Science in the Office of Space Science and Application, NASA, gives a thorough and exciting presentation of man's efforts to explore space with sophisticated instruments which he sends millions of miles away to take complex measurements of interplanetary space, the moon and the planets. The earth is viewed as a planet immersed in the atmosphere of a typical star, the sun, whose environment is controlled by the radiation emitted by that star. Beginning with a study of the sun which the author describes as the cornerstone to the entire space program, we then explore interplanetary space, and then the earth's environment. We are then introduced to geodeesy, the exploration of the solid earth, after which we explore the moon and the planets. The author concludes with a discussion of space astronomy which is both illuminating and makes fascinating reading.

Thrust Into Space, (224 pages), is a presentation of the subject of propulsion — the key to space exploration and exploitation. The author, Maxwell W. Hunter II, Special Assistant to the Vice President and General Manager, Research and Development with the Lockheed Missile and Space Company, covers this subject from the ancient powder rockets, ballistic missiles and early space rockets to solar system spaceships and starships, each step covering the basic mechanics for the particular velocity region. He covers propulsion from the viewpoint of the system architect rather than the propulsion designer and points out that since we are now engaged in materializing a 2000-year-old dream of mankind going into space, that is why the book is devoted to future propulsion capabilities, not past propulsion history.

In *Guidance and Control of Spacecraft*, (176 pages), Edward Hymoff clearly presents the basic system used to guide and control spacecraft into the far reaches of space. Complex factors involved in the accurate flight of rockets and their payloads are explained fully and readably. Pointing out that man was, and still is, the guidance, Mr. Hymoff takes us through the evolution of the guidance system of the caveman to that of the pilot, astronaut and cosmonaut. He shows how man has conquered space as he knew it then and knows it now — "the oceans, the deserts, the plains, the mountains, the sky above, and the sea. All of this is space." On the subject of guidance and control and navi-

gation of spacecraft, we are taken through the past history to the tremendous strides since the coming of the space age with the Sputnik and, in a chapter entitled "What will be next," a glimpse into the future.

Lightning Out of Israel, by the Associated Press, 160 pages. $4.95. Prentice-Hall, Inc., Englewood Cliffs, N. J. 07632.

THIS beautifully bound and profusely illustrated Commemorative Edition is a chronicle of the stunning six-day blitz by Israel's air and ground forces which staggered and defeated the forces of Egypt, Syria and Jordan. It describes the surprise air attacks which in barely three hours broke the back of Arab air power, stripped the Arab cities and their troops and tanks and artillery of air cover, and all but decided the issue. Israel's 400 plane air force of French-built Mirage and Mystere fighter bombers, filled the morning sky. They swung wide over the Mediterranean, and came in low over Egypt from the west —thus foiling Egypt's prepared radar screen. They struck deep in Jordan, Syria and Iraq, erasing Arab air power on about 25 fields.

Associated Press correspondents relate the historical background of the conflict; the centuries of hate and strife from the biblical days of Isaac and Ishmael, through the various changes in the empires, to the events of 1967. Viewed through the eyes of nameless Jews and Arabs who fought each other, as well as the famed statesmen who debated the issues in the press, radio and television, the Arab-Israeli war is vividly presented both in word and picture. Not only is the broad strategy discussed, the specific tactics and moving stories of the individual heroes and men in the street, are dramatized in chronicle fashion.

Sir George Cayley's Aeronautics 1796 - 1855, by C. H. Gibbs-Smith, 269 pages. $6.00. Her Majesty's Stationery Office of England and distributed by the British Information Service, 845 Third Avenue, New York, N. Y.

A BRITISH Science Museum handbook, it presents the whole story of the aeronautics of Sir George Cayley, Bart., the "Father of Aerial Navigation." Accompanied by some 80 text illustrations and six half-tone plates, all of this remarkable man's aeronautical ideas, designs and achievements is fully documented and described for the first time.

Sir George Cayley is universally recognized as the founder of the science of aerodynamics. In 1799 he broke away from the age-old idea of the ornithopter — the flapping wing machine based on the bird — and introduced the concept of a fixed-wing aeroplane propelled by a separate system of propulsion. He experimented with models which he built and flew (unmanned), the first full-size modern-configuration glider in 1809. The next year he published "On Aerial Navigation," his great triple paper from which is derived the whole of modern dynamics and modern flying. In 1849 Cayley constructed and flew successfully a full-size triplane glider in which a boy was carried for a short distance. Four years later, when Cayley was over 80, the first true man-carrying glider flight was made.

Charles Gibbs-Smith is the author of the previous British Science Museum "The Aeroplane" which has become a standard work and has been acclaimed as an aeronautical classic. The present book is not meant for the amateur or casual reader but for the aviation enthusiast interested in historical and technical research.

The Corps of Engineers: The War Against Japan, by Karl C. Dod, 759 pages. $5.50. The U. S. Government Printing Office, North Capital between G & H Streets, N. W., Washington, D. C.

THE 67th volume in the series "United States Army in World War II" — the comprehensive account of the Military Establishment during the Second World War — is the second to be published in the group of four Corps of Engineers volumes in the subseries "The Technical Services." Dr. Dod covers the prodigious operations of the Army Engineers in the struggle against Japan. As both a combat arm and supply service, it played a versatile part.

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CONTEST CALENDAR

Official Sanctioned Contests of the Academy of Model Aeronautics

DECEMBER

December 17 — Fresno, Calif. (A) Fresno Monthly FF Contest. Site: Near Kerman. F. Gallo CD, 1725 Kenmore Dr. W., Fresno, Calif. 93703.

Dec. 29-31 — Sebring, Fla. (AAA) 14th King Orange Internationals for FF, CL, RC. Spec. Events. Site: Air Terminal. T. Sutor CD, Route 2, Box 842, Avon Park, Fla. 33825.

JANUARY

Jan. 28 — Fresno, Calif. (A) Fresno Monthly Meet for FF. Site: Near Kerman. F. Gallo CD, 1725 Kenmore Dr. W., Fresno, Calif. 93703.

FEBRUARY

Feb. 10-11 — Green Bay, Wisc. (AA) I.C. Winter Jamboree for FF, RC. Site: Bay Beach. R. Cowles CD, 2424 Ducharme Lane, Green Bay, Wisc. 54301.

Feb. 17-18 — Buckeye, Ariz. (AAA) 18th Annual Southwestern Regional Model Airplane Contest for FF, CL, RC. Site: Airport. Q. Webster CD, 3318 E. Sheridan, Phoenix, Ariz. 85012.

Feb. 24-25 — Sebring, Fla. (AAA) P.B. Aircadets Model Meet for FF, CL. Site: Airport. A. Bursey CD, 2336 Redwood Rd., W. Palm Beach, Fla. 33401.

APRIL

Apr. 20-21 — Sebring, Fla. (AAA) Florida State Championships for FF, CL. Site: Airport. J. Wagner CD, 274 E. 9th St., Hialeah, Fla. 33010.

MAY

May 26 — Tucson, Ariz. (AA) Spring Invitational for CL. Site: Rodeo Park. T. Snow CD, 909 E. Ellis, Tucson, Ariz. 85719.

AUGUST

Aug. 10-11 — Oklahoma City, Okla. (AAA) Sooner State Model Championships for FF, CL. Site: Memorial Rd. & N. Western. F. Miller CD, 1900 Rolling Ridge, Bethany, Okla. 73008.

Aug. 31-Sept. 1-2 — Memphis, Tenn. (AA) Memphis RC Annual. Site: MRCC Flying Field. K. K. McClure CD 3465 Powers, Memphis, Tenn. 38128.

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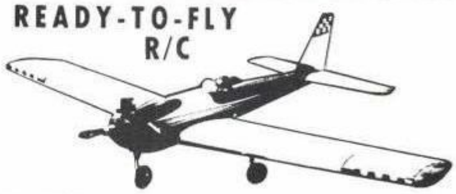

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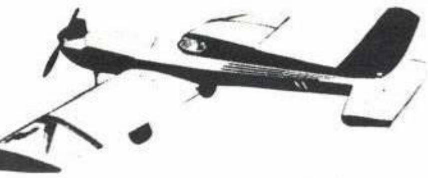

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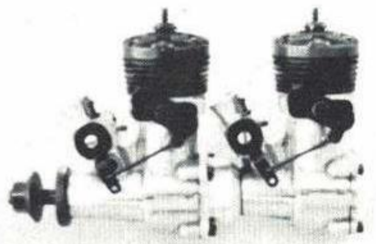

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