RADIO CONTROL AIRCRAFT

INDOOR FLYING WING PLANS INSIDE!

APRIL 1994
DISPLAY UNTIL APRIL 7

MODEL BUILDER

The 1993 Schluter Cup

reviews

AEROBATIC HOTDOGGER: LANIER'S TR-260

THE DOVE FROM NORTHEAST SAILPLANE PRODUCTS

Scale Masters

construction

1918 SOPWITH SWALLOW, PART 2

THE 'EASY WING' INDOOR TAILLESS

K46822 $2.95 CANADA $3.95
04
0 71896 46822 9

FLYING BOOKS from HA

AURORA, The Pentagon's Secret Hypersonic Spyplane. Sweetman. Once again stealth expert Bill Sweetman has blown the cover off the Pentagon's newest sky spy. Forget the rumors. Sweetman has pieced together the evidence, sightings and black budgets to reveal the Mach-5 spyplane in the most detailed account in print. Sixty photos, conceptual drawings and "informed" data not only point to the existence of the plane but also tell how its works. 60 b&w ill., 96 pgs., 7 1/2" x 9 1/4", sfbd..... 3653C **$9.95**

FLYING SCOREBOARDS: Aircraft Mission and Kill Markings. McDowell. Since the First World War, airmen of all nations have marked their aircraft with a record of their achievements; be it missions flown, aircraft shot down, or bombs droped. 64 pgs., over 150 photos, 8 pages in color, plus color side-views, 8 1/2" x 11", sfbd..... 3617A **$8.95**

BENT & BATTERED ROTORS. Mutza. Spectacular photos of choppers down in training and combat. Depicts the hell that pilots and crew experience during battle conditions. 64 pgs., over 150 photos, many in color, color side-view paintings. Incredible stuff. 8 1/2" x 11", sfbd..... 3680A **$9.95**

F-16 FIGHTING FALCON, WALK AROUND. Drendel. A pilots walk around inspection with detail photos of just about everything that hangs onto, fits into, or is marked upon the F-16. Weapons, cockpits, engines, landing gear, etc. Great for the modeler and buff. 80 pgs., 200 plus b/w and color photos, 11" x 8 1/2", sfbd..... 4805A **$14.95**

BLACK SUNDAY, PLOESTI. Hill. August 1, 1943. The legendary low-level raid on the Romanian oil fields by B-24's from American bomb groups. 50th anniversary book offers never-before-published photos from the raid and portrays a sense of intensity and drama of the event. Complete listing of aircraft and crews taking part. 350 photos, 300 pgs., 9" x 12", hdbd. 3598C **$45.00**

100 MISSIONS NORTH. Bell. A fighter pilot's story of the Vietnam War. Harrowing personal account of the extraordinarily dangerous F-105 missions over North Vietnam during 1966-67. Courage, faith, comeradery, and bonds allowed these men to complete their tours. In the dramatic Thud Ridge tradition. 314 pgs., illustrated, 6 1/4" x 9 1/2", hdbd..4796D **$24.00**

LOCKHEED F-94 STARFIRE. Isham & McLaren. The first night/all-weather fighter is chronicled as used by Air Defense Command, Continental Air Command, Alaska and Northeast Air Commands plus Air National Guard. A fine overall history for cold-war buffs. 112 pgs., 220 b/w and color photos, 8 1/2" x 11", sfbd..... 4754 **$19.95**

AIRACOBRA ADVANTAGE: THE FLYING CANNON, Mitchell. Should this often maligned fighter rank with contemporaries, the P-51, P-47 or P-38? This history of the P-39 offers background, testing, combat history, data on every variant, plus an inventory of all known surviving examples in the world. 130 photos, sfbd., 8 1/2" x 11"..... 4731B **$11.95**

VULTEE AIRCRAFT 1932-1947, Thompson. From the V-1 airliner the early Thirties through the P-66 Vanguard, BT-13 Valiant and A31-35 Vengeance to the advanced prototypes of World War II. Design, production and service. 23 scale drawings, specifications and performance. 236 photos, 132 pgs., sfbd. 1183D **$29.95**

THE HORTEN FLYING WING IN WORLD WAR II, Dabrowski. Contemporary of the Northrop Flying Wings, the German aircraft was a little late for the war. History, development and construction details. Rare photo and line drawings. 130 photos, 52pgs., 8 1/4" x 11 3/4", sfbd. 3373C **$8.95**

NEW IN ACTION

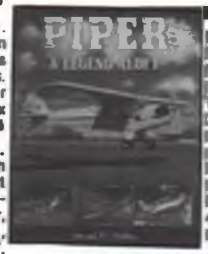
B-52 STRATOFORTRESS	4178A	$8.95
MiG-21 In Action	4179A	$8.95
C-7 CARIBOU In Action	4180A	$8.95
H-60 BLACKHAWK In Action	4181A	$8.95
A-26 INVADER In Action	4018A	$8.95
FOCKE WULF FW 190 In Action	4003A	$8.95
F-104 STARFIGHTER In Action	3613A	$8.95
F/A-18 HORNET In Action	3614A	$8.95
BRISTOL FIGHTER In Action	3615A	$8.95
MOSQUITO - Part 2 In Action	3698A	$8.95
F3H DEMON In Action	4800A	$8.95
P-12/F4B In Action,Feb.	4801A	$8.95
MiG-19 In Action,May	4804A	$8.95
FW-189 In Action, March	4810A	$8.95

COMBAT CLASSICS

MIG, FIFTY YEARS OF SECRET AIRCRAFT DESIGN. Belyakov & Marmain. The West's first look at this secret Russian design bureau, describes every MIG version since 1941, including today's front-line models. Details the mistakes and dead ends as well as the innovations and triumphs. 496 pgs., 334 photos, 6" x 9", hdbd..... 1483C **$42.95**

RICHTHOFEN. Kilduff. Certain to become the major biography of 1994, book is based on new material and carefully researched documents, including Richtofen's own writings. Includes rare archival photos of open-cockpit fighting and a complete list of the Red Baron's victories. 288 pgs., 65 photos, 6" x 9 1/2", hdbd..... 1432C **$27.95**

THE LADY. Perkins & Patterson. An incredible photo-essay portraying the B-17 Flying Fortress thru a crewman's eyes. Pictures tell the story, dramatic in their portrayal of the guts and heart of the ship. For those who never crew a B-17, this is as close as you can get. Wow! 94 photos, 64 pgs., 9" x 12", sfbd..... 3849 **$15.95**



PIPER -A LEGEND ALOFT. Edward Phillips. From the Taylor A-2 Chummy to the Malibu Mirage, PIPER - A LEGEND ALOFT traces the history of C.G. Taylor and William T. Piper, Sr. The establishment of the Piper Aircraft Corportation and its 56-year history as one of the world's most prolific producers of general aviation aircraft. Chronicles development of Piper's single and twin-engine aircraft during the 1950s and 1960s. The most comprehensive Piper history available. Spec., 3 view-drawings, 402 photos, 172 pgs., 8 1/2" x 11", hdbd..... 2502AA **$29.93**

H.A. TOP SELLERS

LOCKHEED'S SKUNK WORKS: THE FIRST FIFTY YEARS. Miller	3622C	**$29.95**
THE TAYLORCRAFT STORY, Peek. 8 1/2" x 11", sfbd	4979C	**$24.95**
AERONCA, A PHOTO HISTORY. Hollenbaugh and Houser	4987D	**$16.95**
CESSNA, A MASTER'S EXPRESSION. Philips	2004AA	**$29.95**
PITTS SPECIALS, Davisson	4679B	**$19.95**
CESSNA WINGS FOR THE WORLD, Single Engine Cessnas	1520D	**$28.00**
PIPER CUBS. Bowers	4774A	**$17.95**
REVOLUTION IN THE SKY. Allen	3490C	**$27.95**
THE NORTHROP STORY. Richard Sanders Allen	SALE 3517	**$12.98**
ILLUSTRATED BUYER'S GUIDE - PIPER. Halberstadt	3660C	**$16.95**
ILLUSTRATED BUYER'S GUIDE - CESSNA. Halberstadt	4808B	**$16.95**
WILLY MESSERSCHMITT. Vann	4809C	**$26.95**
B-24 LIBERATOR. Johnsen	3654C	**$24.95**
B-29 SUPERFORTRESS. Marshall	3661C	**$24.95**
THE LOCKHEED P-38 LIGHTNING: Brodie	2305	**$34.95**
THE THUNDER FACTORY. Stoff	SALE 2971B	**$10.98**
DESERT AIR FORCE. Chinnery	SALE 2998C	**$7.98**
LOCKHEED F-117 STEALTH FT. Sweetman & Goodall	SALE 3228C	**$3.98**
AIRACOBRA ADVANTAGE: THE FLYING CANNON. Mitchell	4731B	**$11.95**
AIM/FAR. 1994 Free Update	1130B	**$12.95**
COMPOSITE BASICS. Marshall. 209 pgs., 8 1/2" x 11", sfbd	3676C	**$30.00**
STRESS WITHOUT TEARS: A Primer on Aircraft Stress Analysis. Tom Rhodes Ph.D. 112 easy pages, 8 1/2" x 11", sfbd	3648C	**$19.95**

U.S. CIVIL AIRCRAFT Joeseph Juptner. The antiquers bible. Encyclopedia of ATC planes giving a complete description, history, production data, performance, specifications with excellent photo coverage. Each volume covers 100 ATC's, 300+ pages.

U.S. CIVIL AIRCRAFT V. 1 ATC 1-100. Joseph Juptner.	1601B	**$29.95**
U.S. CIVIL AIRCRAFT V. 2 ATC 101-200. Joseph Juptner	1602B	**$29.95**
U.S. CIVIL AIRCRAFT V. 3 ATC 201-300. Joseph Juptner	1603B	**$29.95**
U.S. CIVIL AIRCRAFT V. 4 ATC 301-400. Joseph Juptner	1604B	**$29.95**
U.S. CIVIL AIRCRAFT V. 5 ATC 401-500. Joseph Juptner	1605B	**$29.95**
U.S. CIVIL AIRCRAFT V. 6 ATC 501-600. Joseph Juptner	1606B	**$29.95**
U.S. CIVIL AIRCRAFT V. 7 ATC 601-700. Joseph Juptner	1607B	**$29.95**
U.S. CIVIL AIRCRAFT V. 8 ATC 701-800. Joseph Juptner	1608B	**$29.95**
U.S. CIVIL AIRCRAFT V. 9 ATC 801-817. Joseph Juptner	1609B	**$29.95**

94 CALENDARS 94

GHOSTS 1994: A TIME REMEMBERED	9401A	$13.95
VINTAGE FIGHTERS 1914-1945	9402C	$11.95
THE CUTTING EDGE, 1994	9403C	$11.95
AIR POWER - 1994 CALENDAR	9404C	$9.95
VINTAGE AIRCRAFT NOSE ART 1994 CALENDAR	9405N	$9.95
VINTAGE AIRCRAFT NOSE ART 1994 CALENDAR	9405N	$9.95
WORLD OF FLIGHT, 1994.	9406C	$9.95
VARGAS PINUP GIRLS 1994 CALENDAR.	9407C	$10.95

PILOT MANUALS

Reprints of offical USAF training manuals.

P-38	1401B	$8.95	B-25	1410B	$12.95	
P-39	1402B	$8.95	B-26	1411B	$14.95	
P-40	1403B	$8.95	B-29	1436A	$12.95	
P-47	1404B	$8.95	F-6F	1413B	$9.95	
F-51B	2006AA	$14.95	FM-2	1414B	$12.95	
P-61	1405B	$9.95	AT-6	1415B	$9.95	
P-63	1406B	$9.95	SPITFIRE	1416B	$4.95	
F-80	1420B	$9.95	HURRICANE	1417B	$4.95	
P-82	1407B	$9.95	MOSQUITO	1418B	$4.95	
B-17	1408B	$10.95	Me262	1419B	$9.95	
B-24	1409B	$12.95	SR-71	3575D	$99.95	

BROKEN WINGS OF THE SAMURAI. Mikesh. Documents the destruction of the Japanese Air Force by occupation forces - over 11,000 kamikaze aircraft were bulldoged and burned. Survivors are listed as an appendix. Did you know 34 Zekes survive? 199 pgs., 276 rare photos, 8" x 10", hdbd..... 4755C **$34.95**

WINGS OF CESSNA: MODEL 120 TO THE CITATION X. Ed Phillips. This revised edition, covers the entire family: 120, 170, 172, twins, Grand Caravan to the Citation X. Specs, model changes, preformance, price and number built. Three-view drawings, 230 photos, 100 pgs., 8 1/2" x 11", sfbd..... 2011AA **$17.95**

HAWK SAFARI. Rosanik. The search for an existing P-6E absorbed Ralph Rosanik's life. Flying such a bird his childhood dream. His quest through South America searching for an example, and finally constructing a replica. Fraught with adversity in the jungles, and in his business, he persisted. The Hawk is ready to fly today. 77 photos, 182 pgs., 6" x 9", sfbd..... 3662B **$12.95**

THOSE NAVY GUYS AND THEIR PBY's, Freeman. Straightforward detailed account of the Aleutian campaign waged by the Navy in WWII. Long coastal patrols, contacts with the enemy, and the battle to survive in the world's worst weather. Over 140 super photos highlight this first-person narrative. Great reading on a little-known chapter of WWII. 268 pgs., 7 1/2" x 10 1/4", sfbd..... 3625D **$19.95**

DISNEY DON'S BOGTAGS. Rawls. Swamped with request for unit emblems and mascots during WWII, Walt Disney put five full-time artists to work on creating some 1200 cartoon military insignia for fighter and bomber squadrons, and other military units. This is a wonderful selection of over 330examples...Flying Tigers, Mosquito Fleet, Seabees. Most art in color. 96 pgs., 9" x 9", hdbd..... 1190C **$21.95**

BEECHCRAFT: PURSUIT OF PERFECTION, Phillips. Authorized and update, detailed history of every aircraft produced to the present. Covers all military and civilian models with tech specs, production listings. Most complete reference source available. 245 photos, 92 pgs., 8 1/2" x 11", hdbd. 2014AA **$24.95**

WORLD ENCYCLOPEDIA OF AIRCRAFT MANUFACTURES. Gunston. From the Wright Brother pioneers to the present day, a comprehensive and global reference that documents the companies, aircraft produced by more than 3,000 builders since day one. Oddball contraptions along with the famous standard lines of every nation. An excellent reference. 336 pgs., 300 photos, 7 1/2" x 10", hdbd..... 1482C **$32.95**

THE LOCKHEED P-38 LIGHTNING: The definitive Story of Lockheed's P-38 Fighter, Brodie. After 25 years of intensive investigation and research, the first accurate, inside story of the conception, design, development and wartime operation is here! Authored by the most respected P-38 investigative historian—this is the only P-38 book ever endorsed by Kelly Johnson and Brig. Gen. Ben Kelsey, the designer and test pilot respectively. More than 325 photos, 16 pgs. in color. Hdbd. 2305 **$34.95**

PUTNAM SERIES

JAPANESE AIRCRAFT OF 1910-1941, Mikesh and Abe	3432C	**$39.95**
WINGS FOR THE NAVY: History of the Naval AC Factory, 1917-1956, Timble	1921C	**$35.95**
BOEING AIRCRAFT SINCE 1916, Bowers	3397C	**$39.95**
GRUMMAN AVIATION, Francillon	3395C	**$41.95**
SHORTS AIRCRAFT since 1900, Second Ed., Barnes	3398C	**$33.95**
SUPERMARINE AIRCRAFT since 1914, Revised Ed., Andrews & Morgan	3399C	**$29.95**
CURTISS AIRCRAFT, 1907-1947, Bowers	3383C	**$29.95**
LOCKHEED AIRCRAFT since 1913, Francillon	3377C	**$33.95**
McDONNELL DOUGLAS AIRCRAFT since 1920, Francillon	3384C	**$39.95**
GENERAL DYNAMICS AIRCRAFT AND THEIR PREDECESSORS SINCE 1909	3396C	**$42.95**
JAPANESE AIRCRAFT OF THE PACIFIC WAR, Francillon	3158C	**$32.95**
GERMAN AIRCRAFT OF THE SECOND WORLD WAR, Smith & Kay	3157C	**$36.95**

FLYING BOOKS FREE CATALOG

from **Historic Aviation**

1401 H KINGS WOOD RD., EAGAN, MN 55122

14 DAY MONEY BACK GUARANTEE

Charge: ☐ VISA ☐ MasterCard

Acct. No. _____

Exp. Date _____

Send Items: _____ _____

_____ _____

Please Print

Name _____

Address _____

City _____

State _____ Zip _____ Country _____

$ _____ Total for items

$ 94.50 Handling

$ _____ Total Enc. U.S. Funds

Call us *Toll Free*

800-225-5575

Overseas 1-612-454-2493

Charge VISA or Mastercard

MN residents add 6% sales tax.

Dealers invited. Authors manuscripts invited.

MODEL BUILDER
WORLD'S MOST COMPLETE MODEL AIRCRAFT PUBLICATION

CONTENTS

APRIL 1994 • VOLUME 23 • NUMBER 7

COLUMNS

FEATURES

PRODUCTS IN USE

ON THE COVER

Ace reporter and photographer John Lupperger took some great photos at the recent Scale Masters Championships, which took place at Mile Square Park in Fountain Valley, California late last year. Among them were this month's cover shots of Nick Tusa's huge scratch-built 1/3-scale Fokker DVII; another 1/3-scale subject, a modified Balsa USA Sopwith Pup (upper inset) by Don McEntyre; and a 1/5-scale BT-13 (bottom inset), built from a Bert Baker kit by Larry Sutherland. John's coverage of the Scale Masters begins on page 36.

CONSTRUCTION

HELICOPTER WORLD

DEPARTMENTS

PUBLISHER Mark Thiffault
MANAGING EDITOR Phil Bernhardt
ASSISTANT EDITOR Richard Dowdy
ART DIRECTOR Scott A. McPherson
PRODUCTION MANAGER Bill Rice
ACCOUNTING MANAGER Robert Ruiz
OFFICE STAFF Kay Bastnagel
Gina Del Mastro
Jim Lenhart
Brett Thiffault
ADVERTISING Don Kremers
714/ 496-5411

CONTRIBUTORS
Rick Allison
Mike Billinton
Jake Doe
Bruce Edwards
Bill Forrey
Bill Hannan
Roger Jaffe
Eloy Marez
John Pond
Francis Reynolds
Bob Stalick
Art Steinberg
John Thompson
James Wang

MODEL BUILDER (ISSN 0731-4795) is published monthly by Gallant Models, Inc., 32249 Camino Capistrano, Capistrano Beach, CA 92624-0459. Phone (714) 496-5411. Subscriptions $25.00 for one year, $47.00 for two years in U.S. Outside U.S. (except APO AND FPO): Canada $35.00 one year, $66.00 two years; other foreign, $33.00 one year, $66.00 two years. All payments must be in U.S. funds. Change of address notices must be received six weeks before date of issue that new address takes effect. Send old addresses with new (old label preferred). Duplicate issues cannot be sent. Postmaster: send address changes to Model Builder, P.O. Box 2459, Capistrano Beach, CA 92624-0459. Second class postage paid at Dana Point, California, and additional offices. Editorial contributions are welcomed by Model Builder, but cannot be considered for publication unless guaranteed exclusive. Model Builder assumes no responsibility for loss of or damage to editorial contributions received, including but not limited to text in any form, photographs, drawings and art work. Editorial material must be accompanied by return postage, unless return is not desired. Any material accepted for publication is subject to possible revision as may be considered necessary, at publisher's discretion, to meet requirements of its magazines. Publisher assumes no responsibility for accuracy of content, and opinions stated in published materials are those of the contributing author, and do not necessarily reflect those of the publisher. Upon acceptance, payment will be made at our current rate, which covers all author's rights, title to, and interest in, the editorial contributions as described above. Unless prior arrangement is made in writing to Model Builder, submission of editorial material to Model Builder expresses a warranty by the author that such material is in no way an infringement upon the rights of others. Made in U.S.A.

Gallant Models, Inc.
P.O. Box 2459
Capistrano Beach, CA 92624-0459
714/ 496-5411

MEMBER RCHTA

The Ultra-Sport 40™ Custom ARF. 90% prebuilt, 100% Great Planes.

"We hold our Custom ARF Series models up to the same high standards as our world-famous kits. Great Planes has essentially custom-built an Ultra-Sport 40 for you—using the best materials and workmanship." *Don Anderson*

President and Founder
Great Planes Model Manufacturing

Wingspan: 55 in, Wing Area: 566 sq in,
Length: 49.5 in, Weight: 5.25-6.0 lbs,
Wing Loading: 23 oz/sq ft.

Requires: 2-cycle .40-.46 or 4-cycle .60-.70 engine & 4-5 channel radio

Here's a breakthrough for all busy sport fliers—a prebuilt model that can match the uncompromising design, construction and performance standards of a Great Planes Ultra-Sport...

Introducing the Great Planes Ultra-Sport 40 Custom ARF.

Many ARFs put convenience over craftsmanship. But the Ultra-Sport 40 Custom ARF has the same detail-minded engineering you'd find in a Great Planes model kit.

- Its custom-sculpted cowl fits like a glove around almost any engine you use.
- You'll fly with confidence knowing that your model's put together entirely with genuine Great Planes hardware: steel rod-in-tube pushrods, an adjustable engine mount, horns, clevises and much more.
- For pilots who prefer retracts, wheel wells and mounting rails are factory-installed.

Covering the Custom ARF's balsa/ply structure is a state-of-the-art composite featuring a polyfoam base, a plastic skin, multiple color layers and a glossy, fuel-resistant finish. This results in a model that's both stronger and lighter than a conventionally-built balsa kit—for even better overall performance.

And it looks *perfect*. Kit builders work long hours for awesome trims, but this one's already done. Even the pilot figure is included!

The Great Planes Ultra-Sport 40 Custom ARF comes with detailed, photo-illustrated instructions and all aircraft components except radio, engine and propeller. It's 90% prebuilt. But it's 100% Great Planes.

For a free catalog and the location of the dealer nearest you, please call **1-800-682-8948, ext. 031R.**

All major components have been expertly prebuilt. Thanks to precision engineering and Great Planes' fully illustrated, step-by-step instructions, final assembly is fast and easy.

GREAT PLANES™
MODEL MANUFACTURING COMPANY

Distributed Exclusively Through Great Planes Model Distributors Co.
P.O. Box 9021, Champaign, IL 61826-9021

PLANE TALK

WE WANT YOU IN MODEL BUILDER!

Send in your favorite photos with a little information about the plane and yourself. If it's selected to run in "Plane Talk," you'll win a free custom *Model Builder* T-shirt! Send your best to Plane Talk, c/o Model Builder, P.O. Box 2459, Capistrano Beach, CA 92624-0459. Specify shirt size: L, XL or XXL.

Bob Dentinger of Colgate, Wisconsin sent in this photo of his Norcal Aero Continental. "I modified it by building the cowl out of balsa and by building the wing in three sections with a split flap in the center section," he reports. "It's powered by an O.S. .70 Surpass, and the radio is a seven-channel Airtronics. It's covered with Coverite 21st Century fabric." Bob says it's a very scale-like flier, and for his labor is awarded a custom *MB* T-shirt. *Bob Dentinger, W202 N10110 Lannon Rd., Colgate, WI 53017.*

Don Fisher is vice-president of the 46-member Wright Flyers RC Club in Monticello, Minnesota, and has been modeling only since 1988. He recently built this beautiful Sukhoi Su26Mx from an Ohio R/C Models kit. The model copies Clint McHenry's full-scale paint scheme; the blue and white is Hobby Poxy, the pink is catalyzed urethane. Don writes: "It's powered with a G-62 on Dan Reichmuth Ignition and is toned down with a Slimline Pitts smoker muffler and smoke system. I use a JR x-347, lots of heavy-duty servos and a five-cell, 1000-mAH pack. It weighs 20.3 pounds without fluids." *Don Fisher, 23129 185th St., Big Lake, MN 55309.*

"If I can build and fly one of these things, anyone can," writes Mark E. Wood of Carlisle, Massachusetts, whose Carl Goldberg Extra 300 is pictured with kids (from left) Michelle, 5; Brad, 9; and Aimee, 7. He framed it up in about two weeks, then spent two months of tedious work covering it in MonoKote Insignia Blue, Dark Red and White. Cowl and pants were sprayed with Monokote-matching LustreKote paint. Under the cowl is a new ASP 1.08 engine, swinging a Zinger 16x10 prop at 6,800 rpm. "The ASP gets a little warm and shakes like a paint mixer with that prop, but it looks great and provides unlimited vertical," Mark notes. "I've since changed to an APC 15x10, which gives 7,600 rpm. What a prop!" Control is furnished by a Futaba 6NFK FM radio. *Mark E. Wood, 787 Lowell Rd., Carlisle, MA 01741.*

The latest creation of scratch builder Larry Katz is a double-size 1940 Sparky, originally kitted as a rubber model. Larry's 64-inch span model is powered by an O.S. .20 four-stroke and weighs 52 ounces with an Airtronics radio aboard. Covering is red Micafilm, with hand-cut white-on-black MonoKote letters and trim. "It flew off the board, is peppy and not a typical old timer floater," says Larry. His current stable of planes includes a Zipper, Coronet, Kerswap, Lanzo Bomber, Playboy Senior, Air Trails Sportster, Dennyplane and Powerhouse. *Larry Katz, Greenbriar Woodlands, 1658 Buttonwood Ave., Toms River, NJ 08755.*

DO NOT MISS IT!

TOP GUN 94

WORLD CLASS
INVITATIONAL
R/C SCALE CONTEST

APRIL 28th to MAY 1st,'94

at **Palm Beach Polo Club,** in West Palm Beach, Florida
For on-site accommodations: 1-800-327-4204

Sponsored by

MODEL AIRPLANE NEWS
and **ZAP** (Pacer Technology)

Hosted by the **Palm Beach Aero Club**
For travel, hotel and car rental arrangements
call **Cindy Burkey** at **SOUTHPORT TRAVEL:**
1-800-735-0401 or 305-761-1500
For more information send a legal size SASE to:
FTE, 15300 Estancia Lane, W. Palm Bch, FL 33414,
Tel.:1-407-795-6600

A FRANK TIANO PROMOTION

PLANE TALK

"Coming From China" is the name of Chinese modeler Luo Yongxiang's original design. "The fuselage is made of fiberglass with plywood formers, and the wing is covered with cotton sheet. The model is powered by a Sanye .21 engine and equipped with a JR Propo four-channel radio," writes *MB* subscriber Chen Xin, a friend of Yongxiang's and a student at Shanghai University of Technology. "After 12 flights, we are sure that it must be a good design for those model builders under 19 who want to gain high scores in the F3A .21 engine class contest of China." *Chen Xin, Shanghai University of Technology, 149 Yan Chang Road, Box 313, Shanghai, 200072, Peoples Republic of China.*

Larry Paikos sends along a photo of his beautifully built electric-powered Playboy Senior which, as of his writing, has three perfect flights on it. The model is finished in silk and dope in the best Old Timer tradition. Larry is also in the process of building a Comet Sailplane for a geared Astro 25 FAI. He writes: "I've not built anything for at least 45 years. I am pleased with electrics and encourage other 'used-to-build' folks to jump in—you can do it!" *Larry Paikos, 209 River Dr., Bloomfield, IN 47424.*

"I Thought you might like to see a photo of my TIC," writes Wendell Hughes of Canada. "I designed it as a proposal for a full-size ultralight. It looks like a cartoon character in the air, and is powered by two loops of Sig 1/8-inch rubber with a hand-carved prop. It has a 17-inch wingspan and has a very high climb, but the glide is rather steep with that parachute-like wing." *Wendell Hughes, RR 2, Morell, Prince Edward Island, Canada C0A 1S0.*

ELECTRIC FLIGHT from Hobby Lobby

Sale price until April 1, 1994!

A. MT2001 **Alto Electric A-R-F** **$127.00**
73" span for aileron, elevator, motor control. Slopes, thermals, aerobatics! Fully built and covered.

B. GR4280 **Biene Elektro Sailplane** **$189.00**
Ready built! 63" span, superb thermal soarer.

C. GR4207 **Elektro UHU** **$97.00**
75" span soarer with ready built strong plastic fuselage and rib and spar wing.

D. GR4264 **ASW 22 B270 Electric Sailplane** **$219.00**
105" wing span, magnificent plastic body, balsa sheeted foam wing sailplane for the inexpensive GR1165 drive unit.

E. NL001 **Hughes 500 Electric Helicopter** **$189.00**
34" rotor diameter. Great trainer. Also available in a partially assembled kit for $269. This has mechanical parts in operating form and broken in.

F. HLA130 **Freshman Electric Sailplane** . . . . . **$39.00 — SALE! $29.00**
72" span balsa kit, 3 channel very easy flyer for GR297 Graupner Drive System.

G. MID169 Midwest **Electric 'HOTS' Basic Kit,** List $69.95 . . . . . **SALE! $19.00**
41" span, for SPEED 600 motor or .10 gas engine. Aerobatic 4 channel easy-to-build balsa kit is a great performer! When you order "Hots" ask for our special prices on electric flight and radio installations. **Limited Quantity. Please order by phone to assure delivery. No backorders when sold out!**

H. HLA131 **Graduate Electric Sailplane** . . . . . **SALE! $49.00**
Balsa kit, majestic 96" wingspan soarer. For rudder, elevator, throttle control, ailerons optional. Use GR1165 drive system. On our Video 3.

J. HLDS002 **Skimmer Electric Sailplane** **$48.00**
70" span conventional balsa kit for rudder, elevator, motor control. **Guaranteed** to get to thermal height.

K. HLBW001 **PS Flyer Electric** **$39.90**
79" span balsa kit, for 3 channels, very gentle flyer. Use our 3:1 Gear box with motor GR179530 and our big lightweight folding prop GR2870.

L. NEW! HLV001 **Raptor Electric Boosted Sailplane**
Raptor's price and performance are revolutionary! Call Hobby Lobby for FREE CATALOG 23 which has complete description of this highly prefabbed fiberglass sailplane. Call (615) 373-1444.

M. NEW! FREE CATALOG 23
Dozens of new items never seen before in the USA.
Call (615) 373-1444 or mail this coupon.
FREE in the USA. $5 elsewhere.

Name _____

Address _____

City _____ State _____ Zip _____

MB

HOBBY LOBBY INTERNATIONAL, INC.®

5614 Franklin Pike Circle • Brentwood, TN 37027 • (615) 373-1444
Fax: (615) 377-6948

FAZER

SIG

KIT RC-68

The Fun Fly Lazer

Are you tired of seeing "fun fly" models that look like they came right out of a lawn and garden center?

Well sports fans, take a look at the exciting new SIG FAZER! No more stick fuselages! This eye-catching fun fly machine is modeled after one of the most recognized aircraft of all time - Leo Loudenslager's BUD LIGHT LAZER!

Aerodynamically the FAZER is a state-of-the-art fun fly airplane, capable of tight loops and super fast rolls. The FAZER also excels at knife-edge flight, spins, snap rolls, and all the other maneuvers in Leo's bag of tricks. A real plus is the conventional landing gear and steerable tailwheel, giving the FAZER superior ground handling characteristics.

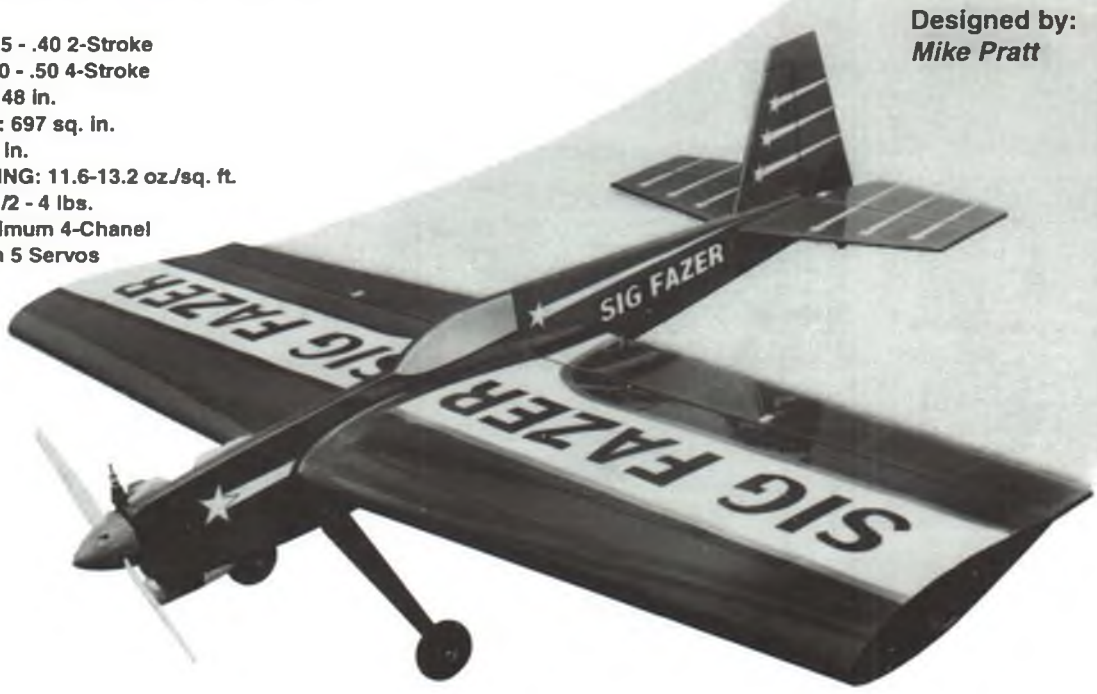
The FAZER was designed and carefully engineered with the help of CAD (computer aided drafting) drawn plans. Also CAD generated tooling ensures a super parts fit. Another example of the quality engineered into SIG kits is the pre-shaped 1/2" balsa profile fuselage. It is routed (not sawn) to the proper shape and requires only final sanding.

KIT FEATURES:

EASY-TO-BUILD ALL WOOD DESIGN
TOP QUALITY SIG BALSA AND PLYWOOD
PRE-SHAPED BALSA PROFILE FUSELAGE
DIE-CUT BALSA RIBS & PLY DOUBLERS
PRE-BENT ALUMINUM LANDING GEAR
PHOTO-ILLUSTRATED INSTRUCTION BOOK
CAD DRAWN FULL SIZE PLANS
GLASS FILLED ENGINE MOUNT
COMPLETE HARDWARE PKG
LARGE DECAL SHEET
SIG EASY HINGES

Designed by:
Mike Pratt

ENGINES: .25 - .40 2-Stroke
.40 - .50 4-Stroke
WINGSPAN: 48 in.
WING AREA: 697 sq. in.
LENGTH: 40 in.
WING LOADING: 11.6-13.2 oz./sq. ft.
WEIGHT: 3-1/2 - 4 lbs.
RADIO: Minimum 4-Chanel with 5 Servos

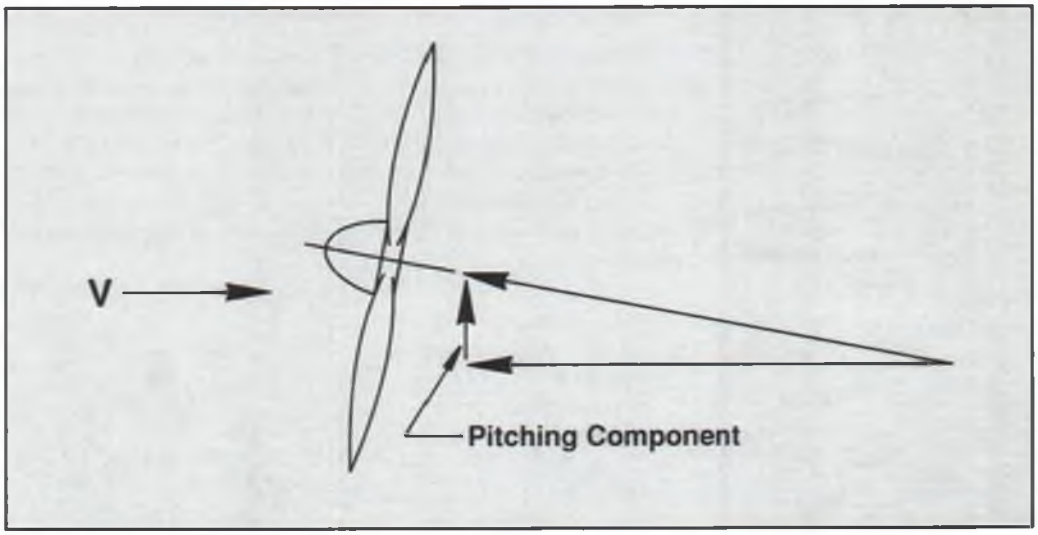


SIG MANUFACTURING CO., INC. . . . . Montezuma, IA 50171

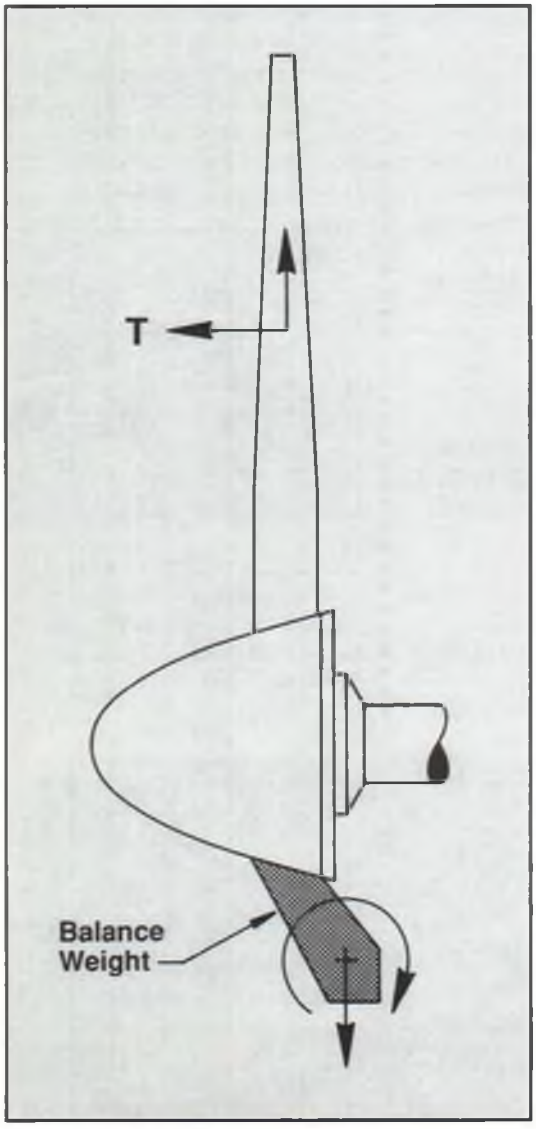
PH: 515-623-5154 FAX: 515-623-3922 Toll Free Orders: 800-247-5008 Modeler's Hot Line: 800-524-7805

BY FRANCIS REYNOLDS

• Are More Prop Blades Better? • P-Factor Explained



A diagrammatic example of Pitching Effect, one of several phenomena often lumped together under the heading of "P-Factor."



Single-blade props are easy enough to balance statically, but balancing them dynamically can be aided by placing the counterweight rearward of the prop itself—explained in text.

I received a letter from J.B. Barkley, of Hixon, Tennessee, in which he asks a question that may be of interest to other readers. I quote in part: "Does efficiency increase in going from single to double-bladed propellers, and if so, how much? From the start, Coupe d'Hiver (a free flight competition rubber class) models have sported single blades. Is this merely for building simplicity, or would efficiency improve by using two blades? One could extend this question to rubber-powered scale, where the options increase to three or four blades."

Good question. In many things, if some is good, more is better. But that doesn't apply here. With the number of prop blades, if some are good, *fewer* are better. (The rule breaks down when we go from one blade to no blades.)

From the standpoint of efficiency alone, a properly designed single-blade prop is better than a conventional two-, three- or four-blader. The reason is that the fewer the blades, the greater the propeller diameter can be. A larger diameter prop will move a larger mass of air at a lower velocity. In non-technical terms, larger propellers get a bigger, better and more efficient bite on the air.

Counterbalanced single-blade props are most common on rubber-powered free flight models. They've also been used to a lesser extent on engine-powered models, for such things as control line speed and free flight. I built and used an adjustable-pitch single-blader 50 years ago. One can easily statically balance a rigid single-blade prop, but the unilateral thrust is not normally balanced out. The result is bad loads on the engine bearings.

One approach to dynamic balancing the one-sided thrust is to rigidly attach the counterweight at an angle to the rear of the blade, so that centrifugal force on the counterweight balances the unilateral thrust on the other side, but I'm not aware of any recent efforts in this direction. Mostly it isn't worth the struggle. Two-bladed props are good enough, and a lot simpler.

More than two blades may be used where the prop clearance is restricted for some reason. I've heard of modelers claiming better performance with a three-blader than with a two, but I suspect such claims are over-simplified. A particular three-blader could be a better match for the model than the two-bladers *that had been tried*, but a perfectly matched two-blade would be better than the three.

These days we have another factor affecting our choice of prop—noise. Some competition pattern guys and gals are using less diameter and lots of pitch to reduce prop noise due to high tip Mach number, and to reduce engine noise by keeping the rpm down. Excessive pitch and reduced diameter will reduce the performance of the model, however.

In full-scale design, multi-bladed props are sometimes used to keep the landing gear short, to clear the aft fuselage on a pusher, etc., but at a price in efficiency. Tip Mach number is also a factor in high-powered full-scale work. If the prop tip

continued on page 14

over the counter

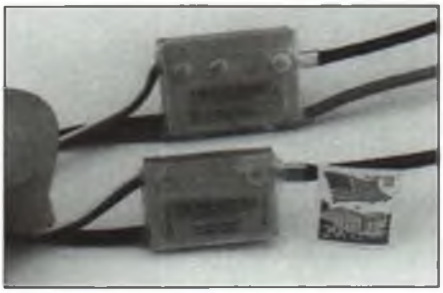
GP'S ARF PATRIOT

Great Planes has recently come out with a 90 percent pre-built ARF version of its jet-like Patriot sport model. Construction is very similar to the ARF Spitfire we told you about here last month—an interlocking wood structure covered with a composite material consisting of a polyfoam base, plastic skin, color layers (red/white/blue/silver) and a clear fuelproof coating. The majority of the construction is already done for you; what remains is final assembly and radio and engine installation. Optional retracts are available, and their installation is detailed in the photo-illustrated instruction manual. The Patriot spans 47 inches and is best powered with a .40-.46 two-stroke. From Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.

WANKEL POWER

One of the new items shown in Hobby Lobby's Catalog 23 is the huge 2.25 cubic inch (37.4cc) Wankel engine made by O.S., marketed in Europe by Graupner and distributed here in the U.S. by Hobby Lobby. Looking very much like the .30-size Wankel that O.S. has produced for years, this new big one is rated at 4.5 horsepower at 10,000 rpm, weighs 4

pounds and is 4-7/8 inches in diameter. Recommended prop is a 20x8 or 18x10. Included but not shown in the photo is a pre-mounted pull starter. Check it out in Hobby Lobby's Catalog 23. If you don't have a copy, you can get one free by writing them at 5614 Franklin Pike Circle, Brentwood, TN 37027, or call (615) 373-1444.



POSTAGE STAMP SPEED CONTROLS

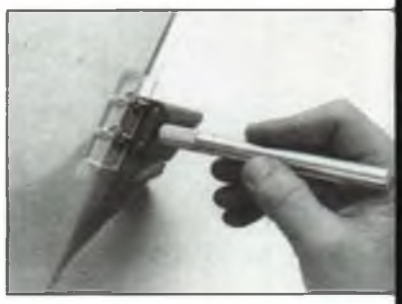
Well, they really may not be quite as small as a postage stamp, but they're sure not much bigger. Astro Flight's new Micro-Series 217 proportional speed control (no brake) weighs just 1/2 ounce and measures 1.25x.9x.25 inches; the 215, which features a brake, is just slightly larger and heavier. Both are designed to handle up to 14 cells and 25 amps continuous. Neither has a BEC circuit. Surprisingly, both of these tiny units have a retail price to match: $49.95 for the 217, and $54.95 for the 215. From Astro Flight, 13311 Beach Ave., Marina Del Rey, CA 90292; (310) 821-6242.

FLY WITH THE ANGELS

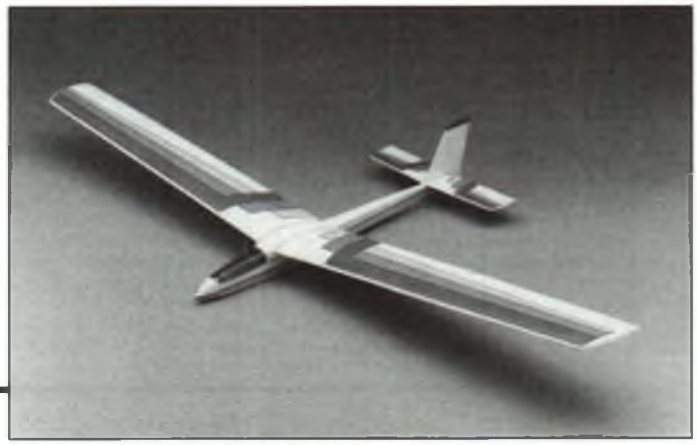
In the February Over The Counter we mentioned that Global Hobby Distributors is now the exclusive U.S. distributor of the pre-built, uncovered airframes produced by Model Tech—what Global is referring to as "BHPs," or Built-up Hand-crafted Planes. Included in the line are two very similar looking but different size rudder/elevator sailplanes, the Angel 1600 and 2000. They span 62-1/2 and 78-1/2 inches respectively and feature built-up balsa fuselages and stabs, with balsa sheeted foam wings routed out for lightness. The fact that they are supplied uncovered means you can finish them to look the way you want, instead of having something that looks exactly like the other guy's. Both kits are complete with clear canopy, basic hardware and instructions. From Global Hobby Distributors, 10725 Ellis Ave., Suite E, Fountain Valley, CA 92728-8610.

DU-BRO'S TRIMMING TOOL

The E/Z Trimmer is a cleverly designed attachment that slips over a #19 X-Acto blade in a #2 handle (the larger of the two X-Acto metal handles) and lets you make straight, precise, professional looking cuts when trimming the covering on your models—sort of like having a knife with a built-in straightedge. Depending on how the guide is installed, the E/Z Trimmer will cut



edges to 1/16, 1/8, 3/16 or 1/4 inch wide. It comes complete with two #19 blades; you supply the #2 handle. From Du-Bro Products, 480 Bonner Rd., Wauconda, IL 60084; (708) 526-2136.

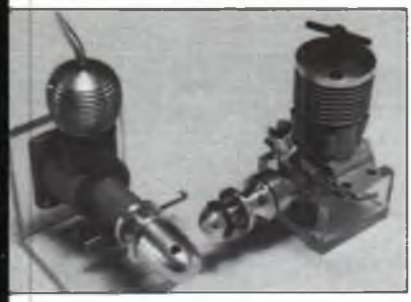


WHAT! ANOTHER STINGER?

Capitalizing on what has turned out to be an exceptionally popular model, the folks at Lanier have come out with the fourth in the Stinger series, the Stinger 40. Specs: 48-inch span, 528 squares, 4-3/4 to 5-1/4 pounds, .32-.46 two-strokes. Construction is the same balsa/foam/ply/plastic technique used in the other Stingers. Also like the other Stingers, the kit is complete with all building materials including wire-cut foam cores, however no hardware is supplied except for the pre-bent aluminum landing gear. Check it out at your local hobby shop. The Stinger 40 is a product of Lanier RC, P.O. Box 458. Oakwood, GA 30566; (404) 532-6401.

FOR O.T. AND NOSTALGIA BUFFS

Dave Platt has contracted with the CS firm in China (makers of the CS racing engines) to produce replicas of two .15-size diesels, the Elfin 2.49 and Oliver III. A recent note from Dave confirmed that both are now in stock and ready for immediate delivery. Elfins are currently dominating the Class A O.T. FF and RC events, and the Oliver is sure to find a niche in FF Nostalgia competition. Both engines are being offered at *very* reasonable prices; full details can be had by sending an SASE to Dave Platt, 1306 Havre N.W., Palm Bay, FL 32907, or call (407) 724-2144.



REQUIRED READING

We've seen books on paper airplanes before, but none have been as much fun as *Planes, Jets, & Helicopters: Great Paper Airplanes*, by John Bringhurst. A respected doctor and family man by day and for years a closet paper airplane folder by night, Mr. Bringhurst has at last put together a book of two dozen of his favorites for others to enjoy. All of them follow his three basic rules: 1) All are folded from a single sheet of 8-1/2x11 paper; 2) No tape, glue or scissors are needed; and 3) They all fly. The designs range from the most basic to quite complex, including a couple you'd swear couldn't be made from one piece of paper, such as the biplane pictured on the book's cover. For each there are clear, illustrated step-by-step folding instructions as well as instructions on flying and trimming. There's a lot of entertainment on tap here, at a cost of only $8.95. *Great Paper Airplanes* is available in bookstores and is published by TAB Books, Blue Ridge Summit, PA 17294-0850.

SILENCE!

For you YS fliers, Advanced Aero Products offers a compact aftermarket muffler designed for both the 120 and 120AC four-strokes. Construction is welded steel, which is intended to eliminate the thermal expansion problem that sometimes occurs with an aluminum muffler screwed to a steel header. Noise reduction is accomplished through exhaust gas expansion and the use of one internal baffle. Priced at $47.95 plus $3.50 S&H, direct or through your local shop. From Advanced Aero Products, Rt. 1, Box 365-C, Anna, TX 75409; (214) 924-3940.

THE '94 SHUTTLES

The engineers at Hirobo have made a number of subtle design changes to their Shuttle helicopters in an effort to increase performance and serviceability. For example, the Shuttle ZX now includes:

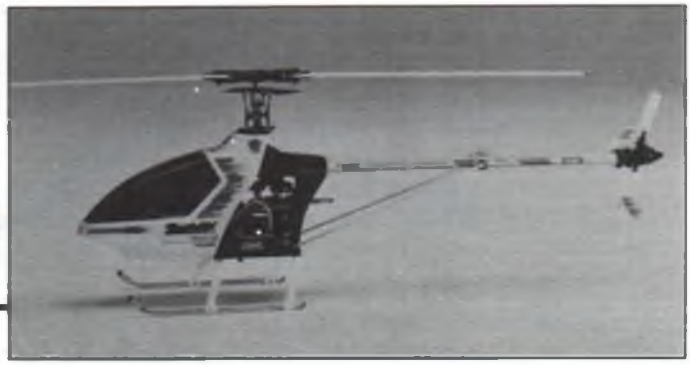
- Shorter center hub for increased stability.
- Adjustable pitch rod length for fine tuning.
- Collective pitch levers mounted on the outside of the frame for easier tuning.
- New frame design for quicker servicing.
- Larger fuel tank.
- Larger tail blades.
- Larger diameter tail control shaft.
- Improved belt starting system.

And the list goes on.

The '94 Shuttle ZX is available both as a kit and in ARF form with an Enya SS35 Heli TN engine installed. Hirobo products are distributed in the U.S. by Altech Marketing, P.O. Box 391, Edison, NJ 08818-0391.

THREE BUCKS WELL SPENT

Three bucks is what it will cost you to get a copy of Bell Model Aircraft Company's 14-page illustrated catalog of free flight scale model plans and kits. Proprietor John Bell offers a selection of 19 model construction plans, 18 multiple-view detail drawings, and four complete kits, with more on the way. Most are WWII military aircraft, with some later types and civilian aircraft included to round things out. Mr. Bell is clearly an experienced FF scale modeler, as the finished models pictured are beautifully built and the plans look to be expertly engineered. Order your catalog from Bell Model Aircraft Co., 650 Pine Crest Dr., Largo, FL 34640. ***MB***



When contacting the manufacturers/distributors mentioned in Over the Counter, please tell them you read about their products in *Model Builder* magazine!

MODEL DESIGN *cont. from page 11*

speed gets close to the speed of sound, we start generating lots of prop noise from shock waves, and the efficiency goes down. By adding more blades we can absorb the same power at the same rpm with a smaller diameter and therefore less tip speed. We compromise between Mach losses and losses due to reduced diameter.

Why not use wider blades instead of more blades if the diameter is restricted? Because narrower, higher aspect ratio blades are more efficient. During WWII we retrofitted some military aircraft with more powerful engines. The landing gears limited the prop diameter, so four *wide* prop blades were used to absorb the added power. It worked, but those fat clubs were less efficient on two counts—number of blades and low aspect ratio.

Gearing a propeller is somewhat like reducing the number of blades. A geared propeller will have a larger diameter (to absorb the power at the lower rpm), therefore it is more efficient than the ungeared prop it replaces. But the gearing itself absorbs some power, adds weight, cost, and maintenance, so to gear or not to gear is a judgment call.

When choosing model props, theory is good, if you are into that sort of thing, but experience is more practical. In the real world the best prop for a given airplane, full-scale or model, is often found by trial and error (make that "comparative testing").

PROPELLERS ARE GYROSCOPES

My friend Kip Jackson reminds me that we should use lightweight props for competition fun flying to reduce the amount of distortion in tight turns and loops due to gyroscopic precession. Our props, with their significant diameter, mass and high rotational speed, are pretty powerful gyroscopes.

(During World War One, tight-turning fighters exhibited gyroscopic problems, especially the ones with rotary engines, where the heavy spinning engine added to the gyroscopic effect from the big prop. Pilots using rotaries in air combat learned that they could make sharp turns safely in one direction, but not in the other, and they had to plan their maneuvering with that in mind.)

Specifically, with normal propeller rotation on a tractor model airplane (a "tractor" airplane is one that is *pulled* by the propeller, as opposed to being pushed), the gyroscopic force from a left turn will tend to raise the nose, and will tend to drop the nose in a right turn. Inside loops will tend to spiral out to the right, and outside loops to the left.

An expert model pilot probably unknowingly compensates for gyroscopic effects, but keeping the weight of the prop down will make for smoother flying in tight maneuvers. Wooden props weigh about half as much as fiber-filled plastic props. That should make a detectable reduction in gyro effects for purists; but plastic props last longer.

P-EFFECTS

The "P-effect" or "P-factor" (where "P" presumably stands for propeller) includes several separate effects which make up the overall effects which the prop has on the airplane in flight and during maneuvers.

Some authorities include more factors in P-effect than others do. The factors often included are torque, gyroscopic effects, asymmetric effect, pitch and yaw moment effects, and propwash effects. Interestingly, the majority of these factors happen to work in such a direction as to make the model yaw and/or roll to the left (with tractor prop and normal engine rotation).

The "cure" for P-effect as a whole is normally considered to be some measure of right thrust. For some of the separate factors, right thrust is a relatively pure solution, but for others it is not, as we shall see. The reason that right thrust generally works better than other possible fixes is that the fix is only there when the problem is there. In other words, neither the P-effects nor right thrust have any effect when the power is off.

• **Torque** is one of the easiest of these separate effects to understand. When the motor exerts torque on the prop, the reaction torque on the airplane tends to roll it to the left.

A .60-size engine puts out around 6 pound-inches of torque in flight, which means a 6 pound-inch left roll moment on the airplane. If all other aspects of the airplane are perfectly true and symmetrical, this roll moment could be balanced in level flight by putting a 0.2-pound weight 30 inches out in the right wing. That fix would be no good, however, because when the engine was off the airplane would have a 6 pound-inch right roll moment. Right thrust isn't a good fix for torque reaction either, because the problem is roll, not yaw.

• **Gyroscopic effects** we have already talked about. Right thrust is not a cure for gyroscopic effects, since these show up only when we pitch or yaw the airplane rapidly. If any fix would help in turns or loops, it would be wrong for straight and level flight. The best fix is a light prop.

• **Asymmetric effect** is aerodynamic. P-effect is sometimes taken to mean this effect alone. It is an interesting one, and a bit difficult to see, but let's try. When a plane under power is pitched or yawed so that the thrustline is not parallel to the flight path (or taxi path), the prop blade on one side has more effective pitch than the blade on the other side, pulls harder, and tends to yaw or pitch the plane. An easy way to see this is to hold a prop horizontally 6 inches in front of your chest, pitch its thrust axis up about 30 degrees, and look down on the blades. One blade is seen to have a lot of pitch, but the other has little or even negative

continued on page 40

BRITAIN'S BEST EXPORTS...

...Touch down in the U.S.A!

You can now be a truly international modeller with the help of the U.K.'s foremost model flight magazines. *Aero Modeller* and *Radio Modeller* magazines could wing their way to the U.S.A. and touch down on your doormat every month with a 1 year Direct Delivery Subscription.

Plus*, we'll send you a *FREE A.S.P. plans handbook worth £2.95!

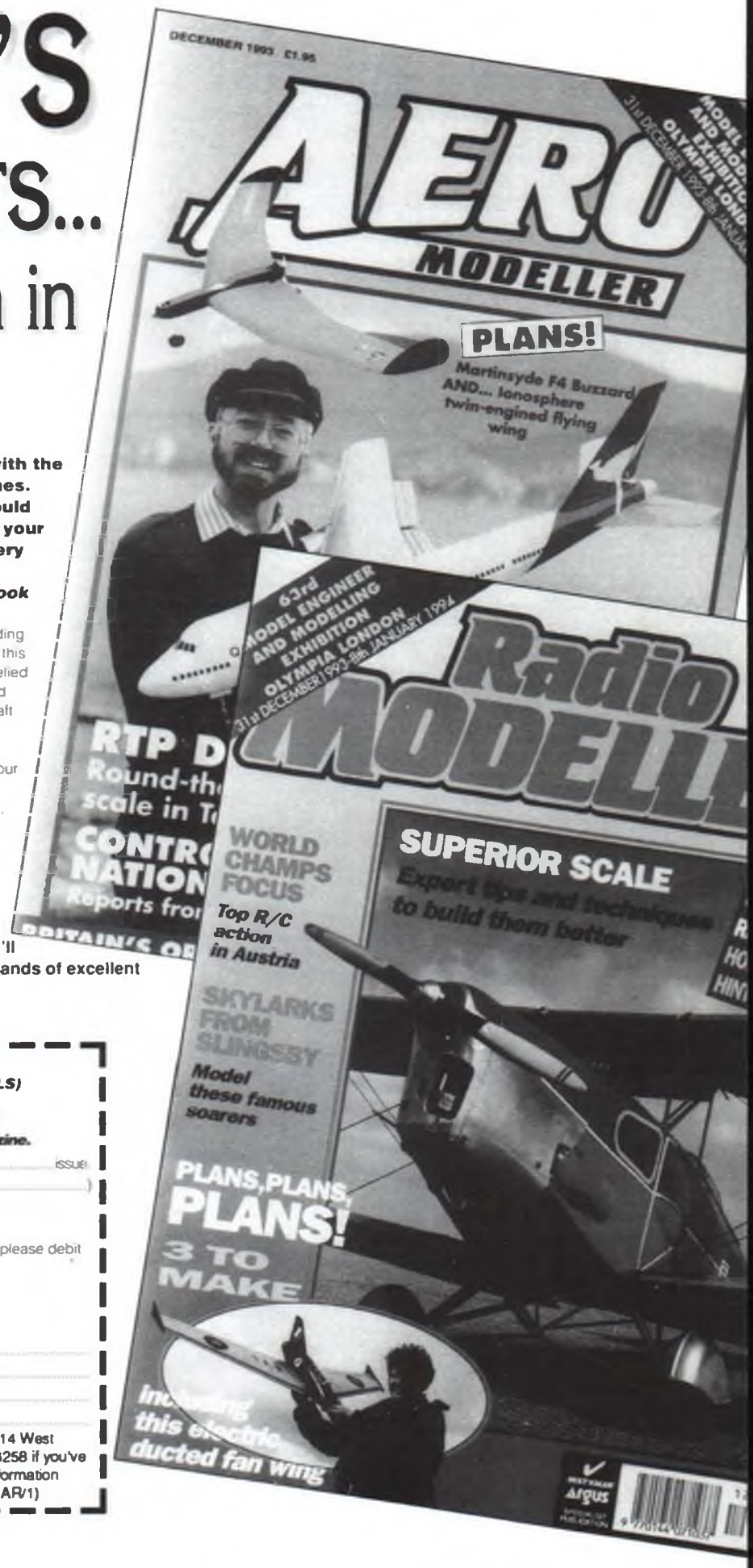
Aero Modeller is famous for its in-depth coverage of model building and flying. Over 50 years of British modelling expertise have made this magazine what it is today. Generations of aircraft modellers have relied on Aero Modeller for the latest information on model designs, sound advice on model building and painting and free plans. This is aircraft modelling at it's best!

Radio Modeller covers and encourages every aspect of radio controlled model flight. Consistent first class features, beautiful colour photography, new designs and free plans have helped to build ***Radio Modeller's*** excellent reputation. Powered models, gliders, slope soarers, thermals and helicopters are all explained in clear and lively articles you'll enjoy reading.

– Keeping you in touch with a whole world of aircraft modelling across the Atlantic!

So what are you waiting for? – for as little as $40 you could guarantee every issue of the U.K.'s best aircraft export is delivered to your door – every month and you'll get the ***A.S.P Plans Service Handbook*** full of thousands of excellent plans, ***FREE!***

Fill in and post this order form today!



Britain's best export!

Post me today! **(PLEASE PRINT IN BLOCK CAPITALS)**

Yes! I would like to take out a subscription to:

☐ ***Aero Modeller* magazine** ☐ ***Radio Modeller* magazine.**

Please commence my subscription from the ..... issue

If renew/extending, please quote subscription number .....

1 Year U.S.A. Subscription Rates (12 issues)

***Aero Modeller* $46 *Radio Modeller* $40**

I enclose my cheque/P.O for $ ..... made payable to ASP or please debit my Access/Visa

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Signature ..... Expiry .....

Name .....

Address .....

..... Post Code .....

Please post this coupon to: WiseOwl Worldwide Publications, 4314 West 238th Street, Torrance, CA 90505, USA or call us on (310) 375-6258 if you've got a credit card, it's faster by phone. You may receive further information about offers and services which may be of interest to you. (AR/1)

PATTERN AIRFOILS 101

Listen up, class. Professor Rick is going to reveal the basics of modern pattern airfoils, what works and what doesn't, and defines some of the more important terms associated with airfoil design.

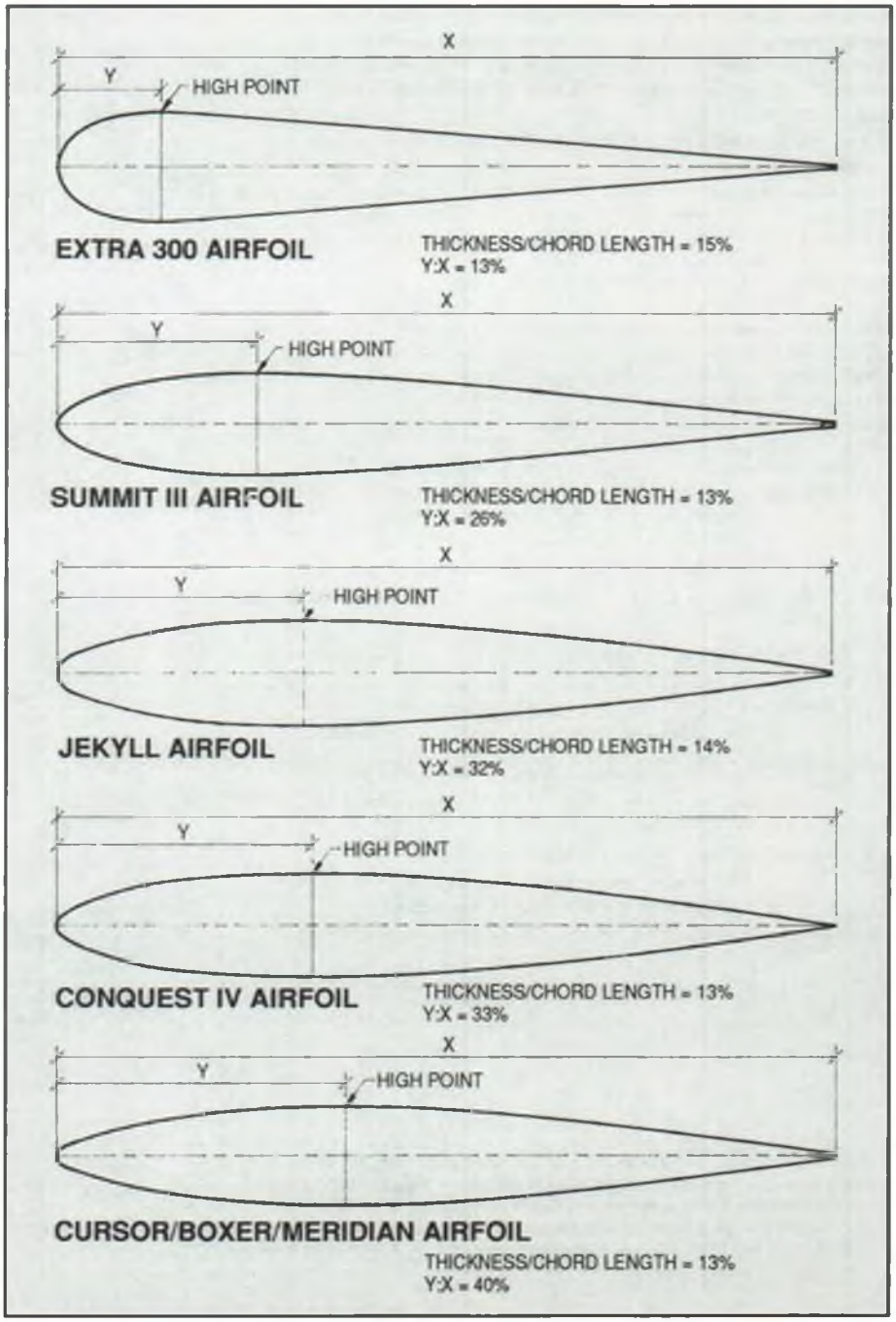
I have been besieged by requests for an article on the subject of pattern airfoils for several years now. I have avoided the subject for an equal time. There is no mystery in this; just your basic cowardice. I lack the requisite union card from MIT or Cal Tech. I am not a trained aerodynamicist. I hold a private pilot certificate, which means I once endured a ground school. For nearly 40 years I have designed and built free flight, control line and finally, RC pattern model aircraft. To do that, I found it helpful to look up a few things. That is the sum total of my qualifications. I have no doubt that I will now suffer the dings and furrows of outraged engineers, all objecting to my excessive generalization, oversimplification, and reliance on my own unsubstantiated opinions. Writing this type of article is like going to the dentist; if you open your mouth, you are likely to get drilled. So be it.

Much dependable information exists about full-scale airfoil sections, and less (but still a good amount) about sections suitable for free flight models and RC sailplanes. I've found practically nothing about symmetrical sections suitable for RC aerobatic models. Most of the sections in pattern use today are "boot sole" airfoils, born of a ship's curve married to somebody's best guess. They are the proud product of "cut and try." Most work surprisingly well. As you can see from the comparison drawing of a few of the modern pattern airfoils I was able to collect from published plans, there are more significant points of difference than you might expect—and these are all from very successful and good flying airplanes!

If you can draw a conclusion from this, it would have to be that there is more than one decent way to get the job done. Is there a best way? Tough question. If there is, I don't believe any of us has found it yet. I do believe some ways I've tried are better than others, at least under certain conditions, and for certain flight tasks. How's that for weaseling around?

Aerodynamics may be a science to the guys who build airliners, but down here among the balsa trees it's still a black art. The only thing we have for sure is insufficient data. The best test rig we have is a contest weekend. The main database is located between our ears, and the process is pure, organic and empirical. No Cray supercomputer, no wind tunnel, and no money for either. Still, we aren't entirely without headlights.

Most of the gigabytes of data from the full-scale arena don't transfer well. As you can deduce from the plot of the full-scale



Plots of different aerobatic aircraft airfoils. The lower four are from various state-of-the-art RC pattern models and are quite similar; the one at the top is from the full-scale Extra 300, and while it works well in full-scale, it's not a good choice for a pattern ship—text tells why.

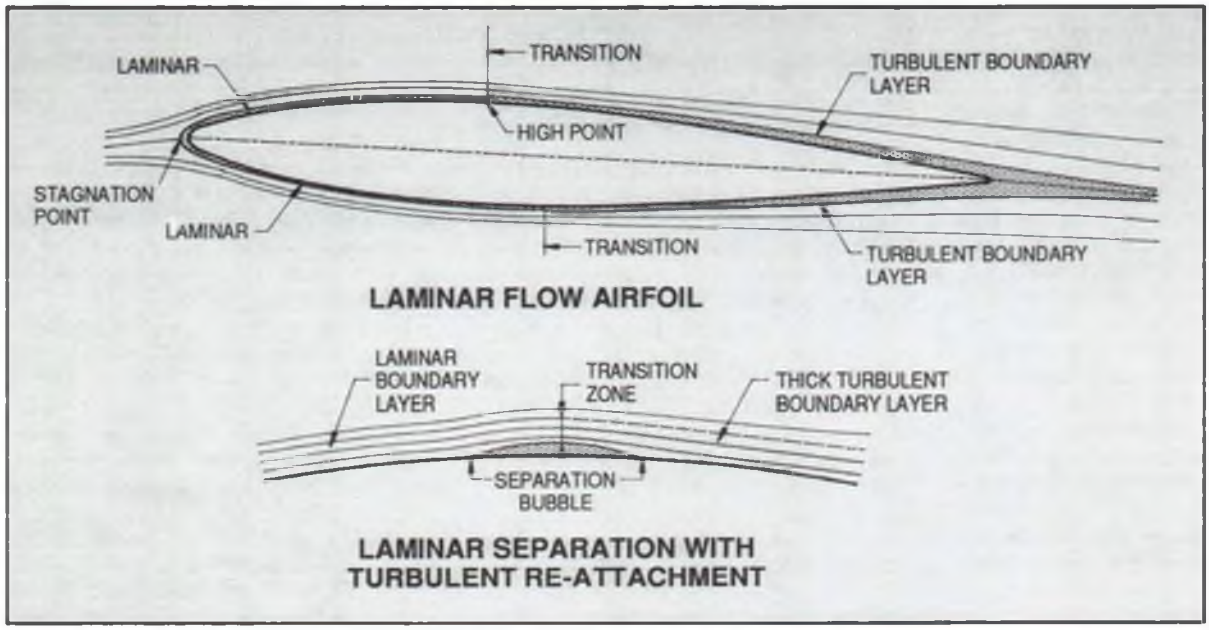
Extra 300 airfoil, the operating conditions are a wee bit different. The most fundamental difference is the size of the air, or Scale Effect. To our little birds, the molecules of air are much larger, relatively speaking, and the relative viscosity (air is a fluid medium, just like water, only thinner and better for breathing) is increased. When you hear talk about "low Reynolds numbers," this is partially what is being expressed, along with other stuff like air density and velocity. And, no, density and viscosity are not the same thing. Density is how heavy, and viscosity is how sticky and gluey. Viscosity tends to keep fluids (like air) in contact with surfaces and resists shearing loads. Translation: as viscosity rises, so does drag. Scale Effect says little airplanes are never as efficient as big ones, and consequently, big airplane airfoils are often a disaster in model scale.

likely), that number will be the radius of a circle that fits the tightest part of the rounded arc of the edge, expressed as a percentage of the chord. "MAC" refers to Mean Aerodynamic Chord, or the average chord of the wing. "Percentage" is the ratio of wing section thickness to length, expressed again as a percentage of the chord. A 13 percent wing is 13 percent as thick as it is wide. Very simple.

That's it. No "stations," camber lines (all of our pattern airfoils are symmetrical), design coefficients of lift or other stuff. Most symmetrical airfoils can be fairly accurately described, and even roughly drawn or reproduced with the aid of a ship's curve, in terms of only nose radius, high point, and percentage thickness. Give two pattern designers only that information and a set chord length, and the airfoils they would produce might vary slightly, but the differ-

In laminar flow, the flow next to the surface skin sorts itself into layers, each usually a few molecules thick. There is very little movement of air molecules between layers. The layers closest to the surface move slowly, those farther up move faster and faster, until the speed of the uppermost layers approaches that of the mainstream. These stacked layers are collectively known as the Boundary Layer, and their total thickness is a few thousandths of an inch. Think of a very narrow freeway with a lot of little lanes, all whizzing along at a different speed, with nobody changing lanes. The guys in the right-hand lane, near the surface, are just poking along, but because they aren't moving fast, they aren't generating much friction or drag. All the rest of the lanes are sliding smoothly over each other, each going faster than the next.

As a wing moves through the transition



This sketch illustrates what happens to the airstream as it flows over a laminar flow section. Both of this month's drawings were generously provided by Gus Ozols of Salient Designs.

I'm going to try to do this without drowning in a sea of equations, abbreviations and esoteric terms that beg definition. The danger of this simplification is inaccuracy. Bear with me.

When you hear airfoils discussed by pattern plane designers, some of the terms have only a passing resemblance to what you might dig out of a text. Terms like "high point," "nose radius," "MAC" and "percentage" are typical. These are good terms for our purposes, and I see no reason change them. We do need to define them, however.

"High Point" refers to the position of the thickest part of the foil, expressed as a percentage of the chord length. A wing with "the high point at 38" would be one where the thickest part of the wing would be found at 38 percent of the chord length, measured back from the leading edge. "Nose Radius" is nothing more than the radius of the wing leading edge—how sharp or rounded. If you hear a number associated with it (un-

ences wouldn't be worth talking about, especially in the air, where it counts. These three main characteristics not only describe the airfoil with reasonable accuracy, but go a long way toward determining its performance characteristics. This is quick and dirty, and empirical/intuitive rather than scientific, but it is also effective.

LAMINAR FLOW VS. TURBULENT FLOW

There are two main kinds of fluid flow over a surface: laminar and turbulent. Which kind we have and where depends on the conditions, like the surface form, smoothness, viscosity and density of the fluid medium, velocity of the flow stream, distance traveled over the surface, etc. All of this is figured into that Reynolds number I mentioned, except for the form and smoothness of the surface, which is up to us. You will have to take part of what follows on faith; I don't have space to explain everything in depth.

from laminar to turbulent flow, this "lane" system is gradually trashed, and it's every molecule for himself. The average flow rate at the skin surface becomes higher, and skin friction (and drag) rises dramatically. The entire boundary layer becomes much thicker and more chaotic. This "pushes" the mainstream flow out farther from the wing surface, and makes the wing look thicker and draggier to the air it is passing through. Often, the innermost layer stops flowing completely at the transition point, and a "separation bubble" of stagnant air forms, forcing the mainstream to flow around it to re-attach to the surface in turbulent flow, and further increasing drag. If this bubble becomes large enough, the flow can be forced completely off the wing and fail to re-attach. When that happens, drag shoots off the scale and lift goes the other direction. The wing is stalled. The main points to remember are that laminar flow means lower drag, and turbulent flow means more drag.

continued

LAMINAR FLOW AIRFOILS

All wing sections operate with a combination of laminar and turbulent flow. Even on so-called "fully turbulent" sections, laminar flow persists for a short distance past the leading edge. Prove this to yourself with a garden hose and a sheet of tin, if you like. Direct the stream onto the slightly curved tin at a slight angle. The flow will first sheet (laminar), and then break up into increasing ripples (turbulent). At the typical pattern model scale, the tendency is for laminar flow to persist proportionally much longer than it does with full-size airplanes. This is because of the relatively higher air viscosity I mentioned earlier.

So what is a "laminar flow" airfoil? Basically nothing more than an airfoil designed to preserve laminar flow for as great a distance as possible over the wing, thus lowering total drag. These airfoils tend to have the high point located farther to the rear, anywhere from 30 to 60 percent of the chord. In full-scale practice, laminar flow is difficult to achieve and hard to preserve for any great distance because of low (relative) air viscosity and high surface irregularity (rivets, panel lines, bugs, etc.). And moving the minimum pressure point too far to the rear can encourage laminar separation (bubbles) to form more readily. A common "plus" characteristic of these sections is a wide "low drag bucket," or drag range. This means that the section can operate efficiently over a relatively wide range of angles of attack. Once the limits of this range are reached, however, drag increases rapidly. A further increase in angle of attack leads to a sharp stall. A slight decrease in operating angle, and the wing unstalls just as readily.

We know a lot about good sections for high lifting capacity at low speeds, or high speed penetration, etc. What makes a good airfoil for our use? Well, pattern planes operate at a relatively (high) constant maneuvering speed during the pattern, turn corners frequently at speed (change in angle of attack), and are called on to stall and unstall immediately and precisely. The wing areas on modern pattern ships are large, and the wing loadings consequently low; a high-lift airfoil (large change in coefficient of lift for small changes in operating angle of attack) isn't really the concern. In fact, such an airfoil tends to "bounce" in heavy weather, is more difficult to trim in pitch, and penetrates poorly. If I had a wish list, I would rather wish for an airfoil that had low drag characteristics over a fairly wide range of angles of attack either side of ideal (less speed scrubbed off in the corners), had an abrupt but very predictable and honest stall when forced to the critical angle of attack (for good snaps and spins), and had good enough low speed characteristics to make takeoff and landing a low-pressure experience.

Aerodynamics may be a science to the guys who build airliners, but down here among the balsa trees it's still a black art. The only thing we have for sure is insufficient data.

The first symmetrical sections used for RC aerobatics were adapted from the control line stunt arena. They were thick, blunt, turbulent flow sections with forward high points and large, rounded leading edges. They featured high lift and higher drag, were practically unstallable (given a large enough stab to control them), were hard to trim, and had fixed "hull speeds"—no matter what the horsepower up front, they went places just so fast and no faster. Many of today's so-called "RC sport" airfoils still closely resemble these ancestral wing sections. They are handed down like family heirloom gold watches, and work about as well.

Attempts to refine these older sections have been made, usually by thinning the percentage thickness to reduce drag and sharpening the nose radius for a crisper stall. These newer sections work a good deal better, but are still fairly high-lift sections with a narrow low-drag range. The better flying aircraft using this type of section are usually at the low end of the wing area range. This is what I mean by more than one good solution being possible. It is mostly a delusion to consider airfoils apart from area, loading, and planform. The end performance of the package is what is important, and all of these factors are very interactive.

A more recent trend has been to use a more laminar flow type of section with a little larger wing. I like this approach, because most of the features I wished for above are built into the section and don't need much compensation.

The section I fly at present is one I first published a decade ago on a sport/pattern design exercise called "Artemis" (*Flying Models,* December '85). It is an NACA "Series 6" derivative. The high point is well back at 40 percent, the nose radius is fairly sharp, and the thickness is about average at 13 percent root, 9-10 percent tip. Although it could be called an NACA 642013, it is actually something like a "cut and try" first cousin. Current aircraft using this section in varying thicknesses are the RC City Cursor, Salient Designs Boxer series, and the Piorun Models Meridian and Python. All of these airplanes have different design features, areas, and planforms, and each flies a little differently, but all share excellent snap and spin characteristics, are very solid in pitch, have good rough weather and vertical penetration, and very good low-speed handling. The section seems to be at its best when the average thickness is 11-12 percent. It likes a larger stab, like 28-30 percent of the wing area, and likes to be balanced well to the rear, at 36-39 percent of the MAC. Is this a perfect foil? No, but it's pretty darn good, and I haven't yet found anything I like better.

Is this the only good wing section out there? By no means! As I pointed out earlier, all the ones in the comparison drawing work well, as do many others I didn't have room to publish. Airfoils aren't the whole story, but they are an area worthy of examination if you are looking for a better flying bird. Don't be afraid to experiment a bit. It's how we got here! ***MB***

Hobby Shack®

SUPERMARKET OF HOBBY GOODS

Tell Us You Ordered A Plane From Our Model Builder Ad And Receive a FREE Gift!

GLOBAL QUALITY KITS
SKYRAIDER

The Skyraider has been designed to be fun to build and easy to fly! Built-in washout makes tip stalls something other Warbirds do...not the Skyraider. The kit features quality, die and machine cut wood parts, crystal clear canopy, formed cowling and scoops, basic hardware, full size plans, and fully illustrated instructions. Span: 62.5 in., Area: 664 sq. in., Weight: 7.5-9 lbs., Engine: .60-.65 2C/.90 4C, Radio: 4 ch. req'd.

NO.232200,
LIST $159.95 ..... Only! **99.99**

GLOBAL QUALITY KITS
EASY ANSWER

The Easy Answer is quick to build and easy to fly! Great for slope or thermal soaring. The kit features quality die and machine cut parts, basic hardware, full size CAD drawn plans, and fully illustrated instructions. Span: 2 Meter, Area: 568 sq. in., Weight: 24-30 oz., Radio: 2 ch. req'd.

NO.232340,
LIST $38.95 ..... Only! **24.99**

MODEL TECH
SONIC 500 BHP

The Sonic 500 BHP is a Built-up Hand-crafted Plane that makes an excellent sport aerobatic model with a .25, or a full-blown Quickie 500 racer with a .40. The kit features pre-built, pre-sanded component parts ready for your choice of finish; pre-sheeted foam core wing, basic hardware, clear canopy, and instructions. Span: 51 in., Area: 504 sq. in., Weight: 3-3.5 lbs., Engine: .25-.40 2C, Radio: 4 ch. req'd.

NO.123750, LIST $106.99 ..... Only! **69.99**

GLOBAL QUALITY KITS
CUTLASS 10

The Cutlass 10 is an exciting model for power or slope flying! The kit features die and machine cut parts, clear canopy, foam core wing, decals, hardware, and plans with illustrated construction notes. Span: 34 in., Area: 220 sq. in., Weight: 22-32 oz., Engine: .10-.15 2C, Radio: 2-3 ch. req'd.

NO.232110,
LIST $49.95 ..... Only! **32.99**

MODEL TECH
P-51 MUSTANG
POWER SCALE SLOPER

The P-51 Mustang Power Scale Sloper has been designed to give you all of the thrills and excitement of flying a WW II fighter as a slope glider. The kit features pre-built, pre-sanded component parts ready for your choice of finish; all wood built-up construction, clear vacuum formed canopy and exhaust stacks, complete hardware, and instructions. Span: 50 in., Area: 428 sq. in., Weight: 32 oz., Radio: 2 ch. req'd. A/E

NO.123635,
LIST $115.00 ..... Only! **74.99**

EZ SPORTS AVIATION
SUKHOI SU-26 30 ARF

The Sukhoi SU-26 30 is an aerobatic ARF capable of spins, point rolls, knife edge flight, Lomcevaks, and more. The kit features pre-built, pre-finished EZ component parts ready for final assembly; molded cowl, clear canopy, complete hardware, and instructions. NO building, NO sanding, NO painting...just a few evenings of EZ assembly. Span: 49.5 in., Area: 446 sq. in., Engine: .25-.36 2C/.48 4C, Radio: 4 ch. req'd.

NO.100810 ..... Only! **189.99**

KWIK BOND CAs
Industrial Strength, Commercial Purity

Four Different Formulas For Every Model Building Need!

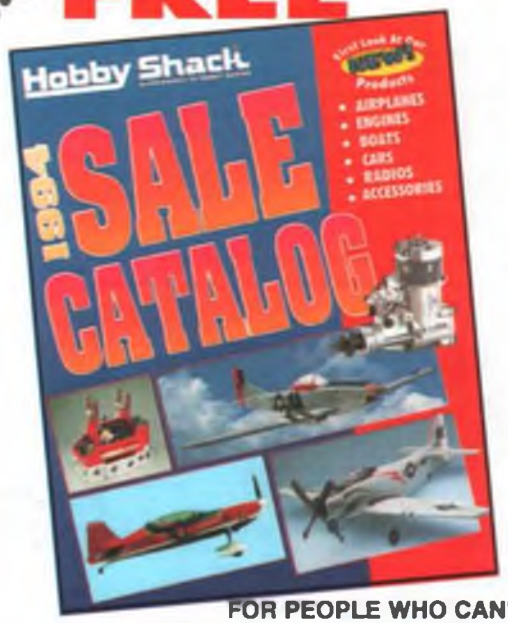
- THIN-Ultra fast cure, quick penetrating, great capillary action.
- THICK-Multi-purpose, bonds almost everything including oily surfaces.
- SLOW-High viscosity, gap filling, best for hardwoods, cures slowly.
- GEL-Super thick, longer working time, best used with activator.

CA Glues & Accessories For Every Application

1 OZ. THIN
NO.887500 ..... Only! **3.69**
2 OZ. THIN
NO.887502 ..... Only! **6.76**
1 OZ. THICK
NO.887510 ..... Only! **3.69**
2 OZ. THICK
NO.887512 ..... Only! **6.76**
1 OZ. SLOW
NO.887520 ..... Only! **3.69**
2 OZ. SLOW
NO.887522 ..... Only! **6.76**
1 OZ. GEL
NO.887530 ..... Only! **3.69**
2 OZ. GEL
NO.887532 ..... Only! **6.76**
KWIK SET 2 OZ. PUMP
NO.887540 ..... Only! **3.99**
KWIK SET 8 OZ. REFILL
NO.887542 ..... Only! **6.99**
2 OZ. DEBOND
NO.887545 ..... Only! **4.27**
KWIK-TIPS (6)
NO.887547 ..... Only! **2.29**

TRIAL PACK SAVE EVEN MORE!
One Each Of The 1 Oz. Bottles Of Kwik Bond CA.
NO.887470, Retail Value! 23.80 ..... Only! **11.99**

Yours **FREE**



FOR PEOPLE WHO CAN'T LIVE WITHOUT RADIO CONTROL!

Call today to receive our expanded, 80 page, 1994 Sale Catalog. The new 1994 Sale Catalog has everything you need to make your R/C hobby more fun than ever before. Loaded with hundreds of items at discount prices!

SEND MY FREE HOBBY SHACK 1994 SALE CATALOG TO:

NAME: _____

ADDRESS: _____

CITY: _____ STATE: _____

ZIP: _____ PHONE: ( ) _____

CALL NOW TO EXPEDITE DELIVERY OF YOUR COPY! (714) 963-9881

ORDERS ONLY
800-854-8471
NATIONWIDE ORDERING

SHIPPING & HANDLING: Continental U.S. $5.75. U.P.S. 2nd day air std. size pkg. to 10 lbs., add $10.00. Alaska & Hawaii 2nd day air to 10 lbs., add $15.00. C.O.D. available on minimum orders of $25.00, add $4.95 more. Oversize pays actual shipping charges.

Hobby Shack
18480 Bandilier Circle, Dept. MB034
Fountain Valley, CA 92728-8610

ASTRODATA'S 'BATGRAPH-DEBUG' ON-BOARD MISSING PULSE DETECTOR

This compact unit is designed to detect problems in your radio system and doubles as a personal frequency monitor. Also discussed: An update on RAM lighting systems.

Many of the larger RC clubs have frequency monitors on hand during contests and fly-ins. Properly used, this equipment can prevent an accident by indicating whether a transmitter has been inadvertently left on or if outside interference is present. Usually these monitors sweep the entire frequency band and you will only hear and/or see the condition of your particular frequency intermittently. Some monitors make it possible to switch to individual frequencies if closer monitoring is desired.

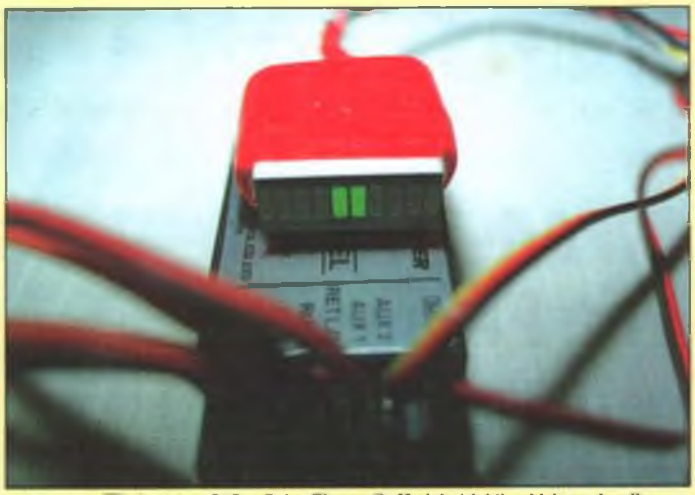
These are expensive pieces of equipment and are not usually available for ordinary flying sessions. However, Jim Wardrope, owner of Astrodata Inc., has developed a device that is capable of monitoring your frequency without having to haul out the club monitor. Astrodata's device is called a "DeBug Pulse Diagnostic Module." It's a missing pulse detector that monitors the pulse train of the transmitter/receiver link. Besides detecting radio interference, the DeBug makes it possible to detect a bad switch, a fractured receiver crystal, intermittent or shorted connections, and other problems that will cause the continuous signal pulse between the transmitter and receiver to be interrupted. It plugs into an unused channel on your receiver.

The DeBug Pulse Diagnostic Module is best used with Astrodata's Batgraph Multi Colored Peak Indicating ESV. The two devices together allow you to monitor your battery condition as well as the pulse train throughout your radio system.

In addition to the two units described above, Astrodata offers a combination unit, the Batgraph ESV with DeBug Option, which incorporates the DeBug and Batgraph ESV into one package just slightly larger than the DeBug unit alone. It is this combination unit that I've been using lately to give my Big Birds an added degree of safety.

The Batgraph/DeBug uses a row of 10 colored LEDs to: 1) show your airborne system voltage, and 2) indicate any prob-

Well-known proponent of electric power, Bob Benjamin turned out this 81-inch span Dynaflite Spitfire, powered by an Astro Flight cobalt 60 on 28 cells. Bob has prepared an article on converting large gas models to electric power, using the Spitfire as an example—watch for it in an upcoming issue of *Model Builder*.



■ LEFT: Jim Wardrope, who does business under the Astrodata, Inc. title, sent this photo of his Batgraph ESV (left) and DeBug Pulse Diagnostic Module (right), which can function as an on-board frequency monitor. There is also a third unit offered, the "Batgraph ESV with DeBug Option," that combines both units into one package only slightly larger than either of these. Columnist Bruce Edwards has been using Astrodata equipment for some time now and recently tried out the new combined unit—see text. ■ RIGHT: The Batgraph-DeBug combination unit is pictured sitting atop a JR Max 6 receiver. Here it is functioning as an ESV; counting from the left, the fifth and sixth LEDs are lit, indicating a system voltage of 5.0/5.1 volts. (The voltage range on this four-cell unit is 4.6 to 5.5 volts, measured in .1-volt increments. The unit can be ordered to read anywhere from 2 to 18 cells.)

lems with your radio signal. Under normal conditions with an uninterrupted pulse, the ESV portion of the device will activate one or sometimes two of the LEDs to display the system voltage. A missing pulse will cause several of the other LEDs to light up, making a very visible indication that something is wrong.

To test the unit, I hooked it up to my JR Max 6 FM receiver, turned on the transmitter first and then the receiver. The DeBug detected all pulses present and accounted for, therefore the LED display merely indicated the airborne system voltage.

Next, the system was turned off, then the receiver was switched on. The DeBug activated all of the LEDs to the left of the system voltage display LED, indicating that all was well and that no outside signal was present.

Finally, I borrowed an FM transmitter that was on the same frequency as my JR system. The foreign transmitter was turned on, then the JR receiver. The DeBug detected the signal and, as designed, remained in the ESV mode of display. Had I been at the flying site and seen this prior to turning on my transmitter, I would have known someone else was on my frequency or that some other source of interference was present.

Your local club may not be able to afford a frequency monitor, but you now have an inexpensive, high-quality tool to indicate whether or not your frequency is clear.

The Batgraph/DeBug combination unit I'm using enables you to find problems within your radio system by the process of elimination. Components can be replaced until the unit tells you the radio system is working properly. The offending component can then be repaired by a qualified technician or simply replaced.

Astrodata's equipment is hand-made in the U.S. and is of excellent quality. I have been using the Batgraph 4C (four-cell) ESV for several years and have experienced no problems with it. I'm planning to use the Batgraph/DeBug combination in my new Ziroli P-40, which represents a considerable investment of time and equipment. For full particulars on Astrodata products, contact Jim Wardrope at 421 S.W. Blakley Ct., Bend, OR 97702, or call (503) 389-2359.

RAM LIGHTING UPDATE

Back in the July 1993 issue I devoted the column to the night flying antics of Bennie Phillips, Bruce Lyons and Allan Poinsett. These three gentlemen had designed a lot of their own night flying systems, using some of the components from RAM (Radio Controlled Models Inc.).

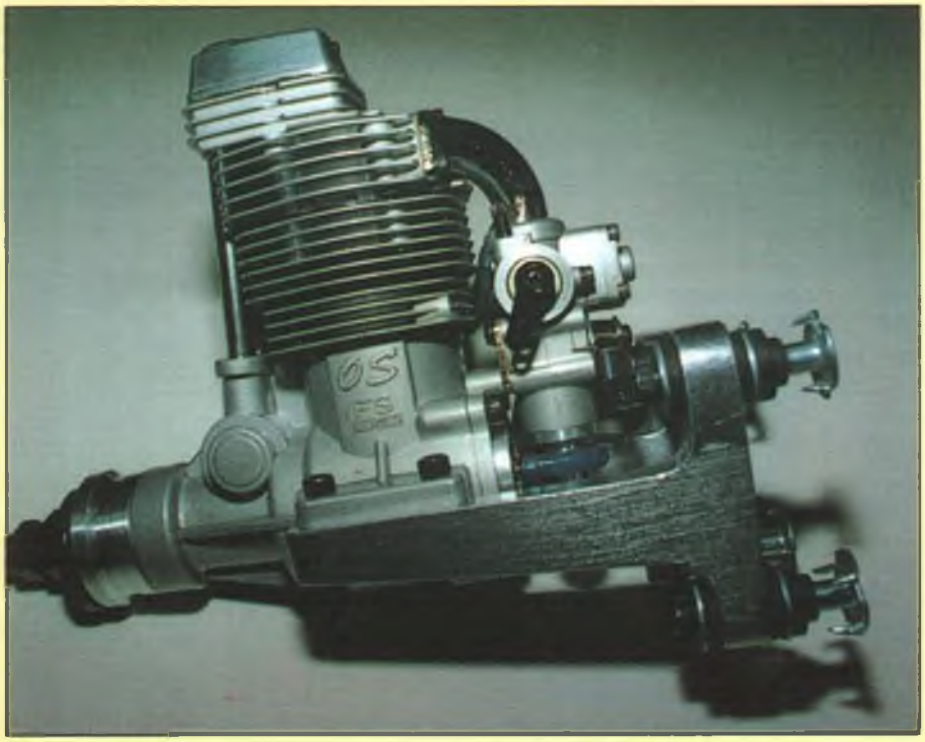
Ralph Warner, RAM's owner, wrote to say that there seemed to be some confusion about the voltages that were being applied to his components. Ralph was kind enough to include a set of his RAM 06 Sky Lights and a complete list of his lighting systems, which he has had available for the last 15 years.

In the July column I interviewed each of the individuals about their systems and the voltages applied to them. Their customized systems were working fine for them.

Thanks to RAM, you do not have to reinvent the wheel if you should decide to try your hand at night flying. If you use some of the techniques I described along with RAM's ideas and equipment, you should have no difficulty putting together a system that will reliably light up your plane for night flying.

Ralph suggested his RAM 06 system for the lights that are strung through the wings and fuselage. The 06 system furnishes three strings of lights with six bulbs per string and

continued on page 23



The latest in J'Tec's long line of engine mounts is the JT-122SV, designed for the pump-equipped O.S. 1.20 Surpass II. Note that this mount also incorporates J'Tec's "Snuf-Vibe" vibration isolators, described in the February '94 Big Birds column. Our columnist is using this setup in the Lanier Laser 200 he's building for an upcoming *Model Builder* review article.

DEAR JAKE

Advice For The Propworn

DEAR JAKE:

I read in *Model Builder* that the experts in RC scale are using gyros to make their airplanes safer to fly. This sounded good to me, so I installed a gyro in my newest scale project, a twin ducted fan F-15.

I got a pretty nice gyro for $2.95 from the local Greek takeout down the street. It was kind of soggy and hard to fit in, and it was beginning to smell funny after a while, but if it makes my plane safer, I'm all for it.

Jake, I'm here to tell you the gyro didn't work worth a darn. My F-15 crashed almost immediately. Based on the above, can you advise me on what to do next?

Pete from Garden Grove, CA

Dear Pete:

Let me speculate here. If I told you that RC submarines were becoming increasingly popular, you'd run down to the local Sub House and buy an Italian Combo with extra vinegar and oil, wouldn't you? You'd stuff some servos and a receiver in between the salami and the provolone, and tuck a battery under the banana peppers. Then you'd be baffled as to why it became waterlogged and sank when you tried it out down at the local pond, right?

You should have signed your letter "Clueless in Garden Grove." The kind of gyro you installed is pronounced "hero," and its grilled lamb and onions aren't going to help your airplane fly safer. The kind of gyro you want is metal and comes with a string you wrap around it and pull to start it spinning. You can get one at any toy store. Once it's spinning, it balances and stays upright. If you mount one in your scale model's fuselage, the airplane will balance and stay upright, too.

Next time, get some advice from an expert before you start a project, or you'll wind up installing a triple-decker sandwich in your car because you heard that the best theft deterrent was The Club.

Jake

DEAR JAKE:

I'm an avid free flighter. I've been active in it for over 20 years. I concentrate mainly on the gas events, staying away from rubber power and scale.

Things are changing fast in free flight. At least it seems that way to me. We have lighter, more powerful engines; lighter, easier-to-install coverings; exotic composite materials for lighter, stronger structures; and intriguing new designs with computer-generated airfoils.

I find all this technological progress fascinating, and I can't help but wonder what my hobby will be like in five to ten years. What do you think is the trend for the future?

Mike in Mechanicsburg, PA

Dear Mike:

I think the one sure trend is that "free" flight will cost more.

Jake

DEAR JAKE:

Recently, I disregarded all your warnings about air travel and tried to fly from Dallas to Ohio. American chose that week to go on strike, and I wound up on the only worse form of transportation—a bus. Boy, were you right! A bus trip will make you appreciate how lovely an overcrowded DC-10 can seem in comparison to the motorcoach experience.

My seat mate spoke no English. Based on the pungent cloud emanating from him, I guessed his occupation to be goat salesman. Across the aisle was a man or a woman (I couldn't tell) wearing a tunic, flailing him/herself with a horsehair flog, and chanting the Tantra. The driver was nice, though. He offered me a swig of whatever it was he had concealed in the brown paper bag,

All in all, it was a very relaxing trip. The ice storm in St. Louis was very soothing, and I arrived in Cincinnati refreshed and thoroughly at ease. I have no idea why I punched out that Salvation Army lady in front of my hotel.

I flew back to Dallas and loved every excruciating minute of the flight.

Irving in Irving, TX

Dear Irving:

They lost your luggage, didn't they? I know because I happened to be traveling that same week. My luggage didn't arrive with my flight. Two days later, the airline called and said they had found it and would deliver it. True to their word, they delivered

continued on page 55

A favorite of biplane lovers, this 1/4-scale Fleet was built from the Concept Models kit by Bob Kreuzinger. The Zenoah G-38 powered model weighs 22 pounds. Photo by Brian Lea.

BIG BIRDS *continued from page 21*

requires a 6- to 9-volt power source. A 9-volt alkaline battery is optimum. The three strings of lights that come with the RAM 06 system would probably have to be lengthened for larger planes, but that is not really a problem.

RAM's lightbulbs on the 06 system are instrument quality bulbs with a life expectancy of 20,000-40,000 hours, so the only way you'll knock one out, short of too much voltage, is a crash. Spare bulbs are readily available.

The RAM 03 Landing Light system will help illuminate your landing area as the plane approaches the runway. The RAM 03 system has two high-intensity bulbs and fixtures that are wired to work independently or simultaneously with other control functions. The power is derived from the 4.8-volt receiver pack.

A strobe light is often helpful for night flying, and the RAM 23 Strobe will provide a bright blinking light for your plane. Two AA pencells will give you 3 hours of light.

If you have any further lighting requirements or need a list of available systems, contact Ralph Warner, Radio Controlled Models, Inc., 229 E. Rollins Rd., Round Lake Beach, IL 60073; (708) 740-8726.

BIG BIRD CONTEST CALENDAR

Plans for the 1994 IMAA Festival, to be held at Arlington Airport in Arlington, Washington on July 15, 16 and 17, continue. IMAA Chapter 163 is the group doing the lion's share of the work, along with much assistance from the Boeing Hawks RC Club.

Arlington Airport is located close to the beautiful city of Arlington, which is surrounded by a very scenic area. Those of us who are fortunate enough to live in the northwest are hoping to have as many 600 Big Birds visit the Festival. See you there! ***MB***

THROTTLES, ETC. PART II

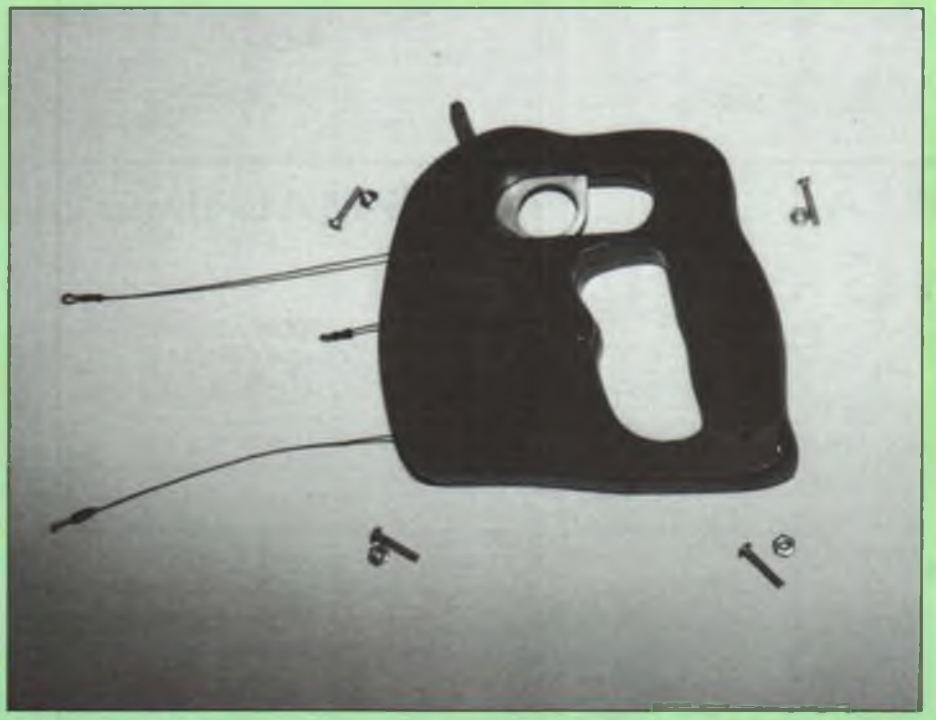
Guest columnist Orin Humphries concludes his dissertation on the intricacies of three-line control systems.

All of your planes with throttles and all of your throttle handles should be set up so that any handle will work on any airplane. Further, you should make your lines uniformly, such that any line in a set will work at any location in the setup. Otherwise, you'll one day find that your throttle won't operate full range for some mysterious reason. The following is how I set up mine.

I have used long aluminum tubing crimps for attaching the leadouts to the bellcrank, but copper would be stronger and I think I'll change to that. With the long tubing crimps, the leadouts can't work around behind the bellcrank. Arrange your leadouts so the throttle leadout emerges exactly in the middle, between your elevator leadouts. It's not crucial to bring the throttle leadout straight out, parallel to the elevator leadouts. Just use the same arrangement on all of your models.

Tie your leadouts' wingtip ends the same way the rulebook shows for control lines.

Over the years I have written that there is a dead zone in the bellcrank's throttle operation. I believed that this was due to some design flaw. I discovered during the preparation of this work that the dead zone results only from the leadouts of the handle and of the airplane not being matched. If, when the two are in the same configuration—say, trigger forward—the length difference between the center and outer leadouts is not the same, the handle won't run the throttle full range. Better craftsmanship on the modeler's part is the solution.



No matter what brand of three-line handle you use, CL expert Orin Humphries recommends taking it apart, checking it carefully for smooth operation, and replacing the leadouts before taking it to the field. The plastic sides are held in place by four machine screws and nuts.

One of the improvements I found is to do something in the opposite order to the way many of us have done for decades. Make the grommet end on the leadout material first. Then, attaching the leadout to the bellcrank or handle so that the grommet is at the place you require is child's play. Trying to get the grommet end to come out exactly where you want it as the last step in the assembly was the source of the mismatching of handle and plane leadouts. They just don't end up where you want them to. This creates the dead zones.

You must decide now whether you want high speed with the trigger forward or backward. High speed when the carb arm is forward would naturally wind up with forward trigger for high speed, but it's your choice. Loosen the carb arm retaining screws and rotate the arms 180 degrees as needed, so that all of your engines are set up the same.

Save the grommets from Perfect brand product wrappers to use in tying off the ends of your lines. Use .021-inch diameter cable for 1/2A size planes and .027-inch for larger.

Move the leadout connect point on the throttle portion of the bellcrank all the way toward the wingtip. Lock your elevators dead level with the stabilizer using sticks and rubber bands. For now, leave about 6 inches between your elevator leadouts' grommets and the leadout guide; this will give you the necessary clearance for the throttle to work and the elevators to be pulled to their limits. Attach your elevator leadouts to the bellcrank with the grommets. Make the grommet end for your throttle leadout and attach it to the throttle portion of the bellcrank with the length difference you want.

How long should you make your throttle leadout? What length difference should you have?

Unfortunately, control handles come with varying lengths between the elevator and throttle leadouts. I measured all of mine years ago and found the difference to average 3-13/16 inches between the elevator lines and throttle line with the trigger forward. Consequently, I took my handles apart and replaced the elevator leadouts. All of my handles now have the same 3-13/16 inch difference and can be used on any of my models. With the plane's centerline pulled tight, the carb not connected, and the elevator locked level, take pains to locate the leadouts with the same length difference as your handles.

It doesn't matter what length difference you choose, so long as you make them all the same and the planes match the handles. Avoiding a zero length difference at either end of the throttle range minimizes chances of hooking up the wrong line to a leadout.

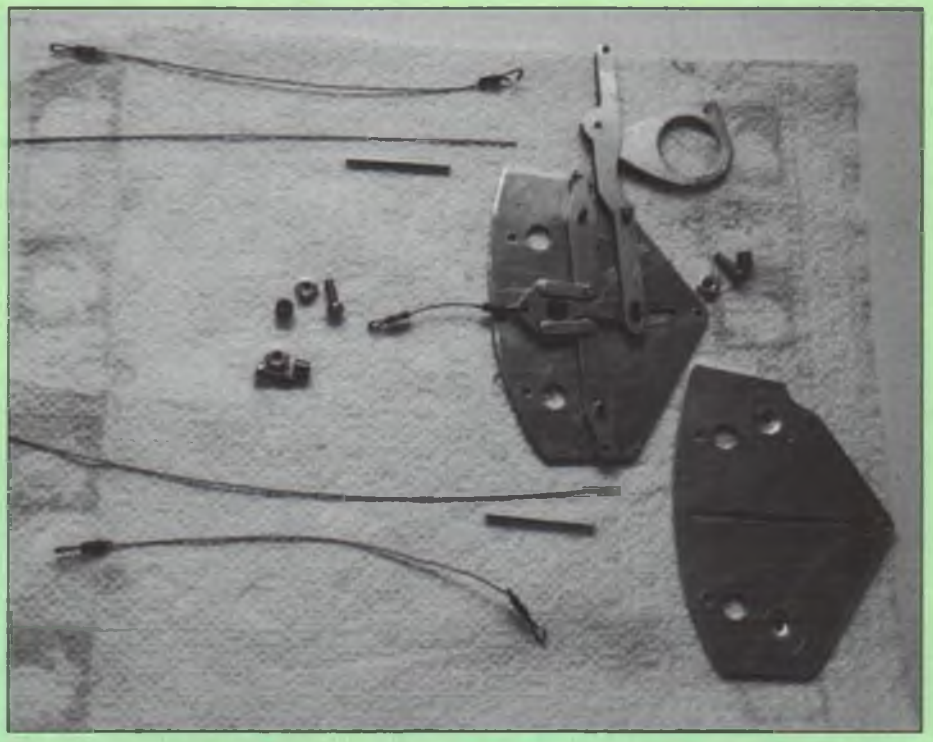
CONNECTING THE BELLCRANK

Pull the plane's outer leadouts tight, as in trigger back. Move the carb arm to full aft. Connect the bellcrank and the carb arm. This approach minimizes the sideward swing of the throttle portion of the crank that arises when the trigger approaches its forward limit.

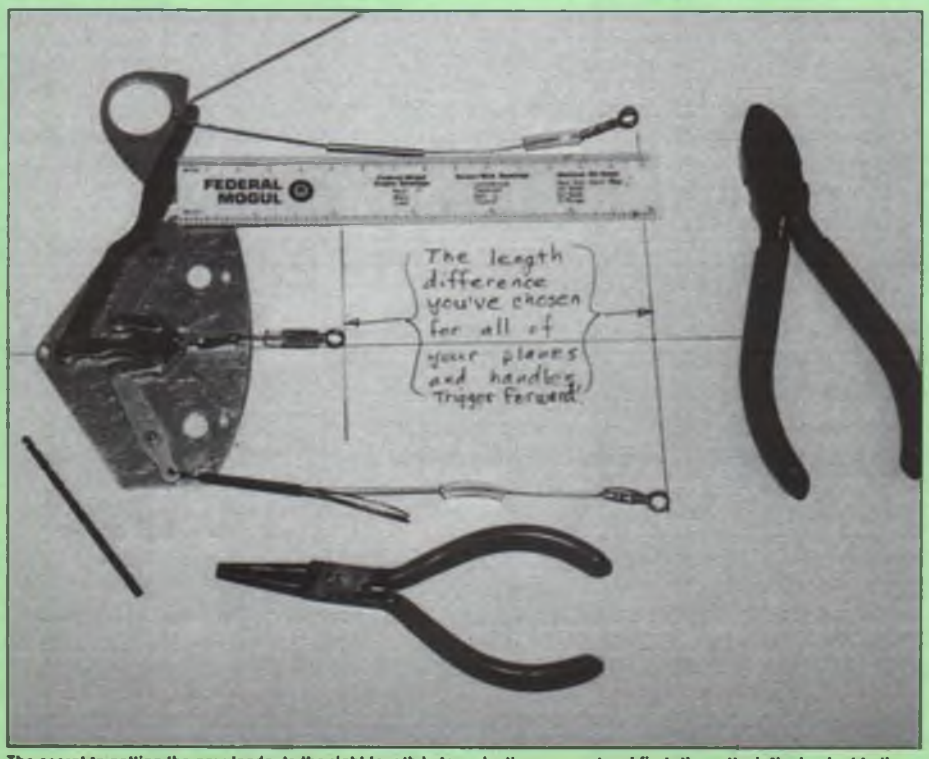
With a handle connected to your leadouts, see if the carb barrel moves through its full range. If it doesn't, try adjusting the length of the throttle rod. If this doesn't solve it, move the throttle rod one hole closer to the carb barrel's axis.

It is absolutely critical that the throttle system work smoothly and effortlessly throughout its range. Carbs with a spring inside will fight you when you try to go to low power. If you wanted trigger back for high speed, just be sure your carb arm is located properly to do that.

It is time to give an alternate method some space. A friend, John Hall, prefers to make up line, leadout and handle sets that are unique to each airplane. He avoids the troubles I mentioned by never disconnecting the sets. They stay together, bagged up and tied to the wing during off times. This, however, requires numerous handles.



This is what the mechanism inside the handle looks like. After cutting off the leadouts, the metal parts should be carefully checked for smooth operation and deburred as needed, including smoothing the edges of the slots in the frames. Also, round the corners of the leadout holes in the bellcrank to prevent premature wear on the leadout wires.



The secret to getting the new leadouts the right length is to make the grommet end first, then attach the leadout to the bellcrank. The difference in length between the elevator and throttle leadouts is the 3-13/16 inches mentioned in text.

HANDLE

Maybe 60 percent of handles are glitchy out of the box. A leisurely hour of tweaking will provide a smooth handle for the rest of your life. *(Columnist's note: Orin will do the "tweaking" described below for $15, including return postage. He can be contacted at the address at the end of the article. Tell him the leadout length difference you want.)* Here's how to do it yourself:

First, the hole for the trigger is larger than most people's fingertip, so my buddy, Stan Johnson, came up with the idea of adding scrap balsa to the backside of the hole to eliminate the slop. It feels much better.

If you are using my approach, you will be replacing the handle's elevator leadouts to get the length difference the same for all your planes, so you should do a few things to make it work smoother.

Remove the sides of the handle and take the metal frame apart. Feel the edges where the sheet metal was stamped out. If you find any rough edges where moving parts rub, smooth them with a small file. Wherever there are scratches on the frames, smooth the ends of the parts doing the scratching. Don't take too much off. To prevent the center leadout from hanging up, file a rounded edge onto the inner edges of the frame next to it, at the front. Put a little lubricant on the contact areas. Three-In-One oil dries to a solid and Marvel Mystery Oil evaporates. Use something else.

The elevator leadouts should be replaced with .027-inch cable. Use copper tube crimps to secure them to the handle. Make them long enough so that the end will be outside the handle housing when the trigger is all the way back. This way they can't hang up when you get nervous and get the handle ahead of your airplane or behind it, and there's an angle there.

Make the crimps parallel to the frame faces. Note: the rulebook states in Paragraph 5 of the Control Line General section that no fewer than three passes of wire through a modeler-made crimp are mandatory for control lines. I treat leadouts the same. With the trigger forward, make the

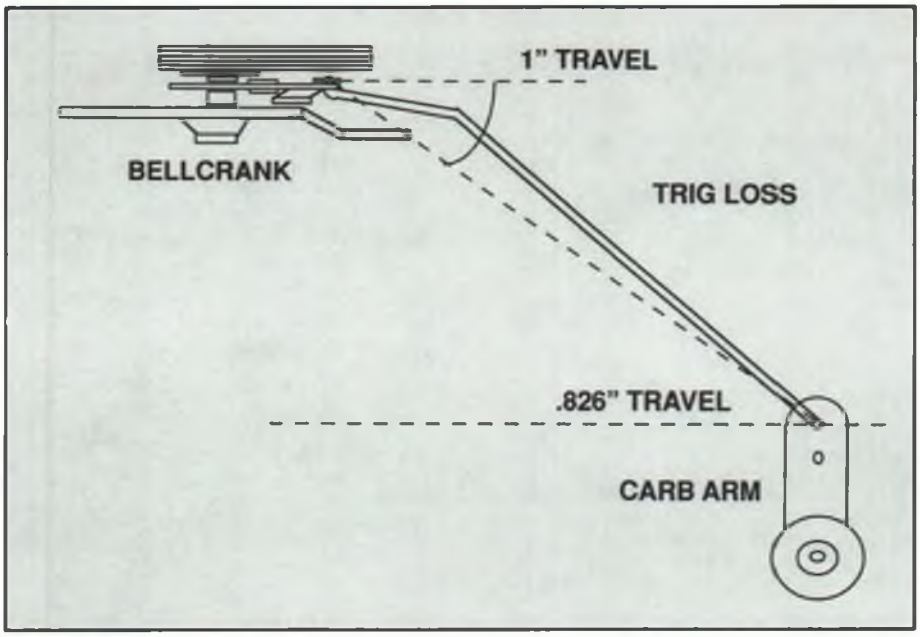


Diagram illustrating the loss of throttle pushrod travel when the bellcrank and carb arm are not in line with each other.

length difference between the elevator and throttle leadouts what you have chosen (I'm stuck with 3-13/16 inches).

Make the grommet end of the handle's leadouts first and then attach this with the long tubing. It's much easier to hit the length difference you want this way. I make a paper gauge to get the length I want. Put the handle back together.

LINES

The three control lines form a crucial link in the system. They must be of equal length, if they are intended to be usable on more than one airplane, or different leadout positions on the same plane.

If you want to make a competition project, check the rulebook for the required line diameter and length before heading for the hobby shop. I buy Sig line kits from my local hobby store if the plane is for competition use because the line lengths are specified to tight margins.

Sig has in the past always put extra line on the reel. Tie off the lines at the length you will determine for your particular wingspan and leadout length. Measure from the center of the grip of your handle to the centerline of the fuselage, including line connector lengths, leadouts at both ends, and handle span.

Pylon brand lines come with both ends ready made; the length they have chosen may or may not fit your competition needs. They may work for sport projects. You could buy two of their two-line sets (they don't make three-line sets) and keep one line as a spare. You could also buy them longer than you need, cut them down, and make new terminations on one end.

I recommend that you buy only one-piece connectors that have the strength test printed on the wrapper. Save the wrapper for the contest judges. The burden of proof of their strength is upon the entrant, according to the rulebook. I can't remember ever having been asked to show proof. Note that you may use only one connector per end of a given line. That is, you may not use additional connectors on a given line end to adjust for a poorly tied line/leadout system.

Tying the lines to the same length plus or minus no more than 1/16 of an inch is a process requiring patience and craftsmanship. It is tedious and exacting work.

Keep in mind that the lines are springy. They stretch to noticeably different lengths with just small changes in line tension. When you tie the next line the same length as the last one, keep them at the same tension.

I make the first end on all three lines in a Sig set with a tubing crimp. A board with two nails is laid on the lawn or in the driveway and all three lines have their grommet slipped over one nail and run out full length. To make your lines a certain length, stretch a tape measure alongside, starting from the other nail.

Measure the following distances (everything that is not actual control line): a) from the plane's centerline to the center leadout when it is pulled tight and the throttle is not connected; b) the distance from the center of the grip of the handle to the handle's center leadout with the trigger all the way forward; c) twice the length of a line connector. Add it all up. Subtract it from the radius of the flying circle you want—say 60 feet. What you get is the length for the lines themselves.

The use of the wire wrap method at the second end will allow for easy correction. Getting the next line to be the same length is all in the fingertips. Be sure you have both lines between the same thumb and finger tip for tension. Never hold one line in each hand. You don't want a difference between succeeding lines, and one arm will pull harder than the other. Re-tie the different one if you miss it.

The third line is to be held between the same thumb and finger as the first two for equal tension in all three lines. Don't let any line be in the crack between finger joints. They should all be out on a finger pad. They should not be touching each other. Make the third one the same length as the first two.

If you miss getting things the same length, the system usually still works, but will have dead zones at one or both ends of the throttle range. Connecting the rod to a closer hole on the carb arm should take care of that. The trigger won't move as far to accomplish full operation.

LINKAGE

That's everything outside the airplane in detail and a glossing over of things inside. We must now look at the throttle rod and its routing.

Looking at it from the side, if the rod is not level with the fuselage when connected to both the carb arm and the bellcrank, you will not get the full range of travel. Trigonometry will take some away from you. If for some reason you can't put the bellcrank at the same level as the carb arm, simply connect the rod to the arm one hole closer to the carb barrel's rotational axis. This will give you the barrel rotation you need. It doesn't matter what route your throttle rod takes getting to the carb arm. It may bend around anything that is in the way. There is, however, no manner of bending it that will eliminate the trigonometric loss of travel

continued on page 81

THE 1918 SOPWITH SWALLOW

The second half of the author's presentation of his outstanding electric-powered Precision Scale WWI model. This month: construction and detailing. Full-size plans for the Swallow are available from both Airdrome and *Model Builder* Plans Service.

CONSTRUCTION BY STEVEN L. STRATT

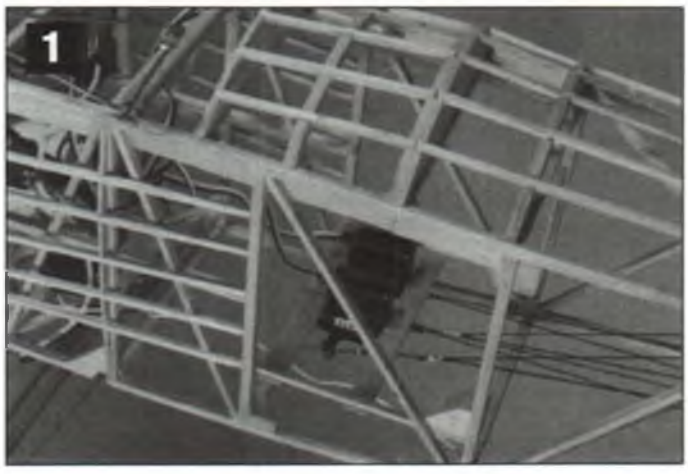
As a tenacious lover of scale and intriguing detail, the WWI and Golden Age aircraft of the '30s have long been my "dreamer's" domain. Most aircraft of these periods greatly resemble large versions of the beautifully crafted free flight balsa models that prevailed in the U.S. prior to WWII and still dominate in Europe.

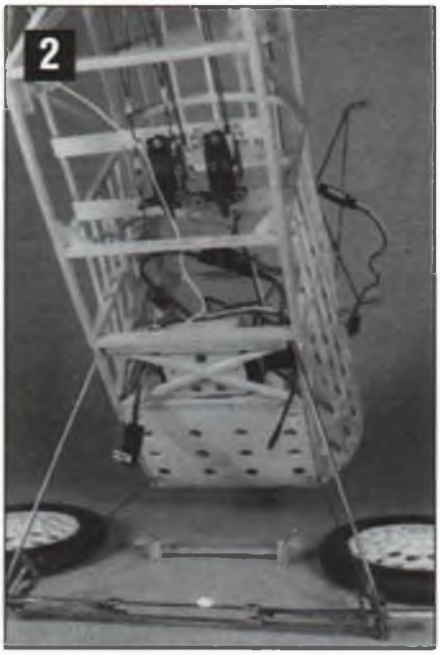
All of the models in the Airdrome hangar are meant to take advantage of the rapidly evolving interest in electric power, thus they all share one essential trait: light but strong classic balsa structures with little hardwood or plywood. The Swallow's basically easy-to-build, squared, boxy 3/16-inch square balsa-framed "Camel" fuselage is a perfect example of this similarity in simplicity.

Unfortunately, when the finished Swallow is viewed by today's average "ARF" modeler, it is too quickly dismissed as a hopelessly difficult project, as it couldn't possibly be completed in less than four days!

Hopefully this brief summary of how to build the model will dispel such pessimism. It will require approximately 90 days for an average

ABOVE: Ain't she a beauty? With its fidelity to scale and excellent handling in the air, it's no wonder the Swallow took top scale honors at the 1992 KRC meet. An important point stressed by the author is that despite the intricate detailing you see here, the model is actually not at all difficult to build. True, the plans are loaded with scale details, but once you get past all that, you'll see that the airframe itself is really quite simple, very similar to an Old Timer free flight ship. When it comes to detailing, one of the most intimidating features is all that swirl-pattern aluminum around the nose, but you can avoid that by modeling the later version of the Swallow, which had a gray-painted cowl and paneling back to where the fuselage fabric starts. If you don't plan to fly in scale competition, you can also simplify things by going to a one-piece straight axle, eliminating the cockpit detail, etc.





balsa-cutting, kit-seasoned builder to complete. Furthermore, the builder can omit many details if restricted by time, patience, domestic opposition (not unheard of!) or skill limits and still produce a rare, unique, historical scale model for electric or wet power. The plans show both, with emphasis on electric.

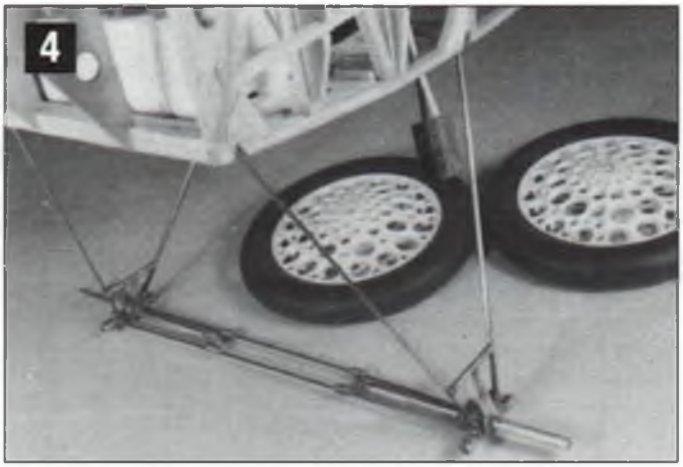
•**Photo #1. The** fuselage is basically a 3/16-inch square medium balsa truss frame with formers and stringers on the top and the sides from the nose to the rear of the cockpit area. Note that the curvature of the cockpit sheeting is insured by the stringers over the cockpit opening, which is cut out after the top sheeting is finished.

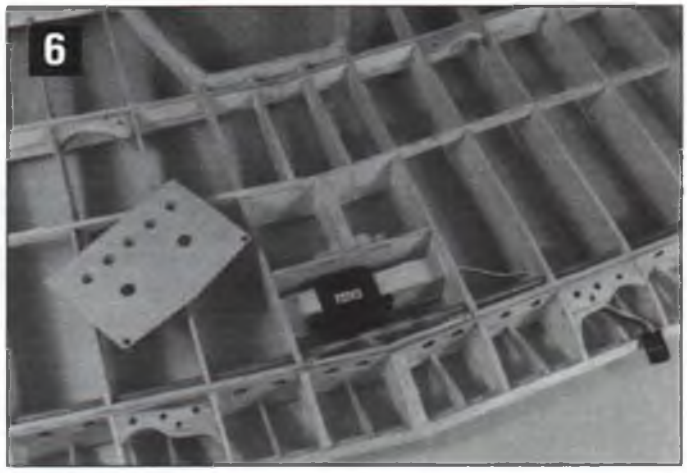
The latest revised plans show the illustrated, much simplified continuous loop cable control system. The Futaba S-133 servos are mounted inverted on 3/32-inch ply rails, and the cables are 36-pound black Dacron, woven, non-stretching trolling line. They are permanently attached by crimped aluminum tubes and a drop of thin CA to a short wire eyelet rod (bent from a large paper clip) that slides into a common servo connector. That's all the adjustment you really need. The plans show how the yoked lines to the elevator are attached to the servo cable yoke.

•**Photo #2.** This bottom view shows the eyelets to the servos and the yoked lines to the elevators. The plans show a removable hatch for the servos and another for the motor battery and receiver battery charge plugs forward of it. The balsa "X" brace supports a 1/32 ply mounting base for the Futaba R127DF receiver. The perforated battery hatch is simply a 1/16 ply base sandwiched to a hard balsa exterior sheet sanded to the nose's bottom contour.

The 3/32-inch music wire landing gear is typical WWI style—a "V" cage with a separate shock-mounted (bungee cord) axle. In this case, however, the axle is split into two independent half-axles—a common Sopwith design practice that imparted a peculiar knock-kneed look to all Sopwith aircraft on the ground. If you're building a "sport scale" version of the Swallow you may choose to go with a one-piece straight axle. The bungee cord at the intersection of the V struts provides much-needed shock absorption—don't omit it. The plans show the scale wheel tread as well as a slightly wider tread for better ground handling and resistance to ground looping.

•**Photo #3.** Top view of the nose section shows the 1/16 music wire cabane struts bound to maple cross braces with 15-pound nylon fish line. Small lengths of fuel tubing were slipped onto the cabane

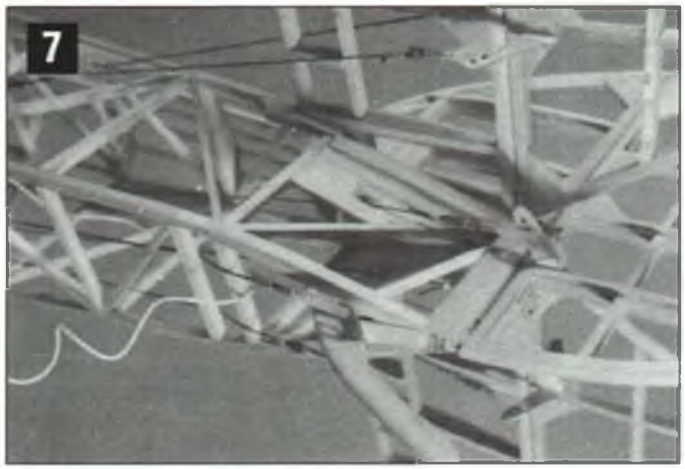


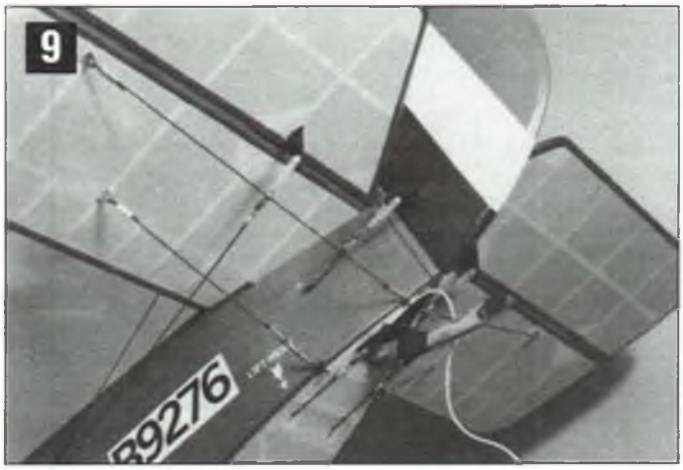


diagonals and positioned at the X contact point to prevent radio interference. The black rectangle on the left side of the nose section is the Astro 207 speed control, and to the right is the Futaba 250-mAH radio battery. The original Astro 15 motor battery seen here is topped by the 30-amp fused harness that SR Batteries made for me, with all Sermos connectors.

•**Photo #4.** At the upper left you can see a pair of 1/16 ply vertical supports for the original 1/16 ply motor mount. This has been changed to a 1/8-inch ply mount to suit the Astro 25 and 40 motors, and the verticals have been eliminated.

Seen here, the scale Sopwith split-axle landing gear is ready for balsa airfoil-shaped strut cladding. Note the aluminum tube covered T-shaped axle movement limiting frames that conceal 3/32-inch music wire soldered to the main "V" struts. Looks complex but it's really simple, light and strong, and has re-





mained undistorted after many landings.

Perforating the Williams Brothers 5-inch wheels saves only about 2 or 3 ounces and is really unnecessary with the powerful Astro 40 system now installed in my model. Use this method only for a really light sport/fun scale model in the 15-25 motor size.

•**Photo #5.** Wing structure is quite simple with scale rib spacing and false ribs at the leading edge. The entire wing is shown on the plans. Most ribs are 3/32 medium balsa with a few thicker ones at the center area and at the rigging attach points. The constant chord makes rib cutting simple. Vertical-grain balsa shear webs go out to the tips.

To save weight, don't use aileron bellcranks. The Swallow's huge wing chord provides ample room for a non-binding curve for Sullivan flexible (red) aileron pushrods. Rigging brackets of 1/32-inch sheet brass are used throughout.

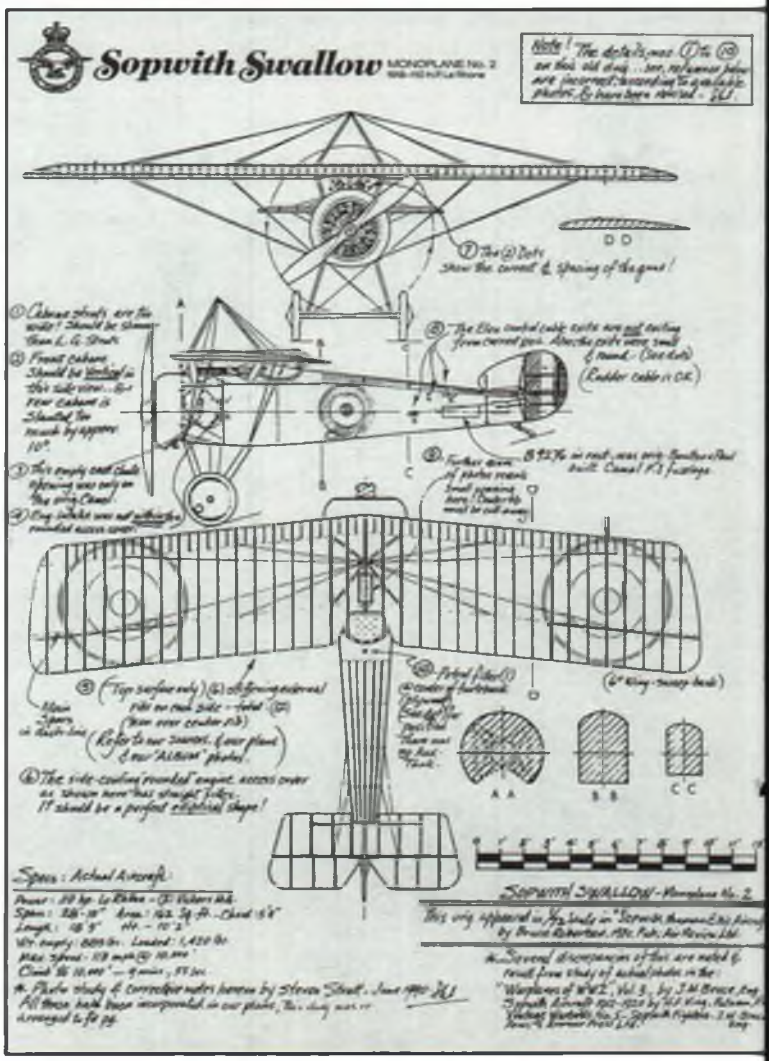
•**Photo #6.** Aileron servo compartment is covered with a lightweight built-up hatch on the underside. The servo is a Futaba S-133.

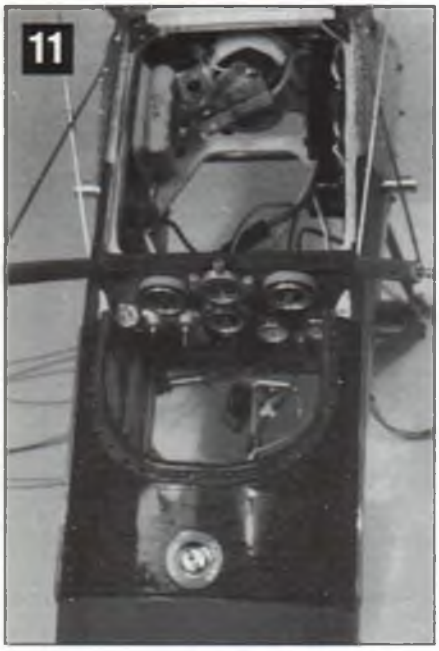
Hardwood cabane strut mounting blocks have been carved away somewhat to reduce weight. The aileron servo connector that aligns with the forward-right side cabane strut for concealment in final assembly can be seen here.

•**Photo #7.** The elevator and rudder control cables exit through 3/32 balsa inserts which are flush with the fuselage sides and serve as "islands" for the covering. The tail is basically a flat framework that receives 3/32 balsa caps top and bottom, which are then sanded to give the stab a scale airfoil shape. Several 3/16 balsa gussets are placed to anchor your favorite flexible hinges, control horns of 1/16 ply, and rigging points.

The scale steerable tail skid is a sandwich of 1/16 ply at the center, flanked by 3/32 balsa for an airfoil section. Don't forget to add a tiny drop of CA at all of the crimped aluminum tubes that secure the control cables! Under stress, cable has been known to slip out of even

Proof-of-scale three-view drawn by the author for scale documentation. An 8-1/2x11 copy of this drawing is included with the plans.

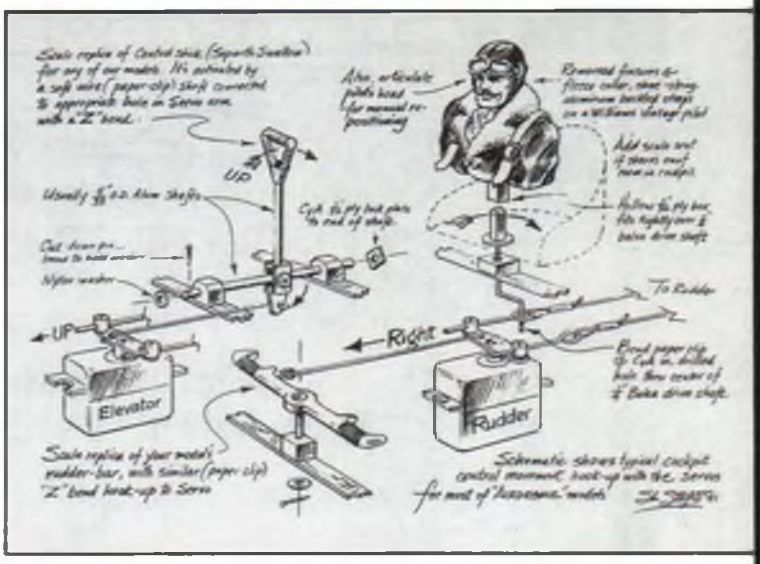




90-degree double crimps! And don't worry about flutter. A reasonably taut system has never fluttered for me yet since 1978, and I'm a lousy, wild model pilot!

•**Photos #8 and #9.** The covered empennage displays its scale rigging and cable controls. I enlarged the tail surfaces by about 15 percent, but the plans also show exact scale outlines for more daring scale fliers. The recommended olive drab Solartex woven fabric covering is amazingly strong and scale-like. To save weight you can omit the three coats of polyurethane gloss clear I sprayed on for a satiny-matte look. That's "antique" Solartex on all bottom surfaces.

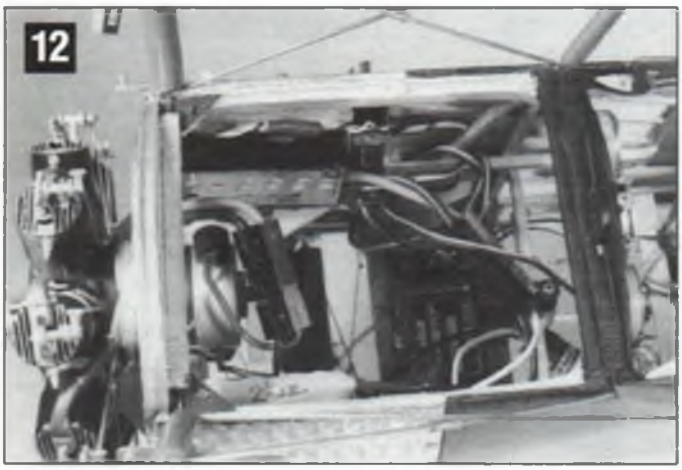
•**Photo #10.** And now for the art of fooling the eye, otherwise known as scale detailing. It's easier than it looks if you follow the hints

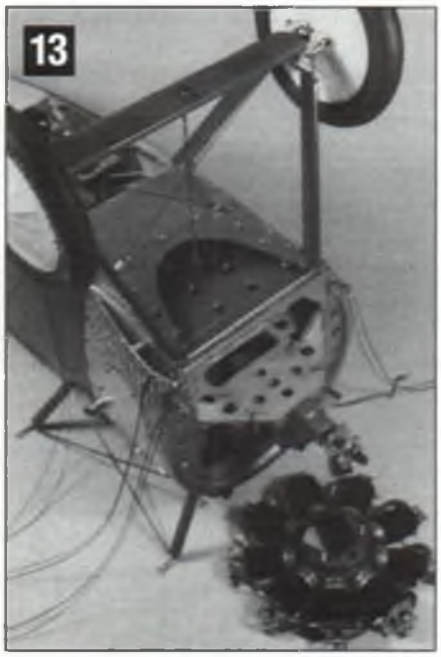


Sketch showing how the cockpit controls and pilot's head are actuated by the servos in the author's model. A similar sketch of the tail surface cable controls hookup and one of the electric power system wiring are supplied when you purchase the Swallow plans.

bination set for about $10.00. After adding the swirl patterns, be sure to spray the cowl with clear Krylon (or a fuelproof clear coating if you share your field with gas fliers) to keep the metal from tarnishing.

•**Photo #11.** The Swallow's cockpit instrument layout is really unknown, but since a standard Camel fuselage was used in modified





presented here. These cosmetic touches can be limited by your available time, patience and skill.

In Part 1 of this article I mentioned that you can opt for a plain gray nose section as used on the later Swallow prototype (a laminated balsa ring cowl will suffice for this) and eliminate the aluminum pot and fancy aluminum paper burnished "swirl" patterns. The aluminum cowl I used came from the bottom half of a Woolworth's 3-quart double boiler pot com-

form, we can guess that it was basically similar to the typical range of Camel instrumentation. This view shows my conjectural cosmetology on this always appealing subject. The triangular spade grip and the rudder bar are probably 100 percent accurate, as they don't seem to vary. Beware of Wylam drawings that took great but show imaginary controls. Note the recessed single petrol cap behind the cockpit, as opposed to the two on all standard Camels.

The "instruments" are glossy direct positive photostats from sheets that I pack with Airdrome plans. No acetate cover is necessary. The bezel rings are slices of aluminum cigar tube or similar size brass tube, carefully cut with your Dremel disc. Yes, they are easily bent and deformed, but keep at it until you get good ones.

All Camel photos show the instruments to be raised out of the mahogany panel, hence those gray disc bases you see separating the instrument faces from the panel's surface. They are simply sealed balsa discs doped gray.

The leather cockpit coaming came from an old jacket of mine, with waxed shoemaker's heavy thread stitching its way through tiny slices of 1/16-inch O.D. brass tubing. The scale plywood paneling is simply art store printed mahogany wood grain on paper, sprayed glossy. The two 7/16-inch O.D. aluminum tube scale engine carburetor intake pipes on either side of the nose section are actually motor (left) and RC

continued on page 80

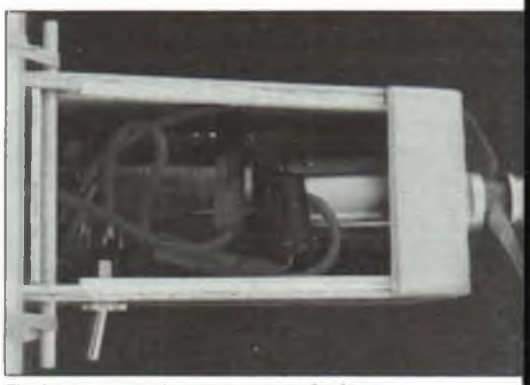
THE AVEOX BRUSHLESS MOTORS

These new motors are the most exciting breakthrough in the field of electric power in several years.

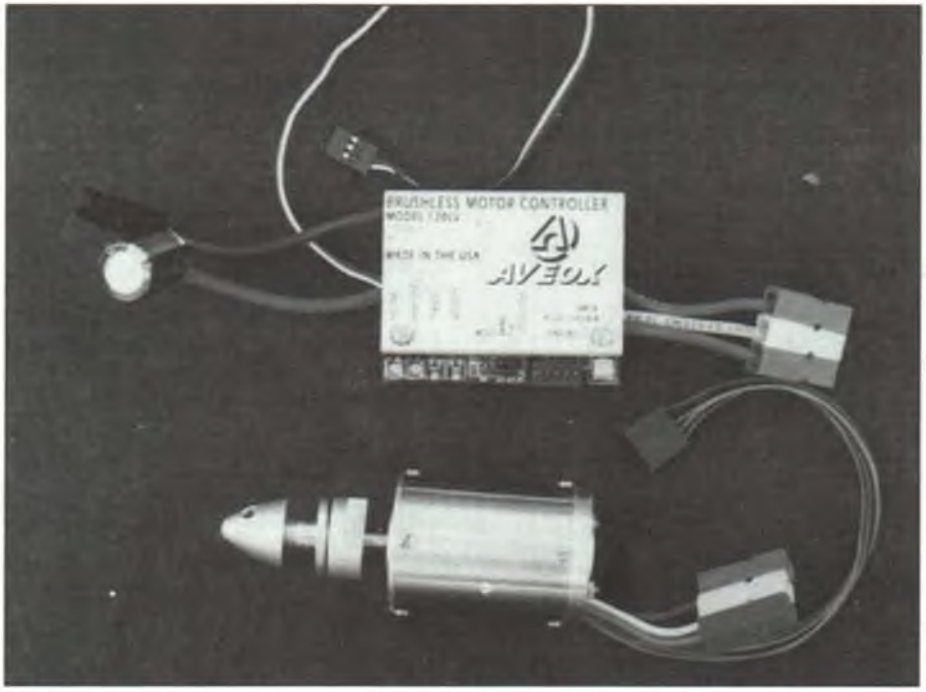
As promised, this month we have a full report on the new brushless motor system from Aveox, Inc. Figure 1 shows the main difference between it and a standard brush motor. In a brush motor, the permanent magnets are attached to the motor housing and the windings are terminated at the commutator. Current is supplied from the battery through brushes that touch the commutator (Figure 2).

As you know, every magnet has a north and south pole; the north pole of one magnet will attract the south pole of another magnet. In a brush motor, the second magnet, an electromagnet, is created when current flows through the windings of the armature. As the electromagnet is energized, its north pole is attracted to the south pole of the permanent magnet and vice-versa, making the armature spin inside the motor housing.

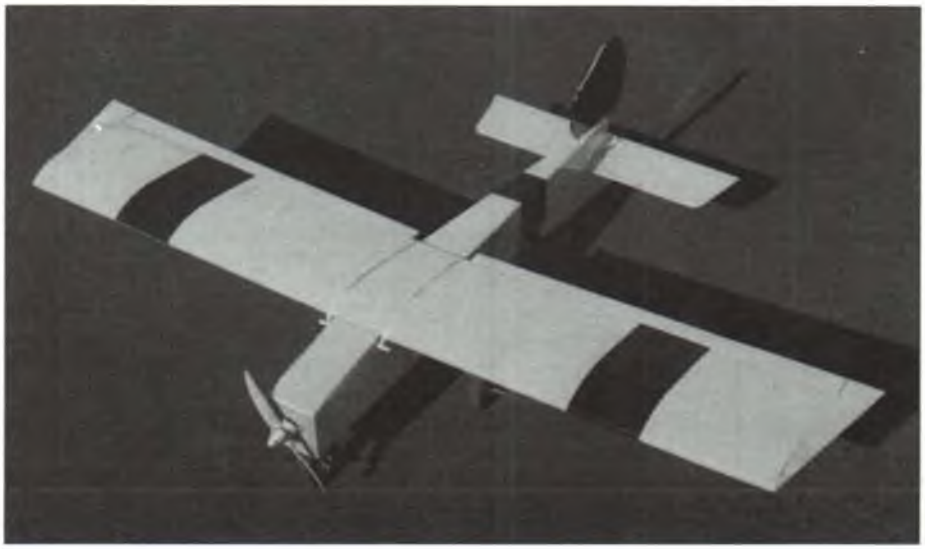
Once the north pole of the permanent magnet meets the south pole of the electromagnet, the commutator breaks the circuit with one set of windings and makes contact with the next. The armature is wound so that the magnetic polarity is shifted when the next set of windings is energized. Opposite poles of the two magnets continue to attract each other and the motor keeps turning.



The Aveox motor and controller installation in the Stik-E. Motor is mounted to the plywood nose plate in a conventional manner, i.e. via screws through the plate and into the motor's front housing.



■ ABOVE: The Aveox AVX 1409/5 brushless motor and its companion controller, as tested by our columnist. This motor is rated at a nominal six to eight cells, but Roger flew it on both seven and 12 cells at Aveox' request. Note that the connectors are the high-capacity Sermos type and are polarized to prevent accidental reverse hookup. It's important to realize that you cannot buy just the motor and expect to use it with an ordinary electronic speed control. The Aveox motor can only be used with the Aveox motor controller, as it is this special unit that electronically controls the current flow to the motor—in effect, doing what the commutator and brushes do in a regular brush motor. ■ RIGHT: To test the Aveox motor, Roger built up a Global Quality Kits "Stik-E," designed for 05 motors. Major considerations in choosing this model were its ease and speed of assembly, and the fact that the fuselage is big enough to accept the somewhat larger-than-normal Aveox motor controller.



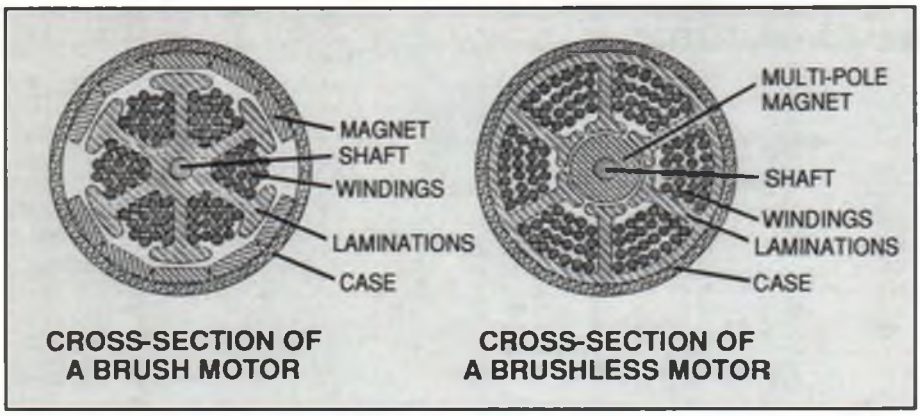


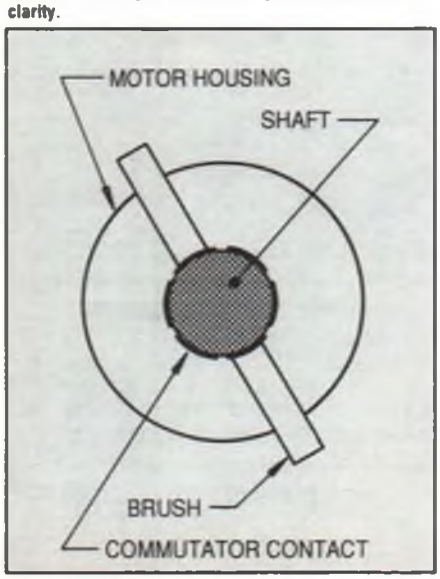
Figure 1. The major differences between a common brush motor and the Aveox brushless motor is demonstrated in this cross-sectional view through both types.

As its name implies, a brushless motor has no brushes because the locations of the permanent magnet and the windings are reversed (refer back to Figure 1). Now the permanent magnet is on the motor shaft and the windings that make up the electromagnet are attached to the motor housing. The current flow direction still must be switched at the proper time to keep the motor running, but since the windings are now stationary in relation to the motor housing, we have no information on the whereabouts of the windings in relation to the magnets. A new way to switch the current flow must be employed.

The answer lies in magnetic sensors placed inside the motor. With just a few sensors and some electronic circuitry, the motor controller can ascertain where the armature is in relation to the motor housing and the windings. With this information the controller can determine which windings to energize to keep the motor spinning. The brushless motor has no parts subjected to constant electrical arcing and high temperature. Aveox says their motor is more efficient than a traditional brush motor, since there are no resistive losses associated with the brush contacts.

Brushless motors have actually been around for quite a while. The engineering required for our particular use—high output, high current and small size—has not been available until recently, and Aveox is capitalizing on this breakthrough in technology.

Figure 2. Cross-section of a typical brush motor at the commutator. Magnets and windings are not shown for clarity.



MOTOR CONFIGURATIONS AND EFFICIENCY

Currently there are five types of Aveox motors available, ranging from a three-turn, seven-cell model to a seven-turn, 16-cell model. Aveox sent me the AVX-1409/5, a five-turn motor recommended for six to eight cells. Although the motor is rated for eight cells, David Palombo at Aveox asked me to run 12 cells—more on this a bit later.

A number of months ago some members of our local electric flying club did a dynamometer test on the next larger motor, the AVX-1412/5, rated for up to 14 cells. They found that the motor efficiency is consistently above 80 percent—not quite the 90 percent that Aveox claims, but still excellent for a mechanical motor.

Aveox also sent me some static-test data, summarized in Table 1.

HOOKUP AND ADJUSTMENT

Hooking up everything and calibrating the motor controller couldn't be easier. The motor requires two separate connections to the control unit, one for the motor windings and one for the magnetic sensors. There are three wires from the windings that terminate in color-coordinated Sermos-type connectors. Matching wires come from the motor control unit, so there's no question as to which wire goes where. The magnetic sensor wires terminate in a computer-like connector that plugs into the motor controller. The controller's battery leads also terminate in Sermos connectors. Everything goes together in a matter of minutes. There isn't a lot of extra wire on this equipment, so you need to make sure that the motor control unit can be placed right next to the motor.

The motor controller also needs to be adjusted to your radio. There are two small controls on the unit that set the maximum throttle and the throttle cut-off positions. Two lights on the circuit board help you find the proper adjustment settings.

There was a compatibility problem between Ace and RCD receivers and the early production Aveox motor control units. The signal protocol of these receivers was not one that the control unit could understand. Aveox has fixed this problem and the control units currently in production should have no problems with these receivers.

TABLE 1—AVEOX MOTOR PERFORMANCE
(Data supplied by Aveox, Inc.)

Motor	Prop	Cells	Voltage @ Controller	Current	RPM
AVX-1409/3	8x4 Graupner	7	6.6	42	13,200
AVX-1409/4	8x4 APC	7	7.4	25	12,000
AVX-1409/4	8x4 APC	8	8.0	28	13,000
AVX-1409/5	8x4 Graupner	7	8.3	18	11,200
AVX-1409/5	8x4 Graupner	8	9.0	21	12,000
AVX-1409/5	9x6 Graupner	7	7.2	27	8,500
AVX-1409/5	10x6 APC	7	7.2	31	8,200
AVX-1409/5	9x6 Graupner	8	7.8	30	9,000
AVX-1409/5	11x5 APC	7	7.0	35	7,400
AVX-1409/5	8x4 Graupner	10	10.5	26	13,500
AVX-1412/5	11x5 APC	7	7.5	26	7,200
AVX-1412/5	11x5 APC	8	8.2	30	7,600
AVX-1412/5	11x5 APC	10	9.2	35	8,400
AVX 1412/7	12x7 APC	7	8.0	16	5,300
AVX-1412/7	11x6 APC	10	10.7	19	7,400
AVX-1412/7	11x6 APC	16	15.4	31	9,500
AVX-1412/7	12x7 APC	14	13.3	36	8,000

FLIGHT TESTS

I have to confess that I had nothing to test the Aveox motor in, so off to the hobby store I went and came home with a Stik-E kit to use as a test-bed. The Stik-E is an 05 electric sport plane fashioned after the ever-popular Ugly Stik. Aveox had asked me to use 12 cells to make the comparison to a 15-size motor, so I complied with pleasure—anything just to build a new plane! The 12-cell pack, the motor and motor controller fit just fine in the plane along with the radio gear.

My Stik-E has a 44-inch wingspan, a wing area of 352 square inches and a ready-to-fly weight of 56-3/4 ounces. Table 2 shows the static test results including my formulas for flight performance as described in the May 1993 *Model Builder*.

TABLE 2—AVEOX MODEL AVX 1409/5 STATIC TEST

Test Model Wing Area ..... 352 sq. in.
RTF Weight (12 cells) ..... 56.75 oz.
RTF Weight (7 cells) ..... 49.75 oz.
Wing Loading (12 cells) ..... 23.2 oz./sq. ft.
Wing Loading (7 cells) ..... 20.4 oz./sq. ft.

12 CELLS—1 VOLT PER CELL

Prop	Amps	RPM	Input Power (W)	Power/Wt.	APR
APC 8x4	41	13,800	492	8.67	0.3734
APC 8x6	47	12,380	564	9.94	0.4281
APC 7x4	26	17,000	312	5.50	0.2368
APC 7x6	39	14,600	468	8.25	0.3552

7 CELLS—1 VOLT PER CELL

Prop	Amps	RPM	Input Power (W)	Power/Wt.	APR
APC 8x4	19	11,600	133	2.34	0.1152
APC 8x6	24	10,500	168	2.96	0.1455
APC 7x4	14	12,900	98	1.73	0.0848
APC 7x6	18	12,000	126	2.22	0.1091

The first set of values in Table 2 are static tests with a 12-cell battery pack; the second set is for a seven-cell pack. As you can see, the 12-cell pack should do the job very well, as the APR values are well above my 0.15 cutoff level. The seven-cell pack might do the job with the 8x6 prop, but the rest of them seem hopeless.

With the 12-cell pack and the APC 8x6 prop, the Stik-E flew like a champ. It was off the ground in just a few feet, climbout was smooth and all aerobatic maneuvers were possible at full throttle. This particular plane flies a nice cruise at half-throttle, saving the batteries and extending the flight time considerably. Throttle response is smooth but a bit sensitive at the high end. I did not experience any radio glitches during any of my flights.

The 8x6 APC prop loaded the motor to 45 amps, so I had to contend with some heat. The plane had very little air circulation (oops!), so the hatch had to be removed and the batteries cooled before I could fly again. The batteries took the brunt of the heat; the motor and controller stayed relatively cool.

Since there is so much power available with the motor, I tried propping it down by flying with an APC 7x4. Performance was a little less lively but still very easy to handle. Aerobatics were still crisp, but there was a noticeable reduction in power. Static current draw went from 47 amps to 26 amps, so the flight time was appreciably longer.

Finally I tried the Stik-E on seven cells and the 8x6 APC prop. As I expected from looking at the performance parameters, the plane flew, but climbout was slow and maintaining enough speed just for a comfortable cruise was a chore. The plane flies on seven cells, but I wouldn't recommend it.

IMPRESSIONS

The Aveox motor is easy to operate and requires very little maintenance. It is also the same diameter of most ferrite motors, making it simple to use in new aircraft and easy to adapt to existing models. Because it has no brushes, it has no protrusions on the sides of the housing, making fuselage design and installation easier. The efficiency of the motor is fairly consistent through a wide range of operating conditions.

The Aveox motor is slightly heavier than a comparable cobalt or ferrite motor system. My motor weighs 8-1/2 ounces and the controller weighs 3-1/2 ounces, for a total of 12 ounces. The weight of a comparable cobalt 15 system would be about 10-1/2 ounces for the motor and traditional speed control. I think that this motor system is very competitive with other systems of its size. However, based on its size, weight, cost and my flight tests with it on seven cells, I do not think this particular Aveox motor system is comparable with smaller size (035 and 05) cobalt systems.

The Aveox motor controller is rather bulky. Granted, there are many things this controller has to do, but none of it is any good if it won't fit in a fuselage. I had to pick my test aircraft based on whether the equipment would fit in the plane. Keep in mind that the Aveox motor *must* be used with their control unit—it won't work with any other type of conventional speed control.

Aveox is paying close attention to early customer feedback and is currently working on a smaller motor that will be better suited for petite models. They are also developing a smaller, computer-based motor control unit. Although the price is relatively still a bit steep (about $320 for the motor and controller unit), I have no doubt that they have a winning motor system, particularly with the improvements currently underway.

The Aveox brushless motor system is available from companies specializing in electric flight equipment and from Aveox direct at P.O. Box 1287, Agoura Hills, CA 91376-1287; (818) 597-8915.

If you own an Aveox motor system, please let me know what you think of it. As always, any other comments, ideas and suggestions are always welcome. Write to me at 6462 Sunny Brae Dr., San Diego, CA 92119, or call me at (619) 463-4453 between 8 a.m. and 5 p.m. Pacific time during the week. **MB**

Soar To New Heights With Hitec

WING SPAN: 66.5"
FLYING WEIGHT: 39 OZ.
MOTOR: RS-540 (SUPPLIED)
RECOMMENDED RADIO: 3 OR 4 CHANNEL
RECOMMENDED BATTERY: 6 CELL, 7.2 VOLT

ENJOY THE FREE FLYING SPIRIT OF HITEC'S WINDCRUISER II

WindCruiser II is a finished, covered kit designed for low-maintenance, easy to fix, "Weekend R/C Fun"! Beginners and pros alike love the stability, ease of it's electric power and free-soaring performance.

- ***Sturdy blow molded fuselage with pre-installed motor.***
- ***Folding prop and R/C mounts.***

The WindCruiser II can be flown as a motor glider/thermal glider or from the slope!

Call For The Hitec Dealer Nearest You:

hitec
10729 Wheatlands Ave. #C
Santee, CA 92071
(619) 258-4940

Hitec Focus 4E radio system & CG-315 charger are the perfect companions for the WindCruiser II. See all these Hitec products at most hobby dealers.

Get a CHARGE out of HITEC!

CG72 for 6-cell (7.2v DC)
CG84 for 7-cell (8.4v DC)
0-30 Minute Timer
2-Amp Taper-off Chg. rate
12v DC-DC Operation
10 oz, 6 1/4" x 2 3/4" x 2 3/4"

Charges 5-7 Cell (6-8.4v)
1200 MAH Min.-1800 MAH Max.
Charge Rate: 3.4 Amps
Auto-cutoff @ Full charge
4 oz, 4 1/2" x 2 1/2" x 7/8"

4-10 Cell (4.8-12v)
270-1800 MAH cap.
Programmable .9-4.5A Fast Chg.
Auto-cutoff with C/8 Trickle
Programmable ESV Battery Test
"Charge Complete" Chime
DC-DC Power Booster
5 oz, 6 1/4" x 3" x 1 1/8"

320 features PLUS
Programmable Battery Cycler
16 oz, 6 1/4" x 3" X 1 7/8"

"One Touch" DC-DC Peak Chargers Automatic Trickle, Polarity Protection, Power, Clips & Cigarette Lighter Adapters Standard.

hitec
10729 Wheatlands Ave. #C
Santee, CA 92071
(619) 258-4940

Surge Protection Circuit
Ripple-free DC Output
Built-in Circuit Breaker
5A, 13.5v DC Capacity
1 1/2 pounds, 6" x 3 1/4" x 1 7/8"

For More Information Call Us Today!

■ ABOVE: Gene Barton's 3rd place A1-H Skyraider has remotely folding wings, flaps, retracts, extending tail hook, and opening and closing canopy. The 1/6-scale model spans 90 inches, weighs 40 pounds, and is powered by a Webra Bully. ■ ABOVE RIGHT: Shailesh Patel's Yellow Aircraft F-14 Tomcat takes off on another search-and-destroy mission. This is a big model at 90 inches span and 35 pounds. Power is two O.S. .91s, construction is glass and foam, finish is K&B Superpoxy. The Tomcat swings the wings in flight—a feat that really gets the crowd's attention. Shailesh hails from Eureka, California. ■ BELOW: Taking all the marbles at the '93 Scale Masters was the incredible Learjet 35A as built and flown by Dennis Crooks of Big Rock, Illinois. Seen here about to touch down after another excellent flight, it's hard to tell the model from the real thing. The 27-pound Lear is powered by two O.S. .77 engines and features a full interior with upholstered seats, curtains, cabin lights, etc. ■ BOTTOM: Just a few of the fantastic full-scale aircraft on display for the Scale Masters participants as they enjoyed a barbecue at nearby Chino Airport.

The immaculate cockpit and cutaway detailing on Terry Nilsch's BVM F86-F helped earn him a well-deserved 2nd place finish. Finish is Ditzler auto enamel and Coverite Presto. Terry uses a JR PCM 10 radio to control the Sabre's many operating features—see text.

'93 Scale Masters Championships

The cream of the RC Scale crop gathered in Southern California late last year to compete in the 14th running of what has become the most prestigious RC Scale contest in America.

■ ABOVE LEFT: When you talk *big*, you've got to include Nick Tusa's 1/3-scale Fokker DVII. At 10-foot span and powered with a Quadra 100, Nick's Fokker filled up a lot of sky when it took to the air. The lozenge paint scheme was hand-painted, and all parts were made by Nick.
■ LEFT: Chino Airport's Planes of Fame Museum was open to a private viewing by Scale Masters participants on Friday night, through arrangements made by event organizers Harris and Tom Lee. Looking into the main hangar at night was like walking into the Twilight Zone of aviation history.

BY JOHN LUPPERGER

The 1993 Scale Masters Championships was much more than just a contest—it was a full-blown aeromodeling and full-scale aviation event extraordinaire. Over 40 of the very finest scale builders/pilots got together in October at Mile Square Park, Fountain Valley, California for four days of intense competition, intense fun, and intense entertainment under the able guidance of the Scale Squadron of Southern California.

The concept of the Scale Masters program was originated in 1980 by Harris Lee, now the National Chairman. Competitors enter any of the 21 regional contests held throughout the year in Canada and the U.S. If they are able to place in the top five at any one of the qualifiers, they are invited to participate in the Scale Masters. As would be expected, this results in the best pilots and the best aircraft coming together for one truly outstanding display of modeling craftsmanship and flying expertise.

The event started on

continued on page 64

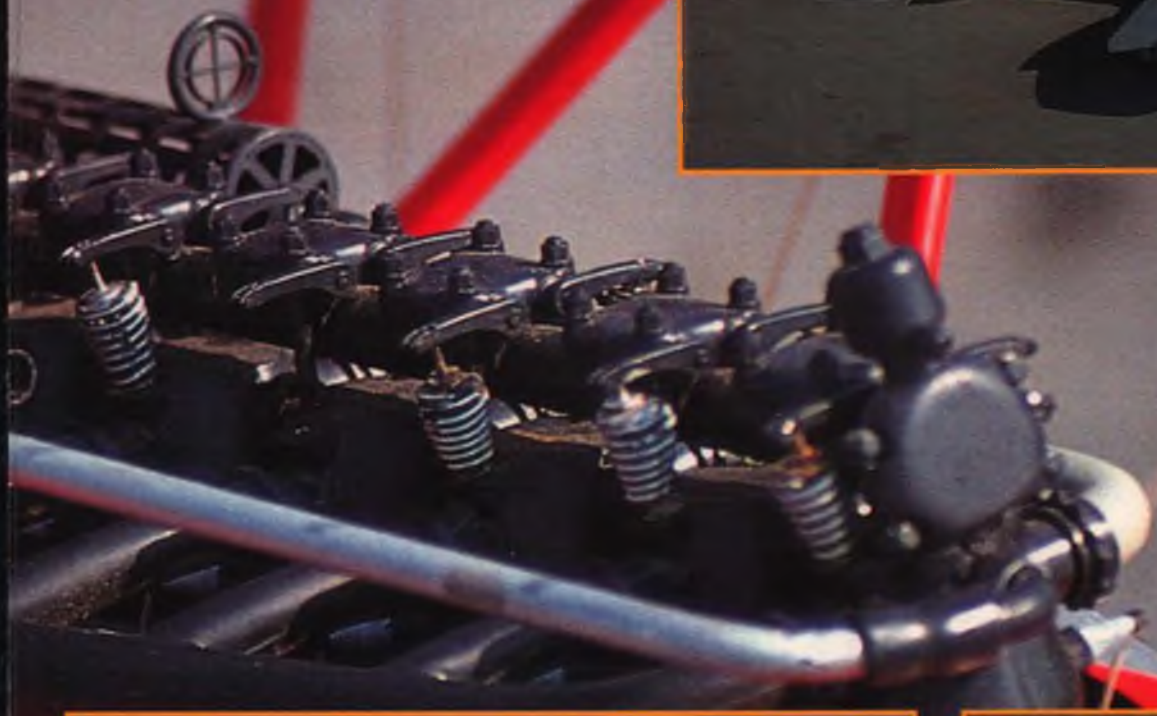
One of the few twins present was the brightly painted DeHavilland DAC-L Twin Otter by Canada's Dave Sawatzky. The 86-inch span model weighs 17 pounds and is powered by two O.S. .46 engines. Note the extensive rivet detail. Dave scored an excellent 92.50 static points, but an average flight score of 74.583 kept him down in 37th place.

1993 SCALE MASTERS TOP TEN

PILOT	MODEL	STATIC	FLIGHT	TOTAL SCORE
1. Dennis Crooks	Learjet 35A	96.50	94.250	190.750
2. Terry Nitsch	F86-F Sabrejet	96.50	92.250	188.750
3. Gene Barton	A1-H Skyraider	95.00	92.917	187.917
4. Shailesh Patel	F-14 Tomcat	96.50	91.333	187.833
5. Diego Lopez	Skyraider	95.00	91.417	186.417
6. Tom Polapink	Sopwith Snipe	96.00	87.750	183.750
7. Jeff Foley	A6M3 Zero	94.50	89.000	183.500
8. Lee Rice	Lockheed F-104	93.50	89.000	182.500
9. Eugene, Job	A6M5 Zero	92.00	90.083	182.083
10. Charlie Nelson	Waco VKS 7F	94.50	86.667	181.167

Definitely one of the bigger models at the Scale Masters was the Balsa USA 1/3-scale Sopwith Pup belonging to Don McEntyre of Eugene, Oregon. At 9-foot span and 36 pounds, the big bipe flies very realistically on its O.S. five-cylinder radial.

■ ABOVE: Doug Crumley's little daughter poses with his 1/4-scale Stinson L-5E, powered by an Enya VT240 twin. Model is finished with Stits Poly-Tone, the same paint as the full-scale subject. Doug uses an Airtronics Vision radio to mix the ailerons to droop with the flaps. Finished 13th. ■ RIGHT: In 20th place was Greg Singleton's Hawker Tempest, scratch built from Bob Holman plans. This model is rare in that it features all-wood construction, except for the fiberglass cowl. The 79-inch span model weighs 22 pounds and is powered by an O.S. BGX-1. Greg reports the model is very docile at all speeds, and that the wide track landing gear makes ground handling a snap.



Close-up of the beautiful Mercedes engine detail in Carl Lindou's Albatros.

■ LEFT: Eduardo Esteves came all the way from Brazil to fly his Rearwin Skyranger, finished 24th. This beautiful 1/4-scale model was built from modified Sid Morgan plans, spans 109 inches, weighs 28 pounds, and is powered by an O.S. FT-300 twin. All of the hardware and fittings were machined by Eduardo. ■ ABOVE: A ship that really amazed our reporter, the scratch-built F-104 by Lee Hice of Texas. Lee's foam/fiberglass model spans only 35 inches and weighs in at 15 pounds, yet is a spectacular flier. An O.S. .91/Dynamax fan combo powered it to an 8th place finish. Seven-channel Futaba radio.

MODEL DESIGN *cont. from page 14*

effective pitch.

Except possibly for purist pattern fliers, the time when this asymmetric P-effect is most apt to be noticed is during takeoff of a taildragger model. With the tail on the ground during the early part of the takeoff run, the airplane and the prop are at a high positive angle, causing left yaw as we have discussed. Interestingly, either right thrust *or downthrust* could eliminate this problem on takeoff. Right thrust would introduce a right yawing moment to cancel the left yawing moment generated by the up-angled prop. Enough downthrust would align the thrust axis with the velocity vector when the tail is down.

In practice, neither down nor right thrust is a pure answer for asymmetric yaw on takeoff, because then the plane would have a built-in yawing or pitching moment after the tail lifts. We normally compensate for this yaw on takeoff by holding a little right rudder, and neutralize the rudder when the asymmetry in airflow over the prop blades goes away. If we neutralize all of this yaw effect on takeoff with right thrust, we will have to hold *left rudder* in flight for zero yaw.

• **Pitch and yaw moment effects** relate to the fact that the prop is (normally) well ahead of the center of gravity. Let me quote Stinton here: "When the plane of rotation of the propeller is no longer normal to the airflow, the thrustline is inclined at an angle of attack to the flow. If an airplane is pitched nose-up, for example, then thrust can be resolved into components normal and tangential to the flight path, the normal component acting in the lifting plane. If the propeller is ahead of the CG, the lifting component is destabilizing. A tractor propeller is destabilizing (and a pusher is stabilizing) in both pitch and yaw." Right or downthrust won't help here, because the problem is present only when the plane is pitched or yawed.

• **Propwash** plays its part in the P-effect when the spiraling airflow behind the prop strikes the wing or the tail surfaces. The effect on the wing and stab is to produce a right roll moment, but the usual effect on the vertical fin is to produce yaw. If the fin is in the customary location above the thrustline, the helical slipstream will strike the left side of the fin, producing a left yaw. This propwash yaw effect can be quite nicely counteracted with right thrust, since it is present whenever power is on.

P-effect is a can of worms. The optimum amounts of right thrust and downthrust help, but there is no way to completely compensate for all of its factors by pre-flight trimming. The pilot provides the remaining compensations. Obviously (and fortunately), we don't have to understand all of the above in order to fly well.

continued on page 55

THE EASY WING

It couldn't be much easier! This clever little flying wing builds quickly and is a real ball to fly. Try one!

BY KEN JOHNSON

Young Jacki Arndt displays the original Easy Wing on the left and the author's indoor version on the right. The original version is the larger of the two.

This model was first seen about 10 years ago in the Paul Revere High School gym in Santa Monica, California. It sprang from the fertile mind of Dick Baxter, of Laguna Niguel, California.

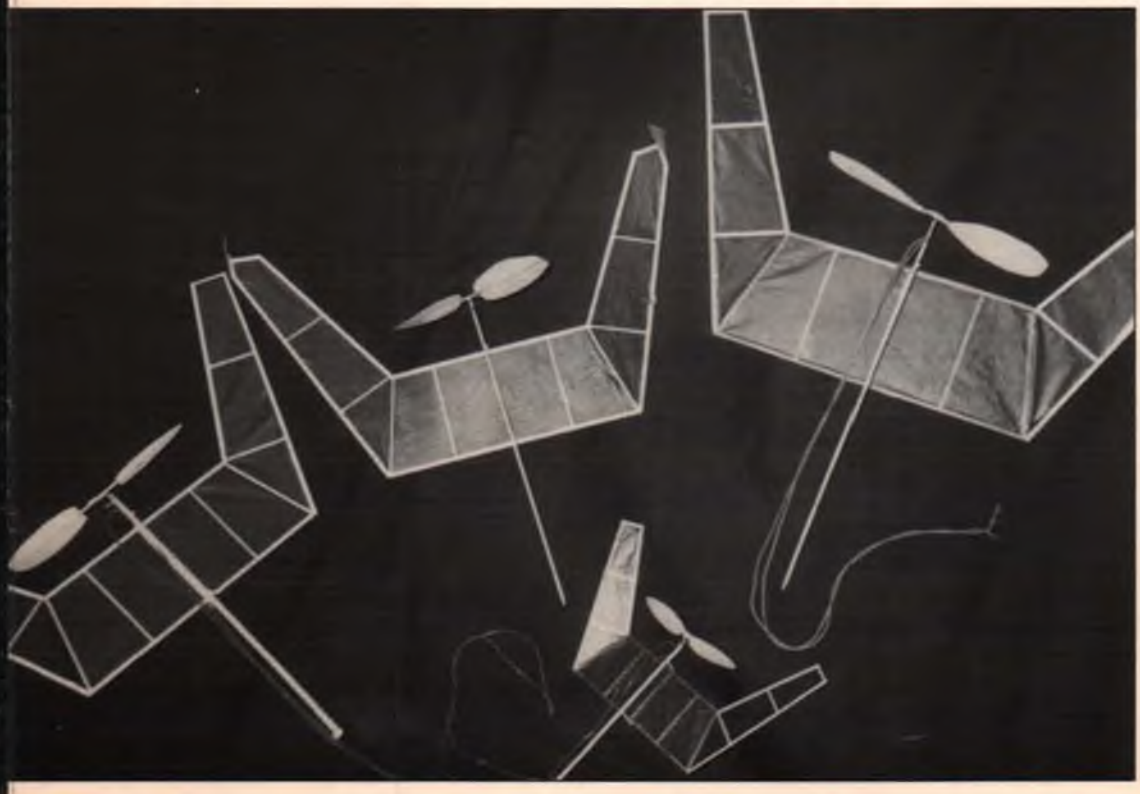
Every so often, Dick comes to our indoor sessions with a new and wondrous flying machine. Most often he experiments with ornithopters, trying a new planform or some linkage that is completely original. I'm currently flying an ornithopter with a wing that wags its tail. It's one of Baxter's concepts. It won't break any duration records, but it sure gets a lot of attention!

My son Chris built an Easy Wing off of Dick's original plan. It flew quite well, even though it was quite heavy by indoor standards. It used a plastic propeller, the wood was heavy, and it was covered with regular Japanese tissue.

I decided to build a lighter indoor version to see how it would fly with lighter wood, a balsa prop and condenser paper covering. The plans were drawn to fit the magazine centerspread, but the model also flies well in larger or smaller sizes. I have a 6-inch version that flies great in my living room. Eventually I plan to blow it up to 40 inches for the Northrop Flying Wing contest at Taft each year.

One of the unusual features of this model is that it uses *no airfoil and no vertical fin!* What it does need in order to fly well is a generous amount of wash-in in the inboard wing.

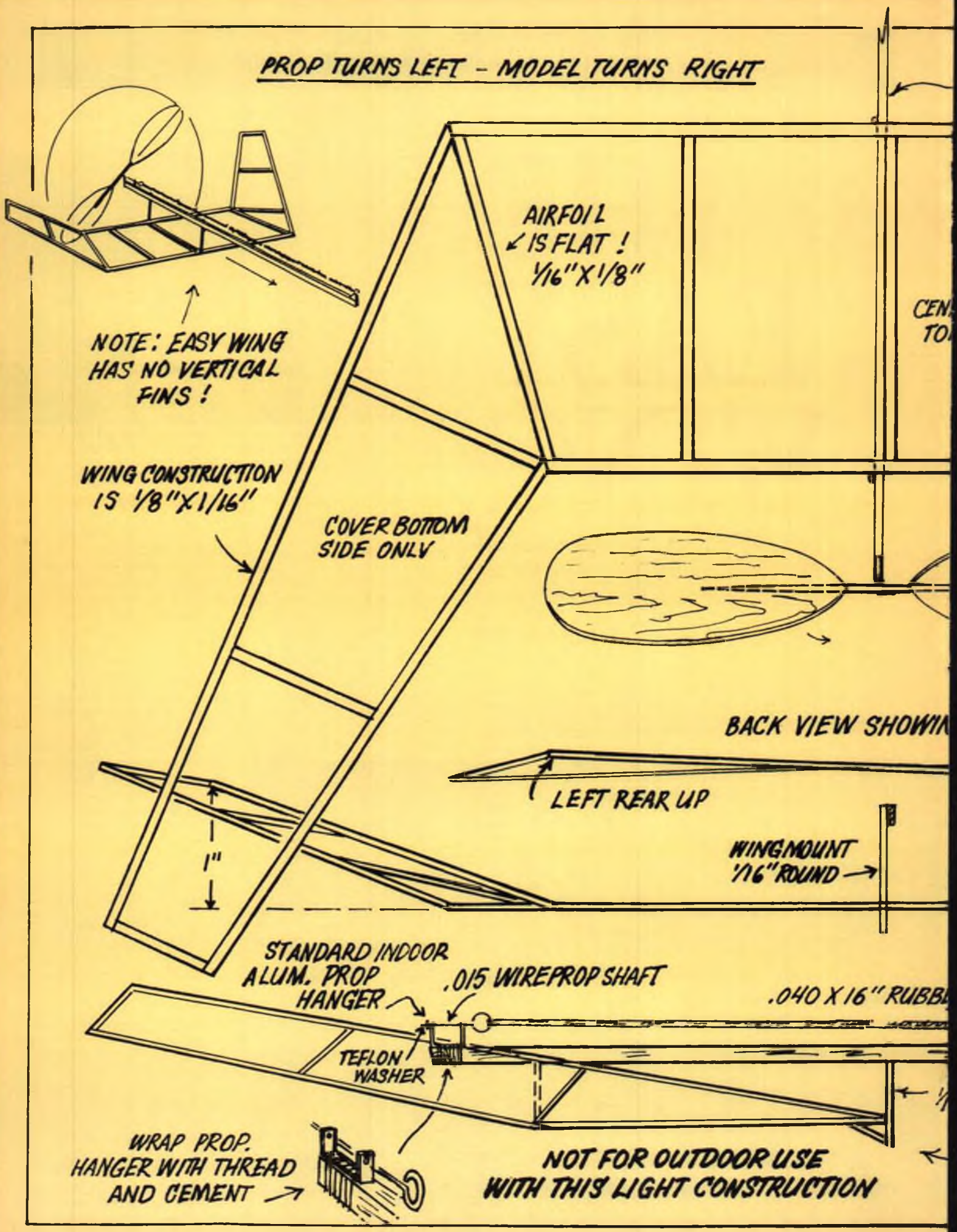
I have two Easy Wings with clockwise-turning propellers and two with counterclockwise props. The clockwise models turn to the right, while the counterclockwise versions turn to the left. Keep in mind that you *must* use wash-in on the inboard wing on both versions. The model turns to the inboard side.

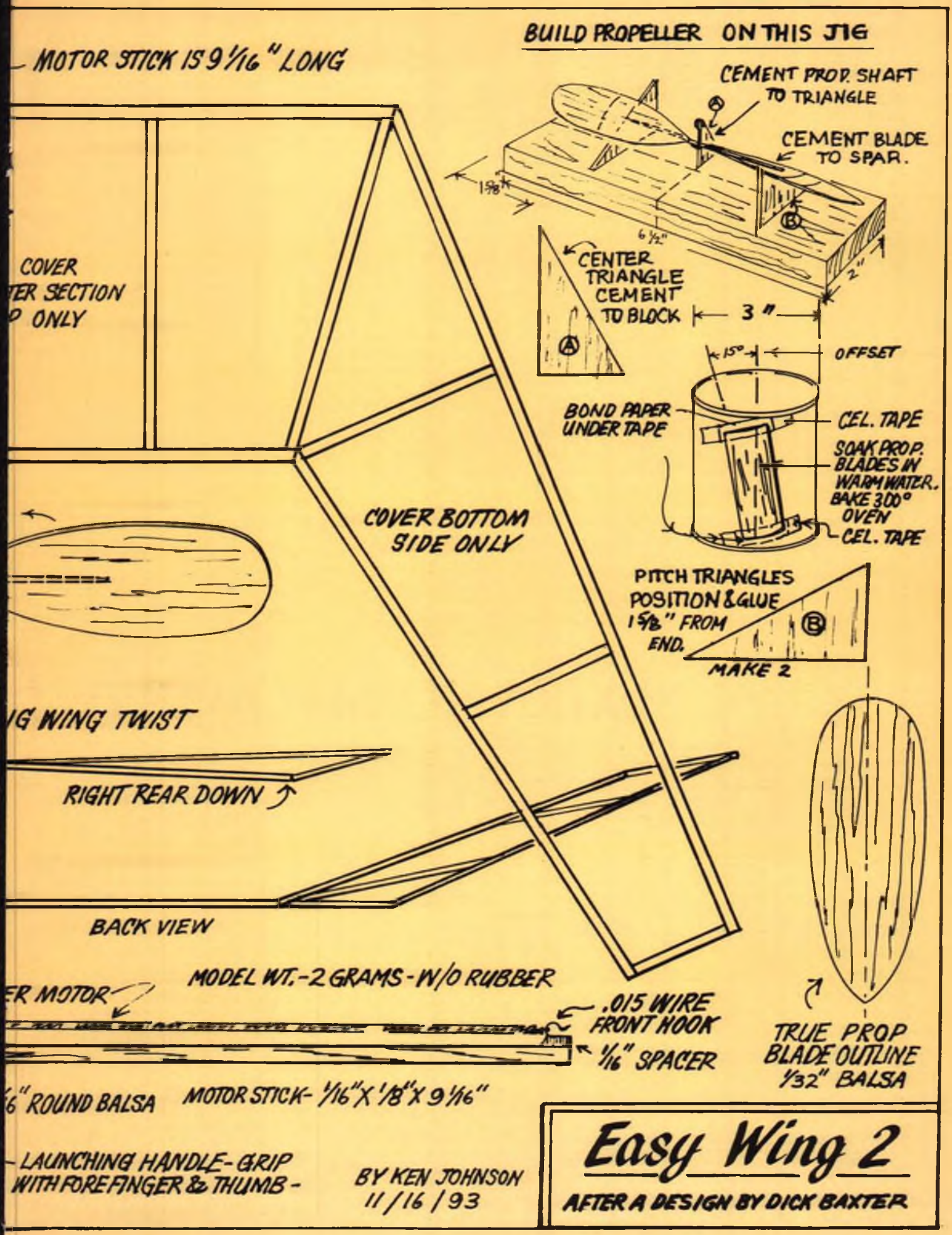


Four of the various sizes of Easy Wing indoor models built by the author. Spans range from 6 inches up to the 13-1/4 inch model built for this article (upper right). All are terrific fliers. Note that one model has vertical fins, which were later discarded after testing revealed no increase in performance.

CONSTRUCTION

The motor stick is made from medium hard balsa. A standard aluminum indoor prop hanger is bound and cemented to the rear of the stick. Form the propeller spar by sanding a 3-inch length of hard 1/16 square balsa to a taper at each end. The square balsa should be sanded round before tapering the ends. Fold a small piece of medium sandpaper in half and spin the balsa to the left and right while drawing it back and forth through the sandpaper, taper-


PROP TURNS LEFT - MODEL TURNS RIGHT
AIRFOIL IS FLAT ! 1/16" X 1/8"
NOTE: EASY WING HAS NO VERTICAL FINS !
WING CONSTRUCTION IS 1/8" X 1/16"
COVER BOTTOM SIDE ONLY
BACK VIEW SHOWIN
LEFT REAR UP
1"
WING MOUNT 1/16" ROUND
STANDARD INDOOR ALUM. PROP HANGER
.015 WIRE PROP SHAFT
.040 X 16" RUBBE
TEFLON WASHER
WRAP PROP. HANGER WITH THREAD AND CEMENT
NOT FOR OUTDOOR USE WITH THIS LIGHT CONSTRUCTION


BUILD PROPELLER ON THIS JIG
MOTOR STICK IS 9 1/16" LONG
CEMENT PROP. SHAFT TO TRIANGLE
CEMENT BLADE TO SPAR.
1 5/8"
6 1/2"
2"
CENTER TRIANGLE CEMENT TO BLOCK
3"
15°
OFFSET
BOND PAPER UNDER TAPE
CEL. TAPE
SOAK PROP. BLADES IN WARM WATER. BAKE 300° OVEN
CEL. TAPE
COVER BOTTOM SIDE ONLY
PITCH TRIANGLES POSITION & GLUE 1 5/8" FROM END.
MAKE 2
RIGHT REAR DOWN
BACK VIEW
MODEL WT. - 2 GRAMS - W/O RUBBER
.015 WIRE FRONT HOOK
1/16" SPACER
TRUE PROP BLADE OUTLINE 1/32" BALSA
MOTOR STICK - 1/16" X 1/8" X 9 1/16"
LAUNCHING HANDLE - GRIP WITH FOREFINGER & THUMB -
BY KEN JOHNSON 11/16/93
Easy Wing 2
AFTER A DESIGN BY DICK BAXTER

The author's son Chris (right) and Easy Wing designer Dick Baxter, with the model Chris built from Dick's plans. It flew well at the annual Northrop Flying Wing contest at Mile Square Park in Fountain Valley, California.

ing toward the tip. When completed, drill a small hole through the center and insert the prop shaft in the hole. Bend the straight end of the shaft 90 degrees, 3/16 of an inch from the end, and cement it to the prop spar. Build the prop jig per the plan. Cement the prop shaft to the upright triangle at the center.

Taper the prop blades at the edges to make them lighter and form an airfoil shape. Soak the blades in warm water, then tape them, at a 15-degree angle off the vertical, to a 3-inch diameter can and bake in a 300-degree oven for 20 minutes. Place each blade on the triangles on the prop jig and cement the blades to the spar. When installing the prop on the hanger, don't forget to place a small Teflon bearing on the shaft between the prop and the hanger.

Build the wing over the plan. Add the dihedral to the wingtips. Cover the center of the wing on the top and the outer panels on the bottom.

The wing mounts are 1/16-inch round balsa. Allow the bottom 3/16-inch of the front mount to hang below the wing. Cut a small diagonal brace and cement it from the bottom of the wing mount to the center wing rib. This little triangle becomes the launching handle for releasing the model. Cement the mount to the wing and the side of the motor stick. The prop hanger is on the top side of the motor stick.

Cement the rear mount to the wing and motor stick. The desired wing wash-in can be achieved by first cementing the rear wing mount to the wing at a slight angle. When the other end of the mount is cemented to the side of the motor stick, the wing will twist into the correct position.

FLYING THE EASY WING

Starting with a small rubber motor (about .040) 16 inches long, wind to about 600 turns and launch. The wing will begin flying in tight circles; an 8-foot circle is a good size. If the model tries to spin in, it means you need more wash-in in the inboard wing. The wing should climb to about 20 feet and go into its cruise. If it's not climbing high enough, make up a new rubber motor .005 thicker in cross section. The size of the motor your model needs will depend on how heavy you built it.

I don't recommend trying this model outdoors if you purposely built it light for indoor flying. It's too delicate for moving air. Build a stronger one for outdoor flying if you like.

If you like the way the model flies, you might try a larger, lighter version with a rolled tube motor stick and a built-up propeller. Polyfilm covering would be ideal for this super-light wing. **MB**

ELECTRONICS CORNER

BY ELOY MAREZ

• Rayovac's 'Renewal' Reusable Alkalines • Servo Reversers

The electronics industry—and all things electronics-related—never seems to stand still. New products are announced every week, if not every day. Some advances have little direct effect on the RC hobby, others can make significant differences. Anything having to do with batteries always gets close scrutiny, the latest in that field being the new "Renewal" reusable alkaline cells from Rayovac Corporation.

This one sneaked up on me completely! Every month I see a good number of non-RC electronics publications, many of which are devoted primarily to new products, but I never saw a thing on these new cells before they appeared in a couple of local stores.

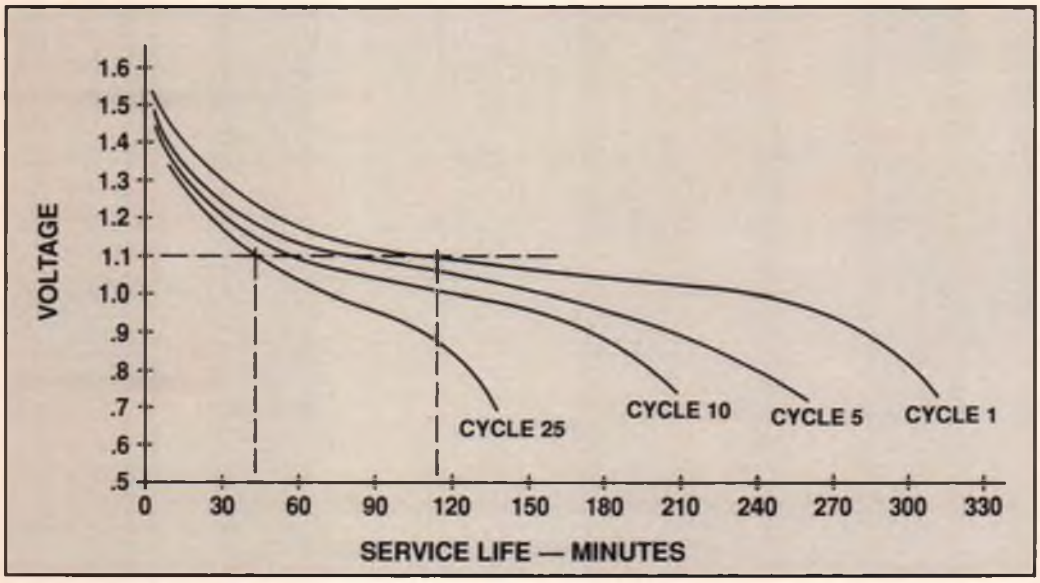
Alkalines in general do have a couple of features that, everything else being equal, would make them superior to our old reliable standby nickel-cadmiums. Important is that they have both a higher voltage and a higher capacity. That is, the alkaline produces 1.5 VDC while the NiCd produces only 1.25, and in the popular AA size, the non-rechargeable alkaline is rated at 1500 mAH, while even the greatly improved NiCds in the same size are good for less than half of that. I know there are other considerations, but the Rayovac cells appeared worth looking into and, having done so, I'd like to share my findings with you.

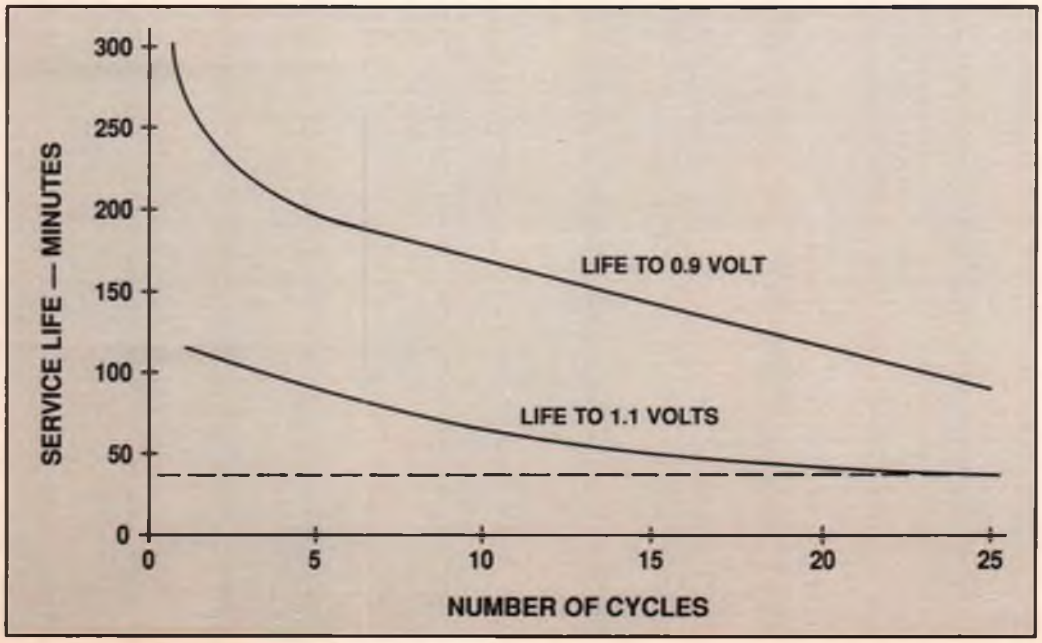
The little brochure available everywhere these cells are being sold makes some good points for them: better than regular alkalines because they are reusable; better than "old fashioned" rechargeables because of their "alkaline" power, probably referring to the points mentioned above; convenient because you always have fresh battery power.

Then the literature goes on to compare Renewal cells to "NiCad Rechargeables." (I guess whoever wrote that little leaflet is not a reader of *MB* and EC, otherwise he/she would know that "NiCad" is a trademarked name for the nickel-cadmium cells manufactured by the Saft Company; the correct reference to them in general is NiCds.) Reference is made to the fact that Renewals do not require initial charging, do not suffer from loss of capacity during storage, and are not plagued by that dreaded but somewhat mythical problem of memory attributed to NiCds. All correct, if one is shopping for batteries for his flashlight or ghetto blaster; but not for use in RC equipment

Renewals are available in the popular AAA, AA, C, and D sizes, single cells only. The capacity ratings require some careful study, as the charts received from Rayovac take them down as far as .8 volt per cell, NiCds being useful only to 1.1

continued on page 76





■ **LEFT TOP: The operating life in minutes, and voltage, of the new Rayovac Renewal rechargeable alkaline cells, into a 3.9-ohm load, at 70 degrees F, after charging with a Rayovac PS-1 Power Station for 12 hours. The dotted lines have been added to provide a comparison to NiCds at the parameters at which we use them. ■ LEFT BOTTOM: Seen here is the reduction in operating time of the Renewal cells as its 25 life cycles are used. Note that although the voltage is higher than that of NiCds (an important point in some applications), the capacity is no greater, and neither are the number of charge/discharge cycles available.**

HANNAN'S HANGAR

BY BILL HANNAN

"Age... is a matter of feeling, not of years."

Our lead-in line this month, by George William Curtis, was found in the *Instant Quotation Dictionary*, published by the Career Institute of New Jersey. We think one of the prime advantages of our hobby is that it keeps one feeling young, regardless of age. Of course, as each new year rolls around, we all tend to think a bit more about our age, don't we? So build a new model!

REFLECTION TIME

Although you are reading this in 1994, it was composed late in 1993, a time for review and contemplation here at the hangar. We continue to be grateful for the freedom and support provided by the *Model Builder* staff, and for the enthusiasm of our readers, whose contributions often set the tone of our topics. We feel very fortunate for the many talented and generous model builders in our audience who keep us supplied with a bountiful harvest of ideas, clippings and photographs.

We do apologize, however, for the delay in publishing some items. In addition to having a large backlog on hand, subjects are usually selected to suit a particular theme. Add to this the usual three-month magazine lead-time, and the result is more waiting. Rest assured that every submission to the hangar is acknowledged, appreciated, and given careful consideration.

Unusual Westland P-12 Lysander variation was built by Joe Barish. Is CO_2 powered and is reported to be a fine flier. Tom Schmitt photo.

George Benson, of Mill Valley, California, also came up with a Westland P-12, however his is rubber powered. George is the designer of the Hi-Max Peanut featured in the December '93 *Model Builder*.

FROM ENGLAND

Pete Redhead, who confesses to being a member of the "start lots, finish nothing" brigade, wrote us to say: "Aeromodelling is truly an international friendship club, a fact brought home when the Bournemouth modelers participated in the local 'all-model' exhibition, which is masterminded by our model boating association. They bring together all the model clubs, craft societies, anything with a hand-made flavour, and it makes for a great opportunity to see what the other people out there are doing.

"During the afternoon I was flying some of my indoor creations when a distinctly transatlantic voice behind me said: 'Is that a microfilm model?' A long chat ensued with a real gentleman, Dan Metz, who happens to be a regular reader of Hannan's Hangar, and who particularly enjoys the philosophical quotations that head-and-tail the column, so you gotta keep finding them!"

ALSO FROM ENGLAND

Mike Colling, of the British Model Flying Association, has announced the 1994 Mini-Stick postal contest. These tiny living-room fliers are very popular, and previous events have attracted entries from many countries.

Rules are fairly simple but quite specific: Maximum wingspan—7 inches; maximum wing chord—2.5 inches; motor stick length—5 inches; maximum model length (less propeller)—10 inches; only plastic or paper covering material is allowed (no

Nicely finished 16-inch span Wedell-Williams racer performs 40 second duration flights for builder Tom Nallen. The full-size machine was flown by both Jimmy Haizlip and his wife Mary in the 1932 Cleveland Air Races.

microfilm); the propeller must be wooden and fixed pitch; and the minimum model weight is 0.43 grams (0.015 ounce).

Contest flights are to be made between January 1st and March 31st, 1994, and any number of sites are permitted. All flights must be timed by someone other than the flier. Prizes will be awarded dependent upon the number of contestants. There is no entry fee, although club member decals or stickers are appreciated.

For official entry forms and more complete rules, send two International Reply Coupons (available from most post offices) to Mike Colling, 403 Mossy Lead Road, Wrightington, Wigan, Lancs., England WN6 9SB.

FROM CONNECTICUT

John Hodgkin attended a Flying Aces Club event at Genesco, New York, and sent this report: "I didn't have a thing to fly in

Pretty 1/20-scale rubber-powered Comper Swift, by C. Newman of Oxford, England in full flight. Ivo Ceresnak photo.

scale and although I did take some models with me, I didn't fly at all. I was too busy meeting modelers whom I had only read about, like Don Srull, Hurst Bowers and Ralph Kuenz of Cloudbuster Race-Wings fame. I met a lot of other great modelers, forgot most of their names, but will never forget their smiling faces. I drove approximately 325 miles to get there and the same coming home alone, but it was worth every bit of it just to be part of the camaraderie that ran through the whole group."

ANYONE FOR STEAM POWER?

Steam-powered models date back to aviation's pioneer era, but were nearly always hampered by bulky and weighty systems. Well, now a group of scientists has constructed a steam engine small enough to fit within the period at the end of this sentence. Ed Whitten sent us an article from the *New York Times* describing the unit, which is said to be 100 times as powerful as a similar size electric motor. Envisioned as an aid to micro-surgery, computer work or other extreme precision tasks, the device employs a heating element to make steam from a droplet of water, which pushes a piston against springs, which return it for another cycle. Obviously impractical for model power application in its present form, it still may offer encouragement for those who would like a tiny alternative form of power.

AND SPEAKING OF PROGRESS

Ed Whitten also sent a clipping from a 1986 newspaper in which writer Cathy Hull quoted H. Ross Perot as saying: "If we did not have such a thing as an airplane today, we would probably need something the size of NASA to make one. It's a good thing the Wright brothers didn't know any better when they made the machine fly."

LATEX RANGERS

Dr. Kenneth Ketner, Box 65135, Lubbock, TX 79464, is striving to increase Junior participation in our hobby, and sent in a set of rules devised by the Latex Rangers squadron of the Flying Aces Club. This is an informal learning program and contest intended for 5th graders and above, using simple rubber-powered models. The purpose is to learn about aviation science, develop model building and flying skills, and to have fun in the context of the basics of good sportsmanship.

The contest may be conducted indoors or outside, and a suggested list of eligible models includes the AMA Cub, Peck-Polymers ROG, Sig Uncle Sam biplane and Sig Parasol. Each participant may chose any two models from the list, and must build them personally. Certain modifications are permitted to improve performance, but each model must employ the furnished propeller and bearing assembly.

Ivo Ceresnak, of the Czech Republic, is a top-notch model flier as well as an expert photographer. Seen here is his rubber-powered Pilatus PC-9 in action.

Each participant must make two recorded flights with two different models, for a total of four flights. Rise-off-ground flights receive bonus points, and the winner is the person with the highest duration from all four flights, including any bonus points. In case of a tie, additional flights are flown to determine the winner.

Additional provisions are featured on the rules sheet, and it's likely that Dr. Ketner would send a copy to anyone who sends him an SASE. Sounds like a fun way to involve more kids!

PRODUCT NEWS

Sandy Peck, of Peck-Polymers, has recently received a new shipment of Gasparin CO_2 powerplants, parts and accessories, and has a complete list available. Featured are various size engines, including twin-cylinder types, fuel tanks, propellers and chargers. We examined one of the new chargers, which is exceptionally well made and attractive with its blue anodized finish. A novel feature is that it can accept either regular or long CO_2 capsules. The CO_2 engine list may be obtained by sending an SASE, or if you wish a copy of the complete Peck catalog, send $4 to Box 710399-M, Santee, CA 92072.

ADDRESS CHANGE

Al Lidberg, who markets an extensive range of model plans and semi-kits, has moved to 1008 E. Baseline Rd., Suite 1074, Tempe, AZ 85283. He offers a complete catalog for $1, which features illustrations and descriptions of all of his productions.

ANTIQUE AIRPLANE CLOTHING

Vern Clements, well known for his scale aircraft drawings, now also markets caps, T-shirts, sweatshirts and sport shirts, all featuring illustrations from Vern's

continued on page 82

Virtually impossible to distinguish from the "real thing," pictured here is the impressive electric-powered Bristol Fighter constructed and flown by P.J. Smart, of Norfolk, England. Another of Ivo Ceresnak's great photos.

BY ART STEINBERG

The Aerobatic TR-260 From Lanier RC

A no-holds-barred semi-scale hotdogger from the largest producer of ARF RC models.

Lanier RC consistently seems to come up with good-looking models that are competitively priced and deliver exceptional performance. Why Lanier models fly so well is probably a combination of factors. First of all, they are designed to be light in weight, and as we all know, lightly loaded airplanes fly better. Lanier also seems to have struck on an ideal airfoil, which is used in most of their models. It seems to impart excellent aerobatic qualities, while at the same time preserving highly stable and dependable slow flight performance. Intermediate pilots need have no fear of flying Lanier products.

The ARF TR-260 we recently assembled and flew was no exception to our previous experience with Lanier's product line. It behaved just as expected, being capable of expertly performing the entire range of pattern maneuvers, plus a complete repertoire of spur-of-the-moment, push-the-sticks-in-every-direction moves. When it comes to putting her back on the ground, it's difficult not to land this model gently. Its descent is slow and predictable, bringing about those feather-light touchdowns that elicit praise and approval from one's flying companions.

The TR-260, as is the case with all Lanier ARFs, is made up of various materials. The wing and horizontal stab are foam, skinned with a hard plastic. The fuselage, cowl and wheel pants are of ABS plastic, while the vertical stab, rudder, elevators and ailerons are balsa. In addition, various thicknesses of plywood are used for the firewall, fuselage reinforcement, wing mounting blocks, wing joiners, and one bulkhead.

Assembling this model is not at all difficult. Several different adhesives are used,

LANIER'S TR-260

WINGSPAN	60 in.
WING AREA	620 sq. in.
FLYING WEIGHT	100 oz. as tested.
WING LOADING	23 oz./sq. ft.
OVERALL LENGTH	44 in.
POWER	.45-.60 two-stroke. .60-.91 four-stroke.
RADIO	Four channels required.

Produced by Lanier RC, P.O. Box 458, Oakwood, GA 30566; (404) 532-6401; FAX: (404) 532-2163.

and you should have a good working knowledge of various glues. The assorted adhesives recommended in the instructions include CA, regular accelerator, accelerator for plastics, RC 56, 5-minute and 30-minute epoxies, and white glue.

The fuselage, wing, horizontal stab, wheel pants and cowl are all finished in solid white plastic and are naturally fuelproof; the vertical stab and all control surfaces are unfinished balsa and require a light sanding and covering with some kind of heat-shrink material. Our TR-260 was finished in white MonoKote, so we ended up with a completely white airplane that just cried out for a color trim motif. For bright, vivid colors, any of the sticky-backed model films work beautifully, or for a really snazzy job, Dumas and Midwest offer some eye-catching stick-on color sheets. The assembled TR-260 looked so impressive that we decided to go first class, and after a little judicious masking, sprayed on some red and blue enamel. The results were quite rewarding.

One way in which Lanier manages to keep the cost of its ARFs down is to let the builder supply much of the hardware. A tempered aluminum landing gear is included, but that's about it. Actually, this is a blessing, as it lets you outfit the model with the brands of hardware of your choice, rather than charging a higher price for a kit with hardware you might not really like. The main items needed are wheels and collars, pushrods, throttle cable, pushrod connectors, strip aileron horns, hinges, motor mount, assorted screws, nuts and bolts, and a fuel tank which the instructions describe as "the bigger, the better." This is a philosophy with which I certainly agree, as there is no such thing as too big a fuel tank. Use the biggest tank you can squeeze in the fuel compartment. Extra fuel on board is extra insurance! Our TR-260 held a

Author's buddy Ray Sprouse poses with the TR-260 prior to the first test flight.

Lanier's TR-260 is one of those rare models that flies even better than it looks. It's capable of the full range of aerobatic maneuvers, including knife-edge flight as seen here.

It's Controversy Time!

Taildragger Tracking: Toe-In or Toe-Out?

Every once in a while a controversy arises among RC fliers, and the flames of these discussions are fanned by us magazine writers. One such memorable and still-ongoing argument concerns the so-called "downwind turn." I really hate to get involved in these things, as a final solution never seems to be found. However, over the past year I've received some reader correspondence which may be of interest to our general readership.

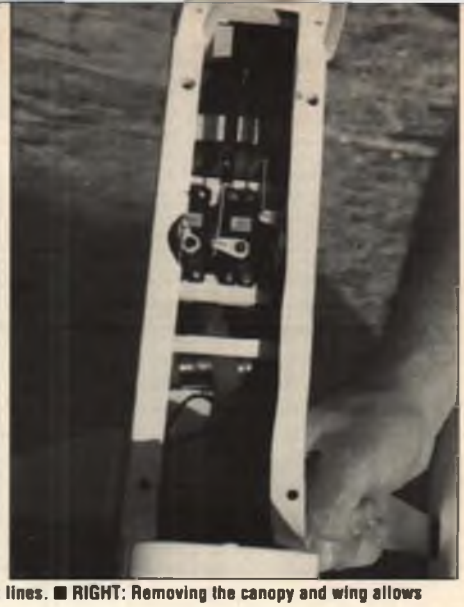
It all began with a comment I made way back in one of my ARFs columns, when I remarked that it was common knowledge that taildraggers track better with a little toe-in on the main wheels. During all the years I've been flying, I found that anyone who had given a little thought to the problem of taildragger ground handling agreed that for proper tracking, the axles of the wheels should be just about even with the leading edge of the wing, and also, a degree or two of toe-in helps to overcome the tendency to ground-loop.

Soon after publication, one of the letters I received came from Bill Berson, of Anchorage, Alaska, maintaining that my toe-in theory was all wet. He included some excellent diagrams to demonstrate that it was actually toe-*out* which prevents ground loops. I did some research, and Bill and I exchanged some further correspondence. A few excerpts from his last letter went like this:

"I was pleased to learn of your research into this issue. Perhaps I should have told you that as an A&P I have full-size airplane experience. One of my customers was able to stabilize his unwieldy taildragger (Piper PA-16) by bending the gear with a long cheater pipe to provide a slight toe-out. The gear had toe-in from a hard landing or some unknown cause. He noticed much-improved ground tracking.

"My information about toe-out comes from an EAA publication I have which describes the dynamics, much as I described in the letter to you. I was not absolutely certain about my position, but I could not believe models would be any different than full-size. I had read at least three recommendations for toe-in in various model magazines (including *MB* July '91 page 12, Big Birds by Bruce Edwards). Apparently the writers are repeating misinformation without testing. My letter to you has served its purpose by sparking an interest in you to address this issue in a future article. I have decided to subscribe to *MB* because of the better-than-average level of technical information."

Many thanks to Bill for his information. However, this debate is far from settled. I've gathered some additional information on this subject, but rather than pursuing the matter further at this time, I would like to invite our readers to contribute any comments which might throw additional light on the topic of taildragger landing gear. Write to Art Steinberg, 2267 Alta Vista Drive, Vista, CA 92084; or FAX me at (619) 726-6907. **MB**



■ LEFT: Handsome ABS plastic cowl comfortably houses the potent O.S. .61 SF ABC and contributes to the airplane's sleek lines. ■ RIGHT: Removing the canopy and wing allows easy access to the radio—in this case, an Airtronics system.

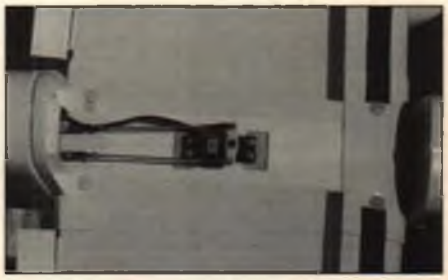
Sullivan 16-ounce tank quite comfortably.

We chose an O.S. .61 SF ABC two-stroke for our model, and finally settled on an APC 11x8 prop for best performance. For those who prefer a four-stroke, I wouldn't hesitate to recommend up to a .90. Our engine provided plenty of power, giving an excellent vertical climb rate and crisp, clean knife-edge performance.

Lanier has been writing instructions for their models for a quarter of a century now, and as one would expect, after this period of refinement, they are unmatched for clarity and understandability. There are helpful building tips scattered throughout the directions, plus a full-size set of plans which leave nothing to the imagination. Several pages are devoted to radio and control system installation, as well as to the proper operation and troubleshooting of glow engines. Although this Lanier kit doesn't conform to the more orthodox construction found in most other ARFs, I find it hard to imagine that anyone will run into any significant assembly problems with this delightful model.

Initial settings on our control surfaces closely followed the factory specs of 3/8-inch up and down on ailerons and elevator and 3/4-inch left and right on the rudder. The plans indicate that for real exciting hotdog flying, you should use all the throw you can get, and as soon as we were satisfied with the initial test flights, we wasted no time in increasing the control throws for maximum performance.

Our TR-260, though it is stand-way-off scale, looks remarkably like the real thing. Actually, it is amazingly attractive, and hardly anyone recognizes it for an ARF. So if you like your models to have the authentic appearance of a full-size airplane, and you are looking for great performance with an eye to impressing the crowd, or possibly even breaking into pattern flying, check out Lanier's TR-260. It flies even better than it looks. Most dealers carry Lanier products, but for more information, contact Lanier RC, P.O. Box 458, Oakwood, GA 30566, or call (404) 532-6401, FAX: (404) 532-2163. ***MB***



With just the canopy removed, the aileron servo and its linkages become easily accessible. Note that the wing is secured with four nylon bolts.

The sturdy pre-bent aluminum landing gear is held in place by three nylon bolts. This landing gear is about the only piece of hardware supplied in the TR-260 kit, a clever marketing idea that keeps the kit price down and allows the buyer to use preferred brands of hardware.

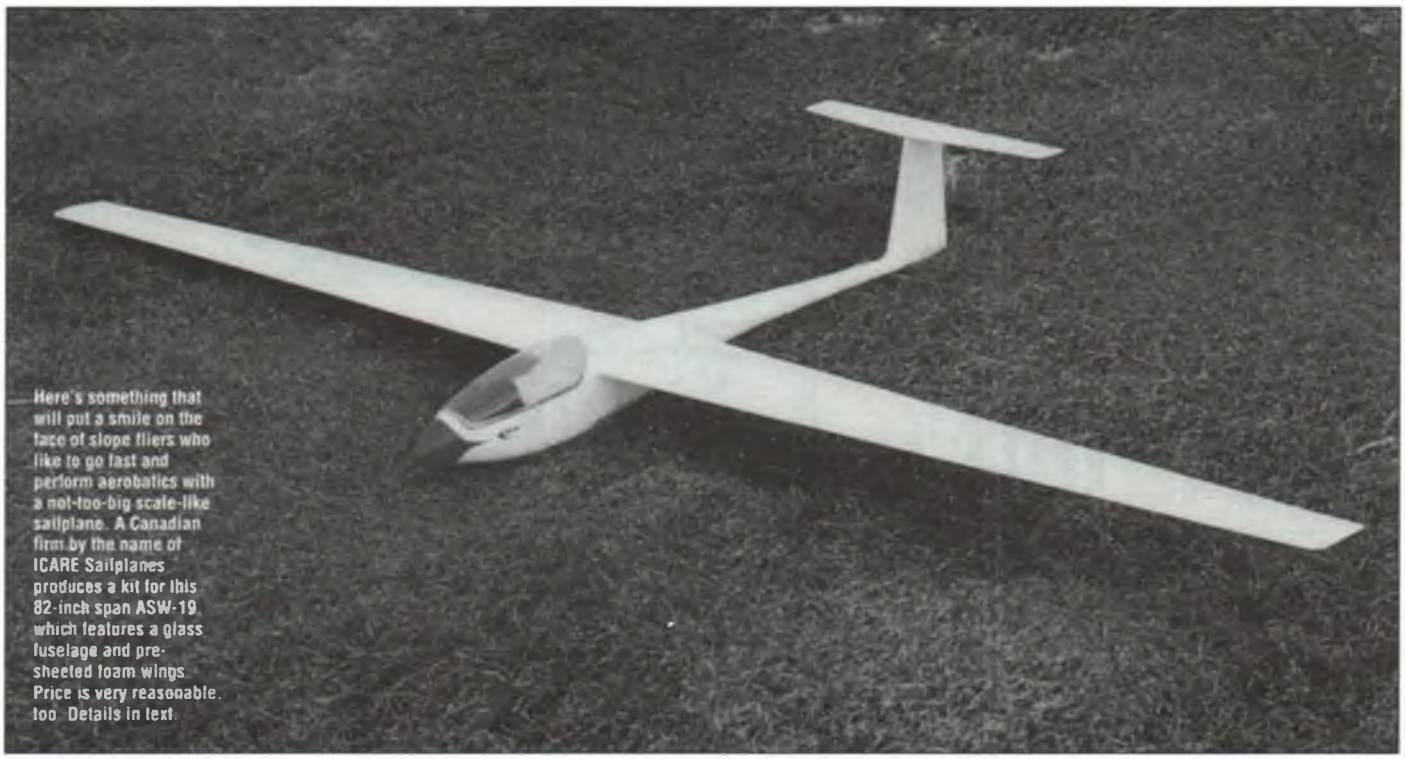
MAILBOX MUSINGS

Bill gets caught up with the mail and also reports on some new products and announcements for the RC Soaring community.

From time to time my mailbox gets particularly full of interesting tidbits that I simply must pass on to *MB*'s readers. This time they range from very interesting new products to major soaring event announcements.

ICARE SAILPLANES

For those who may not be familiar with the name ICARE Sailplanes (I wasn't until very recently), a brief intro is in order.



Here's something that will put a smile on the face of slope fliers who like to go fast and perform aerobatics with a not-too-big scale-like sailplane. A Canadian firm by the name of ICARE Sailplanes produces a kit for this 82-inch span ASW-19 which features a glass fuselage and pre-sheeted foam wings. Price is very reasonable, too. Details in text.

ICARE sprang to life about a year ago when its founder, Etienne Dorig, purchased the model company created by Raymond Size, a Frenchman who produced a line of model sailplanes under his name several years ago in France, then moved the operation to Quebec. ICARE may be reached at 381 Joseph-Huet, Boucherville, Quebec, Canada J4B 2C5; (514) 449-9094.

At present, ICARE (French for "Icarus") offers several scale fiberglass fuselages, semi-kits and two complete sailplane kits, the Salto H 101 and ASW-19. What really sets these models apart from others is their size; they are both smaller than the typical offerings from the continent. The Salto spans only 53 inches, the ASW 82 inches.

According to ICARE, the Salto is specifically designed for aerobatics and performs best in medium to strong slope lift. Airfoil is the Goettingen 795, which is a thin, clean, fast section with a moderate amount of camber (see *MB* August '86). Fuselage is white gelcoated fiberglass, and you can opt for either an all-wood, rib-and-spar wing (the wing ribs come pre-cut), or an ARF foam wing that comes pre-sheeted with obechi. Prices are quite reasonable at $145 for the ARF version and $95 for the conventional kit. Include an additional $10 for shipping. Yes, this is in U.S. dollars, and Dorig does accept personal checks.

The full-size ASW-19 was designed in the mid-70s and was produced in Germany by Alexander Schleicher Flugzeugbau. It is still considered to be a very competitive Standard class (15-meter) sailplane with outstanding performance.

ICARE's 82 inch span, 480 square inch reproduction is a semi-scale model better suited for slope flying, but should also be capable of thermalling on a good day with strong lift. The wings, even though modified, are still quite high in aspect ratio (14:1), so the model should be quite fast at the projected flying weight of 42-44 ounces. Airfoil is a modified Eppler 203. The kit comes with a white gelcoated fiberglass fuselage and factory pre-sheeted obechi/foam wings; there is no wood kit version available as with the Salto. The ASW-19 is priced at $165 plus $15 shipping. Both kits feature a molded clear plastic canopy, all required wood and hardware, plans and instructions.

In addition to the full kits described above, ICARE also offers quite an array of interesting scale fuselages, in scales ranging from 1:7.7 to 1:3.5, including two sizes of the Ka-6e, an Astir Club IIIb, a Mini Mu-28, two sizes of the ASW-19, a PIK 20C, a Pilatus B4, an ASW-20, a vintage 1956 Javelot, a vintage 1958 Bijave, and finally, a scale-like (but not scale) Martinet, a competition cross-country design. Prices range from $55 to $150, and shipping tends to run anywhere from $10 up to $30 depending on length and overall girth. Call for a specific quote. Since Canadian dollars tend to be worth less than U.S. dollars, these fuselages are an even better bargain than they may at first appear.

Nearly all of these fuselages include a

three-view of the full-scale aircraft, a molded clear canopy and fiberglass canopy tray (where applicable). Send $1.00 to ICARE and ask for their four-page catalog, which has much more information than what I'm able to give here.

This looks like a model company worth looking into if you're into scale flying. They offer models that are not available anywhere else!

WORLD SOARING JAMBOREE

MA's Slope Soaring columnist Wil Byers sent a lengthy letter regarding this first-ever event, to be hosted by no fewer than five Washington state soaring clubs and two national associations. It will take place May 28 to June 5 and will include all types of soaring events over the nine days—unlimited thermal duration (TD), 2-meter TD, hand-launch TD, F3J hand-tow TD, F3B multi-task, unlimited slope racing, limited slope racing, and power scale slope models. Additionally, there will be a fun-fly and a cross country race for both scale and non-scale models. If you want to try to set a record, allowance will be made for record attempts.

Apart from the flying events, guest speakers (including Dr. Richard Eppler!) will be at a special banquet dinner and social gathering. Technical seminars will be held as well as a commercial "vendor forum."

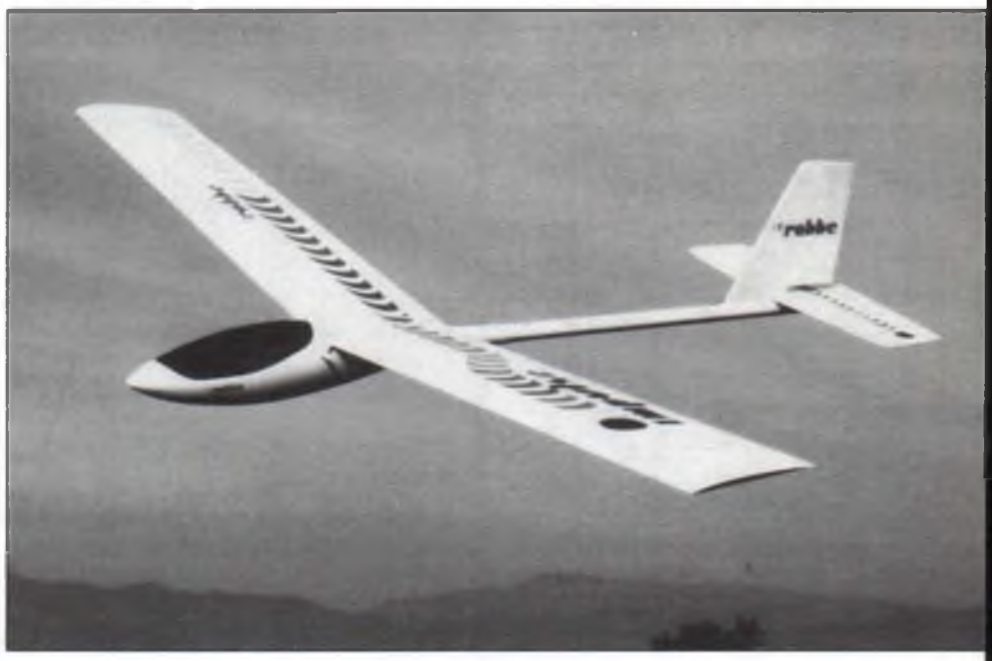
Sounds like a lot to see and do, and a very large undertaking for a large host organization. For more info, write to World Soaring Jamboree Committee, P.O. Box 4267, W. Richland, WA 99352.

1994 LSF NATIONALS

The third annual LSF Nats (the revival of the old SOAR Nats) returns to Indiana this summer—August 6-13. Thermal duration events will once again be run man-on-man in the same format as used in '92 and '93. Other events to be flown include F3B multi-task, F3J hand-tow TD, scale, cross country, hand-launch TD, and two special "non-official" events: hand launch golf and nostalgia sailplane.

All events (except HL golf and cross country) will be held at the AMA National Flying Site in Muncie. This spacious area has already been the venue for major free flight events, and shows much promise as a Nationals soaring site.

All 50 channels will be used, but there are limits on the numbers of entries per channel in the various events; best to get your entries in ASAP. Send an SASE for an entry form to: Mike Stump, 1994 LSF Nationals, 607 Washington St., Cadillac, MI 49601.



■ **LEFT: Neal Capener and his Astro 05 powered Robbe ASH 25 scale sailplane, about to take to the sky above the Olympic National Park in Washington. Neal says this is his favorite sailplane to date, and he's had a few. A mini-review by Neal on this fabulous ARF is included in this month's column.** ■ **ABOVE: For first-time RC fliers, Robbe offers this simple two-channel glider, the Impulse, which comes fully pre-built and covered and is said to require only one evening for assembly. Fuselage consists of a Plura plastic pod and an anodized aluminum tail boom; wing spans 63 inches and is of all-wood construction. Robbe's Balance is a six-cell electric powered version of this same model.**

THE ROBBE ASH 25: A MINI-REVIEW

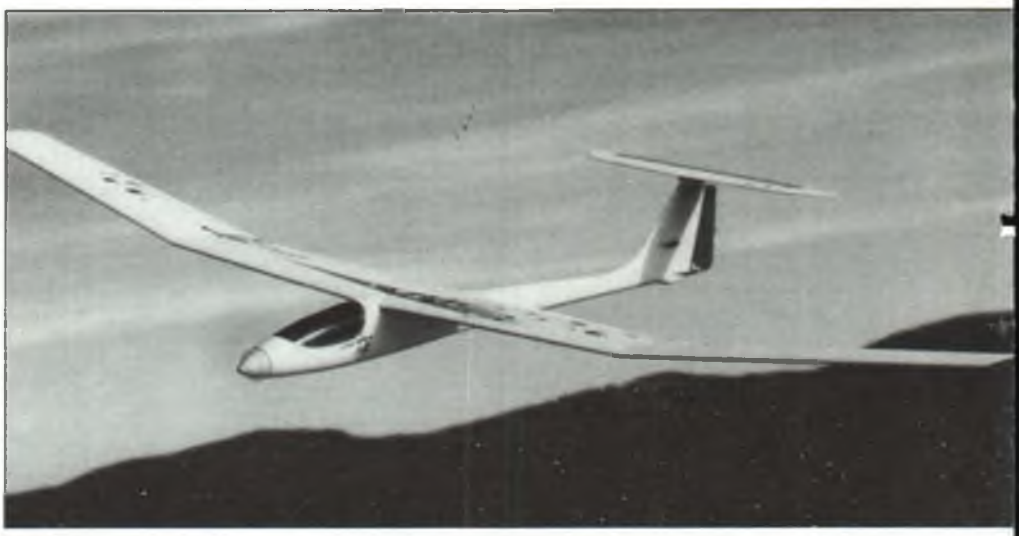
You may recall the piece on Neal Capener's 22-cell Robbe Calibra Pro, which appeared in the February '94 column. In a third communication to this writer, Neal Capener, of Port Angeles, Washington, tells of his experiences with the ASH 25 scale sailplane, also from Robbe Modellsport. His electrification of this big model solves the problem of flat land thermal or mild slope lift launching very nicely. He writes:

"Thanks for including my pictures in your column. Luckily, I am not wanted by the police!

"I want to tell you about the next Robbe plane I finished, an ASH 25 scale sailplane. For some time I've wanted to build a large sailplane that I could fly at the field, at the bluff, or in the mountains. Since I'm the only one in our club who takes sailplanes seriously, a winch is impractical, so electric power is the only way to go.

"When Robbe introduced the ASH 25—a 142-inch wingspan, semi-scale, variable span electric model with airbrakes for less than $300—I ordered one from a local dealer.

"The kit came with a beautifully finished, white gelcoated fiberglass fuselage, a pair



Robbe's "Calibra Soft" is a tamer seven-cell version of the hot Calibra electric motorglider reviewed by our columnist in last month's *Model Builder*. Wings are still factory pre-sheeted with obechi and highly prefabricated, but they now feature polyhedral for rudder/elevator controls (no ailerons). The wingspan has also been shortened to 72.5 inches.

of pre-sheeted wings (obechi over foam), wing extensions, die-cut plywood and balsa, canopy, a bag of hardware, and pre-cut tail surfaces. There was also a plan and instruction book in four languages.

"I knew right away that this one would be a pleasure to build. The quality of the components was obvious. The instructions are clear and broken down into individual steps.

"When construction was finished, I was still waiting for the Astro 15 geared cobalt motor I'd ordered two months before. I was anxious to fly, and with no delivery date on the 15, I installed an Astro 05 that was collecting dust after a mishap that wiped out a Falcon.

"I headed to the flying field with the model weighing well over 6 pounds. I wasn't very optimistic. Well, it flew fast, climbed OK, and landed predictably using the airbrakes.

"Test flying part 2: The first week in October, a warm sunny day, I called in sick at work, loaded the ASH in the van, called a friend to come along, and headed for Obstruction Point (elevation 5500 feet) in Olympic National Park.

"Now this is where this plane is meant to be flown! An Alpine setting, no people, no frequency pin, and a warm wind coming up from the valley below. Fly as long as you want!

"The ASH 25 needs plenty of open space—flying fast, whistling as it goes by, slow rolls, large loops, climbing effortlessly, getting small, airbrakes up, lose a few hundred feet, and then climbing again, graceful. The model has become a favorite, not for everyday flying but for those rare days when conditions are right.

"Time to start thinking of what to fly in the spring. We have a 200-foot bluff here with a straight drop to the ocean. Maybe I'll try a Coyote or a Samurai."

In a follow-up phone conversation with Neal, I learned that he finally has his Astro 15 FAI. Now he is considering how to overcome installation problems. The nose of the ASH is meant for direct drive, and of course, the output shaft on geared Astro motors is offset by about 1/2 inch or so, necessitating some creative design work with firewalls and balsa blocks. Where there's a will, there's a way...

Also, Neal is upgrading his 22-cell (1000 mAH) Robbe Calibra Pro to 27 600-mAH cells to boost performance for the upcoming Celebration of Silent Flight electric meet hosted by the Portland Area Soaring Society. Should prove very interesting and impressive!

Bill Forrey, 3610 Amberwood Ct., Lake Elsinore, CA 92330; (909) 245-1702 after 7:00 p.m. weekdays, pot luck on weekends. ***MB***

To get the most oomph out of every throw on a hand-launch RC job, you must eliminate any chance of the model slipping out of your hand during the throw. A single finger hole in the fuselage bottom is still the most common setup, but an increasing number of fliers are going to the method seen here on Mike Reagan's ship—a faired pair of grips on each side of the fuselage for a two-finger toss. Gives a higher launch, and is probably less drag than having an open hole in the bottom of the fuselage.

MODEL DESIGN *cont. from page 55*

For those who wish to get into this subject in more depth, both *Aerodynamics of Model Aircraft Flight,* by Martin Simons (Argus), and *The Design of the Airplane,* by Darrol Stinton (Van Nostrand Reinhold), are excellent references.

PARTING WORDS

This columnist is not only a modeler and an engineer, but an inventor. I have a number of patents, teach inventing at the University of Washington and Seattle University, am a consultant to other inventors, and have recently written a book on the subject. It's title is *Crackpot or Genius, A Complete Guide to the Uncommon Art of Inventing.* It is published by Chicago Review Press. I suspect that many of the readers of this column are inventor-types at heart. If you have liked my writing here, I think you will enjoy and profit by this book. Like MD&TS, it is informative. It even discusses models a bit.

If it isn't available at your local bookstore, they can order it for you. The retail price is $14.95. As a service to my readers, I am personally selling it for $12 plus $1.50 for postage and handling, for a total of $13.50, and I will mail you a copy.

Francis Reynolds, 3802 127th Ave. N.E., Bellevue, WA 98005-1346; (206) 885-2647. **MB**

DEAR JAKE *continued from page 22*

a suitcase—yours—while I was out. I returned it, of course, and I hope you have it back by now.

Jake

P.S. Those duckies on your underwear are just adorable.

DEAR JAKE:

It's your mother, dear. I know how annoyed you get when I bother you, but this is important, so please don't call the power company and have my lights turned off again.

Do you recall your twin aunts on your father's side, Euphonia and Euphrates? Well, they apparently violated their parole by starting a food fight at St. Benedicts, and now they have to go back to jail. Mrs. Casey, their kindly old neighbor lady, has agreed to take care of their budgie while they're away, but they need somebody to look after their other pet. Would you be interested in housesitting an armadillo?

Love, Mom

Dear Liquor Palace:

Do not, under any circumstances, deliver any more Peppermint Schnapps to Mrs. Millicent Doe of Cherry Blossom Lane.

Regards, Her Son. **MB**

FREE FLIGHT

BY BOB STALICK

Who Won What at the World Champs?

Although I couldn't attend the recent Free Flight World Champs, I've heard many of the stories of that grand event. I can't give you a full meet report, but I can congratulate the winners and acknowledge their accomplishments. So, here we go.

The winning F1A (Glider) team was the Czech Republic, with the U.S. coming in 9th. First place went to British flier Mike Fantam. Randy Weiler placed the highest for the U.S. team at 7th, Matt Gewain was right behind him in 8th, and Tom Coussens was 66th.

The Canadians pulled 1st place team in F1B (Wakefield) with Mathews in 3rd, Roswell 5th, and Ackerley 12th. Northwest flier Norm Beattie served as the Canadian team manager. For the U.S. team, which finished 7th, the order of finish was Fred Pearce in 17th place, Chris Matsuno in 24th, and George Xenakis in 57th.

F1C (Power) was won again by Randy Archer in the second flyoff round. Randy was followed by U.S. fliers Ed Keck in 6th place and Roger Simpson in 17th. The U.S. team finished in 2nd place behind the Ukraine.

The whole affair ran into some last minute problems at AMA HQ, which were solved by the superhuman efforts of the members of the Southern California Aero Team, and especially by Bob Waterman, who is the current president of the National Free Flight Society. Bob took over the management of the operation, set up shop at his mother's house in nearby Bakersfield and made the event happen.

Thanks to all who competed—I heard that this was the largest Free Flight World Champs of any that have been held—and thanks to those who made it happen. Congratulations also to our teams. I wish I could have been there!

The Willamette Modelers Club weather station. On top is an anemometer, below it is a hygrometer (used to measure humidity) from Radio Shack, and at the bottom is a Starline thermal sniffer. All three instruments are mounted to a single panel, which is in turn mounted with Velcro to a telescoping fiberglass pole. At the top of the pole is a thermal streamer.

MODEL OF THE MONTH: NATIONALIST 700

In the August '92 issue, the Nationalist 560 was the featured model. Now I've been informed by NFFS Nostalgia Committee Chairman Bob Larsh that the Nationalist 700 has also been approved. According to Bob, there are enough differences in the two designs that they needed to be dealt with as separate models.

I dropped a line to my buddy Lyman Armstrong to find out the background on the Nationalist. Here's what he had to say:

"I go along with the idea of approving the 700, as it will make good exposure for what I think is one of the best Nostalgia models. The design started, as I recall, when Al Grenoble came to a club contest with Peter Chinn's Internationalist, powered by a Cub .14. The thing was so tail heavy it was impossible to fly, and of course the Cub .14 was anything but a powerhouse. Stan Hill had gotten a Webra for me from a friend of his in Germany, so I loaned it to Grenoble so that he could balance the model and give it some go power.

"About this time, Chet Wicker, Frank Hauser and Bob Fizer formed a club committee to help the Juniors and Seniors. A Senior modeler, Carl Curtis, told Grenoble that he (Curtis) just didn't know what he was doing, so Carl developed the Internationalist as a 1/2A design and placed high at the Nationals, setting a national R.O.W. record.

"A larger version was drawn up and developed for the Torp .29/.32. The story I heard was that the larger version started at 600, then went to 650 and finally ended at 700 square inches. Fuselage shape and pylon height were varied and the twin rudders were finally dropped in favor of a single rudder. I have no idea how many versions were built. I do remember that Chet Wicker had one of the 650 versions with the twin rudders that he must have flown for at least five years.

"About three years ago, Bob Fizer had to move to Arizona for health reasons. He asked that I sell off all of his modeling stuff. Among his plans he had some pieces and shreds—enough that a set of Nationalist 700 plans could be drawn. Frank Hauser, who had also moved (to Oregon), was sent the pieced-together plans and drew up the final set for John Pond."

So there is the story of the Nationalist 700. According to Lyman Armstrong, this is one of the premier large Nostalgia models. It looks like it should perform well, and it's simple enough to be easy to build and trim. Full-size plans are available from John Pond Plans Service, P.O. Box 90310, San Jose, CA 95109-3310. Order plan 71C5. Cost is $10 plus $2 shipping and handling, and California sales tax if applicable. According to Bob Larsh, the Pond plan does not contain the requisite 2-1/2 inch diameter

wheel, and the model is not legal without it—so if you build one, don't forget that wheel. *(Editor's note: We mentioned the missing wheel to John—hopefully he'll add it to the Nationalist 700 plans. In the meantime, if your plans do not show the wheeled landing gear, you can easily add it yourself; the strut is 1/8-inch wire attached to the #3 bulkhead, angles back at just under 30 degrees, and is as long as needed for adequate prop/ground clearance.)*

APRIL MYSTERY MODEL

In the June '93 issue I featured a Jetex-powered stumper as the Mystery Model, and I just found another that I hope gives you the same fits. This one is a payload model, and it won the King Orange Internats (if you remember the KOI, you are old enough to understand this column). The model was powered by a Jetex 150 and had a wingspan of 36 inches. It was featured in a major model magazine and was available as a full-size plan. If you come across it, you may want to double-check the name, as the text calls it one name and the plan doesn't contain the title.

Here's the deal. If you think you know the name of this model, write it on a postcard and send it, along with your name and address, to *Model Builder*. The winner is drawn at random from among the correct entries received. It could be you, and if so, you win a free one-year *MB* subscription. Simple, isn't it?

DECEMBER MYSTERY MODEL WINNER

The February 1957 issue of American Modeler *carried the construction article for Frank Ehling's unusually configured "Heigh-Boy," a high-thrustline 1/2A design originally powered by an Atwood Shriek. This was apparently a tough one to identify, as only four readers responded. And it was frequent entrant Norm Reames, of Middleburg, Ohio, who scored the free one-year* MB *sub.*

MINIPOWER POSTAL CONTEST RESULTS

The first *Model Builder* MiniPower Postal Contest is over, and the results are in. Despite an initial inquiry list of 20 individuals, only six ended up actually flying in the contest. The rules were simple: Build a FF model powered by a Cox .010 and fly it in an AMA-sanctioned contest against at least two other competitors. Two such contests were apparently held, one in Cuckoo, Virginia, at Bill Saunders' farm, and the other in Tangent, Oregon, sponsored by the Willamette Modelers Club. The winners:

1. Bill Barr, 360 seconds, flown at Cuckoo.
2. Ron Baddorf, 307 seconds, flown at Cuckoo.
3. Bob Stalick, 271 seconds, flown at Tangent.
4. Ross Thompson, 223 seconds, flown at Tangent.
5. Jim Bocckinfuso, 97 seconds, flown at Cuckoo.
6. Chuck Gode, 53 seconds, flown at Tangent.

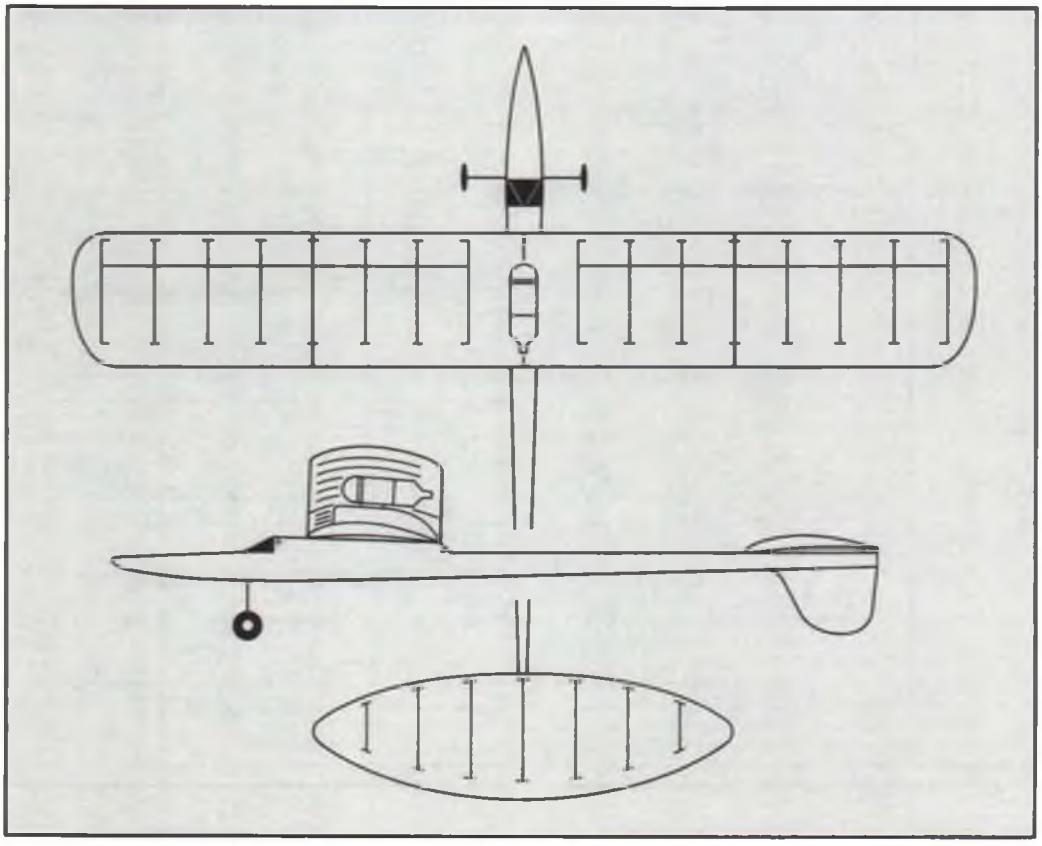
Third place in the *Model Builder* MiniPower Postal Contest went to columnist Bob Stalick and his Pee Wee Bee. See text for contest results. Photo by Chuck O'Donnell.

Each of the contestants completed a brief description of his model, which will be included in this column next month. However, to whet your curiosity, Barr flew a 24-inch span version of Clem's Witchhawk, nicknamed the Baby Hawk; Baddorf flew a reduced size Goldberg Interceptor; Stalick few a Pee Wee Bee; Thompson flew a scaled-down Starduster X, nicknamed the Mini-X; Bocckinfuso flew a model that he claims is 23 years old, and he is embarrassed to give any more information about it; and Gode flew his .010 Spacer, featured as the full-size center-spread plan in last month's *Model Builder*. More next month as well as some comments and recommendations for improvements in this contest.

FIELD-BASED WEATHER STATION

Not long ago, Herb Sessums of Bishop, California was advertising Kilo Marine windspeed

MYSTERY MODEL



Ed Barray built this reduced size Satellite for Pee Wee 30 competition. It was his first gas model in many years. Flies as well as it looks.

indicators. The Willamette Modelers Club decided to buy one and use it as a weather station during our contests. One was purchased and mounted on a panel which also contained a Starline thermometer/thermal detector with remote sensor, and a Radio Shack hygrometer. The panel was mounted on a pole, at the top of which was a short strip of Mylar streamer.

The whole assembly was placed on the field a short distance away from the operations tent and used periodically by the contest management to determine the weather conditions. Numerous modelers would also queue up to see what was happening. It was possible to tell wind speed, wind direction, humidity and temperature at 15 feet above the ground as well as at eye level all at one spot. Contestants appreciated the information, and we got away from those endless conversations about how fast that last gust of wind really was.

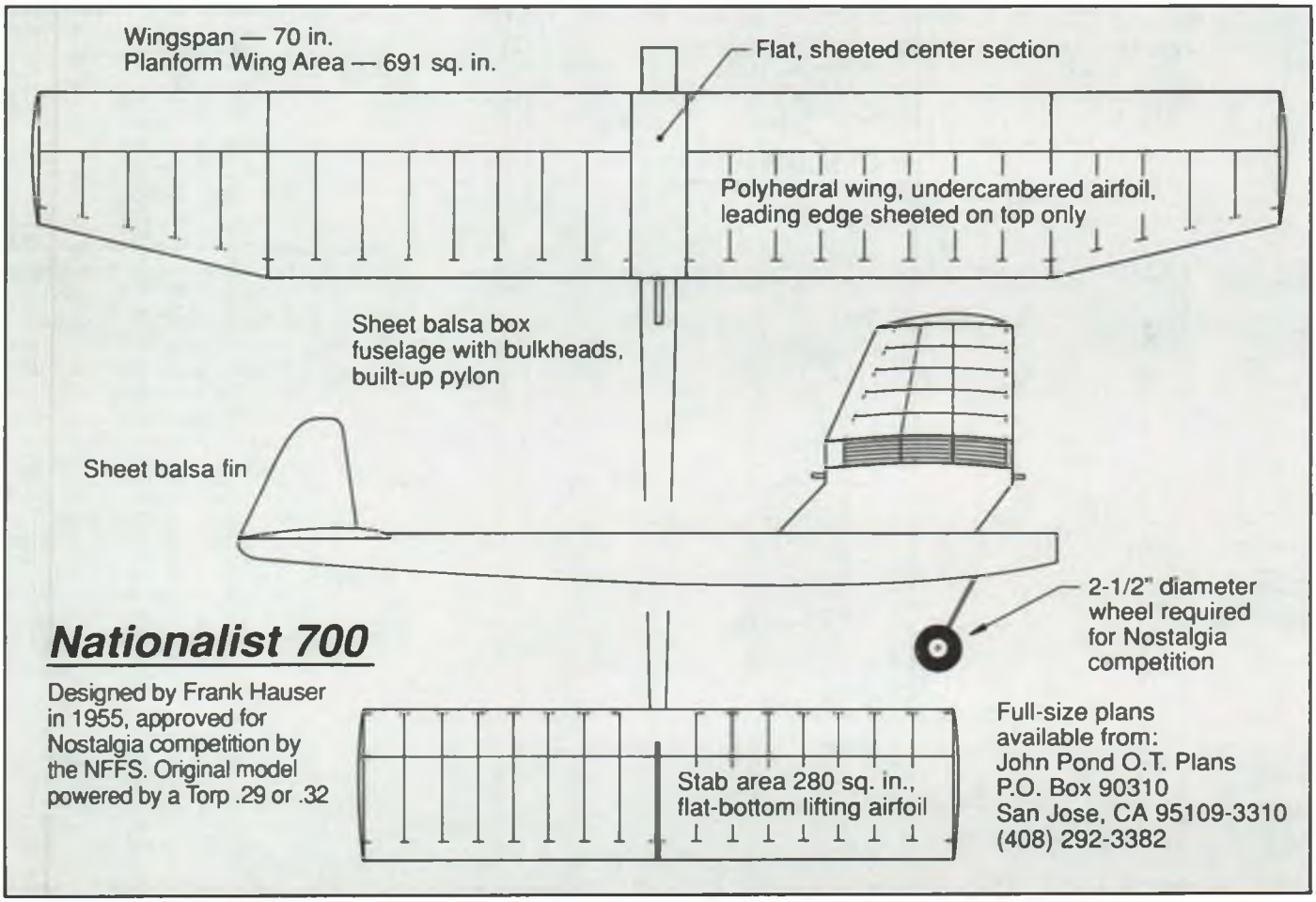
If you're interested in the windspeed anemometer, contact Herb Sessums, P.O. Box 754, Bishop, CA 93515, or call (619) 873-6436. The hygrometer is available at your local Radio Shack, and the thermal detector can be purchased directly from Starline International, 6146 E. Cactus Wren Rd., Scottsdale, AZ 85253.

TOO LATE FOR 1994 CALENDARS?

Dave Linstrum has produced some 1994 scale model calendars that he's offering for sale. Instead of the Playmate of the Month, this gem features four ink sketches and eight reduced model plans. According to Dave, there are a dozen planes worth modeling right there on your wall. And on top of this, you get 365 days organized into 12 generally equal installments beginning with January 1 and ending sometime in December. All for $5. Is this a deal or what? Order now before more of the year disappears. Send your order to Dave Linstrum, 11530 Woodglen, Jacksonville, FL 32223. Tell ol' Dave that you heard about his calendar in *MB* Free Flight.

THE END

That's it for now. Before I sign off, let me apologize for missing the deadline for the January issue. It was nice to get those phone calls and letters supporting this column, but it was my fault, so please don't blame *MB's* management. You can bet that I'll be more punctual in the future. So, thanks for your concern. Until next time, catch a thermal for me. ***MB***



Nationalist 700

Designed by Frank Hauser in 1955, approved for Nostalgia competition by the NFFS. Original model powered by a Torp .29 or .32

Full-size plans available from:
John Pond O.T. Plans
P.O. Box 90310
San Jose, CA 95109-3310
(408) 292-3382

BY SHERMAN KNIGHT

NSP'S 'Dove' Two-Meter Competition Sailplane

Light weight and state-of-the-art design and construction make this Northeast Sailplane Products kit competitive with the best of today's high-performance two-meters.

The Dove is a relatively new entry into the two-meter competition sailplane market, having been available for about a year now. With its high aspect ratio wing, from a distance it looks like an Open class ship. It is extremely light for a two-meter—22 to 25 ounces—and when flown slowly, acts much like a hand-launch glider. The Dove is a full-function sailplane and can be set up with either three or five servos. For competition flying, the five-servo setup with a computer radio is the best way to go.

The Dove is one of several kits produced exclusively for Northeast Sailplane Products by Mel Culpepper of Chuperosa fame. Construction consists of a Kevlar-reinforced epoxyglass fuselage, epoxyglass canopy, balsa sheeted foam wing, and built-up wood tail surfaces. Overall, I found the kit quality to be very high.

The kit arrives with all of the parts and hardware necessary for the three-servo control setup. For a five-servo model (one servo for each aileron and a separate servo for the rudder), you'll have to supply some additional servo linkage hardware. Otherwise, the only additional materials needed are adhesives, covering and paint. The first run of Dove kits (from which mine was built) were supplied with plans and only three pages of instructions. For an experienced builder, the plans alone were enough, but for someone who had never built a model like this before, the plans and instructions together left many unanswered questions. Later I was able to review a set of the updated instructions supplied in current Dove kits. These new instructions are a vast improvement and will be of significant help to the less experienced builder.

I have to confess that I nearly gave up when building my Dove. Not only were those early instructions inadequate, but during construction I realized that the wing servos (I built the five-servo setup) were going to protrude from the bottom of the wing by about 1/64 of an inch. It was enough to leave me a little dissatisfied with the kit. I got busy at work, and the model sat for several weeks with no new construction.

However, that all changed when I flew a friend's Dove for the first time. I was flabbergasted with the flying ability of the airplane. The SD7037 airfoil allows this lightly loaded sailplane to fly relatively fast, and also to slow down and float like a hand-launch. The flaps worked extremely well, and I was able to hand-catch my friend's airplane on my very first flight. Needless to say, I had my Dove finished in short order.

CONSTRUCTION

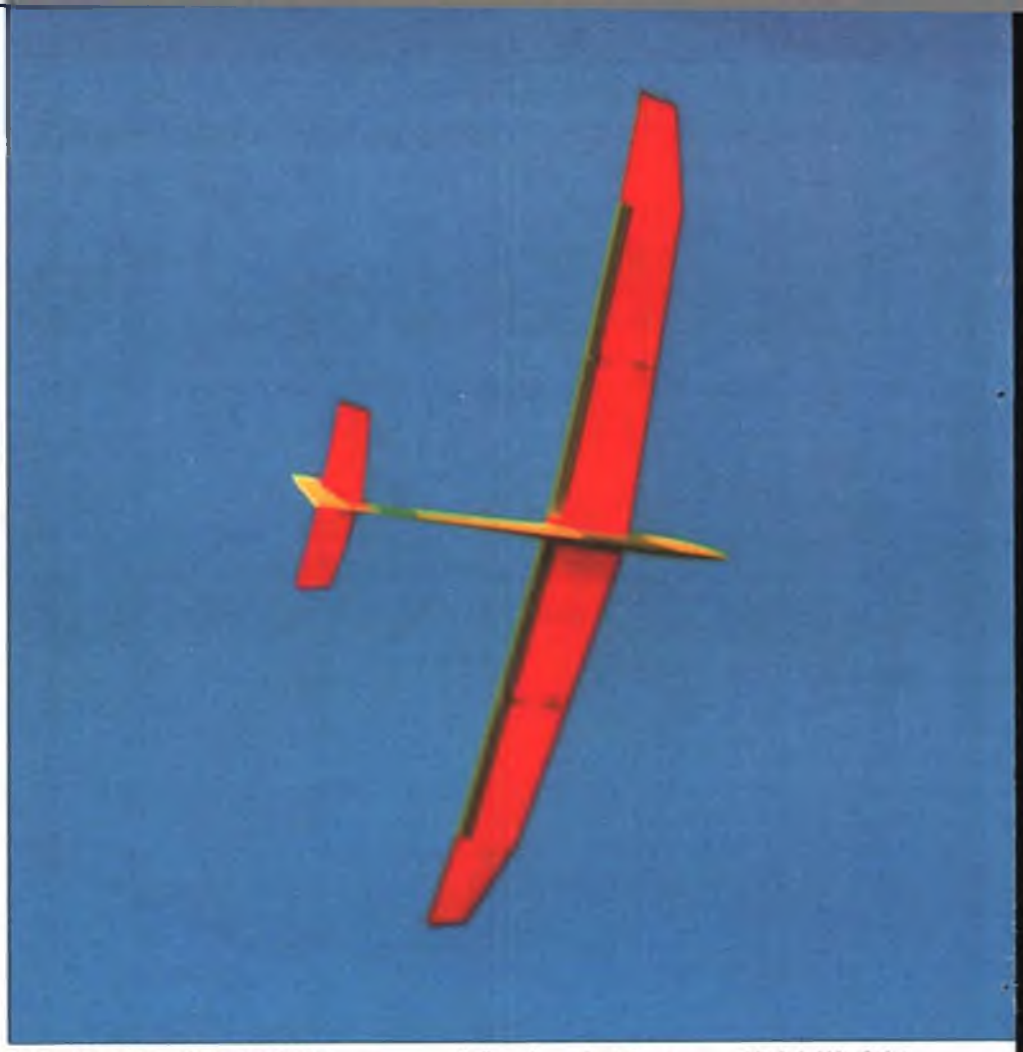
If you are looking to try vacuum bagging for the first time, the Dove kit comes highly recommended. The white foam cores come in four separate pieces and have pre-cut spar channels. The beds are full chord, i.e., the trailing edge of the beds extends clear to the trailing edge of the wing. This is a must to insure the proper amount of under-camber in the thin

NSP'S DOVE TWO-METER SAILPLANE

WINGSPAN	78-3/4 in.
WING AREA	510 sq. in.
ASPECT RATIO	12.16
FLYING WEIGHT	22-25 oz. (22.5 oz. as tested)
WING LOADING	6.2-7 oz./sq. ft.
AIRFOIL	SD7037
CONTROLS	Ailerons, elevator, rudder, flaps
PRICE	$119.95 (kit); $239.95 (obechi/foam pre-sheeted wings)

Available exclusively from Northeast Sailplane Products, 16 Kirby Lane, Williston, VT 05495. (802) 658-9482.

PHOTOS BY JEFF KASNER



Looking for all the world like an open-class ship, the author's Dove circles tightly to core a low-altitude bubble. Owing to its very light weight and use of the excellent SD7037 airfoil, the Dove can be safely maneuvered near the ground without fear of tip-stalling.

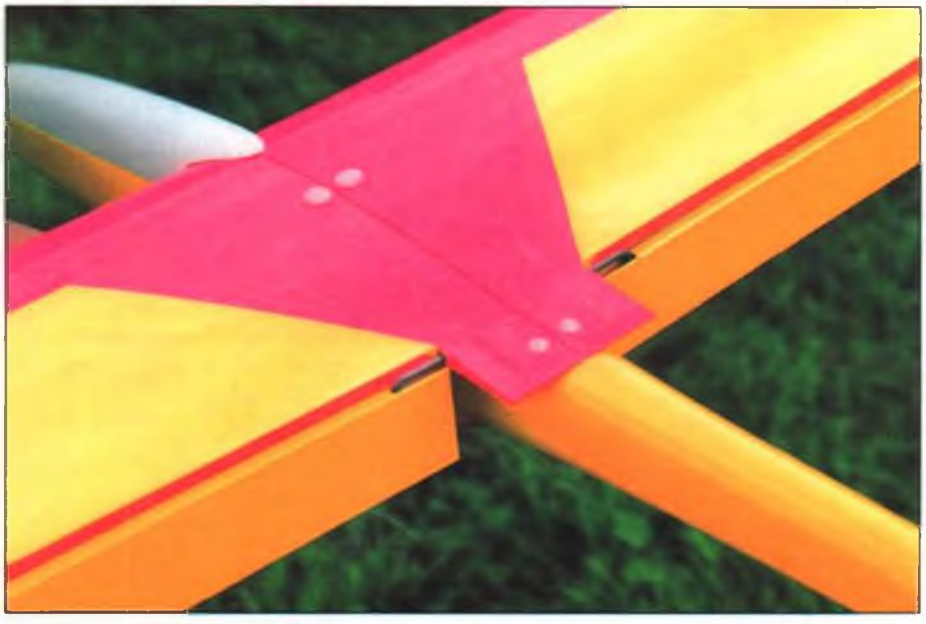
Underside view with the flaps and ailerons in the "crow" configuration. This setup requires a computer radio (the author uses a JR x-347) and five servos—two for ailerons, one for flaps, one for elevator and one for rudder. The flap servo is mounted at the root of one of the wing halves and is connected to the other half's flap linkage before bolting the wing to the fuselage. An exceptionally clean-looking ship, no?

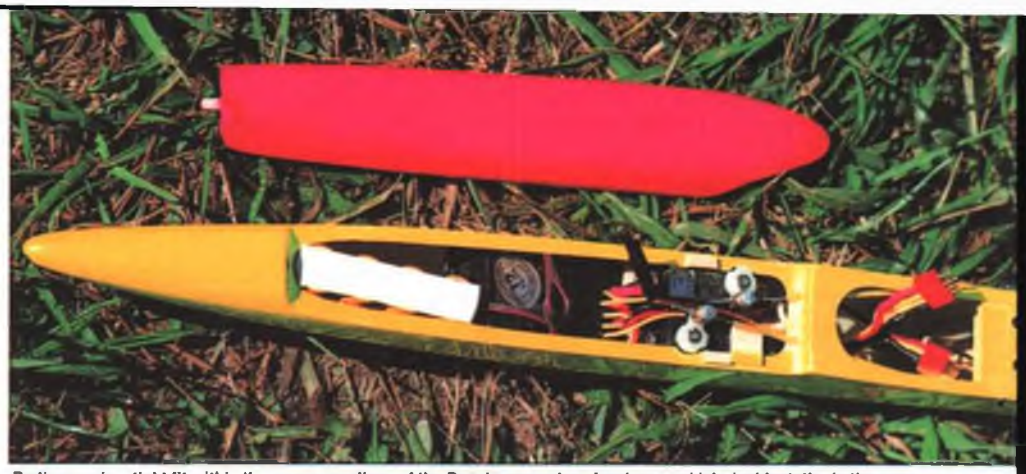
trailing edge area of the wing.

The kit includes 1-inch wide fiberglass tape to be installed along the trailing edge, and 2-ounce fiberglass cloth squares to be used as reinforcement above and below each aileron servo. Also included is unidirectional carbon fiber for the spar caps.

With the three-servo setup, in which one fuselage-mounted servo drives both ailerons and the rudder, you'll need to install the cable guides on the upper surface of the foam core before adding the sheeting. With the five-servo setup, you'll need to install extended servo leads. Finally, with all the

The flaps are hinged along the bottom and can be dropped a full 90 degrees. Wing is built in two halves—could also be made in one piece if you prefer—and mounts to the fuselage with two main bolts and two small bolts at the trailing edge.





Radio gear is a tight fit within the narrow confines of the Dove's epoxyglass fuselage—which, incidentally, is the same one used on NSP's sleek Sparrow slope glider. Here, two RCD Apollo 24 micro servos (rudder and elevator) are mounted side by side at the rear of the cockpit; in the middle is an RCD 535 FM micro receiver, and up front is a 270-mAH battery pack.

prep work done, the skins can be epoxied to the cores, placed in the vacuum bag and left to cure. Of course, if you don't have access to a vacuum bag setup, the wing panels can be sandwiched between the upper and lower foam beds, loaded with weights and left to cure. Both techniques are presented in detail in the instructions.

Once you've done a sheeted foam wing project, you'll never go back to building an open-frame wing. It takes only one or two evenings at most to prepare the foam core and spar assembly, assemble the wing skins, and pre-cut the other materials such as carbon fiber and fiberglass.

If you're using a fluorescent film covering as I did, install the leading edges and flap and aileron hinge line facing with white or aliphatic resin glue. This facilitates sanding, and the glue will not react adversely with the fluorescent pigments like epoxy or CA.

Micro servos are a must for mounting inside the wing. The RCD Apollo 24 servos I used are just under 9/16-inch wide and stick out the bottom of the wing slightly. The servos are simply a press fit into the servo wells. (Wrap a length of dental floss under each servo so you can easily pull them out.) Although I was somewhat skeptical of this mounting system, it has worked very well. Once the servos are installed, simply cover them with clear tape or your favorite covering material.

The Dove's fuselage is the same one that NSP uses in their Sparrow slope glider. It's extremely strong and yet very narrow; the end of the tail boom is only 3/8 of an inch in diameter.

Outfitting the fuselage is simple. There are no internal bulkheads. You need only install the wing hold-down bolt blocks at the CG and at the trailing edge, and servo rails—the location will depend on whether you're building the three-servo or the five-servo setup. You may have to enlarge the wing saddle opening to accept the flap control linkage, as I did, and may also need to enlarge the opening at the nose to accept your battery pack.

The fin is pre-cut 1/8-inch balsa with a hardboard cover on each side of the lower portion. The rudder and stab are built from balsa strip stock. The tail feathers are extremely light, and I suspect that some builders will want to beef them up or install longer joiner wires. I found that they are plenty strong as is, and haven't had anything that even resembles a failure.

FINISHING

I finished the wing and tail surfaces on my Dove with Goldberg's Ultracote fluorescent film, and sprayed the fuselage with one of the Oracover-matching polyurethane paints sold by Hobby Lobby. Because the Oracover and Ultracote colors appear to be identical, the paint matches the Ultracote perfectly. The fin, horizontal stab, bottom of the wing and the top of the wing leading edge are fluorescent pink; the remainder of the top of the wing, the rudder and the fuselage are fluorescent yellow. Wow!

FLYING

For a two-meter airplane, the Dove is exceptionally easy to fly. Launching with approximately 1/4-inch down flap and no elevator compensation, the airplane goes straight up on a high-start. The most surprising part of the high-start launch is how fast it goes up. You're left with the impression that somebody placed an model rocket motor up the tailpipe and lit it off right as you let go. Winch launches are about the same. Because of the Dove's light weight (mine weighs 22-1/2 ounces, and that's with five servos aboard) and relatively small wing, it takes a while to figure out the right tapping rhythm. Because of its light weight, it won't zoom like an aircraft weighing twice as much. Nevertheless, on those still-air days, even with a higher launch, the other plane will be on the ground first. Also because of its light weight, the Dove is capable of extremely tight maneuvers very close to the ground. I've noticed no tendency for my model to tip stall.

I hope you're getting the impression that I'm impressed with this airplane, because I truly am. The Dove also performs quite well on the slope, but it's not a racer or a speed ship. The Dove is designed specifically for thermal duration flying, and it does this

The Dove's rudder and full-flying stab are of built-up balsa stick construction—very light and plenty strong enough for the job.

exceptionally well.

After a few flights I started experimenting with the CG. It's now 3-7/8 inches back from the leading edge, or about 5/8-inch behind the location shown on the plans. The towhook has been moved back an equal amount.

I entered the Dove in a recent club contest and scored my first 1000-point round in two-meter. However, I had the most fun at the lunch break by hand-launching twice into 10-minute-plus flights. I never thought I would really enjoy flying two-meter competitively, but the Dove has changed that.

I have flown several two-meters, including the Alcyone 2M, Sagitta 600, Olympic 650, Raven SC20, Pixie, and other similar aircraft. If someone were to ask me to recommend a two-meter sailplane, the Dove would receive my full endorsement. I think this is the best all-around two-meter you can buy. ***MB***

Sherman couldn't be happier with his new two-meter contest ship. The Dove is a model that warrants your serious consideration if you are at all interested in two-meter competition. If building time is at a premium, NSP also offers the Dove with pre-sheeted obechi/foam wings, which will speed things up considerably. A 180-page catalog of all of NSP's kits and accessories is available for $7 postpaid—see their ad elsewhere in this issue.

SCALE MASTERS cont. from page 39

Thursday, October 21 with static judging. Flying commenced on Friday morning and ran through Sunday afternoon. On Friday afternoon the ZAP gang (the main sponsors of the event) had a bus take the pilots and their spouses out to the private hangar of Harris and Tom Lee at Chino Airport, where they enjoyed a barbecue and private showing of vintage aircraft including Staggerwings, Stearmans, AT-6 Texans, Wacos, a Vultee BT-13, Curtiss Robin, Beech D-18, J-3 Cub, Luscombe Silvaire, deHavilland Vampire, P-51 Mustangs, F4U-5 Corsair, Grumman F-6F Hellcat, and a couple of Douglas AD-1 Skyraiders just to round things out! For selected VIPs and the press there were rides in an AT-6 and a beautiful red Staggerwing. One of my great thrills in life was getting a ride in that big red bipe. I guess my next scale model will have to be a red Staggerwing!

As if all of that weren't enough, Harris Lee and the Scale Squadron arranged for the Chino Planes of Fame Museum to be open for a private viewing by the Scale Masters participants until 9:00 p.m. night. This gave the pilots a chance to see some of the aircraft that they have modeled, up close and personal. The museum has a wide variety of vintage, rare and one-of-a-kind aircraft. It was wonderful to walk among the full-scale aircraft without a crowd of spectators around. It was an experience that none of us will never forget.

The big 76.4-inch span, scratch-built VKS 7F Waco Cabin took Charles Nelson to a 10th place finish. The 16-pound bipe is built to 2-1/4"=1' scale and features flaps, operating position lights, anti-collision beacon, and retractable landing lights. It's a copy of the last Waco ever built. Finish is Sig Coverall and dope. Charles came all the way from Berlin, Massachusetts to compete in the Scale Masters.

Saturday was the day the spectators came out in force at Mile Square. There were literally thousands of people from all over Southern California, Arizona and Nevada. One gentleman I talked to had come all the way from Ohio just to watch. Participants came from all over the U.S., Canada, Germany and Brazil. The quality of the models was amazing—the highest static score was 96.5, shared by three different contestants. A perfect score would have been 200 points—100 static, 100 flying (the average of three 100-point flights)—and the winner's score was 190.75! There was a spread of less than 4.5 points in the top five finishers' scores.

Out of the top 10, there were four prop-driven Warbirds, one WWI fighter, one Golden Era bipe, and four ducted fan jets. I'm not normally a devotee of ducted fan models, but the ones at the Scale Masters were fantastic in their complexity and perfection, and their performance was phenomenal. Since space is limited, I'll just go over the top placing jet models and let the photos tell the rest of the Scale Masters story.

Twenty-sixth place went to Carl Lindou, who flew this beautiful Proctor 1/4-scale Albatros D.VA in his first Scale Masters Championship. Covering is Solartex, paint is a combination of K&B Superpoxy and dope mixed with mahogany stain. Carl did a great job of putting some very realistic flights on the 88-inch span, 21-pound, Super Tigre 3000 powered model.

Dennis Crooks of Illinois took 1st place with his 1/6-scale Lear 35A, which uses a Frankel fiberglass fuselage with scratch-built wings and engine nacelles. The 80-inch span model weighs in at 27 pounds and is powered by two O.S. .77s. Control is via a Futaba 1024 9VAP radio. Some of the special features include a full interior, landing lights, brakes, spoilers, flaps, and individual engine throttle control. Not only is this model the epitome of scale perfection, its performance is extremely realistic. It only took a little imagination to believe you were looking at the real thing. The low, high-speed passes were unbelievable!

Terry Nitsch of Ohio came in 2nd with his Bob Violett Models 1/8-scale F86-F Sabre, powered by a BVM .91. Control is supplied by a JR PCM 10 radio. Functions include speed brakes, sliding canopy, droppable tanks, flaps, retracts, gear doors, aluminum simulated skin with rivets and panels, and a cockpit loaded with enough detail to boggle the mind. Terry is truly a skilled jet pilot; he put the Sabre through its paces in a manner that would make any full-scale jet jockey proud. With the BVM engine the F86 had ample power to deliver the speed and performance that one would expect from a jet.

In 4th place was Shallesh Patel of California flying a 1/9-scale Yellow Aircraft F-14 Tomcat. The 90-inch span jet weighs in at 35 pounds and is powered by two O.S. .91 engines. Control is supplied by a Futaba 1024 9VAP radio with a myriad of servos and electronics. Features include a sliding canopy, brakes, retracts, and full swing wing function. Shallesh's F-14 was the loudest jet on the field; the sound it made on each high-speed pass made the hair on the back of your neck stand up! Although Shallesh did not maneuver with the wings in the swung-back position, he did demonstrate the function in a high-speed, level pass on each flight.

Finally, the jet that had me completely enthralled every time it flew was Texas modeler Lee Rice's 1/8-scale, scratch-built F-104. The model spans only 35 inches, weighs in at 15 pounds and is powered by an O.S. .91 mounted in a Dynamax fan. It's a real feat of engineering and pilot skill that anyone could get a model F-104 to even fly in the first place, let alone finish in 8th place against some of the toughest competition around! What was surprising to me was the relatively short ground run of Lee's model and the stability it exhibited. It's hard to believe that a 15-pound model can perform so well with so little wing. If there were an award for flying skill and tenacity, my vote would go to Lee Rice and his F-104.

The model community owes special thanks to the Scale Squadron, the Orange Coast R/C Club, National Chairman Lee Harris, Contest Manager Diego Lopez, Contest Directors Gordon Truax and Roy Pratt, Chief Judge Kent Walters, and the pilots for presenting us with the best Scale Masters Championships ever. And let's not forget the sponsors who make it possible to present the contestants with such great prizes and trophies: the ZAP Gang, Futaba, M.A.T., Aviation International Replica Builders Co., Gene Barton Landing Gear, Robart, JR/Horizon Hobby Distributors, Airtronics Inc., Air Age, Bob Holman Plans, Byron Originals, Carl Goldberg Models, Coverite, Fox Manufacturing, Hobby Poxy, Hobby Shack, Prop Wash Video, Dryset, R/C Report, Scale Model Research, Sig Manufacturing, Sullivan Products, Top Gun Aircraft, Tower Hobbies, JP Products, Tru-Turn Products, and El Pollo Loco. ***MB***

The 1993 Schluter Cup

Our roving heli columnist reports on what has become one of the largest RC helicopter meets in the U.S.

BY JAMES M. WANG

The 1993 Schluter Cup was held on September 18 and 19 at Mercer County Park in West Windsor, New Jersey. The contest was well organized and ran smoothly, but unfortunately Saturday's weather did not cooperate fully and some of the pilots ended up flying in a light rain. Sunday brought clear blue sky. Chatting with old and new friends made it well worth the 140-mile drive for me to attend this premier contest.

A total of 64 pilots registered for the five competition events: Class 1, 2 and 3 (beginner to advanced), Expert FAI, and Scale. Ten pilots signed up for Scale, but only eight flew. Yours truly was drafted as one of the Scale flight judges.

On Saturday morning the cloudbase was so low that the FAI models sometimes disappeared during the approach to the 180-degree autorotation maneuver. The afternoon brought intermittent rainfall, so that the contest had to be stopped a few times. During the Scale flying, some of the contestants were flying in pretty big droplets. At least we judges had a tent over our heads!

This year's FAI winner was Cliff Hiatt, of Florida. I have always had a lot of respect for Cliff. His machines are always meticulously clean and well built. I am very impressed by the knowledge of helicopters that he has gained over the years of just flying RC models.

Cliff deserved his win. He practices six days a week, and says the problem of practicing in Florida is that it is usually calm or nearly so, and as we all know, the wind always blows at contests.

■ LEFT: This immaculate .60-size Miniature Aircraft XL-Pro in an Optima fuselage belongs to 1st place FAI winner Cliff Hiatt. It uses the new XL-Pro wood blades which have a 14 percent thick modified NACA0012 airfoil. Interestingly, the top four FAI winners all used Futaba 9ZHP radios with Futaba 153 gyros and S9201 servos. ■ RIGHT: Second place FAI winner Tom Dooley with his backup model, a Hirobo Tsurugi. See text for an interesting discussion on how Tom sets up his models.

Cliff had first pick of any prize from the table, but instead of one of the expensive Rossi or Webra engines or a Schluter Procopter, he picked a package of fuel line and left the high-dollar prizes for the others. Cliff also waves and thanks the judges after every round. He is truly a good sportsman.

A hint from Cliff toward getting a smooth hover is to run the motor nice and rich. You do this by opening the idle adjustment screw and main needle valve. If the tail vibrates horizontally, it indicates that the engine is running rough. I noticed this on my Concept 60; after I richened the mixture, the shake disappeared. With a rich setting there will be a thick blue exhaust smoke, and the motor will sound "consistent." If you notice a significant loss of power or the engine won't idle for a long time (at least a minute), then you are running *too*

1993 SCHLUTER CUP RESULTS

CLASS 1	CLASS 2	CLASS 3	FAI	SCALE
1. Tony Hamdi	Handi Homann	Dana Swah	Cliff Hiatt	Michael Armocida
2. Paul Drajem	John D'Arcangel	Lance Murphy	Tom Dooley	Al Smith
3. Robert Burgo	Lance Frohman	Ralph Dalusio	Stan Olzaski	Michael Swift
4. Vinny Riccobono	Dave Storey	Michael Swift	Ray St. Onge	Richard Bell
5. Alex Valdes	Mike Bendjouya	Richard Bell	Len Sabato	Handi Homann

helicopter world

■ LEFT: Everyone stopped to watch when Mike Swift flew his O.S. .32H powered Boeing Vertol Ch-46 tandem rotor helicopter with Hirobo mechanics. Mike placed a well deserved 3rd out of eight entries in Scale. ■ RIGHT: Close-up of the immaculate cockpit detail in Al Smith's Bell 222 Airwolf, with GMP Cobra mechanics. Placed 2nd in Scale.

■ LEFT: Tim Lampe's Concept 60 is hidden inside a Kyosho Interceptor fiberglass fuselage. It has an O.S. .61 SX-H engine with Hatori 669 muffler. Stan Olzaski flew an equally beautiful Interceptor to 3rd place in FAI. ■ RIGHT: Cliff Hiatt transports his XL-Pro/Optima in this custom-made container borrowed from Ted Schoonard of Miniature Aircraft. Construction is cardboard with 1/2-inch Styrofoam, fiberglass cloth and epoxy. No disassembly of the model is required.

1993 SCHLUTER CUP • TOP FIVE FAI PILOT/HELICOPTER SPECIFICATIONS

	Cliff Hiatt	Tom Dooley	Stan Olzaski	Ray St. Onge	Len Sabato
Helicopter	XL-Pro	Eagle EX	Concept 60	Futura	Kalt Alpha II
Fuselage	Optima	None	Interceptor	None	None
Model Wt.	11.25	11.5	11.5	11.0	10.5
Main Rotor Blades:					
Type	XL-Pro	DY F1	HI-Product Progressive	NHP Double Reflex	KSJ
Material	Wood	Fiberglass	Fiberglass	Carbon Fiber	Wood Core w/fiberglass
Weight (gms)	190	200	200	175	200
Length (mm)	690	680	660	680	660
Tail Blades:					
Type	NHP	HI Pro. TC31	Kyosho	NHP	Kalt/NHP
Material	Carbon Fiber	Carbon Fiber	Plastic	Carbon Fiber	Carbon Fiber
Engine	O.S. 61SXH	YS 61SFH	O.S. 61SXH	O.S. 61SXH	YS 61SFH
Exhaust Muffler	Hatori	Hatori	Hatori	Hatori	Hatori
Radio	Futaba 9ZHP	Futaba 9ZHP	Futaba 9VHP	Futaba 9ZHP	JR PCM-10S
Gyro	Futaba 153	Futaba 153	Futaba 153	Futaba 153	JR 1000
Servos	9201	9201	9201	9201	4131
Hover RPM	1200	1250	1400	1450	1450
Forward Flight RPM	1700	1600	1700	1650	1650

rich. Some fuels also seem to run smoother in hover than others. I was using one brand of fuel and the tail shook; when I switched to Byron 15 percent, the shake stopped.

The 2nd place FAI winner was Tom Dooley. Tom is one of the nicest heli pilots you will find. He is always ready and willing to answer anyone's questions. Tom was also a member of the 1989 U.S. FAI team.

Recently, Tom let me fly both his SST Eagle and his Tsurugi, both of which are set up for FAI competition. They are extremely mellow and docile to fly. The hover rpm is very slow, only 1280, as measured using an LCD optical tachometer. The roll cyclic on Tom's machine is quite "dead"; you can move the roll cyclic stick almost halfway and the model will not jerk over. The fore/aft cyclic is slightly more responsive.

The slow cyclic control response is primarily due to the slow rotor rpm, not a lack of paddle

continued on page 75

PLUG SPARKS

BY JOHN POND

The Bomber Has Been Banned!

According to the Australian SAM 1788 newsletter, *Duration Times*, a committee headed by Basil Healey has been directed to draft a set of new rules for the RC Antique event, and what they came up with are some interesting revisions and ideas that we in SAM USA might consider adopting.

Most interesting to note in the proposed rules was the banning of pylon models—brought about by the overall superior performance of the Lanzo Bomber. Tests conducted by members of the Rules Revision Committee show that, using the same engine, the Bomber climbs 20 percent higher than other models of comparable size and weight. The glide is superlative on calm days, but as one would suspect, on windy days it suffers from poor penetration, as do all pylon models.

Photo No. 1. The late Chet Lanzo, photographed at the 1988 Lawrenceville SAM Champs with his 8-foot span Bomber, the model that has been built in such great numbers and has so dominated the O.T. and Antique RC events of late that the Aussies are proposing a special Antique event that would effectively exclude the Bomber and all other pylon designs—details in text.

On the foregoing basis, a new "1938 Antique" event is being proposed which would replace the existing Antique event, and which is open to any non-scaled Antique class cabin fuselage, non-cabin fuselage or cabane strut model—no pylons. Engines are limited to pre-1950 spark ignition and diesels. A hot racing engine would no longer be needed, as the proposed rules feature no fewer than *eight* different motor runs, depending on engine make/type, the idea being to allow everyone to be equally competitive regardless of the engine used.

Photo No. 2. As an alternative to the Bomber, consider the Dallaire Sportster, a 9-footer that has proven to be one of the best cabin designs for RC Texaco competition. This O&R .60 powered example was the first of several Dallaires built by Pond since 1973.

Under these rules, the Antique event would no longer be a "Lanzo Bomber Benefit" as has been the case over the last several years in America. In Australia, one out of three Texaco and Antique entries are Bombers. Too many!

Photo No. 1 shows what started all the controversy. Seen at Lawrenceville in 1988 is Chet Lanzo with his Bomber. This model won Texaco at the Westover AFB SAM Champs in 1986 and the rush was on!

Before getting into the proposed rules too far, we are picturing a few models that comply with the proposed rules and which would make good alternate choices for competition.

Photo No. 2. A 9-foot Dallaire Sportster built by this columnist for RC in 1973 using an Ohlsson .60. The Dallaire later became a very popular RC Texaco subject with an open-rocker O.S. .60 four-stroke engine.

Photo No. 3. Joe Elgin brought this writer's attention to the good-looking Thracy Petrides "Privateer" from the September 1938 *M.A.N.* Super Cyclone power in this 87-inch payload model.

Photo No. 4. Jack Albrecht built a lovely copy of the model that won the Nationals, a 1938

■ **ABOVE: Photo No. 3. Not often seen in SAM RC competition but a good flier nevertheless, this is the Privateer as originally designed by Thracey Petrides and published in *M.A.N.* ■ RIGHT: Photo No. 4. Jack Albrecht finished his Anderson-powered Lackey Zenith in pink silk with painted blue trim.**

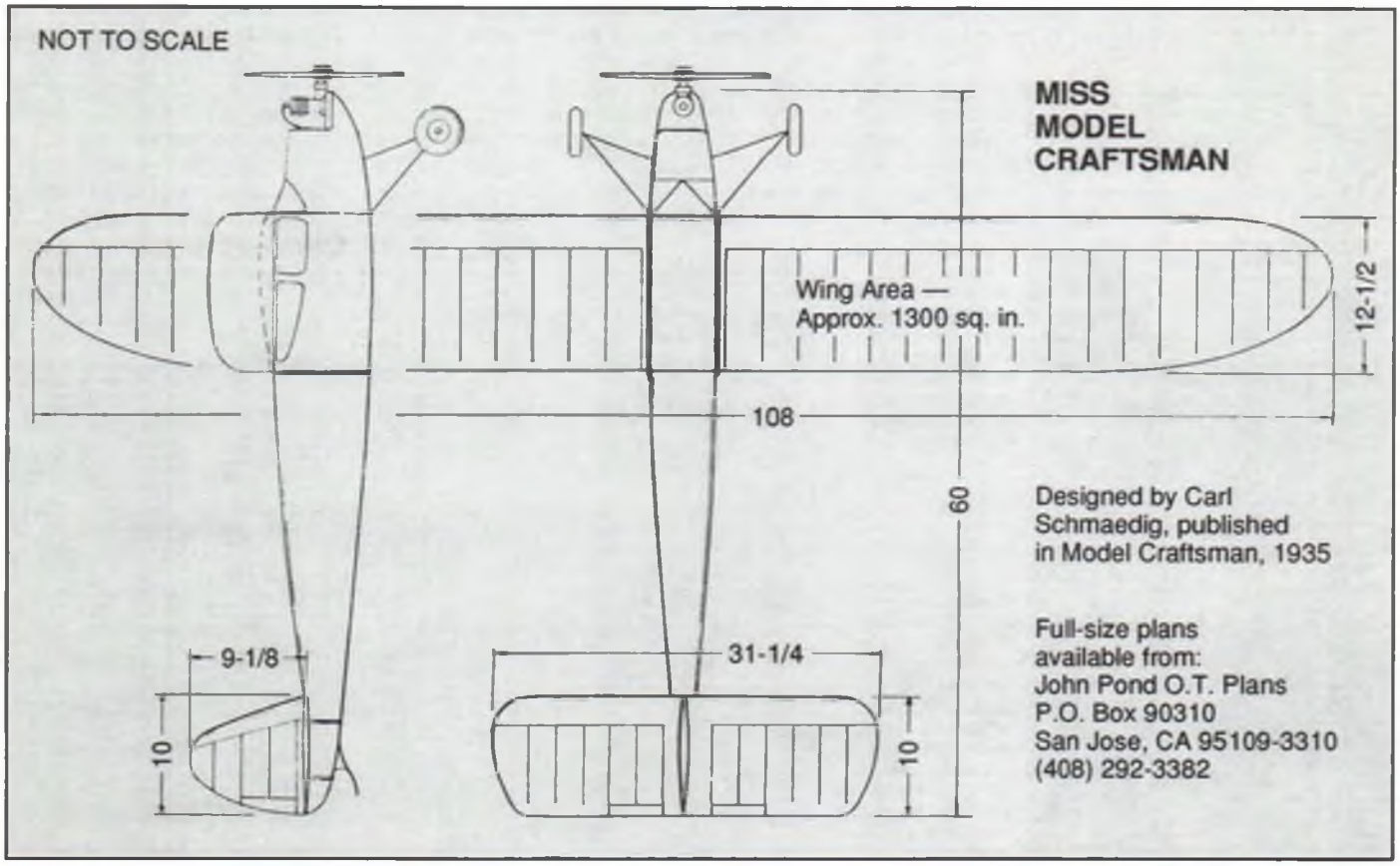
Lackey Zenith with Anderson Spitfire power.

Photo No. 5. How about this Mickey DeAngelis Trenton Terror by Don McCluskey of Texas? The original, as is this one, was powered by a Brown Jr. Good, steady flier.

Photo No. 6. Don't like cabins? How about this Lancer 49 by Australian Colin Borthwick. Was also produced in a 72-inch span version.

Photo No. 7. If you like large, graceful flying models, consider this streamliner built by Francis

MODEL OF THE MONTH



PLUG SPARKS

■ ABOVE: Photo No. 5. A decent flier and about as easy a model to build as you could want. Mickey DeAngelis (who is still active with the SAM 100 club on the East Coast) had his 6-foot Trenton Terror published in *Flying Aces*, April 1937.■ RIGHT: Photo No. 6. New Cyclone kitted three different sizes of the Lancer, a good flier and an attractive alternative to the more normal cabin fuselage layout.

Tlush. Original Tlush-powered model won the 1936 Texaco event.

Photo No. 8. Joe Weathers' gull-winged Mystery Man is a real beauty. The 1938 design raised quite a controversy with its takeoff dolly. This Forster .29 powered copy was built by California's Dick Monaghan.

Photo No. 9. Last but not least, a Diamond Demon as displayed by the original designer, Jerry Stoloff. The model as kitted by Bay Ridge has a 48-inch span.

The following are the engines and the allotted engine runs as proposed for the new 1938 Antique event. Engine runs are handicapped according to engine type and/or capacity, per pound weight of the model, as follows:

•Group 1, 8 seconds per pound: McCoy .60 Red Head Black Case, McCoy .60 Series 20, Dooling .61, Edco .65, Hornet .60.

•Group 2, 11 seconds per pound: Anderson Spitfire .64, Orwick .64 and .73, Cunningham .64, Daniel .64, O&R .60 front intake, Fox .59 long shaft, Nordec .60, Rowell .60, Orr .65, Ball .60, Bungay .60, Blue Streak .65, Hassad .60, Hearns Hobbies Tempest .60, McCoy .49, McCoy .29, McCoy Sportsman .55, Ken .60, and any twin ballrace front or rear induction engine, .60 to .65, not listed in another group.

•Group 3, 15 seconds per pound: SuperCyclone .65, Pacemaker .59, Atwood Champion .60, O&R .60 sideport with large exhaust stack, and Forster .99.

•Group 4, 22 seconds per pound: All other plain bearing or single ballrace spark ignition engines, .57 to .99, not listed in another group, e.g. Brown Jr., Dennymite .57, Contestor .60, O&R .60 sideport with teardrop exhaust stack, Molnar .78 and .99.

•Group 5, 25 seconds per pound: All other spark ignition and diesel engines, .40 to .56.

•Group 6, 29 seconds per pound: All other spark ignition and diesel engines, .23 to .39.

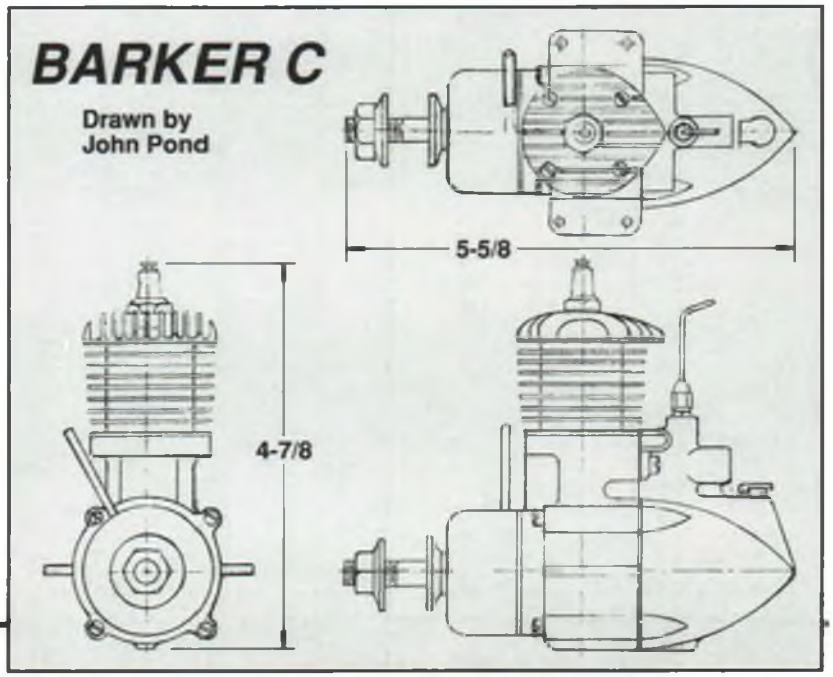
•Group 7, 32 seconds per pound: All other spark ignition and diesel engines, .15 to .22.

•Group 8, 35 seconds per pound: All other spark ignition

Photo No. 7. There are a number of large Antique "streamliners" to choose from, among them the 1936 Texaco winner by Francis Tlush. These big ships are a lot of work to build, but the results are worth it.

Photo No. 8. Here's a real building challenge: the Mystery Man as designed by Joe Weathers and published in *Air Trails*. With its drop-off takeoff dolly, the airplane is very clean and has an excellent glide. Dick Monaghan did a beautiful job on this Forster .29 powered ship.

ENGINE OF THE MONTH



and diesel engines, 1.3cc to .15.

MODEL OF THE MONTH

Back in 1935, a 9-foot cabin model known briefly as the CJ-7 or "Zaic" appeared in *Model Craftsman* magazine over a three-month period. This good-looking cabin model was designed by Carl Schmaedig, a well-known modeler who is still active today.

The Miss Model Craftsman, as it finally was named, was promptly built by this columnist. The model was easy to adjust and in fact was lost on the very day it made its debut at Moffett NAS. The Brown Jr. powered model disappeared after several minutes, never to reappear despite extensive searching and advertising.

Inspired by this startling flight, members of the San Francisco Vultures—Charlie Werle, Dan Lorenzten, Irv Pedersen, and others—built similar models. Each was flown with various degrees of competitive success. This writer also registered a 42-minute flight with his third CJ-7.

Inevitably, the new limited engine run rules forced the abandonment of this large model, although it was flown successfully in the 45-second limited engine run event.

The original design by Schmaedig used a Loutrel engine (predecessor of the GHQ). Later models powered by the more reliable Brown Jr. engines enjoyed more success.

The later Scientific Miss America is little more than a 7-foot version of the CJ-7. This was brought about by Frank Zaic and Carl Schmaedig, when they contracted with Johnny Frisoli of Scientific to build and test a reliable gas model. After losing the first one over the Jersey Pine Barrens, the next one was presented with no further flying or modifications. The Miss America proved to be the best kit in terms of popularity and sales that the Scientific Model Co. ever had.

This columnist would be remiss if he did not mention that he still has his last Miss Model Craftsman, built 20 years ago. This model is still in flyable condition, now using a Baby Cyclone for power.

ENGINE OF THE MONTH

This month's engine is the 1940 Barker Model C, not Class C as most modelers were fond of calling it. For those not familiar with the series, Barkers came in A, B and C models.

This engine featured a steel cylinder with deeply machined fins for maximum cooling. The cast aluminum cylinder head was a teardrop design similar to the Dennymite. A copper gasket between the head and cylinder effectively prevented compression loss.

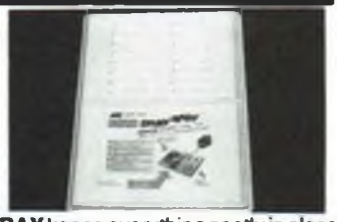
An unusual feature of the gray iron piston was the cutout at the front that allowed the crankshaft counterbalance to clear the piston at the lowest point of the stroke. Crankshaft was steel, machined in one piece.

continued on page 79

MODEL MARKETPLACE

Lots of Good Stuff

Feature of the Month



STAY-TRAY keeps everything neatly in place while building or taking apart. An organizer, 9"x12" @ $2.10. Add 20% for S&H.

Other mini tools available

ADC **Applied Design Corp.**
(310) 375-4120
P.O. Box 3384, Torrance, CA 90510

BACK AFTER A LONG ILLNESS!

NEW Drawings

Old Timers & Antique for your Reed Valve Engine

- Diamond Zipper
- Flying Quaker
- Red Zephyr
- Miss Philly
- Eaglet
- Commodore

1/4A $4.00 1/2A $5.00

STAZLIT FUSE
10' - $3.00 15' - $4.00 25' - $5.00

New Illustrated Plans Book $2.50

B&D MODELS
P.O. Box 12518
Reno, Nevada 89510

Home of the Air Races

THIS BUSINESS IS FOR SALE

6 FLIGHT SYSTEMS

EXPERT ADVICE WHY PAY MORE? FASTEST DELIVERY

THE BEST IN ELECTRIC FLIGHT
specializing in
ASTRO FLIGHT SYSTEMS
sales & distribution
WE CATER TO THE ELECTRIC FLYER

30 years of R/C Experience, 10 years of Electronic Flight experience to assist you with your needs. Discount prices on all items, not just specials. UPS, Priority Mail, or Federal Express.

LARGEST STOCK OF ELECTRIC FLIGHT EQUIPMENT IN THE NORTHEAST

Catalog: USA--$6.00/Foreign--$7.50 VISA & MasterCard

CS FLIGHT SYSTEMS — Charles S. Sylvia
31 Perry Street — Middleboro, MA 02346
Phone (508) 947-2805 6-9 p.m. Evenings — 2-7 p.m. Weekends

ELECTRICS ARE NOW

IMPORTED DIESEL ENGINES
WORLD'S BEST SELECTION

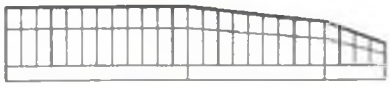
AE, AM, Aurora, Ceccarelli, Cipolla, FIT, KMD, MARS, MK, MDS, MP Jets, MVVS, PAW, Pfeffer, and Silver Swallow diesels . Also replica Mills, MOVO and Letmo diesels as well as many rare imported glow engines.

Ten page catalog $1.00.

CARLSON ENGINE IMPORTS
814 E. Marconi Ave.
Phoenix, AZ 85022-3112
Phone 602-863-1684 Afternoons

NEW RELEASE
Model Design program $50

Version 4.0 of the Model Design program adds screen graphics, multiiple panel wings and automatic foam core template generation to this program's long list of features.



Send SSAE for information and upgrade prices

Chuck Anderson
P.O Box 305
Tullahoma, TN 37388
(615) 455-6430

Runs on XT, 286, 386 or 486 with MS-DOS 3.2 or later.

The Amazing Lazy Bee

This backyard barnstormer is the slowest, most maneuverable, easiest to fly R/C plane **EVER!**

- .049 to .15 or .26 4-Cycle
- Makes Excellent Electric
- Wingloading 4 - 8 oz/sq ft
- Makes great float plane
- Delightful to Fly
- Ideal for Small Fields
- Sprung Landing Gear
- 40" Wingspan

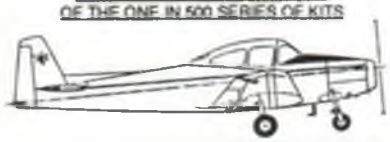
NEW! Full Kit featuring balsa parts precision cut on a band saw, complete plans (3 pages rolled), all required wood, wheels, 36 page instruction book

35 Min. Video
Rent or buy!
$18 ($10 refundable)
Catalog $2

CLANCY AVIATION
219 W. 2ND AVE
MESA, AZ 85210
(602) 649-1534

FULL KIT - $54
FLOAT KIT - $24
(Installs in 5 min!)
Prices include S & H

DIEL'S ENGINEERING, INC.
P.O. BOX 263
AMHERST, OHIO 44001
ANNOUNCING THE SECOND KIT OF THE ONE IN 500 SERIES OF KITS



KIT # LEK-102 THE NORTH AMERICAN (RYAN) NAVION

RUBBER-POWERED FREE FLIGHT SCALE, 17-3/4" SPAN. WE ARE NOW TAKING ADVANCE ORDERS FOR THE SECOND KIT IN OUR NEW LINE OF LIMITED EDITION ONE IN 500 KITS. ORDER NOW FOR MARCH 1994 DELIVERY. ONLY 500 KITS WILL BE PRODUCED.

ADVANCE ORDER PRICE IS $18 PER KIT PLUS $3.50 SHIPPING TO RESERVE YOURS, SEND YOUR PAYMENT IN BY FEBRUARY 28, 1994. PRICE WILL BE $22 AFTER PRODUCTION.

COLLECTORS GET YOUR ORDERS IN NOW!
THESE KITS WILL ONLY BE RUN ONE TIME!!!

FOR MORE INFORMATION AND A COMPLETE CATALOG SEND $2 TO THE ABOVE ADDRESS. CATALOG FREE WITH ORDER IF REQUESTED.

Dave's Wood Products

OBECHI? YA BETCHA!

OBECHI AVAILABLE IN LARGE SHEETS
WIDTHS TO 22"

Please call (509) 548-5201
or send SASE to:
12306 Bergstrasse
Leavenworth, WA 98826

VISA & MC Accepted

MINI ELECTRIC R/C

1 METER SPAN | WARBIRDS | $19.99

send $1.00 for illustrated catalogue of:

Dizzy Bird

- "Gadfly" electric gliders
- 50 watt motors
- (BEC) wiring harness
- motor control units

Telephone (714) 775-4153

POST OFFICE BOX 1249 • WESTMINSTER, CALIFORNIA 92684

ELECTRIC MOTOR BREAKTHROUGH

WHAT DO YOU WANT IN AN .05 ELECTRIC MOTOR FOR YOUR FLYING MODEL???

1. Power 2. Endurance 3. Ball bearings 4. Low cost, replacable brushes 5. Adjustable timing 6. Rebuildable commutator 7. Double balanced armature 8. Ease of dis-assembly 9. Super power magnets 10. Custom armature windings 11. Motor rotation reversible w/o soldering 12. Standard 39 mm Dia. case 13. Standard bolt spacing to fit available gearboxes 13. Heat sinks for brushes 14. Etc. Etc. Etc.

IF THESE FEATURES SOUND IMPOSSIBLE TO OBTAIN IN A SINGLE MOTOR, GUESS AGAIN!!!! These features describe the **"WAR EMERGENCY POWER"** motor, but can't describe the unbelievable power that is developed by this little MONSTER! The .05 Cobalts can't compete with this motor. When they are set up to produce as much or more horsepower, they can't run nearly as long and when they are set up for endurance, they can't produce equivalent power!! We are talking high performance flight with 4-4½ min. full throttle duration, not a 30-40 second blast. For more information and a catalog, send $3.00 to

Model Electronics, Corp.
6500 6th Ave. N.W.
Seattle, WA 98117
1-206-782-7458

DEALER INQUIRIES WELCOME

Add a new Thrill to your R/C Flying with a Radio Controlled Skydiver

The Jump plane releases the Skydiver into space for the free fall. On radio command the parafoil parachute opens and is flying on the Ram-Air chute. Accelerate, slow flight, pattern maneuvers, spirals, stalls, landing flares, etc. Target landings are easy with simple jumping instructions. Send $1.00 for latest catalog.

R/C SKYDIVERS
Box 662MB
St.Croix Falls, WI 54024

PROPORTIONAL REVERSE & PROPORTIONAL FORWARD

High rate Electronic Throttles. These 1.8 X 1.87 X .82" optically isolated units plug in like a servo. Connectors for Futaba, Airtronics, JR, Cirrus, Cannon/Deans & Ace. Order this month and get a free servo.

Buy the **HW55** for R/C CARS and performance boats. 416Amps of MOSFETs handle most '05, 540's, & Astro ferrite motors operated up to 14 cells or 18A genuine continuous duty & 45A starting surge. **$109.95 ea**

Order the **RET44** with 184Amps of MOSFETs for smooth control of scale boats with Dumas, stock 540's, Astro 02-10, geared Astro 15-25 on 12VDC & other motors rated 4.8-16 V DC & 12A continuous duty & 25A starting surge. **$79.95 ea.**

NO RISK 21 DAY EXAMINATION. If you're not satisfied we'll buy it back! One year limited warranty. Visa/Mastercard & COD welcome. To order call toll free to

1 - (800) 8 - VANTEC
460 Casa Real Place, Nipomo, CA93444

Low Cost, Light Weight, Mylar Covering Materials

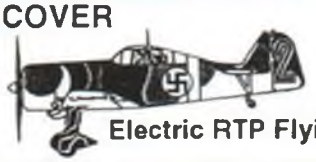
.0015 Thick Heat Skrink Mylar W/Adhesive
.0005 Thick Silver Mylar
.0005 Thick Clear Mylar.
.00025 Thick Clear Mylar
.0000059 Thick Clear Mylar for Indoor
.0000000000012 Thick Microfilm

Used by World Champions since 1980

Send $2 for a completee composite materials catalog

MODEL RESEARCH LABS
25108 MARGUERITE #160
MISSION VIEJO, CA. 92692

DISCOVER



Electric RTP Flying

Clean • Quiet • Easy • Indoor • Outdoor
Single or multi engine, ducted fans.

NEW CATALOG
(including imports from BALLARDS')
Only $1: Includes discount coupon.

SKONK WORKS
1890 Forestdale Ave. • Beavercreek OH 45432
(513) 429-2411

GEAR DOOR CYCLER

For servo operated inner gear doors (Ps1 Style)

Use a Y harness , and install this unit in your retract channel. Each time you activate the retract switch up OR down, the inner doors will open, wait a while (you can set this up to 9 seconds) and then automatically close. Comes preset for maximum servo throw. Works with AM, FM and PCM radios. You add your own leads. Measures just 1.5 X 1.5 X .75 and weighs only 3/4 ounce. Lots cheaper than expensive pneumatic types! Just $39.95 + $2

JOMAR PRODUCTS
3440 RIVERHILLS DR.
CINTI, OH 45244
513-271-3901 VISA & MC OK

P.A.W. DIESELS

.03 TO .60 RC & STD.
THE FRIENDLY QUIET WAY.

Send $1 for lists and useful Diesel info.

ERIC CLUTTON
913 Cedar Lane
Tullahoma, TN 37388

DOCTOR DIESEL'S DIARY
all about diesels. $11.50

FREEDOM FROM GLOWPLUGS & BATTERIES!

SUPERIOR PROPS

BALSA, RUBBER POWER PROPS
Wide variety sizes & Pitches
: FREE WHEELING :
right or left hand; 3 & 4 blade
: FOLDING :
Coupe, wakefield, more Montreal stops korda, gollywock
Available With Z Bar Or Old Time Hardware

Free info. send long SASE to:

Superior Props
2412 Tucson Ave. Pensacola, FL 32526
(904) 944 - 1972

VINTAGE R/C PLANS

PREVIOUSLY SID MORGAN
NEW OWNER FRED NOVACK
5105 PINE HILL CIRCLE
HOWELL, MICH 48843

PBY-5A
108" W.S. .60 ENGS. 4 SHEETS
PLAN 105RC $21.95 + $4.95 S&H U.S.
+ $10.95 FOREIGN

MANY MORE
CATALOG $2.00 U.S., $3.00 FOREIGN

SUKHOI

SPECIFICATIONS
Wing Span: 54" Engine: .35-.45
Weight: 4.5-5 lbs. Radio: 4 Channel

Take a deep breath and experience the modern age of aerobatics with the SUKHOI SU-26M

Budget Kit Price...$69.95 (Balsa not included)
Deluxe Kit (includes Balsa)...**$99.95**
Include $5.00 Shipping & handling. C.O.D. add $5.00

PRECISION AERO
1561 River Highlands Dr., Oconomowoc, WI 53066 • (414) 567-5341

New and Refurbished RADAR GUNS

Call for Our FREE Catalog

Over 20 Different Guns
Great for Lots of Sports
Ideal Tool for the Racer
Rental Program Available
Priced From $395 - $2000

RADAR SALES - 5485 Pineview Ln. - Plymouth - MN - 55442
Phone (612) 557-6654 - Fax (612) 550-0454

THE TWIN AIR .20

The newest model from Northeast Aerodynamics, manufacturers of the popular Train-Aire, Bel-Aire and Sport-Air models. Ask for them at your favorite hobby shop or order direct from the manufacturer.

Specifications—Engine requirement: two .20-.30. Wing span: 58". Wing Area: 625 sq. in. Fuselage length: 43". Fuselage width: 3.5. Overall Weight Range: 5.5 to 6.5 pounds. Wing loading range: 19.5 to 23.9 sq. ft. Radio functions: 4 channel.

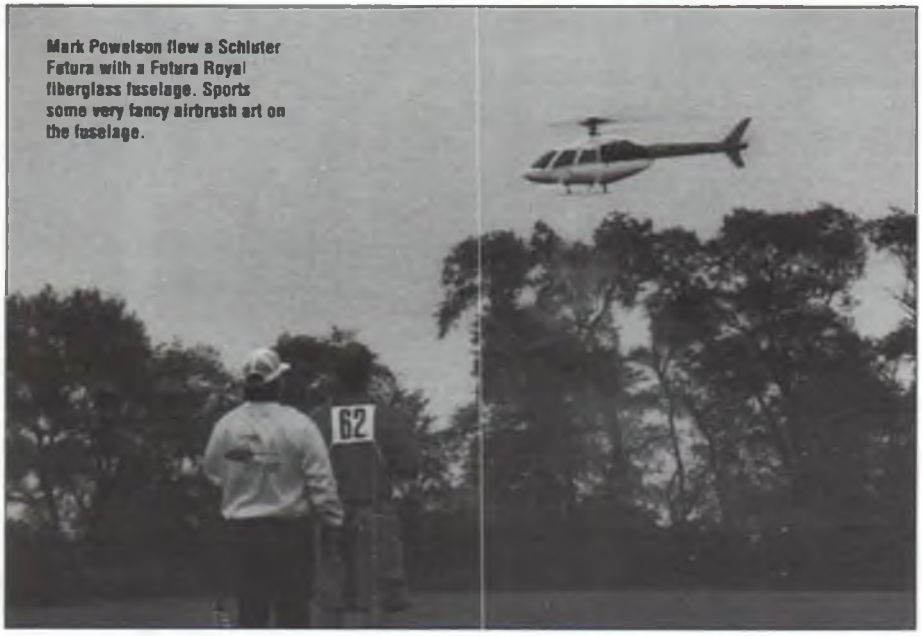
NORTHEAST AERODYNAMICS, INC.
150 Robinson Road, Hudson, NH 03051
(603) 881-5899

■ LEFT: Contest Director David Ramsey doing the static scale judging honors on Cliff Chmiel's Jet Ranger. Cliff came all the way from Florida to attend the Schluter Cup. ■ RIGHT: The identically painted Kait Excalibur and Kait Alpha II belonging to 5th place FAI flier Len Sabato. Both use YS .61 SF-H engines, Hatori 666 mufflers, Kait Orion fiberglass canopies, JR PCM-10S radios, and JR-1000 piezo gyros.

SCHLUTER CUP *cont. from page 67*

throw. I checked the swashplate and paddle tilt; they were maxed out with about 20 degrees of swashplate tilt to each side. Another factor contributing to the slow cyclic feel is the use of heavy Hiller paddles (50 grams each), which produce a strong and stabilizing Bell feedback. The Bell bar is like a mechanical rate gyro. Finally, Tom is using heavy DY-F1 fiberglass blades that weigh 200 grams each. Each blade has a 50-gram lead strip near the tip. Tom has his cyclic controls set up with 16 to 20 percent exponential, which serves to cancel out the rotary motion of the servo wheel and makes the final control linearly proportional to the stick input.

Tail rotor response on Tom's FAI setup is more similar to my own models; a yaw command produces a reasonable rate of rotation. The gyro is set at about 60 percent, which is on the high side. The instant the tail rotor control stick is released, the model stops rotating and locks on immediately. Collective response is slow, but predictable. Again, the mellow response is due to



Mark Powelson flew a Schluter Futura with a Futura Royal fiberglass fuselage. Sports some very fancy airbrush art on the fuselage.

the low rotor speed. The reason for using such a slow rpm is to make the model react more smoothly to control inputs in hover maneuvers. You pay a price in maneuverability, however. Tom says he wouldn't even consider using his FAI contest models for a simple fun-fly event like bottle knocking because they don't have enough control authority to correct for drastic mistakes.

I asked Tom how his setup feels as compared to those of other FAI pilots. Tom says Cliff's models feel similar but are better "prepped and tuned." Tom also says that Wayne Mann's machines have even less control authority than his. According to Tom, you can really move the sticks around and Wayne's machine will not rock back and forth.

Third place in FAI was won by New Yorker Stan Olzaski, flying a Concept 60 with a sleek Kyosho Interceptor fuselage. Unfortunately, I wasn't able to get any details on it except for what's in the chart.

Fourth place in FAI went to Ray St. Onge, flying a Schluter Futura. Ray's experiences at another recent contest serve as an example of the camaraderie among helicopter pilots. Ray's number one heli was having engine problems, so he was using his backup machine. After the first contest day, Ray St. Onge, David Ramsey and I went to David's house to rework Ray's O.S. engine. The front and rear bearings had to be replaced. Ray had a front bearing, and Cliff Hiatt loaned Ray a new rear bearing. Unfortunately, the next morning, Ray found his gyro had gone dead. Again, Cliff Hiatt offered Ray a new Futaba 153 gyro if he needed it. Cliff sure carries a lot of spares with him!

Fifth place in FAI went to Len Sabato. Len flew a beautiful Kalt Alpha II with a Kalt Orion fiberglass canopy. Len is very friendly and can answer any question concerning Kalt helicopters you may have. He is the Kalt rep at Horizon Hobby Distributors.

Most FAI contestants were using driven tail rotors. This has become necessary if you want to nail down the 180-degree autorotation maneuver. A driven tail rotor system allows the tail rotor to turn along with the main blades when the engine is disengaged. This provides yaw control during autorotation, but the drawback is that it sucks up about 15 percent of the rotational energy. Most fliers were using a limited slip design which forces the clutch to turn with the rotors. Ray St. Onge's Futura had a true driven tail rotor, where the main and tail rotors are completely independent from the clutch.

Congratulations to the West Windsor RC Club and to Robbe Modellsport for hosting another great Schluter Cup. Robbe provided prizes to all of the registered fliers. This year's turnout was dampened somewhat by the weather, but it was still one of the largest RC helicopter meets in the country. Contest Director David Ramsey says next year's Schluter Cup will probably take place in June. See you there! ***MB***

ELECTRONICS *continued from page 45*

volts. Again, we are really looking at different applications, but since "NiCads" are referred to in the Renewal brochure, I think we need to clarify these points as they apply to our rather critical applications.

other three are shown at 1.3, therefore an average of 1.2 was used in those calculations.

	Cycle 1	Cycle 25	Comparable NiCd
AAA	333	160	220
AA	638	233	450-700
C	1611	716	1200-1800
D	2452	999	4000-4400

Based on those figures, these are not

Jomar Products offers this simple and lightweight (just 1/4 ounce) servo reversing device, designed to be wired into your servo's leads. In these days, when almost all transmitters have servo reversing switches, such a device can still prove useful, such as when running more than one servo off of one channel, or in other cases—see text.

The most significant thing about these Renewal rechargeable cells is that they are rated for only 25 cycles, and that the capacity lessens with each succeeding cycle. My query to Rayovac brought some interesting graphs, a couple for each of the four different sizes of cells available. I have included only the one for the AA size cells, these being most representative of what we use in NiCds.

The first thing you will notice is that unlike the NiCd, which holds its nominal 1.2 volts for the majority of its useful discharge cycle, the Renewal cell's voltage starts to decline rather rapidly, and continues to do so all the time it is under load. Because our RC equipment is generally intended to be NiCd powered, these having a critical low voltage of 1.1 volts per cell, we must also rate the Renewals to those standards.

Refer now to the chart. The dotted lines are mine, added at the 1.1 volts discharge level. Note that for Cycle 1, the service life in minutes is approximately 115 minutes, or 1.92 hours. Assuming an average useful voltage of 1.3, being midway between 1.5 and 1.1, the 3.9-ohm load stated results in a current of 333 milliamperes (I=E/R; I=1.3/3.9). That amount of current, maintained for 1.92 hours, gives the capacity as 638 milliampere-hours (mAH)—hardly better than most NiCds and less than some of the same physical size.

And that was for Cycle 1. The capacity gets progressively lower as we use up the operating cycles, until, when we get down to Cycle 25, and with the same mathematical exercise shown above, we calculate a capacity of only about 233 mAH.

In summary, and applying the same calculations used above, the following capacity figures are derived for the entire Renewal family, as shown below. Interestingly enough, although the graphs show the initial voltage for the AA cells at 1.5, the batteries that I want in any RC equipment I will use to fly an airplane I care about! On the other hand, Renewal batteries are relatively inexpensive; as I write this, the nearby Thrifty drugstore is selling AAs at four for $4.49. The companion charger, the PS1, good for AA and AAA cells, is $12.99, while the PS2, good for any of the four sizes made, is $24.99. Even with the cost of the charger included, we can see that it would not take many sets of non-rechargeable alkalines to come out even, from which point, the remaining battery power gets cheaper and cheaper.

Using the available Rayovac chargers, charging time for AA and AAA sizes is three to five hours; overnight for the larger cells. Rayovac states their "computer microchip" equipped chargers, or Power Stations as they are referred to, are the only way to charge Renewal cells, and that the chargers should not be used for any other type of rechargeable cells. Not having any experience in that department, I don't have any recommendations of my own, except to ask that if you are tempted, be careful—and share with us what you find out!

In summary, Renewals certainly seem to have some merit for use in RC-related support equipment; fuel pumps, tachometers, etc.—but not in our RC systems. It is a new power source, and given time, we'll certainly figure out uses for any benefits they may have for the RC flier.

• • •

Servo reversers can definitely ease RC system installation problems, especially in dealing with anything other than the average, lots-of-room, basic four-channel airplane. For those of you not familiar with such devices, they are installed between the receiver output and a servo, and reverse the direction of servo travel relative to control stick movement. I know, you have servo reversing switches; another reader, Ralph Knight, of Salem, Virginia, also has them, but

still uses servo reversers. As he tells it:

"Way back in the January '88 *MB*, you printed a schematic from *Modelar* (Czech model magazine) for a servo reverser circuit using only three components. I build mostly sailplanes, and it is often advantageous to run both pushrods along the sides of the narrow fuselage. I sometimes have more than one receiver on a given frequency and don't wish to flip switches. I have busted a couple of models doing that, so I like to use a servo reverser to minimize such stupidities.

"In any case, I built one of the circuits from junk box parts and found it to work well and very dependably. Recently, another glider building friend came up with a similar problem on a rebuilt basket case with an old radio, so we decided to build a few more of the reversers. I did the building, and in the process developed a sort of production line method for making these items quickly and neatly. They take up too much room in a tight glider if assembled on a PC board, but they can be built very slim and neat.

"We built six of the reversers, and all of them worked without a hitch. They also provide an easy means to center the servos and fine-tune their throw."

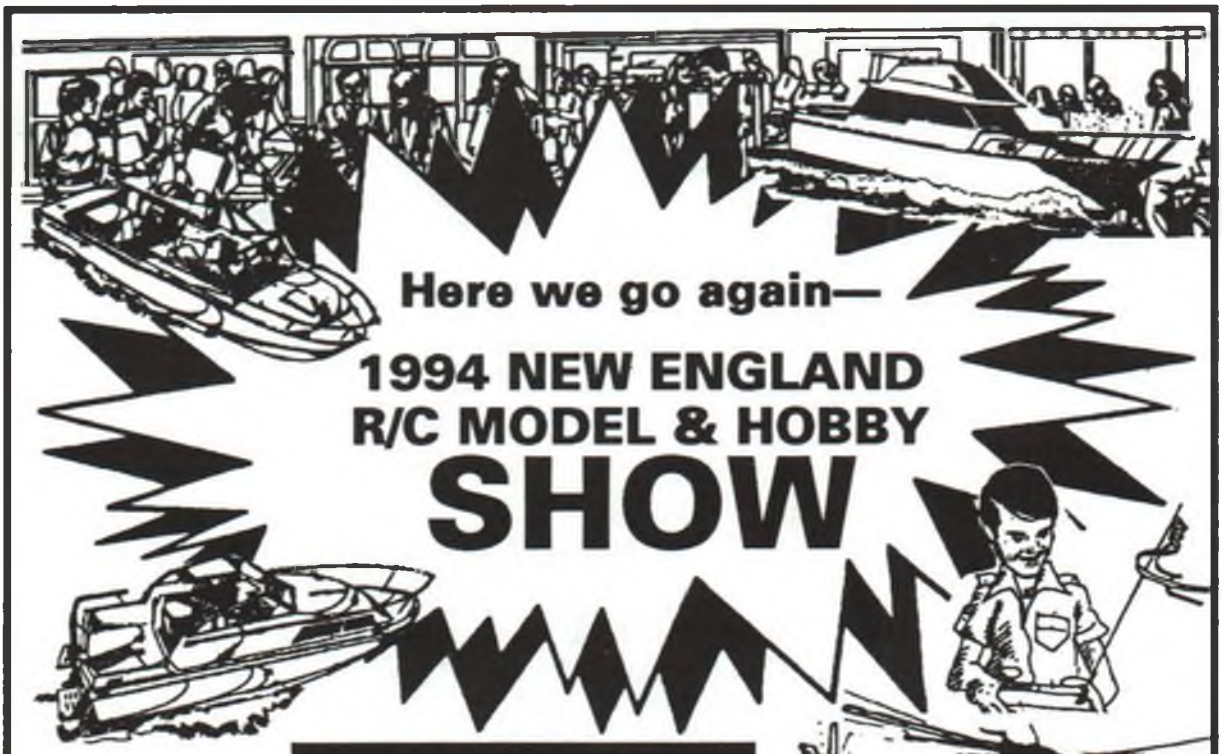
Ralph has indeed streamlined the assembly procedure, and, since they are too lengthy for the space afforded me, is kind enough to offer copies to all interested. I have mentioned here that the nicest folks read EC, have I not? His instructions even include parts I.D. and sources. If you would like a copy, drop an SASE to me or Ralph, whichever is closer. He is at 322 Lake Ave., Salem, VA 24153.

Another servo reverser, this one being commercially available for those of you who don't have the time or inclination to "roll your own," is from Jomar Products, and though it may not be quite as tiny as the one mentioned above, will still fit in the majority of available spaces. It is assembled on a 3/8x1-3/4 inch printed circuit board, and is about 5/16 inch thick. Jomar's circuit is described as boosting the servo signal, and being compatible with PCM receivers, some of which are known to produce marginal servo control signals. A slight increase in signal at the servo effectively takes care of the problem, which is exactly what the Jomar unit does.

In fact, with the transmitter servo switch set to obtain the desired servo action, the Jomar device could be used primarily as a booster, as I know that some receiver-controlled devices such as glow plug lighters or spark ignition cutoffs sometimes fail to operate reliably when plugged directly into the receiver.

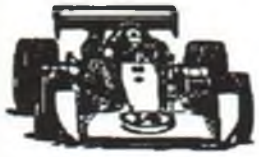
The Jomar servo reverser, less input or output leads, is available direct, at $19.95 plus $2 for shipping. Joe Utasi, the man at Jomar, is at 3440 Riverhills Dr., Cincinnati, OH 45244; (513) 271-3903.

Eloy Marez, 2626 W. Northwood, Santa Ana, CA 92704. ***MB***



Here we go again—

1994 NEW ENGLAND R/C MODEL & HOBBY SHOW



DON'T MISS IT!

APRIL 29 — MAY 1

Friday ..... 10 a.m. - 7 p.m.
Saturday ...9 a.m. - 6 p.m.
Sunday .....9 a.m. - 5 p.m.

SHRINERS AUDITORIUM

99 FORDHAM ROAD, WILMINGTON, MASS.

EXIT 39 OFF I-93, TURN RIGHT, AND TAKE FIRST LEFT AT LIGHTS

617-665-6466, 508-657-4202 – Fax 508-657-8950

RADIO CONTROL CARS, TRUCKS, PLANES, HELICOPTERS, BOATS, MOTORCYCLES • also ROCKETS • PLASTIC MODELS • KITES • MINIATURES • TOOLS • SUPPLIES • ACCESSORIES and more

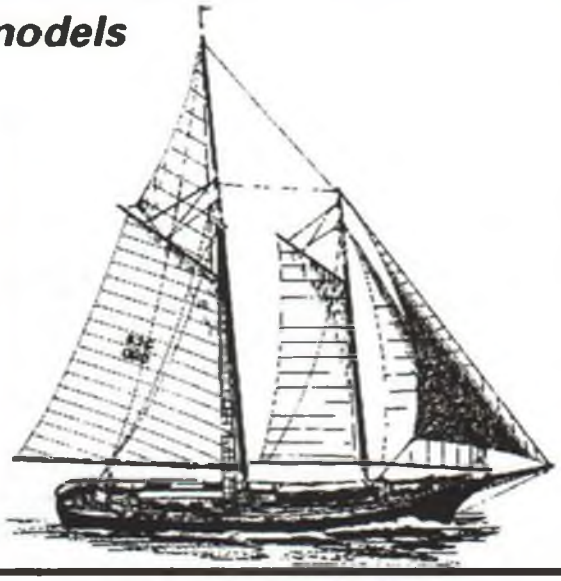
See new and exciting boat models on our huge Boat Pond

TICKETS AT THE DOOR

$5.00

Per person

CHILDREN UNDER 12 FREE WHEN ACCOMPANIED BY AN ADULT



PLUG SPARKS *continued from page 71*

Pressure feed lubrication was provided by drilling the crankshaft. The connecting rod was made of phosphor bronze and the crankcase of sand-cast dow metal.

The very clean cover for the automotive-type timer was easily removable for adjusting the points. This feature was continued in the post-war Barker, known as the "Man-Ul-Matic" version.

Other interesting features on the Barker C include a ventilating system between the fuel tank and crankcase, and most interesting, a "hot-spot" manifold in which the exhaust could pre-heat the incoming fuel.

Specifications given by the manufacturer: displacement, .69 cubic inch; weight, 10 ounces; bore, 15/16 inch; stroke, 1 inch, and total flying weight, 16 ounces. In the November/December 1940 issues of *Model Airplane News,* the Barker was advertised at $8.95 with coil and condenser.

THE LAST DETAIL

Received a letter from Harold Johnson, the unofficial SAM photographer, informing me that Phil "Pinky" Fruchtman died on March 19, 1993. Pinky will be remembered for his "Flounder" design that appeared in the August 1941 issue of *Model Airplane News.* His widow, Audrey Fruchtman, wishes to express her thanks to both Harold and to Sal Taibi, who regarded Pinky as an inspiration to the Skyscraper members for his leadership. ***MB***

Photo No. 9. For a small cabin model, the Bay Ridge Diamond Demon is a good performer. This one, displayed by original designer Jerry Stoloff, is scaled up to 72 inches for a Royal .28; the Bay Ridge kit was a 48-inch model and would have to built to that size for the new proposed 1938 Antique event, as scaling is prohibited.

CLASSIFIED ADVERTISING

IMPORTANT INSTRUCTIONS: Noncommercial (personal items) rate is 40 cents per word, with a minimum of $6.00. Commercial rate is 50 cents per word, with a minimum of $10.00. No ad agency discounts allowed. Phone number counts as two words; "P.O. Box" counts as two words; name and address counts; abbreviations count as whole words and will be spelled out. All ads are payable with order and may be for any consecutive insertion period specified. If an ad is paid to run for three months or more, a renewal notice will be sent before it expires. Send ad payment to: MODEL BUILDER, Classified Ads, P.O. Box 2459, Capistrano Beach, CA 92624-0459.

DO YOU SPEAK MODEL AIRPLANE? Dave Thornburg's one-volume history of American aeromodeling, 1907 to present. 320 pages, $19.95 postpaid. Pony X Press, 5 Monticello Dr., Albuquerque, NM 87123. Phone (505) 299-8749. Check, MO, Visa/MC.

1930s MODEL SHOP! Sawed prop blanks, WWI/Balloon/Streamline balsa wheels, Hinoki wood, color nitrate, balsa, tissue, bobbins, prop hinges, bamboo, old Scale/Contest plans, and more! Illustrated mail order catalog: $2. Oldtimer Model Supply, P.O. Box 7334, Van Nuys, CA 91409.

GIANT SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041-C Heatherwood, Orrville, OH 44667.

WANTED: Model engines and race cars before 1950. Don Blackburn, P. O. Box 15143, Amarillo, TX 79105. (806) 622-1657.

GOLDEN AGE REPRODUCTIONS. Illustrated catalog of 200 plans and 22 kits, canopies, decals, plastic wheels, $2.50. P.O. Box 1685, Andover, MA 01810.

KITS custom cut from your plans. SASE for listing and quote. Repli-Kit, P.O. Box 1412, Inverness, FL 34451-1412.

SCALE DOCUMENTATION—Drawings, photo packs, monographs, unusual aircraft. Illustrated catalog, $2, pp: Bill Young, 8106 Teesdale, North Hollywood, CA 91605.

HOT AIR BALLOON plans. Send $2.00 to Mark Simini, 721 Belmont, Niles, OH 44446.

WANTED: "THERMIC 20" clear plans, 20" span, by JASCO, not JETCO. $20.00. Dale G. Holinbeck, 2230 N.E. 34th St., Lighthouse Pt., FL 33064.

SCALE WWI PLANS, sub-Peanut to 100". Send two $1.00 bills for illustrated catalog. "Smileys," 23 River Bend, Newmarket, NH 03857.

WRENCHES AND GASKETS for vintage and newer engines all precision machined Bob McCord 325 Sylvan Ave Mountain View CA 94041.

REPLICA SWISS WATCHES: 18KT Goldplated! Lowest Prices! 2Y Warranty! Heavy Weight! Waterproof! Sapphire Crystal! Submarins, Daytonas, others! (404) 682-0609, FX (404) 682-1710.

AIRPLANE PLANS on shirts, caps! Super scale plans: Monocoupe, Culver, Rearwin, Bulldog, Goon, Gee Bee Z, R-1, R-2 (used for Delmar's). 1/24-1/3 scale. Catalog/News $4.00, refundable. Vern Clements, 308 Palo Alto, Caldwell, ID 83605.

VANISH FROM POLICE RADAR! Legal Jammers defeat radar and laser guns. Policeman sees "00" on his display. Invented by military radar expert. Brochure: 800-451-4477.

R/C SWAPMEET IN YOUR LIVING ROOM! Nationwide Buy/Sell/Trade Newsletter with fast circulation. Free sample copy. R/C Trader, P.O. Box 145, Big Lake, MN 55309; (612) 295-7521.

GET BACK TO BASICS! Experience the fun of building and flying a hand-launched balsawood glider. Three distinctive high-performance designs offered. Model 8-A is a conventional design with 16-inch wingspan. The 8-B features a polyhedral 17-inch wing and twin tails. More challenging is 8-C with swept-forward 12-inch wing and twin swept-back tails. Each kit is only $4.95 plus $1.00 postage and is complete except for model knife and cement. From Alzart Originals, Dept. B, 6871 Oakridge Lane NW, Alexandria, MN 56308.

FREE FLIGHT Scale Fun with Bill Hannan publications: STICK & TISSUE INTERNATIONAL Volume Three, $9.95; PEANUT POWER (Peanuteer's "bible"), $15.95; PLANS & 3-VIEWS, $9.95; PEANUTS & PISTACHIOS Volume Five, $7.95. Add $2.50 postage for one book; $3.25 for two or more. Illustrated catalog of these and many other model books, $1 (refundable). Hannan's Runway, Box 210M, Magalia, CA 95954.

ENGINES: IGNITION, GLOW, DIESEL. New, used. Sell, trade, buy. $3.00 for large list. R. Eierman, 504 Las Posas, Ridgecrest, CA 93555. (619) 375-5537.

MODEL HOT AIR BALLOONS—Fly thousands of feet high, visible for miles at night. Build for pennies each. Photo illustrated instructions. $5.00 to: Air-Crafts, Dept. B, 62 South Gate Dr., Poughkeepsie, NY 12601.

HELICOPTER SCHOOL: Five days of Hands-on Instruction with X-Cell Helicopters and Futaba Computer Radios. Small classes, tailored to your individual needs. Beginner to Expert. Includes all Meals and Lodging. Over 300 satisfied students and 10,000 flights logged. Located on a 67-acre airport used exclusively for R/C training, owned and operated by Ernie Huber, five-time National Helicopter Champion and Helicopter designer. Send for free information and class schedule NOW! to R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call 1-800-452-1677, outside USA (904) 698-4275, or FAX (904) 698-4724.

LATHES, milling machines, machine shop supplies, machine tools, books, accessories. Catalog $1.00. Blue Ridge, Box 536-MB, Hurricane, WV 25526. 800-872-6500.

MODEL MOTORS—New and used. Accessories, rubber and control line kits. List $1.00. T. Crouss, 100 Smyrna, West Springfield, MA 01089.

SOPWITH *continued from page 31*

system (right) on/off switches.

•**Photo #12.** View of the equipment installation with the motor hatch removed. At the extreme upper left, the aileron servo connector from the receiver is seen dangling. It's made from a 7-inch aileron extension, cut and snaked up through a 1/8-inch diameter aluminum tube glued to the leading edge of the starboard forward cabane strut. On the full-size Swallow, this tube carried the wing-mounted pitot tube. This arrangement allows the connector to be concealed in a little trap door, Scotch taped to the underside of the wing, wherein lies its mating connector.

Since we're at 2"=1' scale, we can use the wonderful Williams Brothers plastic kits of the Le Rhone rotary engine and the twin Vickers guns. Painting them realistically helps greatly, but most modelers leave them in their original matte-black plastic form.

•**Photo #13.** All Camels had concavely scooped-out aluminum bottom panels directly behind the engine. Here the matte black parabolic shaded area is simply airbrushed onto the battery hatch to create this illusion. You can also see the balsa airfoil "sandwich" covering the shock-corded twin swing axles. Strips of Solartex on the bottom hold the two halves together for easy repair, if needed.

•**Photo #14.** This photo reveals the exciting textural changes in paneling that compelled me to go all-out in scale "cosmetology." The burnished nose panels are actually silver foil on paper backing. Sheets of this, as well as the printed paper mahogany grain sheets, are available at good art supply stores. Like the aluminum cowl, these panels should be clear-coated to keep their shine.

To get a fine metallic highlighting on the black plastic Williams Brothers guns, get "Treasure Gold"—T.M. #3070 Pewter wax finish, available in many fine hardware or houseware stores. It's used to renew ornate art or picture frames. Rub it on with your fingers until smooth, then buff it with a clean cloth. Blow off the excess flakes and you'll swear this is oiled gun metal!

When it comes time to fly your Swallow, you are in for a treat. If you have built it carefully and exactly to the plans, it should fly right off the board. The extra weight of the Astro 40's 18-cell battery makes the model handle better on the ground during takeoffs and landings than it did with the lighter battery of the Astro 25 system used earlier. In flight, the model is rock stable and has great penetration, probably on account of most of the mass (the motor and battery) being concentrated in one spot. There is no lack of power with the Astro 40; the model cruises at half throttle and will loop from level flight. Landings are best done three-point. The Swallow *will* ground-loop if you get careless, but staying on top of it and keeping it rolling straight is part of the fun and challenge of flying a taildragger. Enjoy your Swallow! ***MB***

ERRATA

Our apologies to George Kleiman, who should have been credited with last month's cover photo of the Swallow; we didn't discover the error until it was too late to fix. All other photos of the model in last month's article and this were taken by the author. ***MB***

ADVERTISER INDEX

This Advertiser's Index is provided as a service to readers. Due to last-minute changes, we cannot guarantee correct page numbers or listing of all advertisers.

CONTROL LINE

cont. from page 27

if the rod's end points are not level with each other.

What you use for throttle rod material is a matter of preference. I try to avoid Nyrod for two reasons. If there are bends there will be friction in the system. The only time this matters is when it really counts—when line tension is very low in an emergency situation. Another reason is that the plastic housing at the bellcrank end tends to force the bellcrank system to prefer one location when the line tension is low. If the desired throttle position has the plastic tube bent a little and the lines start to get slack, the tube will straighten out and change the throttle for you, perhaps to some place you don't want it at the moment.

I try to stay with piano wire for my throttle rods. They must be adjustable at the carb end.

The last consideration is how you get the throttle rod out of the wing or through the firewall. You must keep oil out of the bellcrank compartment, and you don't want anything that will add drag to the system.

I use the following technique. Put a piece of 3/8-inch brass tube at the point of emergence. Cut the corner off the thinnest plastic bag you can buy. Slip it over the rod, pointy corner forward. Gather the big end around the brass tube section and tie it off with thread. Tie the front end tightly around the rod at the front. To keep it in place, I solder copper wire wraps around the rod in two places close together at the front of the bag corner and one wrap around the brass tube at its front end. This way, the thread ties won't slip off the tube and they stay in place around the rod, sealing it all up. Of course, the corner of the bag must not be stretched taut when the rod is all the way forward or squished when it is all the way back. It has to be longer than the amount of rod travel.

You may ask why the system must be free of resistance. This is a lever system; it magnifies any drag in the system by maybe a factor of three. This will bite you when the line tension is low.

MULTIFUNCTION

Down the road (a long way), an inexpensive alternative to electronic controls for up to six functions beyond throttle and elevator can be had from using two complete three-line setups. Yes, it's a handful, but any multifunction system is for anyone new to throttles.

You can obtain copies of my article explaining this from *Flying Lines*, in care of editor Mike Hazel, 1073 Windemere Drive N.W., Salem, OR 97304.

I will be glad to help you with any questions. Contact Orin Humphries, 19805 48th Ave. W. #A101, Lynnwood, WA 98036-5583; 206-776-5517. Happy Flying!

The elevator leadouts must clear the leadout guide at both extremes of the throttle range. Here the elevator leadout bottoms out at this end of the throttle range.

• • •

The Control Line column welcomes photos of favorite airplanes, questions, technical tips, club and contest reports, and product information. Write John Thompson, 295 W. 38th Ave., Eugene, OR 97405. ***MB***

MODEL PLAN SERVICE

Plan prices subject to change without notice.

ORDERING INSTRUCTIONS: U.S. orders, including APO and FPO, add 20% of total order for shipping and handling. Overseas orders (includes Canada and Mexico) add 50% of total order. Remit payment by International Money Order or U.S. funds, drawn on U.S. bank. Please, no cash or C.O.D.'s. Mastercard or Visa include card number, expiration date, and signature. California residents add 7.75% sales tax. Allow 4-6 weeks for delivery. **Illustrated Plans Catalog, 50 pages, 8.5 X 11", $2.00 ppd.**

All Full-Size plans purchased from MODEL BUILDER Magazine include a reprint of the construction article, if building instructions were part of the article.

No. 3941 SOPWITH SWALLOW $44.00
Steven L. Stratt's magnificent 2"=1' electric-powered scale rendition of an obscure but very attractive WWI monoplane fighter. Voted "Best Scale Airplane" at the 1992 KRC meet, the Swallow spans 60", covers 720 squares and is designed for Astro 25 or 40 power systems. Plans are drawn to Precision Scale standards, but the model is really not difficult to build. Instead of *MB*'s normal S&H rates, add $2.00 for flat folded plans or $4.00 for rolled drawings. Two large sheets. These same plans are offered by Airdrome.

No. 2941 WACO YMF-5 $14.00
Another classic standoff scale aerobatic bipe from prolific designer Al Wheeler, done in his unique all-wood EEE-Z-FLI style of construction. Spans 40", 500 squares, prototype is powered with an O.S. .25. Build it with one or two cockpits and two or four ailerons. Easy to build, looks and flies great.

No. 2942 MINI MAVERICK $5.00
Inspired by Tom Hutchinson's Maverick competition free flight, Dennis Weatherly came up with this simple and great flying Pee Wee 30 model. Designed for a hot Cox Pee Wee .020 (would also make a fun sport flier with an .010), the model spans 30" and has a two-wheel gear, pylon-supported polyhedral wing, elliptical stab and wingtips, and an all-balsa fuselage.

No. 1941 LAZY-H $18.00
What better way to get involved in larger electrics than with a simple, quick building, great flying biplane? Noted electric designer Scott Hartman's Lazy-H is just that. Powered with an Astro 25 on 14 cells, this 49-1/2 inch span, 810 square inch, 5 pound bipe requires only a basic three-channel radio for rudder, elevator and throttle. All-wood construction. Two sheets.

No. 12931 SCHNEIDER SPORT ELECTRIC $14.00
Top electric model designer Bob Benjamin reengineered the Stream, Inc. "Schneider Sport" RC floatplane for electric power, the result being an easy-building ship that strongly resembles a late-20s Schneider Trophy racer and delivers excellent performance on 14 to 18 cell geared electric systems such as the Astro 25 or 40. Equally at home on wheels or floats, the model spans 62-3/4", weighs 7 to 8-1/2 pounds and covers 664 squares.

MINIMUM ORDER: $10.00 • SEND TO: Model Plan Service • P.O. Box 2459 • Capistrano Beach, CA 92624-0459 • 714/ 496-5411

HANNAN *continued from page 47*

plans. Presently available is clothing bearing the Gee Bee Z, Gee Bee R-1, Gee Bee R-2, Hall's Springfield Bulldog racer, Chester's Goon racer, Monocoupe 110, Culver Cadet, and Rearwin Cloudster. For an illustrated clothing price list, send an SASE, or for Vern's complete catalog of plans, his newsletter and the clothing list, send $4 (in the U.S.) or $6 overseas to: 308 Palo Alto Dr., Caldwell, ID 83605.

SKY ETCHINGS INC.

This firm offers aviation memorabilia and collectibles including lithographs, medals, patches, flying badges and T-shirts. Among the themes represented are WWI (medals, badges, Spad, Nungesser and Red Baron T-shirts), Air Racing (Roscoe Turner and Gee Bee T-shirts), and WWII (patches, wings, lithographs and T-shirts). Send an SASE for a complete illustrated brochure: Sky Etchings, Box 855, Syosset, NY 11791.

MODEL PLANS

Flying Scale Incorporated, now operated by Danny and Kerin Galloway, has added nine new plans to the line. Drawn but not quite finished by the late Bill Galloway, the plans were completed by Bill's good friend Jim Poche, and include an Aeronca C-3, Champion Citabria, Fairchild 22, Fairchild 24, Rearwin Speedster, Sopwith Pup, Stinson L-5/OY-1 and Stephens Akro. All are intended as free flight subjects. For a price list of these and other offerings, send the usual SASE to Flying Scale Incorporated, 1905 Colony Rd., Metaire, LA 70003.

AEROMODELLING DIGEST

The *1993 Australia Aeromodelling Digest* features an unusually wide range of subjects, from hand-launched gliders to RC models. Articles cover such diverse subjects as caring for model engines, propeller performance, cross-country sailplanes, safety in modeling and much more. Also included are model construction and historical articles concerning scale and non-scale models of many types, as well as the Sky Cycle, an RC-assisted, person-powered (usually female!) aircraft. Famed model engine designer Gordon Burford and his products are also saluted in this 208-page book, which is available directly from Samaria Concepts, RMB 1798, Benalla, Victoria, 3673, Australia. Visa and Mastercard are accepted, and the price is $18 plus $8 air mail postage.

OLDTIMER SUPPLIES BARGAIN

Here's a real deal on genuine 1940s merchandise, offered as a package deal: seven 14-inch diameter balsa machine-cut propellers, six ball-bearing thrust washers (1/16-inch hole), six 5-1/2 inch long .040 diameter prop hooks, and one #7 round sable hair paint brush. All items are shipped postpaid for $10 from: Edward Schlosser, Box 412, Ridgefield, NJ 07657.

OPENSCALE '94

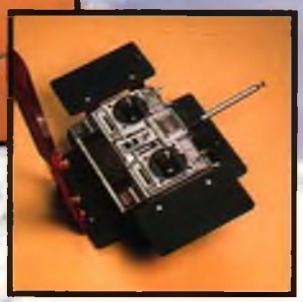
The lovely Medlanky Airfield in the Czech Republic will be the site of another international free flight flying scale model contest, on May 28-29. Last year's event was a big success, and the category rules for rubber, CO_2 and electric power will remain the same this year. Two entries per class are permitted, and there are no size restrictions.

Many tourist attractions are located nearby, and accommodations range from an aeroclub hostel to a hotel, or even your own tent on the airfield, if you prefer. The very reasonable entry fee of $20 includes a special banquet, prize ceremony and "unofficial fun." For full details contact Lubomir Koutny, Zahrebska 33, 61600 Brno, Czech Republic.

SIGN-OFF

"You can't have everything. Where would you put it?" Stephen Wright, via Bill Kincheloe. ***MB***

Aim High.



Radio Transmitter Tray - allows the modeler complete control. It is ergonomically designed with full adjustments of the aluminum shoulder straps and palm rest. **NO. 620**

EZ Trimmer - works like a "straight edge on a knife". It features an adjustable see-thru trim guide with 4 trim sizes, 1/16", 1/8", 3/16", and 1/4". Comes with two #19 knife blades. **No. 661**

Hinge Slotter Kit - makes slotting control surfaces for gluing hinges easy. The centering/parallel guide, centers hinge slotter on up to 3/4" material. The kit includes: 4 handles, a guide, and a centering tool for three different size slotting forks; mini, standard, and heavy duty hinges. Designed to work with all DU-BRO hinges. The 3 slotters and the "picker" are permanently mounted to red nylon handles. **NO. 660**

DU-BRO. The Industry Leader For Innovative Ideas.

For over thirty-five years DU-BRO has been a name you can trust for innovative ideas and value added products. With over 600 products and the largest hardware and accessory line available, DU-BRO continues to keep pace with your modeling needs.

Stop by your local DU-BRO dealer and ask for a free copy of DU-BRO's new 48 page catalog.

DU-BRO

A Name You Can Trust.

480 Bonner Road Wauconda, IL 60084 1.800.848.9411

Super 7 Soaring System

7UGFS
FM Sailplane System

Out on the slopes where the wild thermals play lurks the latest in computerized sailplane systems. The Futaba 7UGFS is the system competition glider pilots have been asking for. The transmitter feels like a custom-fitted glove, all controls configured and adjustable for soaring. Software programming gives you precise mastery over mixing to make complicated maneuvers appear routine. Program normal, speed or start presets and add butterfly or airbrake mixing. 4-model memory, dual and exponential rate control, programmable aileron/flap and flap/aileron mixing can all be easily entered in the transmitter thanks to Futaba's user friendly input system and tips from the Don of glider fliers, Team Futaba's Mr. Dilberg. Yet a computerized, fully customizeable transmitter alone does not a competition sailplane system make. The 7UGFS package includes a narrow fuselage fitting R148DF dual conversion FM receiver with in-line connecter block, NR-4GB 600mAH NiCd and a pair of micro S133 SMT servos. Available in 50 or 72mHz FM, the 7UGFS system has everything the contest sailplane pilot could possibly ask for and more.

NARROW BAND

Futaba

Futaba Corporation of America
P.O. Box 19767, Irvine, CA 92713-9767