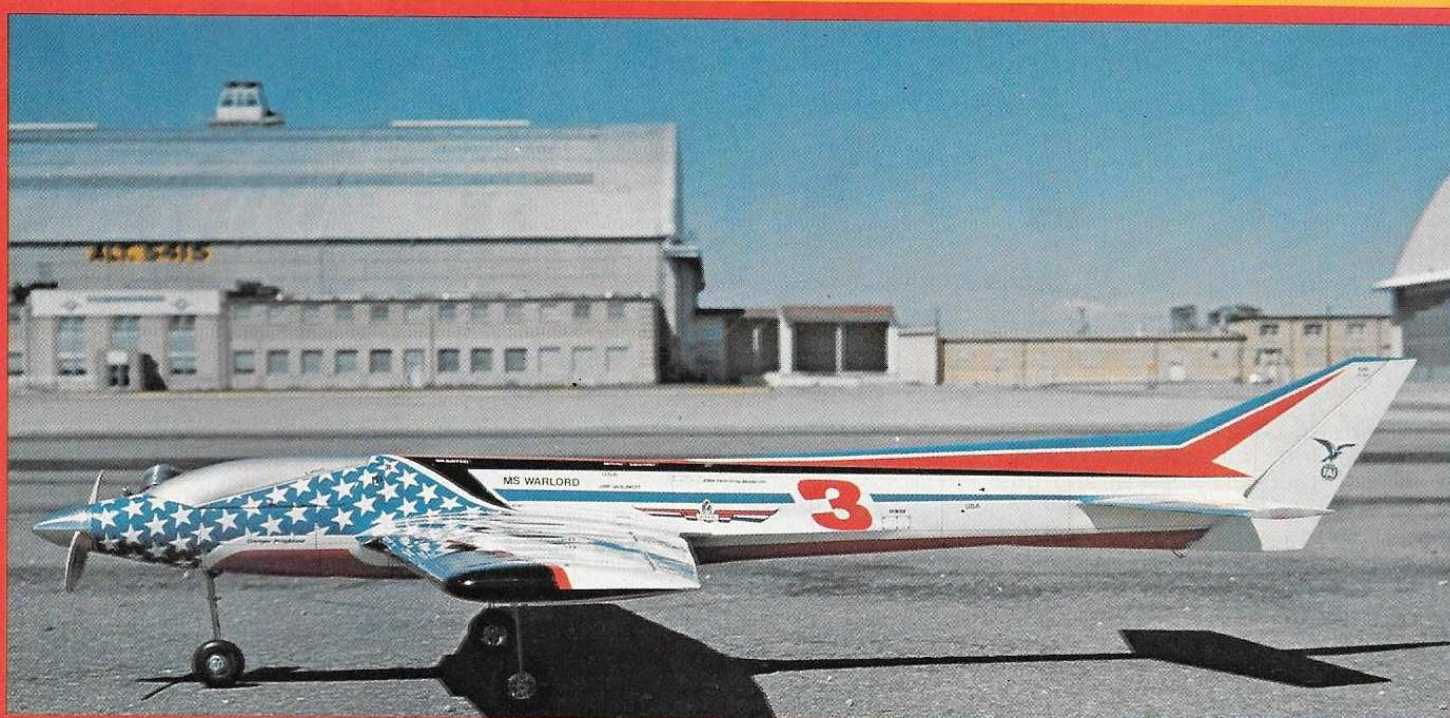


Warlord

A graceful and thoughtfully designed contest pattern plane. Flies great in mile-high Denver—should be fantastic at sea level! / by Jim Wilmot



Above: Minimum frontal area and flowing lines help get the most out of the Warlord's engine/propeller. Sits high on the retract gear for easy rough and grass field operation. Right: The best way to enjoy good flying at high altitudes as in Denver is to have a lightweight plane. With all-balsa construction, this bird can weigh only 6½ lb. even with full-house, fuel, a big 60 and retracts.



Warlord

The Warlord was designed to do only one thing: to win in FAI competition. Initial drawings were completed only after intensive study of the machines flown at the 1971 Internationals. From the information gleaned from this study, future trends were extrapolated and all of my past ten years of competition savvy was smoothly blended into one competent design.

Strict parameters for design were set up in order to achieve perfection. Consistency is first and foremost. Perfection of aeronautical design means nothing if the guidance, propulsion, or retraction systems are not on the same level of perfection. The old adage that the weakest link determines the strength of the chain seems apropos. To this end, Pro-Line, Supertigre, and Rom-Air were chosen respectively.

Consistency is the name of the game in that very often driving some 500 mi. to a contest, only three flights for the weekend will be allowed: two on Saturday and one on Sunday (and that's rough when you only get one flight in a day!). Therefore, there is absolutely no room for mistakes. Every flight has to be the best one of the meet. This principle must also be kept in mind during construction, for a slipup in assembly may (and probably will) blow a contest.

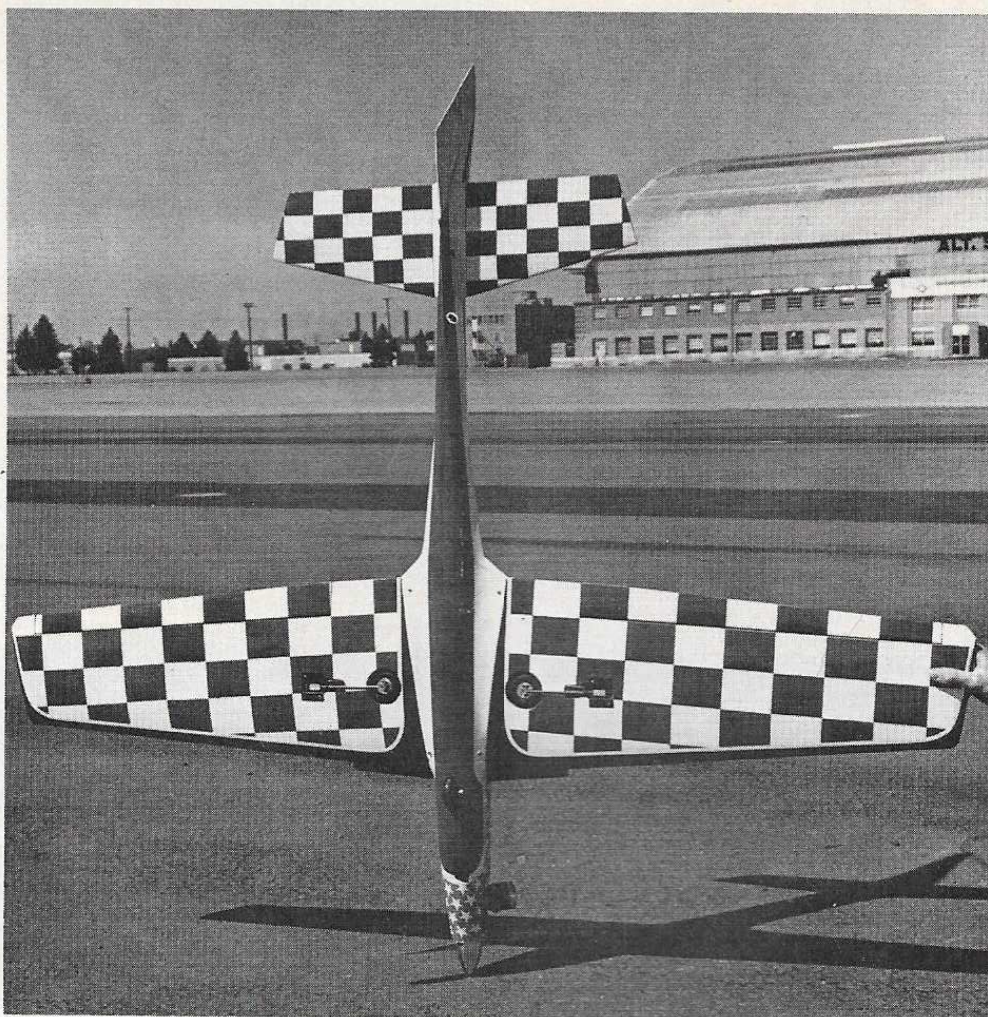
Modern RC competition history may be divided into four main categories; Smog-Hog, Taurus, Kwik-Fli, and post Kwik-Fli era. In this last era, almost any aircraft has the capability of winning any contest; there is no No. One design—they all fly pretty much alike.

Therein lies the rub. An old element has increased in importance—showmanship.

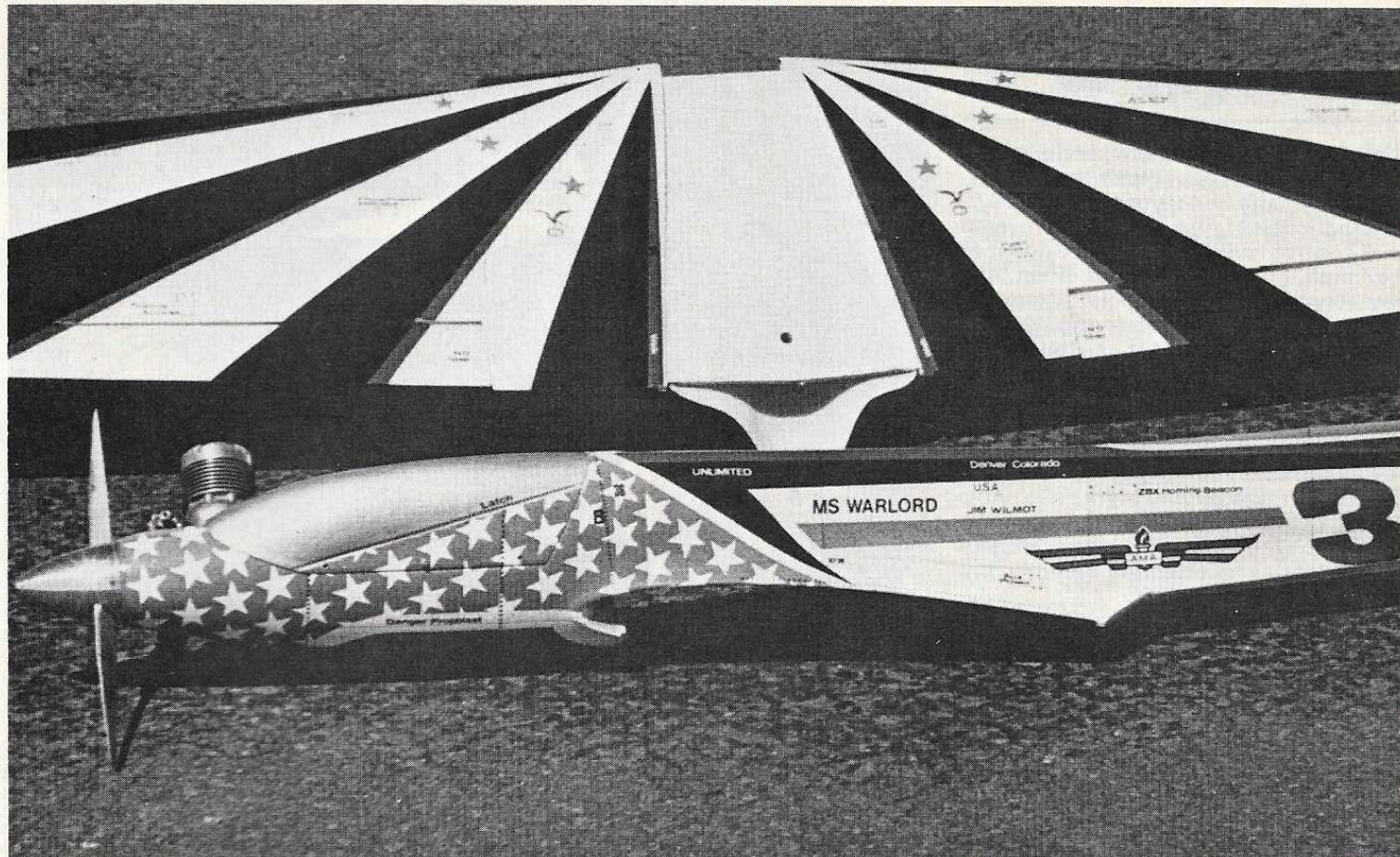
Performance is now simply a given factor; the variable exponent takes the form of presentation and pilot skill. The game has inadvertently developed into a form of one-design competition. To win at this kind of game, one must stand above the competition. The meet must be won before the flight begins through the use of an impressive-looking machine and a tremendous amount of practice.

Here are some of the principles set up in the design stages of the Warlord: The airframe must be such that power can be utilized as efficiently as possible. It should be smaller than the *Warlock* (my design featured in November 1972 AAM) and yet appear to be the same size as the current trend. Appearance should be given same priority as performance.

To achieve these goals, one main point was kept in mind at all times: cut drag wherever possible. I chose a 12½% somewhat laminar section, a heavily contoured fuselage and employed a flying stab. All information was fed into a CR-193 "computer" (modular exponents) and it was determined that, at periods of barometric pressure 29.98, 67° temperature, 34° dew point and



Top: Control surface areas are large; ailerons can be lowered for landing flaps. Note the highly recommended stall strip on the wing near the fuselage. **Above:** Heavily contoured fuselage is such that power can be utilized efficiently. **Opposite, top:** The wheel, when retracted, is partially out in the breeze; a big fuel tank fits easily. **Bottom:** There's a lot of room in front even with retracts.



Warlord

45% humidity, optimum performance would be achieved. (These are the forecasted climatic conditions for the 1975 Internationals.) Also it was discovered that control reversal would be evident at 147 mph. (The sound-barrier effect, like the Reynolds effect, reacts differently on models.) Therefore a flying stab was a necessity. The fuselage contours plotted out by the CR-193 were not possible if a normal balsa framework was used. So a fiberglass mold was machined out of platinum-aluminum alloy noted for its resistance to warpage. (I wouldn't put you on now, would I?)

Here I should warn you about the treacherous pitfalls that may ensnare the builder as he attempts to mimic my melange.

Construction

Fuselage: First of all, note that the construction has been altered from fiberglass to wood to simplify the chore. It has also been widened a smidgen to allow more room for equipment. (Some alleged authorities accuse me of designing too thin a fuselage.)

The basic structure should cause no real trouble if it is built on a jig. (The new A-Justo-Jig would probably work nicely.) Use a long, flat pine board with squaring blocks.

Note that the fuselage wraps around the front portion of the wing leading edge, which eliminates the need for front wing bolts or dowels. The bottom hatch for the wing is cut out *after* the fuselage is hacked out. Also, each wing servo (retract and aileron) is mounted on the bottom of the wing center section. Thus aileron trim can be adjusted without taking the entire wing off the fuselage, and the Rom-Air retract switch can be inspected easily. The rudder, elevator, and throttle servos are mounted on a 1/16" ply tray, which takes up very little room, can be fitted into tight spaces, and removed in about half a minute. For this kind of installation, use Kwik-Link connections on all servo output disks.

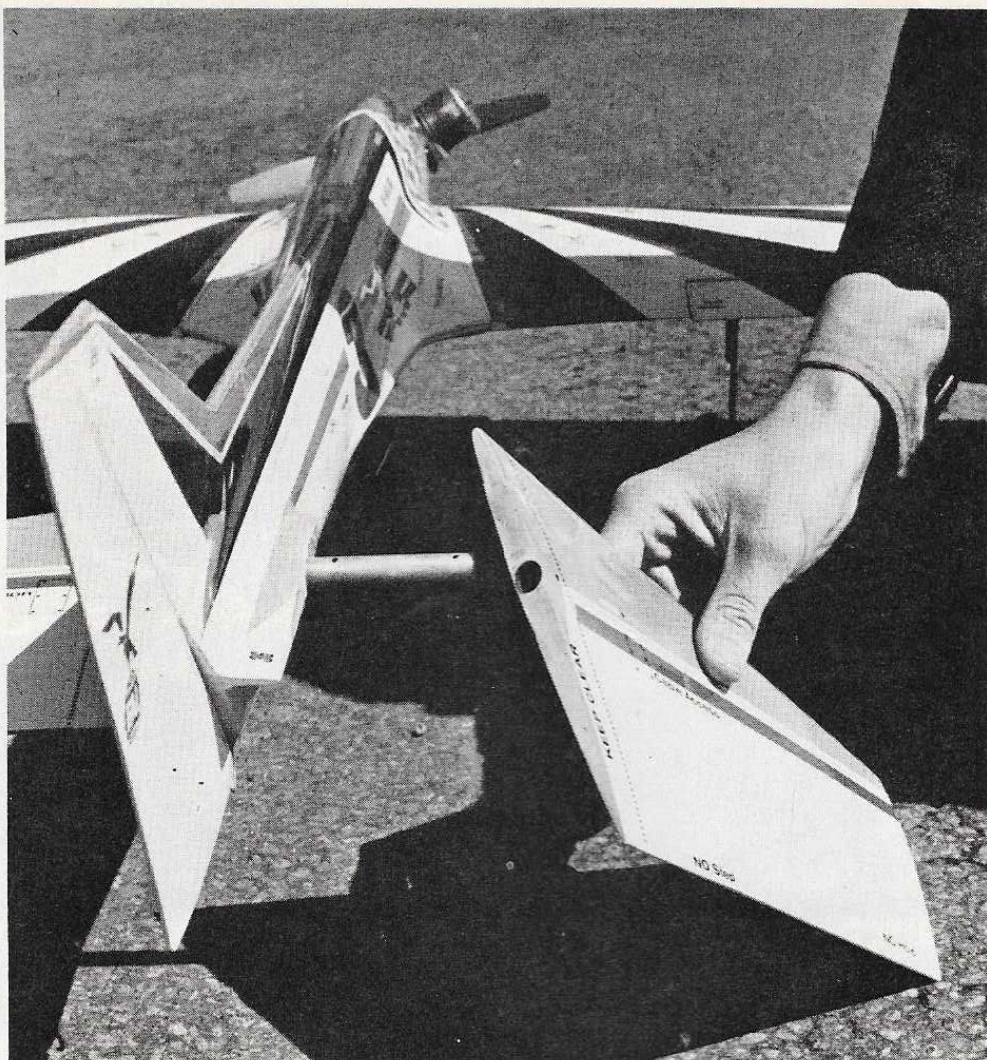
The canopy and cowl are made from fiberglass; the canopy may also be molded from clear plastic. The molds can be made in the wood-fiberglass tradition, or carved from styrofoam using the balloon-forming process.

The Wilmot lost-mold process is another method in which a plug is made from wood or finished styrofoam, and a thin coating of plaster is spread on the outside and left to dry. Then the plug is slipped out of the plaster, and a coating of matte fiberglass is placed in the plaster cavity and left to cure. Finally, the plaster is simply broken off with a blunt instrument (such as a size D sledgehammer) which leaves a quicky fiberglass cowl.

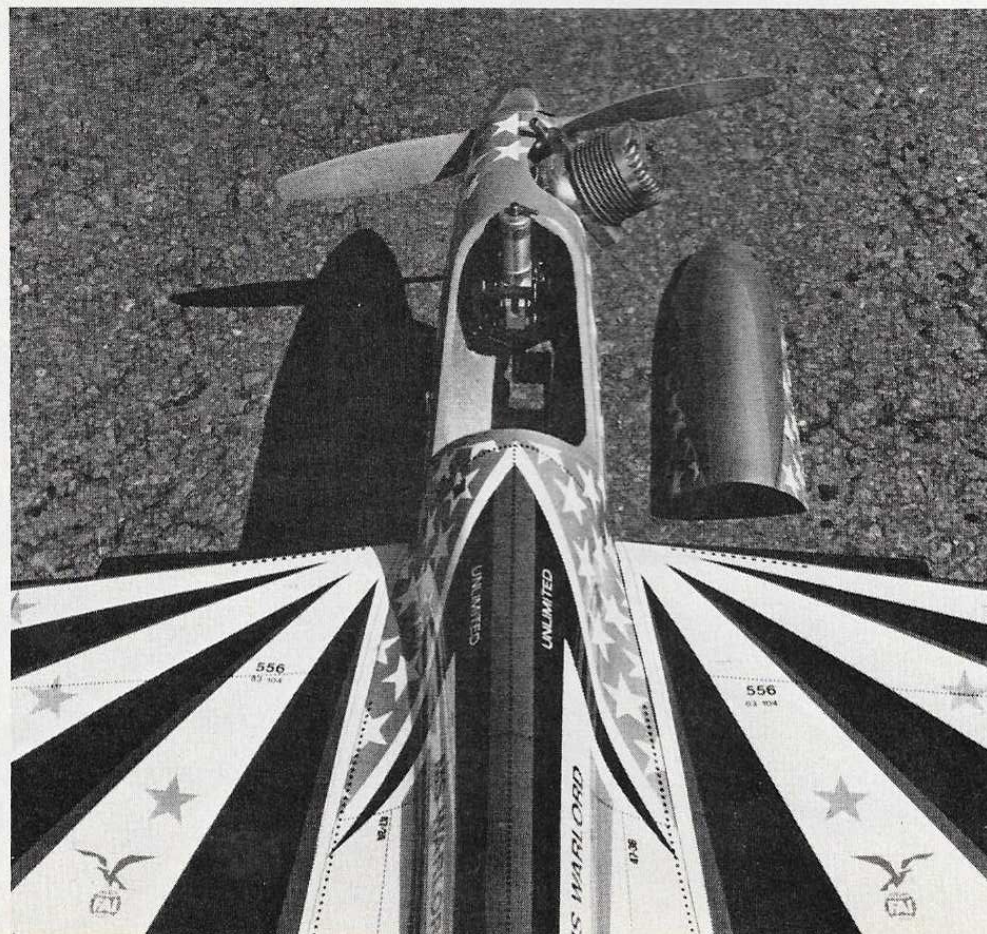
The firewall is a little tricky. Both the engine backplate and the Rom-Air nose gear must be bolted on their re-

Plans on page 32

Text continued on page 85



Above: No wing keying dowel is needed here. Fuselage wraps around the wing leading edge and the fillets fit on the "step" at the center of the wing (see text). Below: All-moving stabs are becoming popular. The author first tried them successfully in his Warlock design (November 1972 AAM). Control is smoother with less drag; parts are removeable for easy transportation.



WARLORD

(Continued from page 30)

No. 1021, Bronco—A Class I or II Navy Carrier plane for two 19s or two 29s of the OV-1A C.O.I.N. fighter. The large plan sheets. \$6.00

No. 0923, Vertigo—A CL vertical take-off-and-landing biplane. Uses throttled 19 for power. Really flies, lots of fun. \$2.75

No. 0922, Aqua-Vent Floats—Simple curves make these easy to build. Sized for 15 to 30 powered planes. Designed for quick lift-off with low power. \$2.50

No. 0921, Hot Pants—Jerry Nelson's large-bodied, realistic-looking, home-built type RC Pattern design. Smooth flyer uses all-moving stab. \$4.00

No. 0825, S.S.P. RC Helicopter—Gene Rock's very successful large trainer helicopter needs only 40 to 45 size engine. Designed for home builder with minimum machined parts, gyro-stabilized tail rotor, all belt drive, 4 channel radios. \$6.00. Also recommended is Plan No. 0826 with full-size drawings for all special machined parts. \$2.00

AAM will present up-dates on the design during 1973 as experience of readers and designer shows need.

No. 0824, Ryan SC—Unusual 049 free flight scale model is low wing with excellent flight stability. Flies fast and handles wind easily. \$2.75

No. 0823, Apteryx—New style mylar-over-foam wing on fast, tough, AMA Combat plane by Robert Mellen. Construction offers perfect airfoil and tapered wing. \$2.25

No. 0822, Nemesis II—Howard Rush's winning AMA Combat ship. Ultra-light, balsa and silk, very quick. \$2.25

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No. 0723, Quickie Mk 4—RC competitor for Class A and B. Conventional looking low wing flies easily, builds very fast. \$2.00

No. 0722, Wizrod 350—Ron St. Jean's combination of past FF power winners in a 350 sq. in. 049 screamer. \$1.75

No. 0721, Douglas Devastator—Navy Carrier competitor for 40 or 60 of colorful shipboard fighter. A tough plane and a winner. \$3.00

No. 0623, Chance Vought "Skimmer"—U.S. Navy experimental shipboard fighter is real flying saucer. For Profile Carrier events, by Frank Scott. \$4.50

No. 0622, Denlight Special—Well updated four-year-old Forum I racer by deBolt has many unique features for Speed. All balsa construction. Two-sheet plans. \$2.00

No. 0621, So-Long—Miniaturized Old-Timer for 020 Power event and Sport flying. Easy to make. \$1.50

No. 0523, Pegasus—A take-apart RC job designed for transportation in its own box. Full house with a 19, stunts well. \$2.50

No. 0522, Lil' Rebel—Fast and very durable 15 Goodyear CL racer is a consistent winner. \$2.25

No. 0521, Satellite 1000—Huge and highly-detailed plans for one of FF's most winning designs. For screaming 40s. \$8.50

No. 0424, Dragonette—Compact version of Kraft's Dragon Fli uses hot 40 and flies just like a big one—fast and smooth. \$3.00

No. 0423, Squeeze-Banger—FAI Combat anyone? Fast flying 15 ship from Canada is a winner. \$2.00

No. 0422, RCX4—Bat-like winged Sport RC Plane for big motors, 4-channels, and crowd pleasing flights. \$4.50

No. 0421, Quarter Pint—A 020-powered Tenderfoot free flight patterned after an antique design of 30 years ago. With decal. \$2.00

No. 0324, 2T—ACE-foam-winged RC trainer for 049 power carries 2-channel bricks with ease. Ample wing area for long glides too. \$2.00

spective sides. Believe it or not there is room with some left over if they are bolted as shown on the plans, and a nutplate is slipped over the backside of the Rom-Air unit. 4-40 bolts go into this nutplate from the front of the firewall and are countersunk so that the engine backplate mount can be bolted flush to the firewall.

The engine mount must be removed to tighten up the nose gear bolts. These bolts should be secured temporarily with Titebond to prevent loosening from vibration. A 1/8" rubber spacer can be placed between the firewall and the nose gear to cut down on the vibration picked up by the gear.

Wing: Again, this is a relatively straightforward structure and should be jig-built. One tricky item with which to deal is the "step" I have built into the center section of the wing. This step is included so that the large fuselage fillets can blend smoothly into the wing. Normally a very thin fillet edge is used; however, this was impossible in the fiberglass version. As a result the "step" was developed which also serves to keep the wing from shifting and prevents oil from seeping into the servo areas.

Be sure to fiberglass the center section with medium-weight cloth and a good resin such as Whitewater. This is just about all that holds the wing together, but it seems to be more than adequate.

Wheel wells for the retracts can be made out of styrofoam cups, from Ajax cans or any other cardboard tubes that give clearance for the wheels. The aileron torque rods are of 1/8" music wire, and are supported at each end by aluminum bushings. The wing is an open-bay type and should not be fully sheeted if the FAI wing loading is to be observed.

Stall strips are made of 1/2" triangular stock, and faired smoothly into the center leading edge, just outside the fuselage. They serve two purposes: they cause the center section to stall before the tips (which is mandatory at high altitudes and heavy weights); and they keep the wing from shifting because they snug up against the fuselage.

Ailerons can be carved out of sheet, or built up from 3/32" sheet. Wing tip weight will be necessary to counter the offset engine and muffler combination.

Flying Stab: This particular flying stab is identical to the very successful Warlock. Out of six aircraft with this stab, I've had no trouble with any of them, and one ship is going on its third year of flying. The heart of the system is the 1/2 and 7/16" brass tubes which are the pivots.

The basic stab is carved out of a single piece of 1/2" sheet balsa, with the 1/2" tube epoxied in place to serve as the high point of the airfoil. Unbelievable as it may seem, a true stab can be carved by just using a rasp and sanding block. Once the shape is achieved, the stab center section is cut out with a

S/B

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$\frac{1}{2}$ DIAMOND

So, here we are again, buried in the depths of a 2/3rd page black and white advertisement—but still trying to get over some meaningful info to the miniature aircraft sportsman. We have traditionally taken the newsletter approach in many of our (??) advertisements. Frankly, we have had more response to this type of advertising than to the four color approach. We will drop a four color cover ad on you from time to time, however, just to make sure Roy and Duke know that we are still alive.

HAWK 460

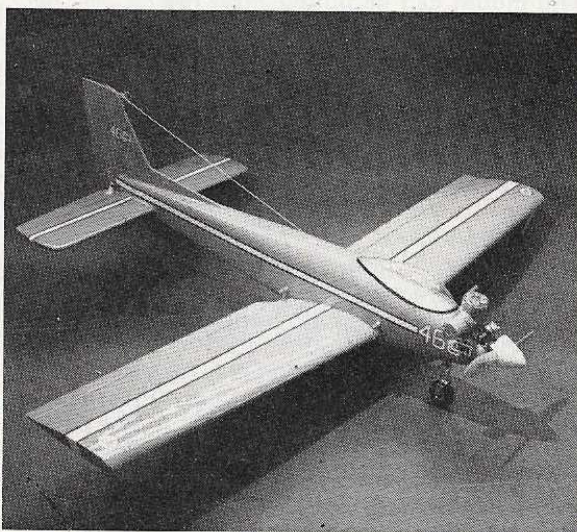
Last year we introduced our first kit—the Hawk 460 (.30 to .40 cu. in.). The concept here is ① Inexpensive; ② Different—foam reinforced with wood. ③ Durable—if covered with cloth and epoxy. ④ Flies great—especially in slow flight—landing approach. ⑤ A significant difference—the Hawk is almost an ARF but it is still a model that you can work on and patch if necessary.

Major John Woods, USAF, England, came up with an idea for this type of construction years ago. John is coming to work for World Engines in 1973 when he retires from flying jet flyers for Uncle.

The Cincinnati Radio Control Model Club took on the Hawk for a building project this past winter—68 members building 68 Hawks. You should see the variations in finishing techniques. Many fuselages are being finished with laminated balsa and/or veneer.

1/2 DIAMOND

The 1/2 Diamond is a crazy by-product of the Hawk. We used the top wing mold—the rest of the molds for the Diamond are new. The 1/2 Diamond is ① The first really expendable R/C plane. ② Very, very quick to build. ③ Strong wing and slab sided fuselage that can be reinforced. ④ Really flies good and will handle a hot .40. ⑤ Pylon—why not fly an expendable model in pylon so you can dare and tangle in the turns? We admire the guys who take their very scale Goodyear's to the



HAWK 460

\$29.98

battlefield, 1/2 Diamonds scoot along with their somewhat symmetrical wings and the gear permanently retracted.

World Engines took on the Hawk and 1/2 Diamond projects head-on. We decided to crap shoot and to make our own foam molds which turned out very successful and quite different than the type of molds generally used in foam molding. Why do we do this? The only one reason is that we had to prove model builders can do anything.

What's the 1/2 Diamond name bit? The upper side of the airfoil is conventional—lower side is diamond shaped. We checked

this out in a wind tunnel before we went to the mat with the mold. In actuality the 1/2 Diamond flies beautifully so the wind tunnel was correct.

NO WHEELS

How come no wheels? A landing gear complicates a model. Landing gears have drag. Landing gears rip out the bottom of fuselages. You can fly the 1/2 Diamond virtually from anywhere as it hand launches (no runway) and can be belied in on its plywood belly in grass or weeds or, if you are in west Texas, into the mesquite. All this in a box with a string for \$19.98



1/2 DIAMOND

\$19.98

band saw, through 1/2" tube and all. Then the 7/16" tube is inserted in the center section tube and S-3 is soldered to the 7/16" tube after the clearance holes have been cut out of the 1/2" tube with a Dremel tool. At this point, you should have the center section, with a full-length 7/16" tube running through the 1/2" tube, and a tiller that rotates the 7/16" tube. The flying stab halves are fastened onto this 7/16" tube by 3/8" sheet metal screws.

Finally, epoxy the stab center section onto the fuselage and install the aileron-type tiller on the tiller bar. Be sure to use a straight-line fiberglass pushrod and a good slop-free servo on the flying stab. While there are no flutter tendencies, try holding one half out of a car window doing 70 mph and notice how much force is present. If the stab is steady, very little effort is needed to rotate it, but a good amount of effort is required to hold onto it. Make sure the center section is epoxied on solidly and fillet well. Finish the stab halves with fiberglass resin to prevent warping.

At present, I still have No. One Warlord which weighs 8½ lb. with fuel, a much thinner wing (10%) and a Webra 61. It has a tremendous amount of flight time behind it and I have never had any stab problems. Trust me, it works.

The fruits of my labor were evident at the 1972 Nationals. I left Colorado with a brand-new Warlord that had been flown a total of 5½ min. I thought that if I didn't fly my No. One ship before the NATS, I couldn't possibly crash it as had happened before at the last two Glenviews due to circumstances beyond my control (obviously a theory born out of desperation). Once at the NATS, I found that the Warlord's uniqueness had charmed the judges as I was receiving 1-2 points per maneuver (which I didn't deserve on an untrimmed aircraft). Unfortunately, I suffered a mishap right in the middle of the NATS, not just before it, and as a result, I had to leave Warlord No. Two in a trash can. (That was before I switched to Pro-Line.) *C'est la guerre.* Who knows what evil lurks at this year's NATS. See you there!

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