WOLFGANG MATT'S ARROW

The reigning world champion pattern airplane has some very interesting features.

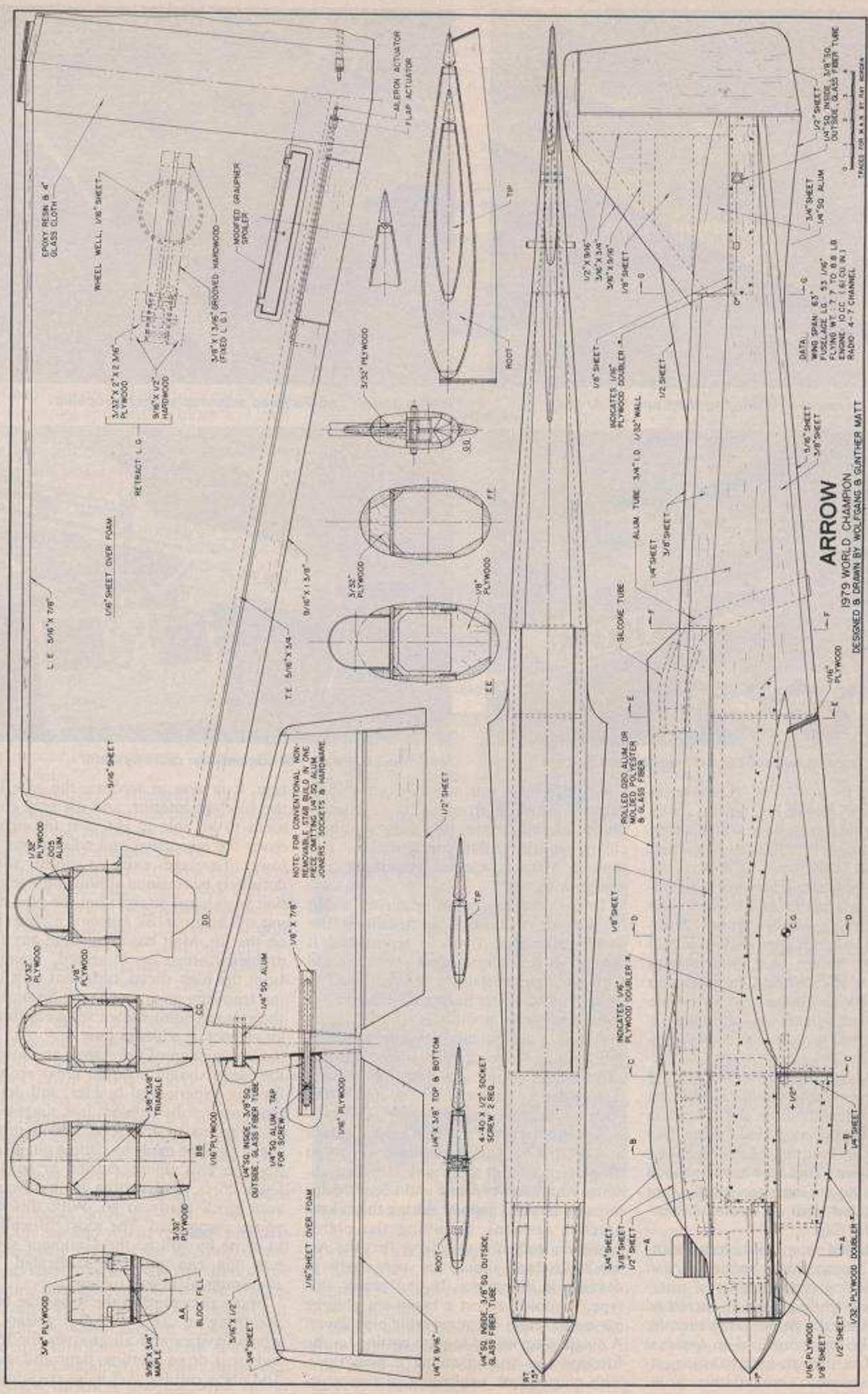
TEXT BY ART SCHROEDER
(from information supplied by the designer)

ARROW
TYPE: R/C Pattern
WINGSPAN: 63 inches
WING AREA: 713 square inches
LENGTH: 53 1/16 inches
WEIGHT: 7.7-8.8 pounds
ENGINE: .60
RADIO: 4-7 channels

• The ideal pattern aircraft would be one so neutrally stable that the airplane would hold any flight attitude with no control inputs save those to put it in that flight position. Further, this perfect pattern aircraft would respond to aileron with a pure roll (no yaw or pitch response) and to the other controls with equally pure results. Speed would be virtually constant both climbing and diving; vertical climb would be an unlimited factor and the airplane would snap cleanly on heading while still retaining smooth and stable flight in all other attitudes. As a side requirement, the perfect pattern plane would be simple to build, rugged and long lasting, and present smooth, attractive lines; all from readily available, low cost materials. No one has built the perfect pattern plane yet; some HAVE approached it!

Model Airplane News has been a showcase for near-perfect pattern planes ever since it began publishing national and world championship aircraft with the Orion (June 1960). The majority of winners have graced these pages over the years and all have shown a striking similarity by being honed to near perfection through a series of almost constant and subtle modifications on a good initial design. This is true of Hanno Prettner's

Deep fuselage houses tuned pipe. Probably helps knife-edge flight, too.



FULL-SIZE PLANS AVAILABLE . . . PAGE 129.

Reigning world champion Wolfgang Matt and his Arrow.

Webra engine and Variprop adjustable-pitch propeller.

Tuned pipe is housed on top, exhaust ducted out bottom.

Matt used a Webra FM competition radio system.

Curare series, Rhett Miller's Compensator, Phil Kraft's Kwik-Fli, Don Lowe's Phoenix (that ship must have seen a dozen or more variations) and this latest winner, Wolfgang Matt's Arrow.

The Arrow is the reigning world champion aircraft as a result of its win in the 1979 South African World Pattern Championships. The aircraft goes back to a 1973 design called Super Star, which was followed by the 1975 World Championship Atlas, and now the present Arrow. The airplane is, for all intents and purposes, an Atlas modernized to meet current FAI requirements.

Wolfgang Matt felt that the square and snap maneuvers would require a different airfoil with maneuvering flaps and a spoiler. Unlike the integrated spoiler/flap made popular by Prettner, Matt opted for a separated system. This was accomplished by incorporating a Graupner spoiler that could be coupled with or operated separately from the flap.

Since the tuned pipe has become standard in FAI competition because it can meet the silencing requirements of international events while providing increased power, Matt uses the device. However, he did not like the appearance of an external pipe, or the fact that an external pipe unquestionably causes aerodynamic problems since it creates an asymmetric drag pattern. Hence, Matt opted for an interior mount that becomes the biggest single change in the Atlas configuration. The system Matt developed is simple and straightforward.

To ease transportation problems, a fact of life for worldwide competitors, the stabilizer on the Arrow is removable. It can be made in one piece, but I would strongly suggest retaining this feature. The separating stabilizer halves will lead you to individual drive points for the elevators that have a distinct advantage in adjusting for accurate tracking. You might want to experiment with a flying stab using Giezendanner hardware that should fit the Arrow arrangement very nicely.

A combination of built-up balsa fuselage and foam wing/stab is an ideal way to go for pattern aircraft since such structure absorbs vibration very well and keeps equipment somewhat happier during those long practice sessions. Scanning the plans, however, leads one to believe that the Arrow's fuselage should be very easy to develop in fiberglass. If you prefer this type, I would suggest a two-piece plug be carved to retain the removable pipe cover. A single plug would require cutting up the fuselage top and installing a pipe floor, with consequent weakening of the structure. It is wise to separate the pipe from the fuselage interior, and it's very convenient to be able to get at it through the cover for inspection and adjustment. The lower fuselage exhaust point should definitely be retained although the temptation to exhaust straight out the pipe housing will be great. By avoiding a direct blast on the fin, Matt has eliminated any flight problems, real or imagined, stemming from the high speed, turbulent flow coming from the engine exhaust. Secondarily, the exhaust point shown will keep things a lot cleaner at wipe-up time.

Construction of the Arrow as shown on the plans should pose no great problems for any experienced builder, and detailed plans are hardly needed. It is suggested (a good idea with any scratch-built project) that a "kit" be made by cutting out all parts prior to any gluing, cutting or acquiring foam cores, and getting all hardware in your stock ready to go. With this done, you're committed. The most difficult part to come by will be the Graupner spoiler, but this can also be fabricated from aluminum plate and tubing.

Make all cutouts in the wing core before sheathing it. This includes retract and wheel cavities and all grooves for torque rods that drive ailerons, flaps and spoiler. The plans call for 1/16" balsa covering, but

1/32" ply would also do nicely. I prefer a slow curing epoxy to glue sheeting to foam cores and find no excessive weight build-up using this method. The trick is to apply a light coating of glue to the prepared sheets and then remove much of it with a stiff card spatula. Do both top and bottom sheets at the same time, apply them to the cores, replace into the cutout blocks, and weight the whole mess down on a flat surface. And mess it can be, so have some solvent handy to remove glue from your fingers. Prepare the top and bottom sheets somewhat on the generous side since there is some slippage and you want to be sure the total core is covered. When it all cures you will have a straight sheeted core that won't warp, and you will never see sheet separation (which can sometimes occur with contact cements).

After all is cured, trim to the core's outline with knife and sanding block and then add the leading and trailing edges. If you want to overlap sheeting on the leading and trailing edges, they must be glued to the cores prior to sheeting and shaped to correct size. I prefer doing both leading and trailing edge attachment after basic sheeting to avoid any core damage that can result from too aggressive sanding.

Join the cores—no dihedral braces are necessary—upside down with the center joint 5/8" above the surface and the tips flush on the surface. This will give you the correct dihedral angle. When cured, apply fiberglass cloth to the center joint. The system I use involves pulling the cloth into place and then Hot Stuffing the edges into place; only then is the resin flowed on. This procedure results in a very neat center joint.

The stabilizer is sheeted in the same way. Before sheeting, make the two attachment cavities. The larger one has 1/8" x 1/8" balsa sheet sides and caps of 1/4" x 3/8" balsa; all forming a 3/8" i.d. box. This cavity holds a 1/4" i.d. glass fiber tube that, in turn, plugs into a 1/4" o.d. tube or rod that is built into the fuselage. The front stub is similar, though shorter, and does not require the indicated setscrew. The Giezendanner plug-in stab system (Part No. GMP 901) or flying stab system (GMP 900) will ease this chore and is available from Giezendanner USA, P.O. Box 818, Pottstown, PA 19464. I also recommend the control horn fitting (GMP 1300) for stabilizer and rudder pushrod connection.

Wolfgang Matt designed a nice straight line in his fuselage construction, the top of the basic sheet sides. Make two sides with all doublers glued in place and join with formers upside down, placing those straight edges down on your workbench. Sheet the top and you have a structure that can be easily handled for addition of the various slabs, blocks and sheets that shape the thing out. Be sure you add the triangular stock that adds such tremendous strength. Be very fussy on setting up the basic structure for 1/2° positive wing incidence, zero stabilizer, 1° down thrust and 1.5° right thrust. I like the Matt motor mount arrangement. The basic 9/16" x 3/4" maple mounts surrounded by balsa blocks and heavy balsa slabs will absorb engine vibration to a level much greater than lighter structures or fiberglass fuselages. I would suggest epoxy around that front end. You ought to have a ball shaping the structure when all the bits and pieces have been added. The wing fillet would be best formed in Epoxolite putty over a 1/32" ply base between wing and fuselage wing opening. This Sig product permits bringing a fillet shape to near completion when forming it, with very little sanding needed after it hardens.

Don't eliminate the .005" aluminum plate over the fuselage top (pipe floor). It will keep things from getting too hot in that radio compartment. The pipe covering can be formed simply of light aluminum (.020") sheet, fiberglass sheet or even 1/32" plywood.

Any high-performance pattern bird requires careful setup prior to flight to insure reasonable results on those early flights. Use your trammeling techniques and redo anything off the designer's specs. The full performance can only be extracted by in-flight adjustment, good equipment and lots of practice. For the adjustments, I suggest you read the section on adjustment by Jim Kirkland that accompanied his Intruder article (*M.A.N.*, April 1971). A more definitive article on pattern adjustment has yet to be written—it should be in any serious pattern competitor's library. Reprints of this article are available from

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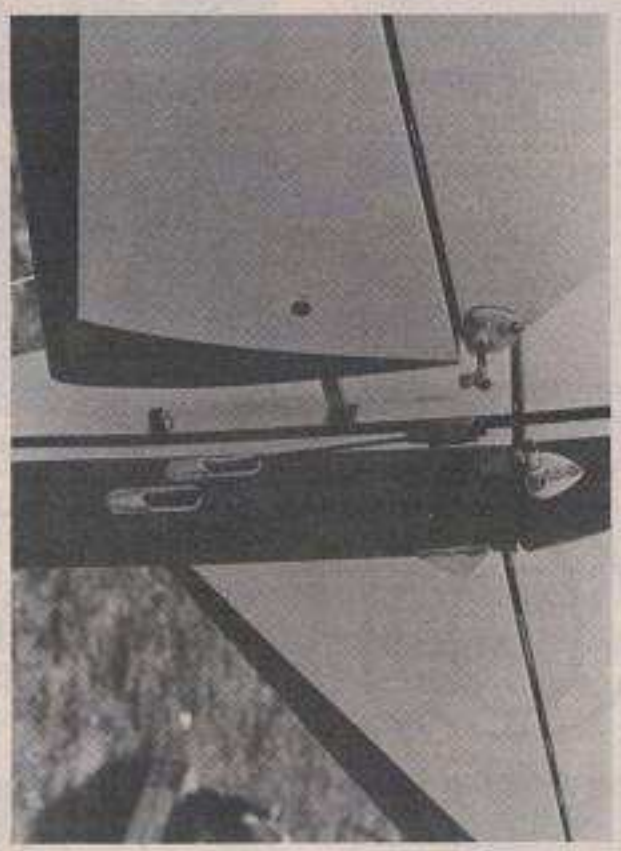
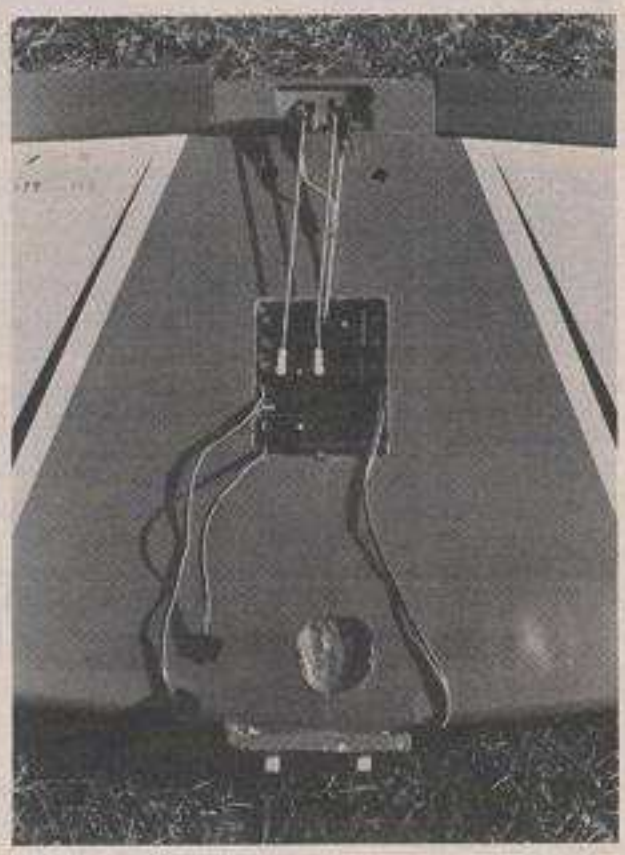
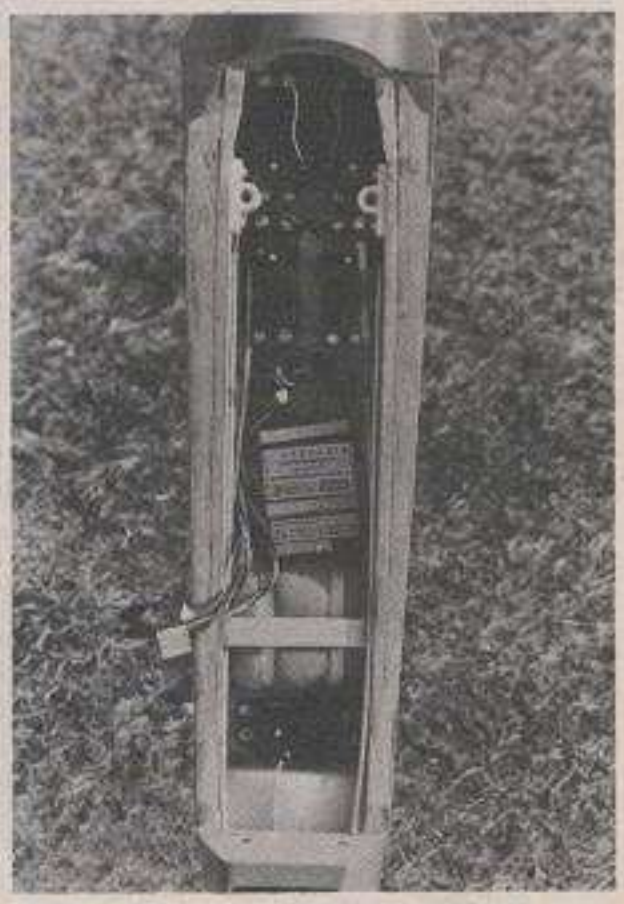


Stabilizer is removable for transport.



Aileron, flap, retract servos in wing.

Pipe housing has cooling grille at rear.



Rudder, elevator, throttle, prop pitch, retract servos are mounted in fuselage.

to find the "Magic Muffler" in our hobby shops at a future date.

I've put together a Form I type model that displays a number of things relative to the thinking behind the scenes these days, and included some pictures of a past design of mine that was used for the purpose (simply because it was the only thing available at the moment). This "Pogo" is only one example of the type of model that would be eligible for the proposed FAI Pylon event. It is not the ultimate, but it does show that the proposed rules would allow model designs that cannot be used under the current provisional rules. The point is, many such racers exist and being able to use them would allow a great many R/C racing people to try the FAI event, thus increasing interest and participation.

Another point is that it is quite possible to use a muffler with a typical Form I model, and since pressure is increasing for us to quiet down our racers, this is an important consideration. For those of you who would like to race and cannot because of muffler regulations in your area, you might try using a Formula I, or ¼ Midget for that matter, arranged so that it could be flown with or without a muffler. The required change from one mode to the other should present no big problem, and at least such a setup would get you into racing.

Of course, it was the "Magic Muffler" that gave us the incentive for this Pogo project. By using the Pogo, we had a ready-built model for which a considerable amount of flight data is available, and converting it to use a muffler would allow direct performance comparisons. After considerable forethought (when you start cutting and fitting, you just can't make a mistake or you're in trouble), the actual work required to complete the conversion did not really take a great deal of time. What became quite obvious is that such a muffler installation could easily be *designed* into the normal construction of a new model.

The photos show the Pogo with the muffler installed, and it certainly does not distract from the appearance in any way. To keep the muffler within the airframe obviously requires space, space that would normally be used for fuel tanks and even radio gear. The simple answer seems to be to first give the muffler the space it requires and then use whatever room remains for the other equipment. In the case of the Pogo, this required a specially shaped fuel tank to maintain enough capacity and some minor reshuffling of the radio gear. Of course, if you were starting from scratch, you could simply relocate the tank and radio gear.

There are several problems that have to be considered when using an enclosed muffler. It must be well secured to the airframe so that it will stay in place. The muffler gets hot, so it must be insulated from the airframe. Lastly, it must be cooled, so air must be fed to its outside, ducted through the airframe, and expelled. What all this amounts to is a suitable duct in the airframe structure to contain the muffler, arranged so that air can enter it from some source (engine cooling air is apparently sufficient) and then exit, and within which there is a means of securing the aft end of the muffler.

This particular installation added four ounces of weight to the unmuffled craft, but this figure could probably be reduced with a "scratch installation." In any event, it seems like a small price to pay.

We certainly filled the space this month with what has to be called "specialized" news. While it may be interesting and perhaps even exciting, it is not the real intent of "FLN." We do want to discuss what *you* are interested in, but to do so we have to hear from you—so please write and let us know what you'd like to read about on these pages. Hal deBolt, 49 Colden Court, Buffalo, NY 14225. ■

ARROW

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M.A.N. for $2.00 each, including postage.

The original Arrow employed a Webra Speed 61 with rear exhaust on 8% nitro and 15% synthetic oil in its fuel. While Matt doesn't specify the pipe, certainly the Webra pipe would be fine, as would the ED pipe. The only constraint would be in terms of fit into the available compartment space. Included in the power department

are a Perry Pump and Dynamix carburetor.

Matt (and Prettner as well) is using the new variable pitch propeller (available from Hobby Lobby). He says, "I think the Varioprop is one of the most promising devices I have ever seen in this sport and it can help the R/C flier perform much better maneuvers when its use is fully understood. The noise level of this prop is very low." Landing gear is a new Swiss product, "Colibri"; I have no idea as to American outlets for the gear, but certainly the easily available Rhom or Sonic units will fit this bird.

In 1979, Wolfgang Matt switched to the new Webra FM 9-channel radio. This system is clearly in the "super" competition class, with dual rates on three functions, exponential on three functions, inside and outside adjustable snap buttons, switch in and out for coupled flaps/elevator, mixing control for landing flaps (which programs correction for pitch when flap is deployed), three-position control for variable pitch propeller, and servo reversing for all nine channels.

Wolfgang sums it all up by saying, "The Arrow is an airplane that flies very easily for an experienced pilot. The inside tuned pipe helps to stabilize the airplane and enhances windy weather straight flight. This was a big advantage at the World Championships in Johannesburg." If your pattern potential has been lagging a bit, give the Arrow a try—it may be just your ticket to the 1981 WC. By the way, if you would like a kit for this latest attempt at a "perfect pattern plane," check in at Hobby Barn (P.O. Box 17856, Tucson, AZ 85731). The kit features an epoxy glass fuselage, foam wing and stab, along with sheeting and hardware in the deluxe version. If you prefer to build from scratch, plans are available from *M.A.N.*

Either way, I think you'll like the Arrow. It is an honest design and flies even better than the Atlas, a ship I've had some experience with. By the way, balance the Arrow at about 40% as a starting point. If you balance it right, it may balance those pattern scores for you. ■

SOARING NEWS

(Continued from page 37)

pin parts to the workboard to hold 'em. If you have thick plywood parts, it's easier to cut them with a Dremel saw or similar motor tool than it is to hack 'em out with a razor blade—and a lot faster, too. If the right kit was chosen, the plywood will be all cut for you. If not, bite the bullet and do it yourself. Maybe a friend will let you use his saw. All done, everything square and correct, according to plan? Okay, check and re-check every joint. Some of them will have to be gone over for extra strength on the *inside* corners. Use some Titebond on the tip of a small paintbrush (like those little watercolor brushes), and fill each joint to form a fillet. Not heavy, or blob-